FDOT District 1
Structures Design

Project Description:
SR 70 FROM W OF SR 31 TO SE HIGHLANDS COUNTY LINE

Financial Project ID. Nos.
451942-2-52-01
Segment 9-10

BRIDGE TECHNICAL MEMORANDUM

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August 2025

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1. Executive Summary

The widening and multi-lane reconstruction of SR 70 from W of SR 31 to SE Highlands County Line Road is part of a larger strategic corridors project which aims to improve operational conditions for emergency evacuations along the SR 70 corridor. The SR 70 project limits include two bridge sites, Whidden Creek (MP 16.896) and Joshua Creek (MP 19.705), and five bridge culverts; Tiger Bay (MP 22.828), Mossy Gully (MP 24.160), D.C.I Canal (MP 24.691), Long Point Marsh (MP 27.573) and Parker Creek (MP 30.916).

The proposed bridge typical section and the new alignment will be accommodated within the existing right-of-way corridor along the project limits and will require replacement of both bridges and all five bridge culverts. The proposed typical section will accommodate two 12′-0″ lanes in each direction with 10′-0″ outside shoulder and 6′-0″ inside shoulder. Additional features include a 14′-0″ shared use path for pedestrians and bicycles and a pedestrian underpass on the east creek bank of the proposed Joshua Creek bridge. The dual bridge crossings over Whidden and Joshua Creek shall be built to provide large-mammal crossings, while the five proposed open bridges at the existing bridge culvert locations shall provide small/medium-mammal crossings. Wildlife crossings shall be provided on each side of the waterway at all bridge locations.

The purpose of this Bridge Technical Memorandum is to present alternatives for replacing two bridges and five bridge culverts and to determine which alternative shall be carried forward to the design stage of the project. This report will recommend a structure alternative based on hydraulic opening requirements, evaluation of geometric clearances, viable superstructure and substructure types, wildlife crossings, pedestrian underpass, constructability and economy. The existing route has no reasonably viable detour so phased construction which maintains traffic is critical.

The recommended alternative at each bridge location, including bridge length, number of spans, span lengths and skew angles are listed in the Table 1.

Table 1: Bridge Configurations

SR 70 over:	Bridge Length (FT)	Span Configuration	Skew (Degree)
Whidden Creek	140	2-Spans: 64′-76′	0
Joshua Creek	180	2-Spans: 90′-90′	0
Tiger Bay	76	1-Span: 76′	0
Mossy Gully	96	1-Span: 96′	-15
D.C.I Canal	76	1-Span: 76′	15
Long Point Marsh	96	1-Span: 96′	15
Parker Creek	96	1-Span: 96′	0

All proposed bridge superstructures utilize Florida-I 36-inch Beams (FIB). The end bents and intermediate bents where applicable are founded on 18-inch precast concrete piles. Recommended alternatives provide optimized cost and enhanced pedestrian and wildlife connectivity. The recommended alternatives meet all project criteria and are partially constructed off the existing roadway alignment which minimizes impacts on traffic during the phased construction of this project.

Estimated bridge construction cost for the recommended alternative is presented in Table 2. Costs shown in Table 2 include only the bridge and approach slabs.

Table 2: Engineer's Bridge Construction Cost Estimates

SR 70 over:	Total Cost	Total Deck Area (WB & EB Bridge)	Cost per Square Foot (WB & EB Bridge)
Whidden Creek	$3,394,225	14,012 SF	$242/SF
Joshua Creek	$4,192,365	18,015 SF	$233/SF
Tiger Bay	$1,979,920	7,606 SF	$260/SF
Mossy Gully	$2,506,121	9,608 SF	$261/SF
D.C.I Canal	$2,076,847	7,606 SF	$273/SF
Long Point Marsh	$2,292,742	9,608 SF	$239/SF
Parker Creek	$2,110,976	9,608 SF	$220/SF
Overall Total	**$18,553,196**	**76,063 SF**	**$244/SF**

2. Introduction

2.1 Purpose of the Bridge Technical Memorandum

The purpose of this Bridge Technical Memorandum is to present alternatives for accommodating reconstruction of two bridges and five bridge culverts within the project limits. These structures are included in the multi-lane reconstruction of SR 70 from W of SR 31 to SE Highlands County Line Road, which is part of a larger strategic corridors project aiming to improve operational conditions for emergency evacuations along the SR 70 corridor. This report will address geometric requirements, viable superstructure and substructure types, construction sequencing and wildlife crossings. The optimal solution will be selected based on economy, constructability, and functionality while accommodating wildlife crossings at all bridges locations. The selected bridges will be recommended as the alternatives to be carried forward to request for qualification (RFQ) documentation.

2.2 Project Location

This project is located along SR 70, starting east of the city of Arcadia to Highlands County Line Road covering approximately 16.8 miles. The project limits are divided into two segments.

The first segment, Segment 9, begins west of State Road 31 (MP 14.973) and ends at County Road 760 (MP 20.190). The second segment, Segment 10, begins at County Road 760 and ends at Highlands County Line Road (MP 31.763).

Refer to Figure 1 for overall project location, Figure 2 for existing bridge locations, and Figure 3 for existing bridge culvert locations.

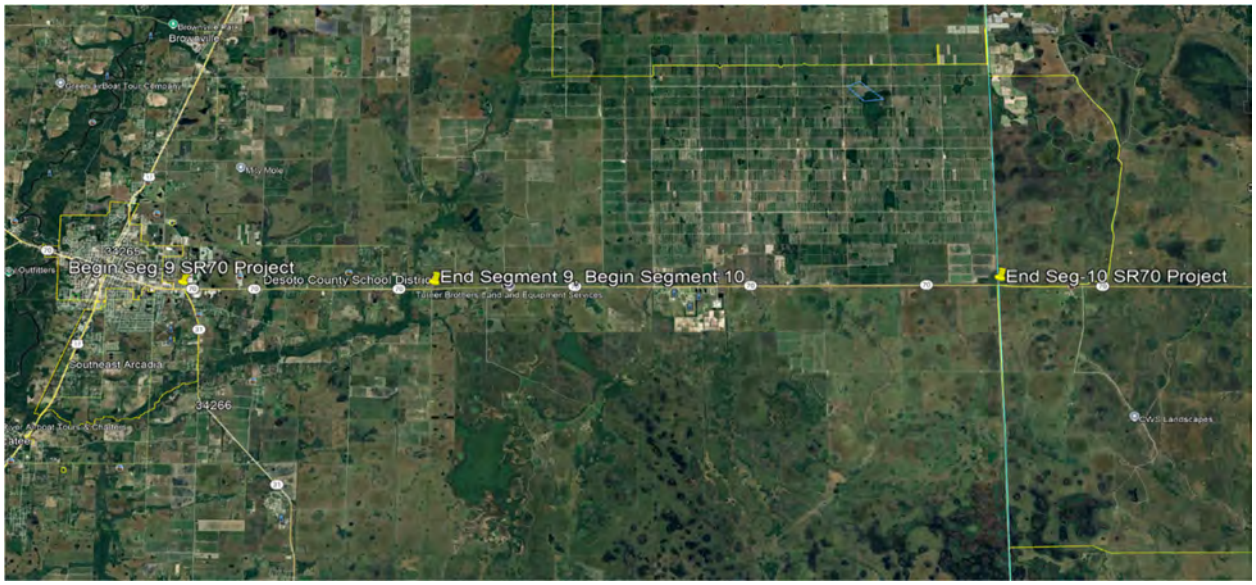


Figure 1: Project Location

Figure 2: Bridge Locations

Figure 3: Bridge Culvert Locations

2.3 Project Description

The project runs from MP 14.973 to MP 31.763 along SR 70. SR 70 is a designated hurricane evacuation route and part of Florida's Strategic Intermodal System (SIS). Facilities on the SIS are subject to specific standards and criteria for design speed, level of service, and other requirements. The existing SR 70 roadway configuration does not meet SIS facility criteria. This project aims to improve operational capacity for emergency evacuations, correct existing inadequate cross section and substandard geometrics, improve vehicular and pedestrian safety, and increase the level of service to an area of critical economic interest while at the same time providing adequate wildlife crossings throughout this corridor.

The two bridges and five bridge culverts as described in the executive summary were constructed approximately 66 years ago. Considering the age of these structures and to accommodate proposed typical sections, the new alignment and the addition of the wildlife crossings and the pedestrian underpass at Jousha Creek, full reconstruction of all existing bridges and bridge culverts is recommended. The proposed dual bridge system shall be built to accommodate westbound and eastbound bridges separated by 40'-0" median and a 25'-4" clearance between the bridge copings. Proposed bridges shall accommodate at minimum existing hydraulic openings as well as wildlife crossings on each side of the waterway at the bridge end bents.

Bridge culverts were initially considered at the existing bridge culvert locations. Based on discussion with District 1 structures and given the required overall length and width of the bridge culverts needed, compromised effectiveness of the wildlife crossings due to limited

natural light and the difficulty to maintain these long bridge culverts and wildlife crossings, a dual open bridge system is recommended at all these locations.

The proposed typical section will be accommodated within the right of way corridor along the project limits. The proposed typical section of the westbound and eastbound bridges will accommodate two 12'-0" lanes, 6'-0" inside and 10'-0" outside shoulders protected by 36" Single-Slope traffic railing. A 14'-0" shared use path will be located on the westbound bridge at Whidden and Joshua creek and shift to the eastbound side for the proposed bridges at the existing bridge culvert locations. The shared use path drop-off is protected by a 42" bridge pedestrian/bicycle steel railing on the outside.

Bridges over Whidden Creek and Joshua Creek are not skewed and will have a 2-span configuration for an overall bridge length of 140' and 180' respectively. Bridges over Tiger Bay will have a 1-span configuration and no skew for an overall bridge length of 76'. Bridges over Mossy Gully will have 1-span configuration and a -15° skew for an overall bridge length of 96'. Bridges over D.C.I Canal will have 1-span configuration and 15° skew for an overall bridge length of 76'. Bridges over Long Point Marsh will have a 1-span configuration and a 15° skew for an overall bridge length of 96'. Lastly, bridges over Parker Creek will have a 1-span configuration and no skew for an overall bridge length of 96'.

2.4 Existing Roadway

Segment 9 along SR 70 facility is a two-lane undivided roadway with 12'-0" travel lanes, 5'-0" paved shoulders (See Figure 4).

Figure 4: Roadway Segment 9 (Looking East)

Segment 10 along SR 70 facility is either a two-lane or three-lane undivided roadway with 12'-0" travel lanes and 5'-0" paved shoulders (See Figure 5).

Figure 5: Roadway Segment 10 (Looking East)

Both segments have open roadside ditches within varying widths of existing right-of-way. SR 70 is designated as a rural principal arterial highway, a SIS highway, and a Florida Division of Emergency Management designated evacuation route.

2.5 Existing Bridges

The SR 70 Segment 9 & 10 project limits include two bridges, one over Whidden Creek (Bridge # 040024, Figure 6) and one over Joshua Creek (Bridge # 040027, Figure 7). Both bridges are concrete slab bridges and were constructed in 1959-1960. Each bridge consists of six 20'-0" spans for an overall length of 120'.

Figure 6: SR 70 over Whidden Creek

Figure 7: SR 70 over Joshua Creek

SR 70 Segment 9 & 10 project limits also include five bridge culverts. The bridge culvert at Tiger Bay (Bridge # 040031, Figure 8) is approximately 85' long, perpendicular to the roadway alignment and consists of 3 barrels of 10' wide x 7' tall.

Figure 8: Bridge Culvert at Tiger Bay

The bridge culvert at Mossy Gully (Bridge # 040032, Figure 9) is approximately 56' long, at a skew of minus 15 degrees and consists of 4 barrels of 12' wide x 8' tall.

Figure 9: Bridge Culvert at Mossy Gully

The bridge culvert at D.C.I Canal (Bridge # 040033, Figure 10) is approximately 58' long at a skew of plus 15 degrees and consists of 3 barrels of 8' wide x 9' tall. (25.3' wide / 29.5' along the skew)

Figure 10: Bridge Culvert at D.C.I Canal

The bridge culvert at Long Point Marsh (Bridge # 040037, Figure 11) is approximately 64' long at a skew of plus 16 degrees and consists of 4 barrels of 10' wide x 7' tall. (44' wide/46 along the skew)

Figure 11: Bridge Culvert at Long Point Marsh

The bridge culvert at Parker Creek (Bridge # 040940, Figure 12) is approximately 57' long, perpendicular to the roadway alignment consisting of 4 barrels of 12' wide x 7' tall. (52' wide)

Figure 12: Bridge Culvert at Parker Creek

3. Design Criteria & Requirements

The following sections contain relevant design criteria and other requirements used to evaluate the proposed improvements.

3.1 Design Specifications

- AASHTO LRFD Bridge Design Specifications, 9th Edition
- FDOT Structures Manual, 2025
- FDOT Standard Specifications for Road and Bridge Construction, FY 25-26
- FDOT Standards Plans, FY 25-26
- FDOT Design Manual, 2025
- FDOT Bridge Load Rating Manual, 2023
- FDOT Soils and Foundation Handbook, 2024
- FDOT Drainage Manual, 2025

3.2 Design Loads

- Design Live Load: HL-93 with Dynamic Load Allowance
- Permit Live Load: FL120
- Dead Loads: Per FDOT Structures Manual – Structures Design Guidelines (SDG) 2.2
- Wind Loads: Per SDG 2.4 and AASHTO LRFD Bridge Design Specifications
- Thermal Loads: Per SDG 2.7 and AASHTO LRFD Bridge Design Specifications
- Vehicular Collision Force: Per SDG 2.6
- Redundancy, Ductility and Operational Importance Factors: Per SDG 2.10, $\eta_R = 1.0$, $\eta_D = 1.0$ & $\eta_I = 1.0$

3.3 Aesthetics

There are currently no aesthetic guidelines for the SR 70 corridor within the project limits that are applicable to the proposed bridge or bridge culvert locations.

Given the rural nature of the project location, the bridges are:

- Not highly visible to many users
- Not located in or adjacent to parks nor recreational areas
- Not solely pedestrian bridges

For the reasons listed above, Level One Aesthetics per FDM 121.9.3 are appropriate and committing additional resources as enhanced aesthetics are not warranted. Level One Aesthetics will be achieved by applying general surface finishing to the exposed concrete surfaces such as traffic barriers and fascia elements per FDOT Construction Specifications 400-15.2.1. Per SDG 1.4.5, the use of a Class 2 Surface Finish is preferred for all concrete elements except for bridge decks. The bridge deck will be finished per FDOT Construction Specifications 400-15.2.5.

3.4 Maintenance of Traffic (MOT) Requirements

Because there is no reasonably viable detour available, it is critical to maintain traffic on SR 70 throughout the duration of construction. All bridges are to be constructed in two phases. Per approved typical sections, proposed westbound alignment will be constructed north of the existing alignment while traffic is maintained at the existing alignment of SR 70. Embankments of all alternatives evaluated can tie down to existing ground outside of the existing SR-70 typical section. This will allow the existing SR 70 facility to remain in service throughout the duration of phase one bridge construction. The second phase construction consists of shifting traffic to the newly constructed westbound facility while constructing the proposed bridges along the eastbound alignment.

3.5 Wildlife Connectivity

Wildlife crossings will be provided at each existing bridge and bridge culvert location. In addition, two conventional box culverts located at MP. 28.638 and 29.953 will provide wildlife crossings either with a standalone box or shelves within the proposed box culvert. The profile of SR 70 will be increased as necessary to accommodate the vertical clearance of the wildlife crossings and certain driveway access may need to be reconstructed to meet the profile rise. Access will be maintained to all properties during reconstruction.

To determine federal and state protected animal species that have the potential to occur within the project area, site-specific data was collected and evaluated in 2016-2018 and 2023.

The study identified the following endangered/threatened species in the area of the project: Eastern Indigo Snake, Blue-Tailed Mole Skink, Sand Skink, Gopher Tortoise, Florida Scrub-Jay, Bald Eagle, Wood Stork, Crested Caracara, Little Blue Heron, Tricolored Heron, Southeastern American Kestrel, Florida Sandhill Crane, Roseate Spoonbill, Black Skimmer, Florida Panther, and Florida Black Bear.

Proposed bridges over Whidden Creek (Bridge # 040024) and Joshua Creek (Bridge # 040027) will accommodate the crossings of small and large mammals on each side of the waterway at the bridge end bents. Proposed open bridges at the existing bridge culvert locations will accommodate the crossings of small and medium animals on each side of the waterway at the bridge end bents. To encourage wildlife crossings at these locations, the proposed structures provide ample natural light and accommodate the following:

At existing bridge locations:

- Wildlife crossing elevation to be a minimum of 1 foot above normal high water.
- Minimum flat horizontal clearance of 10 feet.
- Minimum vertical clearance of 8 feet.

At existing bridge culvert locations:

- Wildlife crossing elevation to be a minimum of 1 foot above normal high water.
- Minimum flat horizontal clearance of 3 feet
- Minimum vertical clearance of 6 feet.

3.6 Utility Requirements

The following utilities are in proximity to proposed bridge layouts:

SR 70 over Whidden Creek (Bridge # 040024)

- Florida Power & Light (FPL) Company: Overhead electric is located on the north side. Portion of the proposed riprap for the westbound bridge is located below the existing powerline. However, proposed relocated power lines do not pose any conflicts.
- Florida Gas Transmission (FGT) Company: Gas line is located outside of FDOT right-of-way on the south side and therefore does not pose any conflict.
- Comcast buried telephone line on the north side is within FDOT right-of-way but does not pose a conflict.
- CLink overhead telephone line on the south side is within FDOT right-of-way. Wooden poles conflict with proposed riprap for the eastbound bridge and will need to be relocated.
- Desoto County: 16" sanitary pipe is within FDOT right-of-way on the south side and near the proposed footprint of the eastbound bridge. This pipe will need to be relocated.

SR 70 over Joshua Creek (Bridge # 040027)

- Florida Power & Light (FPL) Company: Overhead electric is located on the north side and power lines do not pose any conflicts.
- Florida Gas Transmission (FGT) Company: Gas line is located outside of FDOT right-of-way on the south side and therefore does not pose any conflict.
- Comcast buried telephone line on the north side is within FDOT right-of-way but does not pose a conflict.
- CLink overhead telephone line on the south side is within FDOT right-of-way. Wooden poles conflict with proposed riprap for the eastbound bridge and will need to be relocated.
- Desoto County: 16" sanitary pipe is within FDOT right-of-way on the south side and near the proposed footprint of the eastbound bridge. This pipe will need to be relocated.

SR 70 over Tiger Bay (Bridge # 040031)

- Florida Power & Light (FPL) Company: Overhead electric is located on the south side within FDOT right of way, however power lines do not pose any conflicts.
- Florida Gas Transmission (FGT) Company: Gas line is located outside of FDOT right-of-way on the south side and therefore does not pose any conflict.
- Comcast buried telephone line is located on the south side within FDOT right-of-way. This buried telephone line is within the proposed footprint of the eastbound riprap bridge and will need to be relocated.
- CLink overhead telephone line on the south side is within FDOT right-of-way. Wooden poles conflict with proposed riprap for the eastbound bridge and will need to be relocated.
- Desoto County: 16" sanitary pipe is within FDOT right-of-way on the south side and near the proposed footprint of the eastbound bridge. This pipe will need to be relocated.

SR 70 over Mossy Gully (Bridge # 040032)

- Florida Power & Light (FPL) Company: Overhead electric is located on the south side within FDOT right of way, however power lines do not pose any conflicts.
- Florida Gas Transmission (FGT) Company: Gas line is located outside of FDOT right-of-way on the south side and therefore does not pose any conflict.
- Comcast buried telephone line is located on the north side within FDOT right-of-way. This buried telephone line is within the proposed footprint of the eastbound riprap bridge and will need to be relocated.
- CLink overhead telephone line on the south side is within FDOT right-of-way. Wooden poles conflict with proposed riprap for the eastbound bridge and will need to be relocated.

- Desoto County: 16" sanitary pipe is within FDOT right-of-way on the south side and near the proposed footprint of the eastbound bridge. This pipe will need to be relocated.

SR 70 over D.C.I Canal (Bridge # 040033)

- Florida Power & Light (FPL) Company: Overhead electric is located on the south side within FDOT right of way, however power lines do not pose any conflicts.
- Overhead electric is also located on the east side crossing SR70 but it's not in conflict with the proposed bridge.
- Florida Gas Transmission (FGT) Company: Gas line is located outside of FDOT right-of-way on the south side and therefore does not pose any conflict.
- Comcast buried telephone line on the north side is within FDOT right-of-way but does not pose a conflict.
- CLink overhead telephone line on the south side is within FDOT right-of-way. Wooden poles conflict with proposed riprap for the eastbound bridge and will need to be relocated.
- Desoto County: 16" sanitary pipe is within FDOT right-of-way on the south side and within the proposed footprint of the eastbound riprap bridge. This pipe will need to be relocated.

SR 70 over Long Point Marsh (Bridge # 040037)

- Florida Power & Light (FPL) Company: Overhead electric located on the north and south side are within FDOT right of way, however power lines do not pose any conflicts.
- Florida Gas Transmission (FGT) Company: Gas line is located outside of FDOT right-of-way on the south side and therefore does not pose any conflict.
- Comcast buried telephone line on the north side is within FDOT right-of-way but does not pose a conflict.
- CLink overhead telephone line on the south side is within FDOT right-of-way. Wooden poles conflict with proposed riprap for the eastbound bridge and will need to be relocated.

SR 70 over Parker Creek (Bridge # 040940)

- Florida Power & Light (FPL) Company: Overhead electric is located on the south side within FDOT right of way, however power lines do not pose any conflicts.
- Florida Gas Transmission (FGT) Company: Gas line is located outside of FDOT right-of-way on the south side and therefore does not pose any conflict.
- CLink buried telephone lines on the south side are within FDOT right-of-way. Buried lines conflict with proposed riprap for the eastbound bridge and will need to be relocated.

For further utility information refer to the utility plan sheets.

3.7 Constructability and Maintenance Requirements

The bridge alternatives have been evaluated for constructability. As mentioned previously, the proposed westbound bridges will be constructed off the existing alignment which allows significant areas for contractor staging. The construction laydown areas are at each end of the proposed bridge and are limited to by the FDOT right-of-way (see Figure 13).

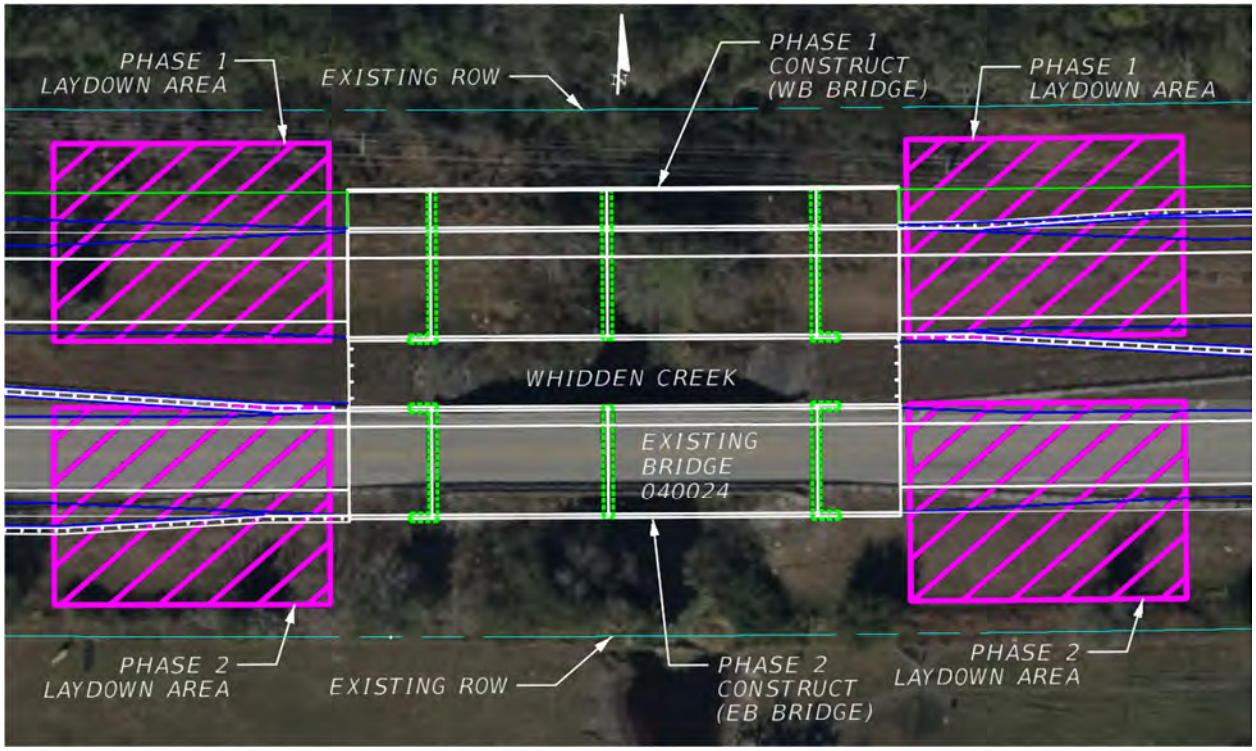


Figure 13: Construction Laydown Areas (Whidden Creek Shown, other bridges similar)

Substructure elements are similar for each alternative and can be constructed using common methods with pile delivery via truck and pile driving via crane mounted pile driving hammers. For superstructure alternatives, the heaviest element would be the 96-foot long 36-inch FIB. Weight of this beams should not pose an unreasonable challenge for common construction practices such as beam delivery via truck and beam erection via readily available cranes. Use of Florida-I Beams would require stay-in-place forms for the construction of the C.I.P. deck. Although the project location is remote, there is an existing ready-mix supplier within reasonably distance to the project location so set retarding admixtures should not be required for CIP concrete.

3.8 Lighting Requirements

There is currently no roadway lighting provided within the project limits. Lighting is not proposed on either of the bridges. If lighting becomes warranted along this segment in the future, the bridges will need to be retrofitted with light pole pedestals to support any required bridge mounted lighting structures.

3.9 Bicycle and Pedestrian Facilities

The project accommodates pedestrians and bicycles through a 14'-0" multi-use trail along the north side of the westbound SR 70 typical section at Whidden and Joshua bridge locations and along the south side of the eastbound SR 70 typical section at for the proposed bridges at the existing bridge culvert locations. Per FDM 260.2.2, the same 14'-0" multi-use trail width will be provided across the bridges. The requirements of the Americans with Disabilities Act (ADA) such as 2% maximum cross slope (FDM 222.2.1.3), 5% maximum longitudinal grade (FDM 266.3), and expansion joint widths will be met. Per District 1 direction, the pedestrian underpass at the east side of the proposed Jousha Creek bridge shall provide a minimum of 10'-0" pedestrians and bicycles wide path and a 10'-0" minimum vertical clearance to the proposed bridge low member. Per FDM 224.1.1, pedestrian underpass shall be placed and must remain free from standing water up to and including the 10-year storm event.

3.10 Other Considerations

Precast bridge elements considered for this project include Florida-I Beams, Florida Slab Beams, and square concrete piling. These elements are standard precast elements on FDOT projects and can be supplied from multiple precast manufacturers.

Precast bent caps were evaluated per the criteria of FDM 121.19.1 and are not considered feasible given the low production volume. Additionally, any reduction in construction duration by use of precast bent caps would not significantly reduce traffic impacts as the proposed bridge construction is off alignment in both phases and is not expected to have measurable impacts to traffic.

The proposed bridges are Category 1 per FDM 121.3.1 and do not meet the criteria for critical, landmark or signature bridges, therefore an evaluation of bridge security is not required per FDM 121.9.6. The criteria of FDM 260.5 recommends the use of separate structures if the open space between bridges is 20 feet or more. Given the provided open space of 25'-4" between the proposed bridges, separate structures are recommended at all bridge locations. This open space between the bridges also facilitates natural lighting for the wildlife crossings.

4. Superstructure Alternatives

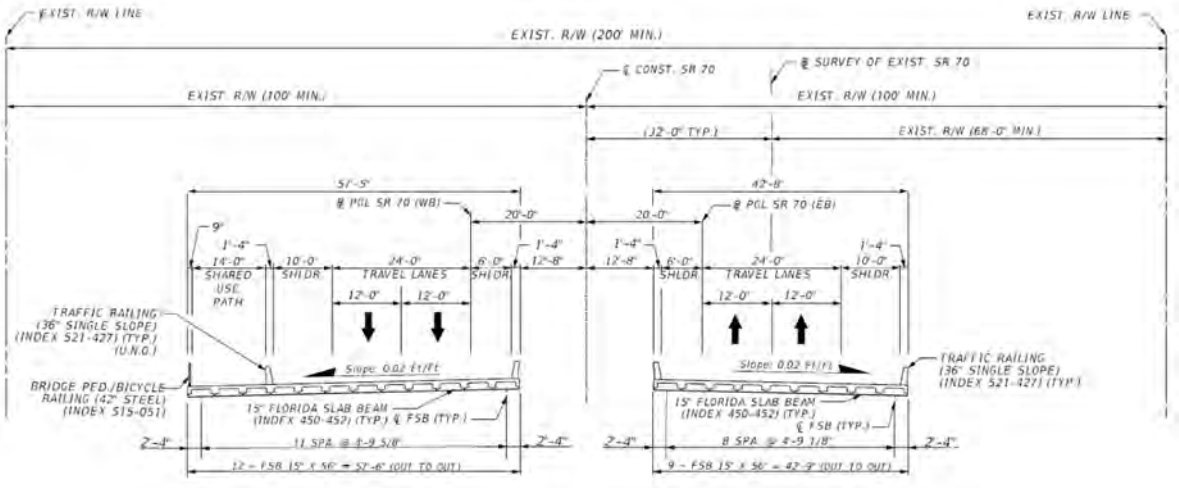
4.1 Bridge Superstructure Alternative No. 1 (FSB's)

For the bridges over Whidden Creek and Joshua Creek, bridge Alternative 1 consists of a three-span and a four-span configuration respectively. Geometrically, the proposed Whidden Creek bridge is 140' long (45'-50'-45') and Joshua Creek bridge is 180' long (45'-45'-45'-45'). Both bridges are not skewed. Span lengths have been sized to accommodate proposed wildlife crossings within the existing natural ground line of the channel and maintain a reasonable

distance from the existing bridge piles for the eastbound bridge. Span lengths at Joshua Creek have also been sized to accommodate the proposed pedestrian underpass.

All proposed bridges at the existing bridge culverts have a two-span configuration. Bridges over Tiger Bay have no skew and an overall bridge length of 76' (38'-38'). Bridges over Mossy Gully have a -15° skew and an overall bridge length of 96' (48'-48'). Bridges over D.C.I Canal will have and 15° skew and an overall bridge length of 76' (38'-38'). Bridges over Long Point Marsh have a 15° skew and an overall bridge length of 96' (48'-48'). Lastly, bridges over Parker Creek have no skew and an overall bridge length of 96' (48'-48'). Span lengths have been sized to maintain the existing channel and accommodate proposed wildlife crossings per Section 3.5 of this technical memorandum.

Bridge Alternative 1 investigates the use of FSB-15 for the superstructure. This alternative results in the shortest structure depth. The eastbound bridges at Whidden and Joshua Creek and the westbound bridges at the existing bridge culvert locations will have 9(nine) 56-inch-wide FSB-15s spaced at 4'-9 1/8" with 1 1/8" gaps between flanges. The westbound bridges at Whidden and Joshua Creek and the eastbound bridges at the existing bridge culvert locations will have 12(twelve) 56-inch-wide FSB-15s spaced at 4'-9 5/8" with 1 5/8" gaps between flanges. Bridges over Whidden Creek and Joshua Creek are over 100-feet in length and are therefore classified as "Long Bridges" per FDOT Structures Design Guidelines (SDG) 4.2.1. The CIP topping provided will be a minimum of 6.5". All other bridges are less than a 100-feet are therefore classified as "Short Bridges" requiring a 6" minimum CIP topping. All beam detailing for the FSB's is consistent with SPI FDOT Index 450-450. Refer to Figure 14-A and 14-B for details of the typical sections of Alternative 1.



TYPICAL SECTION
(BRIDGE OVER WHIDDEN CREEK)
(BRIDGE OVER JOSHUA CREEK)

Figure 14-A: Alternative 1 Typical Sections - Bridges over Whidden and Joshua Creek

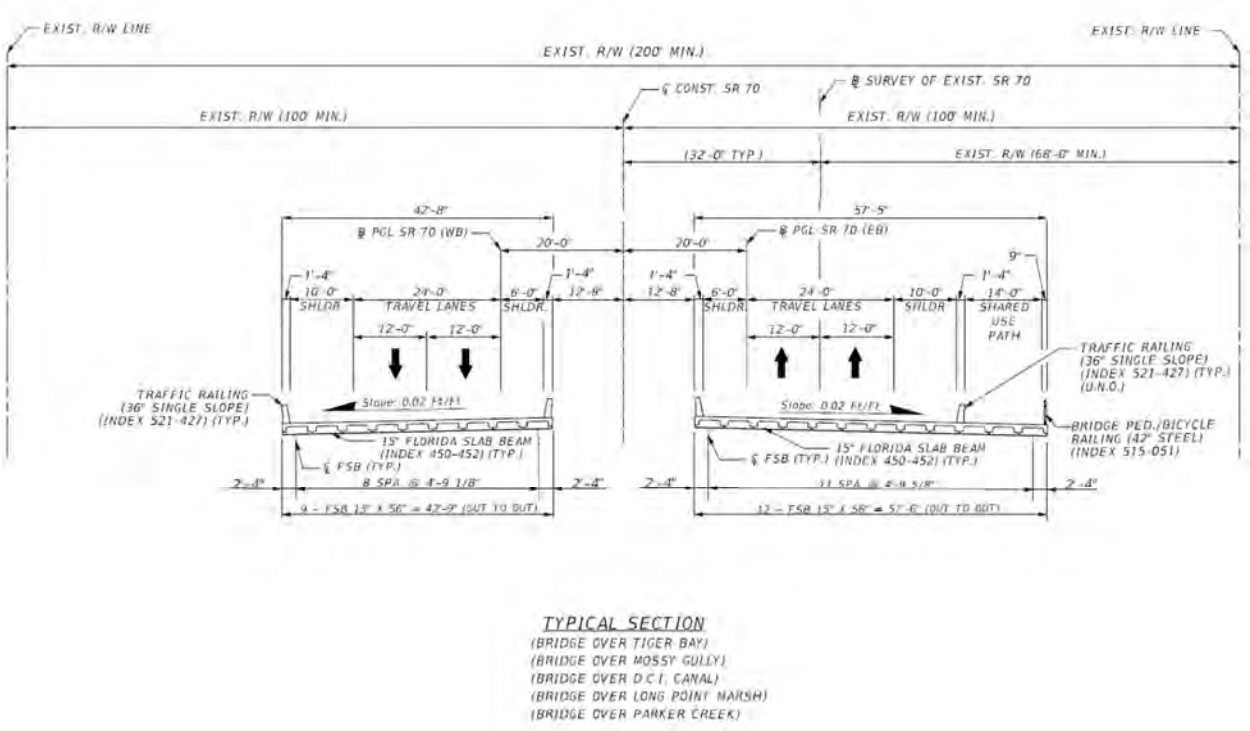


Figure 14-B: Alternative 1 Typical Sections - Bridges over Existing Bridge Culverts

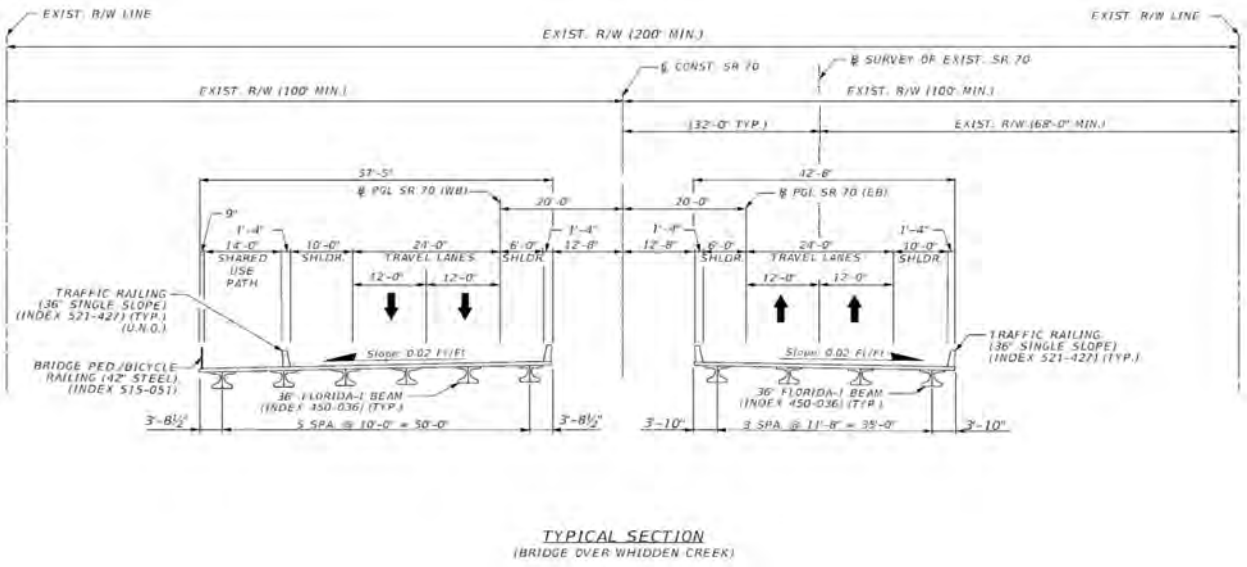
4.2 Bridge Superstructure Alternative No. 2 (FIB's)

For the bridges over Whidden Creek and Joshua Creek, bridge Alternative 2 consists of a two-span configuration. Geometrically, the proposed Whidden Creek bridge is 140' long (64'-76') and Joshua Creek bridge is 180' long (90'-90'). Both bridges are not skewed. Span lengths have been sizes to accommodate proposed wildlife crossings within the existing natural ground line of the channel and maintain a reasonable distance from the existing bridge piles for the eastbound bridge. Span lengths at Joshua Creek have also been sized to accommodate the proposed pedestrian underpass.

All proposed bridges at the existing bridge culverts have a single span configuration. Bridges over Tiger Bay have no skew and an overall bridge length of 76'. Bridges over Mossy Gully have a -15° skew and an overall bridge length of 96'. Bridges over D.C.I Canal will have and 15° skew and an overall bridge length of 76'. Bridges over Long Point Marsh have a 15° skew and an overall bridge length of 96'. Lastly, bridges over Parker Creek have no skew and an overall bridge length of 96'. Span lengths have been sized to maintain the existing channel and accommodate proposed wildlife crossings per Section 3.5 of this technical memorandum.

Bridge Alternative 2 investigates the use of 36-inch Florida-I Beams (FIB-36) for the superstructure. This alternative results in the tallest structure depth. Beam spacing has been optimized in four unique typical sections.

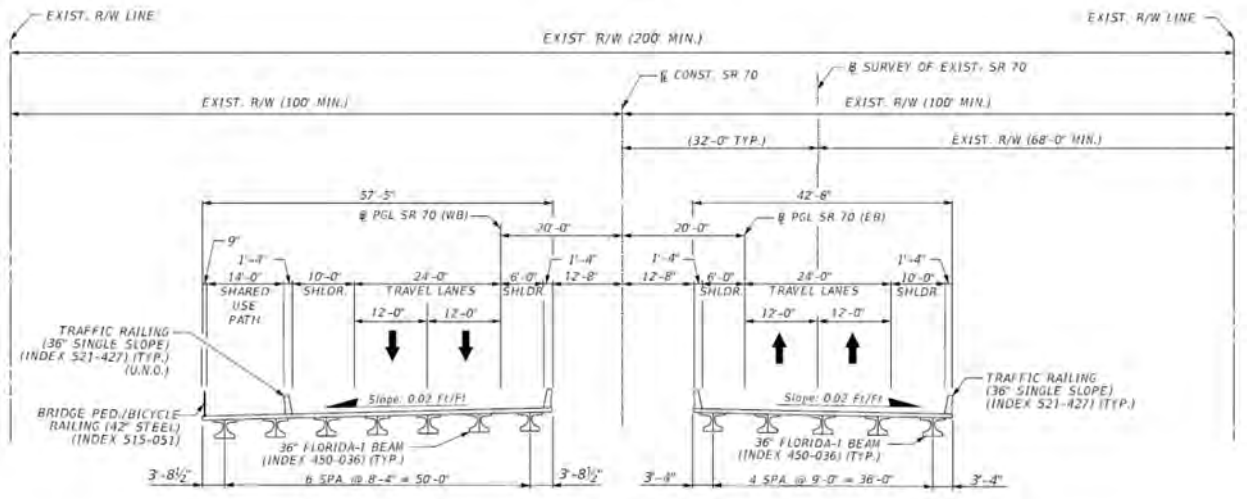
Bridges over Whidden Creek: The westbound bridge will have six (6) FIB-36s spaced at 10'-0" with 3'-8 1/2" deck overhangs. The eastbound bridge will have four (4) FIB-36s spaced at 11'-8" with 3'-10" deck overhangs. Refer to Figure 15-A for details of the typical section.



TYPICAL SECTION
(BRIDGE OVER WHIDDEN CREEK)

Figure 15-A: Alternative 2 Typical Section – Bridge over Whidden Creek

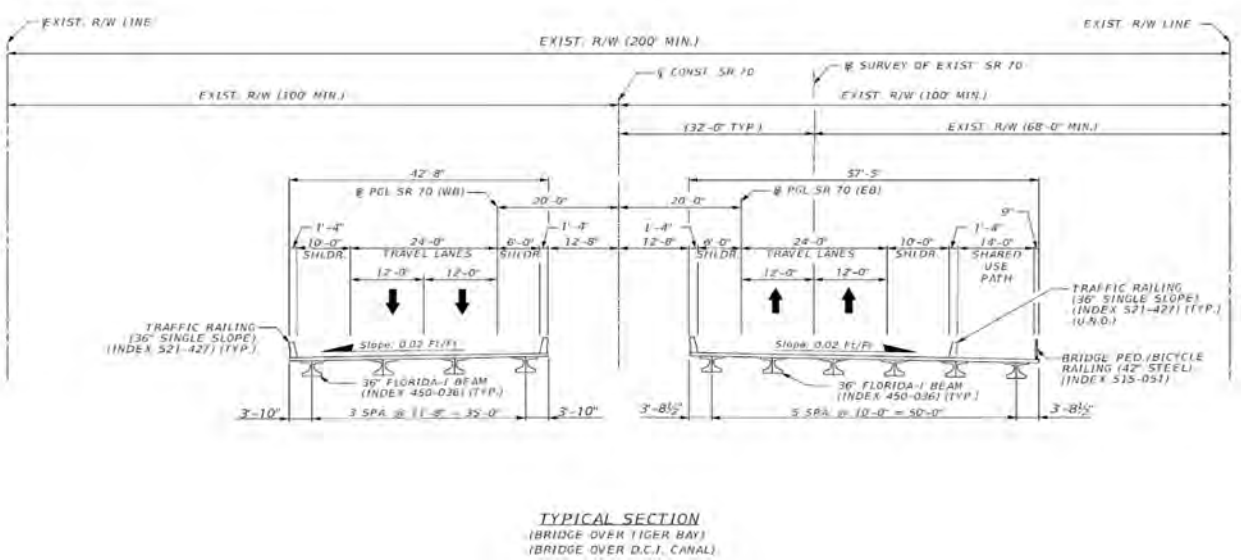
Bridges over Joshua Creek: The westbound bridge will have seven (7) FIB-36s spaced at 8'-4" with 3'-8 1/2" deck overhangs. The eastbound bridge will have five (5) FIB-36s spaced at 9'-0" with 3'-4" deck overhangs. Refer to Figure 15-B for details of the typical section.



TYPICAL SECTION
(BRIDGE OVER JOSHUA CREEK)

Figure 15-B: Alternative 2 Typical Section - Bridge over Joshua Creek

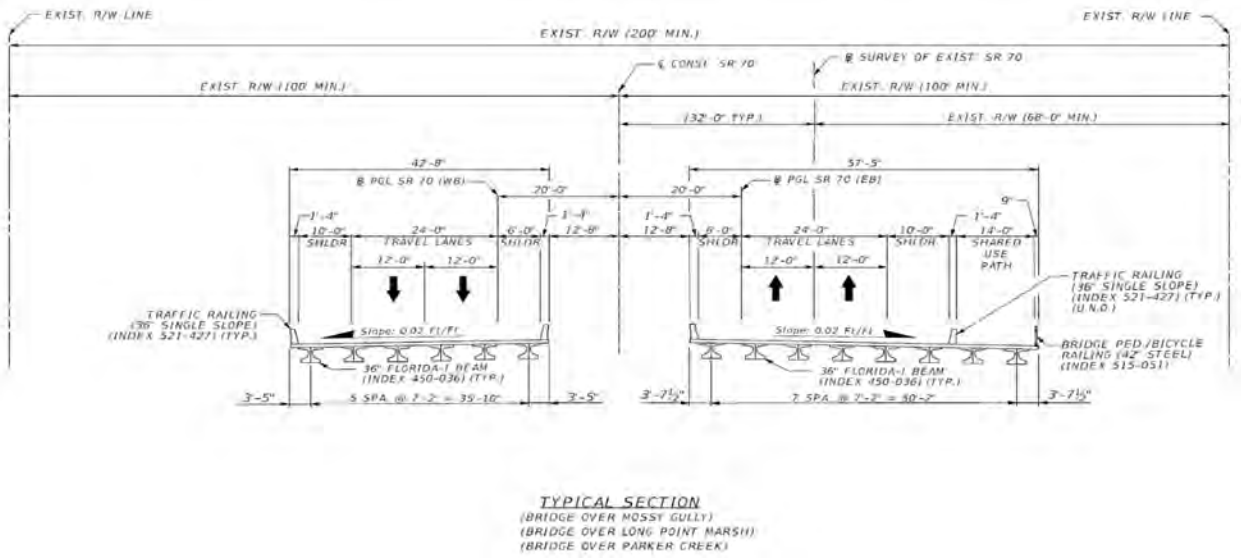
Bridges over Tiger Bay & D.C.I Canal: The westbound bridge will have four (4) FIB-36s spaced at 11'-8" with 3'-10" deck overhangs. The eastbound bridge will have six (6) FIB-36s spaced at 10'-0" with 3'-8 1/2" deck overhangs. Refer to Figure 16-A for details of the typical section.



TYPICAL SECTION
(BRIDGE OVER TIGER BAY)
(BRIDGE OVER D.C.I. CANAL)

Figure 16-A: Alternative 2 Typical Section: Bridges over Tiger Bay and D.C.I. Canal

Bridges over Mossy Gully, Long Point Marsh & Parker Creek: The westbound bridge will have six (6) FIB-36s spaced at 7'-2" with 3'-5" deck overhangs. The eastbound bridge will have eight (8) FIB-36s spaced at 7'-2" with 3'-7 1/2" deck overhangs. Refer to Figure 16-B for details of the typical section.



TYPICAL SECTION
(BRIDGE OVER MOSSY GULLY)
(BRIDGE OVER LONG POINT MARSH)
(BRIDGE OVER PARKER CREEK)

Figure 16-B: Alternative 2 Typical Section: Bridge over Mossy Gully, Long Point Marsh & Parker Creek

A cast-in-place concrete deck is proposed over all beams for both bridges. Bridge over Whidden Creek and Joshua Creek are over 100-feet in length and are therefore classified as "Long Bridges" per FDOT Structures Design Guidelines (SDG) 4.2.1. The CIP concrete bridge deck thickness will be 8.5" per SDG 4.2.2.A. All other bridges are less than 100-feet in length and are therefore classified as "Short Bridges" requiring an 8" minimum bridge deck thickness. Alternative 1 and Alternative 2 will accommodate typical sections and wildlife crossings as described under Section "2.3 Project Description" and Section "3.5 Wildlife Connectivity", respectively. The bridge decks are to be planed and grooved transversely per SDG 4.2.3 and FDOT Construction Specifications 400-15. The multi-use trail portion of the bridges will not be grooved transversely. Expansion joints consisting of poured joints with backer rods (FDOT Index 458-110) are anticipated.

5. Foundation and Substructure Alternatives

5.1 Geotechnical Investigation and Environmental Classifications

A geotechnical investigation has been completed and a Bridge Geotechnical Report has been submitted to the District 1 Geotechnical Office. Bridge Environmental Classification are listed in the Table 3.

Table 3: Bridge Environmental Classification

SR 70 over:	Superstructure	Substructure Concrete	Substructure Steel
Whidden Creek	Slightly Aggressive	Moderately Aggressive	Extremely Aggressive
Joshua Creek	Slightly Aggressive	Moderately Aggressive	Extremely Aggressive
Tiger Bay	Slightly Aggressive	Slightly Aggressive	Moderately Aggressive
Mossy Gully	Slightly Aggressive	Moderately Aggressive	Extremely Aggressive
D.C.I Canal	Slightly Aggressive	Moderately Aggressive	Extremely Aggressive
Long Point Marsh	Slightly Aggressive	Moderately Aggressive	Moderately Aggressive
Parker Creek	Slightly Aggressive	Moderately Aggressive	Moderately Aggressive

For complete geotechnical reports see Appendix E.

5.2 Shallow Foundations at End Bents

Shallow foundations such as spread footings or Geosynthetic Reinforced (GRS) abutments are dependent on the nominal bearing resistance of the founding soils and total and differential settlements. Differential settlements may exceed acceptable limits between bridge ends. As mentioned in the Bridge Geotechnical Reports, the upper soils encountered in the borings are very loose to loose. Based on the anticipated loading conditions for roadway bridges of this size, a shallow footing would have to be relatively large for bearing capacity and settlement

criteria to be achieved or would require some form of subsurface remediation to increase the bearing capacity and decrease settlement potential. Another obstacle to the use of shallow foundations is the potential for disruption of the founding soils if the nearby utilities are to be serviced. For these reasons, shallow foundations are not considered a feasible option and are not considered further.

5.3 Deep Foundations at End Bents and Intermediate Bents

There are multiple deep foundation options which may be feasible such as drilled shafts, driven steel piles and driven concrete piles. Each are discussed in detail within this section. Additional information can be found in the Geotechnical Reports, Appendix E.

Drilled shaft foundations offer the benefits of providing large axial and lateral capacities with a single unit and can be installed with less vibration than driven piles. A drawback of drilled shafts is their effectiveness is highly reliant on construction procedures and quality control. Drilled shafts are typically used in locations where there are rock or very dense soil layers at shallow depths. The borings for these bridge sites typically do not provide rock or dense bearing layers of sufficient thickness at shallow depths, the rural setting does not demand reduced construction vibration, and the superstructure configurations under consideration do not impart large loads to require drilled shafts. For these reasons, drilled shafts are not considered a feasible option and are not considered further.

Driven steel piles such as H-piles or pipe piles are low displacement piles and offer the benefit of being easily spliced in the case of highly variable soils in which production pile lengths may vary from those anticipated by design or if required pile lengths become too long to ship. Additionally, steel piles are more easily driven through dense soil layers and their low displacement nature allows them to be installed with less vibration than high displacement piles. The drawbacks of steel piles are the required sacrificial thickness due to corrosion and the higher cost/capacity versus driven concrete piles. For these reasons and considering the extremely aggressive steel substructures environmental classification at multiple bridge locations, steel H-piles will not be considered further.

Driven Precast Prestressed Concrete (PSC) piles are commonly used as bridge foundations in Florida and the Bridge Geotechnical Report notes that the PSC piles generally offer a lower cost per ton of capacity than other pile types. The drawbacks of PSC piles are complex splicing and high vibration levels during installation. The rural setting of this project does not demand reduced construction vibration. Given the site soil profiles and relatively small, anticipated pile reactions for these bridges, 18-inch PSC piles will be utilized for the preliminary design of all bridge foundations.

6. Geometry

6.1 Horizontal Alignments and Vertical Profiles

For horizontal alignments and vertical profiles refer to the plan and elevation sheets provided in Appendix C.

6.2 Horizontal and Vertical Clearances

None of the bridges are designated as navigable channels, therefore the horizontal and vertical clearances were set based on the requirements of the pedestrian underpass, wildlife crossing discussed in Section 3.5 and the 2' drainage drift vertical clearance required per FDM 260.8.1. Both alternatives meet the minimum recommended horizontal and vertical requirements.

7. Retaining Wall Justification Report

Bridges over Whidden creek require MSE walls on the north side of the westbound bridge at begin and end bridge to accommodate the proposed typical section within the right-of-way. Preliminary calculations require an overall MSE wall length of 248' with an average exposed height of approximately 8' on the northwest side. Similarly, the northeast side requires an MSE wall length of 325' with an average exposed height of approximately 10'. All other end bents at Whidden creek will utilize parallel wingwalls with standard slope protections. Wingwalls for the recommended alternative 2 (FIB's) require pile support and the details and cost estimates reflect those conditions.

Bridges over Joshua creek require wrap around MSE walls at begin and end of bridge to accommodate the proposed typical section and the pedestrian underpass within the right-of-way. Preliminary calculations require an overall MSE wall length of 666' on the northwest and 480' on the southwest side. Similarly, the northeast side requires an MSE wall length of 565' and 495' on the southeast side. These MSE walls have an average exposed height of approximately 9' to 10'. On the northeast side, a gravity wall with an approximate length of 640' is needed to accommodate the approach of the shared use path to the bridge underpass.

Proposed bridges at the existing five bridge culvert locations do not require the use of MSE walls. Preliminary slope protections were considered and maintained within the right-of-way. Certain locations in the proximity of these five bridges require gravity walls outside the footprint of the roadway typical section to avoid encroaching in the right-of-way and will be further investigated upon completion of the bridge hydraulic reports (BHR's). Upon the approval of the BHR's, slope protection details will be reevaluated, and any need of walls will be considered further at that time.

Per SDG 3.13.2.B, the use of coarse aggregate may be required given the Design High Water (DWH) elevation is above the adjacent MSE wall ground surface. During plans development, this will be investigated further, and the appropriate MSE backfill material will be identified.

The cost of the MSE walls, gravity walls and fill between the two alternatives was considered when comparing the overall cost of both alternatives and is included on the "Bridge Cost Analysis Summary" table in Appendix A. Temporary retaining walls are not anticipated to be required to facilitate construction of the bridges.

8. Quantities and Engineer's Cost Estimates

Quantities and cost estimates were developed and are presented in Appendix B. Cost estimates are based per BDR Cost Estimating in SDG Chapter 9 and historical FDOT bid tabulations. The cost of raising the roadway profile for Alternative 2 (FIB's) higher than the profile for Alternative 1 (FSB's) has been included in the overall cost comparison analysis. Cost estimates for both Alternatives are presented in Figure 19 below.

SR 70 Seg 9-10
Bridge Cost Analysis Summay

FSB Alternative

Bridge Crossing	Span Lengths	Bridge Skew	FSB WB	FSB EB	Total Cost EB & WB ($)	Total Bridge (SF)	Cost per Square Foot
WHIDDEN CREEK	45-50-45	0	$2,292,028	$1,778,965	$4,070,992	14012	$291
JOSHUA CREEK	45-45-45-45	0	$3,000,567	$2,327,662	$5,328,228	18015	$296
TIGER BAY	38-38	0	$1,243,275	$1,502,518	$2,745,792	7606	$361
MOSSY GULLY	48-48	-15	$1,494,271	$1,896,676	$3,390,948	9608	$353
D.C.I. CANAL	38-38	15	$1,291,205	$1,652,121	$2,943,326	7606	$387
LONG POINT MARSH	48-48	15	$1,370,476	$1,753,970	$3,124,446	9608	$325
PARKER CREEK	48-48	0	$1,282,440	$1,527,417	$2,809,857	9608	$292
			Total Cost (FSB's Alternative) =		$24,413,589	76063	$321

FIB Alternative

Bridge Crossing	Span Lengths	Bridge Skew	FIB WB	FIB EB	Total Cost EB & WB ($)	Total Bridge (SF)	Cost per Square Foot
WHIDDEN CREEK	64-76	0	$1,943,862	$1,450,364	$ 3,394,225	14012	$242
JOSHUA CREEK	90-90	0	$2,395,648	$1,796,717	$ 4,192,365	18015	$233
TIGER BAY	76	0	$848,034	$1,131,887	$ 1,979,920	7606	$260
MOSSY GULLY	96	-15	$1,081,948	$1,424,173	$ 2,506,121	9608	$261
D.C.I. CANAL	76	15	$881,084	$1,195,762	$ 2,076,847	7606	$273
LONG POINT MARSH	96	15	$989,913	$1,302,829	$ 2,292,742	9608	$239
PARKER CREEK	96	0	$916,844	$1,194,132	$ 2,110,976	9608	$220
			Total Bridge Cost (FIB's Alternative) =		$18,553,196	76063	$244
			Additional Roadway Cost, Fill & Retaining Walls (FIB Alternative) =		$2,885,327		
			Total Cost FIB ALternative =		$21,438,522		

Overall cost saving for the FIB Alternative = $2,975,067

1. Costs shown on the tables above include the cost for the bridge & approach slabs only.
2. The additional cost shown for Fill & Retaining Walls is the differece between the two Alternative FIB's vs. FSB's.

Figure 17: Bridge Cost Analysis Summary

9. Conclusions and Recommendations

Although both alternatives meet the minimum project criteria, Alternative 2 (FIB's) is recommended for the construction of the proposed new bridges. Proposed end bents and intermediate bents will utilize deep foundations supported on either 18-inch or 24-inch precast concrete piles. The Bridge Cost Analysis Summary shows significant cost saving of $2,975,065 in comparison to the Alternative 1 (FSB's) even after considering the additional cost for MSE, gravity walls and fill due to higher profiles required to accommodate recommended alternative.

This finding is consistent with the historical bridge cost estimate range shown on SDG 9.2.3, where medium span FIB bridges are more economical than short span FSB bridges on both, the low and high range cost per bridge SF.

Alternative 2 (FIB's) utilize one fewer Intermediate bent at each bridge location for both eastbound and westbound bridges at all water crossings except for the Joshua creek bridge where two fewer intermediate bents are utilized. The substructure and foundation savings, plus the lower cost of the FIB's themselves vs. FSB's in general, make the FIB's clearly the best value alternative.

APPENDIX – A

QUANTITY AND COST ESTIMATE COMPUTATIONS

Project: SR 70: Segment 9-10	**Job No:** 75614	**Design Criteria Document:** FDOT Structures Manual
Client: Desoto County – District 1	**Discipline:** Structures	**Calculation No:** 1

Name or Description of Calculation: Estimated Bridge Costs

Note: Unique QF 06 to be created for each revision of a calculation.

Calc. Rev. No.	Description of Change (i.e., Original Issue or description of changes since last revision)	Confirmation required with other deliverables (Y/N)	List Deliverables for which confirmation is required (NA if none) Add additional rows as necessary	Confirmation Verified by Originator of Calc for each deliverable listed (Y/N)

Calculation Objective: Calculate BDR level cost estimates and compare alternates at each bridge site.

Calculation Methodology/List of Assumptions:

- Costs for items in the BDR spreadsheet are determined using preliminary quantities.
- FSB unit cost is interpolated based on the width of the FSB
- Quantities for each bridge are calculated based on two alternatives:
  - Span lengths based on using Florida Slab Beams 15-inch.
  - Florida I-Beams 36-inch to minimize the number of spans.

References/Inputs:

- Calculated quantities for Alternate 1 (FSB15) and Alternate 2 (FIB36)
- Calculations to estimate number and length of piles at each bridge location.
- Pile Capacity Curves at each bridge location.

Attachments: (List each attachment following the subject calculation)

Conclusions: Based on the cost comparison, Alternate 2 (FIB36) is the recommended alternative.

Document Check:	Name:	Signature:	Date:
Originator:	George Vaso	GGV	06/25
Checker:	Charles Boyd/ Zaid Haddad	CEB/ZHY	06/25
Backchecker:	George Vaso	GGV/ZYH	06/25
Updater:	George Vaso	GGV/ZYH	06/25
Verifier:	Charles Boyd/ Zaid Haddad	CEB/ZYH	06/25

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FLORIDA SLAB BEAM COST ESTIMATE ALTERNATIVE

SR 70 OVER WHIDDEN CREEK COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	2331	$396,270
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$396,270

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	81.0	$162,053
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$162,053

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	11,749	$17,623
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$17,623

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$575,947**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.		**Subtotal**	

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**13.4**	**$21,511**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**1500**	**$744,834**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$744,834**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	219	$307,138
[1] Including cost of shrinkage reducing admixture.		Subtotal	$307,138

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	44,974	$62,963
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$62,963

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**280**	**$56,000**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**	**140**	**$25,200**
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$81,200**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**230**	**$22,967**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$22,967**

Superstructure Subtotal **$1,219,102**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00	851.7	$7,665
Bridge Deck Grooving for Short Bridge	$12.00		
Bridge Deck Grooving for Long Bridge	$8.00	622.2	$4,978
	Grooving and Planing Subtotal		$12,643

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	383	$344,500
Carbon Reinforcing Steel (per Pound)	$1.50	25,519	$38,278
Railing Type 36" Single-Slope (per Lin. Foot)	$200	120.0	$24,000
Panel/Picket Railing (42") steel (Type 1 & 2) (per Lin. Foot)	$180	60.0	$10,800
	Approach Slab Subtotal		$417,578

Unadjusted Total	$2,225,269

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %.	3%	$66,758
For construction over traffic and/or phased construction, increase by 20 %. [1]		
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$66,758

Substructure Subtotal	$575,947
Superstructure Subtotal	$1,219,102
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$12,643
Detour Bridge Subtotal	
Approach Slab Subtotal	$417,578
Conditional Variables	$66,758
Total Cost	$2,292,028

Total Square Feet of Deck	8038

Cost per Square Foot (not including Approach Slab)	$233

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	81.0	11,749
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	219	44,974
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	128	25,519

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction

2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$233**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1740	$295,800
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$295,800

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	66.9	$133,825
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$133,825

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	9,702	$14,553
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$14,553

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$444,179**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.		**Subtotal**	

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**11.0**	**$17,600**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**1227**	**$609,410**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$609,410**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	167	$233,587
[1] Including cost of shrinkage reducing admixture.		Subtotal	$233,587

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	34,204	$47,885
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$47,885

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers

Traffic Railings [1]	Cost per Lin. Foot	Quantity	Cost
32" Vertical Face	$170		
42" Vertical Face	$190		
36" Single-Slope Median	$190		
36" Single-Slope	$200	280	$56,000
42" Single-Slope	$260		
Thrie Beam Retrofit	$330		
Thrie Beam Panel Retrofit	$200		
Vertical Face Retrofit	$230		
Rectangular Tube Retrofit	$190		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	$120		
Single Bullet Railing [1]	$80		
Double Bullet Railing [1]	$100		
Panel/Picket Railing (42") steel (Type 1 & 2)	$180		
Panel/Picket Railing (42") steel (Type 3-5)	$240		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	$130		
Panel/Picket Railing (42") aluminum (Type 3-5)	$200		
Panel/Picket Railing (48") steel (Type 1 & 2)	$210		
Panel/Picket Railing (48") steel (Type 3-5)	$270		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	$160		
Panel/Picket Railing (48") aluminum (Type 3-5)	$220		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		Subtotal	$56,000

8. Expansion Joints

Type	Cost per Lin. Foot	Quantity	Cost
Poured Joint With Backer Rod	$100	171	$17,067
Strip Seal	$550		
Finger Joint < 6"	$1,900		
Finger Joint > 6"	$3,300		
Modular 6"	$1,100		
Modular 8"	$1,600		
Modular 12"	$2,000		
		Subtotal	$17,067

Superstructure Subtotal **$963,949**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00	622.2	$5,600
Bridge Deck Grooving for Short Bridge	$12.00		
Bridge Deck Grooving for Long Bridge	$8.00	622.2	$4,978
	Grooving and Planing Subtotal		$10,578

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	284	$256,000
Carbon Reinforcing Steel (per Pound)	$1.50	18,963	$28,444
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	120.0	$24,000
	Approach Slab Subtotal		$308,444

Unadjusted Total	$1,727,150

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	Increase/	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$51,815
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$51,815

Substructure Subtotal	$444,179
Superstructure Subtotal	$963,949
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$10,578
Detour Bridge Subtotal	
Approach Slab Subtotal	$308,444
Conditional Variables	$51,815
Total Cost	$1,778,965

Total Square Feet of Deck	5973
Cost per Square Foot (not including Approach Slab)	$246

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	66.9	9,702
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	167	34,204
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	94.8	18,963

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction

2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$246**

SR 70 OVER
JOSHUA CREEK
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	4062	$690,540
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$690,540

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	**$1,900**		
48 in	**$2,000**		
60 in	**$2,500**		
72 in	**$3,200**		
84 in	**$3,600**		
96 in	**$4,400**		
108 in	**$5,000**		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	**$450**		
48 in	**$500**		
60 in	**$650**		
72 in	**$800**		
84 in	**$1,000**		
96 in	**$1,200**		
108 in	**$1,400**		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	**$1,800**		
Mass Concrete Class II [1]	**$1,600**		
Concrete Class IV [1]	**$2,000**	**100.2**	**$200,442**
Mass Concrete Class IV [1]	**$1,500**		
Seal Concrete [1]	**$1,600**		
Bulkhead Concrete [1]	**$2,400**		
		Subtotal	$200,442

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	**$1.50**	**14,532**	**$21,798**
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	**$1.90**		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	**$7.00**		
Post-tensioning Steel, Strand - Grout Filler	**$16**		
Post-tensioning Steel, Bar - Grout Filler	**$20**		
Post-tensioning Steel, Strand - Flexible Filler	**$48**		
Post-tensioning Steel, Bar - Flexible Filler	**$60**		
		Subtotal	**$21,798**

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	**$1.50**		
#4 bar	**$2.00**		
#5 bar	**$2.30**		
#6 bar	**$2.70**		
#7 bar	**$3.50**		
#8 bar	**$4.50**		
#9 bar	**$5.80**		
#10 bar	**$7.20**		
#11 bar	**$8.50**		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$912,780**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**17.9**	**$28,681**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**1927**	**$956,994**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$956,994**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000
[2] Interpolate between given prices for intermediate width FSBs.
[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	282	$395,399
[1] Including cost of shrinkage reducing admixture.		Subtotal	$395,399

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	57,898	$81,057
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$81,057

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers

Traffic Railings [1]	Cost per Lin. Foot	Quantity	Cost
32" Vertical Face	$170		
42" Vertical Face	$190		
36" Single-Slope Median	$190		
36" Single-Slope	$200	360	$72,000
42" Single-Slope	$260		
Thrie Beam Retrofit	$330		
Thrie Beam Panel Retrofit	$200		
Vertical Face Retrofit	$230		
Rectangular Tube Retrofit	$190		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	$120		
Single Bullet Railing [1]	$80		
Double Bullet Railing [1]	$100		
Panel/Picket Railing (42") steel (Type 1 & 2)	$180	180	$32,400
Panel/Picket Railing (42") steel (Type 3-5)	$240		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	$130		
Panel/Picket Railing (42") aluminum (Type 3-5)	$200		
Panel/Picket Railing (48") steel (Type 1 & 2)	$210		
Panel/Picket Railing (48") steel (Type 3-5)	$270		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	$160		
Panel/Picket Railing (48") aluminum (Type 3-5)	$220		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$104,400**

8. Expansion Joints

Type	Cost per Lin. Foot	Quantity	Cost
Poured Joint With Backer Rod	$100	287	$28,708
Strip Seal	$550		
Finger Joint < 6"	$1,900		
Finger Joint > 6"	$3,300		
Modular 6"	$1,100		
Modular 8"	$1,600		
Modular 12"	$2,000		
		Subtotal	**$28,708**

Superstructure Subtotal **$1,566,558**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00	1095.0	$9,855
Bridge Deck Grooving for Short Bridge	$12.00		
Bridge Deck Grooving for Long Bridge	$8.00	800.0	$6,400
	Grooving and Planing Subtotal		$16,255

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	383	$344,500
Carbon Reinforcing Steel (per Pound)	$1.50	25,519	$38,278
Railing Type 36" Single-Slope (per Lin. Foot)	$200	120.0	$24,000
Panel/Picket Railing (42") steel (Type 1 & 2) (per Lin. Foot)	$180	60.0	$10,800
	Approach Slab Subtotal		$417,578

Unadjusted Total	$2,913,171

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$87,395
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$87,395

Substructure Subtotal	$912,780
Superstructure Subtotal	$1,566,558
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$16,255
Detour Bridge Subtotal	
Approach Slab Subtotal	$417,578
Conditional Variables	$87,395
Total Cost	$3,000,567

Total Square Feet of Deck	10335

Cost per Square Foot (not including Approach Slab)	$250

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	100.2	14,532
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	282	57,898
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	128	25,519

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$250**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	3018	$513,060
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$513,060

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	83.9	$167,838
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$167,838

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	12,168	$18,252
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$18,252

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$699,150**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type

Neoprene Bearing Pads	Cost per Cubic Foot	Quantity	Cost
Composite Neoprene Bearing Pads	$1,800		
Plain Neoprene Bearing Pads	$1,600	14.7	$23,467
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	$10,000		
251- 500	$12,000		
501- 750	$14,000		
751-1000	$15,000		
1001-1250	$16,000		
1251-1500	$18,000		
1501-1750	$21,000		
1751-2000	$24,000		
>2000	$27,000		
		Subtotal	

2. Bridge Girders

Structural Steel (includes coating costs)	Cost per Pound	Quantity	Cost
Plate Girders, Straight [1]	$4.60		
Plate Girders, Curved [1]	$5.50		
Box Girders, Straight [1]	$5.50		
Box Girders, Curved [1]	$6.00		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	Cost per Lin. Foot	Quantity	Cost
Florida U-Beam; 48" [1]	$1,100		
Florida U-Beam; 54" [1]	$1,200		
Florida U-Beam; 63" [1]	$1,250		
Florida U-Beam; 72" [1]	$1,300		
Florida Slab Beam 12" x 48" [2]	$340		
Florida Slab Beam 12" x 60" [2]	$410		
Florida Slab Beam 15" x 48" [2]	$410		
Florida Slab Beam 15" x 56"	$497	1577	$782,995
Florida Slab Beam 15" x 60" [2]	$540		
Florida Slab Beam 18" x 48" [2]	$500		
Florida Slab Beam 18" x 60" [2]	$640		
AASHTO Type II Beam	$280		
Florida-I Beam; 36	$350		
Florida-I Beam; 45	$380		
Florida-I Beam; 54	$410		
Florida-I Beam; 63	$440		
Florida-I Beam; 72	$470		
Florida-I Beam; 78	$480		
Florida-I Beam; 84	$500		
Florida-I Beam; 96	$540		
		Subtotal	$782,995

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	215	$300,699
		Subtotal	$300,699

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	44,031	$61,643
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$61,643

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers

Traffic Railings [1]	Cost per Lin. Foot	Quantity	Cost
32" Vertical Face	$170		
42" Vertical Face	$190		
36" Single-Slope Median	$190		
36" Single-Slope	$200	360	$72,000
42" Single-Slope	$260		
Thrie Beam Retrofit	$330		
Thrie Beam Panel Retrofit	$200		
Vertical Face Retrofit	$230		
Rectangular Tube Retrofit	$190		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	$120		
Single Bullet Railing [1]	$80		
Double Bullet Railing [1]	$100		
Panel/Picket Railing (42") steel (Type 1 & 2)	$180		
Panel/Picket Railing (42") steel (Type 3-5)	$240		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	$130		
Panel/Picket Railing (42") aluminum (Type 3-5)	$200		
Panel/Picket Railing (48") steel (Type 1 & 2)	$210		
Panel/Picket Railing (48") steel (Type 3-5)	$270		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	$160		
Panel/Picket Railing (48") aluminum (Type 3-5)	$220		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		Subtotal	$72,000

8. Expansion Joints

Type	Cost per Lin. Foot	Quantity	Cost
Poured Joint With Backer Rod	$100	213	$21,333
Strip Seal	$550		
Finger Joint < 6"	$1,900		
Finger Joint > 6"	$3,300		
Modular 6"	$1,100		
Modular 8"	$1,600		
Modular 12"	$2,000		
		Subtotal	$21,333

Superstructure Subtotal **$1,238,671**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00	800.0	$7,200
Bridge Deck Grooving for Short Bridge	$12.00		
Bridge Deck Grooving for Long Bridge	$8.00	800.0	$6,400
	Grooving and Planing Subtotal		$13,600

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	284	$256,000
Carbon Reinforcing Steel (per Pound)	$1.50	18,963	$28,444
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	120.0	$24,000
	Approach Slab Subtotal		$308,444

Unadjusted Total	$2,259,866

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %.	3%	$67,796
For construction over traffic and/or phased construction, increase by 20 %. [1]		
	3%	$67,796

[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.

Substructure Subtotal	$699,150
Superstructure Subtotal	$1,238,671
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$13,600
Detour Bridge Subtotal	
Approach Slab Subtotal	$308,444
Conditional Variables	$67,796
Total Cost	$2,327,662

Total Square Feet of Deck	7680

Cost per Square Foot (not including Approach Slab)	$263

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	83.9	12,168
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	215	44,031
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	95	18,963

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$263**

SR 70 OVER
TIGER BAY
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1571	$267,070
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$267,070

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	**$1,900**		
48 in	**$2,000**		
60 in	**$2,500**		
72 in	**$3,200**		
84 in	**$3,600**		
96 in	**$4,400**		
108 in	**$5,000**		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	**$450**		
48 in	**$500**		
60 in	**$650**		
72 in	**$800**		
84 in	**$1,000**		
96 in	**$1,200**		
108 in	**$1,400**		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	**$1,800**		
Mass Concrete Class II [1]	**$1,600**		
Concrete Class IV [1]	**$2,000**	**49.9**	**$99,717**
Mass Concrete Class IV [1]	**$1,500**		
Seal Concrete [1]	**$1,600**		
Bulkhead Concrete [1]	**$2,400**		
		Subtotal	$99,717

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	**$1.50**	**7,229**	**$10,844**
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	**$1.90**		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	**$7.00**		
Post-tensioning Steel, Strand - Grout Filler	**$16**		
Post-tensioning Steel, Bar - Grout Filler	**$20**		
Post-tensioning Steel, Strand - Flexible Filler	**$48**		
Post-tensioning Steel, Bar - Flexible Filler	**$60**		
		Subtotal	**$10,844**

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	**$1.50**		
#4 bar	**$2.00**		
#5 bar	**$2.30**		
#6 bar	**$2.70**		
#7 bar	**$3.50**		
#8 bar	**$4.50**		
#9 bar	**$5.80**		
#10 bar	**$7.20**		
#11 bar	**$8.50**		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$377,631**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type

Neoprene Bearing Pads	Cost per Cubic Foot	Quantity	Cost
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**7.3**	**$11,733**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders

Structural Steel (includes coating costs)	Cost per Pound	Quantity	Cost
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	Cost per Lin. Foot	Quantity	Cost
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**662**	**$328,545**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$328,545**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	86	$120,489
[1] Including cost of shrinkage reducing admixture.		Subtotal	$120,489

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	17,643	$24,700
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$24,700

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**152**	**$30,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$30,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**128**	**$12,800**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$12,800**

Superstructure Subtotal **$516,934**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	338	$4,053
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		**$4,053**

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	284	$256,000
Carbon Reinforcing Steel (per Pound)	$1.50	18,963	$28,444
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	120.0	$24,000
	Approach Slab Subtotal		**$308,444**

Unadjusted Total **$1,207,063**

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$36,212
	3%	**$36,212**

[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.

Substructure Subtotal	**$377,631**
Superstructure Subtotal	**$516,934**
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	**$4,053**
Detour Bridge Subtotal	
Approach Slab Subtotal	**$308,444**
Conditional Variables	**$36,212**
Total Cost	**$1,243,275**

Total Square Feet of Deck **3243**

Cost per Square Foot (not including Approach Slab) **$288**

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	49.9	7,229
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	86	17,643
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	94.8	18,963

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$288**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1954	$332,180
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$332,180

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	65.4	$130,774
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$130,774

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	9,481	$14,222
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$14,222

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$477,176**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**9.0**	**$14,341**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**662**	**$328,545**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$328,545**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	108	$151,272
[1] Including cost of shrinkage reducing admixture.		Subtotal	$151,272

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	22,151	$31,011
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$31,011

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**152**	**$30,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$30,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**172**	**$17,225**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$17,225**

Superstructure Subtotal **$558,453**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	462	$5,548
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,548

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	383	$344,500
Carbon Reinforcing Steel (per Pound)	$1.50	25,519	$38,278
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	120.0	$24,000
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	60.0	$10,800
	Approach Slab Subtotal		$417,578

Unadjusted Total	$1,458,755

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$43,763
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$43,763

Substructure Subtotal	$477,176
Superstructure Subtotal	$558,453
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,548
Detour Bridge Subtotal	
Approach Slab Subtotal	$417,578
Conditional Variables	$43,763
Total Cost	$1,502,518

Total Square Feet of Deck	4364
Cost per Square Foot (not including Approach Slab)	$249

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	65.4	9,481
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	108	22,151
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	127.6	25,519

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$249**

SR 70 OVER
MOSSY GULLY
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	2120	$360,400
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$360,400

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	51.8	$103,697
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$103,697

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	7,518	$11,277
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$11,277

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$475,374**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**7.6**	**$12,147**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**841**	**$417,573**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$417,573**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	108	$151,132
		Subtotal	$151,132

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	22,130	$30,982
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$30,982

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$38,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**128**	**$12,800**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$12,800**

Superstructure Subtotal **$650,886**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	427	$5,120
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,120

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	295	$265,067
Carbon Reinforcing Steel (per Pound)	$1.50	19,635	$29,452
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	124.3	$24,850
	Approach Slab Subtotal		$319,369

Unadjusted Total	$1,450,749

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %.	3%	$43,522
For construction over traffic and/or phased construction, increase by 20 %. [1]		
	3%	$43,522

[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.

Substructure Subtotal	$475,374
Superstructure Subtotal	$650,886
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,120
Detour Bridge Subtotal	
Approach Slab Subtotal	$319,369
Conditional Variables	$43,522
Total Cost	$1,494,271

Total Square Feet of Deck	4096

Cost per Square Foot (not including Approach Slab)	$287

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	51.8	7,518
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	108	22,130
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	98.2	19,635

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$287**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	2623	$445,910
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$445,910

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	68.1	$136,218
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$136,218

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	9,876	$14,814
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$14,814

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$596,942**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**9.3**	**$14,847**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**1028**	**$510,366**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$510,366**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	142	$198,444
[1] Including cost of shrinkage reducing admixture.		Subtotal	$198,444

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	29,058	$40,681
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$40,681

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$38,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**172**	**$17,225**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$17,225**

Superstructure Subtotal **$805,117**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	584	$7,008
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$7,008

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	396	$356,701
Carbon Reinforcing Steel (per Pound)	$1.50	26,422	$39,633
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	124	$24,850
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	62	$11,183
	Approach Slab Subtotal		$432,367

Unadjusted Total	$1,841,433

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$55,243
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$55,243

Substructure Subtotal	$596,942
Superstructure Subtotal	$805,117
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$7,008
Detour Bridge Subtotal	
Approach Slab Subtotal	$432,367
Conditional Variables	$55,243
Total Cost	$1,896,676

Total Square Feet of Deck	5512

Cost per Square Foot (not including Approach Slab)	$266

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	68.1	9,876
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	142	29,058
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	132.1	26,422

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$266**

SR 70 OVER
DCI CANAL
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1754	$298,180
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$298,180

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	51.8	$103,697
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$103,697

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	7,518	$11,277
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$11,277

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$413,154**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**7.6**	**$12,147**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**661**	**$328,173**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$328,173**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	86	$120,453
[1] Including cost of shrinkage reducing admixture.		Subtotal	$120,453

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	17,638	$24,693
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$24,693

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**152**	**$30,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$30,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**133**	**$13,303**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$13,303**

Superstructure Subtotal **$517,021**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	338	$4,053
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$4,053

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	295	$265,067
Carbon Reinforcing Steel (per Pound)	$1.50	19,635	$29,452
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	124.3	$24,850
	Approach Slab Subtotal		$319,369

Unadjusted Total	$1,253,597

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %.	3%	$37,608
For construction over traffic and/or phased construction, increase by 20 %. [1]		
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$37,608

Substructure Subtotal	$413,154
Superstructure Subtotal	$517,021
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$4,053
Detour Bridge Subtotal	
Approach Slab Subtotal	$319,369
Conditional Variables	$37,608
Total Cost	$1,291,205

Total Square Feet of Deck	3243

Cost per Square Foot (not including Approach Slab)	$300

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	51.8	7,518
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	86	17,638
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	98.2	19,635

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$300**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	2206	$375,020
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$375,020

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	**$1,900**		
48 in	**$2,000**		
60 in	**$2,500**		
72 in	**$3,200**		
84 in	**$3,600**		
96 in	**$4,400**		
108 in	**$5,000**		
		Subtotal	

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	**$450**		
48 in	**$500**		
60 in	**$650**		
72 in	**$800**		
84 in	**$1,000**		
96 in	**$1,200**		
108 in	**$1,400**		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	**$1,800**		
Mass Concrete Class II [1]	**$1,600**		
Concrete Class IV [1]	**$2,000**	**68.1**	**$136,218**
Mass Concrete Class IV [1]	**$1,500**		
Seal Concrete [1]	**$1,600**		
Bulkhead Concrete [1]	**$2,400**		
		Subtotal	$136,218

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	**$1.50**	**9,876**	**$14,814**
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	**$1.90**		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	**$7.00**		
Post-tensioning Steel, Strand - Grout Filler	**$16**		
Post-tensioning Steel, Bar - Grout Filler	**$20**		
Post-tensioning Steel, Strand - Flexible Filler	**$48**		
Post-tensioning Steel, Bar - Flexible Filler	**$60**		
		Subtotal	**$14,814**

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	**$1.50**		
#4 bar	**$2.00**		
#5 bar	**$2.30**		
#6 bar	**$2.70**		
#7 bar	**$3.50**		
#8 bar	**$4.50**		
#9 bar	**$5.80**		
#10 bar	**$7.20**		
#11 bar	**$8.50**		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$526,052**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**9.3**	**$14,847**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**808**	**$401,100**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$401,100**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	113	$158,216
		Subtotal	$158,216

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	23,167	$32,434
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$32,434

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**152**	**$30,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$30,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**179**	**$17,884**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$17,884**

Superstructure Subtotal **$640,034**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	462	$5,548
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,548

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	396	$356,701
Carbon Reinforcing Steel (per Pound)	$1.50	26,422	$39,633
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	124	$24,850
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	62	$11,183
	Approach Slab Subtotal		$432,367

Unadjusted Total	$1,604,001

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the

Conditional Variables	% Increase/ Decrease	Cost (+/-)
increase cost by 3 %.	3%	$48,120
For construction over traffic and/or phased construction, increase by 20 %. [1]		
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$48,120

Substructure Subtotal	$526,052
Superstructure Subtotal	$640,034
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,548
Detour Bridge Subtotal	
Approach Slab Subtotal	$432,367
Conditional Variables	$48,120
Total Cost	$1,652,121

Total Square Feet of Deck	4364

Cost per Square Foot (not including Approach Slab)	$280

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	68.1	9,876
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	113	23,167
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	132.1	26,422

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$280**

SR 70 OVER
LONG POINT MARSH
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1413	$240,210
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$240,210

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	**$1,900**		
48 in	**$2,000**		
60 in	**$2,500**		
72 in	**$3,200**		
84 in	**$3,600**		
96 in	**$4,400**		
108 in	**$5,000**		
		Subtotal	

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	**$450**		
48 in	**$500**		
60 in	**$650**		
72 in	**$800**		
84 in	**$1,000**		
96 in	**$1,200**		
108 in	**$1,400**		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	**$1,800**		
Mass Concrete Class II [1]	**$1,600**		
Concrete Class IV [1]	**$2,000**	**51.8**	**$103,697**
Mass Concrete Class IV [1]	**$1,500**		
Seal Concrete [1]	**$1,600**		
Bulkhead Concrete [1]	**$2,400**		
		Subtotal	$103,697

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	**$1.50**	**7,518**	**$11,277**
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	**$1.90**		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	**$7.00**		
Post-tensioning Steel, Strand - Grout Filler	**$16**		
Post-tensioning Steel, Bar - Grout Filler	**$20**		
Post-tensioning Steel, Strand - Flexible Filler	**$48**		
Post-tensioning Steel, Bar - Flexible Filler	**$60**		
		Subtotal	**$11,277**

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	**$1.50**		
#4 bar	**$2.00**		
#5 bar	**$2.30**		
#6 bar	**$2.70**		
#7 bar	**$3.50**		
#8 bar	**$4.50**		
#9 bar	**$5.80**		
#10 bar	**$7.20**		
#11 bar	**$8.50**		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$355,184**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**7.6**	**$12,147**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**841**	**$417,573**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$417,573**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	108	$151,132
		Subtotal	$151,132

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	22,130	$30,982
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$30,982

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$38,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**128**	**$12,800**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$12,800**

Superstructure Subtotal **$650,886**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	427	$5,120
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,120

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	295	$265,067
Carbon Reinforcing Steel (per Pound)	$1.50	19,635	$29,452
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	124.3	$24,850
	Approach Slab Subtotal		$319,369

Unadjusted Total	$1,330,559

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$39,917
	3%	$39,917

[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.

Substructure Subtotal	$355,184
Superstructure Subtotal	$650,886
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,120
Detour Bridge Subtotal	
Approach Slab Subtotal	$319,369
Conditional Variables	$39,917
Total Cost	$1,370,476

Total Square Feet of Deck	4096

Cost per Square Foot (not including Approach Slab)	$257

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	51.8	7,518
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	108	22,130
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	98.2	19,635

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$257**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1808	$307,360
18" w/carbon steel strand (Driven Battered) [2]	$190		$0
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		$0
24" w/carbon steel strand (Driven Battered) [2]	$220		$0
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		$0
30" w/carbon steel strand (Driven Battered) [2]	$245		$0
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		$0
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		$0
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		$0
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		$0
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		$0
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		$0
Heavy mild steel reinforcing in pile head (each)[2]	$350		$0
		Subtotal	$307,360

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		$0
14 x 89 H Section	$140		$0
18" Pipe Pile	$200		$0
20" Pipe Pile	$250		$0
24" Pipe Pile	$300		$0
30" Pipe Pile	$400		$0
		Subtotal	$0

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		$0
48 in	$1,100		$0
60 in	$1,500		$0
72 in	$1,900		$0
84 in	$2,300		$0
96 in	$2,900		$0
108 in	$3,400		$0
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		$0
48 in	$1,600		$0
60 in	$2,000		$0
72 in	$2,500		$0
84 in	$2,900		$0
96 in	$3,500		$0
108 in	$4,000		$0

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		$0
48 in	$2,000		$0
60 in	$2,500		$0
72 in	$3,200		$0
84 in	$3,600		$0
96 in	$4,400		$0
108 in	$5,000		$0
		Subtotal	$0

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		$0
48 in	$500		$0
60 in	$650		$0
72 in	$800		$0
84 in	$1,000		$0
96 in	$1,200		$0
108 in	$1,400		$0
		Subtotal	$0

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800	0.0	$0
Mass Concrete Class II [1]	$1,600		$0
Concrete Class IV [1]	$2,000	68.1	$136,218
Mass Concrete Class IV [1]	$1,500		$0
Seal Concrete [1]	$1,600		$0
Bulkhead Concrete [1]	$2,400		$0
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$136,218

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	9,876	$14,814
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		$0
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		$0
Post-tensioning Steel, Strand - Grout Filler	$16		$0
Post-tensioning Steel, Bar - Grout Filler	$20		$0
Post-tensioning Steel, Strand - Flexible Filler	$48		$0
Post-tensioning Steel, Bar - Flexible Filler	$60		$0
		Subtotal	$14,814

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		$0
#4 bar	$2.00		$0
#5 bar	$2.30		$0
#6 bar	$2.70		$0
#7 bar	$3.50		$0
#8 bar	$4.50		$0
#9 bar	$5.80		$0
#10 bar	$7.20		$0
#11 bar	$8.50		$0
		Subtotal	$0

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$458,392**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		**$0**
Temporary	**$30**		**$0**
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		**$0**
12" x 30"	**$260**		**$0**
12" x 30" with FRP	**$370**		**$0**
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		**$0**
Permanent Anchored Wall [1]	**$80**		**$0**
Temporary Cantilever Wall	**$25**		**$0**
Temporary Anchored Wall [1]	**$50**		**$0**
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		**$0**
42" Vertical Face	**$500**		**$0**
36" Single-Slope	**$450**		**$0**
42" Single-Slope	**$490**		**$0**
		Subtotal	$0

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		**$0**
		Subtotal	**$0**

Walls Subtotal **$0**

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		**$0**
Class IV Concrete	**$2,000**		**$0**
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		**$0**
		Subtotal	**$0**

Box Culvert Subtotal **$0**

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		**$0**
Plain Neoprene Bearing Pads	**$1,600**	**9.3**	**$14,847**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		**$0**
251- 500	**$12,000**		**$0**
501- 750	**$14,000**		**$0**
751-1000	**$15,000**		**$0**
1001-1250	**$16,000**		**$0**
1251-1500	**$18,000**		**$0**
1501-1750	**$21,000**		**$0**
1751-2000	**$24,000**		**$0**
>2000	**$27,000**		**$0**
		Subtotal	$0

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		**$0**
Plate Girders, Curved [1]	**$5.50**		**$0**
Box Girders, Straight [1]	**$5.50**		**$0**
Box Girders, Curved [1]	**$6.00**		**$0**
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		**$0**
Florida U-Beam; 54" [1]	**$1,200**		**$0**
Florida U-Beam; 63" [1]	**$1,250**		**$0**
Florida U-Beam; 72" [1]	**$1,300**		**$0**
Florida Slab Beam 12" x 48" [2]	**$340**		**$0**
Florida Slab Beam 12" x 60" [2]	**$410**		**$0**
Florida Slab Beam 15" x 48" [2]	**$410**		**$0**
Florida Slab Beam 15" x 56"	**$497**	**1028**	**$510,366**
Florida Slab Beam 15" x 60" [2]	**$540**		**$0**
Florida Slab Beam 18" x 48" [2]	**$500**		**$0**
Florida Slab Beam 18" x 60" [2]	**$640**		**$0**
AASHTO Type II Beam	**$280**		**$0**
Florida-I Beam; 36	**$350**		**$0**
Florida-I Beam; 45	**$380**		**$0**
Florida-I Beam; 54	**$410**		**$0**
Florida-I Beam; 63	**$440**		**$0**
Florida-I Beam; 72	**$470**		**$0**
Florida-I Beam; 78	**$480**		**$0**
Florida-I Beam; 84	**$500**		**$0**
Florida-I Beam; 96	**$540**		**$0**
		Subtotal	**$510,366**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		$0
Box Girder Concrete, Curved	$2,400		$0
Deck Concrete Class II	$1,400		$0
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		$0
Topping Concrete for slab beams and units[1]	$1,400	142	$198,444
		Subtotal	$198,444

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		$0
> 300,000 SF AND ≤ 500,000 SF	$2,500		$0
> 500,000 SF	$2,400		$0
		Subtotal	$0

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	29,058	$40,681
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		$0
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		$0
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		$0
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		$0
Post-tensioning Steel, Bar - Grout Filler	$20		$0
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		$0
Post-tensioning Steel, Bars - Flexible Filler	$60		$0
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$40,681

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		$0
#4 bar	$2.00		$0
#5 bar	$2.30		$0
#6 bar	$2.70		$0
#7 bar	$3.50		$0
#8 bar	$4.50		$0
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	$0

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		**$0**
42" Vertical Face	**$190**		**$0**
36" Single-Slope Median	**$190**		**$0**
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		**$0**
Thrie Beam Retrofit	**$330**		**$0**
Thrie Beam Panel Retrofit	**$200**		**$0**
Vertical Face Retrofit	**$230**		**$0**
Rectangular Tube Retrofit	**$190**		**$0**
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		**$0**
Single Bullet Railing [1]	**$80**		**$0**
Double Bullet Railing [1]	**$100**		**$0**
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		**$0**
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		**$0**
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		**$0**
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		**$0**
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		**$0**
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		**$0**
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		**$0**
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		**$0**
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$38,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**172**	**$17,225**
Strip Seal	**$550**		**$0**
Finger Joint < 6"	**$1,900**		**$0**
Finger Joint > 6"	**$3,300**		**$0**
Modular 6"	**$1,100**		**$0**
Modular 8"	**$1,600**		**$0**
Modular 12"	**$2,000**		**$0**
		Subtotal	**$17,225**

Superstructure Subtotal **$805,117**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00	0.0	$0
Bridge Deck Grooving for Short Bridge	$12.00	584	$7,008
Bridge Deck Grooving for Long Bridge	$8.00	0.0	$0
	Grooving and Planing Subtotal		$7,008

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		$0
	Detour Bridge Subtotal		$0

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	396	$356,701
Carbon Reinforcing Steel (per Pound)	$1.50	26,422	$39,633
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	124	$24,850
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	62	$11,183
	Approach Slab Subtotal		$432,367

Unadjusted Total	$1,702,883

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the

Conditional Variables	% Increase/	Cost (+/-)
increase cost by 3 %.	3%	$51,087
For construction over traffic and/or phased construction, increase by 20 %. [1]		$0
	3%	$51,087

[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.

Substructure Subtotal	$458,392
Superstructure Subtotal	$805,117
Walls Subtotal	$0
Box Culverts Subtotal	$0
Grooving and Planing Subtotal	$7,008
Detour Bridge Subtotal	$0
Approach Slab Subtotal	$432,367
Conditional Variables	$51,087
Total Cost	$1,753,970

Total Square Feet of Deck	5512

Cost per Square Foot (not including Approach Slab)	$240

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		0
Pile Bents	145	68.1	9,876
Single Column Piers >25'	210		0
Single Column Piers <25'	150		0
Multiple Column Piers >25'	215		0
Multiple Column Piers <25'	195		0
Bascule Piers	110		0
Standard Deck Slabs	205	142	29,058
Isotropic Deck Slabs	125		0
Concrete Box Girders, Pier Seg	225		0
Concrete Box Girders, Typ. Seg	165		0
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		0
Approach Slab	200	132.1	26,422

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$240**

SR 70 OVER
PARKER CREEK
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	998	$169,660
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$169,660

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	**$1,900**		
48 in	**$2,000**		
60 in	**$2,500**		
72 in	**$3,200**		
84 in	**$3,600**		
96 in	**$4,400**		
108 in	**$5,000**		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	**$450**		
48 in	**$500**		
60 in	**$650**		
72 in	**$800**		
84 in	**$1,000**		
96 in	**$1,200**		
108 in	**$1,400**		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	**$1,800**		
Mass Concrete Class II [1]	**$1,600**		
Concrete Class IV [1]	**$2,000**	**49.9**	**$99,717**
Mass Concrete Class IV [1]	**$1,500**		
Seal Concrete [1]	**$1,600**		
Bulkhead Concrete [1]	**$2,400**		
		Subtotal	$99,717

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	**$1.50**	**7,229**	**$10,844**
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	**$1.90**		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	**$7.00**		
Post-tensioning Steel, Strand - Grout Filler	**$16**		
Post-tensioning Steel, Bar - Grout Filler	**$20**		
Post-tensioning Steel, Strand - Flexible Filler	**$48**		
Post-tensioning Steel, Bar - Flexible Filler	**$60**		
		Subtotal	**$10,844**

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	**$1.50**		
#4 bar	**$2.00**		
#5 bar	**$2.30**		
#6 bar	**$2.70**		
#7 bar	**$3.50**		
#8 bar	**$4.50**		
#9 bar	**$5.80**		
#10 bar	**$7.20**		
#11 bar	**$8.50**		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$280,221**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type

Neoprene Bearing Pads	Cost per Cubic Foot	Quantity	Cost
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**7.3**	**$11,733**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders

Structural Steel (includes coating costs)	Cost per Pound	Quantity	Cost
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	Cost per Lin. Foot	Quantity	Cost
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**842**	**$417,945**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$417,945**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	108	$151,168
		Subtotal	$151,168

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	22,135	$30,989
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$30,989

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$38,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**128**	**$12,800**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$12,800**

Superstructure Subtotal **$651,302**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	427	$5,120
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,120

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.	Detour Bridge Subtotal		

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	284	$256,000
Carbon Reinforcing Steel (per Pound)	$1.50	18,963	$28,444
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	120.0	$24,000
	Approach Slab Subtotal		$308,444

Unadjusted Total	$1,245,088

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$37,353
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$37,353

Substructure Subtotal	$280,221
Superstructure Subtotal	$651,302
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,120
Detour Bridge Subtotal	
Approach Slab Subtotal	$308,444
Conditional Variables	$37,353
Total Cost	$1,282,440

Total Square Feet of Deck	4096

Cost per Square Foot (not including Approach Slab)	$238

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	49.9	7,229
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	108	22,135
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	94.8	18,963

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$238**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1243	$211,310
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$211,310

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	**$1,900**		
48 in	**$2,000**		
60 in	**$2,500**		
72 in	**$3,200**		
84 in	**$3,600**		
96 in	**$4,400**		
108 in	**$5,000**		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	**$450**		
48 in	**$500**		
60 in	**$650**		
72 in	**$800**		
84 in	**$1,000**		
96 in	**$1,200**		
108 in	**$1,400**		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	**$1,800**		
Mass Concrete Class II [1]	**$1,600**		
Concrete Class IV [1]	**$2,000**	**65.4**	**$130,774**
Mass Concrete Class IV [1]	**$1,500**		
Seal Concrete [1]	**$1,600**		
Bulkhead Concrete [1]	**$2,400**		
		Subtotal	$130,774

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	**$1.50**	**9,481**	**$14,222**
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	**$1.90**		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	**$7.00**		
Post-tensioning Steel, Strand - Grout Filler	**$16**		
Post-tensioning Steel, Bar - Grout Filler	**$20**		
Post-tensioning Steel, Strand - Flexible Filler	**$48**		
Post-tensioning Steel, Bar - Flexible Filler	**$60**		
		Subtotal	**$14,222**

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	**$1.50**		
#4 bar	**$2.00**		
#5 bar	**$2.30**		
#6 bar	**$2.70**		
#7 bar	**$3.50**		
#8 bar	**$4.50**		
#9 bar	**$5.80**		
#10 bar	**$7.20**		
#11 bar	**$8.50**		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$356,306**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**		
Plain Neoprene Bearing Pads	**$1,600**	**9.0**	**$14,341**
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**	**842**	**$417,945**
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**		
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$417,945**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000		
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400	135	$189,600
		Subtotal	$189,600

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	27,763	$38,868
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$38,868

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$38,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**172**	**$17,225**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$17,225**

Superstructure Subtotal **$702,037**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	584	$7,008
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$7,008

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	383	$344,500
Carbon Reinforcing Steel (per Pound)	$1.50	25,519	$38,278
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	120.0	$24,000
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	60.0	$10,800
	Approach Slab Subtotal		$417,578

Unadjusted Total	$1,482,929

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the

Conditional Variables	% Increase/	Cost (+/-)
increase cost by 3 %.	3%	$44,488
For construction over traffic and/or phased construction, increase by 20 %. [1]		
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$44,488

Substructure Subtotal	$356,306
Superstructure Subtotal	$702,037
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$7,008
Detour Bridge Subtotal	
Approach Slab Subtotal	$417,578
Conditional Variables	$44,488
Total Cost	$1,527,417

Total Square Feet of Deck	5512

Cost per Square Foot (not including Approach Slab)	$201

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	65.4	9,481
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	135	27,763
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	127.6	25,519

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$201**

FLORIDA-I BEAM COST ESTIMATE ALTERNATIVE

HNTB

SR 70 OVER WHIDDEN CREEK COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1787	$303,790
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$303,790

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	94.5	$188,920
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$188,920

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	13,697	$20,545
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$20,545

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$513,255**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.		**Subtotal**	

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**24.00**	**$43,200**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$43,200

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**837**	**$292,775**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$292,775**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000
[2] Interpolate between given prices for intermediate width FSBs.
[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	224.4	$448,863
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
[1] Including cost of shrinkage reducing admixture.		Subtotal	$448,863

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	46,008	$64,412
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$64,412

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**280**	**$56,000**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**	**140**	**$25,200**
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$81,200**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**115**	**$11,483**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$11,483**

Superstructure Subtotal **$941,933**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00	851.7	$7,665
Bridge Deck Grooving for Short Bridge	$12.00		
Bridge Deck Grooving for Long Bridge	$8.00	851.7	$6,813
	Grooving and Planing Subtotal		$14,478

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	383	$344,500
Carbon Reinforcing Steel (per Pound)	$1.50	25,519	$38,278
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	120.0	$24,000
Panel/Picket Railing (42") steel (Type 1 & 2)	$180	60.0	$10,800
	Approach Slab Subtotal		$417,578

Unadjusted Total	$1,887,245

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$56,617
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$56,617

Substructure Subtotal	$513,255
Superstructure Subtotal	$941,933
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$14,478
Detour Bridge Subtotal	
Approach Slab Subtotal	$417,578
Conditional Variables	$56,617
Total Cost	$1,943,862

Total Square Feet of Deck	8038

Cost per Square Foot (not including Approach Slab)	$190

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	94.5	13,697
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	224	46,008
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	127.6	25,519

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$190**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1426	$242,420
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$242,420

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	80.5	$161,077
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$161,077

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	11,678	$17,517
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$17,517

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$421,014**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.		**Subtotal**	

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**16.00**	**$28,800**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$28,800

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**558**	**$195,183**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$195,183**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	166.0	$331,934
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
[1] Including cost of shrinkage reducing admixture.		Subtotal	$331,934

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	34,023	$47,633
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$47,633

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**280**	**$56,000**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$56,000**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**85**	**$8,533**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$8,533**

Superstructure Subtotal **$668,083**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00	622.2	$5,600
Bridge Deck Grooving for Short Bridge	$12.00		
Bridge Deck Grooving for Long Bridge	$8.00	622.2	$4,978
	Grooving and Planing Subtotal		$10,578

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	284	$256,000
Carbon Reinforcing Steel (per Pound)	$1.50	18,963	$28,444
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	120.0	$24,000
	Approach Slab Subtotal		$308,444

Unadjusted Total	$1,408,120

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %.	3%	$42,244
For construction over traffic and/or phased construction, increase by 20 %. [1]		
	3%	$42,244

[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.

Substructure Subtotal	$421,014
Superstructure Subtotal	$668,083
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$10,578
Detour Bridge Subtotal	
Approach Slab Subtotal	$308,444
Conditional Variables	$42,244
Total Cost	$1,450,364

Total Square Feet of Deck	5973

Cost per Square Foot (not including Approach Slab)	$191

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	80.5	11,678
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	166	34,023
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	94.8	18,963

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$191**

SR 70 OVER
JOSHUA CREEK
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	2509	$426,530
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$426,530

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	88.2	$176,320
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$176,320

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	12,783	$19,175
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$19,175

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$622,024**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**28.00**	**$50,400**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$50,400

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**1256**	**$439,571**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$439,571**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	289.4	$578,750
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
[1] Including cost of shrinkage reducing admixture.		Subtotal	$578,750

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	59,322	$83,051
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$83,051

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**360**	**$72,000**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**	**180**	**$32,400**
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$104,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**115**	**$11,483**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$11,483**

Superstructure Subtotal **$1,267,655**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00	1095.0	$9,855
Bridge Deck Grooving for Short Bridge	$12.00		
Bridge Deck Grooving for Long Bridge	$8.00	1095.0	$8,760
	Grooving and Planing Subtotal		$18,615

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	383	$344,500
Carbon Reinforcing Steel (per Pound)	$1.50	25,519	$38,278
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	120.0	$24,000
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	60.0	$10,800
	Approach Slab Subtotal		$417,578

Unadjusted Total	$2,325,872

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$69,776
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$69,776

Substructure Subtotal	$622,024
Superstructure Subtotal	$1,267,655
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$18,615
Detour Bridge Subtotal	
Approach Slab Subtotal	$417,578
Conditional Variables	$69,776
Total Cost	$2,395,648

Total Square Feet of Deck	10335

Cost per Square Foot (not including Approach Slab)	$191

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	88.2	12,783
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	289	59,322
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	127.6	25,519

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$191**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1981	$336,770
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$336,770

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	74.2	$148,477
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$148,477

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	10,765	$16,147
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$16,147

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$501,394**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type

Neoprene Bearing Pads	Cost per Cubic Foot	Quantity	Cost
Composite Neoprene Bearing Pads	**$1,800**	**20.00**	**$36,000**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$36,000

2. Bridge Girders

Structural Steel (includes coating costs)	Cost per Pound	Quantity	Cost
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	Cost per Lin. Foot	Quantity	Cost
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**897**	**$313,979**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$313,979**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000
[2] Interpolate between given prices for intermediate width FSBs.
[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	214.4	$428,889
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
		Subtotal	$428,889

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	43,961	$61,546
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$61,546

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**360**	**$72,000**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$72,000**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**85**	**$8,533**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$8,533**

Superstructure Subtotal **$920,947**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00	800.0	$7,200
Bridge Deck Grooving for Short Bridge	$12.00		
Bridge Deck Grooving for Long Bridge	$8.00	800.0	$6,400
	Grooving and Planing Subtotal		$13,600

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	284	$256,000
Carbon Reinforcing Steel (per Pound)	$1.50	18,963	$28,444
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	120.0	$24,000
	Approach Slab Subtotal		$308,444

Unadjusted Total	$1,744,385

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:
** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %.	3%	$52,332
For construction over traffic and/or phased construction, increase by 20 %. [1]		
	3%	$52,332

[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.

Substructure Subtotal	$501,394
Superstructure Subtotal	$920,947
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$13,600
Detour Bridge Subtotal	
Approach Slab Subtotal	$308,444
Conditional Variables	$52,332
Total Cost	$1,796,717

Total Square Feet of Deck	7680

Cost per Square Foot (not including Approach Slab)	$194

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	74.2	10,765
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	214	43,961
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	94.8	18,963

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$194**

SR 70 OVER
TIGER BAY
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1098	$186,660
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$186,660

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	**$1,900**		
48 in	**$2,000**		
60 in	**$2,500**		
72 in	**$3,200**		
84 in	**$3,600**		
96 in	**$4,400**		
108 in	**$5,000**		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	**$450**		
48 in	**$500**		
60 in	**$650**		
72 in	**$800**		
84 in	**$1,000**		
96 in	**$1,200**		
108 in	**$1,400**		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	**$1,800**		
Mass Concrete Class II [1]	**$1,600**		
Concrete Class IV [1]	**$2,000**	**63.3**	**$126,524**
Mass Concrete Class IV [1]	**$1,500**		
Seal Concrete [1]	**$1,600**		
Bulkhead Concrete [1]	**$2,400**		
		Subtotal	$126,524

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	**$1.50**	**9,173**	**$13,759**
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	**$1.90**		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	**$7.00**		
Post-tensioning Steel, Strand - Grout Filler	**$16**		
Post-tensioning Steel, Bar - Grout Filler	**$20**		
Post-tensioning Steel, Strand - Flexible Filler	**$48**		
Post-tensioning Steel, Bar - Flexible Filler	**$60**		
		Subtotal	**$13,759**

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	**$1.50**		
#4 bar	**$2.00**		
#5 bar	**$2.30**		
#6 bar	**$2.70**		
#7 bar	**$3.50**		
#8 bar	**$4.50**		
#9 bar	**$5.80**		
#10 bar	**$7.20**		
#11 bar	**$8.50**		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$326,943**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**8.00**	**$14,400**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$14,400

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**303**	**$106,167**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$106,167**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	85.0	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
[1] Including cost of shrinkage reducing admixture.		Subtotal	

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	17,423	$24,393
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$24,393

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**152**	**$30,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$30,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**85**	**$8,533**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$8,533**

Superstructure Subtotal	**$183,893**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	338	$4,053
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$4,053

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.	Detour Bridge Subtotal		

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	284	$256,000
Carbon Reinforcing Steel (per Pound)	$1.50	18,963	$28,444
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	120.0	$24,000
	Approach Slab Subtotal		$308,444

Unadjusted Total	$823,334

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$24,700
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$24,700

Substructure Subtotal	$326,943
Superstructure Subtotal	$183,893
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$4,053
Detour Bridge Subtotal	
Approach Slab Subtotal	$308,444
Conditional Variables	$24,700
Total Cost	$848,034

Total Square Feet of Deck	3243

Cost per Square Foot (not including Approach Slab)	$166

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	63.3	9,173
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	85	17,423
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	94.8	18,963

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$166**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1463	$248,710
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$248,710

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	71.1	$142,210
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$142,210

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	10,310	$15,465
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$15,465

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$406,385**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**12.00**	**$21,600**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$21,600

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**455**	**$159,250**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$159,250**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000
[2] Interpolate between given prices for intermediate width FSBs.
[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	115.0	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
		Subtotal	

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	23,568	$32,995
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$32,995

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**152**	**$30,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**	**76**	**$13,680**
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$44,080**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**115**	**$11,483**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$11,483**

Superstructure Subtotal **$269,408**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	462	$5,548
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,548

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	383	$344,500
Carbon Reinforcing Steel (per Pound)	$1.50	25,519	$38,278
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	120.0	$24,000
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	60.0	$10,800
	Approach Slab Subtotal		$417,578

Unadjusted Total	$1,098,919

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the

Conditional Variables	% Increase/	Cost (+/-)
increase cost by 3 %.	3%	$32,968
For construction over traffic and/or phased construction, increase by 20 %. [1]		
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$32,968

Substructure Subtotal	$406,385
Superstructure Subtotal	$269,408
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,548
Detour Bridge Subtotal	
Approach Slab Subtotal	$417,578
Conditional Variables	$32,968
Total Cost	$1,131,887

Total Square Feet of Deck	4364

Cost per Square Foot (not including Approach Slab)	$164

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	71.1	10,310
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	115	23,568
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	127.6	25,519

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$164**

SR 70 OVER
MOSSY GULLY
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1646	$279,820
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$279,820

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	**$1,900**		
48 in	**$2,000**		
60 in	**$2,500**		
72 in	**$3,200**		
84 in	**$3,600**		
96 in	**$4,400**		
108 in	**$5,000**		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	**$450**		
48 in	**$500**		
60 in	**$650**		
72 in	**$800**		
84 in	**$1,000**		
96 in	**$1,200**		
108 in	**$1,400**		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	**$1,800**		
Mass Concrete Class II [1]	**$1,600**		
Concrete Class IV [1]	**$2,000**	**63.1**	**$126,126**
Mass Concrete Class IV [1]	**$1,500**		
Seal Concrete [1]	**$1,600**		
Bulkhead Concrete [1]	**$2,400**		
		Subtotal	$126,126

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	**$1.50**	**9,144**	**$13,716**
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	**$1.90**		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	**$7.00**		
Post-tensioning Steel, Strand - Grout Filler	**$16**		
Post-tensioning Steel, Bar - Grout Filler	**$20**		
Post-tensioning Steel, Strand - Flexible Filler	**$48**		
Post-tensioning Steel, Bar - Flexible Filler	**$60**		
		Subtotal	**$13,716**

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	**$1.50**		
#4 bar	**$2.00**		
#5 bar	**$2.30**		
#6 bar	**$2.70**		
#7 bar	**$3.50**		
#8 bar	**$4.50**		
#9 bar	**$5.80**		
#10 bar	**$7.20**		
#11 bar	**$8.50**		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$419,662**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**12.00**	**$21,600**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$21,600

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**575**	**$201,238**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$201,238**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	112.1	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
		Subtotal	

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	22,980	$32,171
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$32,171

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$38,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**129**	**$12,875**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$12,875**

Superstructure Subtotal **$306,284**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	427	$5,120
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,120

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.	Detour Bridge Subtotal		

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	295	$265,067
Carbon Reinforcing Steel (per Pound)	$1.50	19,635	$29,452
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	124.3	$24,850
	Approach Slab Subtotal		$319,369

Unadjusted Total	$1,050,435

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$31,513
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$31,513

Substructure Subtotal	$419,662
Superstructure Subtotal	$306,284
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,120
Detour Bridge Subtotal	
Approach Slab Subtotal	$319,369
Conditional Variables	$31,513
Total Cost	$1,081,948

Total Square Feet of Deck	4096
Cost per Square Foot (not including Approach Slab)	$186

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	63.1	9,144
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	112	22,980
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	98.2	19,635

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$186**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	2116	$359,720
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$359,720

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	77.4	$154,860
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$154,860

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	11,227	$16,841
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$16,841

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$531,421**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**16.00**	**$28,800**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$28,800

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**767**	**$268,317**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$268,317**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000
[2] Interpolate between given prices for intermediate width FSBs.
[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	150.4	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
		Subtotal	

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	30,836	$43,170
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$43,170

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**	**96**	**$17,280**
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$55,680**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**159**	**$15,929**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$15,929**

Superstructure Subtotal **$411,896**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	584	$7,008
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$7,008

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	396	$356,701
Carbon Reinforcing Steel (per Pound)	$1.50	26,422	$39,633
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	124.3	$24,850
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	62.1	$11,183
	Approach Slab Subtotal		$432,367

Unadjusted Total	$1,382,692

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the

Conditional Variables	% Increase/	Cost (+/-)
increase cost by 3 %.	3%	$41,481
For construction over traffic and/or phased construction, increase by 20 %. [1]		
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$41,481

Substructure Subtotal	$531,421
Superstructure Subtotal	$411,896
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$7,008
Detour Bridge Subtotal	
Approach Slab Subtotal	$432,367
Conditional Variables	$41,481
Total Cost	$1,424,173

Total Square Feet of Deck	5512

Cost per Square Foot (not including Approach Slab)	$180

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	77.4	11,227
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	150	30,836
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	132.1	26,422

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$180**

SR 70 OVER
DCI CANAL
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1226	$208,420
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$208,420

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	62.7	$125,344
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$125,344

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	9,087	$13,631
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$13,631

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$347,395**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type

Neoprene Bearing Pads	Cost per Cubic Foot	Quantity	Cost
Composite Neoprene Bearing Pads	**$1,800**	**8.00**	**$14,400**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$14,400

2. Bridge Girders

Structural Steel (includes coating costs)	Cost per Pound	Quantity	Cost
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	Cost per Lin. Foot	Quantity	Cost
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**303**	**$106,159**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$106,159**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	86.3	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
		Subtotal	

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	17,698	$24,777
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$24,777

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**152**	**$30,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$30,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**89**	**$8,869**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$8,869**

Superstructure Subtotal **$184,604**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	338	$4,053
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$4,053

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	295	$265,067
Carbon Reinforcing Steel (per Pound)	$1.50	19,635	$29,452
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	124.3	$24,850
	Approach Slab Subtotal		$319,369

Unadjusted Total	$855,422

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$25,663
	3%	$25,663

[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.

Substructure Subtotal	$347,395
Superstructure Subtotal	$184,604
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$4,053
Detour Bridge Subtotal	
Approach Slab Subtotal	$319,369
Conditional Variables	$25,663
Total Cost	$881,084

Total Square Feet of Deck	3243

Cost per Square Foot (not including Approach Slab)	$173

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	62.7	9,087
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	86	17,698
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	98.2	19,635

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$173**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1635	$277,950
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$277,950

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	77.0	$154,078
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
		Subtotal	$154,078

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	11,171	$16,756
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$16,756

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$448,784**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**12.00**	**$21,600**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$21,600

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**455**	**$159,238**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$159,238**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000
[2] Interpolate between given prices for intermediate width FSBs.
[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	116.3	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
		Subtotal	

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	23,849	$33,388
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$33,388

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**152**	**$30,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**	**76**	**$13,680**
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$44,080**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**159**	**$15,929**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$15,929**

Superstructure Subtotal **$274,235**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	462	$5,548
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,548

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	396	$356,701
Carbon Reinforcing Steel (per Pound)	$1.50	26,422	$39,633
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	124.3	$24,850
Panel/Picket Railing (42") steel (Type 1 & 2)	$180	62.1	$11,183
	Approach Slab Subtotal		$432,367

Unadjusted Total	$1,160,934

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the

Conditional Variables	% Increase/	Cost (+/-)
increase cost by 3 %.	3%	$34,828
For construction over traffic and/or phased construction, increase by 20 %. [1]		
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$34,828

Substructure Subtotal	$448,784
Superstructure Subtotal	$274,235
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,548
Detour Bridge Subtotal	
Approach Slab Subtotal	$432,367
Conditional Variables	$34,828
Total Cost	$1,195,762

Total Square Feet of Deck	4364

Cost per Square Foot (not including Approach Slab)	$175

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	77.0	11,171
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	116	23,849
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	132.1	26,422

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$175**

SR 70 OVER
LONG POINT MARSH
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1107	$188,190
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$188,190

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	64.1	$128,178
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$128,178

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	9,293	$13,939
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$13,939

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$330,308**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**12.00**	**$21,600**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$21,600

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**575**	**$201,238**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$201,238**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	112.1	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
		Subtotal	

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	22,980	$32,171
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$32,171

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$38,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**129**	**$12,875**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$12,875**

Superstructure Subtotal **$306,284**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	427	$5,120
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,120

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.	Detour Bridge Subtotal		

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	295	$265,067
Carbon Reinforcing Steel (per Pound)	$1.50	19,635	$29,452
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	124.3	$24,850
	Approach Slab Subtotal		$319,369

Unadjusted Total	$961,080

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$28,832
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$28,832

Substructure Subtotal	$330,308
Superstructure Subtotal	$306,284
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,120
Detour Bridge Subtotal	
Approach Slab Subtotal	$319,369
Conditional Variables	$28,832
Total Cost	$989,913

Total Square Feet of Deck	4096
Cost per Square Foot (not including Approach Slab)	$164

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	64.1	9,293
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	112	22,980
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	98.2	19,635

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$164**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	1423	$241,910
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$241,910

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.

[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	77.4	$154,860
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$154,860

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	11,227	$16,841
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$16,841

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$413,611**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**16.00**	**$28,800**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$28,800

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**767**	**$268,317**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$268,317**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000
[2] Interpolate between given prices for intermediate width FSBs.
[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	150.4	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
		Subtotal	

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	30,836	$43,170
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$43,170

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**	**96**	**$17,280**
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$55,680**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**159**	**$15,929**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$15,929**

Superstructure Subtotal **$411,896**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	584	$7,008
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$7,008

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	396	$356,701
Carbon Reinforcing Steel (per Pound)	$1.50	26,422	$39,633
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	124.3	$24,850
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	62.1	$11,183
	Approach Slab Subtotal		$432,367

Unadjusted Total $1,264,882

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the

Conditional Variables	% Increase/	Cost (+/-)
increase cost by 3 %.	3%	$37,946
For construction over traffic and/or phased construction, increase by 20 %. [1]		
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$37,946

Substructure Subtotal	$413,611
Superstructure Subtotal	$411,896
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$7,008
Detour Bridge Subtotal	
Approach Slab Subtotal	$432,367
Conditional Variables	$37,946
Total Cost	$1,302,829

Total Square Feet of Deck 5512

Cost per Square Foot (not including Approach Slab) $158

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	77.4	11,227
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	150	30,836
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	132.1	26,422

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$158**

SR 70 OVER
PARKER CREEK
COST ESTIMATE

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	774	$131,580
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$131,580

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	64.7	$129,358
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)		Subtotal	$129,358

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	9,378	$14,068
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$14,068

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$275,006**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.		**Subtotal**	

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**12.00**	**$21,600**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$21,600

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		

[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound.
Inorganic zinc coating systems have an expected life cycle of 20 years.

Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**575**	**$201,250**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$201,250**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	110.8	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
[1] Including cost of shrinkage reducing admixture.		Subtotal	

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	22,705	$31,787
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$31,787

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**		
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$38,400**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**85**	**$8,533**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$8,533**

Superstructure Subtotal **$301,570**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	427	$5,120
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$5,120

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.	Detour Bridge Subtotal		

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	284	$256,000
Carbon Reinforcing Steel (per Pound)	$1.50	18,963	$28,444
Railing Type per Superstructure Section 6 (per Lin. Foot)	$200	120.0	$24,000
	Approach Slab Subtotal		$308,444

Unadjusted Total	$890,140

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the effected units of the superstructure and/or substructure.

Conditional Variables	% Increase/ Decrease	Cost (+/-)
For construction over open water, floodplains that flood frequently or other similar areas, increase cost by 3 %. For construction over traffic and/or phased construction, increase by 20 %. [1]	3%	$26,704
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$26,704

Substructure Subtotal	$275,006
Superstructure Subtotal	$301,570
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$5,120
Detour Bridge Subtotal	
Approach Slab Subtotal	$308,444
Conditional Variables	$26,704
Total Cost	$916,844

Total Square Feet of Deck	4096
Cost per Square Foot (not including Approach Slab)	$149

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	64.7	9,378
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	111	22,705
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	94.8	18,963

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost as supplied herein. Include a written explanation in the BDR if the cost falls outside the provided range.

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$149**

Bridge Development Report Cost Estimating

Effective 01/01/2025

Step One: Estimate Component Items

Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

A. Bridge Substructure

1. Prestressed Concrete Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot [1]	Quantity	Cost
18" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$170	995	$169,150
18" w/carbon steel strand (Driven Battered) [2]	$190		
24" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$200		
24" w/carbon steel strand (Driven Battered) [2]	$220		
30" w/carbon steel strand (Driven Plumb or 1" Batter) [2]	$225		
30" w/carbon steel strand (Driven Battered) [2]	$245		
18" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$190		
18" w/CFRP or Stainless Steel Strand (Driven Battered)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$210		
24" w/CFRP or Stainless Steel Strand (Driven Battered)	$230		
30" w/CFRP or Stainless Steel Strand (Driven Plumb or 1" Batter)	$320		
30" w/CFRP or Stainless Steel Strand (Driven Battered)	$340		
Heavy mild steel reinforcing in pile head (each)[2]	$350		
		Subtotal	$169,150

[1] When silica fume, metakaolin or ultrafine fly ash is used add $10/LF to the piling cost.
[2] When heavy mild steel reinforcing is used in the pile head, add $350.

2. Steel Piling, (furnished and installed)

Size of Piling	Cost per Lin. Foot	Quantity	Cost
14 x 73 H Section	$130		
14 x 89 H Section	$140		
18" Pipe Pile	$200		
20" Pipe Pile	$250		
24" Pipe Pile	$300		
30" Pipe Pile	$400		
		Subtotal	

3. Drilled Shaft (not including Excavation)

Dia. (On land with casing salvaged)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,000		
48 in	$1,100		
60 in	$1,500		
72 in	$1,900		
84 in	$2,300		
96 in	$2,900		
108 in	$3,400		
Dia. (In water with casing salvaged)	**Cost per Lin. Foot**	**Quantity**	**Cost**
42 in	$1,500		
48 in	$1,600		
60 in	$2,000		
72 in	$2,500		
84 in	$2,900		
96 in	$3,500		
108 in	$4,000		

Dia. (In water with permanent casing)	Cost per Lin. Foot	Quantity	Cost
42 in	$1,900		
48 in	$2,000		
60 in	$2,500		
72 in	$3,200		
84 in	$3,600		
96 in	$4,400		
108 in	$5,000		
		Subtotal	

A. Bridge Substructure (continued)

4. Drilled Shaft Excavation

Dia.	Cost per Lin. Foot	Quantity	Cost
42 in	$450		
48 in	$500		
60 in	$650		
72 in	$800		
84 in	$1,000		
96 in	$1,200		
108 in	$1,400		
		Subtotal	

5. Substructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Concrete Class II [1]	$1,800		
Mass Concrete Class II [1]	$1,600		
Concrete Class IV [1]	$2,000	71.5	$142,992
Mass Concrete Class IV [1]	$1,500		
Seal Concrete [1]	$1,600		
Bulkhead Concrete [1]	$2,400		
		Subtotal	$142,992

[1] Admixtures: For Calcium Nitrite add $100/cy (@4.5 gal/cy) and for highly reactive pozzolans add $100/cy (@ 60 lb./cy)

6. Substructure Reinforcing and Post-tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.50	10,367	$15,550
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.90		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$7.00		
Post-tensioning Steel, Strand - Grout Filler	$16		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand - Flexible Filler	$48		
Post-tensioning Steel, Bar - Flexible Filler	$60		
		Subtotal	$15,550

7. Substructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
#9 bar	$5.80		
#10 bar	$7.20		
#11 bar	$8.50		
		Subtotal	

Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.

Substructure Subtotal **$327,692**

B. Walls

1. Retaining Walls			
MSE Walls	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent	**$70**		
Temporary	**$30**		
Sheet Pile Walls, Prestressed Concrete	**Cost per Lin. Foot**	**Quantity**	**Cost**
10" x 30"	**$210**		
12" x 30"	**$260**		
12" x 30" with FRP	**$370**		
Sheet Pile Walls, Steel	**Cost per Sq. Foot**	**Quantity**	**Cost**
Permanent Cantilever Wall	**$45**		
Permanent Anchored Wall [1]	**$80**		
Temporary Cantilever Wall	**$25**		
Temporary Anchored Wall [1]	**$50**		
Traffic Railings with Junction Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$460**		
42" Vertical Face	**$500**		
36" Single-Slope	**$450**		
42" Single-Slope	**$490**		
		Subtotal	

[1] Includes the cost of anchors, waler steel, miscellaneous steel for permanent/temporary walls and concrete face for permanent walls.

2. Noise Wall			
Type	**Cost per Sq. Foot**	**Quantity**	**Cost**
Noise Wall	**$60**		
		Subtotal	

Walls Subtotal

C. Box Culverts

1. Box Culverts			
Concrete	**Cost per Cubic Yard**	**Quantity**	**Cost**
Class II Concrete	**$1,900**		
Class IV Concrete	**$2,000**		
Reinforcing Steel	**Cost per Pound**	**Quantity**	**Cost**
Carbon Reinforcing Steel	**$1.50**		
		Subtotal	

Box Culvert Subtotal

D. Bridge Superstructure

1. Bearing Type			
Neoprene Bearing Pads	**Cost per Cubic Foot**	**Quantity**	**Cost**
Composite Neoprene Bearing Pads	**$1,800**	**16.00**	**$28,800**
Plain Neoprene Bearing Pads	**$1,600**		
Multirotational Bearings (Capacity in kips)	**Cost per Each**	**Quantity**	**Cost**
1- 250	**$10,000**		
251- 500	**$12,000**		
501- 750	**$14,000**		
751-1000	**$15,000**		
1001-1250	**$16,000**		
1251-1500	**$18,000**		
1501-1750	**$21,000**		
1751-2000	**$24,000**		
>2000	**$27,000**		
		Subtotal	$28,800

2. Bridge Girders			
Structural Steel (includes coating costs)	**Cost per Pound**	**Quantity**	**Cost**
Plate Girders, Straight [1]	**$4.60**		
Plate Girders, Curved [1]	**$5.50**		
Box Girders, Straight [1]	**$5.50**		
Box Girders, Curved [1]	**$6.00**		
[1] When weathering steel (uncoated) is used, reduce the price by $0.15 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.			
Prestressed Concrete Girders and Slabs	**Cost per Lin. Foot**	**Quantity**	**Cost**
Florida U-Beam; 48" [1]	**$1,100**		
Florida U-Beam; 54" [1]	**$1,200**		
Florida U-Beam; 63" [1]	**$1,250**		
Florida U-Beam; 72" [1]	**$1,300**		
Florida Slab Beam 12" x 48" [2]	**$340**		
Florida Slab Beam 12" x 60" [2]	**$410**		
Florida Slab Beam 15" x 48" [2]	**$410**		
Florida Slab Beam 15" x 56"	**$497**		
Florida Slab Beam 15" x 60" [2]	**$540**		
Florida Slab Beam 18" x 48" [2]	**$500**		
Florida Slab Beam 18" x 60" [2]	**$640**		
AASHTO Type II Beam	**$280**		
Florida-I Beam; 36	**$350**	**767**	**$268,333**
Florida-I Beam; 45	**$380**		
Florida-I Beam; 54	**$410**		
Florida-I Beam; 63	**$440**		
Florida-I Beam; 72	**$470**		
Florida-I Beam; 78	**$480**		
Florida-I Beam; 84	**$500**		
Florida-I Beam; 96	**$540**		
		Subtotal	**$268,333**

[1] Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following cost: $1,000,000

[2] Interpolate between given prices for intermediate width FSBs.

[3] When using alternative reinforcing materials per ***SDG*** 4.3.1, contact at least two precasters for their input regarding cost.

D. Bridge Superstructure (continued)

3. Cast-in-Place Superstructure Concrete

Type	Cost per Cubic Yard	Quantity	Cost
Box Girder Concrete, Straight	$2,000		
Box Girder Concrete, Curved	$2,400		
Deck Concrete Class II	$1,400		
Deck Concrete Class IV	$2,000	149.0	
Precast Deck Overlay Concrete Class IV	$1,800		
Topping Concrete for slab beams and units[1]	$1,400		
		Subtotal	

[1] Including cost of shrinkage reducing admixture.

4. Concrete for Precast Segmental Box Girders, Cantilever Construction

Concrete Cost by Deck Area	Cost per Cubic Yard	Quantity	Cost
≤ 300,000 SF	$2,600		
> 300,000 SF AND ≤ 500,000 SF	$2,500		
> 500,000 SF	$2,400		
		Subtotal	

5. Reinforcing and Post-Tensioning Steel

Type	Cost per Pound	Quantity	Cost
Carbon Reinforcing Steel, ASTM A615, Gr. 60 or 75	$1.40	30,554	$42,776
Low-Carbon Chromium Reinforcing Steel, ASTM A1035, Gr. 100	$1.80		
Stainless Reinforcing Steel, ASTM A955, Gr. 60 or 75, or ASTM A276, UNS S31653 or S31803	$6.50		
Post-tensioning Steel, Strand; longitudinal - Grout Filler	$16		
Post-tensioning Steel, Strand; transverse - Grout Filler	$20		
Post-tensioning Steel, Bar - Grout Filler	$20		
Post-tensioning Steel, Strand; longitudinal - Flexible Filler	$48		
Post-tensioning Steel, Bars - Flexible Filler	$60		
Note: Post-tensioning steel cost includes components of post-tensioning system (anchors, duct, and filler)		Subtotal	$42,776

6. Superstructure GFRP Reinforcing Bars

Type	Cost per Lin. Foot	Quantity	Cost
#3 bar	$1.50		
#4 bar	$2.00		
#5 bar	$2.30		
#6 bar	$2.70		
#7 bar	$3.50		
#8 bar	$4.50		
Add $2.00 per hook or bend for stirrups and $2.00 per revolution for circular spirals. Add a lump sum of $5,000 per bar size of each lot of GFRP reinforcing bars to estimate the cost of testing.		Subtotal	

7. Railings and Barriers			
Traffic Railings [1]	**Cost per Lin. Foot**	**Quantity**	**Cost**
32" Vertical Face	**$170**		
42" Vertical Face	**$190**		
36" Single-Slope Median	**$190**		
36" Single-Slope	**$200**	**192**	**$38,400**
42" Single-Slope	**$260**		
Thrie Beam Retrofit	**$330**		
Thrie Beam Panel Retrofit	**$200**		
Vertical Face Retrofit	**$230**		
Rectangular Tube Retrofit	**$190**		
Pedestrian/Bicycle Railings:	**Cost per Lin. Foot**	**Quantity**	**Cost**
Concrete Parapet (27") [1]	**$120**		
Single Bullet Railing [1]	**$80**		
Double Bullet Railing [1]	**$100**		
Panel/Picket Railing (42") steel (Type 1 & 2)	**$180**	**96**	**$17,280**
Panel/Picket Railing (42") steel (Type 3-5)	**$240**		
Panel/Picket Railing (42") aluminum (Type 1 & 2)	**$130**		
Panel/Picket Railing (42") aluminum (Type 3-5)	**$200**		
Panel/Picket Railing (48") steel (Type 1 & 2)	**$210**		
Panel/Picket Railing (48") steel (Type 3-5)	**$270**		
Panel/Picket Railing (48") aluminum (Type 1 & 2)	**$160**		
Panel/Picket Railing (48") aluminum (Type 3-5)	**$220**		
[1] Combine cost of Bullet Railings with Concrete Parapet or Traffic Railing, as appropriate.		**Subtotal**	**$55,680**

8. Expansion Joints			
Type	**Cost per Lin. Foot**	**Quantity**	**Cost**
Poured Joint With Backer Rod	**$100**	**115**	**$11,483**
Strip Seal	**$550**		
Finger Joint < 6"	**$1,900**		
Finger Joint > 6"	**$3,300**		
Modular 6"	**$1,100**		
Modular 8"	**$1,600**		
Modular 12"	**$2,000**		
		Subtotal	**$11,483**

Superstructure Subtotal **$407,073**

E. Miscellaneous Items

1. Bridge Deck Grooving and Planing

Type	Cost per Sq. Yard	Quantity	Cost
Bridge Deck Planing	$9.00		
Bridge Deck Grooving for Short Bridge	$12.00	584	$7,008
Bridge Deck Grooving for Long Bridge	$8.00		
	Grooving and Planing Subtotal		$7,008

2. Detour Bridges

Type	Cost per Sq. Foot	Quantity	Cost
Acrow Detour Bridge [1]	$90		
	Detour Bridge Subtotal		

[1] Using FDOT supplied components. The cost is for the bridge proper (measured out-to-out) and does not include approach work, surfacing, or guardrail.

3. Approach Slab

Approach Slab Material	Cost per Unit	Quantity	Cost
Cast-in-Place Concrete (per Sqaure Yard)	$900	383	$344,500
Carbon Reinforcing Steel (per Pound)	$1.50	25,519	$38,278
Railing Type per Superstructure Section 6(per Lin. Foot)	$200	120.0	$24,000
Panel/Picket Railing (42") steel (Type 1 & 2)(per Lin. Foot)	$180	60.0	$10,800
	Approach Slab Subtotal		$417,578

Unadjusted Total	$1,159,351

Step Two: Estimate Conditional Variables and Cost per Square Foot

After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

** Phased construction is defined as construction over traffic or construction requiring multiple phases to complete the

Conditional Variables	% Increase/	Cost (+/-)
increase cost by 3 %.	3%	$34,781
For construction over traffic and/or phased construction, increase by 20 %. [1]		
[1] Phased construction is defined as construction requiring multiple phases to complete the construction of the entire cross section of the bridge. The 20 percent premium is applied to the affected units of the superstructure and/or substructure.	3%	$34,781

Substructure Subtotal	$327,692
Superstructure Subtotal	$407,073
Walls Subtotal	
Box Culverts Subtotal	
Grooving and Planing Subtotal	$7,008
Detour Bridge Subtotal	
Approach Slab Subtotal	$417,578
Conditional Variables	$34,781
Total Cost	$1,194,132

Total Square Feet of Deck	5512

Cost per Square Foot (not including Approach Slab)	$141

Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel pounds per cubic yard of concrete.

Location	Pounds of Steel per Cubic Yard	Cubic Yds.	Tot. Pounds
Pile Abutments	135		
Pile Bents	145	71.5	10,367
Single Column Piers >25'	210		
Single Column Piers <25'	150		
Multiple Column Piers >25'	215		
Multiple Column Piers <25'	195		
Bascule Piers	110		
Standard Deck Slabs	205	149	30,554
Isotropic Deck Slabs	125		
Concrete Box Girders, Pier Seg	225		
Concrete Box Girders, Typ. Seg	165		
C.I.P. Flat Slabs @ 30ft & 15" Deep	220		
Approach Slab	200	127.6	25,519

Step Three: Cost Estimate Comparison to Historical Bridge Cost

The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are

New Construction (2023 Cost Per Square Foot)		
Bridge Type	**Low**	**High**
Short Span Bridges[1]		
CIP Reinforced Concrete Flat Slab	$140	$320
Florida Slab Beam with CIP Topping	$180	$300
Medium Span Bridges[1]		
Florida I-Beam (FIB) with CIP Deck; FIB36 thru FIB84	$110	$200
Florida I-Beam (FIB) with CIP Deck; FIB96	$190	$270
AASHTO Type II Beam with CIP Deck	$110	$230
Steel I-Girder with CIP Deck; Simple Span[2]	$200	$320
Steel I-Girder with CIP Deck; Continuous Span[2]	$210	$330
Steel Box Girder with CIP Deck; Span Range from 150-feet to 280-feet (add 15% for horizontal curvature)[2]	$220	$340
Segmental Concrete Box Girders; Cantilever Construction	Insuffient Data	
Movable Bridge; Bascule Spans and Piers	Insuffient Data	
Demolition Cost		
Typical	$45	$90
Bascule	Insufficient Data	
Project Type		
Widening (Construction Only)	$165	$240
Widening Removal Work	$115	$215

1 Increase the cost by 20% for phased construction
2 Cost range based on limited data due to use of non-conventional contracts

Estimated Cost per Square Foot **$141**

SR 70 Seg 9-10
Bridge Cost Analysis Summay

FSB Alternative

Bridge Crossing	Span Lengths	Bridge Skew	FSB		Total Cost EB & WB ($)	Total Bridge (SF)	Cost per Square Foot
			WB	EB			
WHIDDEN CREEK	45-50-45	0	$2,292,028	$1,778,965	$4,070,992	14012	$291
JOSHUA CREEK	45-45-45-45	0	$3,000,567	$2,327,662	$5,328,228	18015	$296
TIGER BAY	38-38	0	$1,243,275	$1,502,518	$2,745,792	7606	$361
MOSSY GULLY	48-48	-15	$1,494,271	$1,896,676	$3,390,948	9608	$353
D.C.I. CANAL	38-38	15	$1,291,205	$1,652,121	$2,943,326	7606	$387
LONG POINT MARSH	48-48	15	$1,370,476	$1,753,970	$3,124,446	9608	$325
PARKER CREEK	48-48	0	$1,282,440	$1,527,417	$2,809,857	9608	$292
				Total Cost (FSB's Alternative) =	$24,413,589	76063	$321

FIB Alternative

Bridge Crossing	Span Lengths	Bridge Skew	FIB		Total Cost EB & WB ($)	Total Bridge (SF)	Cost per Square Foot
			WB	EB			
WHIDDEN CREEK	64-76	0	$1,943,862	$1,450,364	$ 3,394,225	14012	$242
JOSHUA CREEK	90-90	0	$2,395,648	$1,796,717	$ 4,192,365	18015	$233
TIGER BAY	76	0	$848,034	$1,131,887	$ 1,979,920	7606	$260
MOSSY GULLY	96	-15	$1,081,948	$1,424,173	$ 2,506,121	9608	$261
D.C.I. CANAL	76	15	$881,084	$1,195,762	$ 2,076,847	7606	$273
LONG POINT MARSH	96	15	$989,913	$1,302,829	$ 2,292,742	9608	$239
PARKER CREEK	96	0	$916,844	$1,194,132	$ 2,110,976	9608	$220
				Total Bridge Cost (FIB's Alternative) =	$18,553,196	76063	$244
				Additional Roadway Cost, Fill & Retaining Walls (FIB Alternative) =	$2,885,327		
				Total Cost FIB ALternative =	$21,438,522		

Overall cost saving for the FIB Alternative =	$2,975,067

1. Costs shown on the tables above include the cost for the bridge & approach slabs only.
2. The additional cost shown for Fill & Retaining Walls is the differece between the two Alternative FIB's vs. FSB's.

FLORIDA SLAB BEAM PILE QUANTITIES ESTIMATE

BRIDGE PILE QUANTITY ESTIMATE

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

Yellow = INPUT Green = OUTPUT

1. Prestressed Concrete Piling: (45'-50'-45' Span Length: WB - FSB Option)

From Beam Design Calculations (Service Loads):

LL for interior beams include Impact per SDG 3.1.L

45' Span Loads:

$R45_{DL.int} := 31.6 \cdot kip$

$R45_{LL.int.EB} := 42.4 \cdot kip$

$R45_{DL.ext} := 31.1 \cdot kip$

$R45_{LL.ext.EB} := 47.34 \cdot kip$

$R45_{LL.int.IB} := 53.6 \cdot kip$

$R45_{LL.ext.IB} := 59.9 \cdot kip$

50' Span Loads:

$R50_{DL.int} := 35.2 \cdot kip$

$R50_{LL.int.EB} := 43.73 \cdot kip$

$R50_{DL.ext} := 34.6 \cdot kip$

$R50_{LL.ext.EB} := 48.83 \cdot kip$

$R50_{LL.int.IB} := 55.1 \cdot kip$

$R50_{LL.ext.IB} := 61.5 \cdot kip$

Number of FSB's

$N_{FSB} := 12$

$tons := 2 \cdot kip$

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

$Rail_{ped} := 0.03 \cdot \frac{kip}{ft}$

Average End Bent Load per Beam

$$R_{DL.EB} := \frac{(N_{FSB} - 2) \cdot R45_{DL.int} + 2 \cdot R45_{DL.ext}}{N_{FSB}} \qquad R_{DL.EB} = 31.5\,kip$$

$$R_{LL.EB} := \frac{(N_{FSB} - 2) \cdot R45_{LL.int.EB} + 2 \cdot R45_{LL.ext.EB}}{N_{FSB}} \qquad R_{LL.EB} = 43.2\,kip$$

Average Int. Bent Load per Beam

$$R_{DL.IB} := \frac{(N_{FSB} - 2) \cdot \frac{(R45_{DL.int} + R50_{DL.int})}{2} + (R45_{DL.ext} + R50_{DL.ext})}{N_{FSB}} \qquad R_{DL.IB} = 33.3\,kip$$

$$R_{LL.IB} := \frac{(N_{FSB} - 2) \cdot \frac{(R45_{LL.int.IB} + R50_{LL.int.IB})}{2} + (R45_{LL.ext.IB} + R50_{LL.ext.IB})}{N_{FSB}} \qquad R_{LL.IB} = 55.4\,kip$$

End Bent Cap DL for Pile Loads

$EB_{Length} := 59.25 \cdot ft$

$EB_{Width} := 3 \cdot ft$

$EB_{Height} := 3 \cdot ft$

Approach Slab DL for Pile Loads

$AS_w := 57.417 \cdot ft$

$AS_l := 30 \cdot ft$

$AP_t := 1 \cdot ft$

Wingwall DL for Pile Loads

$WW_l := 7 \cdot ft$

$WW_w := 0.833 \cdot ft$

$WW_h := 4.917 \cdot ft$

$EB_{DL.Cap} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{DL.Cap} = 40 \cdot tons$

$EB_{DL.AS} := 0.5 \cdot AS_l \cdot \left(AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped}\right)$ $EB_{DL.AS} = 71.3 \cdot tons$

$EB_{DL.WW} := 2 \cdot WW_l \cdot WW_w \cdot WW_h \cdot \gamma_{conc}$ $EB_{DL.WW} = 4.3 \cdot tons$

$EB_{DL} := EB_{DL.Cap} + EB_{DL.AS} + EB_{DL.WW}$ $EB_{DL} = 115.6 \cdot tons$

Intermediate Bent Dead Load: $IB_{Length} := 57.58 \cdot ft$ $IB_{Width} := 3.583 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 46.4 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := \left(1.25 \cdot R_{DL.EB} + 1.75 \cdot R_{LL.EB}\right) \cdot N_{FSB} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 834.7 \cdot tons$

$Total_{IB.Load} := 2 \cdot \left(1.25 \cdot R_{DL.IB} + 1.75 \cdot R_{LL.IB}\right) \cdot N_{FSB} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1721 \cdot tons$

Geotech for 18" PCP Max. NBR 275 tons and 20 Tons Downdrag at End Bents: $NBR_{Max} := 230 \cdot tons$ $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

(conservative)

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$ $Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 5.47$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$ $EB_{Piles} = 6$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 139 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 212 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 9.98$ $IB_{Piles} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}}\right)$ $IB_{Piles} = 10$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$ $Effective_{IB.FDL} = 172 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$ $Effective_{IB.NBR} = 229 \cdot tons$

Top of deck Elevation (see profiles spreadsheet) $Elev_{Whidden} := 62.45 \cdot ft$

$Deck_H := 6.5 \cdot in$ $Beam_H := 15 \cdot in$ $Haunch := 1 \cdot in$

$Neoprene := 0.125 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$$Elev_{Cutoff.Whidden} := Elev_{Whidden} - Deck_H - Haunch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$$

Aproximate pile cutoff elevations for all piles $Elev_{Cutoff.Whidden} = 58.56 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 212 \cdot tons$ $Elev_{tip.EB.Whidden} := -13 \cdot ft$

$Effective_{IB.NBR} = 229 \cdot tons$ $Elev_{tip.IB.Whidden} := -15 \cdot ft$

Total Quantity of Pile at Whidden Creek Bridge

$Pile_{length.EB.Whidden} := Elev_{Cutoff.Whidden} - Elev_{tip.EB.Whidden}$ $Pile_{length.EB.Whidden} = 71.6 \cdot ft$

$Pile_{length.IB.Whidden} := Elev_{Cutoff.Whidden} - Elev_{tip.IB.Whidden}$ $Pile_{length.IB.Whidden} = 73.6 \cdot ft$

$Total_{Length.EB.Whidden} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Whidden}$ $Total_{Length.EB.Whidden} = 859 \cdot ft$

$Total_{Length.IB.Whidden} := 2IB_{Piles} \cdot Pile_{length.IB.Whidden}$ $Total_{Length.IB.Whidden} = 1471 \cdot ft$

$Total_{Piles.Whidden} := Total_{Length.EB.Whidden} + Total_{Length.IB.Whi}$ $Total_{Piles.Whidden} = 2330.1 \cdot ft$

$$Quantity_{Piles.Whidden} := ceil\left(\frac{Total_{Piles.Whidden}}{ft}\right)$$

$Quantity_{Piles.Whidden} = 2331$

BRIDGE PILE QUANTITY ESTIMATE

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

Yellow = INPUT Green = OUTPUT

1. Prestressed Concrete Piling: (45'-50'-45' Span Length: EB - FSB Option)

From Beam Design Calculations (Service Loads):

LL for interior beams include Impact per SDG 3.1.L

45' Span Loads:

$R45_{DL.int} := 31.3 \cdot kip$

$R45_{DL.ext} := 30.8 \cdot kip$

$R45_{LL.int.EB} := 42.4 \cdot kip$

$R45_{LL.ext.EB} := 47.34 \cdot kip$

$R45_{LL.int.IB} := 53.6 \cdot kip$

$R45_{LL.ext.IB} := 59.9 \cdot kip$

50' Span Loads:

$R50_{DL.int} := 34.8 \cdot kip$

$R50_{DL.ext} := 34.3 \cdot kip$

$R50_{LL.int.EB} := 43.73 \cdot kip$

$R50_{LL.ext.EB} := 48.83 \cdot kip$

$R50_{LL.int.IB} := 55.1 \cdot kip$

$R50_{LL.ext.IB} := 61.5 \cdot kip$

Number of FSB's

$N_{FSB} := 9$

$tons := 2 \cdot kip$

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

$Rail_{ped} := 0 \cdot \frac{kip}{ft}$

Average End Bent Load per Beam

$$R_{DL.EB} := \frac{(N_{FSB} - 2) \cdot R45_{DL.int} + 2 \cdot R45_{DL.ext}}{N_{FSB}} \qquad R_{DL.EB} = 31.2\,kip$$

$$R_{LL.EB} := \frac{(N_{FSB} - 2) \cdot R45_{LL.int.EB} + 2 \cdot R45_{LL.ext.EB}}{N_{FSB}} \qquad R_{LL.EB} = 43.5\,kip$$

Average Int. Bent Load per Beam

$$R_{DL.IB} := \frac{(N_{FSB} - 2) \cdot \frac{(R45_{DL.int} + R50_{DL.int})}{2} + (R45_{DL.ext} + R50_{DL.ext})}{N_{FSB}} \qquad R_{DL.IB} = 32.9\,kip$$

$$R_{LL.IB} := \frac{(N_{FSB} - 2) \cdot \frac{(R45_{LL.int.IB} + R50_{LL.int.IB})}{2} + (R45_{LL.ext.IB} + R50_{LL.ext.IB})}{N_{FSB}} \qquad R_{LL.IB} = 55.8\,kip$$

End Bent Cap DL for Pile Loads

$EB_{Length} := 44.5 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

Approach Slab DL for Pile Loads

$AS_w := 42.67 \cdot ft$ $AS_l := 30 \cdot ft$ $AP_t := 1 \cdot ft$

Wingwall DL for Pile Loads

$WW_l := 7 \cdot ft$ $WW_w := 0.833 \cdot ft$ $WW_h := 4.917 \cdot ft$

$EB_{DL.Cap} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{DL.Cap} = 30 \cdot tons$

$EB_{DL.AS} := 0.5 \cdot AS_{l} \cdot \left(AS_{w} \cdot AP_{t} \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped} \right)$ $EB_{DL.AS} = 54.5 \cdot tons$

$EB_{DL.WW} := 2 \cdot WW_{l} \cdot WW_{w} \cdot WW_{h} \cdot \gamma_{conc}$ $EB_{DL.WW} = 4.3 \cdot tons$

$EB_{DL} := EB_{DL.Cap} + EB_{DL.AS} + EB_{DL.WW}$ $EB_{DL} = 88.8 \cdot tons$

Intermediate Bent Dead Load: $IB_{Length} := 42.833 \cdot ft$ $IB_{Width} := 3.583 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 34.5 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := \left(1.25 \cdot R_{DL.EB} + 1.75 \cdot R_{LL.EB} \right) \cdot N_{FSB} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 629 \cdot tons$

$Total_{IB.Load} := 2 \cdot \left(1.25 \cdot R_{DL.IB} + 1.75 \cdot R_{LL.IB} \right) \cdot N_{FSB} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1292.0 \cdot tons$

Geotech for 18" PCP Max.
NBR 275 tons and 20 Tons
Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

(conservative)

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$ $Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 4.12$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}} \right)$ $EB_{Piles} = 5$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 126 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 194 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 7.49$ $IB_{Piles.Calc} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}} \right)$ $IB_{Piles.Calc} = 8$

Use 7 Piles as the NBR is still reasonable: $IB_{Piles} := 7$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$ $Effective_{IB.FDL} = 185 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$ $Effective_{IB.NBR} = 246 \cdot tons$

Top of deck Elevation (see profiles spreadsheet)

$Elev_{Whidden} := 62.45 \cdot ft$

$Deck_H := 6.5 \cdot in$ $Beam_H := 15 \cdot in$ $Haunch := 1 \cdot in$

$Neoprene := 0.125 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Whidden} := Elev_{Whidden} - Deck_H - Haunch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Whidden} = 58.56 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 194 \cdot tons$ $Elev_{tip.EB.Whidden} := -11 \cdot ft$

$Effective_{IB.NBR} = 246 \cdot tons$ $Elev_{tip.IB.Whidden} := -16 \cdot ft$

Total Quantity of Pile at Whidden Creek Bridge

$Pile_{length.EB.Whidden} := Elev_{Cutoff.Whidden} - Elev_{tip.EB.Whidden}$ $Pile_{length.EB.Whidden} = 69.6 \cdot ft$

$Pile_{length.IB.Whidden} := Elev_{Cutoff.Whidden} - Elev_{tip.IB.Whidden}$ $Pile_{length.IB.Whidden} = 74.6 \cdot ft$

$Total_{Length.EB.Whidden} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Whidden}$ $Total_{Length.EB.Whidden} = 696 \cdot ft$

$Total_{Length.IB.Whidden} := 2IB_{Piles} \cdot Pile_{length.IB.Whidden}$ $Total_{Length.IB.Whidden} = 1044 \cdot ft$

$Total_{Piles.Whidden} := Total_{Length.EB.Whidden} + Total_{Length.IB.Whi}$ $Total_{Piles.Whidden} = 1739.6 \cdot ft$

$$Quantity_{Piles.Whidden} := ceil\left(\frac{Total_{Piles.Whidden}}{ft}\right)$$

$Quantity_{Piles.Whidden} = 1740$

BRIDGE PILE QUANTITY ESTIMATE

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

Yellow = INPUT Green = OUTPUT

1. Prestressed Concrete Piling: (45'-45'-45-45' Span Length: WB - FSB Option)

From Beam Design Calculations (Service Loads):

LL for interior beams include Impact per SDG 3.1.L

45' Span Loads:

$R_{DL.int} := 31.6 \cdot kip$ $R_{LL.int.EB} := 42.4 \cdot kip$ $R_{LL.int.IB} := 53.6 \cdot kip$

Number of FSB's

$R_{DL.ext} := 31.1 \cdot kip$ $R_{LL.ext.EB} := 47.34 \cdot kip$ $R_{LL.ext.IB} := 59.9 \cdot kip$ $N_{FSB} := 12$

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$ $Rail_{36in} := 0.430 \frac{kip}{ft}$ $Rail_{ped} := 0.03 \cdot \frac{kip}{ft}$ $tons := 2 \cdot kip$

Average DL per Beam: $R_{DL} := \frac{(N_{FSB} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{FSB}}$ $R_{DL} = 31.5\,kip$

$R_{LL.EB} := \frac{2 \cdot R_{LL.ext.EB} + 2 \cdot R_{LL.int.EB} + (N_{FSB} - 4) \cdot R_{LL.int.EB}}{N_{FSB}}$ $R_{LL.EB} = 43.2\,kip$

$R_{LL.IB} := \frac{2 \cdot R_{LL.ext.IB} + 2 \cdot R_{LL.int.IB} + (N_{FSB} - 4) \cdot R_{LL.int.IB}}{N_{FSB}}$ $R_{LL.IB} = 54.7\,kip$

End Bent Cap DL for Pile Loads $EB_{Length} := 59.25 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

Approach Slab DL for Pile Loads $AS_w := 57.417 \cdot ft$ $AS_l := 30 \cdot ft$ $AP_t := 1 \cdot ft$

Wingwall DL for Pile Loads $WW_l := 7 \cdot ft$ $WW_w := 0.833 \cdot ft$ $WW_h := 4.917 \cdot ft$

$EB_{DL.Cap} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{DL.Cap} = 40 \cdot tons$

$EB_{DL.AS} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{DL.AS} = 71.3 \cdot tons$

$EB_{DL.WW} := 2 \cdot WW_l \cdot WW_w \cdot WW_h \cdot \gamma_{conc}$ $EB_{DL.WW} = 4.3 \cdot tons$

$EB_{DL} := EB_{DL.Cap} + EB_{DL.AS} + EB_{DL.WW}$ $EB_{DL} = 115.6 \cdot tons$

Intermediate Bent Dead Load: $IB_{Length} := 57.58 \cdot ft$ $IB_{Width} := 3.583 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 46.4 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := \left(1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.EB}\right) \cdot N_{FSB} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 835 \cdot tons$

$Total_{IB.Load} := 2 \cdot \left(1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.IB}\right) \cdot N_{FSB} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1678 \cdot tons$

Geotech for 18" PCP Max. NBR 275 tons and 20 Tons Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

(conservative)

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$ $Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 5.47$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$ $EB_{Piles} = 6$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 139 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 212 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 9.73$ $IB_{Piles} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}}\right)$ $IB_{Piles} = 10$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$ $Effective_{IB.FDL} = 168 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$ $Effective_{IB.NBR} = 224 \cdot tons$

Top of deck Elevation (see profiles spreadsheet) $Elev_{Joshua} := 73.15 \cdot ft$

$Deck_H := 6.5 \cdot in$ $Beam_H := 15 \cdot in$ $Haunch := 1 \cdot in$

$Neoprene := 0.125 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Joshua} := Elev_{Joshua} - Deck_H - Haunch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles $Elev_{Cutoff.Joshua} = 69.26 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 212 \cdot tons$

$Elev_{tip.EB.Joshua} := -26 \cdot ft$

$Effective_{IB.NBR} = 224 \cdot tons$

$Elev_{tip.IB.Joshua} := -28 \cdot ft$

Total Quantity of Pile at Joshua Creek Bridge

$Pile_{length.EB.Joshua} := Elev_{Cutoff.Joshua} - Elev_{tip.EB.Joshua}$ $Pile_{length.EB.Joshua} = 95.3 \cdot ft$

$Pile_{length.IB.Joshua} := Elev_{Cutoff.Joshua} - Elev_{tip.IB.Joshua}$ $Pile_{length.IB.Joshua} = 97.3 \cdot ft$

$Total_{Length.EB.Joshua} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Joshua}$ $Total_{Length.EB.Joshua} = 1143 \cdot ft$

$Total_{Length.IB.Joshua} := 3IB_{Piles} \cdot Pile_{length.IB.Joshua}$ $Total_{Length.IB.Joshua} = 2918 \cdot ft$

$Total_{Piles.Joshua} := Total_{Length.EB.Joshua} + Total_{Length.IB.Joshua}$ $Total_{Piles.Joshua} = 4061.1 \cdot ft$

$Quantity_{Piles.Joshua} := ceil\left(\frac{Total_{Piles.Joshua}}{ft}\right)$ $Quantity_{Piles.Joshua} = 4062$

BRIDGE PILE QUANTITY ESTIMATE

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

Yellow = INPUT Green = OUTPUT

1. Prestressed Concrete Piling: (45'-45'-45'-45' Span Length: EB - FSB Option)

From Beam Design Calculations (Service Loads):

LL for interior beams include Impact per SDG 3.1.L

45' Span Loads:

$R_{DL.int} := 31.3 \cdot kip$ $R_{LL.int.EB} := 42.4 \cdot kip$ $R_{LL.int.IB} := 53.6 \cdot kip$

$R_{DL.ext} := 30.8 \cdot kip$ $R_{LL.ext.EB} := 47.34 \cdot kip$ $R_{LL.ext.IB} := 59.9 \cdot kip$

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$ $Rail_{36in} := 0.430 \frac{kip}{ft}$ $Rail_{ped} := 0 \cdot \frac{kip}{ft}$

Number of FSB's

$N_{FSB} := 9$

$tons := 2 \cdot kip$

Average End Bent Load per Beam

Average DL per Beam: $R_{DL} := \frac{(N_{FSB} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{FSB}}$ $R_{DL} = 31.2\,kip$

$R_{LL.EB} := \frac{2 \cdot R_{LL.ext.EB} + 2 \cdot R_{LL.int.EB} + (N_{FSB} - 4) \cdot R_{LL.int.EB}}{N_{FSB}}$ $R_{LL.EB} = 43.5\,kip$

$R_{LL.IB} := \frac{2 \cdot R_{LL.ext.IB} + 2 \cdot R_{LL.int.IB} + (N_{FSB} - 4) \cdot R_{LL.int.IB}}{N_{FSB}}$ $R_{LL.IB} = 55\,kip$

End Bent Cap DL for Pile Loads $EB_{Length} := 44.5 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

Approach Slab DL for Pile Loads $AS_w := 42.67 \cdot ft$ $AS_l := 30 \cdot ft$ $AP_t := 1 \cdot ft$

Wingwall DL for Pile Loads $WW_l := 7 \cdot ft$ $WW_w := 0.833 \cdot ft$ $WW_h := 4.917 \cdot ft$

$EB_{DL.Cap} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{DL.Cap} = 30 \cdot tons$

$EB_{DL.AS} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{DL.AS} = 54.5 \cdot tons$

$EB_{DL.WW} := 2 \cdot WW_l \cdot WW_w \cdot WW_h \cdot \gamma_{conc}$ $EB_{DL.WW} = 4.3 \cdot tons$

$EB_{DL} := EB_{DL.Cap} + EB_{DL.AS} + EB_{DL.WW}$ $EB_{DL} = 88.8 \cdot tons$

Intermediate Bent Dead Load: $IB_{Length} := 42.833 \cdot ft$ $IB_{Width} := 3.583 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 34.5 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := \left(1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.EB}\right) \cdot N_{FSB} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 629 \cdot tons$

$Total_{IB.Load} := 2 \cdot \left(1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.IB}\right) \cdot N_{FSB} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1260 \cdot tons$

Geotech for 18" PCP Max. NBR 275 tons and 20 Tons Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

(conservative)

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$ $Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 4.12$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$ $EB_{Piles} = 5$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 126 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 194 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 7.31$ $IB_{Piles.Calc} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}}\right)$ $IB_{Piles.Calc} = 8$

Use 7, NBR Still Reasonable $IB_{Piles} := 7$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$ $Effective_{IB.FDL} = 180 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$ $Effective_{IB.NBR} = 240 \cdot tons$

Top of deck Elevation (see profiles spreadsheet) $Elev_{Joshua} := 73.15 \cdot ft$

$Deck_H := 6.5 \cdot in$ $Beam_H := 15 \cdot in$ $Haunch := 1 \cdot in$

$Neoprene := 0.125 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Joshua} := Elev_{Joshua} - Deck_H - Haunch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles $Elev_{Cutoff.Joshua} = 69.26 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 194 \cdot tons$ $Elev_{tip.EB.Joshua} := -24 \cdot ft$

$Effective_{IB.NBR} = 240 \cdot tons$ $Elev_{tip.IB.Joshua} := -30 \cdot ft$

Total Quantity of Pile at Joshua Creek Bridge

$Pile_{length.EB.Joshua} := Elev_{Cutoff.Joshua} - Elev_{tip.EB.Joshua}$ $Pile_{length.EB.Joshua} = 93.3 \cdot ft$

$Pile_{length.IB.Joshua} := Elev_{Cutoff.Joshua} - Elev_{tip.IB.Joshua}$ $Pile_{length.IB.Joshua} = 99.3 \cdot ft$

$Total_{Length.EB.Joshua} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Joshua}$ $Total_{Length.EB.Joshua} = 933 \cdot ft$

$Total_{Length.IB.Joshua} := 3IB_{Piles} \cdot Pile_{length.IB.Joshua}$ $Total_{Length.IB.Joshua} = 2085 \cdot ft$

$Total_{Piles.Joshua} := Total_{Length.EB.Joshua} + Total_{Length.IB.Joshua}$ $Total_{Piles.Joshua} = 3017.2 \cdot ft$

$Quantity_{Piles.Joshua} := ceil\left(\frac{Total_{Piles.Joshua}}{ft}\right)$ $Quantity_{Piles.Joshua} = 3018$

BRIDGE PILE QUANTITY ESTIMATE

Yellow = INPUT Green = OUTPUT

1. Prestressed Concrete Piling: (38'-38' Span Length: WB - FSB Option)

$Rail_{36in} := 0.430 \frac{kip}{ft}$ $Rail_{ped} := 0 \cdot \frac{kip}{ft}$

From Beam Design Calculations (Service Loads):
For LL, use skewed beam design reactions
for the first 2 int. beams on each side (FSB)
LL for interior beams include Impact per SDG 3.1.L

$tons := 2 \cdot kip$

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$R_{DL.int} := 26.4 \cdot kip$ $R_{LL.int.skew.EB} := 46.78 \cdot kip$ $R_{LL.int.skew.IB} := 59.5 \cdot kip$

$R_{DL.ext} := 26.0 \cdot kip$ $R_{LL.ext.skew.EB} := 52.24 \cdot kip$ $R_{LL.ext.skew.IB} := 66.4 \cdot kip$

$R_{LL.int.EB} := 40.19 \cdot kip$ $R_{LL.int.IB} := 51.1 \cdot kip$

Number of FSB's
$N_{FSB} := 9$

Average DL per Beam: $R_{DL} := \frac{(N_{FSB} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{FSB}}$ $R_{DL} = 26.3\,kip$

$R_{LL.EB} := \frac{2 \cdot R_{LL.ext.skew.EB} + 2 \cdot R_{LL.int.skew.EB} + (N_{FSB} - 4) \cdot R_{LL.int.EB}}{N_{FSB}}$ $R_{LL.EB} = 44.3\,kip$

$R_{LL.IB} := \frac{2 \cdot R_{LL.ext.skew.IB} + 2 \cdot R_{LL.int.skew.IB} + (N_{FSB} - 4) \cdot R_{LL.int.IB}}{N_{FSB}}$ $R_{LL.IB} = 56.4\,kip$

Use DCI EB geometry due to skew (conservative) (lengths measured in the dgn file)

End Bent DL for Pile Loads: $EB_{Length} := 46.01 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

Approach Slab DL for Pile Loads: $AS_w := 42.67 \cdot ft$ $AS_l := 31.06 \cdot ft$ $AP_t := 1 \cdot ft$

Wingwall DL for Pile Loads: $WW_l := 7 \cdot ft$ $WW_w := 0.833 \cdot ft$ $WW_h := 4.917 \cdot ft$

$EB_{DL.Cap} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{DL.Cap} = 31.1 \cdot tons$

$EB_{DL.AS} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{DL.AS} = 56.4 \cdot tons$

$EB_{DL.WW} := 2 \cdot WW_l \cdot WW_w \cdot WW_h \cdot \gamma_{conc}$ $EB_{DL.WW} = 4.3 \cdot tons$

$EB_{DL} := EB_{DL.Cap} + EB_{DL.AS} + EB_{DL.WW}$ $EB_{DL} = 91.7 \cdot tons$

Intermediate Bent Dead Load: $IB_{Length} := 45.30 \cdot ft$ $IB_{Width} := 3.5833 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 36.5 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.EB}) \cdot N_{FSB} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 612 \cdot tons$

$Total_{IB.Load} := 2 \cdot (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.IB}) \cdot N_{FSB} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1229 \cdot tons$

Geotech for 18" PCP Max.
NBR 275 tons and 20 Tons Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ (conservative)

$DownDrag_{EB} := 20 \cdot tons$

$Compression_{RF} := 0.75$

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$

$Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$

$Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 4.01$

$EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$

$EB_{Piles} = 5$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$

$Effective_{EB.FDL} = 122 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$

$Effective_{EB.NBR} = 190 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 7.13$

$IB_{Piles.Calc} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}}\right)$

$IB_{Piles.Calc} = 8$

Use 7 Piles as the NBR is still reasonable:

$IB_{Piles} := 7$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$

$Effective_{IB.FDL} = 176 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$

$Effective_{IB.NBR} = 234 \cdot tons$

Top of deck Elevation (see profiles spreadsheet)

$Elev_{Tiger} := 80.59 \cdot ft$

$Elev_{DCI} := 81.29 \cdot ft$

$Deck_H := 6 \cdot in$

$Beam_H := 15 \cdot in$

$Huanch := 1 \cdot in$

$Neoprene := 0.125 \cdot in$

$Cap_H := 3 \cdot ft$

$Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Tiger} := Elev_{Tiger} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

$Elev_{Cutoff.DCI} := Elev_{DCI} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Tiger} = 76.75 \cdot ft$

$Elev_{Cutoff.DCI} = 77.45 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 190 \cdot tons$

$Elev_{tip.EB.Tiger} := -14 \cdot ft$

$Elev_{tip.EB.DCI} := -22 \cdot ft$

$Effective_{IB.NBR} = 234 \cdot tons$

$Elev_{tip.IB.Tiger} := -18 \cdot ft$

$Elev_{tip.IB.DCI} := -31 \cdot ft$

Total Quantity of Pile at Tiger Bay Bridge

$Pile_{length.EB.Tiger} := Elev_{Cutoff.Tiger} - Elev_{tip.EB.Tiger}$ $Pile_{length.EB.Tiger} = 90.746 \cdot ft$

$Pile_{length.IB.Tiger} := Elev_{Cutoff.Tiger} - Elev_{tip.IB.Tiger}$ $Pile_{length.IB.Tiger} = 94.7 \cdot ft$

$Total_{Length.EB.Tiger} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Tiger}$ $Total_{Length.EB.Tiger} = 907 \cdot ft$

$Total_{Length.IB.Tiger} := IB_{Piles} \cdot Pile_{length.IB.Tiger}$ $Total_{Length.IB.Tiger} = 663 \cdot ft$

$Total_{Piles.Tiger} := Total_{Length.EB.Tiger} + Total_{Length.IB.Tiger}$ $Total_{Piles.Tiger} = 1570.7 \cdot ft$

$Quantity_{Piles.Tiger} := ceil\left(\frac{Total_{Piles.Tiger}}{ft}\right)$ $Quantity_{Piles.Tiger} = 1571$

Total Quantity of Pile at DCI Canal Bridge

$Pile_{length.EB.DCI} := Elev_{Cutoff.DCI} - Elev_{tip.EB.DCI}$ $Pile_{length.EB.DCI} = 99.4 \cdot ft$

$Pile_{length.IB.DCI} := Elev_{Cutoff.DCI} - Elev_{tip.IB.DCI}$ $Pile_{length.IB.DCI} = 108.4 \cdot ft$

$Total_{Length.EB.DCI} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.DCI}$ $Total_{Length.EB.DCI} = 994 \cdot ft$

$Total_{Length.IB.DCI} := IB_{Piles} \cdot Pile_{length.IB.DCI}$ $Total_{Length.IB.DCI} = 759 \cdot ft$

$Total_{Piles.DCI} := Total_{Length.EB.DCI} + Total_{Length.IB.DCI}$ $Total_{Piles.DCI} = 1753.6 \cdot ft$

$Quantity_{Piles.DCI} := ceil\left(\frac{Total_{Piles.DCI}}{ft}\right)$ $Quantity_{Piles.DCI} = 1754$

BRIDGE PILE QUANTITY ESTIMATE

Yellow = INPUT Green = OUTPUT

1. Prestressed Concrete Piling: (38'-38' Span Length: EB - FSB Option)

From Beam Design Calculations (Service Loads):
For LL, use skewed beam design reactions
for the first 2 int. beams on each side (FSB)
LL for interior beams include Impact per SDG 3.1.L

$Rail_{36in} := 0.430 \frac{kip}{ft}$ $Rail_{ped} := 0.03 \cdot \frac{kip}{ft}$

$tons := 2 \cdot kip$

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$R_{DL.int} := 26.7 \cdot kip$ $R_{LL.int.skew.EB} := 46.78 \cdot kip$ $R_{LL.int.skew.IB} := 59.5 \cdot kip$

$R_{DL.ext} := 26.2 \cdot kip$ $R_{LL.ext.skew.EB} := 52.24 \cdot kip$ $R_{LL.ext.skew.IB} := 66.4 \cdot kip$

$R_{LL.int.EB} := 40.19 \cdot kip$ $R_{LL.int.IB} := 51.1 \cdot kip$

Number of FSB's

$N_{FSB} := 12$

Average DL per Beam:

$$R_{DL} := \frac{(N_{FSB} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{FSB}} \qquad R_{DL} = 26.6\,kip$$

$$R_{LL.EB} := \frac{2 \cdot R_{LL.ext.skew.EB} + 2 \cdot R_{LL.int.skew.EB} + (N_{FSB} - 4) \cdot R_{LL.int.EB}}{N_{FSB}} \qquad R_{LL.EB} = 43.3\,kip$$

$$R_{LL.IB} := \frac{2 \cdot R_{LL.ext.skew.IB} + 2 \cdot R_{LL.int.skew.IB} + (N_{FSB} - 4) \cdot R_{LL.int.IB}}{N_{FSB}} \qquad R_{LL.IB} = 55.1\,kip$$

Use DCI EB geometry due to skew (conservative) (lengths measured in the dgn file)

End Bent DL for Pile Loads

$EB_{Length} := 61.28 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

Approach Slab

$AS_w := 57.417 \cdot ft$ $AS_l := 31.06 \cdot ft$ $AP_t := 1 \cdot ft$

Wingwall DL for Pile Loads

$WW_l := 7 \cdot ft$ $WW_w := 0.833 \cdot ft$ $WW_h := 4.917 \cdot ft$

$EB_{DL.Cap} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{DL.Cap} = 41.4 \cdot tons$

$EB_{DL.AS} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{DL.AS} = 73.8 \cdot tons$

$EB_{DL.WW} := 2 \cdot WW_l \cdot WW_w \cdot WW_h \cdot \gamma_{conc}$ $EB_{DL.WW} = 4.3 \cdot tons$

$EB_{DL} := EB_{DL.Cap} + EB_{DL.AS} + EB_{DL.WW}$ $EB_{DL} = 119.5 \cdot tons$

Intermediate Bent Dead Load:

$IB_{Length} := 60.57 \cdot ft$ $IB_{Width} := 3.5833 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 48.8 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := \left(1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.EB}\right) \cdot N_{FSB} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 804 \cdot tons$

$Total_{IB.Load} := 2 \cdot \left(1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.IB}\right) \cdot N_{FSB} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1616 \cdot tons$

Geotech for 18" PCP Max.
NBR 275 tons and 20 Tons Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ (conservative) $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$ $Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 5.27$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$ $EB_{Piles} = 6$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 134 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 205 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 9.37$ $IB_{Piles.Calc} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}}\right)$ $IB_{Piles.Calc} = 10$

Use 9 Piles as the NBR is still reasonable: $IB_{Piles} := 9$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$ $Effective_{IB.FDL} = 180 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$ $Effective_{IB.NBR} = 239 \cdot tons$

Top of deck Elevation (see profiles spreadsheet) $Elev_{Tiger} := 80.59 \cdot ft$ $Elev_{DCI} := 81.29 \cdot ft$

$Deck_H := 6 \cdot in$ $Beam_H := 15 \cdot in$ $Huanch := 1 \cdot in$

$Neoprene := 0.125 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Tiger} := Elev_{Tiger} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

$Elev_{Cutoff.DCI} := Elev_{DCI} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Tiger} = 76.75 \cdot ft$

$Elev_{Cutoff.DCI} = 77.45 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 205 \cdot tons$

$Elev_{tip.EB.Tiger} := -15 \cdot ft$

$Elev_{tip.EB.DCI} := -25 \cdot ft$

$Effective_{IB.NBR} = 239 \cdot tons$

$Elev_{tip.IB.Tiger} := -18 \cdot ft$

$Elev_{tip.IB.DCI} := -31 \cdot ft$

Total Quantity of Pile at Tiger Bay Bridge

$Pile_{length.EB.Tiger} := Elev_{Cutoff.Tiger} - Elev_{tip.EB.Tiger}$

$Pile_{length.EB.Tiger} = 91.746 \cdot ft$

$Pile_{length.IB.Tiger} := Elev_{Cutoff.Tiger} - Elev_{tip.IB.Tiger}$

$Pile_{length.IB.Tiger} = 94.7 \cdot ft$

$Total_{Length.EB.Tiger} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Tiger}$

$Total_{Length.EB.Tiger} = 1101 \cdot ft$

$Total_{Length.IB.Tiger} := IB_{Piles} \cdot Pile_{length.IB.Tiger}$

$Total_{Length.IB.Tiger} = 853 \cdot ft$

$Total_{Piles.Tiger} := Total_{Length.EB.Tiger} + Total_{Length.IB.Tiger}$

$Total_{Piles.Tiger} = 1953.7 \cdot ft$

$Quantity_{Piles.Tiger} := ceil\left(\frac{Total_{Piles.Tiger}}{ft}\right)$

$Quantity_{Piles.Tiger} = 1954$

Total Quantity of Pile at DCI Canal Bridge

$Pile_{length.EB.DCI} := Elev_{Cutoff.DCI} - Elev_{tip.EB.DCI}$

$Pile_{length.EB.DCI} = 102.4 \cdot ft$

$Pile_{length.IB.DCI} := Elev_{Cutoff.DCI} - Elev_{tip.IB.DCI}$

$Pile_{length.IB.DCI} = 108.4 \cdot ft$

$Total_{Length.EB.DCI} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.DCI}$

$Total_{Length.EB.DCI} = 1229 \cdot ft$

$Total_{Length.IB.DCI} := IB_{Piles} \cdot Pile_{length.IB.DCI}$

$Total_{Length.IB.DCI} = 976 \cdot ft$

$Total_{Piles.DCI} := Total_{Length.EB.DCI} + Total_{Length.IB.DCI}$

$Total_{Piles.DCI} = 2205.4 \cdot ft$

$Quantity_{Piles.DCI} := ceil\left(\frac{Total_{Piles.DCI}}{ft}\right)$

$Quantity_{Piles.DCI} = 2206$

BRIDGE PILE QUANTITY ESTIMATE

Yellow = INPUT Green = OUTPUT

$Rail_{36in} := 0.430 \frac{kip}{ft}$ $Rail_{ped} := 0 \cdot \frac{kip}{ft}$

1. Prestressed Concrete Piling: (48'-48' Span Length: WB - FSB Option)

From Beam Design Calculations (Service Loads):
For LL, use skewed beam design reactions
for the first 2 int. beams on each side (FSB)

$tons := 2 \cdot kip$

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$R_{DL.int} := 33.4 \cdot kip$ $R_{LL.int.skew.EB} := 52.28 \cdot kip$ $R_{LL.int.skew.IB} := 66.0 \cdot kip$

$R_{DL.ext} := 32.9 \cdot kip$ $R_{LL.ext.skew.EB} := 58.38 \cdot kip$ $R_{LL.ext.skew.IB} := 73.7 \cdot kip$

Number of FSB's

$R_{LL.int.EB} := 43.2 \cdot kip$ $R_{LL.int.IB} := 54.5 \cdot kip$ $N_{FSB} := 9$

Average DL per Beam: $R_{DL} := \frac{(N_{FSB} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{FSB}}$ $R_{DL} = 33.3\,kip$

$R_{LL.EB} := \frac{2 \cdot R_{LL.ext.skew.EB} + 2 \cdot R_{LL.int.skew.EB} + (N_{FSB} - 4) \cdot R_{LL.int.EB}}{N_{FSB}}$ $R_{LL.EB} = 48.6\,kip$

$R_{LL.IB} := \frac{2 \cdot R_{LL.ext.skew.IB} + 2 \cdot R_{LL.int.skew.IB} + (N_{FSB} - 4) \cdot R_{LL.int.IB}}{N_{FSB}}$ $R_{LL.IB} = 61.3\,kip$

Use Mossy Gully or Long Point Marsh EB geometry due to skew (conservative) (lengths measured in the dgn file)

End Bent Cap DL for Pile Loads $EB_{Length} := 46.01 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

Approach Slab DL for Pile Loads $AS_w := 42.67 \cdot ft$ $AS_l := 31.06 \cdot ft$ $AP_t := 1 \cdot ft$

Wingwall DL for Pile Loads $WW_l := 7 \cdot ft$ $WW_w := 0.833 \cdot ft$ $WW_h := 4.917 \cdot ft$

$EB_{DL.Cap} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{DL.Cap} = 31.1 \cdot tons$

$EB_{DL.AS} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{DL.AS} = 56.4 \cdot tons$

$EB_{DL.WW} := 2 \cdot WW_l \cdot WW_w \cdot WW_h \cdot \gamma_{conc}$ $EB_{DL.WW} = 4.301 \cdot tons$

$EB_{DL} := EB_{DL.Cap} + EB_{DL.AS} + EB_{DL.WW}$ $EB_{DL} = 91.7 \cdot tons$

Intermediate Bent Dead Load: $IB_{Length} := 45.30 \cdot ft$ $IB_{Width} := 3.5833 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 36.5 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.EB}) \cdot N_{FSB} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 685 \cdot tons$

$Total_{IB.Load} := 2 \cdot (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.IB}) \cdot N_{FSB} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1386 \cdot tons$

Geotech for 18" PCP Max.
NBR 275 tons and 20 Tons
Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ (conservative) $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$ $Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 4.49$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$ $EB_{Piles} = 5$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 137 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 209 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 8.03$ $IB_{Piles.Calc} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}}\right)$ $IB_{Piles.Calc} = 9$

Use 8 Piles as the NBR is still reasonable: $IB_{Piles} := 8$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$ $Effective_{IB.FDL} = 173 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$ $Effective_{IB.NBR} = 231 \cdot tons$

Top of deck Elevation (see profiles spreadsheet)

$Elev_{Mossy} := 81.69 \cdot ft$ $Elev_{Long} := 88.19 \cdot ft$ $Elev_{Parker} := 90.39 \cdot ft$

$Deck_H := 6 \cdot in$ $Beam_H := 15 \cdot in$ $Huanch := 1 \cdot in$

$Neoprene := 0.125 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Mossy} := Elev_{Mossy} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

$Elev_{Cutoff.Long} := Elev_{Long} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

$Elev_{Cutoff.Parker} := Elev_{Parker} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Mossy} = 77.846 \cdot ft$ $Elev_{Cutoff.Long} = 84.35 \cdot ft$ $Elev_{Cutoff.Parker} = 86.55 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 209 \cdot tons$ $Elev_{tip.EB.Mossy} := -39 \cdot ft$ $Elev_{tip.EB.Long} := 9 \cdot ft$ $Elev_{tip.EB.Parker} := 32 \cdot ft$

$Effective_{IB.NBR} = 231 \cdot tons$ $Elev_{tip.IB.Mossy} := -41 \cdot ft$ $Elev_{tip.IB.Long} := 2 \cdot ft$ $Elev_{tip.IB.Parker} := 30 \cdot ft$

Total Quantity of Pile at Mossy Gully Bridge

$Pile_{length.EB.Mossy} := Elev_{Cutoff.Mossy} - Elev_{tip.EB.Mossy}$ $Pile_{length.EB.Mossy} = 116.8 \cdot ft$

$Pile_{length.IB.Mossy} := Elev_{Cutoff.Mossy} - Elev_{tip.IB.Mossy}$ $Pile_{length.IB.Mossy} = 118.8 \cdot ft$

$Total_{Length.EB.Mossy} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Mossy}$ $Total_{Length.EB.Mossy} = 1168 \cdot ft$

$Total_{Length.IB.Mossy} := IB_{Piles} \cdot Pile_{length.IB.Mossy}$ $Total_{Length.IB.Mossy} = 951 \cdot ft$

$Total_{Piles.Mossy} := Total_{Length.EB.Mossy} + Total_{Length.IB.Mossy}$ $Total_{Piles.Mossy} = 2119.2 \cdot ft$

$Quantity_{Piles.Mossy} := ceil\left(\frac{Total_{Piles.Mossy}}{ft}\right)$ $Quantity_{Piles.Mossy} = 2120$

Total Quantity of Pile at Long Point Marsh Bridge

$Pile_{length.EB.Long} := Elev_{Cutoff.Long} - Elev_{tip.EB.Long}$ $Pile_{length.EB.Long} = 75.3 \cdot ft$

$Pile_{length.IB.Long} := Elev_{Cutoff.Long} - Elev_{tip.IB.Long}$ $Pile_{length.IB.Long} = 82.3 \cdot ft$

$Total_{Length.EB.Long} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Long}$ $Total_{Length.EB.Long} = 753 \cdot ft$

$Total_{Length.IB.Long} := IB_{Piles} \cdot Pile_{length.IB.Long}$ $Total_{Length.IB.Long} = 659 \cdot ft$

$Total_{Piles.Long} := Total_{Length.EB.Long} + Total_{Length.IB.Long}$ $Total_{Piles.Long} = 1412.2 \cdot ft$

$Quantity_{Piles.Long} := ceil\left(\frac{Total_{Piles.Long}}{ft}\right)$ $Quantity_{Piles.Long} = 1413$

Total Quantity of Pile at Parker Creek Bridge

$Pile_{length.EB.Parker} := Elev_{Cutoff.Parker} - Elev_{tip.EB.Parker}$ $Pile_{length.EB.Parker} = 54.5 \cdot ft$

$Pile_{length.IB.Parker} := Elev_{Cutoff.Parker} - Elev_{tip.IB.Parker}$ $Pile_{length.IB.Parker} = 56.5 \cdot ft$

$Total_{Length.EB.Parker} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Parker}$ $Total_{Length.EB.Parker} = 545 \cdot ft$

$Total_{Length.IB.Parker} := IB_{Piles} \cdot Pile_{length.IB.Parker}$ $Total_{Length.IB.Parker} = 452 \cdot ft$

$Total_{Piles.Parker} := Total_{Length.EB.Parker} + Total_{Length.IB.Parker}$ $Total_{Piles.Parker} = 997.8 \cdot ft$

$Quantity_{Piles.Parker} := ceil\left(\frac{Total_{Piles.Parker}}{ft}\right)$ $Quantity_{Piles.Parker} = 998$

BRIDGE PILE QUANTITY ESTIMATE

Yellow = INPUT Green = OUTPUT

1. Prestressed Concrete Piling: (48'-48' Span Length: EB - FSB Option)

From Beam Design Calculations (Service Loads):
For LL, use skewed beam design reactions
for the first 2 int. beams on each side (FSB)
LL for interior beams include Impact per SDG 3.1.L

$Rail_{36in} := 0.430 \frac{kip}{ft}$ $Rail_{ped} := 0.03 \cdot \frac{kip}{ft}$

$tons := 2 \cdot kip$ $\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$R_{DL.int} := 33.7 \cdot kip$ $R_{LL.int.skew.EB} := 52.28 \cdot kip$ $R_{LL.int.skew.IB} := 66.0 \cdot kip$

$R_{DL.ext} := 33.2 \cdot kip$ $R_{LL.ext.skew.EB} := 58.38 \cdot kip$ $R_{LL.ext.skew.IB} := 73.7 \cdot kip$

Number of FSB's

$R_{LL.int.EB} := 43.2 \cdot kip$ $R_{LL.int.IB} := 54.5 \cdot kip$ $N_{FSB} := 12$

Average DL per Beam: $R_{DL} := \frac{(N_{FSB} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{FSB}}$ $R_{DL} = 33.6\,kip$

$R_{LL.EB} := \frac{2 \cdot R_{LL.ext.skew.EB} + 2 \cdot R_{LL.int.skew.EB} + (N_{FSB} - 4) \cdot R_{LL.int.EB}}{N_{FSB}}$ $R_{LL.EB} = 47.2\,kip$

$R_{LL.IB} := \frac{2 \cdot R_{LL.ext.skew.IB} + 2 \cdot R_{LL.int.skew.IB} + (N_{FSB} - 4) \cdot R_{LL.int.IB}}{N_{FSB}}$ $R_{LL.IB} = 59.6\,kip$

Use Mossy Gully or Long Point Marsh EB geometry due to skew (conservative) (lengths measured in the dgn file)

End Bent Cap DL for Pile Loads: $EB_{Length} := 61.28 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

Approach Slab: $AS_w := 57.417 \cdot ft$ $AS_l := 31.06 \cdot ft$ $AP_t := 1 \cdot ft$

Wingwall DL for Pile Loads: $WW_l := 7 \cdot ft$ $WW_w := 0.833 \cdot ft$ $WW_h := 4.917 \cdot ft$

$EB_{DL.Cap} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{DL.Cap} = 41.4 \cdot tons$

$EB_{DL.AS} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{DL.AS} = 73.8 \cdot tons$

$EB_{DL.WW} := 2 \cdot WW_l \cdot WW_w \cdot WW_h \cdot \gamma_{conc}$ $EB_{DL.WW} = 4.3 \cdot tons$

$EB_{DL} := EB_{DL.Cap} + EB_{DL.AS} + EB_{DL.WW}$ $EB_{DL} = 119.5 \cdot tons$

Intermediate Bent Dead Load: $IB_{Length} := 60.57 \cdot ft$ $IB_{Width} := 3.5833 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 48.8 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.EB}) \cdot N_{FSB} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 897 \cdot tons$

$Total_{IB.Load} := 2 \cdot (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.IB}) \cdot N_{FSB} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1817 \cdot tons$

Geotech for 18" PCP Max.
NBR 275 tons and 20 Tons
Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ (conservative) $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$ $Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 5.89$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$ $EB_{Piles} = 6$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 150 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 226 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 10.53$ $IB_{Piles.Calc} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}}\right)$ $IB_{Piles.Calc} = 11$

Use 10 Piles as the NBR is still reasonable: $IB_{Piles} := 10$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$ $Effective_{IB.FDL} = 182 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$ $Effective_{IB.NBR} = 242 \cdot tons$

Top of deck Elevation (see profiles spreadsheet)

$Elev_{Mossy} := 81.69 \cdot ft$ $Elev_{Long} := 88.19 \cdot ft$ $Elev_{Parker} := 90.39 \cdot ft$

$Deck_H := 6 \cdot in$ $Beam_H := 15 \cdot in$ $Huanch := 1 \cdot in$

$Neoprene := 0.125 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Mossy} := Elev_{Mossy} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

$Elev_{Cutoff.Long} := Elev_{Long} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

$Elev_{Cutoff.Parker} := Elev_{Parker} - Deck_H - Huanch - Beam_H - Cap_H - Neoprene + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Mossy} = 77.846 \cdot ft$ $Elev_{Cutoff.Long} = 84.35 \cdot ft$ $Elev_{Cutoff.Parker} = 86.55 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 226 \cdot tons$ $Elev_{tip.EB.Mossy} := -40 \cdot ft$ $Elev_{tip.EB.Long} := 4 \cdot ft$ $Elev_{tip.EB.Parker} := 31 \cdot ft$

$Effective_{IB.NBR} = 242 \cdot tons$ $Elev_{tip.IB.Mossy} := -43 \cdot ft$ $Elev_{tip.IB.Long} := 0 \cdot ft$ $Elev_{tip.IB.Parker} := 29 \cdot ft$

Total Quantity of Pile at Mossy Gully Bridge

$Pile_{length.EB.Mossy} := Elev_{Cutoff.Mossy} - Elev_{tip.EB.Mossy}$ $Pile_{length.EB.Mossy} = 117.8 \cdot ft$

$Pile_{length.IB.Mossy} := Elev_{Cutoff.Mossy} - Elev_{tip.IB.Mossy}$ $Pile_{length.IB.Mossy} = 120.8 \cdot ft$

$Total_{Length.EB.Mossy} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Mossy}$ $Total_{Length.EB.Mossy} = 1414 \cdot ft$

$Total_{Length.IB.Mossy} := IB_{Piles} \cdot Pile_{length.IB.Mossy}$ $Total_{Length.IB.Mossy} = 1208 \cdot ft$

$Total_{Piles.Mossy} := Total_{Length.EB.Mossy} + Total_{Length.IB.Mossy}$ $Total_{Piles.Mossy} = 2622.6 \cdot ft$

$Quantity_{Piles.Mossy} := ceil\left(\frac{Total_{Piles.Mossy}}{ft}\right)$ $Quantity_{Piles.Mossy} = 2623$

Total Quantity of Pile at Long Point Marsh Bridge

$Pile_{length.EB.Long} := Elev_{Cutoff.Long} - Elev_{tip.EB.Long}$ $Pile_{length.EB.Long} = 80.3 \cdot ft$

$Pile_{length.IB.Long} := Elev_{Cutoff.Long} - Elev_{tip.IB.Long}$ $Pile_{length.IB.Long} = 84.3 \cdot ft$

$Total_{Length.EB.Long} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Long}$ $Total_{Length.EB.Long} = 964 \cdot ft$

$Total_{Length.IB.Long} := IB_{Piles} \cdot Pile_{length.IB.Long}$ $Total_{Length.IB.Long} = 843 \cdot ft$

$Total_{Piles.Long} := Total_{Length.EB.Long} + Total_{Length.IB.Long}$ $Total_{Piles.Long} = 1807.6 \cdot ft$

$Quantity_{Piles.Long} := ceil\left(\frac{Total_{Piles.Long}}{ft}\right)$ $Quantity_{Piles.Long} = 1808$

Total Quantity of Pile at Parker Creek Bridge

$Pile_{length.EB.Parker} := Elev_{Cutoff.Parker} - Elev_{tip.EB.Parker}$ $Pile_{length.EB.Parker} = 55.5 \cdot ft$

$Pile_{length.IB.Parker} := Elev_{Cutoff.Parker} - Elev_{tip.IB.Parker}$ $Pile_{length.IB.Parker} = 57.5 \cdot ft$

$Total_{Length.EB.Parker} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Parker}$ $Total_{Length.EB.Parker} = 667 \cdot ft$

$Total_{Length.IB.Parker} := IB_{Piles} \cdot Pile_{length.IB.Parker}$ $Total_{Length.IB.Parker} = 575 \cdot ft$

$Total_{Piles.Parker} := Total_{Length.EB.Parker} + Total_{Length.IB.Parker}$ $Total_{Piles.Parker} = 1242.0 \cdot ft$

$Quantity_{Piles.Parker} := ceil\left(\frac{Total_{Piles.Parker}}{ft}\right)$ $Quantity_{Piles.Parker} = 1243$

FLORIDA-I BEAM PILE QUANTITIES ESTIMATE

BRIDGE PILE QUANTITY ESTIMATE

Yellow = INPUT Green = OUTPUT

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{ped} := 0.03 \cdot \frac{kip}{ft}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

1. Prestressed Concrete Piling: (64'-76' Span Length: WB - FIB Option)

From Beam Design Calculations (Service Loads):

$N_{Beams} := 6$

$tons := 2 \cdot kip$

64' Span Loads:

$R64_{DL.int} := 78.5 \cdot kip$

$R64_{DL.ext} := 70.7 \cdot kip$

$R64_{LL.int.EB} := 78.5 \cdot kip$

$R64_{LL.ext.EB} := 73.0 \cdot kip$

$R64_{LL.int.IB} := 98.0 \cdot kip$

$R64_{LL.ext.IB} := 91.2 \cdot kip$

76' Span Loads:

$R76_{DL.int} := 88.5 \cdot kip$

$R76_{DL.ext} := 79.9 \cdot kip$

$R76_{LL.int.EB} := 83.7 \cdot kip$

$R76_{LL.ext.EB} := 79.2 \cdot kip$

$R76_{LL.int.IB} := 103.7 \cdot kip$

$R76_{LL.ext.IB} := 98.1 \cdot kip$

Average End Bent Load per Beam

$$R_{DL.EB} := \frac{(N_{Beams} - 2) \cdot R76_{DL.int} + 2 \cdot R76_{DL.ext}}{N_{Beams}} \qquad R_{DL.EB} = 85.6\,kip$$

$$R_{LL.EB} := \frac{(N_{Beams} - 2) \cdot R76_{LL.int.EB} + 2 \cdot R76_{LL.ext.EB}}{N_{Beams}} \qquad R_{LL.EB} = 82.2\,kip$$

Average Int. Bent Load per Beam

$$R_{DL.IB} := \frac{(N_{Beams} - 2) \cdot \frac{(R64_{DL.int} + R76_{DL.int})}{2} + (R64_{DL.ext} + R76_{DL.ext})}{N_{Beams}} \qquad R_{DL.IB} = 80.8\,kip$$

$$R_{LL.IB} := \frac{(N_{Beams} - 2) \cdot \frac{(R64_{LL.int.IB} + R76_{LL.int.IB})}{2} + (R64_{LL.ext.IB} + R76_{LL.ext.IB})}{N_{Beams}} \qquad R_{LL.IB} = 98.8\,kip$$

End Bent Cap DL for Pile Loads

$EB_{Length} := 59.5 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

End Bent Back Wall DL for Pile Loads

$BW_{Length} := 57.5 \cdot ft$ $BW_{Width} := 1 \cdot ft$ $BW_{Height} := 3.4 \cdot ft$

Approach Slab

$AS_w := 57.417 \cdot ft$ $AS_l := 30 \cdot ft$ $AP_t := 1 \cdot ft$

$EB_{Cap.DL} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{Cap.DL} = 40.2 \cdot tons$

$EB_{BW.DL} := BW_{Length} \cdot BW_{Width} \cdot BW_{Height} \cdot \gamma_{conc}$ $EB_{BW.DL} = 14.7 \cdot tons$

$EB_{AS.DL} := 0.5 \cdot AS_{l} \cdot \left(AS_{w} \cdot AP_{t} \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped} \right)$ $EB_{AS.DL} = 71.3 \cdot tons$

$EB_{DL} := EB_{Cap.DL} + EB_{BW.DL} + EB_{AS.DL}$ $EB_{DL} = 126.1 \cdot tons$

Intermediate Bent Dead Load: $IB_{Length} := 57.417 \cdot ft$ $IB_{Width} := 3.5 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 45.2 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := \left(1.25 \cdot R_{DL.EB} + 1.75 \cdot R_{LL.EB} \right) \cdot N_{Beams} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 910.3 \cdot tons$

$Total_{IB.Load} := 2 \cdot \left(1.25 \cdot R_{DL.IB} + 1.75 \cdot R_{LL.IB} \right) \cdot N_{Beams} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1699.5 \cdot tons$

Geotech for 18" PCP Max. NBR 275 tons and 20 Tons Downdrag at End Bents: $NBR_{Max} := 230 \cdot tons$ $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

(conservative)

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$ $Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 5.97$ $EB_{Piles.Calc} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}} \right)$ $EB_{Piles.Calc} = 6$

Use 7 Piles to limit pile spacing at 10' max. and maintain optimum EB pile cap depth. Use $EB_{Piles} := 7$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 130 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 200 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 9.85$ $IB_{Piles} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}} \right)$ $IB_{Piles} = 10$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$ $Effective_{IB.FDL} = 170 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$ $Effective_{IB.NBR} = 227 \cdot tons$

Top of deck Elevation (see profiles spreadsheet) $Elev_{Whidden} := 64.65 \cdot ft$

$Deck_H := 8.5 \cdot in$ $Haunch := 1 \cdot in$ $Beam_H := 3 \cdot ft$ $Ped_H := 4 \cdot in$

$Bearing_H := 3 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$$Elev_{Cutoff.Whidden} := Elev_{Whidden} - Deck_H - Haunch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Ca}$$

Aproximate pile cutoff elevations for all piles $Elev_{Cutoff.Whidden} = 58.27 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 200 \cdot tons$ $Elev_{tip.EB.Whidden} := -12 \cdot ft$

$Effective_{IB.NBR} = 227 \cdot tons$ $Elev_{tip.IB.Whidden} := -15 \cdot ft$

Total Quantity of Pile at Whidden Creek Bridge

$Pile_{length.EB.Whidden} := Elev_{Cutoff.Whidden} - Elev_{tip.EB.Whidden}$ $Pile_{length.EB.Whidden} = 70.275 \cdot ft$

$Pile_{length.IB.Whidden} := Elev_{Cutoff.Whidden} - Elev_{tip.IB.Whidden}$ $Pile_{length.IB.Whidden} = 73.3 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support) $WW_{Piles.Whidden} := 1 \cdot 2$

$Pile_{length.WW.Whidden} := 0.5 \cdot Pile_{length.EB.Whidden}$ $Pile_{length.WW.Whidden} = 35.1 \cdot ft$

$Total_{Length.EB.Whidden} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Whidden}$ $Total_{Length.EB.Whidden} = 984 \cdot ft$

$Total_{Length.IB.Whidden} := IB_{Piles} \cdot Pile_{length.IB.Whidden}$ $Total_{Length.IB.Whidden} = 733 \cdot ft$

$Total_{Length.WW.Whidden} := WW_{Piles.Whidden} \cdot Pile_{length.WW.Whid}$ $Total_{Length.WW.Whidden} = 70 \cdot ft$

$$Total_{Piles.Whidden} := Total_{Length.EB.Whidden} + Total_{Length.IB.Whidden} + Total_{Length.WW.Whidden}$$

$Total_{Piles.Whidden} = 1786.9 \cdot ft$

$$Quantity_{Piles.Whidden} := ceil\left(\frac{Total_{Piles.Whidden}}{ft}\right)$$

$Quantity_{Piles.Whidden} = 1787$

BRIDGE PILE QUANTITY ESTIMATE

Yellow = INPUT Green = OUTPUT

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$tons := 2 \cdot kip$

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

1. Prestressed Concrete Piling: (64'-76' Span Length: EB - FIB Option)

From Beam Design Calculations (Service Loads):
Impact included for IB

$N_{Beams} := 4$

64' Span Loads:

$R64_{DL.int} := 87.7 \cdot kip$

$R64_{DL.ext} := 76.4 \cdot kip$

$R64_{LL.int.EB} := 87.6 \cdot kip$

$R64_{LL.ext.EB} := 77.8 \cdot kip$

$R64_{LL.int.IB} := 109.3 \cdot kip$

$R64_{LL.ext.IB} := 97.1 \cdot kip$

76' Span Loads:

$R76_{DL.int} := 110.3 \cdot kip$

$R76_{DL.ext} := 96.5 \cdot kip$

$R76_{LL.int.EB} := 97.3 \cdot kip$

$R76_{LL.ext.EB} := 86.5 \cdot kip$

$R76_{LL.int.IB} := 120.0 \cdot kip$

$R76_{LL.ext.IB} := 106.6 \cdot kip$

Average End Bent Load per Beam

$$R_{DL.EB} := \frac{(N_{Beams} - 2) \cdot R76_{DL.int} + 2 \cdot R76_{DL.ext}}{N_{Beams}} \qquad R_{DL.EB} = 103.4\,kip$$

$$R_{LL.EB} := \frac{(N_{Beams} - 2) \cdot R76_{LL.int.EB} + 2 \cdot R76_{LL.ext.EB}}{N_{Beams}} \qquad R_{LL.EB} = 91.9\,kip$$

Average Int. Bent Load per Beam

$$R_{DL.IB} := \frac{(N_{Beams} - 2) \cdot \frac{(R64_{DL.int} + R76_{DL.int})}{2} + (R64_{DL.ext} + R76_{DL.ext})}{N_{Beams}} \qquad R_{DL.IB} = 92.7\,kip$$

$$R_{LL.IB} := \frac{(N_{Beams} - 2) \cdot \frac{(R64_{LL.int.IB} + R76_{LL.int.IB})}{2} + (R64_{LL.ext.IB} + R76_{LL.ext.IB})}{N_{Beams}} \qquad R_{LL.IB} = 108.2\,kip$$

End Bent Cap DL for Pile Loads

$EB_{Length} := 44.75 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

End Bent Back Wall DL for Pile Loads

$BW_{Length} := 42.75 \cdot ft$ $BW_{Width} := 1 \cdot ft$ $BW_{Height} := 3.4 \cdot ft$

Approach Slab

$AS_w := 42.67 \cdot ft$ $AS_l := 30 \cdot ft$ $AP_t := 1 \cdot ft$

$EB_{Cap.DL} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{Cap.DL} = 30.2 \cdot tons$

$EB_{BW.DL} := BW_{Length} \cdot BW_{Width} \cdot BW_{Height} \cdot \gamma_{conc}$ $EB_{BW.DL} = 10.9 \cdot tons$

$EB_{AS.DL} := 0.5 \cdot AS_{l} \cdot \left(AS_{w} \cdot AP_{t} \cdot \gamma_{conc} + 2 \cdot Rail_{36in} \right)$ $EB_{AS.DL} = 54.5 \cdot tons$

$EB_{DL} := EB_{Cap.DL} + EB_{BW.DL} + EB_{AS.DL}$ $EB_{DL} = 95.6 \cdot tons$

Intermediate Bent Dead Load:

$IB_{Length} := 42.67 \cdot ft$ $IB_{Width} := 3.5 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 33.6 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := \left(1.25 \cdot R_{DL.EB} + 1.75 \cdot R_{LL.EB} \right) \cdot N_{Beams} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 699.6 \cdot tons$

$Total_{IB.Load} := 2 \cdot \left(1.25 \cdot R_{DL.IB} + 1.75 \cdot R_{LL.IB} \right) \cdot N_{Beams} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1263.4 \cdot tons$

Geotech for 18" PCP Max. NBR 275 tons and 20 Tons Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ (conservative)

$DownDrag_{EB} := 20 \cdot tons$

$Compression_{RF} := 0.75$

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$ $Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 4.59$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}} \right)$ $EB_{Piles} = 5$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 140 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 213 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 7.32$ $IB_{Piles} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}} \right)$ $IB_{Piles} = 8$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$ $Effective_{IB.FDL} = 158 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$ $Effective_{IB.NBR} = 211 \cdot tons$

Top of deck Elevation (see profiles spreadsheet) $Elev_{Whidden} := 64.65 \cdot ft$

$Deck_H := 8.5 \cdot in$ $Haunch := 1 \cdot in$ $Beam_H := 3 \cdot ft$ $Ped_H := 4 \cdot in$

$Bearing_H := 3 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Whidden} := Elev_{Whidden} - Deck_H - Haunch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Ca}$

Aproximate pile cutoff elevations for all piles $Elev_{Cutoff.Whidden} = 58.27 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 213 \cdot tons$ $Elev_{tip.EB.Whidden} := -13 \cdot ft$

$Effective_{IB.NBR} = 211 \cdot tons$ $Elev_{tip.IB.Whidden} := -13 \cdot ft$

Total Quantity of Pile at Whidden Creek Bridge

$Pile_{length.EB.Whidden} := Elev_{Cutoff.Whidden} - Elev_{tip.EB.Whidden}$ $Pile_{length.EB.Whidden} = 71.275 \cdot ft$

$Pile_{length.IB.Whidden} := Elev_{Cutoff.Whidden} - Elev_{tip.IB.Whidden}$ $Pile_{length.IB.Whidden} = 71.3 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support) $WW_{Piles.Whidden} := 2 \cdot 2$

$Pile_{length.WW.Whidden} := 0.5 \cdot Pile_{length.EB.Whidden}$ $Pile_{length.WW.Whidden} = 35.6 \cdot ft$

$Total_{Length.EB.Whidden} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Whidden}$ $Total_{Length.EB.Whidden} = 713 \cdot ft$

$Total_{Length.IB.Whidden} := IB_{Piles} \cdot Pile_{length.IB.Whidden}$ $Total_{Length.IB.Whidden} = 570 \cdot ft$

$Total_{Length.WW.Whidden} := WW_{Piles.Whidden} \cdot Pile_{length.WW.Whid}$ $Total_{Length.WW.Whidden} = 143 \cdot ft$

$Total_{Piles.Whidden} := Total_{Length.EB.Whidden} + Total_{Length.IB.Whidden} + Total_{Length.WW.Whidden}$

$Total_{Piles.Whidden} = 1425.5 \cdot ft$

$$Quantity_{Piles.Whidden} := ceil\left(\frac{Total_{Piles.Whidden}}{ft}\right)$$

$Quantity_{Piles.Whidden} = 1426$

BRIDGE PILE QUANTITY ESTIMATE

Yellow = INPUT Green = OUTPUT

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

Impact included for IB

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{ped} := 0.03 \cdot \frac{kip}{ft}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

$tons := 2 \cdot kip$

1. Prestressed Concrete Piling: (90'-90' Span Length: WB - FIB Option)

From Beam Design Calculations (Service Loads):

$N_{Beams} := 7$

$R_{DL.int} := 90.6 \cdot kip$ $R_{LL.int.EB} := 78.5 \cdot kip$ $R_{LL.int.IB} := 96.5 \cdot kip$

$R_{DL.ext} := 86.4 \cdot kip$ $R_{LL.ext.EB} := 77.1 \cdot kip$ $R_{LL.ext.IB} := 94.7 \cdot kip$

Average DL per Beam: $R_{DL} := \frac{(N_{Beams} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{Beams}}$ $R_{DL} = 89.4\,kip$

Average LL EB Beam: $R_{LL.EB} := \frac{(N_{Beams} - 2) \cdot R_{LL.int.EB} + 2 \cdot R_{LL.ext.EB}}{N_{Beams}}$ $R_{LL.EB} = 78.1\,kip$

Average LL IB Beam: $R_{LL.IB} := \frac{(N_{Beams} - 2) \cdot R_{LL.int.IB} + 2 \cdot R_{LL.ext.IB}}{N_{Beams}}$ $R_{LL.IB} = 96\,kip$

End Bent Cap DL for Pile Loads $EB_{Length} := 59.5 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

End Bent Back Wall DL for Pile Loads $BW_{Length} := 57.5 \cdot ft$ $BW_{Width} := 1 \cdot ft$ $BW_{Height} := 3.4 \cdot ft$

Approach Slab $AS_w := 57.417 \cdot ft$ $AS_l := 30 \cdot ft$ $AP_t := 1 \cdot ft$

$EB_{Cap.DL} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{Cap.DL} = 40.2 \cdot tons$

$EB_{BW.DL} := BW_{Length} \cdot BW_{Width} \cdot BW_{Height} \cdot \gamma_{conc}$ $EB_{BW.DL} = 14.7 \cdot tons$

$EB_{AS.DL} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{AS.DL} = 71.3 \cdot tons$

$EB_{DL} := EB_{Cap.DL} + EB_{BW.DL} + EB_{AS.DL}$ $EB_{DL} = 126.1 \cdot tons$

Intermediate Bent Dead Load: $IB_{Length} := 57.417 \cdot ft$ $IB_{Width} := 3.5 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 45.2 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.EB}) \cdot N_{Beams} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 1027.1 \cdot tons$

$Total_{IB.Load} := 2 \cdot (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.IB}) \cdot N_{Beams} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 2015 \cdot tons$

Geotech for 18" PCP Max.
NBR 275 tons and 20 Tons
Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ (conservative)

$DownDrag_{EB} := 20 \cdot tons$

$Compression_{RF} := 0.75$

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$

$Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$

$Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 6.74$

$EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$

$EB_{Piles} = 7$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$

$Effective_{EB.FDL} = 147 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$

$Effective_{EB.NBR} = 222 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 11.68$

$IB_{Piles} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}}\right)$

$IB_{Piles} = 12$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$

$Effective_{IB.FDL} = 168 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$

$Effective_{IB.NBR} = 224 \cdot tons$

Top of deck Elevation (see profiles spreadsheet)

$Elev_{Joshua} := 75.4 \cdot ft$

$Deck_H := 8.5 \cdot in$ $Haunch := 1 \cdot in$ $Beam_H := 3 \cdot ft$ $Ped_H := 4 \cdot in$

$Bearing_H := 3 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Joshua} := Elev_{Joshua} - Deck_H - Haunch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Joshua} = 69.02 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 222 \cdot tons$

$Elev_{tip.EB.Joshua} := -27 \cdot ft$

$Effective_{IB.NBR} = 224 \cdot tons$

$Elev_{tip.IB.Joshua} := -28 \cdot ft$

Total Quantity of Pile at Joshua Creek Bridge

$Pile_{length.EB.Joshua} := Elev_{Cutoff.Joshua} - Elev_{tip.EB.Joshua}$ $Pile_{length.EB.Joshua} = 96 \cdot ft$

$Pile_{length.IB.Joshua} := Elev_{Cutoff.Joshua} - Elev_{tip.IB.Joshua}$ $Pile_{length.IB.Joshua} = 97 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support)

$WW_{Piles.Joshua} := 0$

$Pile_{length.WW.Joshua} := 0.5 \cdot Pile_{length.EB.Joshua}$ $Pile_{length.WW.Joshua} = 48 \cdot ft$

$Total_{Length.EB.Joshua} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Joshua}$ $Total_{Length.EB.Joshua} = 1344 \cdot ft$

$Total_{Length.IB.Joshua} := IB_{Piles} \cdot Pile_{length.IB.Joshua}$ $Total_{Length.IB.Joshua} = 1164 \cdot ft$

$Total_{Length.WW.Joshua} := WW_{Piles.Joshua} \cdot Pile_{length.WW.Joshua}$ $Total_{Length.WW.Joshua} = 0 \cdot ft$

$Total_{Piles.Joshua} := Total_{Length.EB.Joshua} + Total_{Length.IB.Joshua} + Total_{Length.WW.Joshua}$

$Total_{Piles.Joshua} = 2508.7 \cdot ft$

$Quantity_{Piles.Joshua} := ceil\left(\frac{Total_{Piles.Joshua}}{ft}\right)$ $Quantity_{Piles.Joshua} = 2509$

BRIDGE PILE QUANTITY ESTIMATE

Yellow = INPUT Green = OUTPUT

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

Impact included for IB

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{ped} := 0.0 \cdot \frac{kip}{ft}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

$tons := 2 \cdot kip$

1. Prestressed Concrete Piling: (90'-90' Span Length: EB - FIB Option)

From Beam Design Calculations (Service Loads):

$N_{Beams} := 5$

$R_{DL.int} := 95.2 \cdot kip$ $R_{LL.int.EB} := 82.9 \cdot kip$ $R_{LL.int.IB} := 101.8 \cdot kip$

$R_{DL.ext} := 87.4 \cdot kip$ $R_{LL.ext.EB} := 75.0 \cdot kip$ $R_{LL.ext.IB} := 92.2 \cdot kip$

Average DL per Beam:

$$R_{DL} := \frac{(N_{Beams} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{Beams}} \qquad R_{DL} = 92.08\ kip$$

Average LL EB Beam:

$$R_{LL.EB} := \frac{(N_{Beams} - 2) \cdot R_{LL.int.EB} + 2 \cdot R_{LL.ext.EB}}{N_{Beams}} \qquad R_{LL.EB} = 79.74\ kip$$

Average LL IB Beam:

$$R_{LL.IB} := \frac{(N_{Beams} - 2) \cdot R_{LL.int.IB} + 2 \cdot R_{LL.ext.IB}}{N_{Beams}} \qquad R_{LL.IB} = 98\ kip$$

End Bent Cap DL for Pile Loads

$EB_{Length} := 44.75 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

End Bent Back Wall DL for Pile Loads

$BW_{Length} := 42.75 \cdot ft$ $BW_{Width} := 1 \cdot ft$ $BW_{Height} := 3.4 \cdot ft$

Approach Slab

$AS_w := 42.67 \cdot ft$ $AS_l := 30 \cdot ft$ $AP_t := 1 \cdot ft$

$EB_{Cap.DL} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{Cap.DL} = 30.2 \cdot tons$

$EB_{BW.DL} := BW_{Length} \cdot BW_{Width} \cdot BW_{Height} \cdot \gamma_{conc}$ $EB_{BW.DL} = 10.9 \cdot tons$

$EB_{AS.DL} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{AS.DL} = 54.5 \cdot tons$

$EB_{DL} := EB_{Cap.DL} + EB_{BW.DL} + EB_{AS.DL}$ $EB_{DL} = 95.6 \cdot tons$

Intermediate Bent Dead Load:

$IB_{Length} := 42.67 \cdot ft$ $IB_{Width} := 3.5 \cdot ft$ $IB_{Height} := 3 \cdot ft$

$IB_{DL} := IB_{Length} \cdot IB_{Width} \cdot IB_{Height} \cdot \gamma_{conc}$ $IB_{DL} = 33.6 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.EB}) \cdot N_{Beams} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 756.1 \cdot tons$

$Total_{IB.Load} := 2 \cdot (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.IB}) \cdot N_{Beams} + 1.25 \cdot IB_{DL}$ $Total_{IB.Load} = 1475 \cdot tons$

Geotech for 18" PCP Max.
NBR 275 tons and 20 Tons
Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ (conservative)

$DownDrag_{EB} := 20 \cdot tons$

$Compression_{RF} := 0.75$

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$

$Max_{EB.FDL} = 152.5 \cdot tons$

$Max_{IB.FDL} := Compression_{RF} \cdot NBR_{Max}$

$Max_{IB.FDL} = 172.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 4.96$

$EB_{Piles.Calc} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$

$EB_{Piles.Calc} = 5$

Use 6 Piles: Calcs too close to 5

$EB_{Piles} := 6$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$

$Effective_{EB.FDL} = 126 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$

$Effective_{EB.NBR} = 195 \cdot tons$

$\frac{Total_{IB.Load}}{Max_{IB.FDL}} = 8.55$

$IB_{Piles} := ceil\left(\frac{Total_{IB.Load}}{Max_{IB.FDL}}\right)$

$IB_{Piles} = 9$

$Effective_{IB.FDL} := \frac{Total_{IB.Load}}{IB_{Piles}}$

$Effective_{IB.FDL} = 164 \cdot tons$

$Effective_{IB.NBR} := \frac{Effective_{IB.FDL}}{Compression_{RF}}$

$Effective_{IB.NBR} = 218 \cdot tons$

Top of deck Elevation (see profiles spreadsheet)

$Elev_{Joshua} := 75.40 \cdot ft$

$Deck_H := 8.5 \cdot in$ $Haunch := 1 \cdot in$ $Beam_H := 3 \cdot ft$ $Ped_H := 4 \cdot in$

$Bearing_H := 3 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Joshua} := Elev_{Joshua} - Deck_H - Haunch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Joshua} = 69.02 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 195 \cdot tons$

$Elev_{tip.EB.Joshua} := -24 \cdot ft$

$Effective_{IB.NBR} = 218 \cdot tons$

$Elev_{tip.IB.Joshua} := -27 \cdot ft$

Total Quantity of Pile at Joshua Creek Bridge

$Pile_{length.EB.Joshua} := Elev_{Cutoff.Joshua} - Elev_{tip.EB.Joshua}$ $Pile_{length.EB.Joshua} = 93 \cdot ft$

$Pile_{length.IB.Joshua} := Elev_{Cutoff.Joshua} - Elev_{tip.IB.Joshua}$ $Pile_{length.IB.Joshua} = 96 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support)

$WW_{Piles.Joshua} := 0$

$Pile_{length.WW.Joshua} := 0.5 \cdot Pile_{length.EB.Joshua}$ $Pile_{length.WW.Joshua} = 46.5 \cdot ft$

$Total_{Length.EB.Joshua} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Joshua}$ $Total_{Length.EB.Joshua} = 1116 \cdot ft$

$Total_{Length.IB.Joshua} := IB_{Piles} \cdot Pile_{length.IB.Joshua}$ $Total_{Length.IB.Joshua} = 864 \cdot ft$

$Total_{Length.WW.Joshua} := WW_{Piles.Joshua} \cdot Pile_{length.WW.Joshua}$ $Total_{Length.WW.Joshua} = 0 \cdot ft$

$Total_{Piles.Joshua} := Total_{Length.EB.Joshua} + Total_{Length.IB.Joshua} + Total_{Length.WW.Joshua}$

$Total_{Piles.Joshua} = 1980.5 \cdot ft$

$Quantity_{Piles.Joshua} := ceil\left(\frac{Total_{Piles.Joshua}}{ft}\right)$ $Quantity_{Piles.Joshua} = 1981$

BRIDGE PILE QUANTITY ESTIMATE

$tons := 2 \cdot kip$

Yellow = INPUT Green = OUTPUT

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

1. Prestressed Concrete Piling: (76' Span Length: WB - FIB Option)

From Beam Design Calculations (Service Loads):

$N_{Beams} := 4$

$R_{DL.int} := 98.6 \cdot kip$ $R_{LL.int} := 97.7 \cdot kip$

$R_{DL.ext} := 86.2 \cdot kip$ $R_{LL.ext} := 86.8 \cdot kip$

Use skewed beam design reactions due to higher LL reactions (conservative).

Average DL per Beam:

$$R_{DL} := \frac{(N_{Beams} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{Beams}} \qquad R_{DL} = 92.4\,kip$$

Average LL per Beam:

$$R_{LL} := \frac{(N_{Beams} - 2) \cdot R_{LL.int} + 2 \cdot R_{LL.ext}}{N_{Beams}} \qquad R_{LL} = 92.25\,kip$$

Use DCI EB geometry due to skew (conservative) (lengths measured in the dgn file)

End Bent Cap DL for Pile Loads

$EB_{Length} := 46.33 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

End Bent Back Wall DL for Pile Loads

$BW_{Length} := 44.08 \cdot ft$ $BW_{Width} := 1 \cdot ft$ $BW_{Height} := 3.4 \cdot ft$

Approach Slab

$AS_w := 42.67 \cdot ft$ $AS_l := 31.06 \cdot ft$ $AP_t := 1 \cdot ft$

$EB_{Cap.DL} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{Cap.DL} = 31.3 \cdot tons$

$EB_{BW.DL} := BW_{Length} \cdot BW_{Width} \cdot BW_{Height} \cdot \gamma_{conc}$ $EB_{BW.DL} = 11.2 \cdot tons$

$EB_{AS.DL} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in})$ $EB_{AS.DL} = 56.4 \cdot tons$

$EB_{DL} := EB_{Cap.DL} + EB_{BW.DL} + EB_{AS.DL}$ $EB_{DL} = 98.9 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL}) \cdot N_{Beams} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 677.5 \cdot tons$

Geotech for 18" PCP Max. NBR 275 tons and 20 Tons Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

(conservative)

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 4.44 \qquad EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right) \qquad EB_{Piles} = 5$$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 135 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 207 \cdot tons$

Top of deck Elevation (see profiles spreadsheet) $Elev_{Tiger} := 82.76 \cdot ft$ $Elev_{DCI} := 83.46 \cdot ft$

$Deck_H := 8 \cdot in$ $Huanch := 1 \cdot in$ $Beam_H := 3 \cdot ft$ $Ped_H := 4 \cdot in$

$Bearing_H := 3 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Tiger} := Elev_{Tiger} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

$Elev_{Cutoff.DCI} := Elev_{DCI} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles $Elev_{Cutoff.Tiger} = 76.43 \cdot ft$ $Elev_{Cutoff.DCI} = 77.13 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 207 \cdot tons$ $Elev_{tip.EB.Tiger} := -15 \cdot ft$ $Elev_{tip.EB.DCI} := -25 \cdot ft$

Total Quantity of Pile at Tiger Bay Bridge

$Pile_{length.EB.Tiger} := Elev_{Cutoff.Tiger} - Elev_{tip.EB.Tiger}$ $Pile_{length.EB.Tiger} = 91.4 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for the wingwall support) $WW_{Piles.Tiger} := 2 \cdot 2$

$Pile_{length.WW.Tiger} := 0.5 \cdot Pile_{length.EB.Tiger}$ $Pile_{length.WW.Tiger} = 45.7 \cdot ft$

$Total_{Length.EB.Tiger} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Tiger}$ $Total_{Length.EB.Tiger} = 914 \cdot ft$

$Total_{Length.WW.Tiger} := WW_{Piles.Tiger} \cdot Pile_{length.WW.Tiger}$ $Total_{Length.WW.Tiger} = 183 \cdot ft$

$Total_{Piles.Tiger} := Total_{Length.EB.Tiger} + Total_{Length.WW.Tiger}$ $Total_{Piles.Tiger} = 1097.1 \cdot ft$

$Quantity_{Piles.Tiger} := ceil\left(\frac{Total_{Piles.Tiger}}{ft}\right)$ $Quantity_{Piles.Tiger} = 1098$

Total Quantity of Pile at DCI Canal Bridge

$Pile_{length.EB.DCI} := Elev_{Cutoff.DCI} - Elev_{tip.EB.DCI}$ $Pile_{length.EB.DCI} = 102.1 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support) $WW_{Piles.DCI} := 2 \cdot 2$

$Pile_{length.WW.DCI} := 0.5 \cdot Pile_{length.EB.DCI}$ $Pile_{length.WW.DCI} = 51.1 \cdot ft$

$Total_{Length.EB.DCI} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.DCI}$ $Total_{Length.EB.DCI} = 1021 \cdot ft$

$Total_{Length.WW.DCI} := WW_{Piles.DCI} \cdot Pile_{length.WW.DCI}$ $Total_{Length.WW.DCI} = 204 \cdot ft$

$Total_{Piles.DCI} := Total_{Length.EB.DCI} + Total_{Length.WW.DCI}$ $Total_{Piles.DCI} = 1225.5 \cdot ft$

$Quantity_{Piles.DCI} := ceil\left(\frac{Total_{Piles.DCI}}{ft}\right)$ $Quantity_{Piles.DCI} = 1226$

BRIDGE PILE QUANTITY ESTIMATE

$tons := 2 \cdot kip$

Yellow = INPUT Green = OUTPUT

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{ped} := 0.03 \cdot \frac{kip}{ft}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

1. Prestressed Concrete Piling: (76' Span Length: EB - FIB Option)

From Beam Design Calculations (Service Loads):

$N_{Beams} := 6$

$R_{DL.int} := 88.5 \cdot kip$ $R_{LL.int.EB} := 87.7 \cdot kip$

$R_{DL.ext} := 79.9 \cdot kip$ $R_{LL.ext.EB} := 82.9 \cdot kip$

Use skewed beam design reactions due to higher LL reactions (conservative).

Average DL per Beam:

$$R_{DL} := \frac{(N_{Beams} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{Beams}} \qquad R_{DL} = 85.633\,kip$$

Average LL EB Beam:

$$R_{LL.EB} := \frac{(N_{Beams} - 2) \cdot R_{LL.int.EB} + 2 \cdot R_{LL.ext.EB}}{N_{Beams}} \qquad R_{LL.EB} = 86.1\,kip$$

Use DCI EB geometry due to skew (conservative) (lengths measured in the dgn file)

End Bent Cap DL for Pile Loads

$EB_{Length} := 61.53 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

End Bent Back Wall DL for Pile Loads

$BW_{Length} := 59.37 \cdot ft$ $BW_{Width} := 1 \cdot ft$ $BW_{Height} := 3.4 \cdot ft$

Approach Slab

$AS_w := 57.417 \cdot ft$ $AS_l := 31.06 \cdot ft$ $AP_t := 1 \cdot ft$

$EB_{Cap.DL} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{Cap.DL} = 41.5 \cdot tons$

$EB_{BW.DL} := BW_{Length} \cdot BW_{Width} \cdot BW_{Height} \cdot \gamma_{conc}$ $EB_{BW.DL} = 15.1 \cdot tons$

$EB_{AS.DL} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{AS.DL} = 73.8 \cdot tons$

$EB_{DL} := EB_{Cap.DL} + EB_{BW.DL} + EB_{AS.DL}$ $EB_{DL} = 130.5 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL.EB}) \cdot N_{Beams} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 936.2 \cdot tons$

Geotech for 18" PCP Max. NBR 275 tons and 20 Tons Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

(conservative)

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 6.14$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$ $EB_{Piles} = 7$

$$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}} \qquad Effective_{EB.FDL} = 134 \cdot tons$$

$$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}} \qquad Effective_{EB.NBR} = 205 \cdot tons$$

Top of deck Elevation (see profiles spreadsheet)

$Elev_{Tiger} := 82.76 \cdot ft$ $Elev_{DCI} := 83.46 \cdot ft$

$Deck_H := 8 \cdot in$ $Huanch := 1 \cdot in$ $Beam_H := 3 \cdot ft$ $Ped_H := 4 \cdot in$

$Bearing_H := 3 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$$Elev_{Cutoff.Tiger} := Elev_{Tiger} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$$

$$Elev_{Cutoff.DCI} := Elev_{DCI} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Tiger} = 76.43 \cdot ft$ $Elev_{Cutoff.DCI} = 77.13 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 205 \cdot tons$ $Elev_{tip.EB.Tiger} := -15 \cdot ft$ $Elev_{tip.EB.DCI} := -25 \cdot ft$

Total Quantity of Pile at Tiger Bay Bridge

$Pile_{length.EB.Tiger} := Elev_{Cutoff.Tiger} - Elev_{tip.EB.Tiger}$ $Pile_{length.EB.Tiger} = 91.4 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support)

$WW_{Piles.Tiger} := 2 \cdot 2$

$Pile_{length.WW.Tiger} := 0.5 \cdot Pile_{length.EB.Tiger}$ $Pile_{length.WW.Tiger} = 45.7 \cdot ft$

$Total_{Length.EB.Tiger} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Tiger}$ $Total_{Length.EB.Tiger} = 1280 \cdot ft$

$Total_{Length.WW.Tiger} := WW_{Piles.Tiger} \cdot Pile_{length.WW.Tiger}$ $Total_{Length.WW.Tiger} = 183 \cdot ft$

$Total_{Piles.Tiger} := Total_{Length.EB.Tiger} + Total_{Length.WW.Tiger}$ $Total_{Piles.Tiger} = 1462.8 \cdot ft$

$$Quantity_{Piles.Tiger} := ceil\left(\frac{Total_{Piles.Tiger}}{ft}\right) \qquad Quantity_{Piles.Tiger} = 1463$$

Total Quantity of Pile at DCI Canal Bridge

$Pile_{length.EB.DCI} := Elev_{Cutoff.DCI} - Elev_{tip.EB.DCI}$ $Pile_{length.EB.DCI} = 102.1 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support) $WW_{Piles.DCI} := 2 \cdot 2$

$Pile_{length.WW.DCI} := 0.5 \cdot Pile_{length.EB.DCI}$ $Pile_{length.WW.DCI} = 51.1 \cdot ft$

$Total_{Length.EB.DCI} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.DCI}$ $Total_{Length.EB.DCI} = 1430 \cdot ft$

$Total_{Length.WW.DCI} := WW_{Piles.DCI} \cdot Pile_{length.WW.DCI}$ $Total_{Length.WW.DCI} = 204 \cdot ft$

$Total_{Piles.DCI} := Total_{Length.EB.DCI} + Total_{Length.WW.DCI}$ $Total_{Piles.DCI} = 1634 \cdot ft$

$Quantity_{Piles.DCI} := ceil\left(\frac{Total_{Piles.DCI}}{ft}\right)$ $Quantity_{Piles.DCI} = 1635$

BRIDGE PILE QUANTITY ESTIMATE

Yellow = INPUT Green = OUTPUT

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$tons := 2 \cdot kip$

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

1. Prestressed Concrete Piling: (96' Span Length: WB - FIB Option)

From Beam Design Calculations (Service Loads):

$N_{Beams} := 6$

$R_{DL.int} := 93.3 \cdot kip$ $R_{LL.int} := 76.3 \cdot kip$

Use skewed beam design reactions due to higher LL reactions (conservative).

$R_{DL.ext} := 90.0 \cdot kip$ $R_{LL.ext} := 73.3 \cdot kip$

Average DL per Beam:

$$R_{DL} := \frac{(N_{Beams} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{Beams}} \qquad R_{DL} = 92.2\,kip$$

Average LL per Beam:

$$R_{LL} := \frac{(N_{Beams} - 2) \cdot R_{LL.int} + 2 \cdot R_{LL.ext}}{N_{Beams}} \qquad R_{LL} = 75.3\,kip$$

Use Mossy Gully or Long Point Marsh EB geometry due to skew (conservative) (lengths measured in the dgn file)

End Bent Cap DL for Pile Loads

$EB_{Length} := 46.33 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

End Bent Back Wall DL for Pile Loads

$BW_{Length} := 44.08 \cdot ft$ $BW_{Width} := 1 \cdot ft$ $BW_{Height} := 3.4 \cdot ft$

Approach Slab

$AS_w := 42.67 \cdot ft$ $AS_l := 31.06 \cdot ft$ $AP_t := 1 \cdot ft$

$EB_{Cap.DL} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{Cap.DL} = 31.3 \cdot tons$

$EB_{BW.DL} := BW_{Length} \cdot BW_{Width} \cdot BW_{Height} \cdot \gamma_{conc}$ $EB_{BW.DL} = 11.2 \cdot tons$

$EB_{AS.DL} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in})$ $EB_{AS.DL} = 56.4 \cdot tons$

$EB_{DL} := EB_{Cap.DL} + EB_{BW.DL} + EB_{AS.DL}$ $EB_{DL} = 98.9 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL}) \cdot N_{Beams} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 864.7 \cdot tons$

Geotech for 18" PCP Max. NBR 275 tons and 20 Tons Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ (conservative) $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 5.67 \qquad EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right) \qquad EB_{Piles} = 6$$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 144 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 219 \cdot tons$

Top of deck Elevation (see profiles spreadsheet)

$Elev_{Mossy} := 83.86 \cdot ft$ $Elev_{Long} := 90.36 \cdot ft$ $Elev_{Parker} := 92.56 \cdot ft$

$Deck_H := 8 \cdot in$ $Huanch := 1 \cdot in$ $Beam_H := 3 \cdot ft$ $Ped_H := 4 \cdot in$

$Bearing_H := 3 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Mossy} := Elev_{Mossy} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

$Elev_{Cutoff.Long} := Elev_{Long} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

$Elev_{Cutoff.Parker} := Elev_{Parker} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Mossy} = 77.527 \cdot ft$ $Elev_{Cutoff.Long} = 84.03 \cdot ft$ $Elev_{Cutoff.Parker} = 86.23 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 219 \cdot tons$

$Elev_{tip.EB.Mossy} := -40 \cdot ft$ $Elev_{tip.EB.Long} := 5 \cdot ft$ $Elev_{tip.EB.Parker} := 31 \cdot ft$

Total Quantity of Pile at Mossy Gully Bridge

$Pile_{length.EB.Mossy} := Elev_{Cutoff.Mossy} - Elev_{tip.EB.Mossy}$ $Pile_{length.EB.Mossy} = 117.5 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support)

$WW_{Piles.Mossy} := 2 \cdot 2$

$Pile_{length.WW.Mossy} := 0.5 \cdot Pile_{length.EB.Mossy}$ $Pile_{length.WW.Mossy} = 58.8 \cdot ft$

$Total_{Length.EB.Mossy} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Mossy}$ $Total_{Length.EB.Mossy} = 1410 \cdot ft$

$Total_{Length.WW.Mossy} := WW_{Piles.Mossy} \cdot Pile_{length.WW.Mossy}$ $Total_{Length.WW.Mossy} = 235 \cdot ft$

$Total_{Piles.Mossy} := Total_{Length.EB.Mossy} + Total_{Length.WW.Mossy}$ $Total_{Piles.Mossy} = 1645.4 \cdot ft$

$Quantity_{Piles.Mossy} := ceil\left(\frac{Total_{Piles.Mossy}}{ft}\right)$ $Quantity_{Piles.Mossy} = 1646$

Total Quantity of Pile at Long Point Marsh Bridge

$Pile_{length.EB.Long} := Elev_{Cutoff.Long} - Elev_{tip.EB.Long}$ $Pile_{length.EB.Long} = 79 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support) $WW_{Piles.Long} := 2 \cdot 2$

$Pile_{length.WW.Long} := 0.5 \cdot Pile_{length.EB.Long}$ $Pile_{length.WW.Long} = 39.5 \cdot ft$

$Total_{Length.EB.Long} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Long}$ $Total_{Length.EB.Long} = 948 \cdot ft$

$Total_{Length.WW.Long} := WW_{Piles.Long} \cdot Pile_{length.WW.Long}$ $Total_{Length.WW.Long} = 158 \cdot ft$

$Total_{Piles.Long} := Total_{Length.EB.Long} + Total_{Length.WW.Long}$ $Total_{Piles.Long} = 1106.4 \cdot ft$

$Quantity_{Piles.Long} := ceil\left(\frac{Total_{Piles.Long}}{ft}\right)$ $Quantity_{Piles.Long} = 1107$

Total Quantity of Pile at Parker Creek Bridge

$Pile_{length.EB.Parker} := Elev_{Cutoff.Parker} - Elev_{tip.EB.Parker}$ $Pile_{length.EB.Parker} = 55.2 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support) $WW_{Piles.Parker} := 2 \cdot 2$

$Pile_{length.WW.Parker} := 0.5 \cdot Pile_{length.EB.Parker}$ $Pile_{length.WW.Parker} = 27.6 \cdot ft$

$Total_{Length.EB.Parker} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Parker}$ $Total_{Length.EB.Parker} = 663 \cdot ft$

$Total_{Length.WW.Parker} := WW_{Piles.Parker} \cdot Pile_{length.WW.Parker}$ $Total_{Length.WW.Parker} = 110 \cdot ft$

$Total_{Piles.Parker} := Total_{Length.EB.Parker} + Total_{Length.WW.Parker}$ $Total_{Piles.Parker} = 773.2 \cdot ft$

$Quantity_{Piles.Parker} := ceil\left(\frac{Total_{Piles.Parker}}{ft}\right)$ $Quantity_{Piles.Parker} = 774$

BRIDGE PILE QUANTITY ESTIMATE

$tons := 2 \cdot kip$

Yellow = INPUT Green = OUTPUT

EB = End Bent
IB = Inter. Bent
int = Interior
ext = exterior
BW = Backwall
WW = Wingwall
AS = App. Slab

$\gamma_{conc} := 0.150 \cdot \frac{kip}{ft^3}$

$Rail_{ped} := 0.03 \cdot \frac{kip}{ft}$

$Rail_{36in} := 0.430 \frac{kip}{ft}$

1. Prestressed Concrete Piling: (96' Span Length: EB - FIB Option)

From Beam Design Calculations (Service Loads):

$R_{DL.int} := 93.0 \cdot kip$ $R_{LL.int} := 76.3 \cdot kip$ $N_{Beams} := 8$

$R_{DL.ext} := 90.8 \cdot kip$ $R_{LL.ext} := 75.4 \cdot kip$

Use skewed beam design reactions due to higher LL reactions (conservative).

Average DL per Beam: $R_{DL} := \frac{(N_{Beams} - 2) \cdot R_{DL.int} + 2 \cdot R_{DL.ext}}{N_{Beams}}$ $R_{DL} = 92.45\ kip$

Average LL per Beam: $R_{LL} := \frac{(N_{Beams} - 2) \cdot R_{LL.int} + 2 \cdot R_{LL.ext}}{N_{Beams}}$ $R_{LL} = 76.075\ kip$

Use Mossy Gully or Long Point Marsh EB geometry due to skew (conservative) (lengths measured in the dgn file)

End Bent Cap DL for Pile Loads $EB_{Length} := 61.53 \cdot ft$ $EB_{Width} := 3 \cdot ft$ $EB_{Height} := 3 \cdot ft$

End Bent Back Wall DL for Pile Loads $BW_{Length} := 59.37 \cdot ft$ $BW_{Width} := 1 \cdot ft$ $BW_{Height} := 3.4 \cdot ft$

Approach Slab $AS_w := 57.417 \cdot ft$ $AS_l := 31.06 \cdot ft$ $AP_t := 1 \cdot ft$

$EB_{Cap.DL} := EB_{Length} \cdot EB_{Width} \cdot EB_{Height} \cdot \gamma_{conc}$ $EB_{Cap.DL} = 41.5 \cdot tons$

$EB_{BW.DL} := BW_{Length} \cdot BW_{Width} \cdot BW_{Height} \cdot \gamma_{conc}$ $EB_{BW.DL} = 15.1 \cdot tons$

$EB_{AS.DL} := 0.5 \cdot AS_l \cdot (AS_w \cdot AP_t \cdot \gamma_{conc} + 2 \cdot Rail_{36in} + Rail_{ped})$ $EB_{AS.DL} = 73.8 \cdot tons$

$EB_{DL} := EB_{Cap.DL} + EB_{BW.DL} + EB_{AS.DL}$ $EB_{DL} = 130.5 \cdot tons$

Factored Loads:Ignore LL at the approach slabs for the end bents and conservatively consider maximum live load reaction at each beam location for estimating pile loads.

$Total_{EB.Load} := (1.25 \cdot R_{DL} + 1.75 \cdot R_{LL}) \cdot N_{Beams} + 1.25 \cdot EB_{DL}$ $Total_{EB.Load} = 1157.8 \cdot tons$

Geotech for 18" PCP Max. NBR 275 tons and 20 Tons Downdrag at End Bents:

$NBR_{Max} := 230 \cdot tons$ (conservative) $DownDrag_{EB} := 20 \cdot tons$ $Compression_{RF} := 0.75$

$Max_{EB.FDL} := Compression_{RF} \cdot NBR_{Max} - DownDrag_{EB}$ $Max_{EB.FDL} = 152.5 \cdot tons$

$\frac{Total_{EB.Load}}{Max_{EB.FDL}} = 7.59$ $EB_{Piles} := ceil\left(\frac{Total_{EB.Load}}{Max_{EB.FDL}}\right)$ $EB_{Piles} = 8$

$Effective_{EB.FDL} := \frac{Total_{EB.Load}}{EB_{Piles}}$ $Effective_{EB.FDL} = 145 \cdot tons$

$Effective_{EB.NBR} := \frac{Effective_{EB.FDL} + DownDrag_{EB}}{Compression_{RF}}$ $Effective_{EB.NBR} = 220 \cdot tons$

Top of deck Elevation (see profiles spreadsheet)

$Elev_{Mossy} := 83.86 \cdot ft = Elev_{Long} := 90.36 \cdot ft$ $Elev_{Parker} := 92.56 \cdot ft$

$Deck_H := 8 \cdot in$ $Huanch := 1 \cdot in$ $Beam_H := 3 \cdot ft$ $Ped_H := 4 \cdot in$

$Bearing_H := 3 \cdot in$ $Cap_H := 3 \cdot ft$ $Emb_{Cap} := 1 \cdot ft$

$Elev_{Cutoff.Mossy} := Elev_{Mossy} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

$Elev_{Cutoff.Long} := Elev_{Long} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

$Elev_{Cutoff.Parker} := Elev_{Parker} - Deck_H - Huanch - Beam_H - Cap_H - Ped_H - Bearing_H + Emb_{Cap}$

Aproximate pile cutoff elevations for all piles

$Elev_{Cutoff.Mossy} = 77.527 \cdot ft$ $Elev_{Cutoff.Long} = 84.03 \cdot ft$ $Elev_{Cutoff.Parker} = 86.23 \cdot ft$

Pile Tip elevation per Capacity Curves Provided By Geotech :

$Effective_{EB.NBR} = 220 \cdot tons$

$Elev_{tip.EB.Mossy} := -40 \cdot ft$ $Elev_{tip.EB.Long} := 5 \cdot ft$ $Elev_{tip.EB.Parker} := 31 \cdot ft$

Total Quantity of Pile at Mossy Gully Bridge

$Pile_{length.EB.Mossy} := Elev_{Cutoff.Mossy} - Elev_{tip.EB.Mossy}$ $Pile_{length.EB.Mossy} = 117.5 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support) $WW_{Piles.Mossy} := 2 \cdot 2$

$Pile_{length.WW.Mossy} := 0.5 \cdot Pile_{length.EB.Mossy}$ $Pile_{length.WW.Mossy} = 58.8 \cdot ft$

$Total_{Length.EB.Mossy} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Mossy}$ $Total_{Length.EB.Mossy} = 1880 \cdot ft$

$Total_{Length.WW.Mossy} := WW_{Piles.Mossy} \cdot Pile_{length.WW.Mossy}$ $Total_{Length.WW.Mossy} = 235 \cdot ft$

$Total_{Piles.Mossy} := Total_{Length.EB.Mossy} + Total_{Length.WW.Mossy}$ $Total_{Piles.Mossy} = 2115.5 \cdot ft$

$Quantity_{Piles.Mossy} := ceil\left(\frac{Total_{Piles.Mossy}}{ft}\right)$ $Quantity_{Piles.Mossy} = 2116$

Total Quantity of Pile at Long Point Marsh Bridge

$Pile_{length.EB.Long} := Elev_{Cutoff.Long} - Elev_{tip.EB.Long}$ $Pile_{length.EB.Long} = 79 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support)

$WW_{Piles.Long} := 2 \cdot 2$

$Pile_{length.WW.Long} := 0.5 \cdot Pile_{length.EB.Long}$ $Pile_{length.WW.Long} = 39.5 \cdot ft$

$Total_{Length.EB.Long} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Long}$ $Total_{Length.EB.Long} = 1264 \cdot ft$

$Total_{Length.WW.Long} := WW_{Piles.Long} \cdot Pile_{length.WW.Long}$ $Total_{Length.WW.Long} = 158 \cdot ft$

$Total_{Piles.Long} := Total_{Length.EB.Long} + Total_{Length.WW.Long}$ $Total_{Piles.Long} = 1422.5 \cdot ft$

$Quantity_{Piles.Long} := ceil\left(\frac{Total_{Piles.Long}}{ft}\right)$ $Quantity_{Piles.Long} = 1423$

Total Quantity of Pile at Parker Creek Bridge

$Pile_{length.EB.Parker} := Elev_{Cutoff.Parker} - Elev_{tip.EB.Parker}$ $Pile_{length.EB.Parker} = 55.2 \cdot ft$

Piles @ wingwalls (Estimate half EB pile length for wingwall & cap support)

$WW_{Piles.Parker} := 2 \cdot 2$

$Pile_{length.WW.Parker} := 0.5 \cdot Pile_{length.EB.Parker}$ $Pile_{length.WW.Parker} = 27.6 \cdot ft$

$Total_{Length.EB.Parker} := 2 \cdot EB_{Piles} \cdot Pile_{length.EB.Parker}$ $Total_{Length.EB.Parker} = 884 \cdot ft$

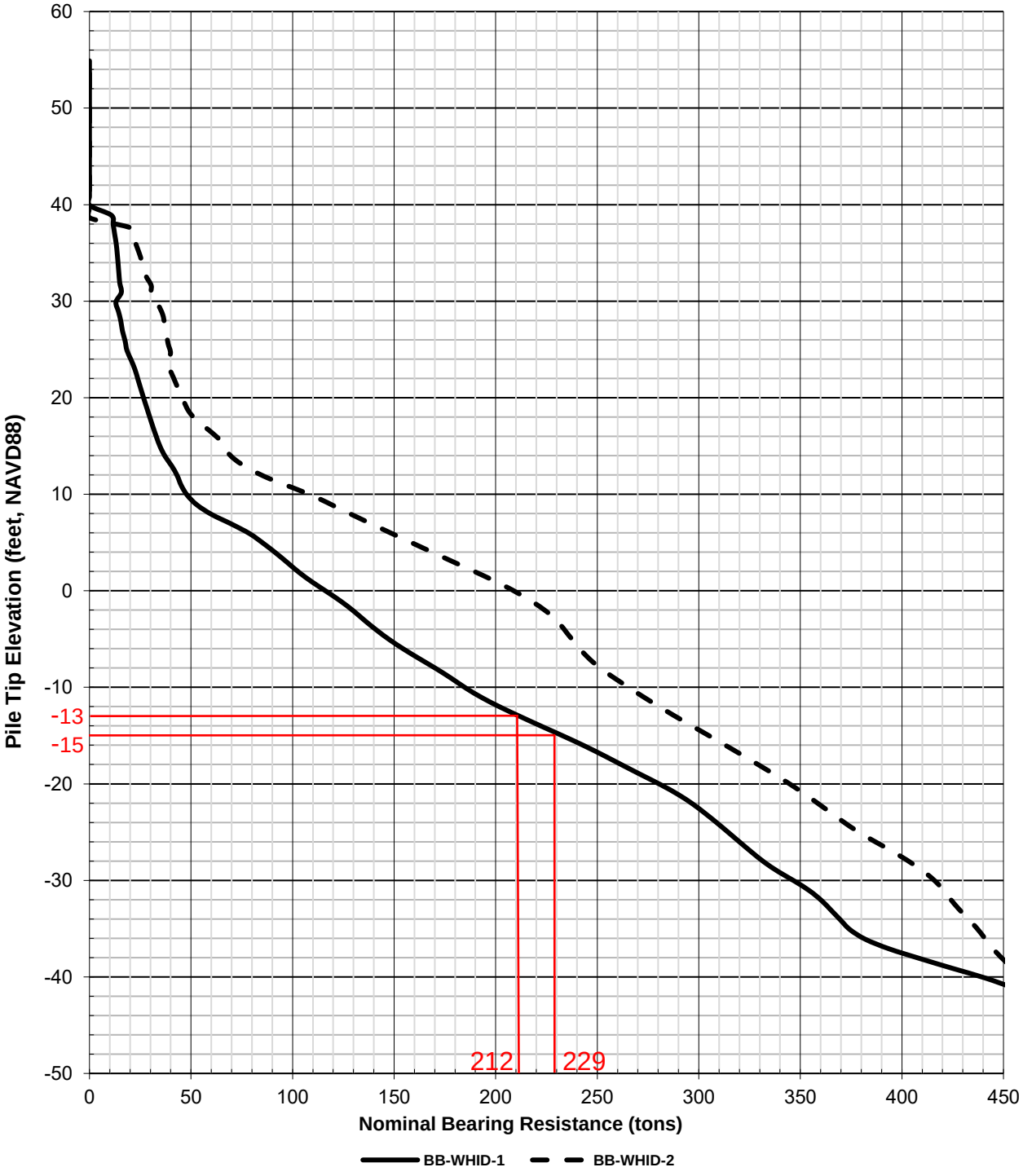
$Total_{Length.WW.Parker} := WW_{Piles.Parker} \cdot Pile_{length.WW.Parker}$ $Total_{Length.WW.Parker} = 110 \cdot ft$

$Total_{Piles.Parker} := Total_{Length.EB.Parker} + Total_{Length.WW.Parker}$ $Total_{Piles.Parker} = 994.1 \cdot ft$

$Quantity_{Piles.Parker} := ceil\left(\frac{Total_{Piles.Parker}}{ft}\right)$ $Quantity_{Piles.Parker} = 995$

FLORIDA SLAB BEAM PILE CAPACITY CURVES ESTIMATE

SR 70 over Whidden Creek
18x18 inch Square Concrete Piles

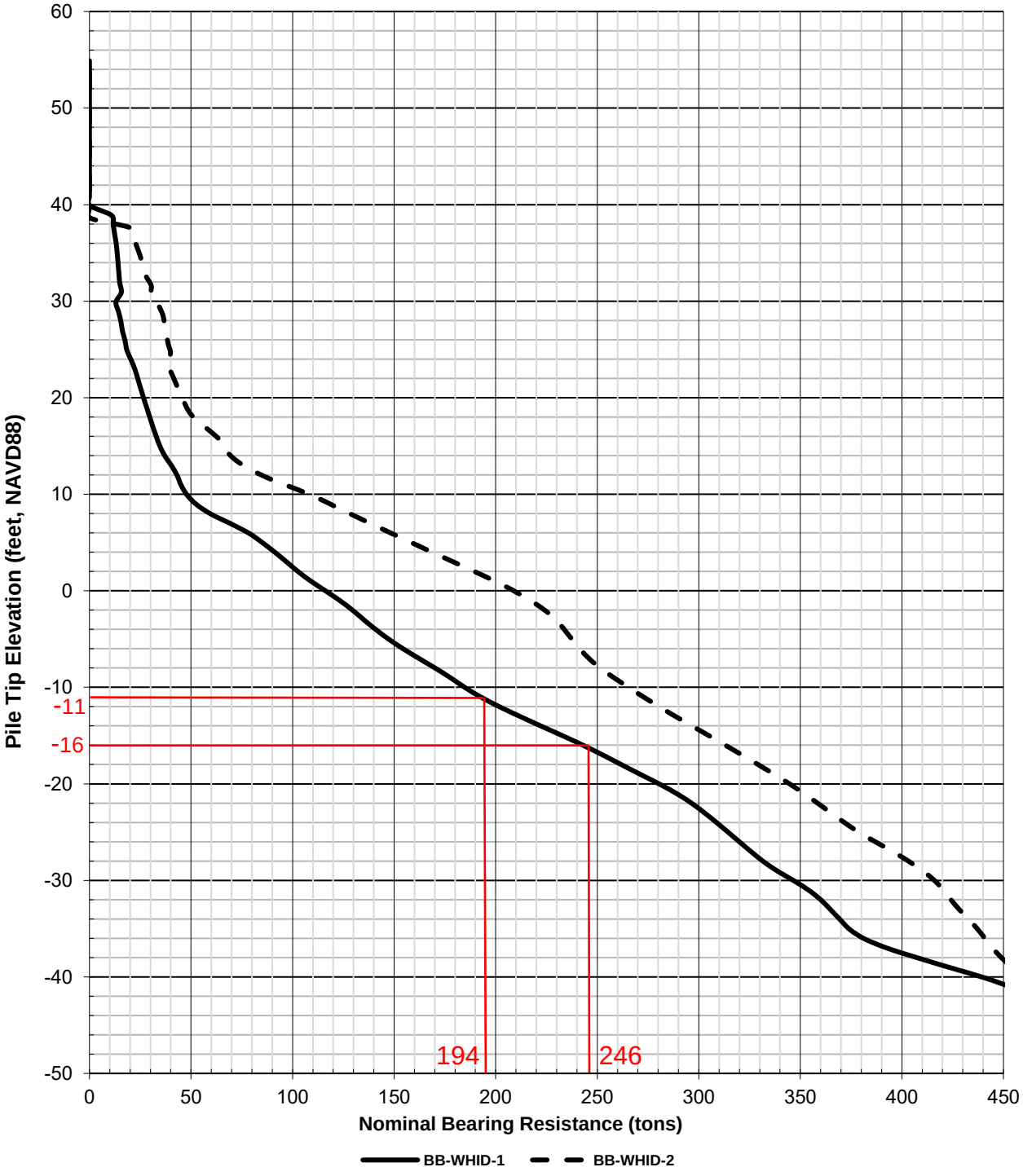


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to CR 760
SR 70 over Whidden Creek
DeSoto County, FL
FPID No. 451690-1-32-01

SR 70 over Whidden Creek
18x18 inch Square Concrete Piles



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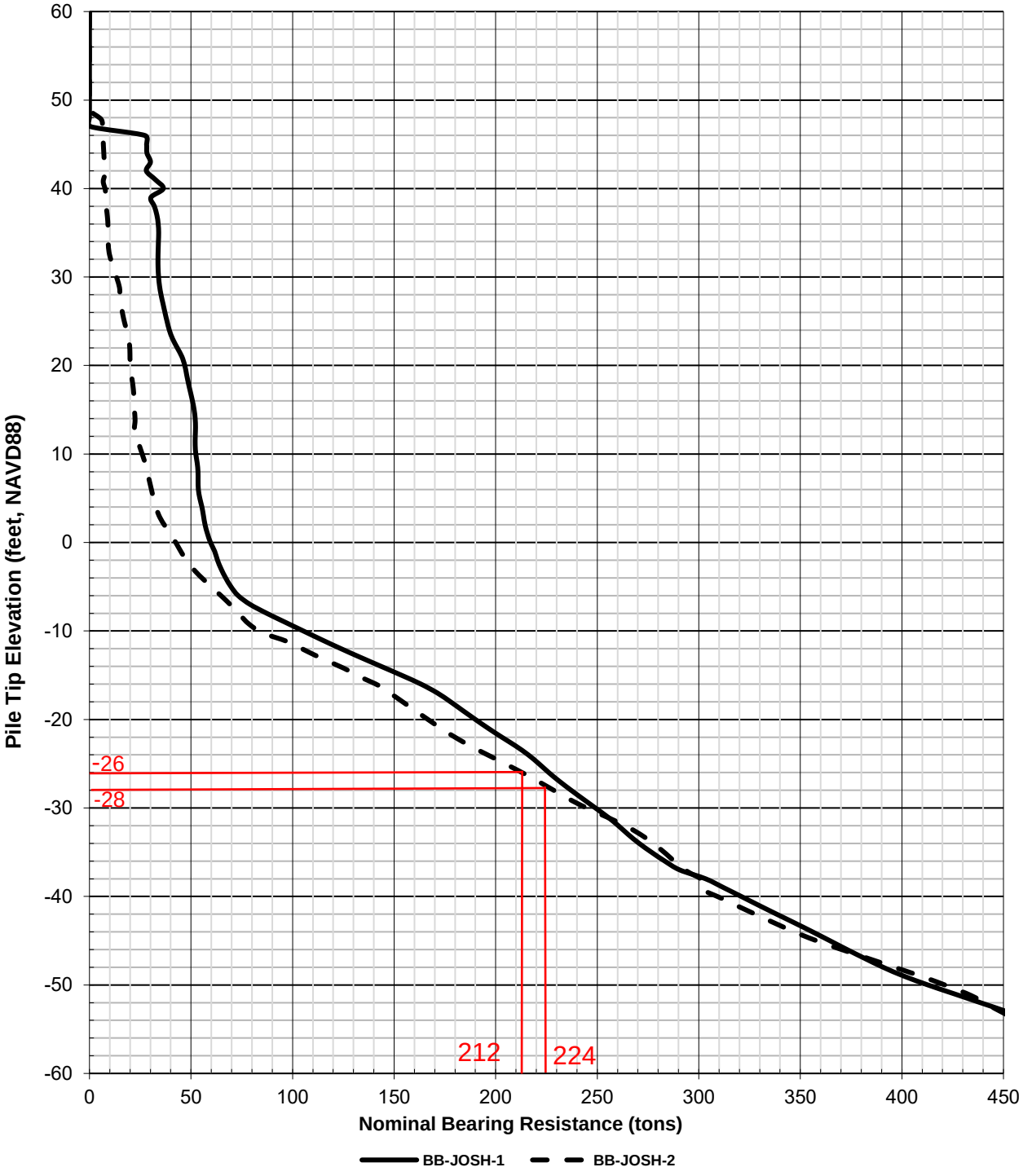
DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to CR 760
SR 70 over Whidden Creek
DeSoto County, FL
FPID No. 451690-1-32-01

SR 70 over Joshua Creek
18x18 inch Square Concrete Piles



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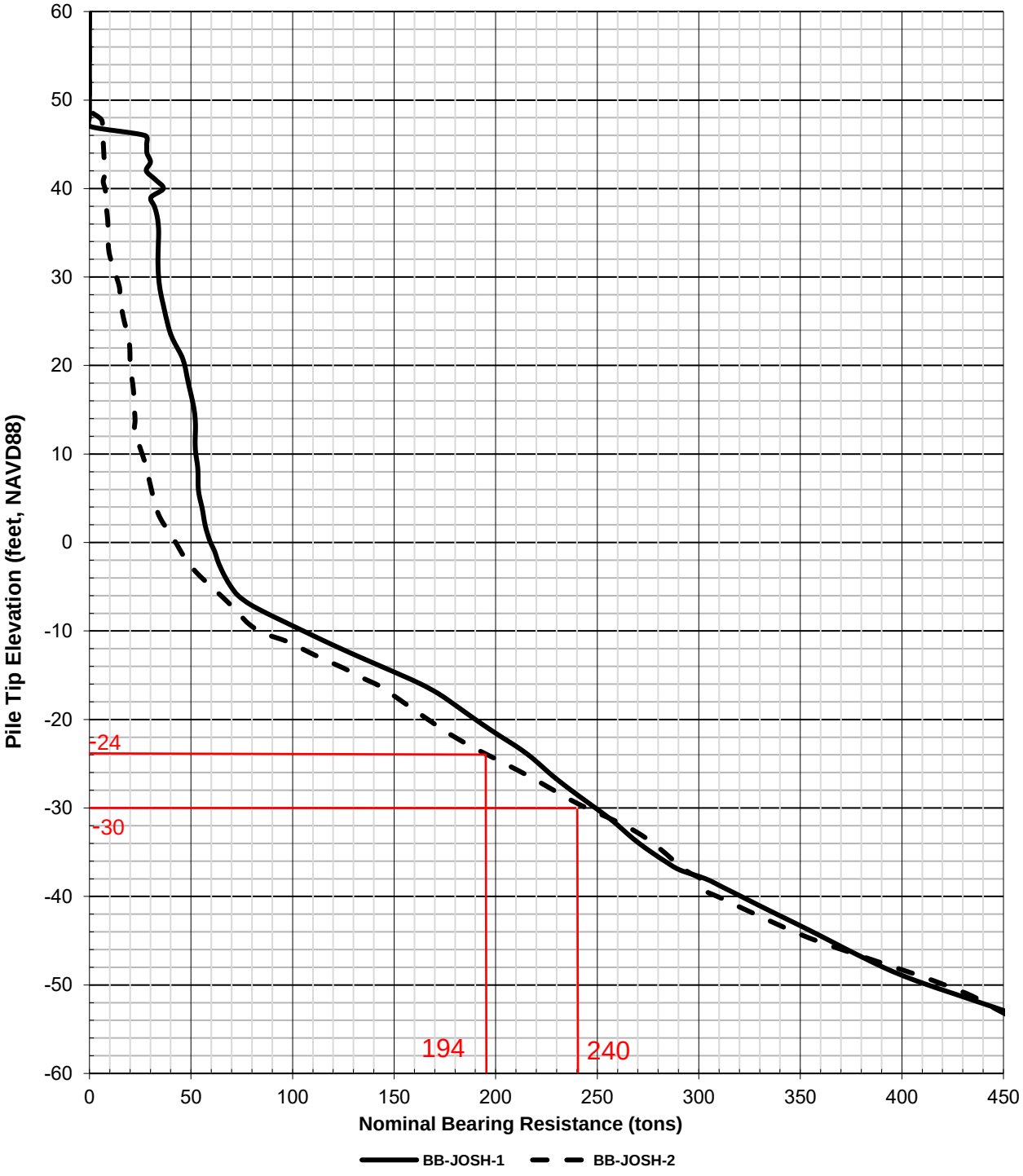
DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to CR 760
SR 70 over Joshua Creek
DeSoto County, FL
FPID No. 451690-1-32-01

SR 70 over Joshua Creek
18x18 inch Square Concrete Piles



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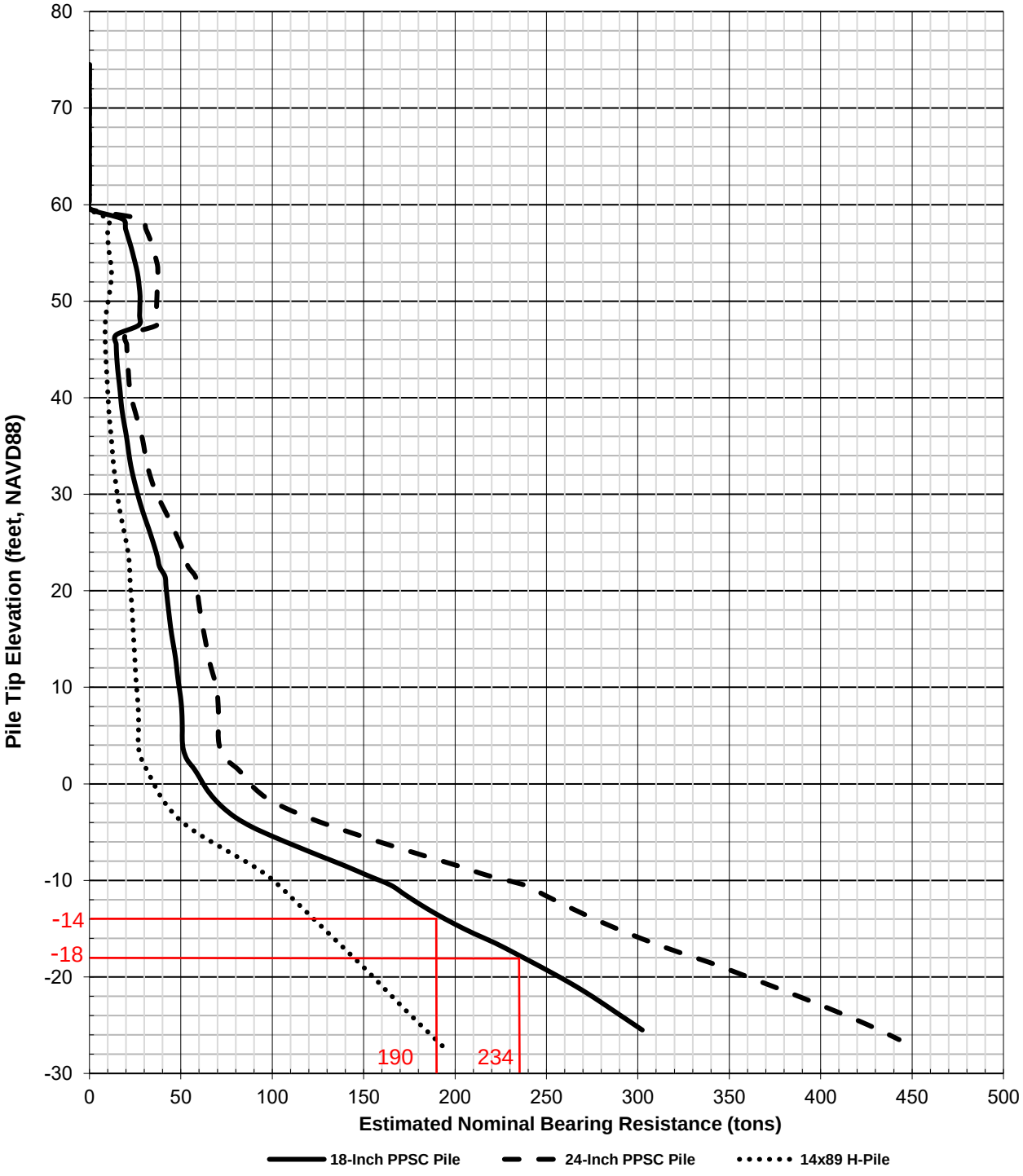
DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to CR 760
SR 70 over Joshua Creek
DeSoto County, FL
FPID No. 451690-1-32-01

SR 70 over Tiger Bay
SPT Boring BB-TIG-2



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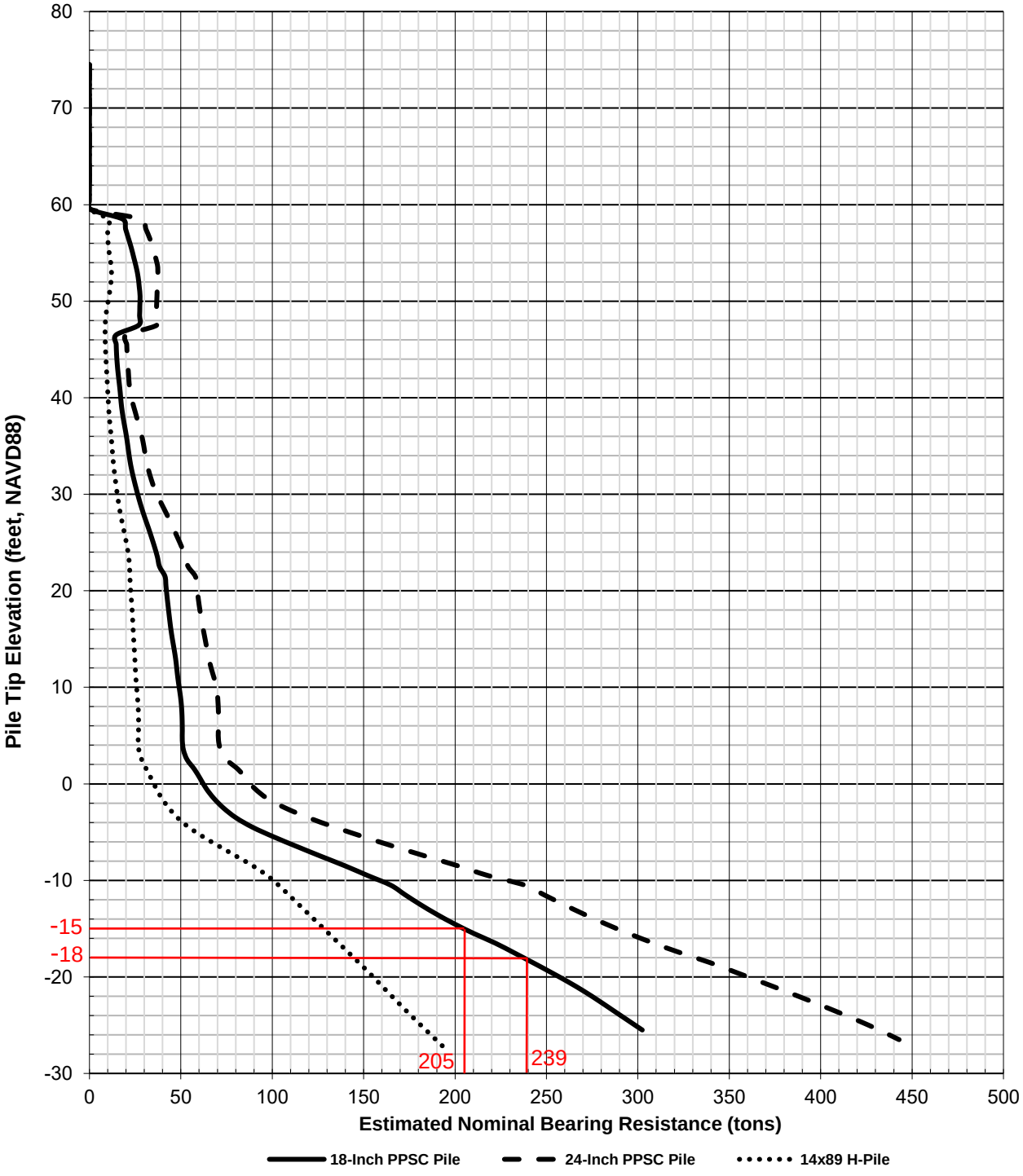
DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Tiger Bay
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Tiger Bay
SPT Boring BB-TIG-2



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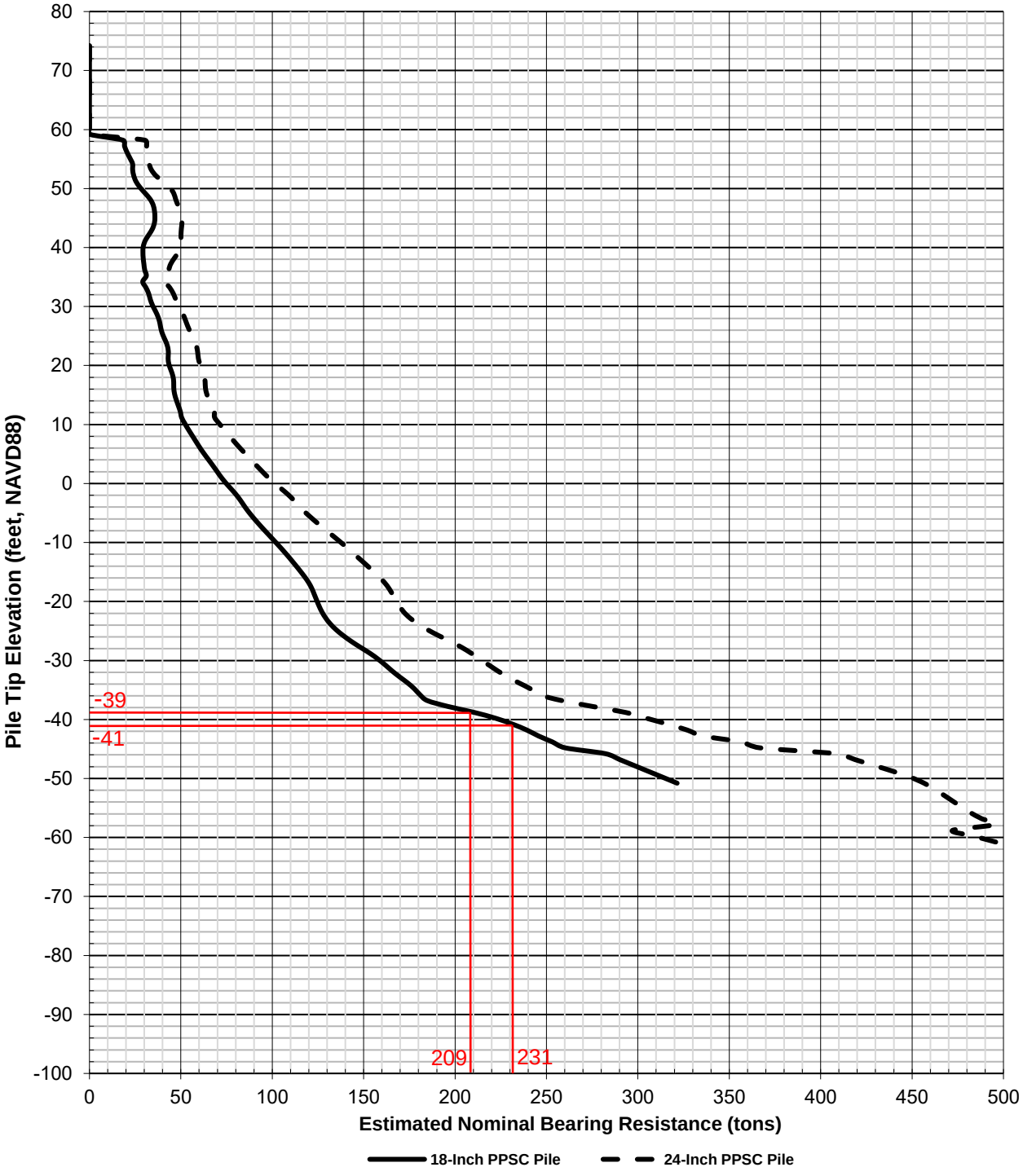
DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Tiger Bay
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Mossy Gully
SPT Boring BB-MOSS-1



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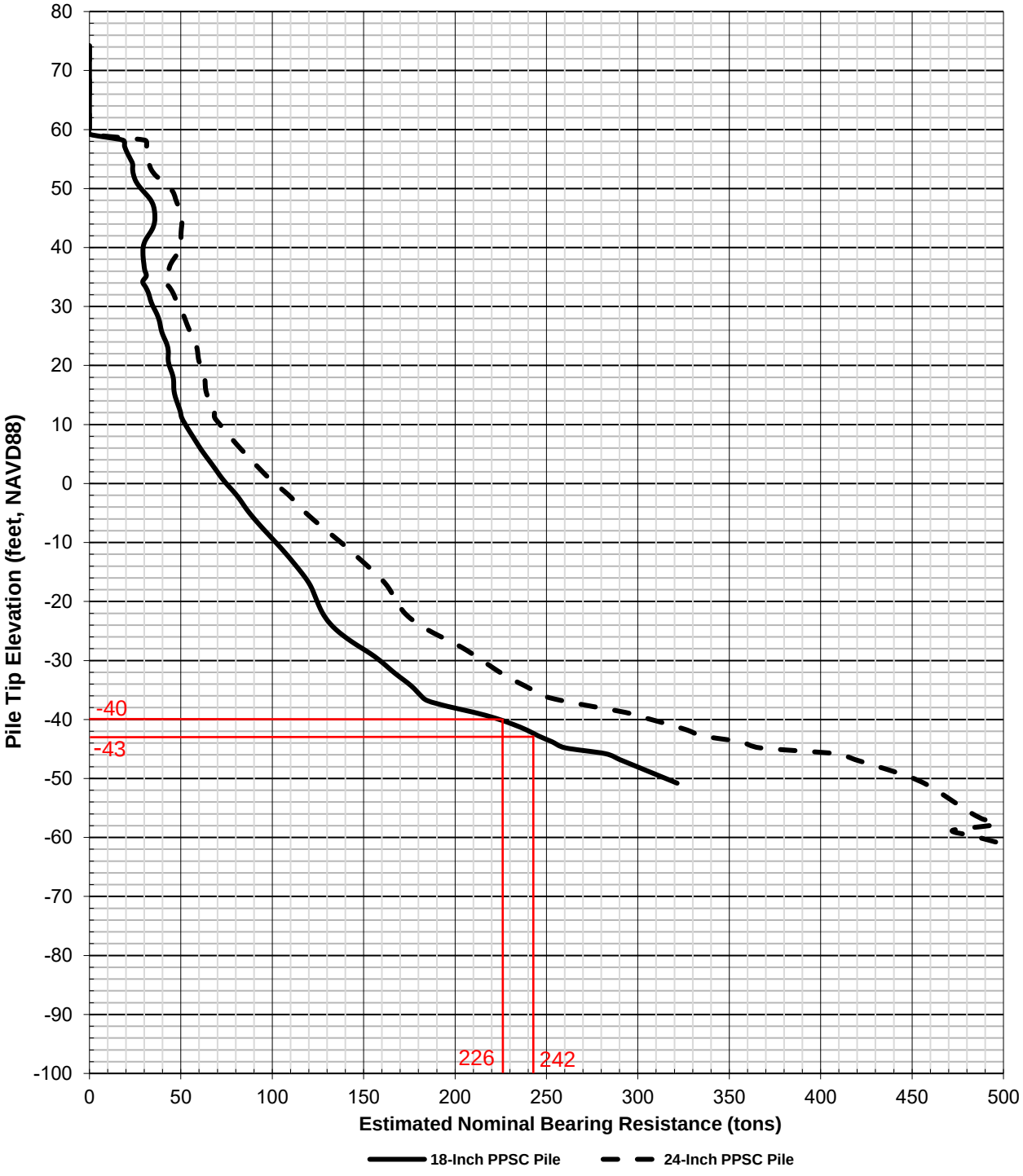
DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Mossy Gully
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Mossy Gully
SPT Boring BB-MOSS-1



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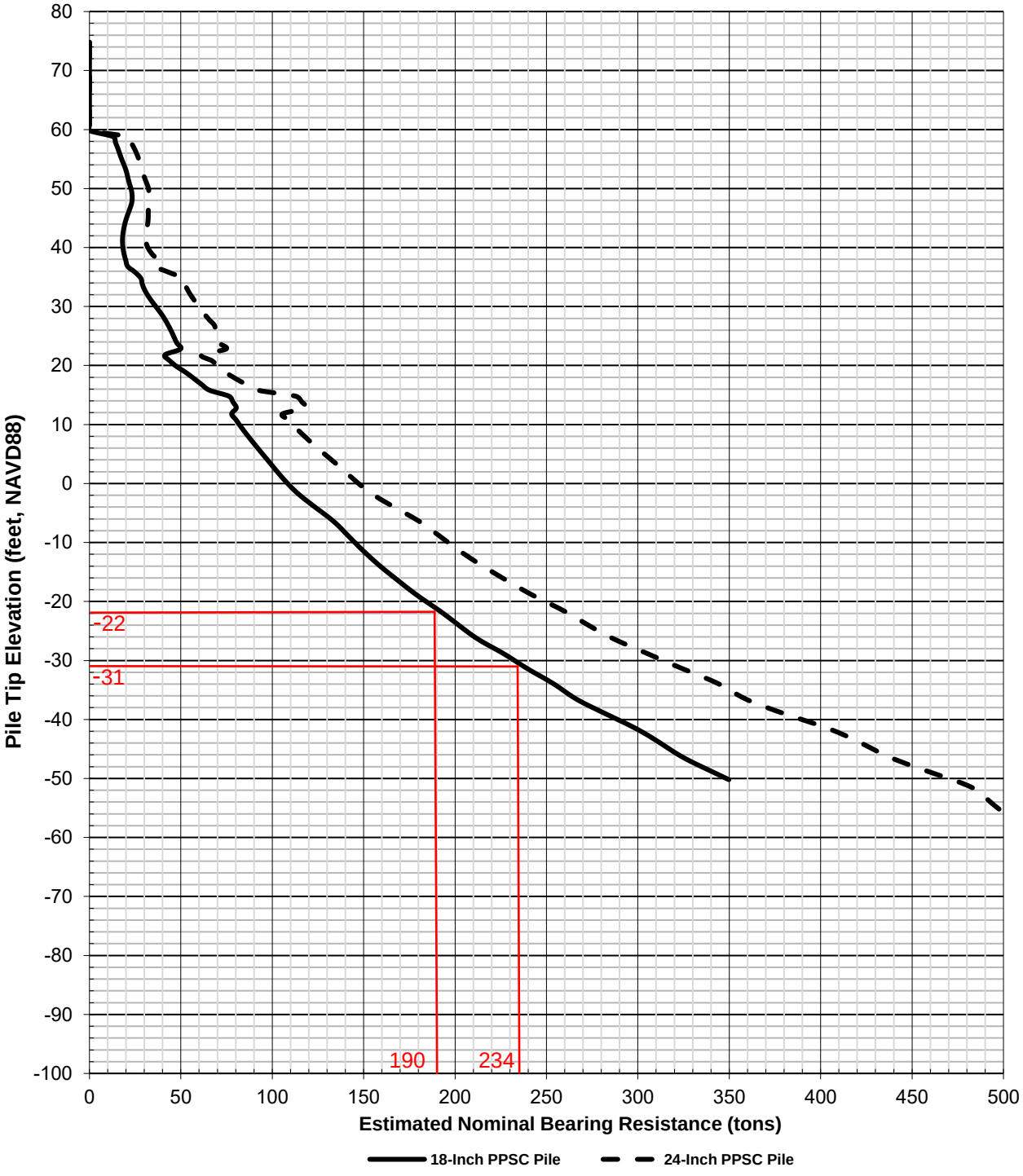
DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Mossy Gully
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over D.C.I. Canal
SPT Boring BB-DCI-1



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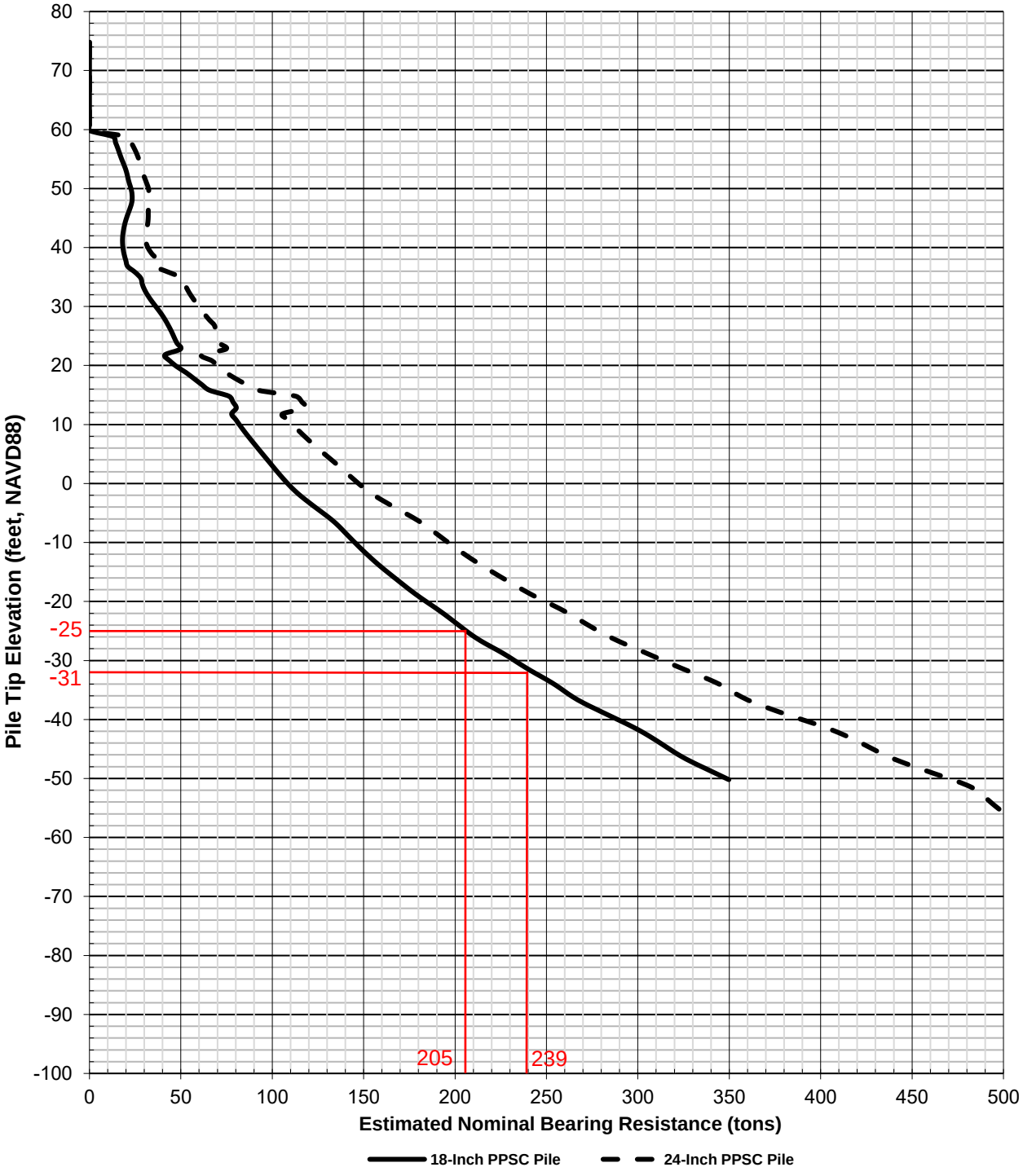
DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	FEB 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over D.C.I. Canal
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over D.C.I. Canal
SPT Boring BB-DCI-1



TIERRA
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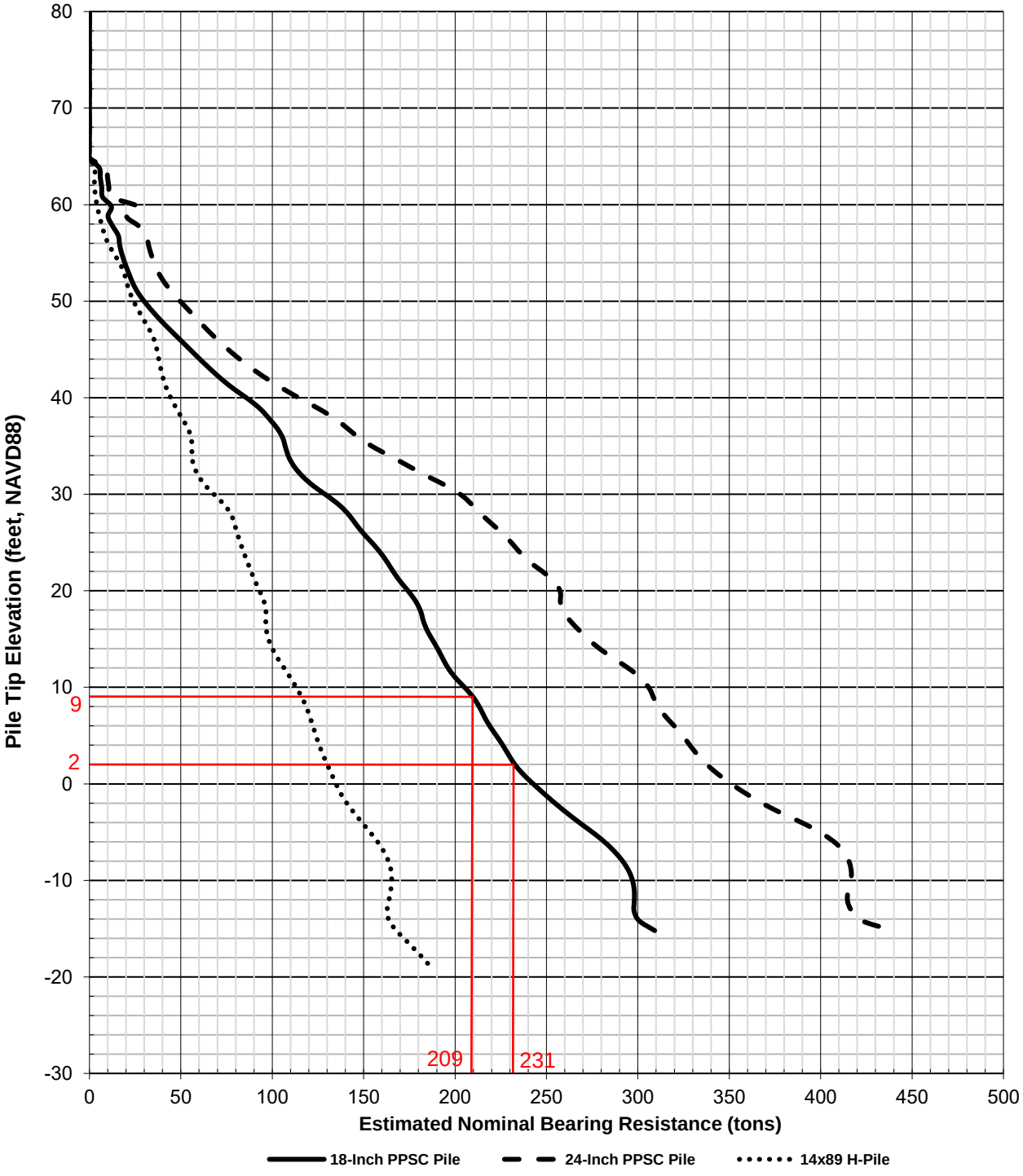
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	FEB 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over D.C.I. Canal
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Long Point Marsh
SPT Boring BB-LONG-1

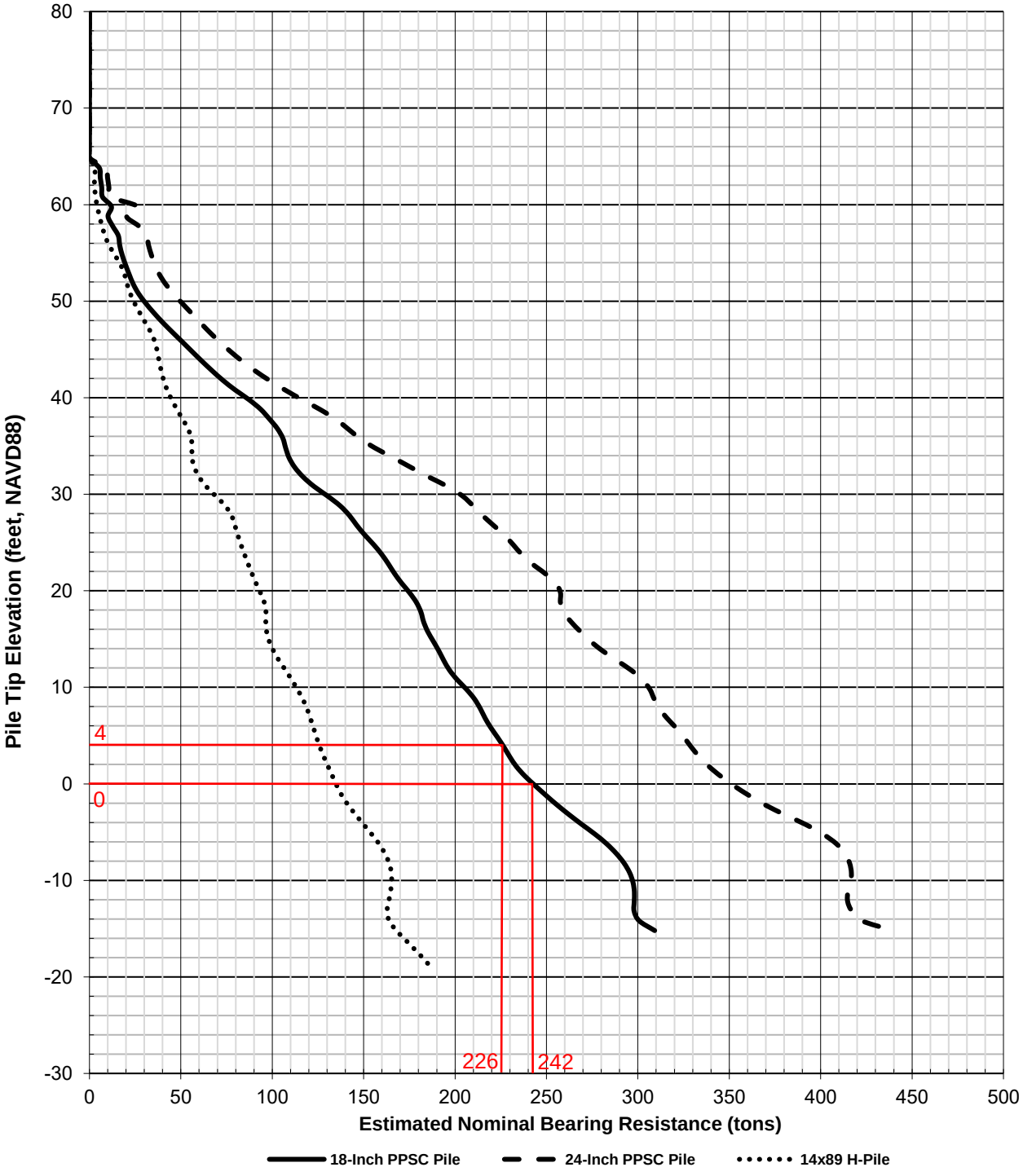


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Long Point Marsh
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Long Point Marsh
SPT Boring BB-LONG-1

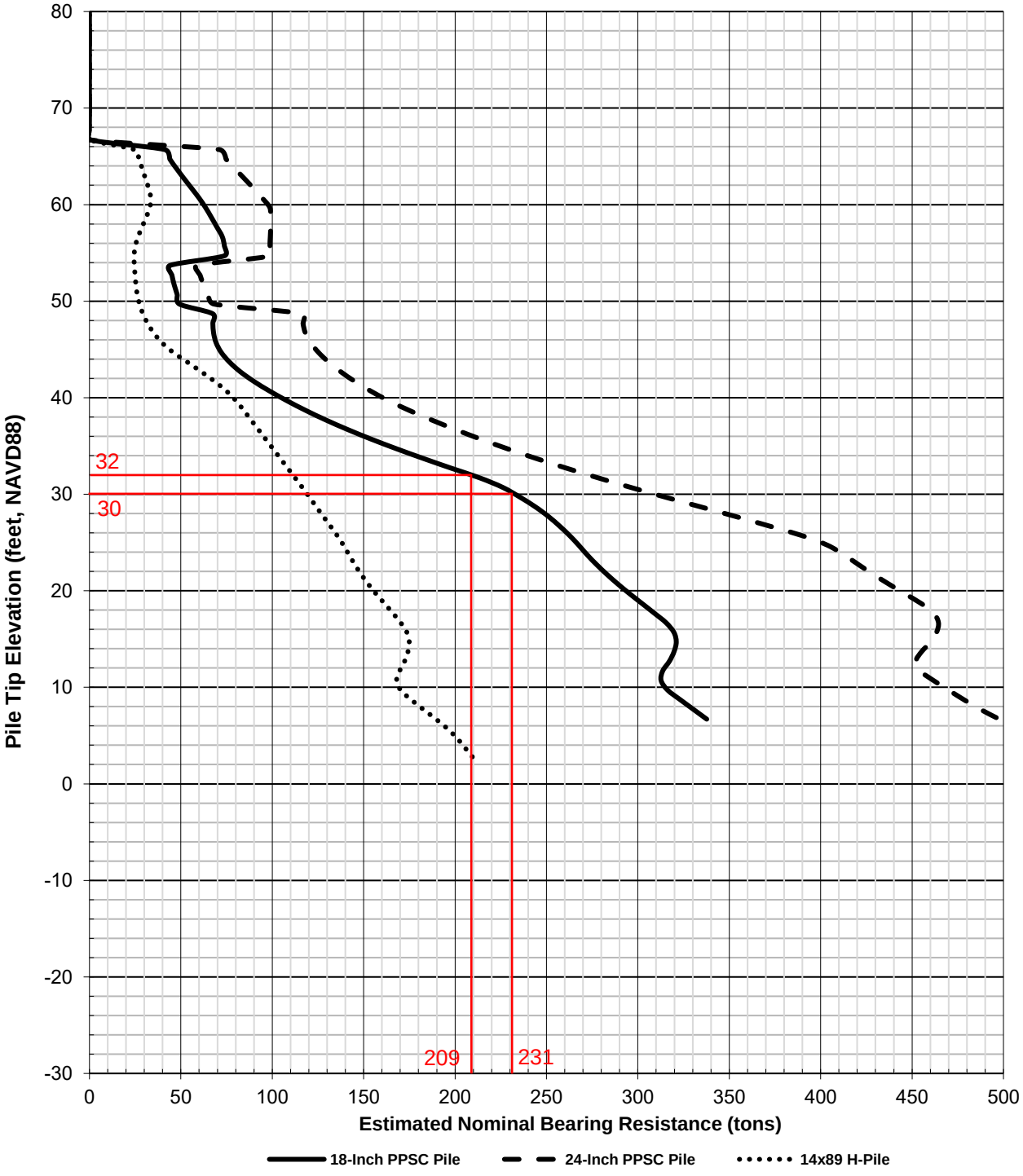


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Long Point Marsh
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Parker Creek
SPT Boring BB-PARK-1



TIERRA
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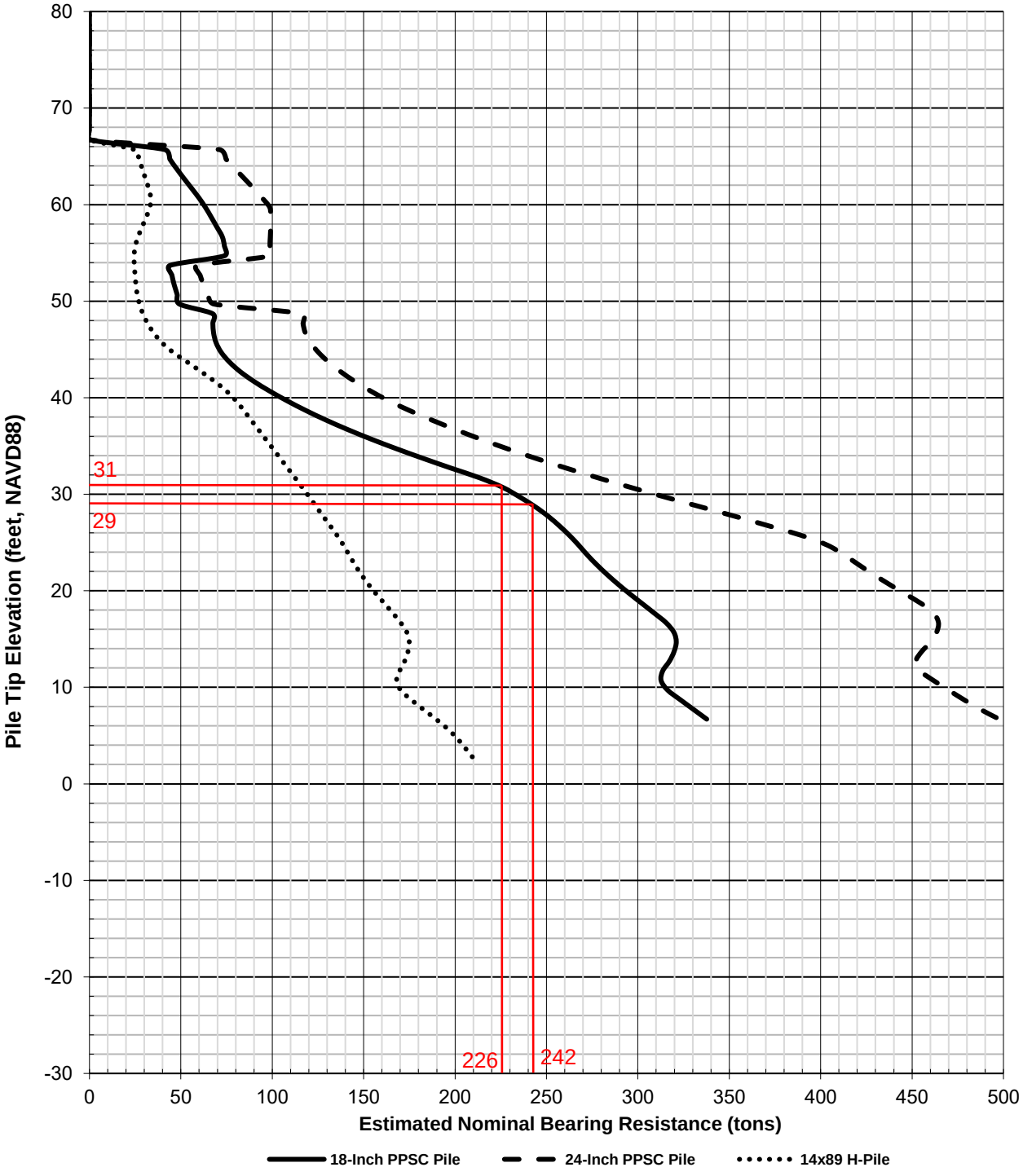
DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	FEB 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Parker Creek
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Parker Creek
SPT Boring BB-PARK-1



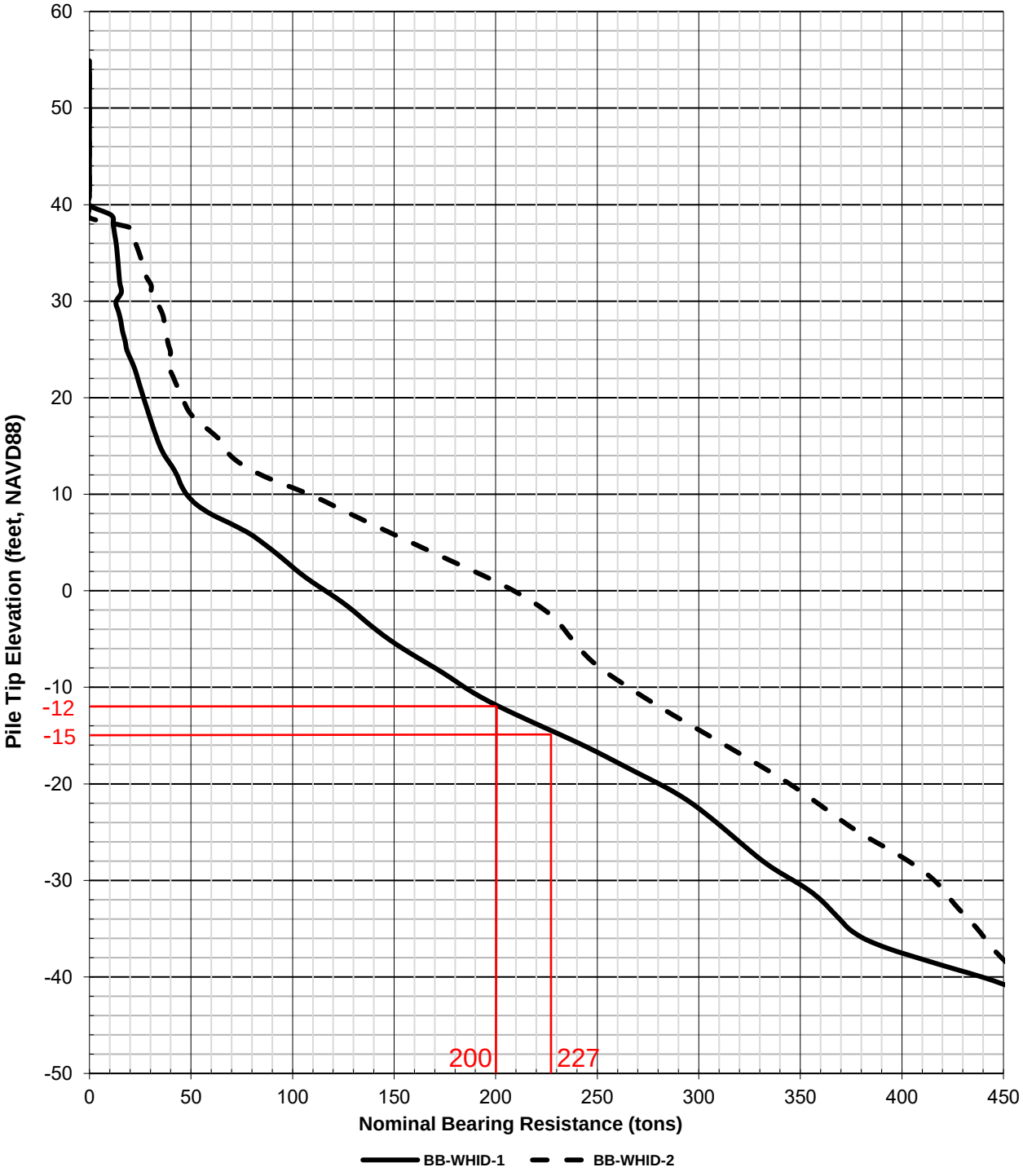
TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	FEB 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Parker Creek
DeSoto County, FL
FPID No. 451942-2-52-01

FLORIDA-I BEAM PILE CAPACITY CURVES ESTIMATE

SR 70 over Whidden Creek
18x18 inch Square Concrete Piles

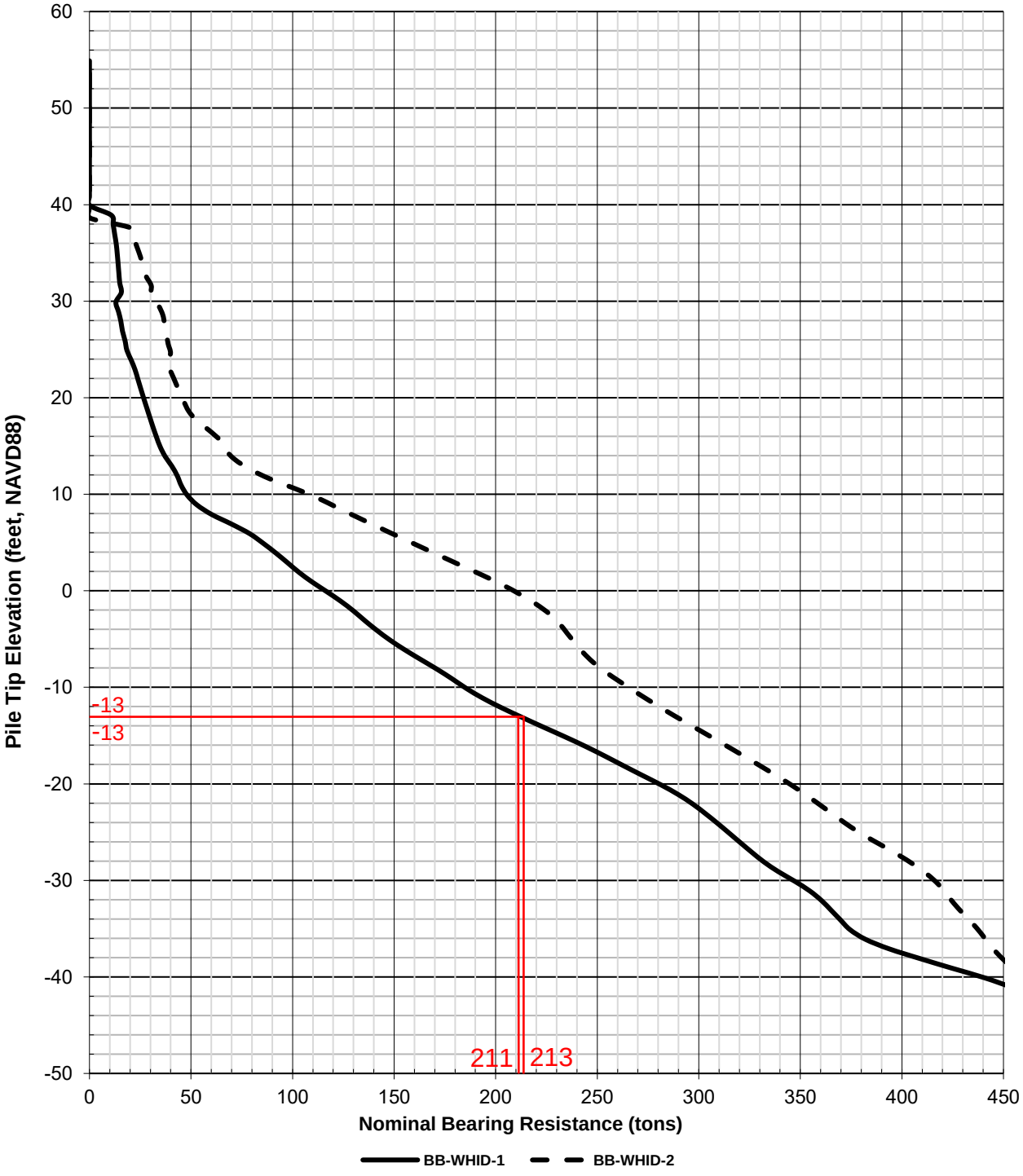


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to CR 760
SR 70 over Whidden Creek
DeSoto County, FL
FPID No. 451690-1-32-01

SR 70 over Whidden Creek
18x18 inch Square Concrete Piles

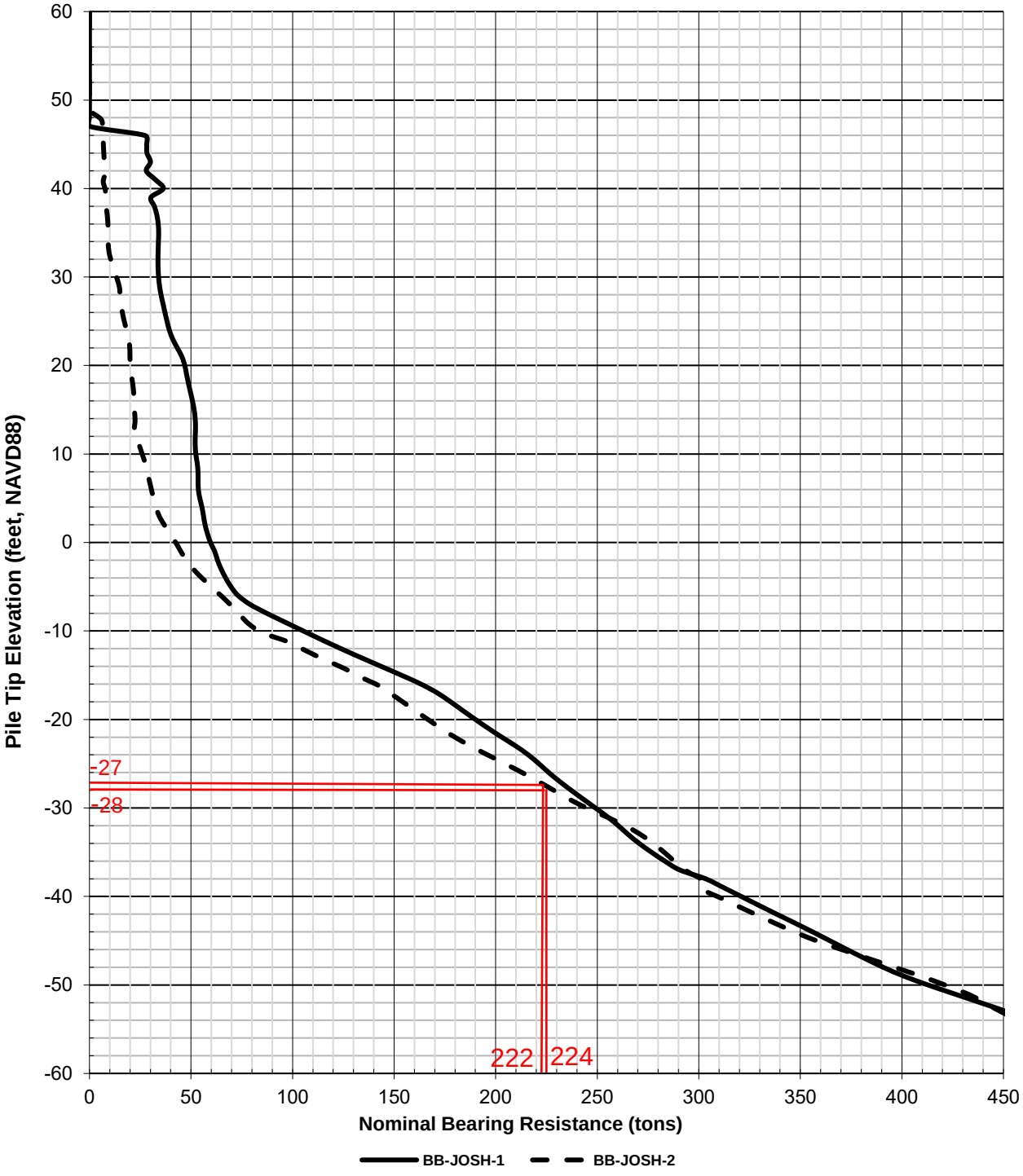


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to CR 760
SR 70 over Whidden Creek
DeSoto County, FL
FPID No. 451690-1-32-01

SR 70 over Joshua Creek
18x18 inch Square Concrete Piles

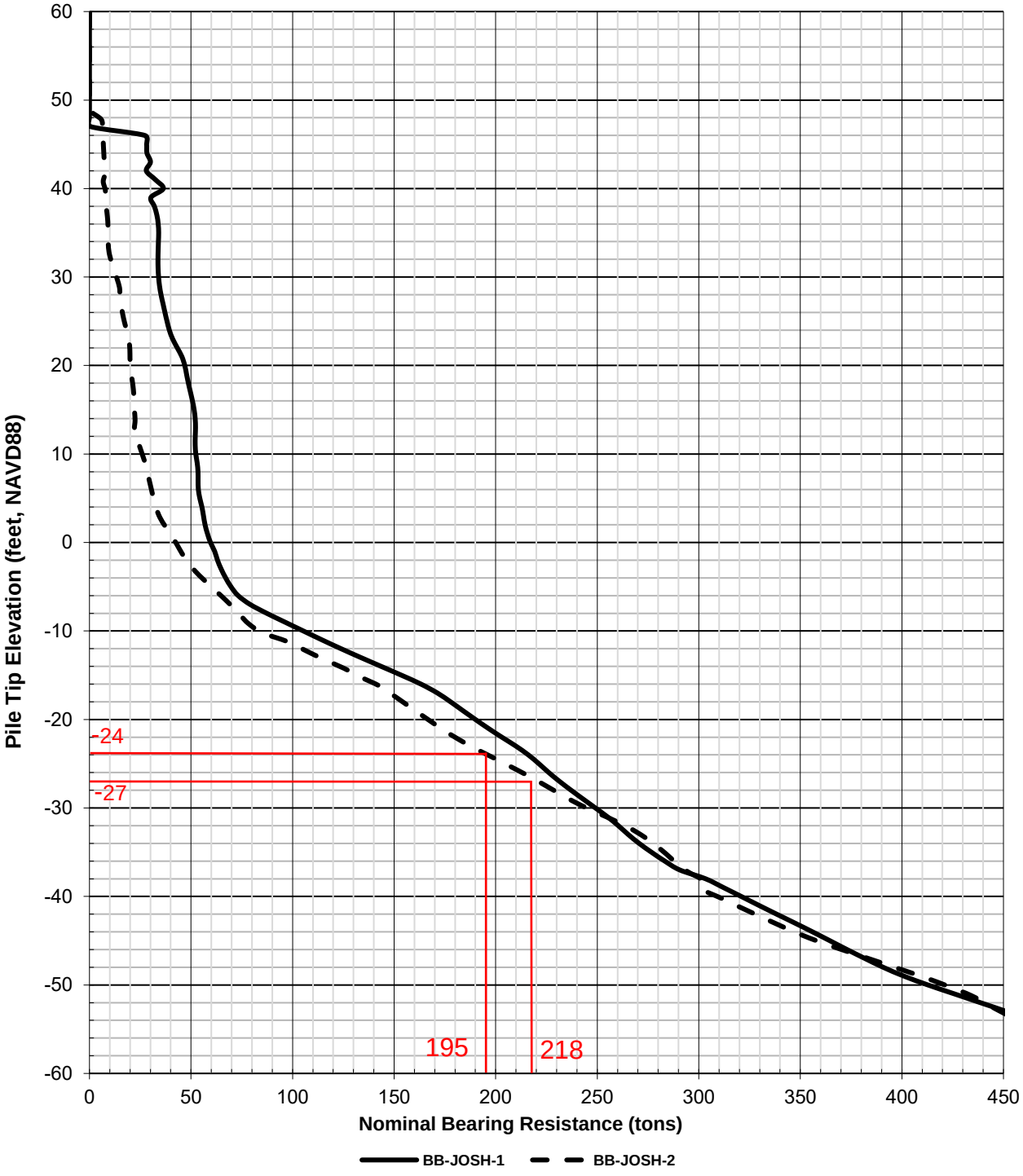


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to CR 760
SR 70 over Joshua Creek
DeSoto County, FL
FPID No. 451690-1-32-01

SR 70 over Joshua Creek
18x18 inch Square Concrete Piles

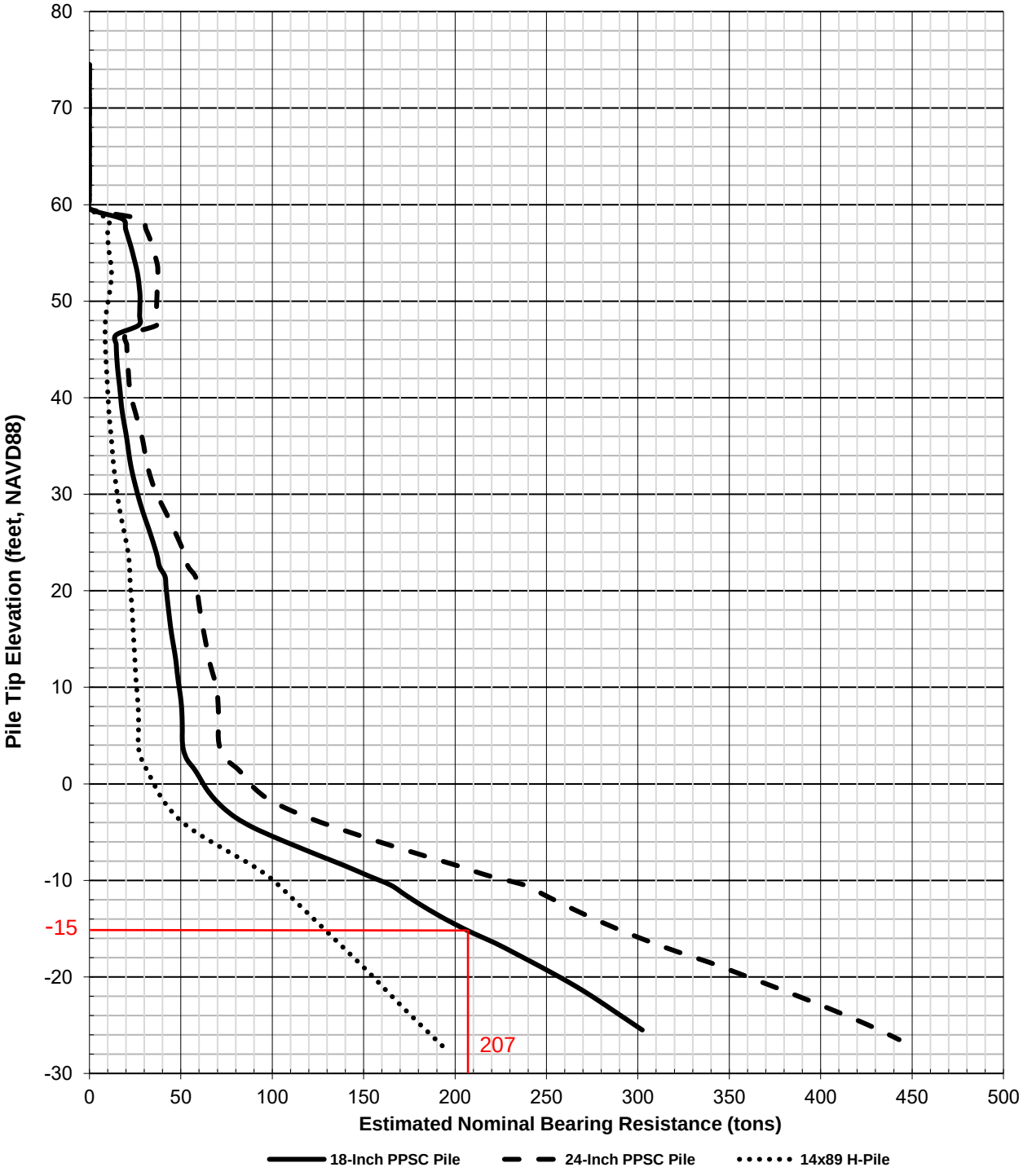


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to CR 760
SR 70 over Joshua Creek
DeSoto County, FL
FPID No. 451690-1-32-01

SR 70 over Tiger Bay
SPT Boring BB-TIG-2

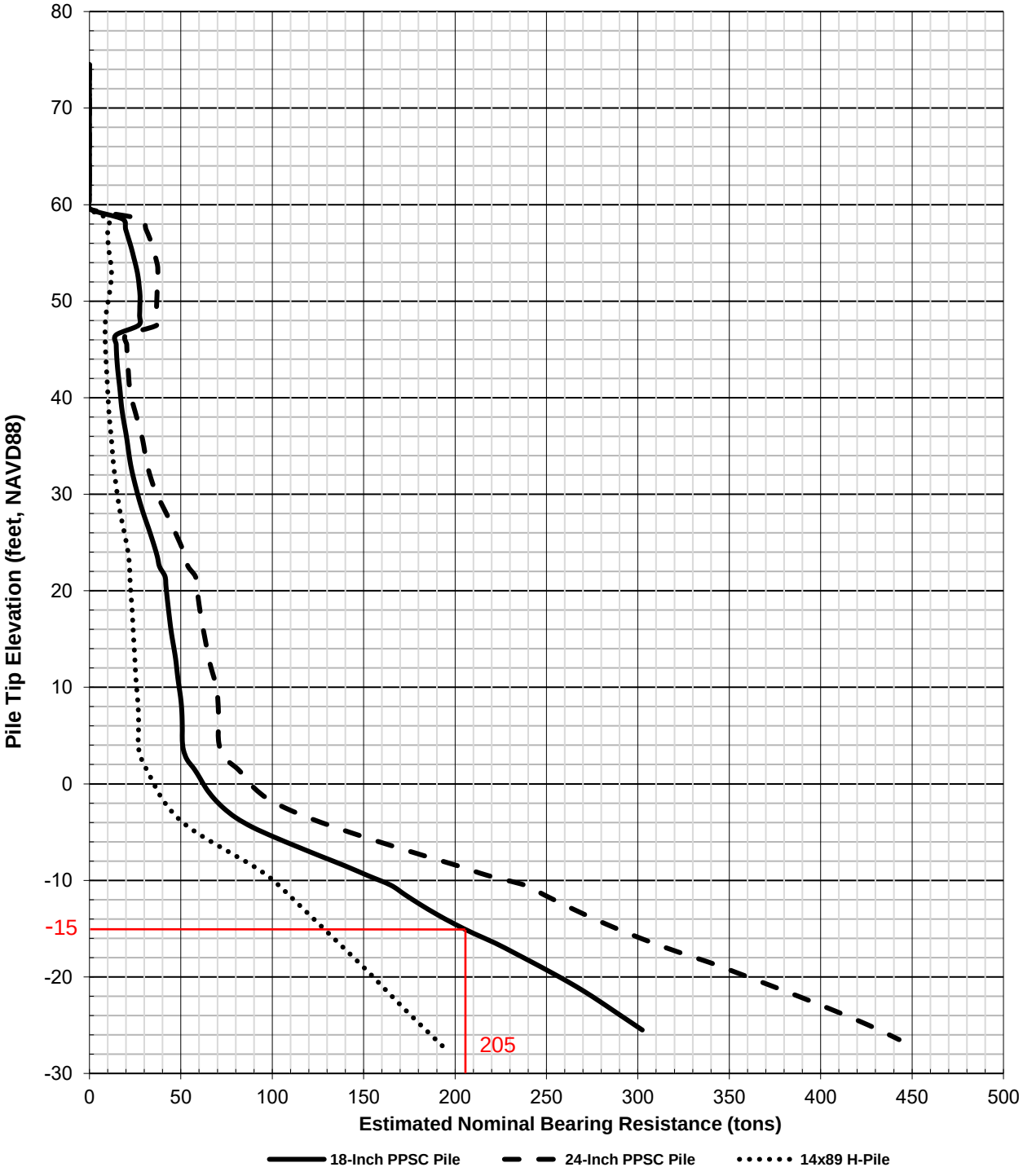


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Tiger Bay
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Tiger Bay
SPT Boring BB-TIG-2

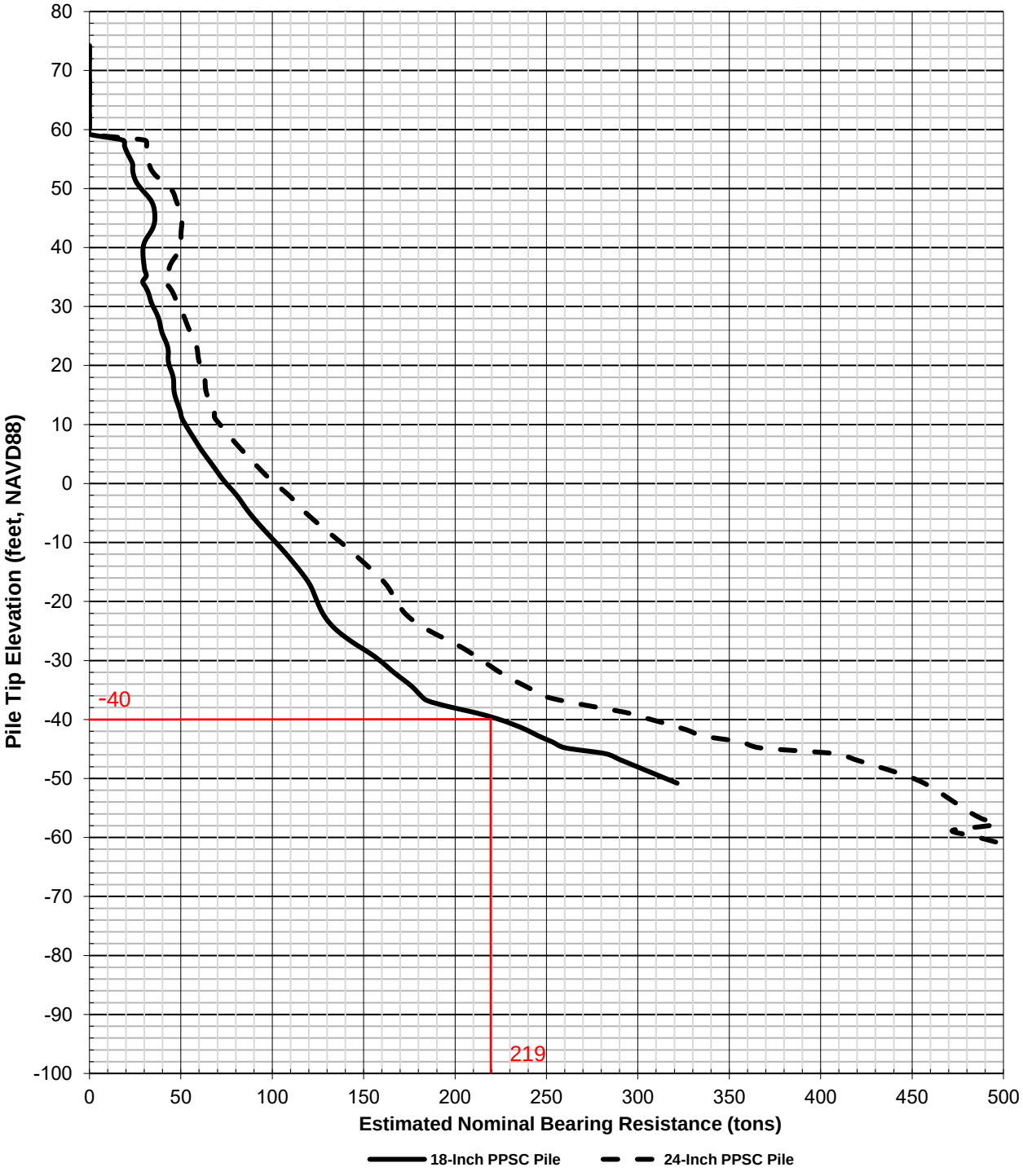


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Tiger Bay
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Mossy Gully
SPT Boring BB-MOSS-1



TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

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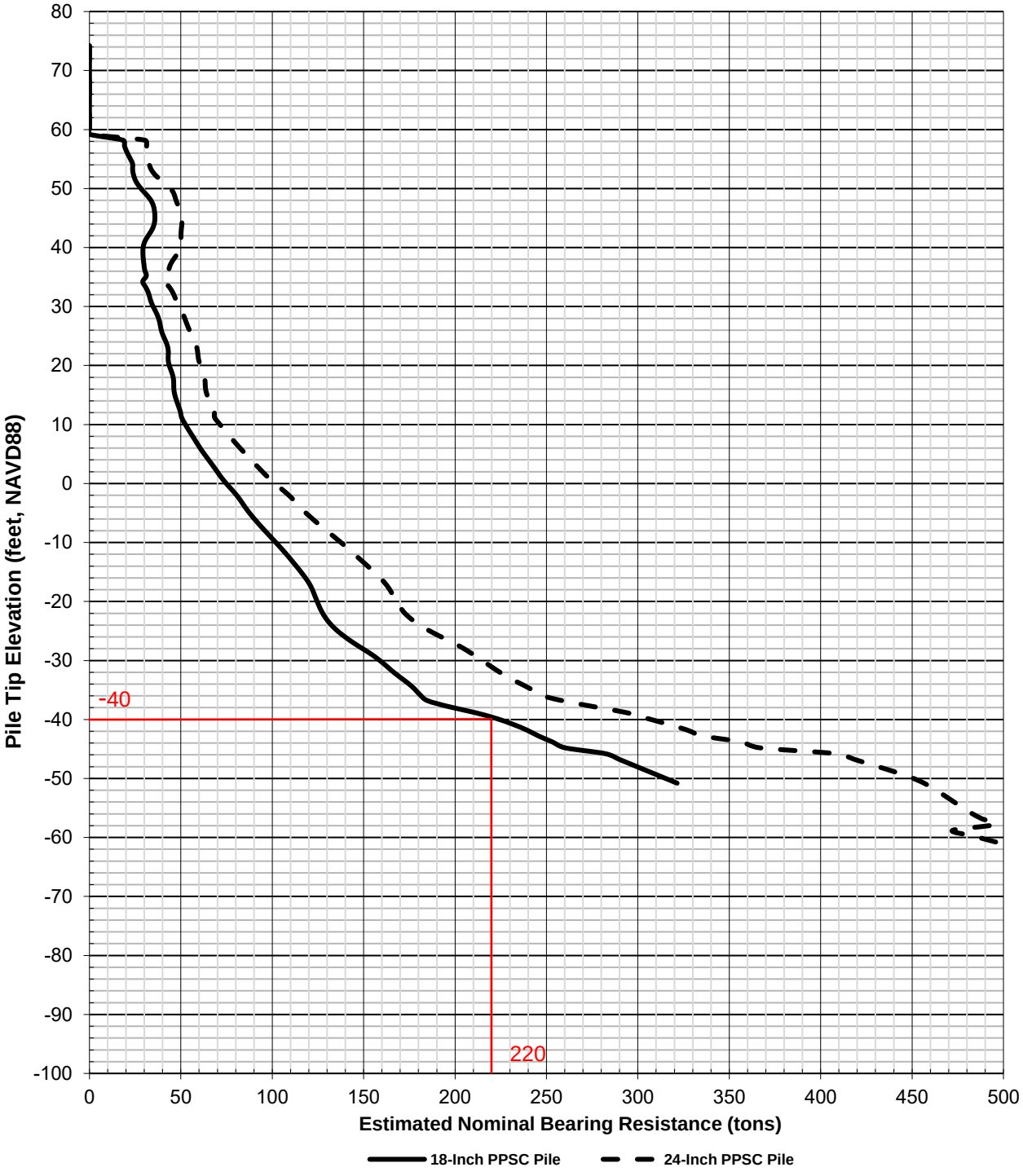
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Mossy Gully
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Mossy Gully
SPT Boring BB-MOSS-1



TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
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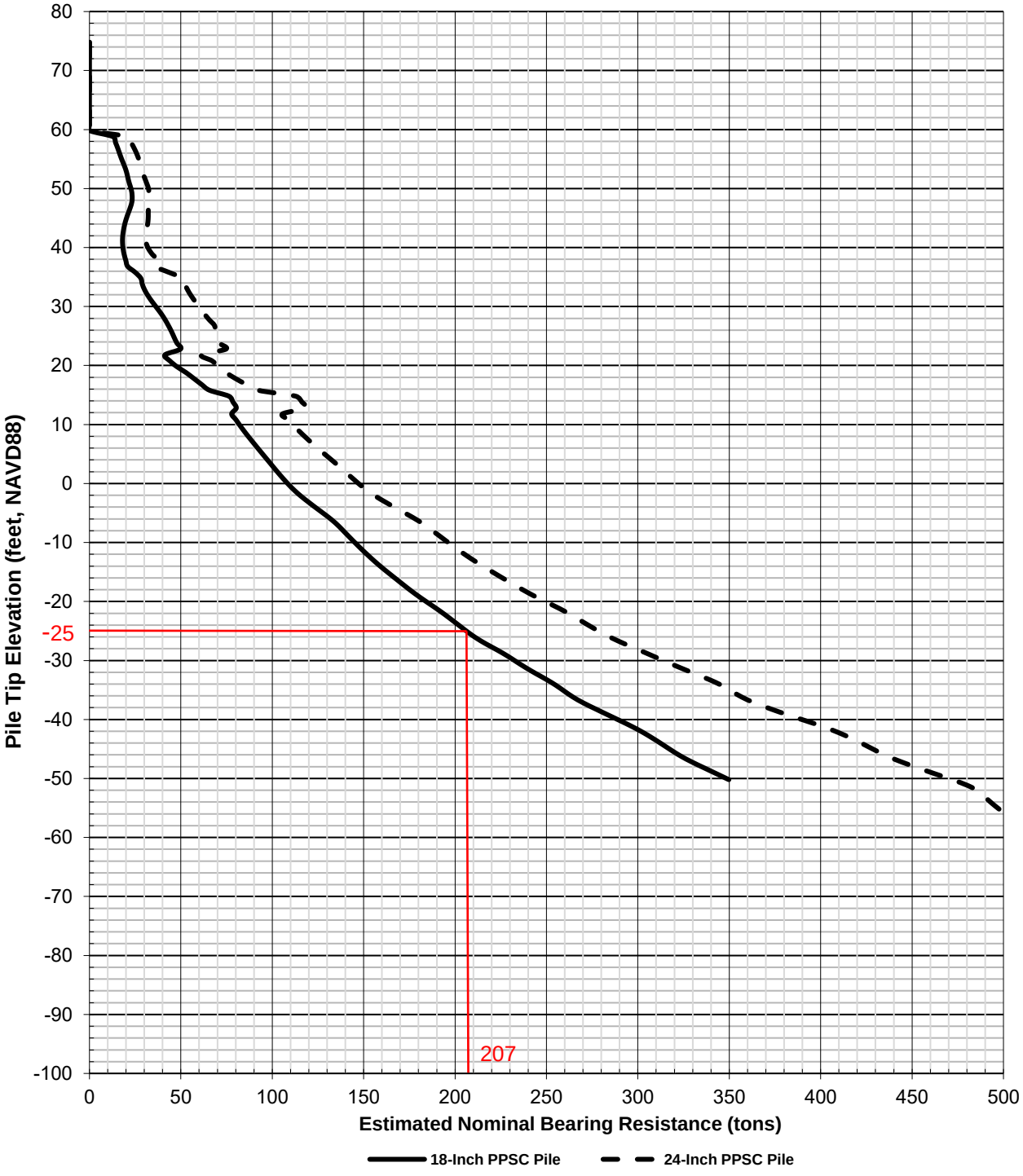
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Mossy Gully
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over D.C.I. Canal
SPT Boring BB-DCI-1

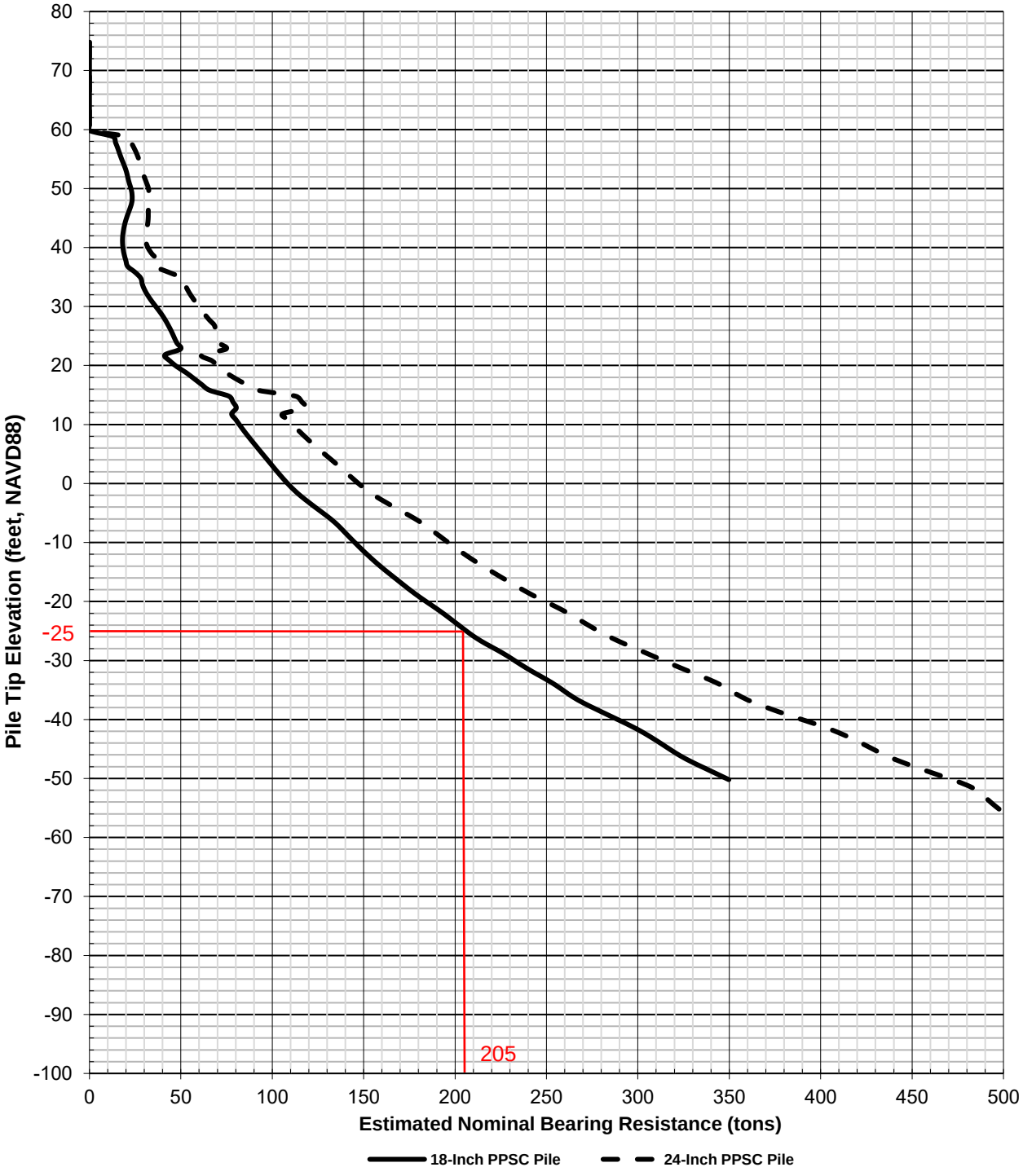


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	FEB 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over D.C.I. Canal
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over D.C.I. Canal
SPT Boring BB-DCI-1



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ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
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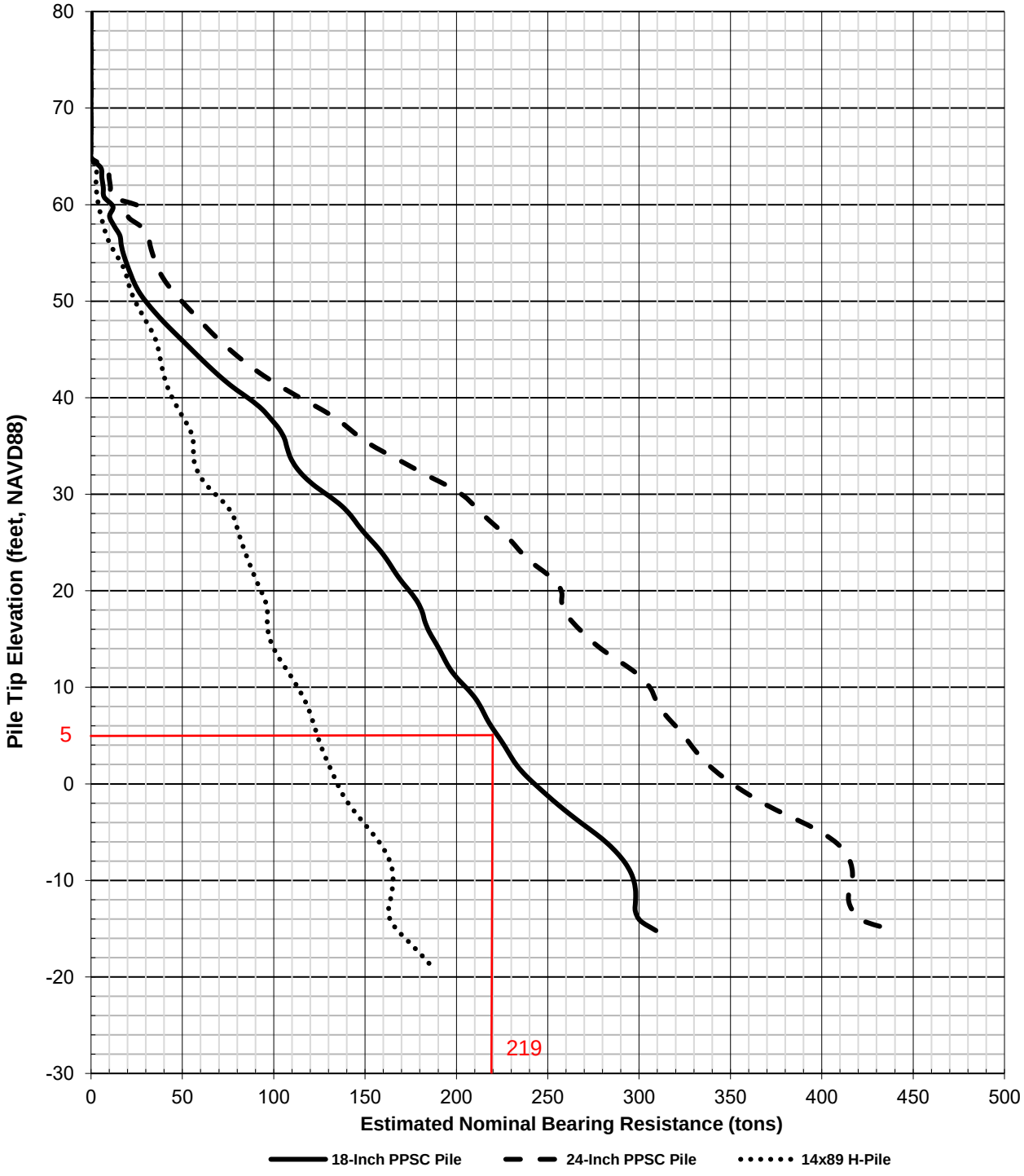
MEN	FEB 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over D.C.I. Canal
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Long Point Marsh
SPT Boring BB-LONG-1



TIERRA
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ENVIRONMENTAL • ENGINEERING

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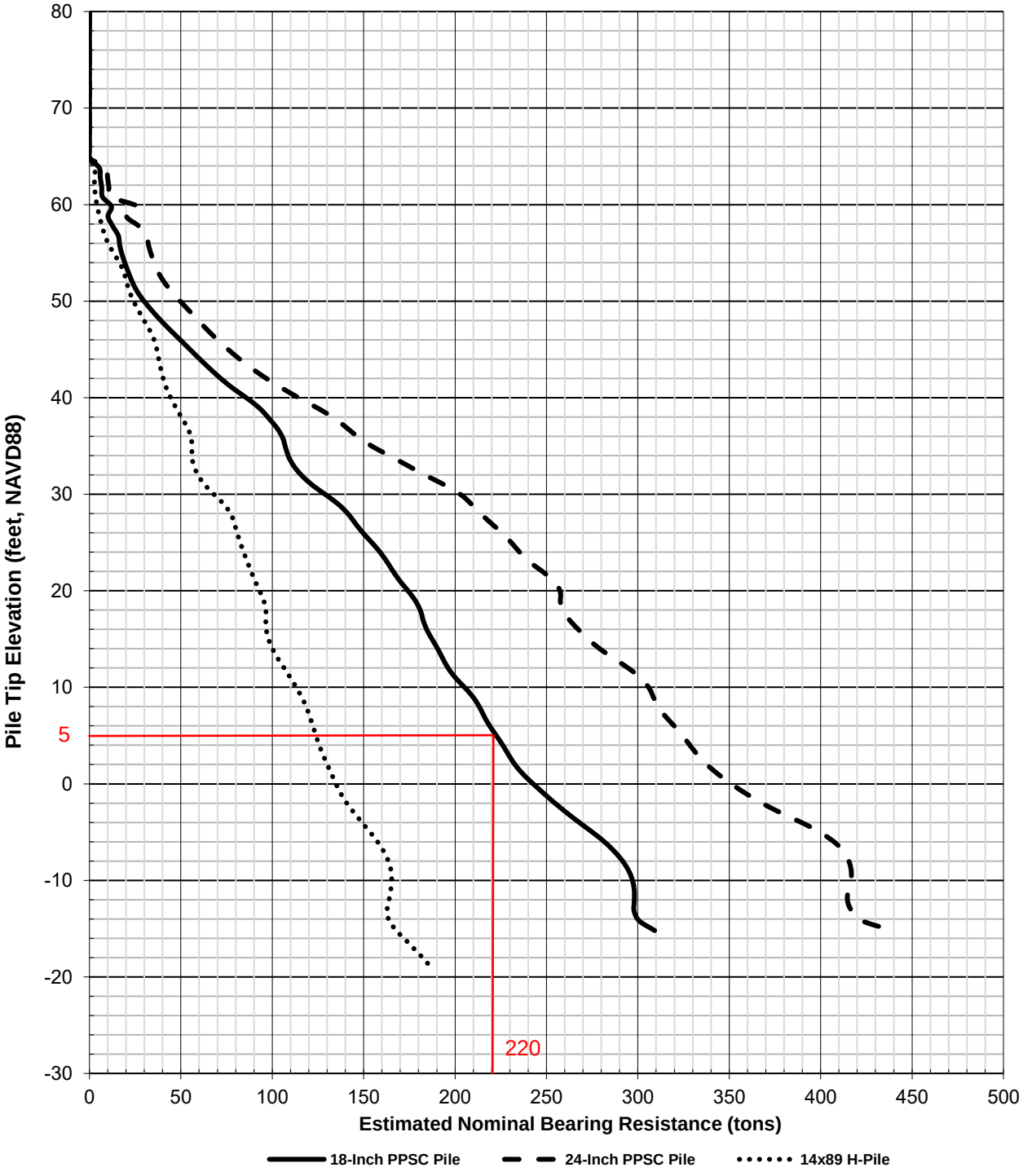
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Long Point Marsh
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Long Point Marsh
SPT Boring BB-LONG-1



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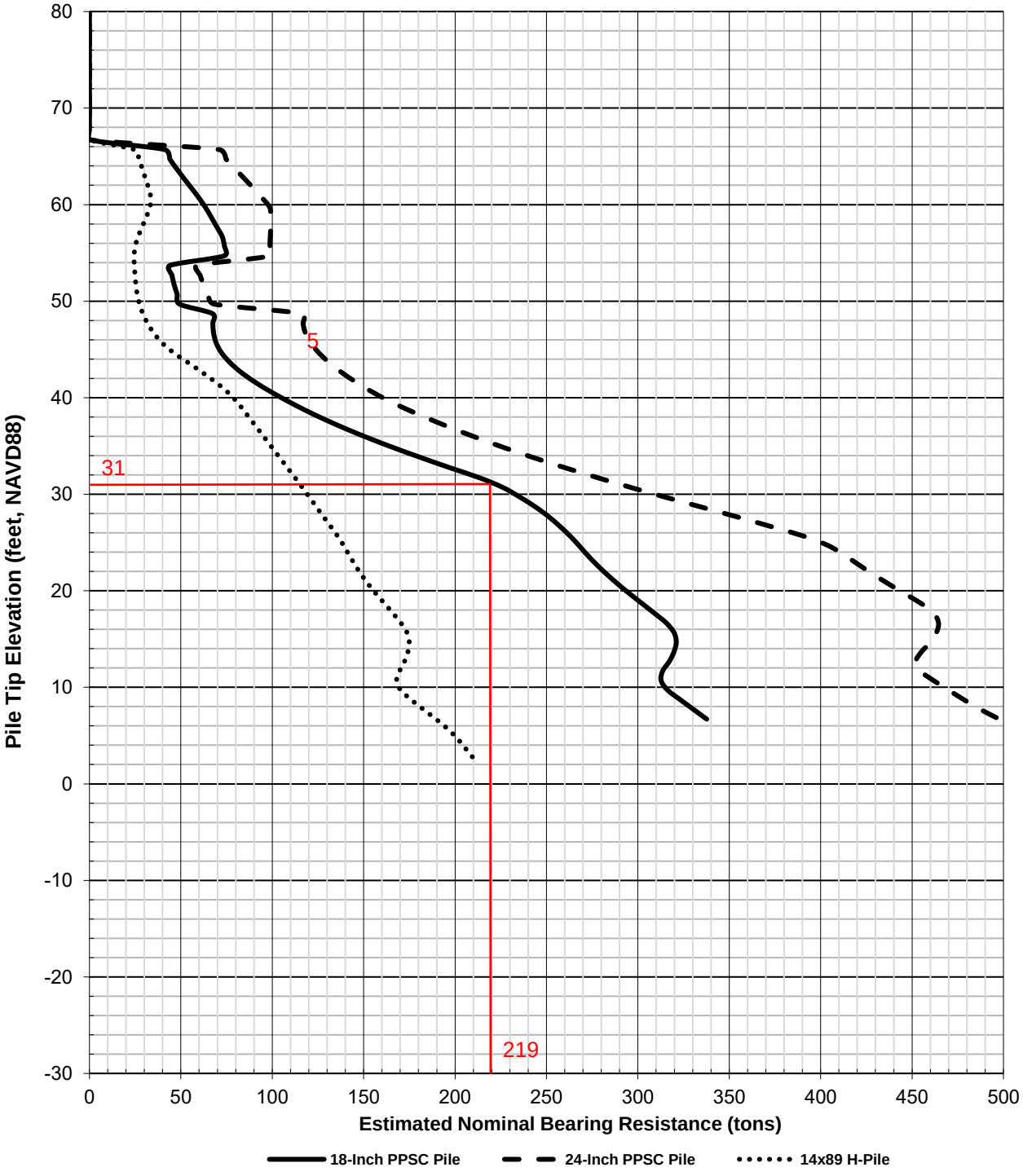
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Long Point Marsh
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Parker Creek
SPT Boring BB-PARK-1



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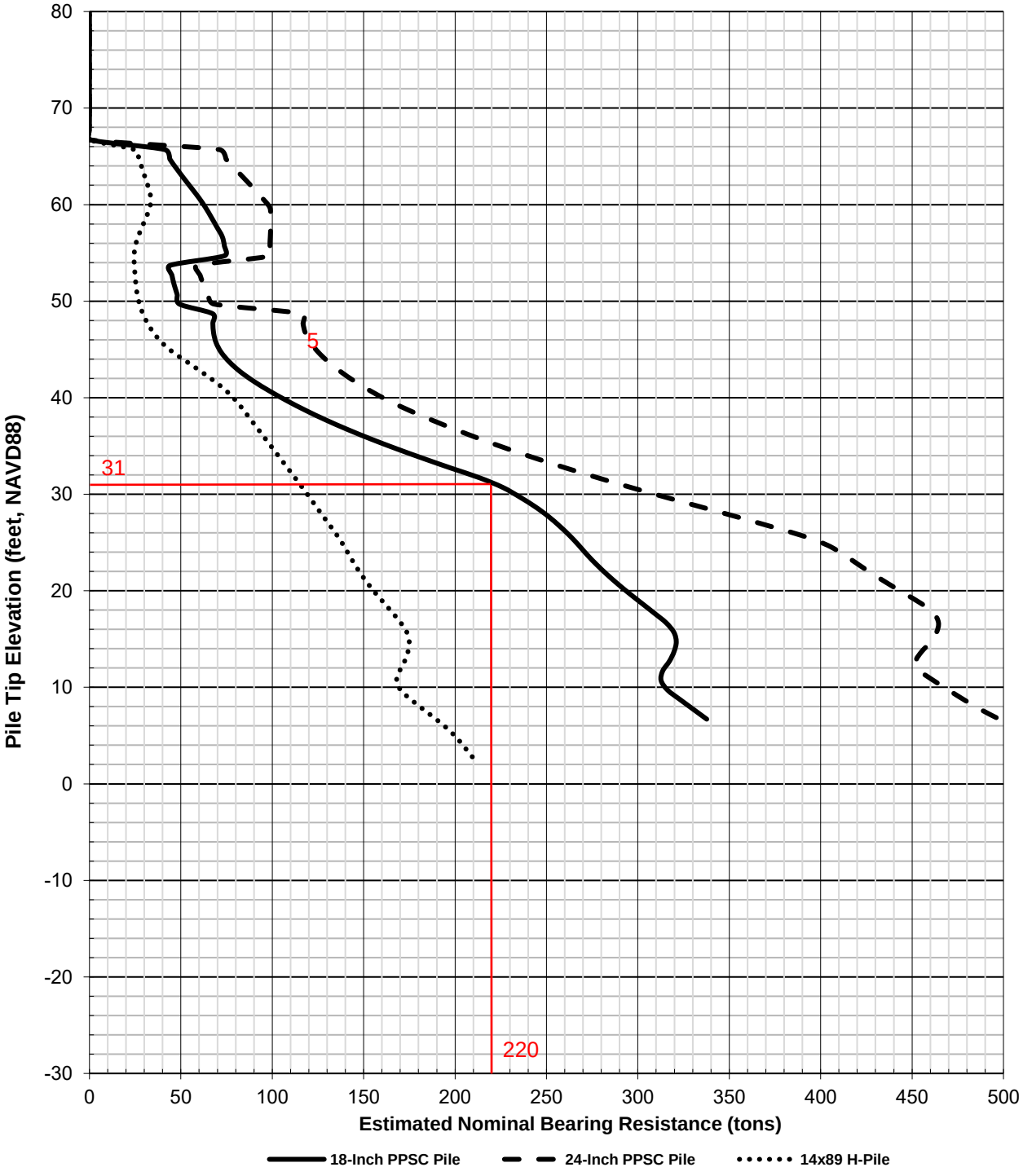
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Parker Creek
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Parker Creek
SPT Boring BB-PARK-1



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DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
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MEN	FEB 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Parker Creek
DeSoto County, FL
FPID No. 451942-2-52-01

PRELIMINARY WALL
COST ANALYSIS
FSB vs. FIB

FSB Alternative Wall

Bridge Crossing	MSE WALL Limits				Gravity WALL Limits		
	Begin Sta.	End Sta.	Avg. Height (FT)	Area (SF)	Begin Sta.	End Sta.	Wall (LF)
40024 - Whidden Creek	4104+02.00	4105+40.73	6.25	866	N/A	N/A	N/A
	4106+82.82	4108+67.00	8.22	1513	N/A	N/A	N/A
40027 - Joshua Creek	4248+46.00	4253+76.25	7.58	4017	4255+45.25	4260+84.00	539
	4255+45.25	4260+10.00	7.58	3520			
	124.417		10	1244			
	4249+66.00	4253+76.25	8.98	3682			
	4255+45.25	4259+45.00	7.19	2872			
	124.417		10	1244			
40031 - Tiger Bay	N/A				4420+14.80	4422+06.00	191
40032 - Mossy Gully	N/A				4491+40.00	4494+86.00	346
40033 - DCI Canal	N/A				N/A		
40037 - Long Point Marsh	N/A				N/A		
40940 - Parker Creek	N/A				4845+43.00	4845+97.02	54
	Total MSE Wall Area (SF) =			**18959**	**Total Gravity Wall Area (LF) =**		**1130**

FIB Alternative Wall

Bridge Crossing	MSE WALL Limits				Gravity WALL Limits		
	Begin Sta.	End Sta.	Avg. Height (FT)	Area (SF)	Begin Sta.	End Sta.	Wall (LF)
40024 - Whidden Creek	4102+93.00	4105+40.73	7.86	1947	N/A		
	4106+82.82	4110+08.00	9.59	3117			
40027 - Joshua Creek	4247+10.00	4253+76.25	8.84	5886	4255+45.25	4261+84.00	639
	4255+45.25	4261+10.00	9.12	5151			
	124.417		10	1244			
	4248+97.00	4253+76.25	10.64	5099			
	4255+45.25	4260+40.00	8.56	4235			
	124.417		10	1244			
40031 - Tiger Bay	N/A				4420+14.80	4423+62.00	347
40032 - Mossy Gully	N/A				4487+33.00	4488+87.78	155
					4490+17.82	4496+67.50	650
40033 - DCI Canal	N/A				N/A		
40037 - Long Point Marsh	N/A				4667+80.00	4668+91.23	111
					4670+21.26	4672+34.00	213
40940 - Parker Creek	N/A				4840+42.50	4845+97.02	555
					4850+27.14	4853+30.00	303
	Total MSE Wall Area (SF) =			**27923**	**Total Gravity Wall Area (LF) =**		**2972**

Additional Roadway Cost to Accommodate FIB Alternative

Pay Item 548-12 Retaining Wall System

MSE Walls	Area (SF)	Cost ($/SF)	Cost $
Permanent	8964	$68.53	**$614,330**

12 month statewide moving average (2024/06/01 to 2025/05/31)

Pay Item 400-0-11 Concrete Class NS, Gravit Wall

Wall Length ft	Concrete Cy/ft	Total Cy	Concrete Cost ($/Cy)	Total Wall Cost $
1842	0.22	405	$1,003.31	**$406,535**

12 month statewide moving average (2024/06/01 to 2025/05/31)
Scheme 1, Avg. exposed height 3' / slopes no steeper than 1:2 - 0.22Cy/ft) See Index 400-011

Pay Item 120-6 EMBANKMENT

Total Emb. CY	Cost $/Cy	Total Cy
101440	$18.38	**$1,864,461**

12 month statewide moving average (2024/06/01 to 2025/05/31)

Total Additional Cost ($)
$2,885,327

APPENDIX – B

APPROVED TYPICAL SECTION PACKAGE

STATE OF FLORIDA

DEPARTMENT OF TRANSPORTATION

TYPICAL SECTION PACKAGE

FINANCIAL PROJECT ID 451942-2-52-01

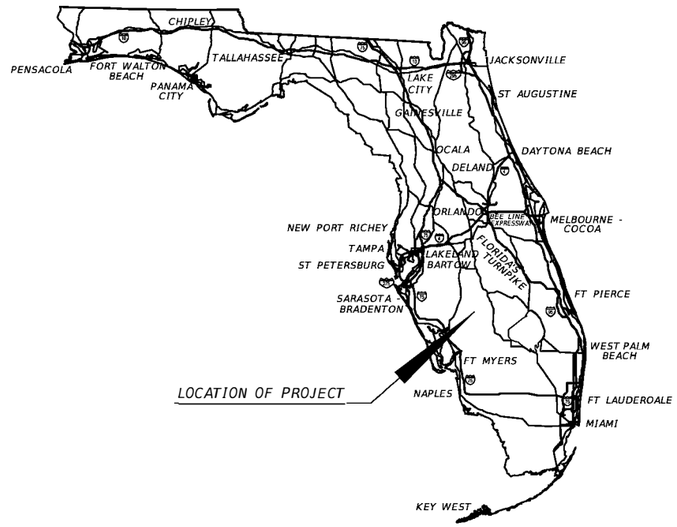
DESOTO COUNTY (04040000)

STATE ROAD NO. 70

ADD LANES AND RECONSTRUCT

FROM WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

PROJECT LOCATION URL:	https://tinyurl.com/y9623uwm https://tinyurl.com/3v7essae
PROJECT LIMITS:	BEGIN M.P. 14.973 – END M.P. 31.763
EXCEPTIONS:	NONE
BRIDGE LIMITS:	040024 – M.P. 16.896–16.919 040027 – M.P. 19.705–19.728
RAILROAD CROSSING:	NONE



FDOT DISTRICT DESIGN ENGINEER

CONCURRING WITH:
TYPICAL SECTION ELEMENTS
TARGET SPEED
DESIGN & POSTED SPEEDS

FDOT DISTRICT TRAFFIC OPERATIONS ENGINEER

CONCURRING WITH:
TARGET SPEED
DESIGN & POSTED SPEEDS

FDOT DISTRICT INTERMODAL SYSTEMS DEVELOPMENT MANAGER

CONCURRING WITH:
CONTEXT CLASSIFICATION
TARGET SPEED

FDOT DISTRICT STRUCTURES DESIGN ENGINEER

CONCURRING WITH:
TYPICAL SECTION ELEMENTS

FHWA TRANSPORTATION ENGINEER

CONCURRING WITH:
TYPICAL SECTION ELEMENTS

LOCAL TRANSPORTATION ENGINEER

CONCURRING WITH:
TYPICAL SECTION ELEMENTS

NOT USED

CONCURRING WITH:

NOT USED

CONCURRING WITH:

APPROVED BY:

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY:

NICOLAS LEON
LICENSE
No 78538
STATE OF FLORIDA
PROFESSIONAL ENGINEER

ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

HNTB CORPORATION
555 NORTH BROADWAY AVE
BARTOW, FL 33830
CERTIFICATE OF AUTHORIZATION: 6500
NICOLAS LEON, P.E. NO. 78538

THE ABOVE NAMED PROFESSIONAL ENGINEER SHALL BE RESPONSIBLE FOR THE FOLLOWING SHEETS IN ACCORDANCE WITH RULE 61G15-23.004, F.A.C.

INDEX OF SHEETS

SHEET NO	SHEET DESCRIPTION
1	COVER SHEET
2	TYPICAL SECTION NO. 1
3	TYPICAL SECTION NO. 2
4	TYPICAL SECTION NO. 3
5	TYPICAL SECTION NO. 4

PROJECT CONTROLS

CONTEXT CLASSIFICATION

( ) C1 : NATURAL
( ) C2 : RURAL
( ) C2T : RURAL TOWN
( ) C3R : SUBURBAN RES.
( ) N/A : L.A. FACILITY
(X) C3C : SUBURBAN COMM.
( ) C4 : URBAN GENERAL
( ) C5 : URBAN CENTER
( ) C6 : URBAN CORE

FUNCTIONAL CLASSIFICATION

( ) INTERSTATE
( ) FREEWAY/EXPWY.
(X) PRINCIPAL ARTERIAL
( ) MINOR ARTERIAL
( ) MAJOR COLLECTOR
( ) MINOR COLLECTOR
( ) LOCAL

HIGHWAY SYSTEM

( ) NATIONAL HIGHWAY SYSTEM
(X) STRATEGIC INTERMODAL SYSTEM
(X) STATE HIGHWAY SYSTEM
( ) OFF-STATE HIGHWAY SYSTEM

ACCESS CLASSIFICATION

( ) 1 - FREEWAY
( ) 2 - RESTRICTIVE w/Service Roads
(X) 3 - RESTRICTIVE w/660 ft. Connection Spacing
( ) 4 - NON-RESTRICTIVE w/2640 ft. Signal Spacing
(X) 5 - RESTRICTIVE w/440 ft. Connection Spacing
( ) 6 - NON-RESTRICTIVE w/1320 ft. Signal Spacing
( ) 7 - BOTH MEDIAN TYPES

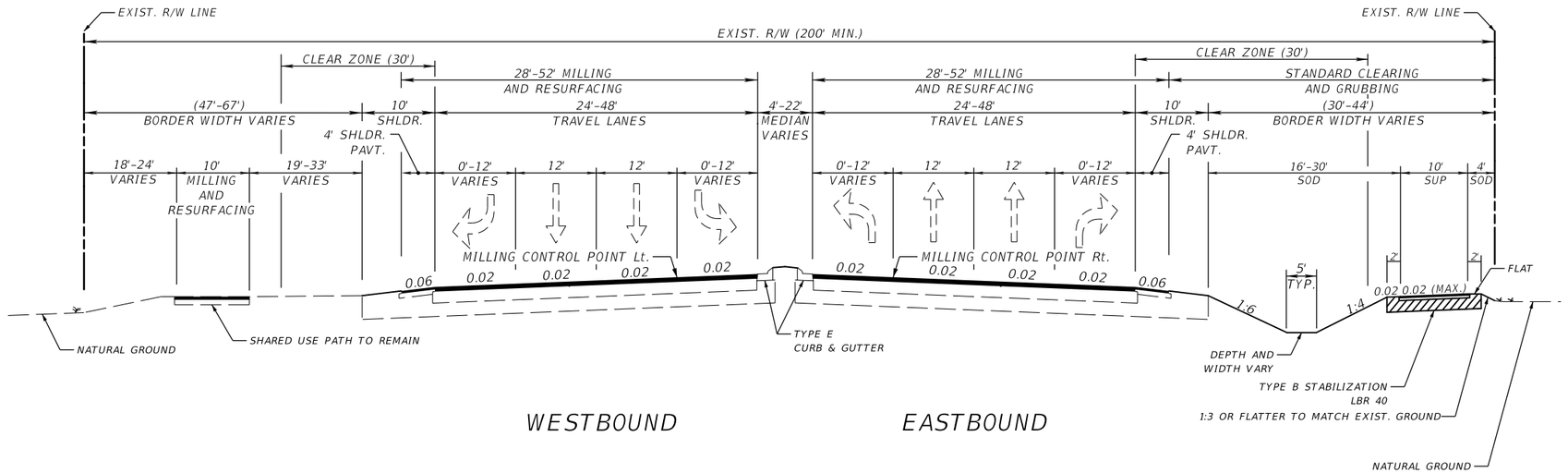
CRITERIA

(X) NEW CONSTRUCTION / RECONSTRUCTION
( ) RESURFACING (LA FACILITIES)
( ) RRR (ARTERIALS & COLLECTORS)

POTENTIAL EXCEPTIONS AND VARIATIONS RELATED TO TYPICAL SECTION:

MEDIAN WIDTH VARIATION

TYPICAL SECTION No. 1



MILLING & RESURFACING

SR 70
M.P. 14.973 TO M.P. 15.748
(STA. 4006+64.47 TO STA. 4043+00.00)

NOT TO SCALE

TRAFFIC DATA

CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D = 54.3% T = 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED = 45 & 55 MPH

FINANCIAL PROJECT ID	SHEET NO.
451942-2-52-01	2

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

PROJECT CONTROLS

CONTEXT CLASSIFICATION

( ) C1 : NATURAL
( ) C3C : SUBURBAN COMM.
(X) C2 : RURAL
( ) C4 : URBAN GENERAL
( ) C2T : RURAL TOWN
( ) C5 : URBAN CENTER
( ) C3R : SUBURBAN RES.
( ) C6 : URBAN CORE
( ) N/A : L.A. FACILITY

FUNCTIONAL CLASSIFICATION

( ) INTERSTATE
( ) MAJOR COLLECTOR
( ) FREEWAY/EXPWY.
( ) MINOR COLLECTOR
(X) PRINCIPAL ARTERIAL
( ) LOCAL
( ) MINOR ARTERIAL

HIGHWAY SYSTEM

( ) NATIONAL HIGHWAY SYSTEM
(X) STRATEGIC INTERMODAL SYSTEM
(X) STATE HIGHWAY SYSTEM
( ) OFF-STATE HIGHWAY SYSTEM

ACCESS CLASSIFICATION

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CRITERIA

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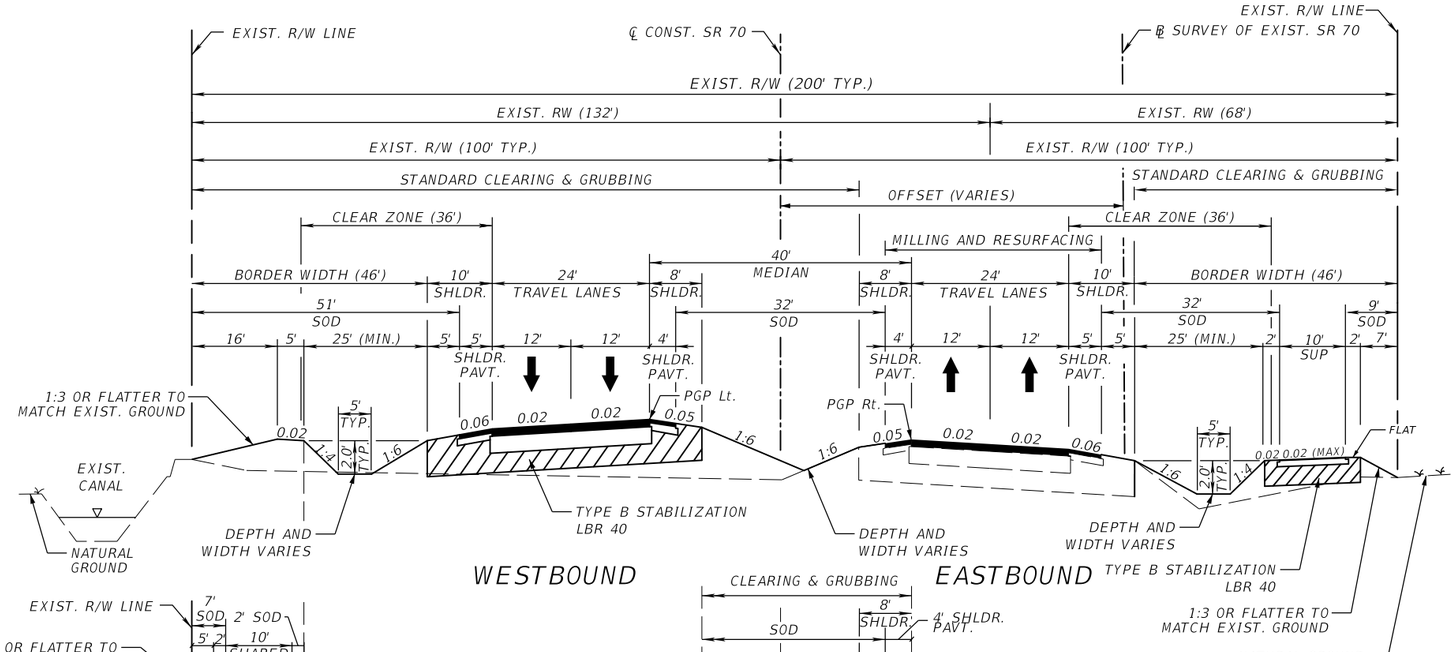
( ) RESURFACING (LA FACILITIES)
( ) RRR (ARTERIALS & COLLECTORS)

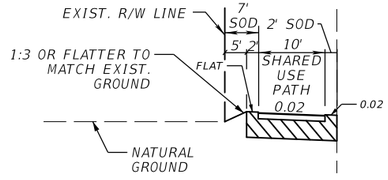
POTENTIAL EXCEPTIONS AND VARIATIONS RELATED TO TYPICAL SECTION:

TYPICAL SECTION No. 2

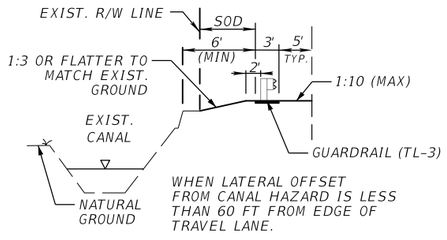


WESTBOUND

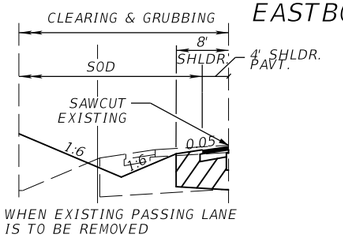
EASTBOUND



WHEN SHARED USE PATH PROVIDED



WHEN LATERAL OFFSET FROM CANAL HAZARD IS LESS THAN 60 FT FROM EDGE OF TRAVEL LANE.



WHEN EXISTING PASSING LANE IS TO BE REMOVED

NOT TO SCALE

TRAFFIC DATA

CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D = 54.3% T = 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 65 MPH
POSTED SPEED = 65 MPH
TARGET SPEED = 65 MPH

EB MILLING & RESURFACING/ WB NEW CONSTRUCTION

SR 70
M.P. 15.748 TO M.P. 16.896
(STA. 4043+00.00 TO 4105+60.00)
M.P. 16.919 TO M.P. 19.705
(STA. 4106+80.00 TO 4253+80.00)
M.P. 19.728 TO M.P. 31.763
(STA. 4255+20.00 TO 4980+15.00)

FINANCIAL PROJECT ID	SHEET NO.
451942-2-52-01	3

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

PROJECT CONTROLS

CONTEXT CLASSIFICATION

( )	C1 : NATURAL	( )	C3C : SUBURBAN COMM.
(X)	C2 : RURAL	( )	C4 : URBAN GENERAL
( )	C2T : RURAL TOWN	( )	C5 : URBAN CENTER
( )	C3R : SUBURBAN RES.	( )	C6 : URBAN CORE
( )	N/A : L.A. FACILITY		

FUNCTIONAL CLASSIFICATION

( )	INTERSTATE	( )	MAJOR COLLECTOR
( )	FREEWAY/EXPWY.	( )	MINOR COLLECTOR
(X)	PRINCIPAL ARTERIAL	( )	LOCAL
( )	MINOR ARTERIAL		

HIGHWAY SYSTEM

- ( ) NATIONAL HIGHWAY SYSTEM
- (X) STRATEGIC INTERMODAL SYSTEM
- (X) STATE HIGHWAY SYSTEM
- ( ) OFF-STATE HIGHWAY SYSTEM

ACCESS CLASSIFICATION

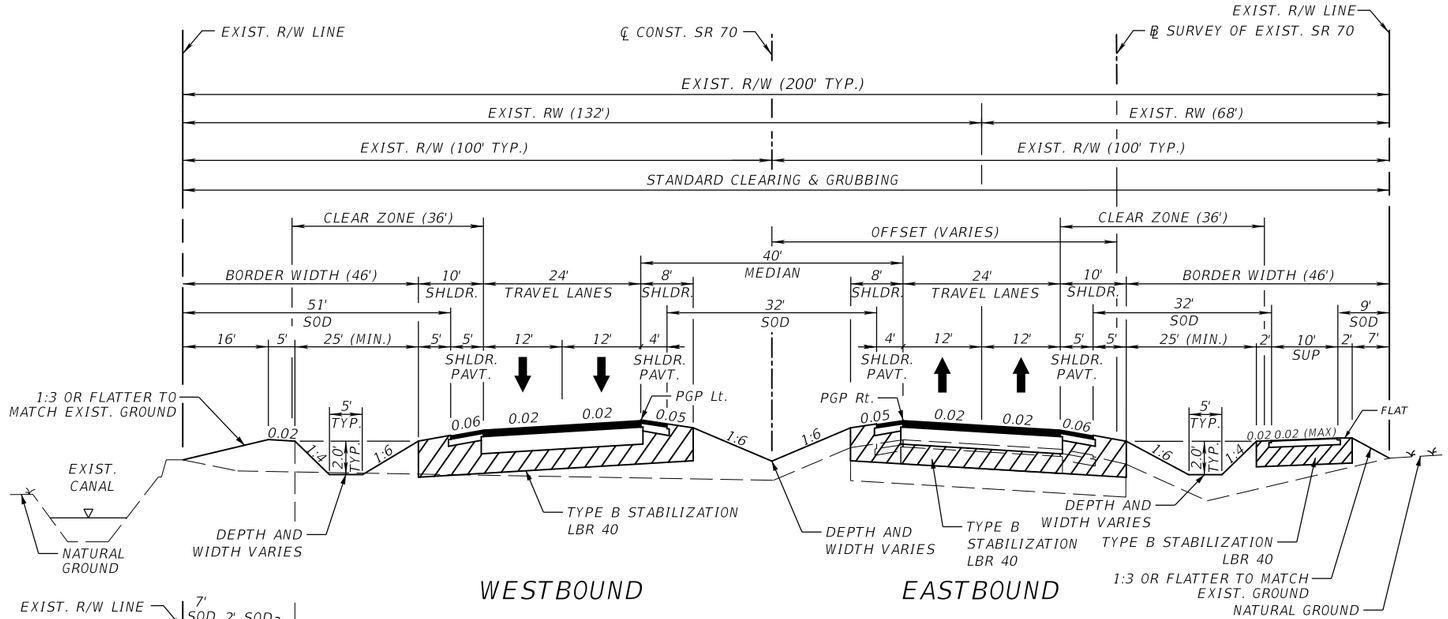
- ( ) 1 - FREEWAY
- ( ) 2 - RESTRICTIVE w/Service Roads
- (X) 3 - RESTRICTIVE w/660 ft. Connection Spacing
- ( ) 4 - NON-RESTRICTIVE w/2640 ft. Signal Spacing
- ( ) 5 - RESTRICTIVE w/440 ft. Connection Spacing
- ( ) 6 - NON-RESTRICTIVE w/1320 ft. Signal Spacing
- ( ) 7 - BOTH MEDIAN TYPES

CRITERIA

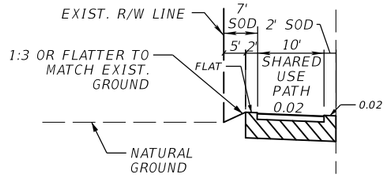
- (X) NEW CONSTRUCTION / RECONSTRUCTION
- ( ) RESURFACING (LA FACILITIES)
- ( ) RRR (ARTERIALS & COLLECTORS)

POTENTIAL EXCEPTIONS AND VARIATIONS RELATED TO TYPICAL SECTION:

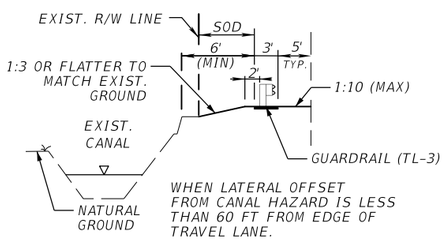
TYPICAL SECTION No. 3



NOT TO SCALE



WHEN SHARED USE PATH PROVIDED



TRAFFIC DATA

CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D = 54.3% T = 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 65 MPH
POSTED SPEED = 65 MPH
TARGET SPEED = 65 MPH

SR 70
FOR BRIDGE AND WILDLIFE CROSSING APPROACHES.
LIMITS TO BE DETERMINED

NEW CONSTRUCTION

SR 70

FINANCIAL PROJECT ID	SHEET NO.
451942-2-52-01	4

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

PROJECT CONTROLS

CONTEXT CLASSIFICATION

( ) C1 : NATURAL
(X) C2 : RURAL
( ) C2T : RURAL TOWN
( ) C3R : SUBURBAN RES.
( ) N/A : L.A. FACILITY
( ) C3C : SUBURBAN COMM.
( ) C4 : URBAN GENERAL
( ) C5 : URBAN CENTER
( ) C6 : URBAN CORE

FUNCTIONAL CLASSIFICATION

( ) INTERSTATE
( ) FREEWAY/EXPWY.
(X) PRINCIPAL ARTERIAL
( ) MINOR ARTERIAL
( ) MAJOR COLLECTOR
( ) MINOR COLLECTOR
( ) LOCAL

HIGHWAY SYSTEM

( ) NATIONAL HIGHWAY SYSTEM
(X) STRATEGIC INTERMODAL SYSTEM
(X) STATE HIGHWAY SYSTEM
( ) OFF-STATE HIGHWAY SYSTEM

ACCESS CLASSIFICATION

( ) 1 - FREEWAY
( ) 2 - RESTRICTIVE w/Service Roads
(X) 3 - RESTRICTIVE w/660 ft. Connection Spacing
( ) 4 - NON-RESTRICTIVE w/2640 ft. Signal Spacing
( ) 5 - RESTRICTIVE w/440 ft. Connection Spacing
( ) 6 - NON-RESTRICTIVE w/1320 ft. Signal Spacing
( ) 7 - BOTH MEDIAN TYPES

CRITERIA

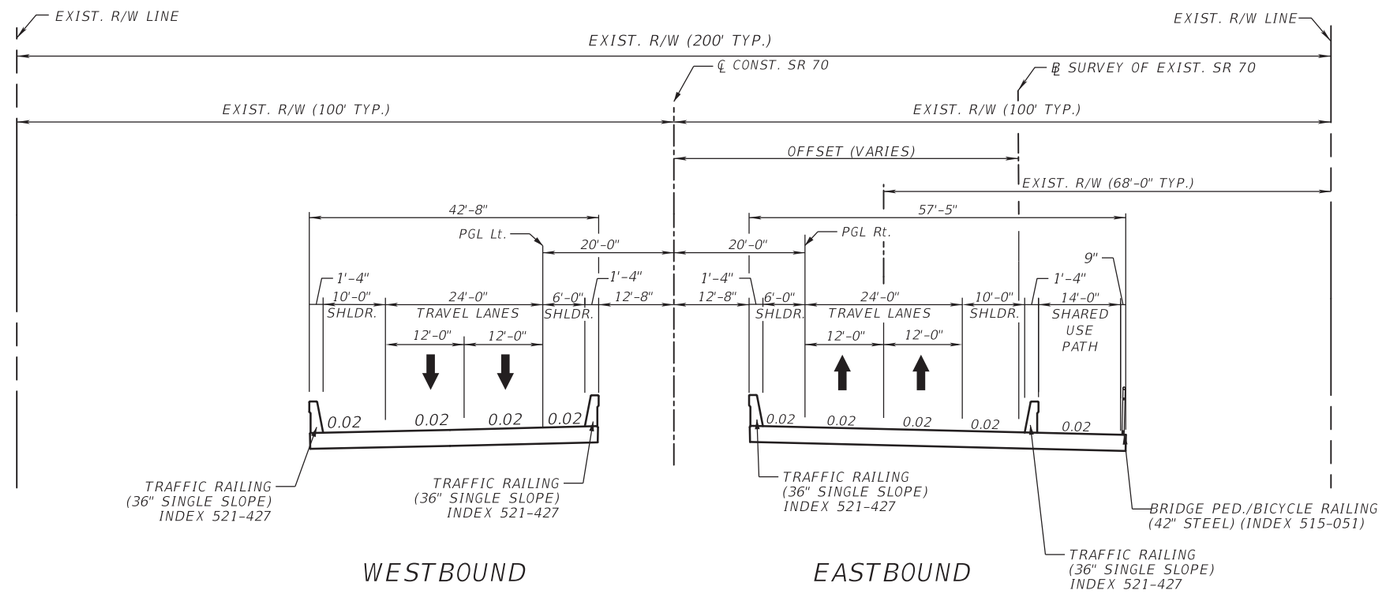
(X) NEW CONSTRUCTION / RECONSTRUCTION
( ) RESURFACING (LA FACILITIES)
( ) RRR (ARTERIALS & COLLECTORS)

POTENTIAL EXCEPTIONS AND VARIATIONS RELATED TO TYPICAL SECTION:

TYPICAL SECTION No. 4

Per District 1 instruction, shared use path shall be moved from the eastbound bridge to the westbound bridge over Whidden & Joshua creek bridges. Therefore, the typical sections at these two bridges shall be swapped.

SR 70 OVER WHIDDEN CREEK (# 040024)
SR 70 OVER JOUSHA CREEK (# 040024)



~~SR 70 BRIDGE OVER WHIDDEN CREEK (#0024) AND~~
~~SR 70 BRIDGE OVER JOSHUA CREEK (#0027)~~
M.P. 16.896 TO M.P. 16.919
(STA. 4105+40.00 TO STA. 4106+79.95)
M.P. 19.705 TO M.P. 19.728
~~(STA. 4253+80.00 TO STA. 4255+20.00)~~

NOT TO SCALE

Typical sections remain as shown above for all proposed bridges over the existing bridge culverts.

SR 70 OVER TIGER BAY (# 040031)
SR 70 OVER MOSSY GULLY (# 040032)
SR 70 OVER D.C.I. CANAL (# 040033)
SR 70 OVER LONG POINT MARCH (# 040037)
SR 70 OVER PARKER CREEK (# 040940)

TRAFFIC DATA

CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D = 54.3% T = 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 65 MPH
POSTED SPEED = 65 MPH
TARGET SPEED = 65 MPH

BRIDGE NO. TBD

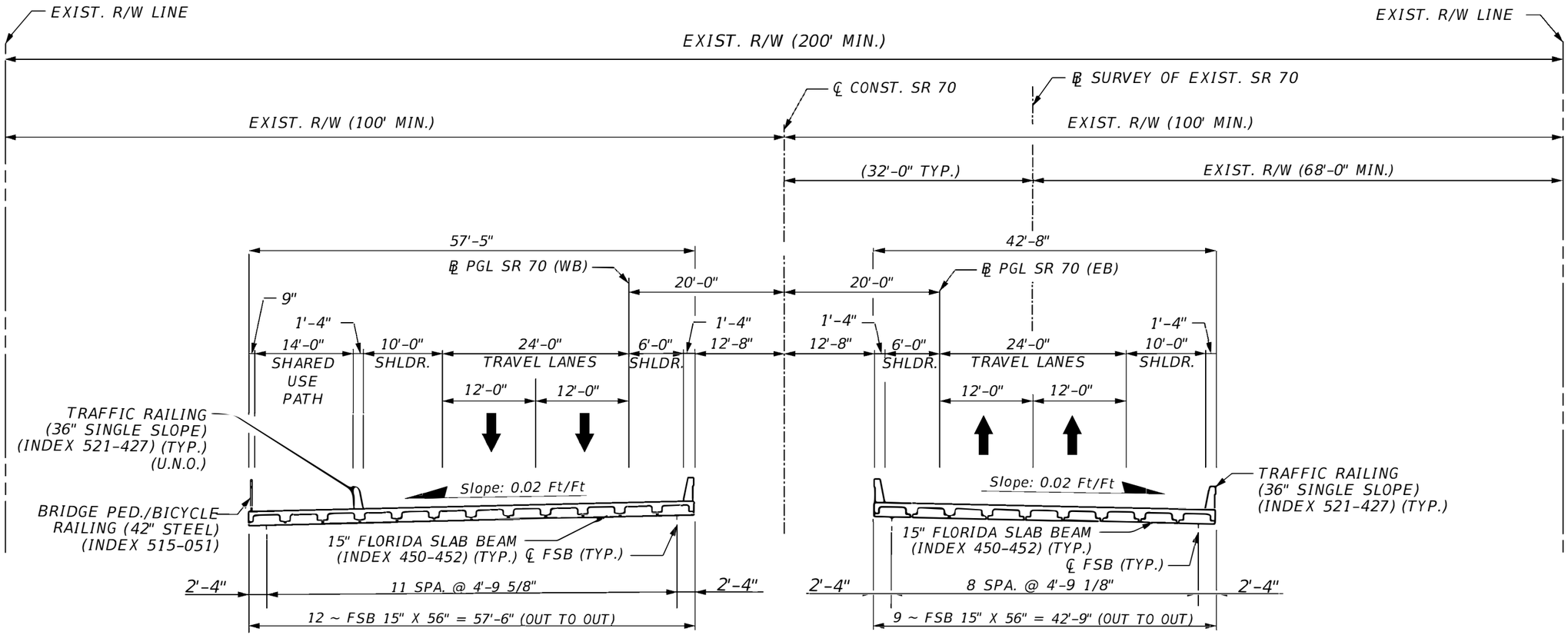
FINANCIAL PROJECT ID	SHEET NO.
451942-2-52-01	5

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

APPENDIX - C

STRUCTURES EXHIBIT PLANS

FLORIDA SLAB BEAM
EXHIBIT PLANS



TYPICAL SECTION

(BRIDGE OVER WHIDDEN CREEK)
(BRIDGE OVER JOSHUA CREEK)

BRIDGE NOS. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - TYPICAL SECTION THROUGH BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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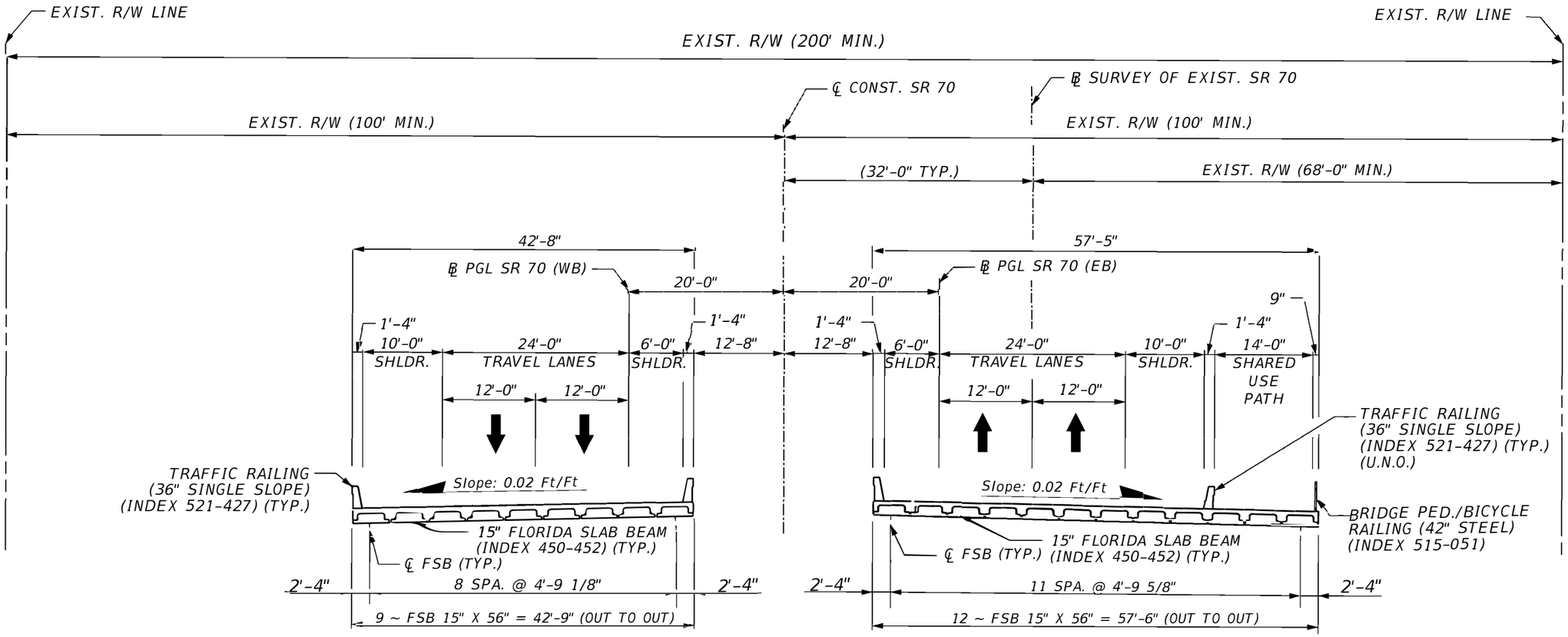
gvaso 7/3/2025 12:06:02 PM



TYPICAL SECTION

(BRIDGE OVER TIGER BAY)
(BRIDGE OVER MOSSY GULLY)
(BRIDGE OVER D.C.I. CANAL)
(BRIDGE OVER LONG POINT MARSH)
(BRIDGE OVER PARKER CREEK)

BRIDGE NOS. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	F NANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - TYPICAL SECTION THROUGH BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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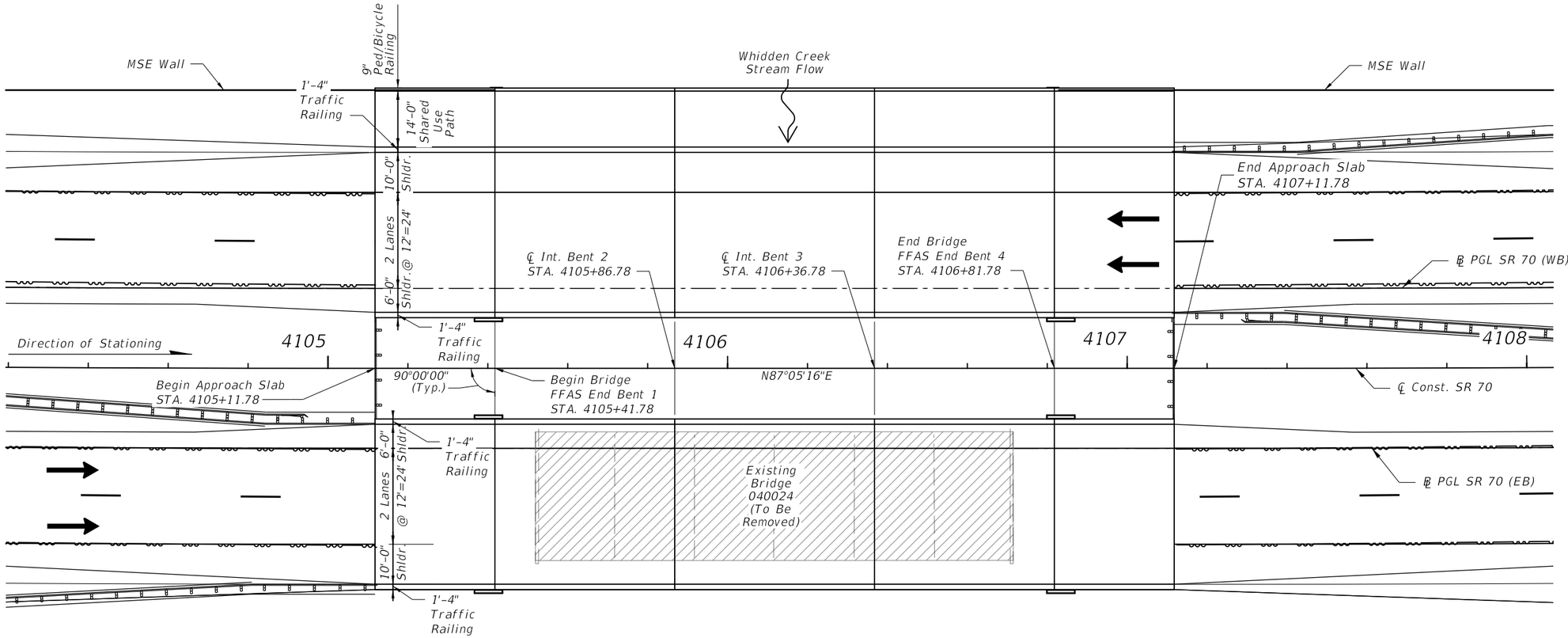


LEGEND:

Soil Boring Location (TBD)

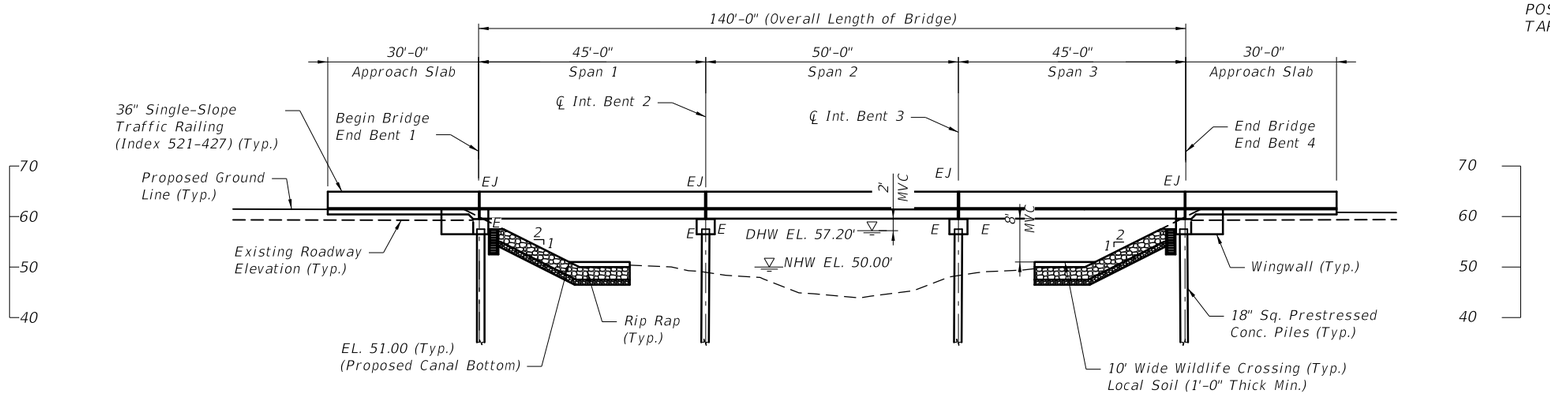
Existing Structure to be Removed

Rip Rap

TRAFFIC DATA

CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =

PLAN



ELEVATION

(Existing Bridge not Shown for Clarity)

VERTICAL CURVE DATA (TBD)

BRIDGE NO. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY:	TVT 06-25
CHECKED BY:	GGV 06-25
DESIGNED BY:	GGV 06-25
CHECKED BY:	CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - PLAN AND ELEVATION
SR 70 OVER WHIDDEN CREEK

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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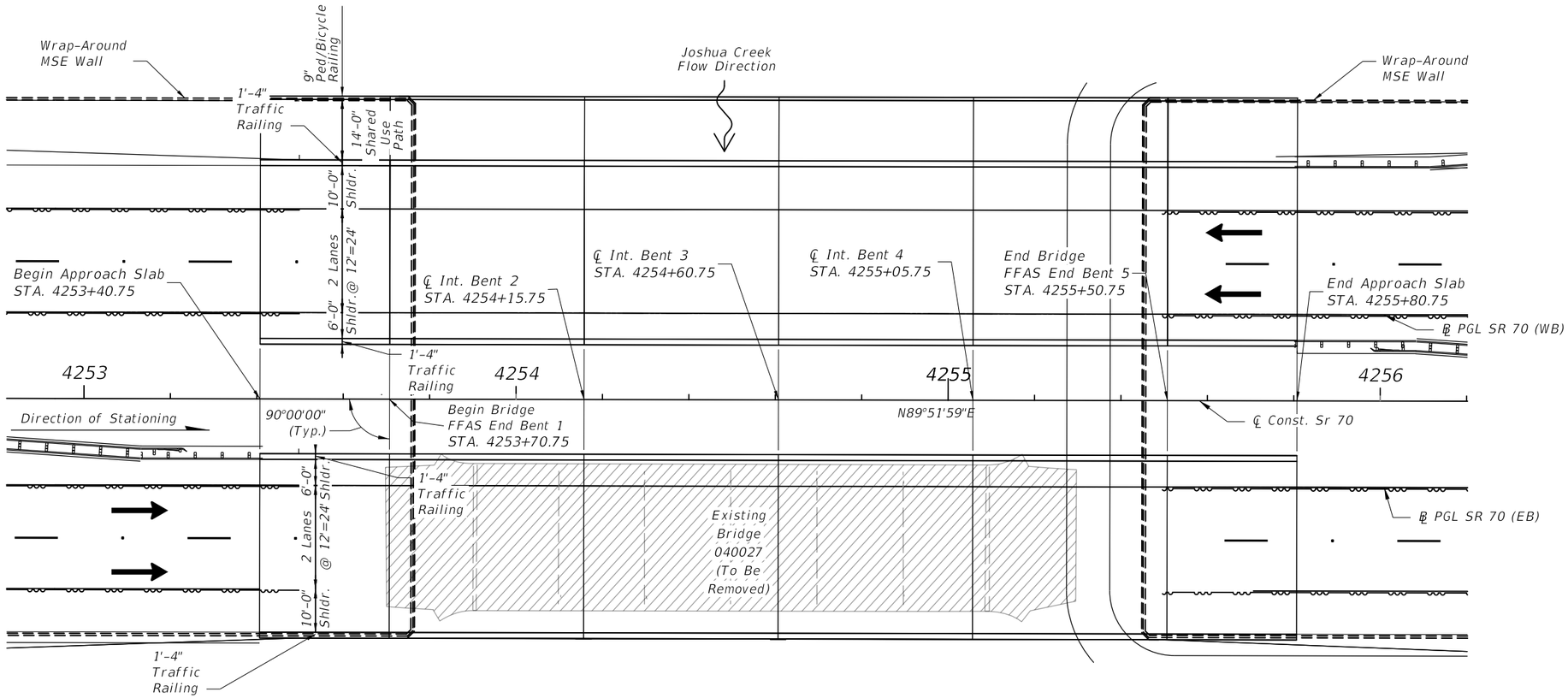


PLAN

LEGEND:

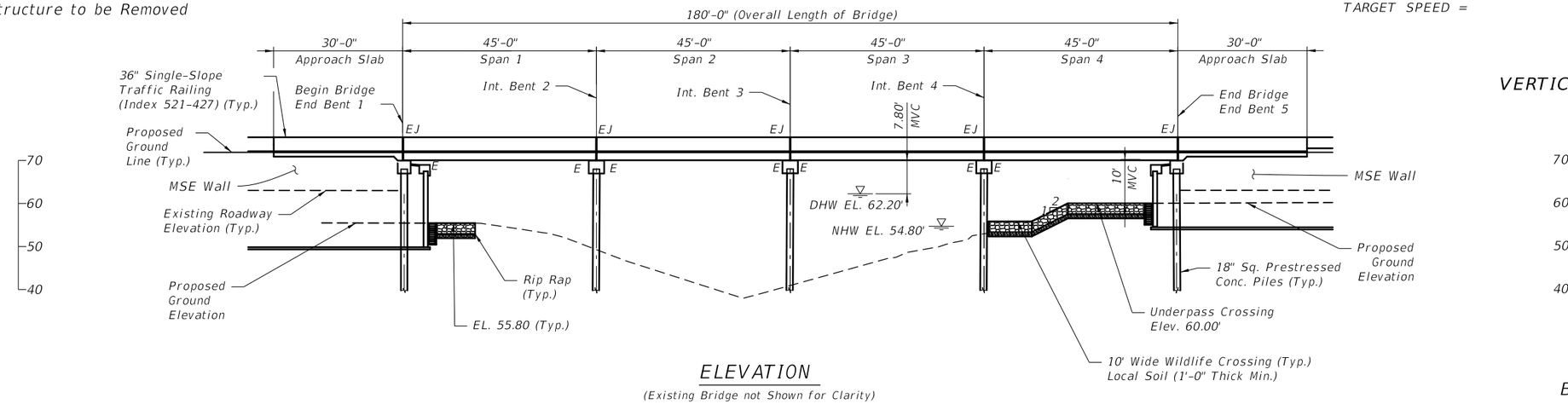
Soil Boring Location (TBD)

Existing Structure to be Removed

Rip Rap

TRAFFIC DATA

CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =



ELEVATION

(Existing Bridge not Shown for Clarity)

VERTICAL CURVE DATA (TBD)

BRIDGE NO. TBD

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

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CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

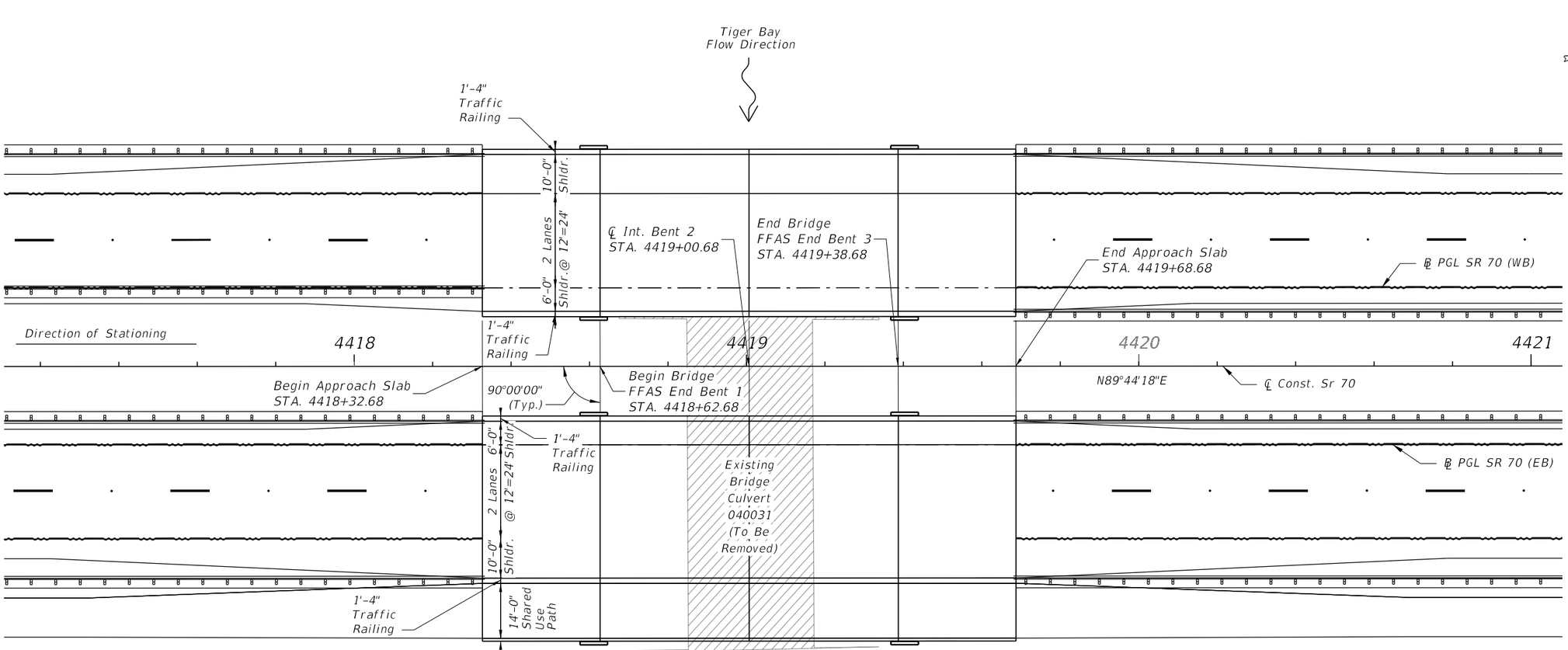
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - PLAN AND ELEVATION
SR 70 OVER JOSHUA CREEK

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

REF. DWG. NO.

SHEET NO. TBD



PLAN

LEGEND:

Soil Boring Location (TBD)

Existing Structure to be Removed

Rip Rap

TRAFFIC DATA

CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
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DESIGN SPEED = 55 MPH
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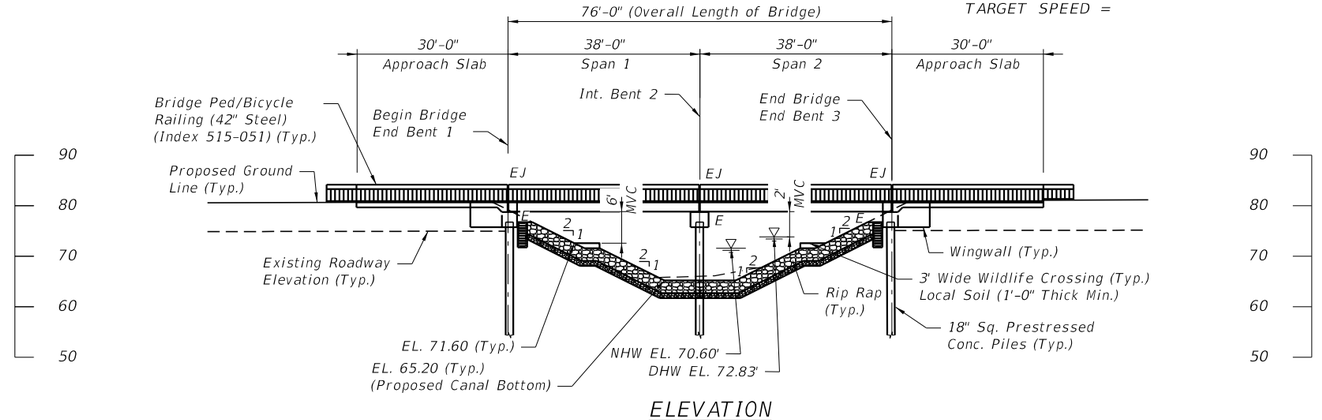
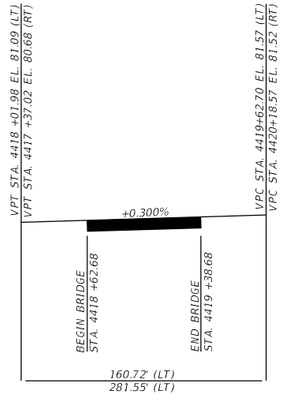
TARGET SPEED =



ELEVATION

(Existing Bridge Culvert not Shown for Clarity)



VERTICAL CURVE DATA

BRIDGE NO. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY:	TVT 03-25
CHECKED BY:	GGV 03-25
DESIGNED BY:	GGV 03-25
CHECKED BY:	CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - PLAN AND ELEVATION
SR 70 OVER TIGER BAY

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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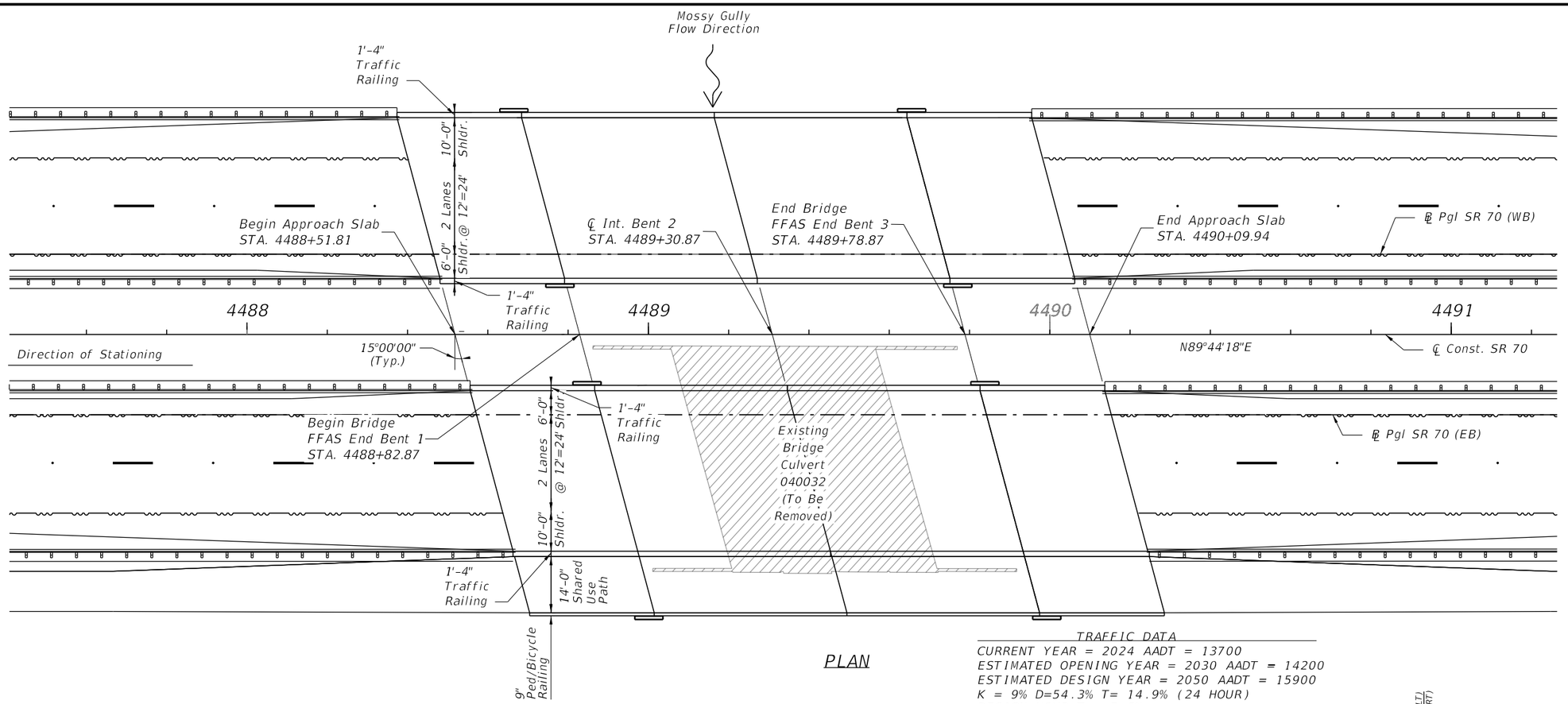

PLAN

TRAFFIC DATA
CURRENT YEAR = 2024 AADT = 13700
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ESTIMATED DESIGN YEAR = 2050 AADT = 15900
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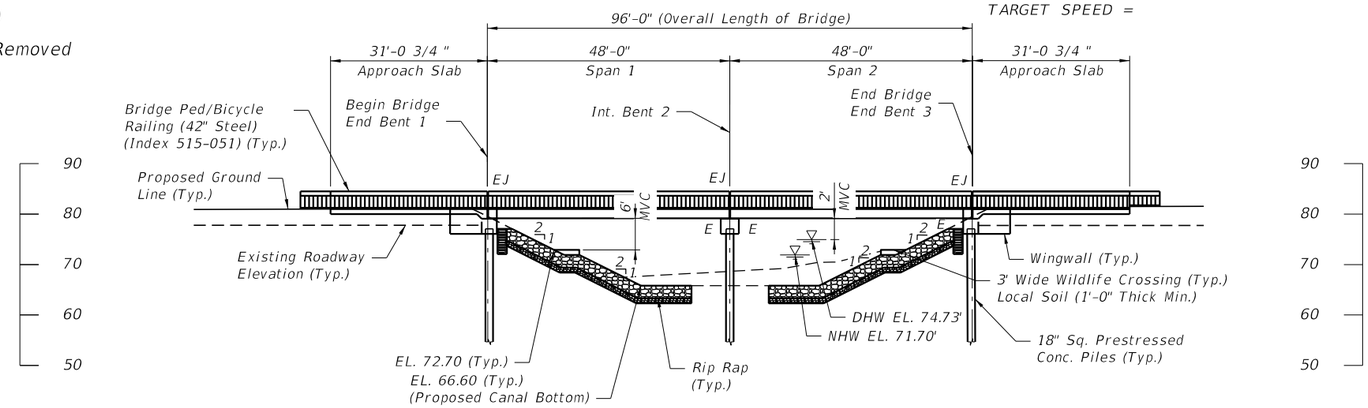
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =

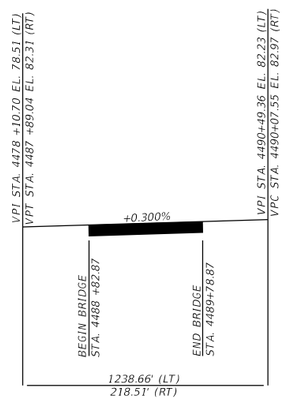
LEGEND:

Soil Boring Location (TBD)
Existing Structure to be Removed
Rip Rap



ELEVATION

(Existing Bridge Culvert not Shown for Clarity)



VERTICAL CURVE DATA

BRIDGE NO. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - PLAN AND ELEVATION
SR 70 OVER MOSSY GULLY

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

REF. DWG. NO.

SHEET NO. TBD

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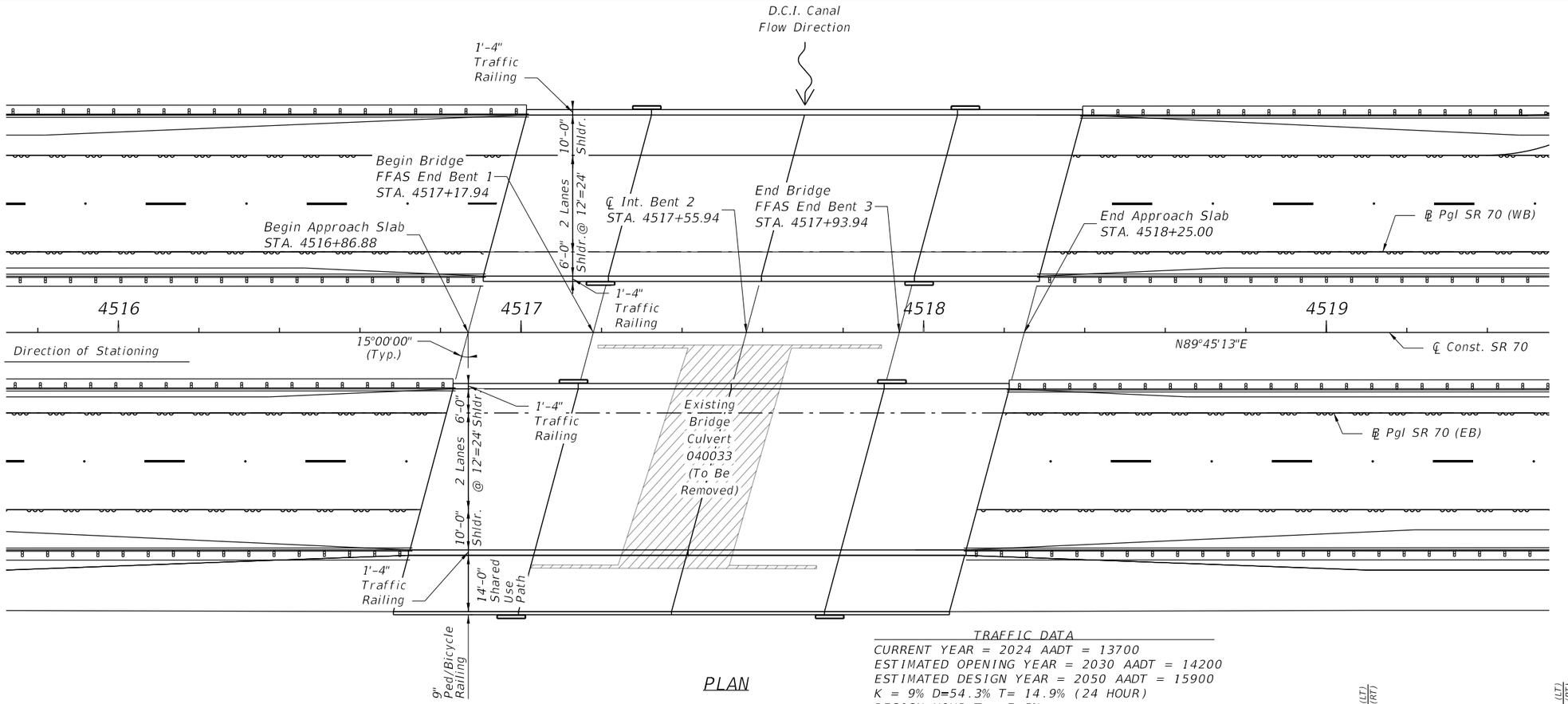

PLAN

TRAFFIC DATA
CURRENT YEAR = 2024 AADT = 13700
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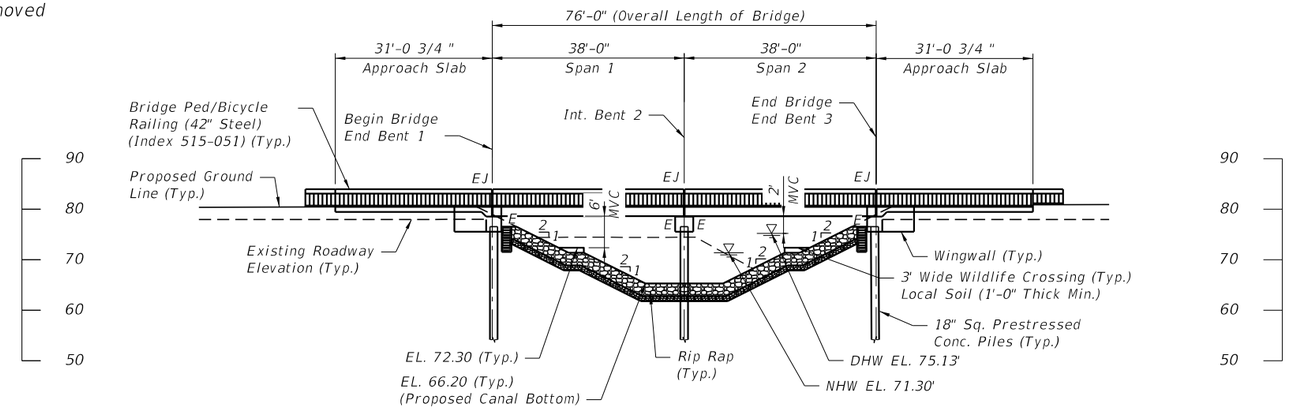
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =

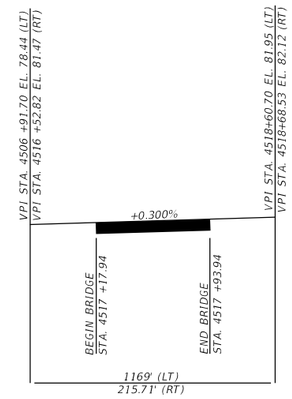
LEGEND:

Soil Boring Location (TBD)
Existing Structure to be Removed
Rip Rap



ELEVATION

(Existing Bridge Culvert not Shown for Clarity)



VERTICAL CURVE DATA

BRIDGE NO. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - PLAN AND ELEVATION
SR 70 OVER D.C.I. CANAL

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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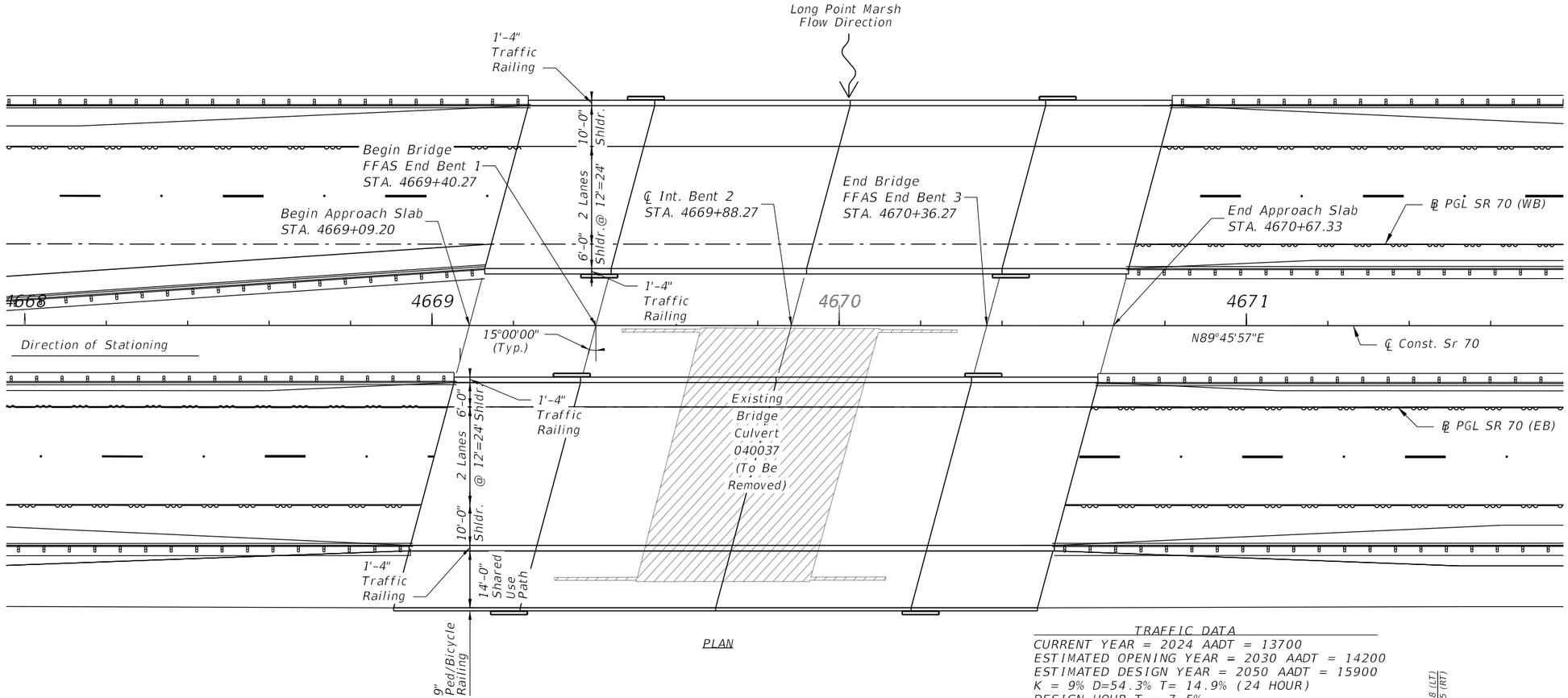
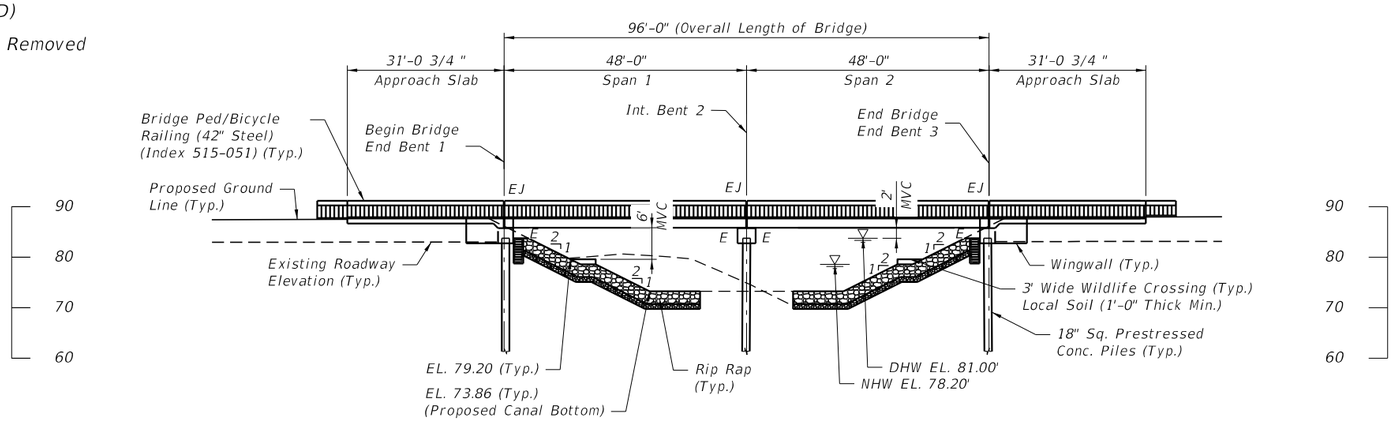


PLAN

TRAFFIC DATA
CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =

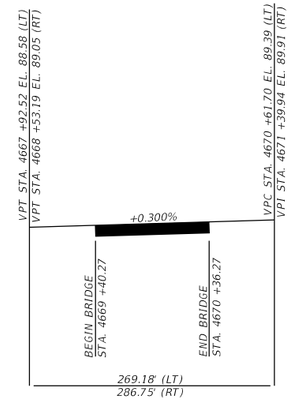
LEGEND:

Soil Boring Location (TBD)
Existing Structure to be Removed
Rip Rap



ELEVATION

(Existing Bridge Culvert not Shown for Clarity)



VERTICAL CURVE DATA

BRIDGE NO. TBD

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - PLAN AND ELEVATION
SR 70 OVER LONG POINT MARSH

REF. DWG. NO.

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO. TBD

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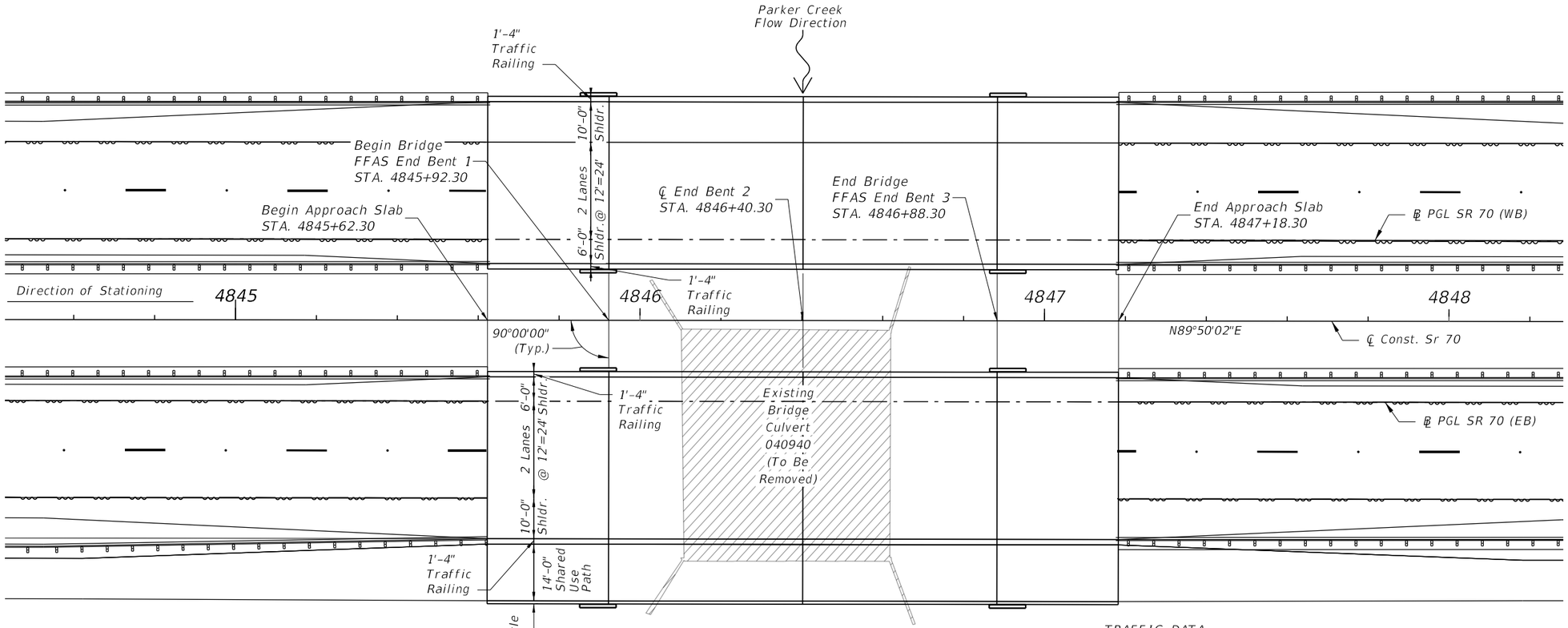
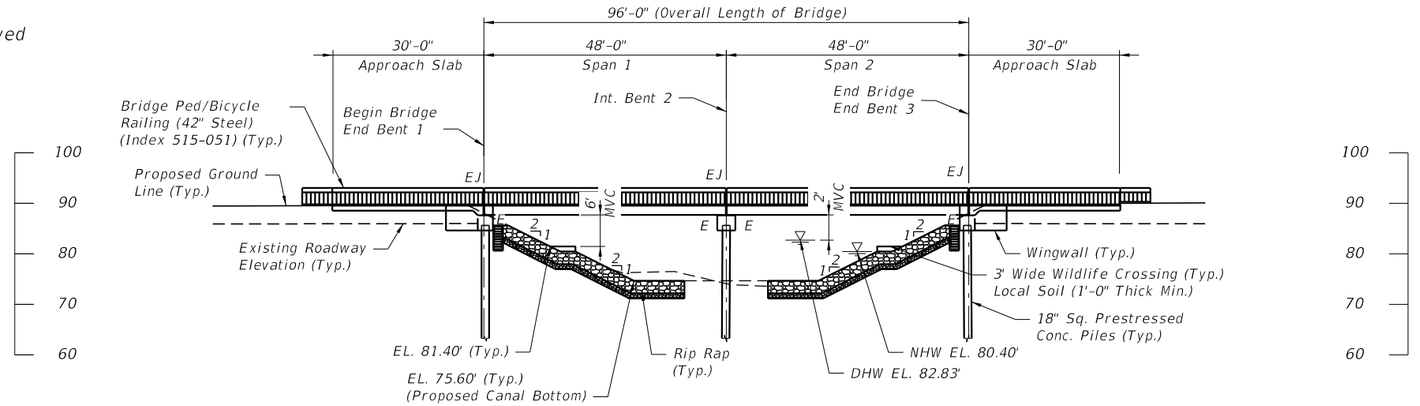


PLAN

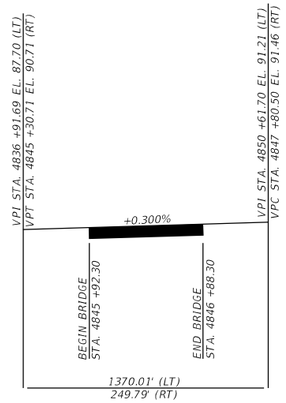
TRAFFIC DATA
CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =

LEGEND:

Soil Boring Location (TBD)
Existing Structure to be Removed
Rip Rap



ELEVATION
(Existing Bridge Culvert not Shown for Clarity)



VERTICAL CURVE DATA

BRIDGE NO. TBD

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - PLAN AND ELEVATION
SR 70 OVER PARKER CREEK

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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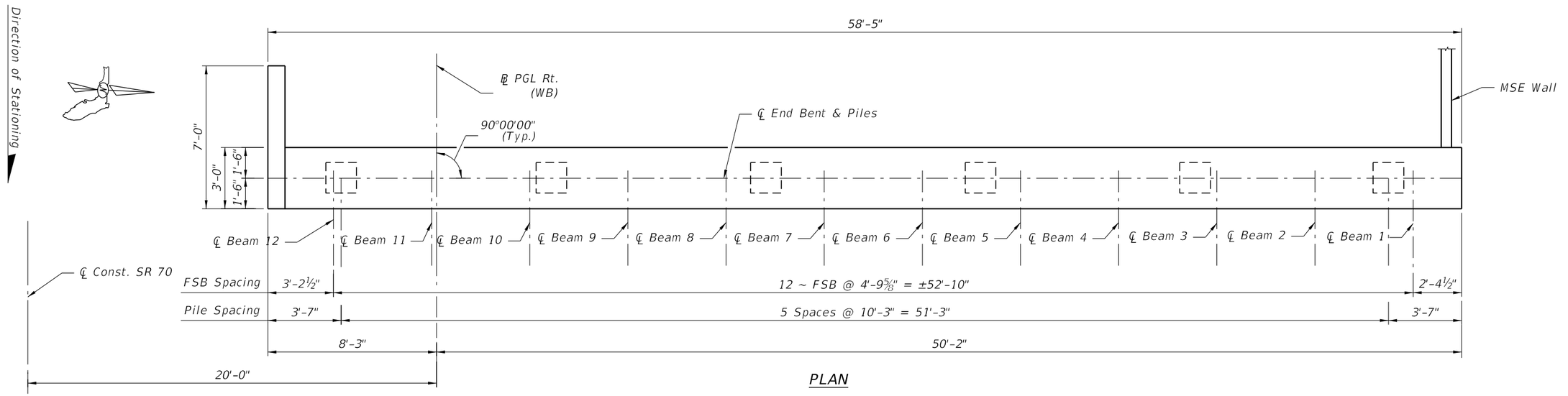
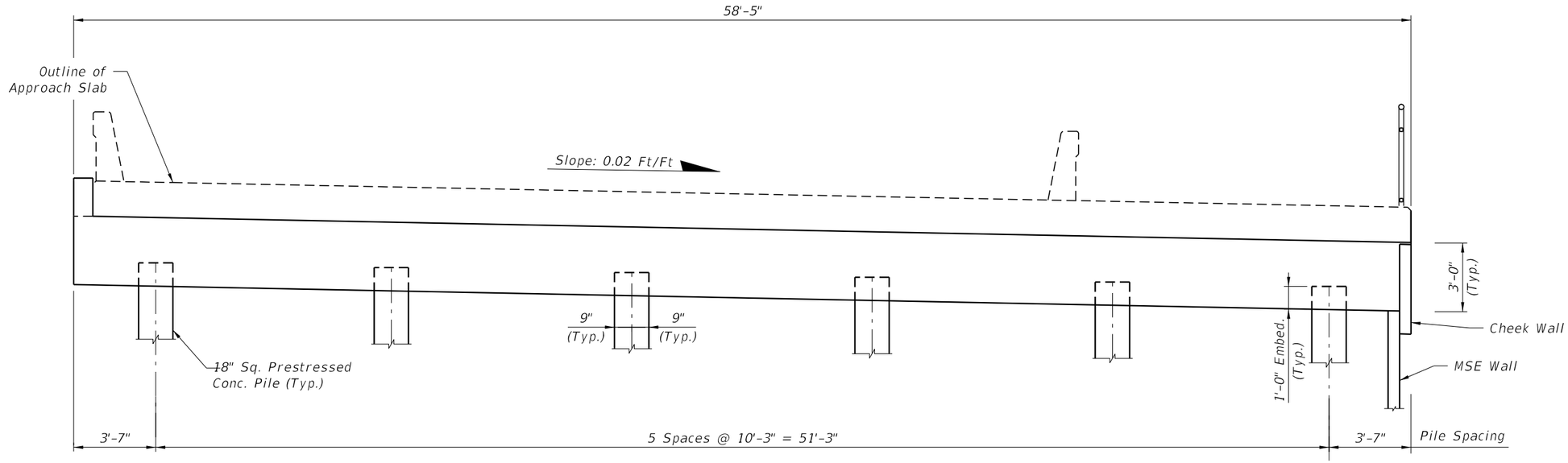


PLAN

(End Bent 1 shown, Other End Bent Similar)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

WHIDDEN CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - END BENT WESTBOUND BRIDGES

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

REF. DWG. NO.:

SHEET NO.: TBD

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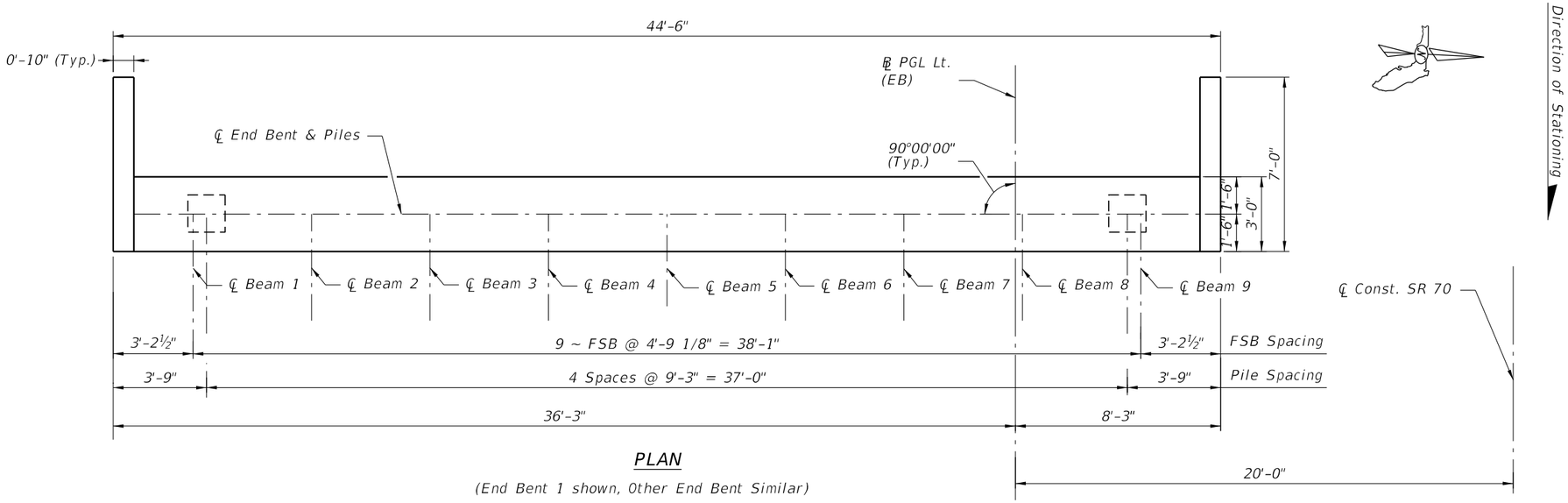
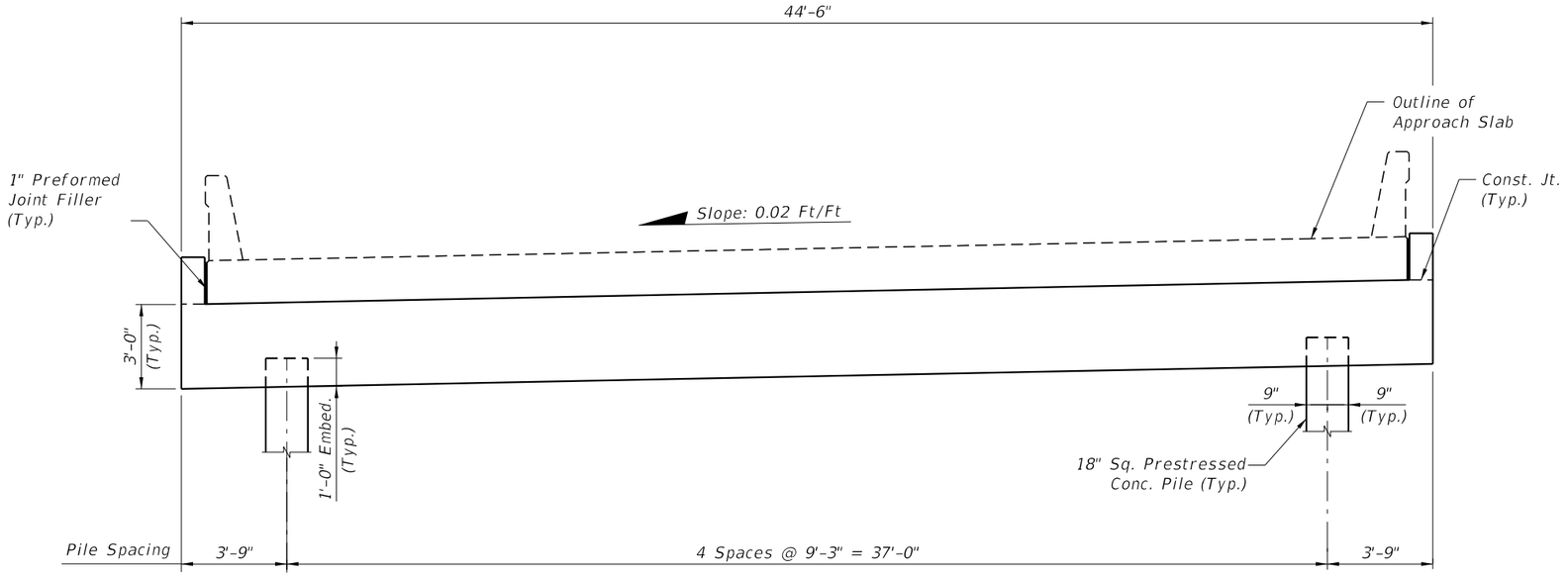


PLAN

(End Bent 1 shown, Other End Bent Similar)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

WHIDDEN CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

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CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - END BENT EASTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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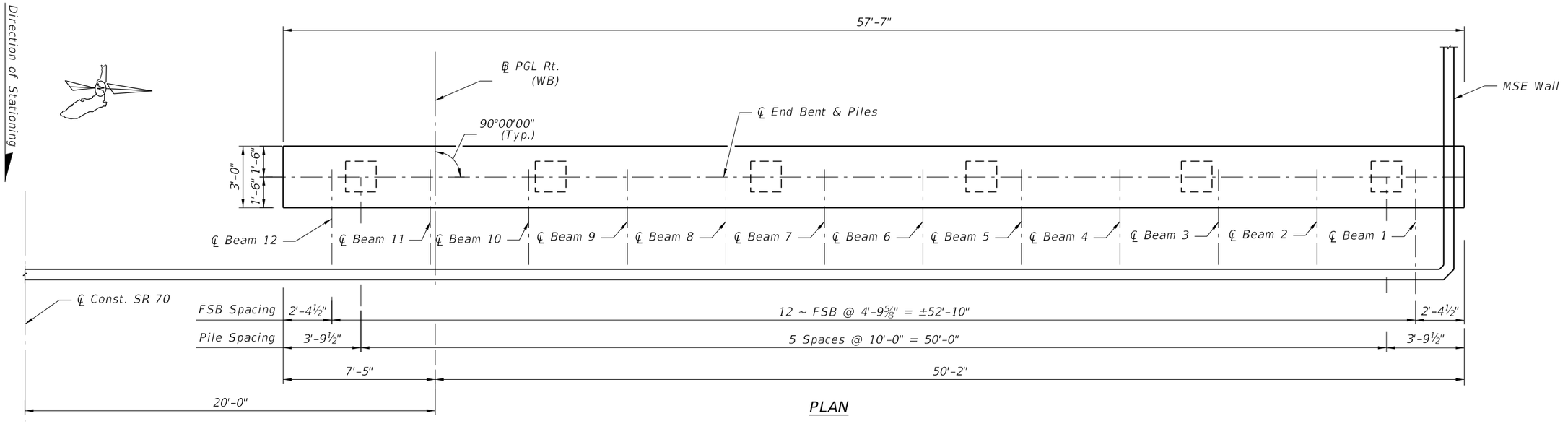
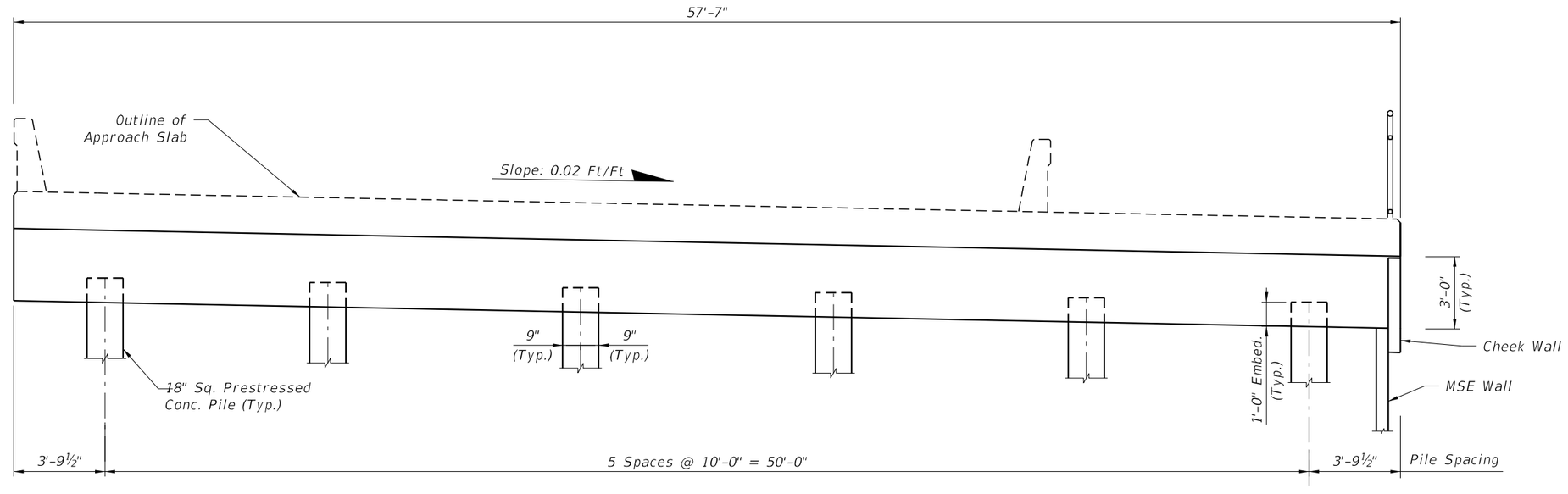


PLAN

(End Bent 1 shown, Other End Bent Similar)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

JOSHUA CREEK BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - END BENT
WESTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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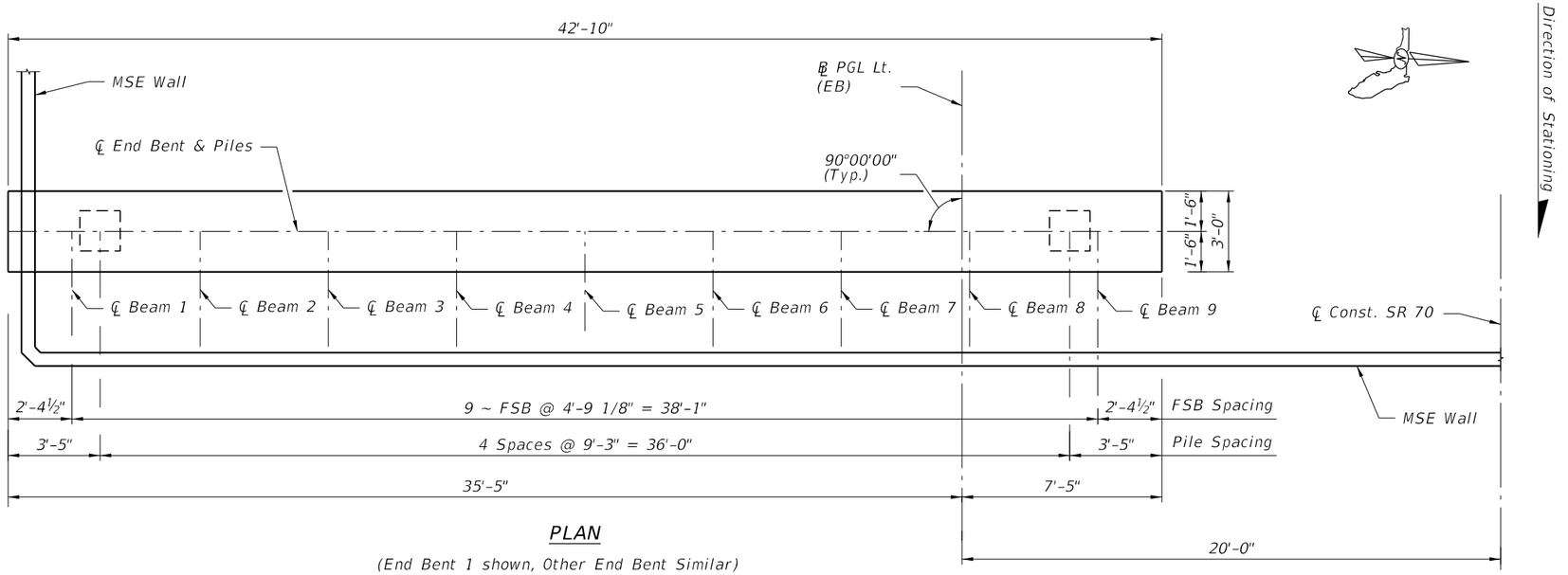
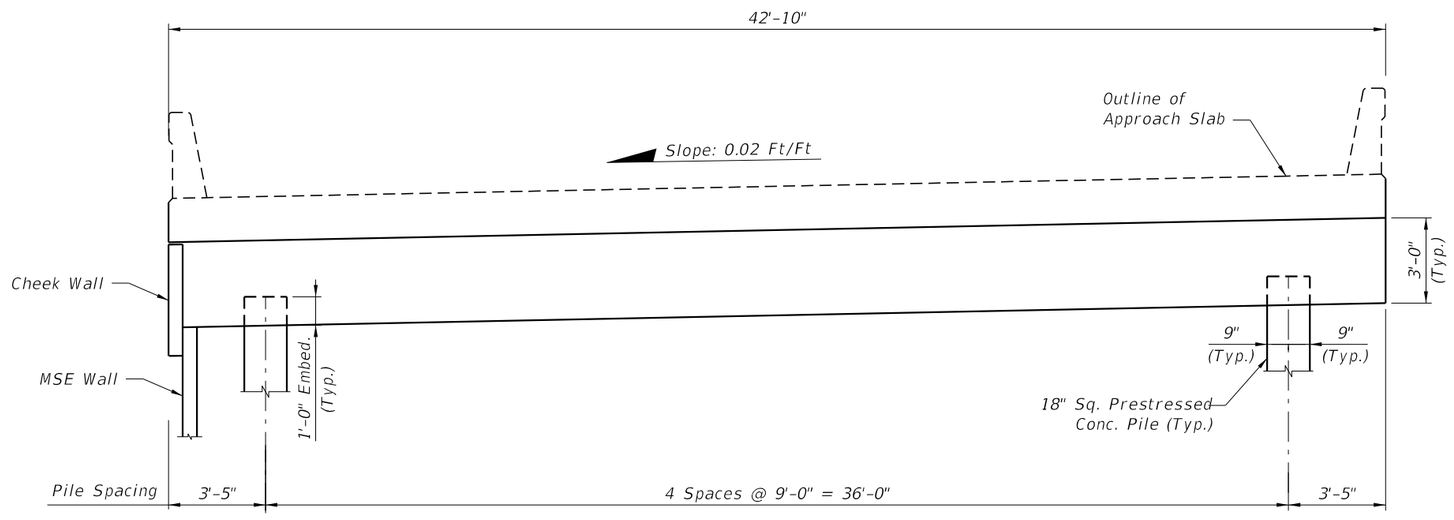


PLAN

(End Bent 1 shown, Other End Bent Similar)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

JOSHUA CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - END BENT EASTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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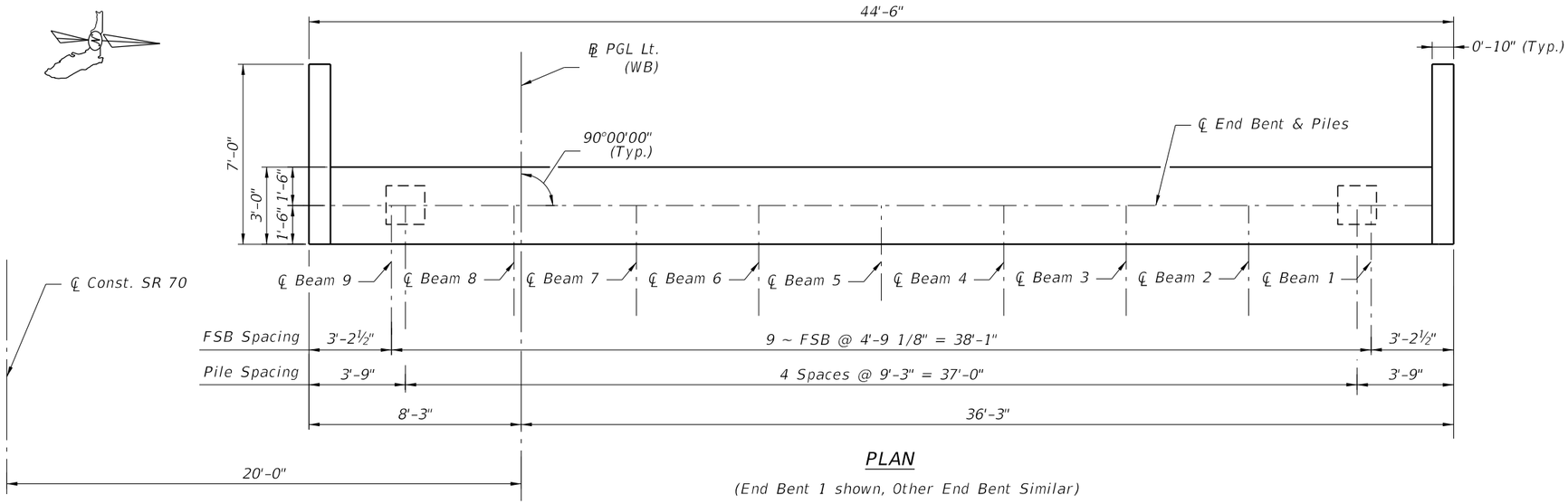
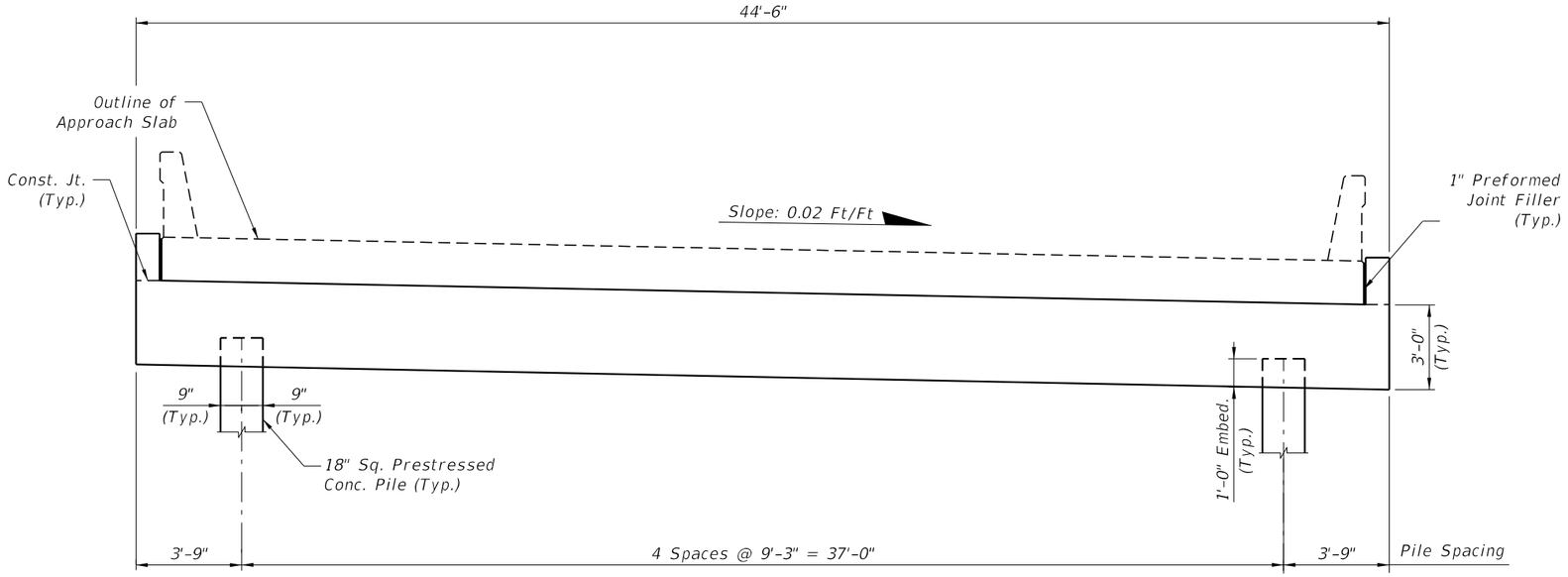
Direction of Stationing



PLAN

(End Bent 1 shown, Other End Bent Similar)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

TIGER BAY BRIDGE
PARKER CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY:	CHECKED BY:	DESIGNED BY:	CHECKED BY:
TVT 06-25	GGV 06-25	GGV 06-25	CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - END BENT WESTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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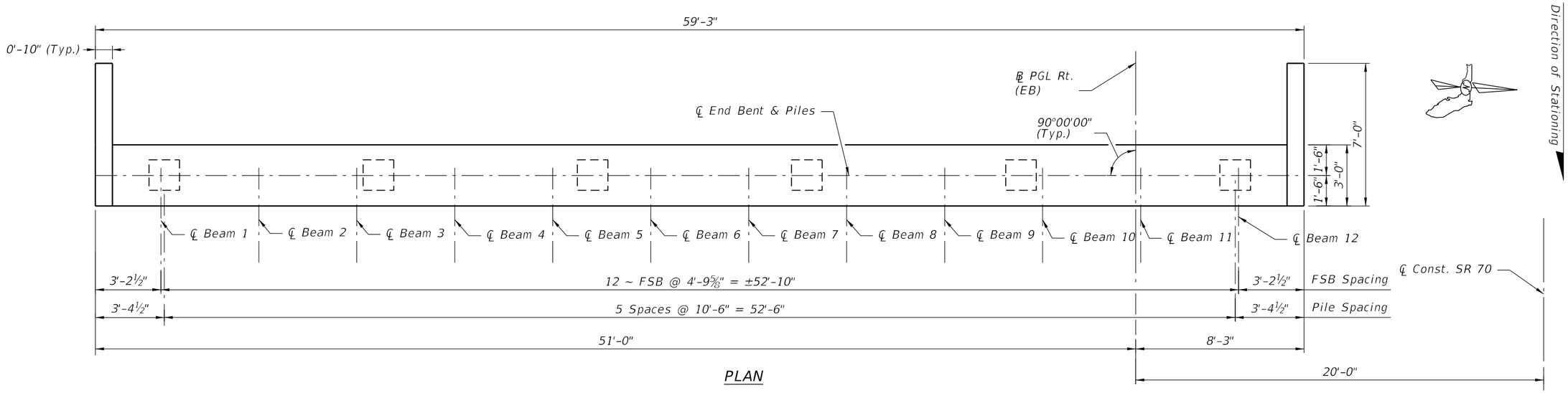
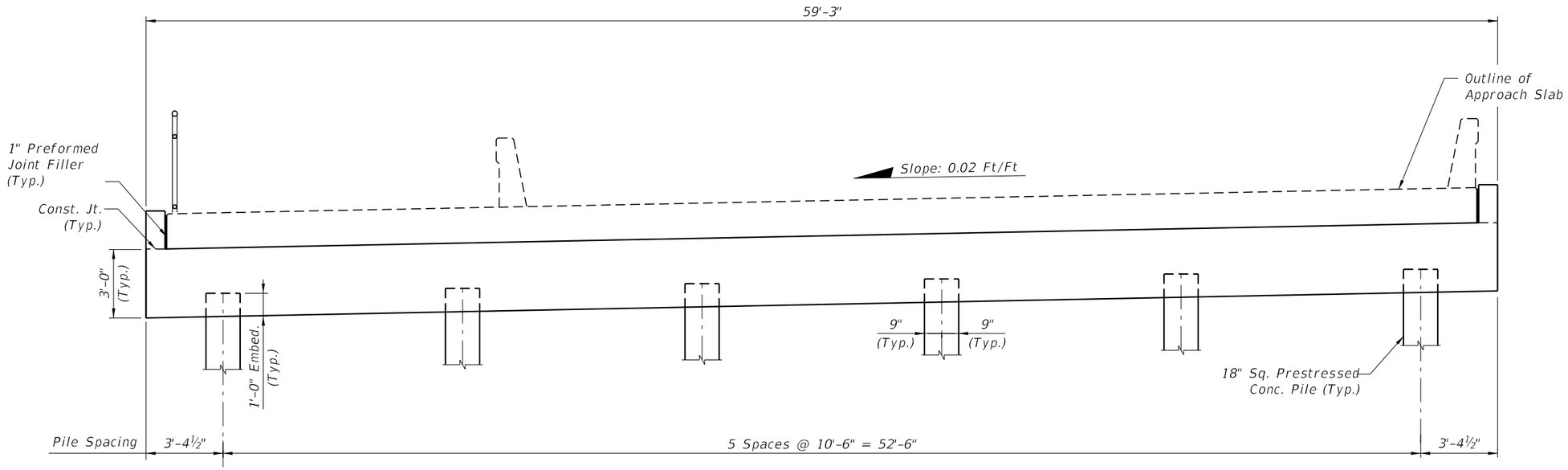


PLAN

(End Bent 1 shown, Other End Bent Similar)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

TIGER BAY BRIDGE
PARKER CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - END BENT
EASTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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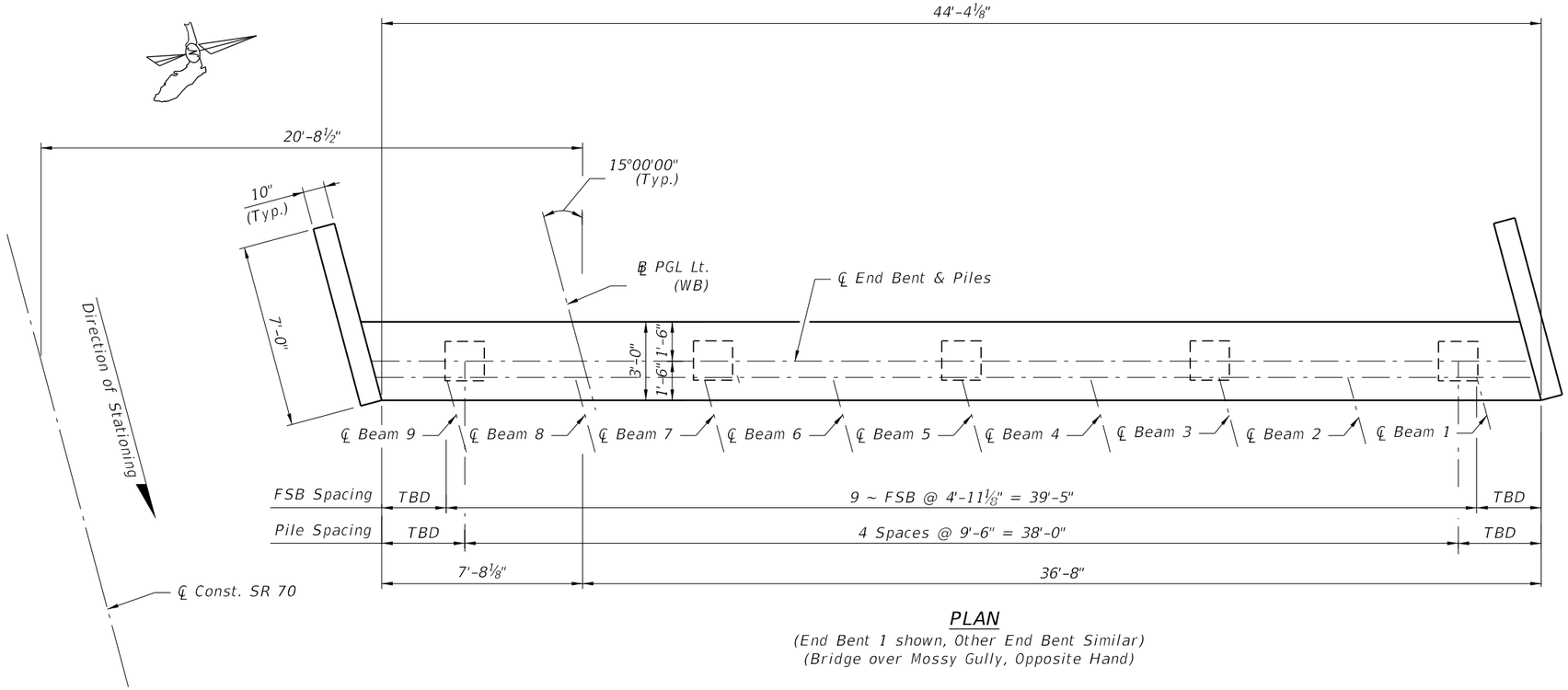
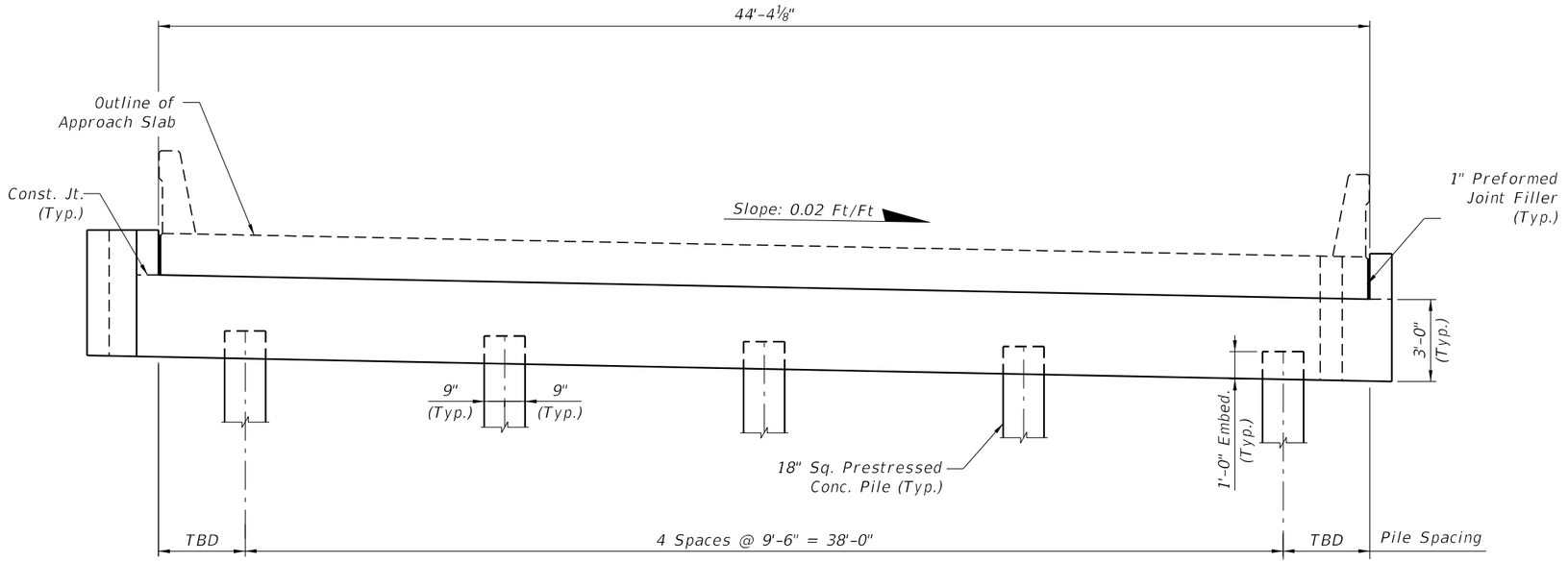


PLAN

(End Bent 1 shown, Other End Bent Similar)
(Bridge over Mossy Gully, Opposite Hand)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)
(Bridge over Mossy Gully, Opposite Hand)

MOSSY GULLY BRIDGE
D.C.I. CANAL BRIDGE
LONG POINT MARSH BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - END BENT WESTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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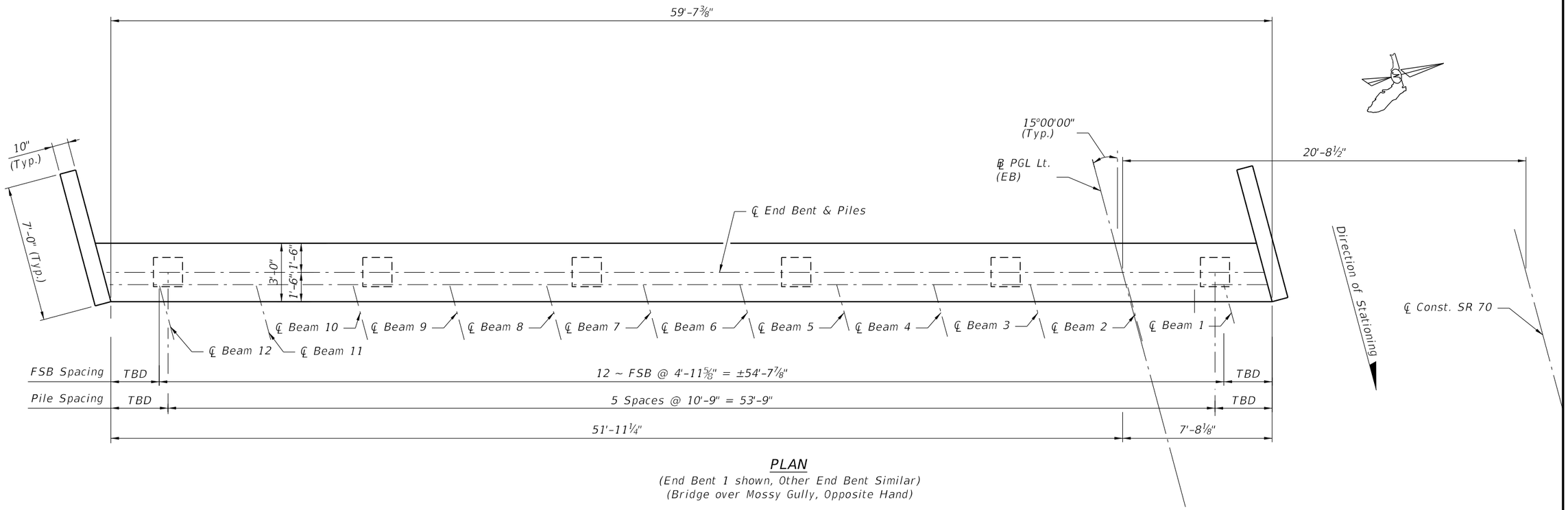
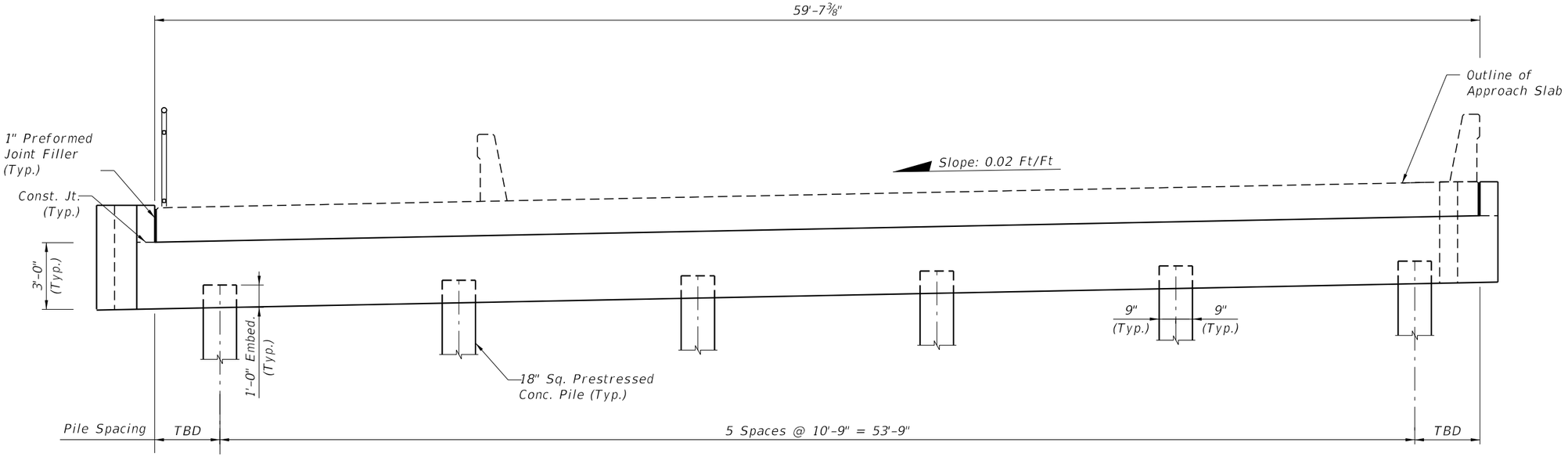


PLAN

(End Bent 1 shown, Other End Bent Similar)
(Bridge over Mossy Gully, Opposite Hand)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)
(Bridge over Mossy Gully, Opposite Hand)

MOSSY GULLY BRIDGE
D.C.I. CANAL BRIDGE
LONG POINT MARSH BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - END BENT
EASTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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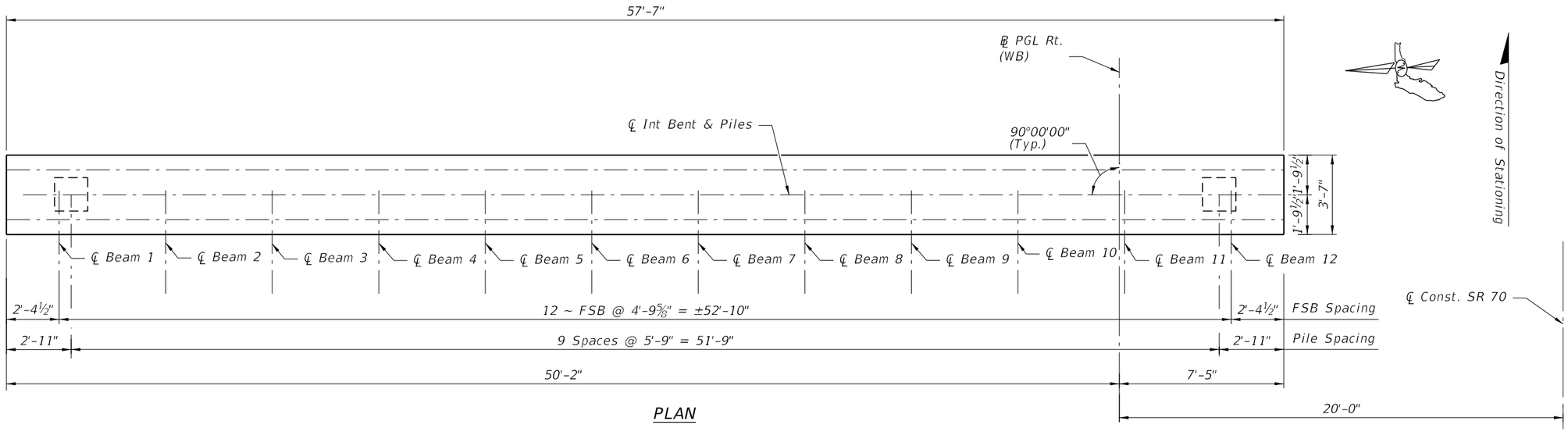
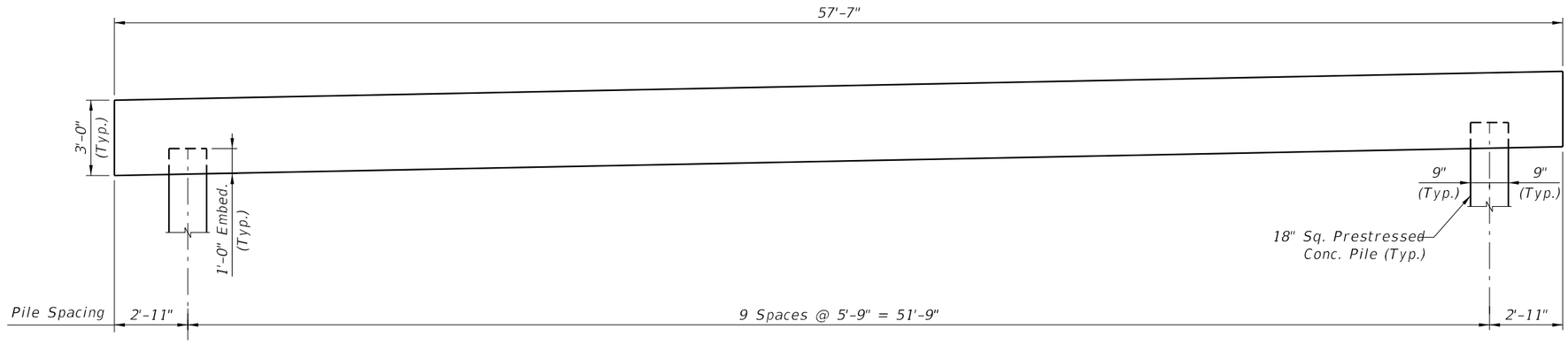


PLAN

(Int Bent 2 shown)



ELEVATION

(Int Bent 2 shown)

WHIDDEN CREEK BRIDGE
JOSHUA CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY:	TVT 06-25
CHECKED BY:	GGV 06-25
DESIGNED BY:	GGV 06-25
CHECKED BY:	CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - INT. BENT
WESTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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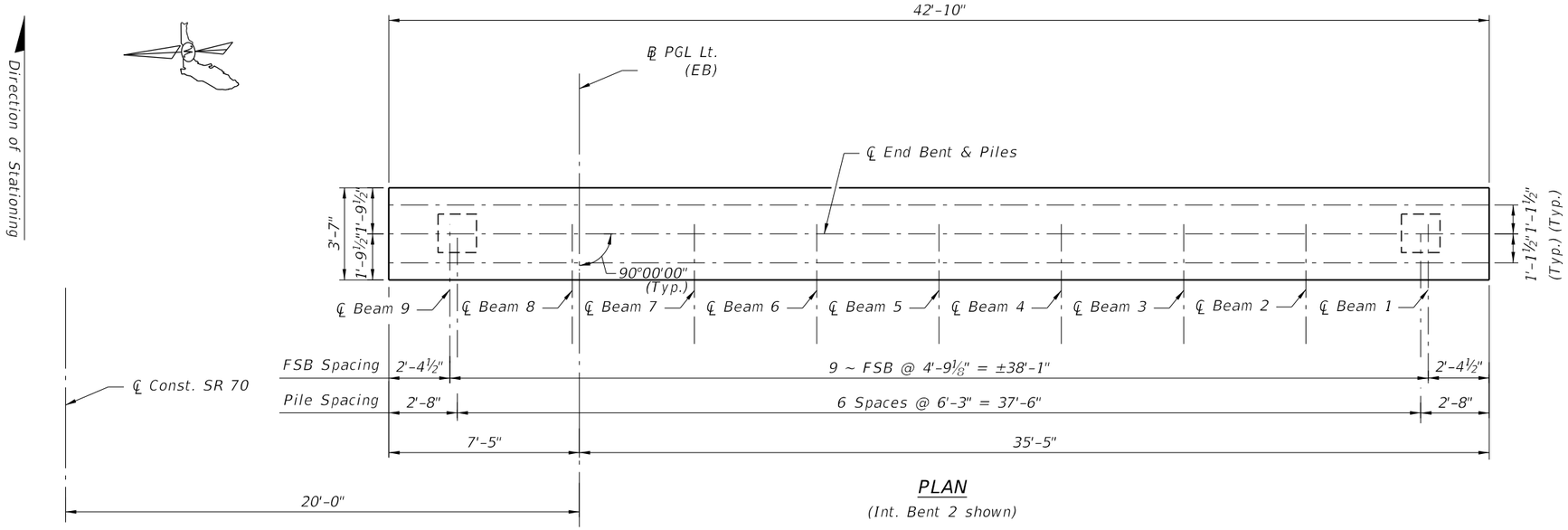
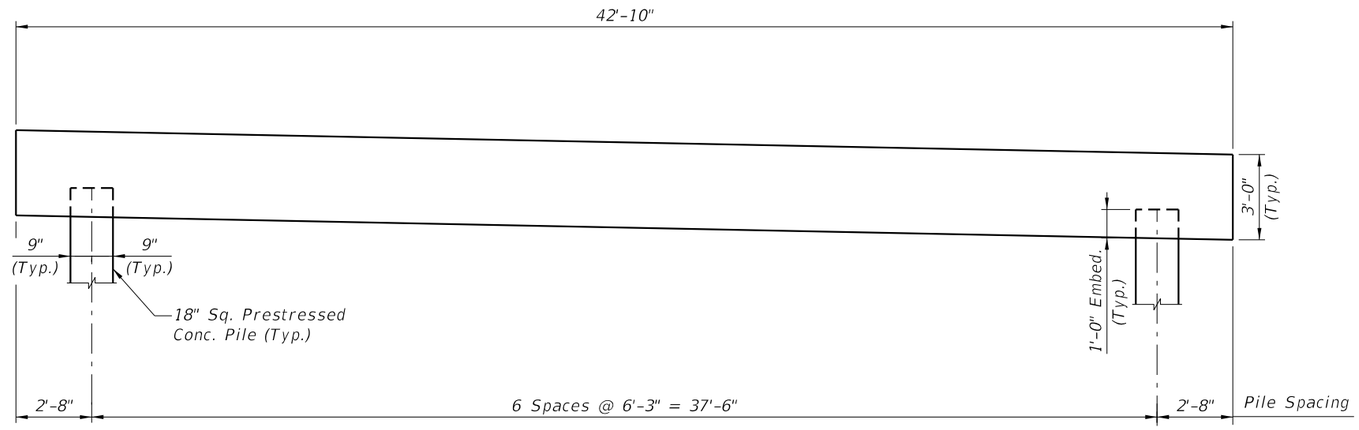


PLAN

(Int. Bent 2 shown)



ELEVATION

(Int. Bent 2 shown)

WHIDDEN CREEK BRIDGE
JOSHUA CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
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201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - INT. BENT
EASTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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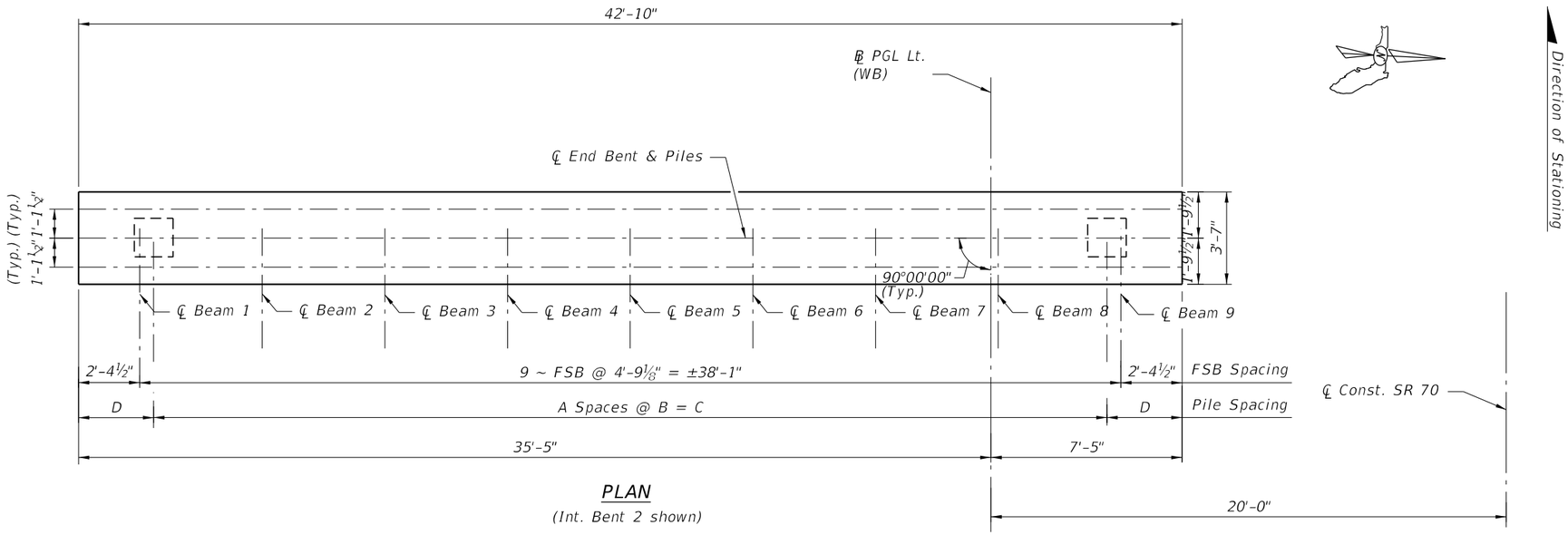
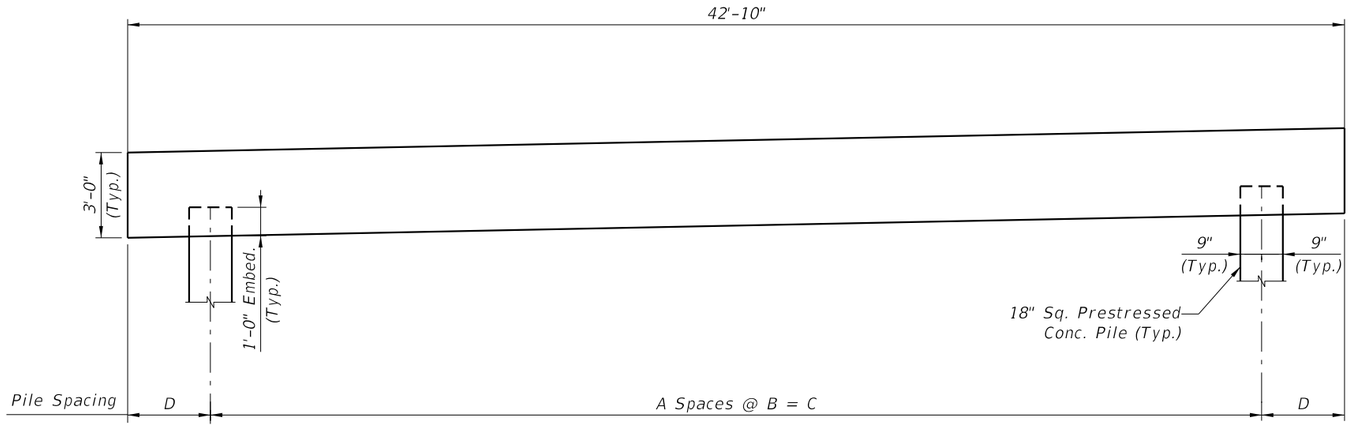


PLAN

(Int. Bent 2 shown)

Direction of Stationing

BRIDGE CROSSING	A	B	C	D
TIGER BAY BRIDGE	6	6'-3"	37'-6"	2'-8"
PARKER CREEK BRIDGE	7	5'-4"	37'-4"	2'-9"



ELEVATION

(Int. Bent 2 shown)

TIGER BAY BRIDGE
PARKER CREEK BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - INT. BENT
WESTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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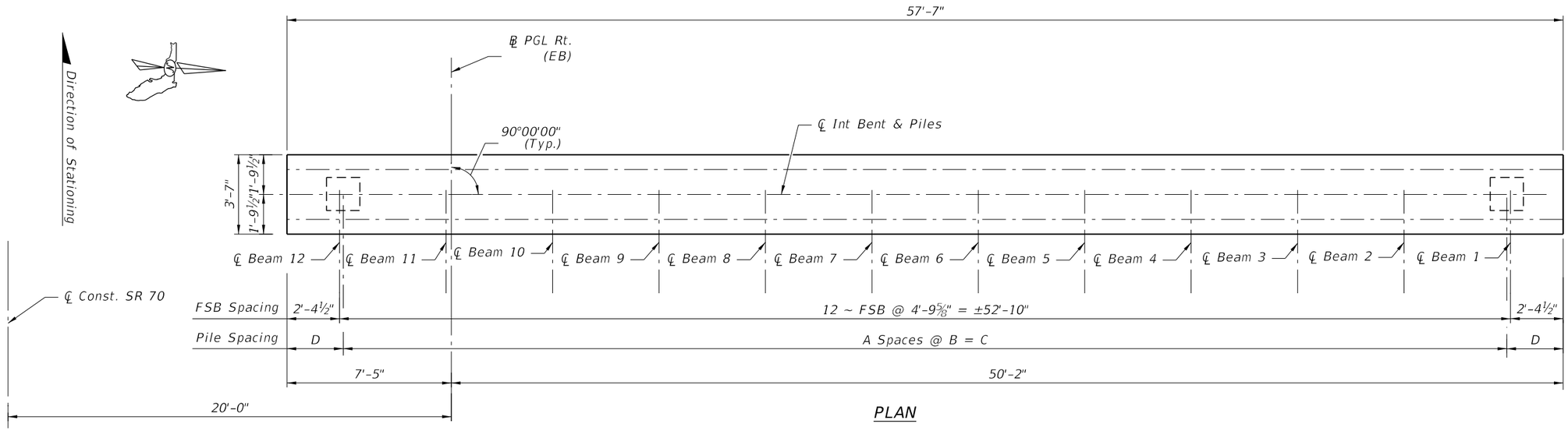
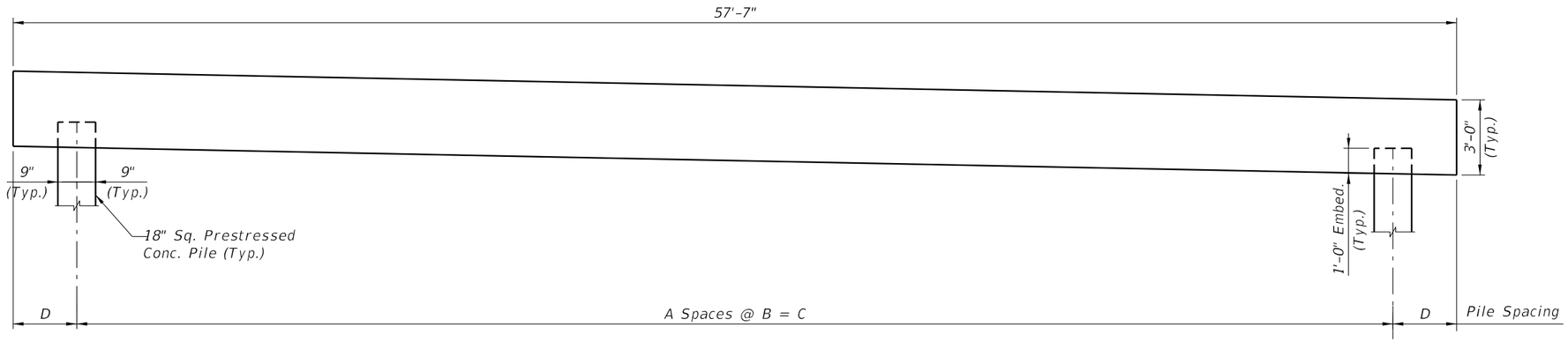


PLAN

(Int Bent 2 shown)

BRIDGE CROSSING	A	B	C	D
TIGER BAY BRIDGE	8	6'-6"	52'-0"	2'-9½"
PARKER CREEK BRIDGE	9	5'-9"	51'-9"	2'-11"



ELEVATION

(Int Bent 2 shown)

TIGER BAY BRIDGE
PARKER CREEK BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

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DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - INT. BENT EASTBOUND BRIDGES
REF. DWG. NO.:
PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE
SHEET NO.: TBD

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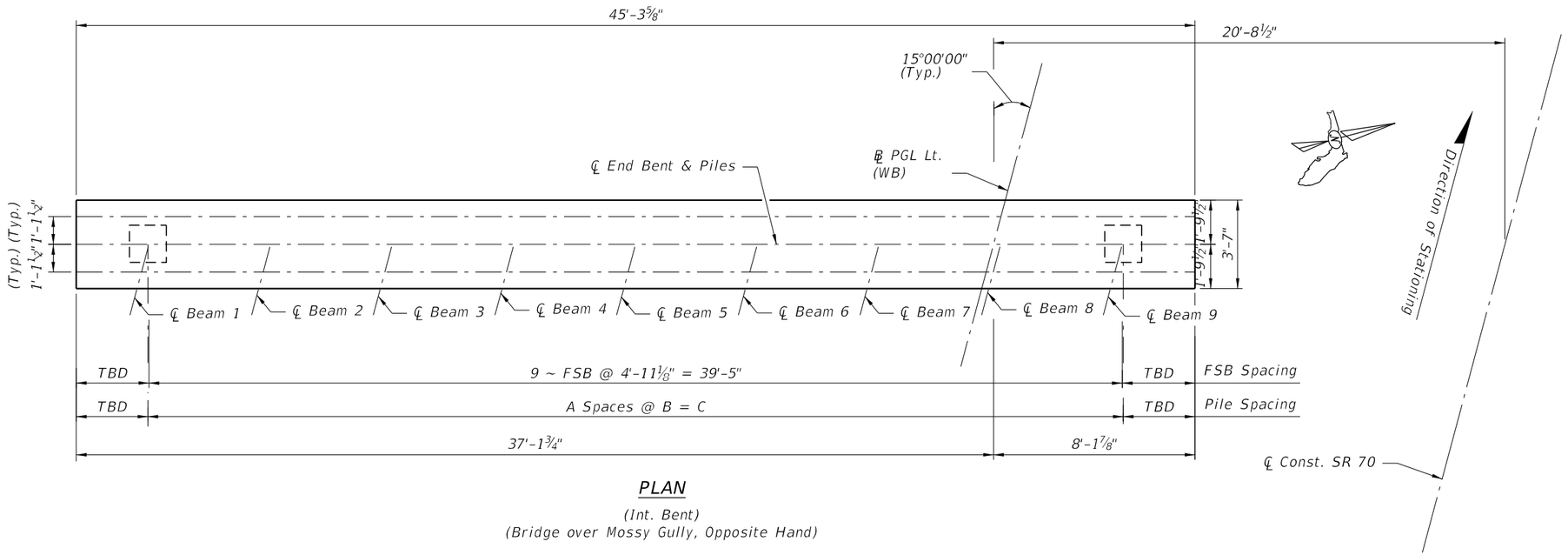
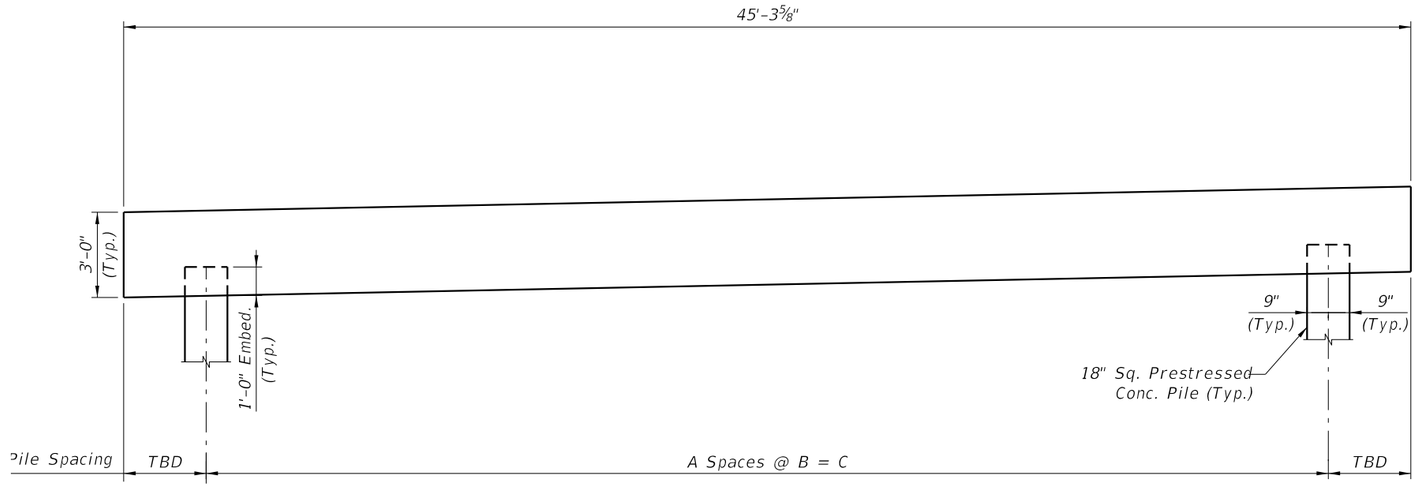


PLAN

(Int. Bent)
(Bridge over Mossy Gully, Opposite Hand)



ELEVATION

(Int. Bent)
(Bridge over Mossy Gully, Opposite Hand)

BRIDGE CROSSING	A	B	C
MOSSY GULLY BRIDGE	7	5'-8"	39'-8"
D.C.I. CANAL BRIDGE	6	6'-7"	39'-6"
LONG POINT MARSH BRIDGE	7	5'-8"	39'-8"

MOSSY GULLY BRIDGE
D.C.I. CANAL BRIDGE
LONG POINT MARSH BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
		NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE			

GJERGJI VASO, P.E.
P.E. License Number: 72509
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TAMPA, FL 33602

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CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - INT. BENT WESTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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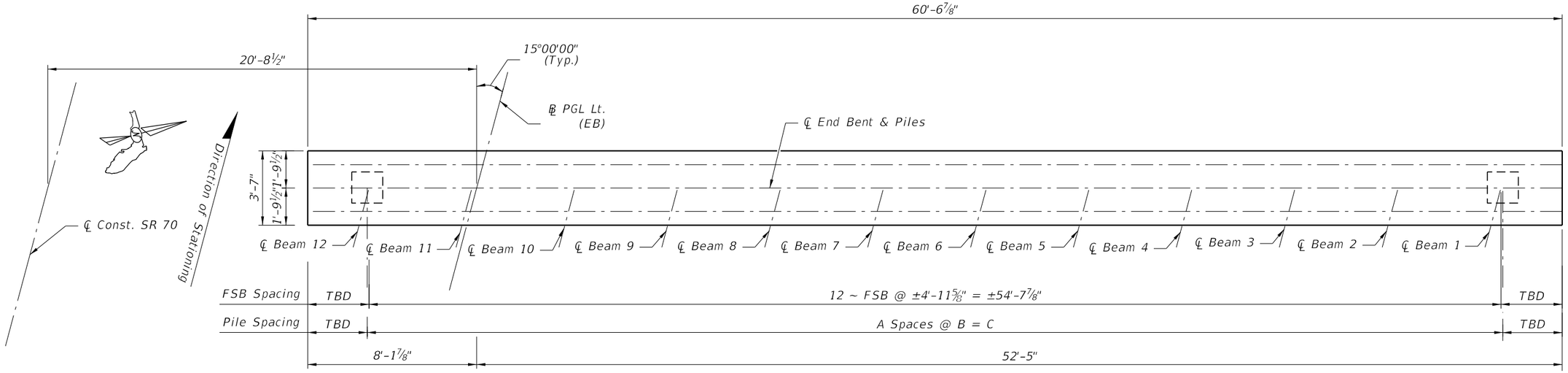
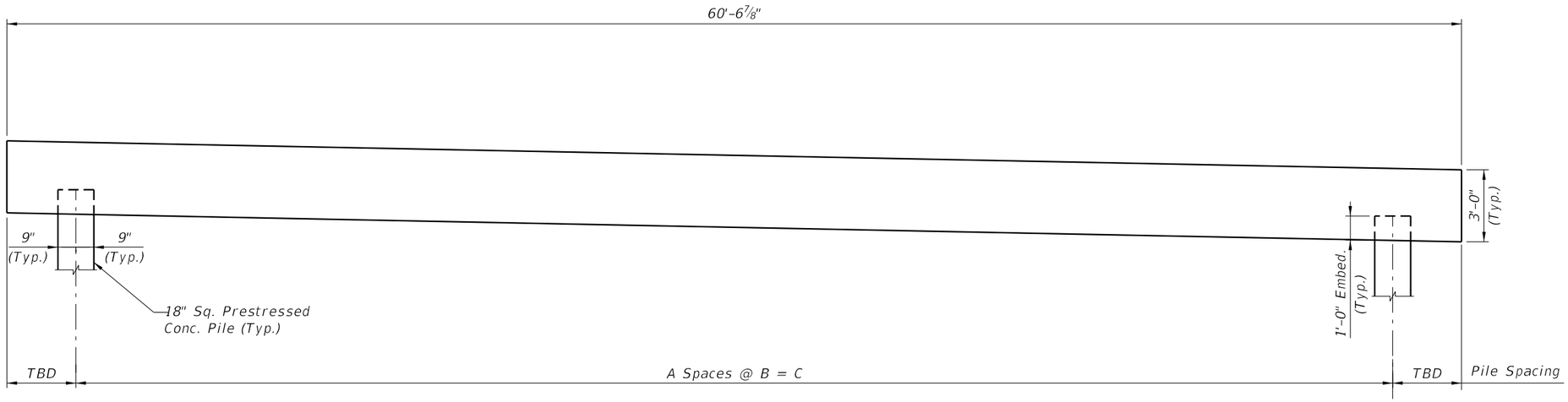


PLAN

(Int. Bent)
(Bridge over Mossy Gully, Opposite Hand)

BRIDGE CROSSING	A	B	C
MOSSY GULLY BRIDGE	9	6'-2"	55'-6"
D.C.I. CANAL BRIDGE	8	6'-11"	55'-4"
LONG POINT MARSH BRIDGE	9	6'-2"	55'-6"



ELEVATION

(Int. Bent)
(Bridge over Mossy Gully, Opposite Hand)

MOSSY GULLY BRIDGE
D.C.I. CANAL BRIDGE
LONG POINT MARSH BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
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TAMPA, FL 33602

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CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FSB - INT. BENT
EASTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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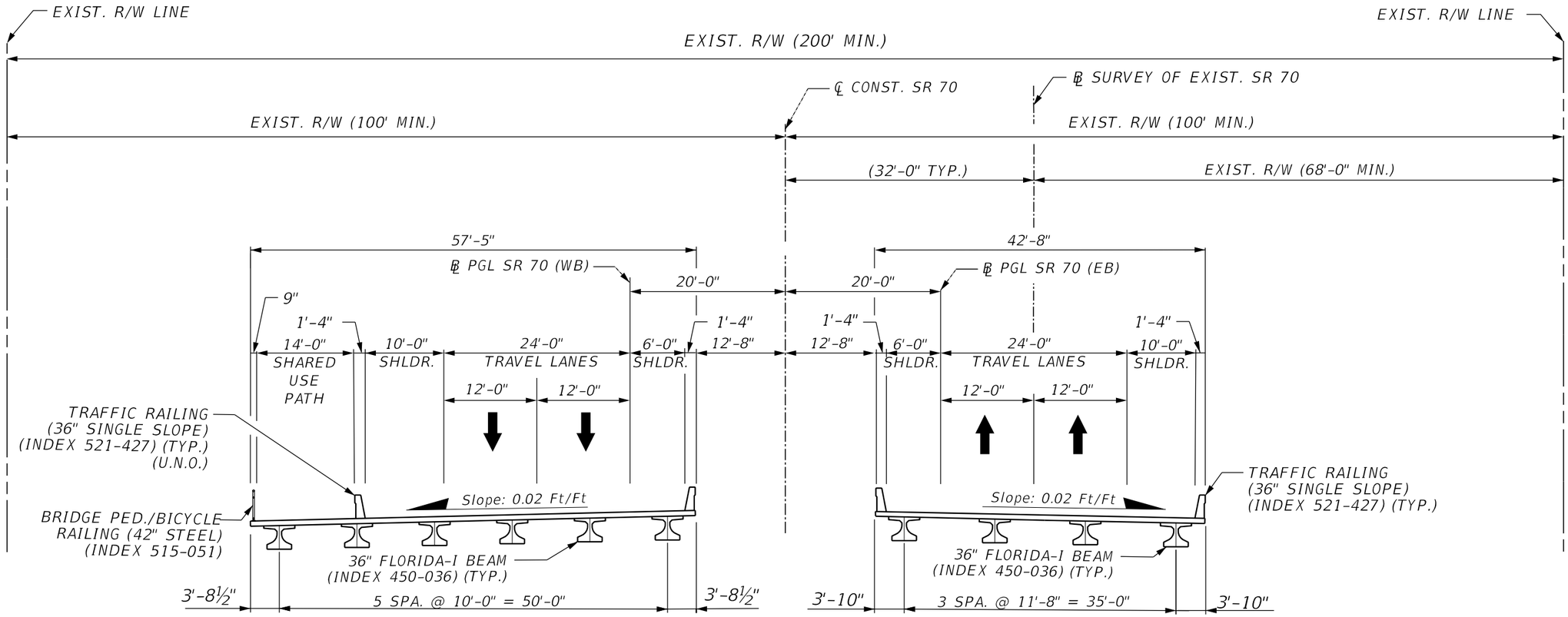
FLORIDA I-BEAM
EXHIBIT PLANS



TYPICAL SECTION

(BRIDGE OVER WHIDDEN CREEK)

BRIDGE NOS. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
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201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - TYPICAL SECTION THROUGH BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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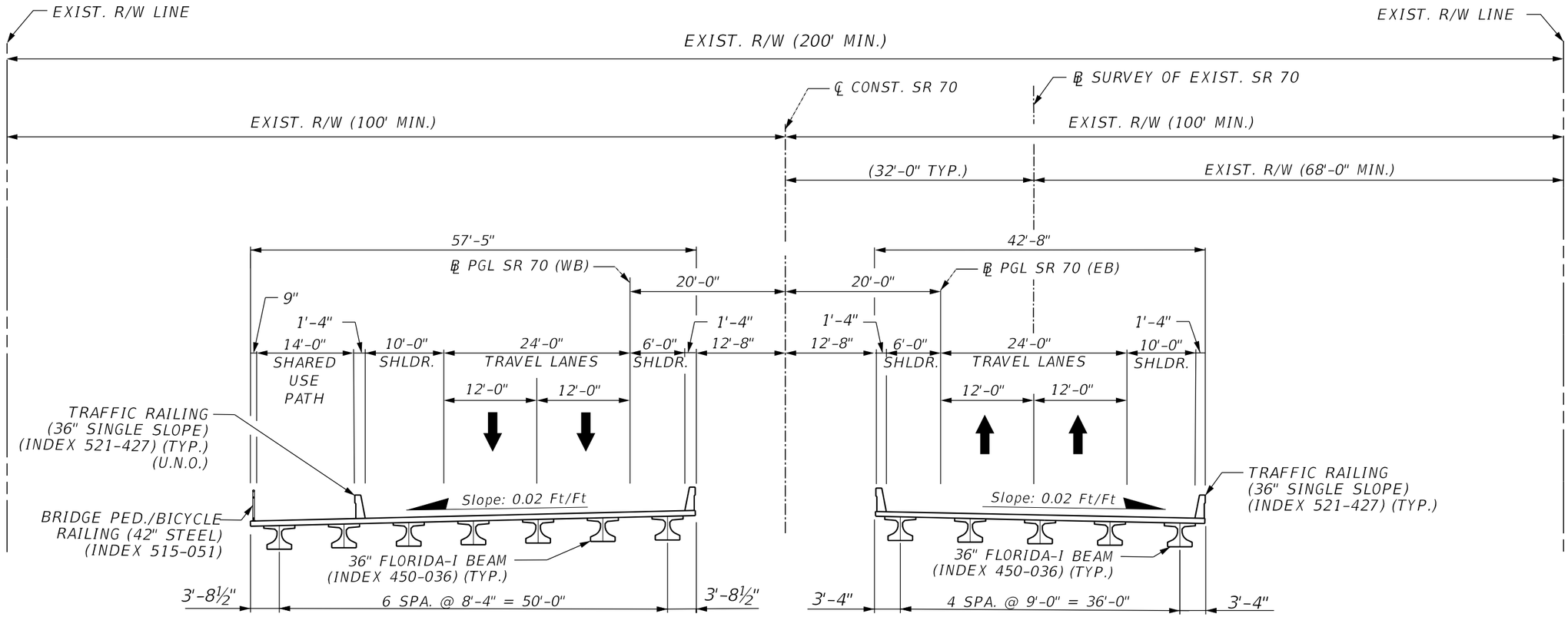

TYPICAL SECTION

(BRIDGE OVER JOSHUA CREEK)

BRIDGE NOS. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
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HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

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DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - TYPICAL SECTION THROUGH BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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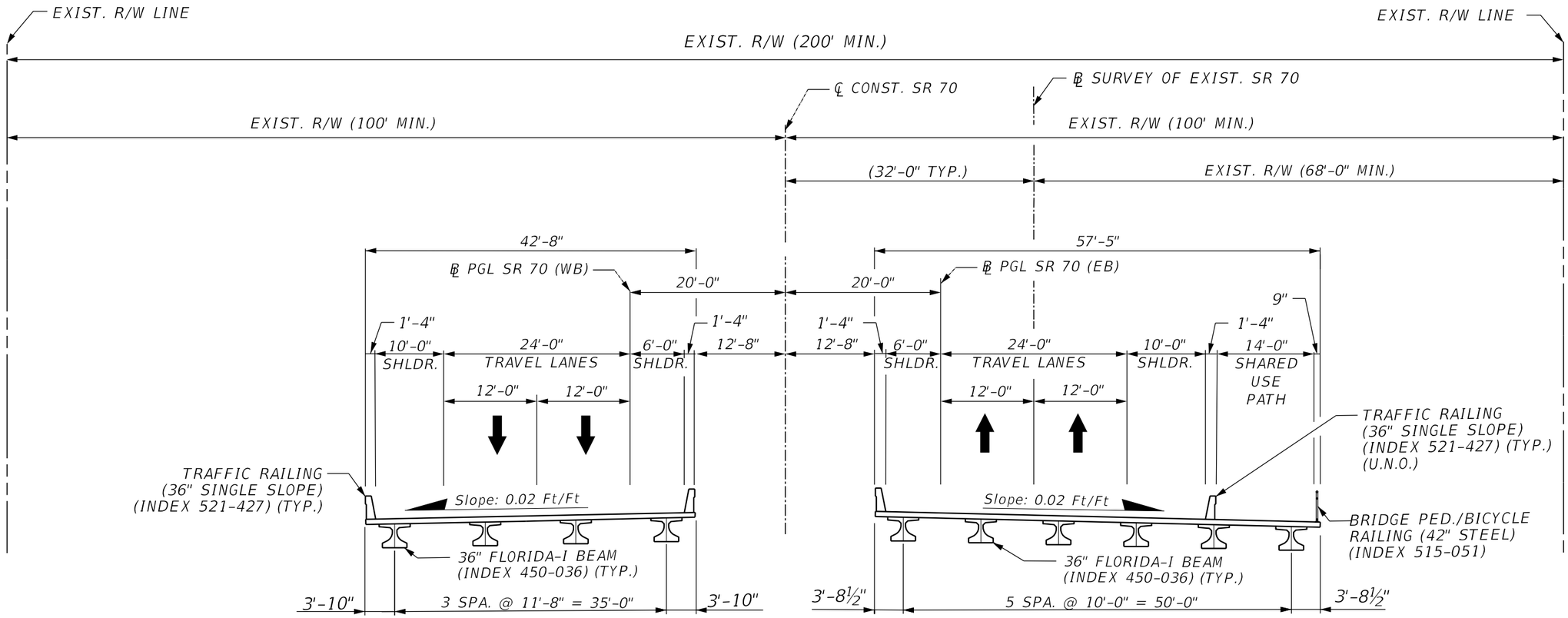

TYPICAL SECTION

(BRIDGE OVER TIGER BAY)
(BRIDGE OVER D.C.I. CANAL)

BRIDGE NOS. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - TYPICAL SECTION THROUGH BRIDGE
REF. DWG. NO.:
PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE
SHEET NO.: TBD

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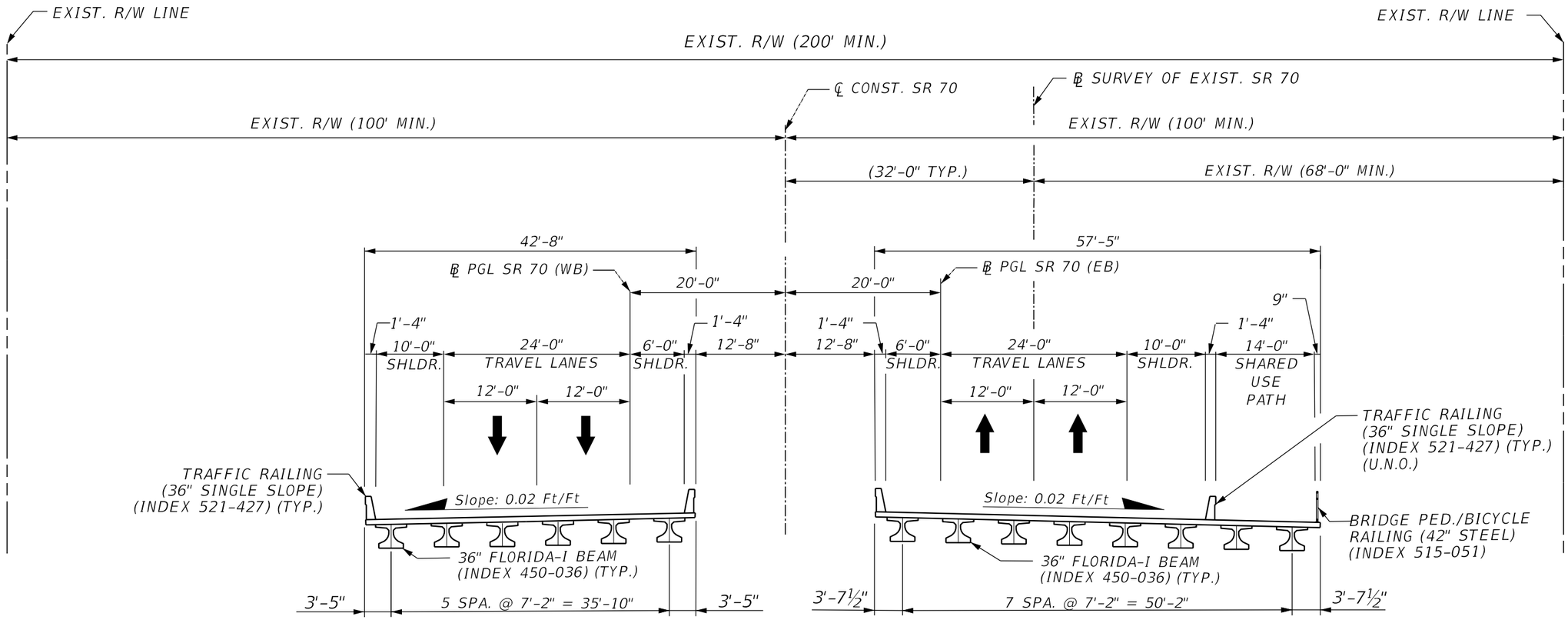

TYPICAL SECTION

(BRIDGE OVER MOSSY GULLY)
(BRIDGE OVER LONG POINT MARSH)
(BRIDGE OVER PARKER CREEK)

BRIDGE NOS. TBD

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - TYPICAL SECTION THROUGH BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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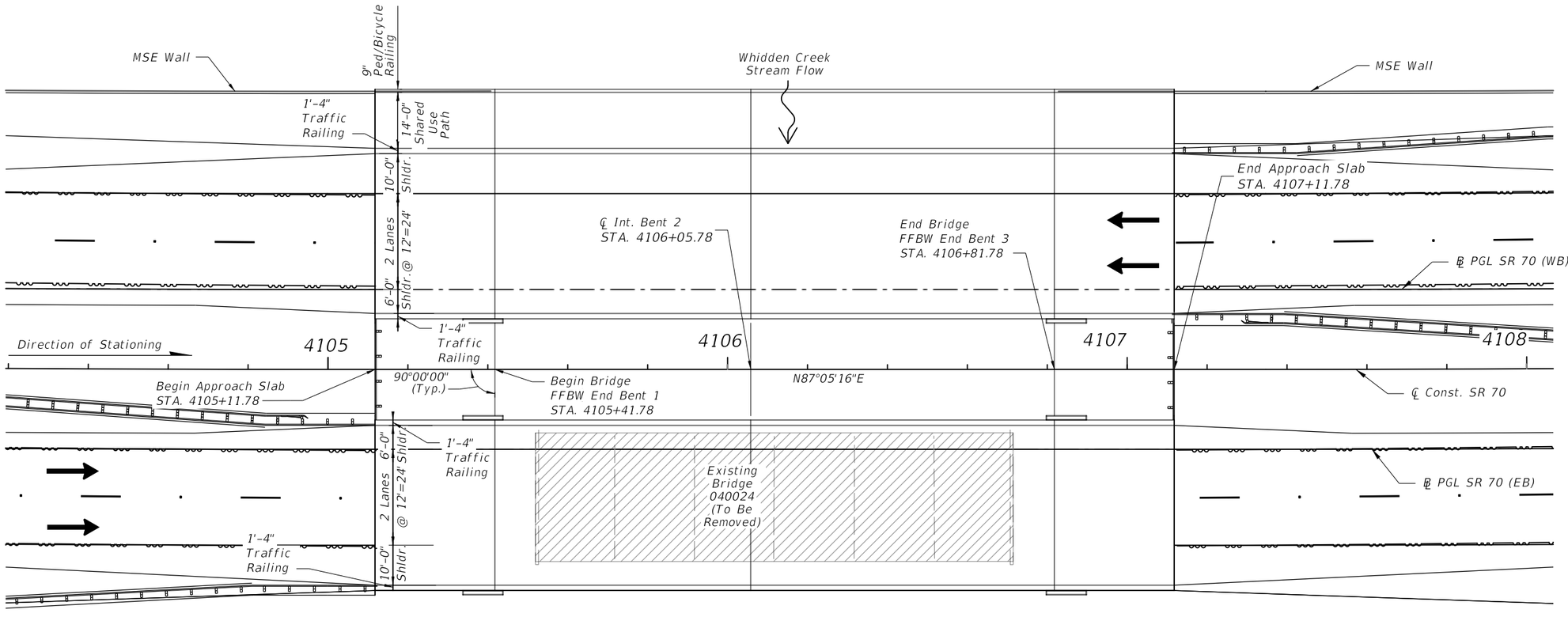


LEGEND:

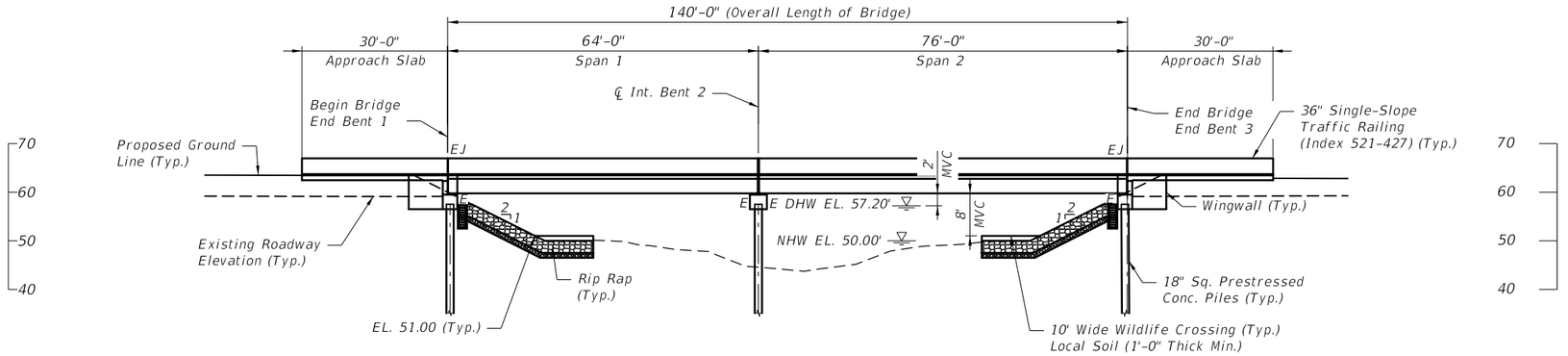
Soil Boring Location (TBD)

Existing Structure to be Removed

Rip Rap

PLAN

TRAFFIC DATA
CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =



ELEVATION

(Existing Bridge not Shown for Clarity)

VERTICAL CURVE DATA (TBD)

BRIDGE NO. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

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CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - PLAN AND ELEVATION
SR 70 OVER WHIDDEN CREEK

REF. DWG. NO.

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO. TBD

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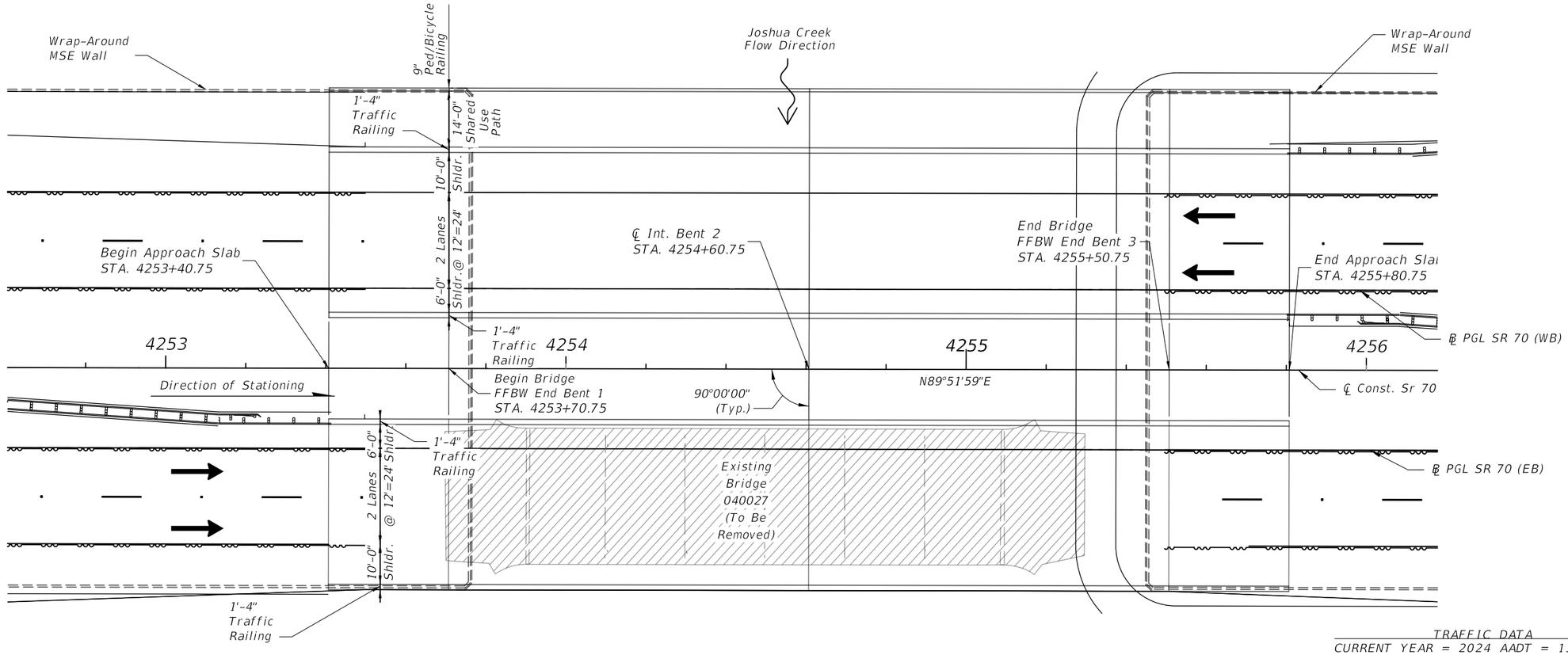


LEGEND:

Soil Boring Location (TBD)

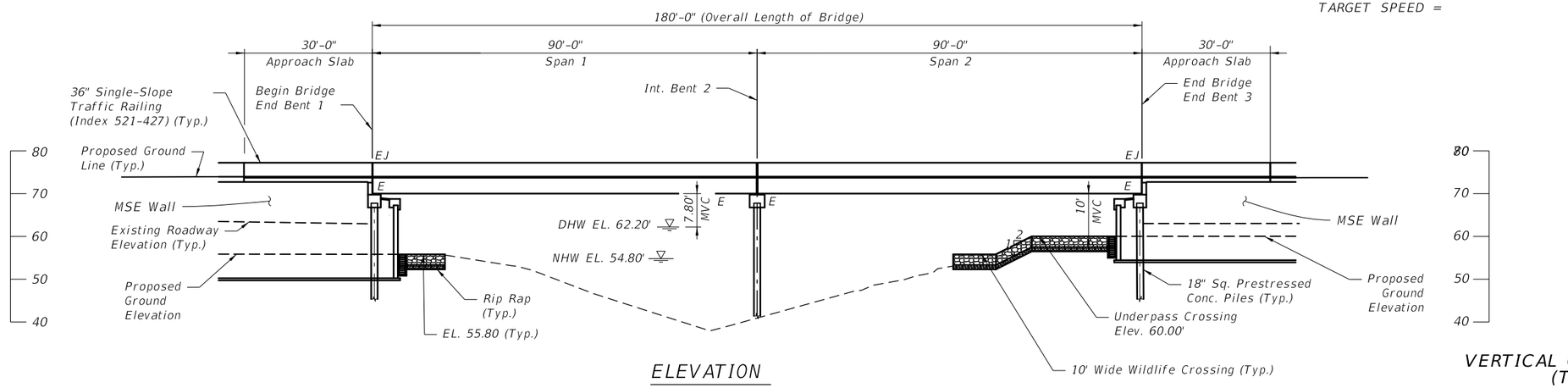
Existing Structure to be Removed

Rip Rap

TRAFFIC DATA

CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =

PLAN



ELEVATION

(Existing Bridge not Shown for Clarity)

VERTICAL CURVE DATA (TBD)

BRIDGE NO. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
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HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

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DESIGNED BY: GGV 06-25
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - PLAN AND ELEVATION
SR 70 OVER JOSHUA CREEK

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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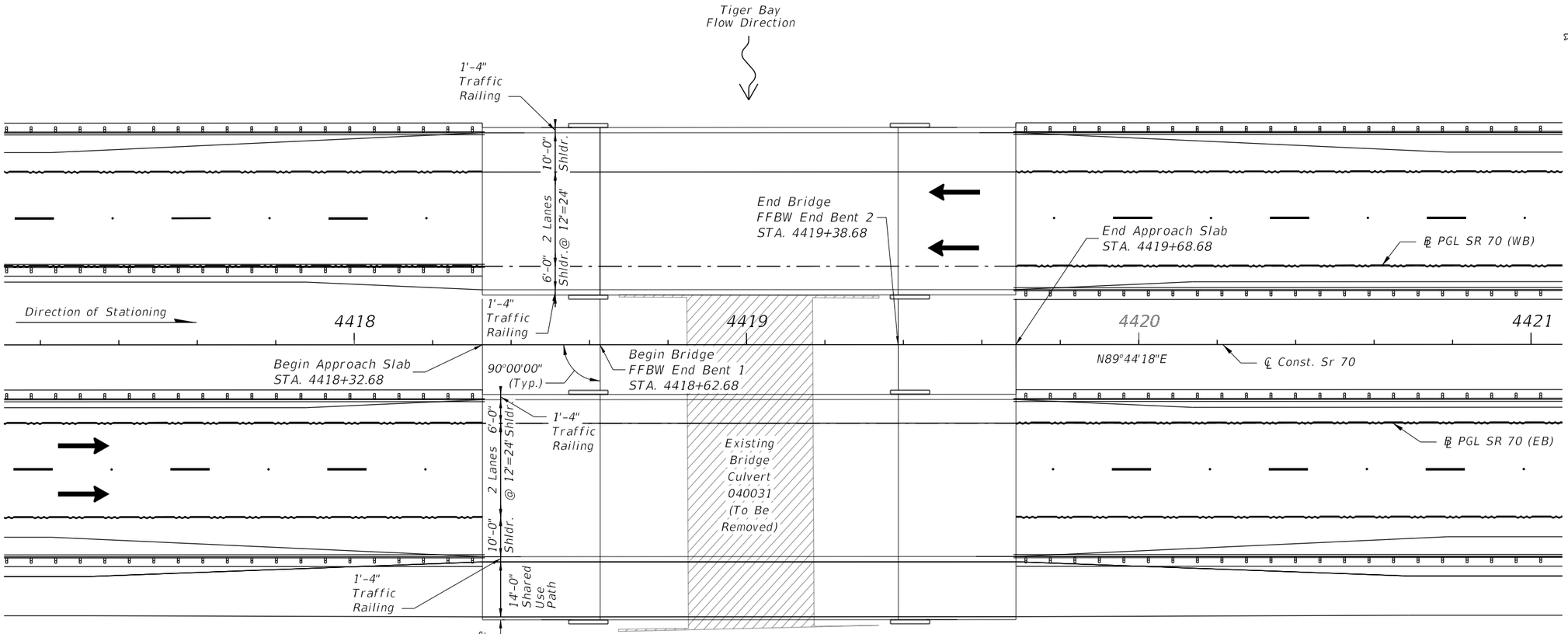


PLAN

LEGEND:

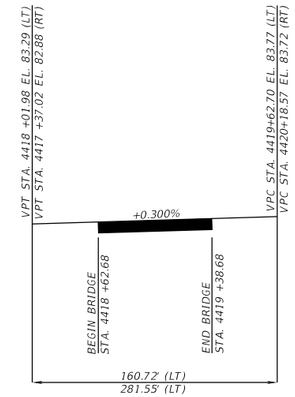
Soil Boring Location (TBD)

Existing Structure to be Removed

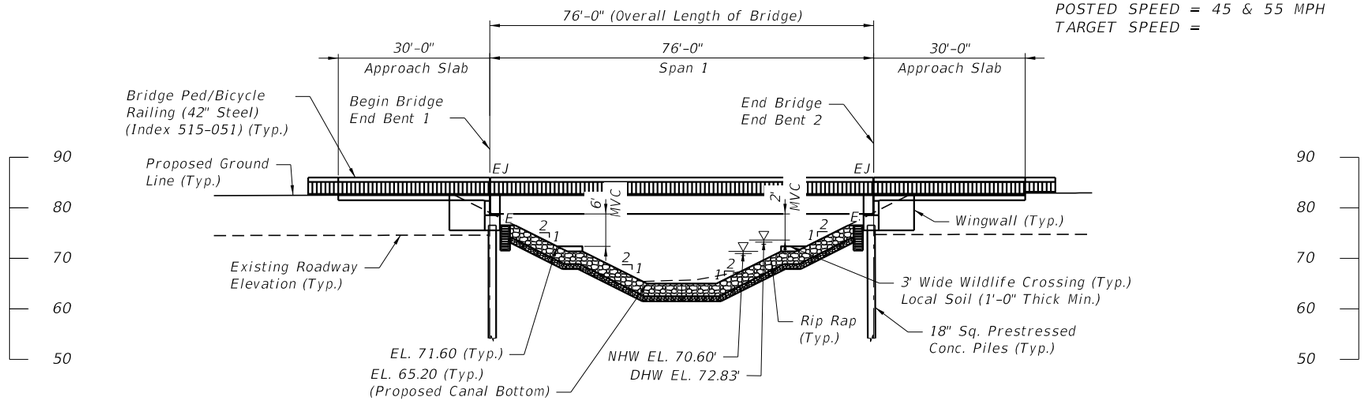
Rip Rap

TRAFFIC DATA

CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =



VERTICAL CURVE DATA



ELEVATION

(Existing Bridge Culvert not Shown for Clarity)

BRIDGE NO. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - PLAN AND ELEVATION
SR 70 OVER TIGER BAY

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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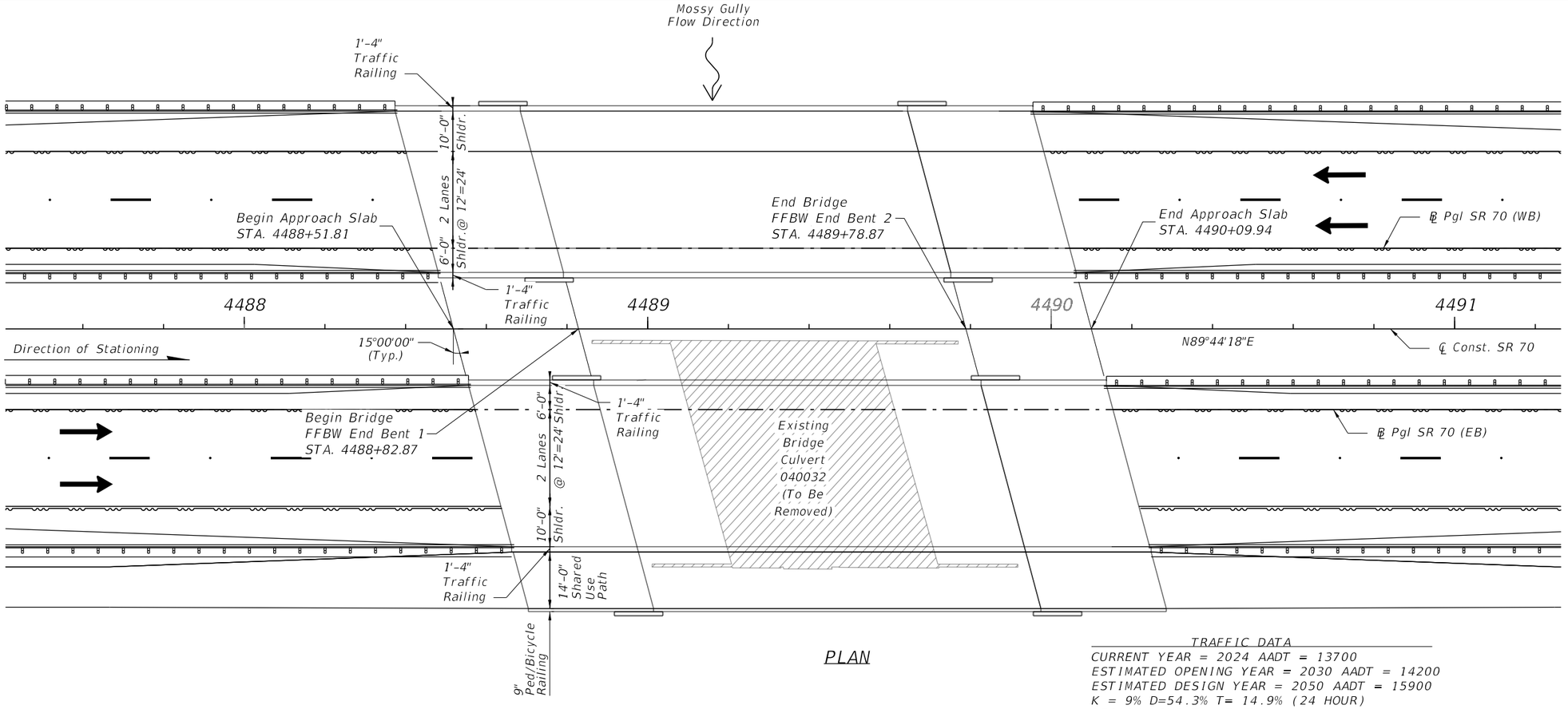
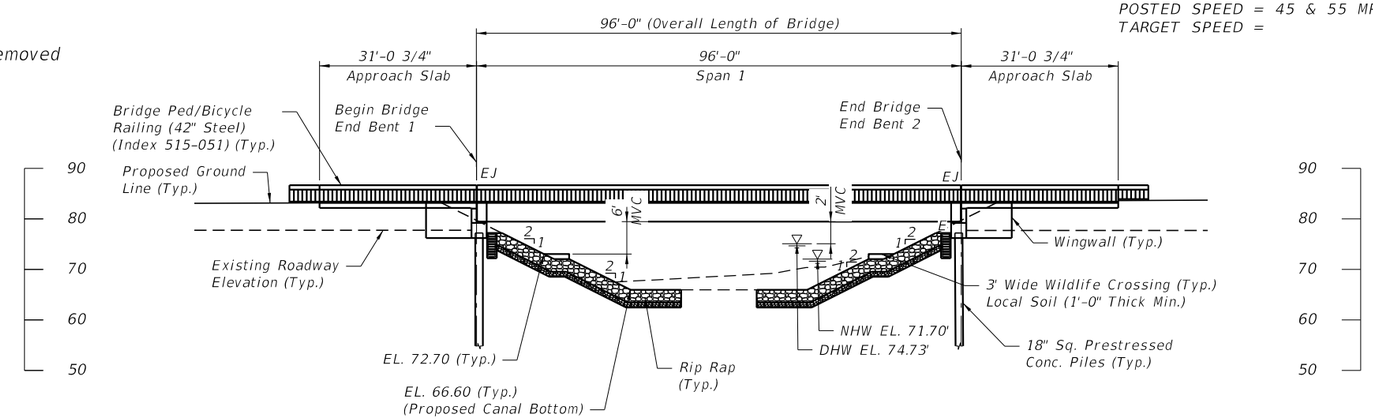


PLAN

TRAFFIC DATA
CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =

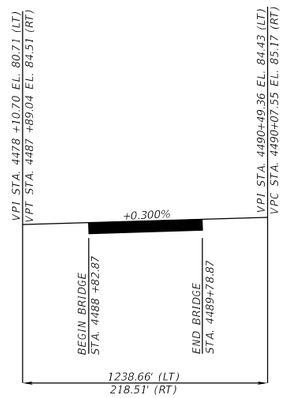
LEGEND:

Soil Boring Location (TBD)
Existing Structure to be Removed
Rip Rap



ELEVATION

(Existing Bridge Culvert not Shown for Clarity)



VERTICAL CURVE DATA

BRIDGE NO. TBD

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - PLAN AND ELEVATION
SR 70 OVER MOSSY GULLY

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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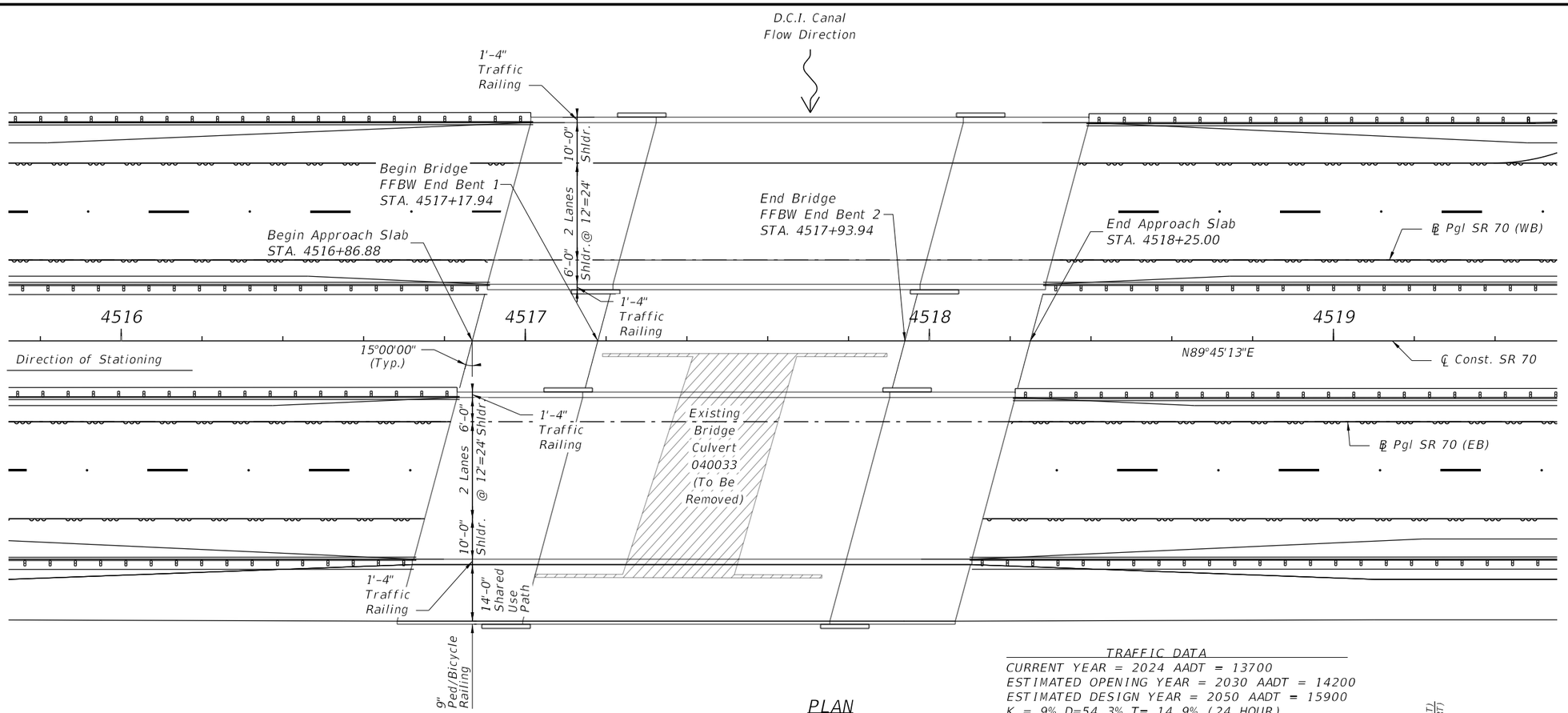
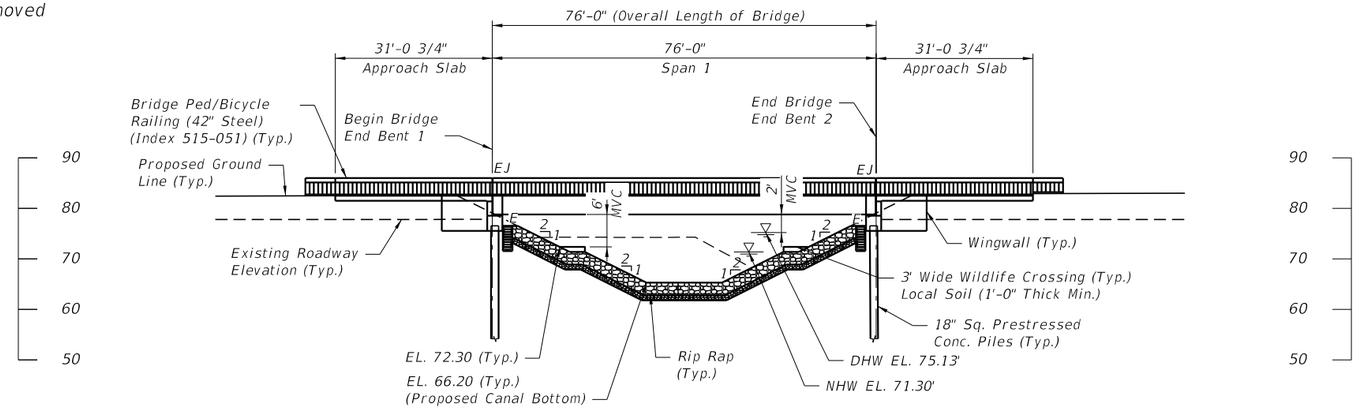


PLAN

TRAFFIC DATA
CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =

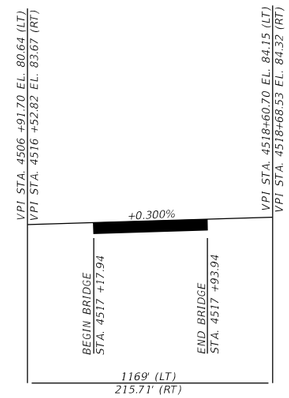
LEGEND:

Soil Boring Location (TBD)
Existing Structure to be Removed
Rip Rap



ELEVATION

(Existing Bridge Culvert not Shown for Clarity)



VERTICAL CURVE DATA

BRIDGE NO. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - PLAN AND ELEVATION
SR 70 OVER D.C.I. CANAL

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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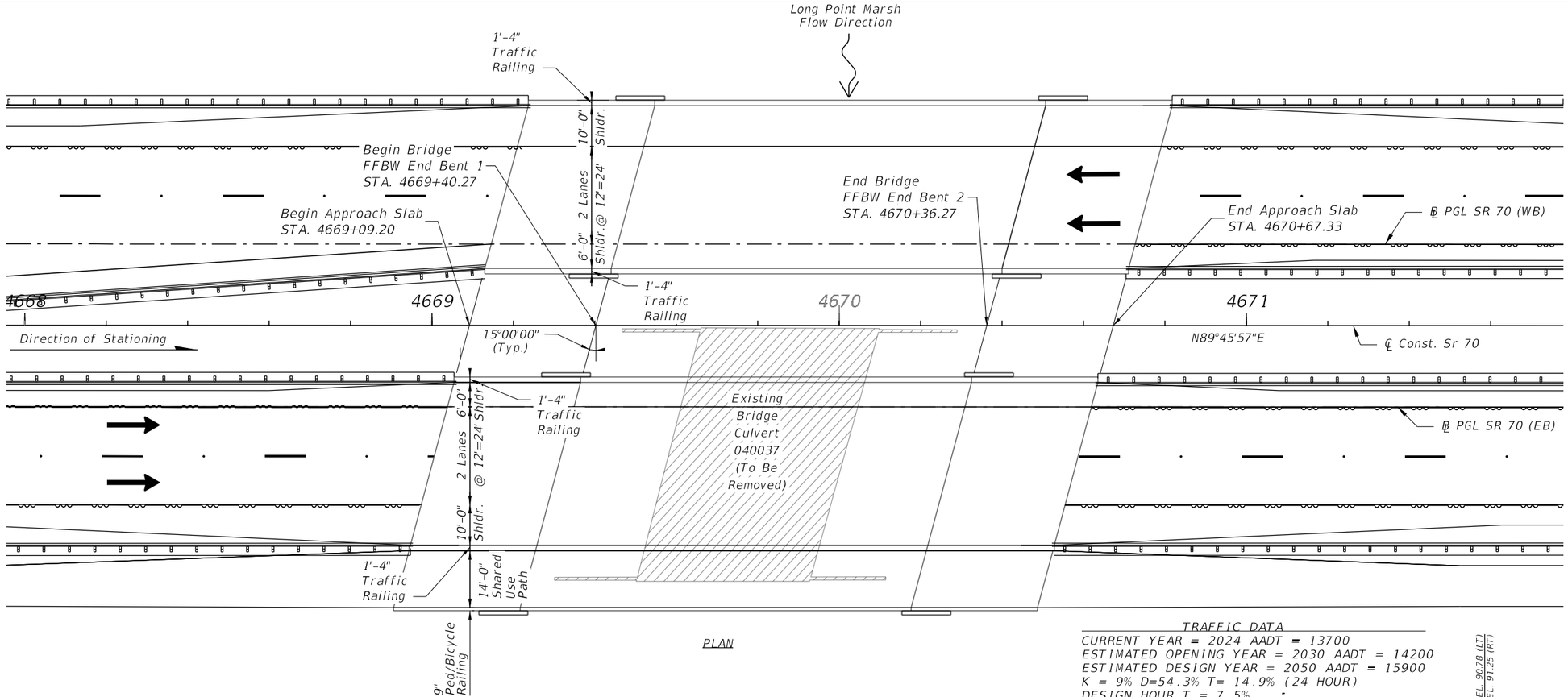

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY:	CHECKED BY:	DESIGNED BY:	CHECKED BY:
TVT 03-25	GGV 03-25	GGV 03-25	CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - PLAN AND ELEVATION
SR 70 OVER LONG POINT MARSH

REF. DWG. NO.

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO. TBD

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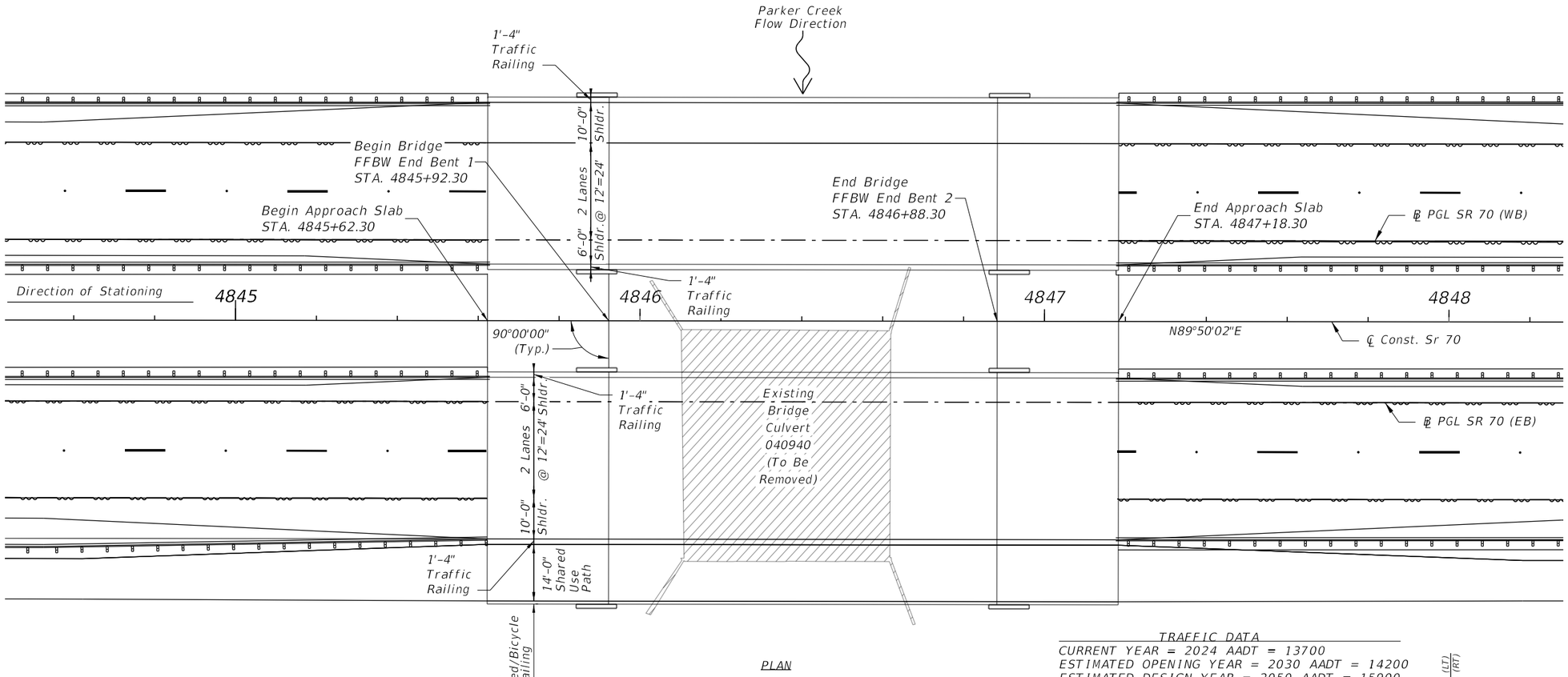


PLAN

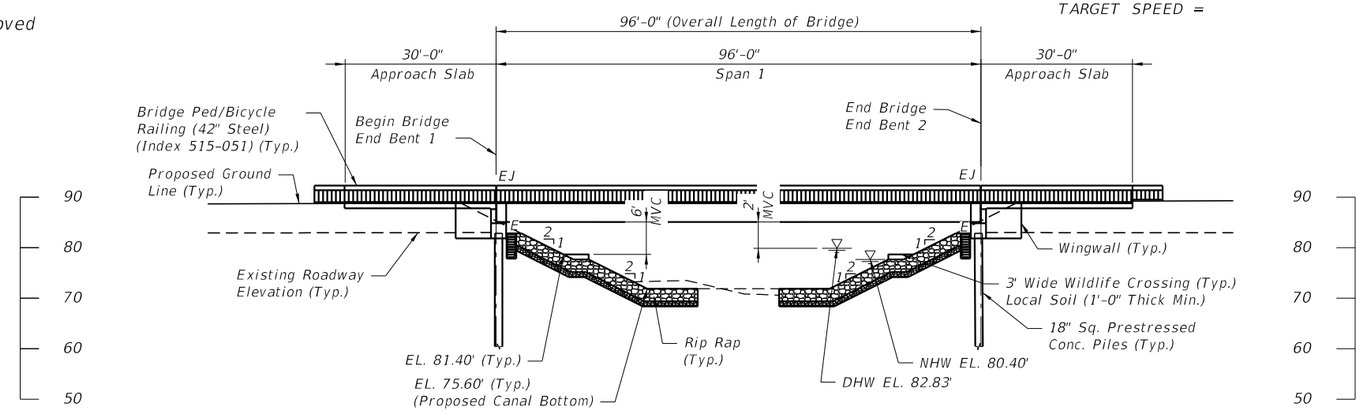
TRAFFIC DATA
CURRENT YEAR = 2024 AADT = 13700
ESTIMATED OPENING YEAR = 2030 AADT = 14200
ESTIMATED DESIGN YEAR = 2050 AADT = 15900
K = 9% D=54.3% T= 14.9% (24 HOUR)
DESIGN HOUR T = 7.5%
DESIGN SPEED = 55 MPH
POSTED SPEED = 45 & 55 MPH
TARGET SPEED =

LEGEND:

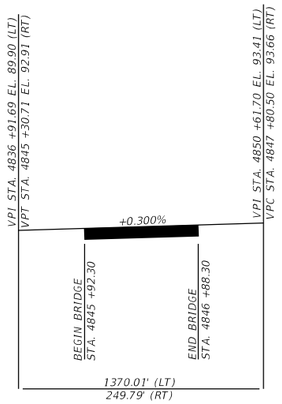
Soil Boring Location (TBD)

Existing Structure to be Removed

Rip Rap



ELEVATION
(Existing Bridge Culvert not Shown for Clarity)



VERTICAL CURVE DATA

BRIDGE NO. TBD

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
		NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE			

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

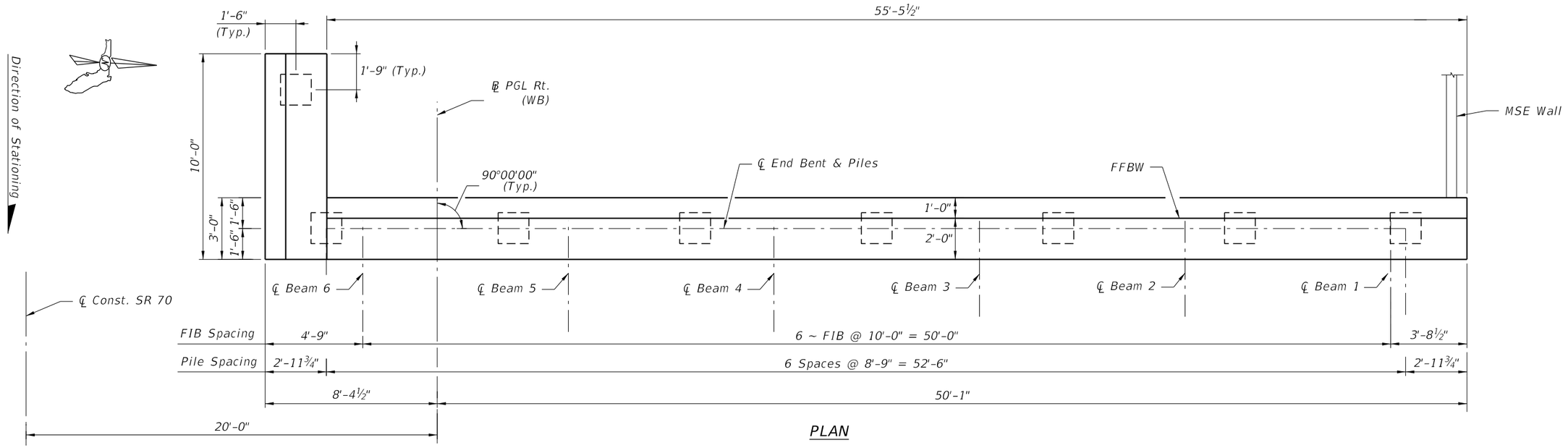
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - PLAN AND ELEVATION
SR 70 OVER PARKER CREEK

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT
WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

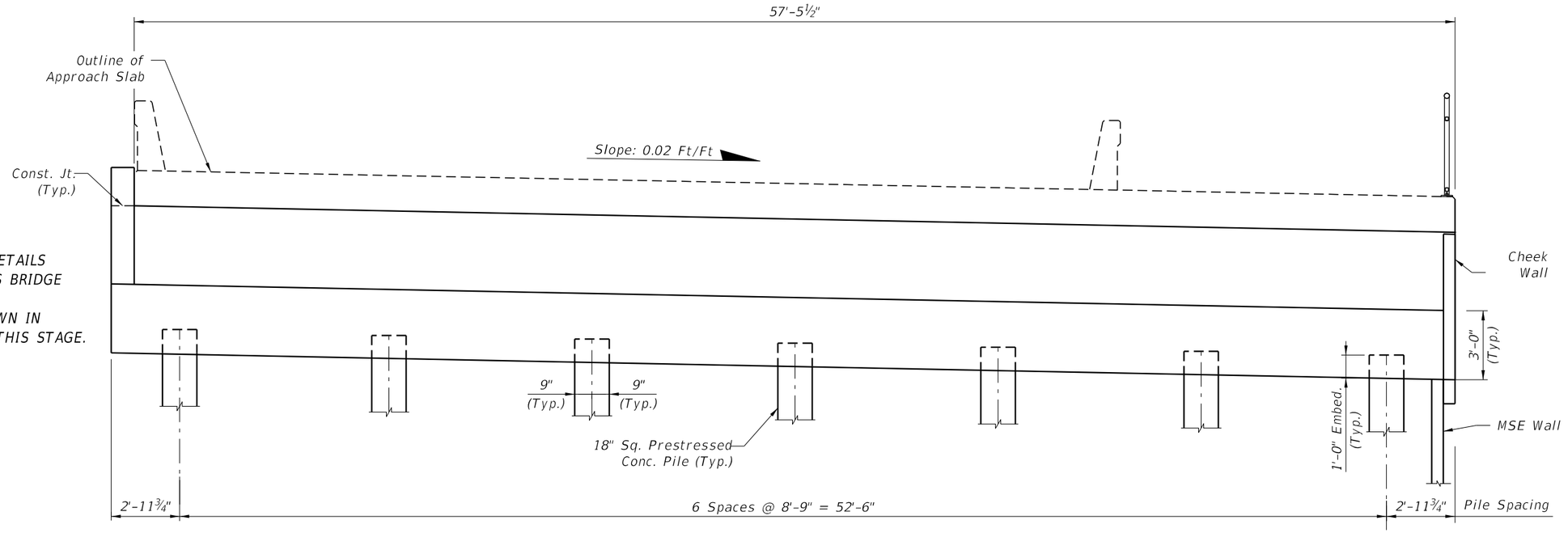
REF. DWG. NO.

SHEET NO. TBD



PLAN

(End Bent 1 shown, Other End Bent Similar)



NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.

ELEVATION

(End Bent 1 shown, Other End Bent Similar)

WHIDDEN CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY:	TVT 06-25
CHECKED BY:	GGV 06-25
DESIGNED BY:	GGV 06-25
CHECKED BY:	CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT WESTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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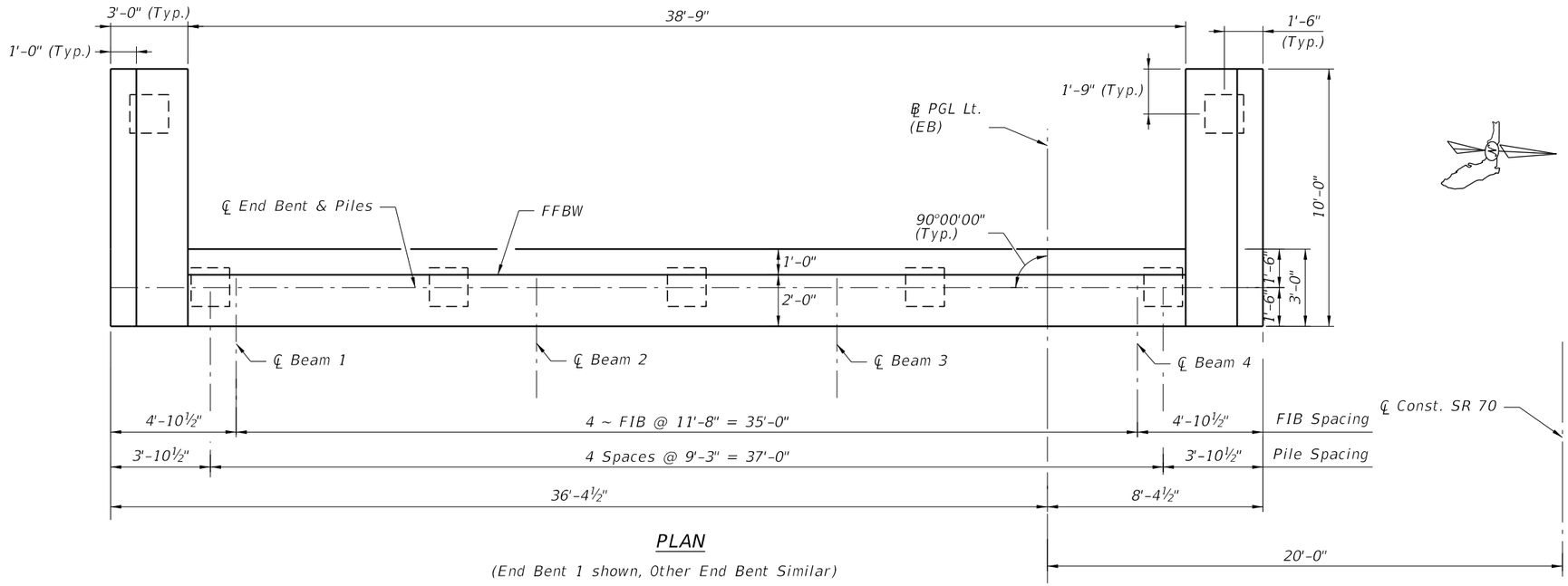
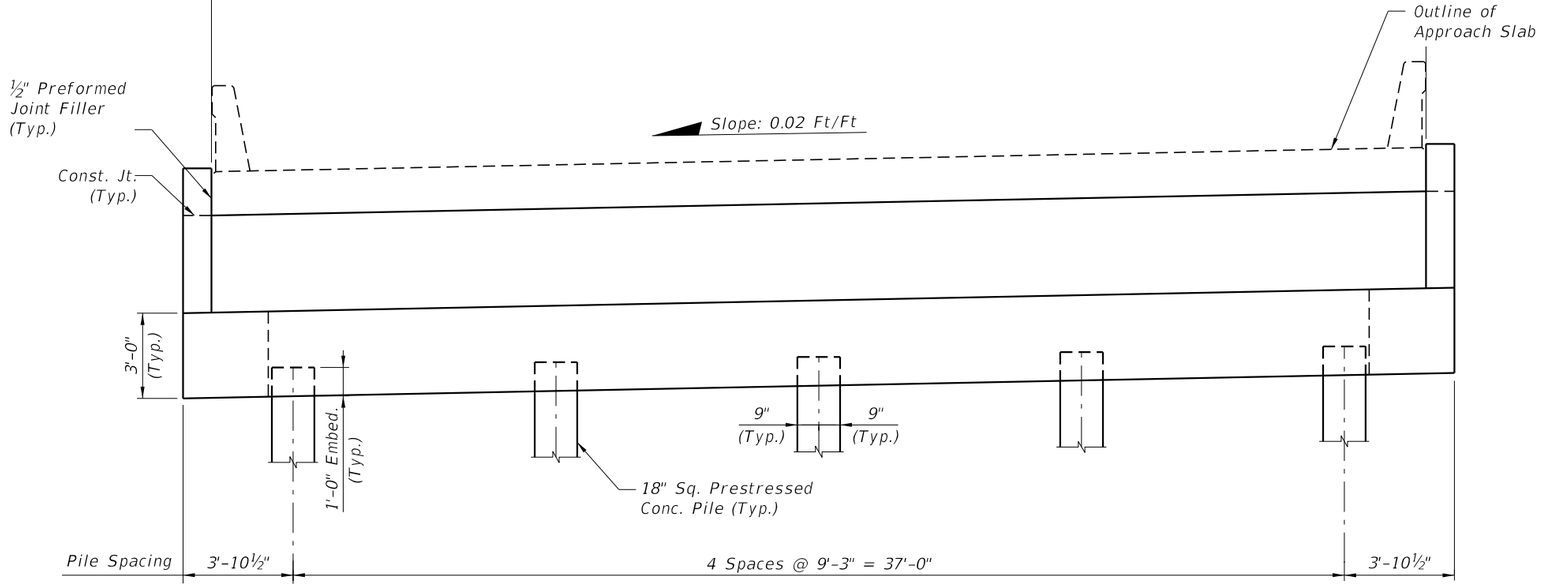


PLAN

(End Bent 1 shown, Other End Bent Similar)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.

WHIDDEN CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT EASTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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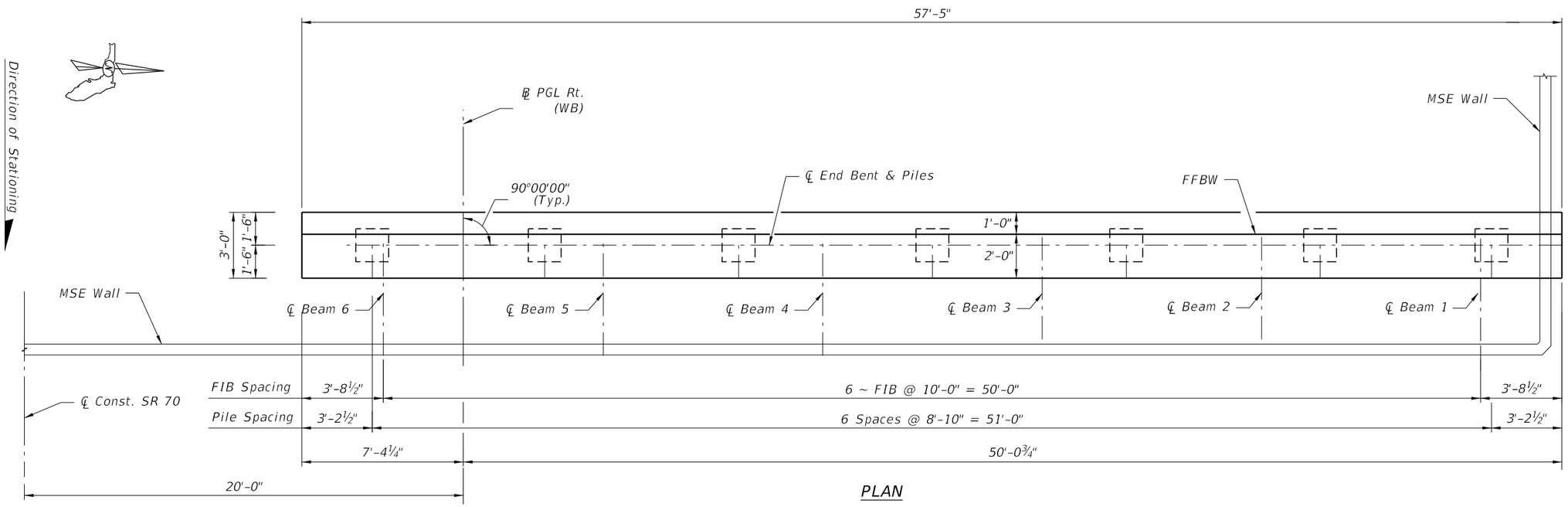
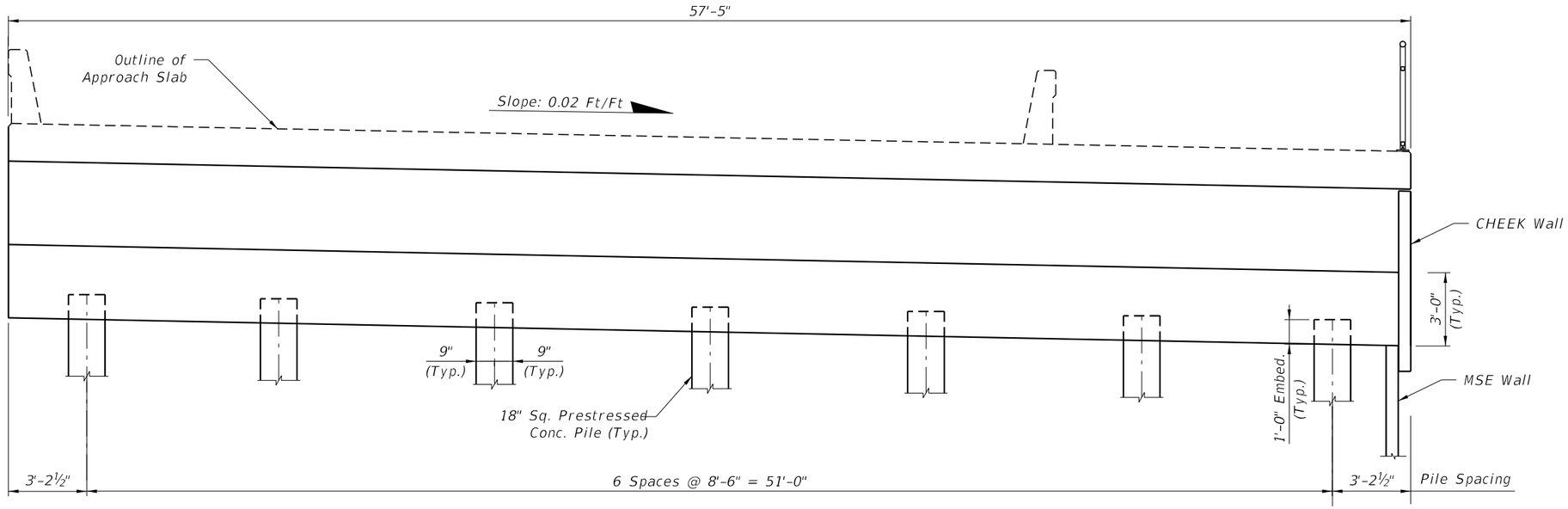


PLAN

(End Bent 1 shown, Other End Bent Similar)



NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.

ELEVATION

(End Bent 1 shown, Other End Bent Similar)

JOSHUA CREEK BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY:	TVT 06-25
CHECKED BY:	GGV 06-25
DESIGNED BY:	GGV 06-25
CHECKED BY:	CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT WESTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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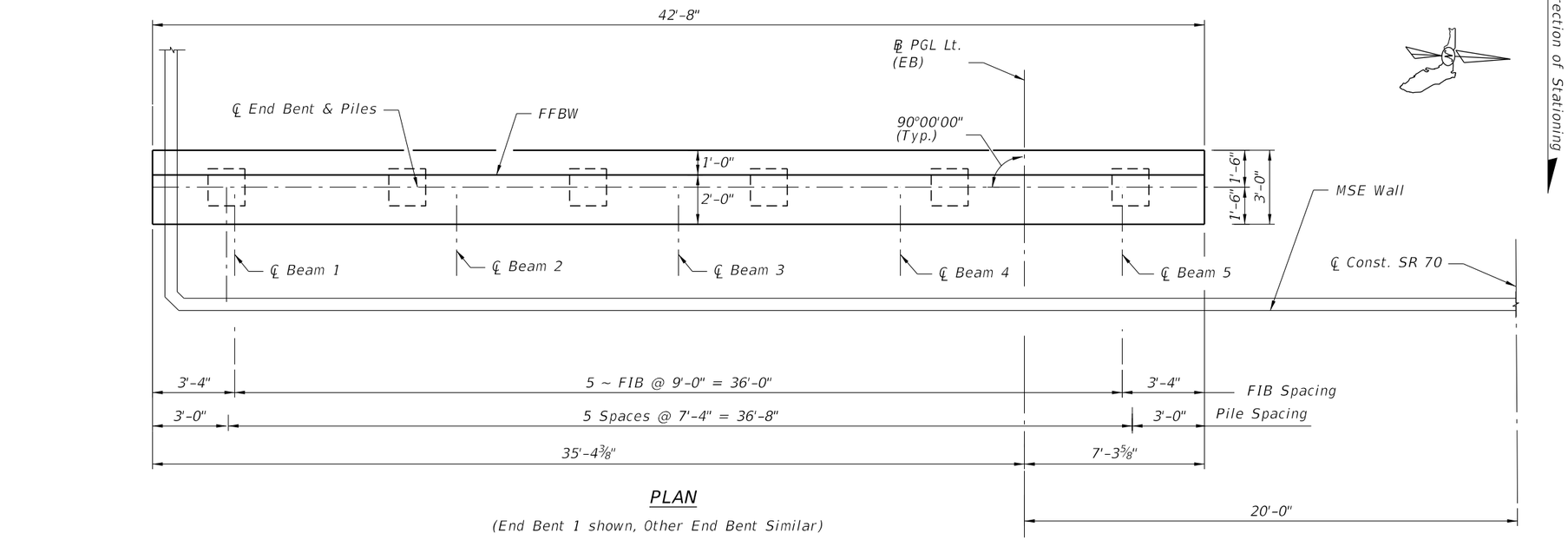
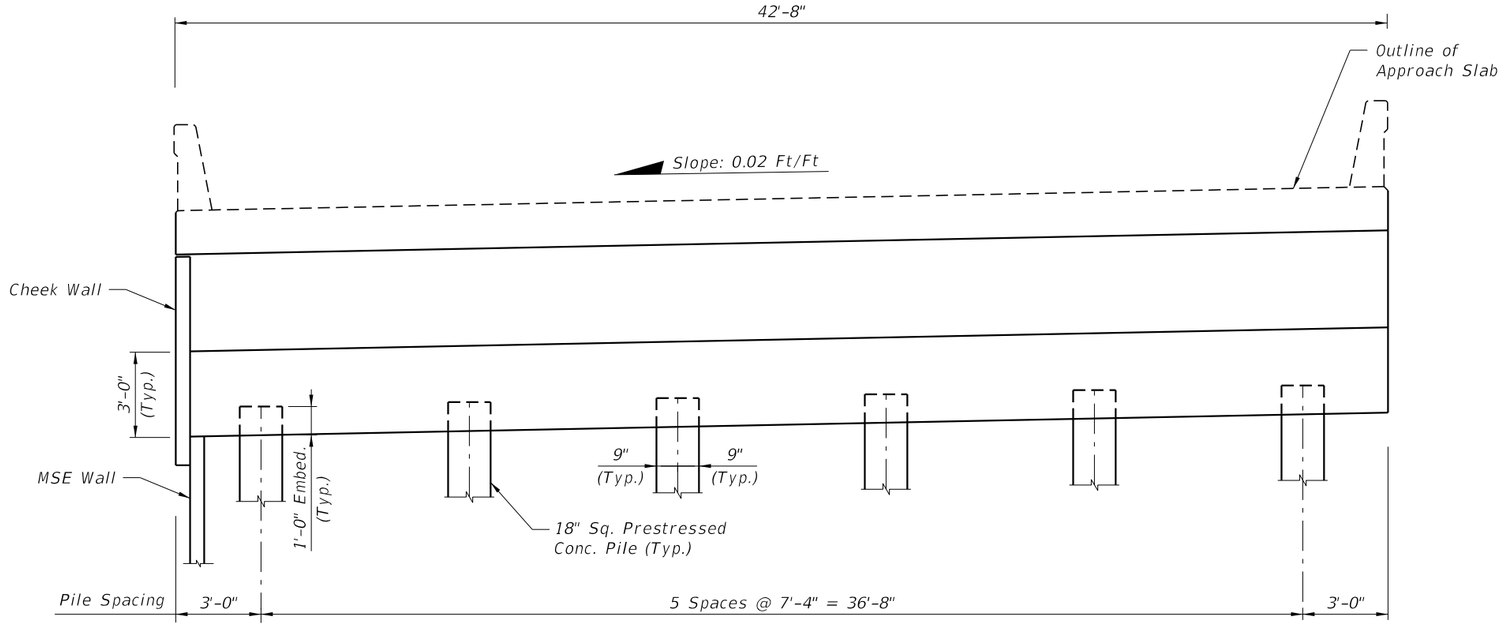


PLAN

(End Bent 1 shown, Other End Bent Similar)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.

JOSHUA CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT EASTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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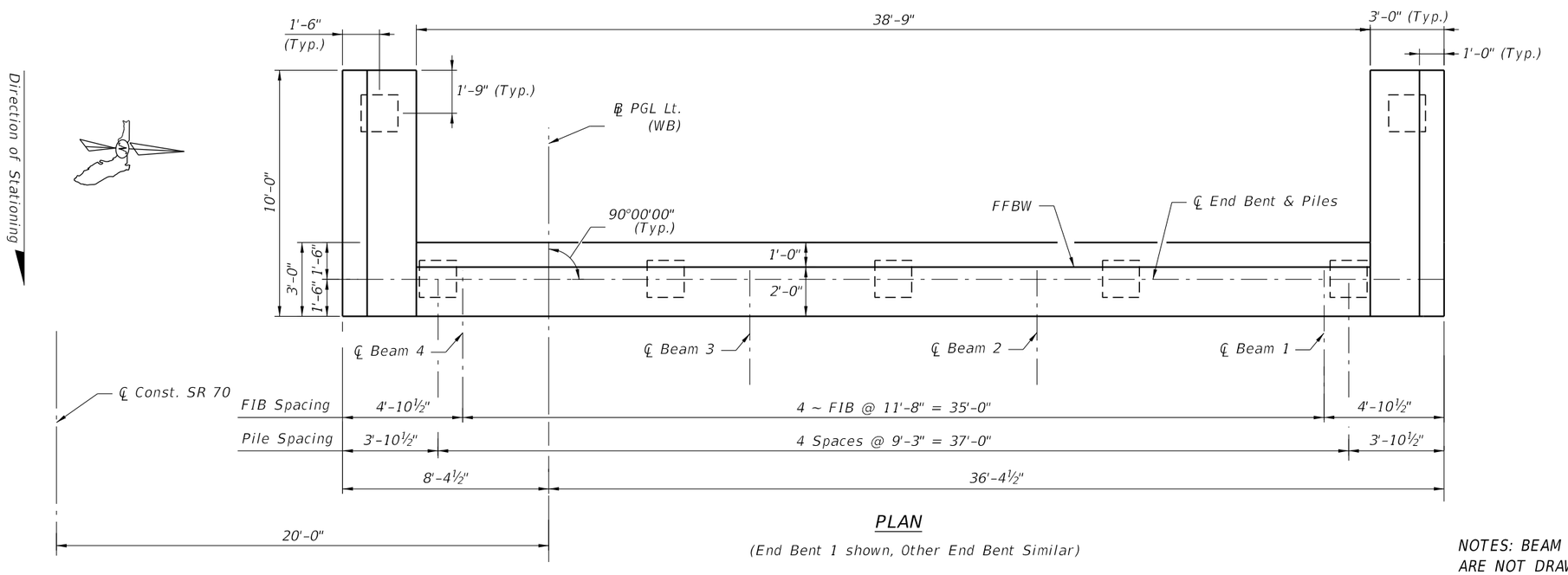
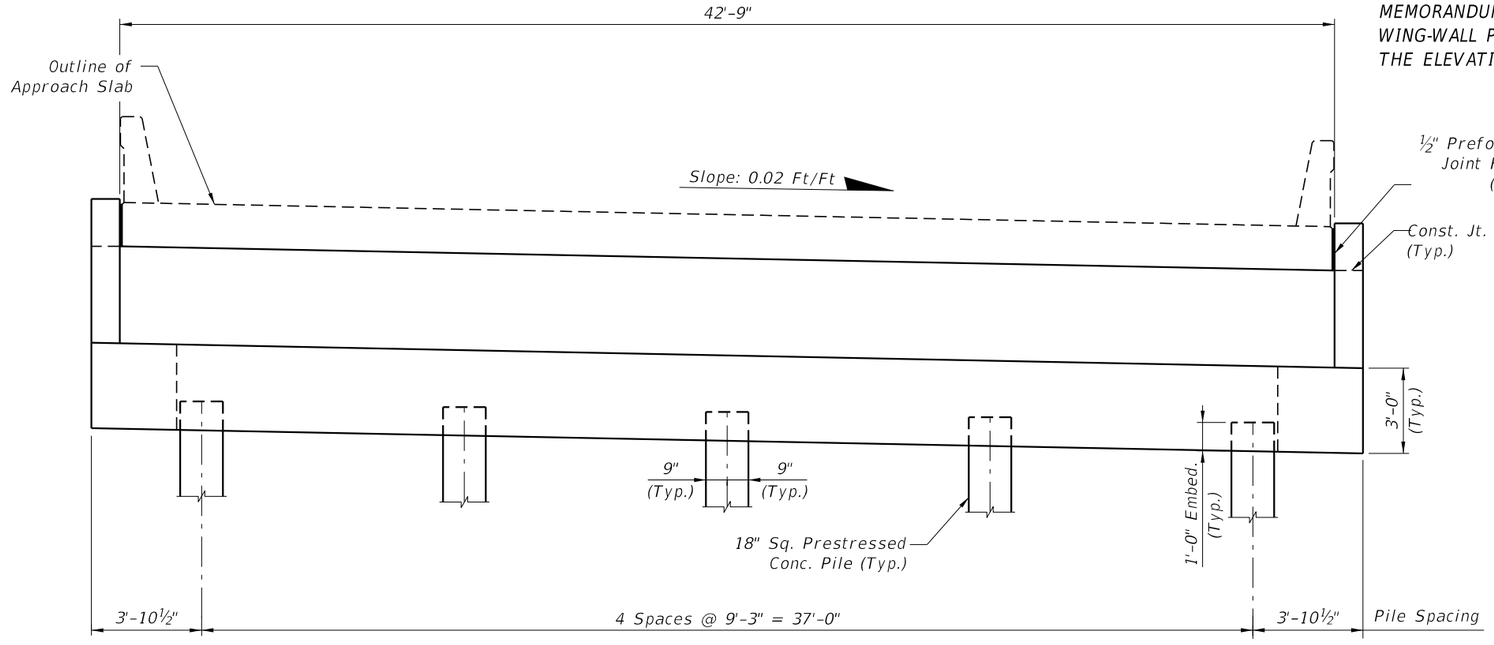


PLAN

(End Bent 1 shown, Other End Bent Similar)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

TIGER BAY BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 06-25
CHECKED BY: GGV 06-25
DESIGNED BY: GGV 06-25
CHECKED BY: CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT WESTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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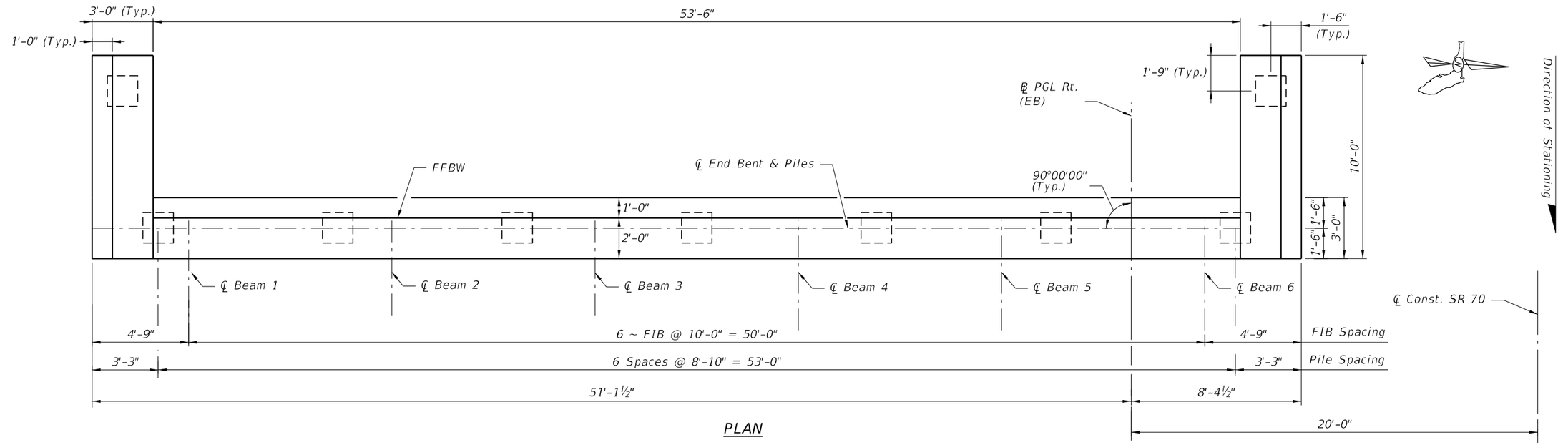
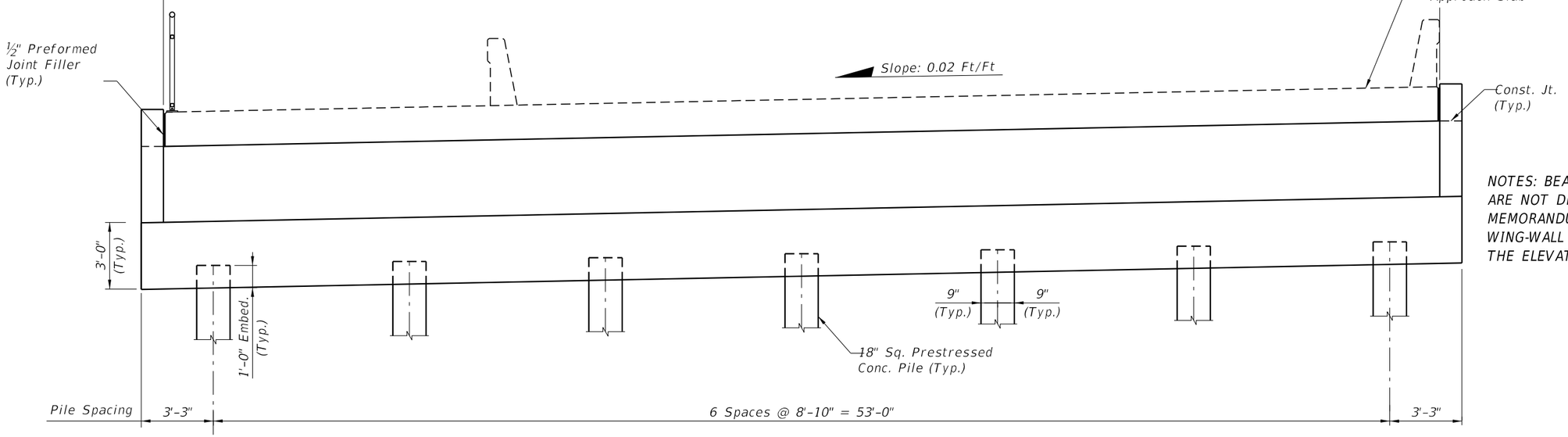


PLAN

(End Bent 1 shown, Other End Bent Similar)



NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.

ELEVATION

(End Bent 1 shown, Other End Bent Similar)

TIGER BAY BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY:	TVT 06-25
CHECKED BY:	GGV 06-25
DESIGNED BY:	GGV 06-25
CHECKED BY:	CEB 06-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT EASTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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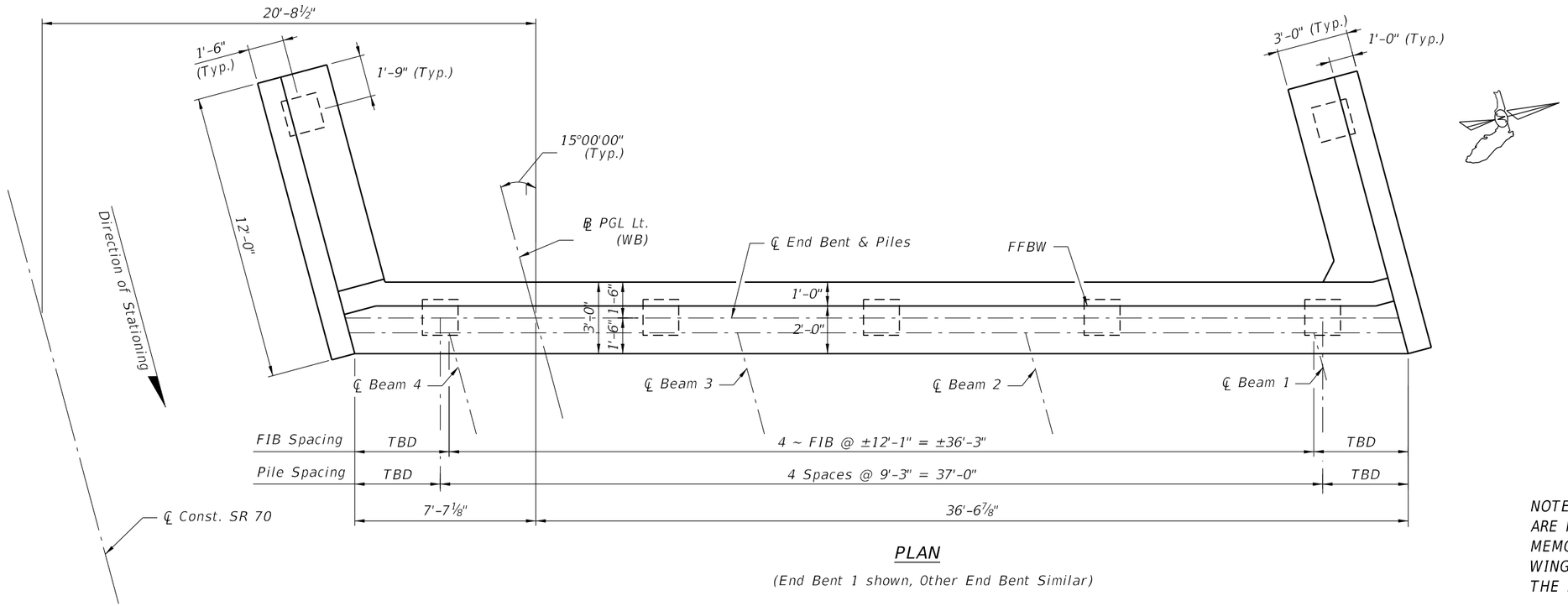
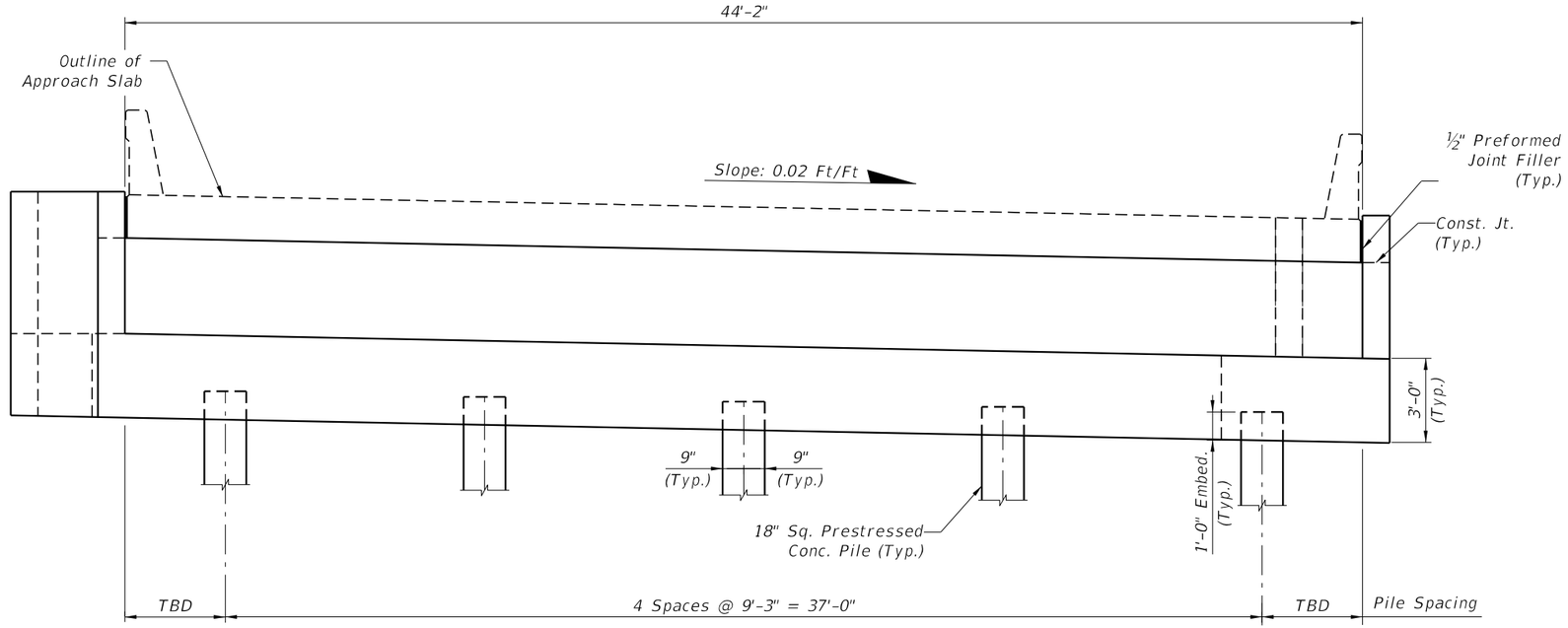


PLAN

(End Bent 1 shown, Other End Bent Similar)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

D.C.I. CANAL BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT WESTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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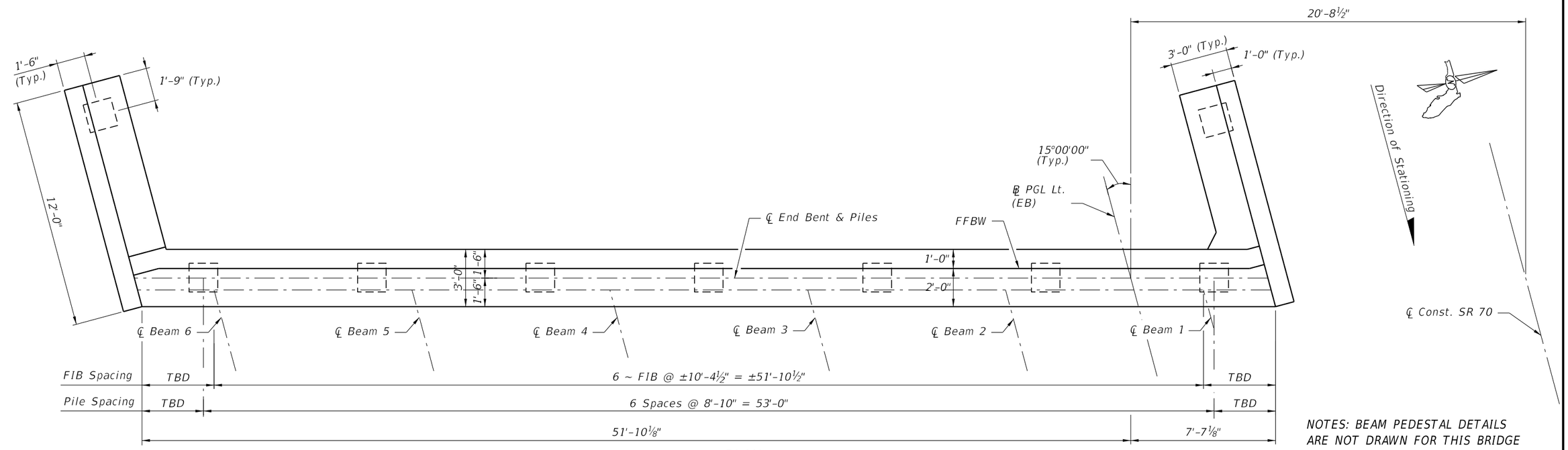
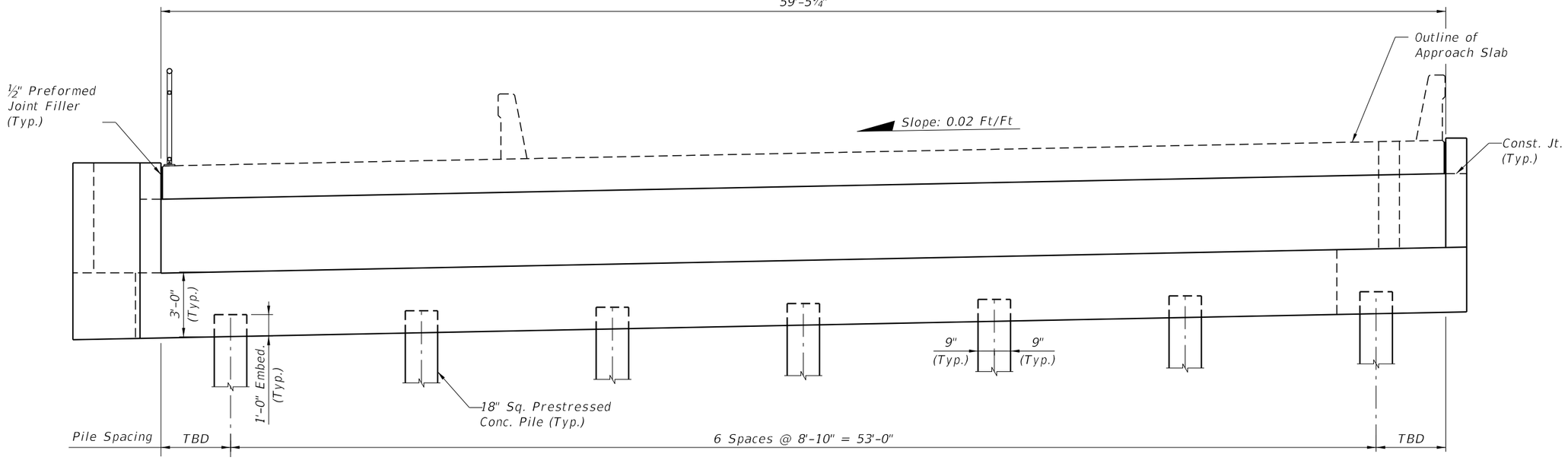


PLAN

(End Bent 1 shown, Other End Bent Similar)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

D.C.I. CANAL BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

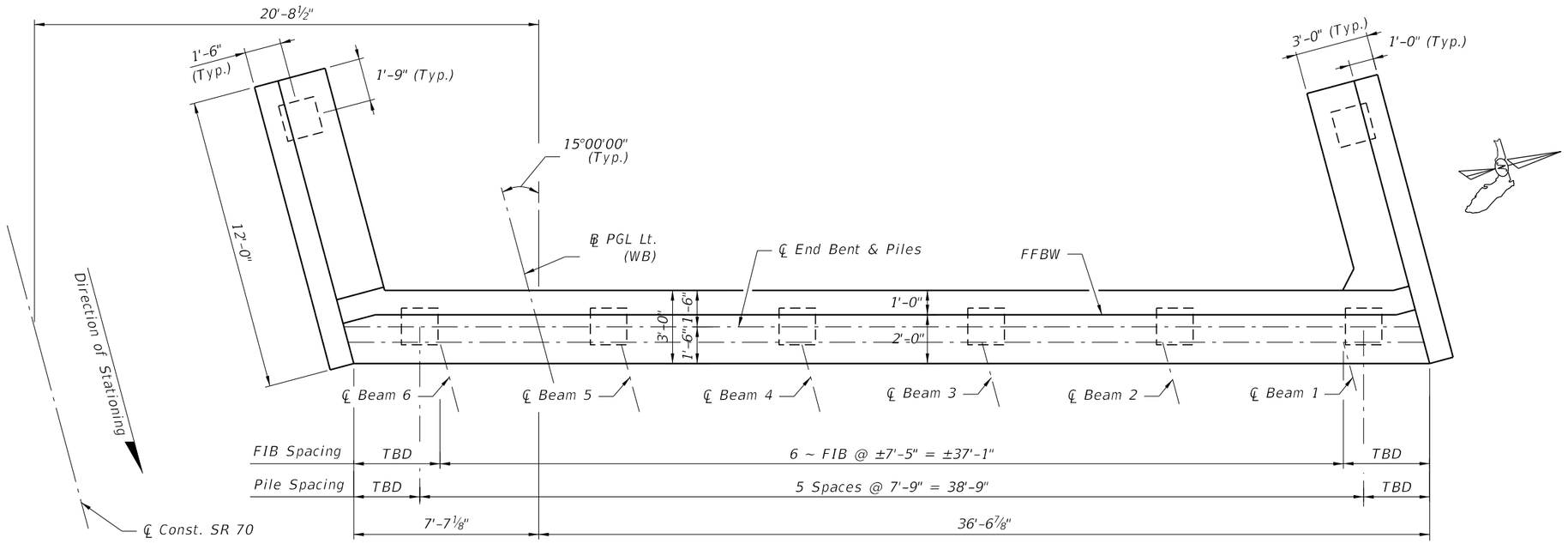
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT EASTBOUND BRIDGE

REF. DWG. NO.:

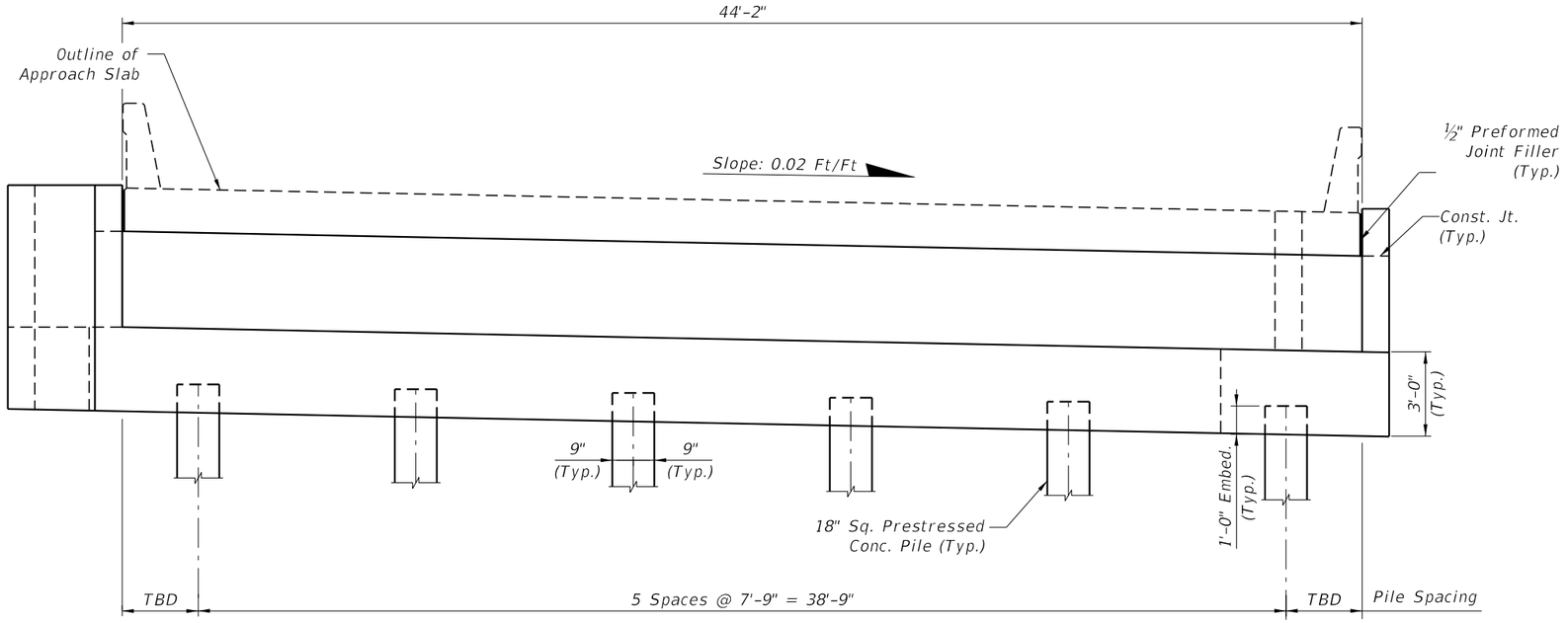
PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD



PLAN

(End Bent 1 shown, Other End Bent Similar)
(Bridge over Mossy Gully, Opposite Hand)



ELEVATION

(End Bent 1 shown, Other End Bent Similar)
(Bridge over Mossy Gully, Opposite Hand)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.

MOSS GULLY CREEK BRIDGE
LONG POINT CREEK BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
HNTB CORPORATION
201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

DRAWN BY: TVT 03-25
CHECKED BY: GGV 03-25
DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT WESTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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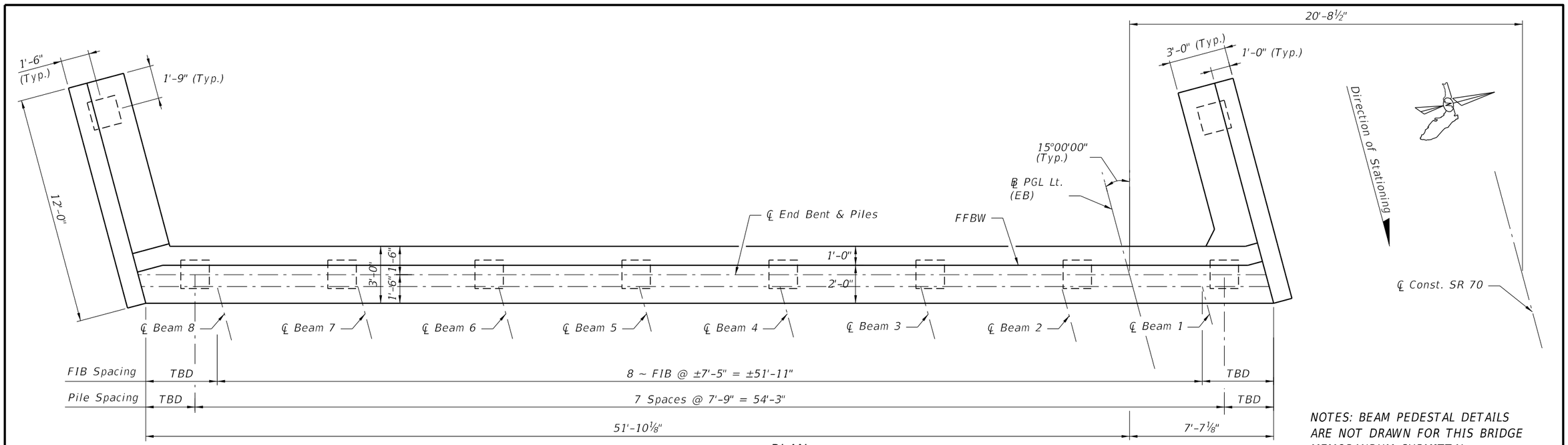
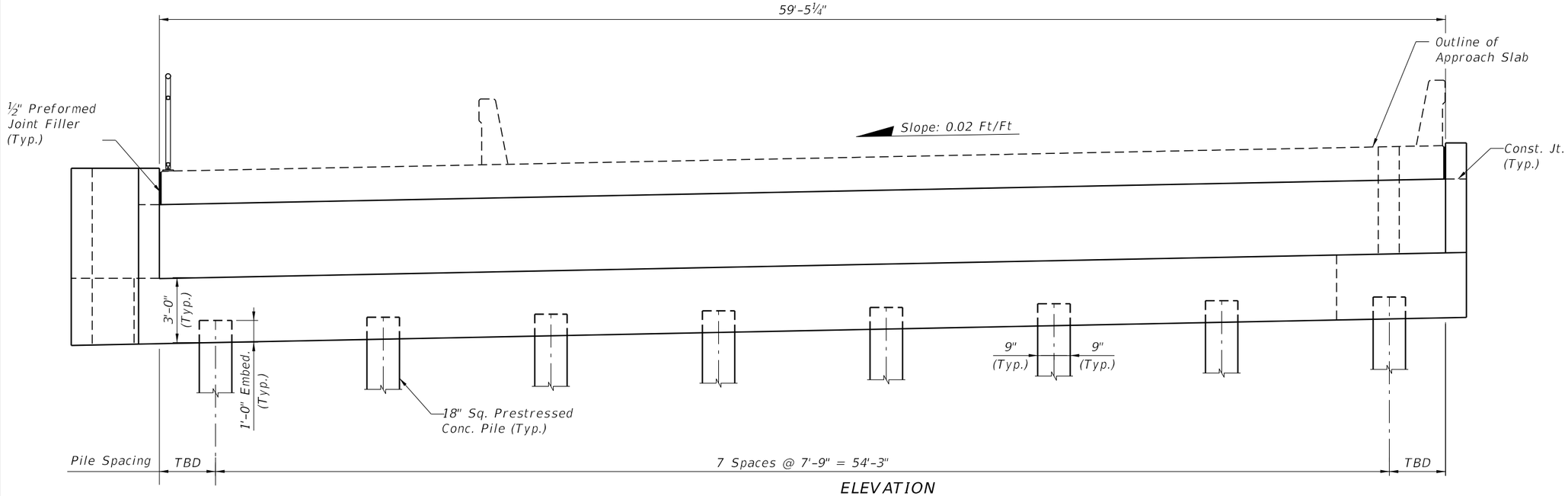


PLAN

(End Bent 1 shown, Other End Bent Similar)
(Bridge over Mossy Gully, Opposite Hand)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL.
WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.



ELEVATION

(End Bent 1 shown, Other End Bent Similar)
(Bridge over Mossy Gully, Opposite Hand)

MOSSY GULLY CREEK BRIDGE
LONG POINT MARSH CREEK BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
P.E. License Number: 72509
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201 N. FRANKLIN ST., SUITE 1200
TAMPA, FL 33602

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DESIGNED BY: GGV 03-25
CHECKED BY: CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT EASTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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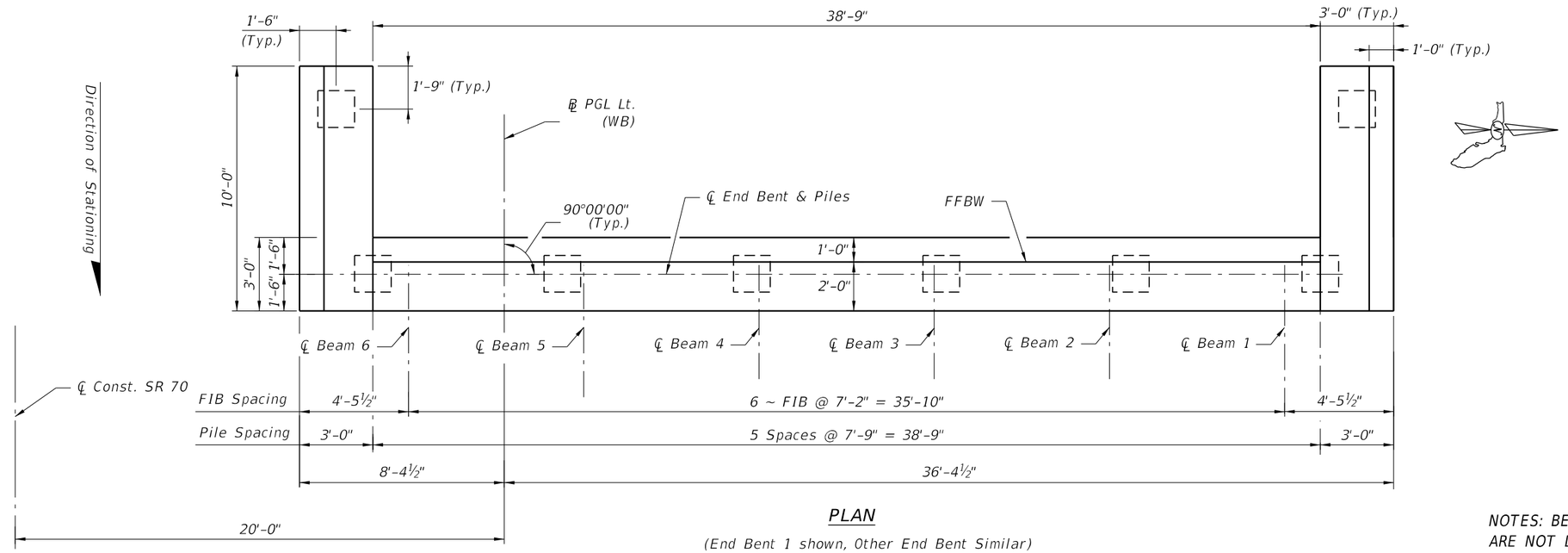
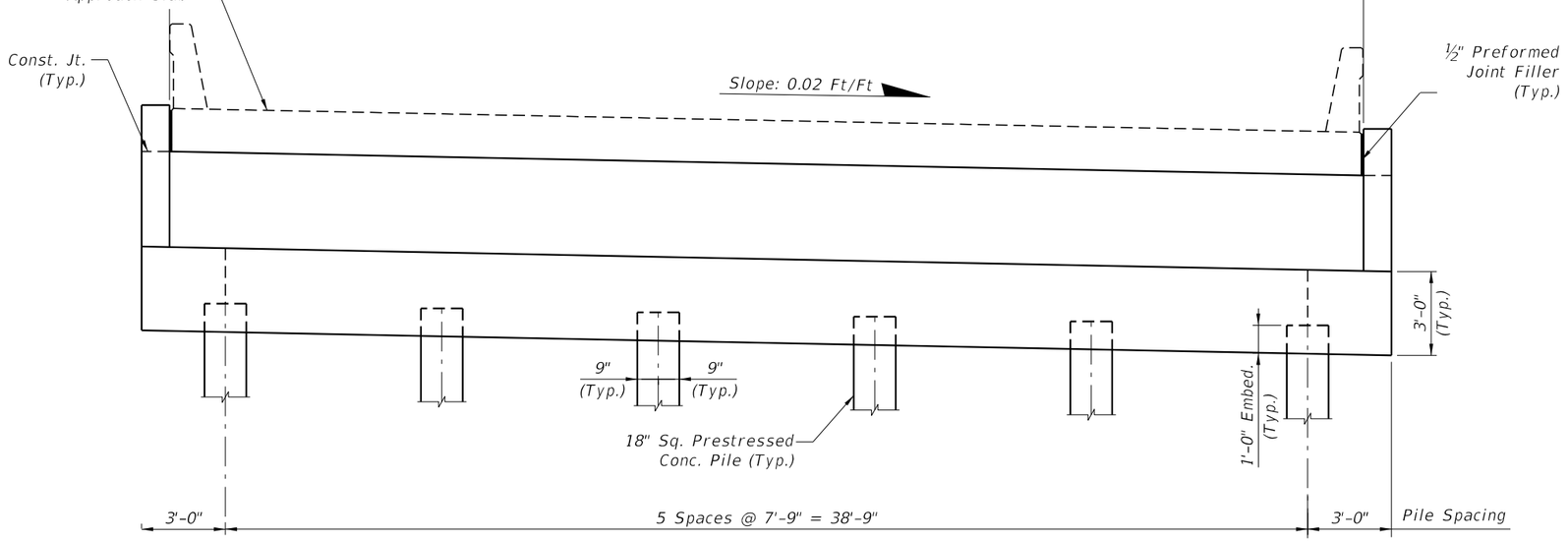


PLAN

(End Bent 1 shown, Other End Bent Similar)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.



ELEVATION

(End Bent 1 shown, Other End Bent Similar)

PARKER CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

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TAMPA, FL 33602

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TVT 03-25	GGV 03-25	GGV 03-25	CEB 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT WESTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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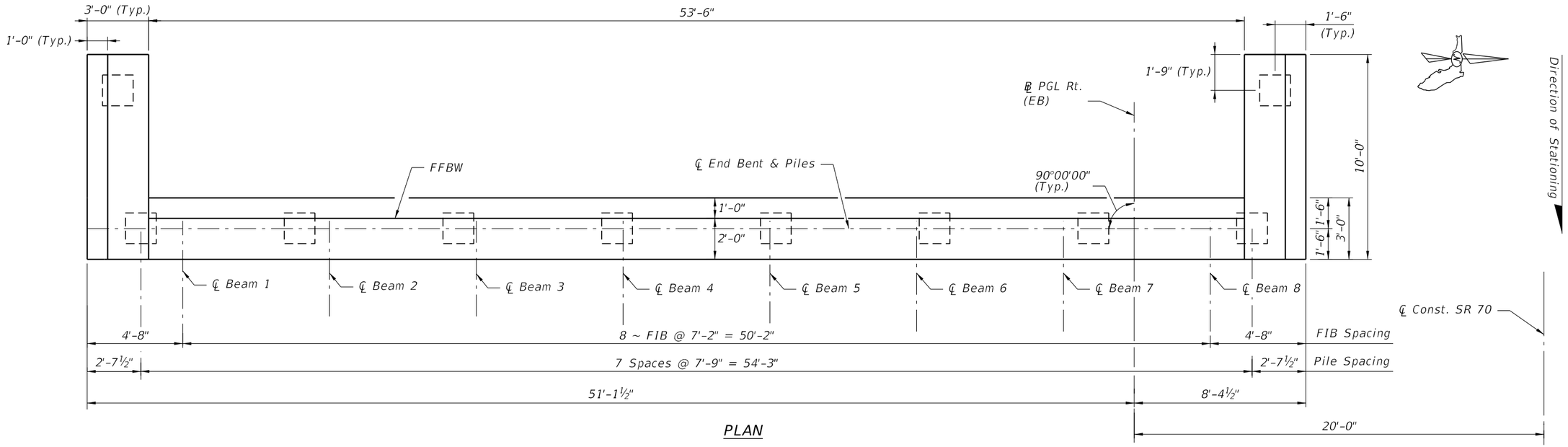
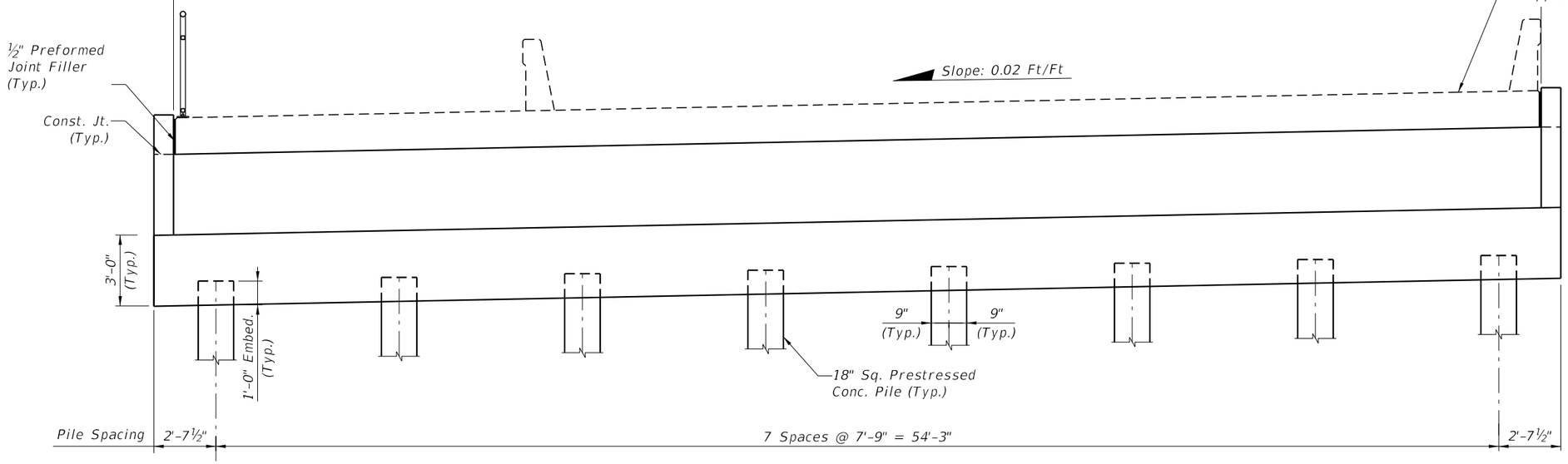


PLAN

(End Bent 1 shown, Other End Bent Similar)



NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL. WING-WALL PILE NOT SHOWN IN THE ELEVATION VIEW AT THIS STAGE.

ELEVATION

(End Bent 1 shown, Other End Bent Similar)

PARKER CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

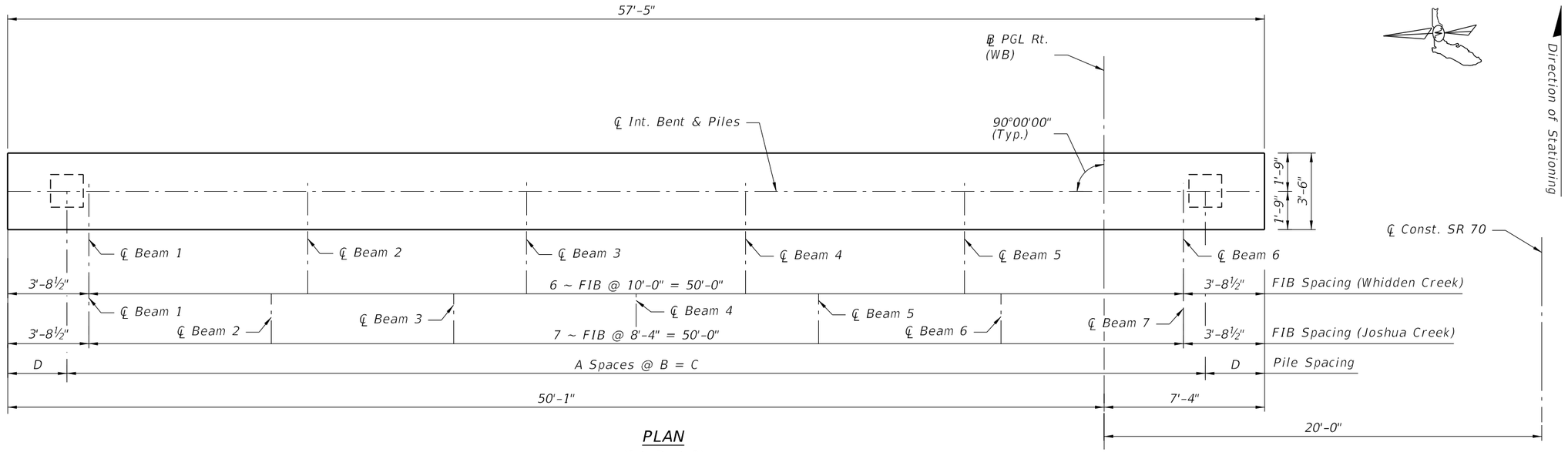
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - END BENT EASTBOUND BRIDGE

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

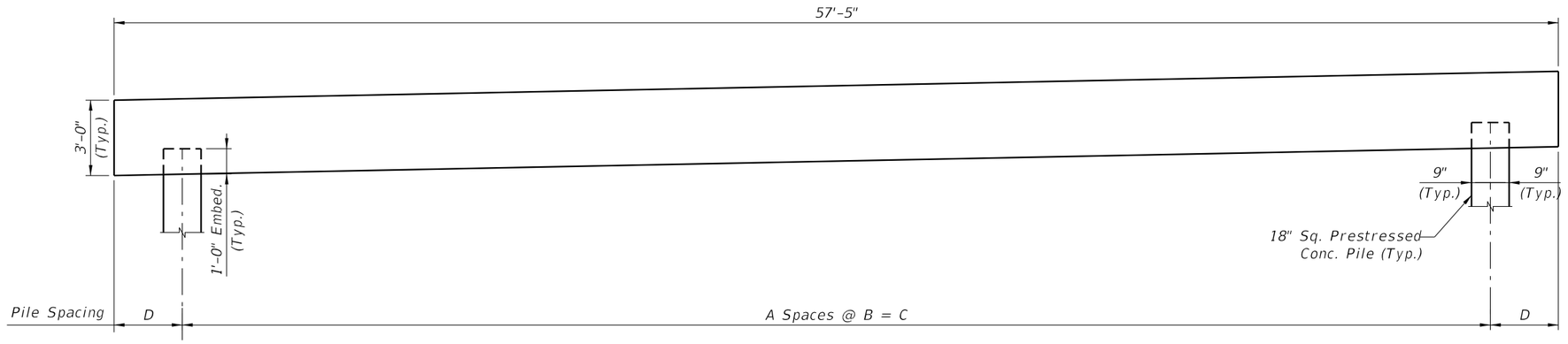
SHEET NO.: TBD



PLAN
(Int. Bent 2)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL.

BRIDGE CROSSING	A	B	C	D
WHIDDEN CREEK BRIDGE	9	5'-10"	52'-6"	2'-5½"
JOSHUA CREEK BRIDGE	11	4'-10"	53'-2"	2'-1½"



ELEVATION
(Int. Bent 2)

WHIDDEN CREEK BRIDGE
JOSHUA CREEK BRIDGE

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION
PRELIMINARY AND SUBJECT TO CHANGE

GJERGJI VASO, P.E.
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201 N. FRANKLIN ST., SUITE 1200
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - INT. BENT WESTBOUND BRIDGES

REF. DWG. NO.:

PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE

SHEET NO.: TBD

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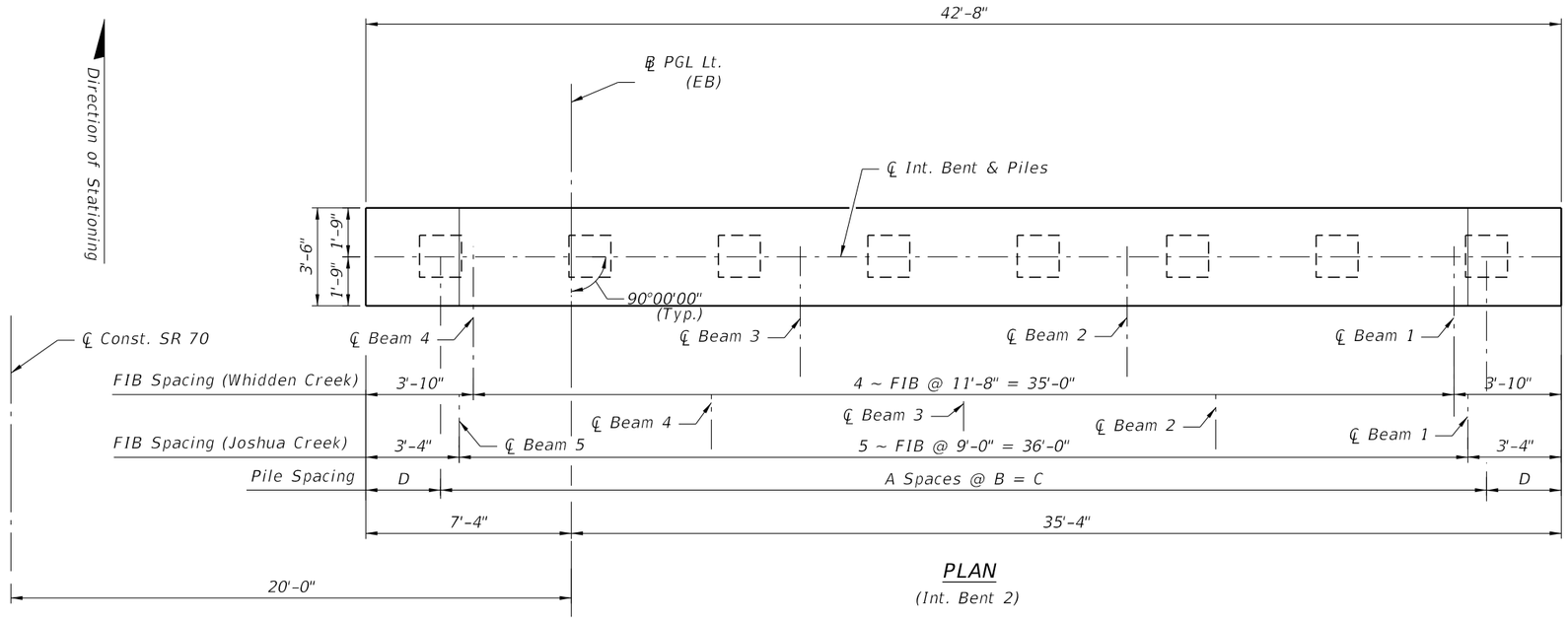
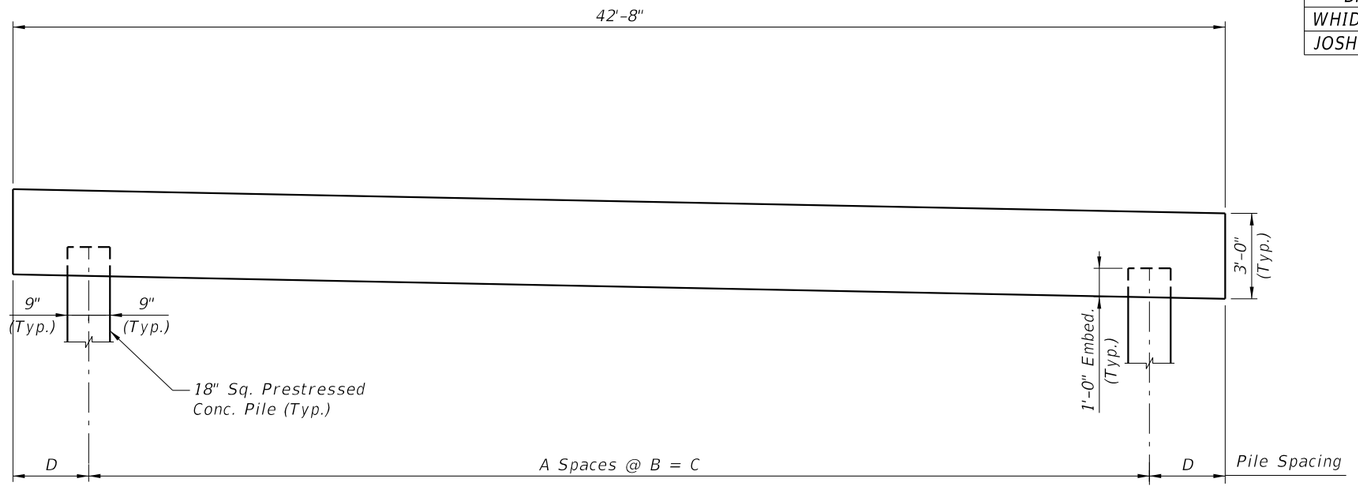


PLAN
(Int. Bent 2)

NOTES: BEAM PEDESTAL DETAILS ARE NOT DRAWN FOR THIS BRIDGE MEMORANDUM SUBMITTAL.

BRIDGE CROSSING	A	B	C	D
WHIDDEN CREEK BRIDGE	7	5'-6"	38'-6"	2'-1"
JOSHUA CREEK BRIDGE	8	4'-10"	38'-8"	2'-0"



ELEVATION
(Int. Bent 2)

WHIDDEN CREEK BRIDGE
JOSHUA CREEK BRIDGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: FIB - INT. BENT EASTBOUND BRIDGES
REF. DWG. NO.
PROJECT NAME: SR 70 ADD LANES AND RECONSTRUCT WEST OF SR 31 TO THE HIGHLANDS COUNTY LINE
SHEET NO. TBD

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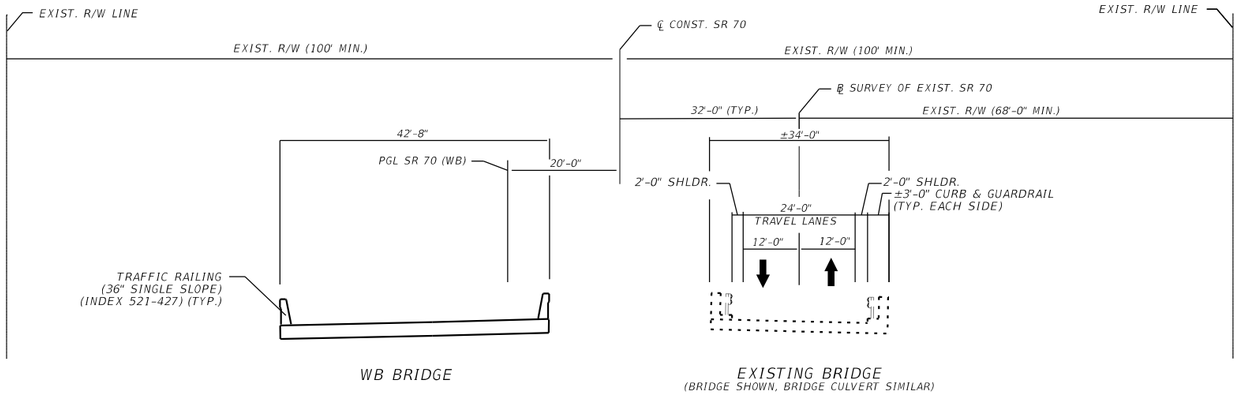

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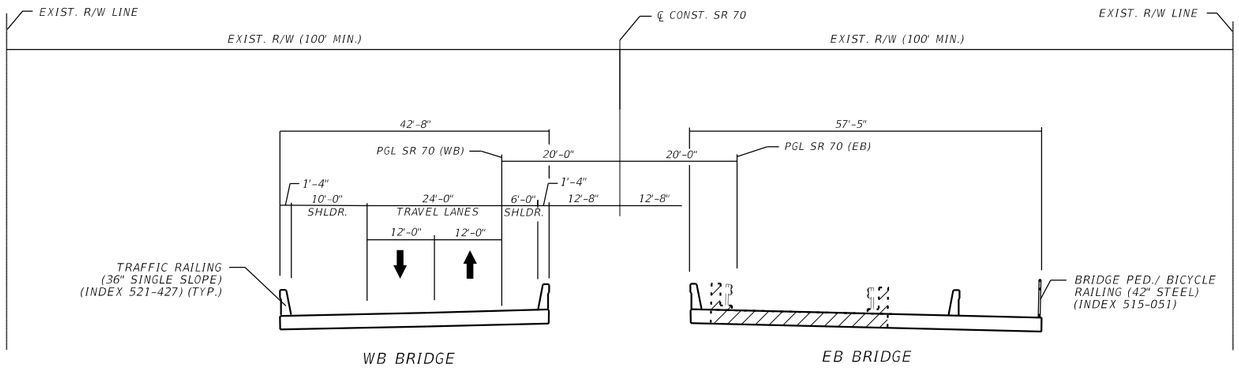

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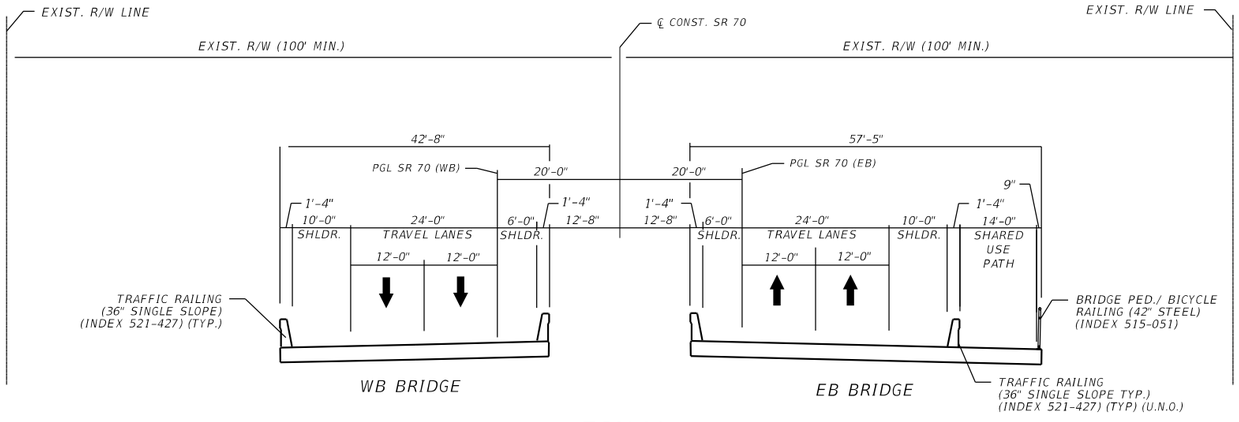

FINAL

PHASE I - CONSTRUCTION
1. CONSTRUCT WESTBOUND BRIDGE.

PHASE II - CONSTRUCTION
1. SHIFT TRAFFIC TO TWO LANES ON WESTBOUND BRIDGE.
2. REMOVE EXISTING BRIDGE OR BRIDGE CULVERT.
3. CONSTRUCT NEW EASTBOUND BRIDGE.

FINAL WORK
1. SHIFT TRAFFIC TO FINAL LOCATION ON BOTH BRIDGES.

NOTE
1. PROPOSED BRIDGE TYPICAL SECTIONS ARE SHOWN AT EXISTING BRIDGE CULVERT LOCATIONS. EASTBOUND AND WESTBOUND TYPICALS ARE SWAPPED AT BRIDGES OVER WHIDDEN & JUSHOA CREEK.

BRIDGE NOS. TBD

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE					

GJERGJI VASO, P.E.
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: CONSTRUCTION SEQUENCE
REF. DWG. NO.:
PROJECT NAME:
SHEET NO.: TBD

APPENDIX - D

BRIDGE DESIGN CALCULATIONS

Project: SR 70: Segment 9-10	**Job No:** 75614	**Design Criteria Document:** FDOT Structures Manual
Client: Desoto County – District 1	**Discipline:** Structures	**Calculation No:** 1

Name or Description of Calculation: Preliminary Bridge Profiles and Vertical Clearances

Note: Unique QF 06 to be created for each revision of a calculation.

Calc. Rev. No.	Description of Change (i.e., Original Issue or description of changes since last revision)	Confirmation required with other deliverables (Y/N)	List Deliverables for which confirmation is required (NA if none) Add additional rows as necessary	Confirmation Verified by Originator of Calc for each deliverable listed (Y/N)

Calculation Objective: Establish preliminary bridge vertical profiles to satisfy minimum required vertical clearances.

Calculation Methodology/List of Assumptions:

- The newly proposed dual bridge crossings over Whidden Creek and Joshua Creek shall be built to accommodate large mammals crossing on each side with an 8'-0" minimum vertical clearance. Proposed bridge over Joshua Creek shall also accommodate a pedestrian crossing with a 10'-0" minimum vertical clearance on the eastside.
- Five proposed open bridges at the existing bridge culvert locations, shall be built to accommodate small to medium mammals crossing with a 6'-0" minimum vertical clearance.
- Wildlife crossings to be a minimum of 1 foot above normal high water.
- 2'-0" minimum drainage drift clearance will be provided over design flood stage at all bridges.

References/Inputs: N/A

Attachments: (List each attachment following the subject calculation): NA

Conclusions: All bridge can be designed and constructed to provide adequate vertical clearances.

Document Check:	Name:	Signature:	Date:
Originator:	George Vaso	GGV	06/25
Checker:	Charles Boyd/Zaid Haddad	CEB	06/25
Backchecker:	George Vaso	GGV	06/25
Updater:	George Vaso	GGV	06/25
Verifier:	Charles Boyd/Zaid Haddad	CEB	06/25

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FLORIDA SLAB BEAM

PRELIMINARY PROFILES

(WHIDDEN CREEK)

PRELIMINARY VERTICAL CLEARANCE
SR 70 OVER WHIDDEN CREEK
(FSB OPTION)

Vert. Clearance for Wildlife Crossing

Existing Bridge #	Description	NHW Elev.	Elev. above NHW (ft)	Vert. Clearance Wildlife (ft)	Superstructure depth (ft)	Lowest Bridge Deck Elev. (At Coping Line)
40024	SR 70 over WHIDDEN CREEK	50.00	1.00	8.00	1.875	60.88

Vert. Clearance for High Water

Bridge #	Description	*Exist. High Water Elev.	Adjust NGVD 29 to NAVD 88	Adjust High Water Elev. to NAVD 88	FEMA 50- year Stage DHW	USE MAX DHW	MVC High Water to Bridge low point	Lowest Bridge Deck Elev.
40024	SR 70 over WHIDDEN CREEK	58.34	1.14	57.20	56.70	57.20	2.00	61.08

Bridge #	Description	Westbound Bridge top of Deck Elev.			Eastbound Bridge top of Deck Elev.		
		Lowest Elev.	PGL	Highest Elev.	Highest Elev.	PGL	Lowest Elev.
40024	SR 70 over WHIDDEN CREEK	61.59	62.30	62.45	62.45	62.300	61.30

Bridge #	Description	Provided Wildlife Crossing Clerance		Clearance Provided to High Water		**Check Vert. Clearance (Wildlife)**	**Check Vert. Clearance (Drift)**
		WB	EB	WB	EB		
40024	SR 70 over WHIDDEN CREEK	8.72	8.42	2.52	2.22	OK	OK

Values in RED are preliminary and subject to change
Manually Input PGL Value to satisfy high water and vertical clearance for wildlife
Superstructure Depth Input
Top of Wildlife Crossing: 6" min, 1 foot preferred, 1.5' max. above NHW
Clear Vertical Clearance: For bridges, 7' min, 8 foot preferred.
Bridge profile elevation shown above shall be satisfied along the entire bridge length
Superstructure Depth = 15/12+6.5/12+1/12 = 1.88' (Assumens 1" Final Camber)
*Per exiting plans 1957-1958

FLORIDA SLAB BEAM

PRELIMINARY PROFILES

(JOSHUA CREEK)

PRELIMINARY VERTICAL CLEARANCE
SR 70 OVER JOSHUA CREEK
(FSB OPTION)

Vert. Clearance for Wildlife Crossing

Existing Bridge #	Description	NHW Elev.	Elev. above NHW (ft)	Vert. Clearance Wildlife (ft)	Superstructure depth (ft)	Lowest Bridge Deck Elev. (At Coping Line)
40027	SR 70 over JOSHUA CREEK	54.80	1.00	8.00	1.875	65.68

Vert. Clearance for High Water

Bridge #	Description	*Exist. High Water Elev.	Adujust NGVD 29 to NAVD 88	Adjust High Water Elev. to NAVD 88	FEMA 50- year Stage DHW	USE MAX DHW	MVC High Water to Bridge low point	Lowest Bridge Deck Elev.
40027	SR 70 over JOSHUA CREEK	61.70	1.17	60.53	62.20	62.20	2.00	66.08

Vert. Clearance for Pedestrian Underpass

Bridge #	Description	10 year Flood Stage Elev.	Min. Vertical Clearance (ft)	Lowest Bridge Deck Elev.
40027	SR 70 over JOSHUA CREEK	60.00	10	**71.88**

Pedestrian Underpass Controls Vertical Profile

Bridge #	Description	Westbound Bridge top of Deck Elev.			Eastbound Bridge top of Deck Elev.		
		Lowest Elev.	PGL	Highest Elev.	Highest Elev.	PGL	Lowest Elev.
40027	SR 70 over JOSHUA CREEK	72.00	**73.00**	73.15	73.15	**73.00**	72.29

Bridge #	Description	Provided Pedestrian Underpass Clearance		**Check Vert. Underpass**
		WB	EB	
40027	SR 70 over JOSHUA CREEK	10.12	10.42	OK

Values in RED are preliminary and subject to change
Manually Input PGL Value to satisfy high water and vertical clearance for wildlife
SuperStructure Depth Input
Top of Wildlife Crossing: 6" min, 1 foot preferred, 1.5' max. above NHW
Clear Vertical Clearance for pedestrians: 10' minimum above 10 year flood event.
Clear Vertical Clearance: For bridges, 7' min, 8 foot preferred.
Bridge profile elevation shown above shall be satisfied along the entire bridge length
Superstructure Depth = 15/12+6.5/12+1/12 = 1.88' (Assumens 1" Final Camber)
*Per exiting plans 1957-1958

FLORIDA SLAB BEAM

PRELIMINARY PROFILES

(TIGER BAY)

(MOSSY GULLY)

(DCI CANAL)

(LONG POINT MARSH)

(PARKER CREEK)

HNTB

PRELIMINARY VERTICAL CLEARANCE
SR 70 OVER EXISTING BRIDGE CULVERTS
(FSB OPTION)

Vert. Clearance for Wildlife Crossing & Drift Clearance

Bridge Number & Location		NHW Elev. (Table below)	DHW Elev. (Table below)	Elev. above NHW for Wildlife (ft)	Vert. Clearance for wildlife (ft)	Super/depth (ft)	Drift Clearance (ft)	Min. Top of Deck Elev. (Per NHW)	Min. Top of Deck Elev. (Per DHW)
Existing Bridge #	Description								
040031	SR 70 over TIGER BAY	70.60	72.83	1	6	1.83	2	79.43	76.66
040032	SR 70 over MOSSY GULLY	71.70	74.73	1	6	1.83	2	80.53	78.56
040033	SR 70 over D.C.I. CANAL	71.30	75.13	1	6	1.83	2	80.13	78.96
040037	SR 70 over LONG POINT MARSH	78.20	81.00	1	6	1.83	2	87.03	84.83
040940	SR 70 over PARKER CREEK	80.40	82.83	1	6	1.83	2	89.23	86.66

Existing Bridge #	Description	Westbound Bridge top of Deck Elev.			Eastbound Bridge top of Deck Elev.		
		Lowest Elev. (At Coping Line)	PGL	Highest Elev.	Highest Elev.	PGL	Lowest Elev. (At Coping Line)
040031	SR 70 over TIGER BAY	79.73	80.44	80.59	80.59	80.440	79.44
040032	SR 70 over MOSSY GULLY	80.83	81.54	81.69	81.69	81.540	80.54
040033	SR 70 over D.C.I. CANAL	80.43	81.14	81.29	81.29	81.140	80.14
040037	SR 70 over LONG POINT MARSH	87.33	88.04	88.19	88.19	88.040	87.04
040940	SR 70 over PARKER CREEK	89.53	90.24	90.39	90.39	90.240	89.24

Existing Bridge #	Description	Wildlife Crossing Clerance (ft)		Drift Clearance (ft)		**Check Vert. Clearance (Wildlife)**	**Check Vert. Clearance (Drift)**
		WB	EB	WB	EB		
040031	SR 70 over TIGER BAY	6.30	6.005	5.07	4.78	OK	OK
040032	SR 70 over MOSSY GULLY	6.30	6.005	4.27	3.98	OK	OK
040033	SR 70 over D.C.I. CANAL	6.30	6.005	3.47	3.18	OK	OK
040037	SR 70 over LONG POINT MARSH	6.30	6.005	4.50	4.21	OK	OK
040940	SR 70 over PARKER CREEK	6.30	6.005	4.87	4.58	OK	OK

Values in RED are preliminary and subject to change

Manually Input PGL Value to satisfy drift and vertical clearance for wildlife. PGL for EB and WB are set at the same elevation.

SuperStructure Depth Input

Top of Wildlife Crossing: 6" min, 1 foot preferred, 1.5' max. above NHW

Clear Vertical Clearance: For bridges, 6' minimum (5.5' per D1 guidance)

Bridge profile elevation shown above shall be satisfied along the entire bridge length

Superstructure Depth = 15/12+6/12+1/12 = 1.83' (Short Bridge - Assume 1" Final Camber)

FLORIDA-I BEAM

PRELIMINARY PROFILES

(WHIDDEN CREEK)

PRELIMINARY VERTICAL CLEARANCE
SR 70 OVER WHIDDEN CREEK
(FIB OPTION)

Vert. Clearance for Wildlife Crossing

Existing Bridge #	Description	NHW Elev.	Elev. above NHW (ft)	Vert. Clearance Wildlife (ft)	Superstructure depth (ft)	Lowest Bridge Deck Elev. (At Coping Line)
40024	SR 70 over WHIDDEN CREEK	50.00	1.00	8.00	4.000	63.00

Vert. Clearance for High Water

Bridge #	Description	*Exist. High Water Elev.	Adjust NGVD 29 to NAVD 88	Adjust High Water Elev. to NAVD 88	FEMA 50- year Stage DHW	USE MAX DHW	MVC High Water to Bridge low point	Lowest Bridge Deck Elev.
40024	SR 70 over WHIDDEN CREEK	58.34	1.14	57.20	56.70	57.20	2.00	63.20

Bridge #	Description	Westbound Bridge top of Deck Elev.			Eastbound Bridge top of Deck Elev.		
		Lowest Elev.	PGL	Highest Elev.	Highest Elev.	PGL	Lowest Elev.
40024	SR 70 over WHIDDEN CREEK	63.50	64.50	64.65	64.65	64.500	63.79

Bridge #	Description	Provided Wildlife Crossing Clerance		Clearance Provided to High Water		**Check Vert. Clearance (Wildlife)**	**Check Vert. Clearance (Drift)**
		WB	EB	WB	EB		
40024	SR 70 over WHIDDEN CREEK	8.50	8.79	2.30	2.59	OK	OK

Values in RED are preliminary and subject to change
Manually Input PGL Value to satisfy high water and vertical clearance for wildlife
SuperStructure Depth Input
Top of Wildlife Crossing: 6" min, 1 foot preferred, 1.5' max. above NHW
Clear Vertical Clearance: For bridges, 7' min, 8 foot preferred.
Bridge profile elevation shown above shall be satisfied along the entire bridge length
Superstructure Depth = FIB36 +1' for deck & buildup
*Per exiting plans 1957-1958

FLORIDA-I BEAM

PRELIMINARY PROFILES

(JOSHUA CREEK)

PRELIMINARY VERTICAL CLEARANCE
SR 70 OVER JOSHUA CREEK
(FIB OPTION)

Vert. Clearance for Wildlife Crossing

Existing Bridge #	Description	NHW Elev.	Elev. above NHW (ft)	Vert. Clearance Wildlife (ft)	Superstructure depth (ft)	Lowest Bridge Deck Elev. (At Coping Line)
40027	SR 70 over JOSHUA CREEK	54.80	1.00	8.00	4.000	67.80

Vert. Clearance for High Water

Bridge #	Description	*Exist. High Water Elev.	Adjust NGVD 29 to NAVD 88	Adjust High Water Elev. to NAVD 88	FEMA 50- year Stage DHW	USE MAX DHW	MVC High Water to Bridge low point	Lowest Bridge Deck Elev.
40027	SR 70 over JOSHUA CREEK	61.70	1.17	60.53	62.20	62.20	2.00	68.20

Vert. Clearance for Pedestrian Underpass

Bridge #	Description	10 year Flood Stage Elev.	Min. Vertical Clearance (ft)	Lowest Bridge Deck Elev.
40027	SR 70 over JOSHUA CREEK	60.00	10	**74.00**

Pedestrian Underpass Controls Vertical Profile

Bridge #	Description	Westbound Bridge top of Deck Elev.			Eastbound Bridge top of Deck Elev.		
		Lowest Elev.	PGL	Highest Elev.	Highest Elev.	PGL	Lowest Elev.
40027	SR 70 over JOSHUA CREEK	74.25	**75.25**	75.40	75.40	**75.25**	74.54

Bridge #	Description	Provided Pedestrian Underpass Clearance		**Check Vert. Underpass**
		WB	EB	
40027	SR 70 over JOSHUA CREEK	10.25	10.54	OK

Values in RED are preliminary and subject to change
Manually Input PGL Value to satisfy high water and vertical clearance for wildlife
SuperStructure Depth Input
Top of Wildlife Crossing: 6" min, 1 foot preferred, 1.5' max. above NHW
Clear Vertical Clearance for pedestrians: 10' minimum above 10 year flood event.
Clear Vertical Clearance: For bridges, 7' min, 8 foot preferred.
Bridge profile elevation shown above shall be satisfied along the entire bridge length
Superstructure Depth = FIB36 +1' for deck & buildup
*Per exiting plans 1957-1958

FLORIDA-I BEAM

PRELIMINARY PROFILES

(TIGER BAY)

(MOSSY GULLY)

(DCI CANAL)

(LONG POINT MARSH)

(PARKER CREEK)

HNTB

PRELIMINARY VERTICAL CLEARANCE
SR 70 OVER EXISTING BRIDGE CULVERTS
(FIB OPTION)

Vert. Clearance for Wildlife Crossing & Drift Clearance

Bridge Number & Location		NHW Elev. (Table below)	DHW Elev. (Table below)	Elev. above NHW for Wildlife (ft)	Vert. Clearance for wildlife (ft)	Super/depth (ft)	Drift Clearance (ft)	Min. Top of Deck Elev. (Per NHW)	Min. Top of Deck Elev. (Per DHW)
Existing Bridge #	Description								
040031	SR 70 over TIGER BAY	70.60	72.83	1	6	4.00	2	81.60	78.83
040032	SR 70 over MOSSY GULLY	71.70	74.73	1	6	4.00	2	82.70	80.73
040033	SR 70 over D.C.I. CANAL	71.30	75.13	1	6	4.00	2	82.30	81.13
040037	SR 70 over LONG POINT MARSH	78.20	81.00	1	6	4.00	2	89.20	87.00
040940	SR 70 over PARKER CREEK	80.40	82.83	1	6	4.00	2	91.40	88.83

Existing Bridge #	Description	Westbound Bridge top of Deck Elev.			Eastbound Bridge top of Deck Elev.		
		Lowest Elev. (At Coping Line)	PGL	Highest Elev.	Highest Elev.	PGL	Lowest Elev. (At Coping Line)
040031	SR 70 over TIGER BAY	81.90	82.61	82.76	82.76	82.610	81.61
040032	SR 70 over MOSSY GULLY	83.00	83.71	83.86	83.86	83.710	82.71
040033	SR 70 over D.C.I. CANAL	82.60	83.31	83.46	83.46	83.310	82.31
040037	SR 70 over LONG POINT MARSH	89.50	90.21	90.36	90.36	90.210	89.21
040940	SR 70 over PARKER CREEK	91.70	92.41	92.56	92.56	92.410	91.41

Existing Bridge #	Description	Wildlife Crossing Clerance (ft)		Drift Clearance (ft)		**Check Vert. Clearance (Wildlife)**	**Check Vert. Clearance (Drift)**
		WB	EB	WB	EB		
040031	SR 70 over TIGER BAY	6.30	6.008	5.07	4.78	OK	OK
040032	SR 70 over MOSSY GULLY	6.30	6.008	4.27	3.98	OK	OK
040033	SR 70 over D.C.I. CANAL	6.30	6.008	3.47	3.18	OK	OK
040037	SR 70 over LONG POINT MARSH	6.30	6.008	4.50	4.21	OK	OK
040940	SR 70 over PARKER CREEK	6.30	6.008	4.87	4.58	OK	OK

Values in RED are preliminary and subject to change

Manually Input PGL Value to satisfy drift and vertical clearance for wildlife. PGL for EB and WB are set at the same elevation.

SuperStructure Depth Input

Top of Wildlife Crossing: 6" min, 1 foot preferred, 1.5' max. above NHW

Clear Vertical Clearance: For bridges, 6' minimum (5.5' per D1 guidance)

Bridge profile elevation shown above shall be satisfied along the entire bridge length

Superstructure Depth = FIB36 +1' for deck & buildup

PRELIMINARY VERTICAL CLEARANCE
SR 70 OVER EXISTING BRIDGE CULVERTS
(FIB OPTION)

Vert. Clearance for Wildlife Crossing & Drift Clearance

Bridge Number & Location		NHW Elev. (Table below)	DHW Elev. (Table below)	Elev. above NHW for Wildlife (ft)	Vert. Clearance for wildlife (ft)	Super/depth (ft)	Drift Clearance (ft)	Min. Top of Deck Elev. (Per NHW)	Min. Top of Deck Elev. (Per DHW)
Existing Bridge #	Description								
040031	SR 70 over TIGER BAY	70.60	72.83	1	6	4.00	2	81.60	78.83
040032	SR 70 over MOSSY GULLY	71.70	74.73	1	6	4.00	2	82.70	80.73
040033	SR 70 over D.C.I. CANAL	71.30	75.13	1	6	4.00	2	82.30	81.13
040037	SR 70 over LONG POINT MARSH	78.20	81.00	1	6	4.00	2	89.20	87.00
040940	SR 70 over PARKER CREEK	80.40	82.83	1	6	4.00	2	91.40	88.83

Existing Bridge #	Description	Westbound Bridge top of Deck Elev.			Eastbound Bridge top of Deck Elev.		
		Lowest Elev. (At Coping Line)	PGL	Highest Elev.	Highest Elev.	PGL	Lowest Elev. (At Coping Line)
040031	SR 70 over TIGER BAY	81.90	82.61	82.76	82.76	82.610	81.61
040032	SR 70 over MOSSY GULLY	83.00	83.71	83.86	83.86	83.710	82.71
040033	SR 70 over D.C.I. CANAL	82.60	83.31	83.46	83.46	83.310	82.31
040037	SR 70 over LONG POINT MARSH	89.50	90.21	90.36	90.36	90.210	89.21
040940	SR 70 over PARKER CREEK	91.70	92.41	92.56	92.56	92.410	91.41

Existing Bridge #	Description	Wildlife Crossing Clerance (ft)		Drift Clearance (ft)		**Check Vert. Clearance (Wildlife)**	**Check Vert. Clearance (Drift)**
		WB	EB	WB	EB		
040031	SR 70 over TIGER BAY	6.30	6.008	5.07	4.78	OK	OK
040032	SR 70 over MOSSY GULLY	6.30	6.008	4.27	3.98	OK	OK
040033	SR 70 over D.C.I. CANAL	6.30	6.008	3.47	3.18	OK	OK
040037	SR 70 over LONG POINT MARSH	6.30	6.008	4.50	4.21	OK	OK
040940	SR 70 over PARKER CREEK	6.30	6.008	4.87	4.58	OK	OK

Values in RED are preliminary and subject to change

Manually Input PGL Value to satisfy drift and vertical clearance for wildlife. PGL for EB and WB are set at the same elevation.

SuperStructure Depth Input

Top of Wildlife Crossing: 6" min, 1 foot preferred, 1.5' max. above NHW

Clear Vertical Clearance: For bridges, 6' minimum (5.5' per D1 guidance)

Bridge profile elevation shown above shall be satisfied along the entire bridge length

Superstructure Depth = FIB36 +1' for deck & buildup

Project: SR 70: Segment 9-10	**Job No:** 75614	**Design Criteria Document:** FDOT Structures Manual
Client: Desoto County – District 1	**Discipline:** Structures	**Calculation No:** 1

Name or Description of Calculation: Beam Design

Note: Unique QF 06 to be created for each revision of a calculation.

Calc. Rev. No.	Description of Change (i.e., Original Issue or description of changes since last revision)	Confirmation required with other deliverables (Y/N)	List Deliverables for which confirmation is required (NA if none) Add additional rows as necessary	Confirmation Verified by Originator of Calc for each deliverable listed (Y/N)

Calculation Objective: Pre; Preliminary beam design for the FSB and FIB alternative for the applicable span lengths.

Calculation Methodology/List of Assumptions: Prestressed Beam v6.2 FDOT software was utilized to design simple span prestressed beams FSB15 and FIB36 in accordance with the AASHTO LRFD Bridge Design Specifications.

References/Inputs: N/A

Attachments: (List each attachment following the subject calculation)

Conclusions: Both FSB15 and FIB36 are feasible superstructure beam alternatives.

Document Check:	Name:	Signature:	Date:
Originator:	George Vaso	GGV	06/25
Checker:	Charles Boyd/ Zaid Haddad	CEB	06/25
Backchecker:	George Vaso	GGV	06/25
Updater:	George Vaso	GGV	06/25
Verifier:	Charles Boyd/ Zaid Haddad	CEB	06/25

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FLORIDA SLAB BEAM DESIGN ALTERNATIVE

HNTB

15” FLORIDA SLAB BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 38 FEET (NO SKEW)
WESTBOUND BRIDGE
(TIGER BAY)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\WB 38' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-38ftSpan-15inx56in_15SkewExtBeam.dat
FSB-38ftSpan-15inx56in_15SkewIntBeam.dat
FSB-38ftSpan-15inx56in_ExtBeam.dat
FSB-38ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

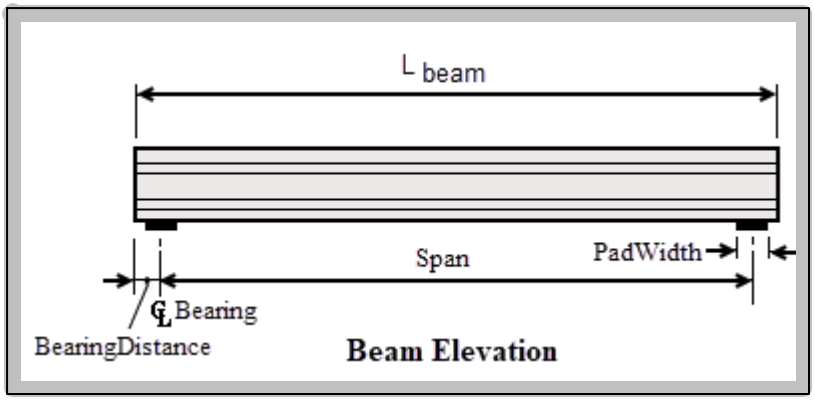
InputDataFile = "FSB-38ftSpan-15inx56in_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



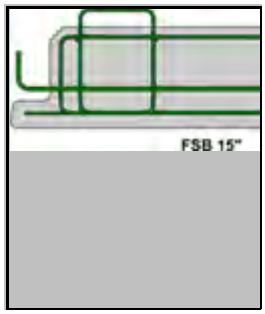
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-38ftSpan-15inx56in_ExtBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	37.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

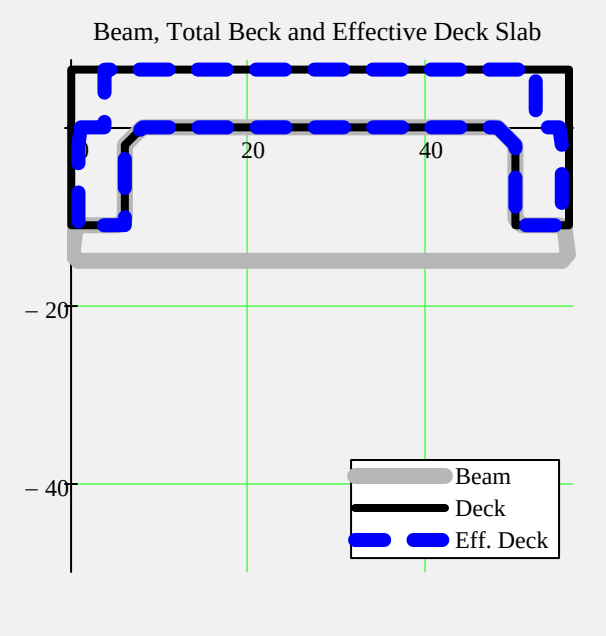
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 56.07 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.55 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 37.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

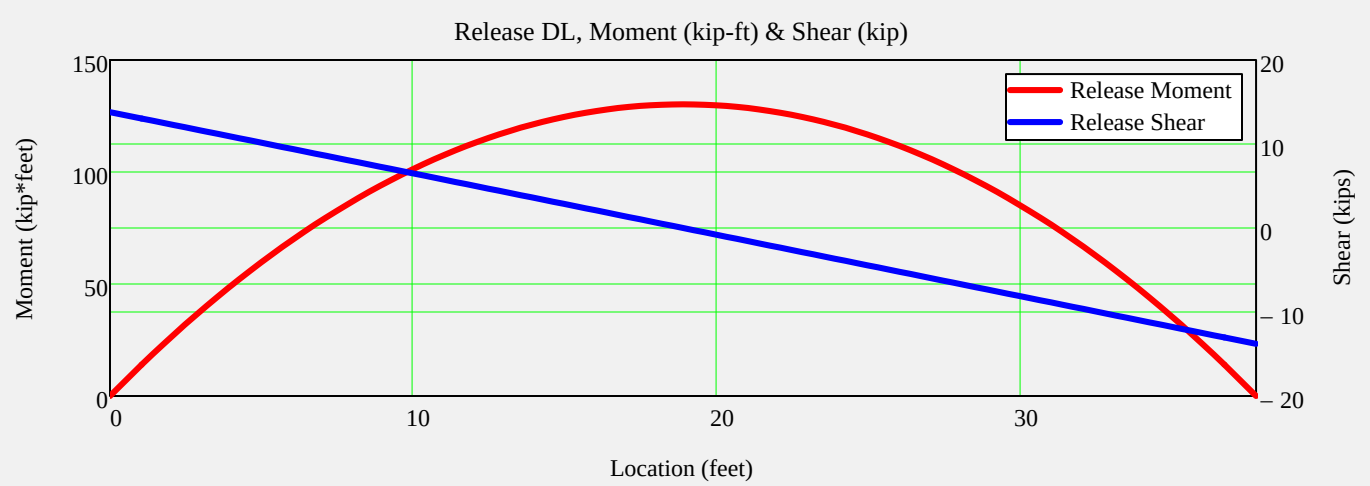
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

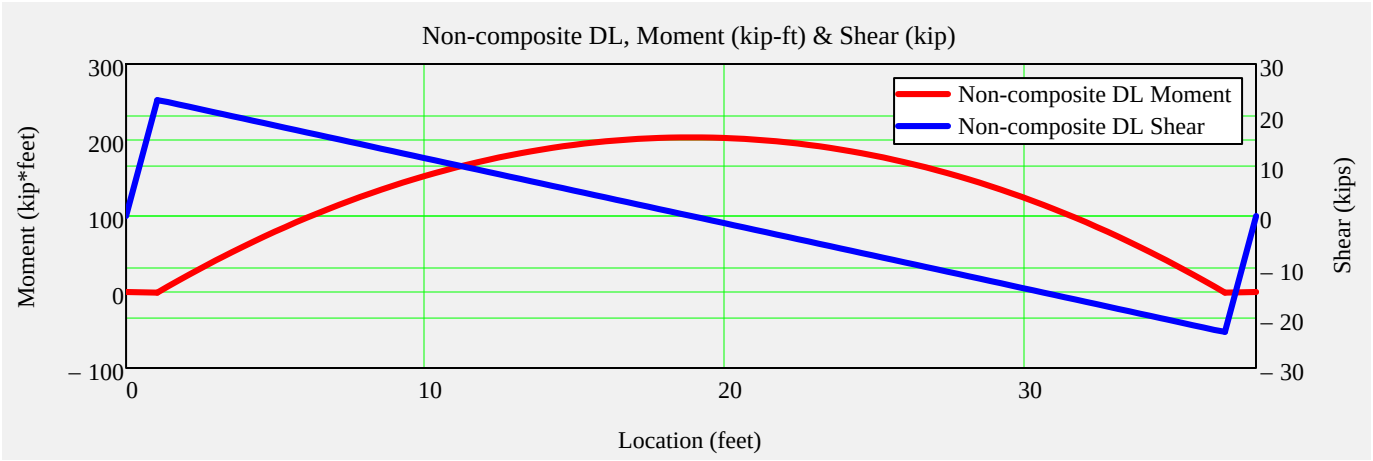
Release Dead Load Moments and Shears

$L_{span} = 35.67\ ft$



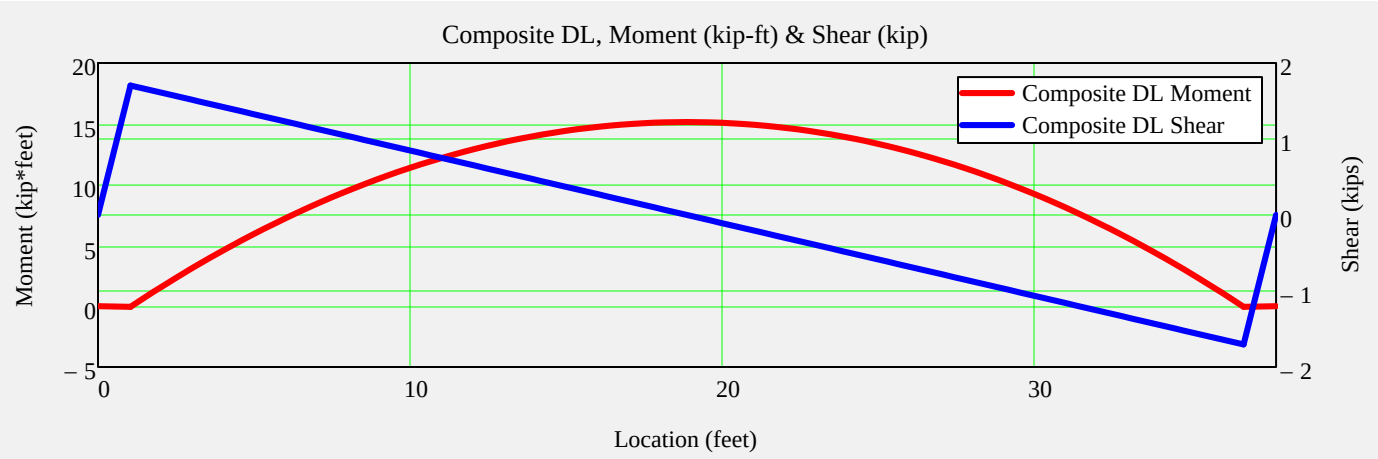
$\max(V_{release}) = 13.8 \cdot kip$ $\max(M_{release}) = 130.2 \cdot kip \cdot ft$ $\min(V_{release}) = -13.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 22.9 \cdot kip$ $\max(M_{dl.non.comp}) = 203.4 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -22.9 \cdot kip$

Composite Dead Load Moments and Shear



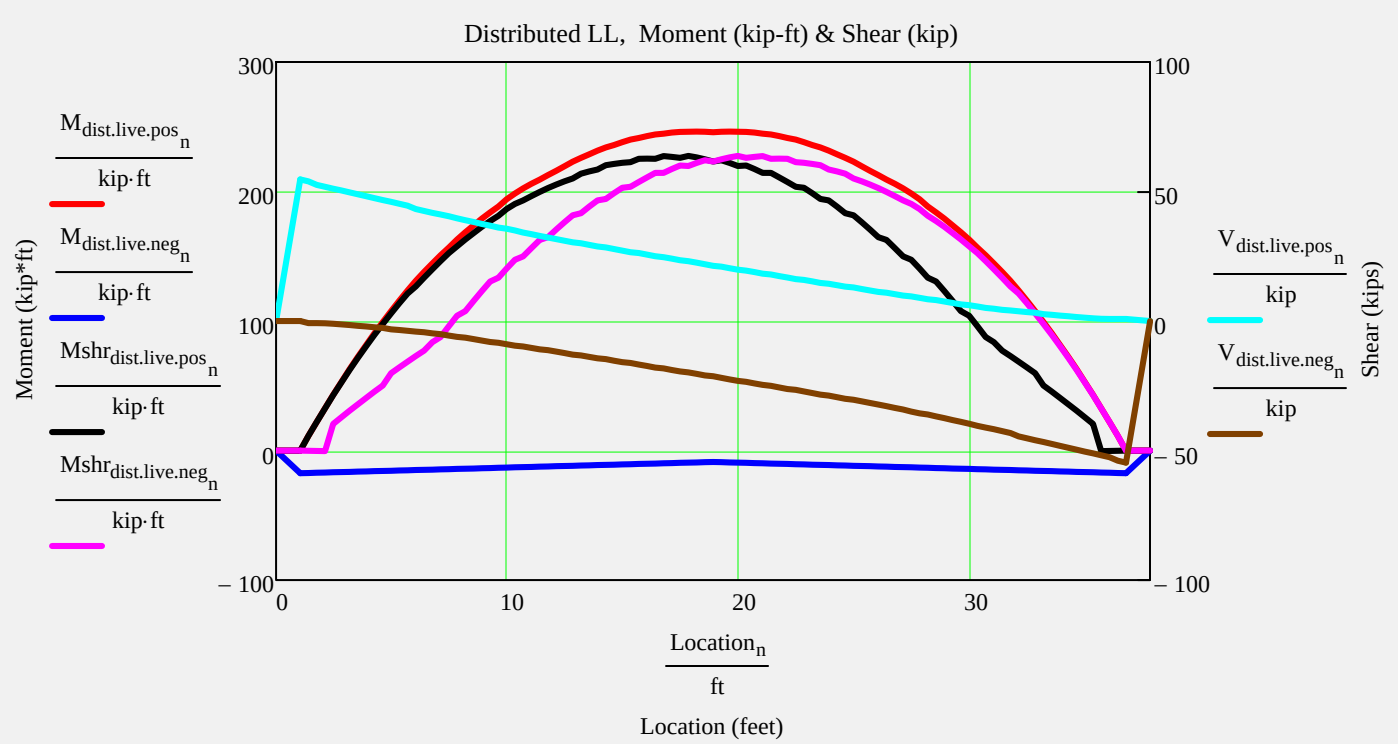
$\max(V_{dl.comp}) = 1.7 \cdot kip$ $\max(M_{dl.comp}) = 15.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -1.7 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 35.67\ ft$ BeamSpacing = 4.67 ft Skew = 0·deg

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor = 1.00

Final Live Load Distribution Factors: $g_{mom} = 0.39$ $g_{mom.fatigue} = 0.25$ $g_{shear} = 0.67$



$\max(V_{dist.live.pos}) = 54.7\cdot kip$

$\max(M_{dist.live.pos}) = 246.3\cdot kip\cdot ft$

$\min(V_{dist.live.neg}) = -54.7\cdot kip$

$Reaction_{LL} = 57.0\cdot kip$

$\min(M_{dist.live.neg}) = -17.5\cdot kip\cdot ft$

$Reaction_{DL} = 26.0\cdot kip$

$\max(Mshr_{dist.live.pos}) = 228\cdot kip\cdot ft$

Beam End Reactions... with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

$Reaction_{truck} = 55.26\cdot kip$ $Reaction_{lane} = 12.08\cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane})\cdot g_{shear}$

Beam End Reactions... without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{LL.without.IM} = 44.88\cdot kip$

Reinforcement Properties

InputDataFile = "FSB-38ftSpan-15inx56in_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

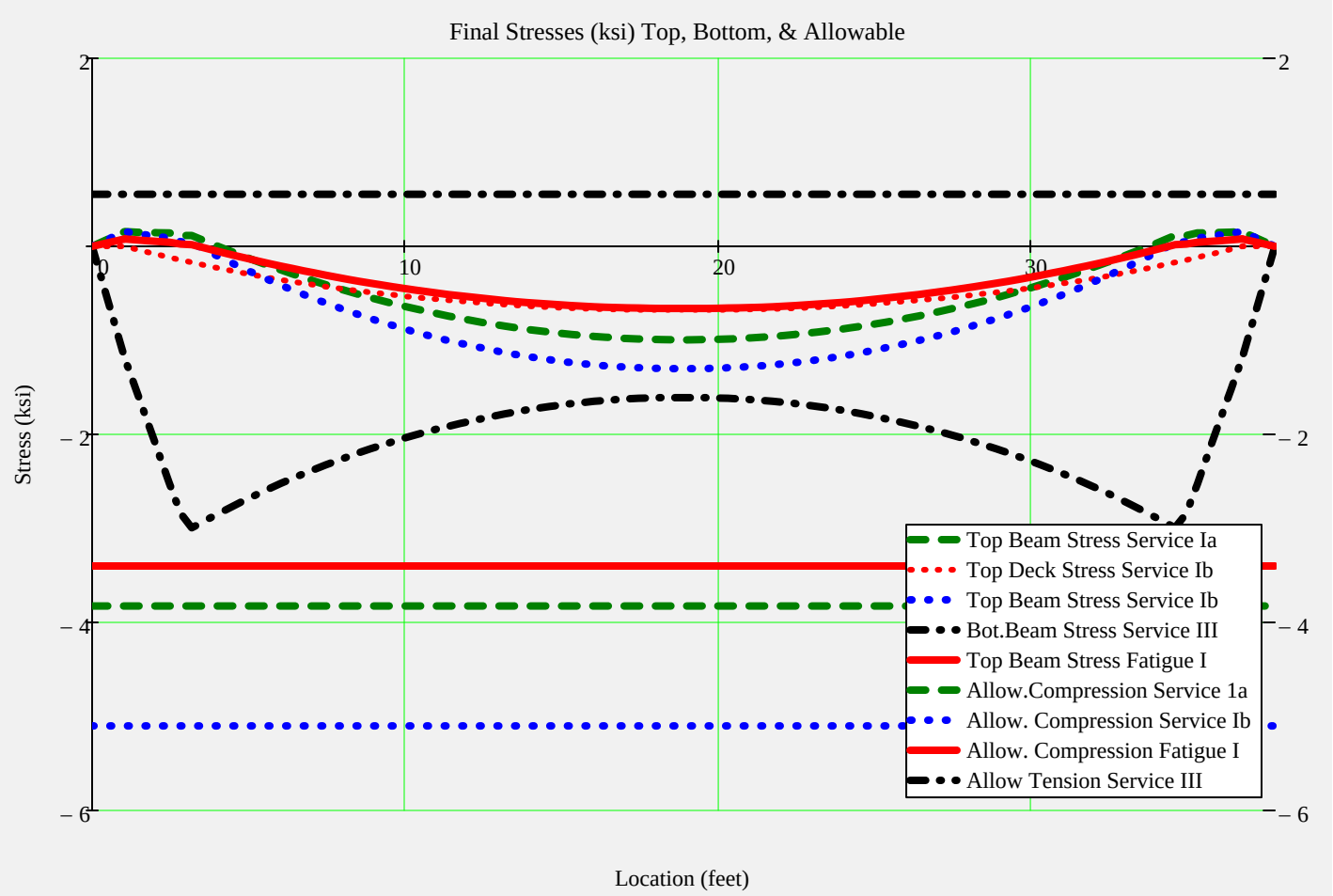
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses

Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.93$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.26$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.26$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.19$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.21	0.59
"Compression @ Release"	3.18	–3.62	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	18.88	–0.99	–3.83
"CompressionIb @ ServiceI"	18.88	–1.30	–5.10
"Compression @ FatigueI"	18.88	–0.66	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

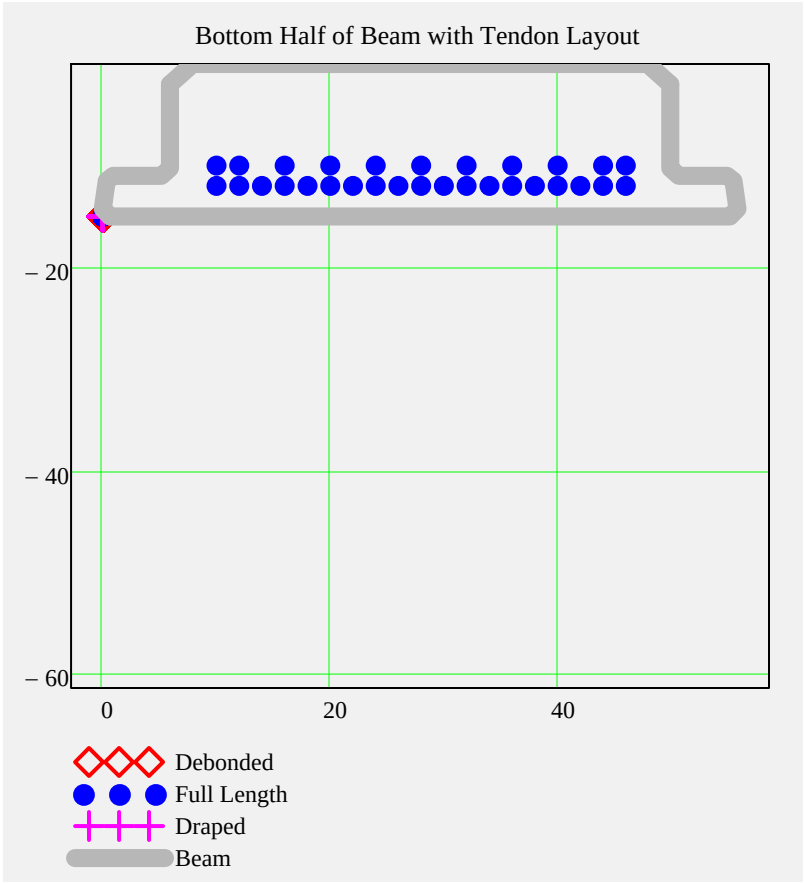
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

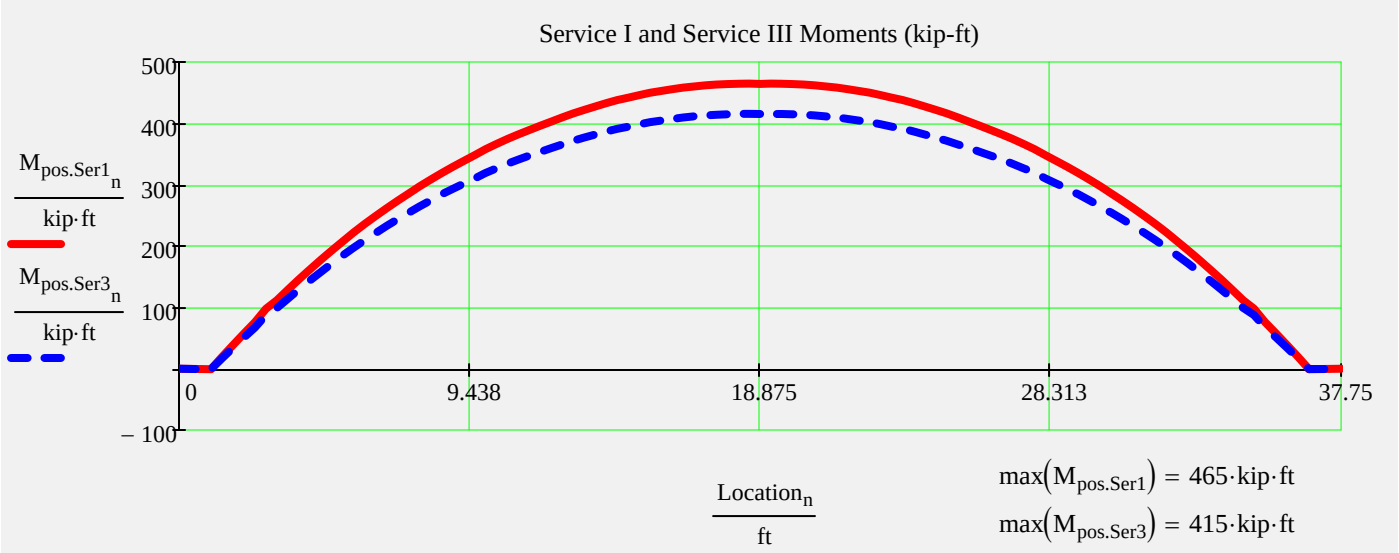
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 465 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 415 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.41 & -3.08 \\ \text{"2"} & -0.47 & -2.64 \\ \text{"4"} & -0.37 & -2.72 \\ \text{"6"} & -0.98 & -2.20 \\ \text{"8"} & -1.30 & -1.61 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1173.3	44867	–4.7

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	130
"Non-Composite DL (incl. beam wt.)"	203
"Composite Dead Load"	15
"Distributed Live Load"	246

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

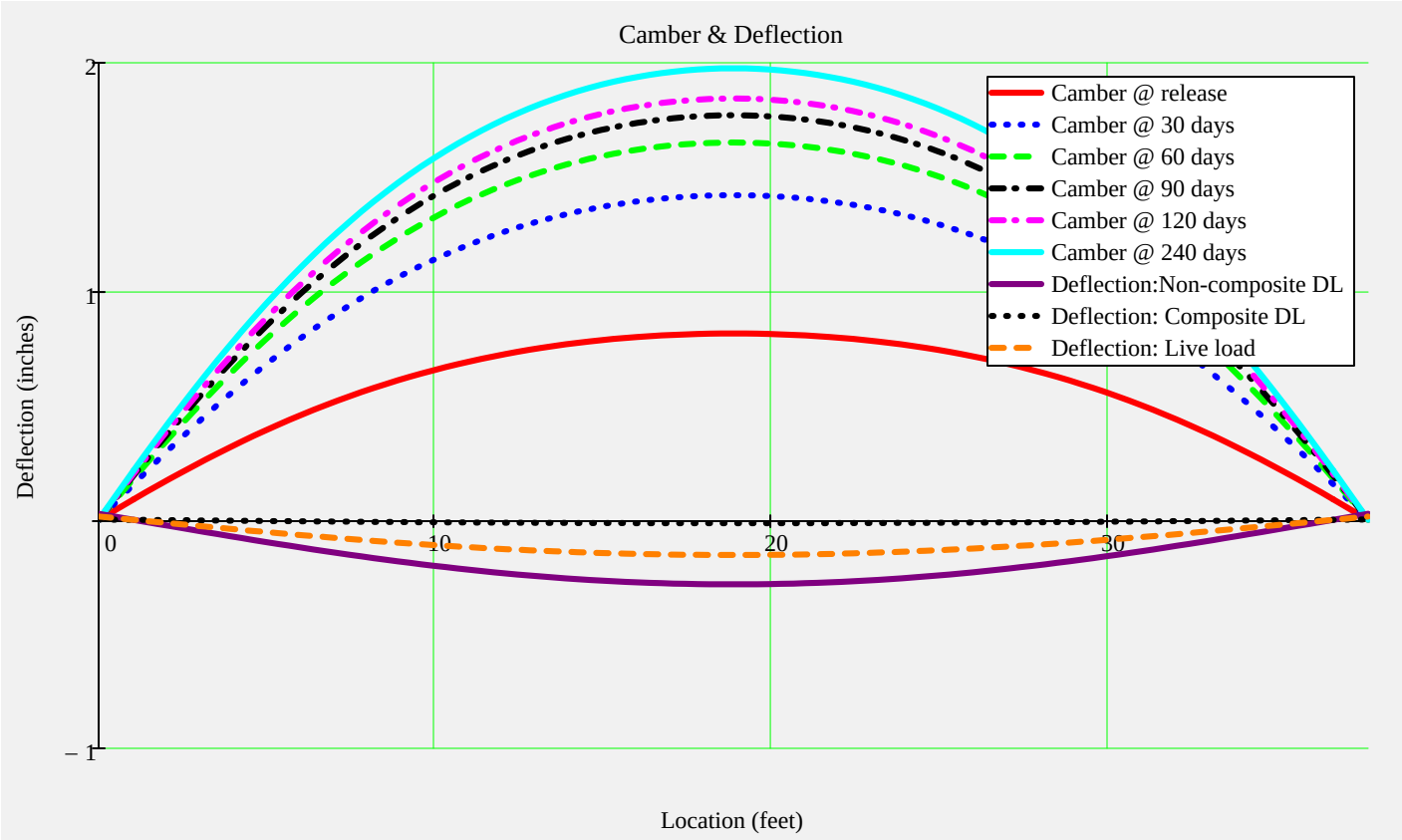
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 35.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.30	0.42	0.82
"30 Days"	–0.09	–0.56	0.72	1.42
"60 Days"	–0.12	–0.66	0.84	1.65
"90 Days"	–0.13	–0.71	0.90	1.77
"120 Days"	–0.14	–0.74	0.94	1.84
"240 Days"	–0.16	–0.79	1.00	1.98
"Non-comp DL"	–0.03	0.03	–0.12	–0.28
"Comp DL"	–0.00	0.00	–0.01	–0.02
"LL"	–0.01	0.02	–0.07	–0.15

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.55 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

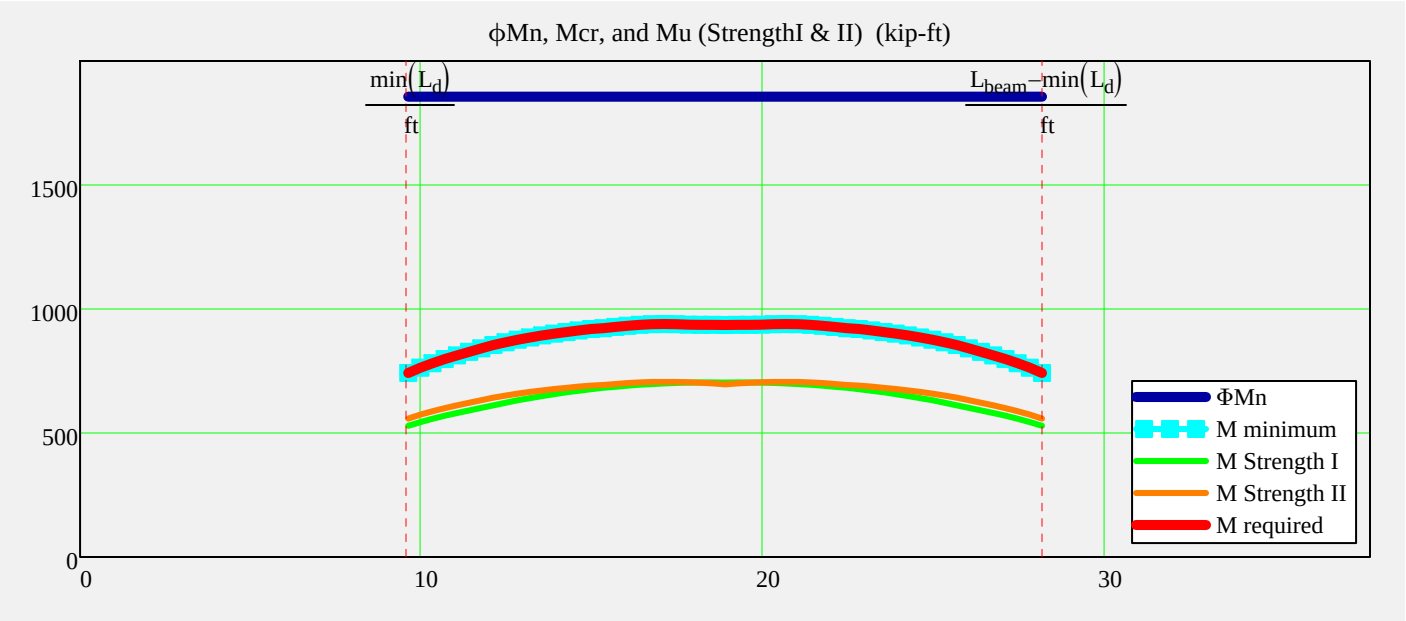
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 706 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 935 \cdot kip \cdot ft$ $M_{reqd_{51}} = 935 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1856 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 28.2\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.51$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

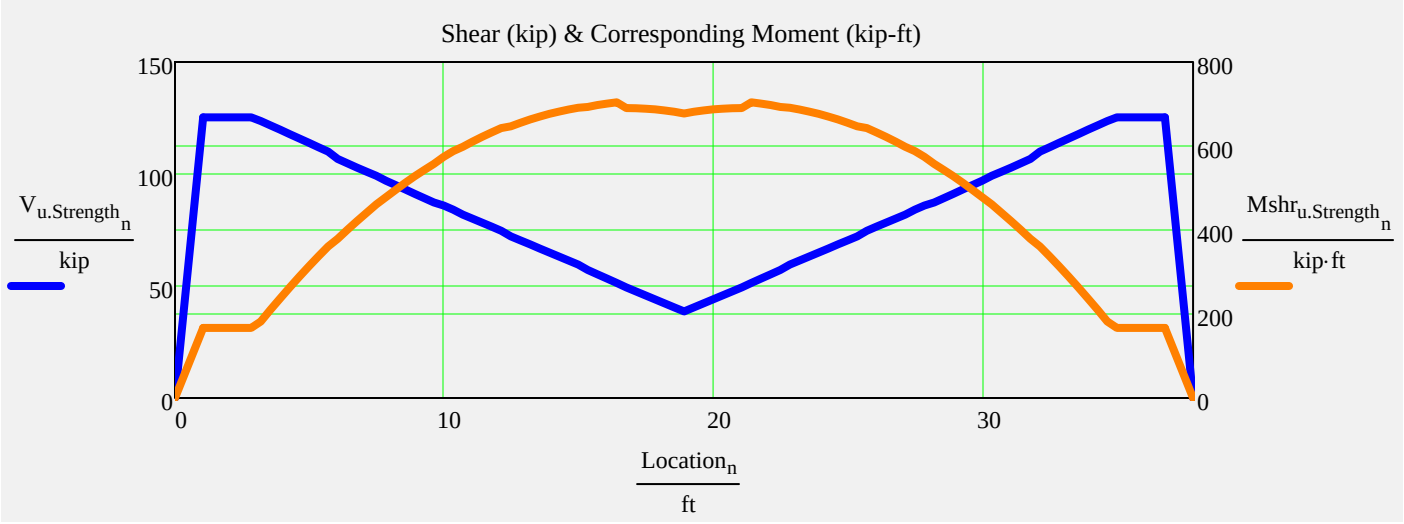
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

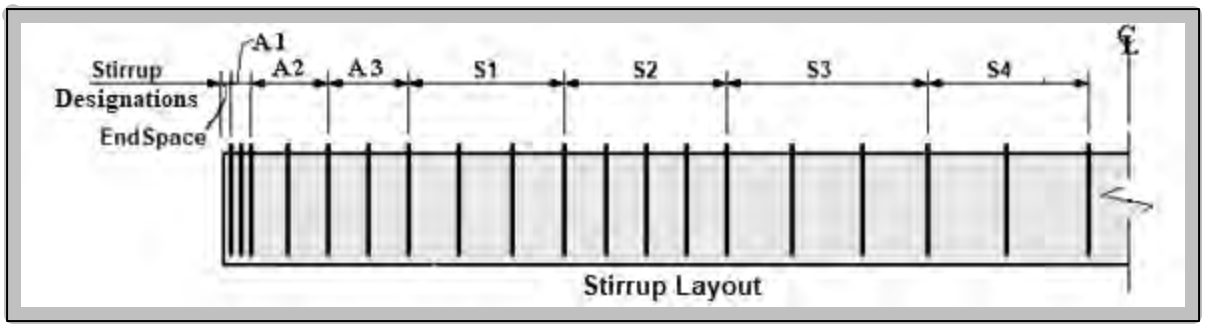
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 126 \\ 137 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 125.3 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 704 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

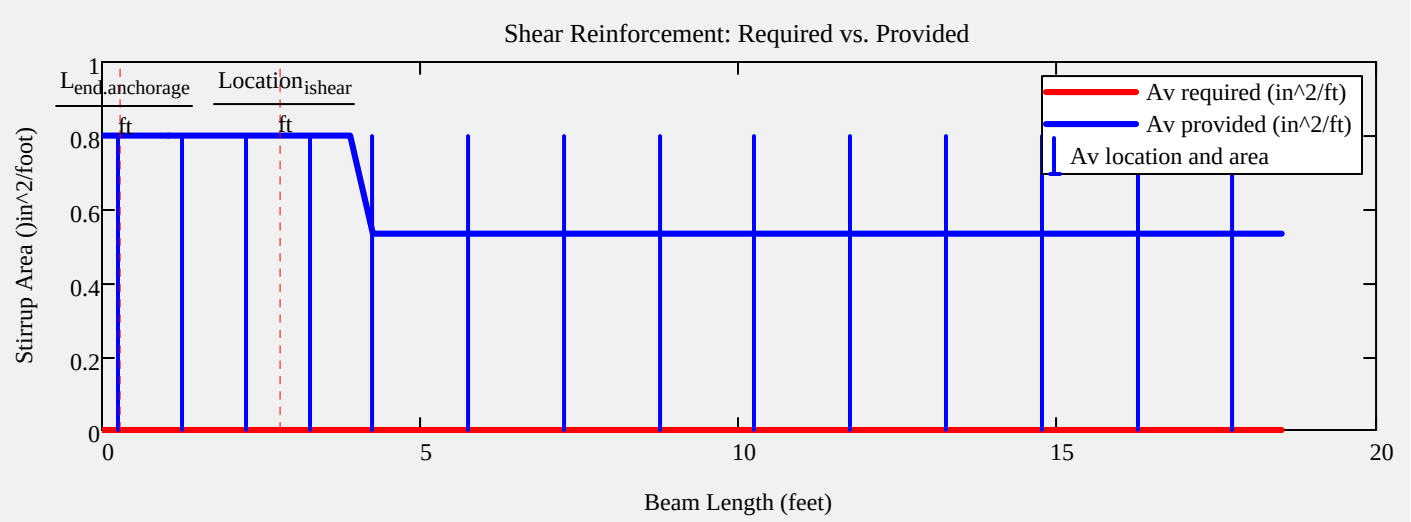
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.83\ ft$

Save Data File

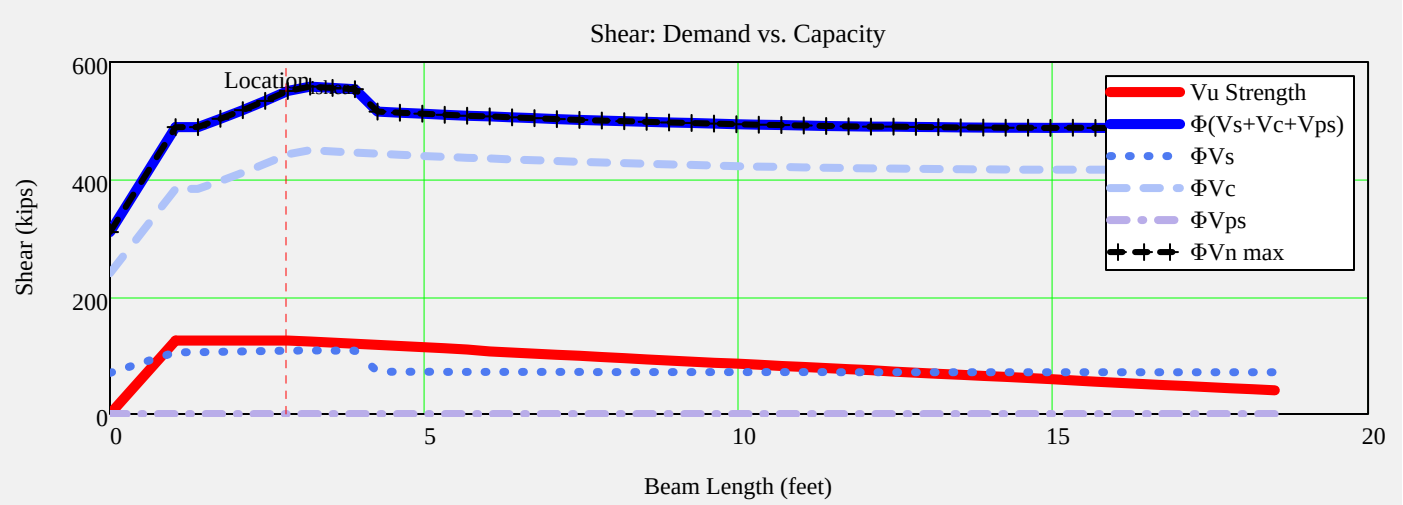
Use current input file

File Name FSB-38ftSpan-15inx56in_ExtBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

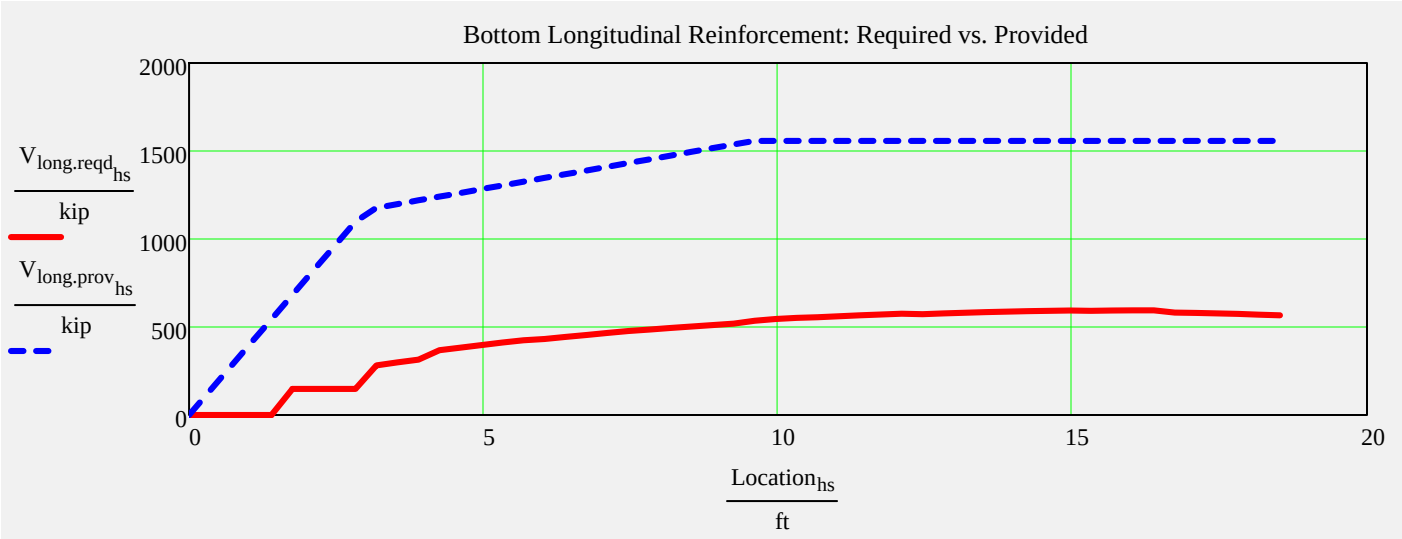
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.25 & 117.81 & 515.59 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.23$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

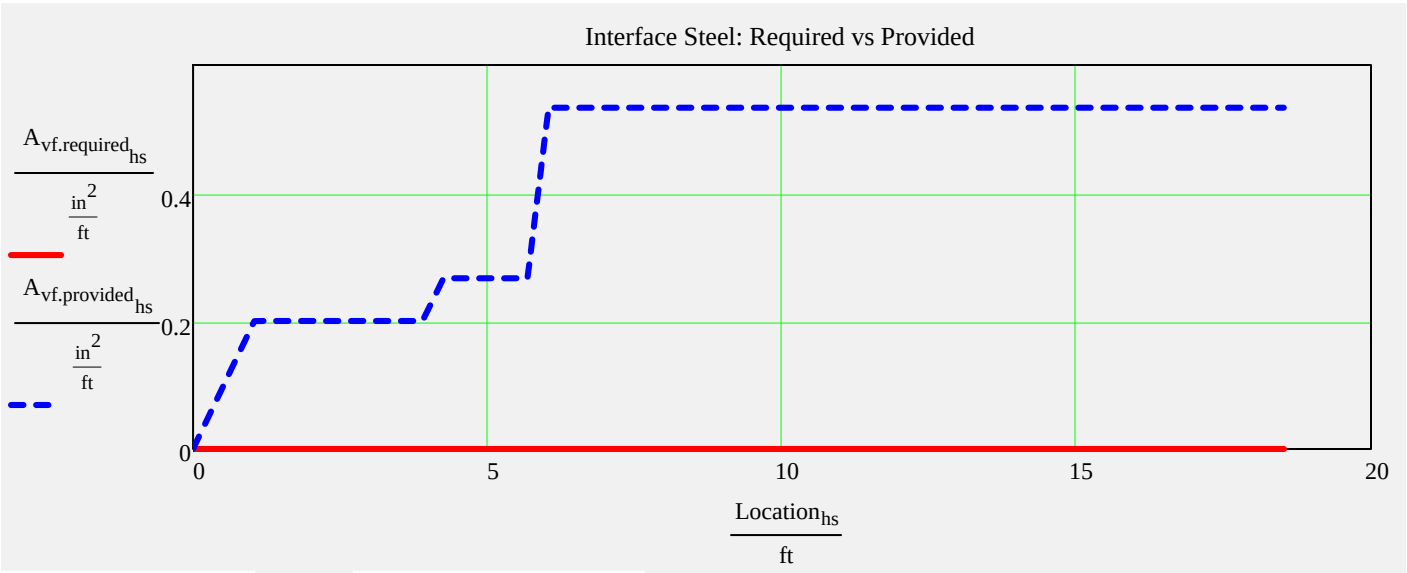


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 16.4 & 594.6 & 1557.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.38$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 7.94 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

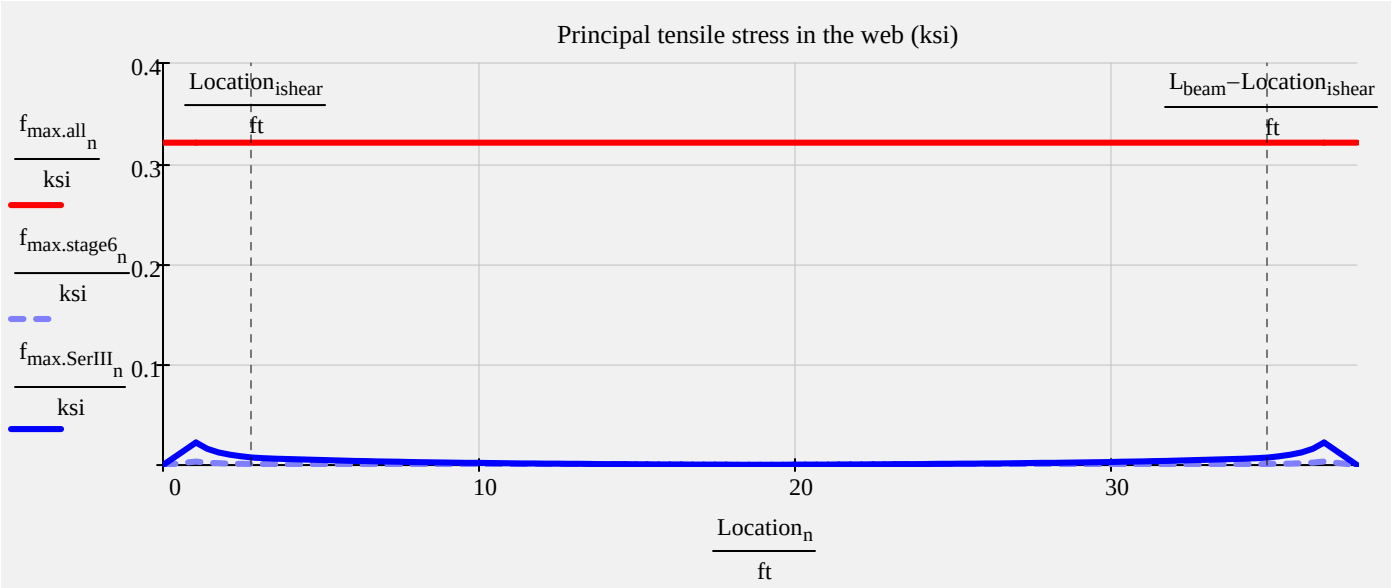
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33.9 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

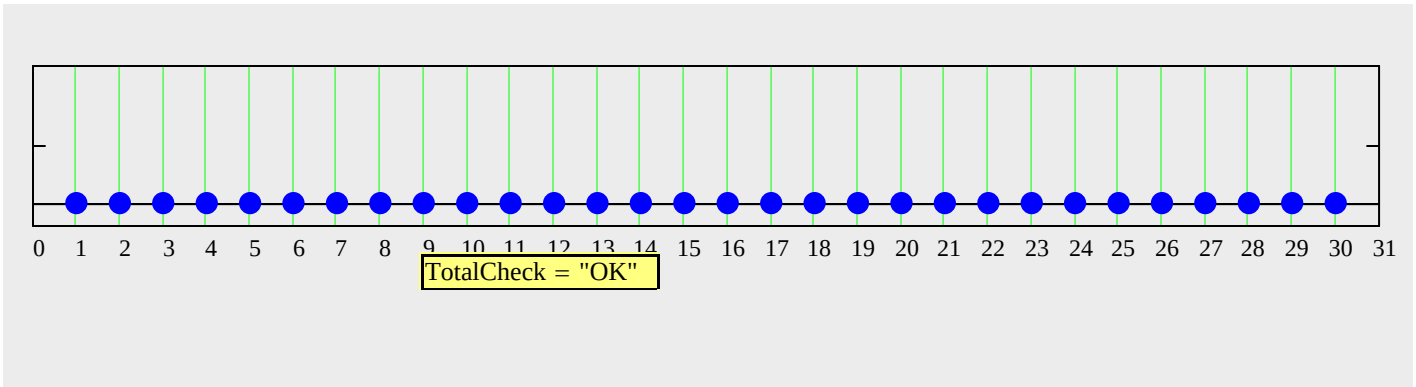
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.39	3.67	"N/A"	17.12	0.67	5.94	"N/A"	3.21	HL-93
"Strength I (Op)"	0.39	4.76	"N/A"	17.12	0.67	7.70	"N/A"	3.21	HL-93
"Service III (Inv)"	0.39	4.97	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.39	5.22	"N/A"	18.55	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.39	3.64	218.11	19.97	0.67	5.30	317.83	3.21	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.36$ $DC_{LongReinf.Permit} = 0.38$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1856	"factored resistance (kip-ft)...."
"γDL"	273	"factored dead load (kip-ft)...."
"γLL"	333	"factored live load (kip-ft)....."
"RF"	4.76	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	518.2	"factored resistance (kip)....."
"γDL"	25.2	"factored dead load (kip)....."
"γLL"	64	"factored live load (kip)....."
"RF"	7.7	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 38 FEET (NO SKEW)
WESTBOUND BRIDGE
(TIGER BAY)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\WB 38' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-38ftSpan-15inx56in_15SkewExtBeam.dat
FSB-38ftSpan-15inx56in_15SkewIntBeam.dat
FSB-38ftSpan-15inx56in_ExtBeam.dat
FSB-38ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

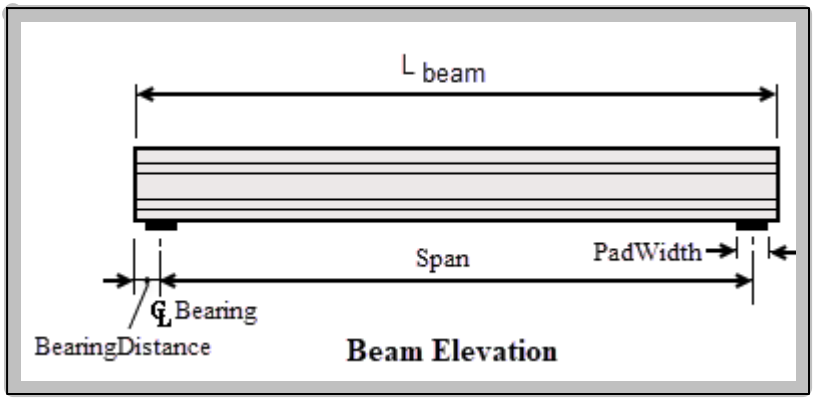
InputDataFile = "FSB-38ftSpan-15inx56in_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



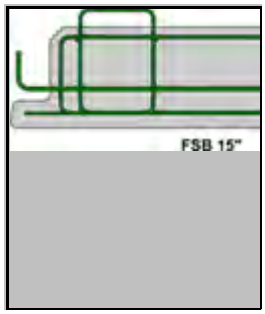
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-38ftSpan-15inx56in_IntBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	37.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

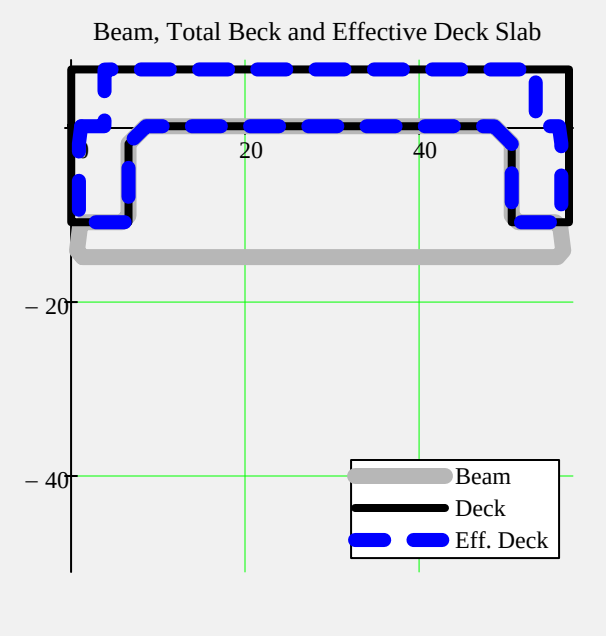
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 57.14 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 0.57 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 37.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

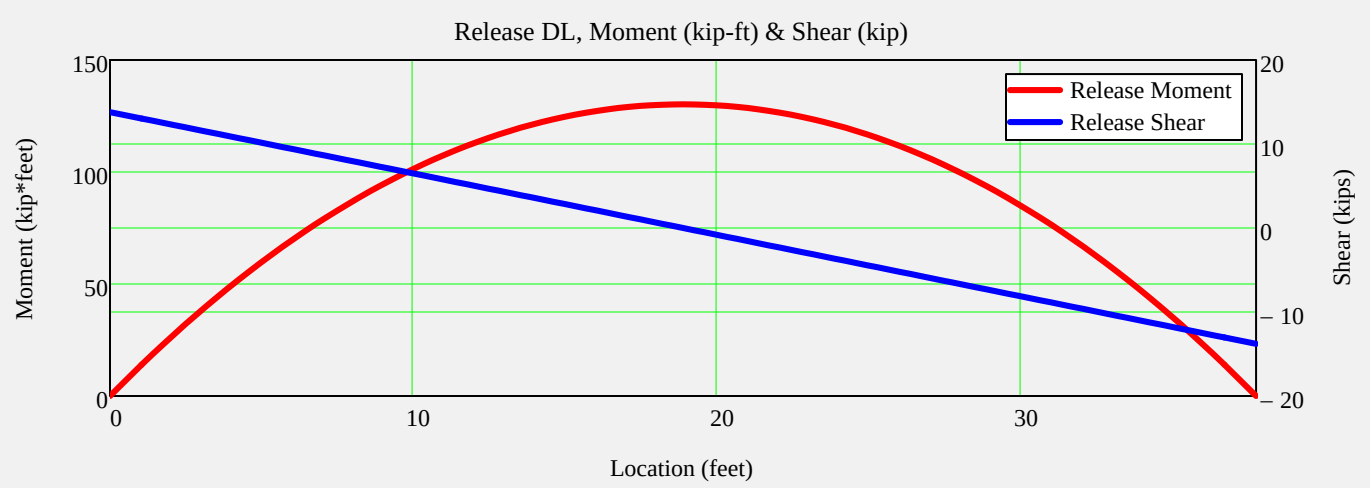
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

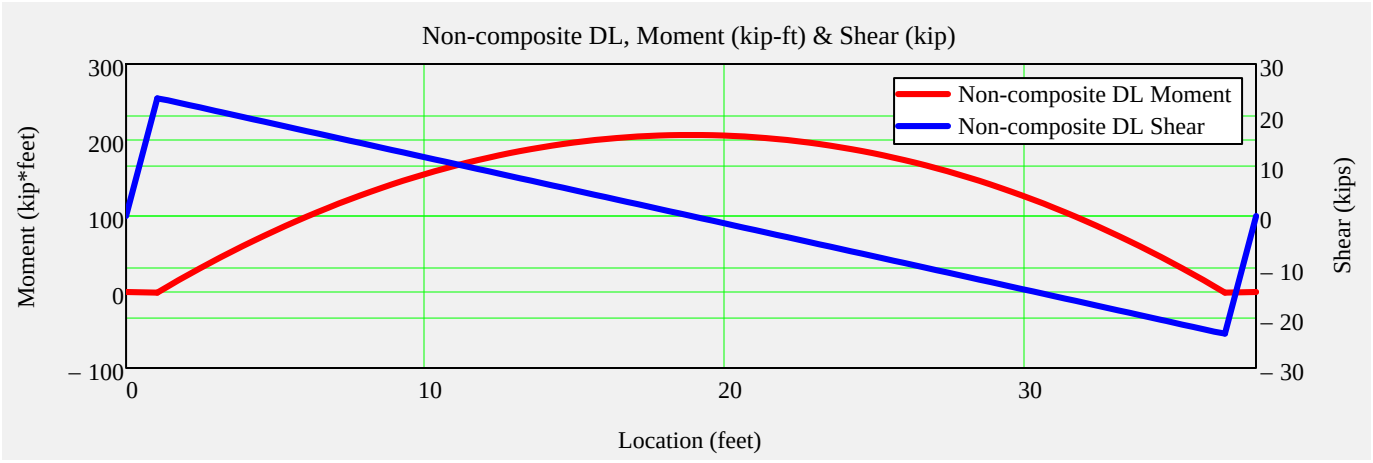
Release Dead Load Moments and Shears

$L_{span} = 35.67\ ft$



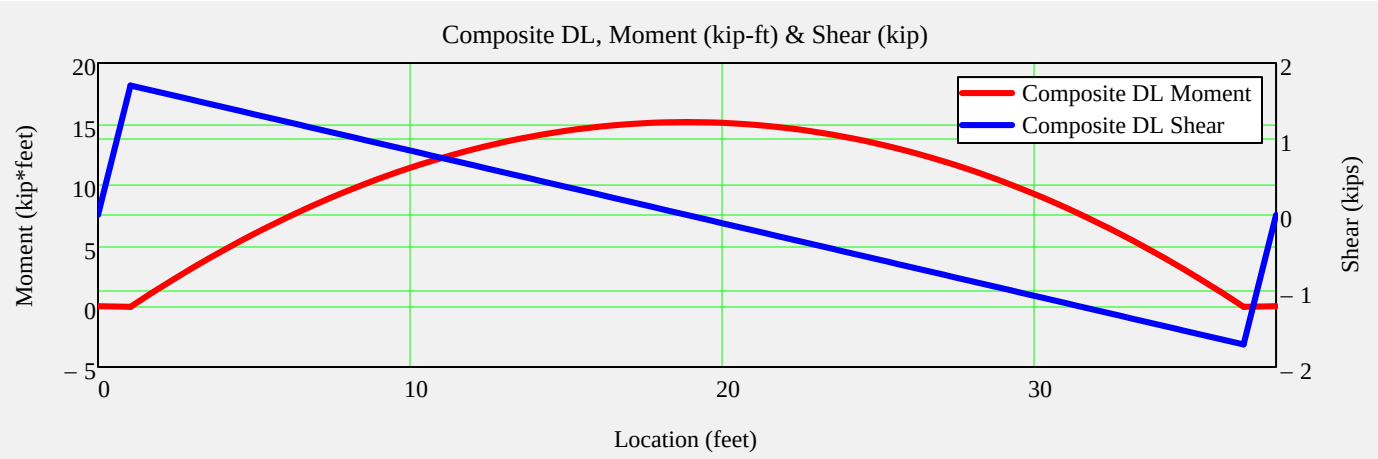
$\max(V_{release}) = 13.8 \cdot kip$ $\max(M_{release}) = 130.2 \cdot kip \cdot ft$ $\min(V_{release}) = -13.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 23.2 \cdot kip$ $\max(M_{dl.non.comp}) = 206.6 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -23.2 \cdot kip$

Composite Dead Load Moments and Shear



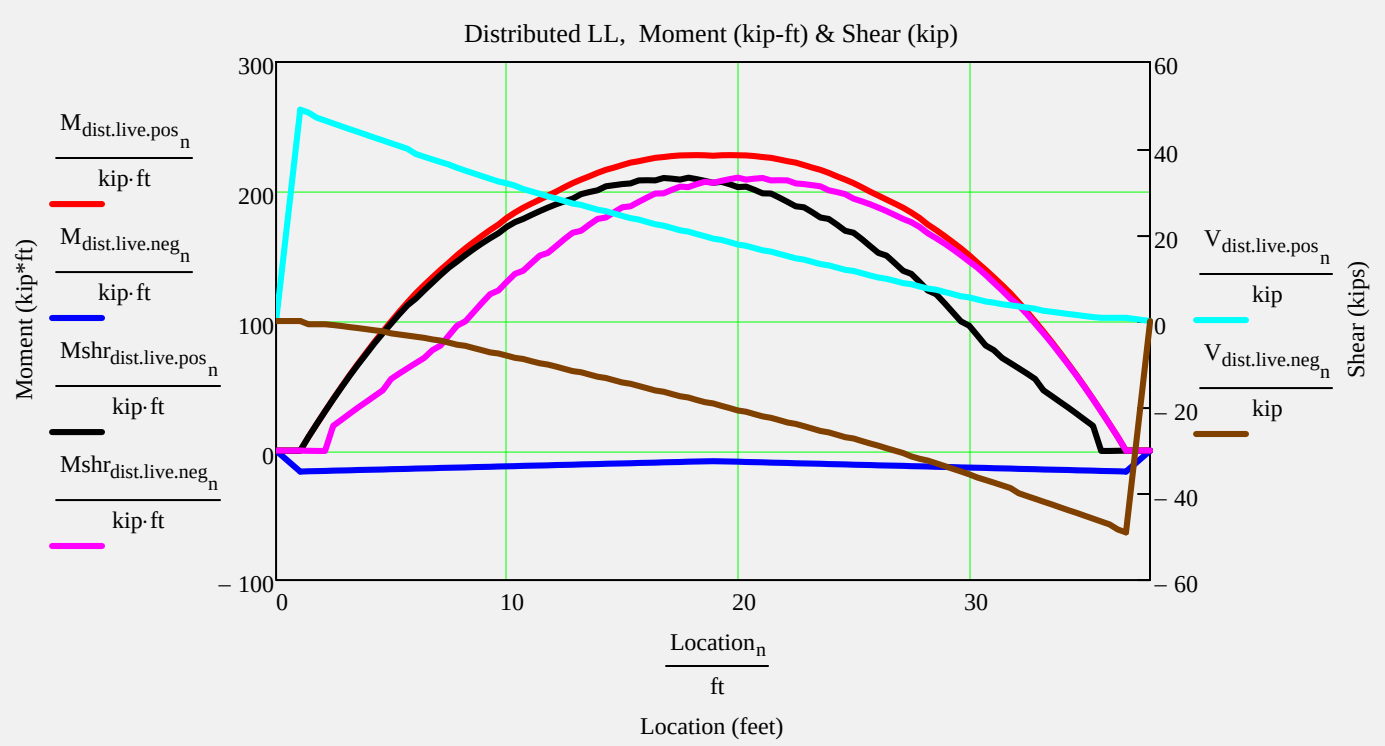
$\max(V_{dl.comp}) = 1.7 \cdot kip$ $\max(M_{dl.comp}) = 15.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -1.7 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 35.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.36$ $g_{mom.fatigue} = 0.22$ $g_{shear} = 0.60$



$\max(V_{dist.live.pos}) = 49.0 \cdot kip$

$\max(M_{dist.live.pos}) = 228.1 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -49.0 \cdot kip$

$Reaction_{LL} = 51.1 \cdot kip$

$\min(M_{dist.live.neg}) = -16.2 \cdot kip \cdot ft$

$Reaction_{DL} = 26.4 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 211 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

$Reaction_{truck} = 55.26 \cdot kip$ $Reaction_{lane} = 12.08 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

Beam End Reactions... without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{LL.without.IM} = 40.19 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-38ftSpan-15inx56in_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

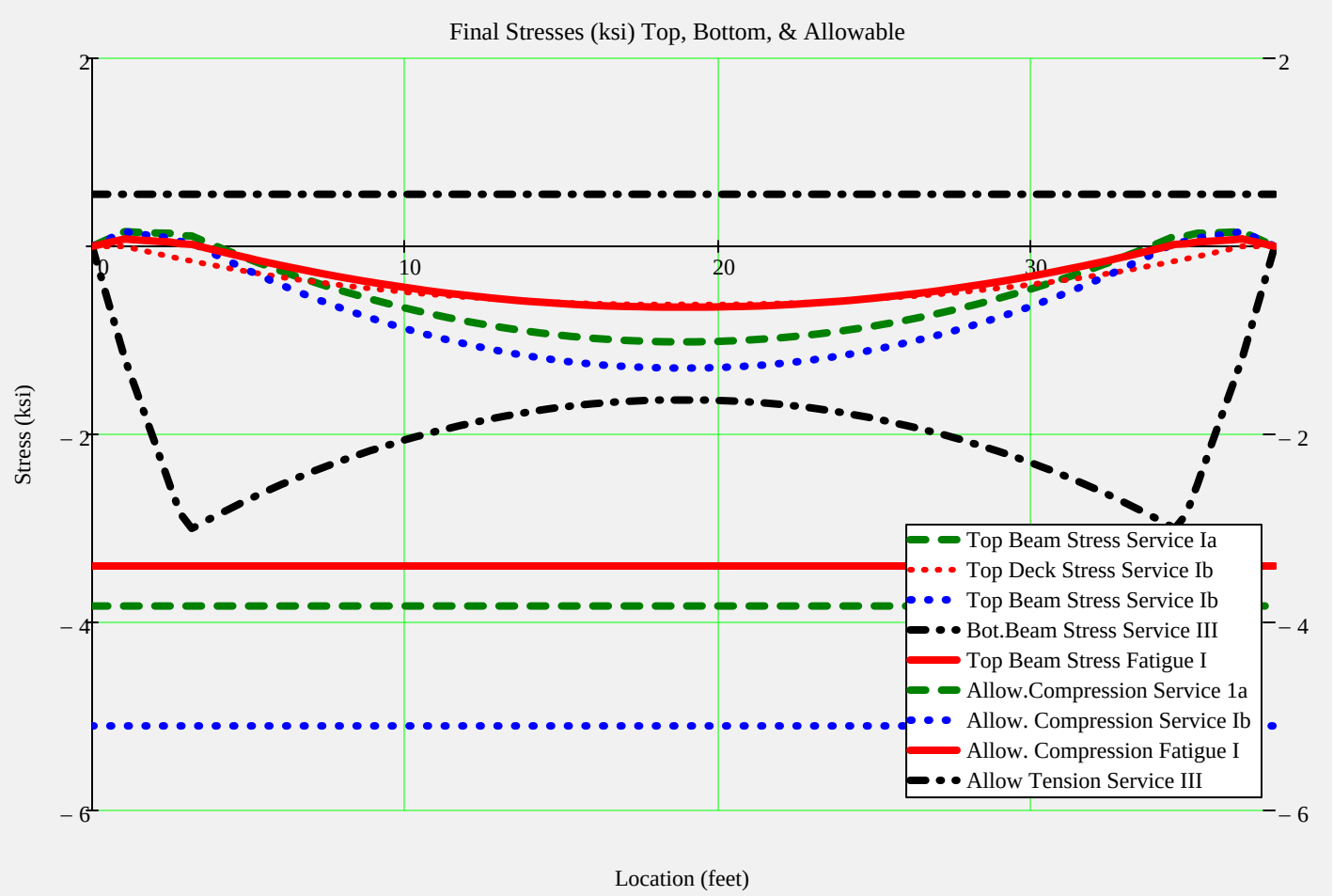
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

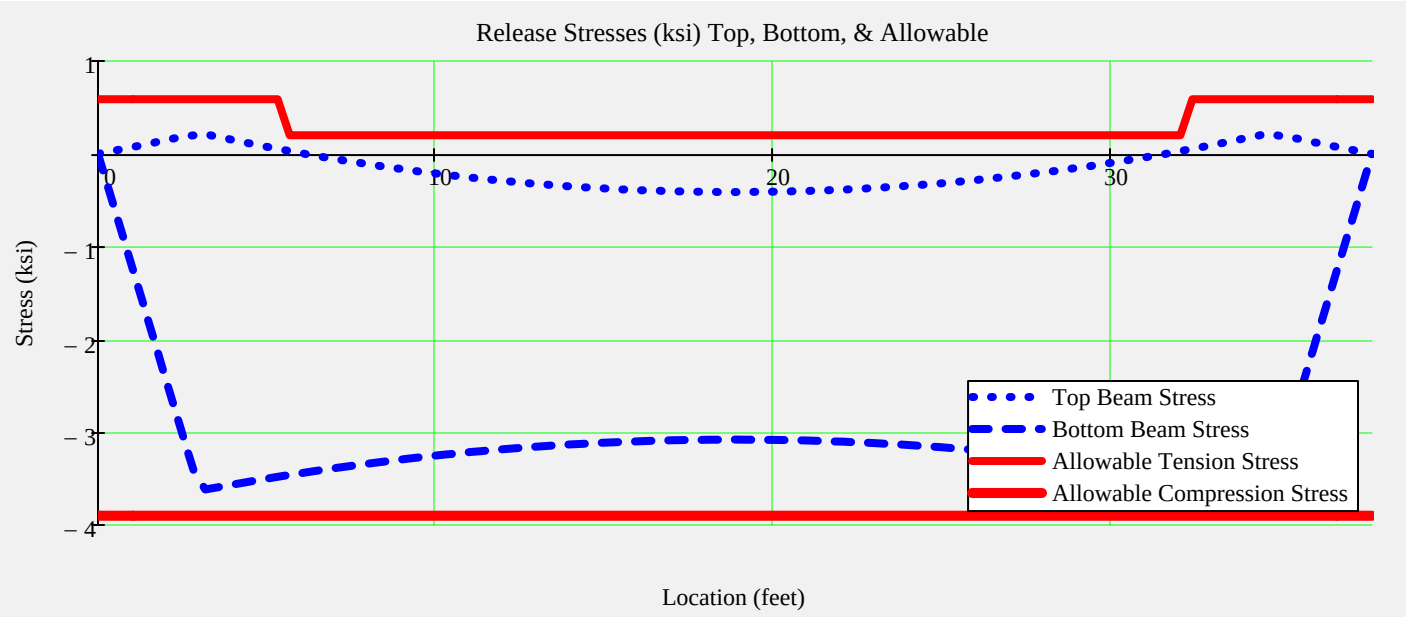
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.93$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.27$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.25$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.19$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.21	0.59
"Compression @ Release"	3.18	–3.62	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	18.88	–1.02	–3.83
"CompressionIb @ ServiceI"	18.88	–1.29	–5.10
"Compression @ FatigueI"	18.88	–0.65	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

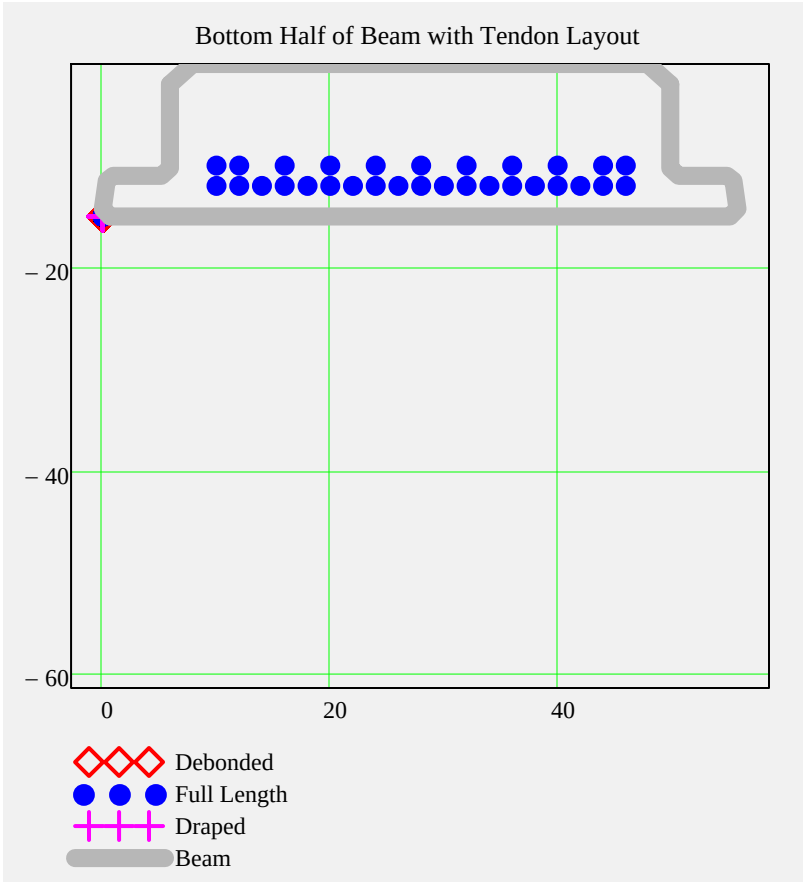
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

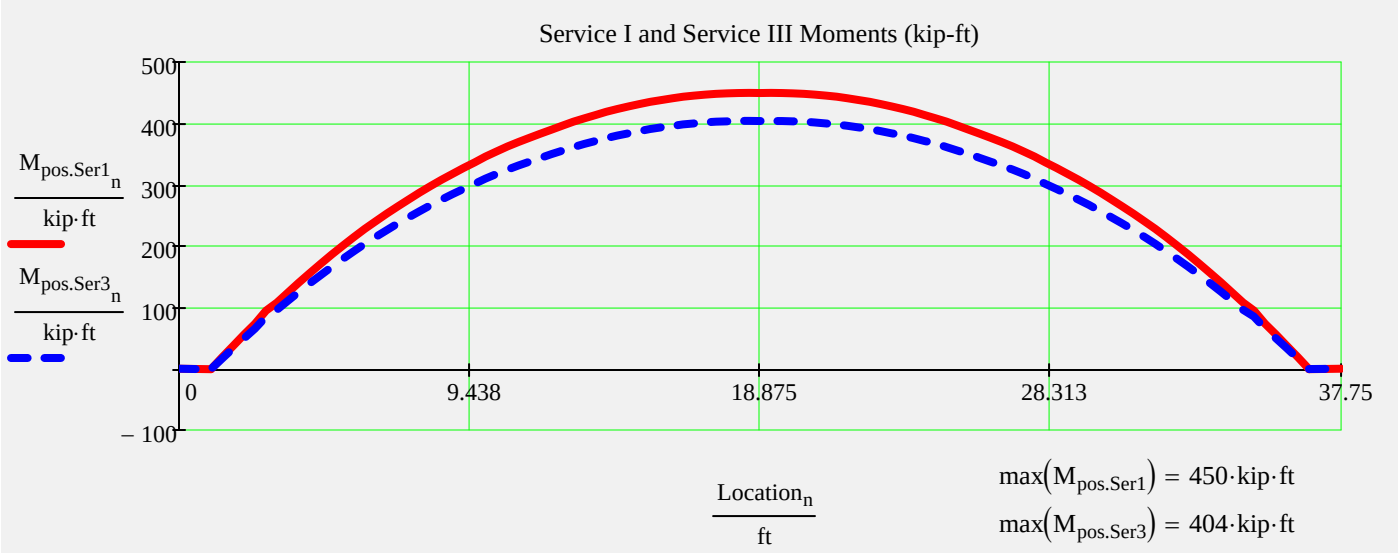
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

Check_f_{pe} = "OK"

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.41	–3.08
"2"	–0.47	–2.64
"4"	–0.37	–2.72
"6"	–1.00	–2.18
"8"	–1.29	–1.63

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1189.7	45382	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	130
"Non-Composite DL (incl. beam wt.)"	207
"Composite Dead Load"	15
"Distributed Live Load"	228

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

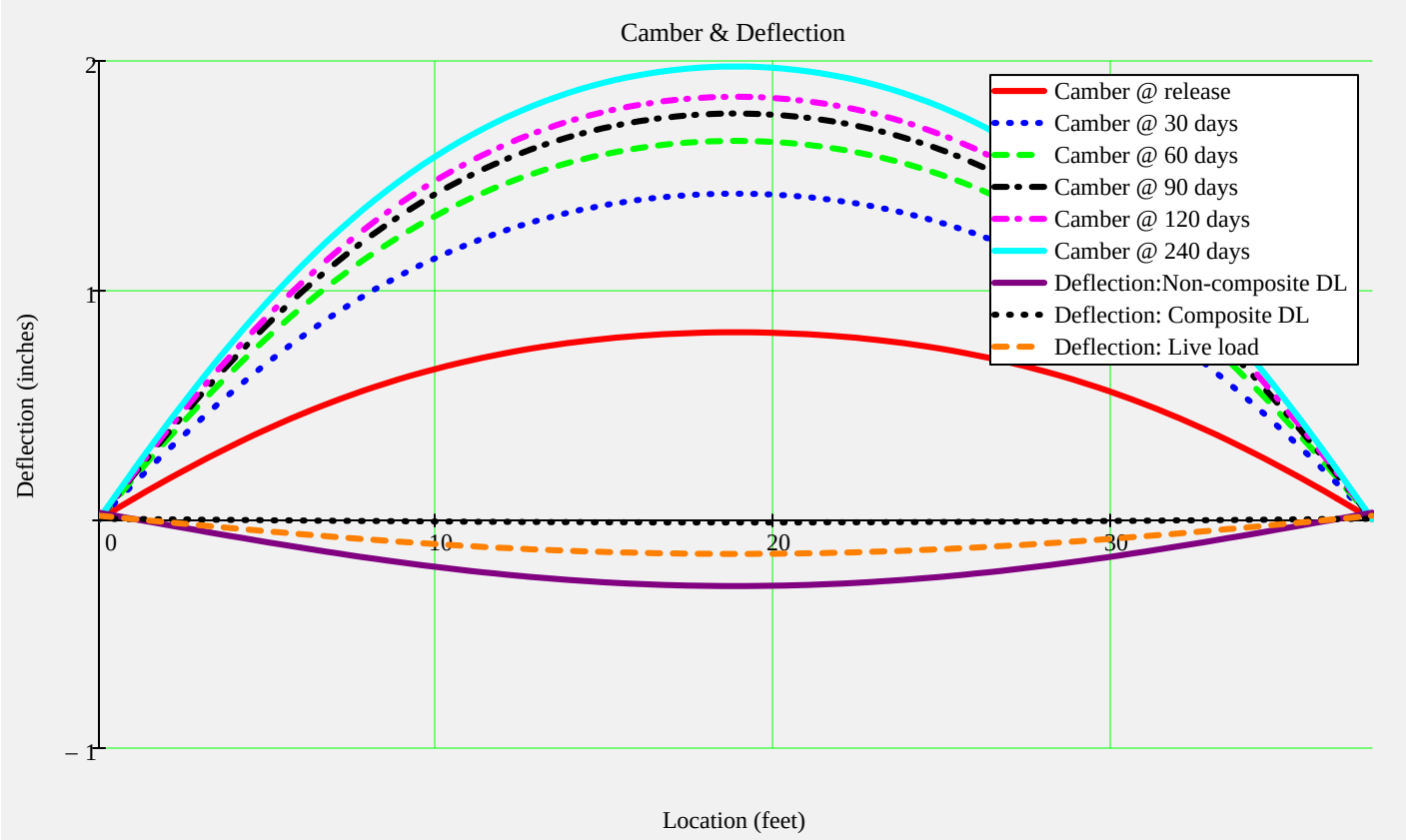
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 35.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.30	0.42	0.82
"30 Days"	–0.09	–0.56	0.72	1.42
"60 Days"	–0.12	–0.66	0.84	1.65
"90 Days"	–0.13	–0.71	0.90	1.77
"120 Days"	–0.14	–0.74	0.94	1.84
"240 Days"	–0.16	–0.79	1.00	1.98
"Non-comp DL"	–0.04	0.03	–0.13	–0.29
"Comp DL"	–0.00	0.00	–0.01	–0.01
"LL"	–0.01	0.02	–0.07	–0.15

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.54 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

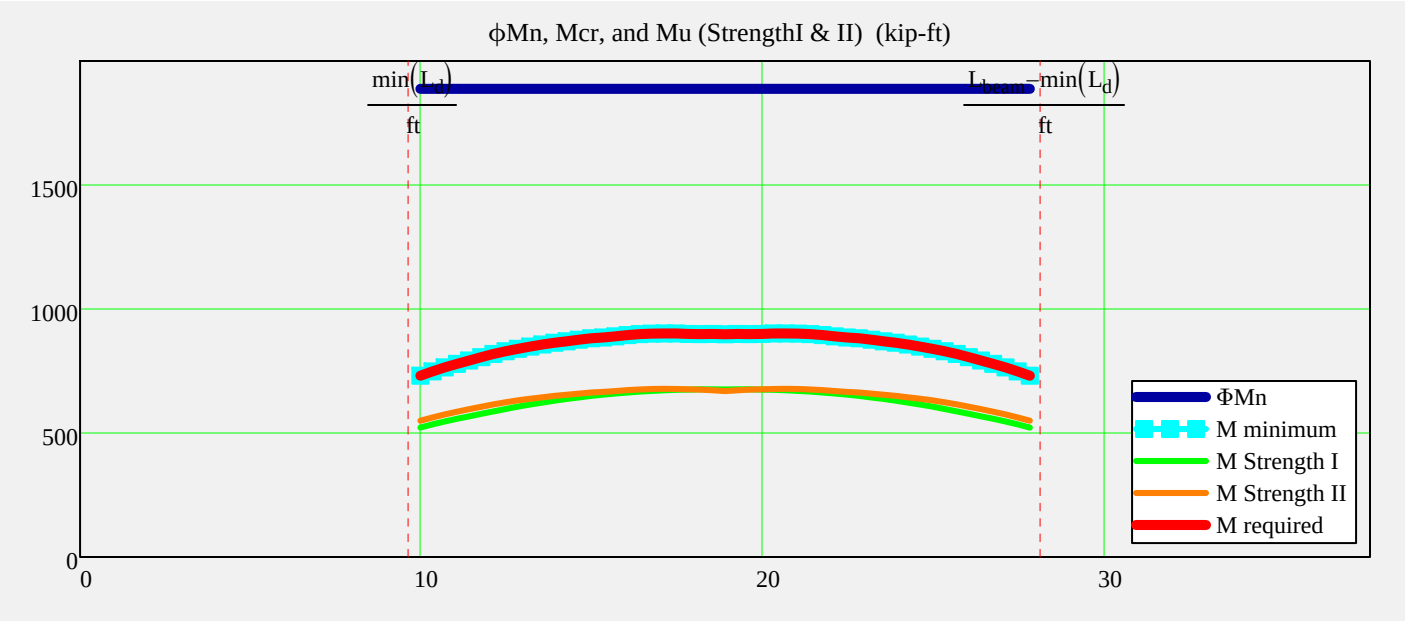
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 678 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 898 \cdot kip \cdot ft$ $M_{reqd_{51}} = 898 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1888 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 28.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.48$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

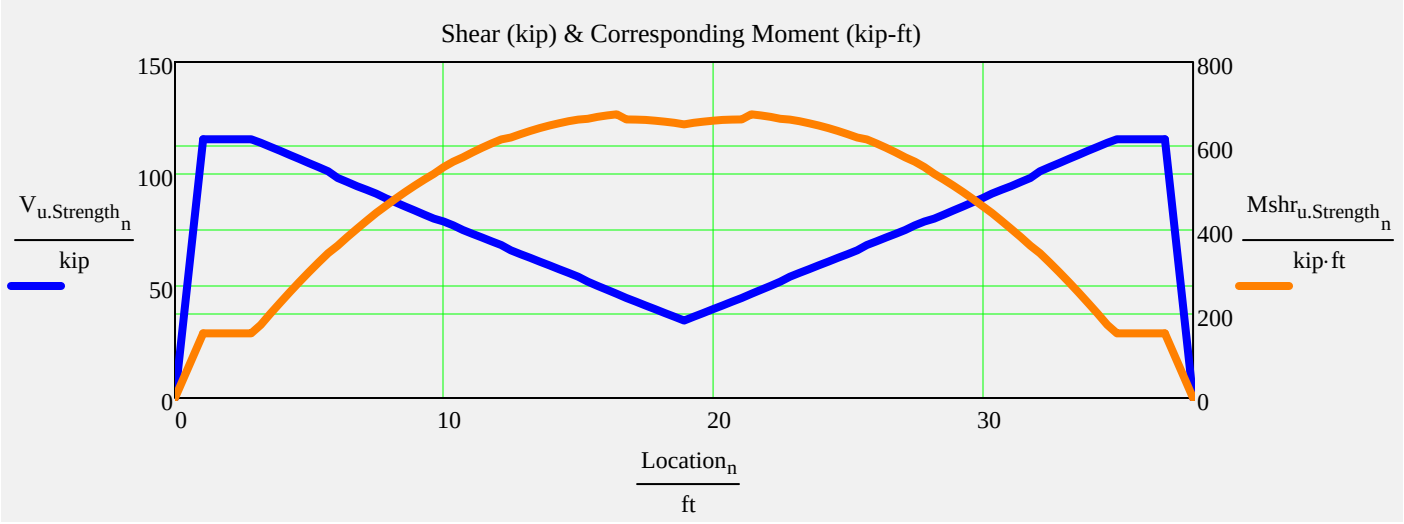
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

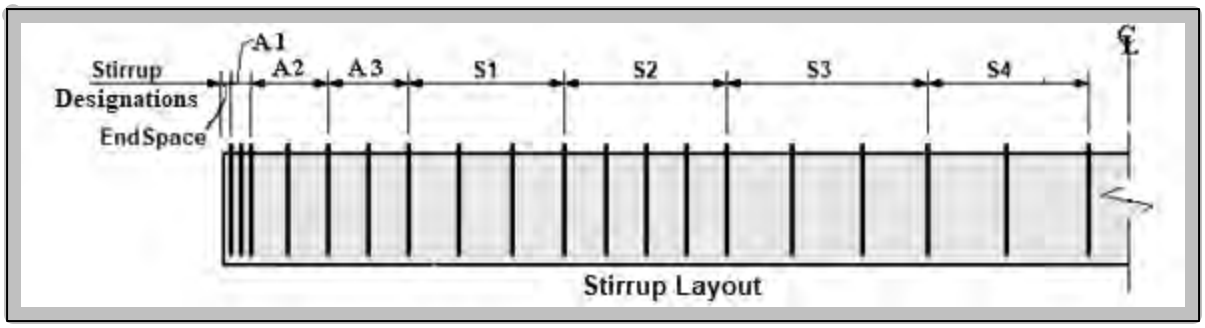
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 117 \\ 126 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 115.5 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 676 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

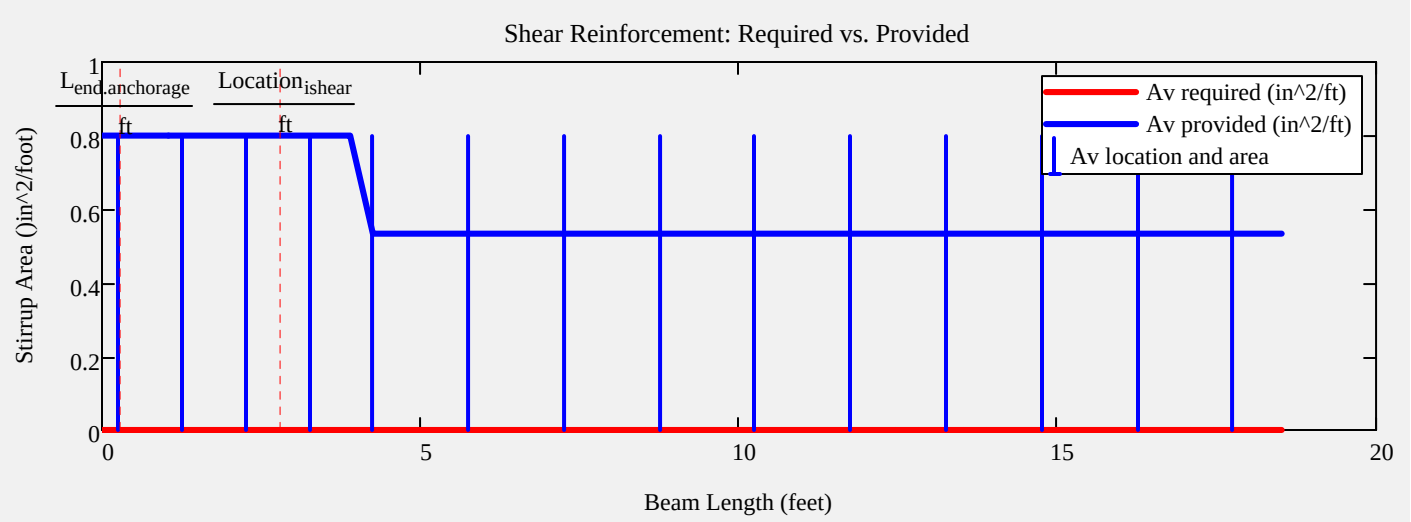
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.83\ ft$

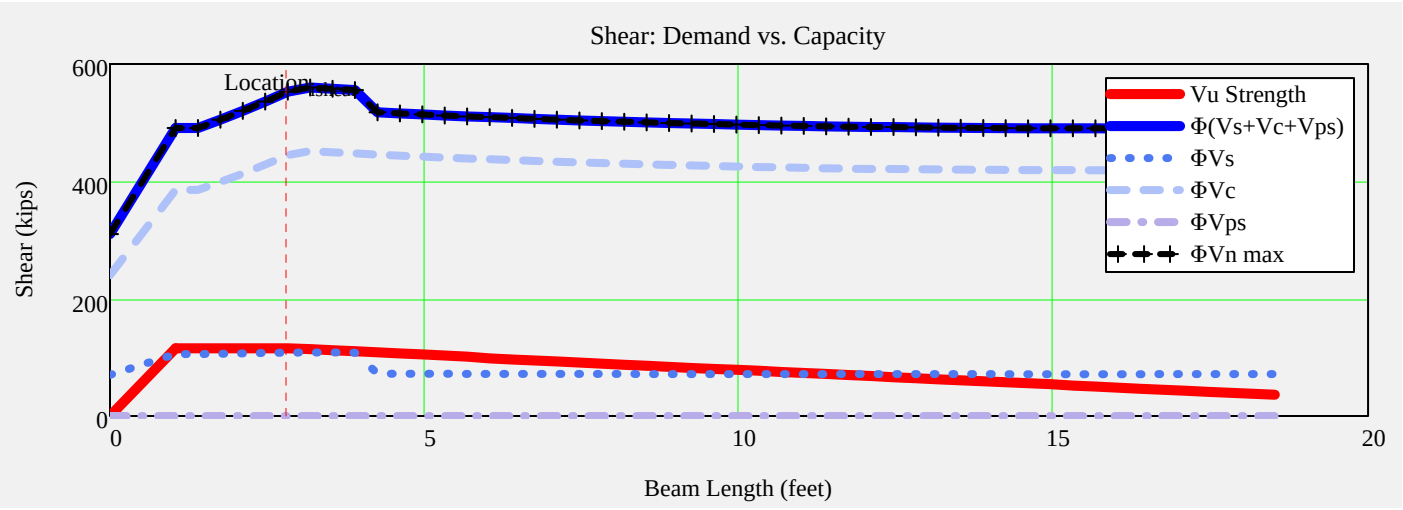
Save Data File ☑ Use current input file

File Name FSB-38ftSpan-15inx56in_IntBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

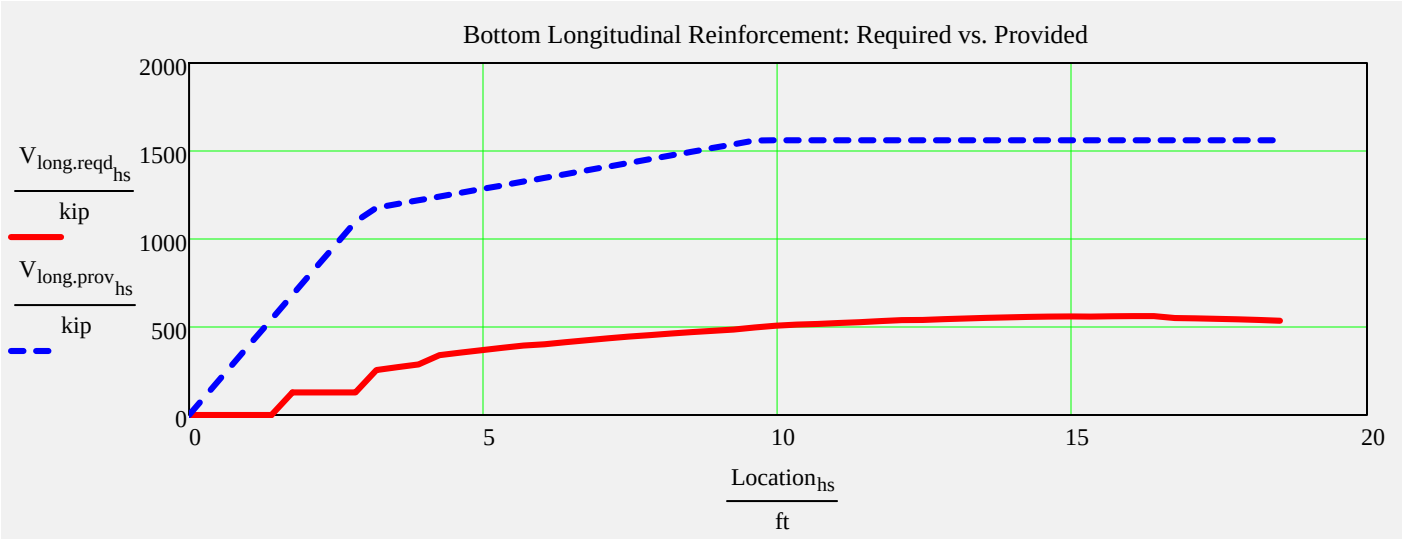
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.25 & 108.50 & 517.63 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.21$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

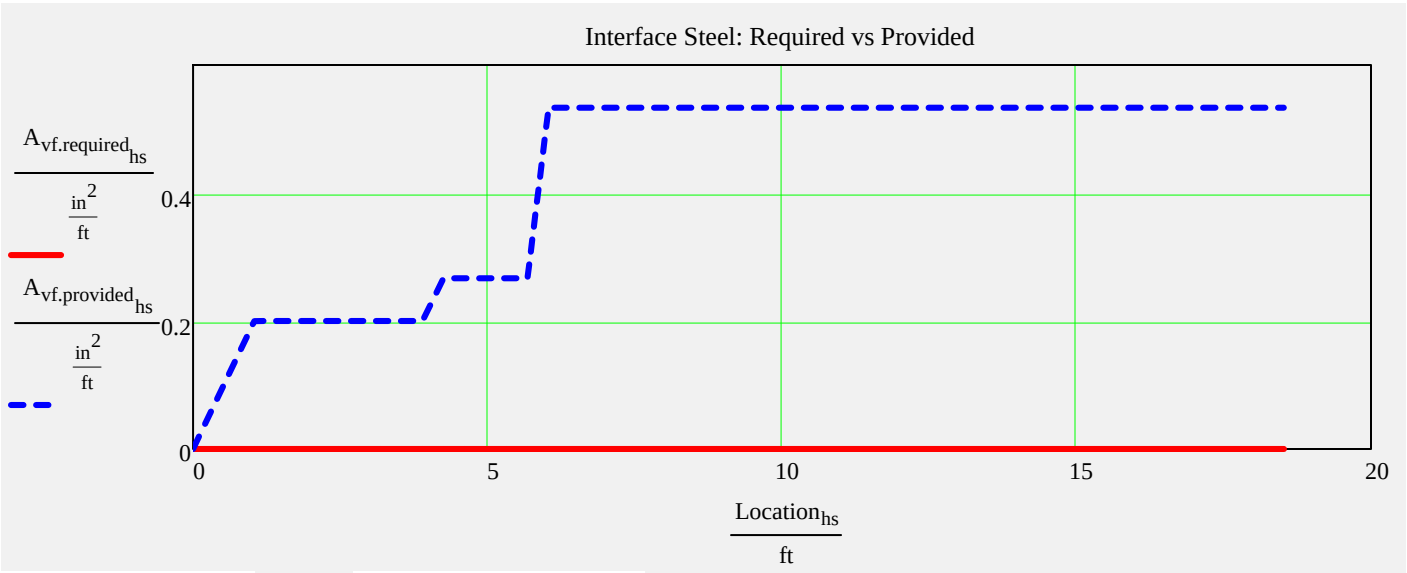


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 16.4 & 561.9 & 1560.5 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.36$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 7.94 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

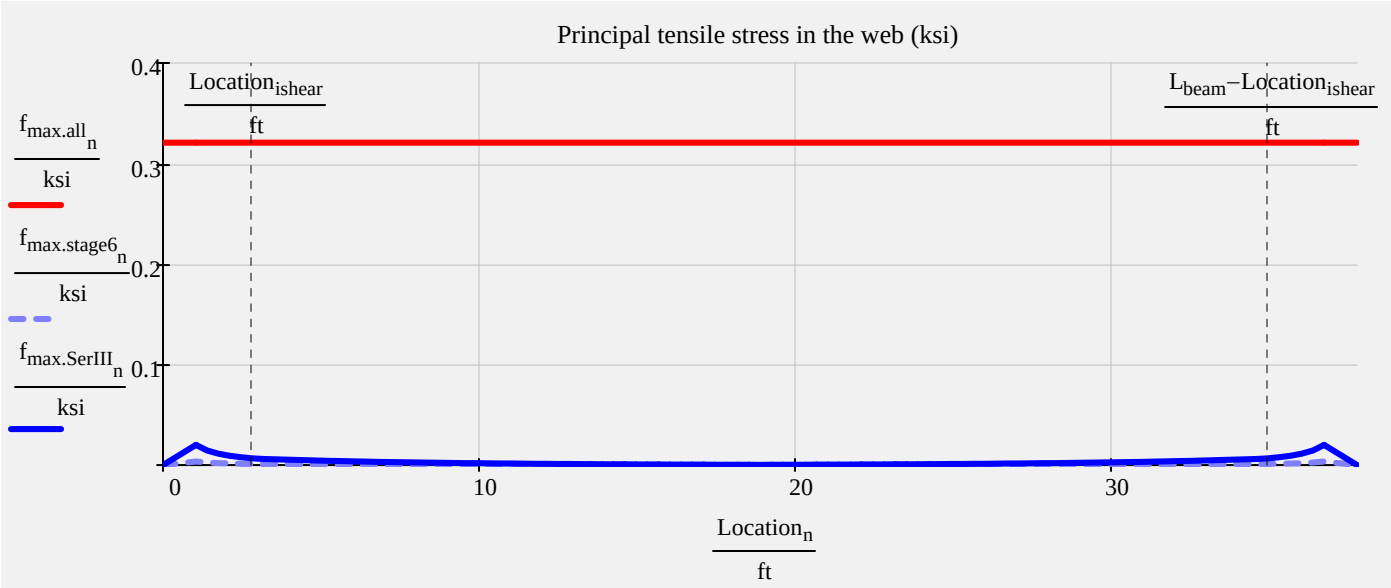
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33.9 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

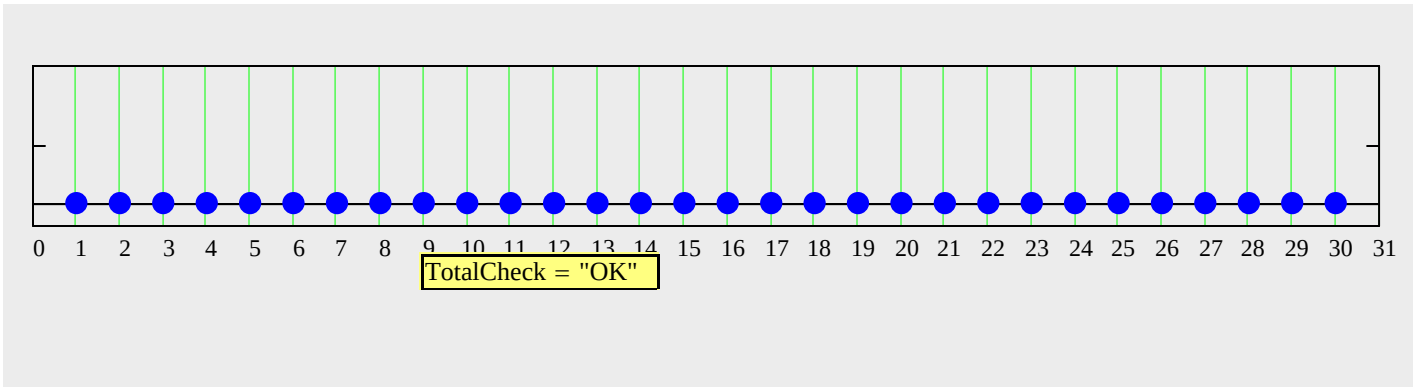
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.36	4.04	"N/A"	17.12	0.60	6.65	"N/A"	3.21	HL-93
"Strength I (Op)"	0.36	5.23	"N/A"	17.12	0.60	8.62	"N/A"	3.21	HL-93
"Service III (Inv)"	0.36	5.37	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.36	5.65	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.36	3.99	239.68	15.69	0.60	5.94	356.12	3.21	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.34$ $DC_{LongReinf.Permit} = 0.36$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1888	"factored resistance (kip-ft)...."
"γDL"	277	"factored dead load (kip-ft)...."
"γLL"	308	"factored live load (kip-ft)....."
"RF"	5.23	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	520	"factored resistance (kip)....."
"γDL"	25.6	"factored dead load (kip)....."
"γLL"	57.4	"factored live load (kip)....."
"RF"	8.62	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 38 FEET (15 DEG. SKEW)
WESTBOUND BRIDGE
(D.C.I CANAL)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\WB 38' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-38ftSpan-15inx56in_15SkewExtBeam.dat
FSB-38ftSpan-15inx56in_15SkewIntBeam.dat
FSB-38ftSpan-15inx56in_ExtBeam.dat
FSB-38ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

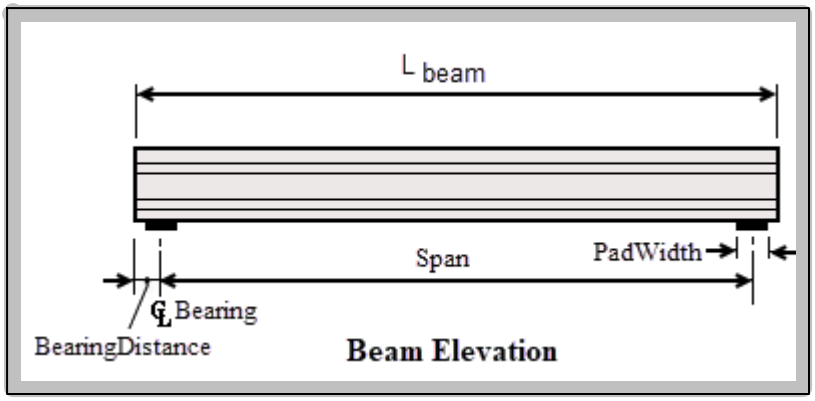
InputDataFile = "FSB-38ftSpan-15inx56in_15SkewExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



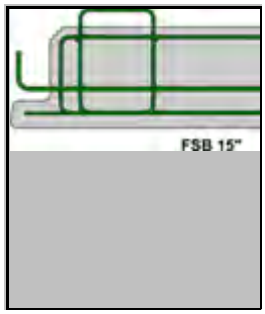
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-38ftSpan-15inx56in_15SkewExtBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	37.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

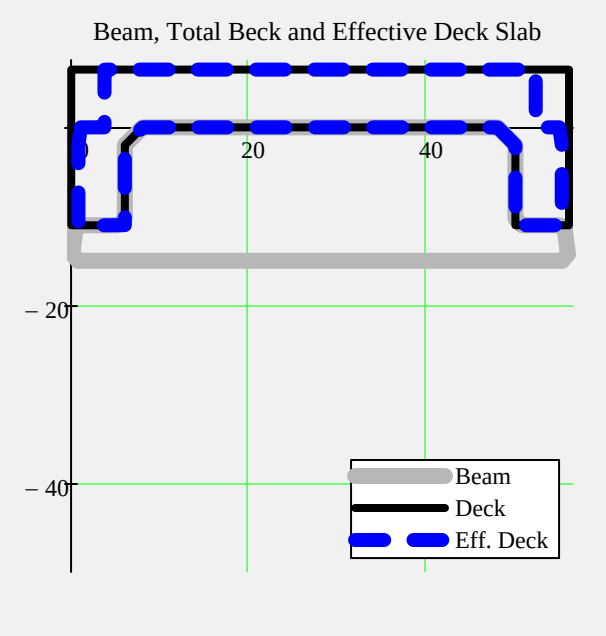
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 56.07 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.55 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 37.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

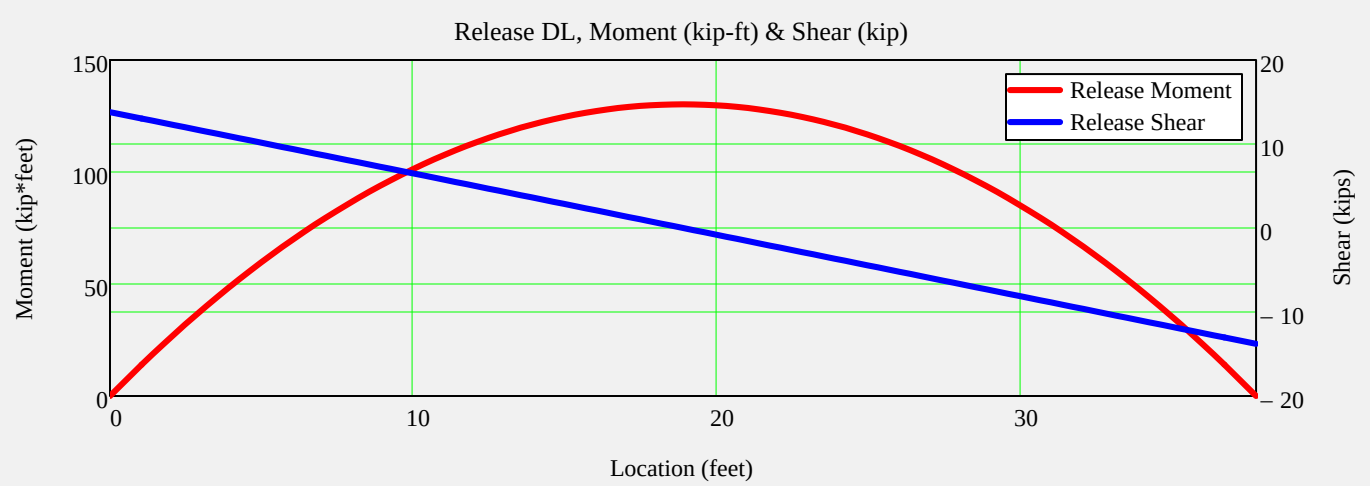
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

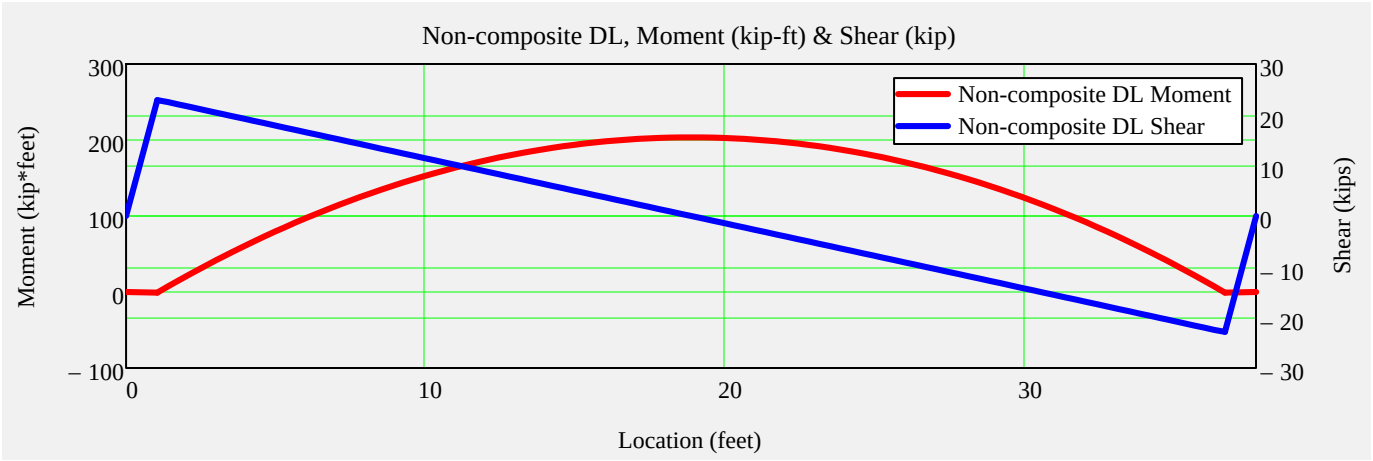
Release Dead Load Moments and Shears

$L_{span} = 35.67\ ft$



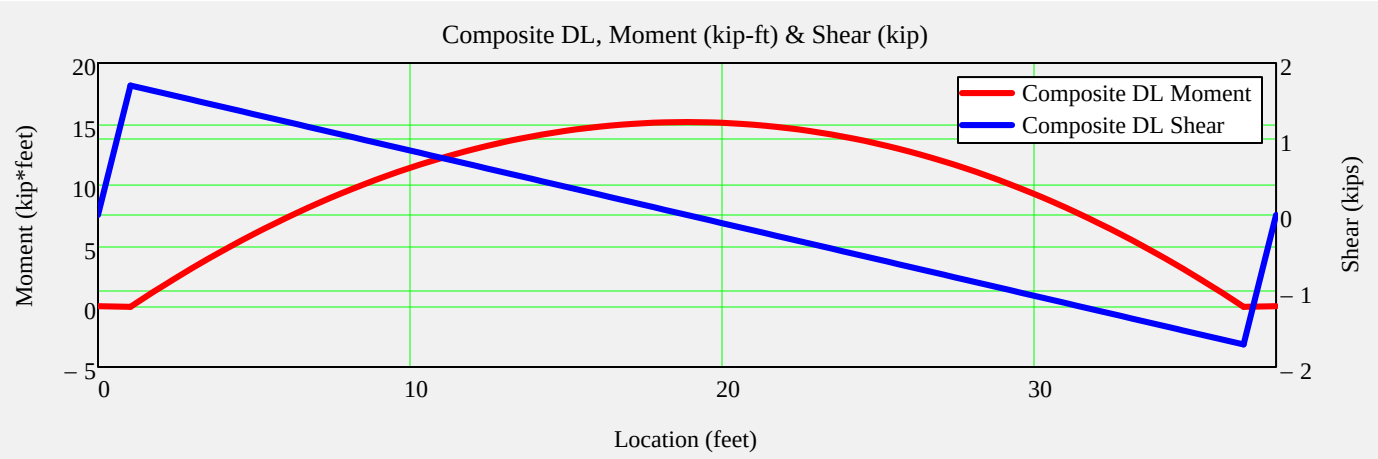
$\max(V_{release}) = 13.8 \cdot kip$ $\max(M_{release}) = 130.2 \cdot kip \cdot ft$ $\min(V_{release}) = -13.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 22.9 \cdot kip$ $\max(M_{dl.non.comp}) = 203.4 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -22.9 \cdot kip$

Composite Dead Load Moments and Shear



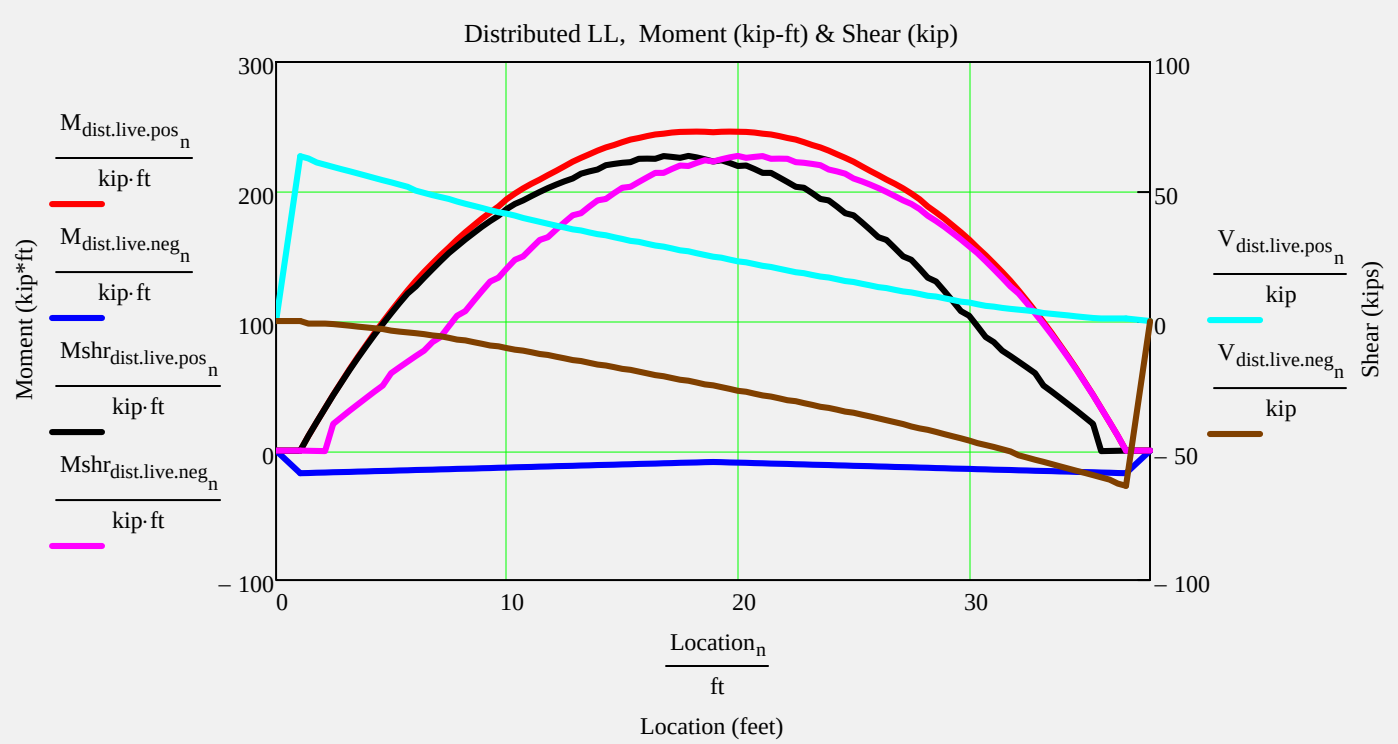
$\max(V_{dl.comp}) = 1.7 \cdot kip$ $\max(M_{dl.comp}) = 15.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -1.7 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 35.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.16$

Final Live Load Distribution Factors: $g_{mom} = 0.39$ $g_{mom.fatigue} = 0.25$ $g_{shear} = 0.78$



$\max(V_{dist.live.pos}) = 63.6 \cdot kip$

$\max(M_{dist.live.pos}) = 246.3 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -63.6 \cdot kip$

$Reaction_{LL} = 66.4 \cdot kip$

$\min(M_{dist.live.neg}) = -17.5 \cdot kip \cdot ft$

$Reaction_{DL} = 26.0 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 228 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

$Reaction_{truck} = 55.26 \cdot kip$ $Reaction_{lane} = 12.08 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

Beam End Reactions... without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{LL.without.IM} = 52.24 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-38ftSpan-15inx56in_15SkewExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

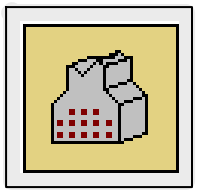
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

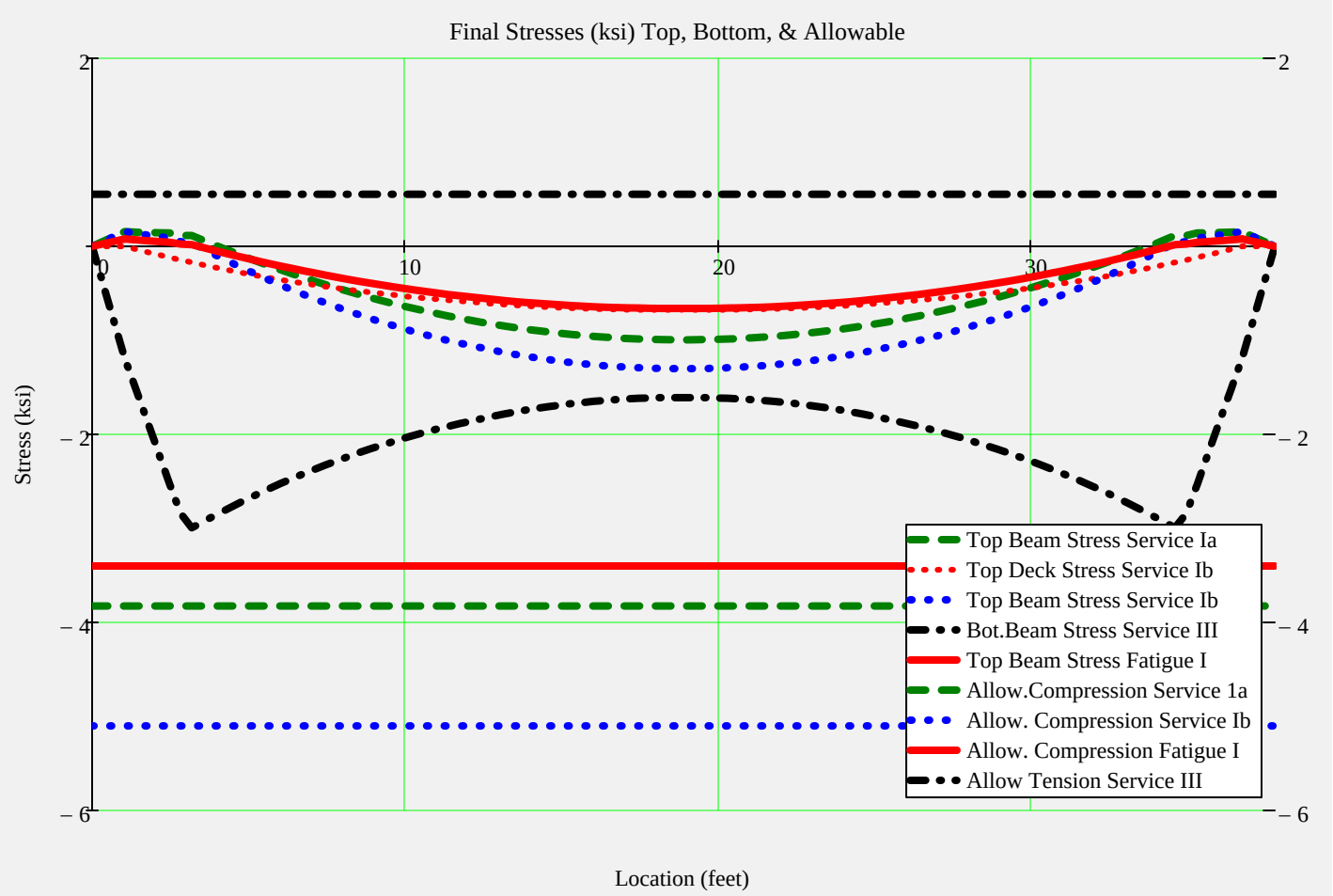
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses

Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.93$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.26$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.26$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.19$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.21	0.59
"Compression @ Release"	3.18	–3.62	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	18.88	–0.99	–3.83
"CompressionIb @ ServiceI"	18.88	–1.30	–5.10
"Compression @ FatigueI"	18.88	–0.66	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

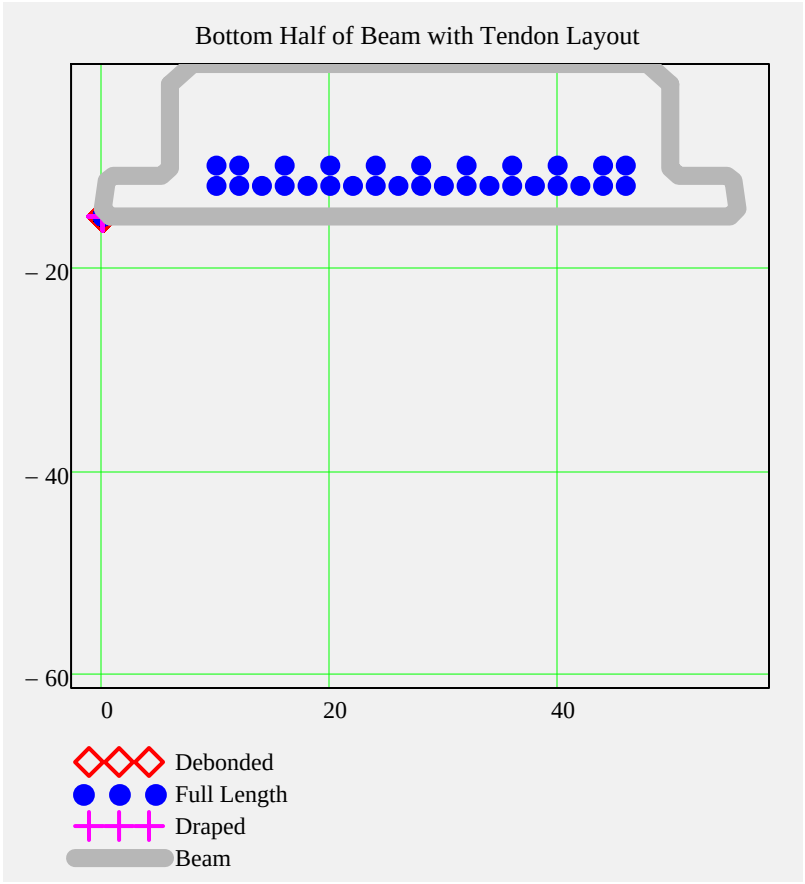
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

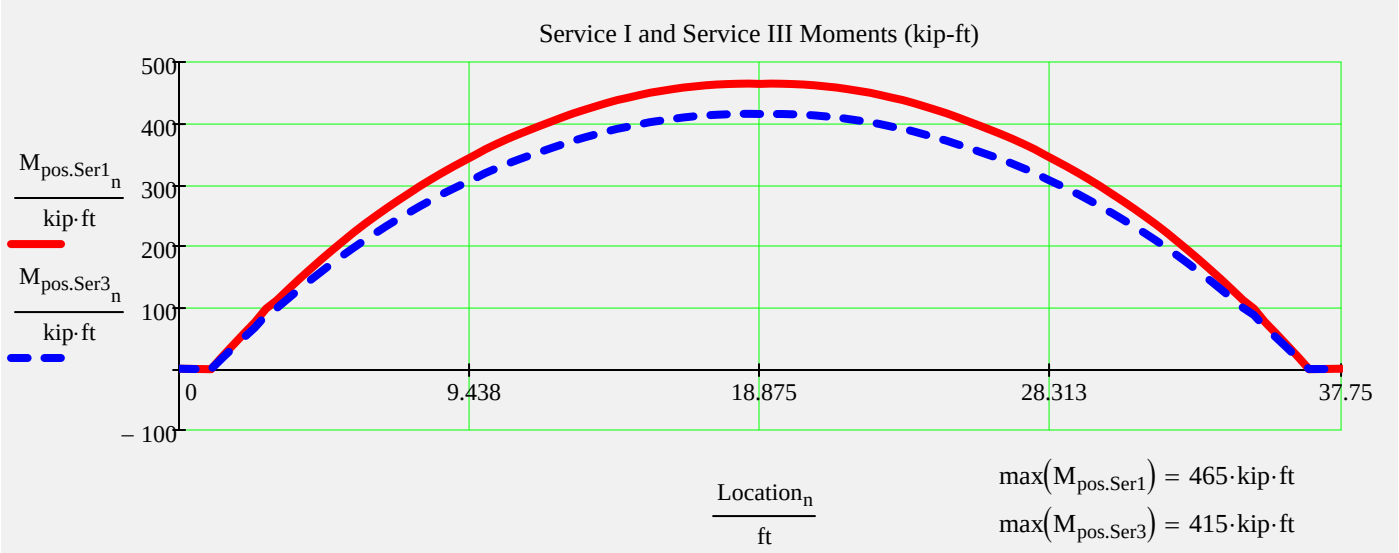
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 465 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 415 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.41 & -3.08 \\ \text{"2"} & -0.47 & -2.64 \\ \text{"4"} & -0.37 & -2.72 \\ \text{"6"} & -0.98 & -2.20 \\ \text{"8"} & -1.30 & -1.61 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1173.3	44867	–4.7

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	130
"Non-Composite DL (incl. beam wt.)"	203
"Composite Dead Load"	15
"Distributed Live Load"	246

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

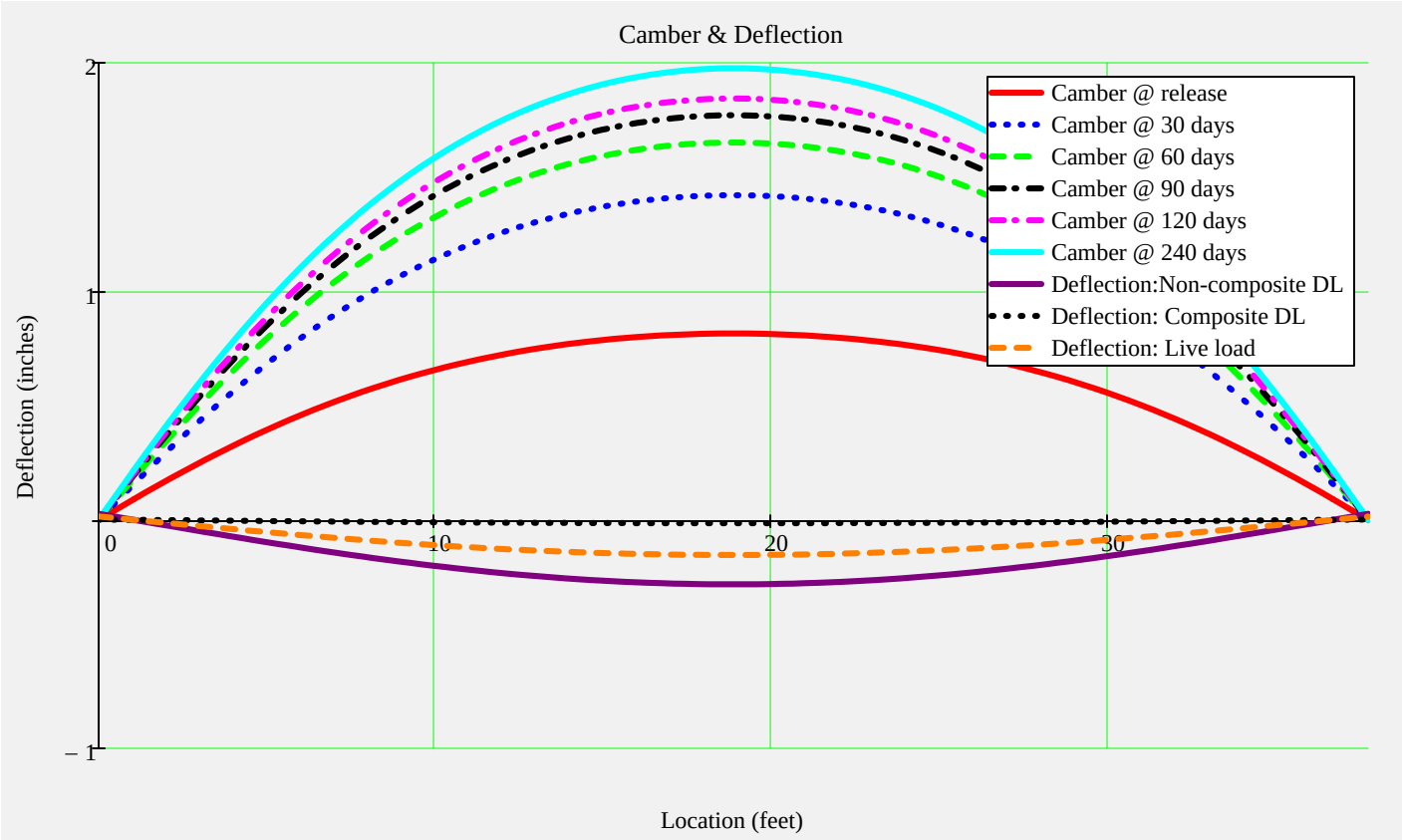
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 35.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.30	0.42	0.82
"30 Days"	–0.09	–0.56	0.72	1.42
"60 Days"	–0.12	–0.66	0.84	1.65
"90 Days"	–0.13	–0.71	0.90	1.77
"120 Days"	–0.14	–0.74	0.94	1.84
"240 Days"	–0.16	–0.79	1.00	1.98
"Non-comp DL"	–0.03	0.03	–0.12	–0.28
"Comp DL"	–0.00	0.00	–0.01	–0.02
"LL"	–0.01	0.02	–0.07	–0.15

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.55 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

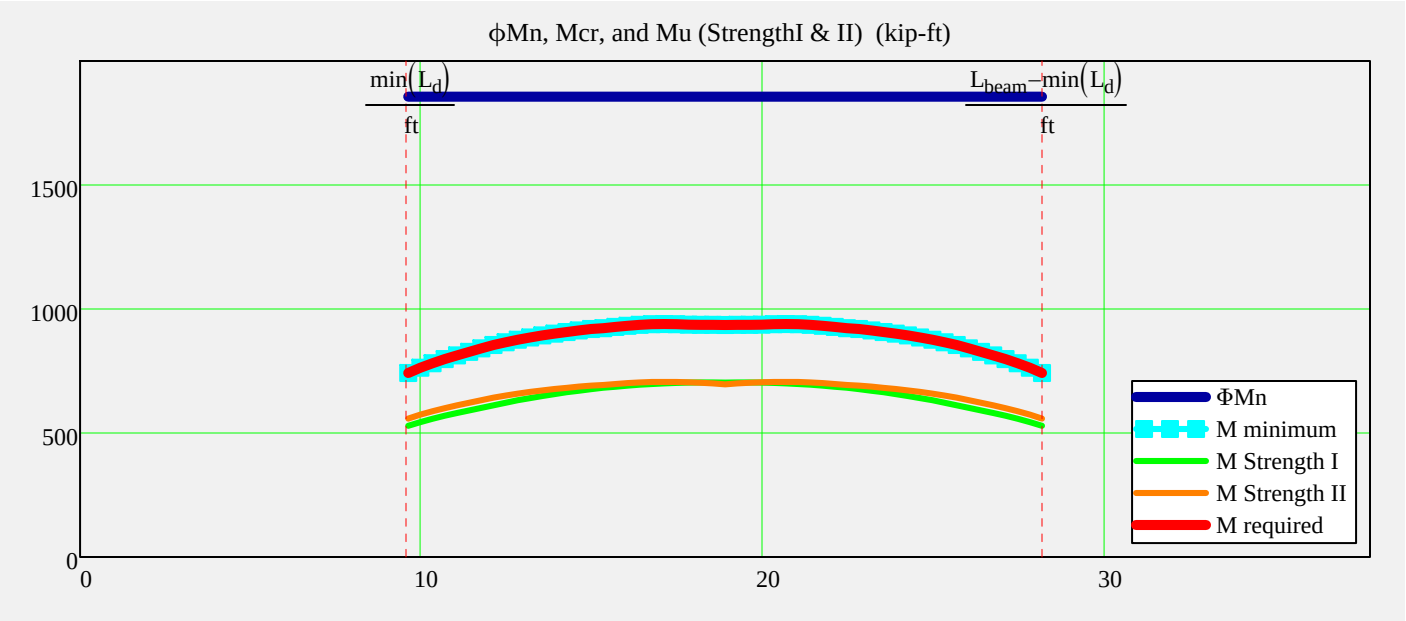
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 706 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 935 \cdot kip \cdot ft$ $M_{reqd_{51}} = 935 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1856 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 28.2\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.51$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

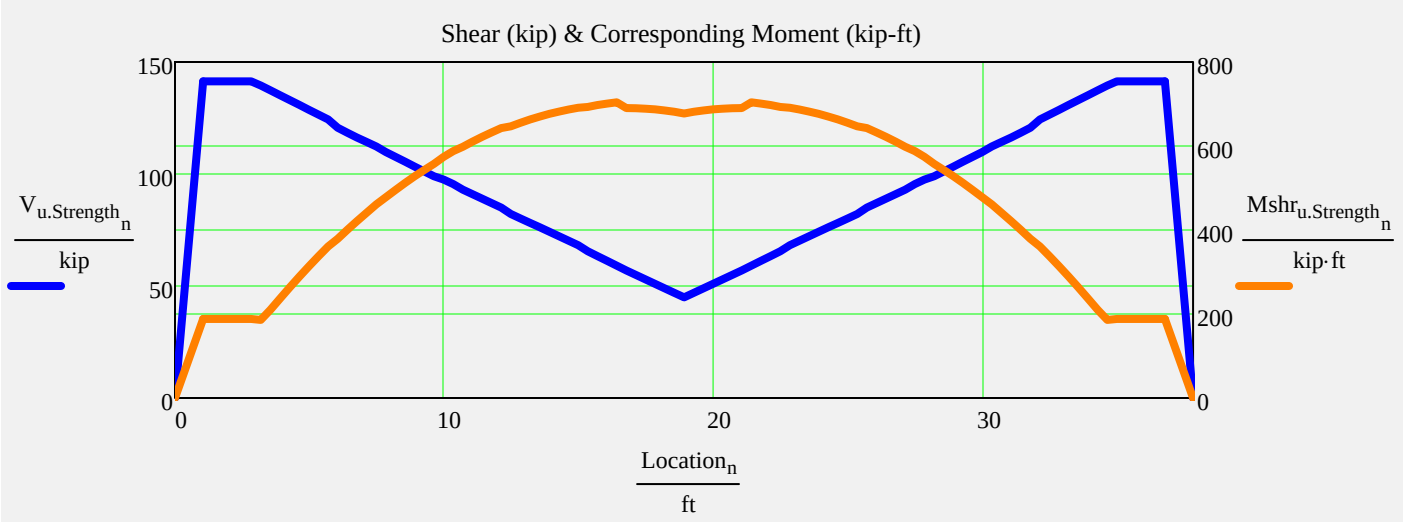
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

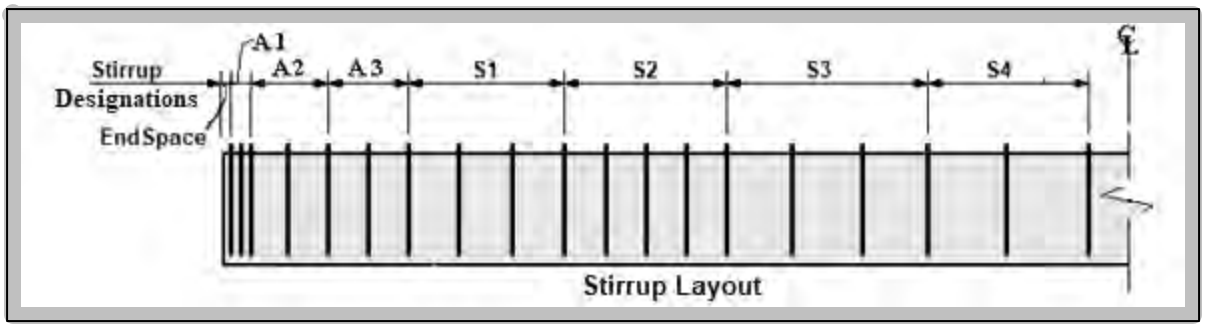
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 142 \\ 154 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 141.4 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 704 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

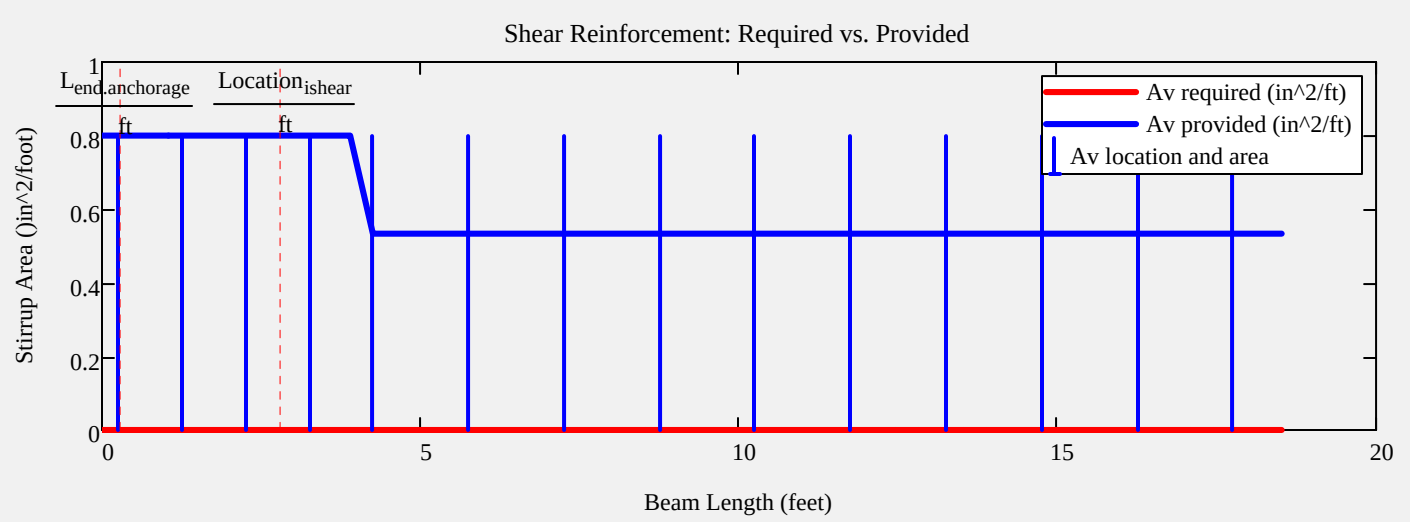
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.83\ ft$

Save Data File

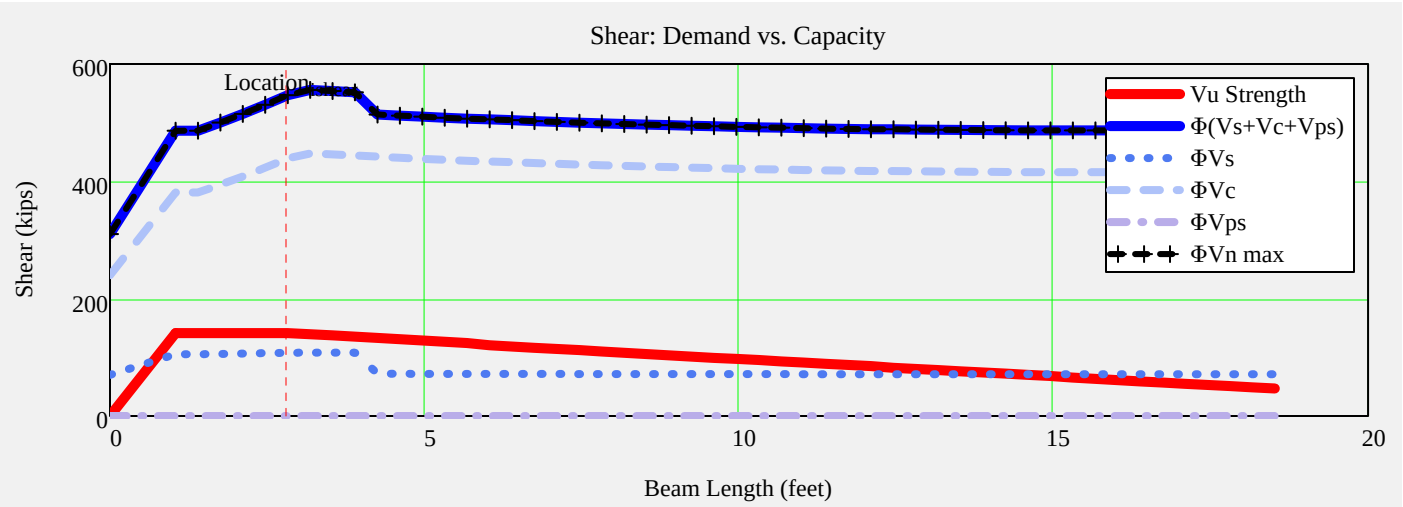
Use current input file

File Name FSB-38ftSpan-15inx56in_15SkewExtBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

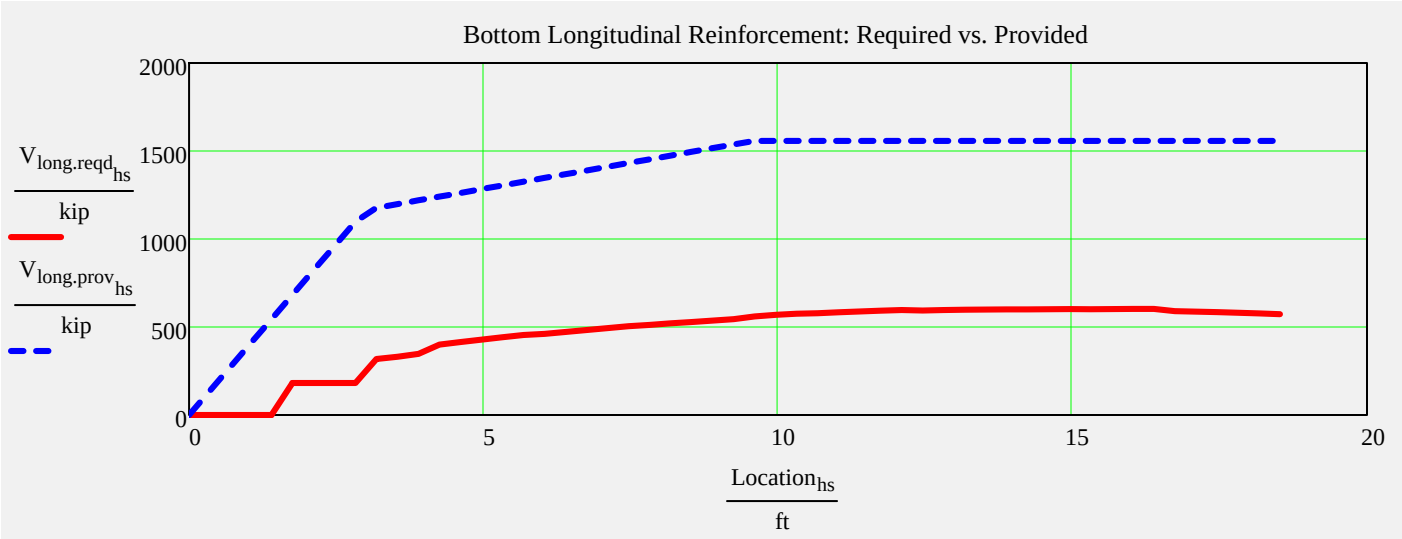
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.25 & 133.00 & 513.88 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.26$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

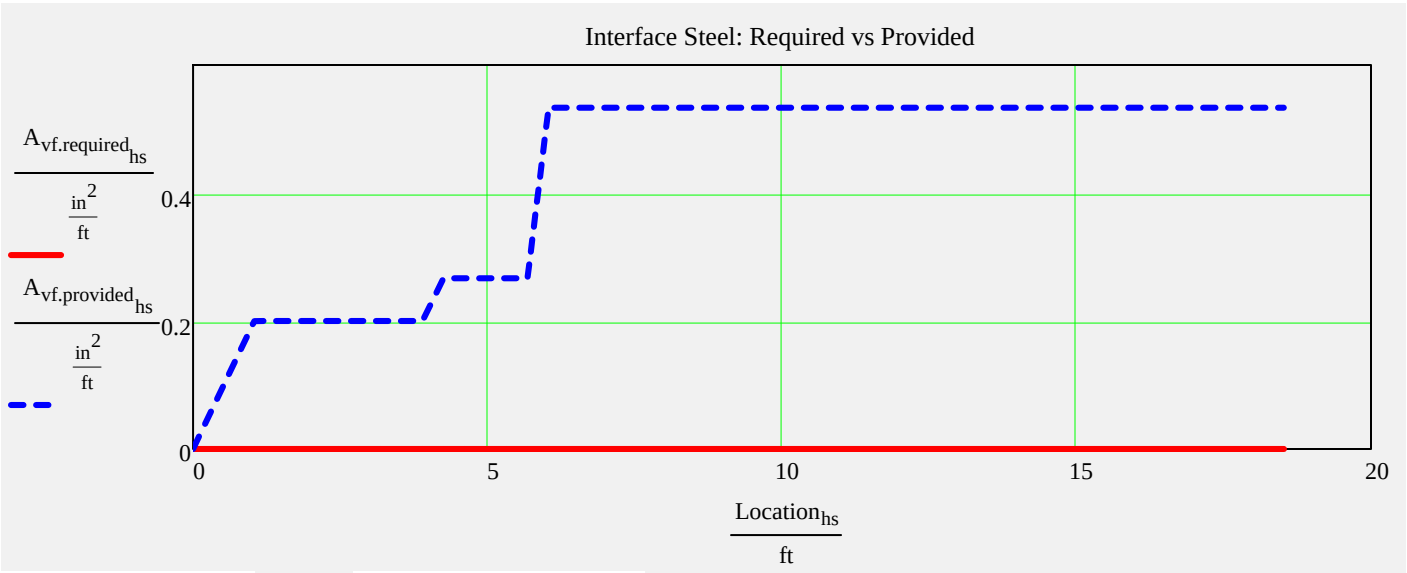


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 16.0 & 602.5 & 1557.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.39$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 7.94 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

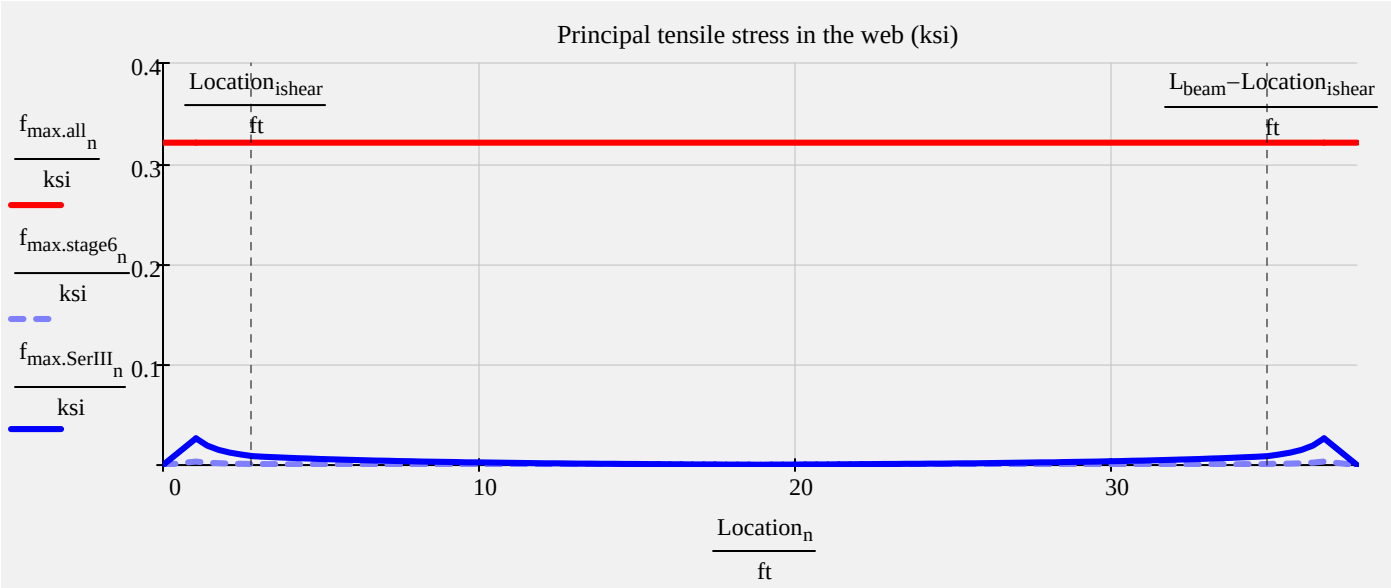
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33.9 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

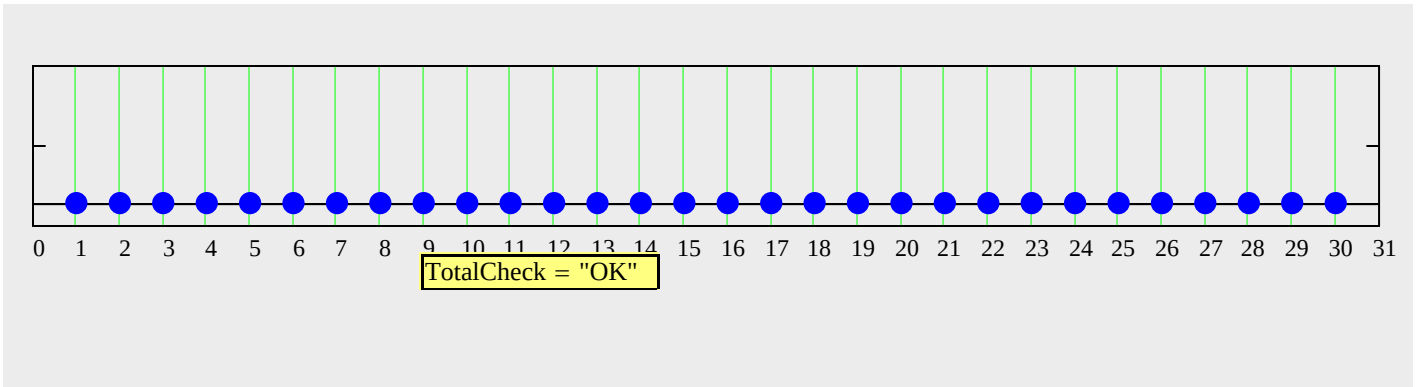
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.39	3.67	"N/A"	17.12	0.78	5.08	"N/A"	3.21	HL-93
"Strength I (Op)"	0.39	4.76	"N/A"	17.12	0.78	6.59	"N/A"	3.21	HL-93
"Service III (Inv)"	0.39	4.97	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.39	5.22	"N/A"	18.55	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.39	3.64	218.11	19.97	0.78	4.53	272.07	3.21	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.37$ $DC_{LongReinf.Permit} = 0.39$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1856	"factored resistance (kip-ft)...."
"γDL"	273	"factored dead load (kip-ft)...."
"γLL"	333	"factored live load (kip-ft)....."
"RF"	4.76	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	516.7	"factored resistance (kip)....."
"γDL"	25.2	"factored dead load (kip)....."
"γLL"	74.6	"factored live load (kip)....."
"RF"	6.59	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 38 FEET (15 DEG. SKEW)
WESTBOUND BRIDGE
(D.C.I CANAL)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\WB 38' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-38ftSpan-15inx56in_15SkewExtBeam.dat
FSB-38ftSpan-15inx56in_15SkewIntBeam.dat
FSB-38ftSpan-15inx56in_ExtBeam.dat
FSB-38ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

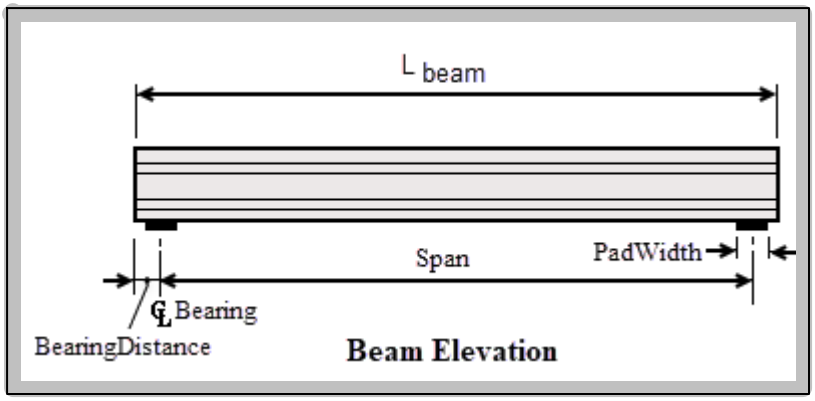
InputDataFile = "FSB-38ftSpan-15inx56in_15SkewIntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



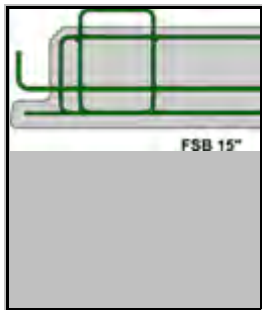
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-38ftSpan-15inx56in_15SkewIntBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	37.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100·ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths ≤ 100·ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

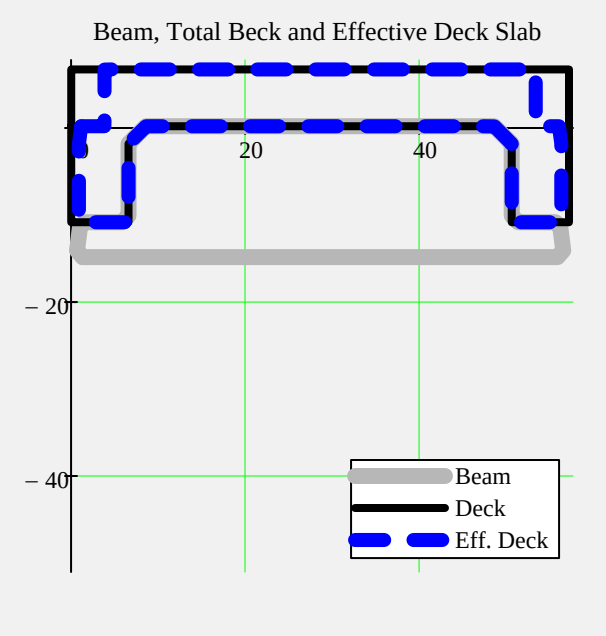
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 57.14 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 0.57 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 37.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

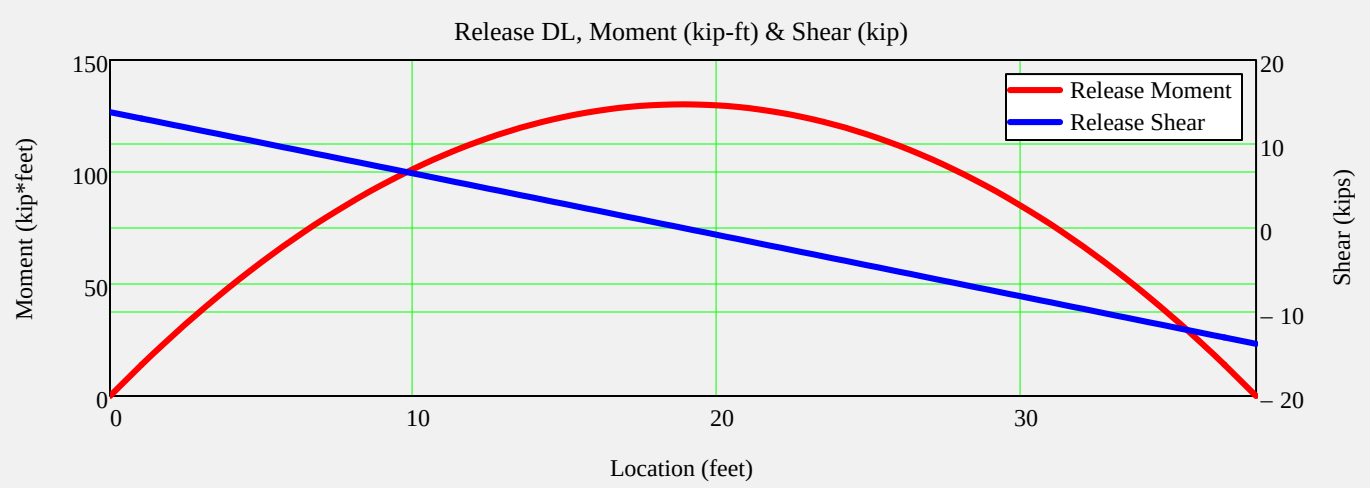
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

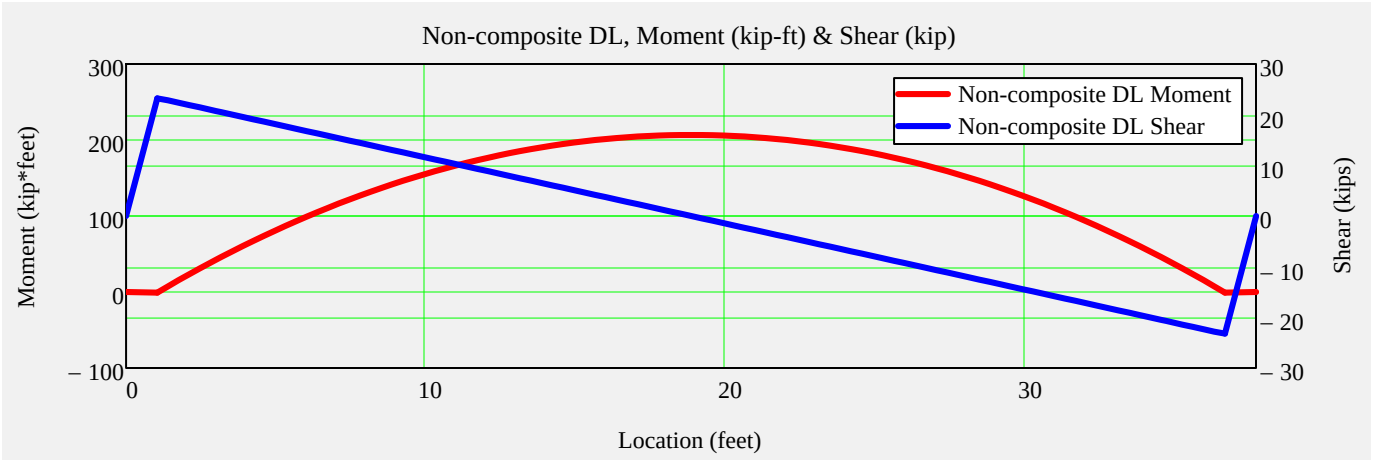
Release Dead Load Moments and Shears

$L_{span} = 35.67\ ft$



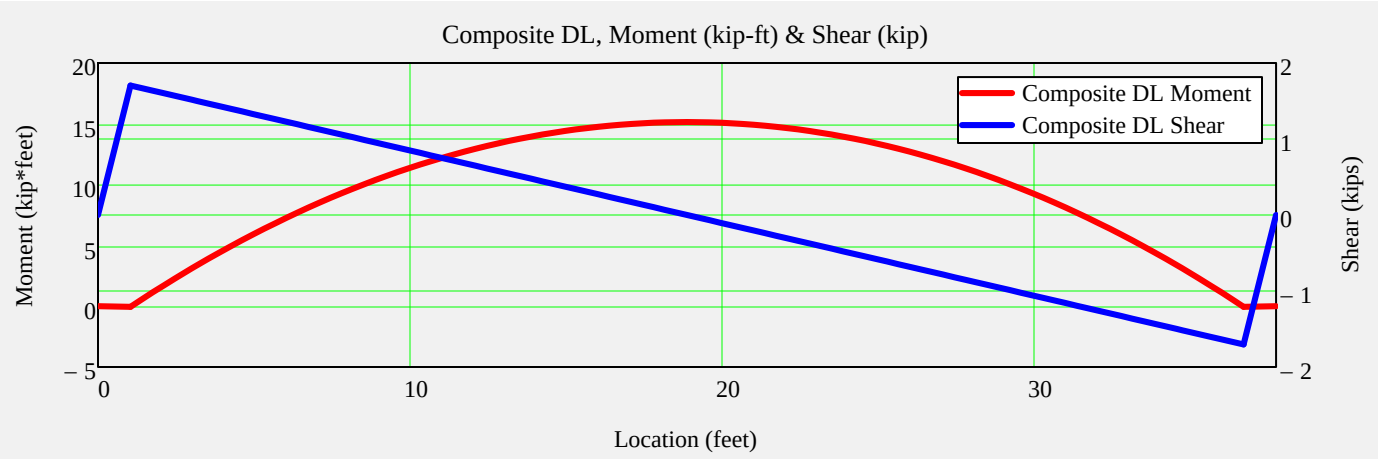
$\max(V_{release}) = 13.8 \cdot kip$ $\max(M_{release}) = 130.2 \cdot kip \cdot ft$ $\min(V_{release}) = -13.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 23.2 \cdot kip$ $\max(M_{dl.non.comp}) = 206.6 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -23.2 \cdot kip$

Composite Dead Load Moments and Shear



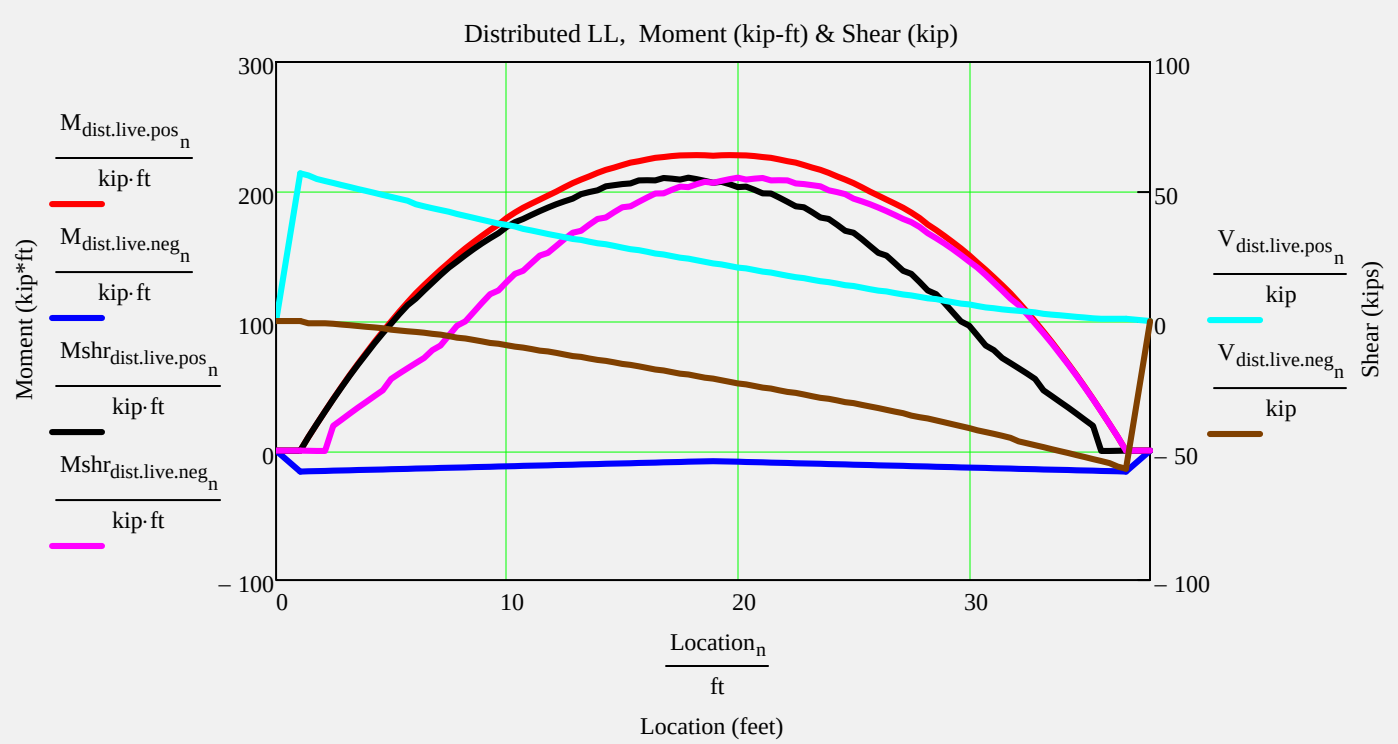
$\max(V_{dl.comp}) = 1.7 \cdot kip$ $\max(M_{dl.comp}) = 15.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -1.7 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 35.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.16$

Final Live Load Distribution Factors: $g_{mom} = 0.36$ $g_{mom.fatigue} = 0.22$ $g_{shear} = 0.69$



$\max(V_{dist.live.pos}) = 57.0 \cdot kip$

$\max(M_{dist.live.pos}) = 228.1 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -57.0 \cdot kip$

$Reaction_{LL} = 59.5 \cdot kip$

$\min(M_{dist.live.neg}) = -16.2 \cdot kip \cdot ft$

$Reaction_{DL} = 26.4 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 211 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

$Reaction_{truck} = 55.26 \cdot kip$ $Reaction_{lane} = 12.08 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

Beam End Reactions... without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{LL.without.IM} = 46.78 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-38ftSpan-15inx56in_15SkewIntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

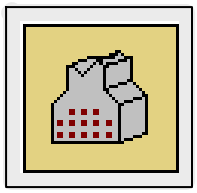
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

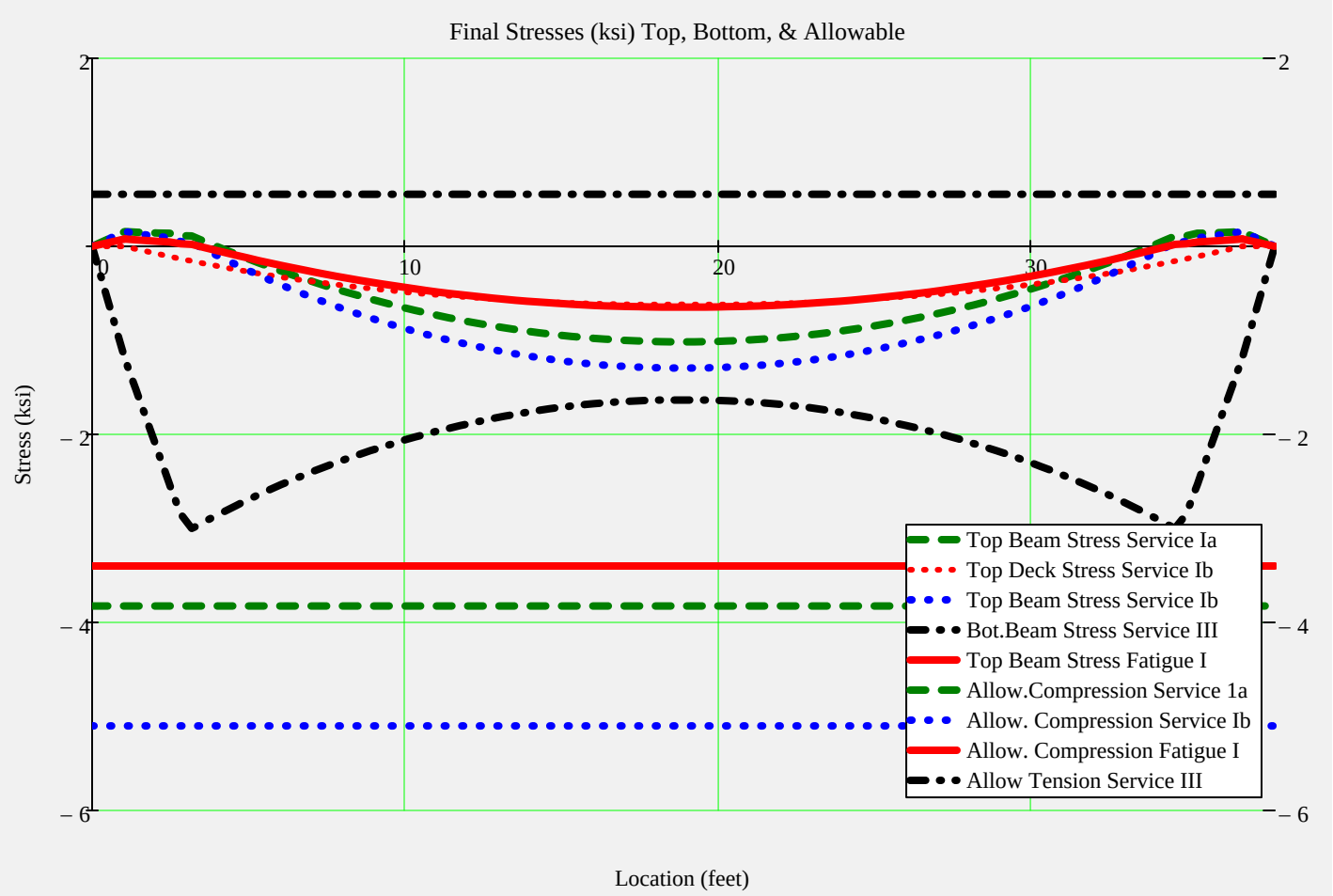
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

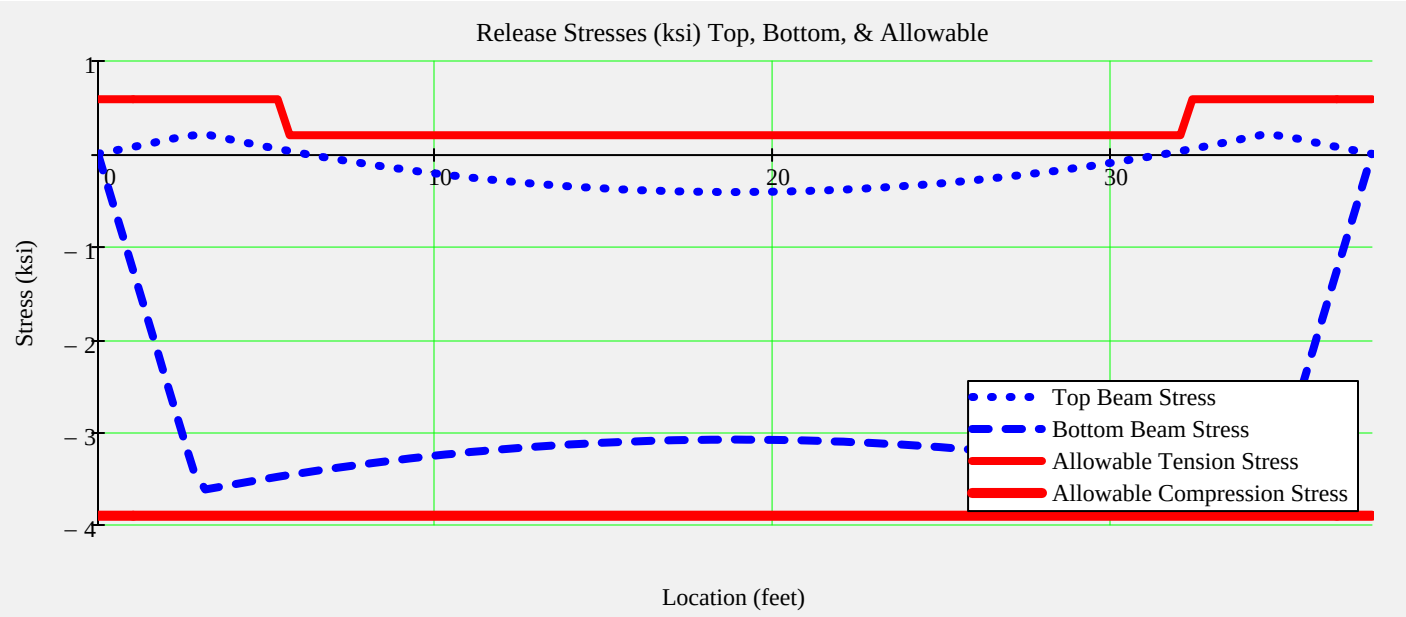
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.93$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.27$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.25$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.19$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.21	0.59
"Compression @ Release"	3.18	–3.62	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	18.88	–1.02	–3.83
"CompressionIb @ ServiceI"	18.88	–1.29	–5.10
"Compression @ FatigueI"	18.88	–0.65	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

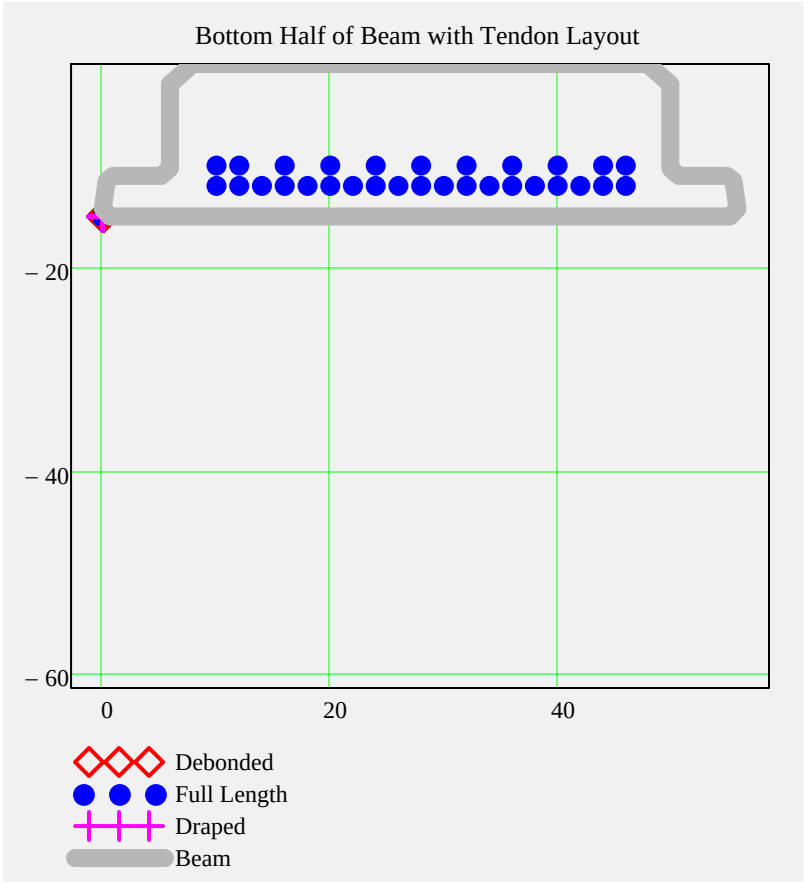
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

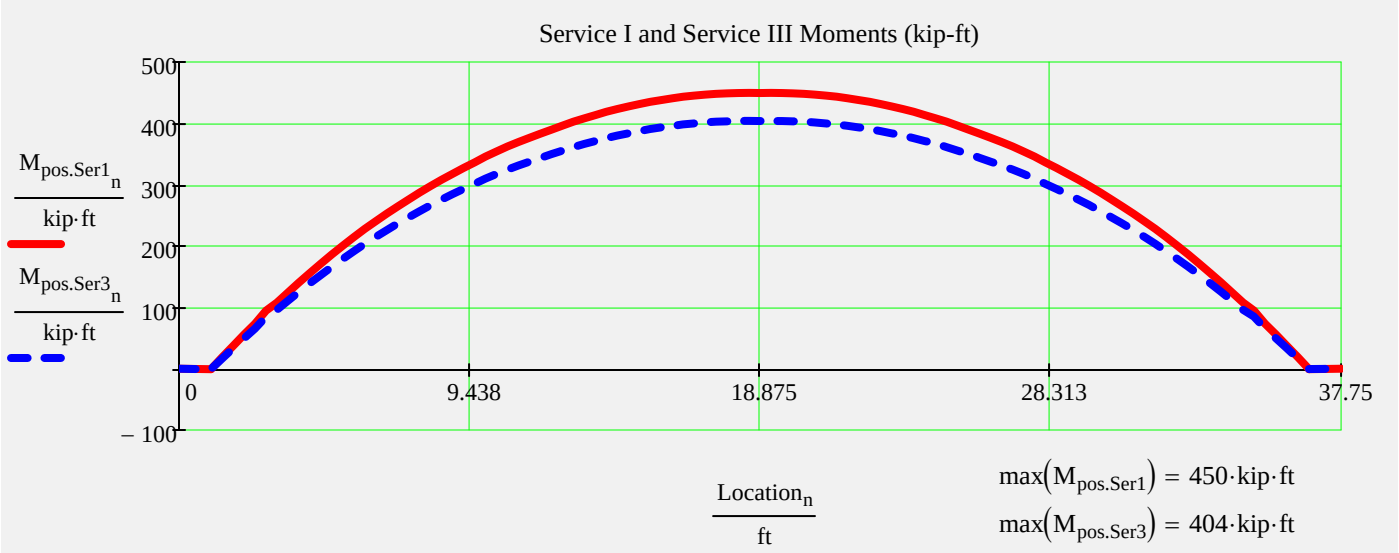
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

Check_f_{pe} = "OK"

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.41	–3.08
"2"	–0.47	–2.64
"4"	–0.37	–2.72
"6"	–1.00	–2.18
"8"	–1.29	–1.63

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1189.7	45382	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	130
"Non-Composite DL (incl. beam wt.)"	207
"Composite Dead Load"	15
"Distributed Live Load"	228

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

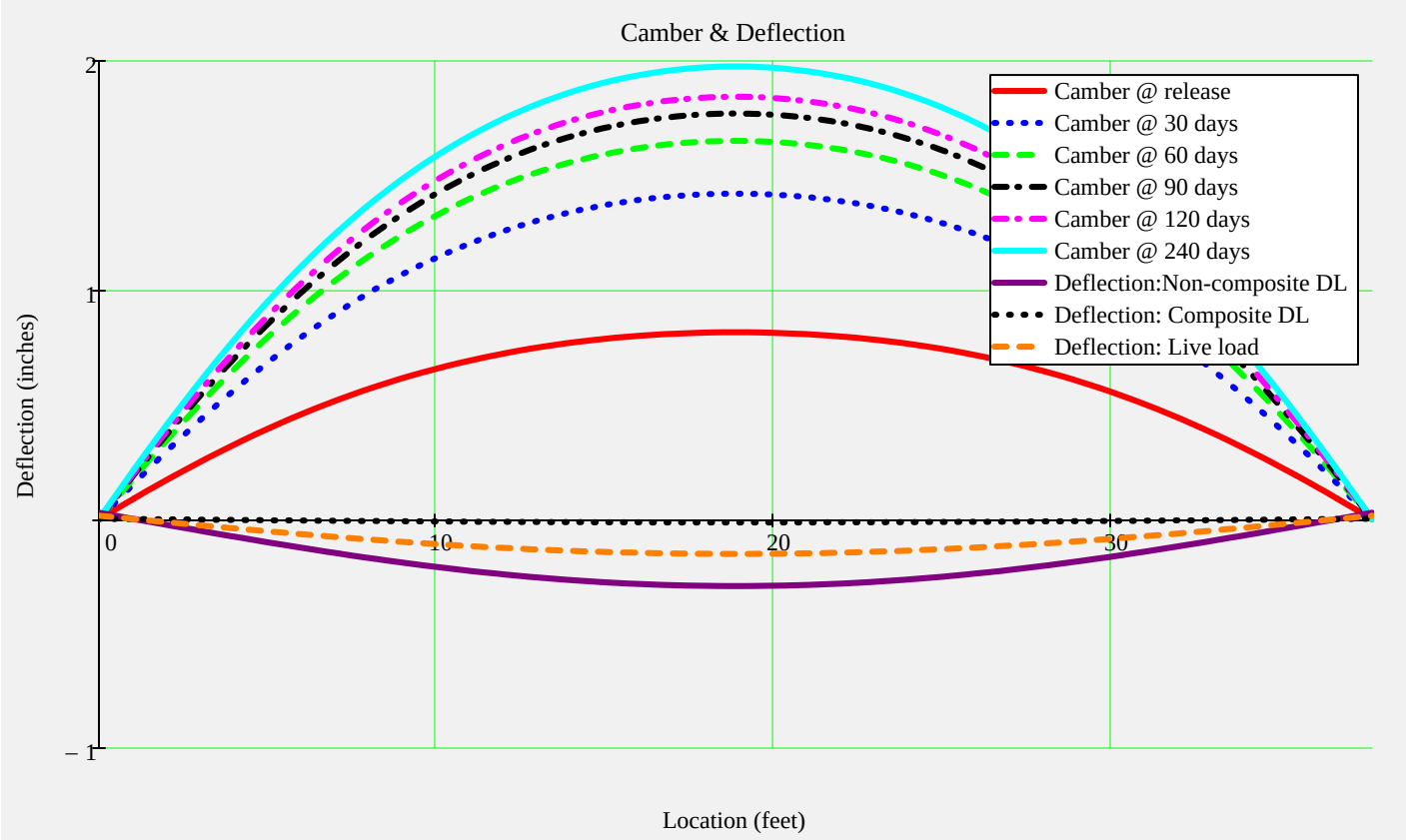
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 35.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.30	0.42	0.82
"30 Days"	–0.09	–0.56	0.72	1.42
"60 Days"	–0.12	–0.66	0.84	1.65
"90 Days"	–0.13	–0.71	0.90	1.77
"120 Days"	–0.14	–0.74	0.94	1.84
"240 Days"	–0.16	–0.79	1.00	1.98
"Non-comp DL"	–0.04	0.03	–0.13	–0.29
"Comp DL"	–0.00	0.00	–0.01	–0.01
"LL"	–0.01	0.02	–0.07	–0.15

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.54 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

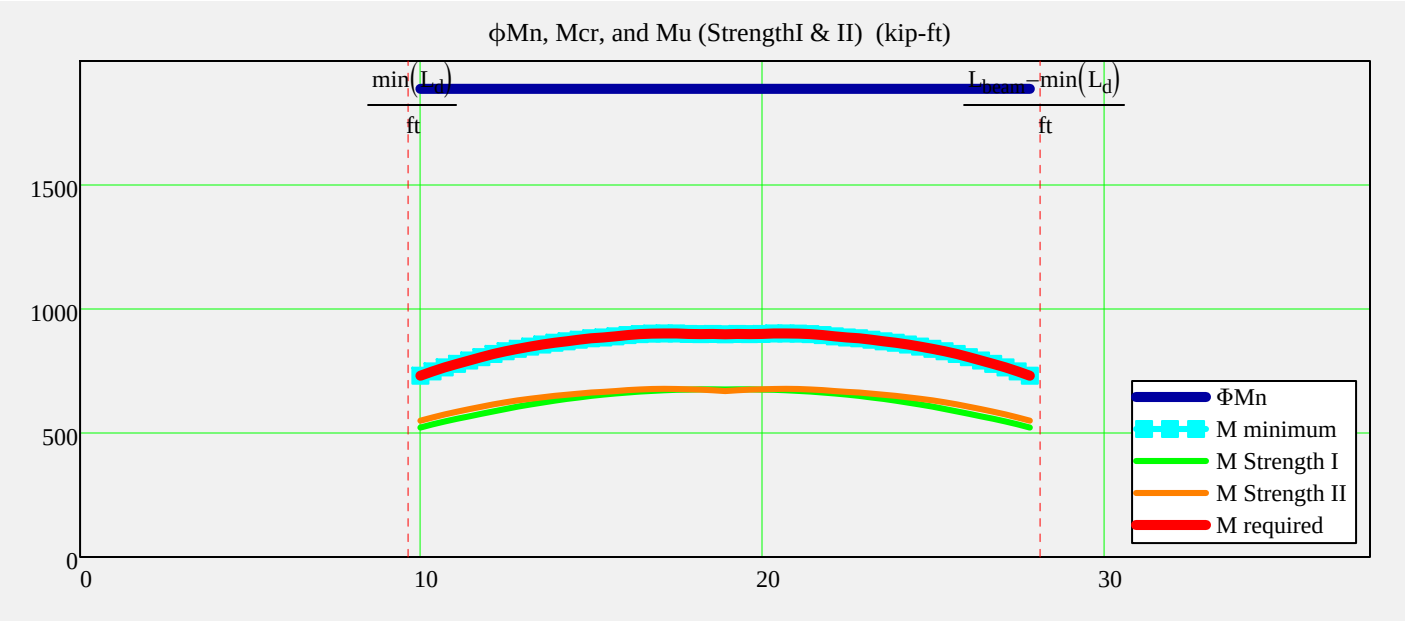
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 678 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 898 \cdot kip \cdot ft$ $M_{reqd_{51}} = 898 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1888 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 28.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.48$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

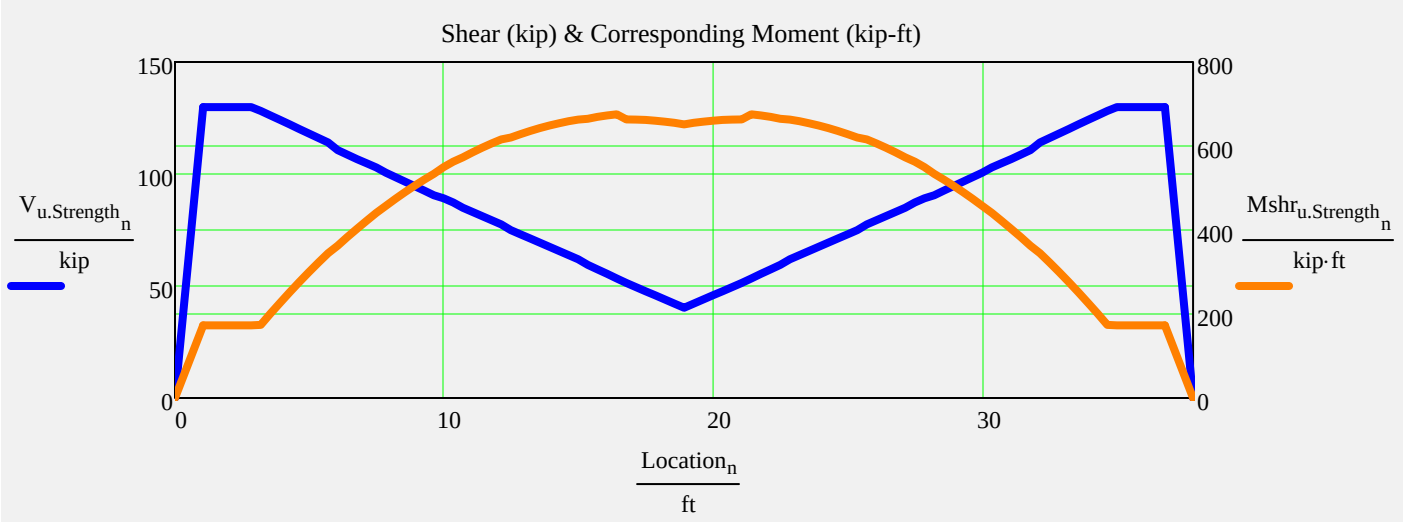
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

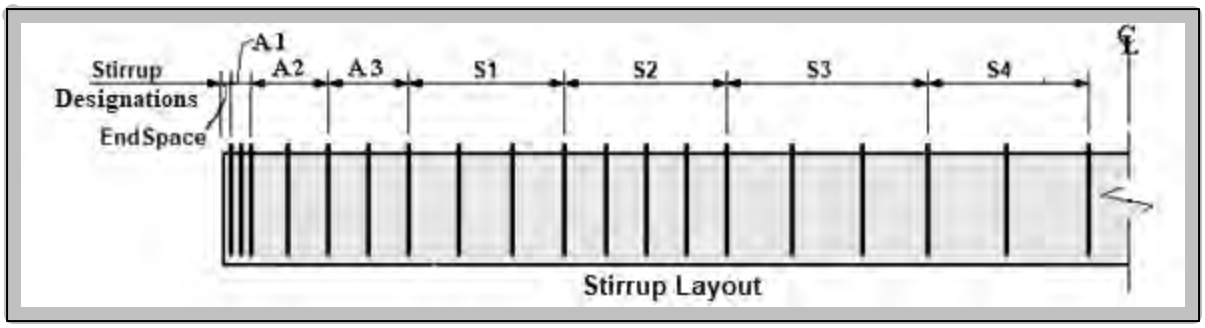
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 131 \\ 142 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 129.9 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 676 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

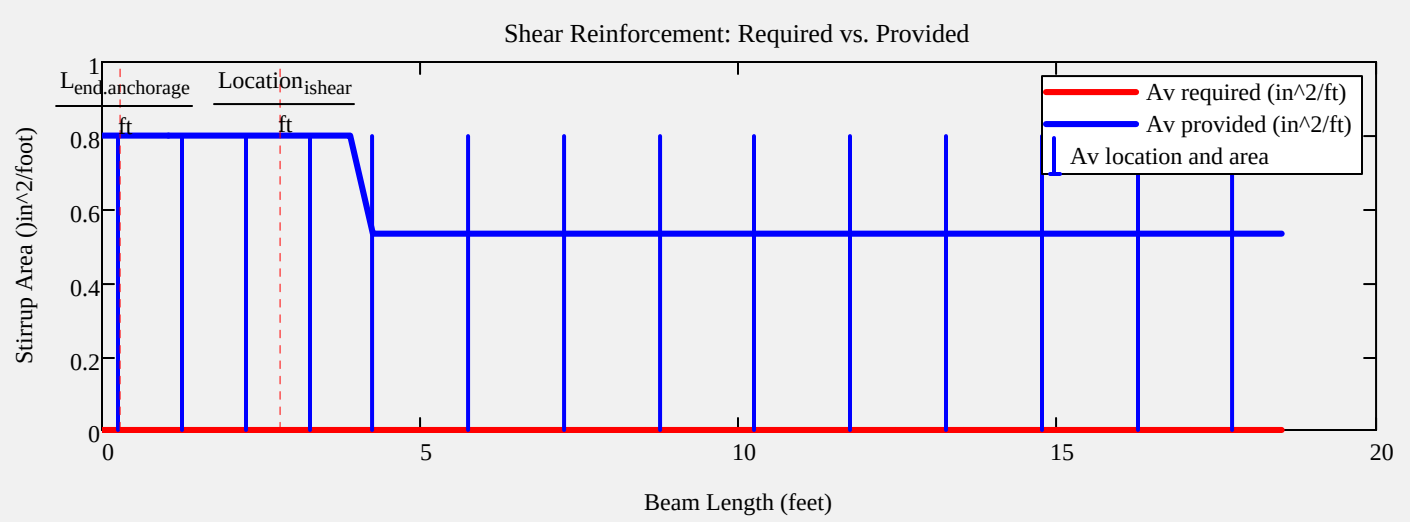
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.83\ ft$

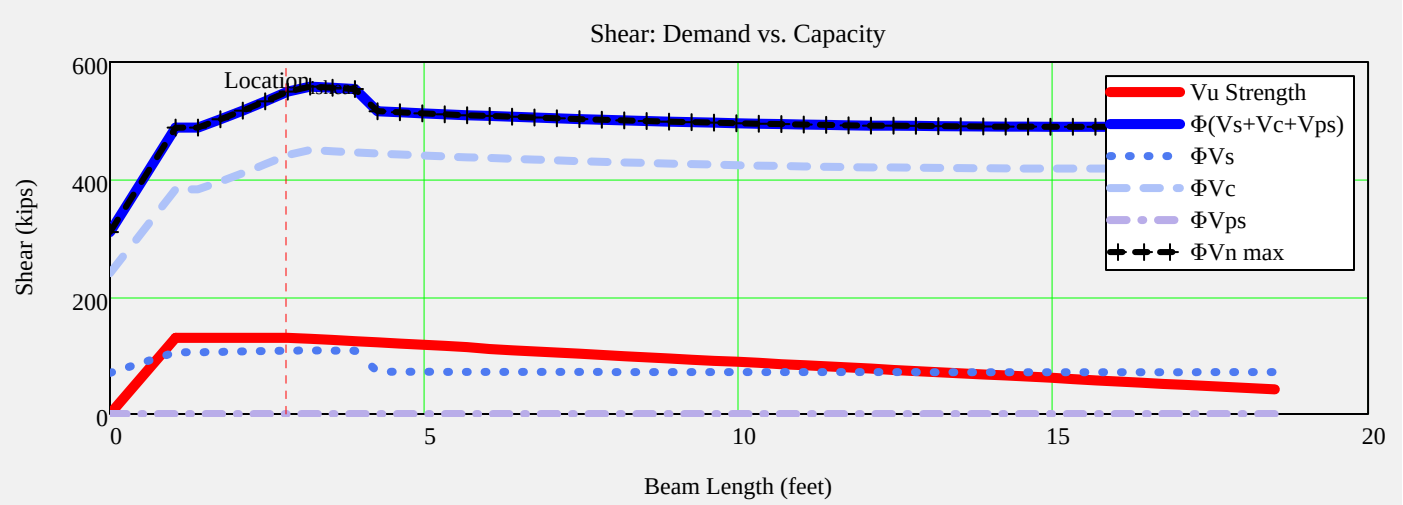
Save Data File ☑ Use current input file

File Name FSB-38ftSpan-15inx56in_15SkewIntBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

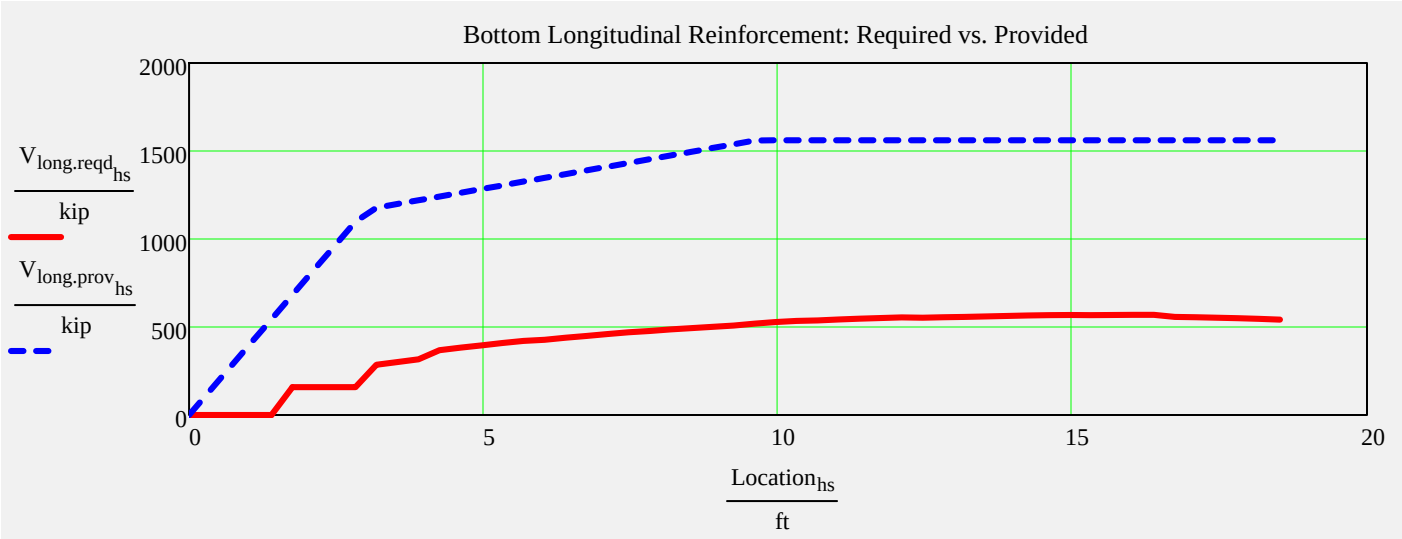
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.25 & 122.11 & 516.09 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.24$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

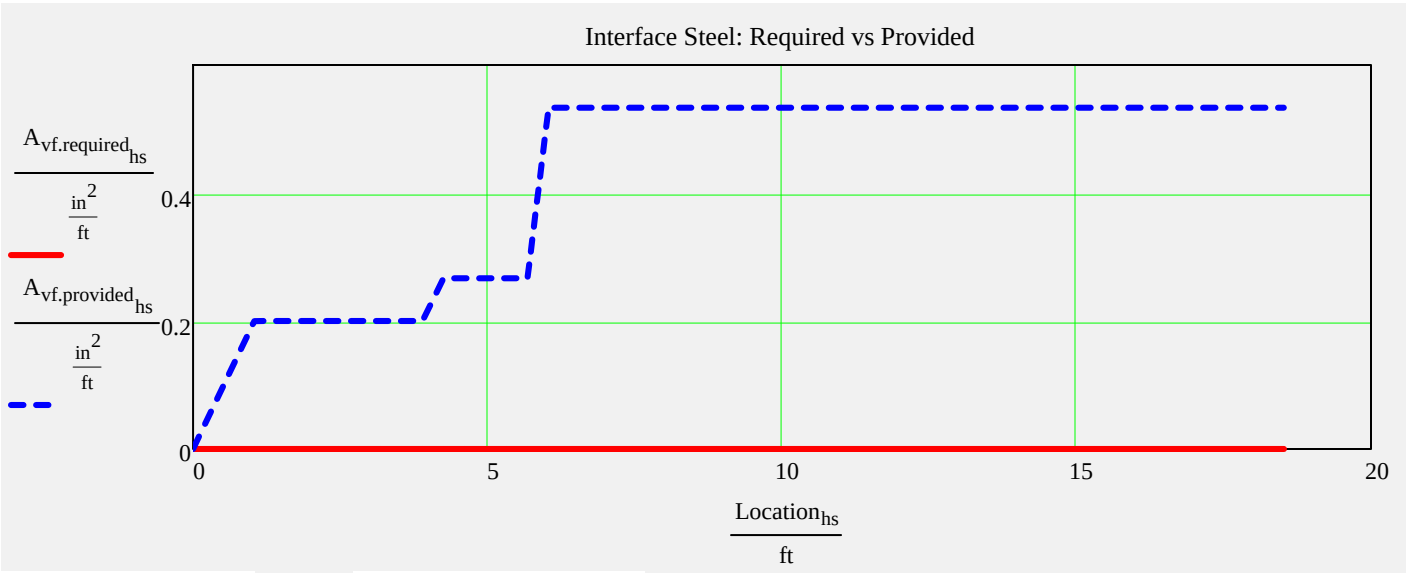


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 16.4 & 569.0 & 1560.5 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.36$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 7.94 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

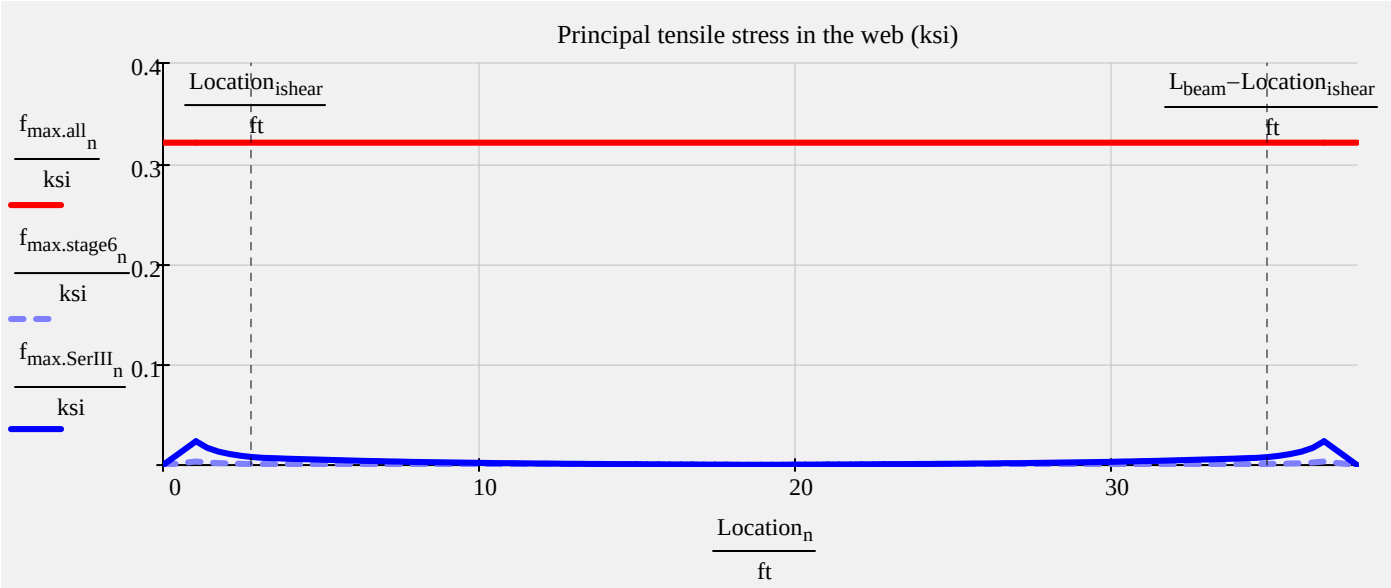
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33.9 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

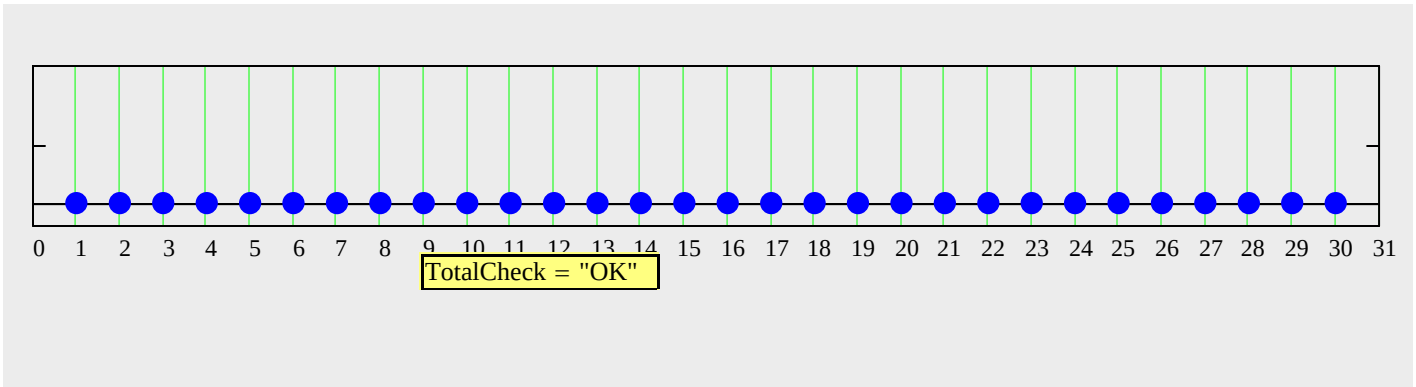
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.36	4.04	"N/A"	17.12	0.69	5.70	"N/A"	3.21	HL-93
"Strength I (Op)"	0.36	5.23	"N/A"	17.12	0.69	7.38	"N/A"	3.21	HL-93
"Service III (Inv)"	0.36	5.37	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.36	5.65	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.36	3.99	239.68	15.69	0.69	5.08	304.96	3.21	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.35$ $DC_{LongReinf.Permit} = 0.36$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1888	"factored resistance (kip-ft)...."
"γDL"	277	"factored dead load (kip-ft)...."
"γLL"	308	"factored live load (kip-ft)....."
"RF"	5.23	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	518.6	"factored resistance (kip)....."
"γDL"	25.6	"factored dead load (kip)....."
"γLL"	66.8	"factored live load (kip)....."
"RF"	7.38	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 38 FEET (NO SKEW)

EASTBOUND BRIDGE

(TIGER BAY)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\EB 38' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-38ftSpan-15inx56in_15Skew_ExtBeam.dat
FSB-38ftSpan-15inx56in_15Skew_IntBeam.dat
FSB-38ftSpan-15inx56in_ExtBeam.dat
FSB-38ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

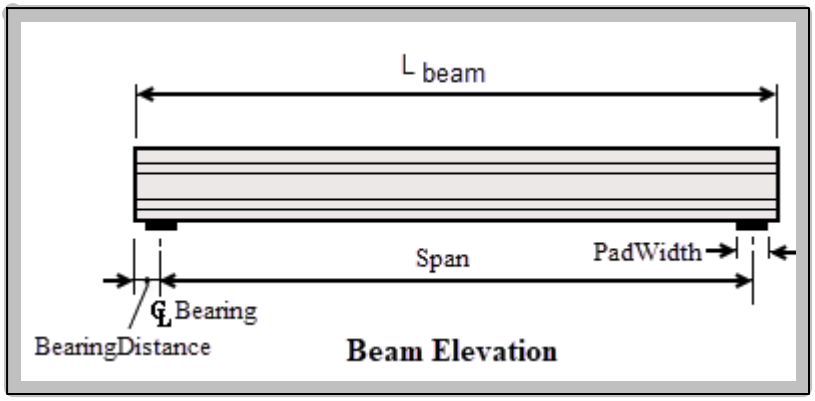
InputDataFile = "FSB-38ftSpan-15inx56in_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

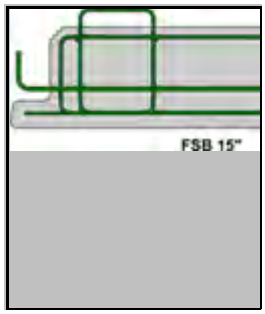
InputDataFile = "FSB-38ftSpan-15inx56in_ExtBeam.dat"

Beam Type: FSB12 / **FSB15** / FSB18

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



L_{beam}	37.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

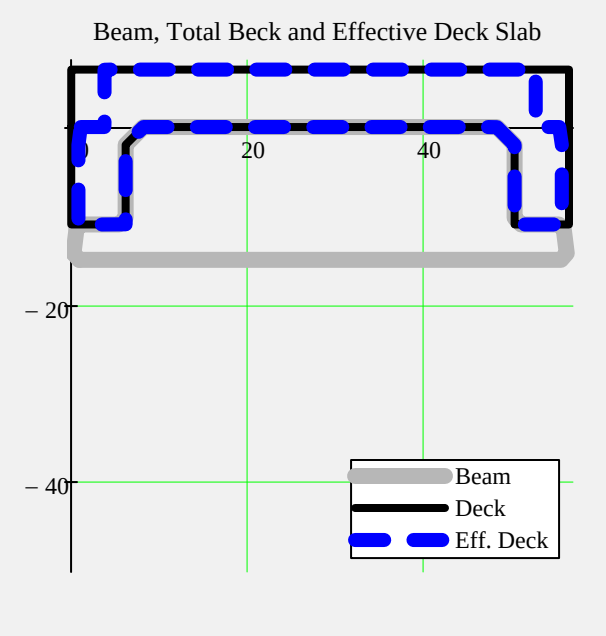
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 56.32 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.56 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 37.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

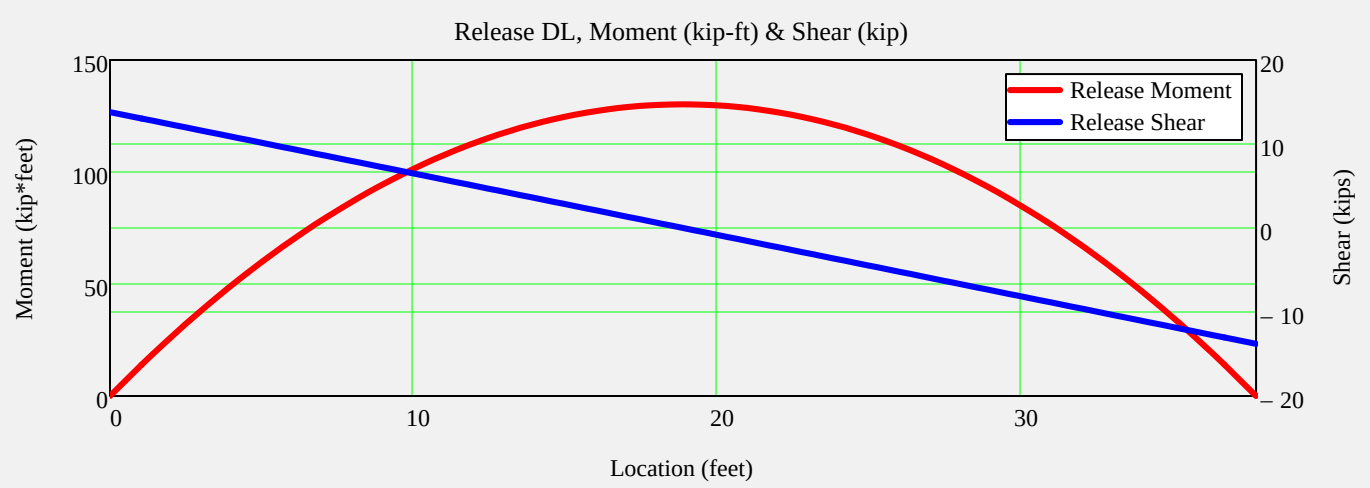
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

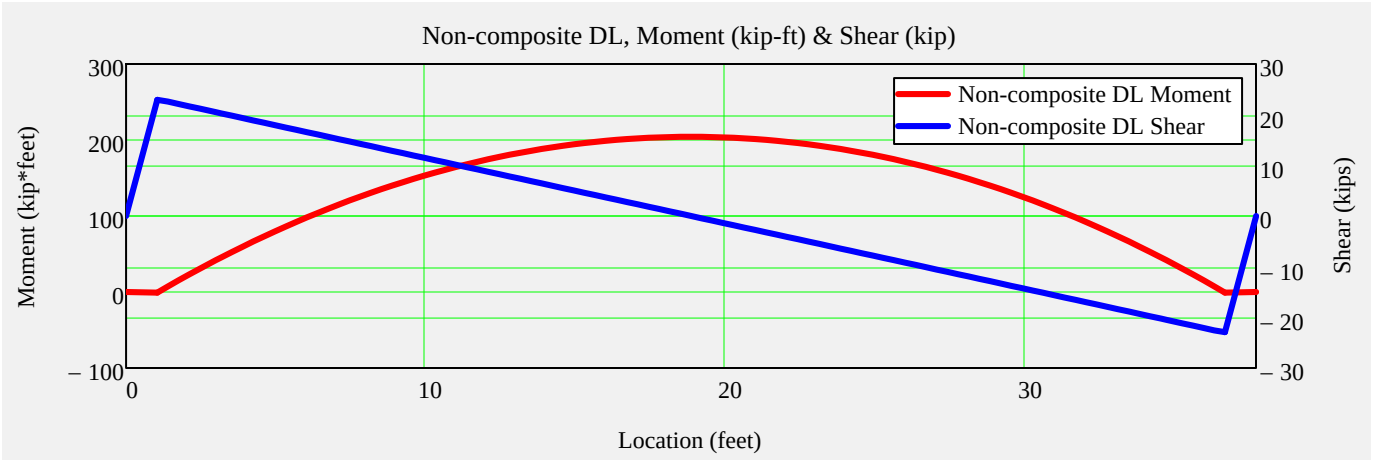
Release Dead Load Moments and Shears

$L_{span} = 35.67\ ft$



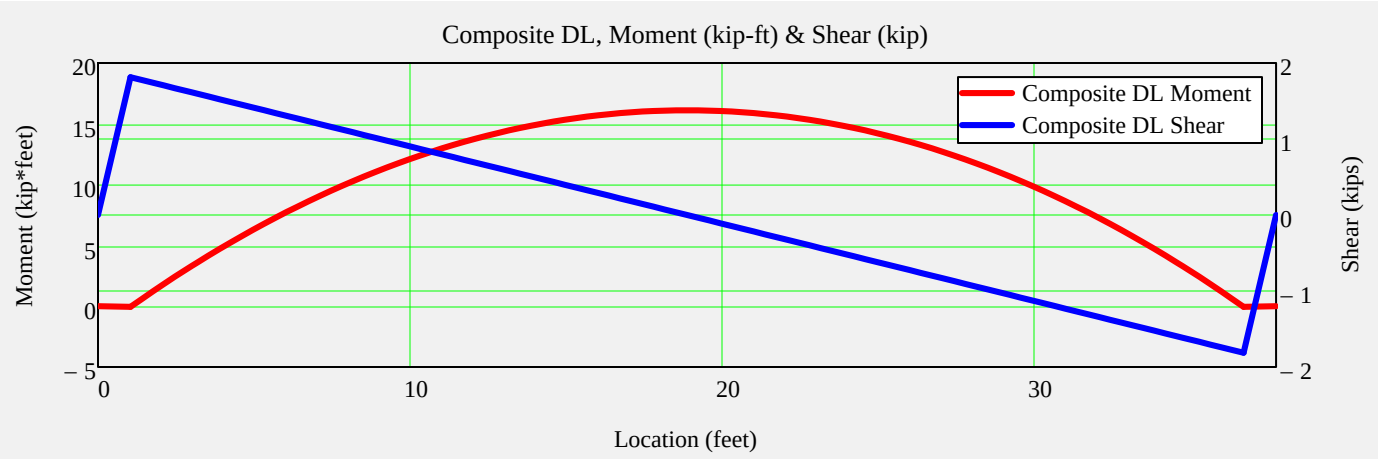
$\max(V_{release}) = 13.8 \cdot kip$ $\max(M_{release}) = 130.2 \cdot kip \cdot ft$ $\min(V_{release}) = -13.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 22.9 \cdot kip$ $\max(M_{dl.non.comp}) = 204.2 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -22.9 \cdot kip$

Composite Dead Load Moments and Shear



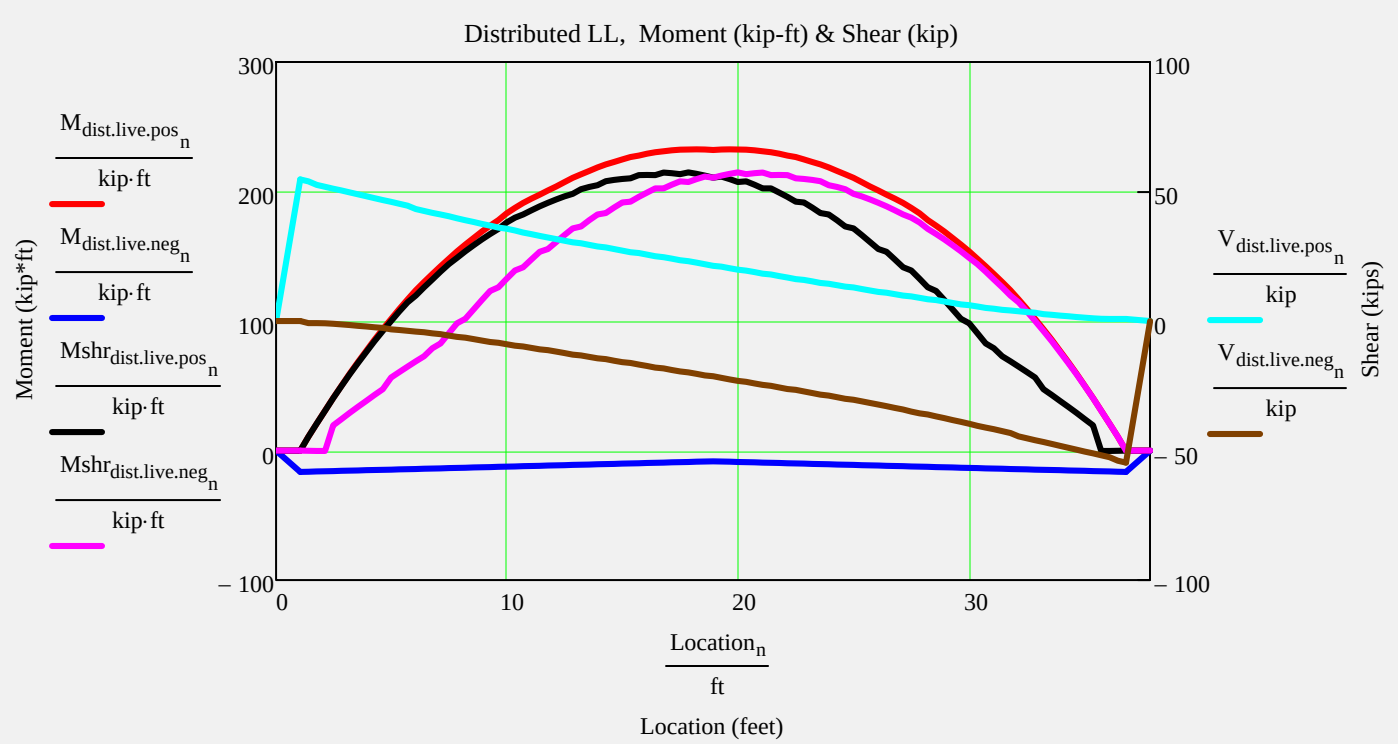
$\max(V_{dl.comp}) = 1.8 \cdot kip$ $\max(M_{dl.comp}) = 16.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -1.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 35.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.37$ $g_{mom.fatigue} = 0.24$ $g_{shear} = 0.67$



$\max(V_{dist.live.pos}) = 54.7 \cdot kip$ $\max(M_{dist.live.pos}) = 232.5 \cdot kip \cdot ft$ $\min(V_{dist.live.neg}) = -54.7 \cdot kip$

$Reaction_{LL} = 57.0 \cdot kip$

$Reaction_{DL} = 26.2 \cdot kip$

$\min(M_{dist.live.neg}) = -16.5 \cdot kip \cdot ft$

$\max(Mshr_{dist.live.pos}) = 215 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{truck} = 55.26 \cdot kip$ $Reaction_{lane} = 12.08 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 44.88 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-38ftSpan-15inx56in_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

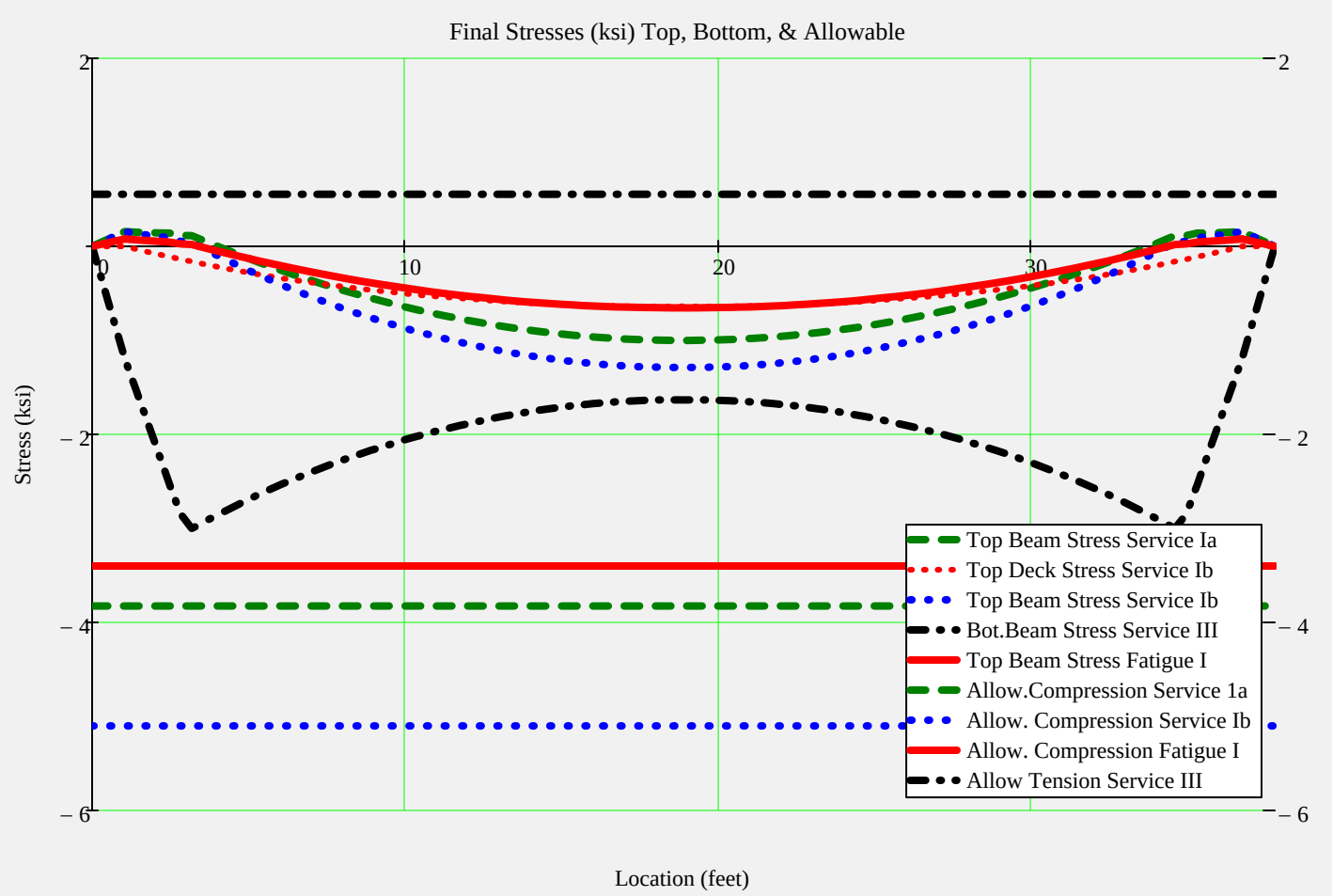
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

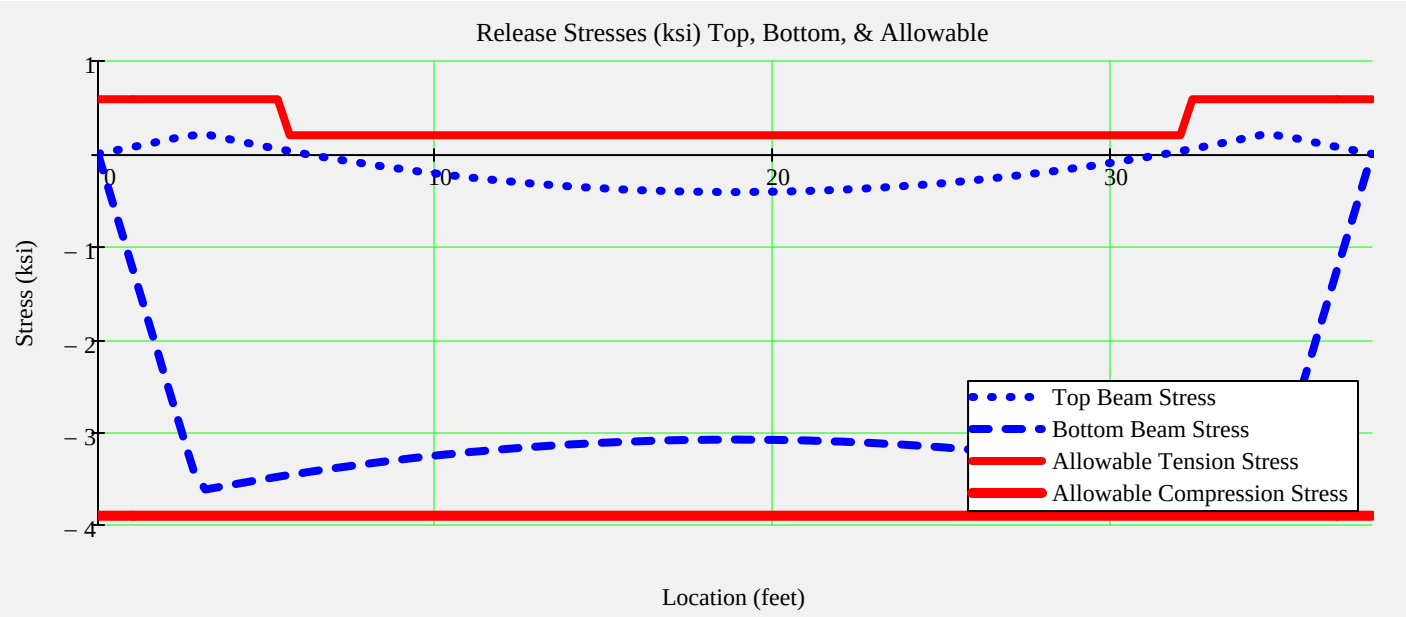
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.93$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.26$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.25$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.19$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.21	0.59
"Compression @ Release"	3.18	–3.62	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	18.88	–1.00	–3.83
"CompressionIb @ ServiceI"	18.88	–1.29	–5.10
"Compression @ FatigueI"	18.88	–0.65	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

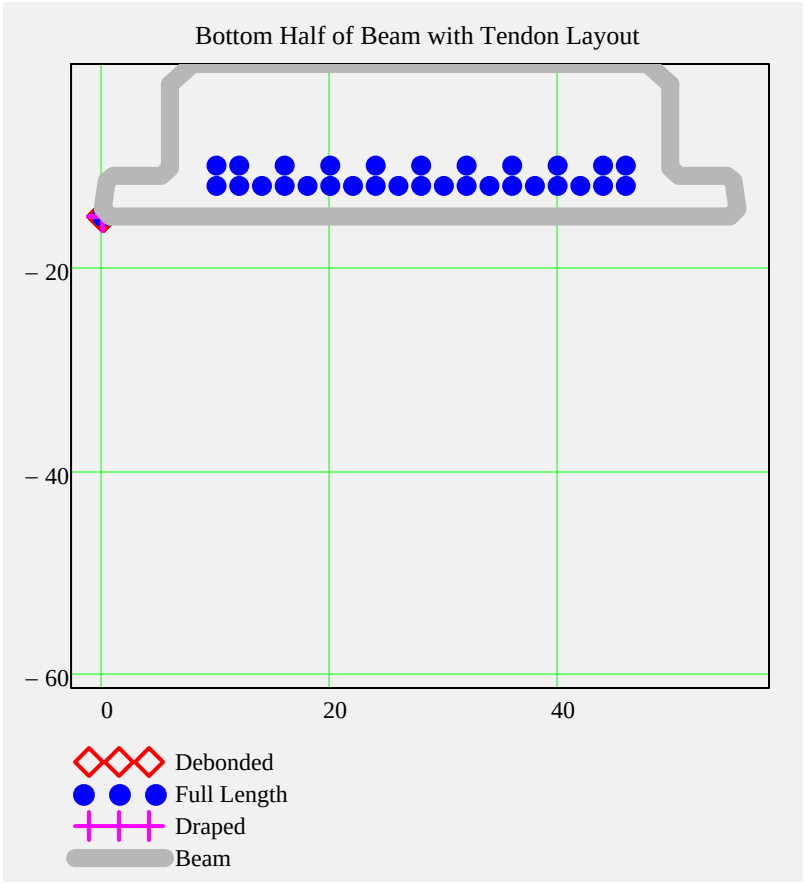
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

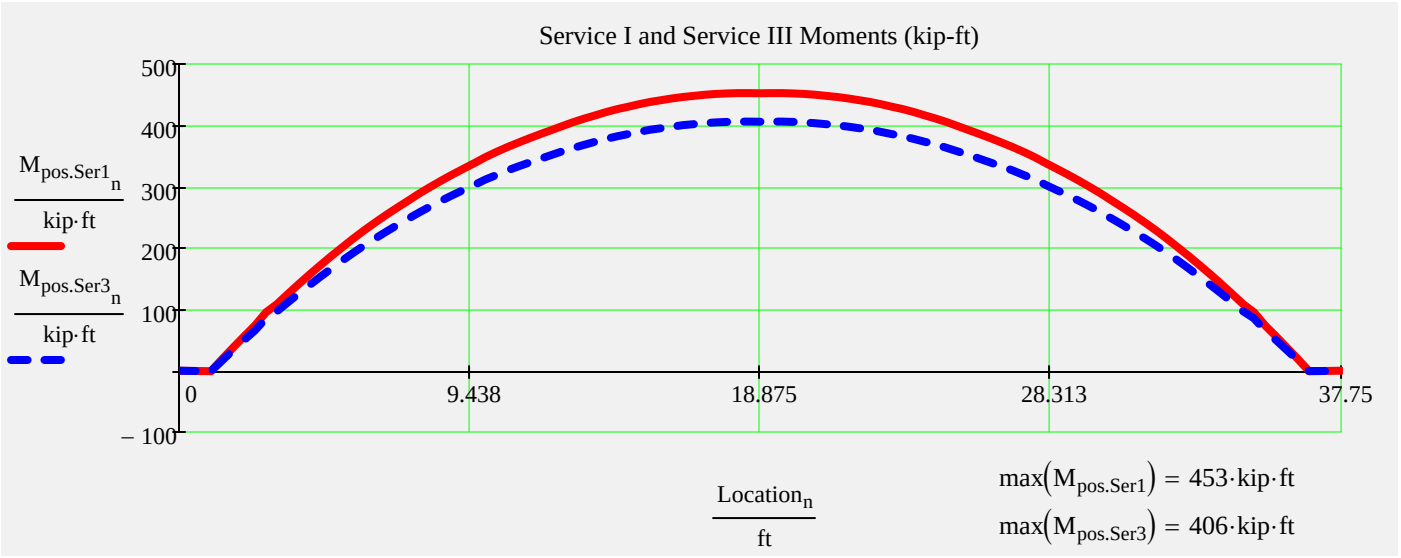
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.41 & -3.08 \\ \text{"2"} & -0.47 & -2.64 \\ \text{"4"} & -0.37 & -2.72 \\ \text{"6"} & -0.98 & -2.19 \\ \text{"8"} & -1.29 & -1.63 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1177.2	44990	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	130
"Non-Composite DL (incl. beam wt.)"	204
"Composite Dead Load"	16
"Distributed Live Load"	232

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

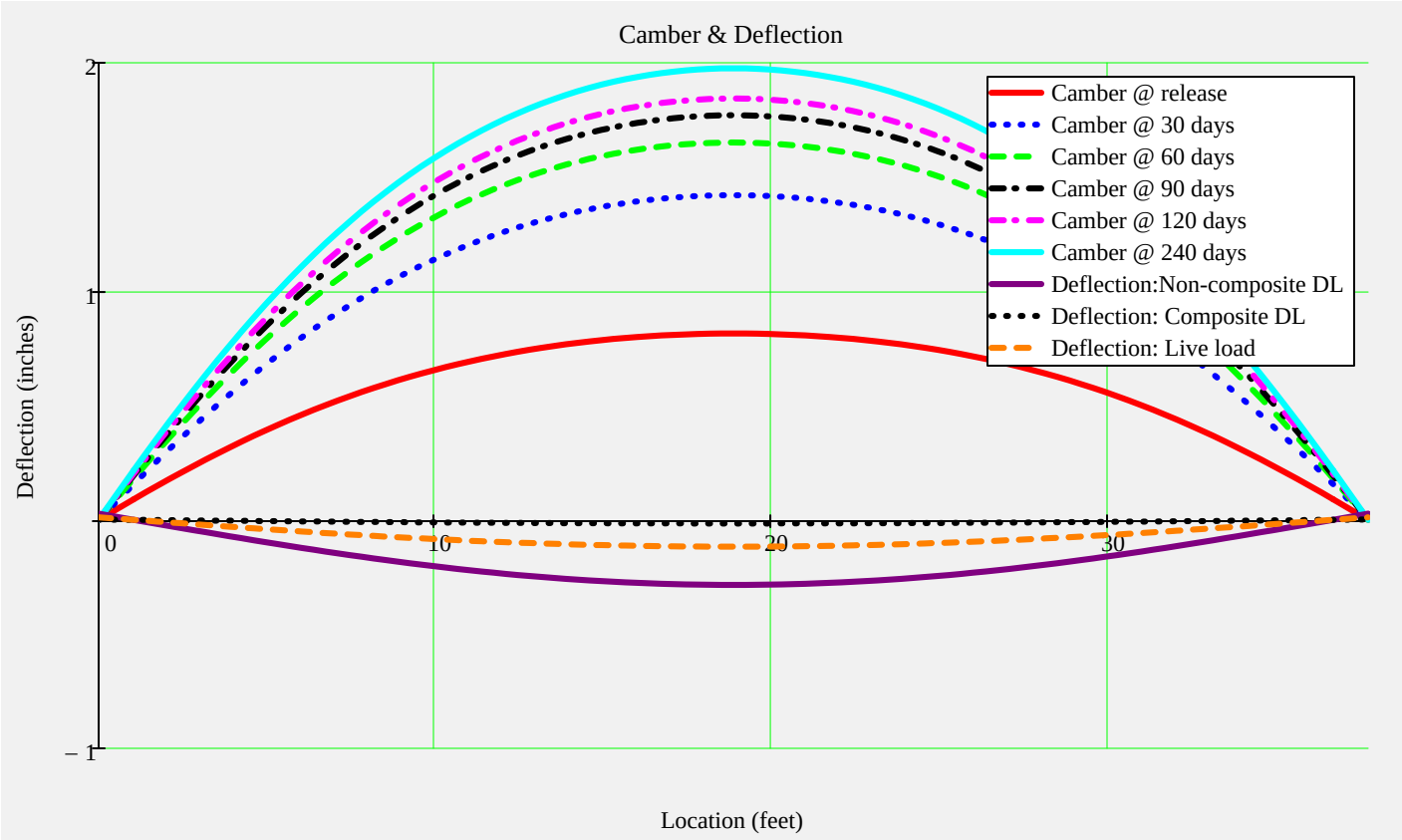
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 35.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.30	0.42	0.82
"30 Days"	–0.09	–0.56	0.72	1.42
"60 Days"	–0.12	–0.66	0.84	1.65
"90 Days"	–0.13	–0.71	0.90	1.77
"120 Days"	–0.14	–0.74	0.94	1.84
"240 Days"	–0.16	–0.79	1.00	1.98
"Non-comp DL"	–0.03	0.03	–0.12	–0.28
"Comp DL"	–0.00	0.00	–0.01	–0.02
"LL"	–0.01	0.02	–0.05	–0.12

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.54 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

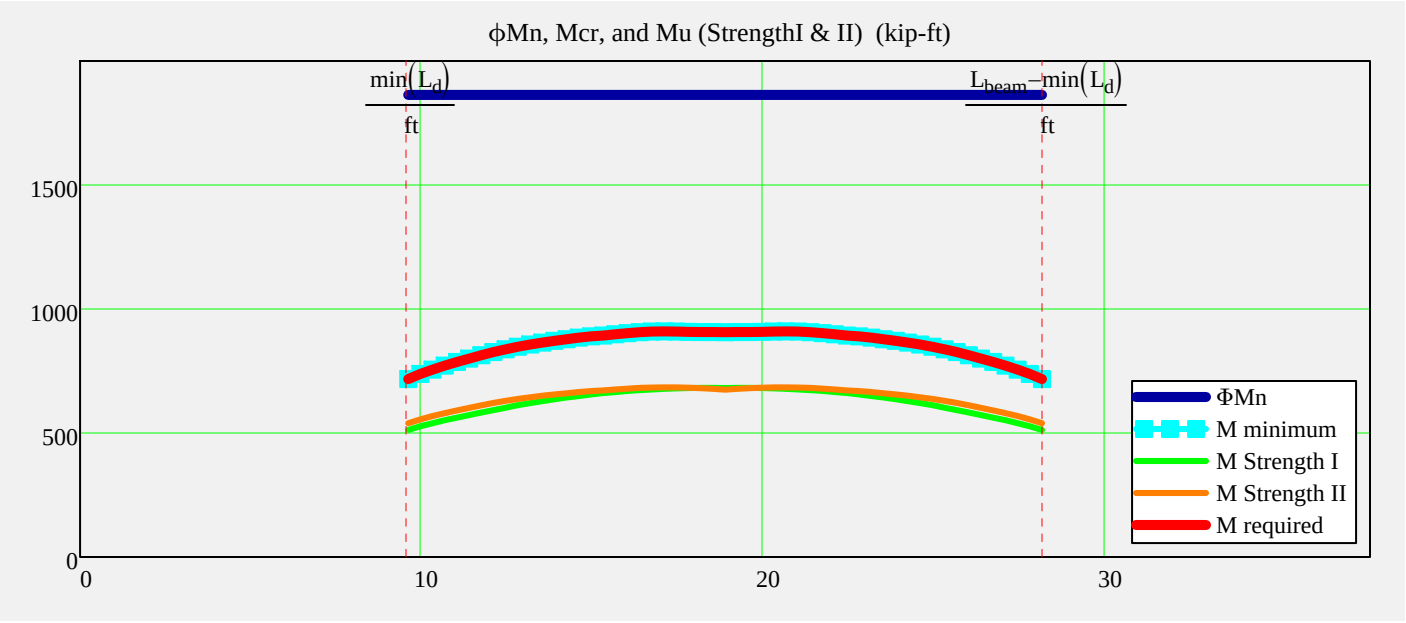
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 684 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 906 \cdot kip \cdot ft$ $M_{reqd_{51}} = 906 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1864 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 28.2\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.49$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

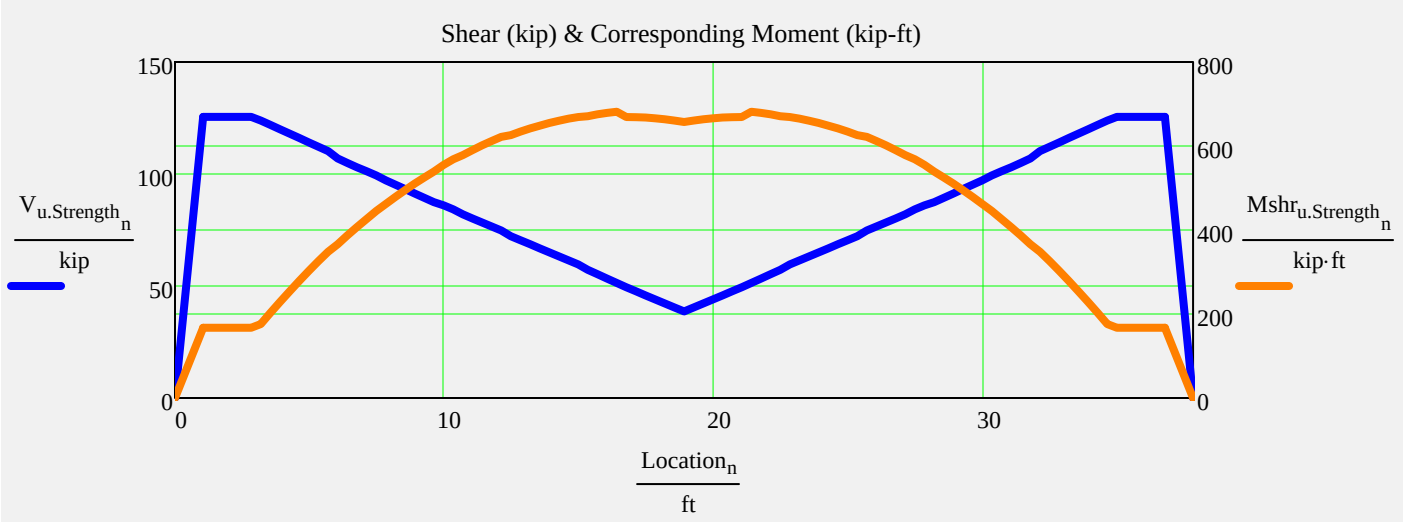
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

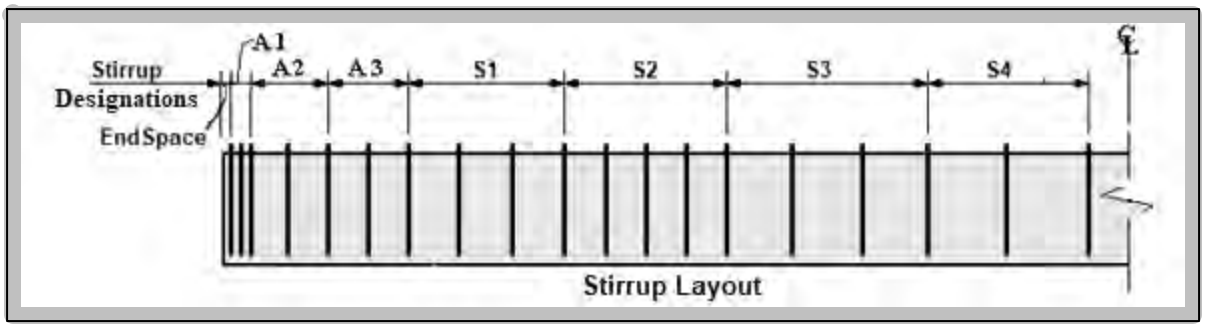
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 127 \\ 137 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 125.5 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 682 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

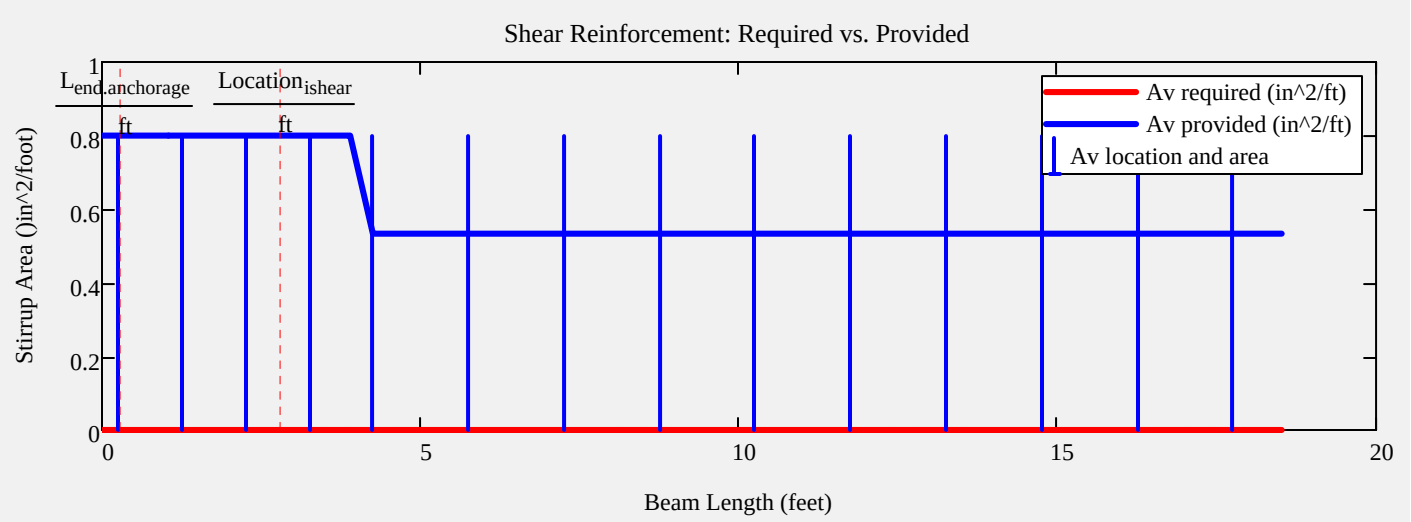
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.83\ ft$

Save Data File

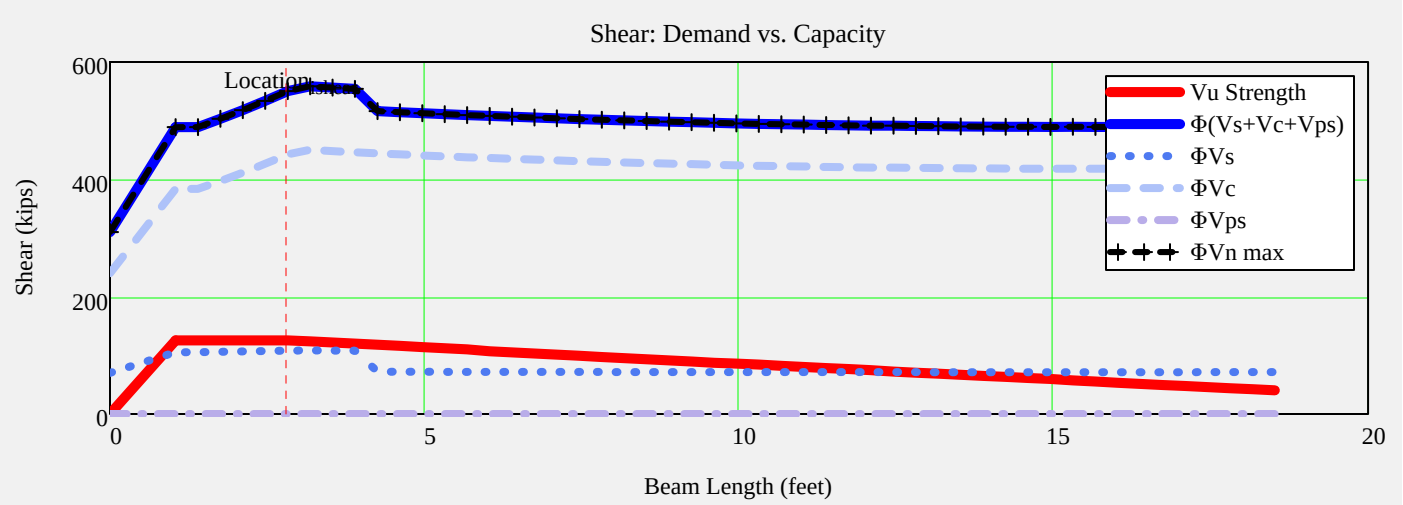
Use current input file

File Name FSB-38ftSpan-15inx56in_ExtBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

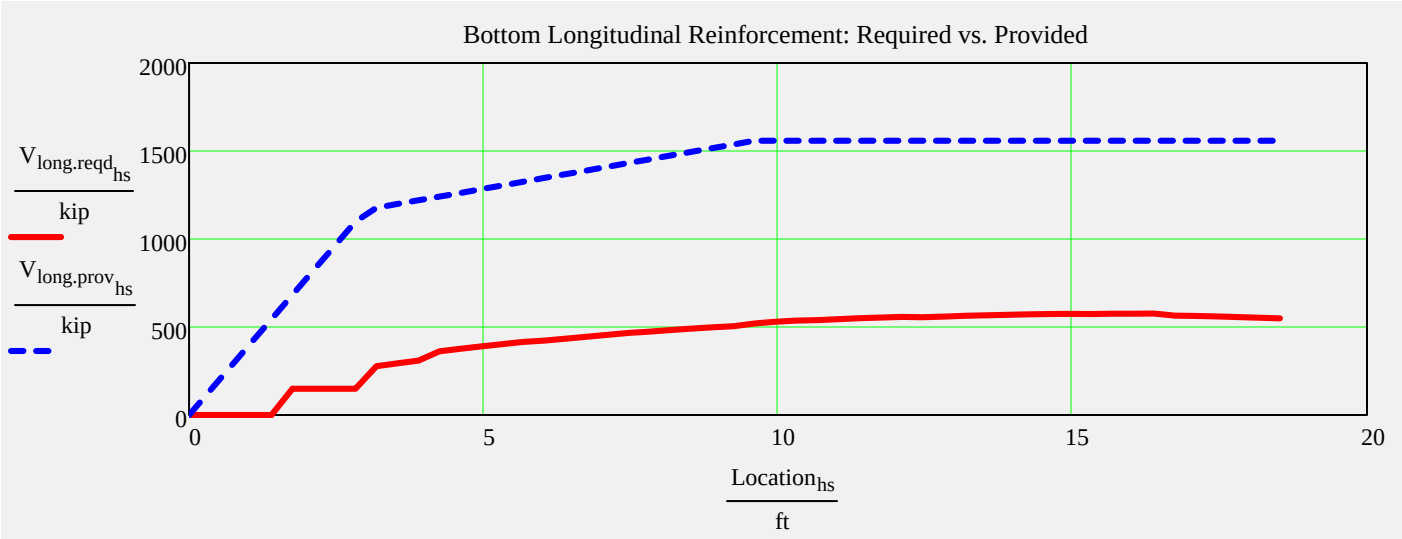
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.25 & 118.01 & 516.34 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.23$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

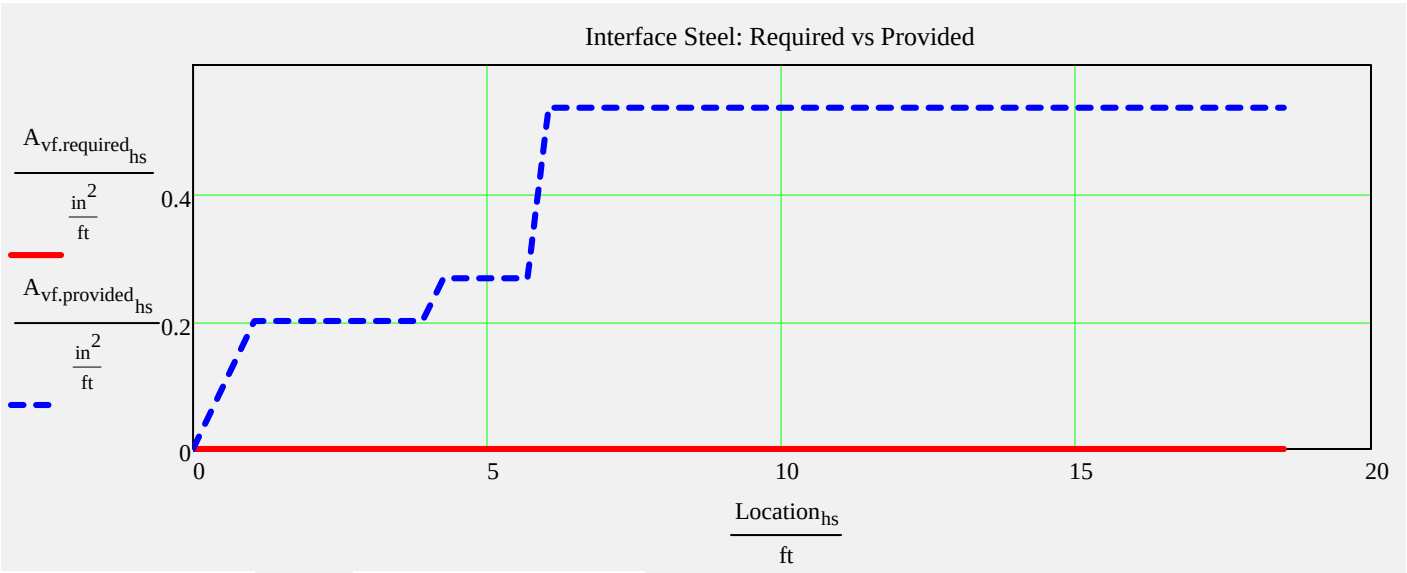


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 16.4 & 576.1 & 1558.2 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.37$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 7.94 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

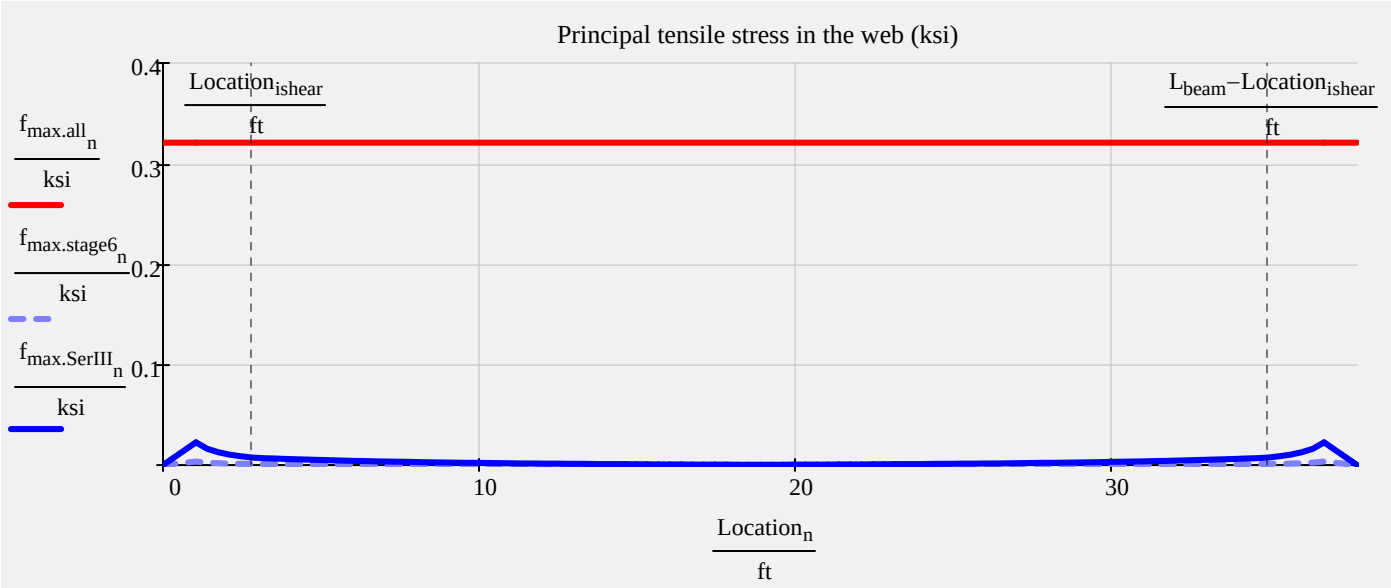
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33.9 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

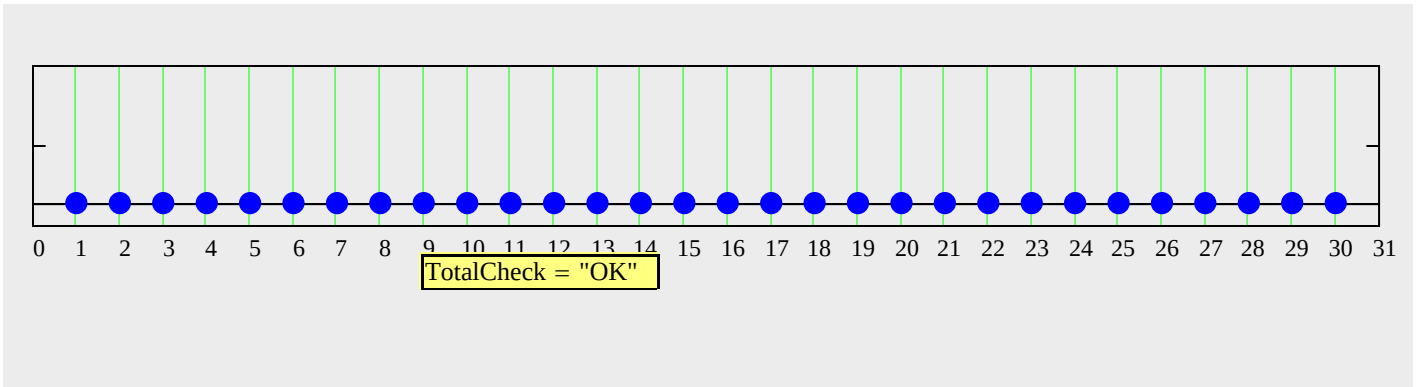
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.37	3.90	"N/A"	18.55	0.67	5.94	"N/A"	3.21	HL-93
"Strength I (Op)"	0.37	5.06	"N/A"	18.55	0.67	7.70	"N/A"	3.21	HL-93
"Service III (Inv)"	0.37	5.26	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.37	5.53	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.37	3.86	231.82	19.97	0.67	5.30	318.18	3.21	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.35$ $DC_{LongReinf.Permit} = 0.37$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1864	"factored resistance (kip-ft)...."
"γDL"	275	"factored dead load (kip-ft)...."
"γLL"	314	"factored live load (kip-ft)....."
"RF"	5.06	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	518.9	"factored resistance (kip)....."
"γDL"	25.4	"factored dead load (kip)....."
"γLL"	64	"factored live load (kip)....."
"RF"	7.7	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 38 FEET (NO SKEW)

EASTBOUND BRIDGE

(TIGER BAY)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\EB 38' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-38ftSpan-15inx56in_15Skew_ExtBeam.dat
FSB-38ftSpan-15inx56in_15Skew_IntBeam.dat
FSB-38ftSpan-15inx56in_ExtBeam.dat
FSB-38ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

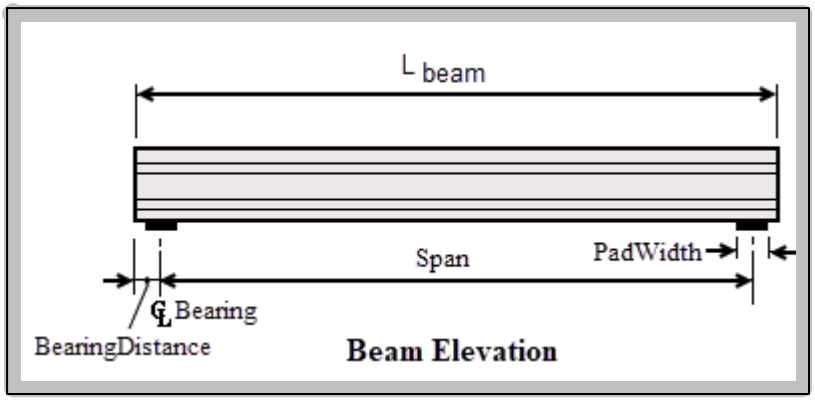
InputDataFile = "FSB-38ftSpan-15inx56in_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



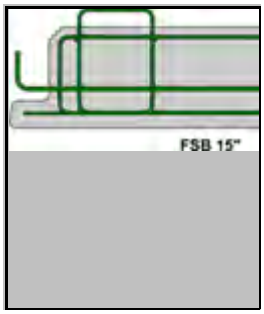
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-38ftSpan-15inx56in_IntBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	37.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(* 0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

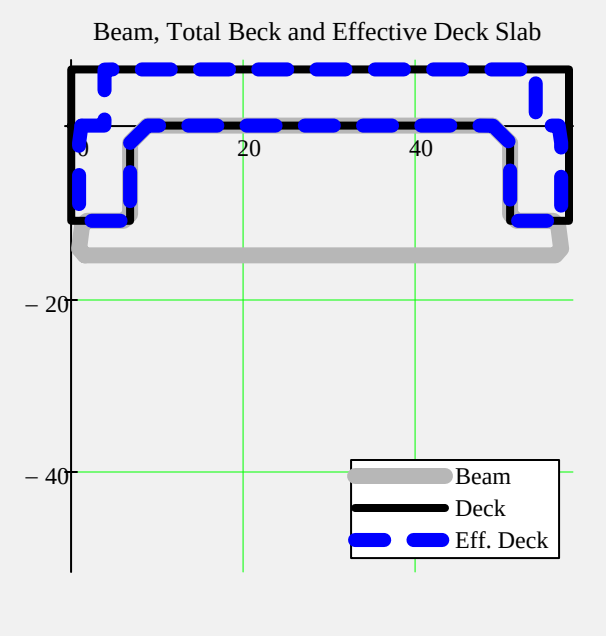
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 57.65 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.58 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 37.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

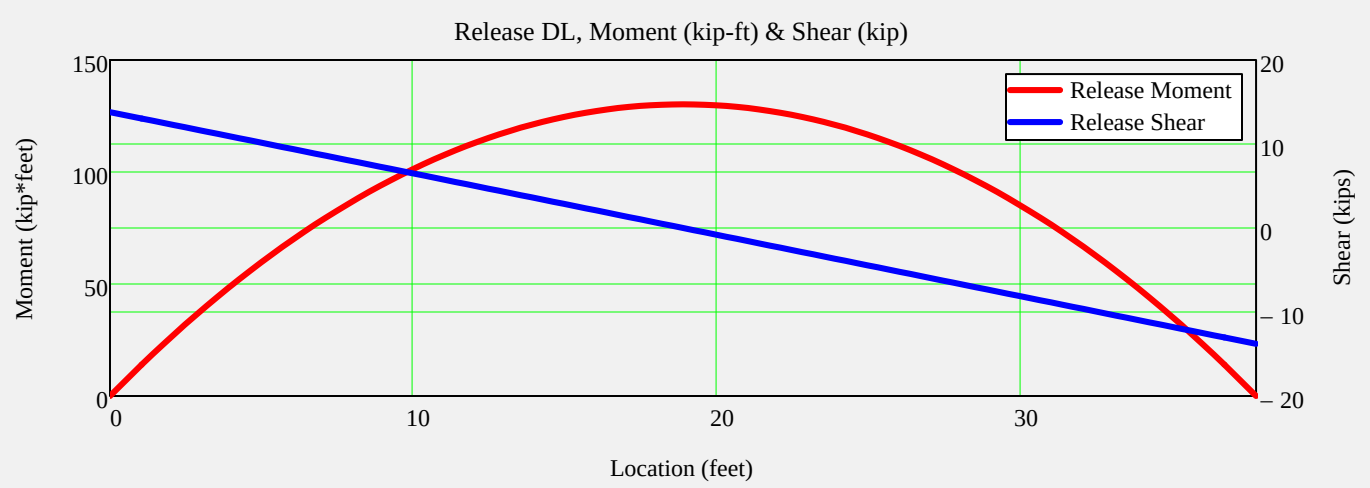
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

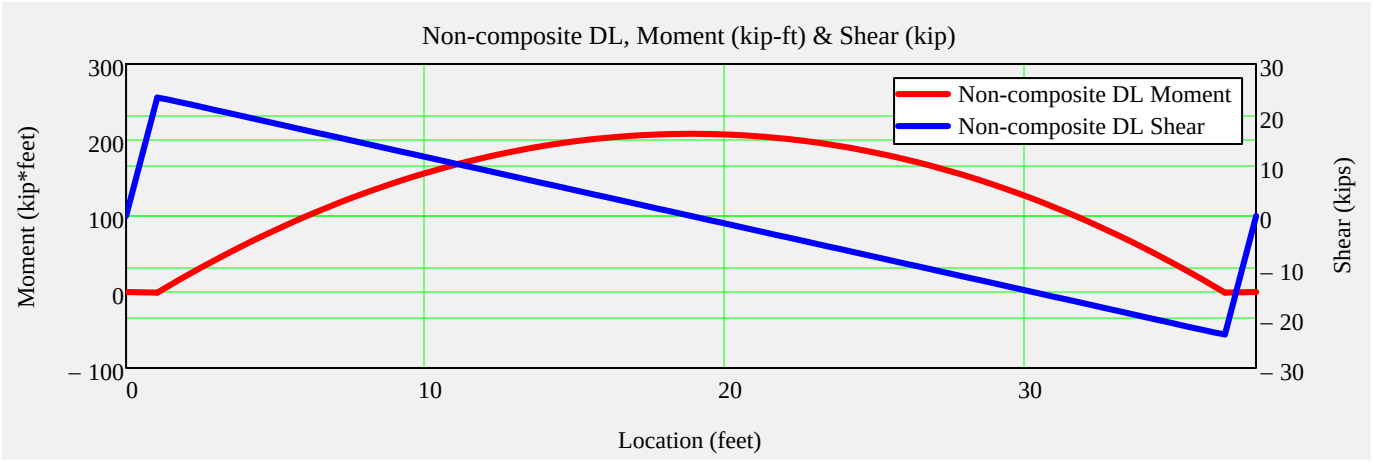
Release Dead Load Moments and Shears

$L_{span} = 35.67\ ft$



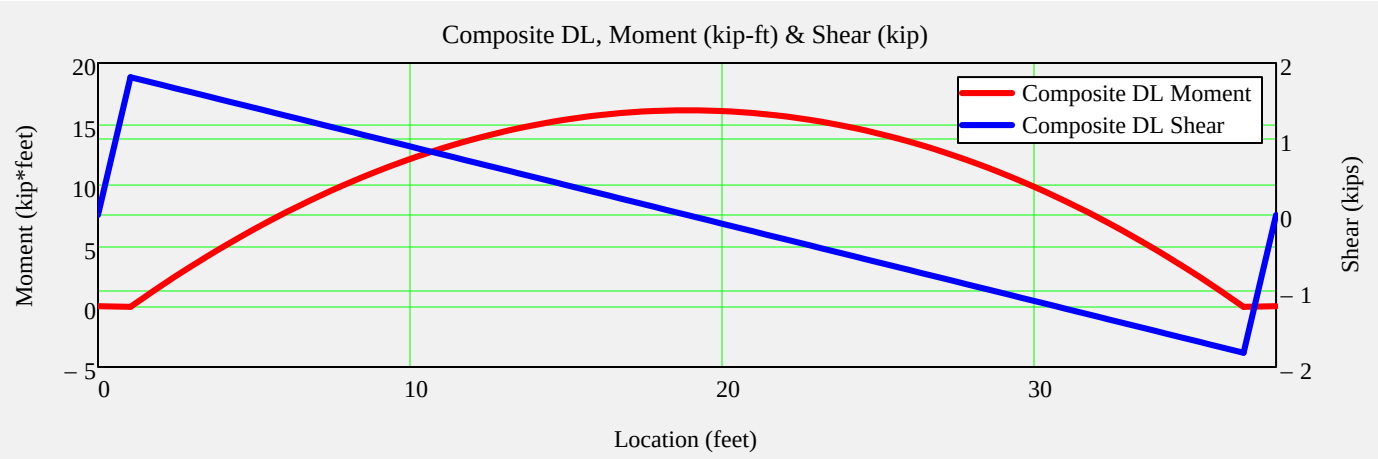
$\max(V_{release}) = 13.8 \cdot kip$ $\max(M_{release}) = 130.2 \cdot kip \cdot ft$ $\min(V_{release}) = -13.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 23.4 \cdot kip$ $\max(M_{dl.non.comp}) = 208.1 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -23.4 \cdot kip$

Composite Dead Load Moments and Shear



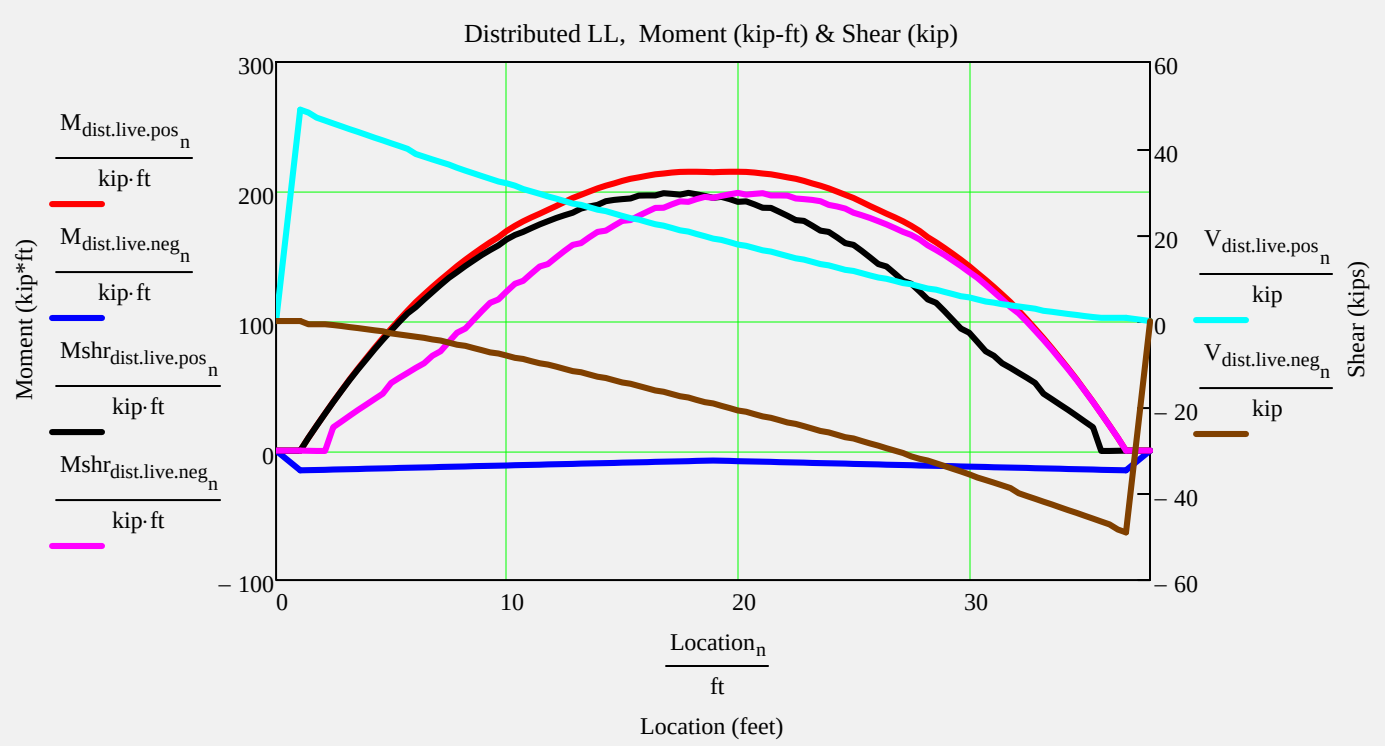
$\max(V_{dl.comp}) = 1.8 \cdot kip$ $\max(M_{dl.comp}) = 16.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -1.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 35.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.34$ $g_{mom.fatigue} = 0.21$ $g_{shear} = 0.60$



$\max(V_{dist.live.pos}) = 49.0 \cdot kip$

$\max(M_{dist.live.pos}) = 215.3 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -49.0 \cdot kip$

$Reaction_{LL} = 51.1 \cdot kip$

$\min(M_{dist.live.neg}) = -15.3 \cdot kip \cdot ft$

$Reaction_{DL} = 26.7 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 199 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{truck} = 55.26 \cdot kip$ $Reaction_{lane} = 12.08 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 40.19 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-38ftSpan-15inx56in_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

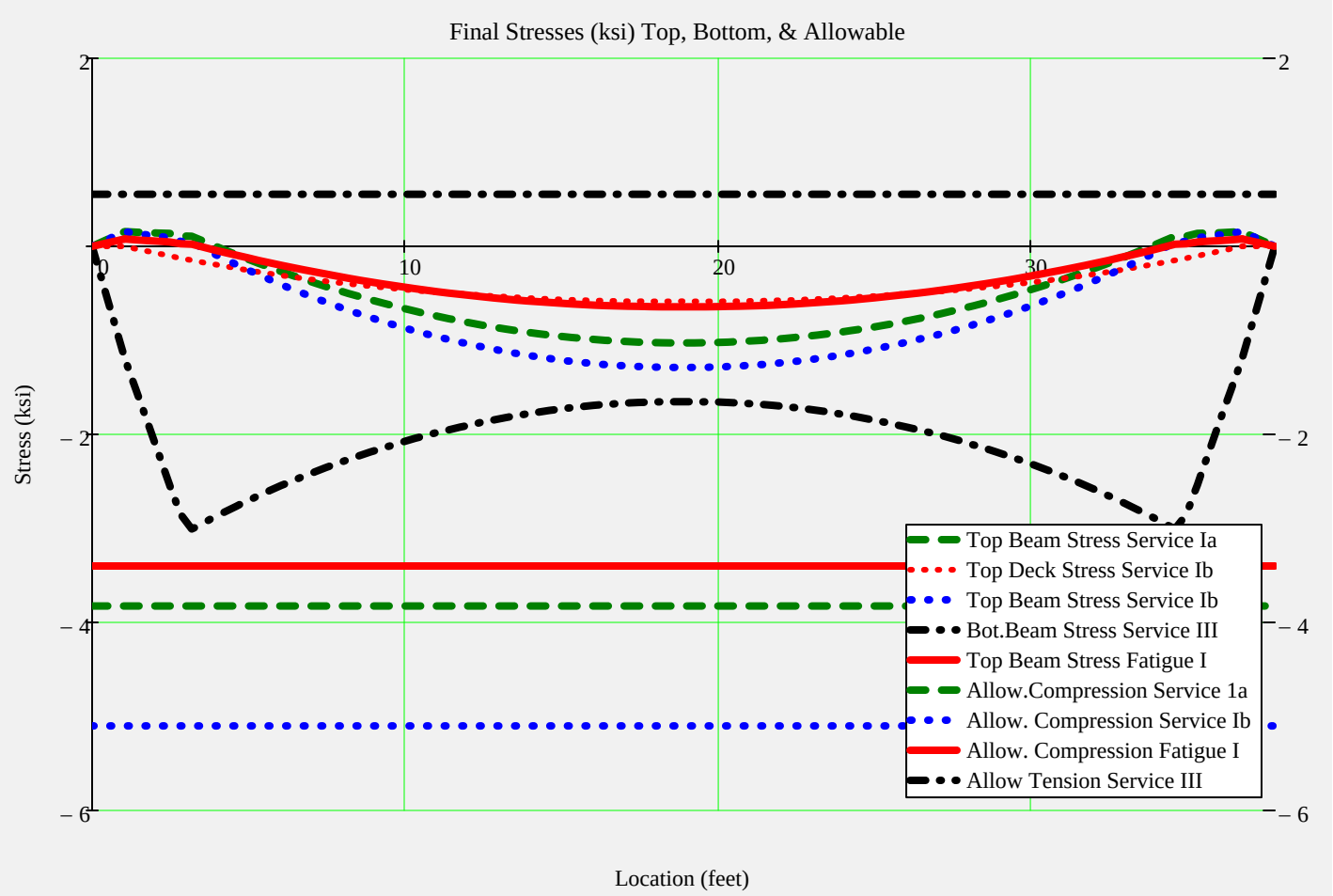
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

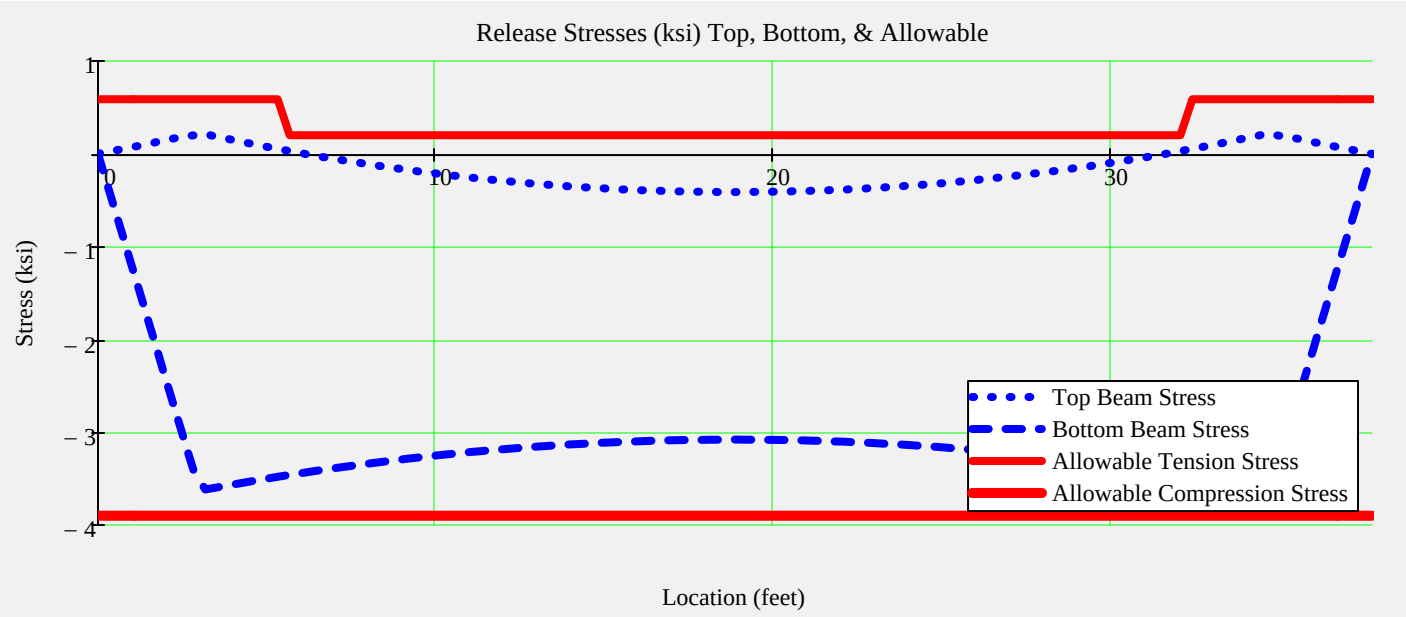
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$\text{Check_f}_{\text{tension.rel}}$ = "OK"	$\max(\text{DC_f}_{\text{tension.rel}}) = 0.72$
Release compression	$\text{Check_f}_{\text{comp.rel}}$ = "OK"	$\max(\text{DC_f}_{\text{comp.rel}}) = 0.93$
*Service III , PS+DL+0.8*LL*	$\text{Check_f}_{\text{tension.ServiceIII}}$ = "OK"	$\max(\text{DC_f}_{\text{tension.ServiceIII}}) = 0.84$
Service Ia , PS+DL	$\text{Check_f}_{\text{comp.ServiceIa}}$ = "OK"	$\max(\text{DC_f}_{\text{comp.ServiceIa}}) = 0.27$
Service Ib , PS+DL+LL	$\text{Check_f}_{\text{comp.ServiceIb}}$ = "OK"	$\max(\text{DC_f}_{\text{comp.ServiceIb}}) = 0.25$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$\text{Check_f}_{\text{comp.FatigueI}}$ = "OK"	$\max(\text{DC_f}_{\text{comp.FatigueI}}) = 0.19$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.21	0.59
"Compression @ Release"	3.18	–3.62	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	18.88	–1.03	–3.83
"CompressionIb @ ServiceI"	18.88	–1.29	–5.10
"Compression @ FatigueI"	18.88	–0.64	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

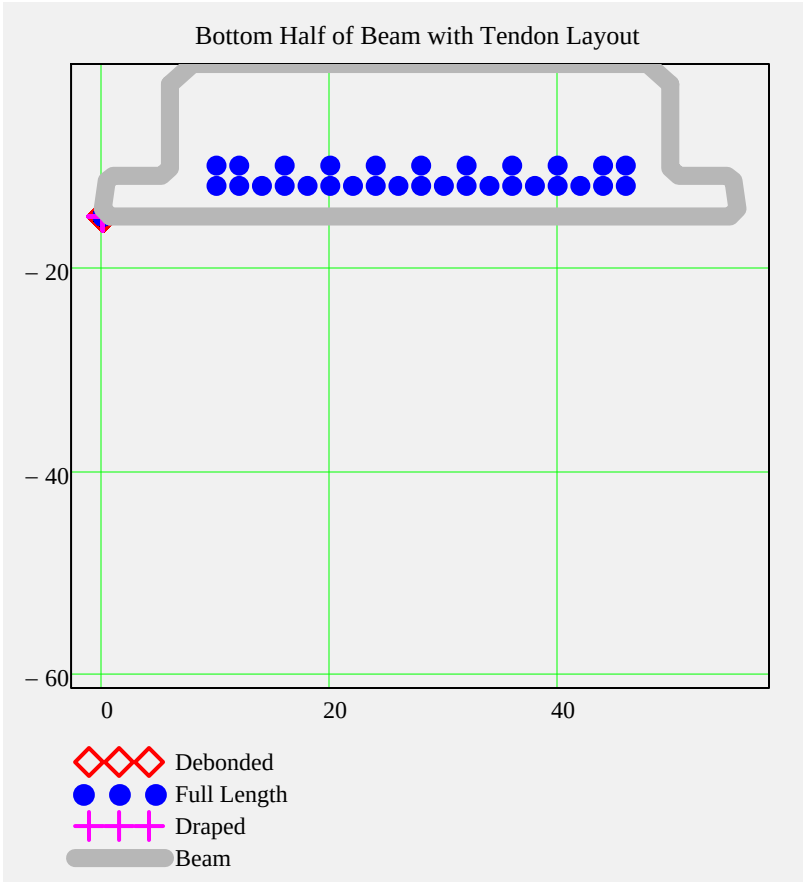
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

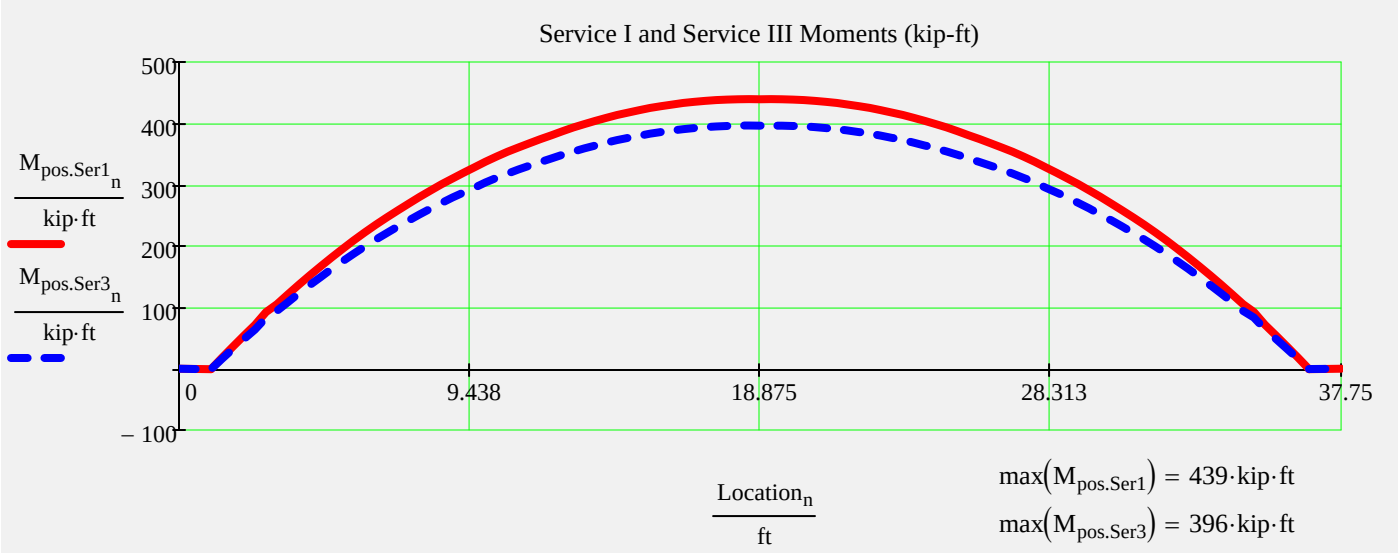
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 439 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 396 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.41 & -3.08 \\ \text{"2"} & -0.47 & -2.64 \\ \text{"4"} & -0.37 & -2.72 \\ \text{"6"} & -1.01 & -2.17 \\ \text{"8"} & -1.29 & -1.65 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1197.5	45628	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	130
"Non-Composite DL (incl. beam wt.)"	208
"Composite Dead Load"	16
"Distributed Live Load"	215

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

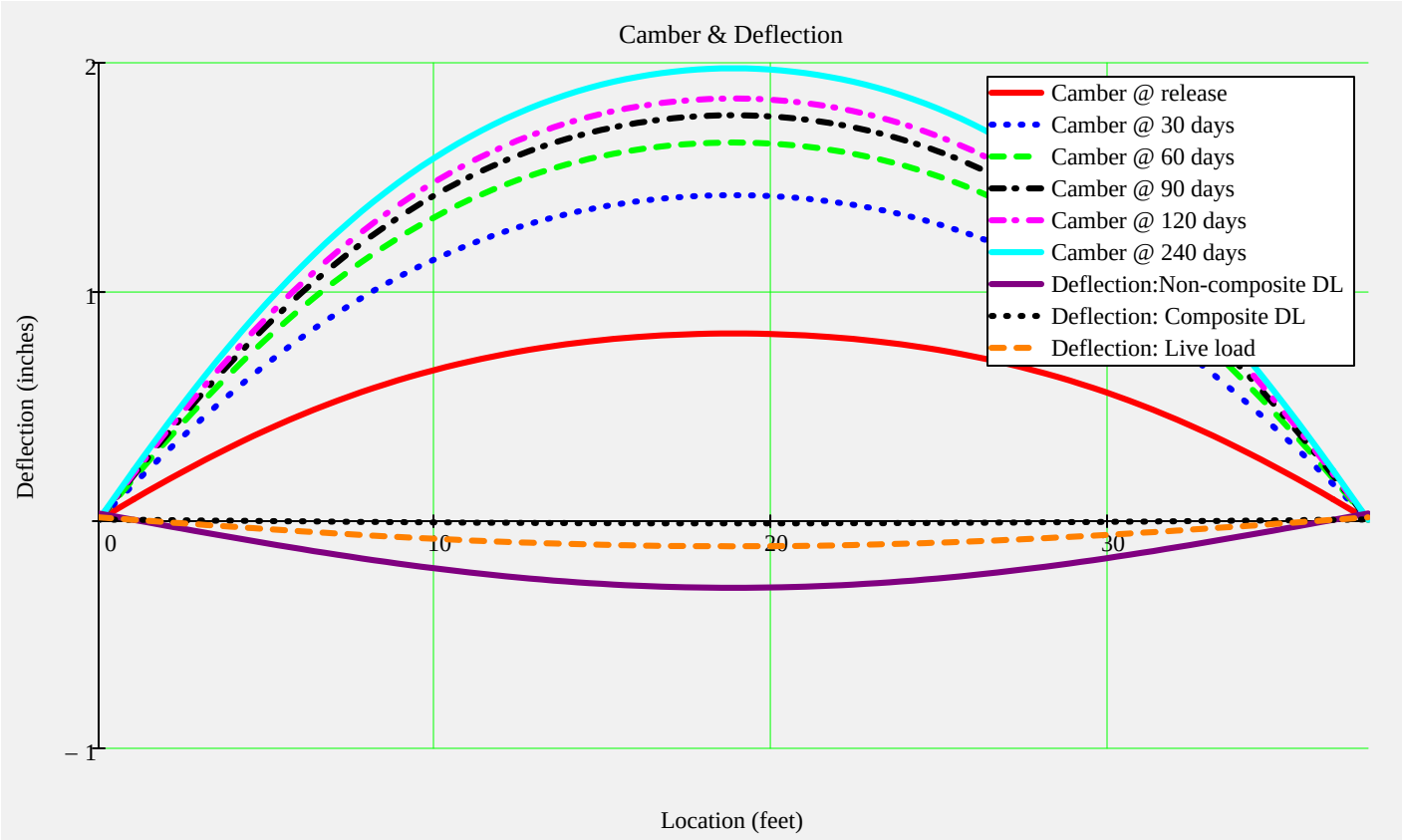
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 35.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.30	0.42	0.82
"30 Days"	–0.09	–0.56	0.72	1.42
"60 Days"	–0.12	–0.66	0.84	1.65
"90 Days"	–0.13	–0.71	0.90	1.77
"120 Days"	–0.14	–0.74	0.94	1.84
"240 Days"	–0.16	–0.79	1.00	1.98
"Non-comp DL"	–0.04	0.03	–0.13	–0.30
"Comp DL"	–0.00	0.00	–0.01	–0.02
"LL"	–0.01	0.02	–0.05	–0.12

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.53 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

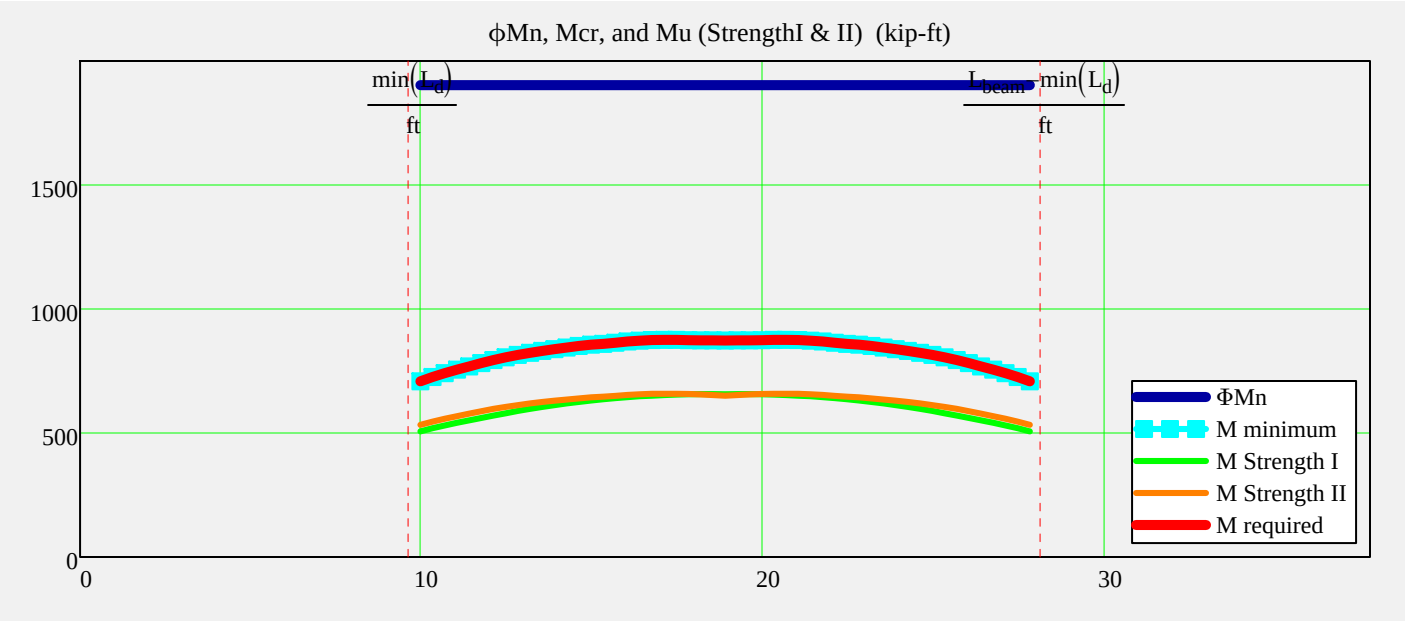
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 658 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 873 \cdot kip \cdot ft$ $M_{reqd_{51}} = 873 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1903 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 28.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.46$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

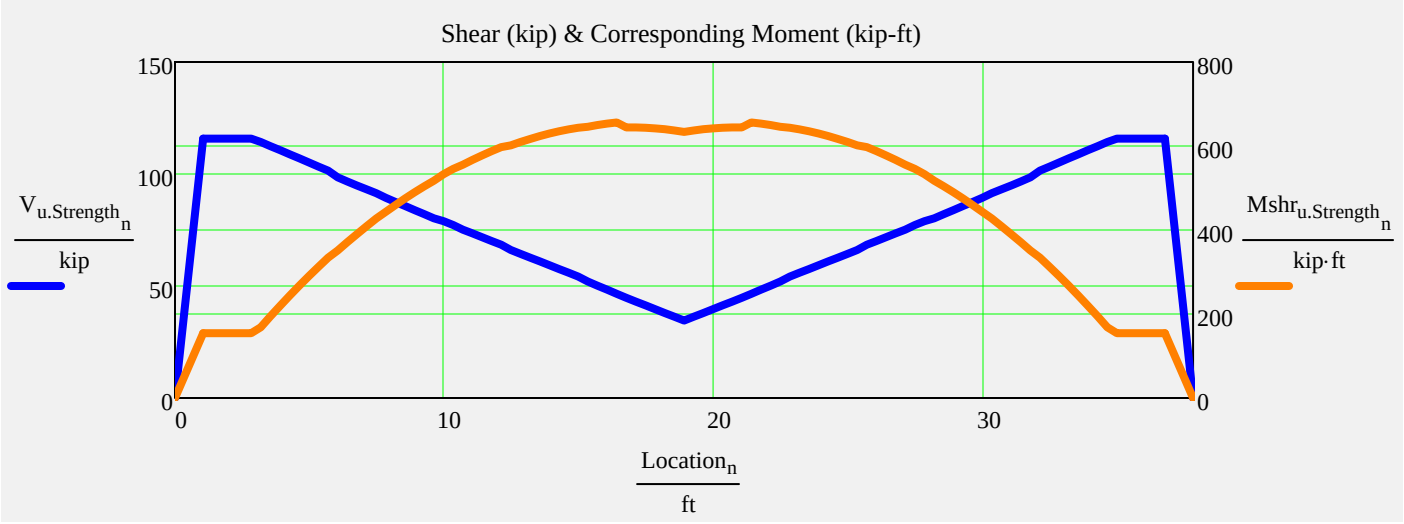
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

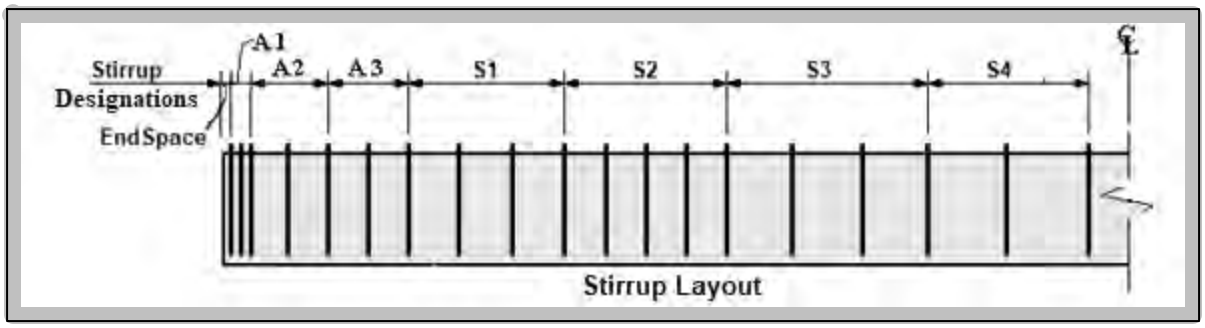
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 117 \\ 126 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 115.8 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 656 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

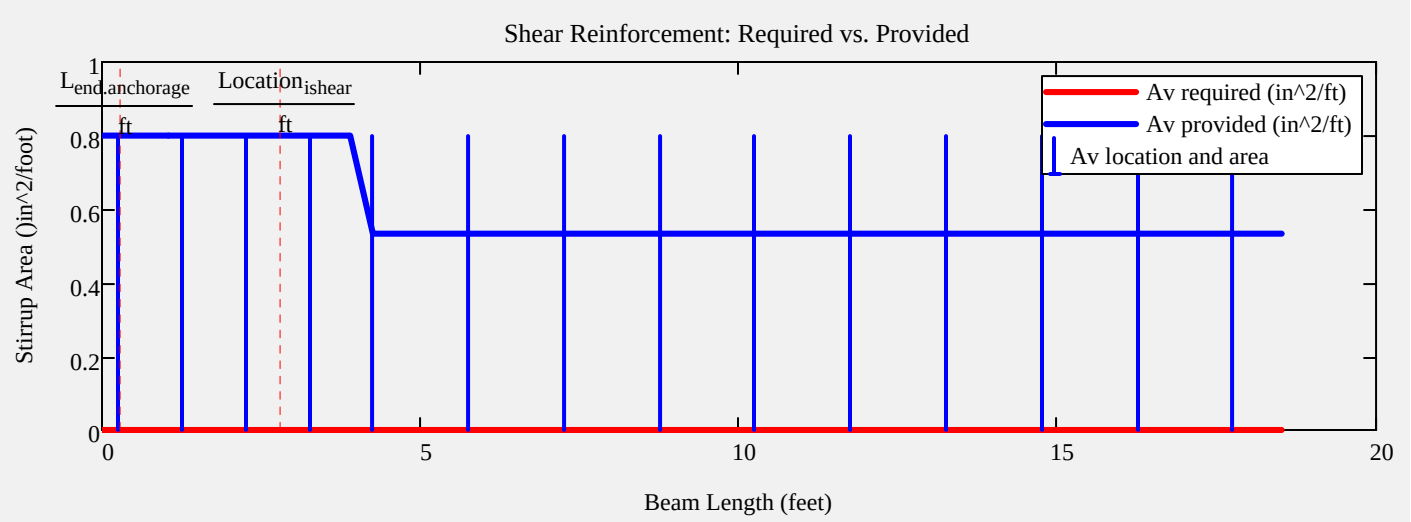
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



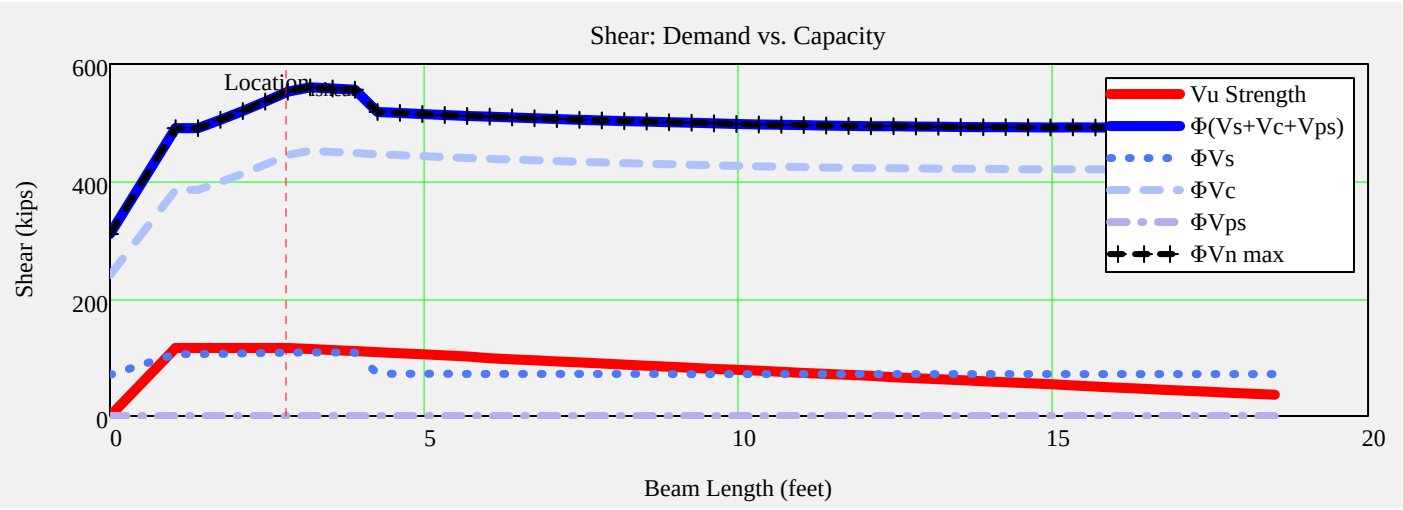
$Location_{ishear} = 2.83\ ft$

Save Data File ☑ Use current input file

File Name FSB-38ftSpan-15inx56in_IntBeam.dat Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

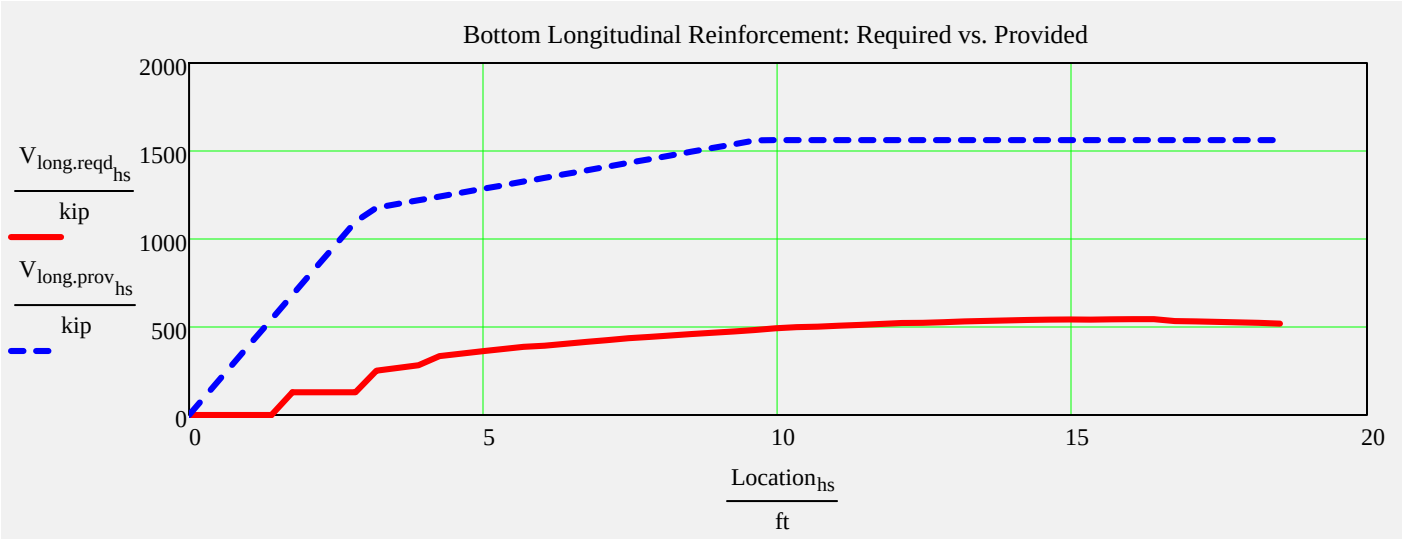
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.25 & 108.79 & 518.29 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.21$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

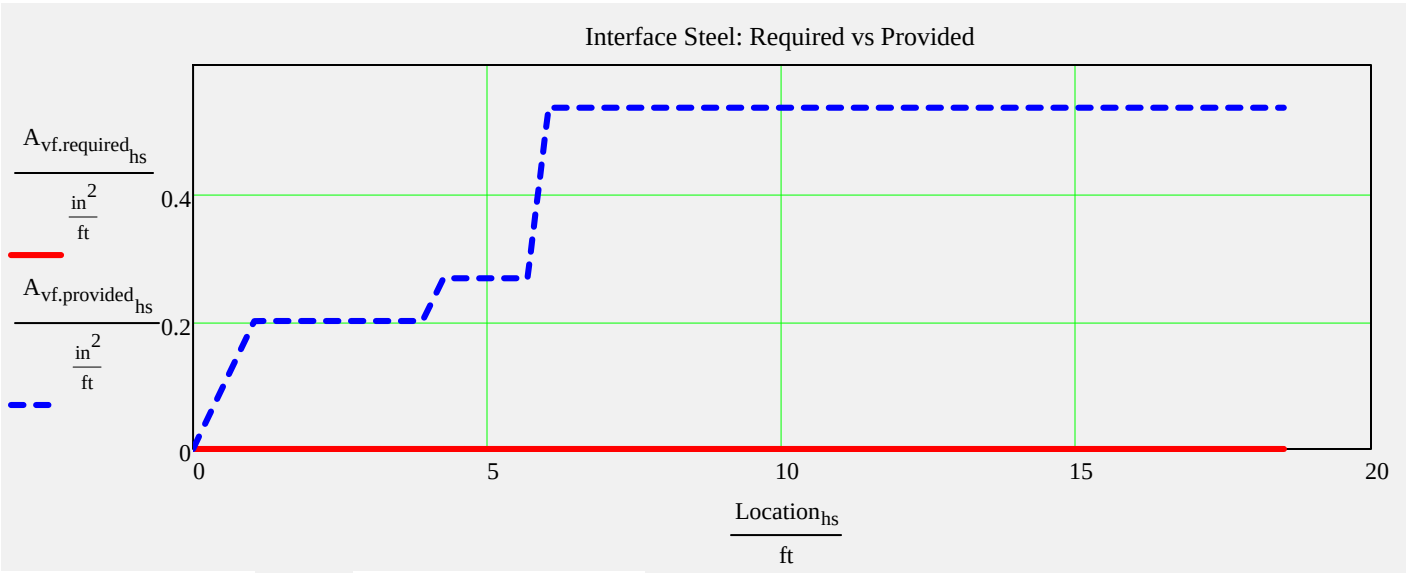


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 16.4 & 544.4 & 1561.9 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.35$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 7.94 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

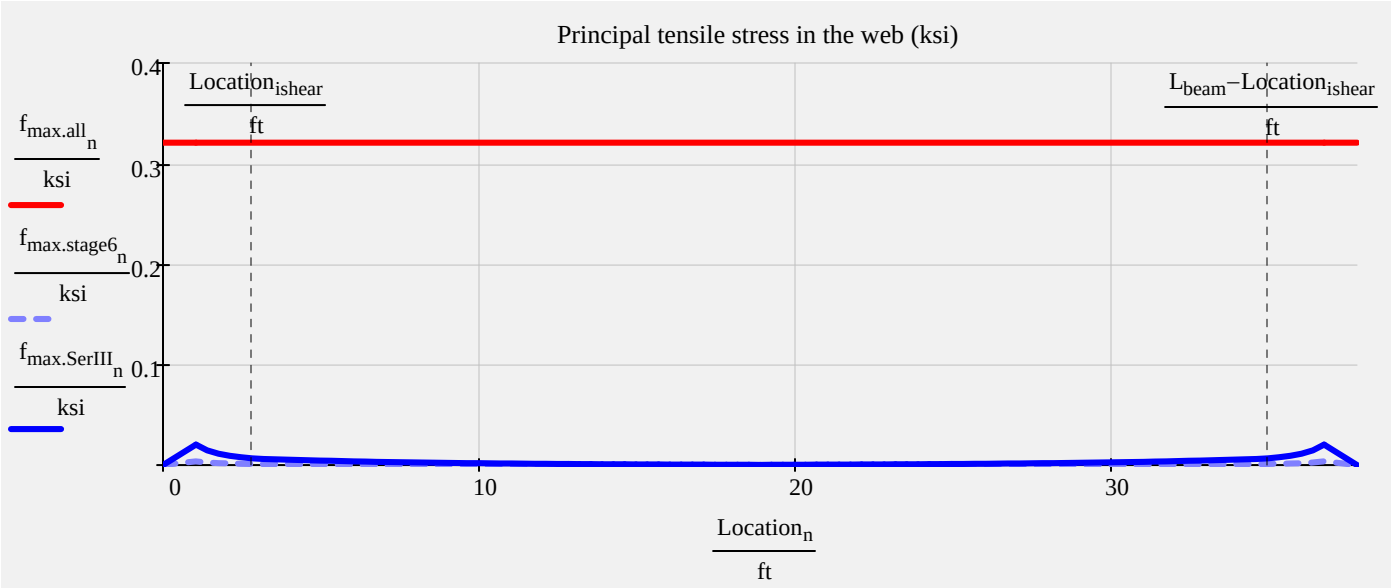
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33.9 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

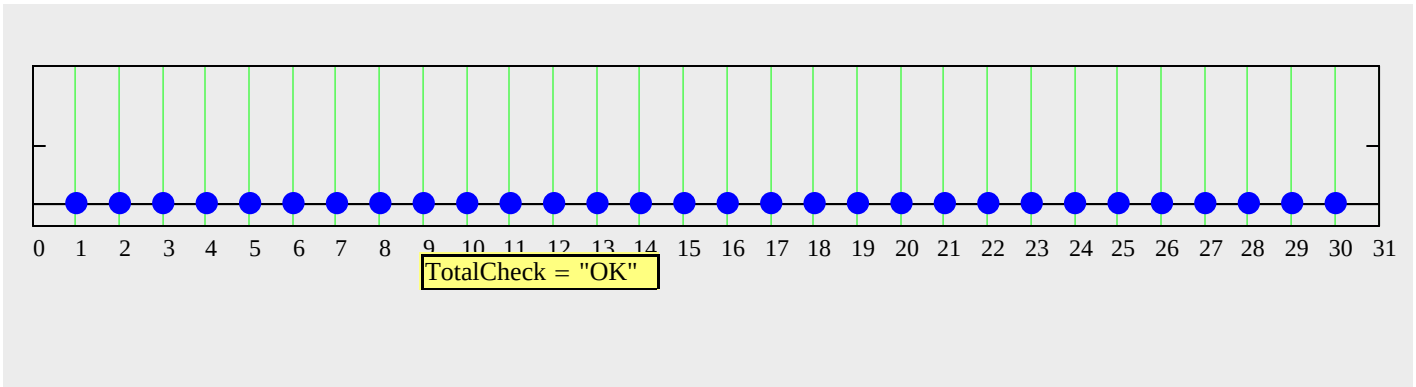
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.34	4.31	"N/A"	17.12	0.60	6.65	"N/A"	3.21	HL-93
"Strength I (Op)"	0.34	5.58	"N/A"	18.55	0.60	8.63	"N/A"	3.21	HL-93
"Service III (Inv)"	0.34	5.69	"N/A"	18.55	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.34	5.98	"N/A"	18.55	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.34	4.26	255.77	15.69	0.60	5.94	356.39	3.21	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.33$ $DC_{LongReinf.Permit} = 0.35$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1903	"factored resistance (kip-ft)...."
"γDL"	280	"factored dead load (kip-ft)...."
"γLL"	291	"factored live load (kip-ft)....."
"RF"	5.58	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	520.6	"factored resistance (kip)....."
"γDL"	25.9	"factored dead load (kip)....."
"γLL"	57.4	"factored live load (kip)....."
"RF"	8.63	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 38 FEET (15 DEG. SKEW)
EASTBOUND BRIDGE
(D.C.I CANAL)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\EB 38' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-38ftSpan-15inx56in_15Skew_ExtBeam.dat
FSB-38ftSpan-15inx56in_15Skew_IntBeam.dat
FSB-38ftSpan-15inx56in_ExtBeam.dat
FSB-38ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

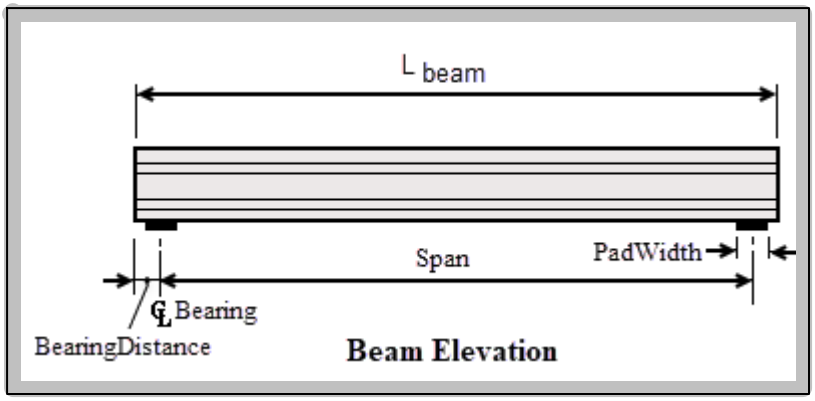
InputDataFile = "FSB-38ftSpan-15inx56in_15Skew_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 24 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

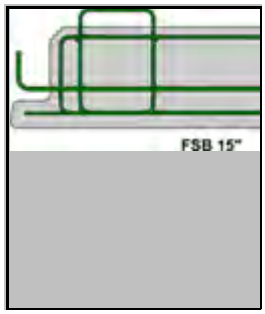
InputDataFile = "FSB-38ftSpan-15inx56in_15Skew_ExtBeam.dat"

Beam Type: FSB12 / **FSB15** / FSB18

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



L_{beam}	37.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

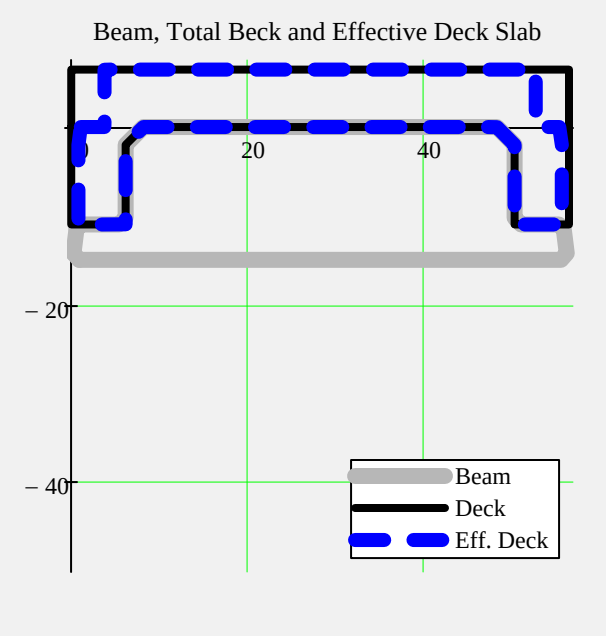
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 56.32 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.56 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 37.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

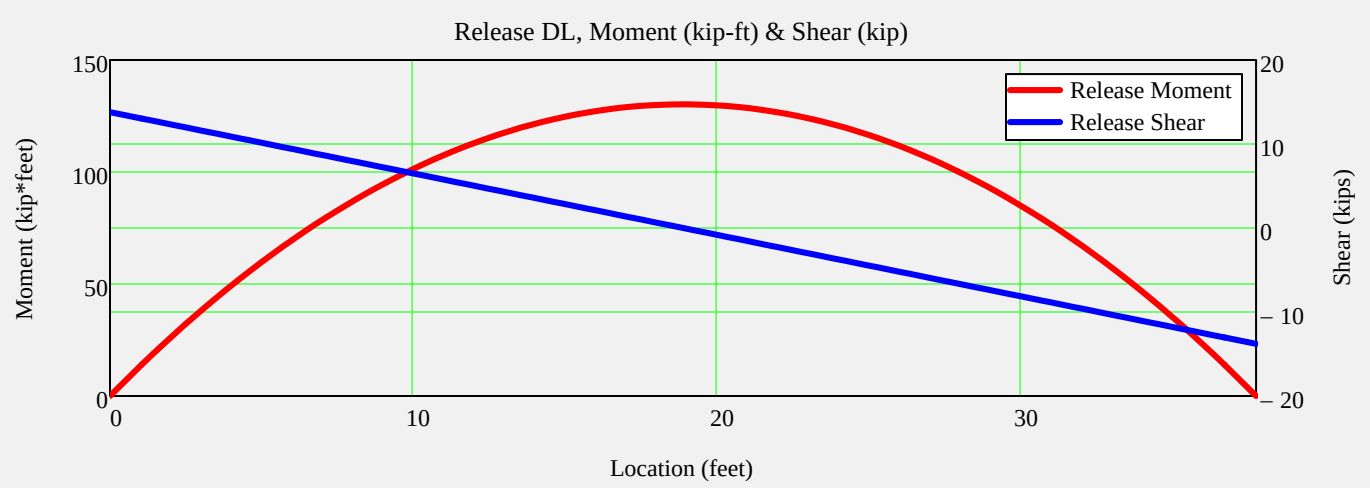
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

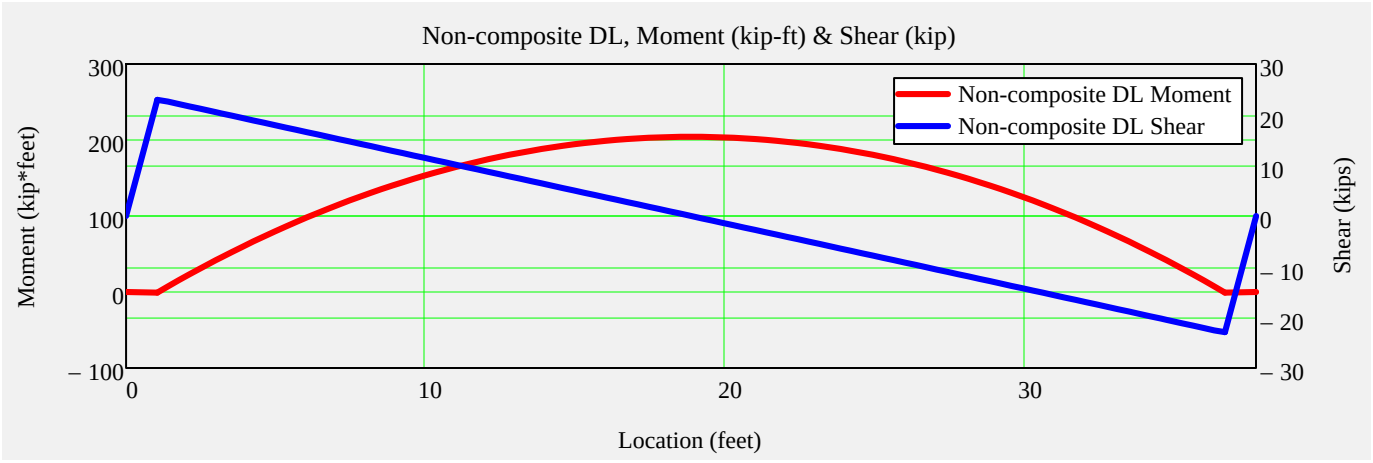
Release Dead Load Moments and Shears

$L_{span} = 35.67\ ft$



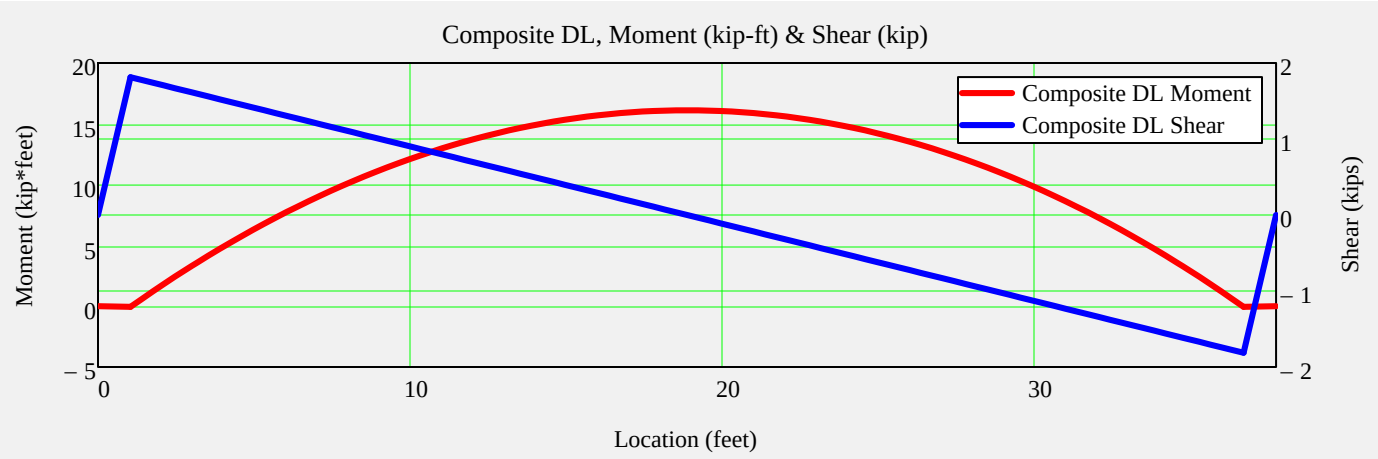
$\max(V_{release}) = 13.8 \cdot kip$ $\max(M_{release}) = 130.2 \cdot kip \cdot ft$ $\min(V_{release}) = -13.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 22.9 \cdot kip$ $\max(M_{dl.non.comp}) = 204.2 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -22.9 \cdot kip$

Composite Dead Load Moments and Shear



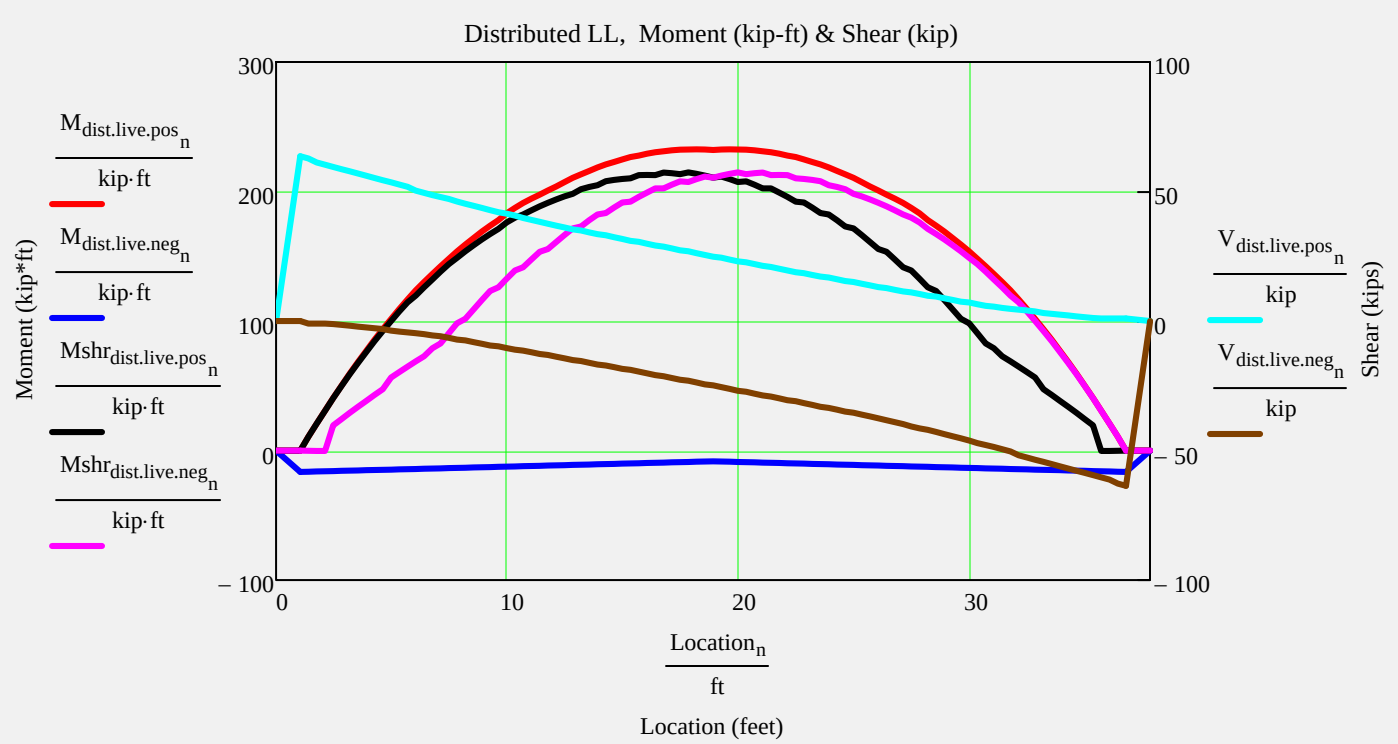
$\max(V_{dl.comp}) = 1.8 \cdot kip$ $\max(M_{dl.comp}) = 16.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -1.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 35.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.16$

Final Live Load Distribution Factors: $g_{mom} = 0.37$ $g_{mom.fatigue} = 0.24$ $g_{shear} = 0.78$



$\max(V_{dist.live.pos}) = 63.6 \cdot kip$

$\max(M_{dist.live.pos}) = 232.5 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -63.6 \cdot kip$

$Reaction_{LL} = 66.4 \cdot kip$

$Reaction_{DL} = 26.2 \cdot kip$

$\min(M_{dist.live.neg}) = -16.5 \cdot kip \cdot ft$

$\max(Mshr_{dist.live.pos}) = 215 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{truck} = 55.26 \cdot kip$ $Reaction_{lane} = 12.08 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 52.24 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-38ftSpan-15inx56in_15Skew_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

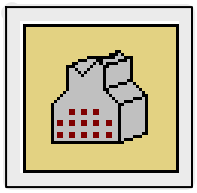
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

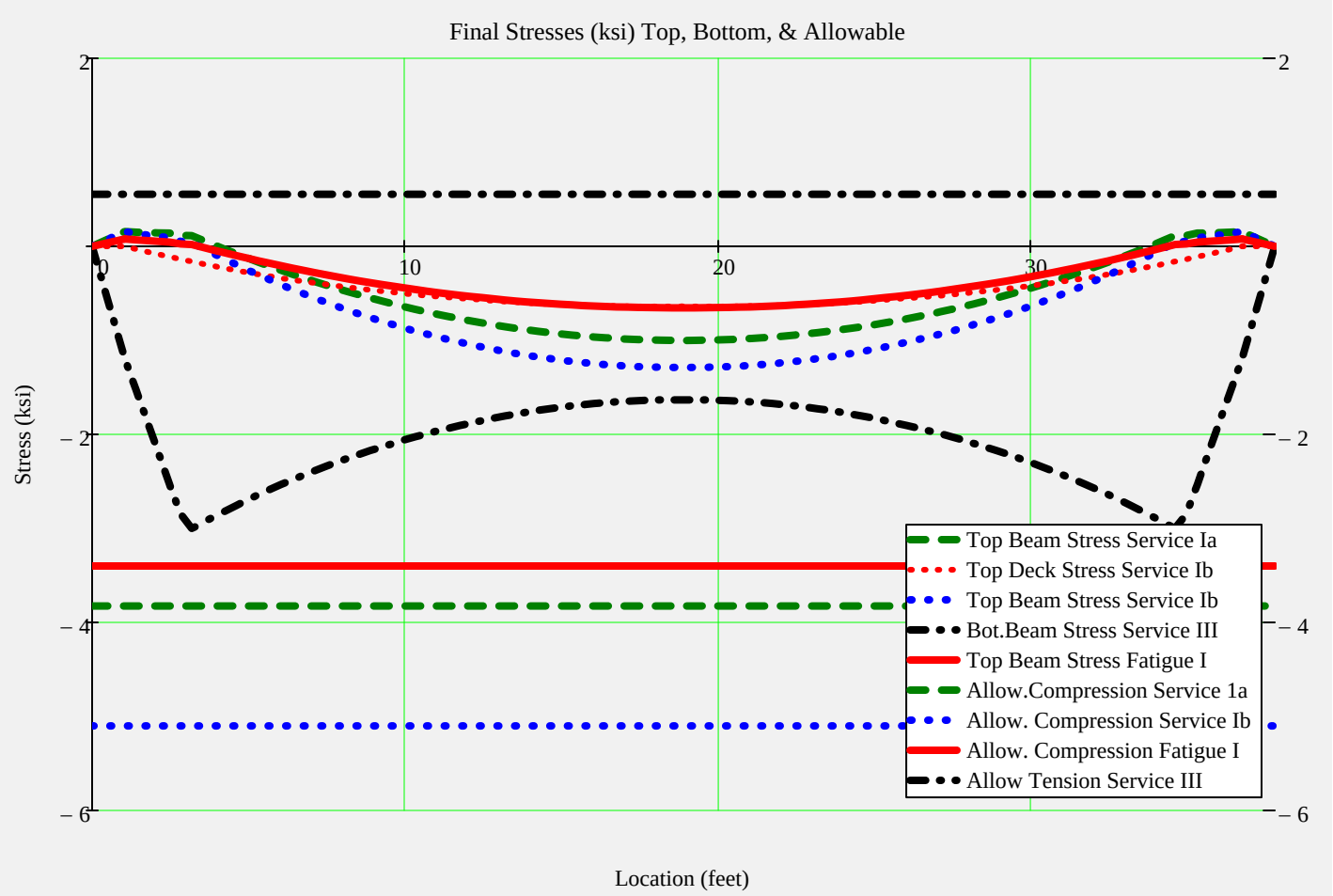
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

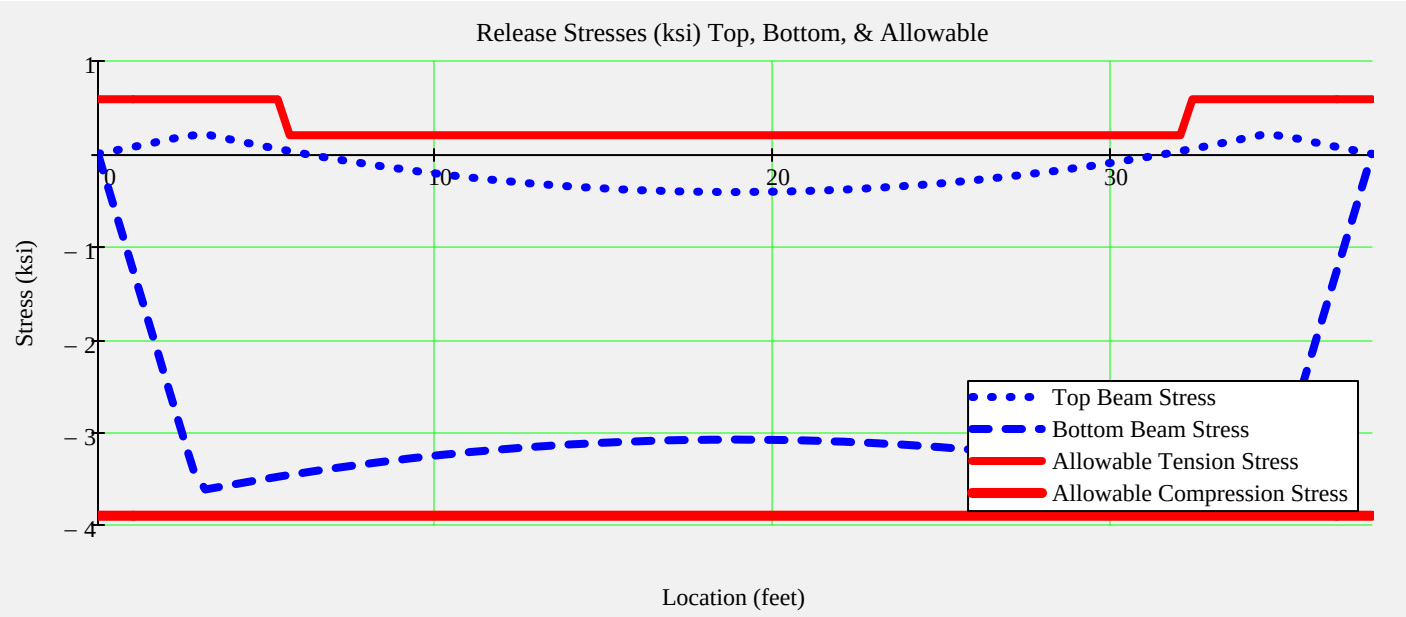
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.93$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.26$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.25$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.19$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.21	0.59
"Compression @ Release"	3.18	–3.62	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	18.88	–1.00	–3.83
"CompressionIb @ ServiceI"	18.88	–1.29	–5.10
"Compression @ FatigueI"	18.88	–0.65	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

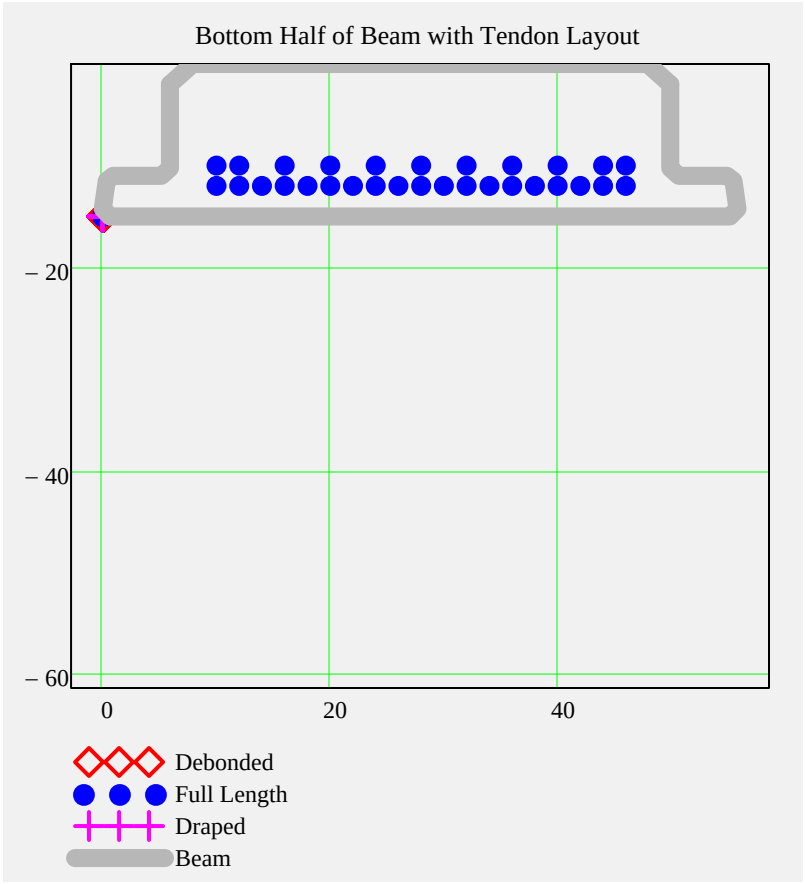
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

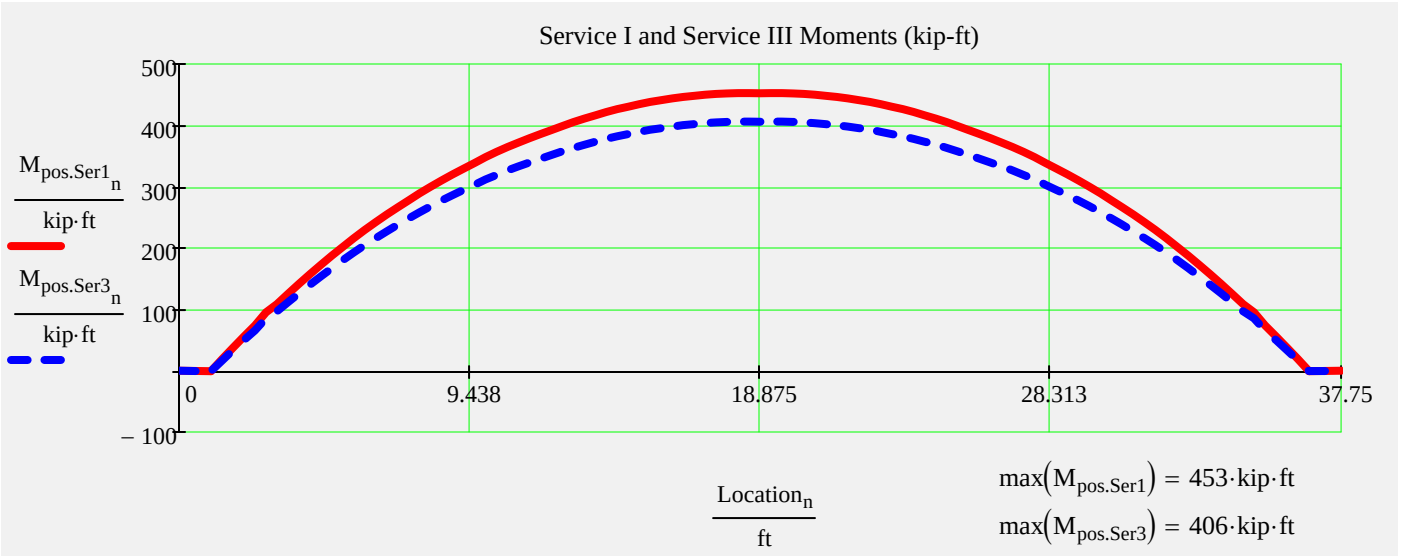
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.41 & -3.08 \\ \text{"2"} & -0.47 & -2.64 \\ \text{"4"} & -0.37 & -2.72 \\ \text{"6"} & -0.98 & -2.19 \\ \text{"8"} & -1.29 & -1.63 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1177.2	44990	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	130
"Non-Composite DL (incl. beam wt.)"	204
"Composite Dead Load"	16
"Distributed Live Load"	232

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

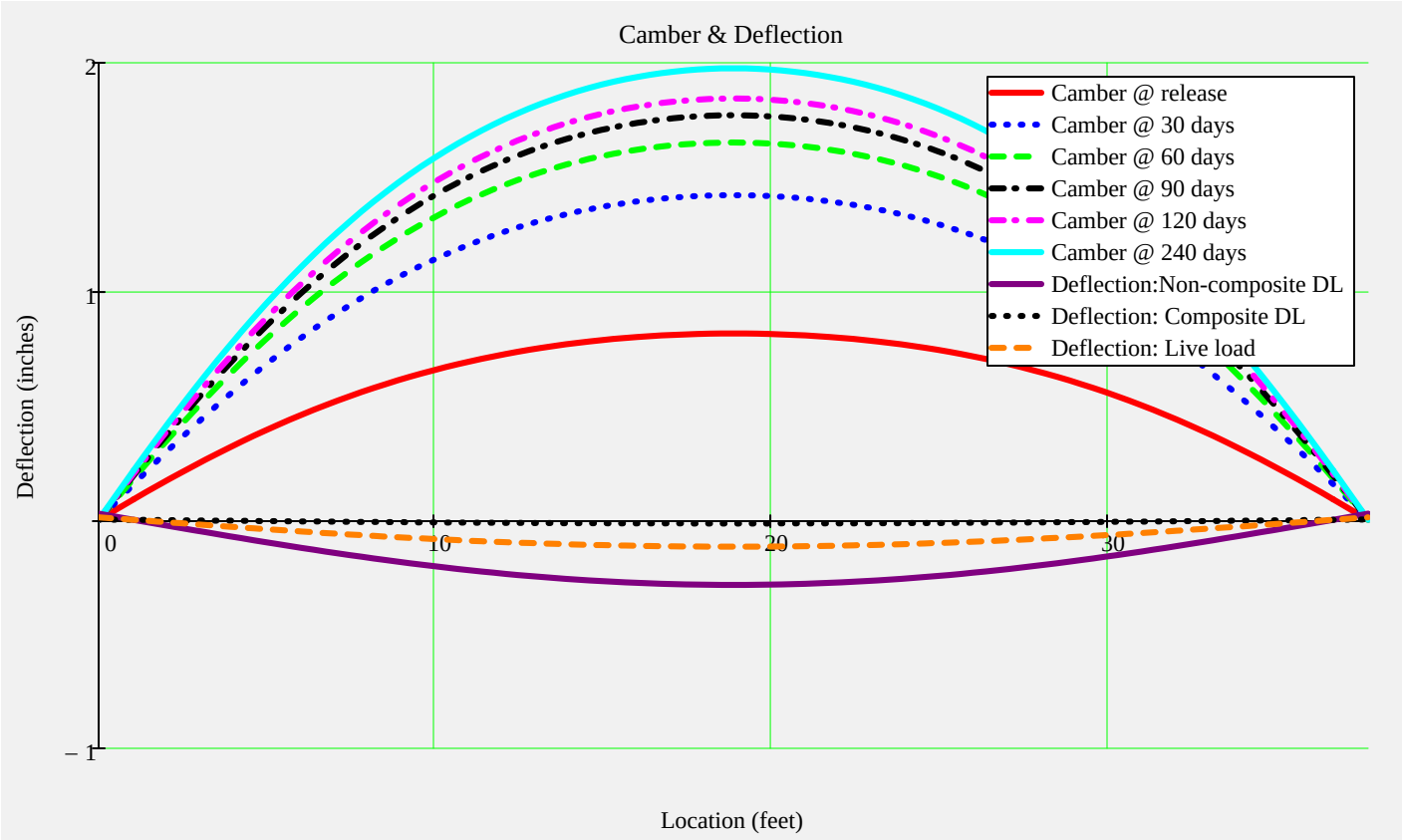
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 35.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.30	0.42	0.82
"30 Days"	–0.09	–0.56	0.72	1.42
"60 Days"	–0.12	–0.66	0.84	1.65
"90 Days"	–0.13	–0.71	0.90	1.77
"120 Days"	–0.14	–0.74	0.94	1.84
"240 Days"	–0.16	–0.79	1.00	1.98
"Non-comp DL"	–0.03	0.03	–0.12	–0.28
"Comp DL"	–0.00	0.00	–0.01	–0.02
"LL"	–0.01	0.02	–0.05	–0.12

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.54 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

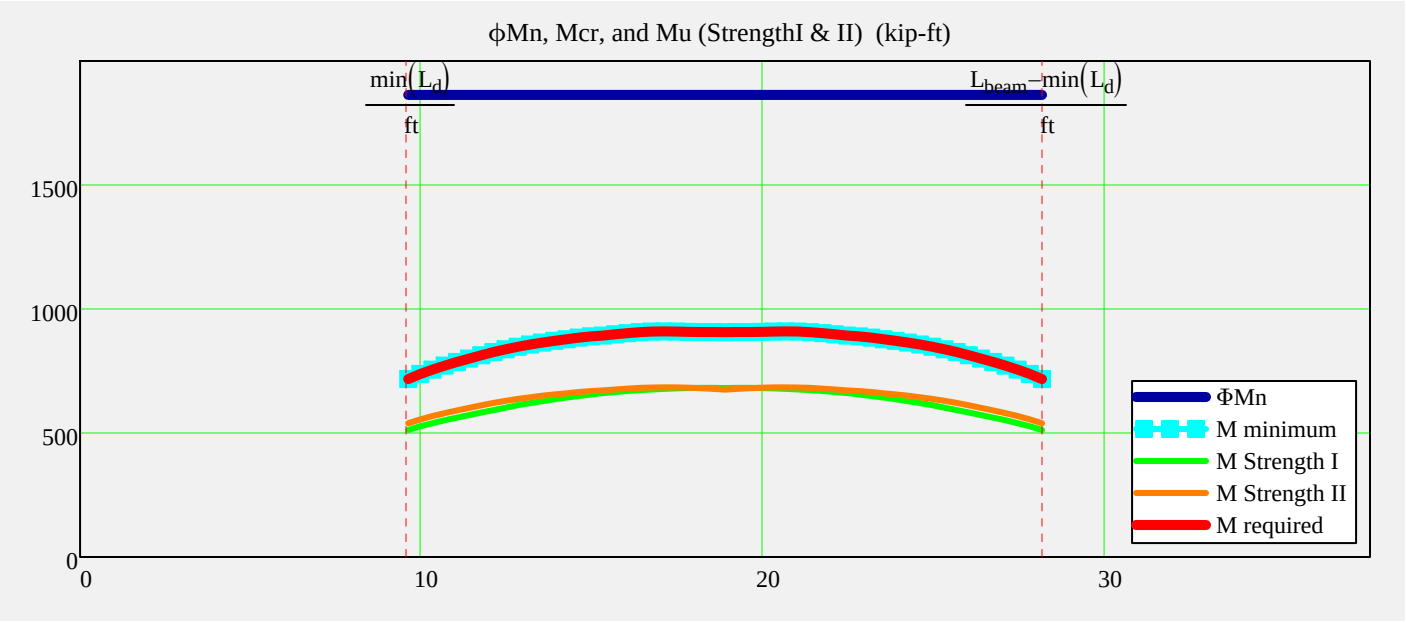
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 684 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 906 \cdot kip \cdot ft$ $M_{reqd_{51}} = 906 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1864 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 28.2\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.49$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

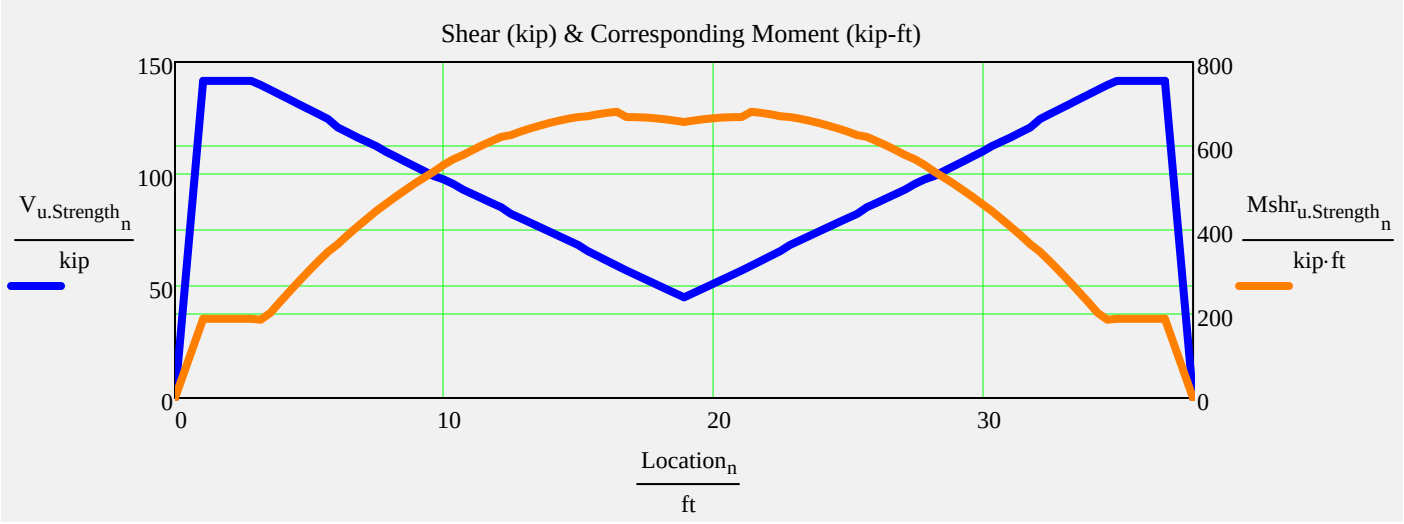
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

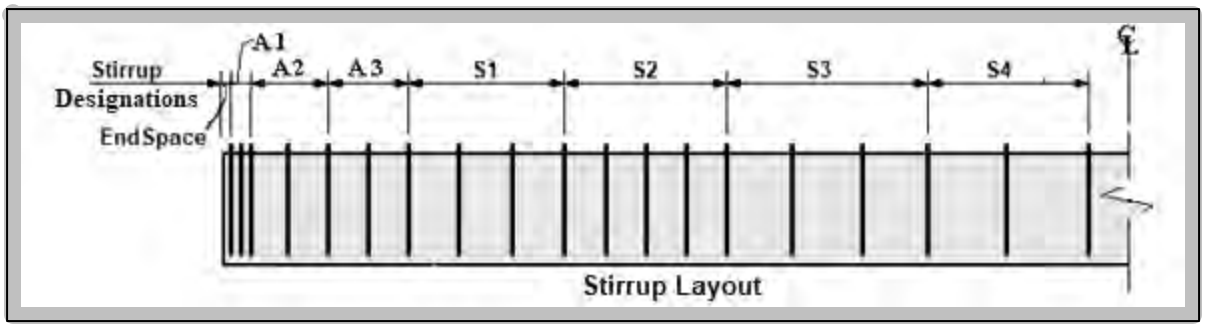
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 142 \\ 154 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 141.6 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 682 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

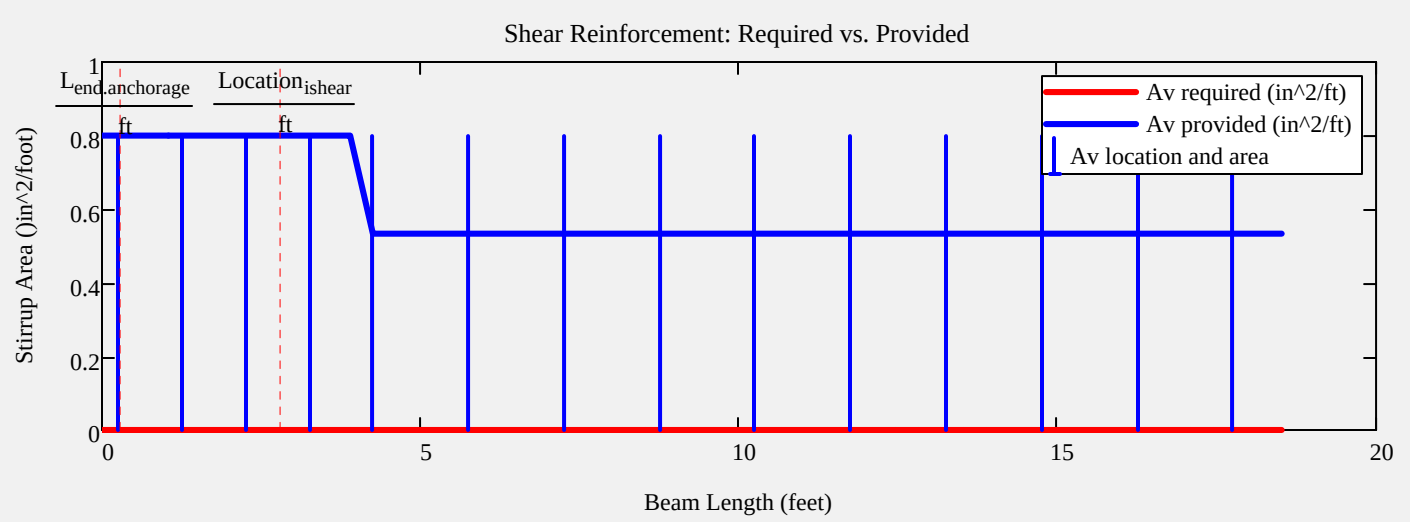
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.83\ ft$

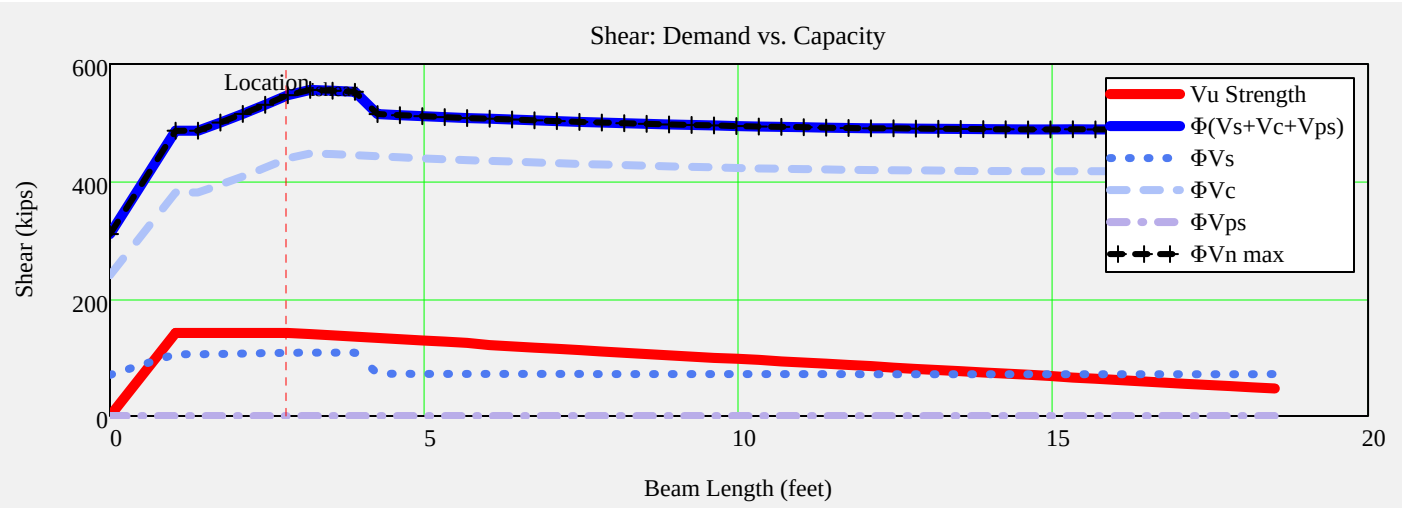
Save Data File ☑ Use current input file

File Name FSB-38ftSpan-15inx56in_15Skew_ExtBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

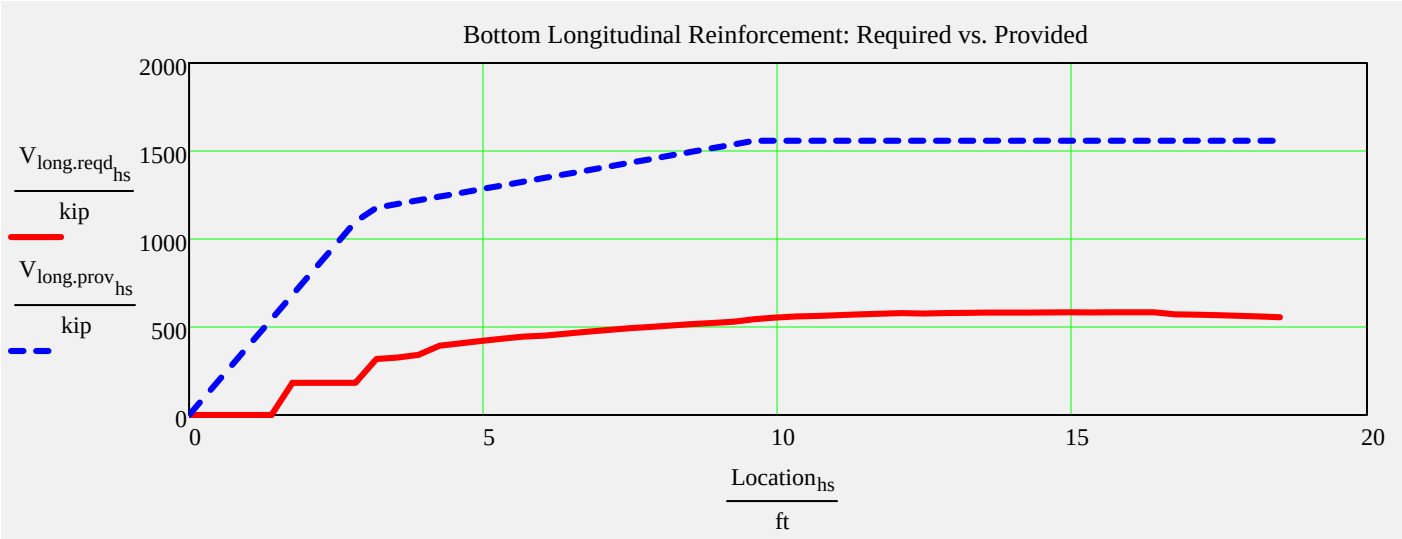
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 2.83 & 141.58 & 546.83 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.26$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

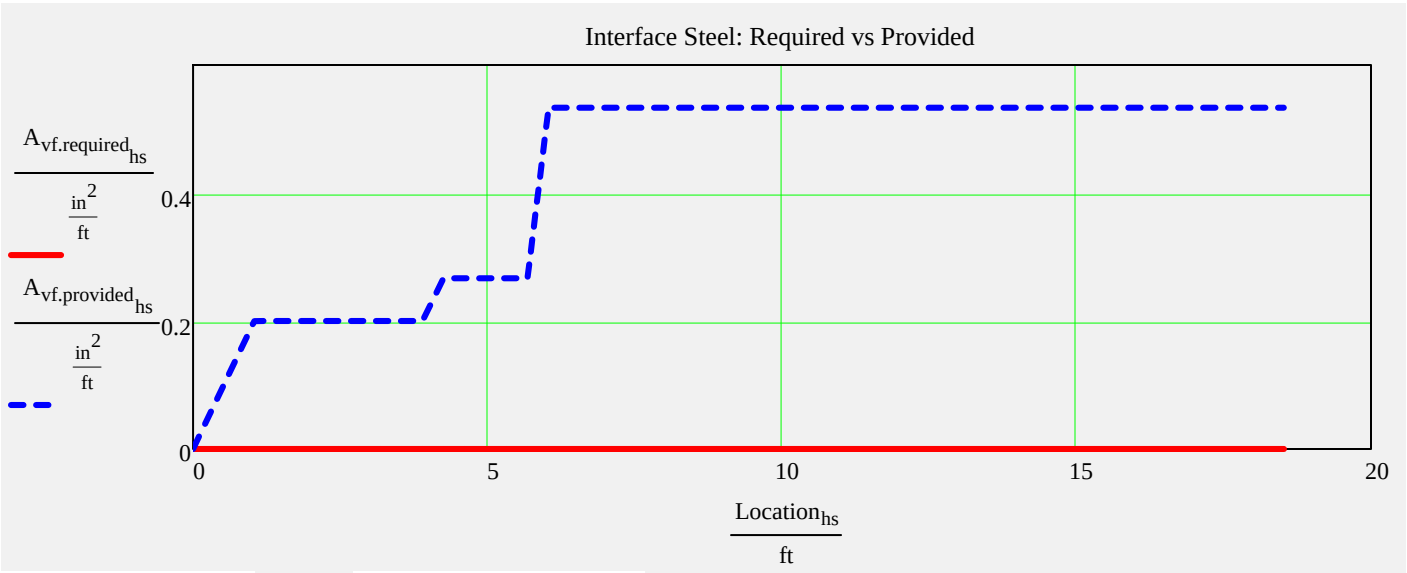


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 16.0 & 584.1 & 1558.2 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.37$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 7.94 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

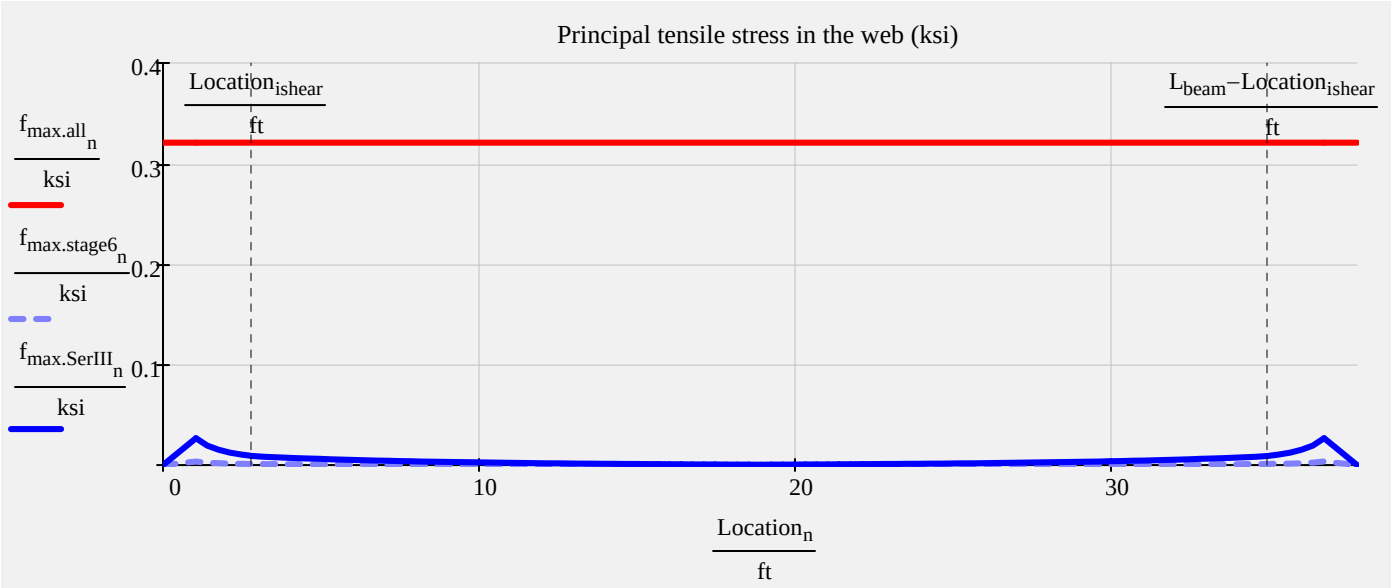
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33.9 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

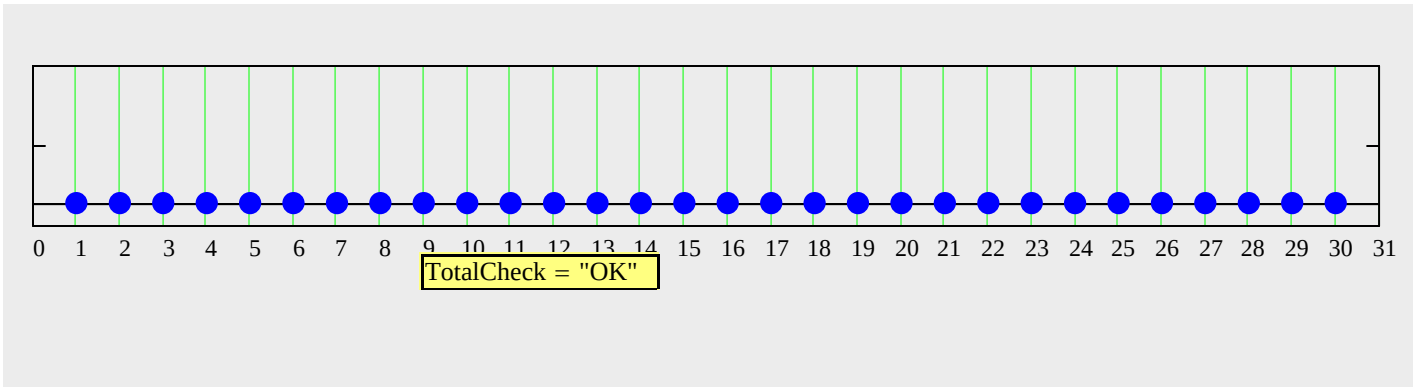
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating}$ =

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.37	3.90	"N/A"	18.55	0.78	5.09	"N/A"	3.21	HL-93
"Strength I (Op)"	0.37	5.06	"N/A"	18.55	0.78	6.60	"N/A"	3.21	HL-93
"Service III (Inv)"	0.37	5.26	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.37	5.53	"N/A"	17.12	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.37	3.86	231.82	19.97	0.78	4.54	272.37	3.21	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93}$ = 0.35 $DC_{LongReinf.Permit}$ = 0.37 $CheckLongReinf_{loadrating}$ = "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment}$ =

"φC"	1864	"factored resistance (kip-ft)...."
"γDL"	275	"factored dead load (kip-ft)...."
"γLL"	314	"factored live load (kip-ft)....."
"RF"	5.06	"HL93 operating rating factor"

$HL93_{Operating.Shear}$ =

"φC"	517.3	"factored resistance (kip)....."
"γDL"	25.4	"factored dead load (kip)....."
"γLL"	74.6	"factored live load (kip)....."
"RF"	6.6	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 38 FEET (15 DEG. SKEW)
EASTBOUND BRIDGE
(D.C.I CANAL)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\EB 38' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-38ftSpan-15inx56in_15Skew_ExtBeam.dat
FSB-38ftSpan-15inx56in_15Skew_IntBeam.dat
FSB-38ftSpan-15inx56in_ExtBeam.dat
FSB-38ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

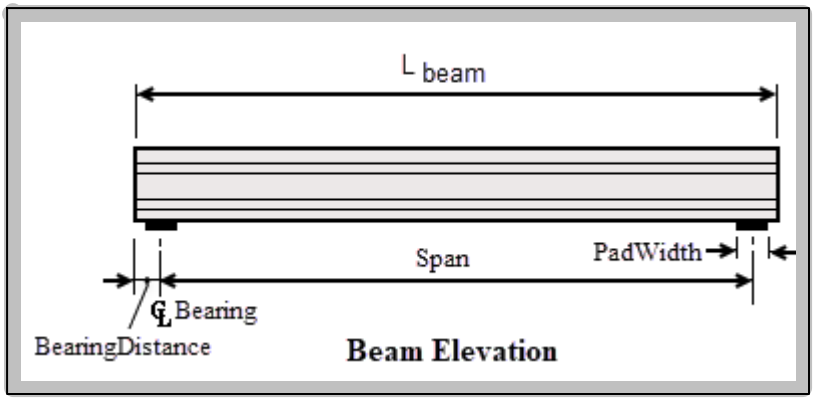
InputDataFile = "FSB-38ftSpan-15inx56in_15Skew_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

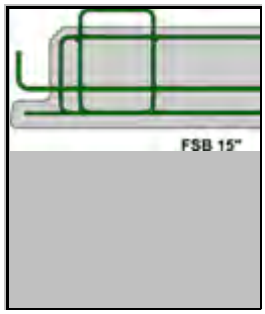
InputDataFile = "FSB-38ftSpan-15inx56in_15Skew_IntBeam.dat"

Beam Type: FSB12 / **FSB15** / FSB18

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



L_{beam}	37.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

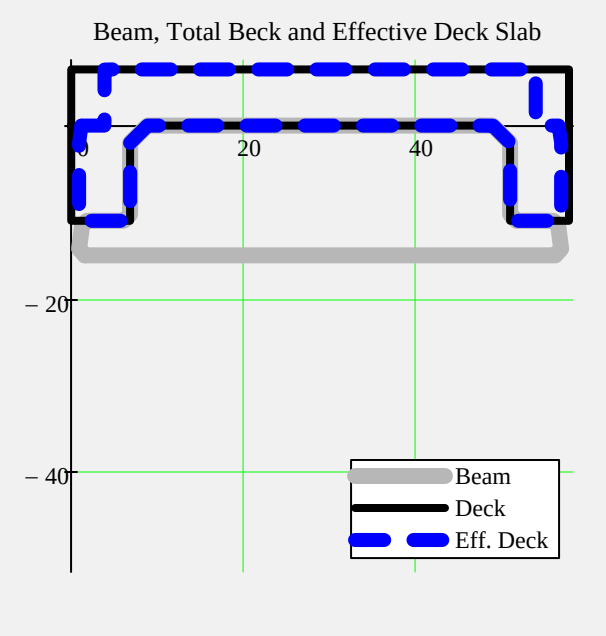
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 57.65 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.58 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 37.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

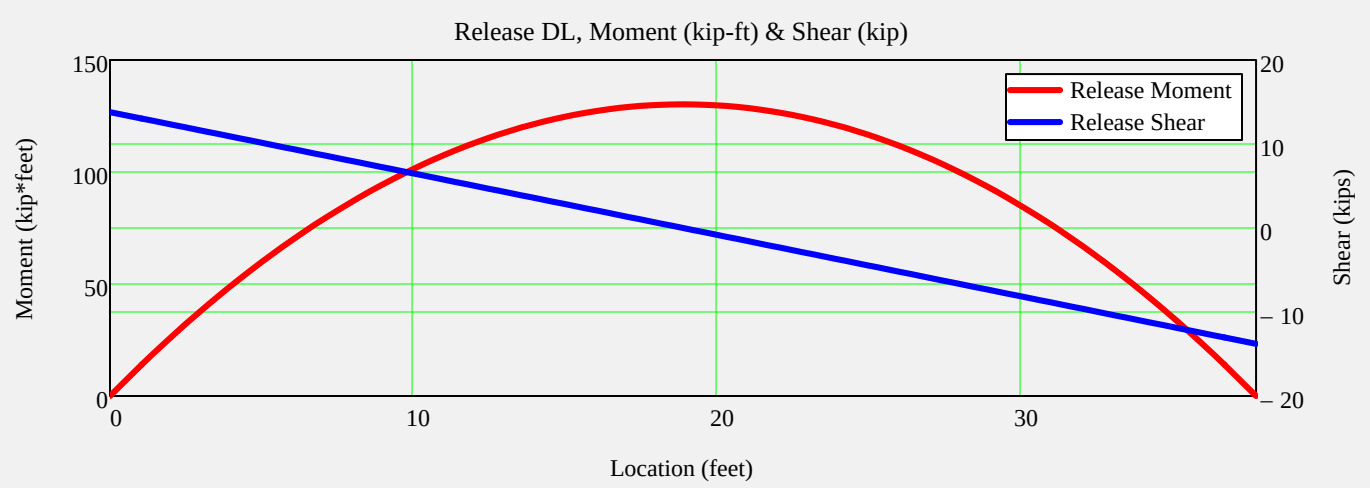
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

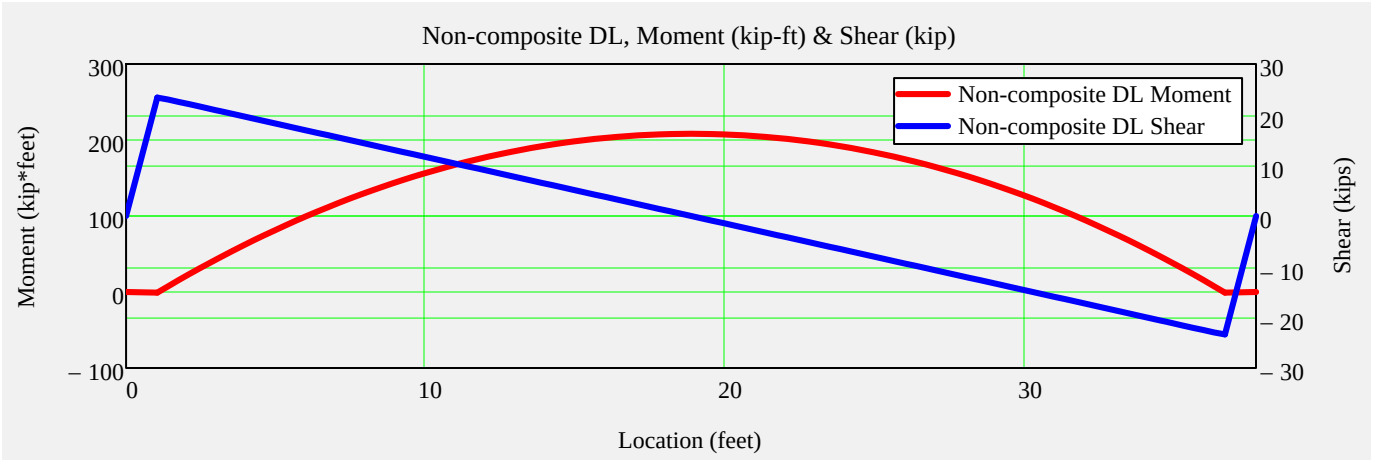
Release Dead Load Moments and Shears

$L_{span} = 35.67\ ft$



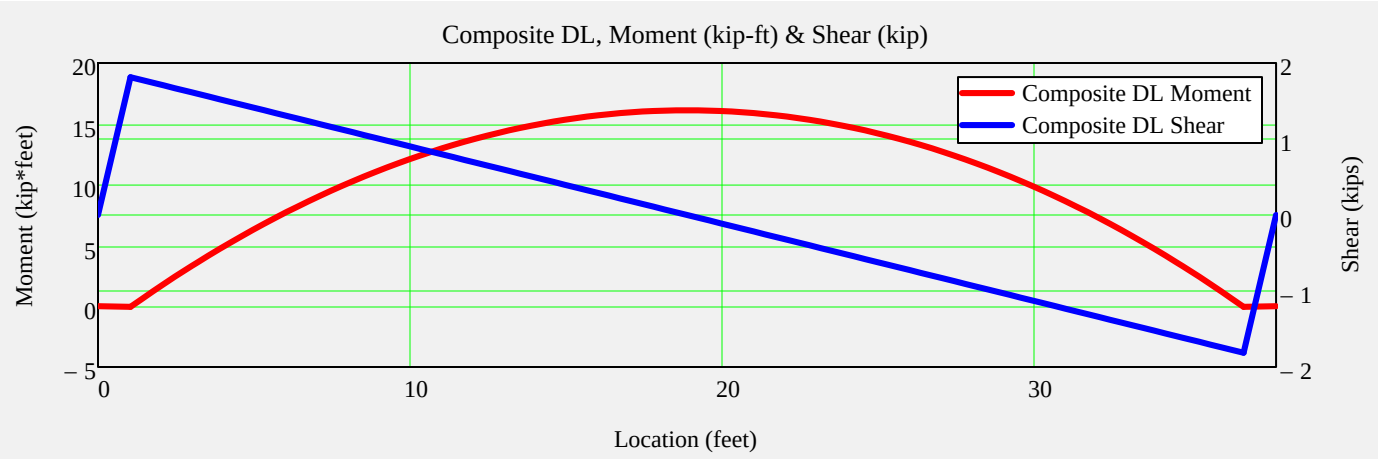
$\max(V_{release}) = 13.8 \cdot kip$ $\max(M_{release}) = 130.2 \cdot kip \cdot ft$ $\min(V_{release}) = -13.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 23.4 \cdot kip$ $\max(M_{dl.non.comp}) = 208.1 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -23.4 \cdot kip$

Composite Dead Load Moments and Shear



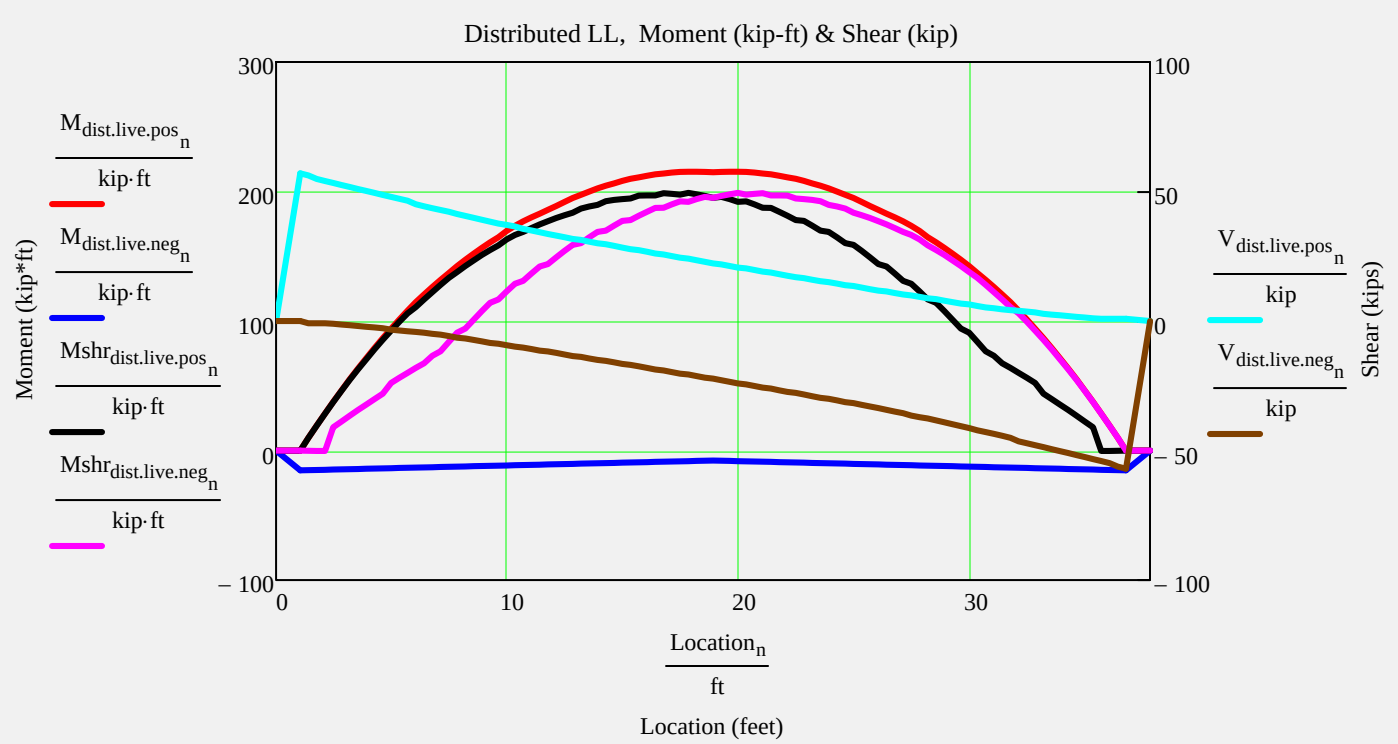
$\max(V_{dl.comp}) = 1.8 \cdot kip$ $\max(M_{dl.comp}) = 16.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -1.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 35.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.16$

Final Live Load Distribution Factors: $g_{mom} = 0.34$ $g_{mom.fatigue} = 0.21$ $g_{shear} = 0.69$



$\max(V_{dist.live.pos}) = 57.0 \cdot kip$

$\max(M_{dist.live.pos}) = 215.3 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -57.0 \cdot kip$

$Reaction_{LL} = 59.5 \cdot kip$

$Reaction_{DL} = 26.7 \cdot kip$

$\min(M_{dist.live.neg}) = -15.3 \cdot kip \cdot ft$

$\max(Mshr_{dist.live.pos}) = 199 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{truck} = 55.26 \cdot kip$ $Reaction_{lane} = 12.08 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 46.78 \cdot kip$

Reinforcement Properties InputDataFile = "FSB-38ftSpan-15inx56in_15Skew_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

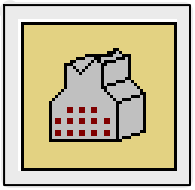
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

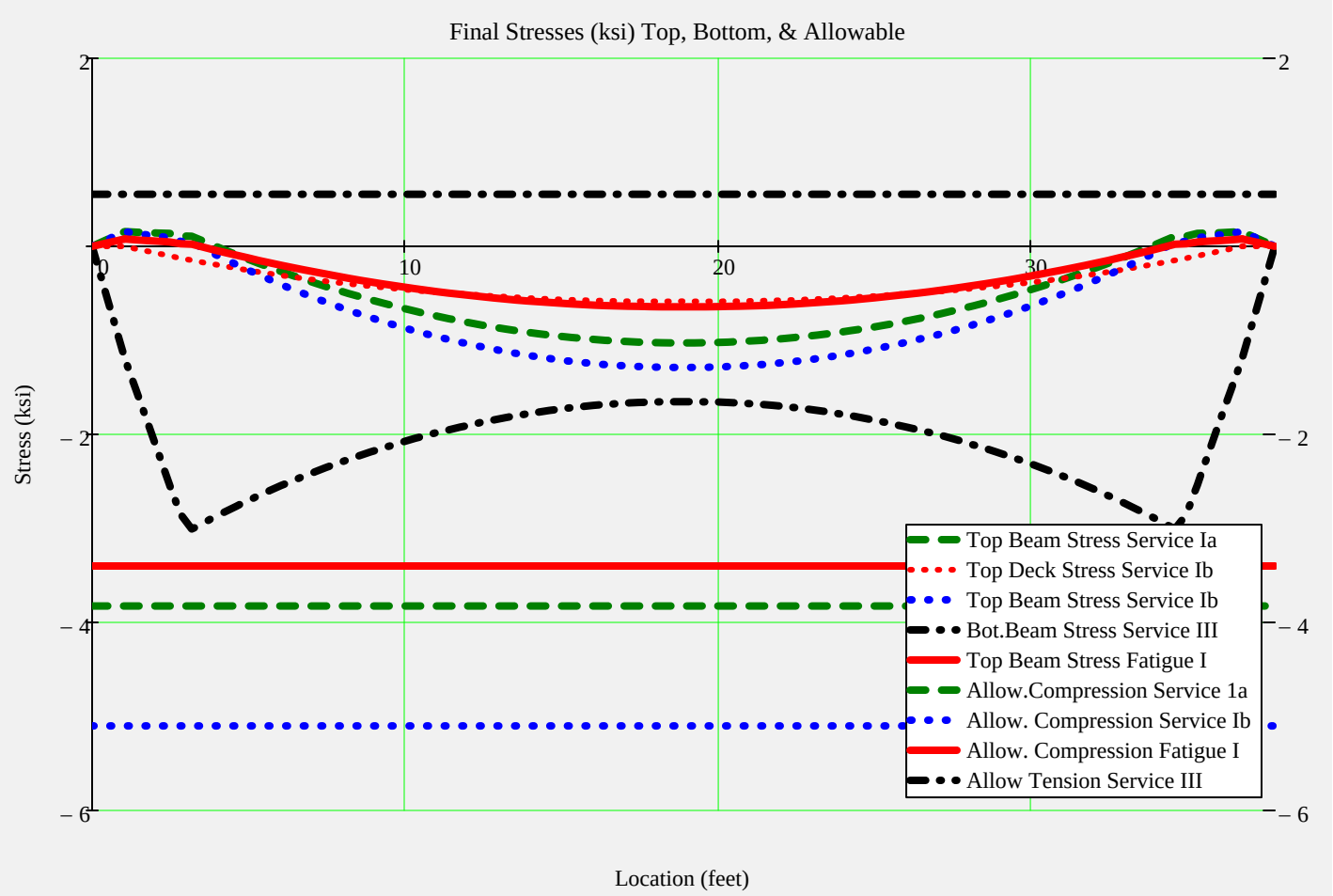
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

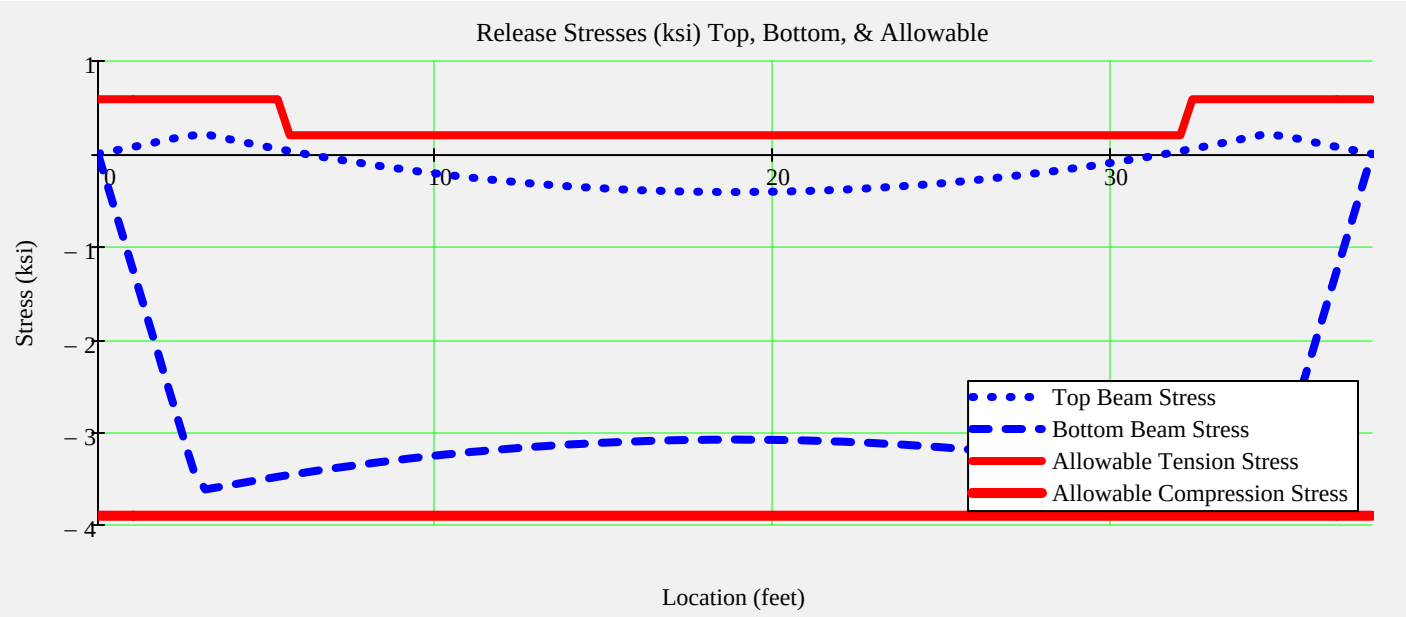
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$\text{Check_f}_{\text{tension.rel}}$ = "OK"	$\max(\text{DC_f}_{\text{tension.rel}}) = 0.72$
Release compression	$\text{Check_f}_{\text{comp.rel}}$ = "OK"	$\max(\text{DC_f}_{\text{comp.rel}}) = 0.93$
*Service III , PS+DL+0.8*LL*	$\text{Check_f}_{\text{tension.ServiceIII}}$ = "OK"	$\max(\text{DC_f}_{\text{tension.ServiceIII}}) = 0.84$
Service Ia , PS+DL	$\text{Check_f}_{\text{comp.ServiceIa}}$ = "OK"	$\max(\text{DC_f}_{\text{comp.ServiceIa}}) = 0.27$
Service Ib , PS+DL+LL	$\text{Check_f}_{\text{comp.ServiceIb}}$ = "OK"	$\max(\text{DC_f}_{\text{comp.ServiceIb}}) = 0.25$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$\text{Check_f}_{\text{comp.FatigueI}}$ = "OK"	$\max(\text{DC_f}_{\text{comp.FatigueI}}) = 0.19$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.21	0.59
"Compression @ Release"	3.18	–3.62	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	18.88	–1.03	–3.83
"CompressionIb @ ServiceI"	18.88	–1.29	–5.10
"Compression @ FatigueI"	18.88	–0.64	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

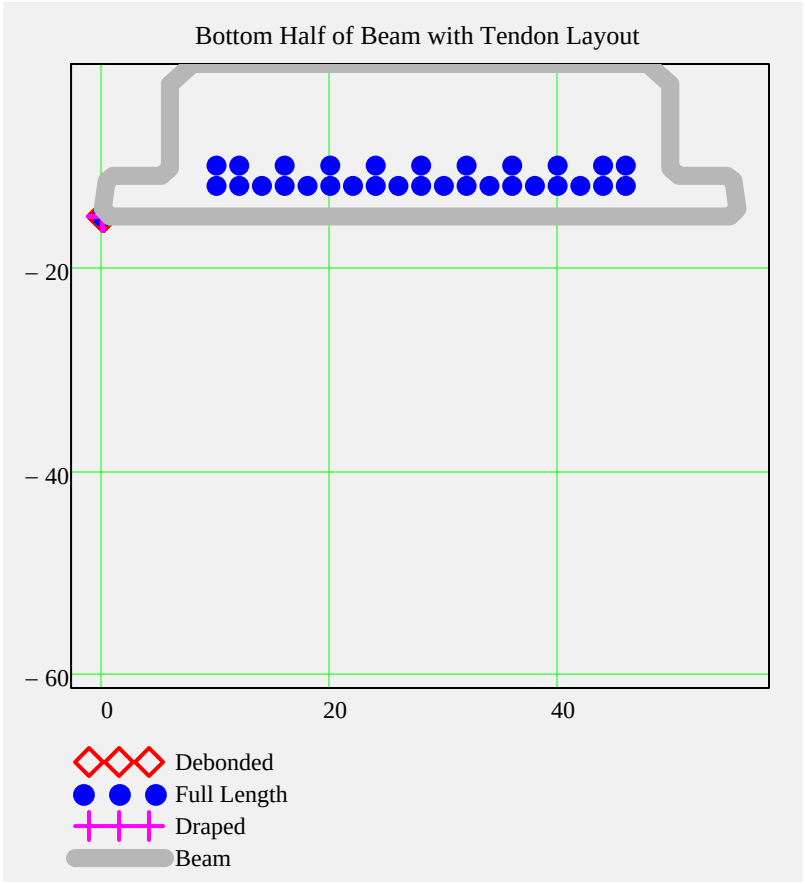
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

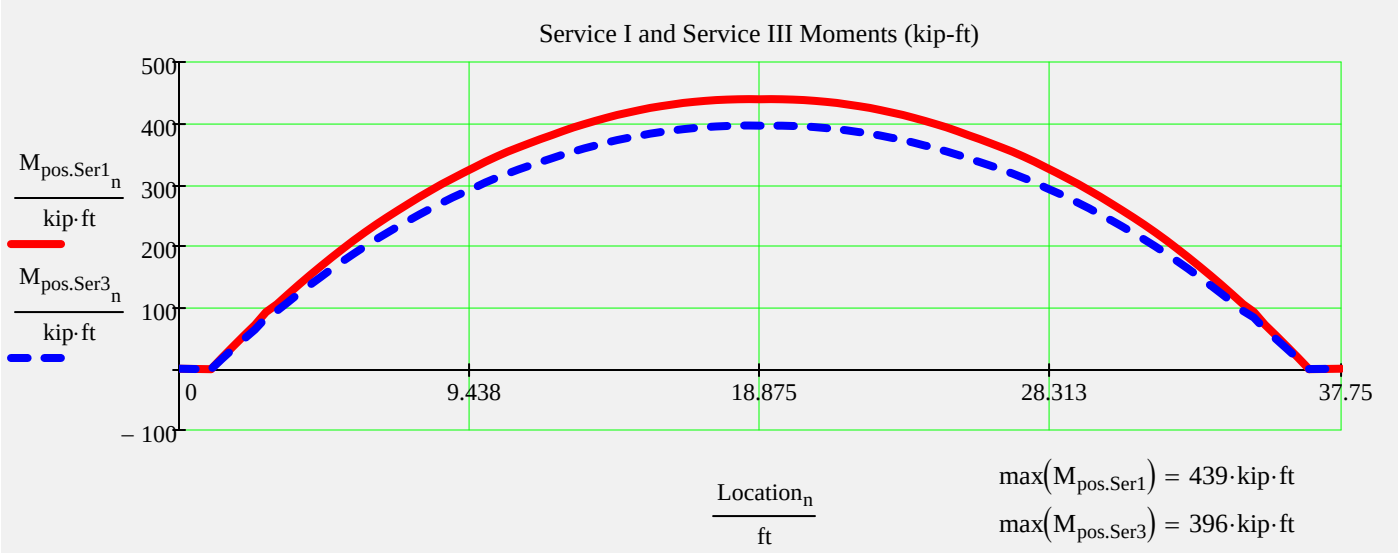
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 439 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 396 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.41 & -3.08 \\ \text{"2"} & -0.47 & -2.64 \\ \text{"4"} & -0.37 & -2.72 \\ \text{"6"} & -1.01 & -2.17 \\ \text{"8"} & -1.29 & -1.65 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1197.5	45628	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	130
"Non-Composite DL (incl. beam wt.)"	208
"Composite Dead Load"	16
"Distributed Live Load"	215

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

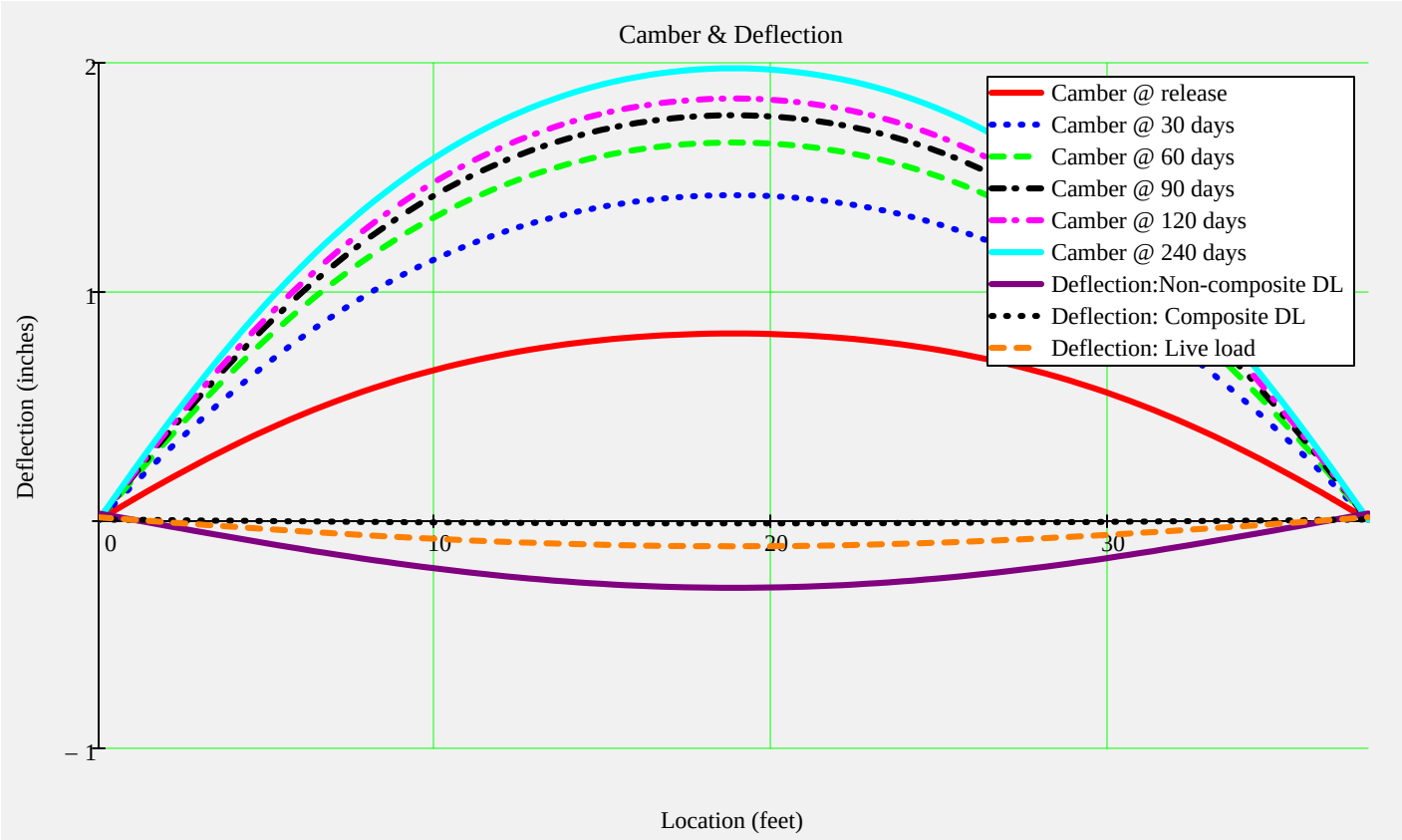
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 35.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.30	0.42	0.82
"30 Days"	–0.09	–0.56	0.72	1.42
"60 Days"	–0.12	–0.66	0.84	1.65
"90 Days"	–0.13	–0.71	0.90	1.77
"120 Days"	–0.14	–0.74	0.94	1.84
"240 Days"	–0.16	–0.79	1.00	1.98
"Non-comp DL"	–0.04	0.03	–0.13	–0.30
"Comp DL"	–0.00	0.00	–0.01	–0.02
"LL"	–0.01	0.02	–0.05	–0.12

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.53 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

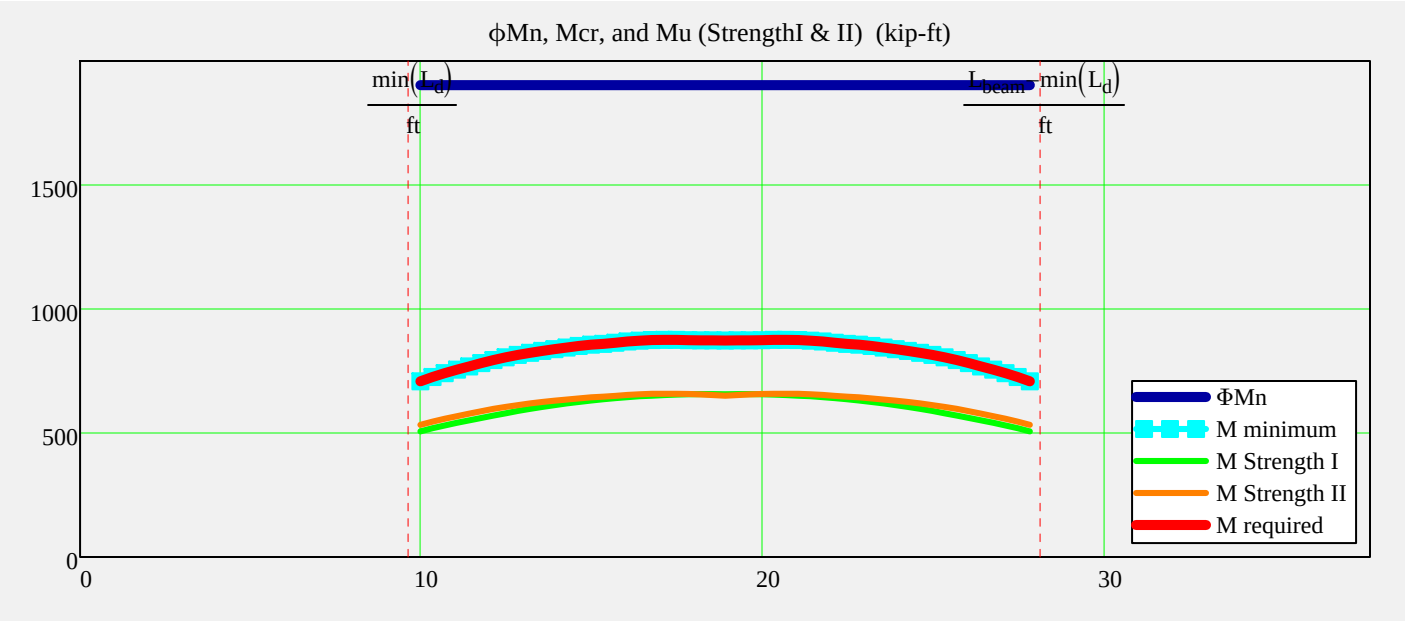
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 658 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 873 \cdot kip \cdot ft$ $M_{reqd_{51}} = 873 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1903 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 28.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.46$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

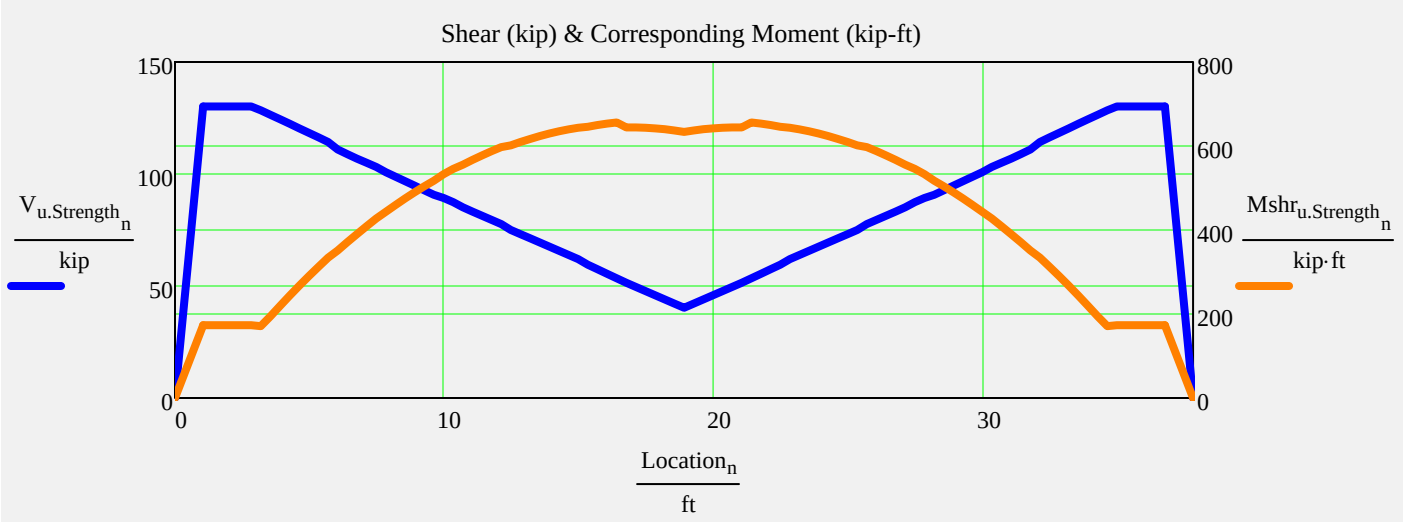
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

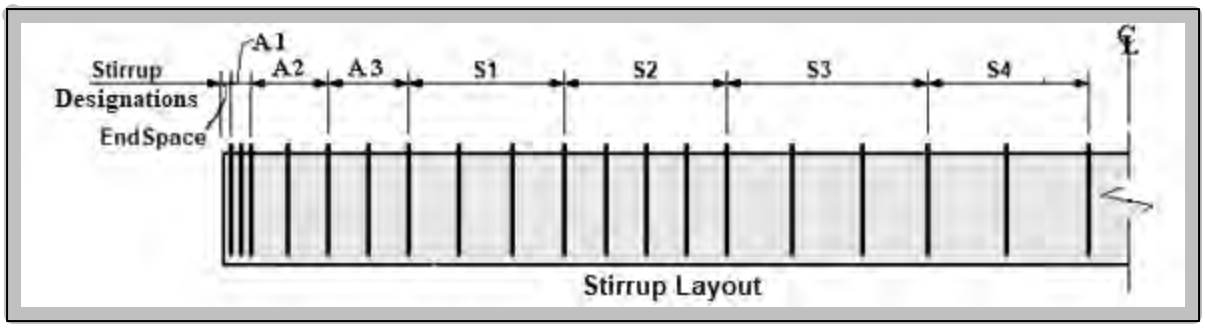
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 131 \\ 142 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 130.2 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 656 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

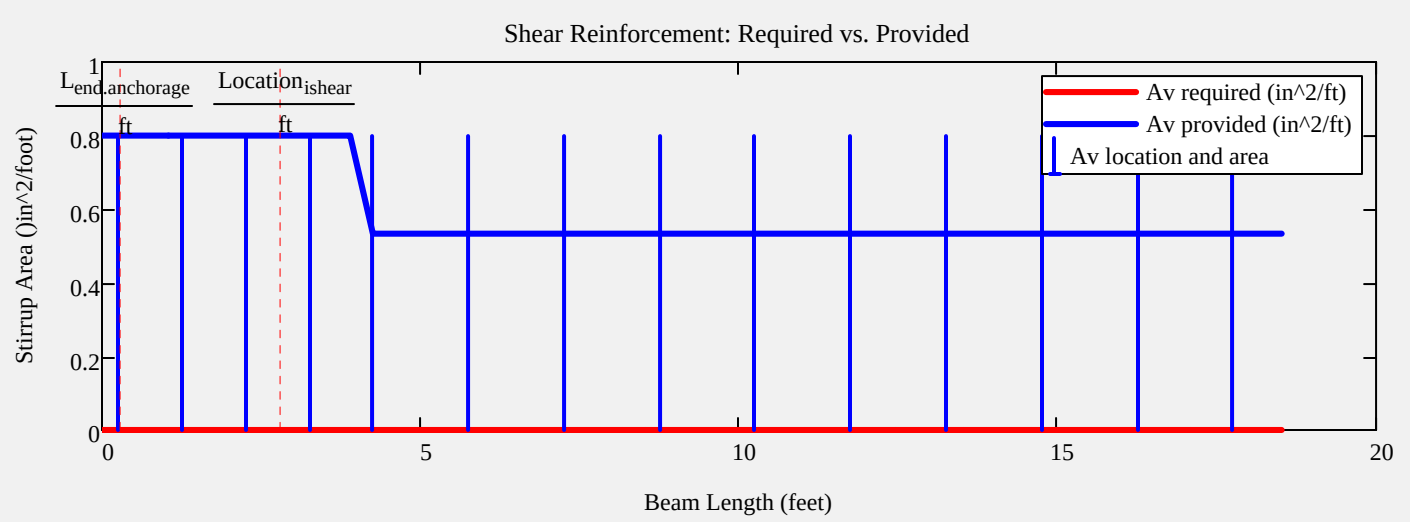
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.83\ ft$

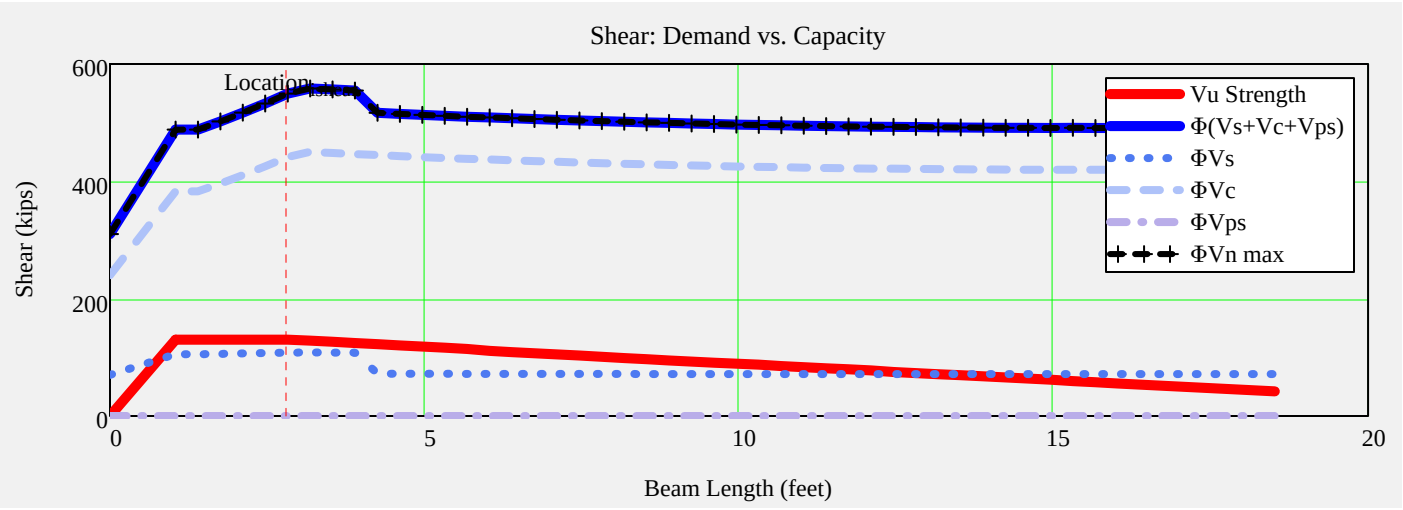
Save Data File ☑ Use current input file

File Name FSB-38ftSpan-15inx56in_15Skew_IntBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

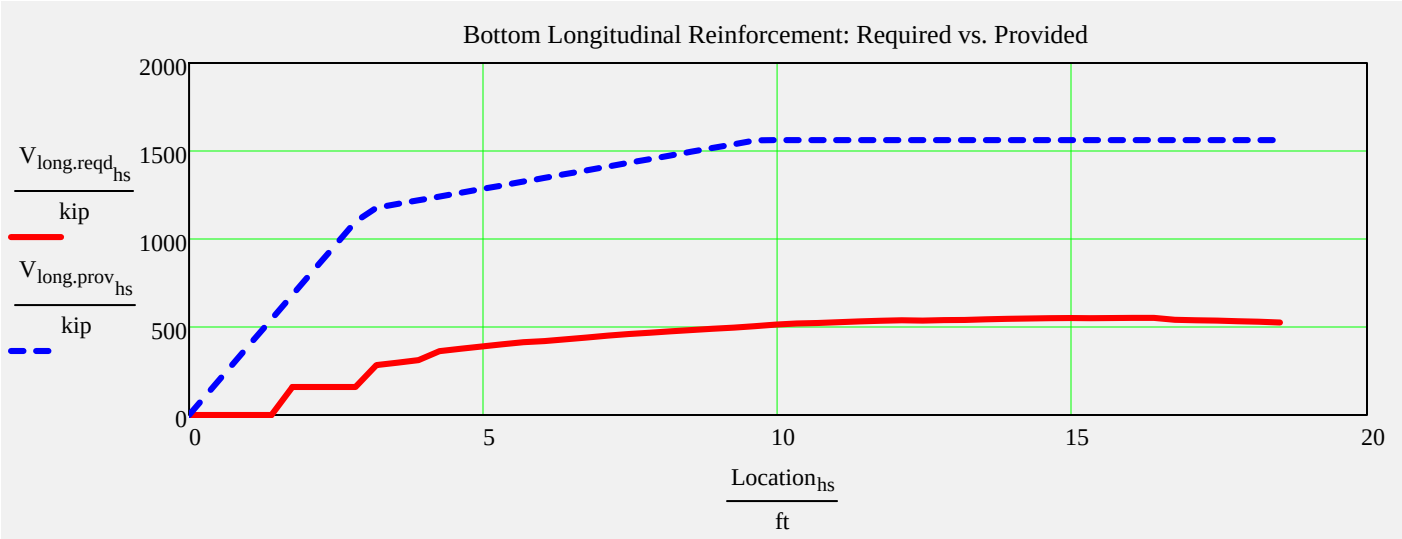
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 2.83 & 130.17 & 549.41 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.24$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

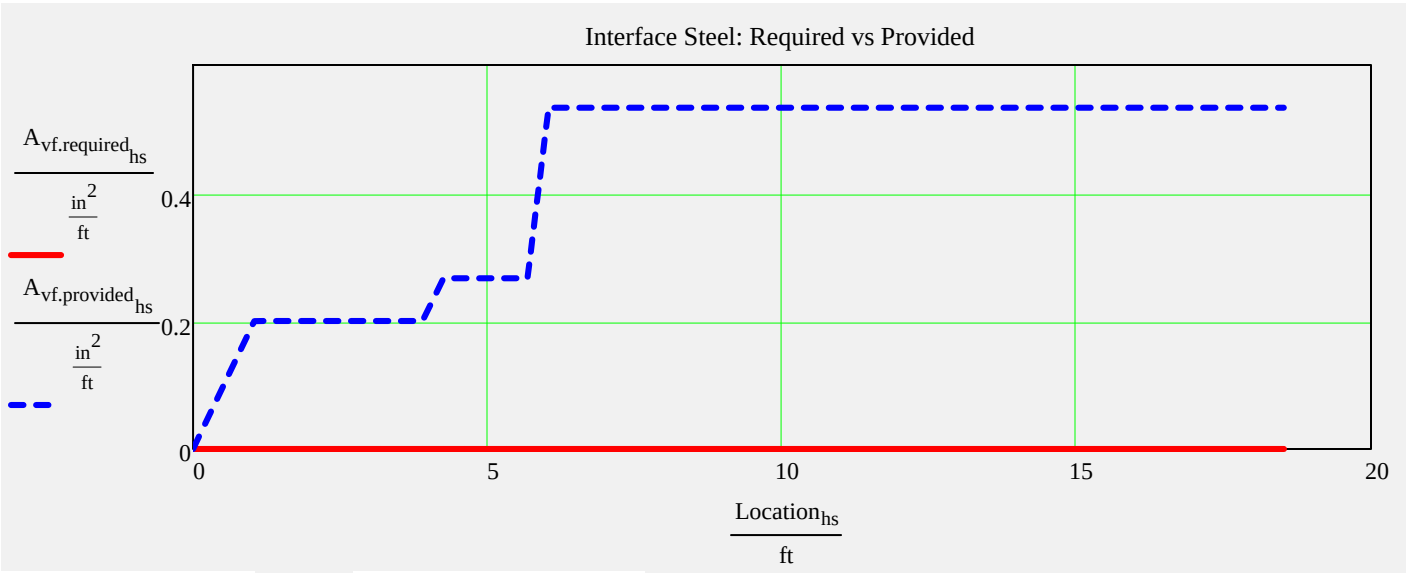


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 16.4 & 551.5 & 1561.9 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.35$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 7.94 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

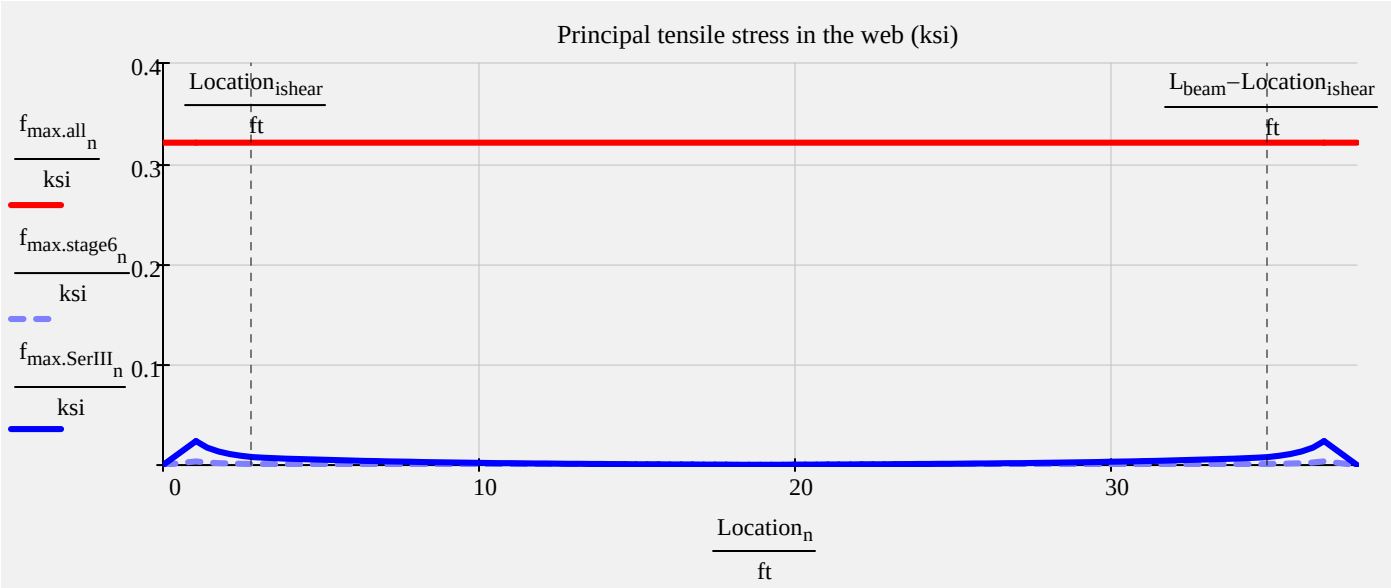
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33.9 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

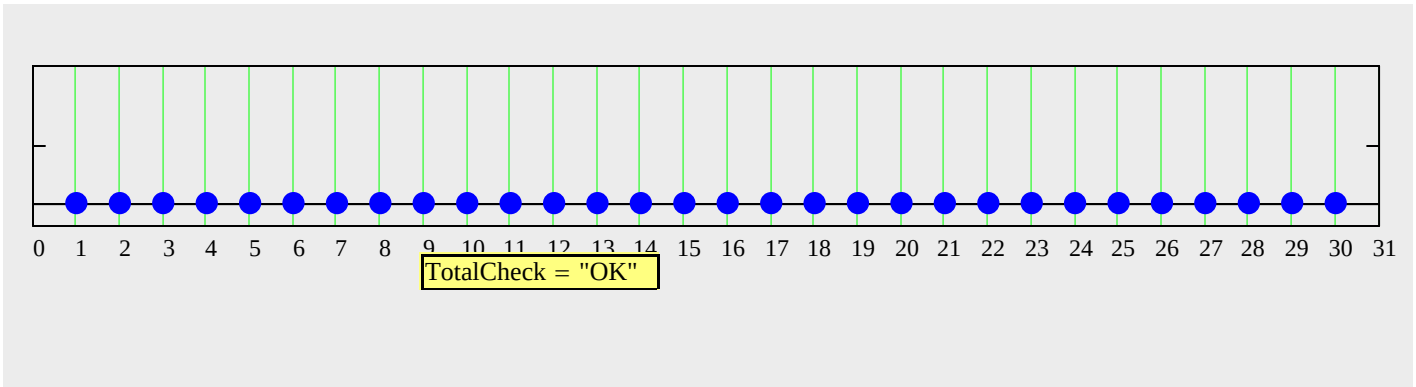
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.34	4.31	"N/A"	17.12	0.69	5.70	"N/A"	3.21	HL-93
"Strength I (Op)"	0.34	5.58	"N/A"	18.55	0.69	7.39	"N/A"	3.21	HL-93
"Service III (Inv)"	0.34	5.69	"N/A"	18.55	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.34	5.98	"N/A"	18.55	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.34	4.26	255.77	15.69	0.69	5.09	305.18	3.21	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.33$ $DC_{LongReinf.Permit} = 0.35$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1903	"factored resistance (kip-ft)...."
"γDL"	280	"factored dead load (kip-ft)...."
"γLL"	291	"factored live load (kip-ft)....."
"RF"	5.58	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	519.2	"factored resistance (kip)....."
"γDL"	25.9	"factored dead load (kip)....."
"γLL"	66.8	"factored live load (kip)....."
"RF"	7.39	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM EXTERIOR BEAM DESIGN

SPAN LENGTH = 45 FEET (NO SKEW)
WESTBOUND BRIDGE
(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\WB 45' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-45ftSpan-15inx56in_ExtBeam.dat
FSB-45ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

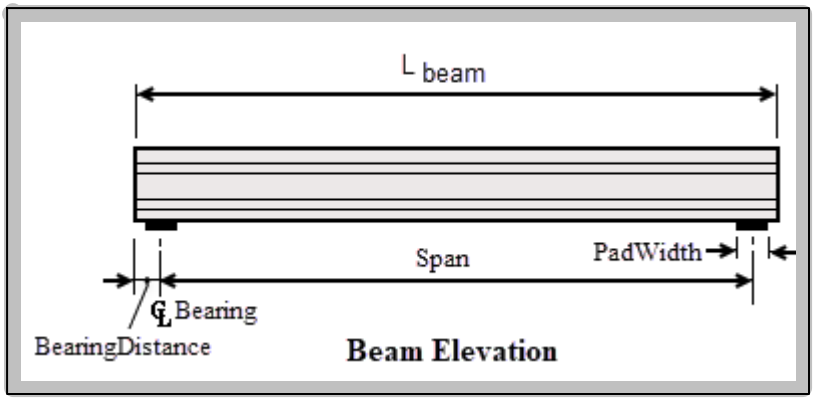
InputDataFile = "FSB-45ftSpan-15inx56in_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

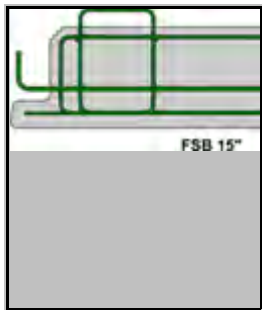
Superstructure Data

InputDataFile = "FSB-45ftSpan-15inx56in_ExtBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	44.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

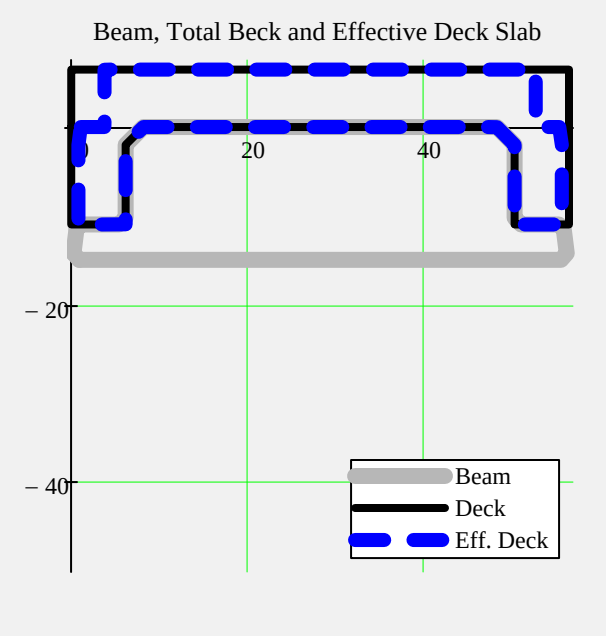
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = 56·in

$b_e = 56.32 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.56 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 44.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

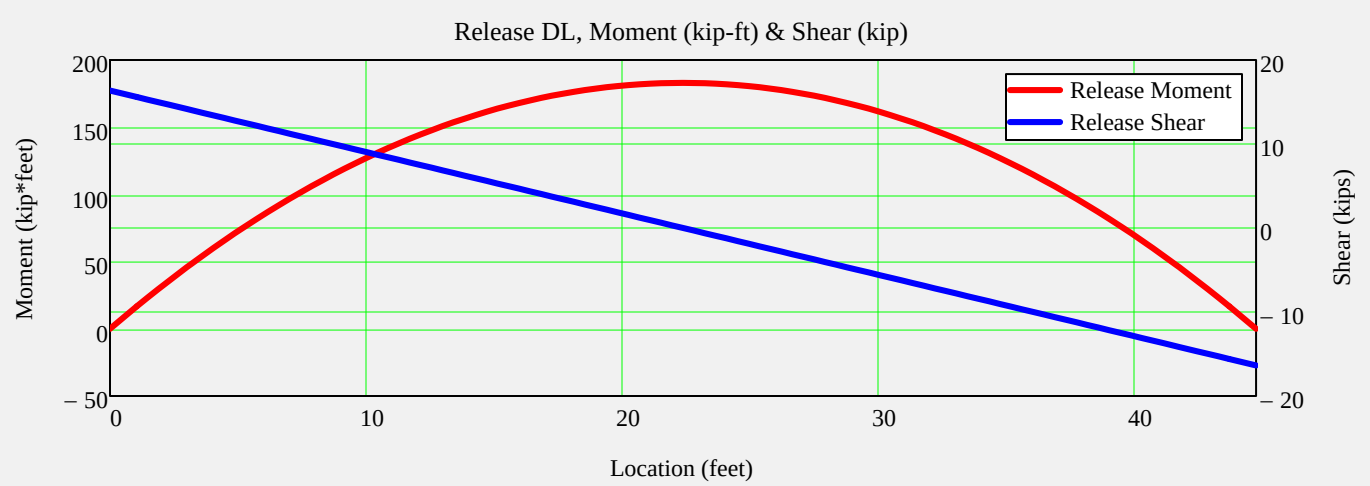
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

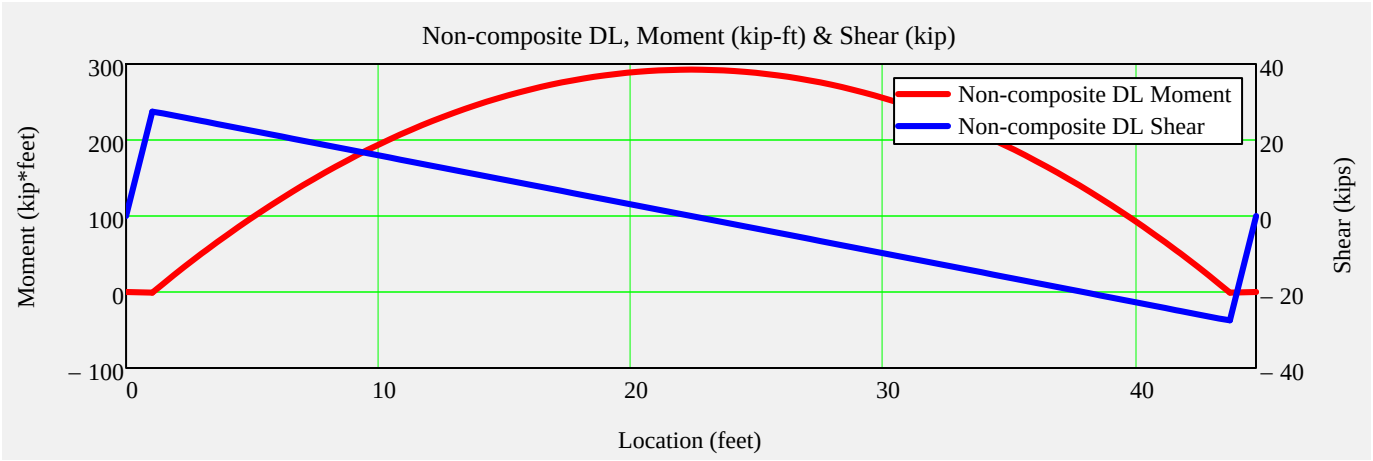
Release Dead Load Moments and Shears

$L_{span} = 42.67\ ft$



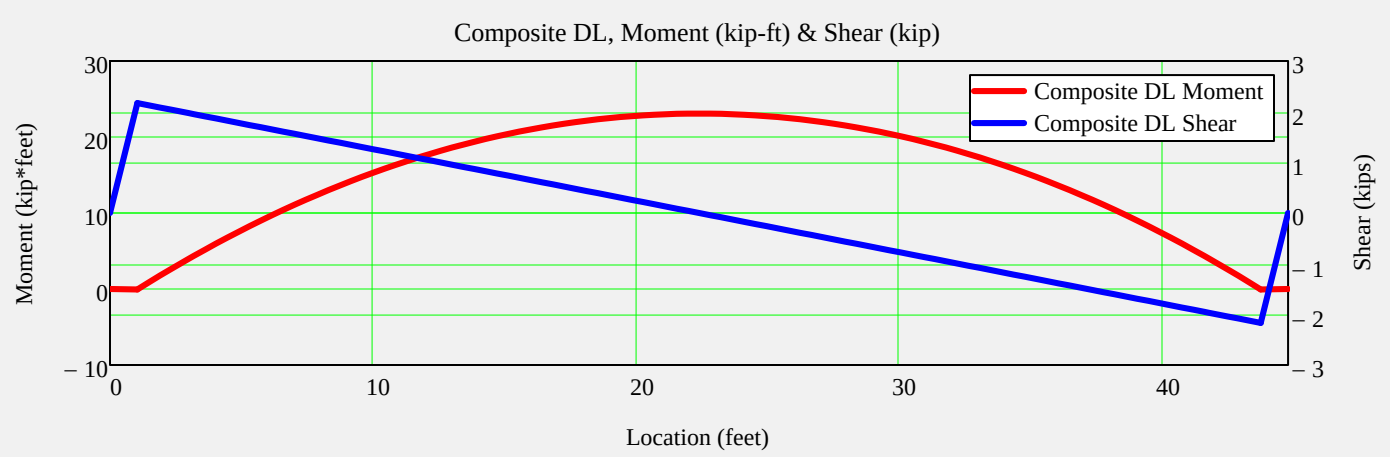
$\max(V_{release}) = 16.4 \cdot kip$ $\max(M_{release}) = 183.0 \cdot kip \cdot ft$ $\min(V_{release}) = -16.4 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 27.4 \cdot kip$ $\max(M_{dl.non.comp}) = 292.6 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -27.4 \cdot kip$

Composite Dead Load Moments and Shear



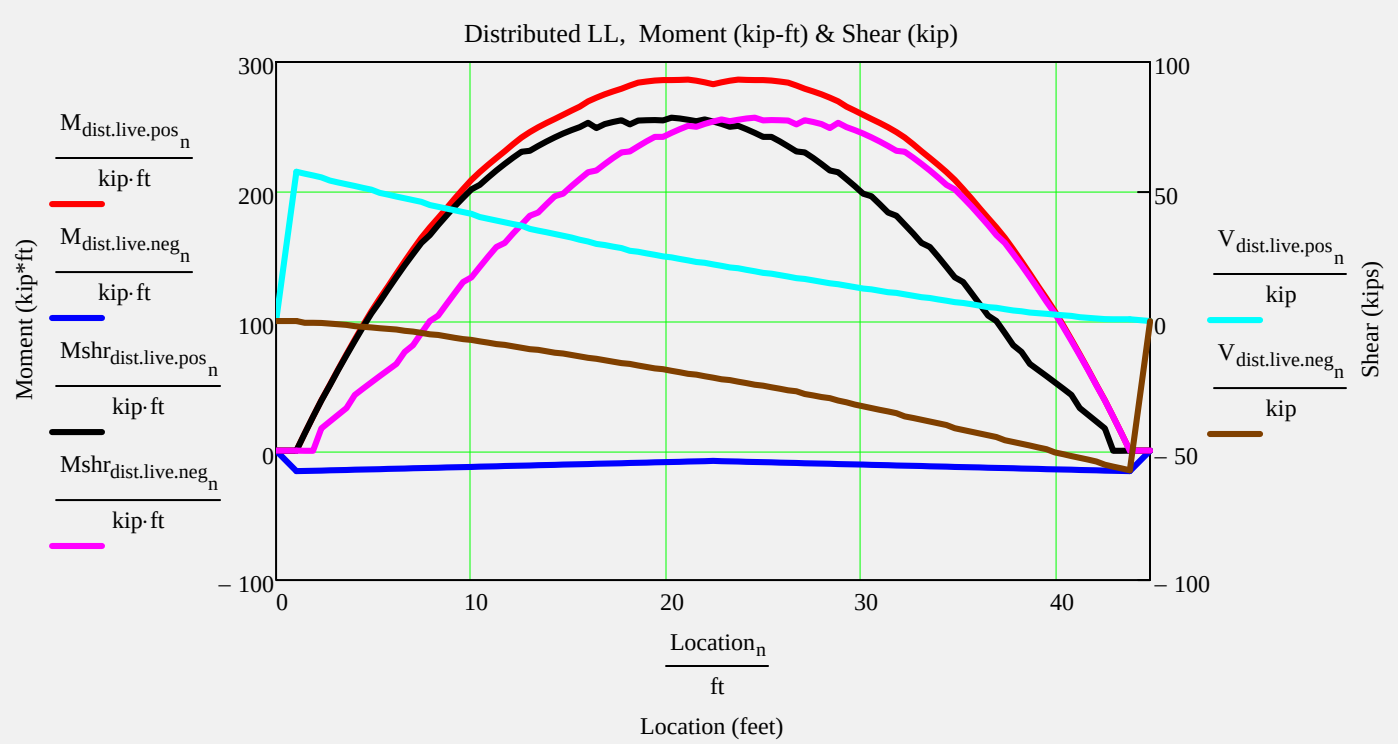
$\max(V_{dl.comp}) = 2.2 \cdot kip$ $\max(M_{dl.comp}) = 23.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.2 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 42.67\ ft$ BeamSpacing = 4.67 ft Skew = 0·deg

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor = 1.00

Final Live Load Distribution Factors: $g_{mom} = 0.36$ $g_{mom.fatigue} = 0.22$ $g_{shear} = 0.65$



$\max(V_{dist.live.pos}) = 57.6\cdot kip$

$\max(M_{dist.live.pos}) = 286.4\cdot kip\cdot ft$

$\min(V_{dist.live.neg}) = -57.6\cdot kip$

$Reaction_{LL} = 59.9\cdot kip$

$\min(M_{dist.live.neg}) = -15.9\cdot kip\cdot ft$

$Reaction_{DL} = 31.1\cdot kip$

$\max(Mshr_{dist.live.pos}) = 257\cdot kip\cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{truck} = 58.01\cdot kip$ $Reaction_{lane} = 14.32\cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane})\cdot g_{shear}$

$Reaction_{LL.without.IM} = 47.34\cdot kip$

Reinforcement Properties

InputDataFile = "FSB-45ftSpan-15inx56in_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

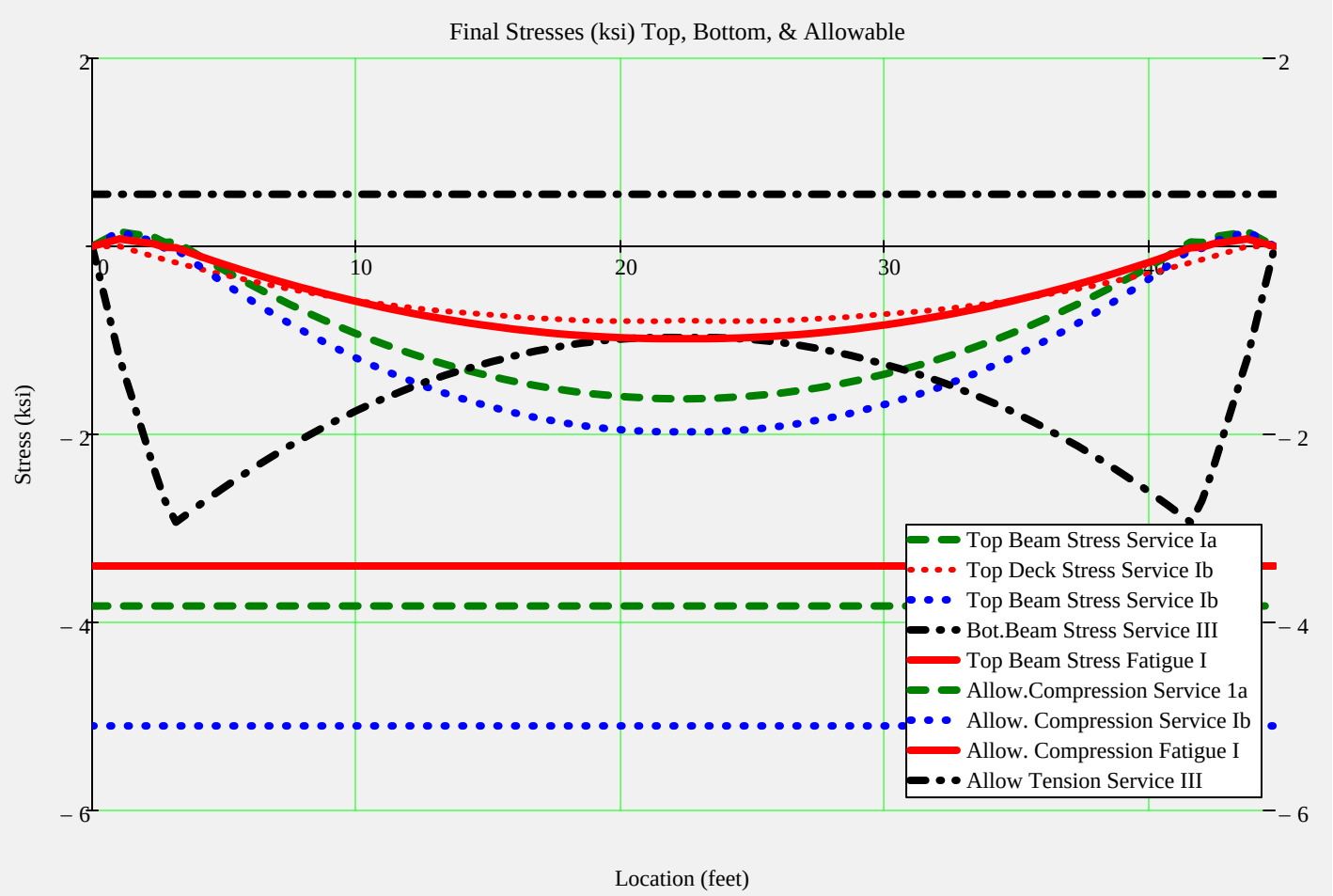
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

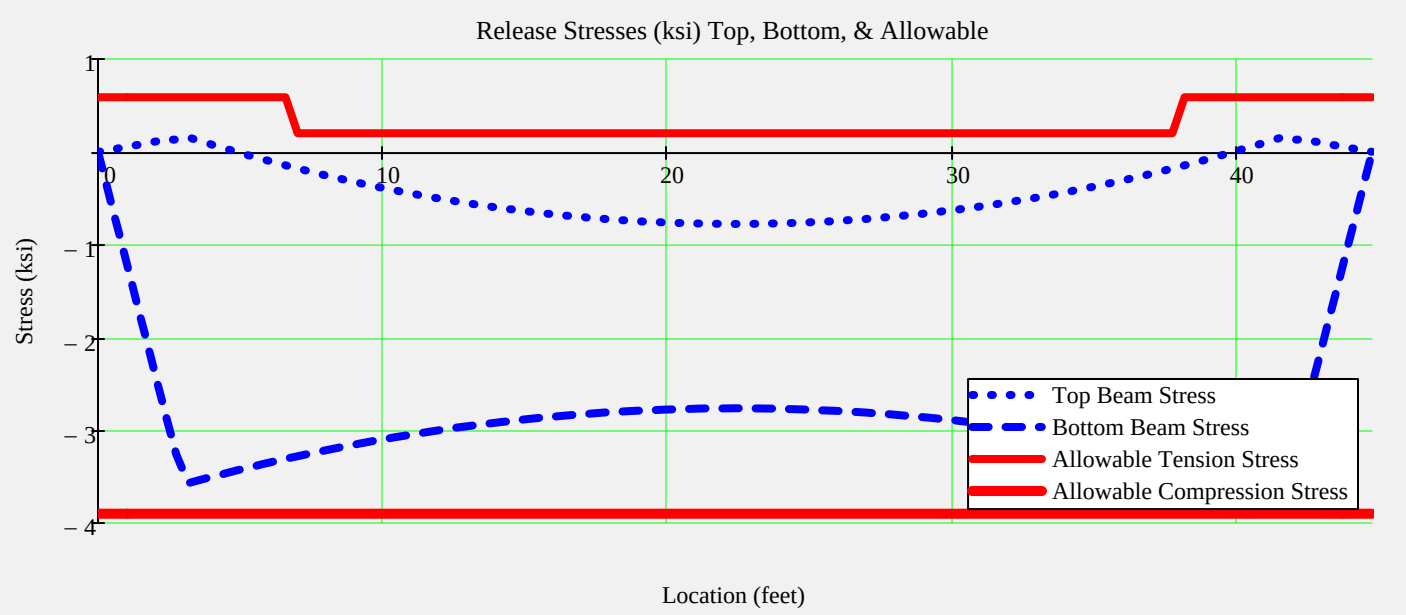
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel} = "OK"$	$\max(DC_f_{tension.rel}) = 0.68$
Release compression	$Check_f_{comp.rel} = "OK"$	$\max(DC_f_{comp.rel}) = 0.92$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII} = "OK"$	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa} = "OK"$	$\max(DC_f_{comp.ServiceIa}) = 0.42$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb} = "OK"$	$\max(DC_f_{comp.ServiceIb}) = 0.39$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI} = "OK"$	$\max(DC_f_{comp.FatigueI}) = 0.29$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.16	0.59
"Compression @ Release"	3.18	–3.57	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	22.38	–1.62	–3.83
"CompressionIb @ ServiceI"	22.80	–1.97	–5.10
"Compression @ FatigueI"	22.38	–0.98	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

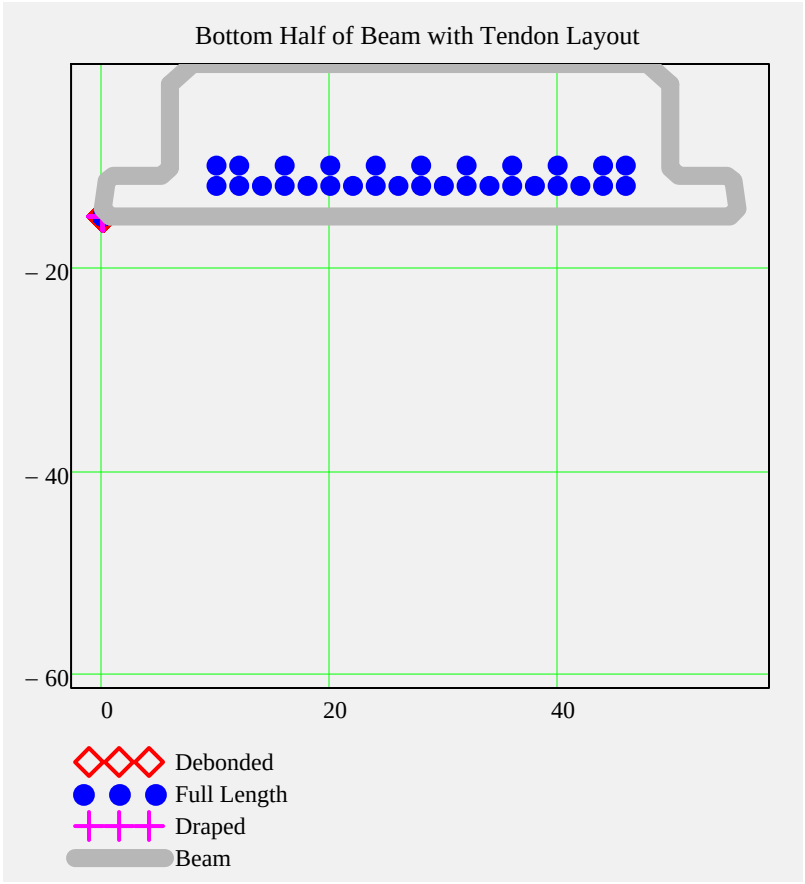
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

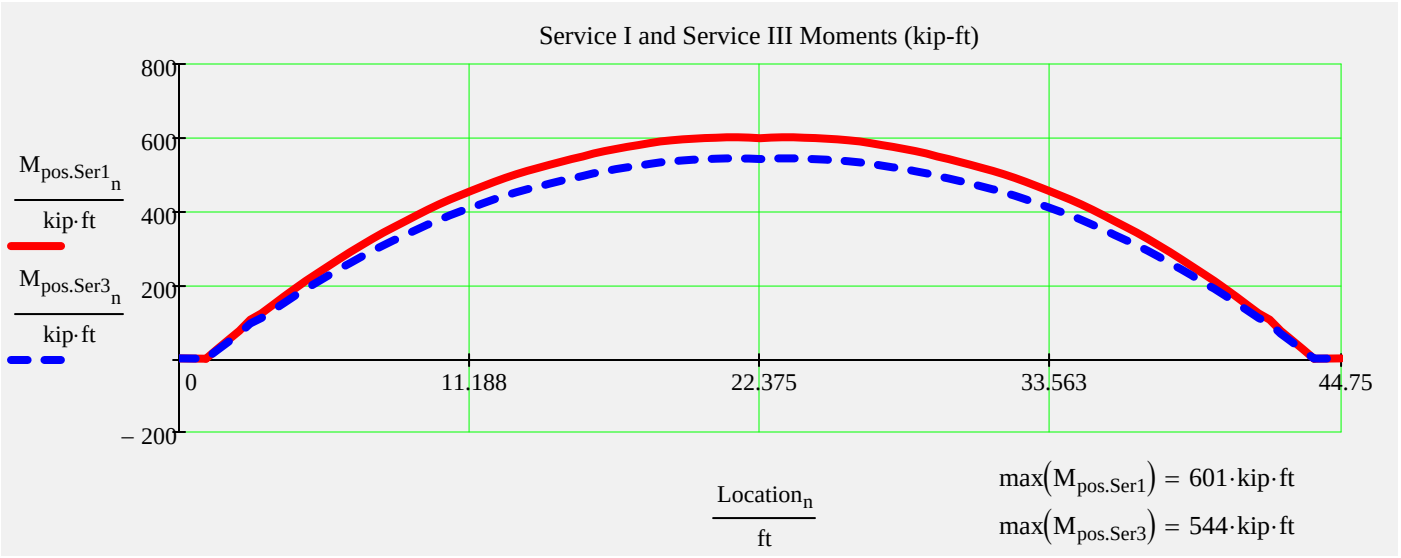
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.78 & -2.76 \\ \text{"2"} & -0.83 & -2.32 \\ \text{"4"} & -0.72 & -2.42 \\ \text{"6"} & -1.59 & -1.66 \\ \text{"8"} & -1.97 & -0.97 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1177.2	44990	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	183
"Non-Composite DL (incl. beam wt.)"	293
"Composite Dead Load"	23
"Distributed Live Load"	283

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

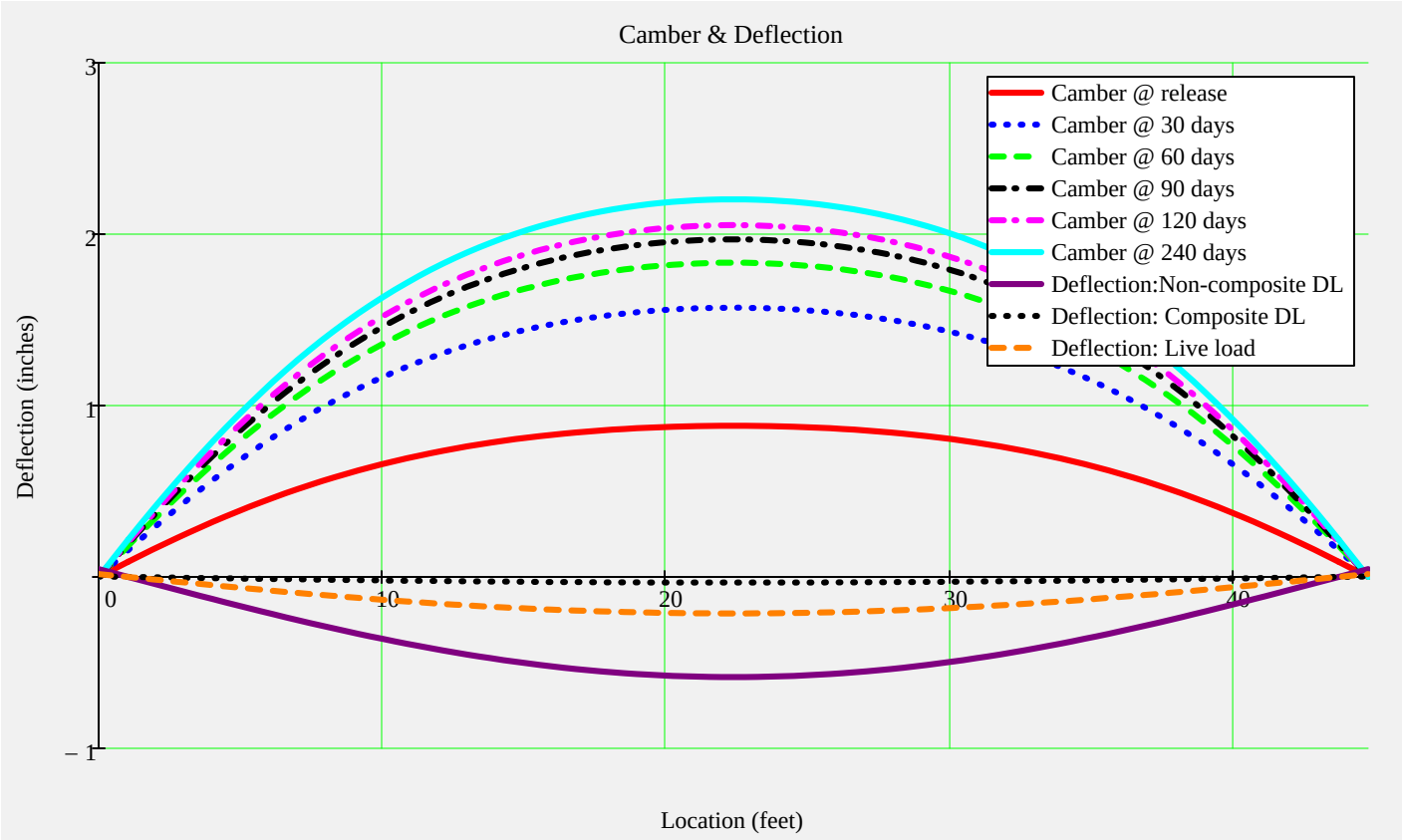
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 42.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.05	–0.34	0.41	0.88
"30 Days"	–0.15	–0.63	0.73	1.57
"60 Days"	–0.19	–0.74	0.84	1.83
"90 Days"	–0.21	–0.80	0.91	1.97
"120 Days"	–0.23	–0.83	0.94	2.05
"240 Days"	–0.25	–0.90	1.01	2.20
"Non-comp DL"	–0.06	0.05	–0.21	–0.58
"Comp DL"	–0.00	0.00	–0.01	–0.03
"LL"	–0.01	0.03	–0.08	–0.21

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.44 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

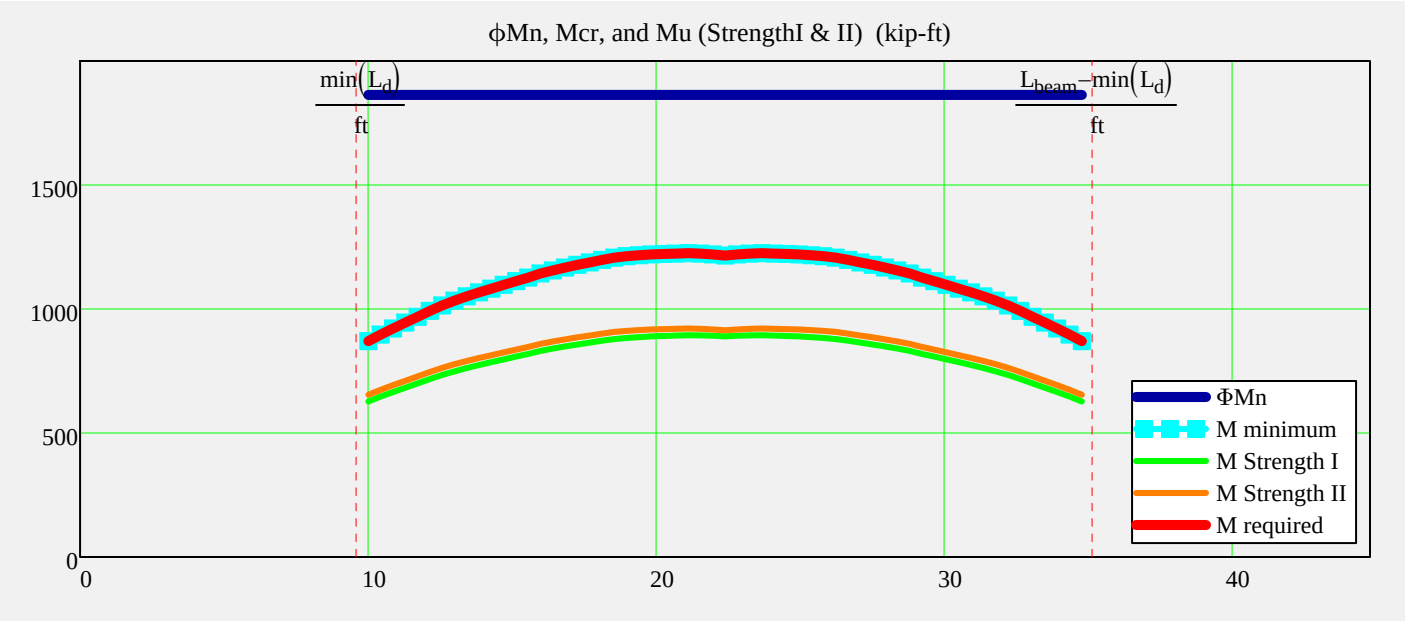
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 921 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1216 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1216 \cdot kip \cdot ft$

$StrandType =$ "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1864 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 35.2\,\text{ft}$

$$DC_{moment_{mn}} := \frac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$$

Demand/Capacity Ratio at locations where all strands are fully developed

$\max(DC_{moment}) = 0.66$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

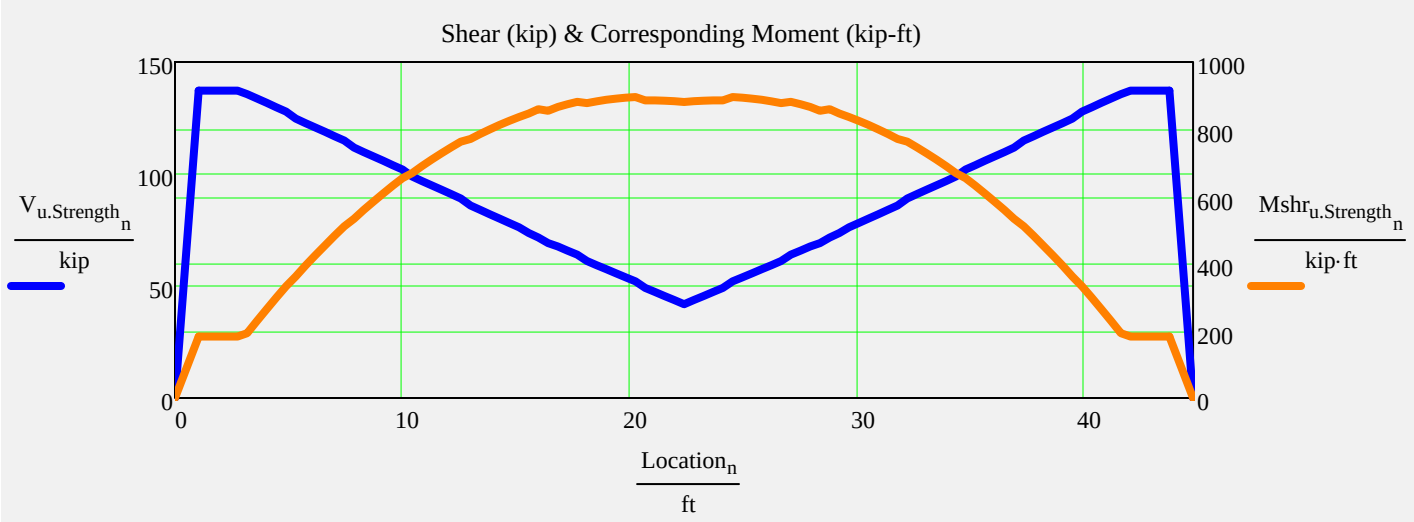
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

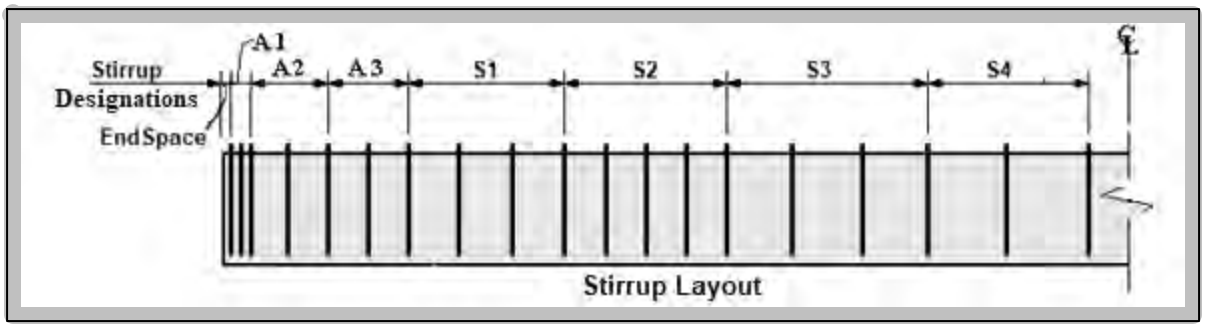
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 138 \\ 147 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 137.2 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 896 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

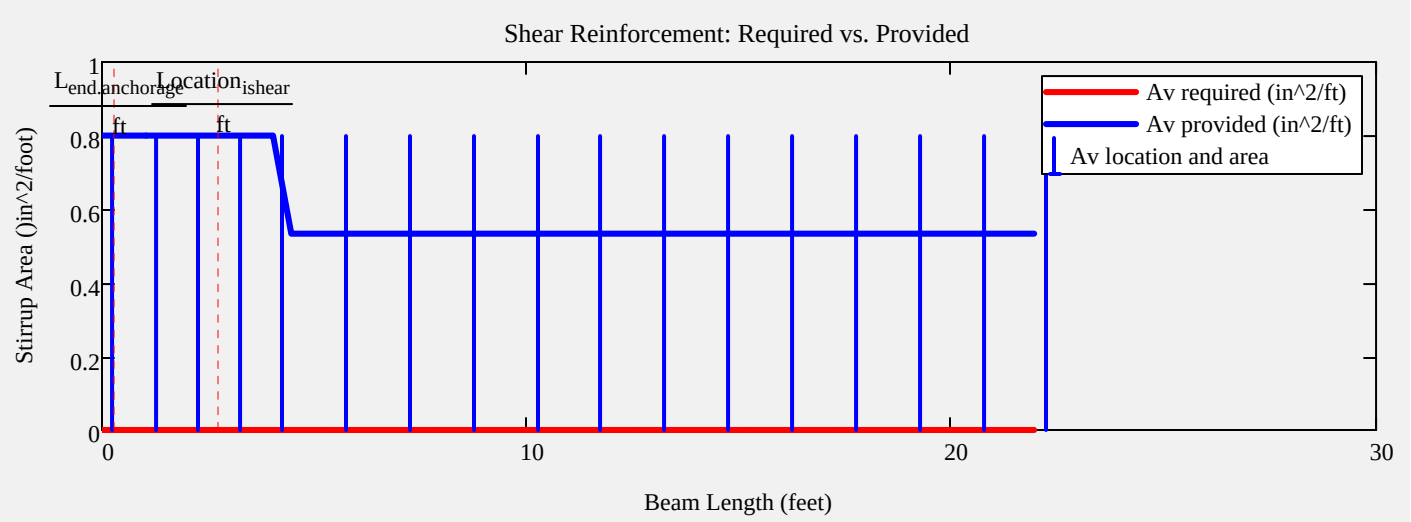
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.75\ ft$

Save Data File

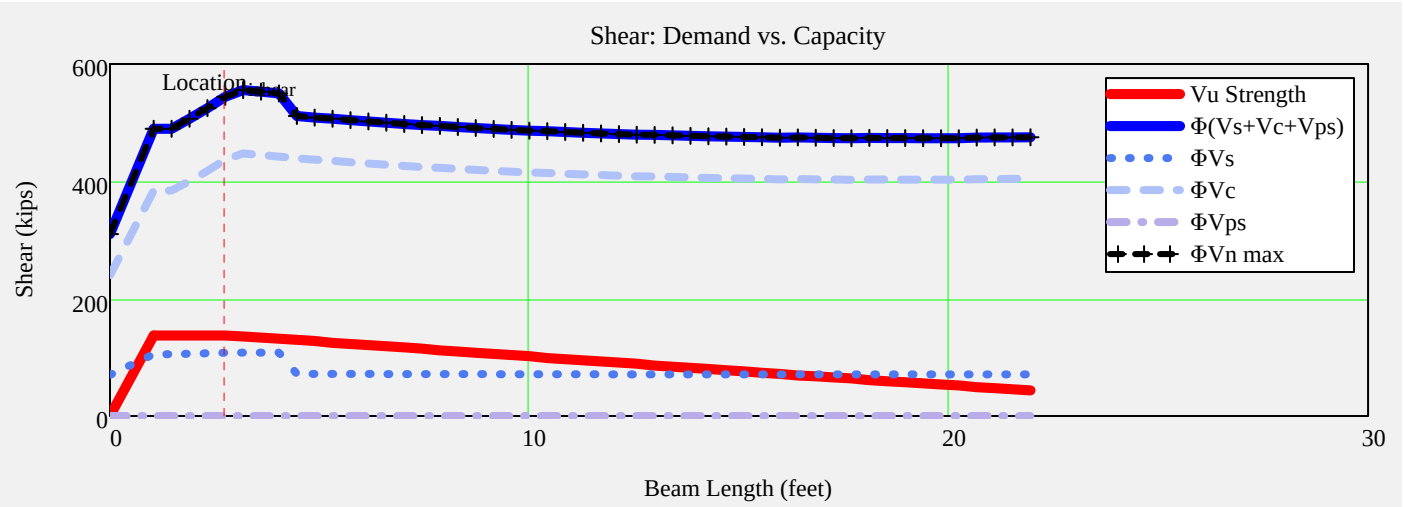
Use current input file

File Name FSB-45ftSpan-15inx56in_ExtBeam.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\WB

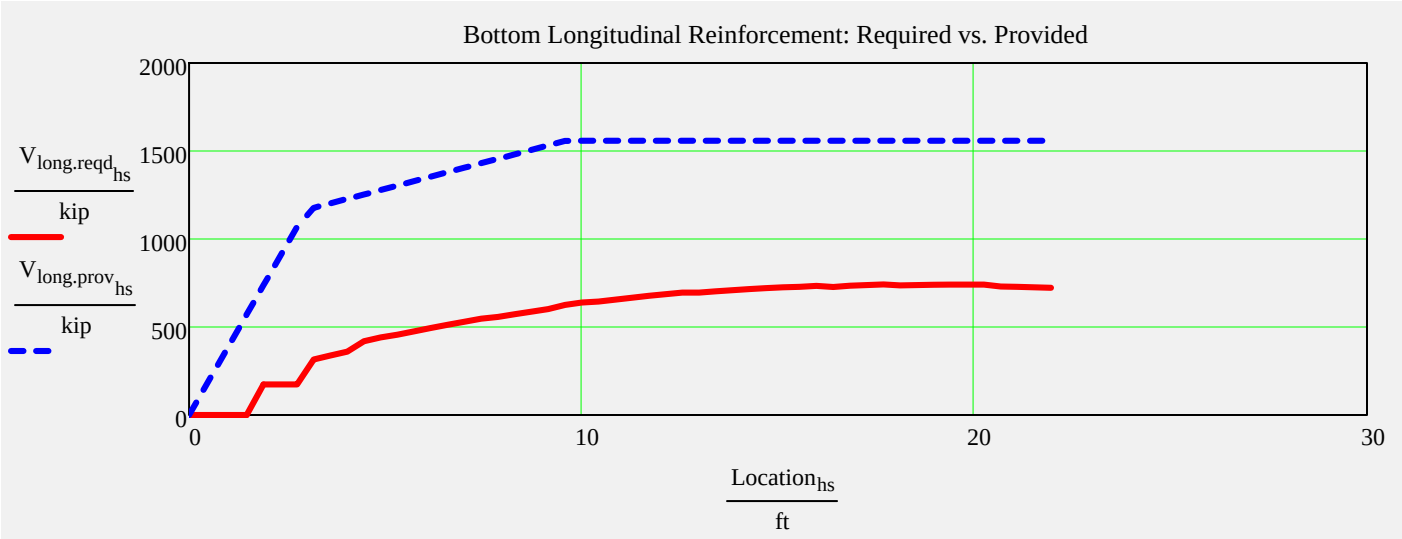
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.46 & 129.80 & 511.27 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.25$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

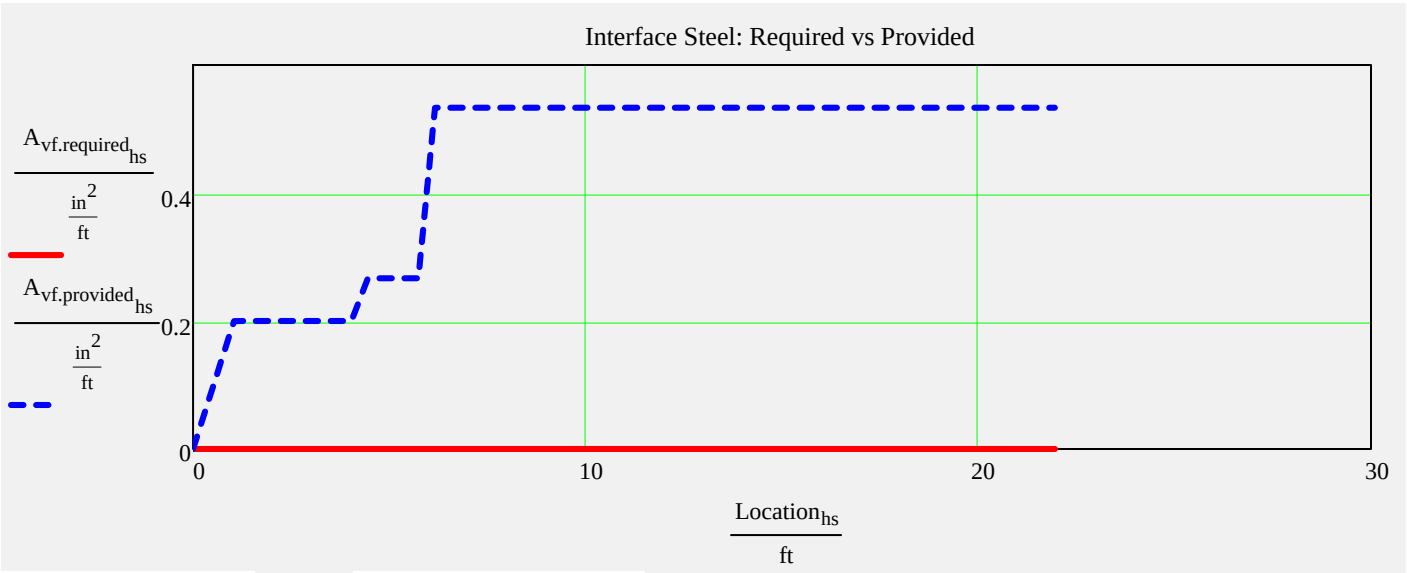


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 17.7 & 742.0 & 1558.2 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.48$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 9.73 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

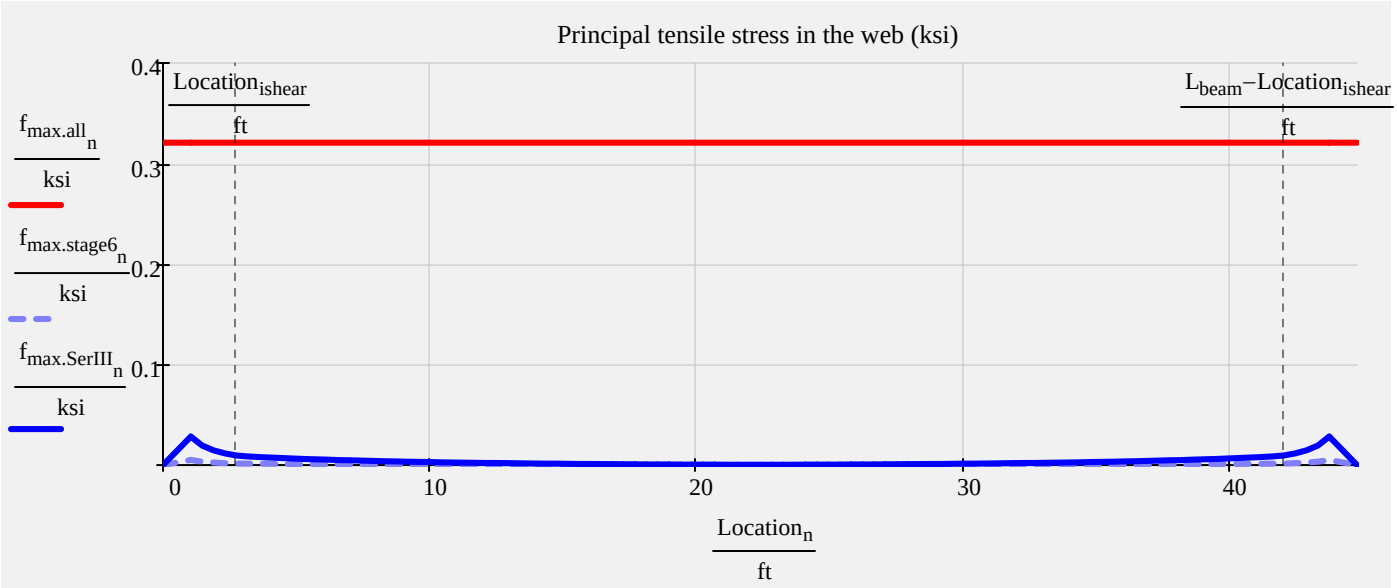
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

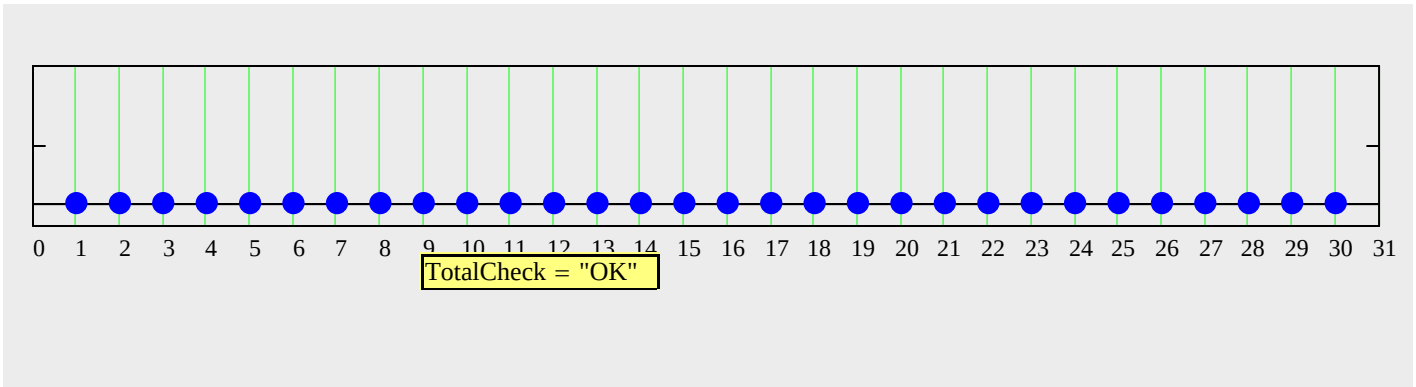
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.36	2.93	"N/A"	20.05	0.65	5.36	"N/A"	3.41	HL-93
"Strength I (Op)"	0.36	3.80	"N/A"	20.05	0.65	6.95	"N/A"	3.41	HL-93
"Service III (Inv)"	0.36	3.41	"N/A"	20.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.36	3.63	"N/A"	22.61	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.36	2.78	167.05	22.61	0.65	4.87	292.07	3.41	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.44$ $DC_{LongReinf.Permit} = 0.48$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1864	"factored resistance (kip-ft)...."
"γDL"	393	"factored dead load (kip-ft)...."
"γLL"	387	"factored live load (kip-ft)....."
"RF"	3.8	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	513.6	"factored resistance (kip)....."
"γDL"	31.2	"factored dead load (kip)....."
"γLL"	69.4	"factored live load (kip)....."
"RF"	6.95	"HL93 operating rating factor"

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\WB 45' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-45ftSpan-15inx56in_ExtBeam.dat
FSB-45ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

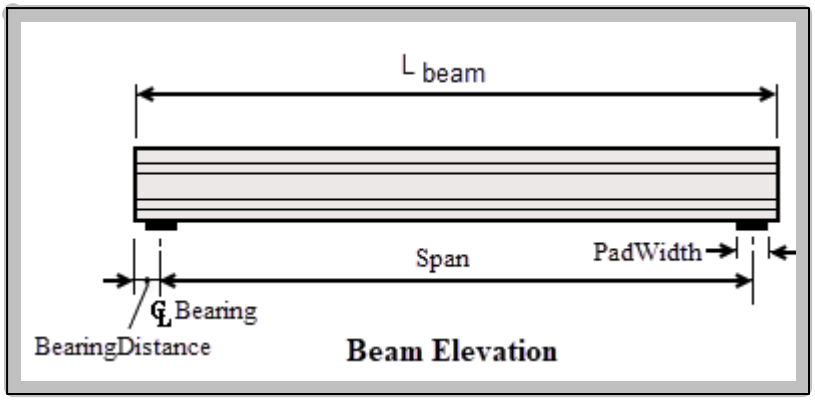
InputDataFile = "FSB-45ftSpan-15inx56in_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



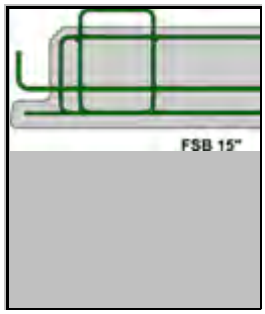
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-45ftSpan-15inx56in_IntBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	44.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

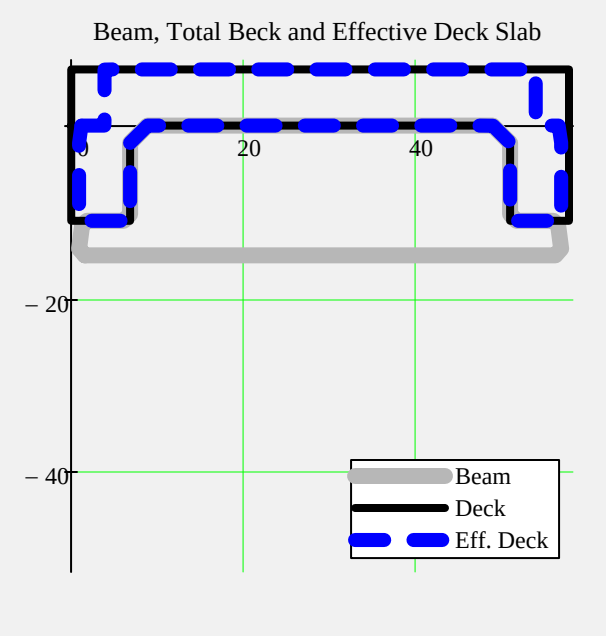
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 57.65 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.58 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 44.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

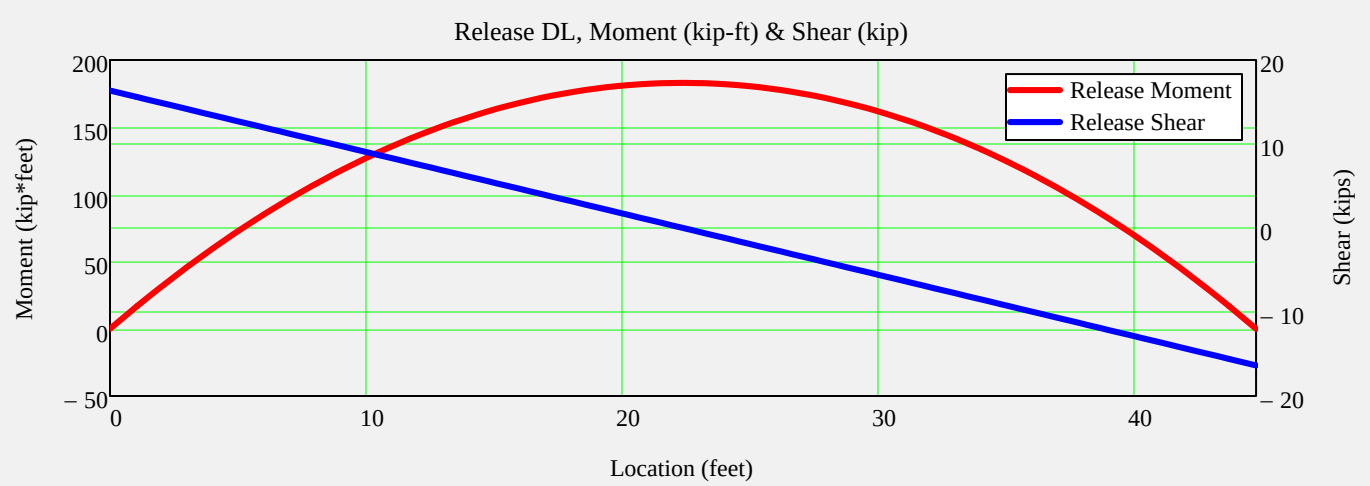
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

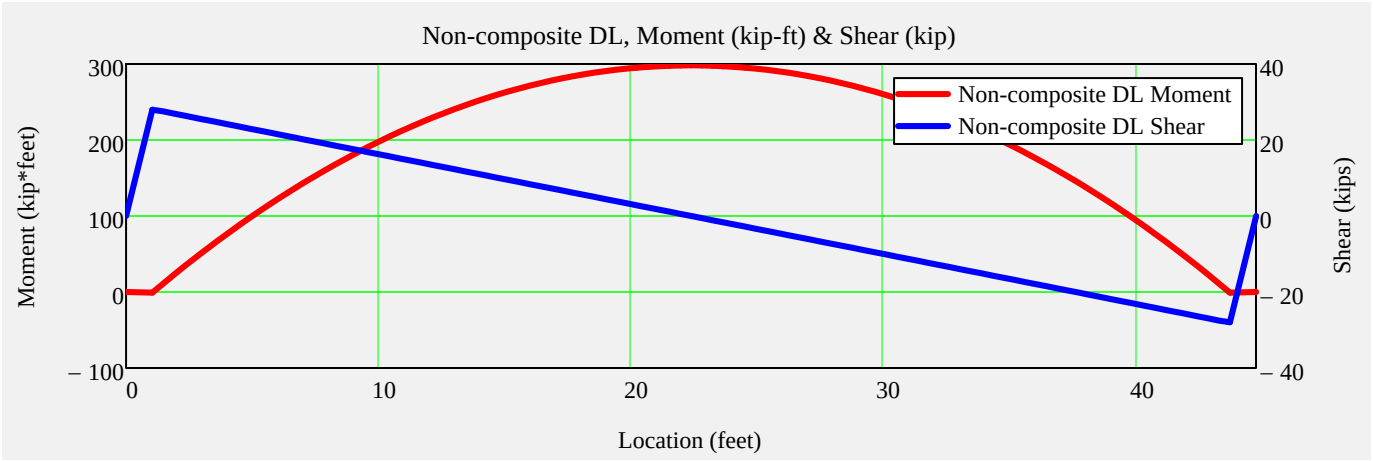
Release Dead Load Moments and Shears

$L_{span} = 42.67\ ft$



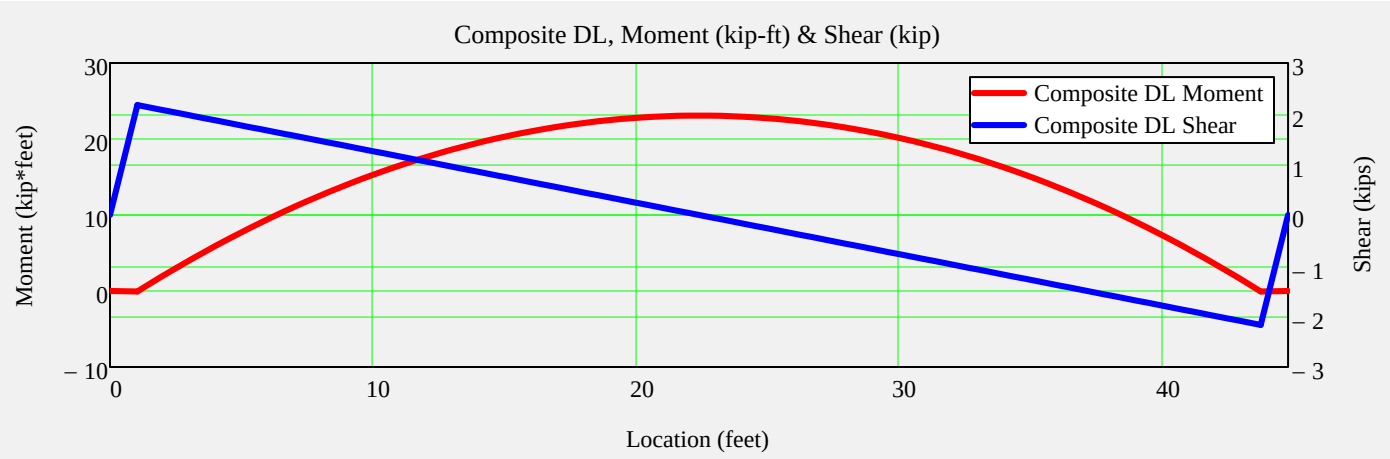
$\max(V_{release}) = 16.4 \cdot kip$ $\max(M_{release}) = 183.0 \cdot kip \cdot ft$ $\min(V_{release}) = -16.4 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 28.0 \cdot kip$ $\max(M_{dl.non.comp}) = 298.2 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -28.0 \cdot kip$

Composite Dead Load Moments and Shear



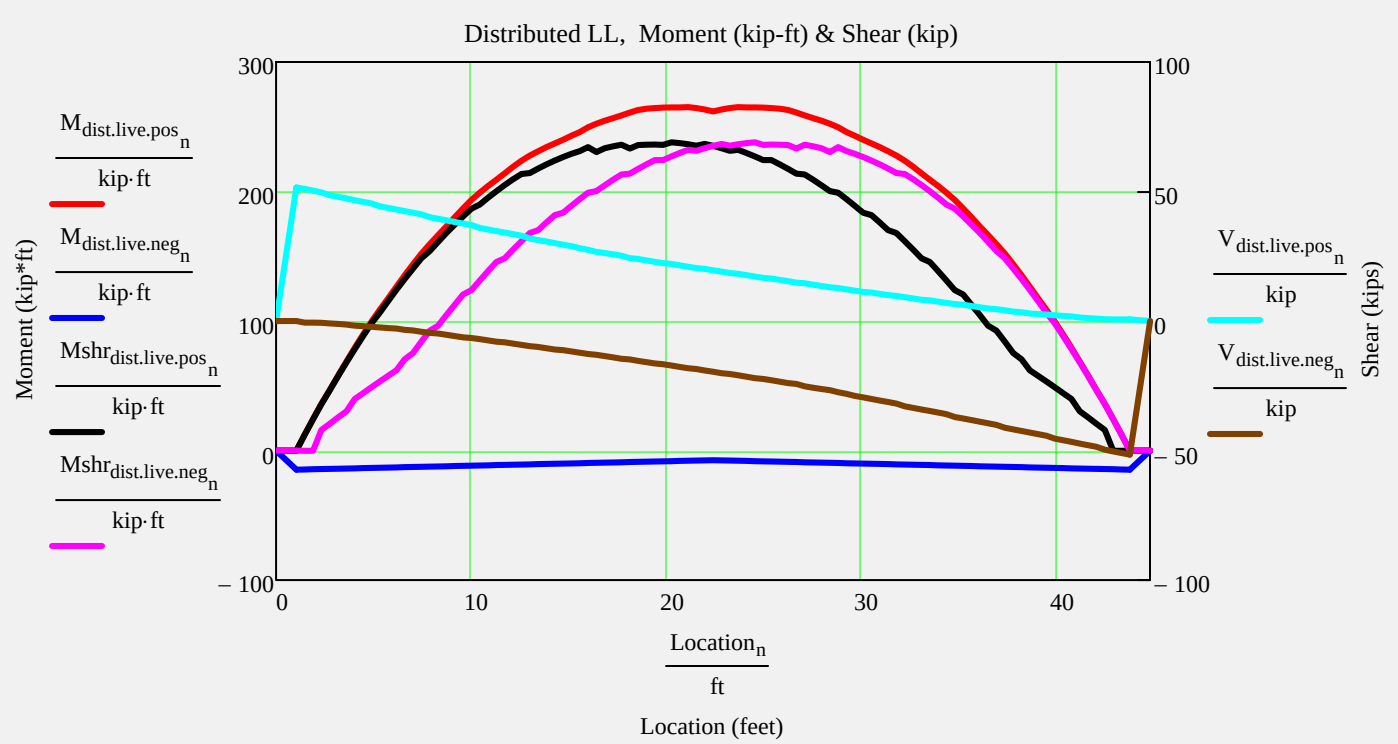
$\max(V_{dl.comp}) = 2.2 \cdot kip$ $\max(M_{dl.comp}) = 23.1 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.2 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 42.67\ ft$ BeamSpacing = 4.67 ft Skew = 0·deg

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor = 1.00

Final Live Load Distribution Factors: $g_{mom} = 0.33$ $g_{mom.fatigue} = 0.19$ $g_{shear} = 0.59$



$\max(V_{dist.live.pos}) = 51.6\cdot kip$ $\max(M_{dist.live.pos}) = 265.2\cdot kip\cdot ft$ $\min(V_{dist.live.neg}) = -51.6\cdot kip$

$Reaction_{LL} = 53.6\cdot kip$ $\min(M_{dist.live.neg}) = -14.7\cdot kip\cdot ft$

$Reaction_{DL} = 31.6\cdot kip$ $\max(Mshr_{dist.live.pos}) = 238\cdot kip\cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{truck} = 58.01\cdot kip$ $Reaction_{lane} = 14.32\cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane})\cdot g_{shear}$

$Reaction_{LL.without.IM} = 42.4\cdot kip$

Reinforcement Properties

InputDataFile = "FSB-45ftSpan-15inx56in_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

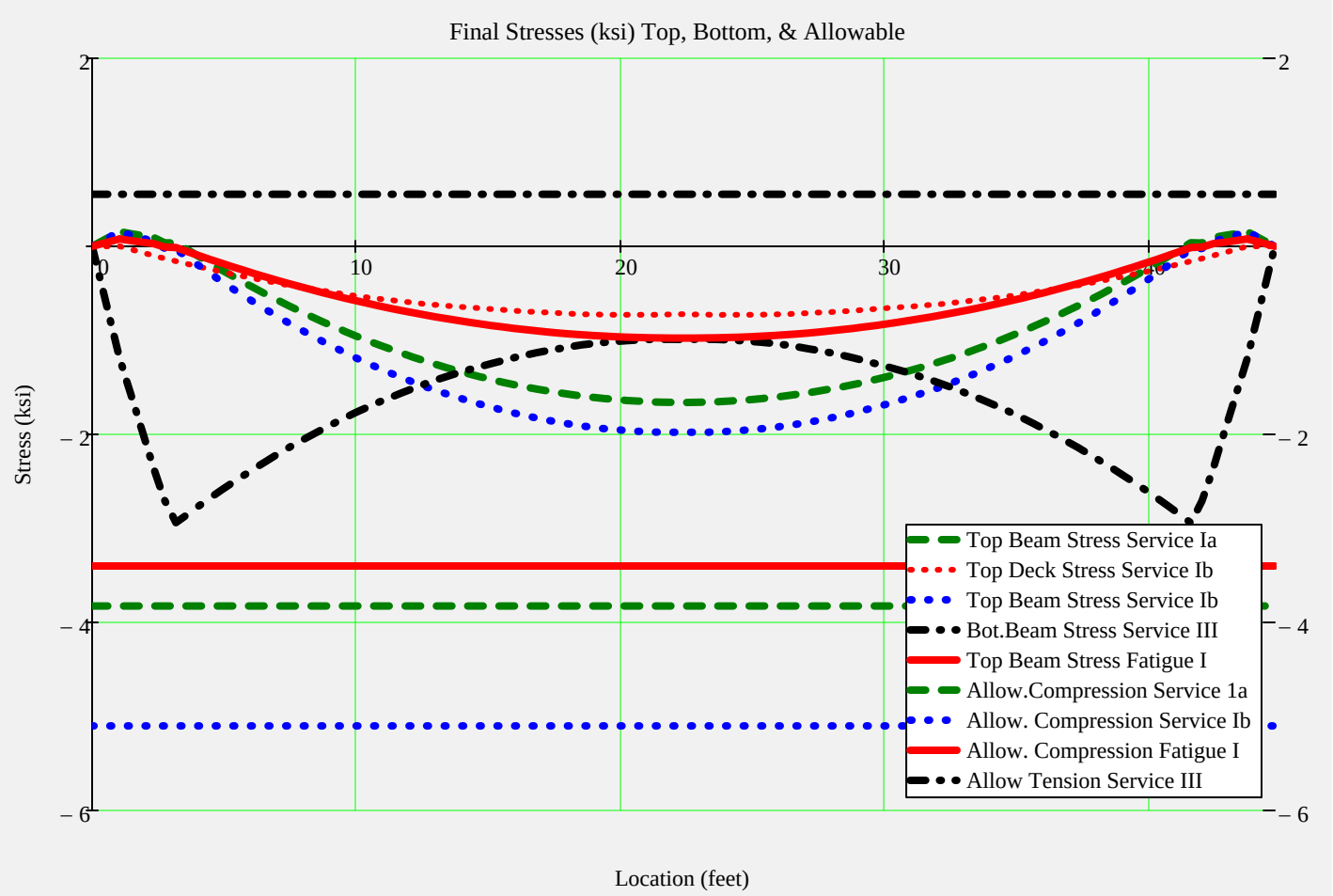
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

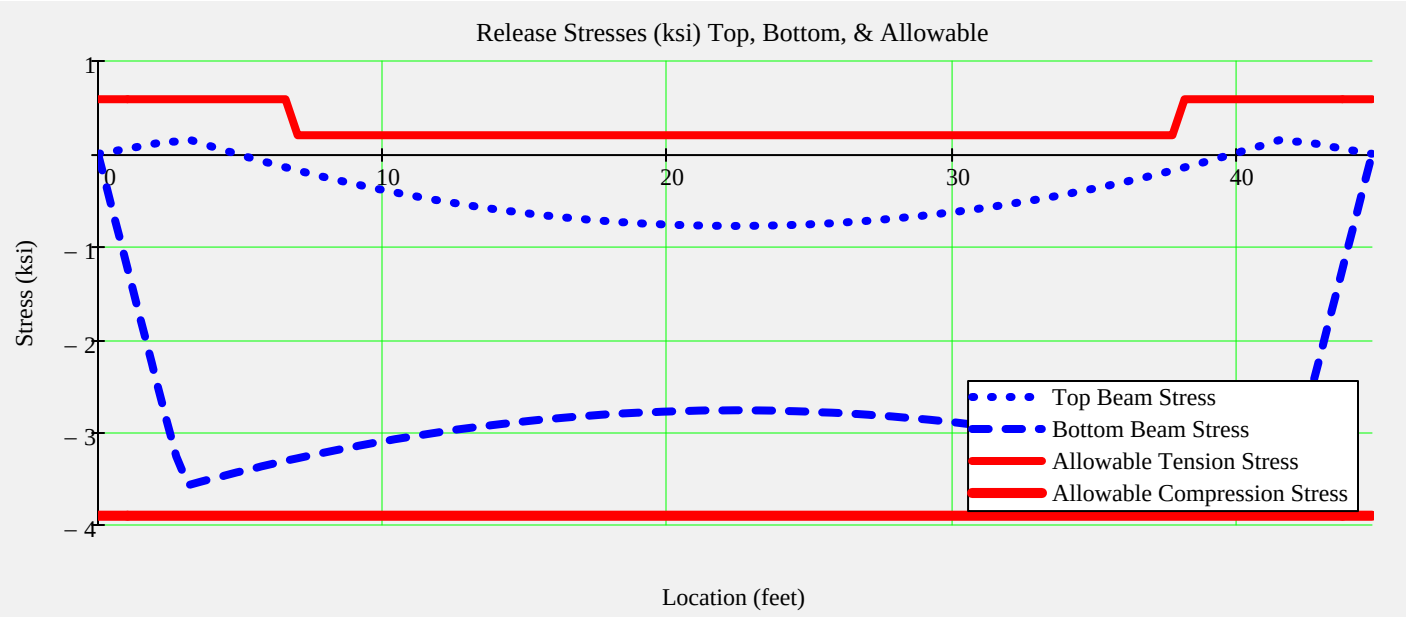
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.68$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.92$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.43$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.39$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.29$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.16	0.59
"Compression @ Release"	3.18	–3.57	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	22.38	–1.66	–3.83
"CompressionIb @ ServiceI"	22.80	–1.98	–5.10
"Compression @ FatigueI"	22.38	–0.98	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

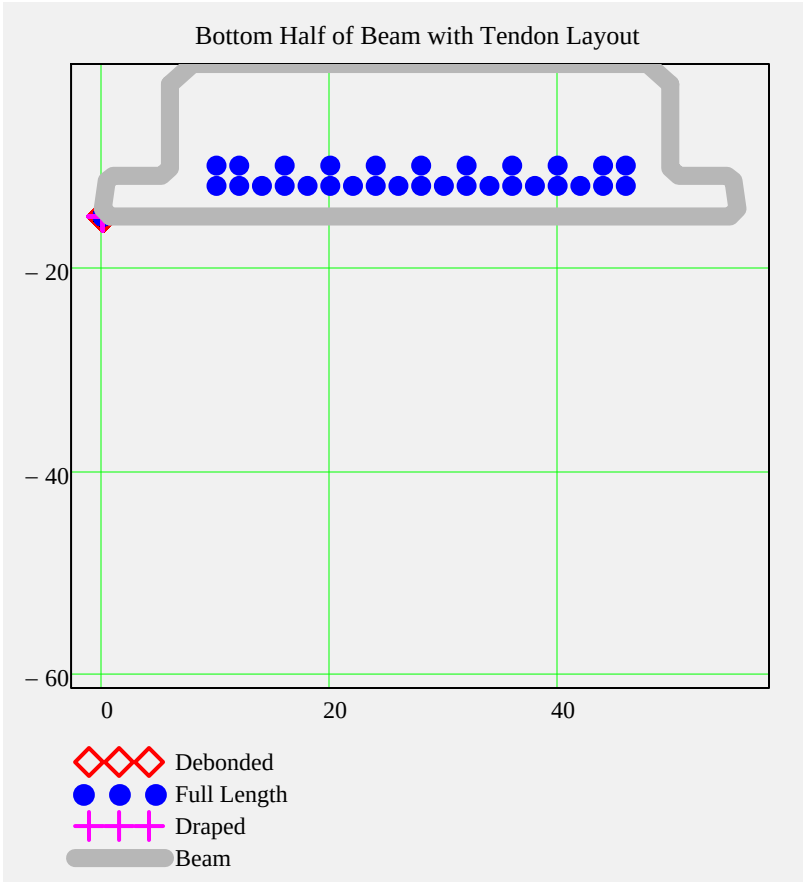
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

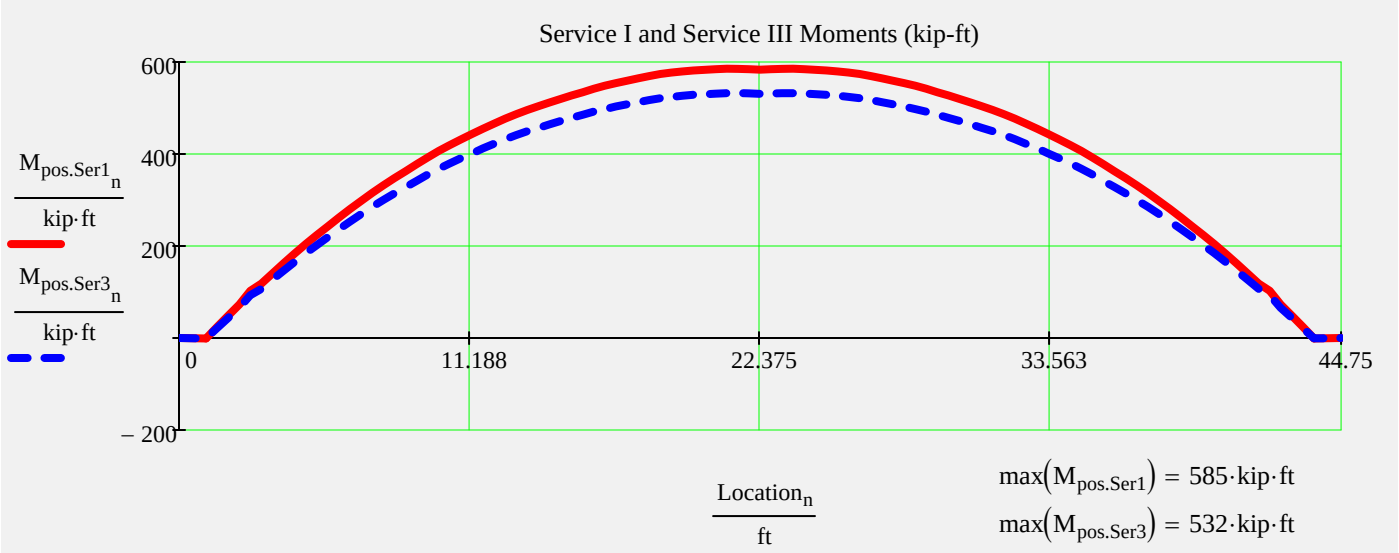
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

Check_f_{pe} = "OK"

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.78	–2.76
"2"	–0.83	–2.32
"4"	–0.72	–2.42
"6"	–1.63	–1.63
"8"	–1.98	–0.99

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1197.5	45628	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	183
"Non-Composite DL (incl. beam wt.)"	298
"Composite Dead Load"	23
"Distributed Live Load"	262

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

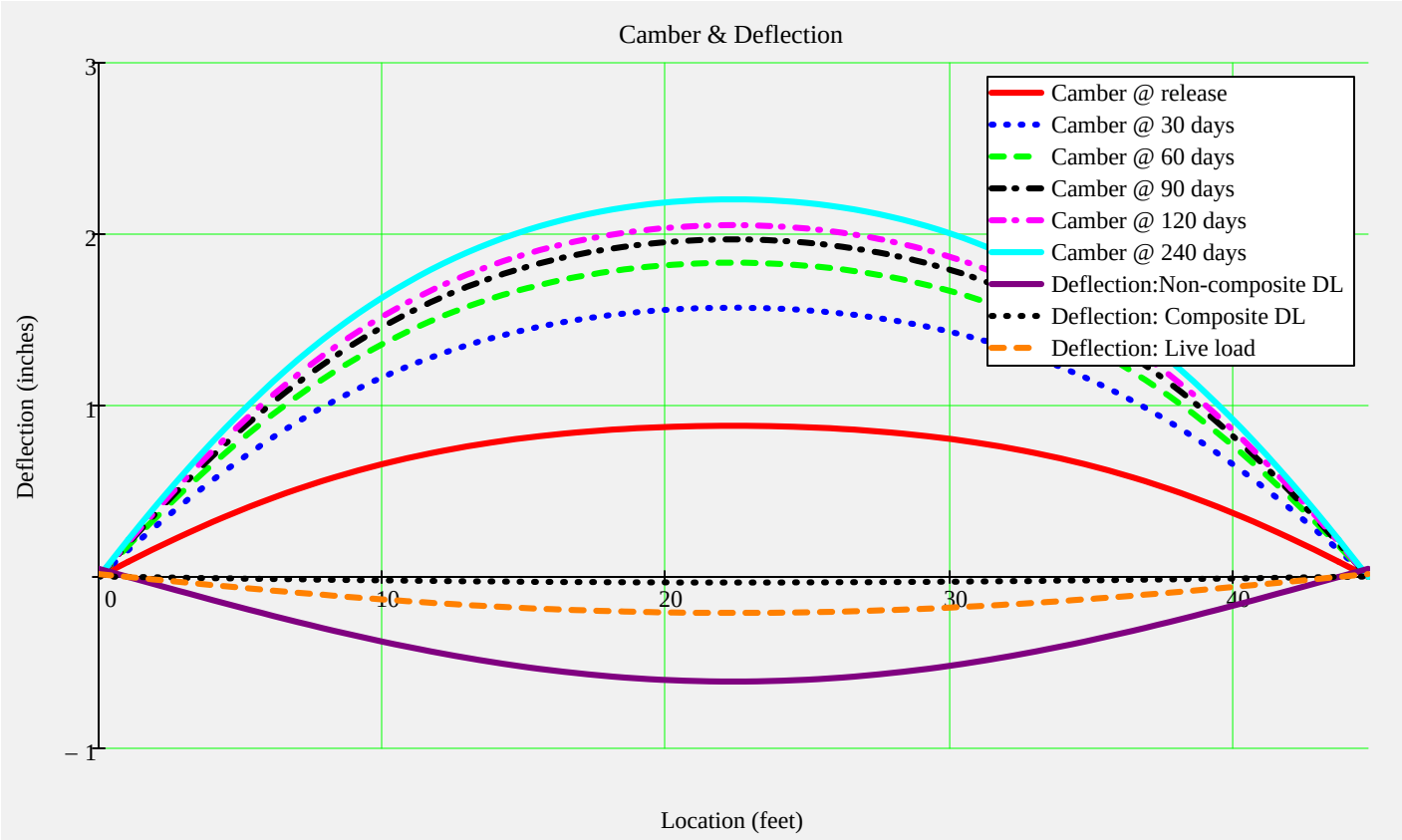
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 42.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.05	–0.34	0.41	0.88
"30 Days"	–0.15	–0.63	0.73	1.57
"60 Days"	–0.19	–0.74	0.84	1.83
"90 Days"	–0.21	–0.80	0.91	1.97
"120 Days"	–0.23	–0.83	0.94	2.05
"240 Days"	–0.25	–0.90	1.01	2.20
"Non-comp DL"	–0.06	0.05	–0.22	–0.61
"Comp DL"	–0.00	0.00	–0.01	–0.03
"LL"	–0.01	0.03	–0.08	–0.21

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.41 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

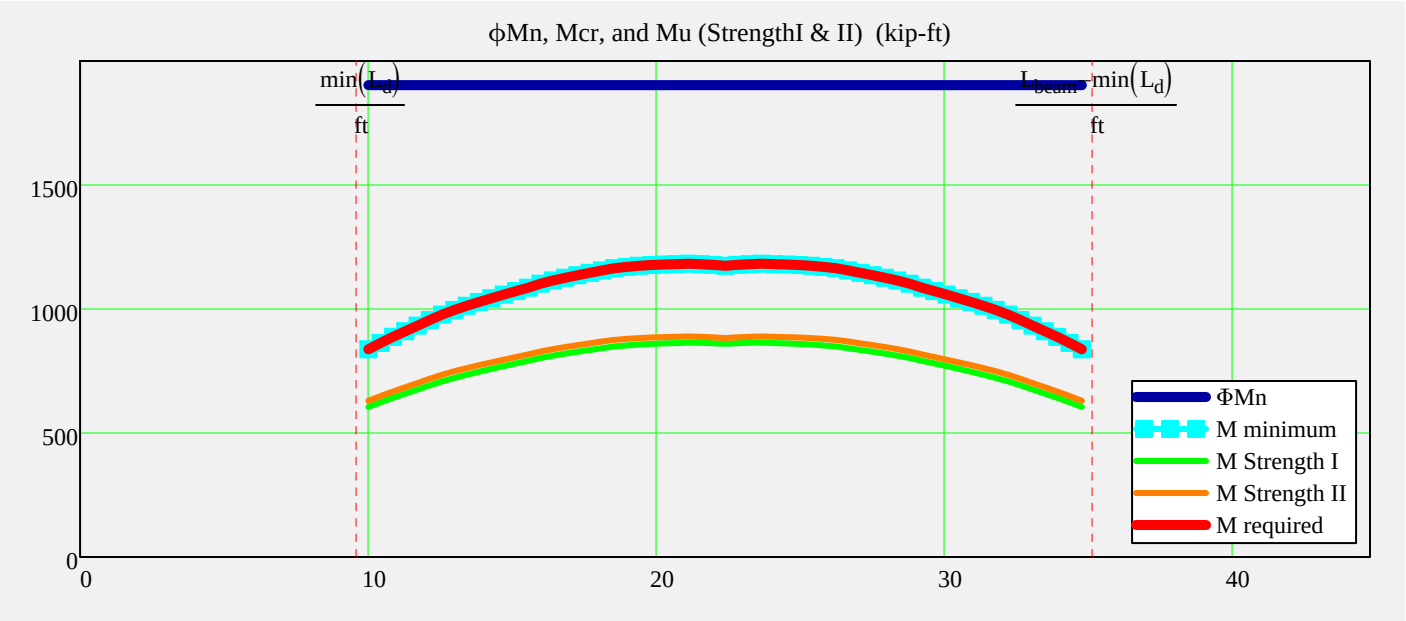
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 889 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1174 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1174 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1903 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 35.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.62$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

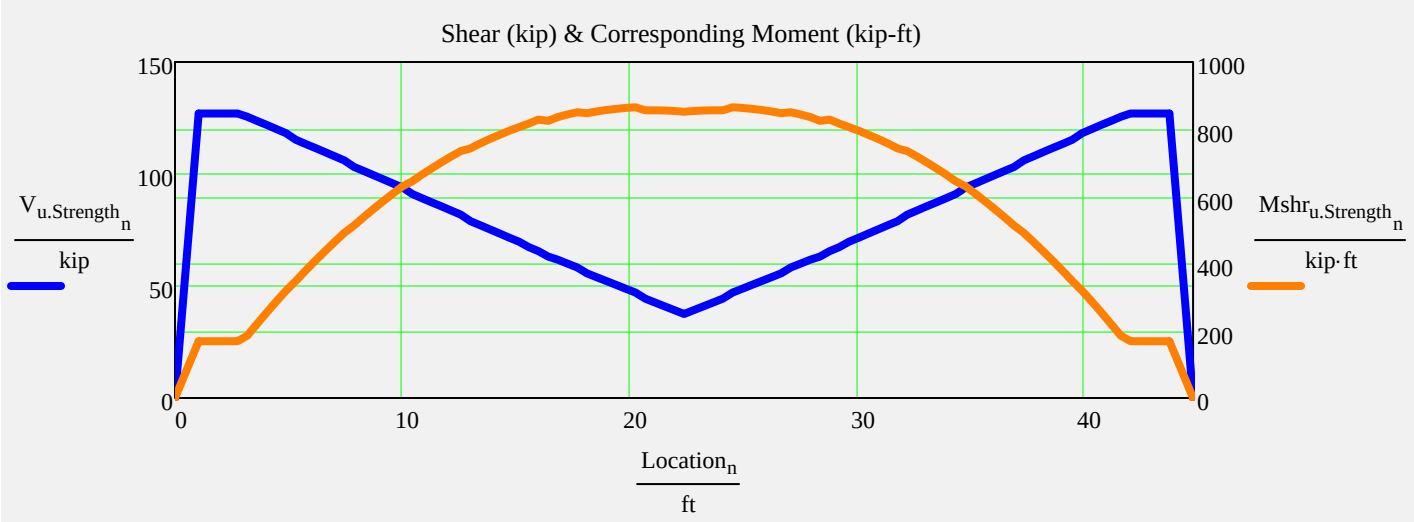
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

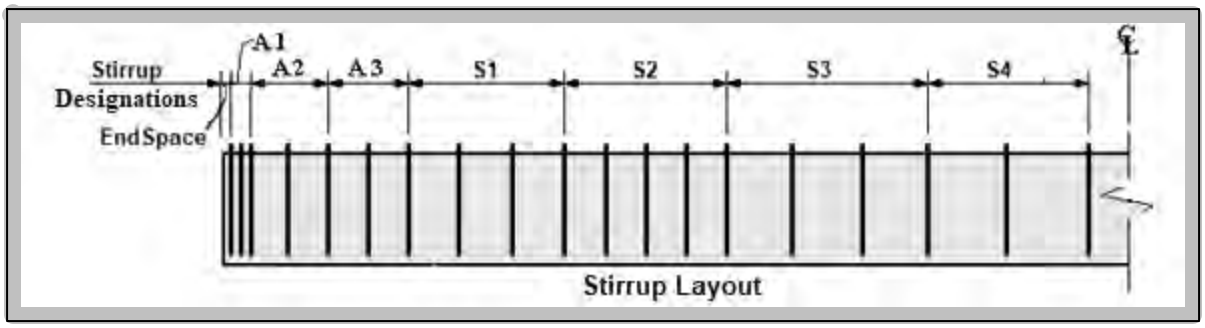
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 128 \\ 136 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 127.0 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 865 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

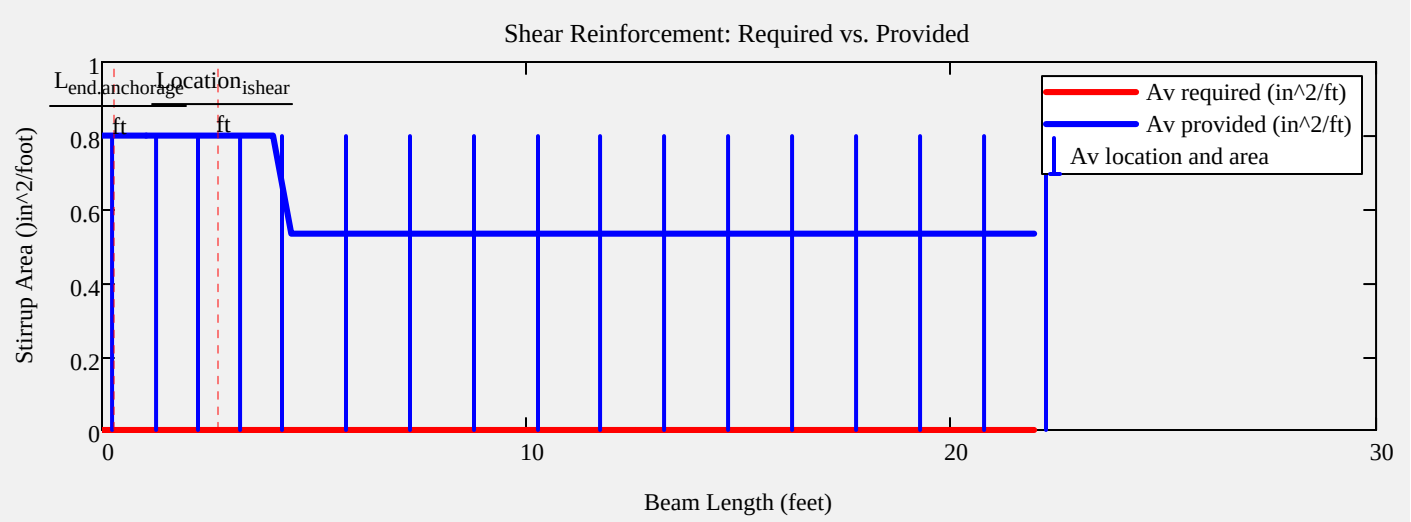
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.75\ ft$

Save Data File

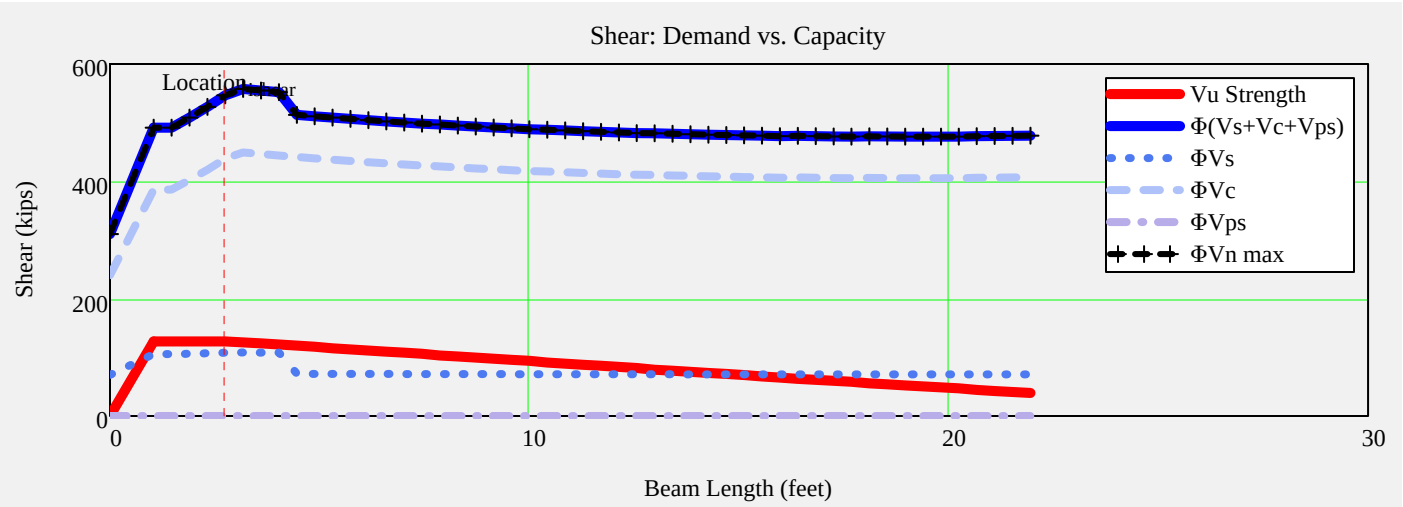
Use current input file

File Name FSB-45ftSpan-15inx56in_IntBeam.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\WB

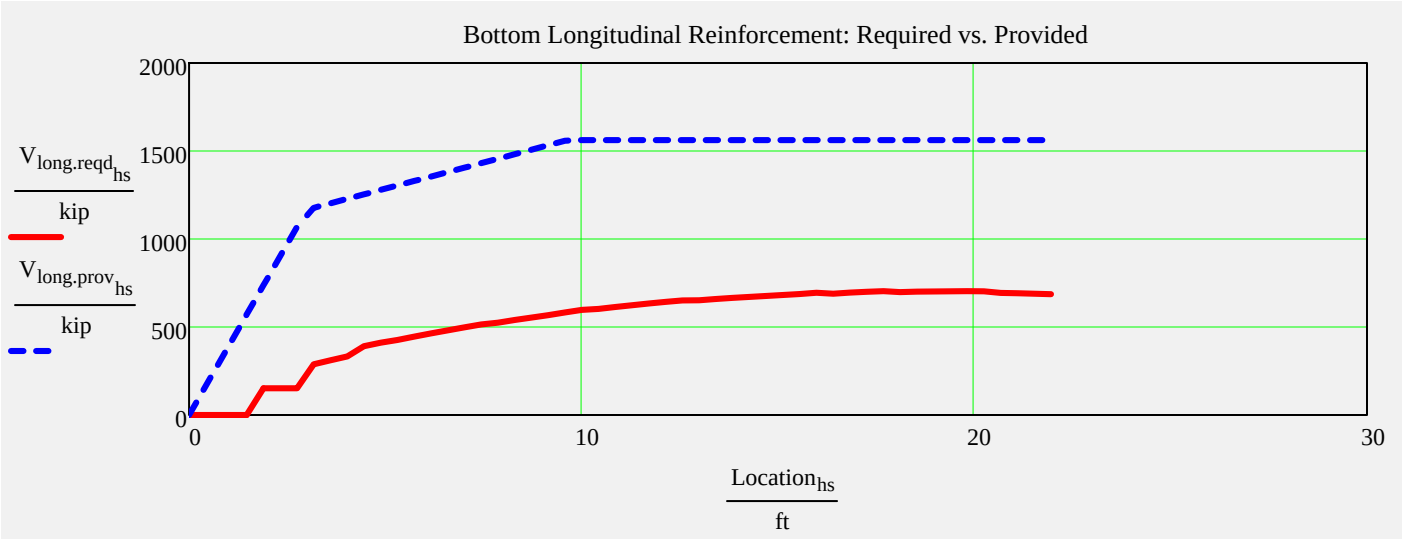
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.46 & 120.06 & 513.32 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.23$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

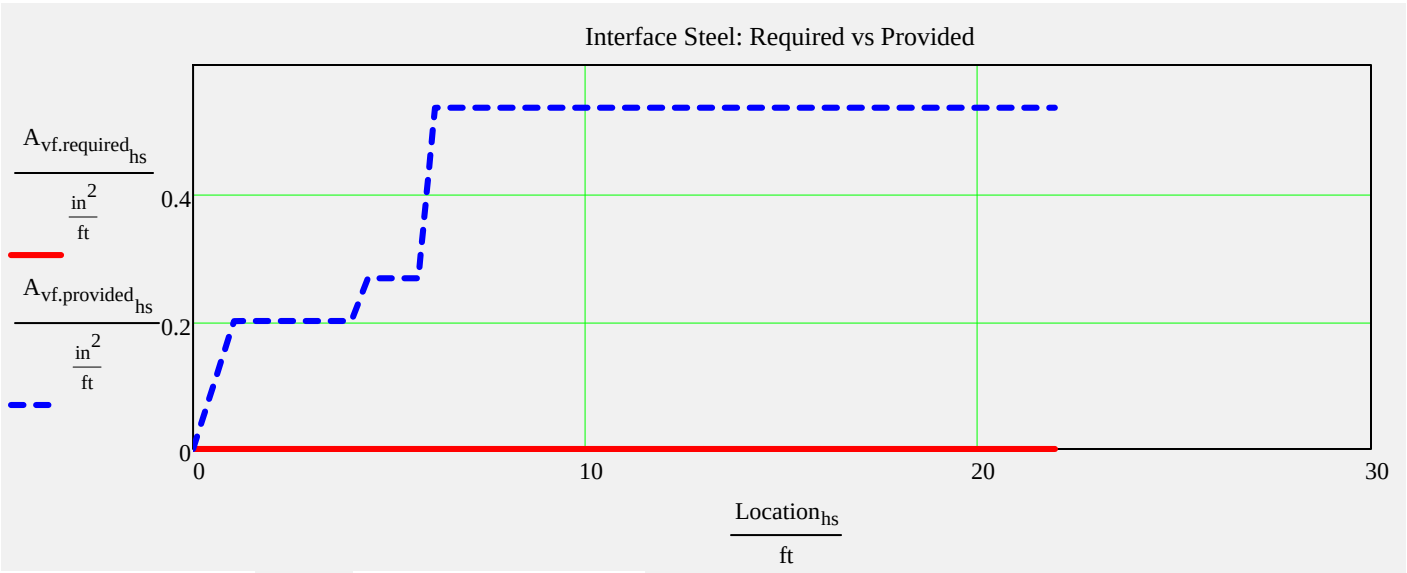


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 17.7 & 703.4 & 1561.9 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.45$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 9.73 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

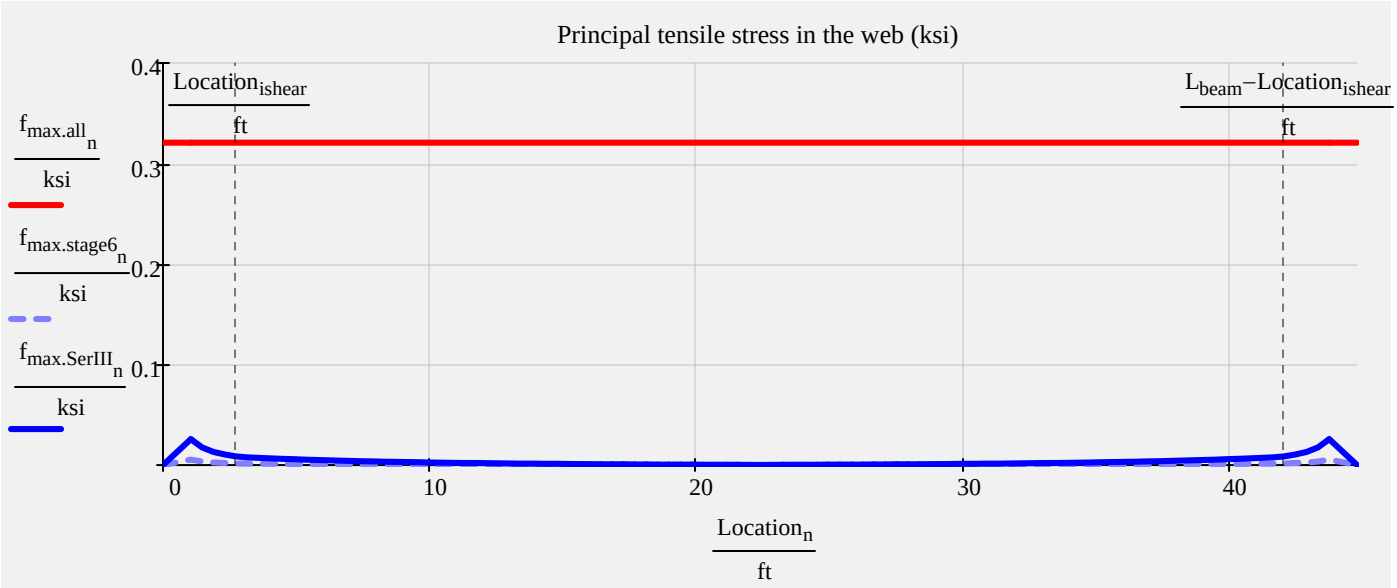
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

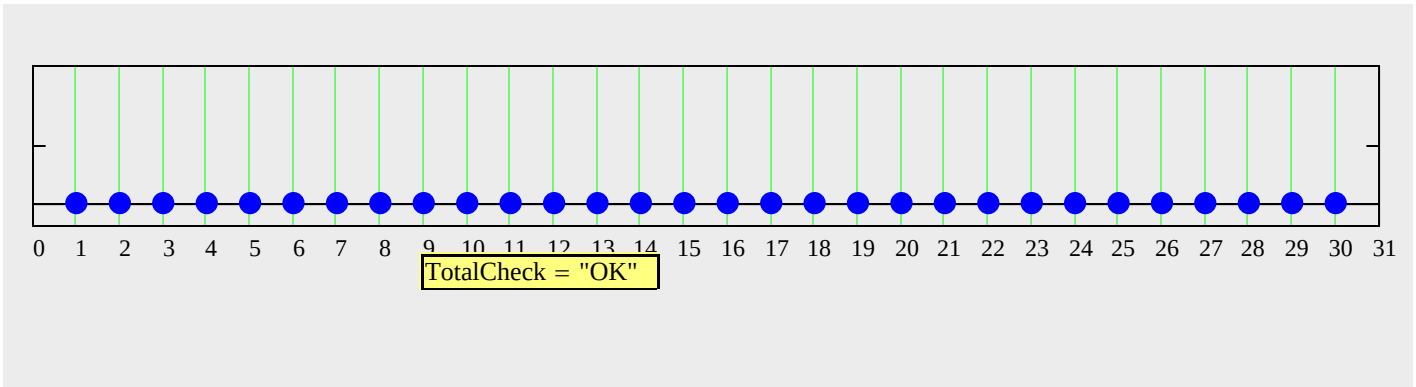
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.33	3.24	"N/A"	20.05	0.59	6.00	"N/A"	3.41	HL-93
"Strength I (Op)"	0.33	4.20	"N/A"	20.05	0.59	7.78	"N/A"	3.41	HL-93
"Service III (Inv)"	0.33	3.66	"N/A"	20.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.33	3.90	"N/A"	22.61	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.33	3.07	184.36	20.05	0.59	5.45	327.16	3.41	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.42$ $DC_{LongReinf.Permit} = 0.45$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1903	"factored resistance (kip-ft)...."
"γDL"	400	"factored dead load (kip-ft)...."
"γLL"	358	"factored live load (kip-ft)....."
"RF"	4.2	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	515.4	"factored resistance (kip)....."
"γDL"	31.7	"factored dead load (kip)....."
"γLL"	62.1	"factored live load (kip)....."
"RF"	7.78	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM EXTERIOR BEAM DESIGN

SPAN LENGTH = 45 FEET (NO SKEW)

EASTBOUND BRIDGE

(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\EB 45' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-45ftSpan-15inx56in_ExtBeam.dat
FSB-45ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

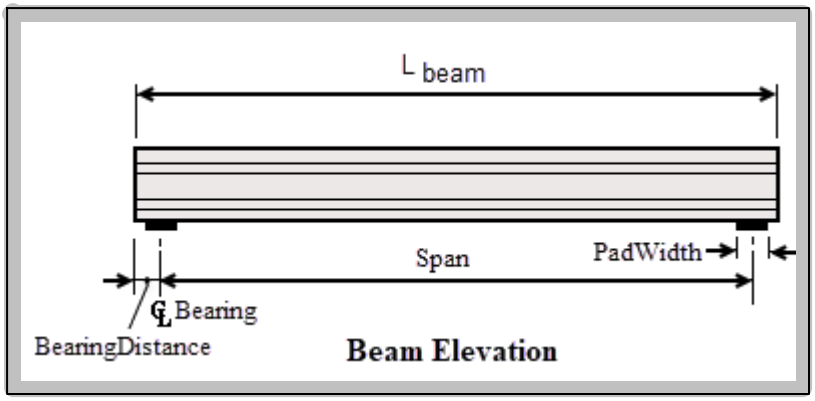
InputDataFile = "FSB-45ftSpan-15inx56in_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

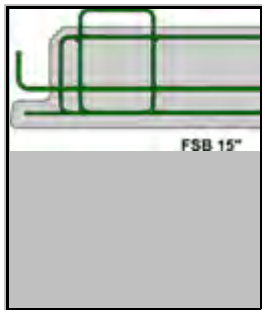
Superstructure Data

InputDataFile = "FSB-45ftSpan-15inx56in_ExtBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	44.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

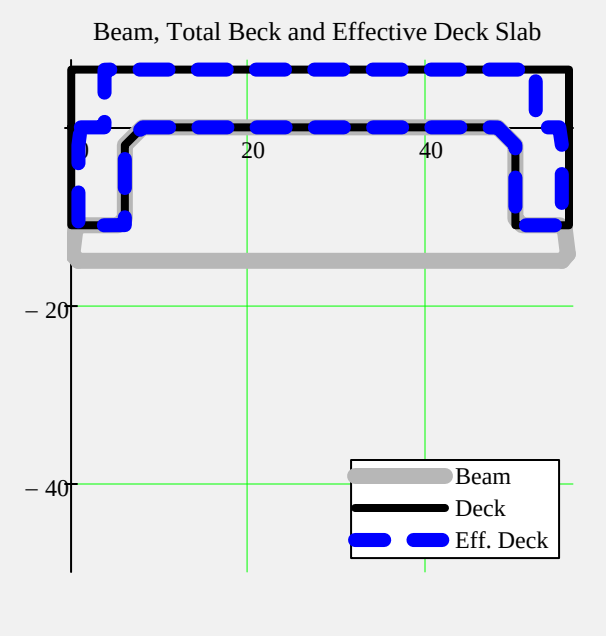
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 56.07 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.55 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 44.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

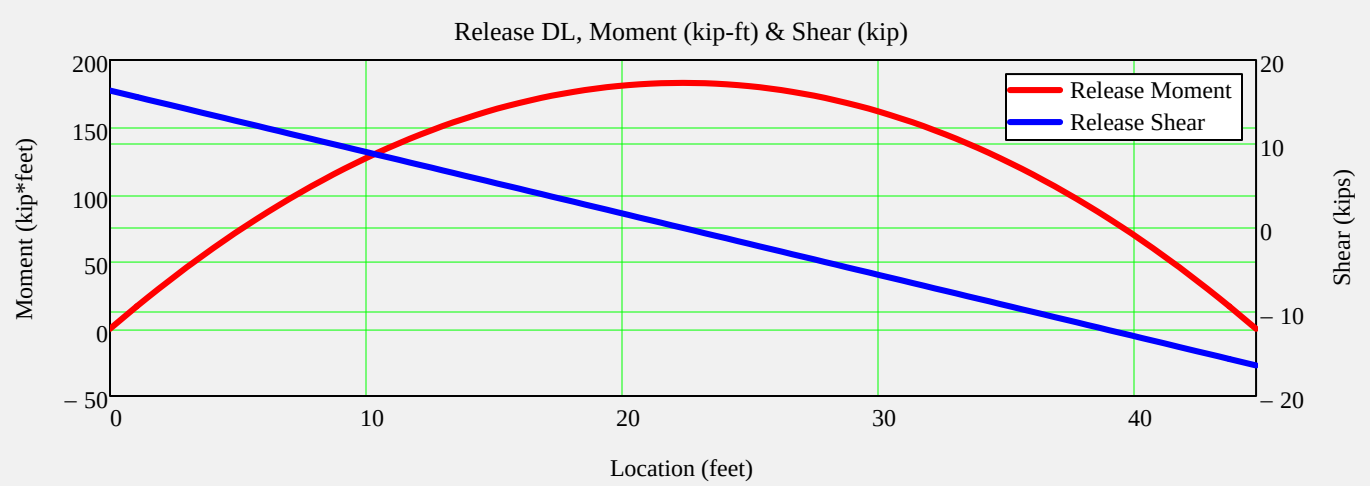
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

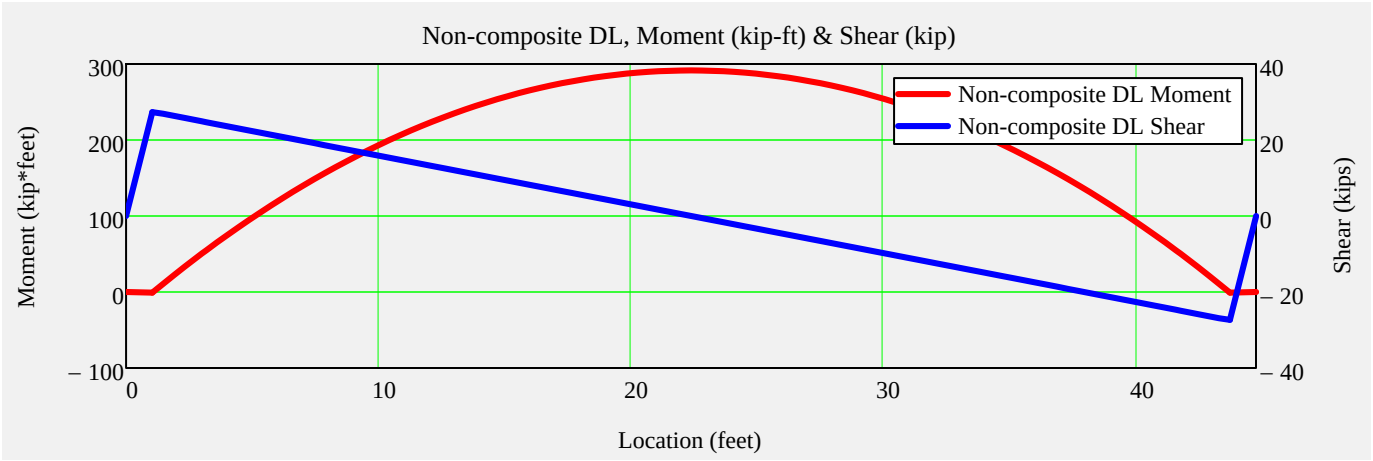
Release Dead Load Moments and Shears

$L_{span} = 42.67\ ft$



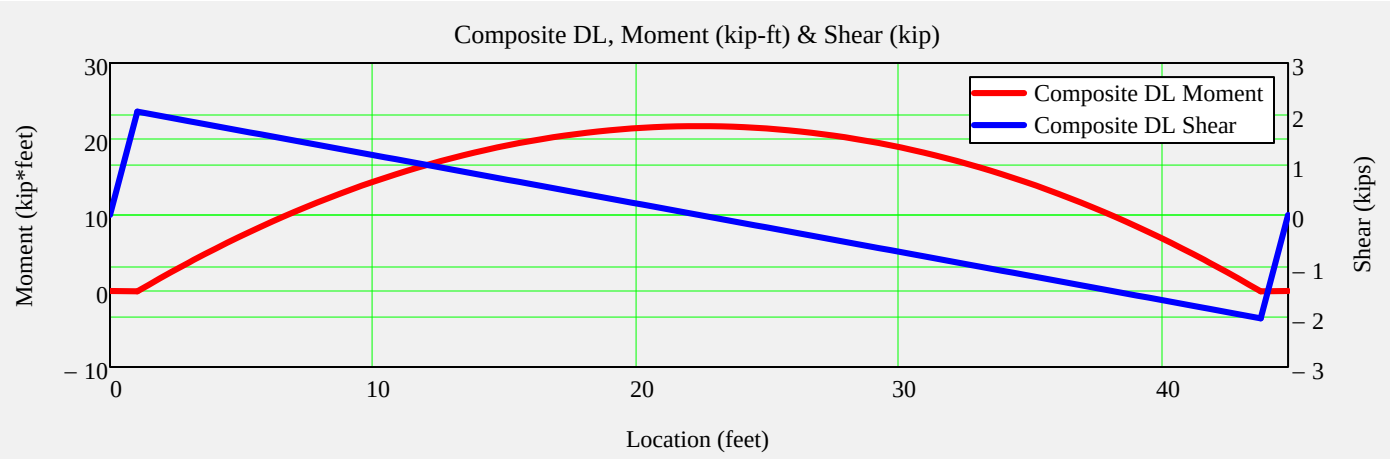
$\max(V_{release}) = 16.4 \cdot kip$ $\max(M_{release}) = 183.0 \cdot kip \cdot ft$ $\min(V_{release}) = -16.4 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 27.3 \cdot kip$ $\max(M_{dl.non.comp}) = 291.5 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -27.3 \cdot kip$

Composite Dead Load Moments and Shear



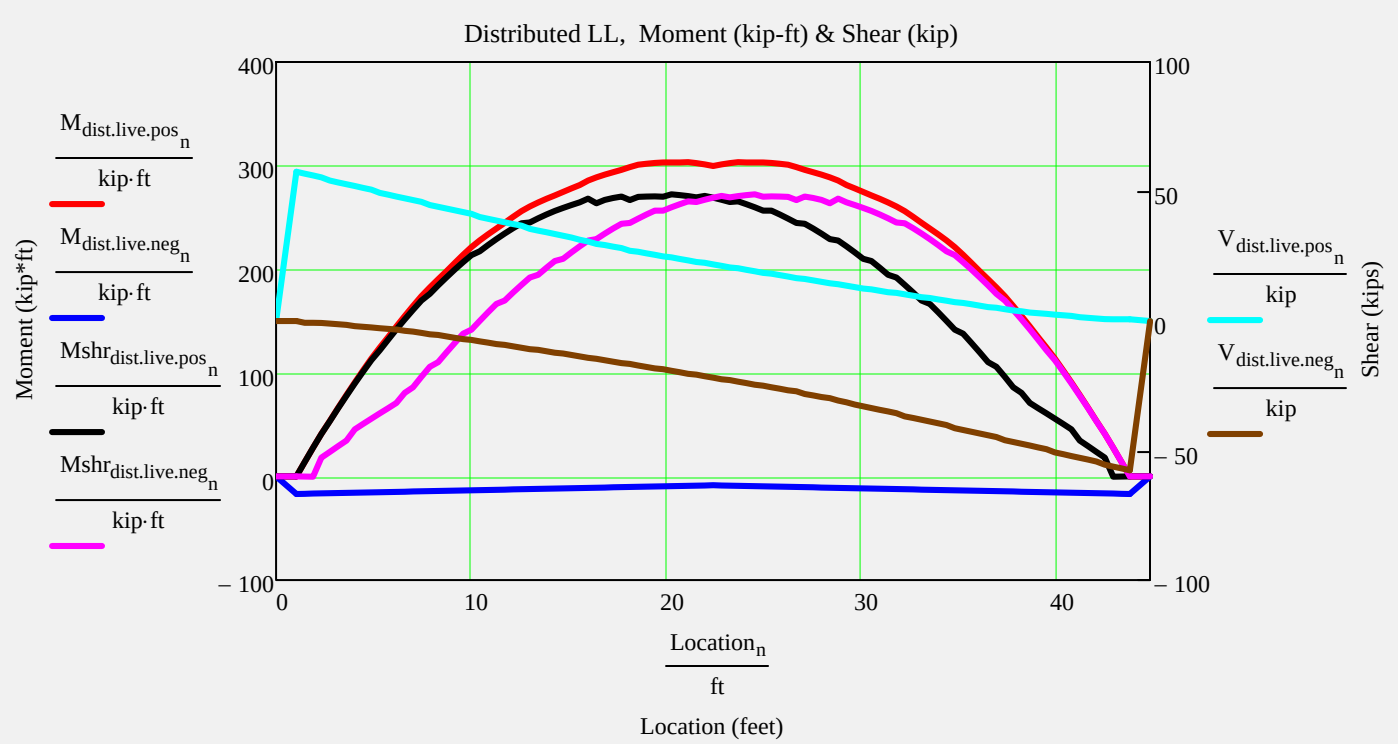
$\max(V_{dl.comp}) = 2.0 \cdot kip$ $\max(M_{dl.comp}) = 21.7 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.0 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 42.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.38$ $g_{mom.fatigue} = 0.23$ $g_{shear} = 0.65$



$\max(V_{dist.live.pos}) = 57.6 \cdot kip$

$\max(M_{dist.live.pos}) = 303.4 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -57.6 \cdot kip$

$Reaction_{LL} = 59.9 \cdot kip$

$\min(M_{dist.live.neg}) = -16.9 \cdot kip \cdot ft$

$Reaction_{DL} = 30.8 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 272 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

$Reaction_{truck} = 58.01 \cdot kip$ $Reaction_{lane} = 14.32 \cdot kip$

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 47.34 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-45ftSpan-15inx56in_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

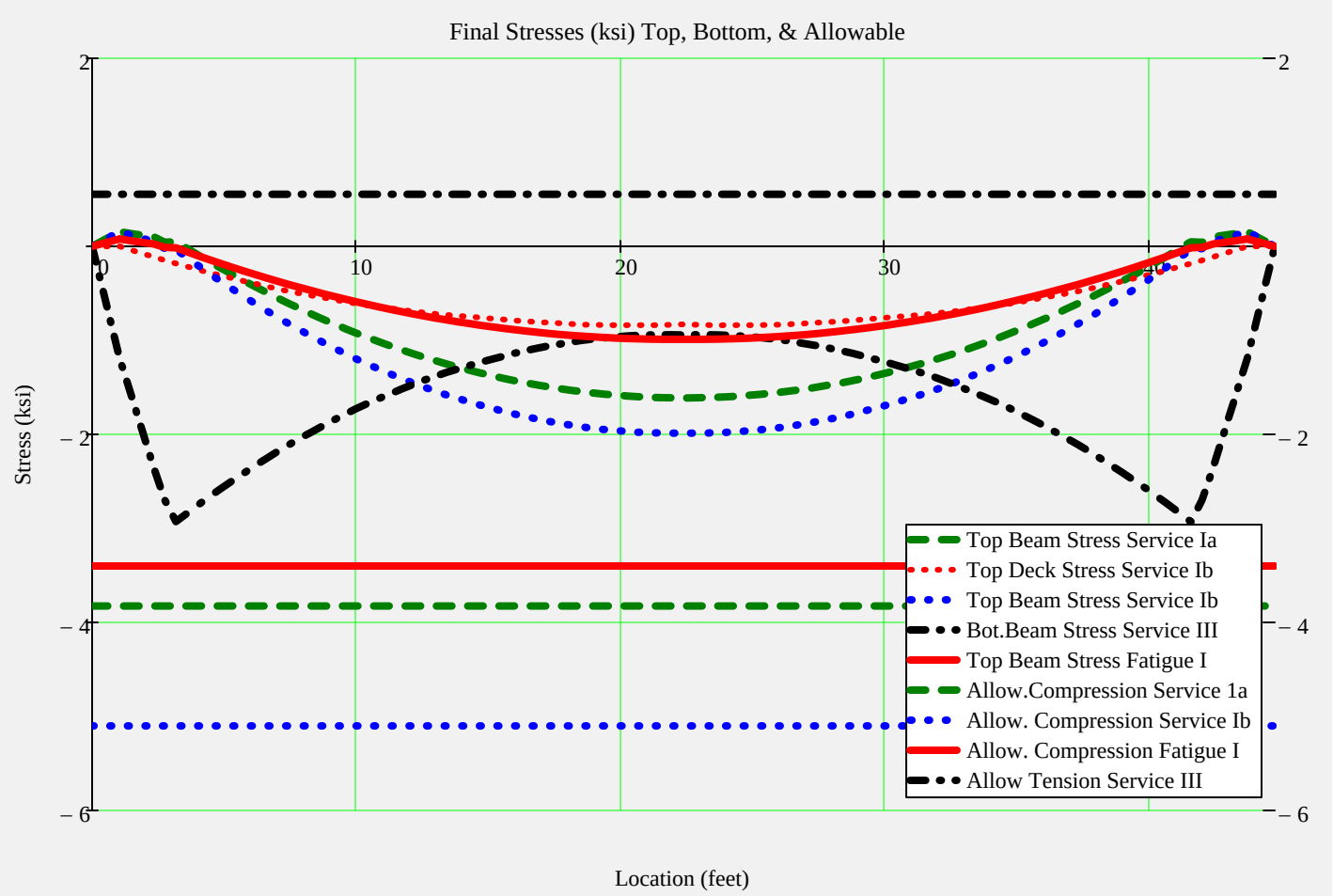
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

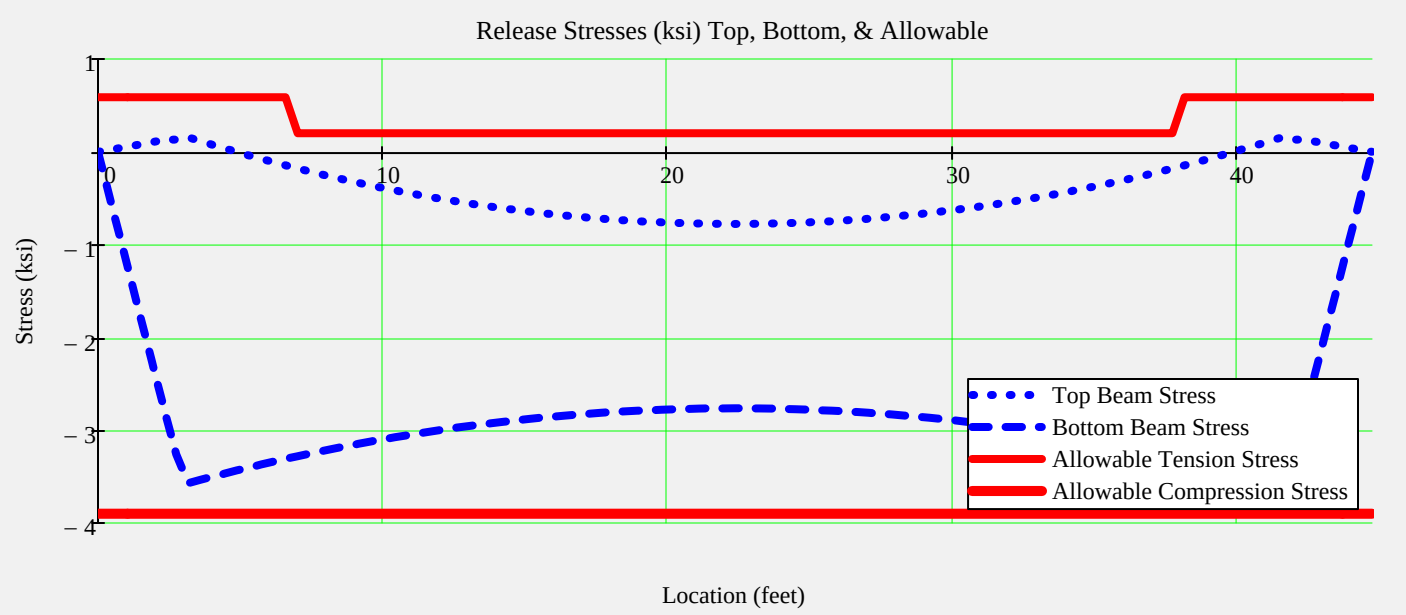
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel} = "OK"$	$\max(DC_f_{tension.rel}) = 0.68$
Release compression	$Check_f_{comp.rel} = "OK"$	$\max(DC_f_{comp.rel}) = 0.92$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII} = "OK"$	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa} = "OK"$	$\max(DC_f_{comp.ServiceIa}) = 0.42$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb} = "OK"$	$\max(DC_f_{comp.ServiceIb}) = 0.39$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI} = "OK"$	$\max(DC_f_{comp.FatigueI}) = 0.29$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.16	0.59
"Compression @ Release"	3.18	–3.57	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	22.38	–1.61	–3.83
"CompressionIb @ ServiceI"	22.80	–1.99	–5.10
"Compression @ FatigueI"	22.38	–0.99	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

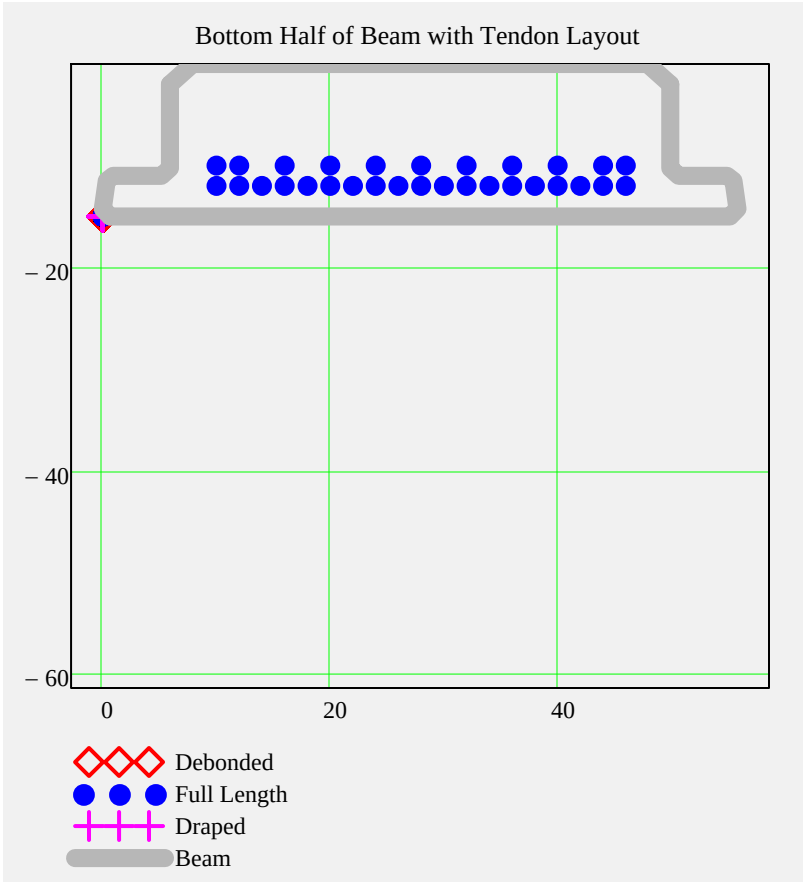
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

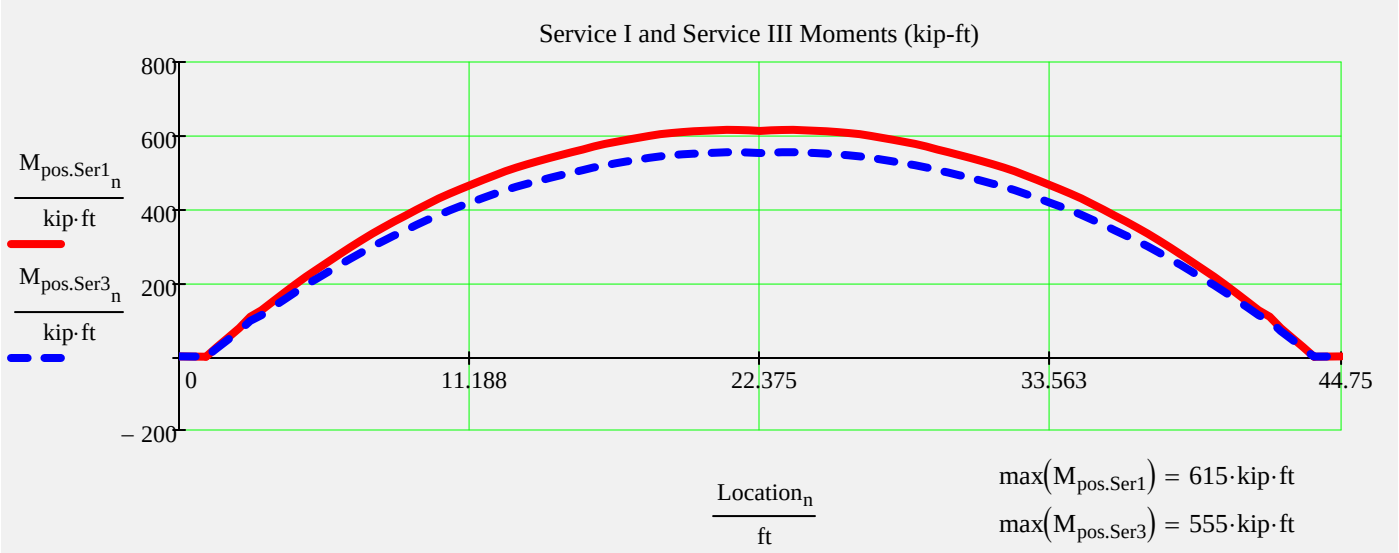
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

Check_f_{pe} = "OK"

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 615 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 555 \cdot kip \cdot ft$

Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.78	–2.76
"2"	–0.83	–2.32
"4"	–0.72	–2.42
"6"	–1.59	–1.67
"8"	–1.99	–0.94

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1173.3	44867	–4.7

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	183
"Non-Composite DL (incl. beam wt.)"	291
"Composite Dead Load"	22
"Distributed Live Load"	300

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

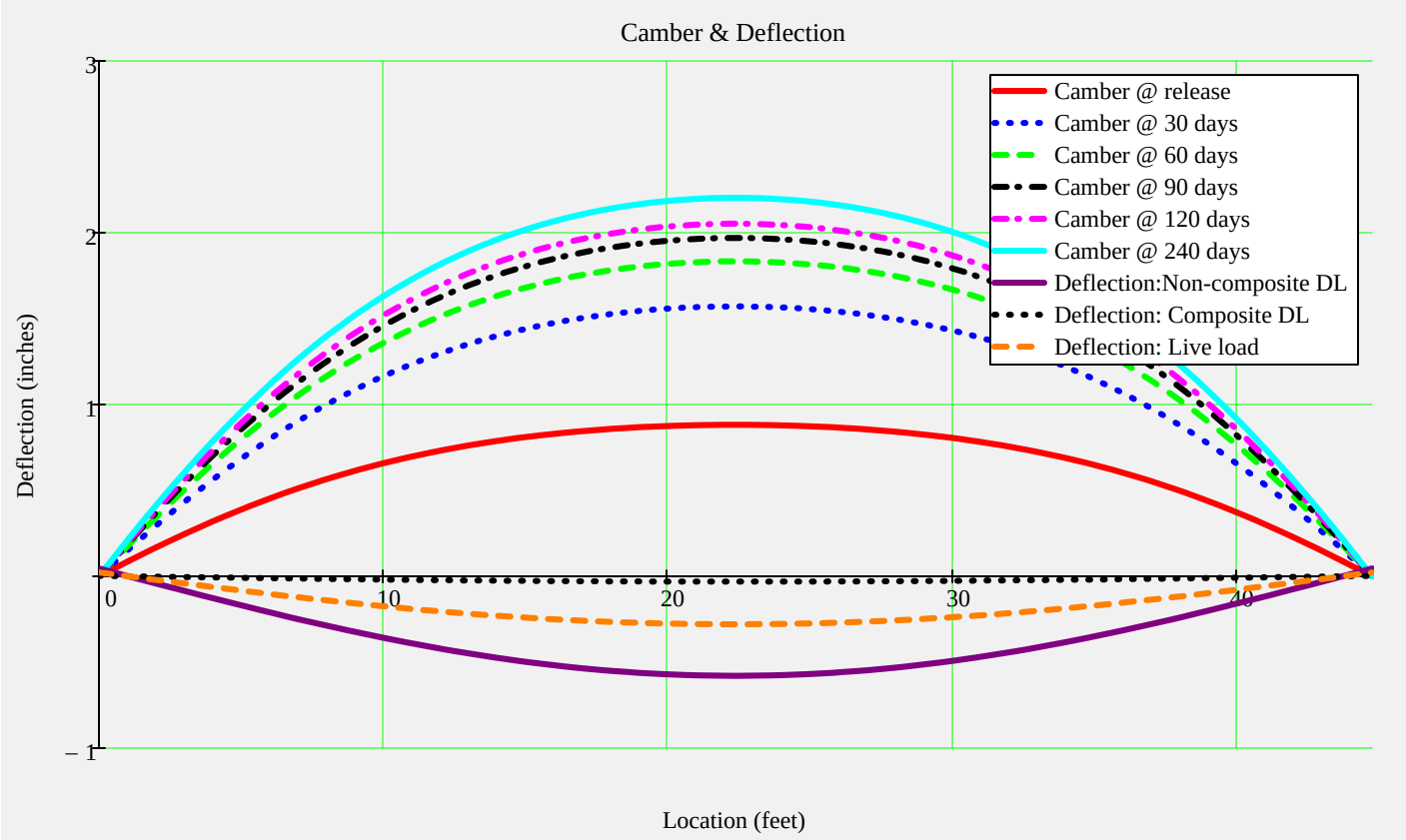
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 42.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.05	–0.34	0.41	0.88
"30 Days"	–0.15	–0.63	0.73	1.57
"60 Days"	–0.19	–0.74	0.84	1.83
"90 Days"	–0.21	–0.80	0.91	1.97
"120 Days"	–0.23	–0.83	0.94	2.05
"240 Days"	–0.25	–0.90	1.01	2.20
"Non-comp DL"	–0.06	0.05	–0.21	–0.58
"Comp DL"	–0.00	0.00	–0.01	–0.03
"LL"	–0.02	0.04	–0.10	–0.28

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.44 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

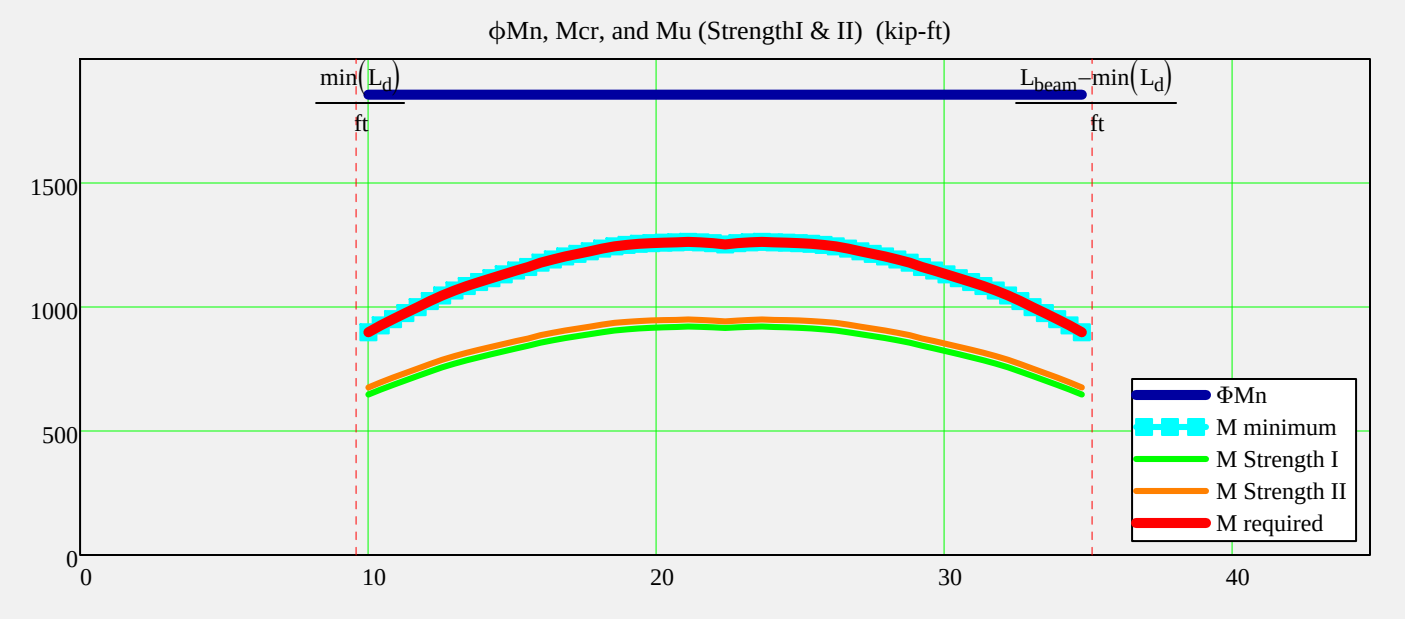
Values at midspan

$LimitStateForMoment_{51} = "Strength\ II"$ $\max(M_{Strength}) = 949 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 1253 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1253 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1856 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 35.2\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.68$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

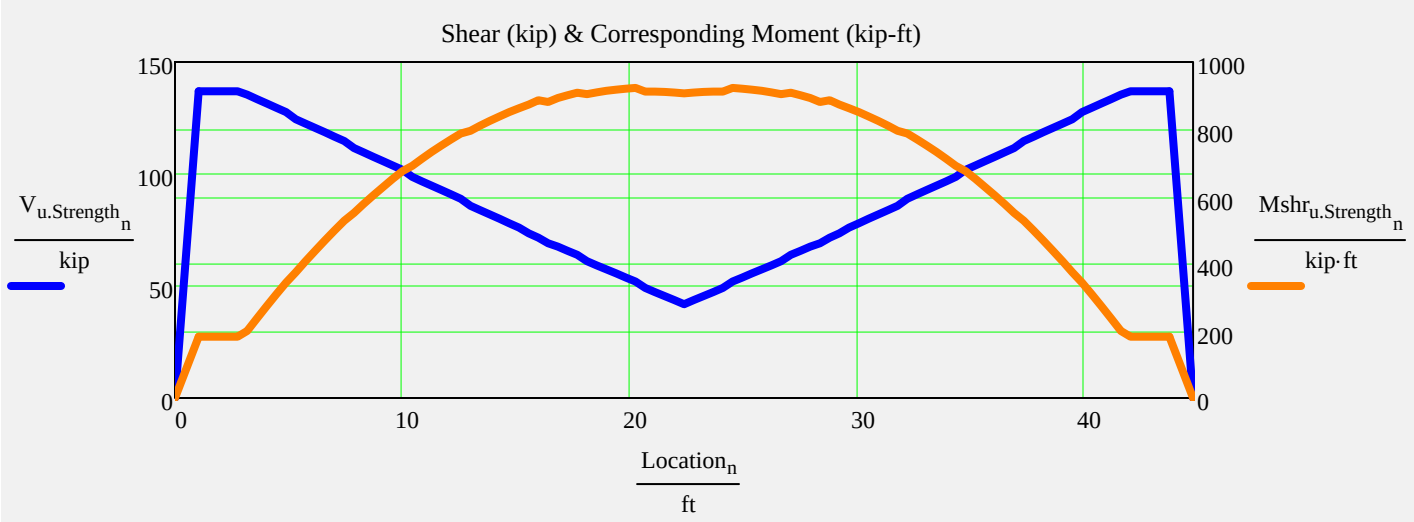
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

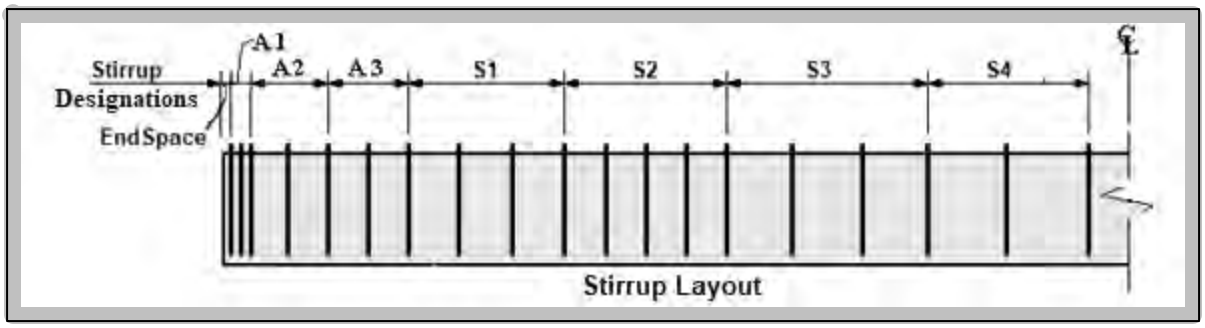
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 138 \\ 146 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 136.9 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 923 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

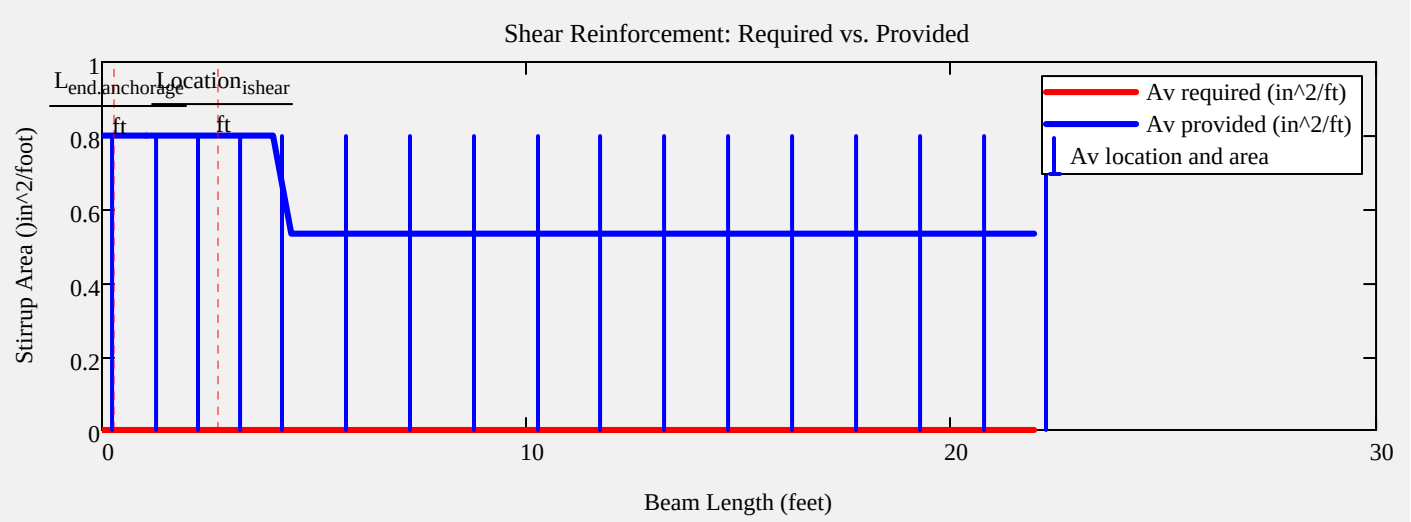
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.75\ ft$

Save Data File

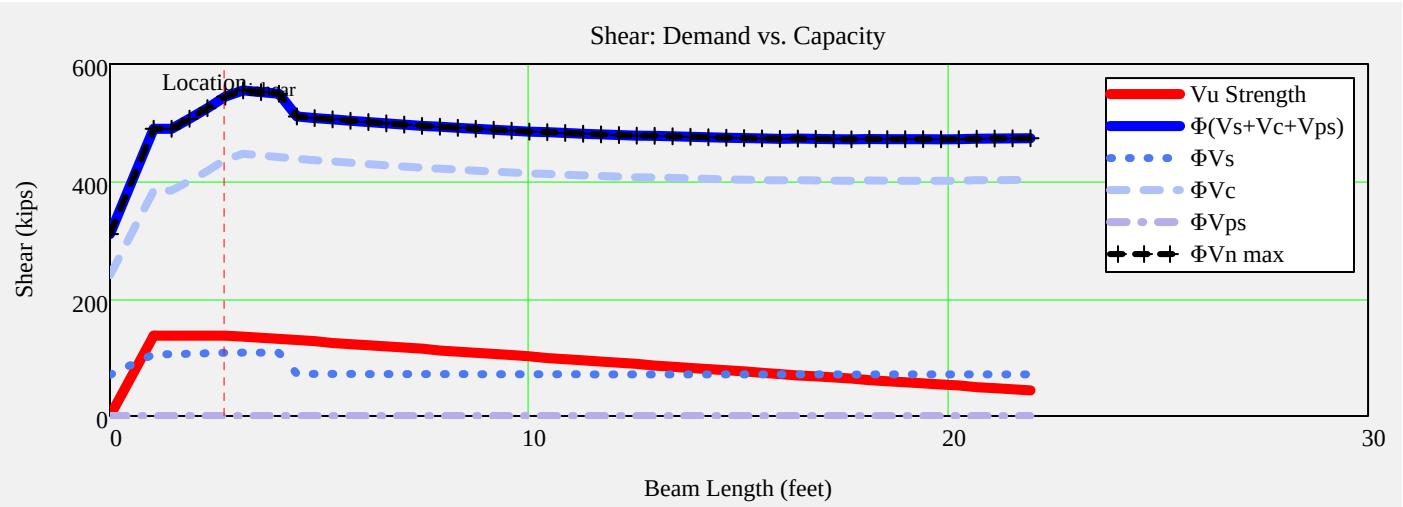
Use current input file

File Name FSB-45ftSpan-15inx56in_ExtBeam.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\EB

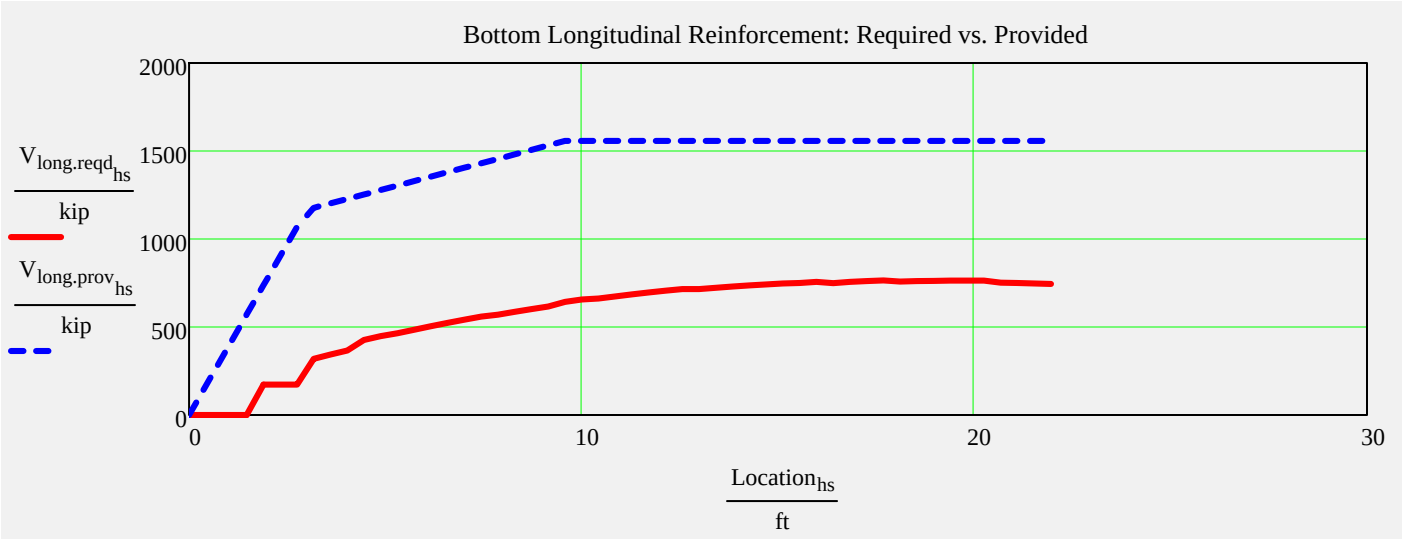
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.46 & 129.56 & 510.47 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.25$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

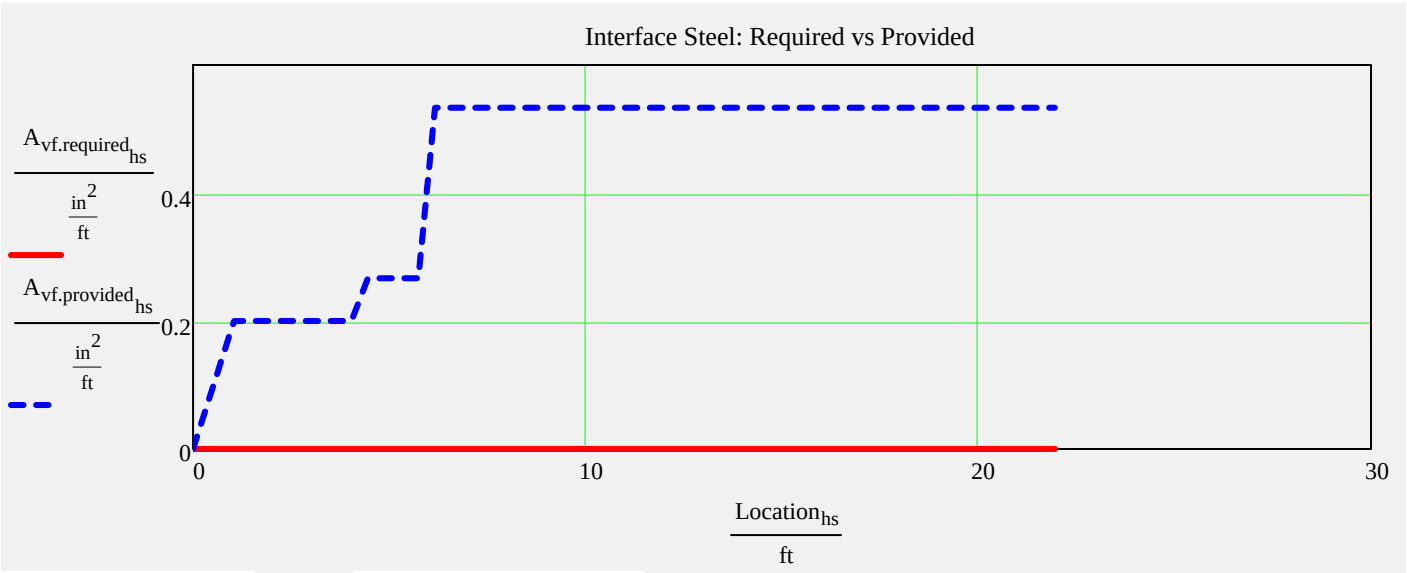


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 17.7 & 764.5 & 1557.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.49$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 9.73 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

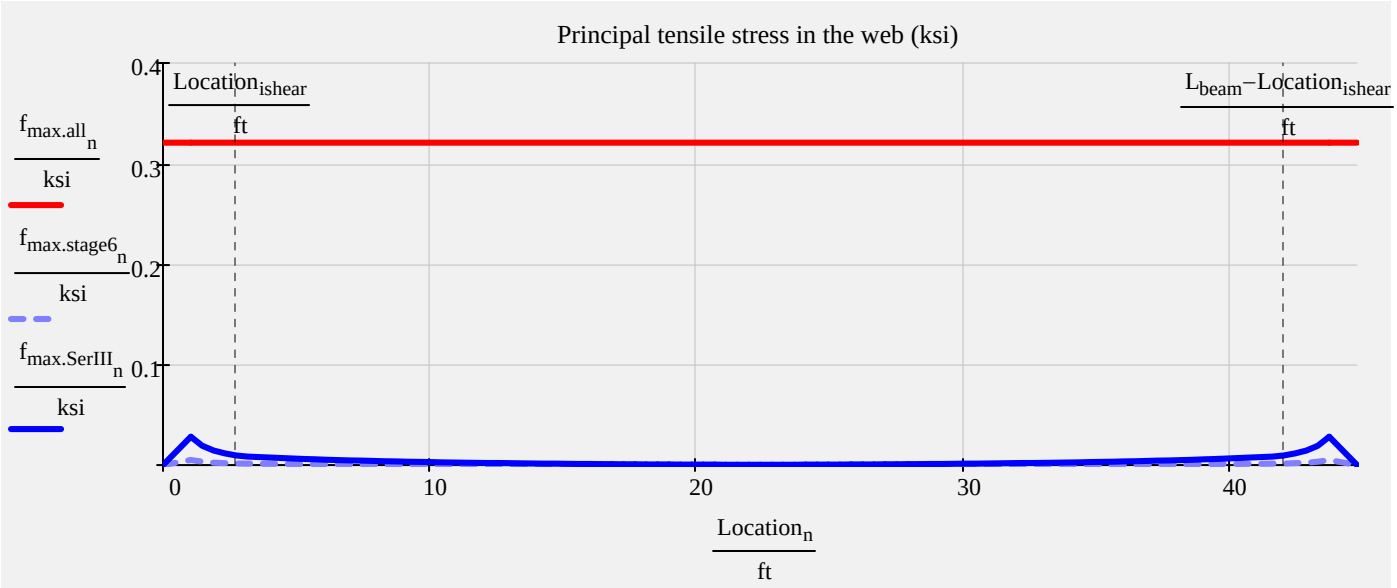
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

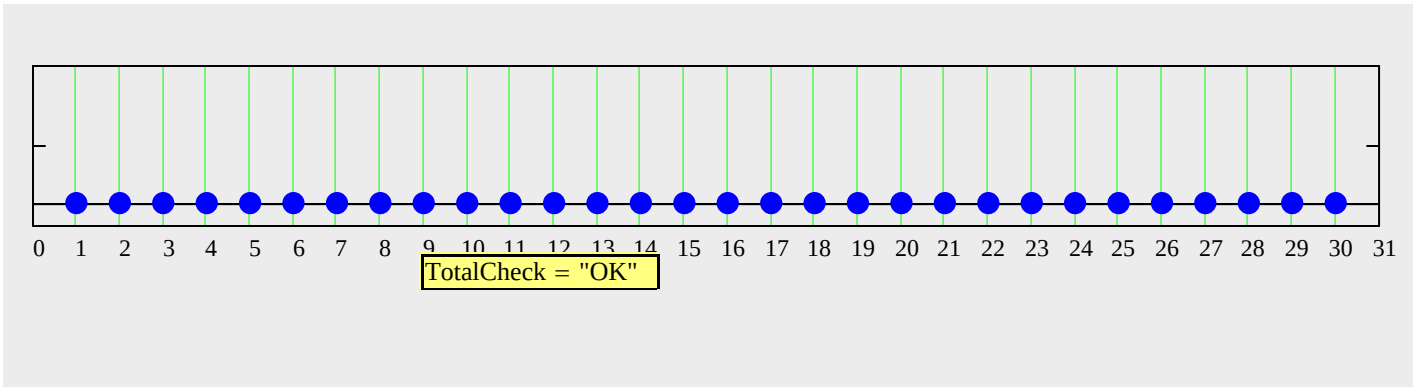
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.38	2.76	"N/A"	20.05	0.65	5.36	"N/A"	3.41	HL-93
"Strength I (Op)"	0.38	3.58	"N/A"	22.61	0.65	6.95	"N/A"	3.41	HL-93
"Service III (Inv)"	0.38	3.23	"N/A"	20.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.38	3.43	"N/A"	20.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.38	2.62	157.23	22.61	0.65	4.86	291.73	3.41	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.46$ $DC_{LongReinf.Permit} = 0.49$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1856	"factored resistance (kip-ft)...."
"γDL"	390	"factored dead load (kip-ft)...."
"γLL"	410	"factored live load (kip-ft)....."
"RF"	3.58	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	512.9	"factored resistance (kip)....."
"γDL"	30.9	"factored dead load (kip)....."
"γLL"	69.4	"factored live load (kip)....."
"RF"	6.95	"HL93 operating rating factor"

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\EB 45' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-45ftSpan-15inx56in_ExtBeam.dat
FSB-45ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

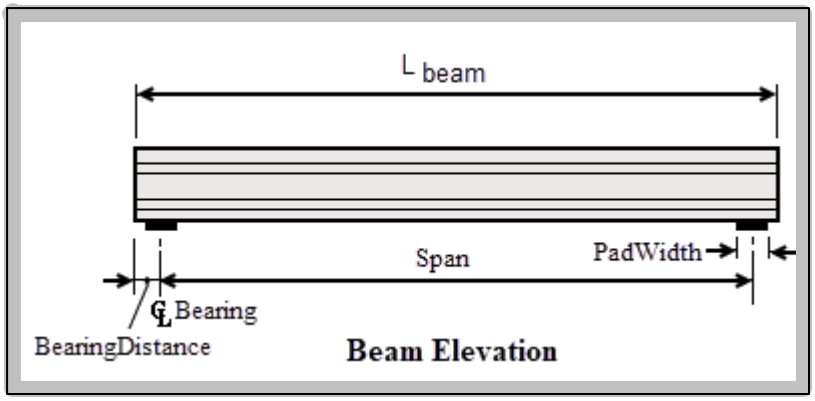
InputDataFile = "FSB-45ftSpan-15inx56in_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



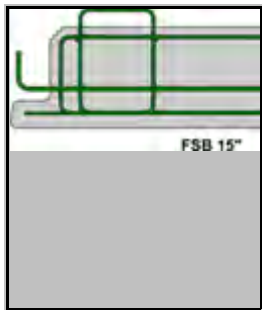
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-45ftSpan-15inx56in_IntBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	44.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

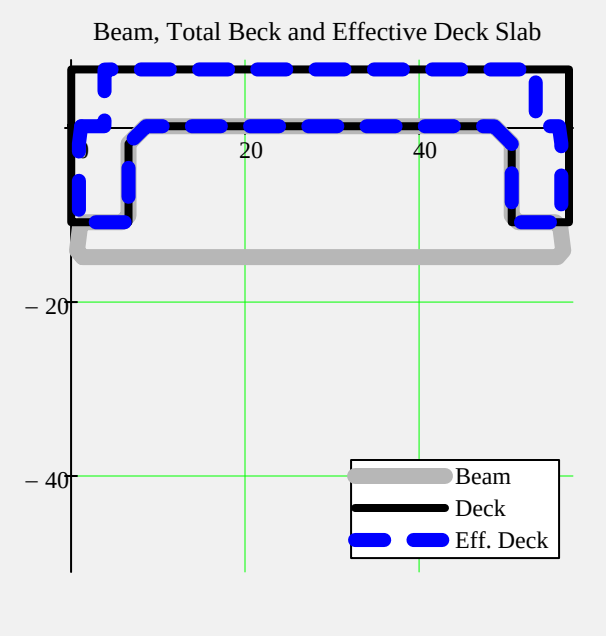
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = 56·in

$b_e = 57.14 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 0.57 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 44.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

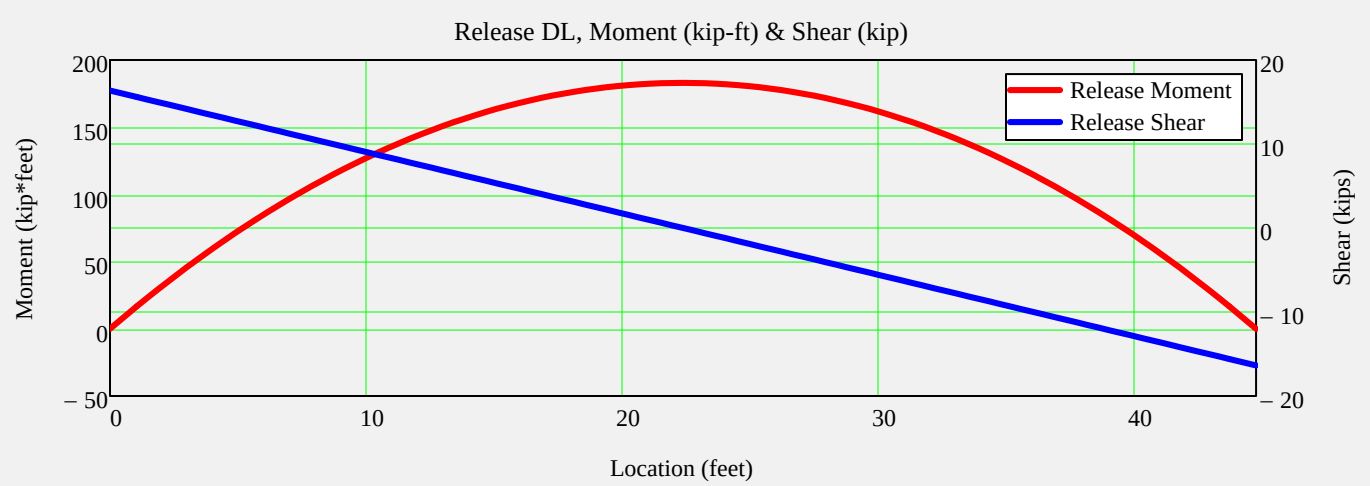
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

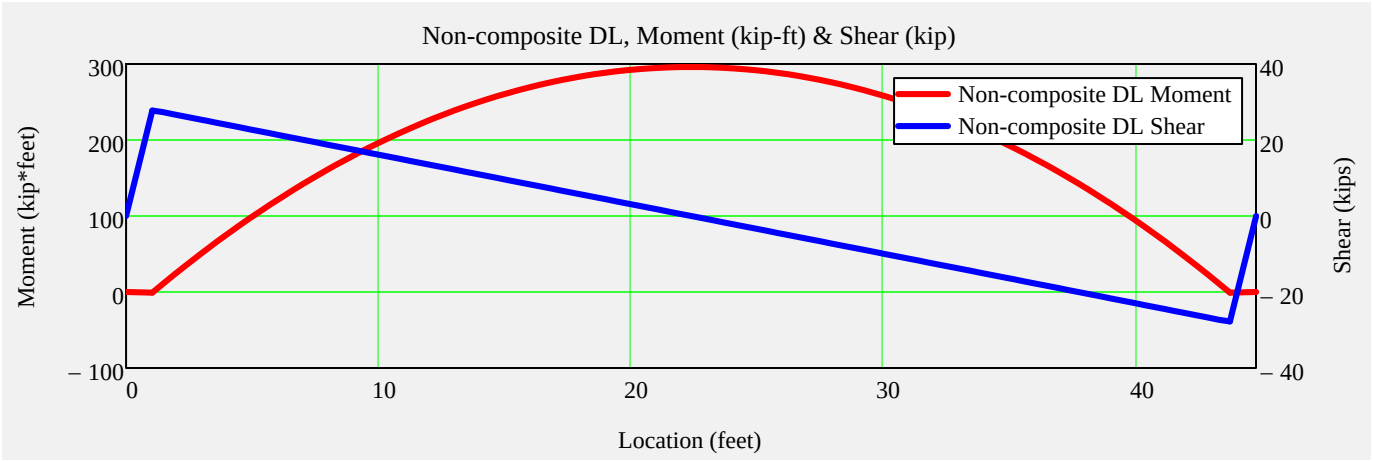
Release Dead Load Moments and Shears

$L_{span} = 42.67\ ft$



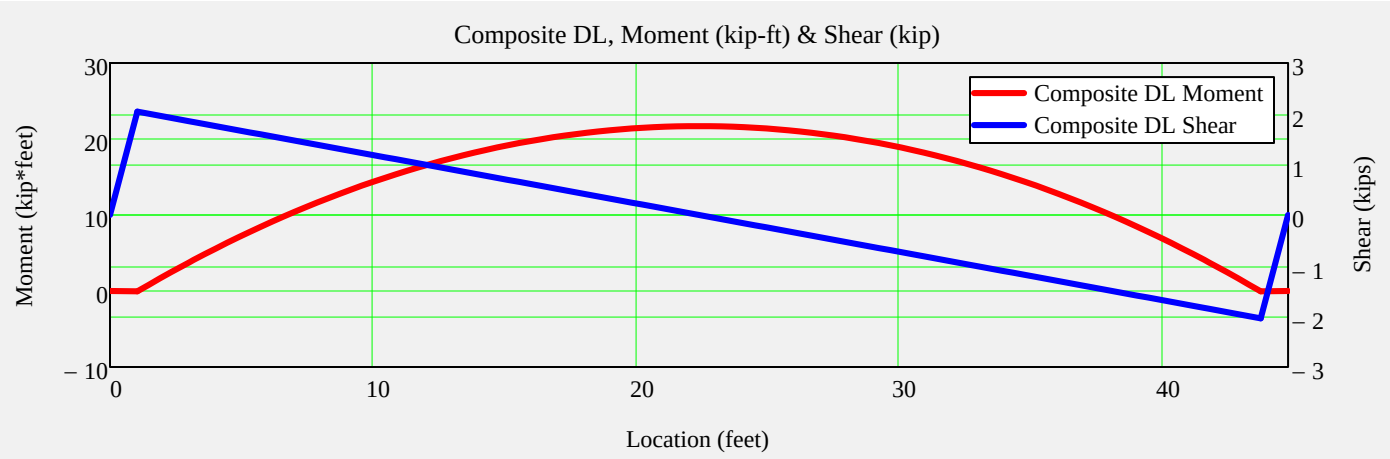
$\max(V_{release}) = 16.4 \cdot kip$ $\max(M_{release}) = 183.0 \cdot kip \cdot ft$ $\min(V_{release}) = -16.4 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 27.8 \cdot kip$ $\max(M_{dl.non.comp}) = 296.0 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -27.8 \cdot kip$

Composite Dead Load Moments and Shear



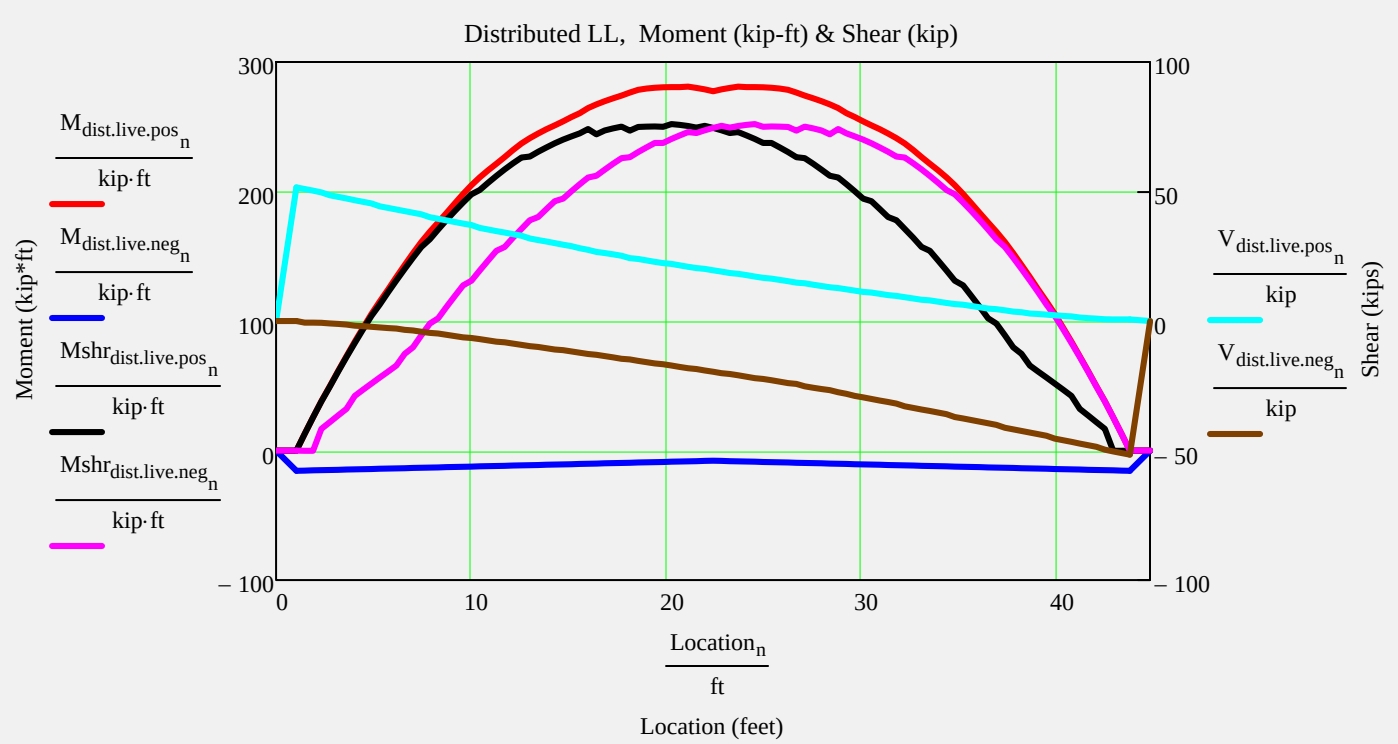
$\max(V_{dl.comp}) = 2.0 \cdot kip$ $\max(M_{dl.comp}) = 21.7 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.0 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 42.67\ ft$ BeamSpacing = 4.67 ft Skew = 0·deg

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor = 1.00

Final Live Load Distribution Factors: $g_{mom} = 0.35$ $g_{mom.fatigue} = 0.2$ $g_{shear} = 0.59$



$\max(V_{dist.live.pos}) = 51.6\cdot kip$

$\max(M_{dist.live.pos}) = 280.9\cdot kip\cdot ft$

$\min(V_{dist.live.neg}) = -51.6\cdot kip$

$Reaction_{LL} = 53.6\cdot kip$

$\min(M_{dist.live.neg}) = -15.6\cdot kip\cdot ft$

$Reaction_{DL} = 31.3\cdot kip$

$\max(Mshr_{dist.live.pos}) = 252\cdot kip\cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

$Reaction_{truck} = 58.01\cdot kip$ $Reaction_{lane} = 14.32\cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane})\cdot g_{shear}$

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{LL.without.IM} = 42.4\cdot kip$

Reinforcement Properties

InputDataFile = "FSB-45ftSpan-15inx56in_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

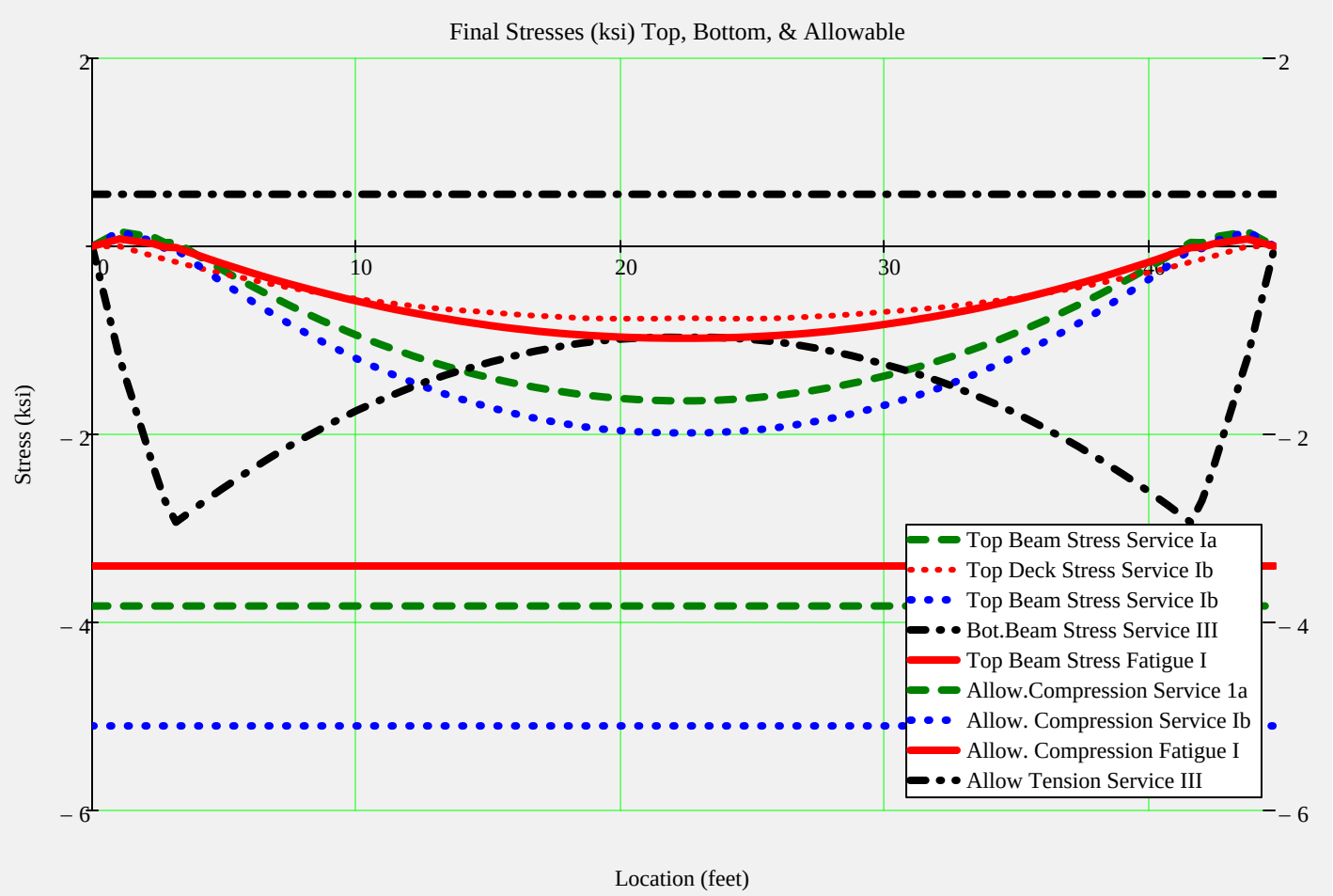
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

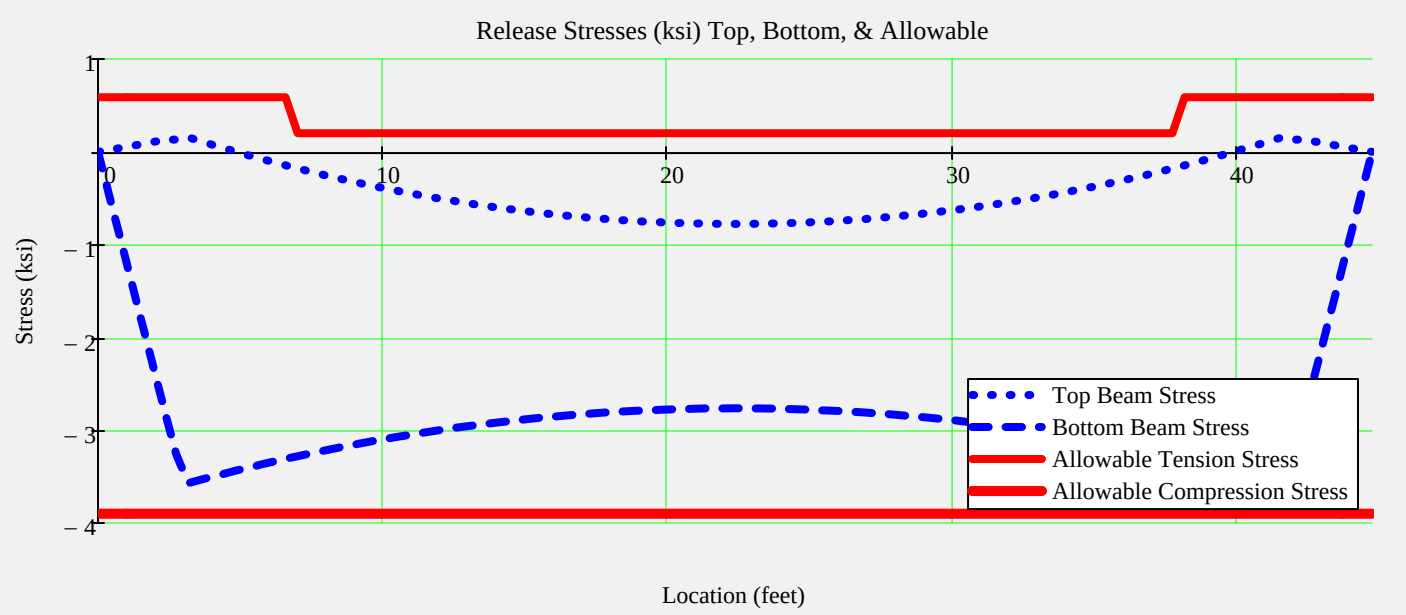
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.68$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.92$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.43$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.39$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.29$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.18	0.16	0.59
"Compression @ Release"	3.18	–3.57	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	22.38	–1.64	–3.83
"CompressionIb @ ServiceI"	22.80	–1.98	–5.10
"Compression @ FatigueI"	22.38	–0.98	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

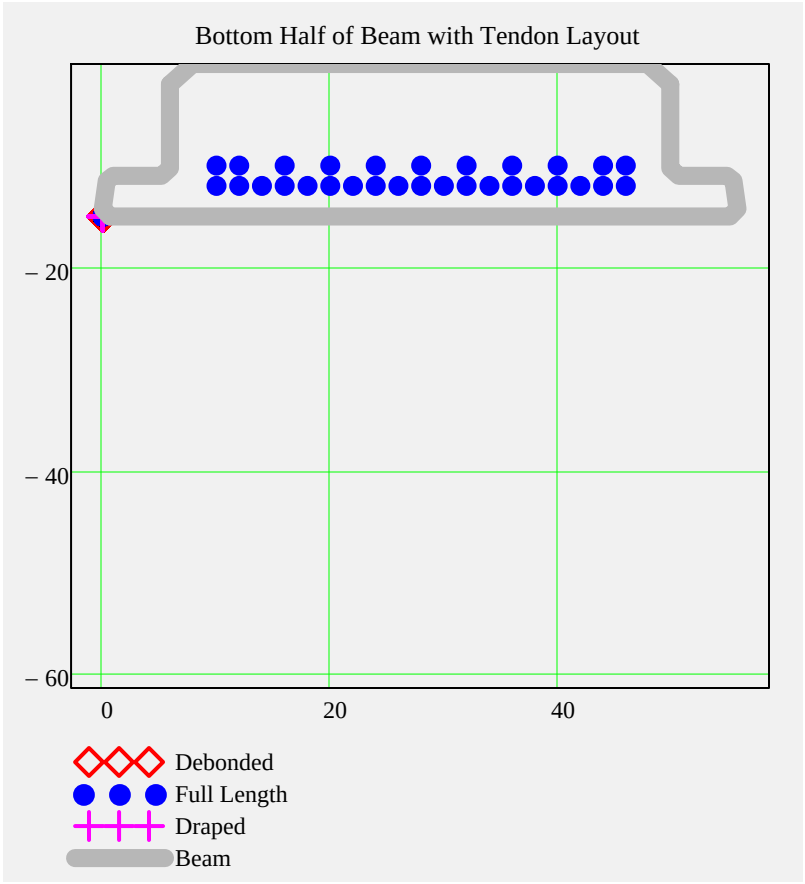
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

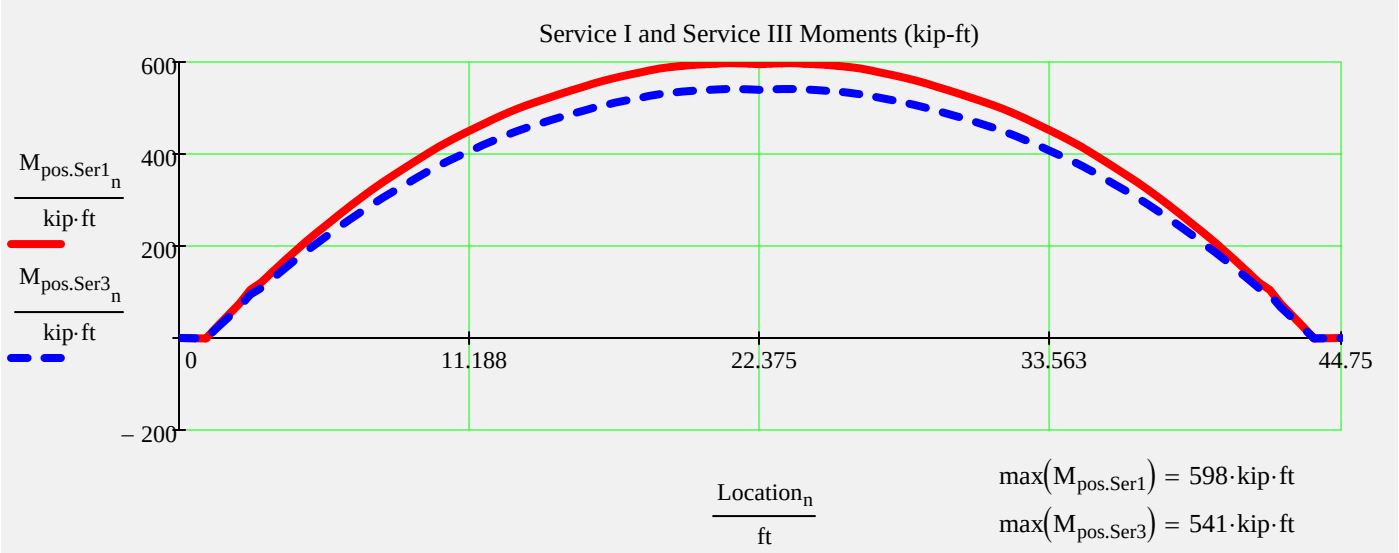
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

Check_f_{pe} = "OK"

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.78	–2.76
"2"	–0.83	–2.32
"4"	–0.72	–2.42
"6"	–1.62	–1.64
"8"	–1.98	–0.97

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1189.7	45382	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	183
"Non-Composite DL (incl. beam wt.)"	296
"Composite Dead Load"	22
"Distributed Live Load"	277

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

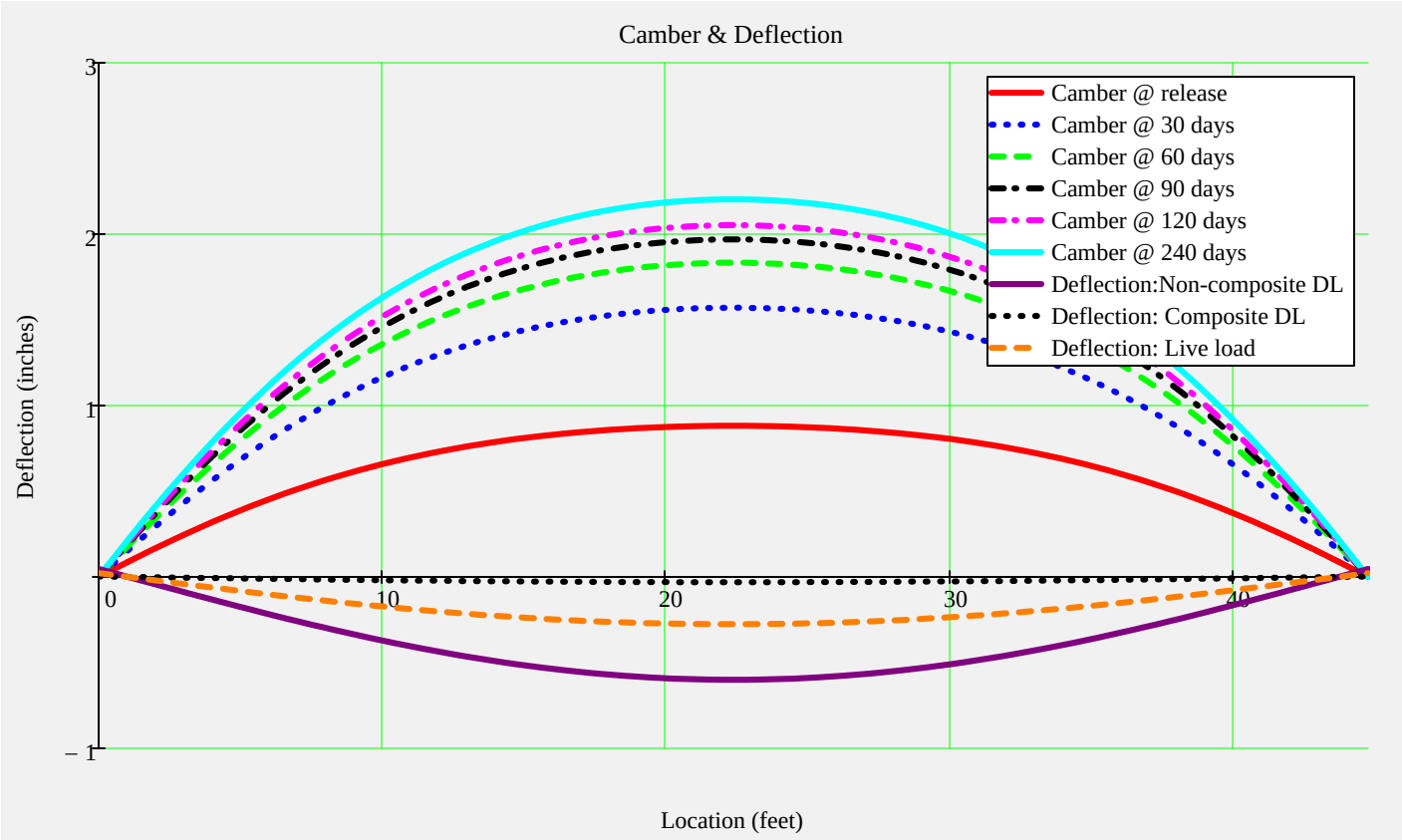
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 42.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.05	–0.34	0.41	0.88
"30 Days"	–0.15	–0.63	0.73	1.57
"60 Days"	–0.19	–0.74	0.84	1.83
"90 Days"	–0.21	–0.80	0.91	1.97
"120 Days"	–0.23	–0.83	0.94	2.05
"240 Days"	–0.25	–0.90	1.01	2.20
"Non-comp DL"	–0.06	0.05	–0.21	–0.60
"Comp DL"	–0.00	0.00	–0.01	–0.03
"LL"	–0.02	0.04	–0.10	–0.28

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.42 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

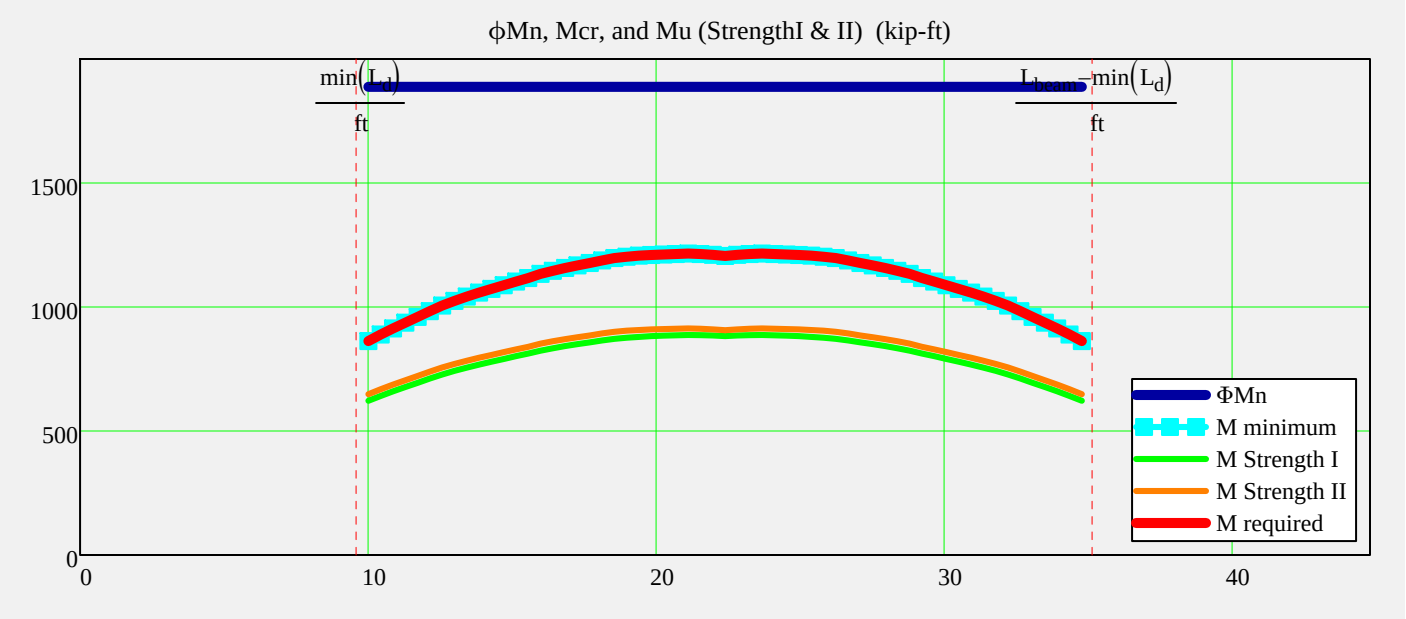
Values at midspan

$LimitStateForMoment_{51} = "Strength\ II"$ $\max(M_{Strength}) = 914 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 1206 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1206 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1888 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 35.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.64$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

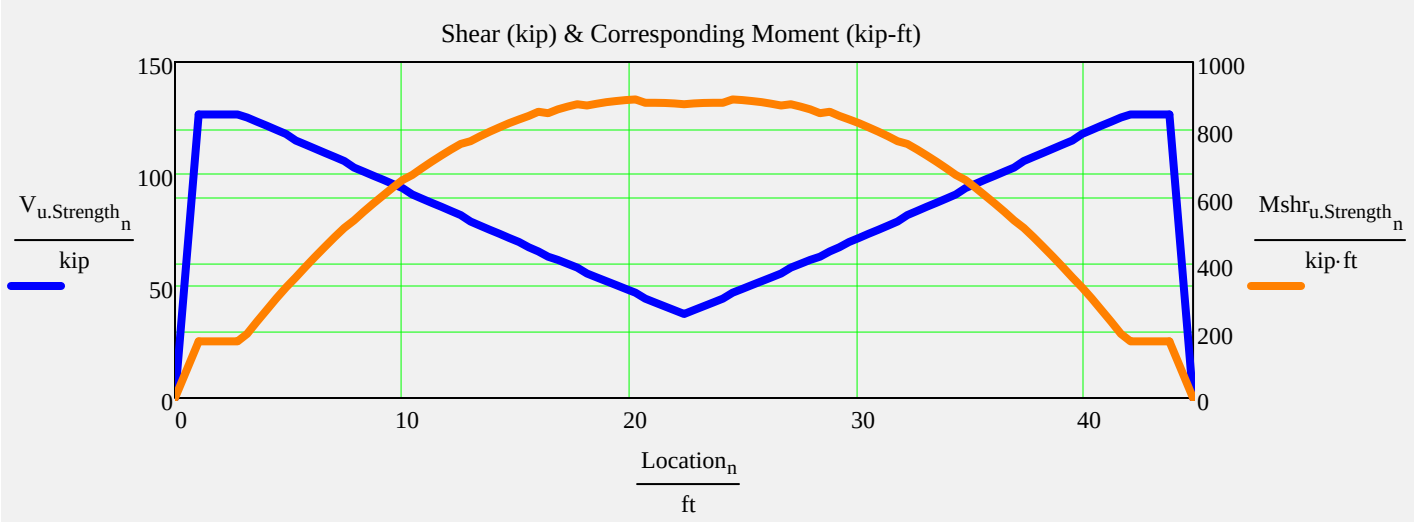
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

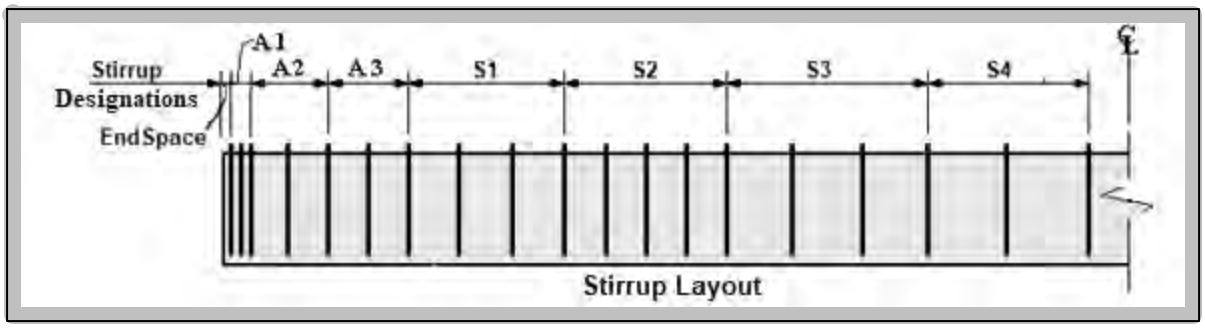
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 128 \\ 135 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 126.6 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 889 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

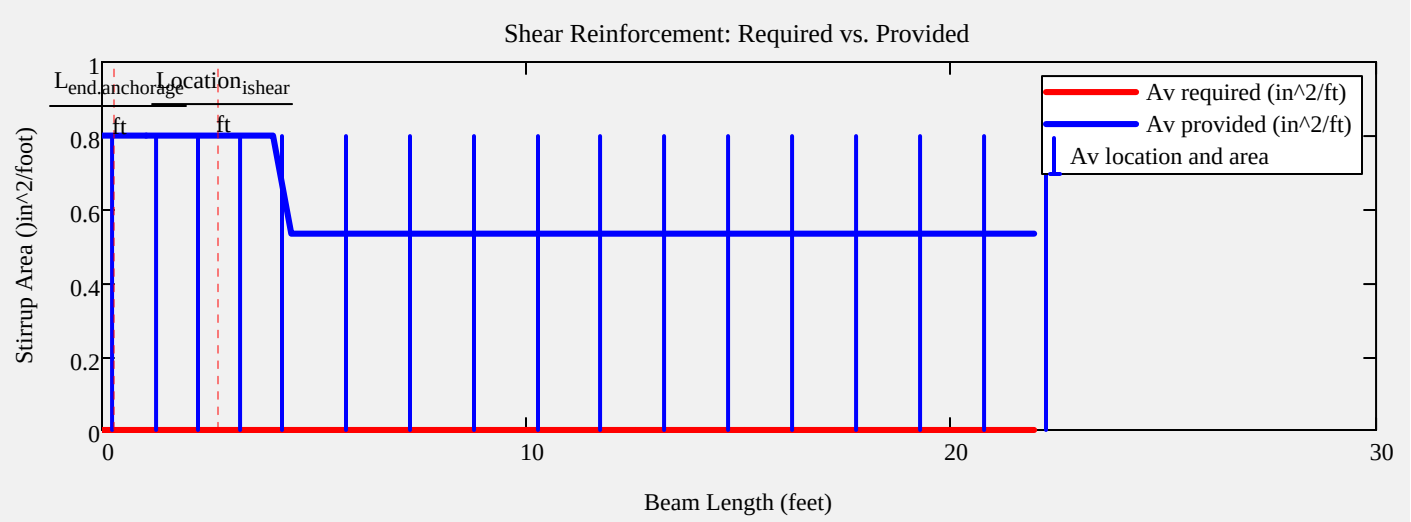
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.75\ ft$

Save Data File

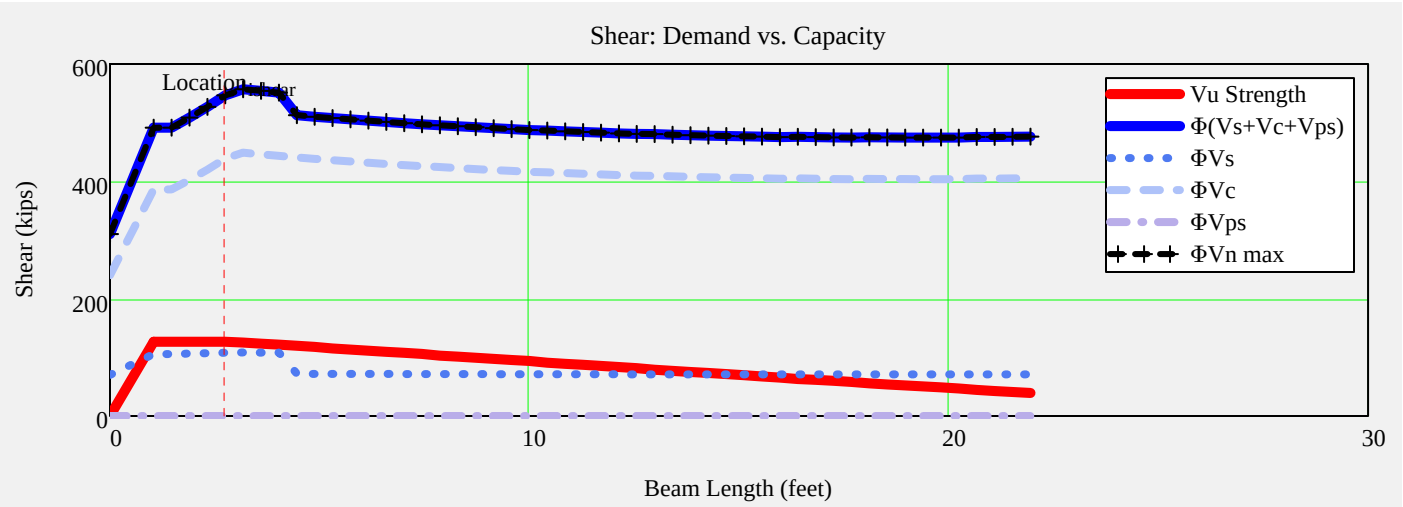
Use current input file

File Name FSB-45ftSpan-15inx56in_IntBeam.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\EB

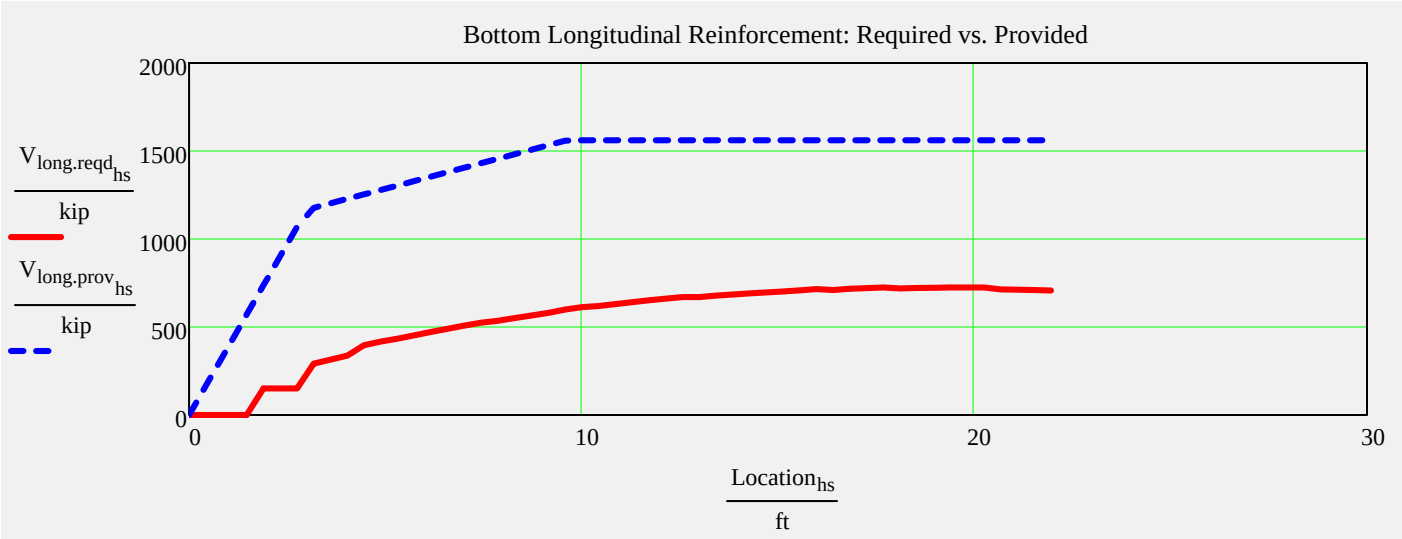
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.46 & 119.71 & 512.62 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.23$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

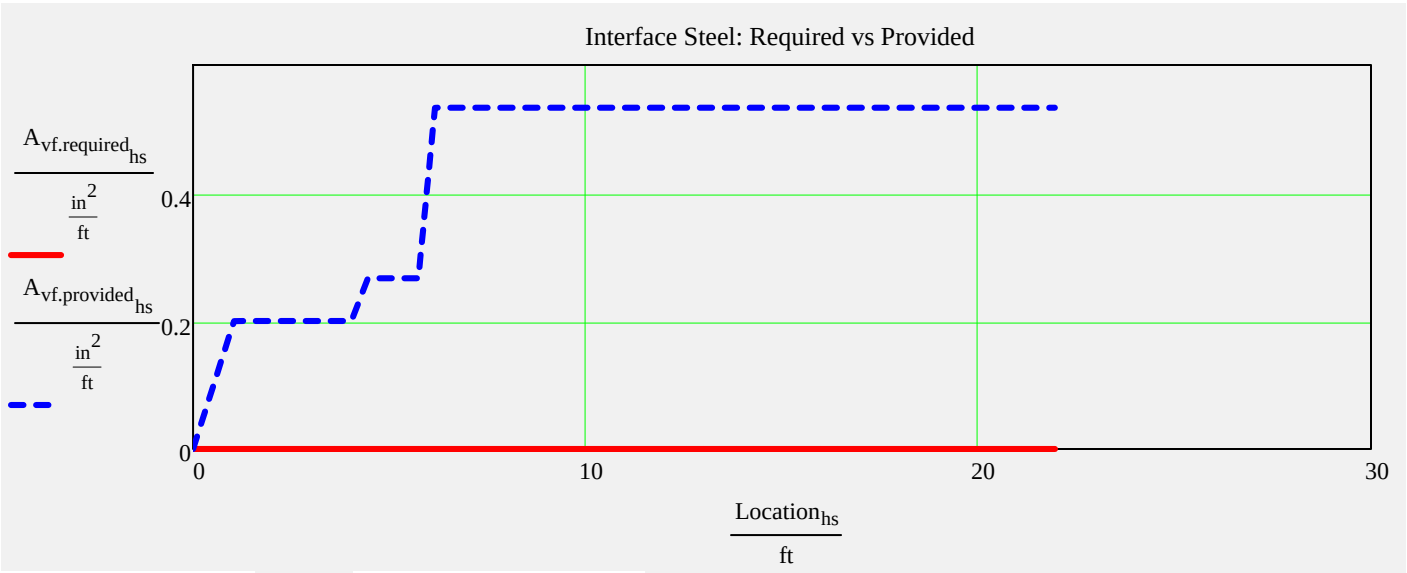


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 17.7 & 724.7 & 1560.5 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.46$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 9.73 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

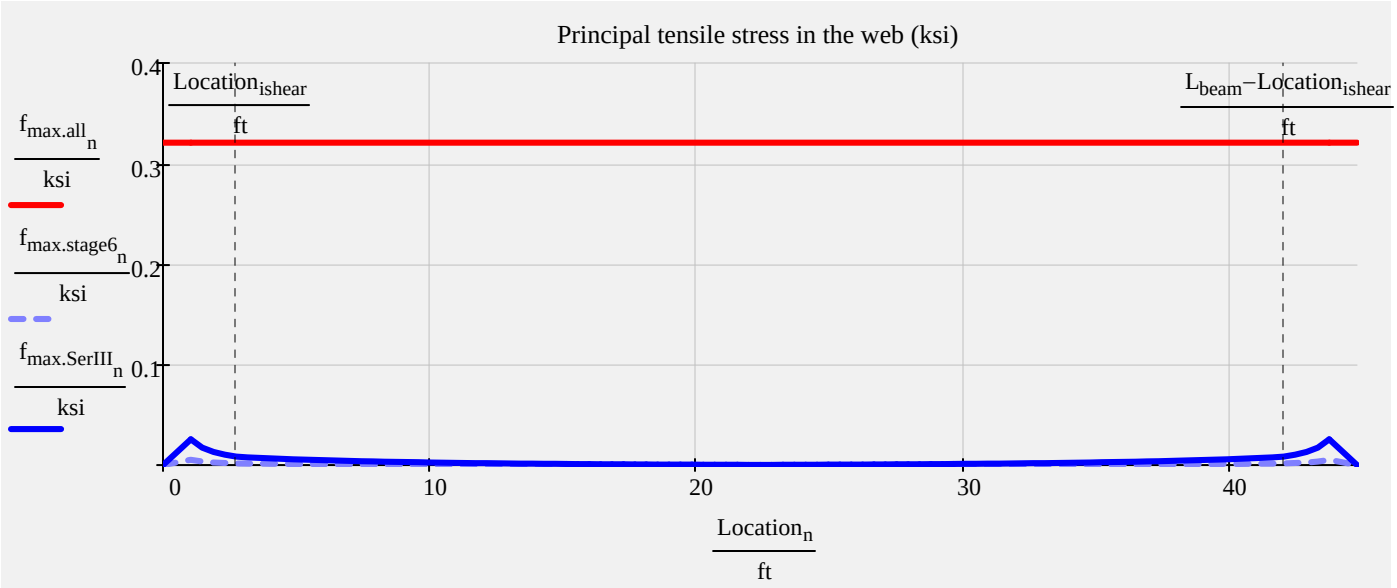
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 33 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ Check_$f_{max.web}$ = "OK"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 10

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

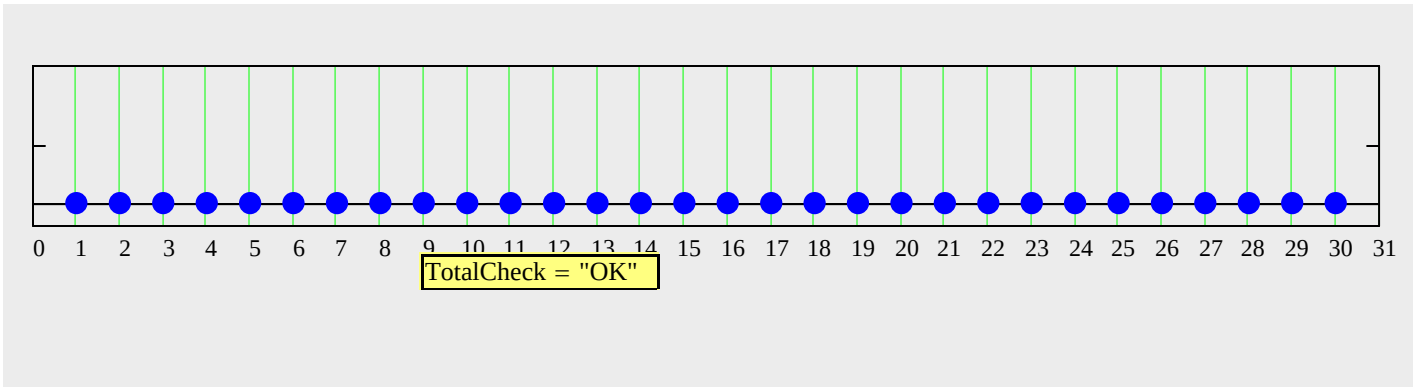
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.35	3.03	"N/A"	20.05	0.59	6.00	"N/A"	3.41	HL-93
"Strength I (Op)"	0.35	3.93	"N/A"	22.61	0.59	7.78	"N/A"	3.41	HL-93
"Service III (Inv)"	0.35	3.47	"N/A"	22.61	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.35	3.69	"N/A"	22.61	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.35	2.88	172.82	22.61	0.59	5.45	326.92	3.41	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.43$ $DC_{LongReinf.Permit} = 0.46$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1888	"factored resistance (kip-ft)...."
"γDL"	396	"factored dead load (kip-ft)...."
"γLL"	379	"factored live load (kip-ft)....."
"RF"	3.93	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	514.8	"factored resistance (kip)....."
"γDL"	31.4	"factored dead load (kip)....."
"γLL"	62.1	"factored live load (kip)....."
"RF"	7.78	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM EXTERIOR BEAM DESIGN

SPAN LENGTH = 48 FEET (NO SKEW)
WESTBOUND BRIDGE
(PARKER CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\WB 48' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-48ftSpan-15inx56in_15SkewExtBeam.dat
FSB-48ftSpan-15inx56in_15SkewIntBeam.dat
FSB-48ftSpan-15inx56in_ExtBeam.dat
FSB-48ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

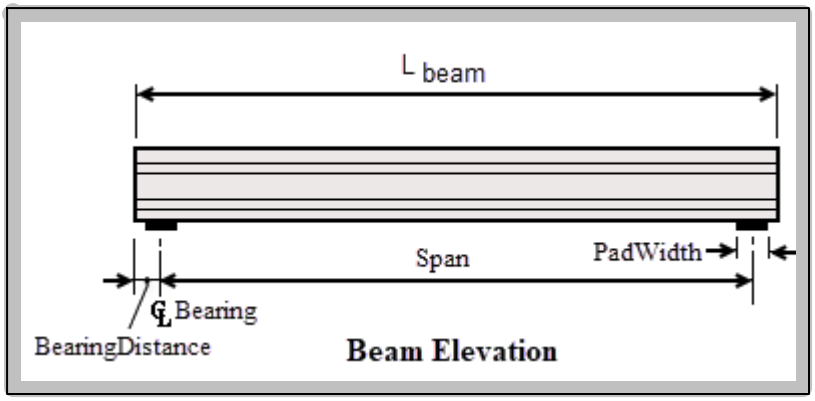
InputDataFile = "FSB-48ftSpan-15inx56in_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

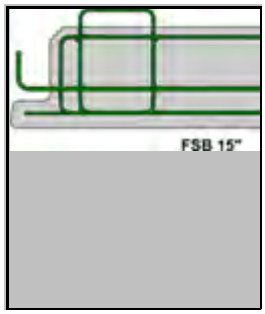
Superstructure Data

InputDataFile = "FSB-48ftSpan-15inx56in_ExtBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	47.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

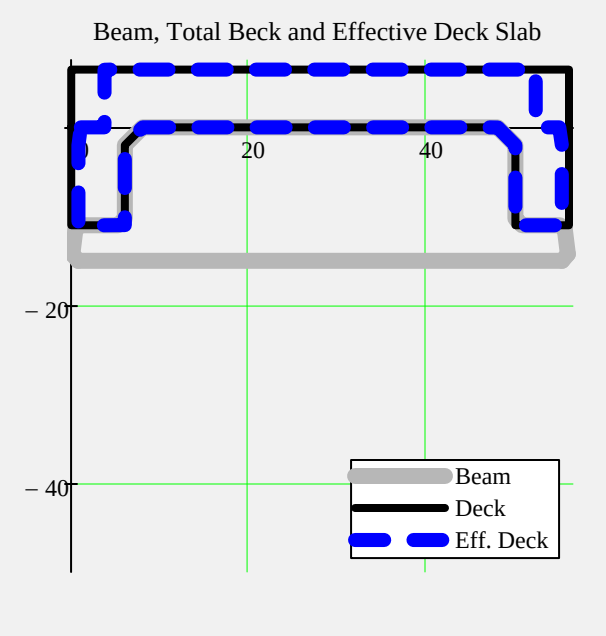
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 56.07 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.55 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 47.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

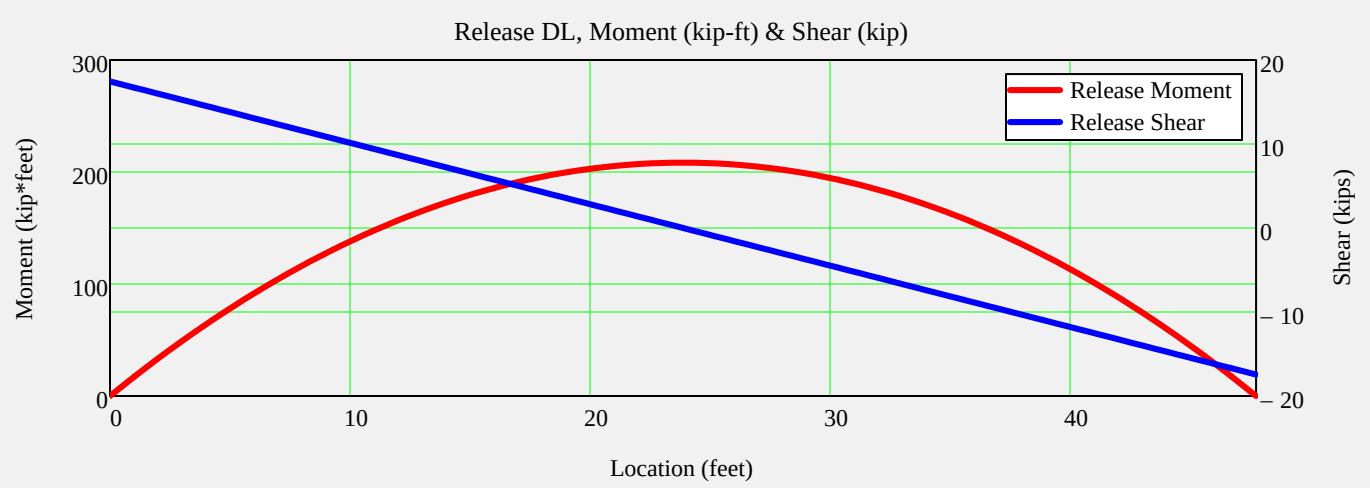
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

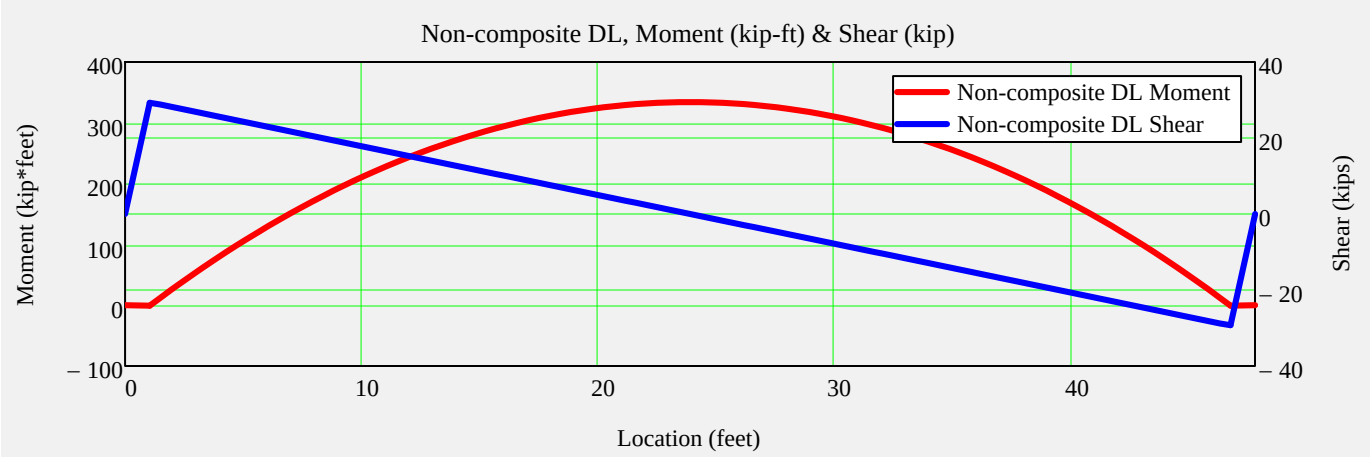
Release Dead Load Moments and Shears

$L_{span} = 45.67\ ft$



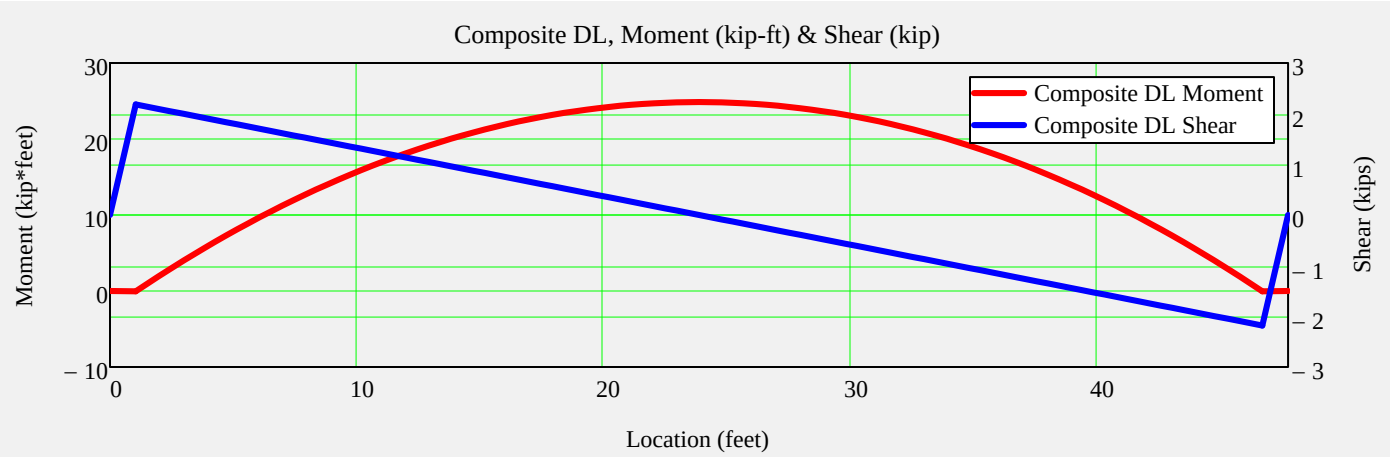
$\max(V_{release}) = 17.5 \cdot kip$ $\max(M_{release}) = 208.3 \cdot kip \cdot ft$ $\min(V_{release}) = -17.5 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 29.3 \cdot kip$ $\max(M_{dl.non.comp}) = 334.0 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -29.3 \cdot kip$

Composite Dead Load Moments and Shear



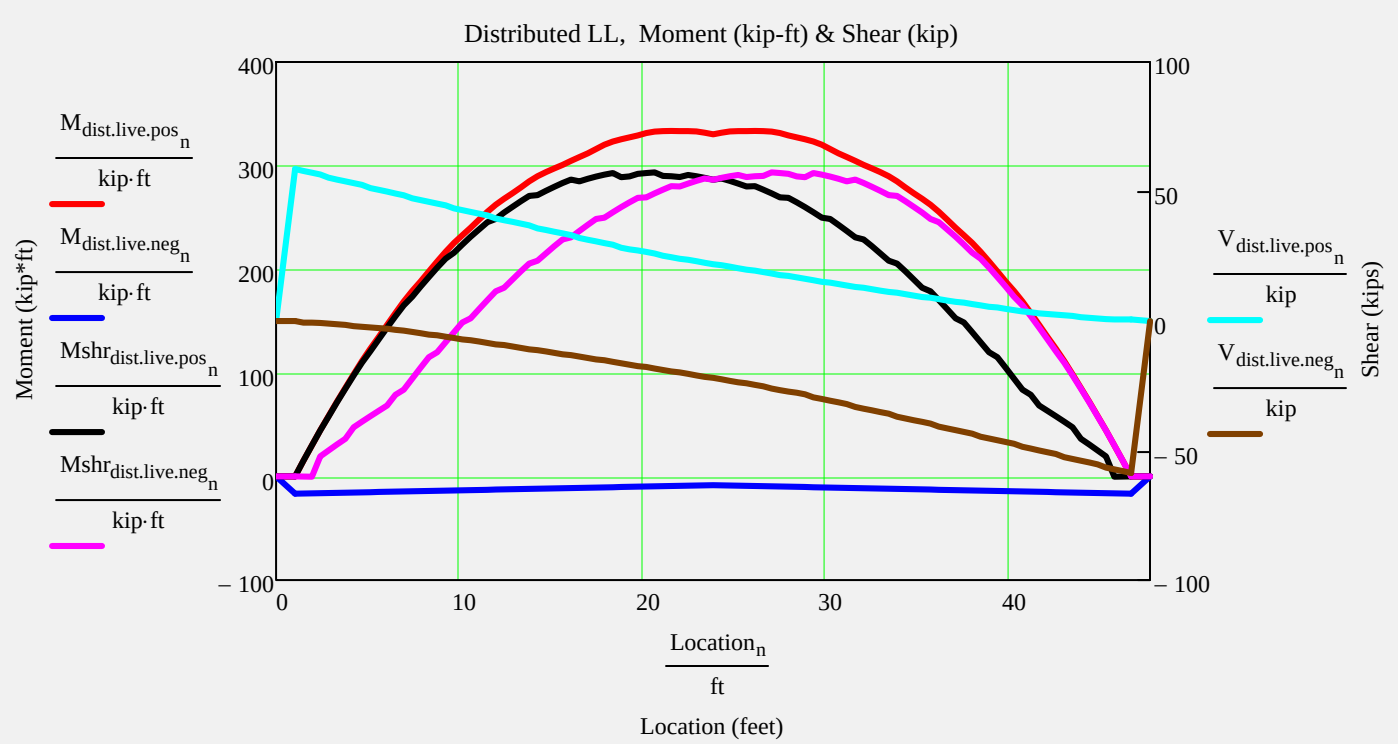
$\max(V_{dl.comp}) = 2.2 \cdot kip$ $\max(M_{dl.comp}) = 24.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.2 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 45.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.37$ $g_{mom.fatigue} = 0.22$ $g_{shear} = 0.65$



$\max(V_{dist.live.pos}) = 58.7 \cdot kip$

$\max(M_{dist.live.pos}) = 333.4 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -58.7 \cdot kip$

$Reaction_{LL} = 60.9 \cdot kip$

$\min(M_{dist.live.neg}) = -16.6 \cdot kip \cdot ft$

$Reaction_{DL} = 32.9 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 293 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions... without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{truck} = 58.93 \cdot kip$ $Reaction_{lane} = 15.28 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 48.24 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-48ftSpan-15inx56in_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

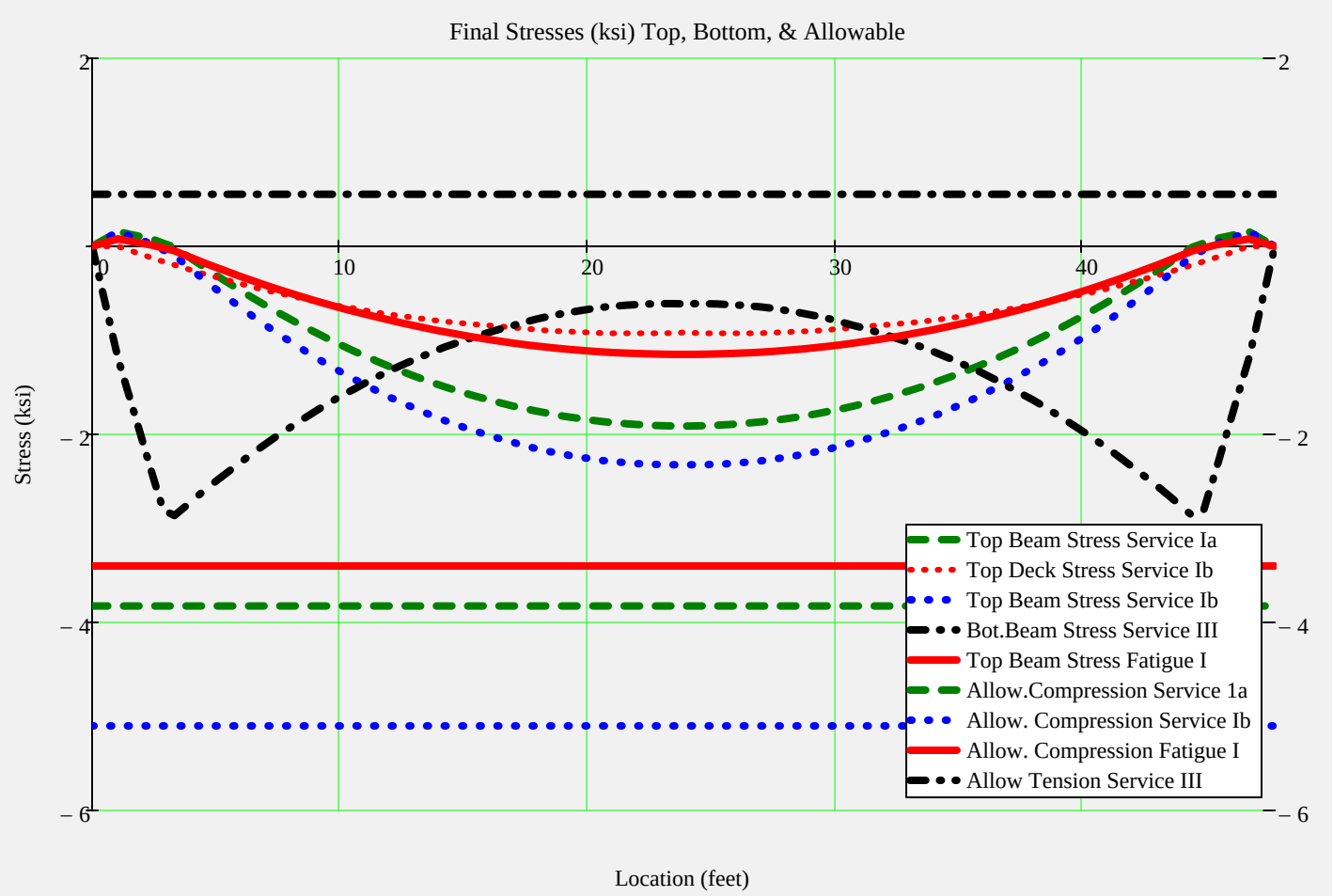
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

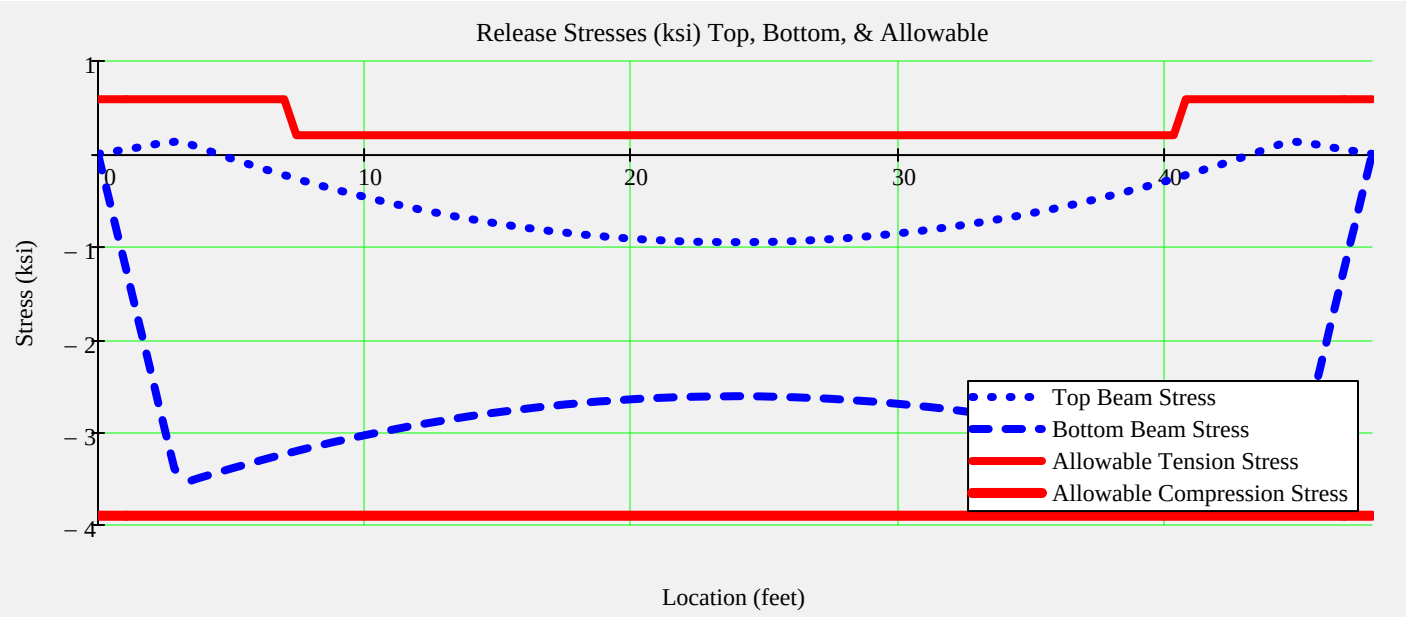
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.70$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.91$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.50$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.46$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.34$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.87	0.13	0.59
"Compression @ Release"	3.32	–3.54	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	23.88	–1.91	–3.83
"CompressionIb @ ServiceI"	24.33	–2.32	–5.10
"Compression @ FatigueI"	23.88	–1.15	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

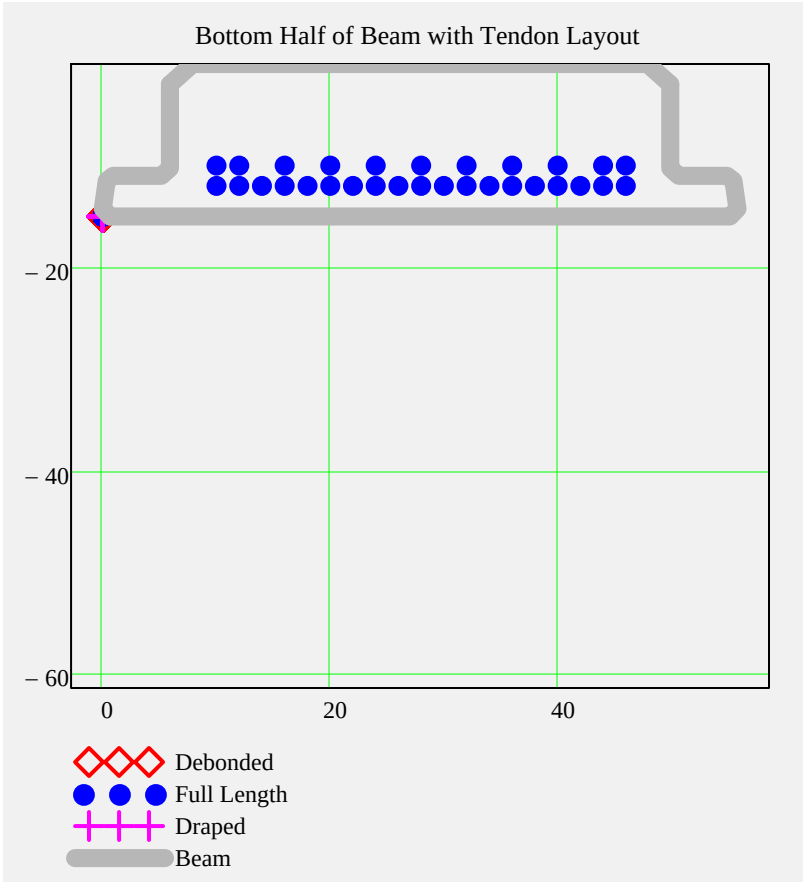
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

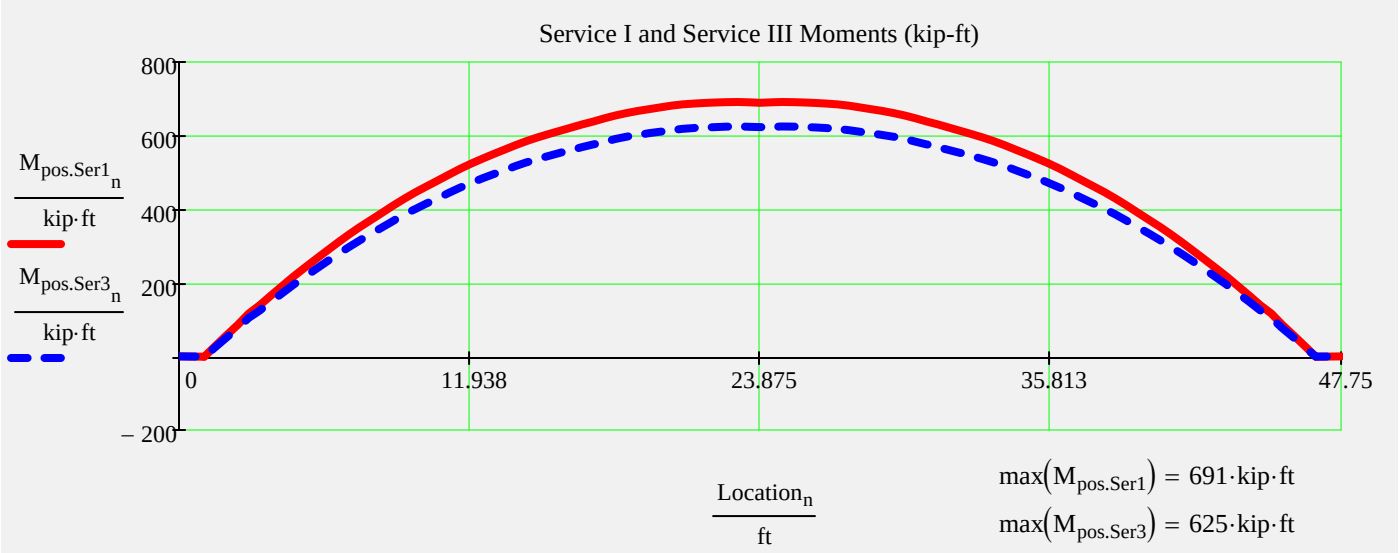
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.95 & -2.61 \\ \text{"2"} & -1.01 & -2.17 \\ \text{"4"} & -0.88 & -2.28 \\ \text{"6"} & -1.88 & -1.41 \\ \text{"8"} & -2.32 & -0.61 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1173.3	44867	–4.7

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	208
"Non-Composite DL (incl. beam wt.)"	334
"Composite Dead Load"	25
"Distributed Live Load"	330

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

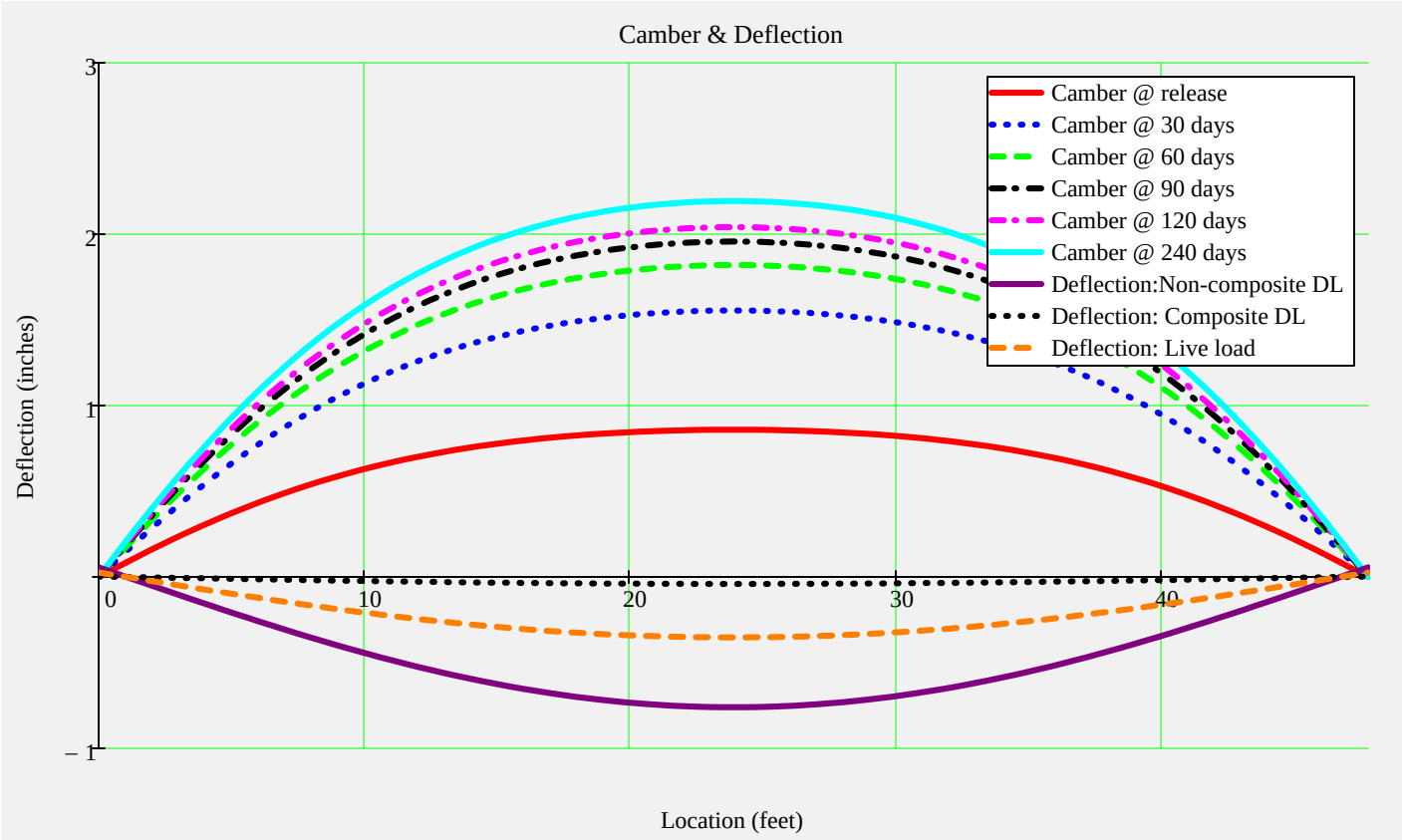
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 45.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.06	–0.35	0.40	0.86
"30 Days"	–0.19	–0.66	0.70	1.55
"60 Days"	–0.23	–0.77	0.82	1.82
"90 Days"	–0.26	–0.83	0.88	1.96
"120 Days"	–0.27	–0.87	0.92	2.04
"240 Days"	–0.30	–0.93	0.99	2.19
"Non-comp DL"	–0.07	0.06	–0.25	–0.76
"Comp DL"	–0.00	0.00	–0.01	–0.04
"LL"	–0.02	0.04	–0.12	–0.35

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.24 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

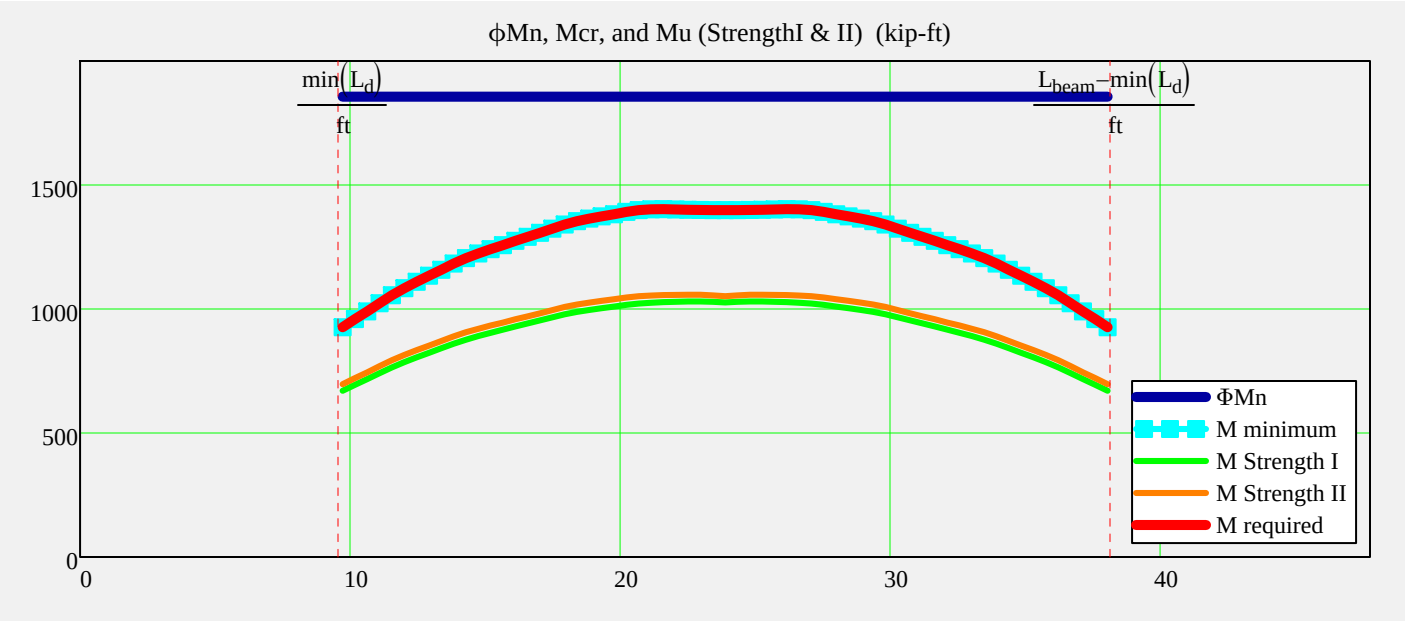
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 1058 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1399 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1399 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1856 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $\quad L_{beam} - \min(L_d) = 38.2\,\text{ft}$

$$DC_{moment_{mn}} := \frac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$$

Demand/Capacity Ratio at locations where all strands are fully developed

$\max(DC_{moment}) = 0.76$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

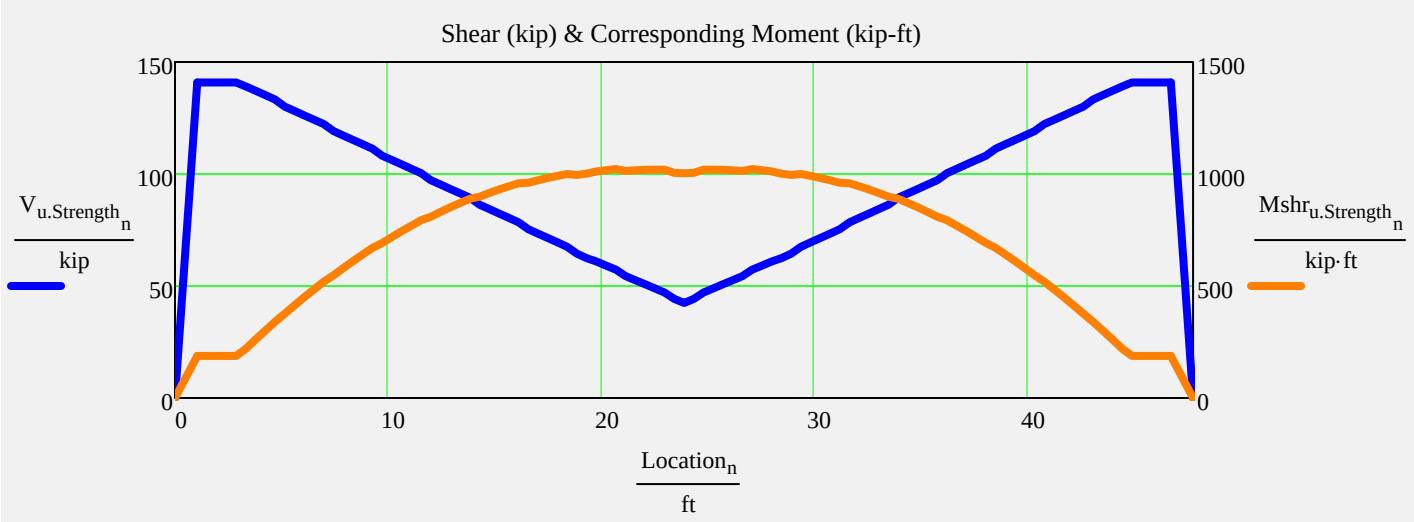
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

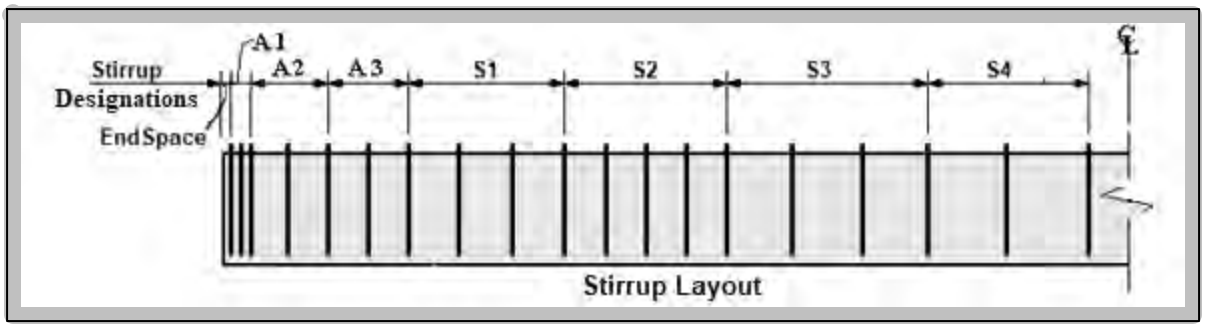
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 142 \\ 150 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 140.8 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 1022 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

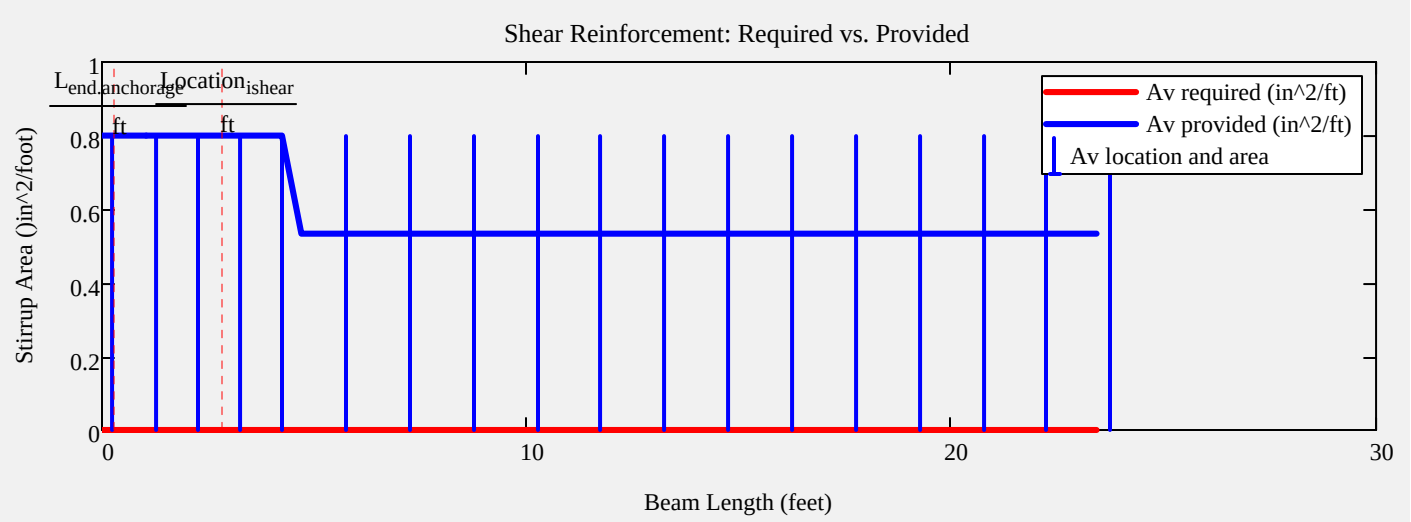
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.87\ ft$

Save Data File

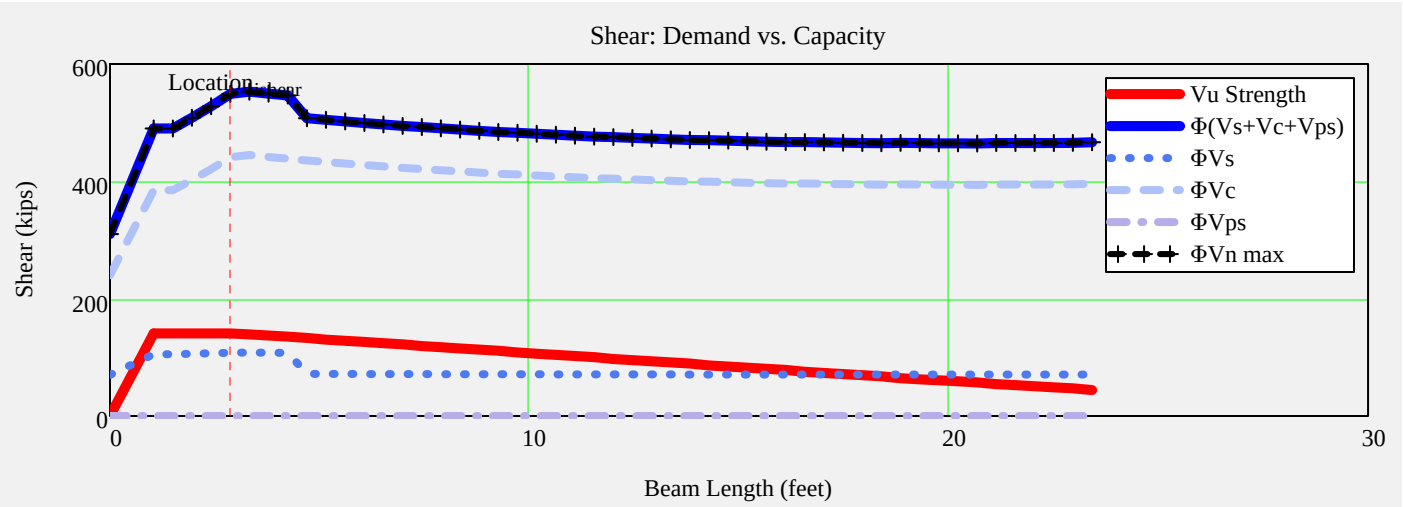
Use current input file

File Name FSB-48ftSpan-15inx56in_ExtBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

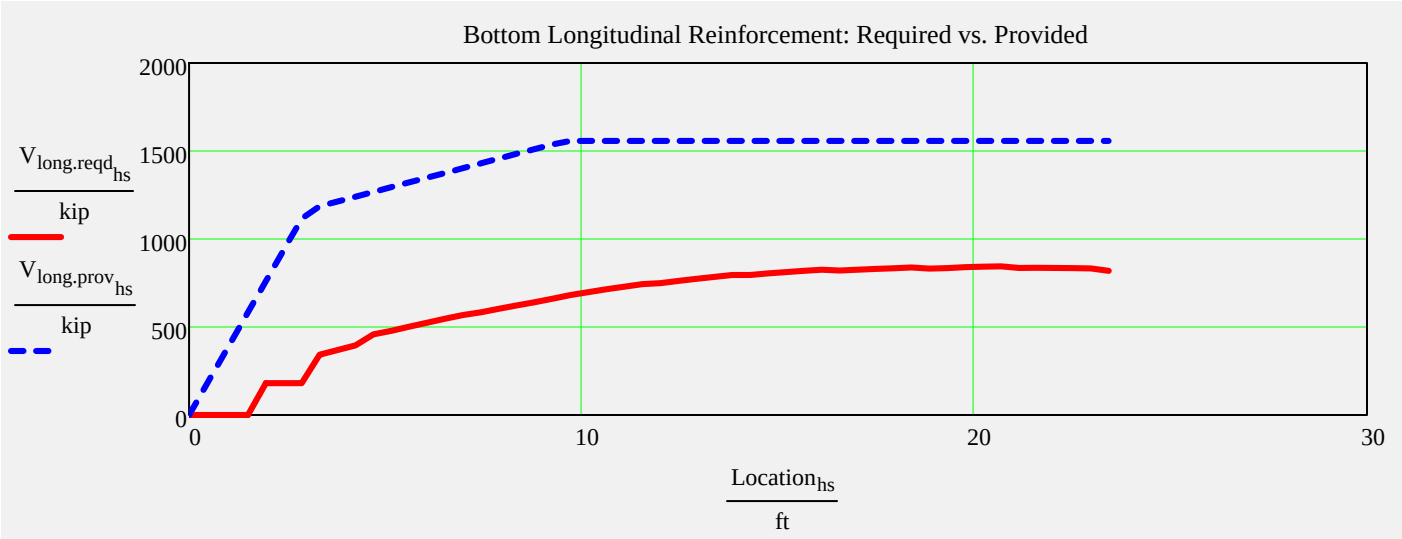
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.70 & 133.22 & 507.42 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.26$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

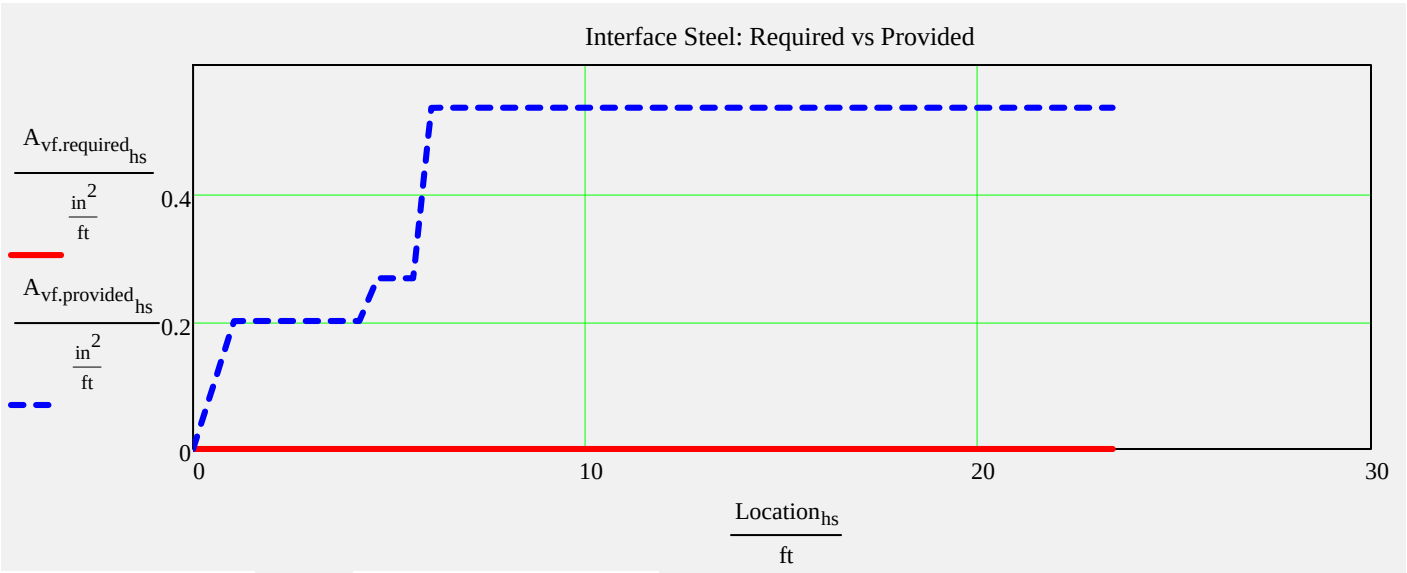


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 20.7 & 844.8 & 1557.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.54$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 10.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

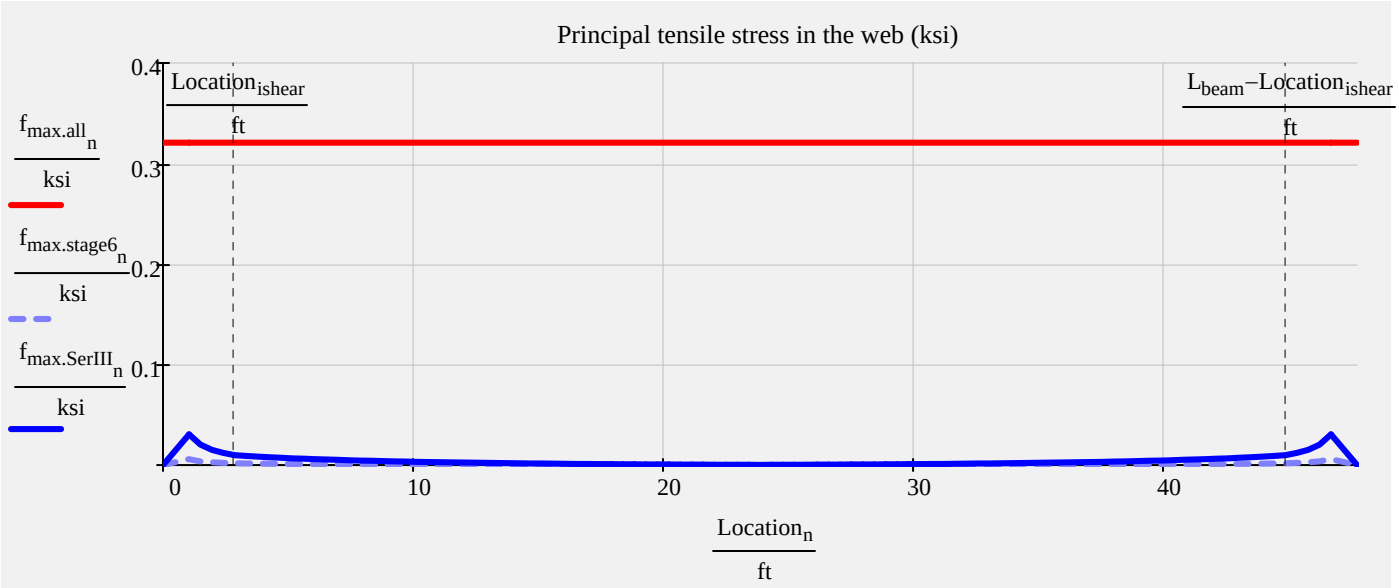
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 34.4 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

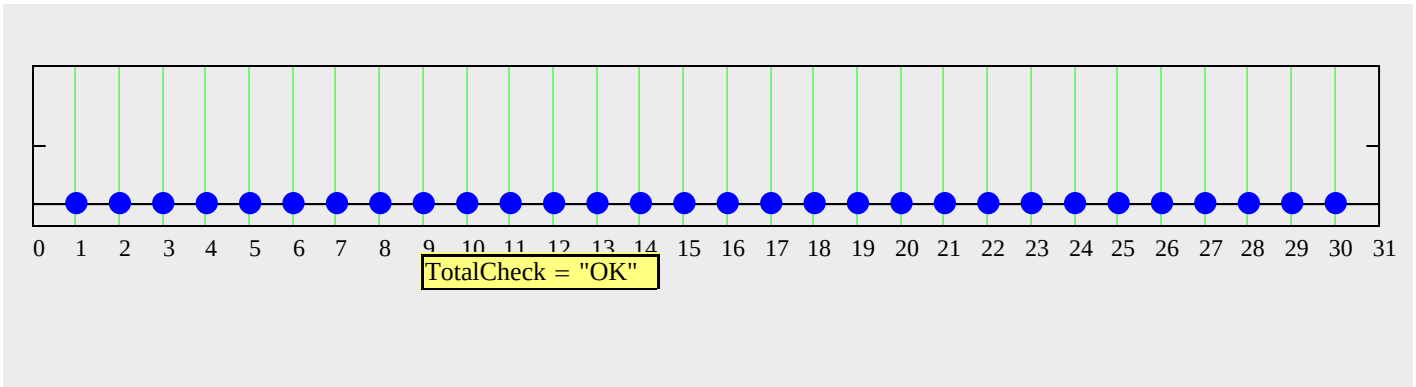
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.37	2.42	"N/A"	24.20	0.65	5.18	"N/A"	3.65	HL-93
"Strength I (Op)"	0.37	3.13	"N/A"	21.46	0.65	6.72	"N/A"	3.65	HL-93
"Service III (Inv)"	0.37	2.58	"N/A"	21.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.37	2.76	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.37	2.31	138.42	21.46	0.65	4.74	284.27	3.65	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.50$ $DC_{LongReinf.Permit} = 0.54$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1856	"factored resistance (kip-ft)...."
"γDL"	447	"factored dead load (kip-ft)...."
"γLL"	450	"factored live load (kip-ft)....."
"RF"	3.13	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	509.7	"factored resistance (kip)....."
"γDL"	33.1	"factored dead load (kip)....."
"γLL"	70.9	"factored live load (kip)....."
"RF"	6.72	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 48 FEET (NO SKEW)
WESTBOUND BRIDGE
(PARKER CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\WB 48' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-48ftSpan-15inx56in_15SkewExtBeam.dat
FSB-48ftSpan-15inx56in_15SkewIntBeam.dat
FSB-48ftSpan-15inx56in_ExtBeam.dat
FSB-48ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

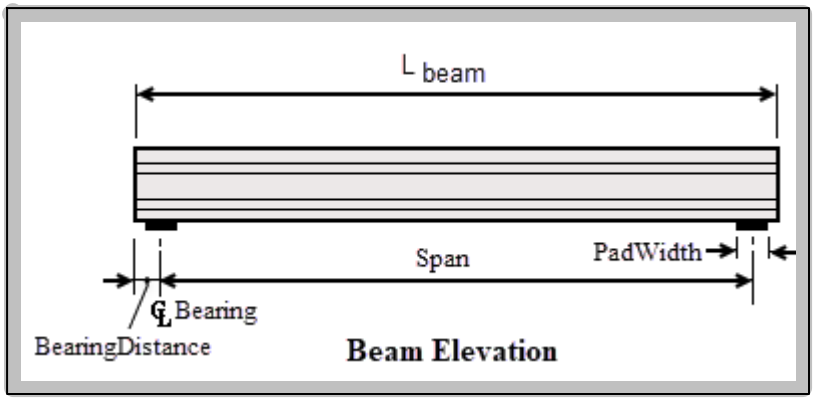
InputDataFile = "FSB-48ftSpan-15inx56in_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



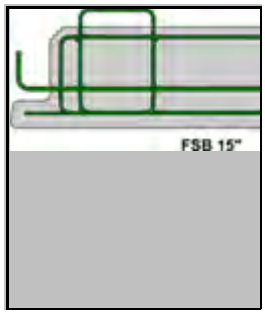
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-48ftSpan-15inx56in_IntBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	47.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

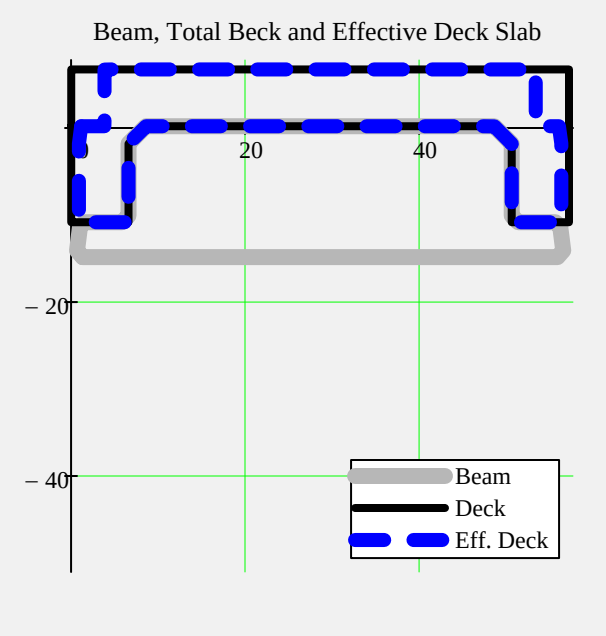
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 57.14 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 0.57 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 47.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

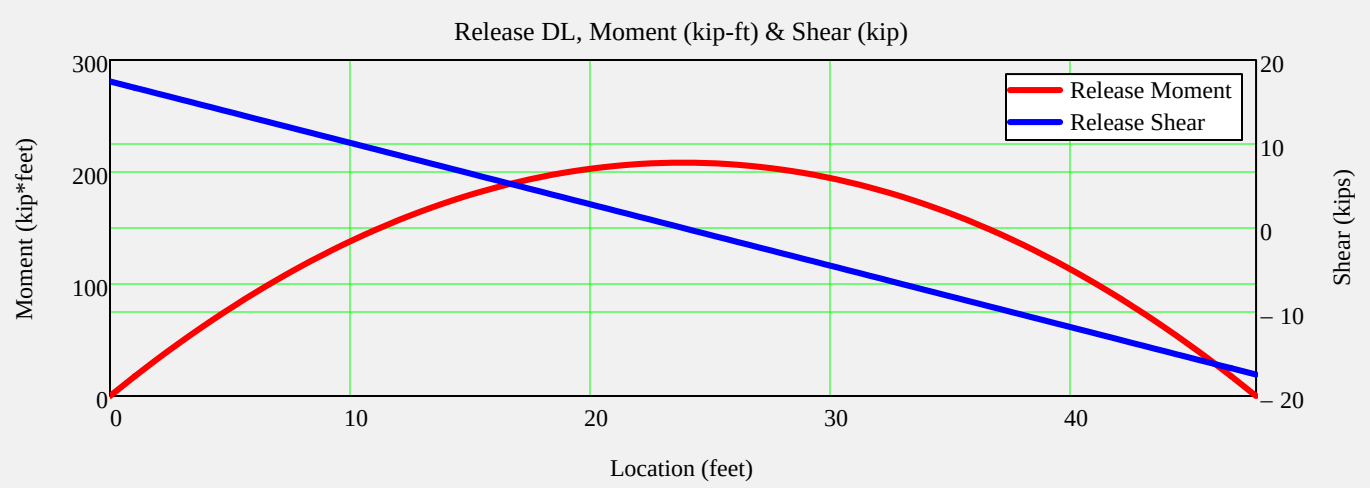
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

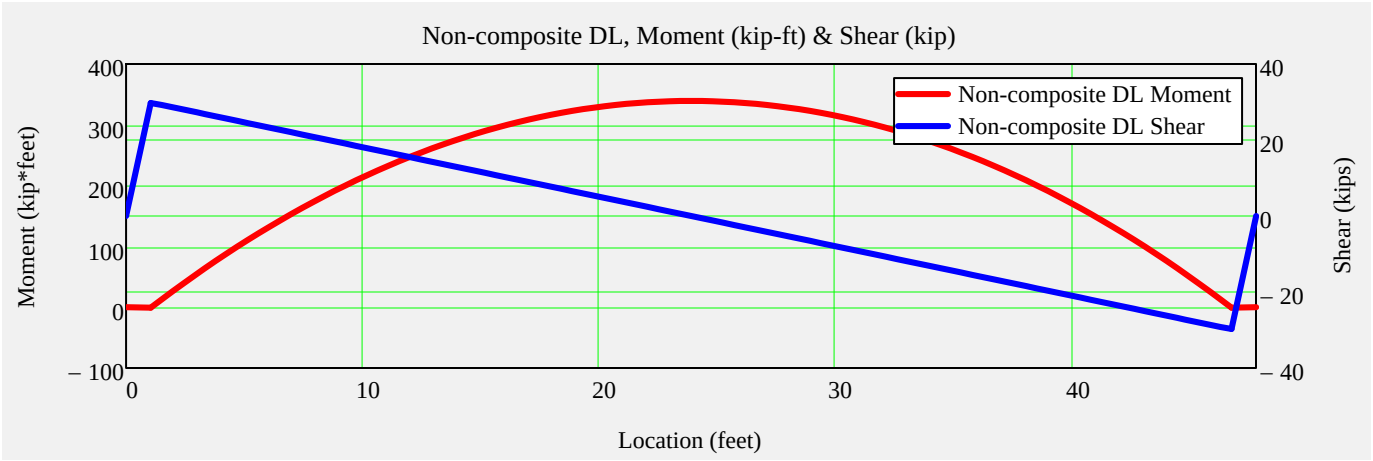
Release Dead Load Moments and Shears

$L_{span} = 45.67\ ft$



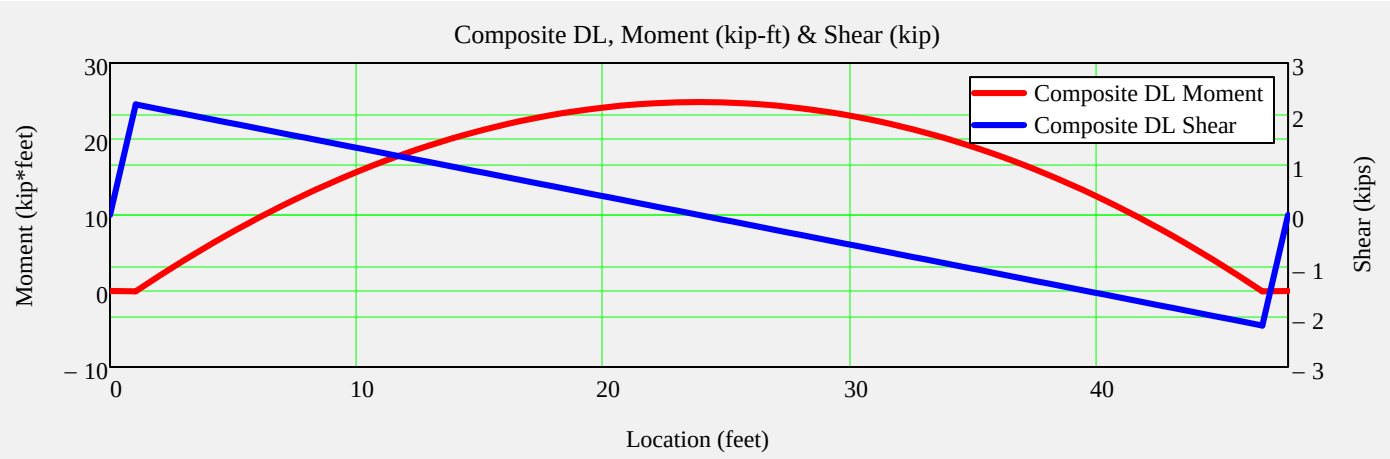
$\max(V_{release}) = 17.5 \cdot kip$ $\max(M_{release}) = 208.3 \cdot kip \cdot ft$ $\min(V_{release}) = -17.5 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 29.7 \cdot kip$ $\max(M_{dl.non.comp}) = 339.2 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -29.7 \cdot kip$

Composite Dead Load Moments and Shear



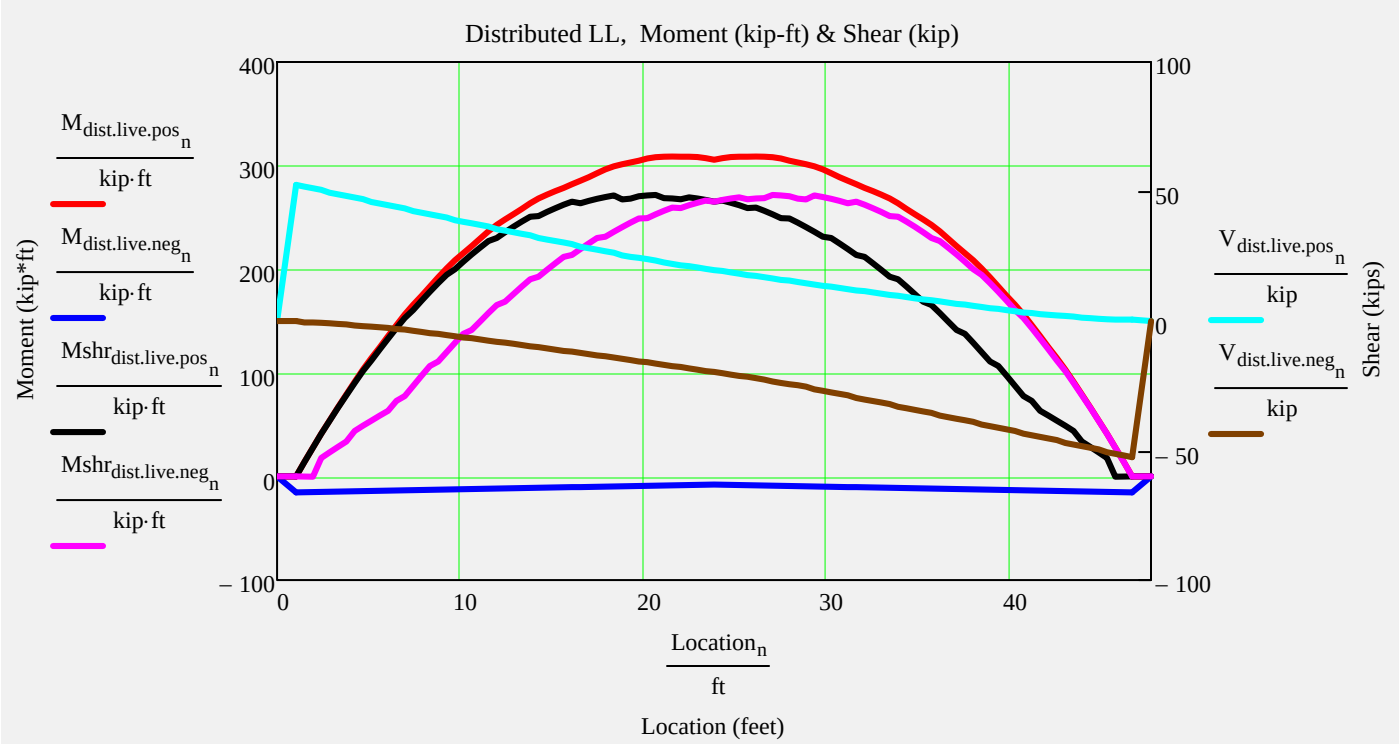
$\max(V_{dl.comp}) = 2.2 \cdot kip$ $\max(M_{dl.comp}) = 24.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.2 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 45.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.34$ $g_{mom.fatigue} = 0.19$ $g_{shear} = 0.58$



$\max(V_{dist.live.pos}) = 52.5 \cdot kip$

$\max(M_{dist.live.pos}) = 308.7 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -52.5 \cdot kip$

$Reaction_{LL} = 54.5 \cdot kip$

$\min(M_{dist.live.neg}) = -15.4 \cdot kip \cdot ft$

$Reaction_{DL} = 33.4 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 272 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions... without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{truck} = 58.93 \cdot kip$ $Reaction_{lane} = 15.28 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 43.2 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-48ftSpan-15inx56in_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

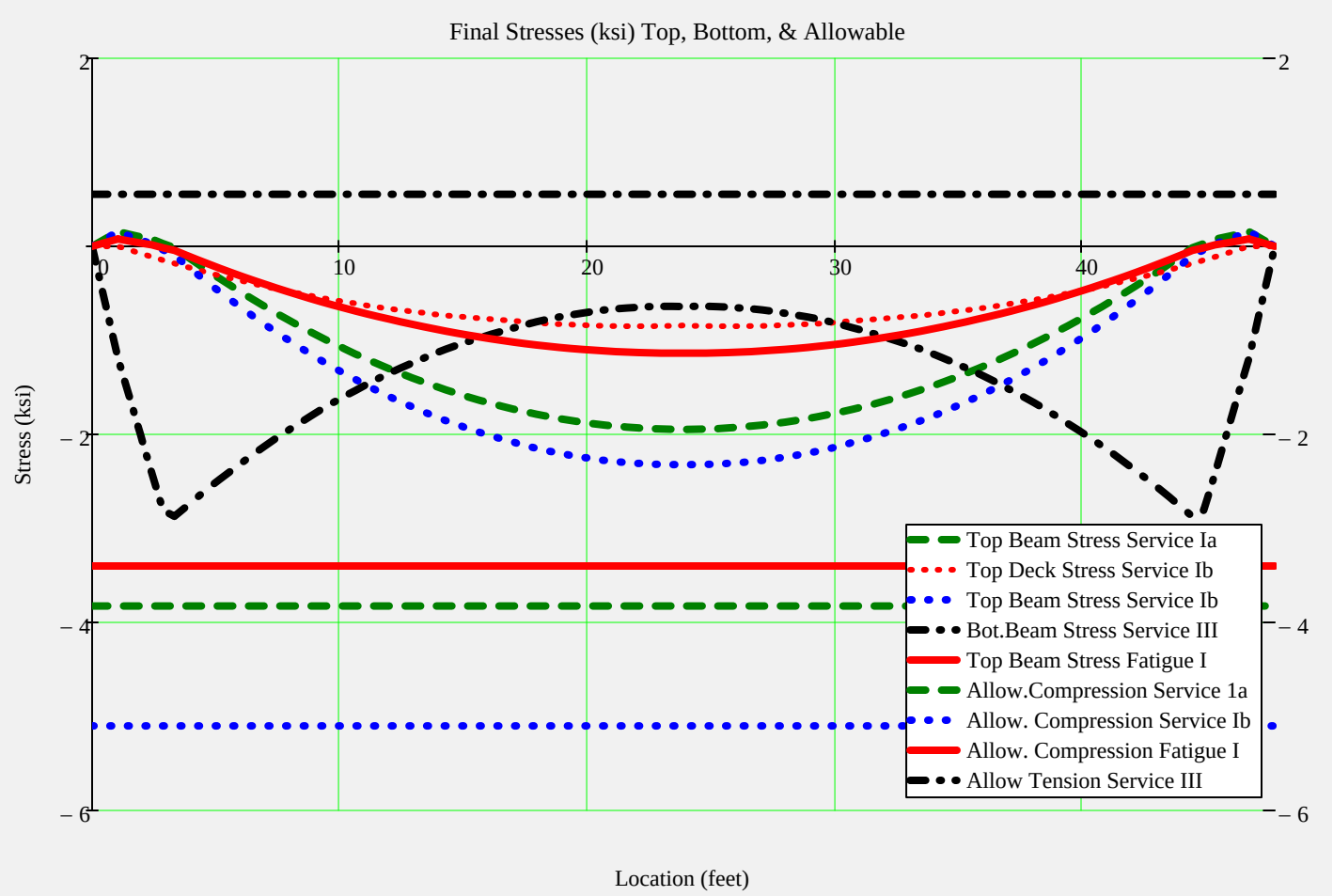
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

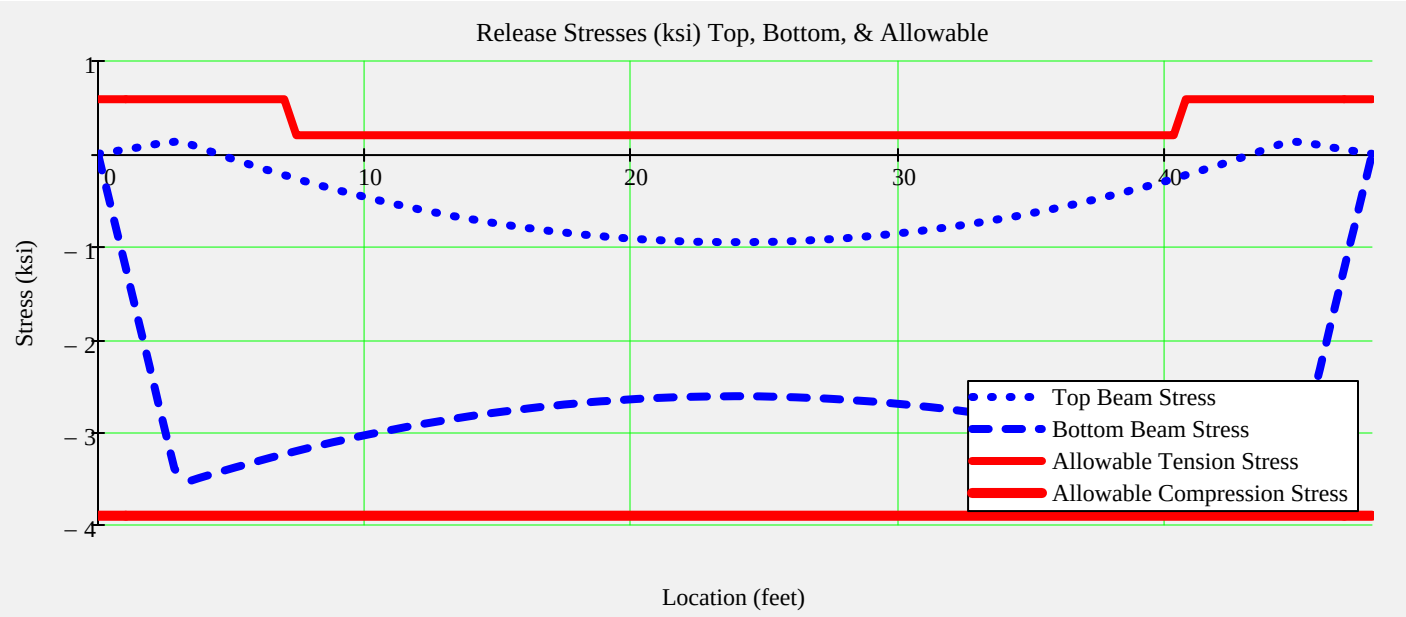
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.70$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.91$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.51$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.46$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.33$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.87	0.13	0.59
"Compression @ Release"	3.32	–3.54	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	23.88	–1.95	–3.83
"CompressionIb @ ServiceI"	24.33	–2.32	–5.10
"Compression @ FatigueI"	23.88	–1.14	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

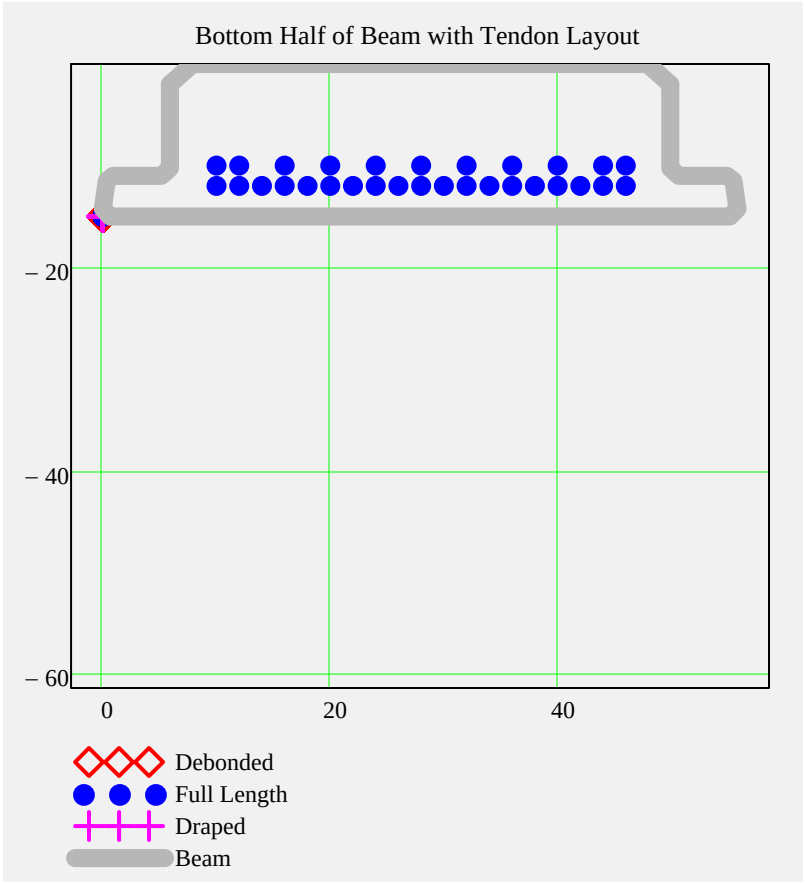
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

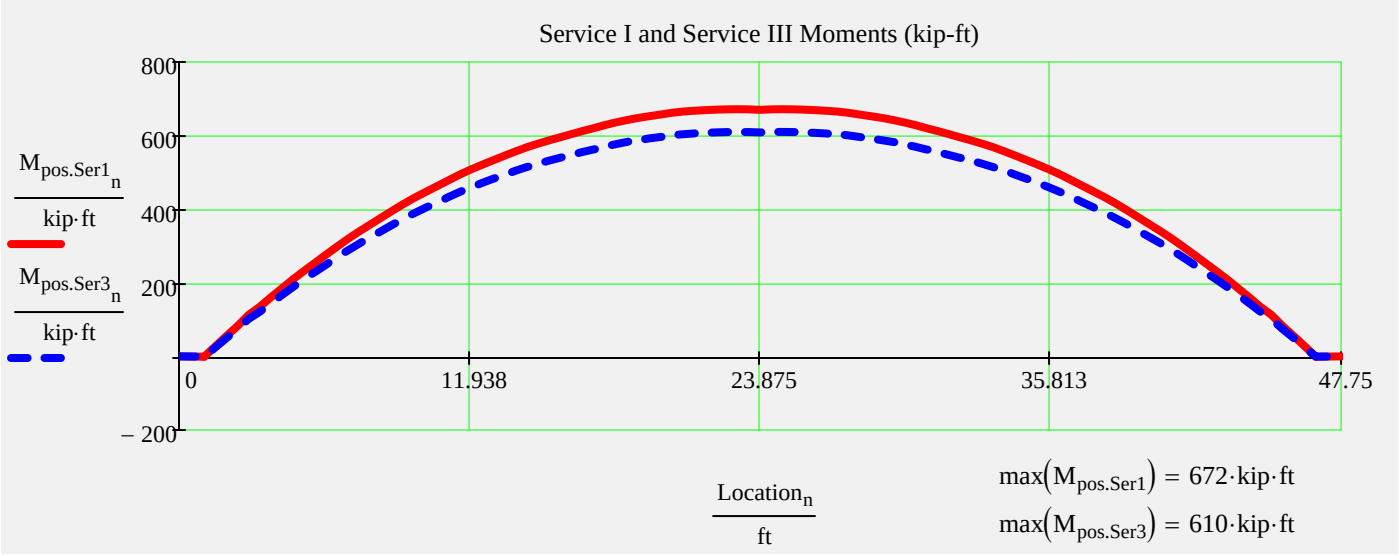
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.95 & -2.61 \\ \text{"2"} & -1.01 & -2.17 \\ \text{"4"} & -0.88 & -2.28 \\ \text{"6"} & -1.92 & -1.38 \\ \text{"8"} & -2.32 & -0.64 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1189.7	45382	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	208
"Non-Composite DL (incl. beam wt.)"	339
"Composite Dead Load"	25
"Distributed Live Load"	306

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

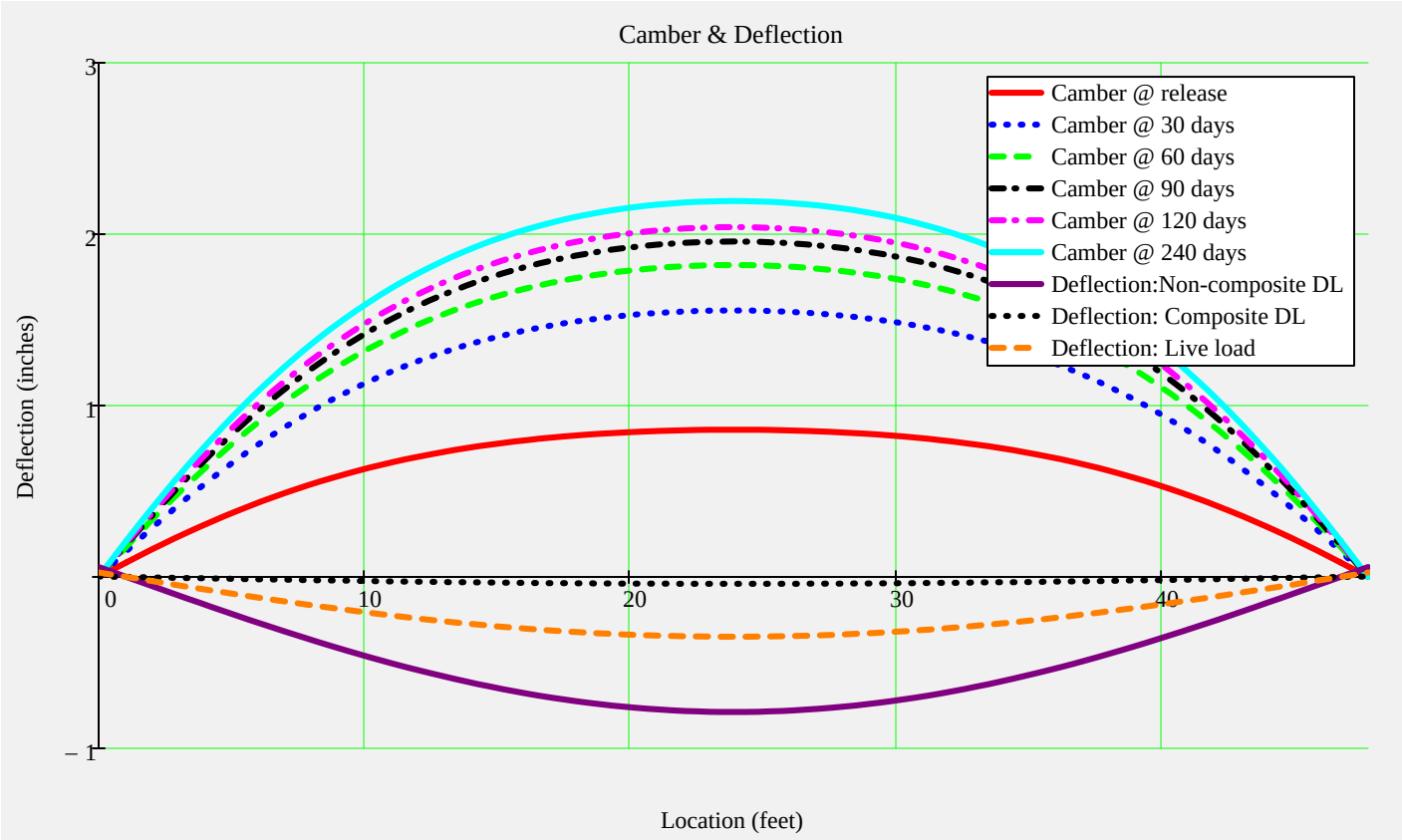
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 45.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.06	–0.35	0.40	0.86
"30 Days"	–0.19	–0.66	0.70	1.55
"60 Days"	–0.23	–0.77	0.82	1.82
"90 Days"	–0.26	–0.83	0.88	1.96
"120 Days"	–0.27	–0.87	0.92	2.04
"240 Days"	–0.30	–0.93	0.99	2.19
"Non-comp DL"	–0.07	0.06	–0.26	–0.79
"Comp DL"	–0.00	0.00	–0.01	–0.04
"LL"	–0.02	0.04	–0.12	–0.35

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.21 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

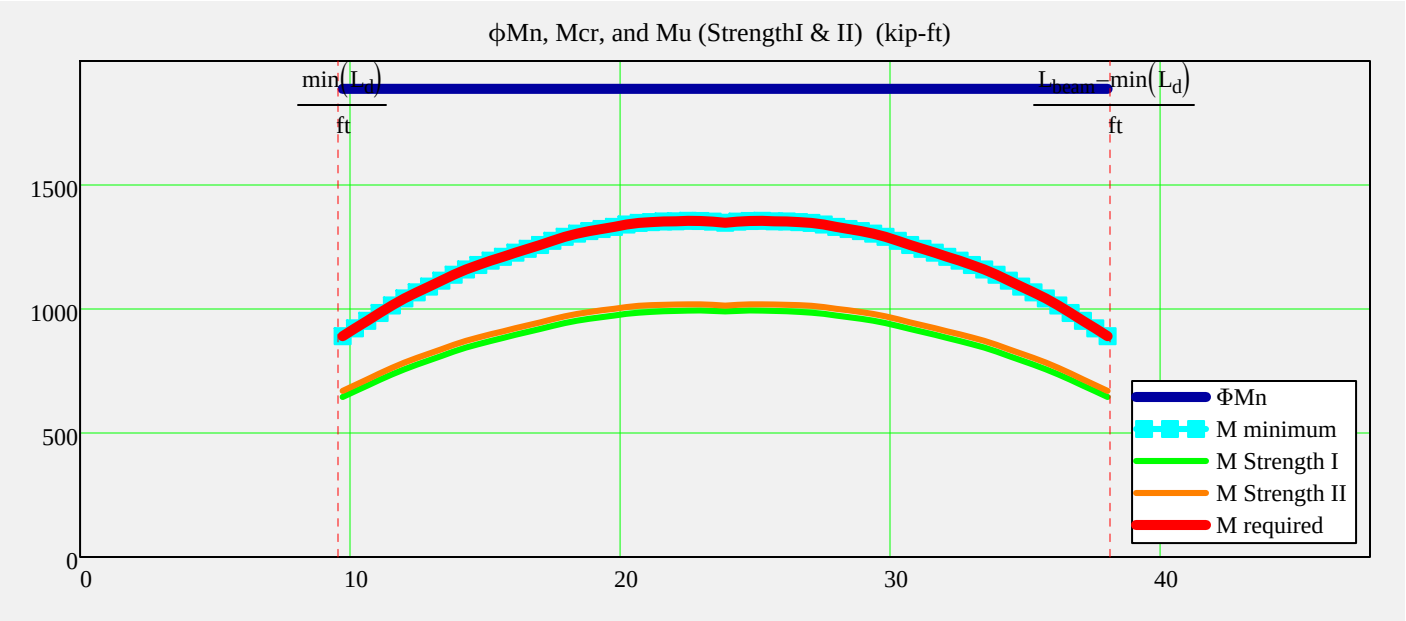
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 1019 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1348 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1348 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1888 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 38.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.72$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

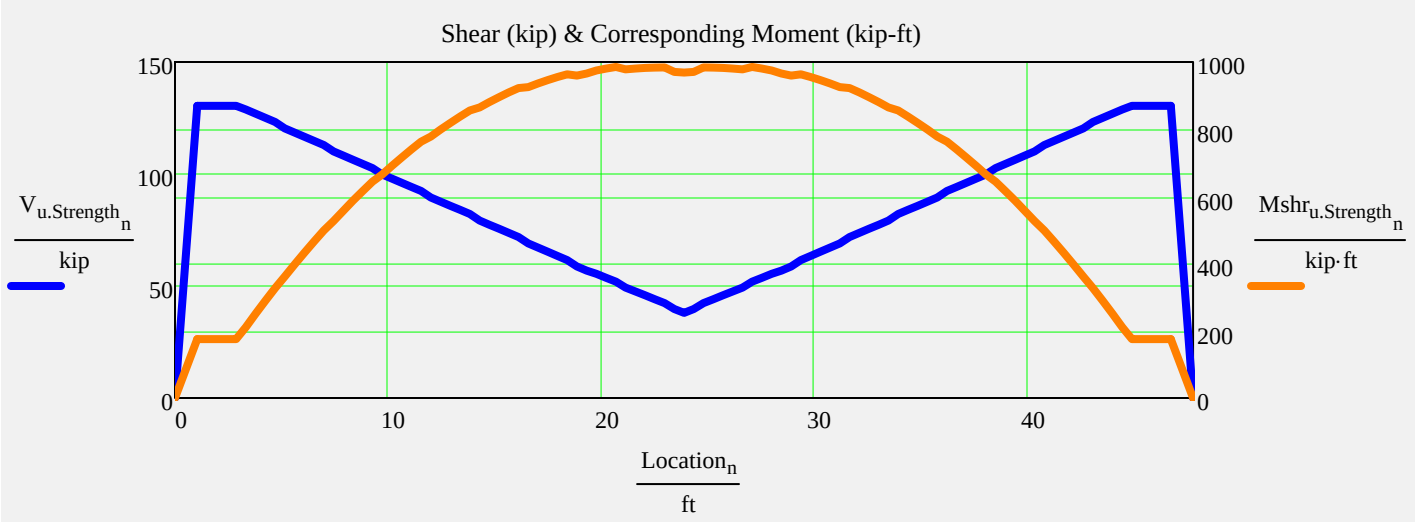
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

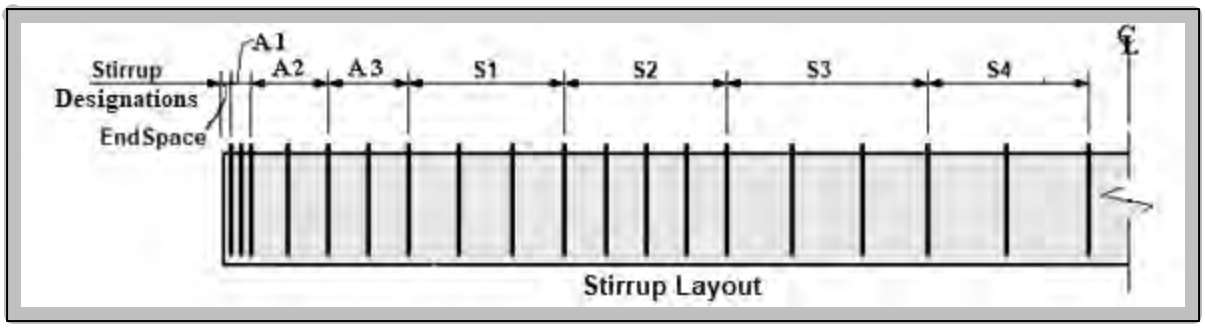
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 132 \\ 139 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 130.4 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 985 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

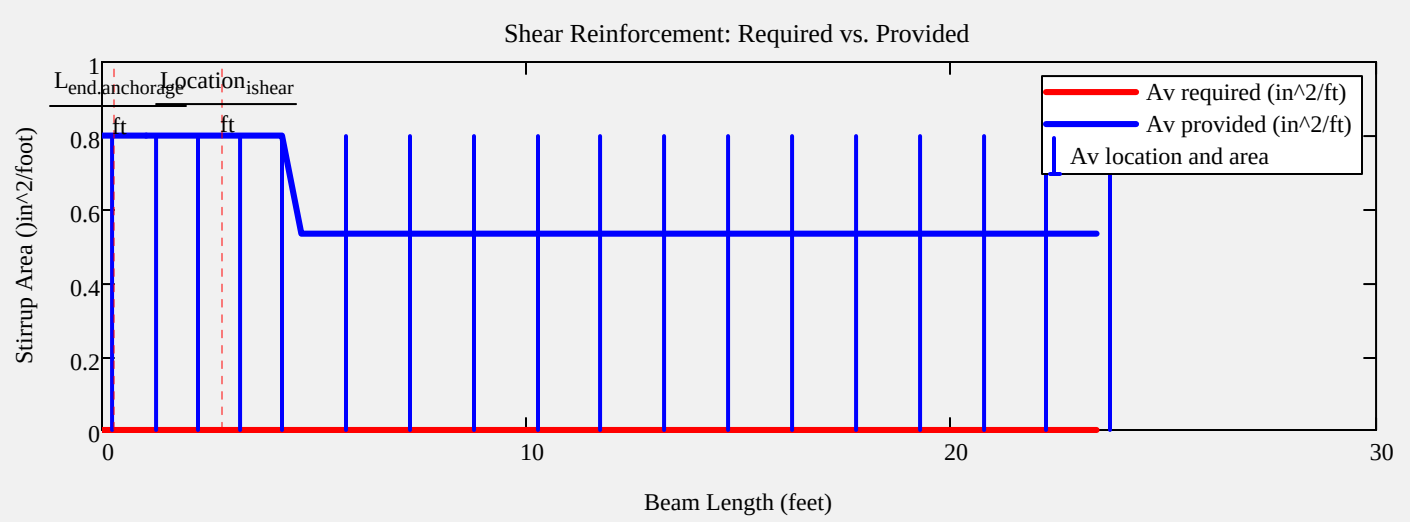
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.87\ ft$

Save Data File

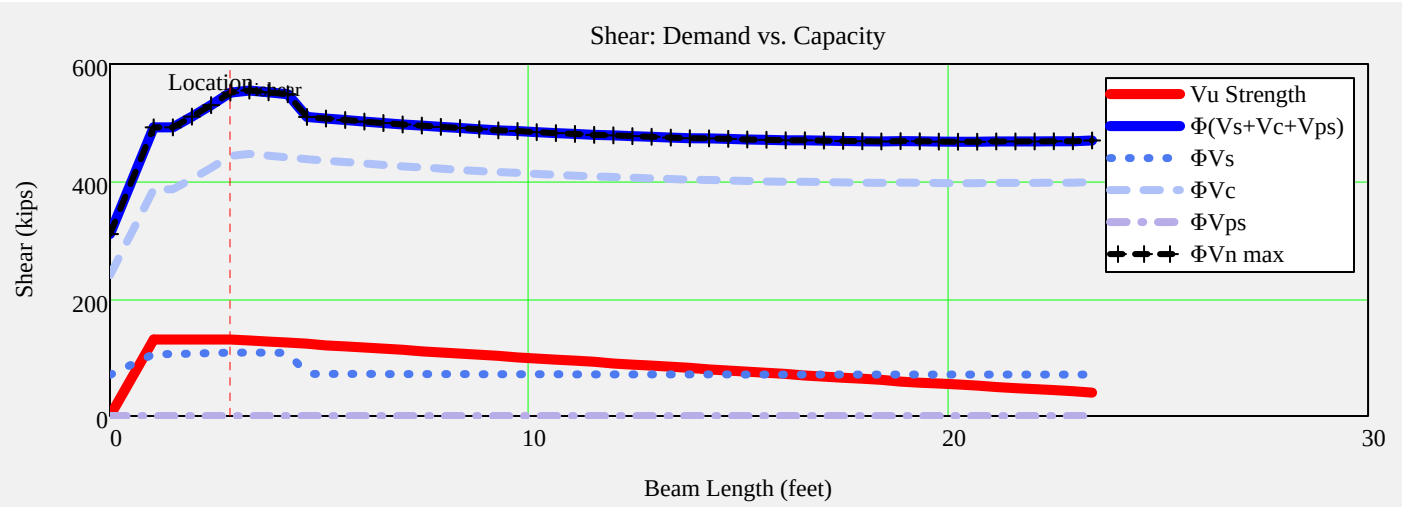
Use current input file

File Name FSB-48ftSpan-15inx56in_IntBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

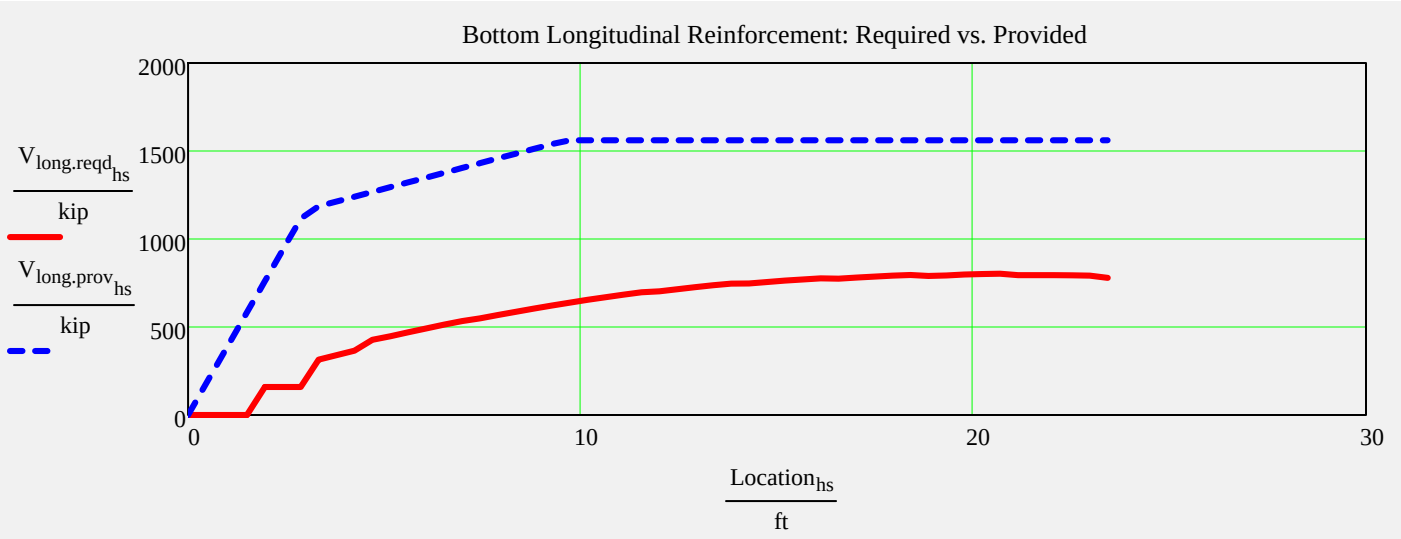
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.70 & 123.24 & 509.63 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.24$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

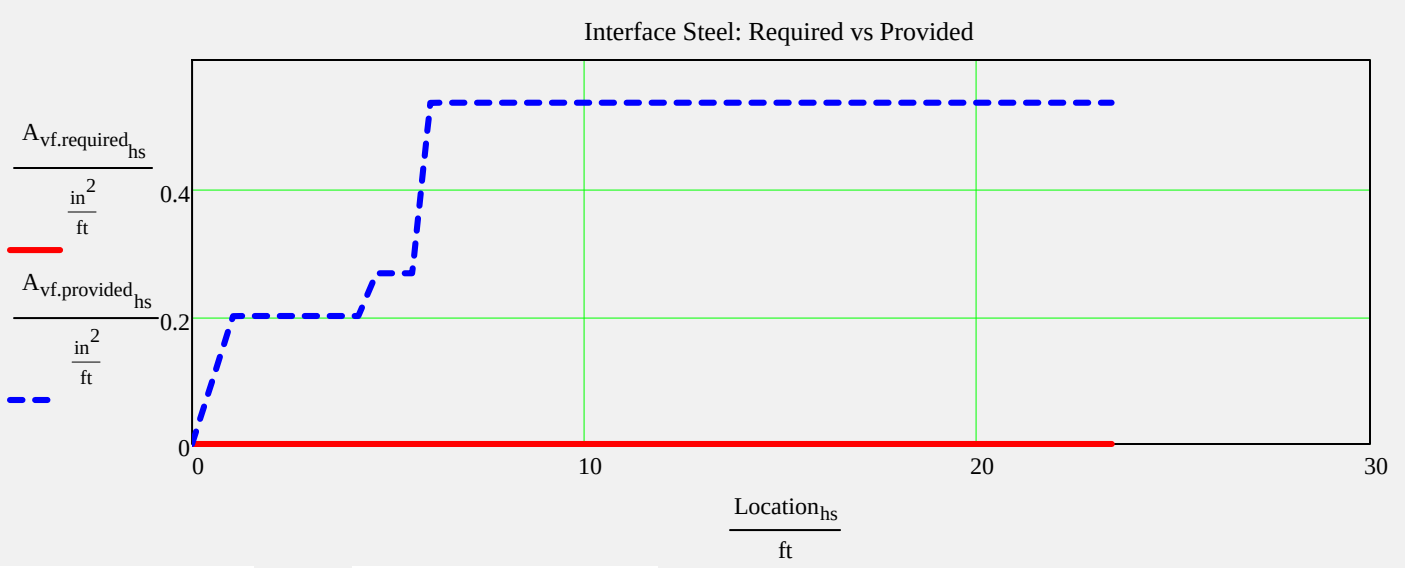


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 20.7 & 802.6 & 1560.5 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.51$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 10.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

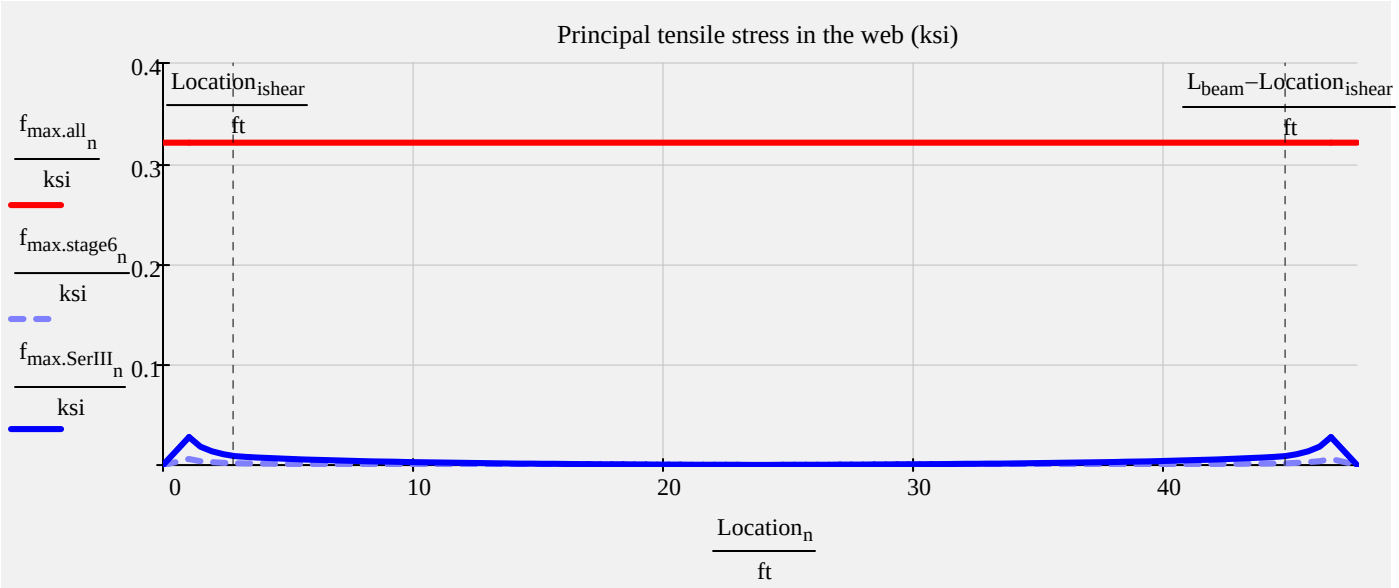
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 34.4 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

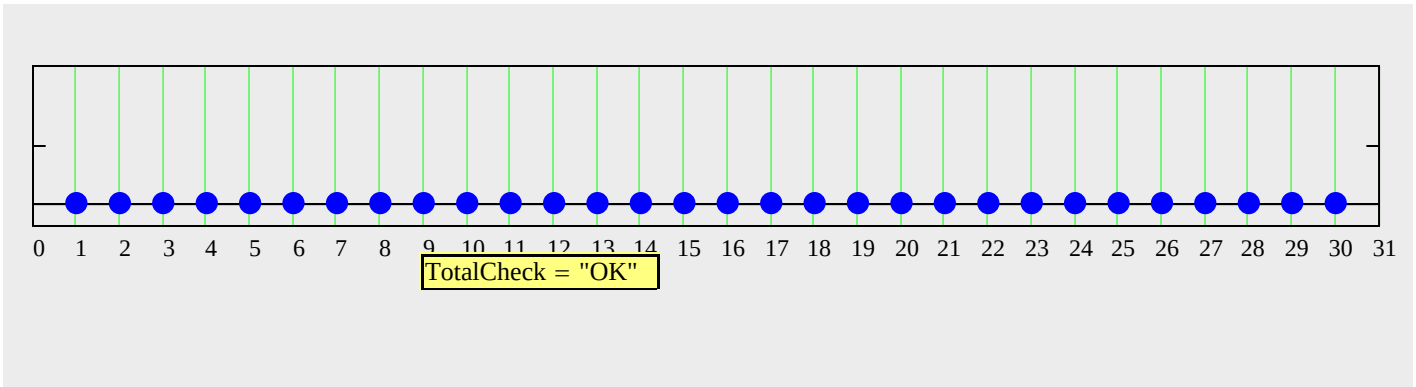
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.34	2.66	"N/A"	24.20	0.58	5.81	"N/A"	3.65	HL-93
"Strength I (Op)"	0.34	3.44	"N/A"	24.20	0.58	7.53	"N/A"	3.65	HL-93
"Service III (Inv)"	0.34	2.76	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.34	2.96	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.34	2.54	152.17	24.20	0.58	5.31	318.59	3.65	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.48$ $DC_{LongReinf.Permit} = 0.51$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1888	"factored resistance (kip-ft)...."
"γDL"	453	"factored dead load (kip-ft)...."
"γLL"	417	"factored live load (kip-ft)....."
"RF"	3.44	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	511.8	"factored resistance (kip)....."
"γDL"	33.6	"factored dead load (kip)....."
"γLL"	63.5	"factored live load (kip)....."
"RF"	7.53	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 48 FEET (15 DEG. SKEW)
WESTBOUND BRIDGE
(MOSSY GULLY & LONG POINT MARSH)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\WB 48' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-48ftSpan-15inx56in_15SkewExtBeam.dat
FSB-48ftSpan-15inx56in_15SkewIntBeam.dat
FSB-48ftSpan-15inx56in_ExtBeam.dat
FSB-48ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

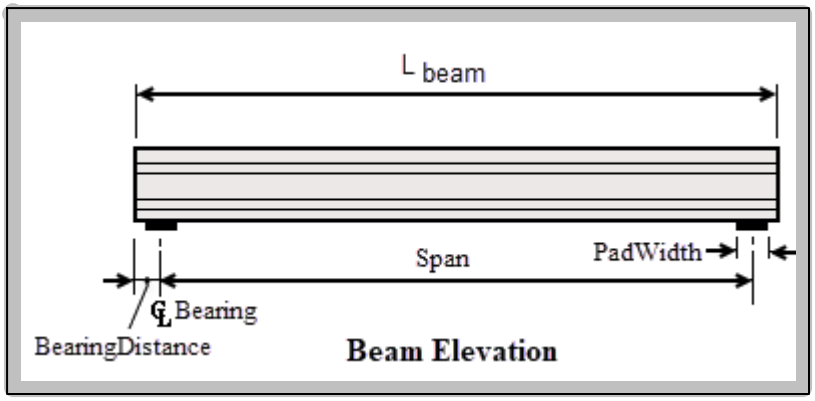
InputDataFile = "FSB-48ftSpan-15inx56in_15SkewExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-48ftSpan-15inx56in_15SkewExtBeam.dat"

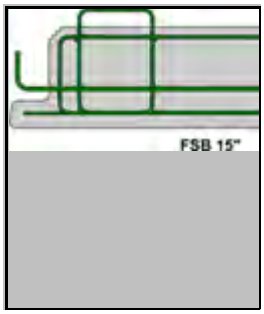
Beam Type

FSB12
FSB15
FSB18

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



L_{beam}	47.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

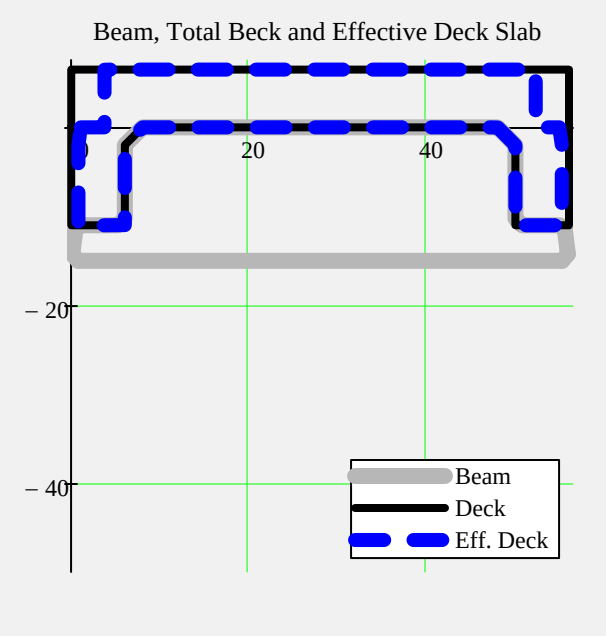
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 56.07 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.55 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 47.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

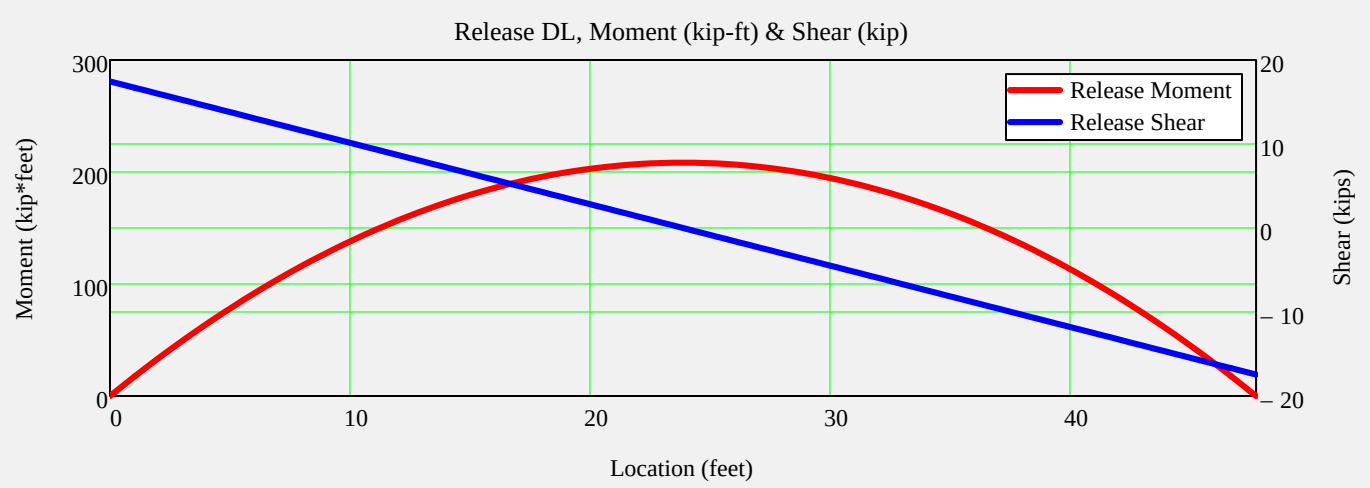
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

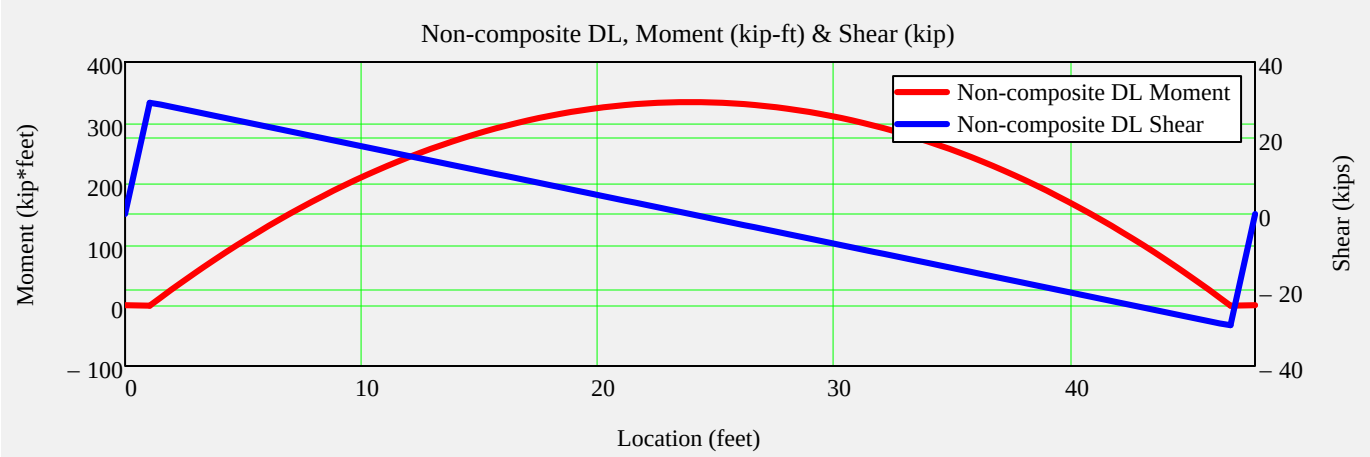
Release Dead Load Moments and Shears

$L_{span} = 45.67\ ft$



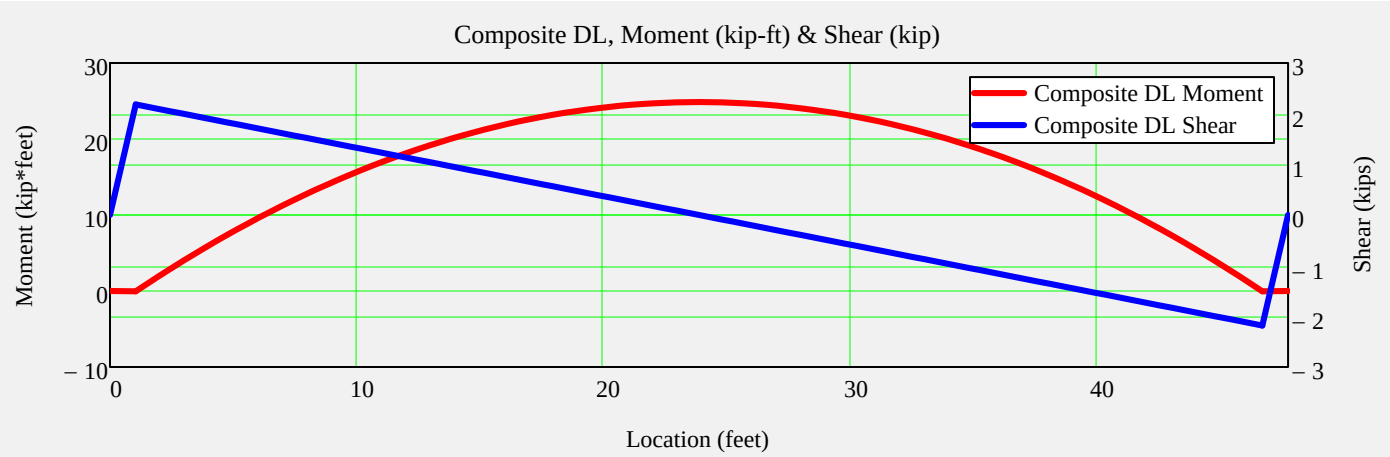
$\max(V_{release}) = 17.5 \cdot kip$ $\max(M_{release}) = 208.3 \cdot kip \cdot ft$ $\min(V_{release}) = -17.5 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 29.3 \cdot kip$ $\max(M_{dl.non.comp}) = 334.0 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -29.3 \cdot kip$

Composite Dead Load Moments and Shear



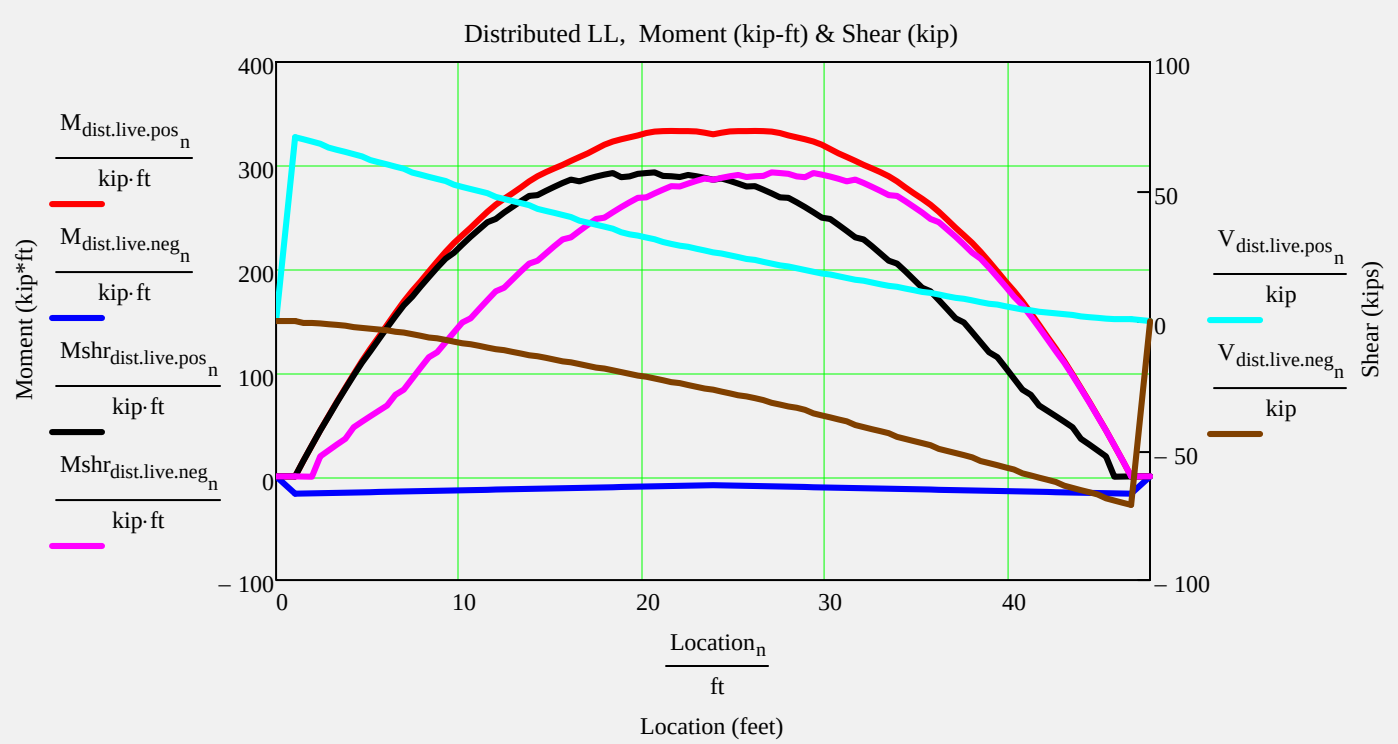
$\max(V_{dl.comp}) = 2.2 \cdot kip$ $\max(M_{dl.comp}) = 24.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.2 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 45.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.21$

Final Live Load Distribution Factors: $g_{mom} = 0.37$ $g_{mom.fatigue} = 0.22$ $g_{shear} = 0.79$



$\max(V_{dist.live.pos}) = 71.0 \cdot kip$ $\max(M_{dist.live.pos}) = 333.4 \cdot kip \cdot ft$ $\min(V_{dist.live.neg}) = -71.0 \cdot kip$

$Reaction_{LL} = 73.7 \cdot kip$ $\min(M_{dist.live.neg}) = -16.6 \cdot kip \cdot ft$

$Reaction_{DL} = 32.9 \cdot kip$ $\max(Mshr_{dist.live.pos}) = 293 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions... without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{truck} = 58.93 \cdot kip$ $Reaction_{lane} = 15.28 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 58.38 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-48ftSpan-15inx56in_15SkewExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

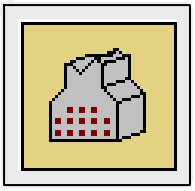
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

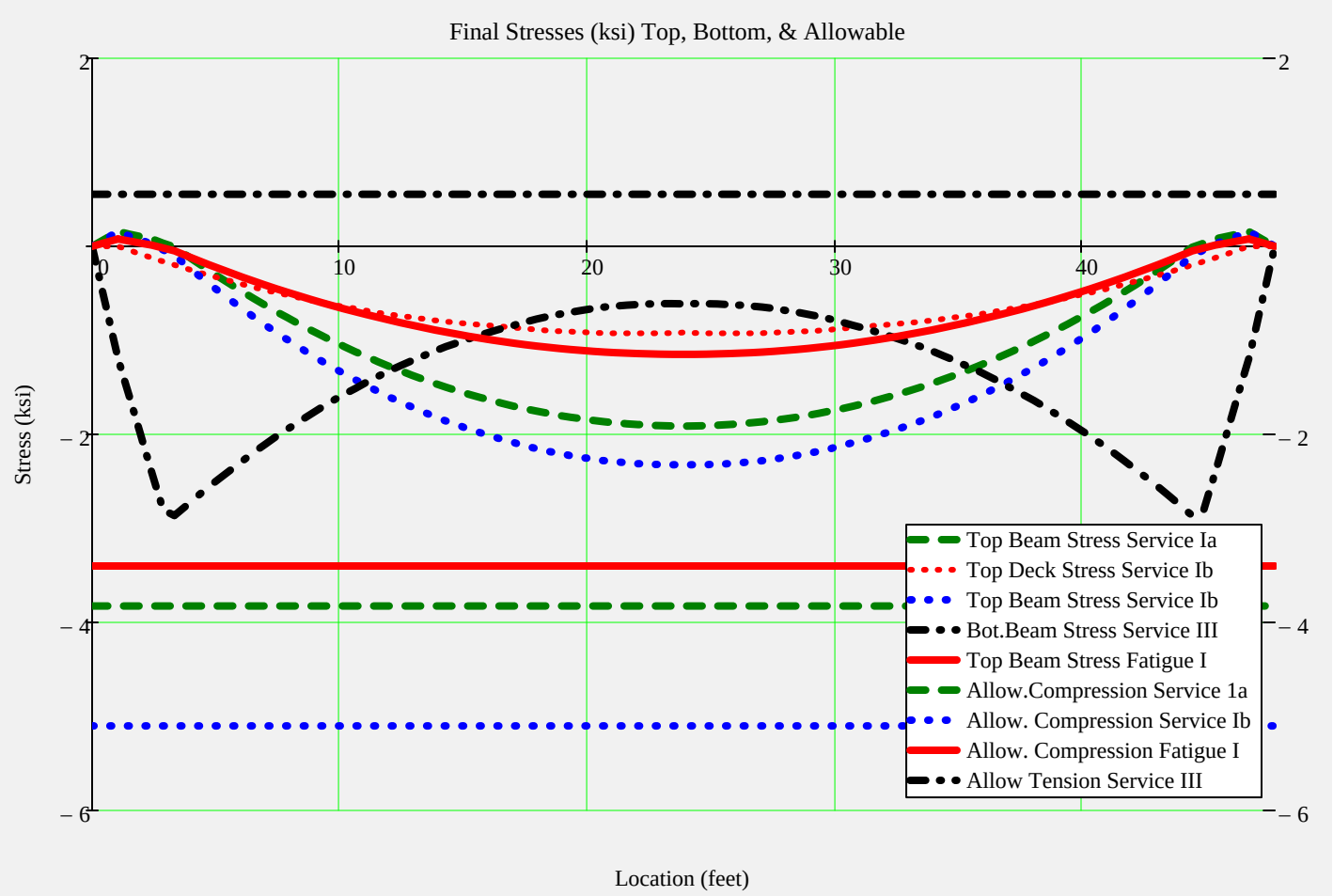
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

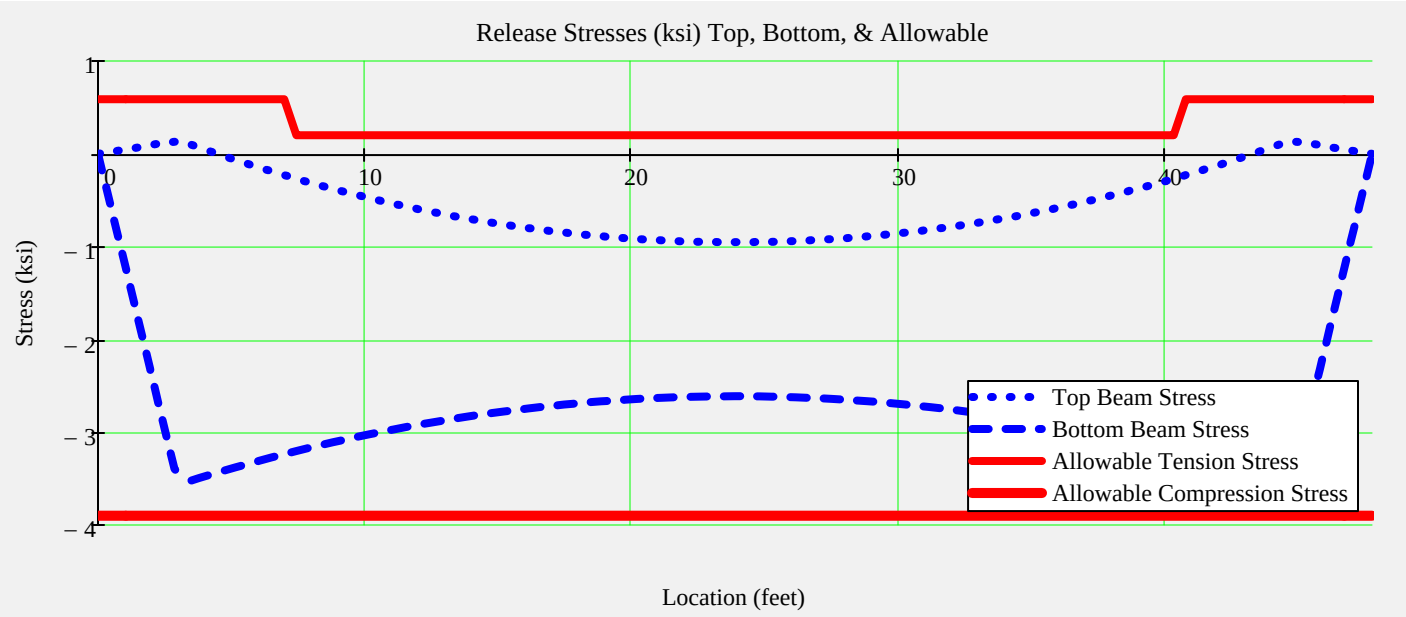
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.70$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.91$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.50$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.46$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.34$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.87	0.13	0.59
"Compression @ Release"	3.32	–3.54	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	23.88	–1.91	–3.83
"CompressionIb @ ServiceI"	24.33	–2.32	–5.10
"Compression @ FatigueI"	23.88	–1.15	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

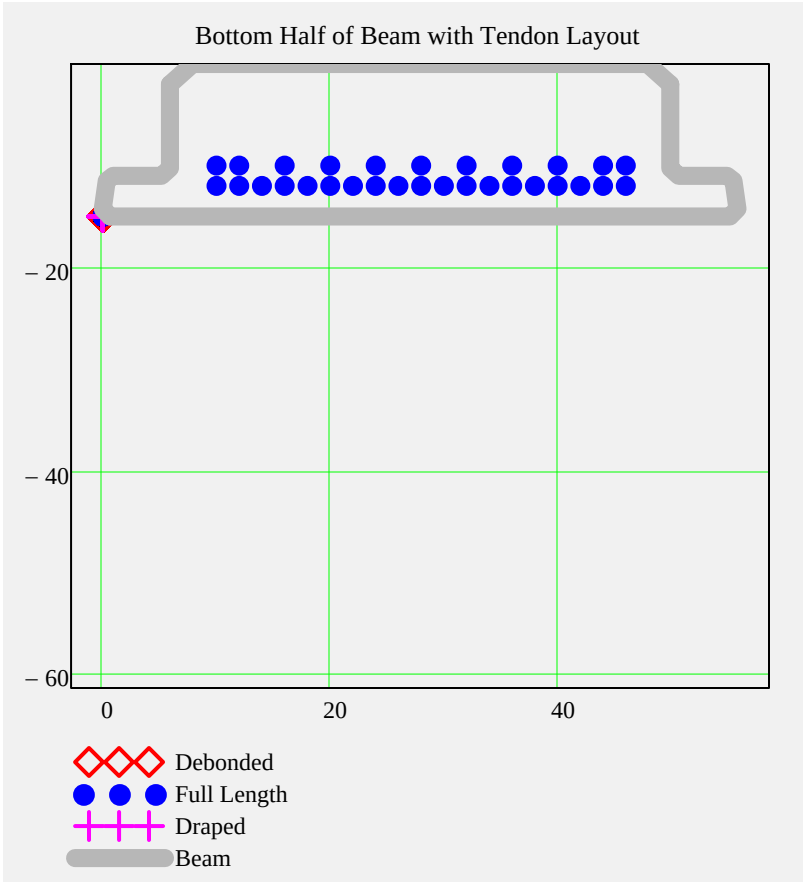
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

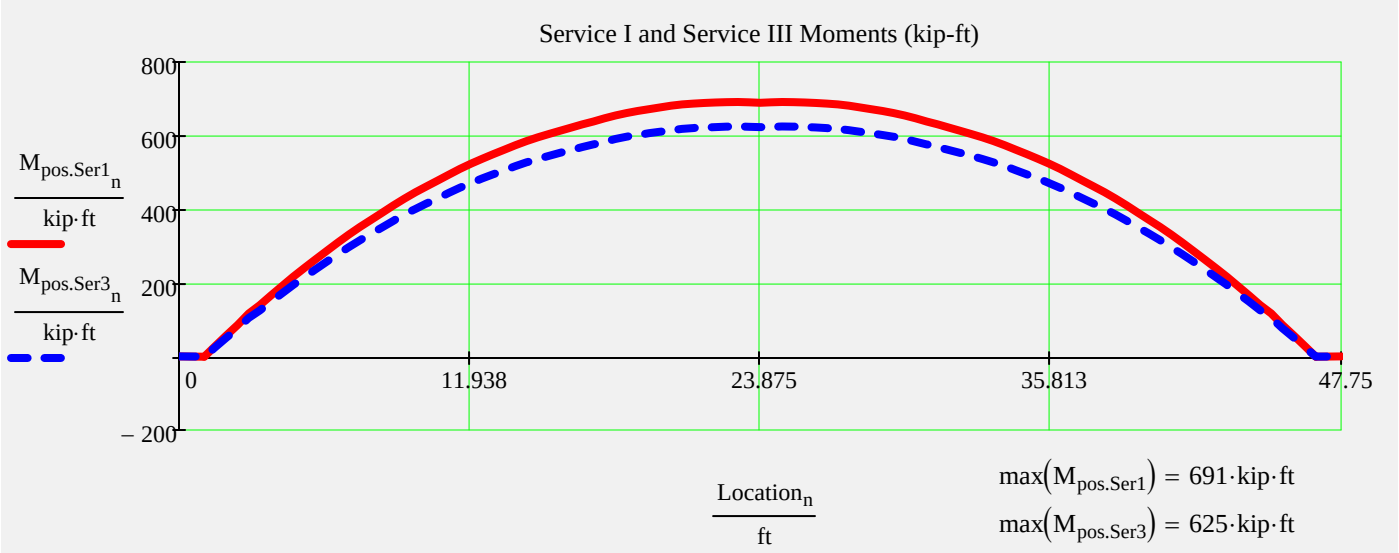
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.95 & -2.61 \\ \text{"2"} & -1.01 & -2.17 \\ \text{"4"} & -0.88 & -2.28 \\ \text{"6"} & -1.88 & -1.41 \\ \text{"8"} & -2.32 & -0.61 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1173.3	44867	–4.7

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	208
"Non-Composite DL (incl. beam wt.)"	334
"Composite Dead Load"	25
"Distributed Live Load"	330

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

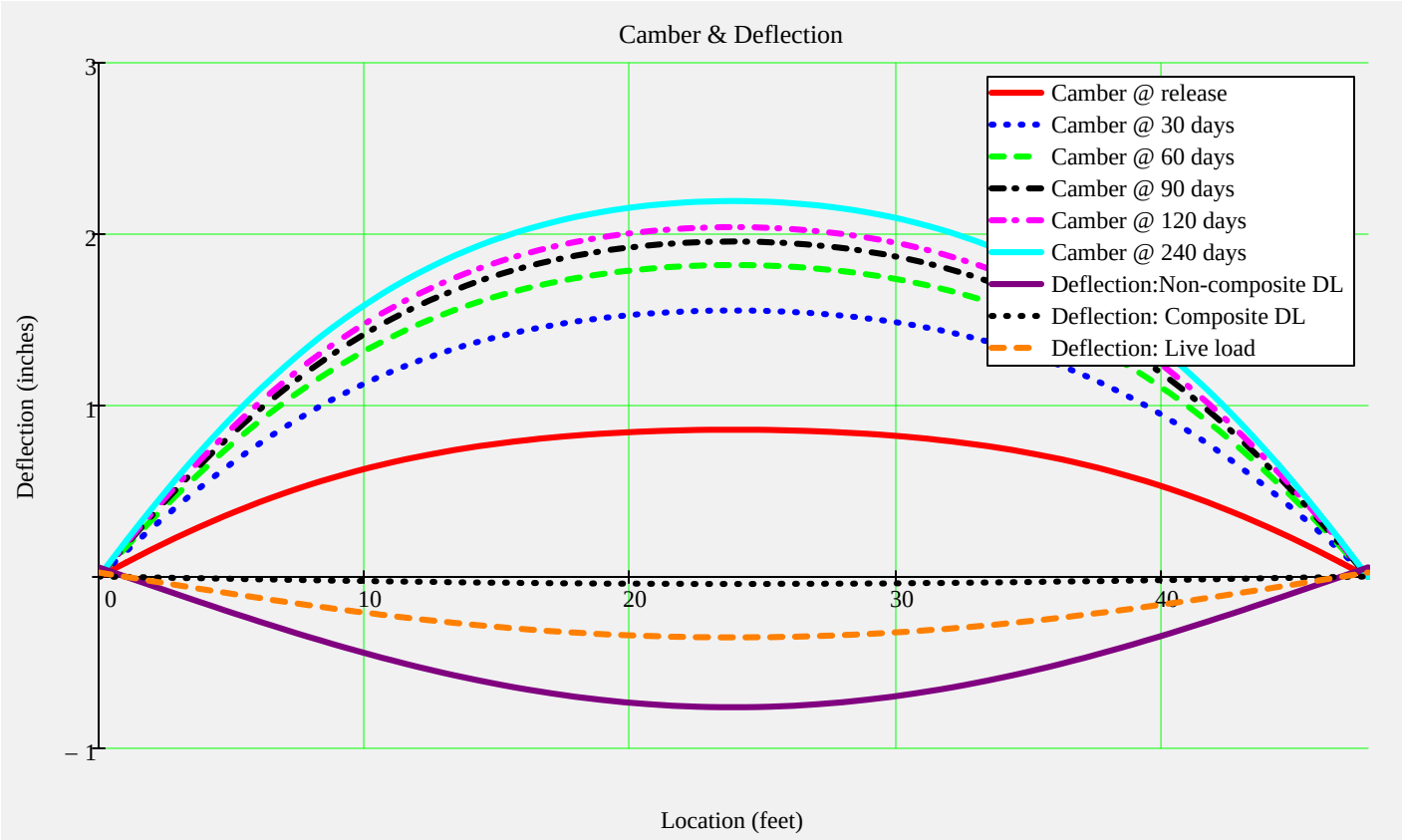
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 45.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.06	–0.35	0.40	0.86
"30 Days"	–0.19	–0.66	0.70	1.55
"60 Days"	–0.23	–0.77	0.82	1.82
"90 Days"	–0.26	–0.83	0.88	1.96
"120 Days"	–0.27	–0.87	0.92	2.04
"240 Days"	–0.30	–0.93	0.99	2.19
"Non-comp DL"	–0.07	0.06	–0.25	–0.76
"Comp DL"	–0.00	0.00	–0.01	–0.04
"LL"	–0.02	0.04	–0.12	–0.35

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.24 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

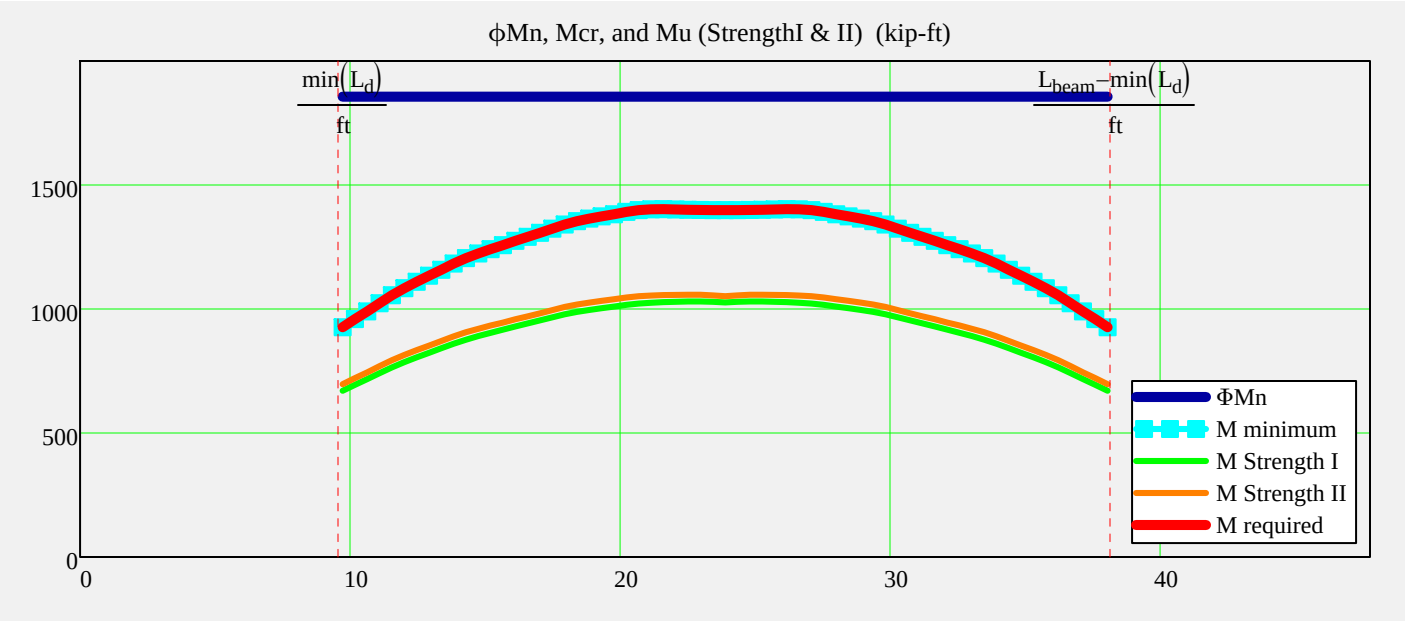
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 1058 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1399 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1399 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1856 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $\quad L_{beam} - \min(L_d) = 38.2\,\text{ft}$

$$DC_{moment_{mn}} := \frac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$$

Demand/Capacity Ratio at locations where all strands are fully developed

$\max(DC_{moment}) = 0.76$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

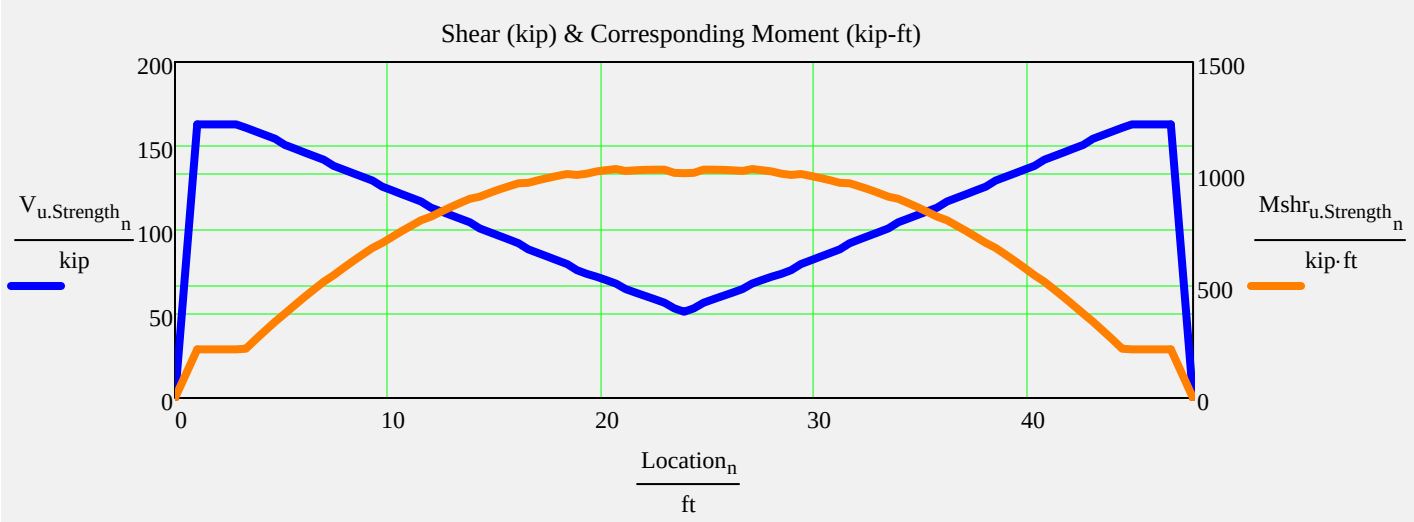
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

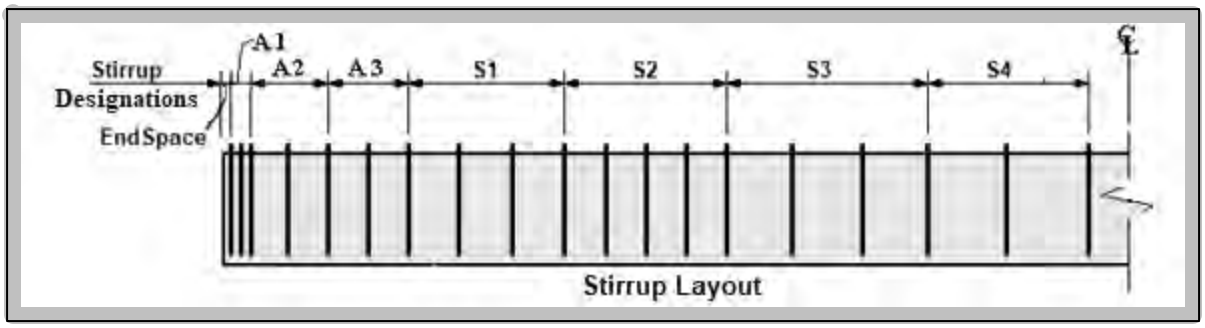
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 164 \\ 173 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 162.8 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 1022 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

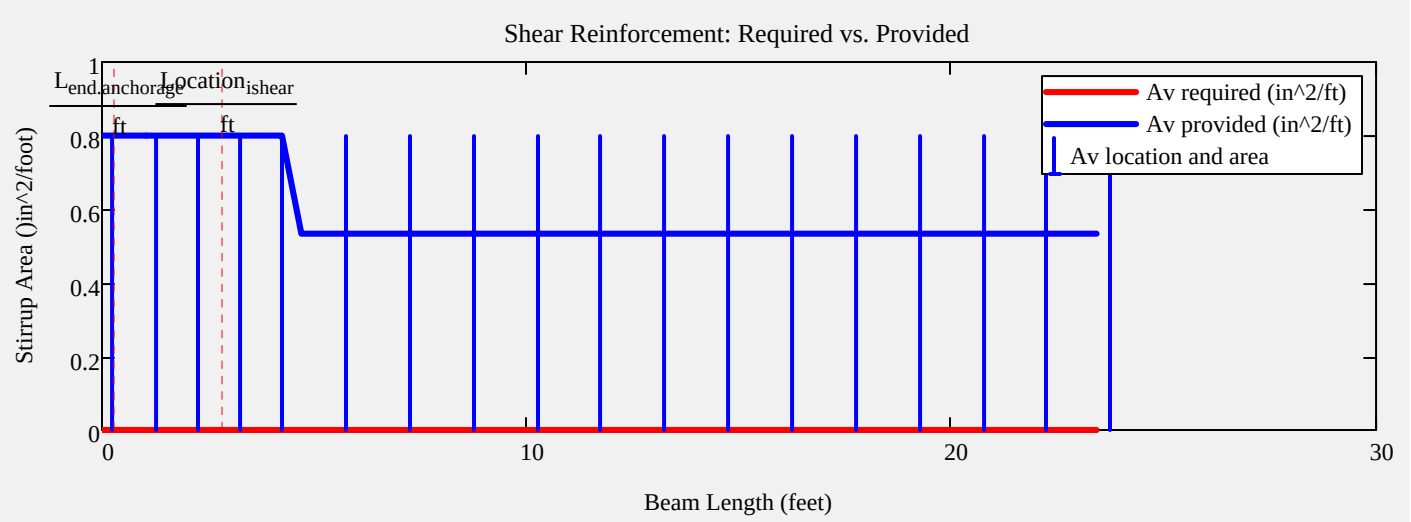
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.87\ ft$

Save Data File

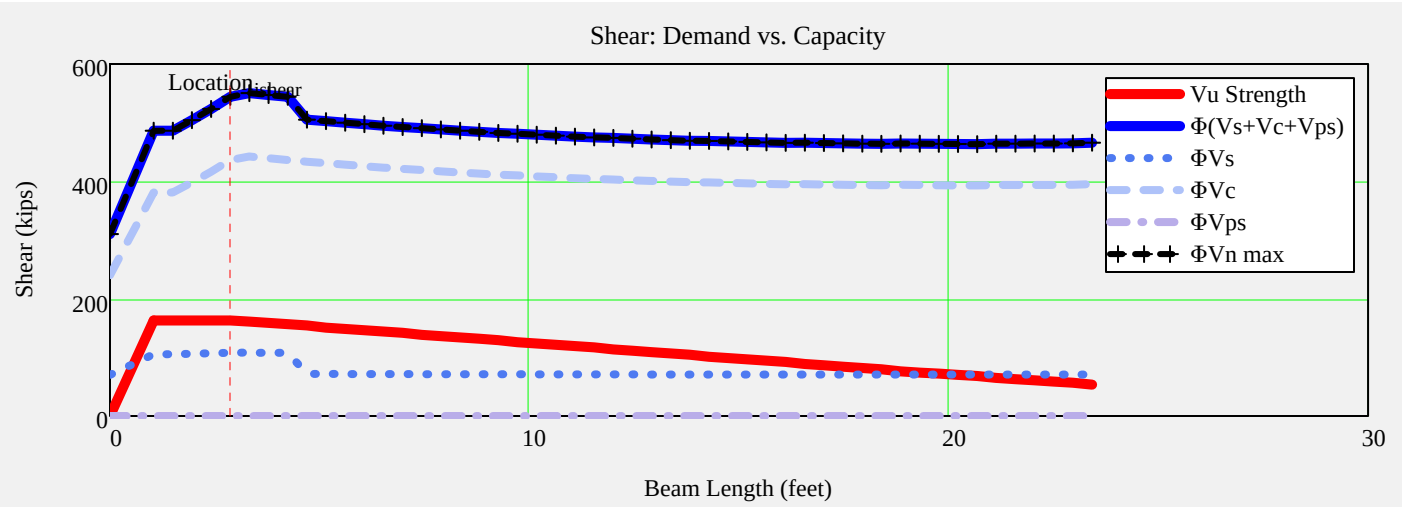
Use current input file

File Name FSB-48ftSpan-15inx56in_15SkewExtBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

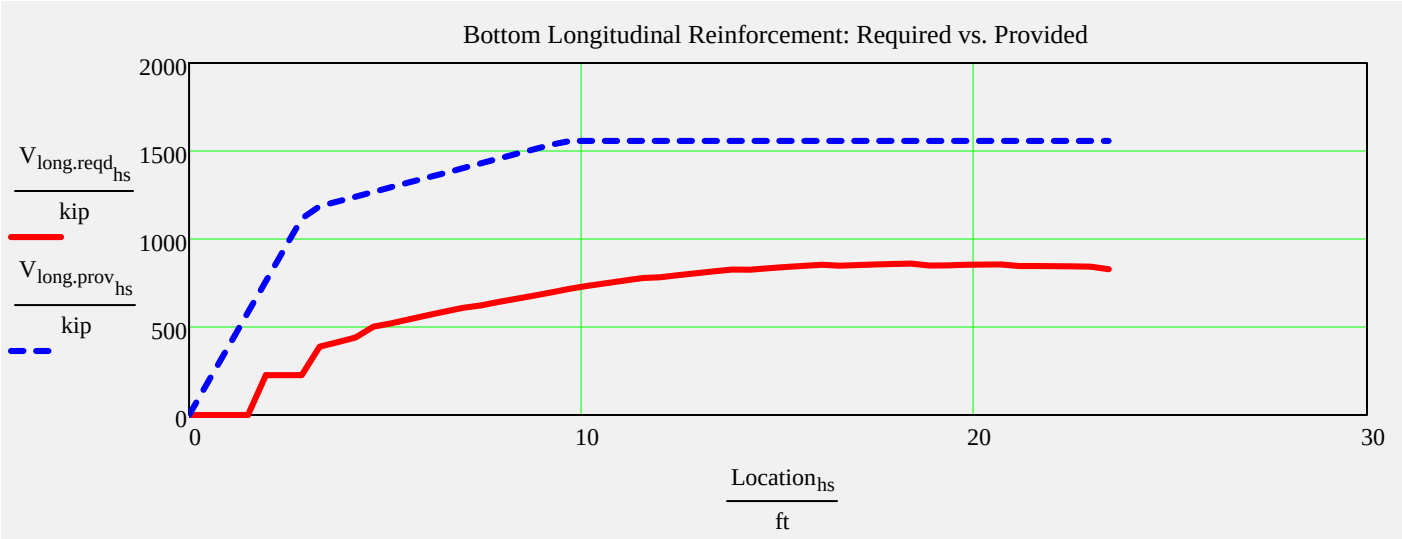
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.70 & 154.26 & 505.14 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.31$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

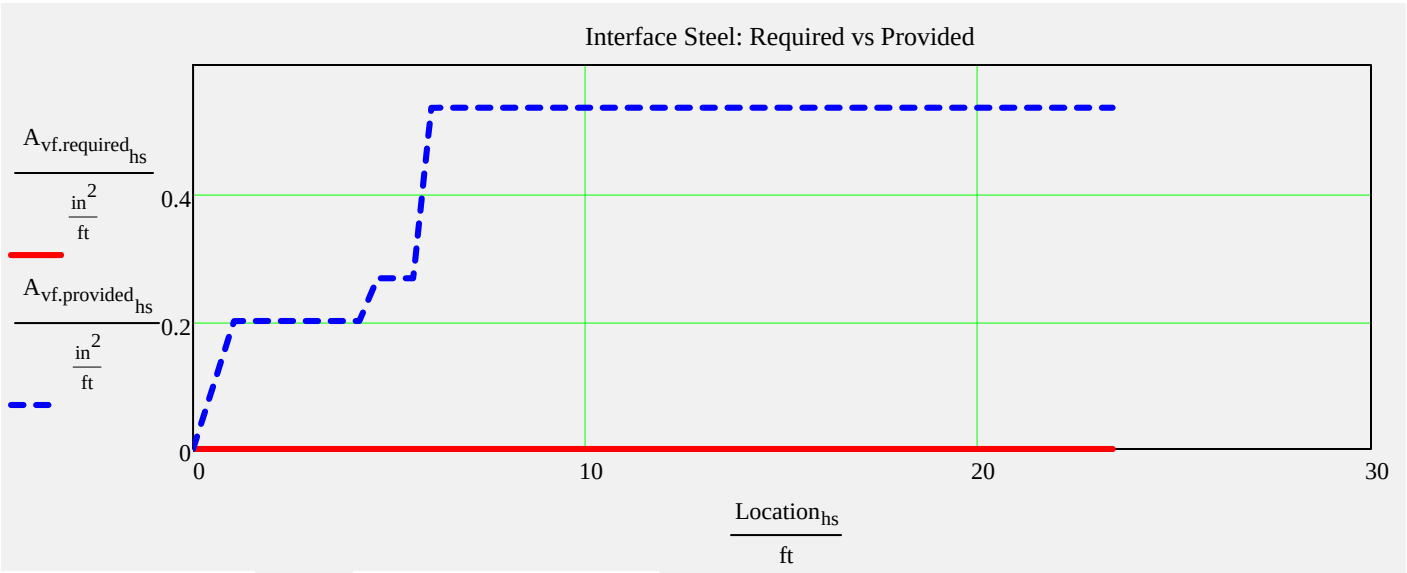


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 18.4 & 860.2 & 1557.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.55$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 10.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

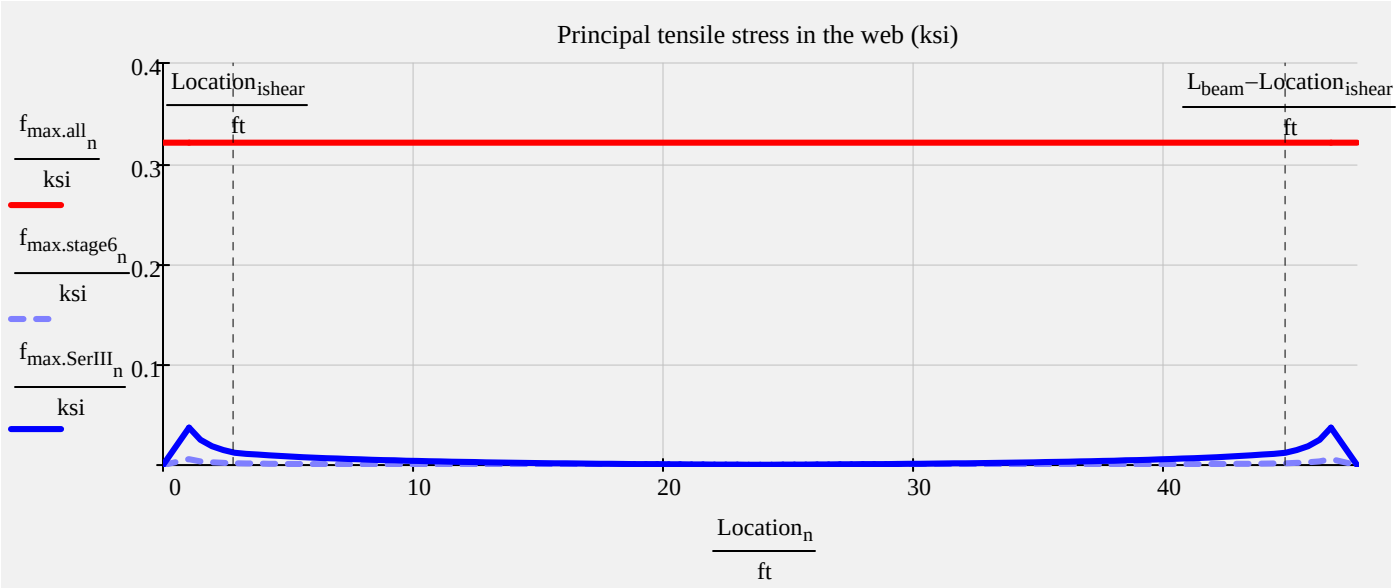
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 34.4 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

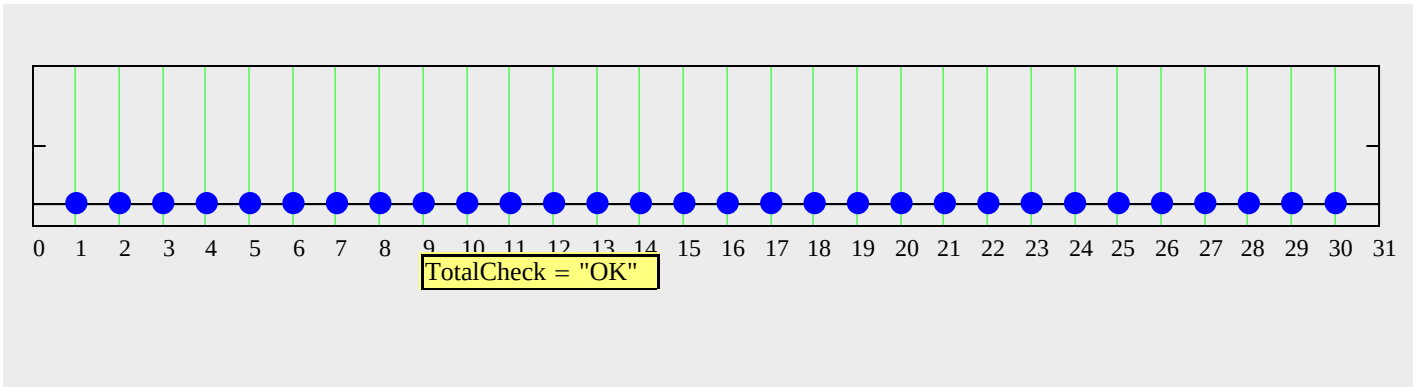
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.37	2.42	"N/A"	24.20	0.79	4.26	"N/A"	3.65	HL-93
"Strength I (Op)"	0.37	3.13	"N/A"	21.46	0.79	5.53	"N/A"	3.65	HL-93
"Service III (Inv)"	0.37	2.58	"N/A"	21.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.37	2.76	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.37	2.31	138.42	21.46	0.79	3.90	233.78	3.65	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.51$ $DC_{LongReinf.Permit} = 0.55$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1856	"factored resistance (kip-ft)...."
"γDL"	447	"factored dead load (kip-ft)...."
"γLL"	450	"factored live load (kip-ft)....."
"RF"	3.13	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	507.6	"factored resistance (kip)....."
"γDL"	33.1	"factored dead load (kip)....."
"γLL"	85.8	"factored live load (kip)....."
"RF"	5.53	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 48 FEET (15 DEG. SKEW)
WESTBOUND BRIDGE
(MOSSY GULLY & LONG POINT MARSH)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\WB 48' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-48ftSpan-15inx56in_15SkewExtBeam.dat
FSB-48ftSpan-15inx56in_15SkewIntBeam.dat
FSB-48ftSpan-15inx56in_ExtBeam.dat
FSB-48ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

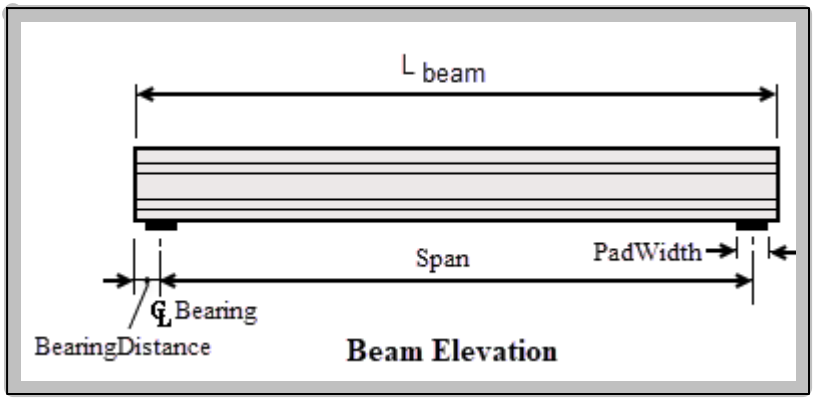
InputDataFile = "FSB-48ftSpan-15inx56in_15SkewIntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



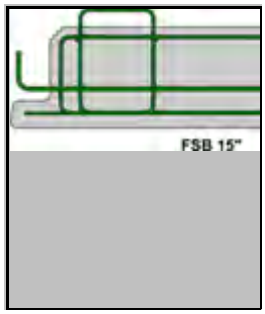
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-48ftSpan-15inx56in_15SkewIntBeam.dat"

Beam Type	FSB12 **FSB15** FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	47.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(* 0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

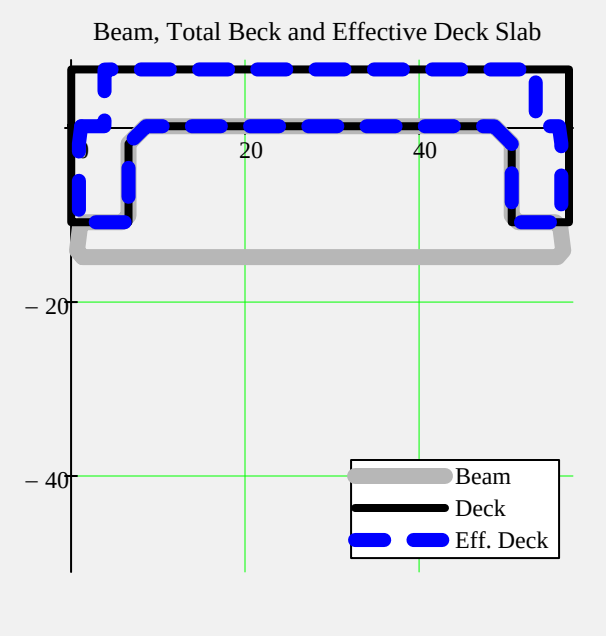
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 57.14 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 0.57 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 47.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

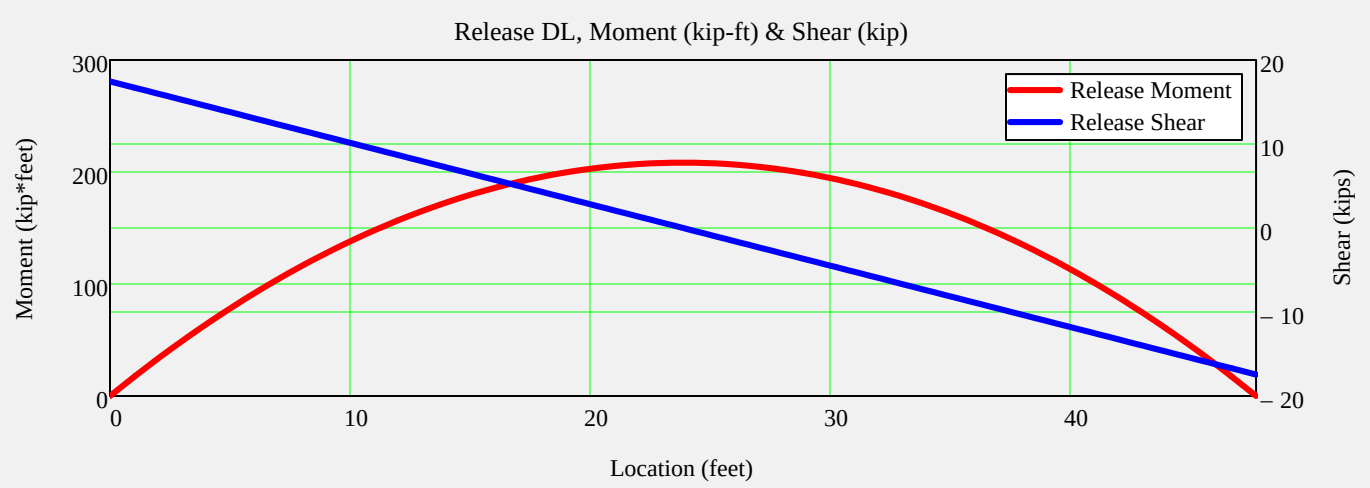
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

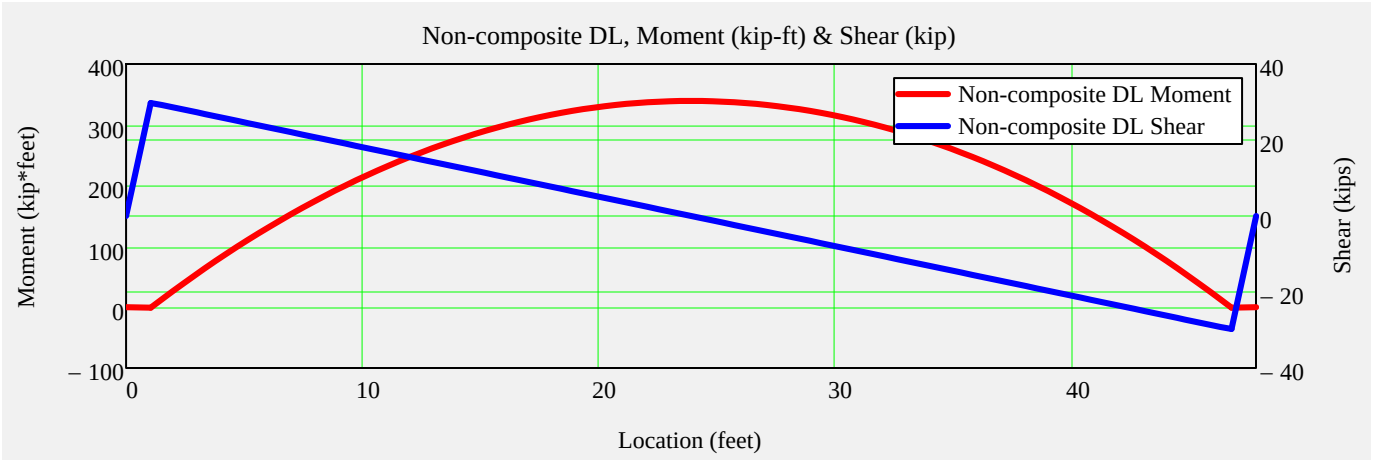
Release Dead Load Moments and Shears

$L_{span} = 45.67\ ft$



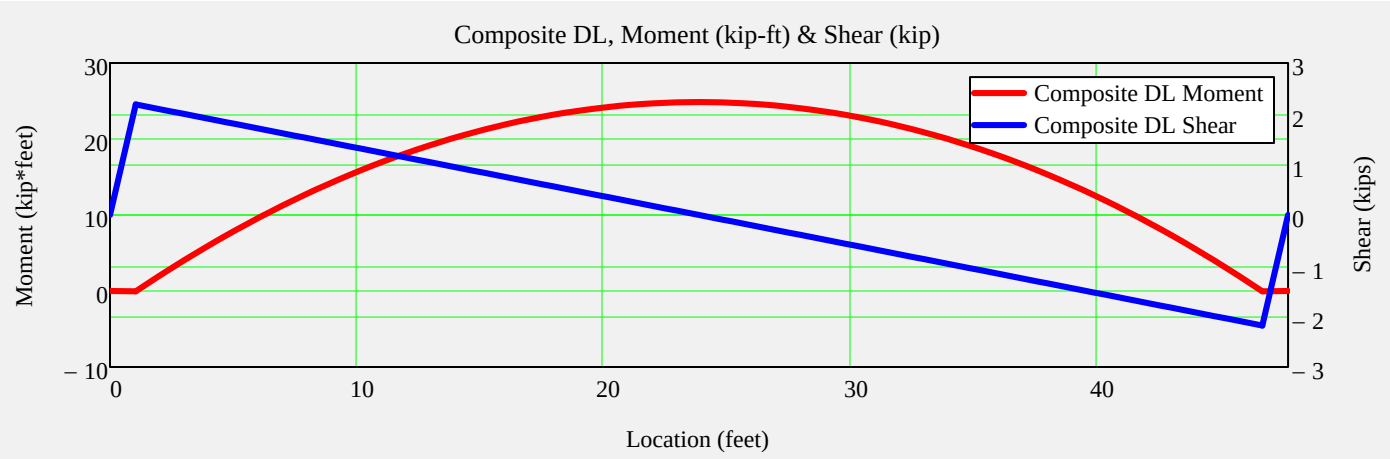
$\max(V_{release}) = 17.5 \cdot kip$ $\max(M_{release}) = 208.3 \cdot kip \cdot ft$ $\min(V_{release}) = -17.5 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 29.7 \cdot kip$ $\max(M_{dl.non.comp}) = 339.2 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -29.7 \cdot kip$

Composite Dead Load Moments and Shear



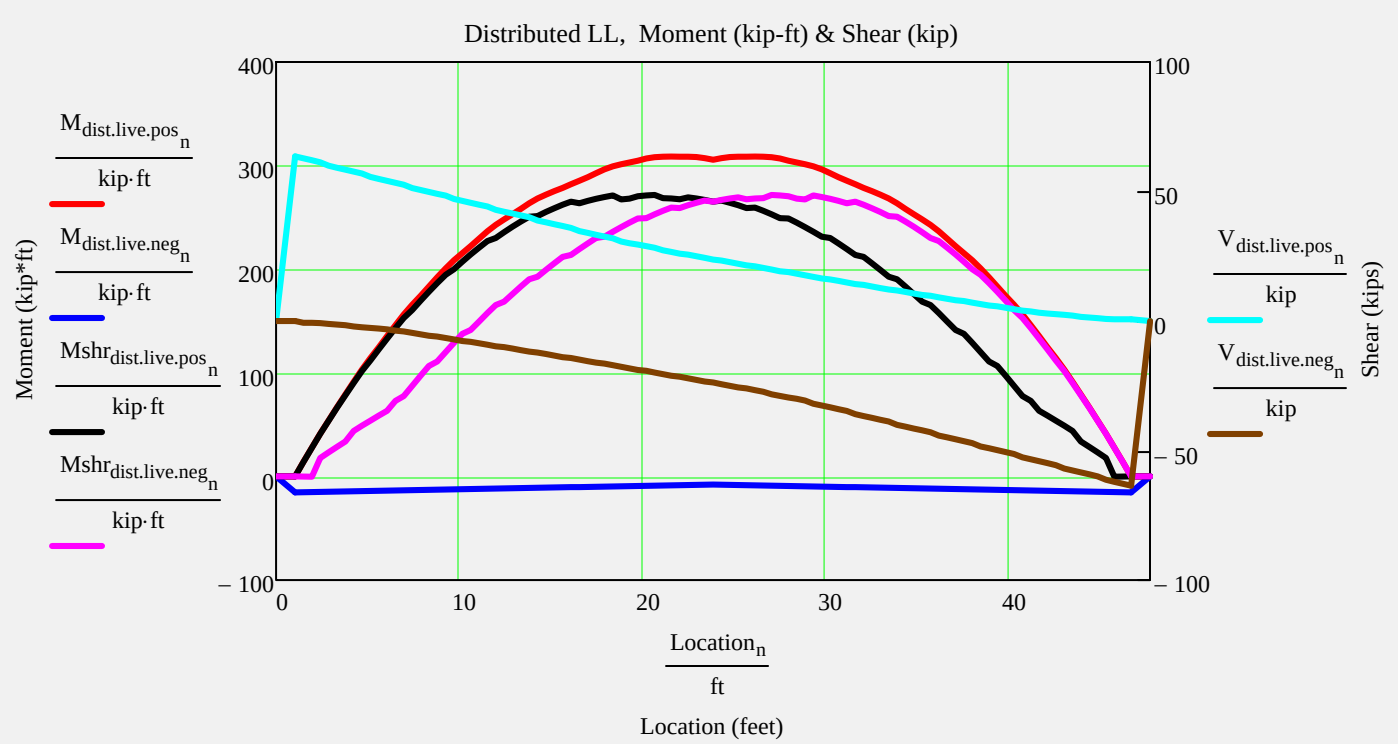
$\max(V_{dl.comp}) = 2.2 \cdot kip$ $\max(M_{dl.comp}) = 24.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.2 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 45.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.21$

Final Live Load Distribution Factors: $g_{mom} = 0.34$ $g_{mom.fatigue} = 0.19$ $g_{shear} = 0.70$



$\max(V_{dist.live.pos}) = 63.6 \cdot kip$

$\max(M_{dist.live.pos}) = 308.7 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -63.6 \cdot kip$

$Reaction_{LL} = 66.0 \cdot kip$

$\min(M_{dist.live.neg}) = -15.4 \cdot kip \cdot ft$

$Reaction_{DL} = 33.4 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 272 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions... without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{truck} = 58.93 \cdot kip$ $Reaction_{lane} = 15.28 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 52.28 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-48ftSpan-15inx56in_15SkewIntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

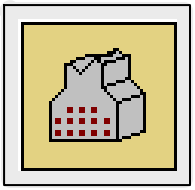
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

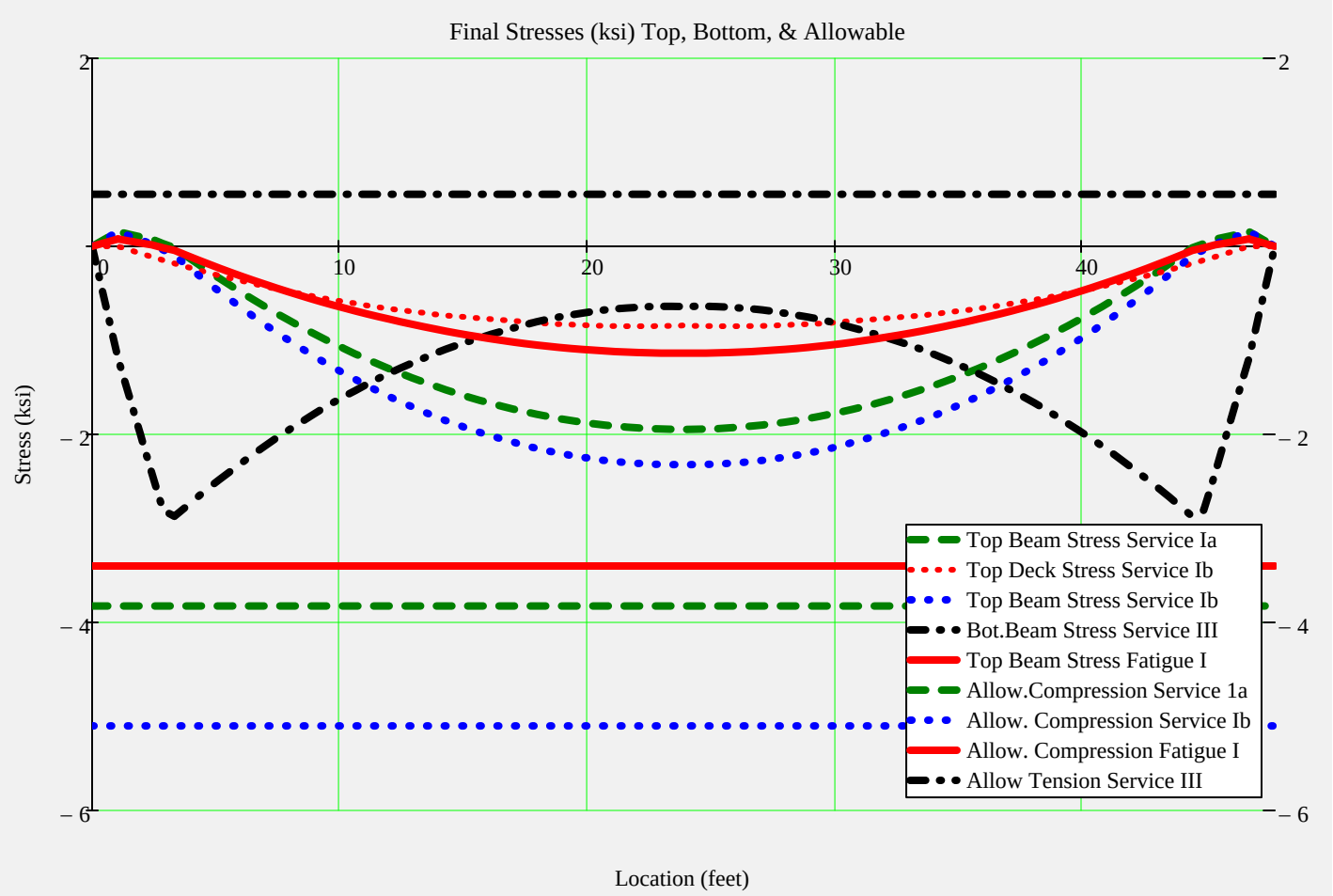
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

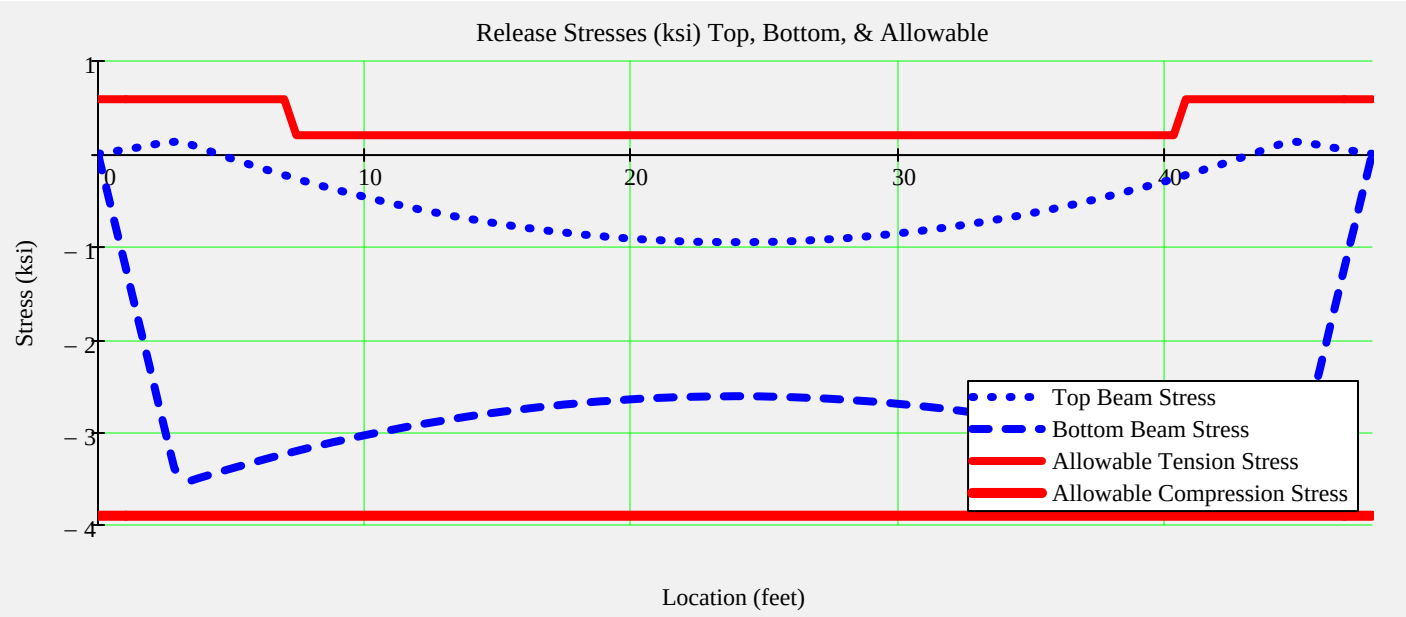
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.70$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.91$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.51$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.46$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.33$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.87	0.13	0.59
"Compression @ Release"	3.32	–3.54	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	23.88	–1.95	–3.83
"CompressionIb @ ServiceI"	24.33	–2.32	–5.10
"Compression @ FatigueI"	23.88	–1.14	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

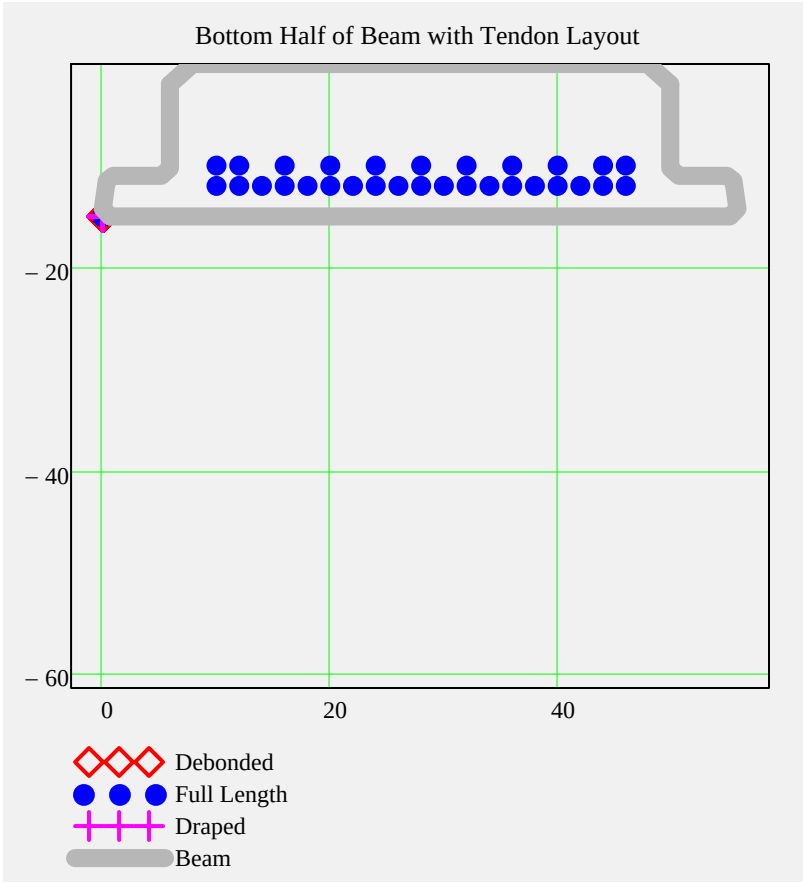
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

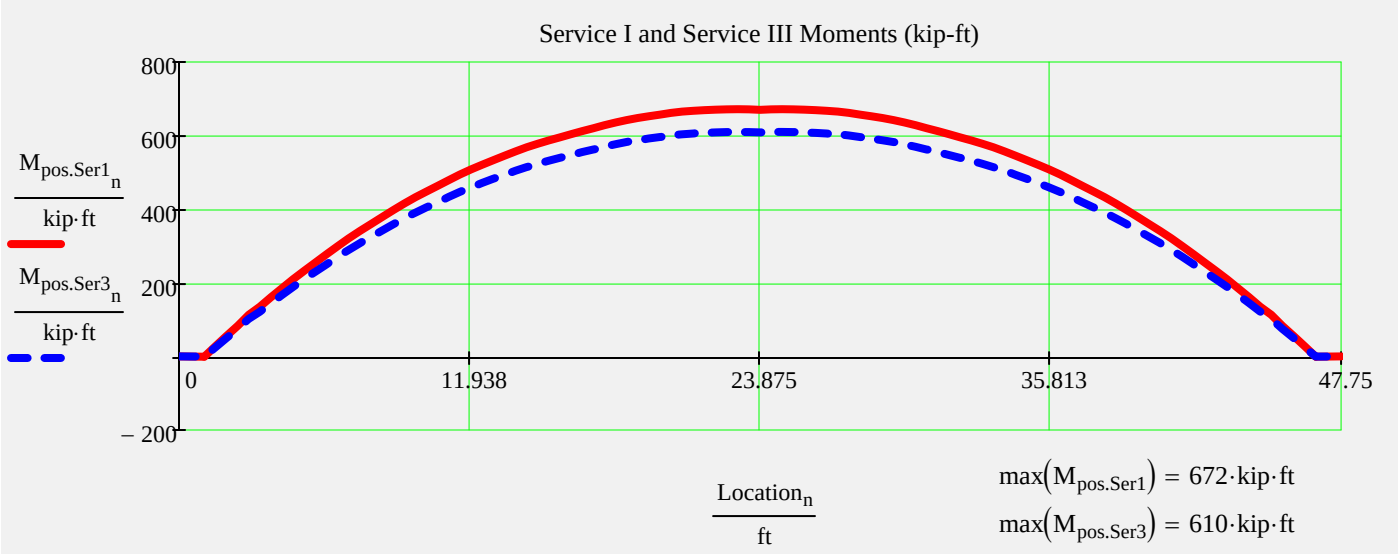
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.95 & -2.61 \\ \text{"2"} & -1.01 & -2.17 \\ \text{"4"} & -0.88 & -2.28 \\ \text{"6"} & -1.92 & -1.38 \\ \text{"8"} & -2.32 & -0.64 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1358 & -357 \\ \text{"@Final (about composite centroid)"} & -1202 & -300 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1189.7	45382	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	208
"Non-Composite DL (incl. beam wt.)"	339
"Composite Dead Load"	25
"Distributed Live Load"	306

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

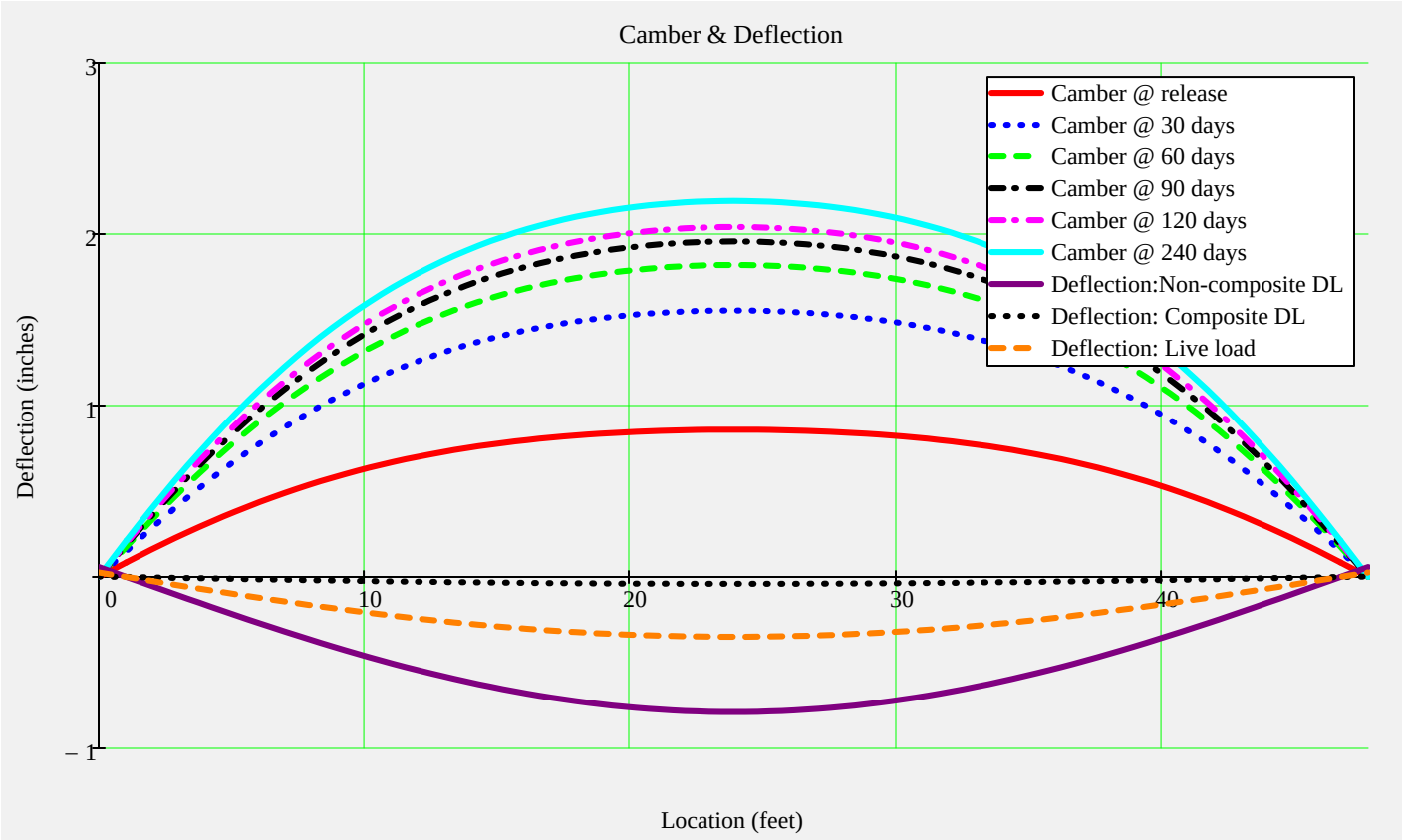
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 45.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.06	–0.35	0.40	0.86
"30 Days"	–0.19	–0.66	0.70	1.55
"60 Days"	–0.23	–0.77	0.82	1.82
"90 Days"	–0.26	–0.83	0.88	1.96
"120 Days"	–0.27	–0.87	0.92	2.04
"240 Days"	–0.30	–0.93	0.99	2.19
"Non-comp DL"	–0.07	0.06	–0.26	–0.79
"Comp DL"	–0.00	0.00	–0.01	–0.04
"LL"	–0.02	0.04	–0.12	–0.35

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.21 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

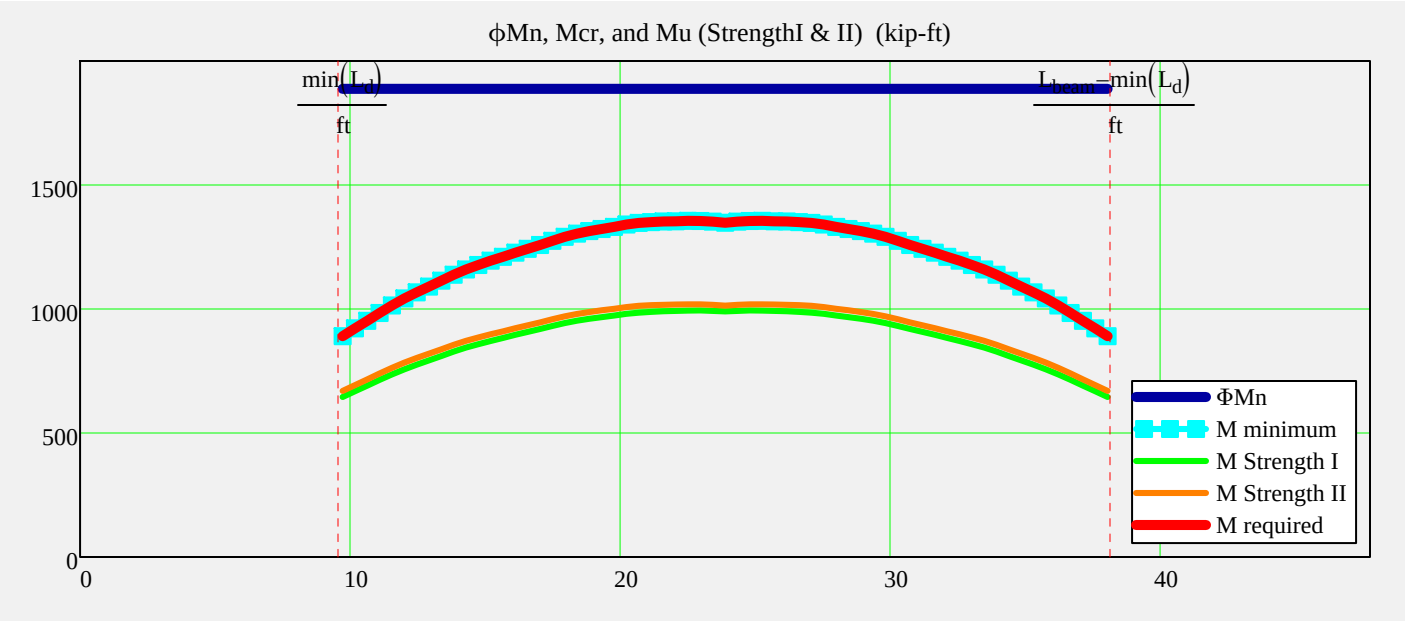
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 1019 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1348 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1348 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1888 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 38.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.72$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

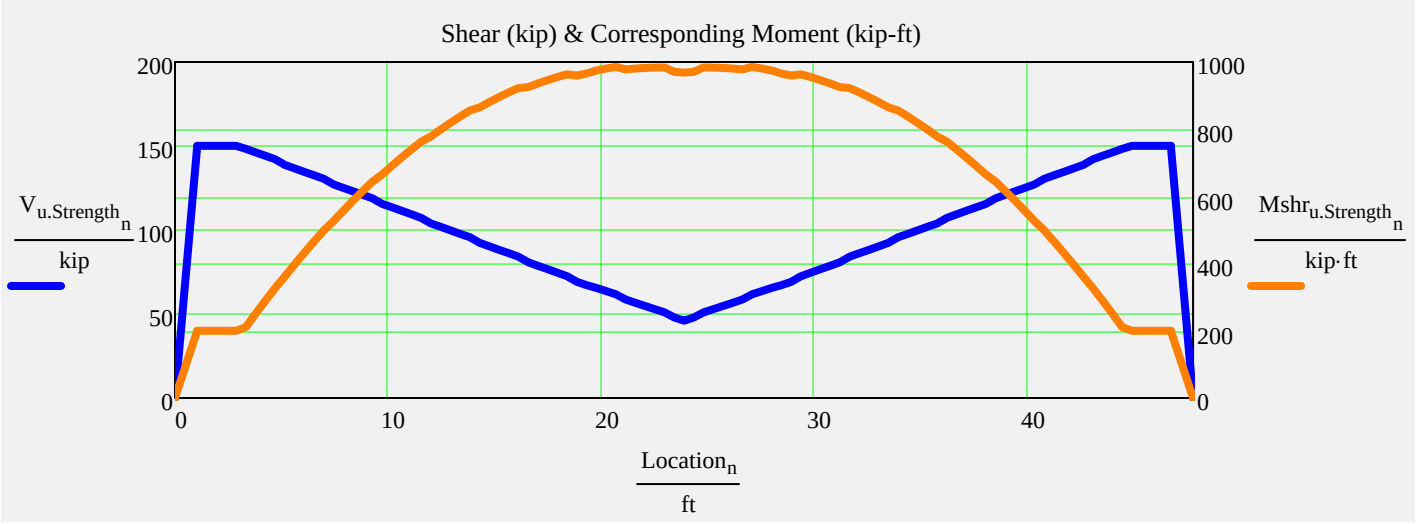
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

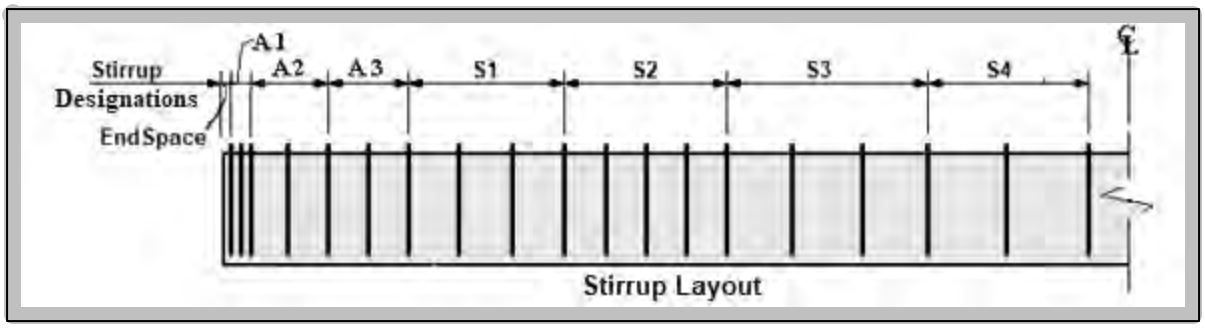
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 151 \\ 160 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 150.1 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 985 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar # 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

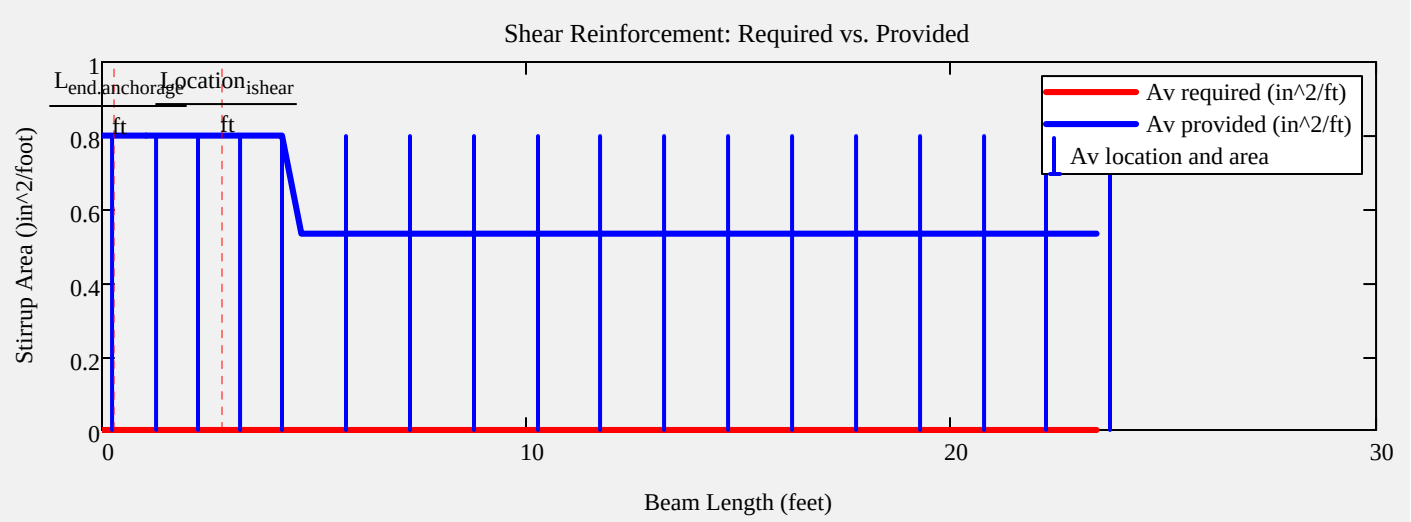
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.87\ ft$

Save Data File

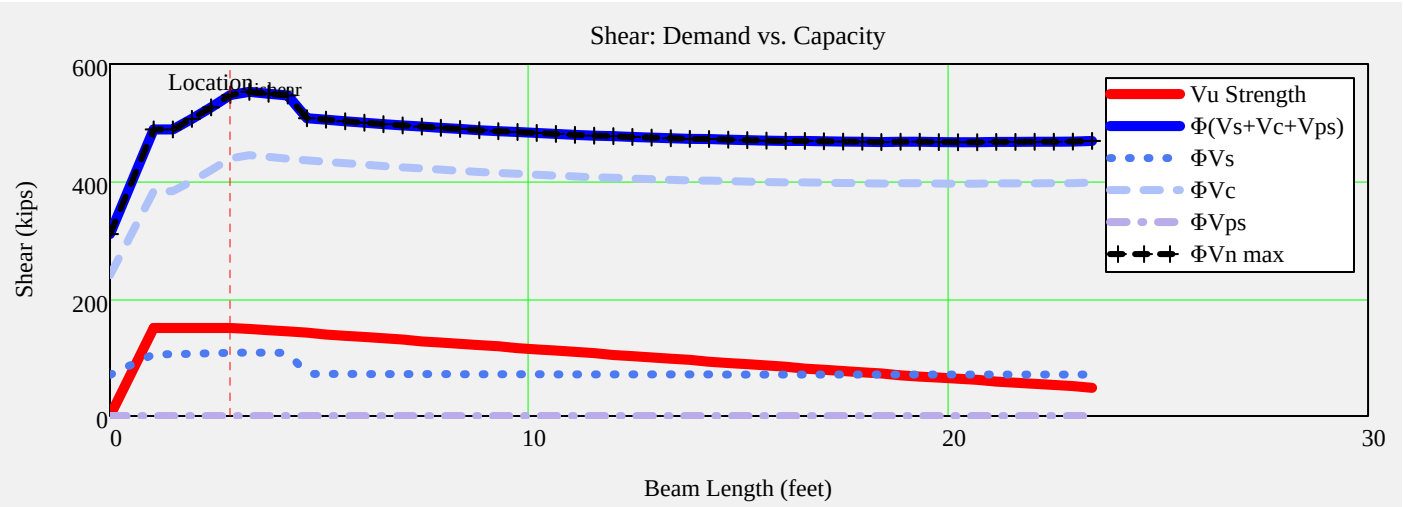
Use current input file

File Name FSB-48ftSpan-15inx56in_15SkewIntBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

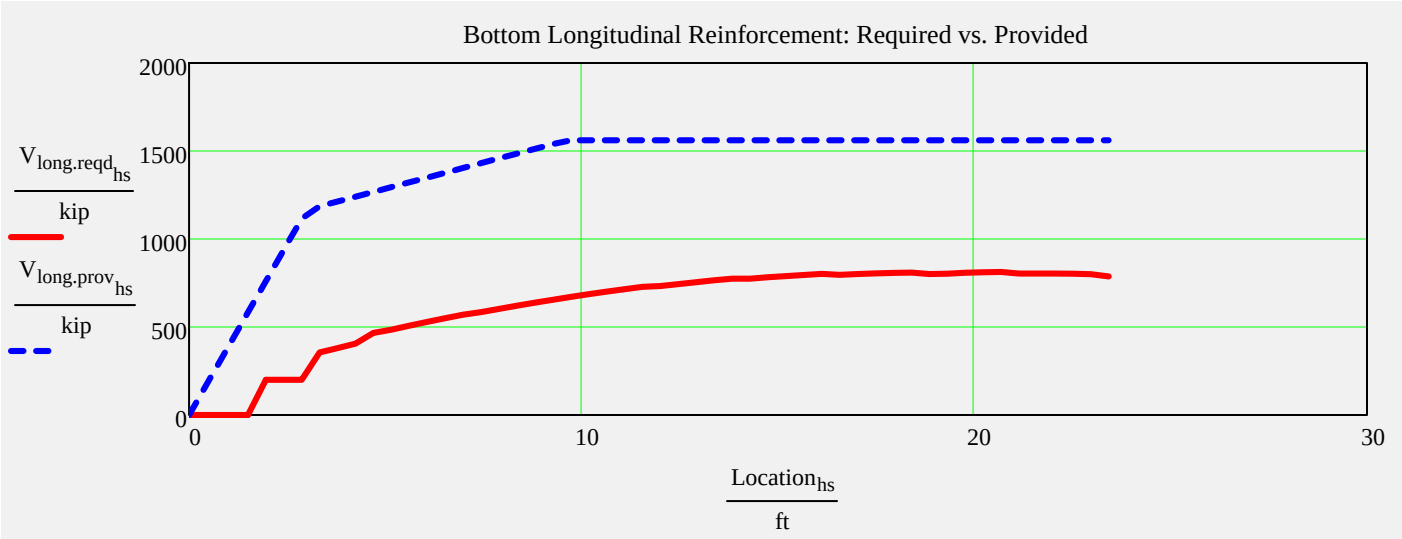
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.70 & 142.08 & 507.57 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.28$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

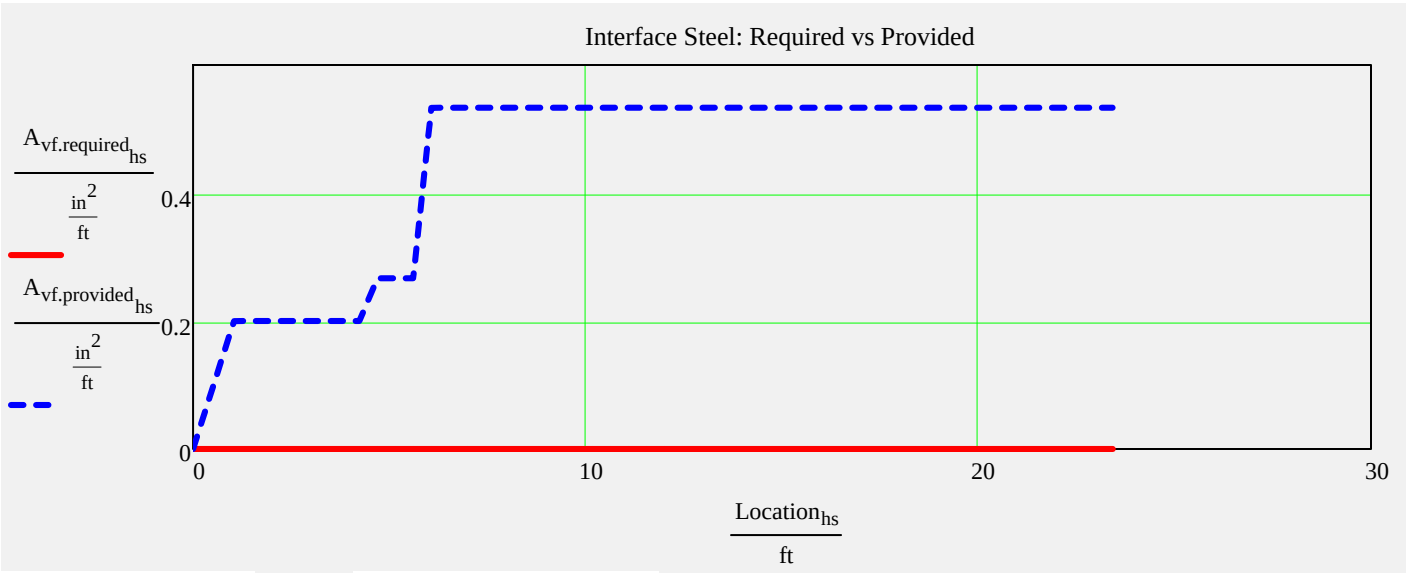


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 20.7 & 812.5 & 1560.5 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.52$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 10.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

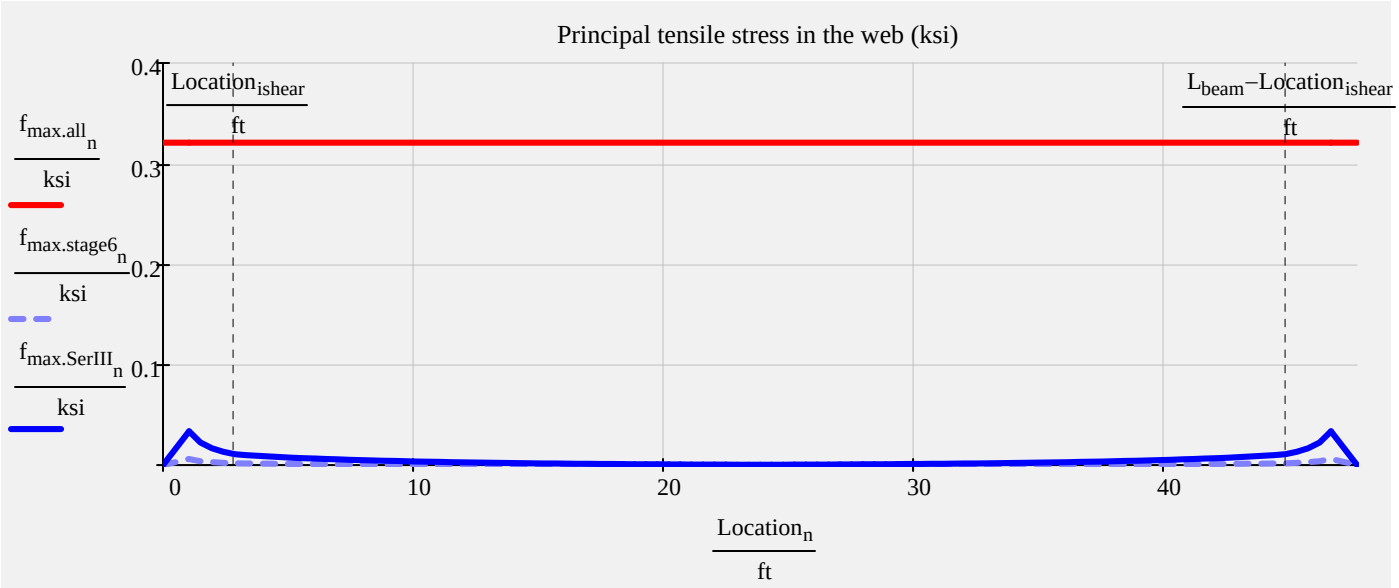
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 34.4 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

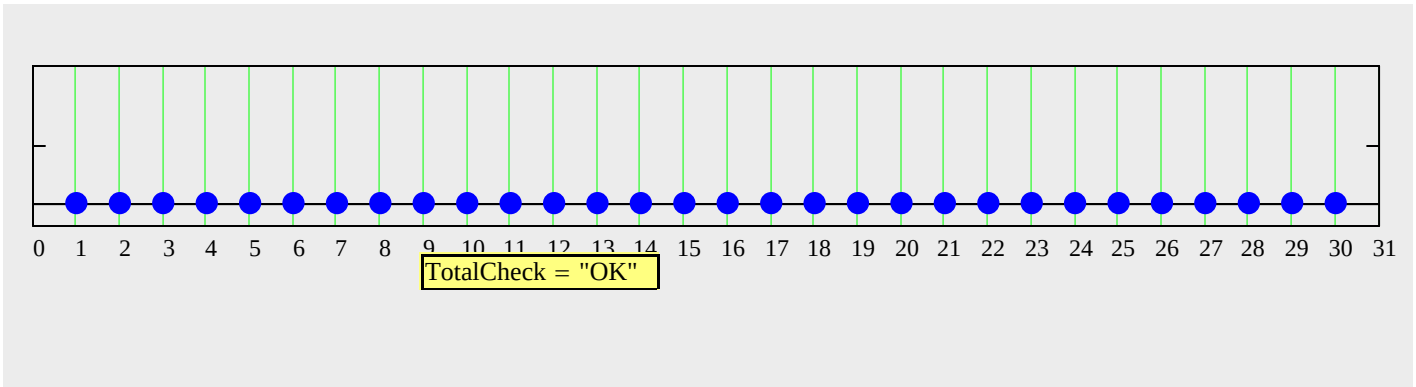
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.34	2.66	"N/A"	24.20	0.70	4.78	"N/A"	3.65	HL-93
"Strength I (Op)"	0.34	3.44	"N/A"	24.20	0.70	6.20	"N/A"	3.65	HL-93
"Service III (Inv)"	0.34	2.76	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.34	2.96	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.34	2.54	152.17	24.20	0.70	4.37	262.13	3.65	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.49$ $DC_{LongReinf.Permit} = 0.52$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1888	"factored resistance (kip-ft)...."
"γDL"	453	"factored dead load (kip-ft)...."
"γLL"	417	"factored live load (kip-ft)....."
"RF"	3.44	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	509.8	"factored resistance (kip)....."
"γDL"	33.6	"factored dead load (kip)....."
"γLL"	76.9	"factored live load (kip)....."
"RF"	6.2	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM EXTERIOR BEAM DESIGN

SPAN LENGTH = 48 FEET (NO SKEW)

EASTBOUND BRIDGE

(PARKER CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\EB 48' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-48ftSpan-15inx56in_15Skew_ExtBeam.dat
FSB-48ftSpan-15inx56in_15Skew_IntBeam.dat
FSB-48ftSpan-15inx56in_ExtBeam.dat
FSB-48ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

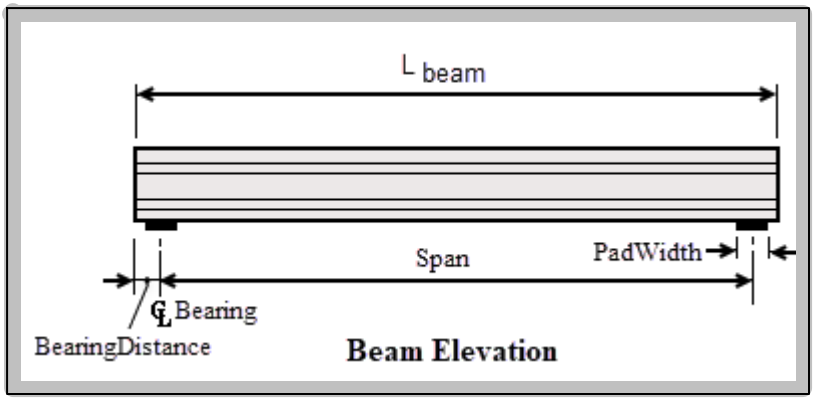
InputDataFile = "FSB-48ftSpan-15inx56in_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

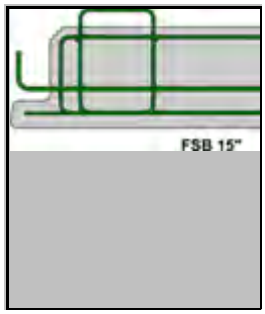
Superstructure Data

InputDataFile = "FSB-48ftSpan-15inx56in_ExtBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	47.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

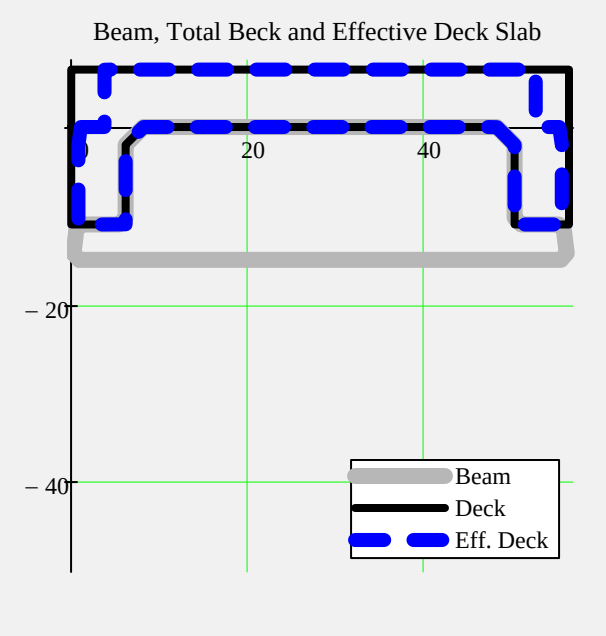
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = 56·in

$b_e = 56.32 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.56 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 47.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

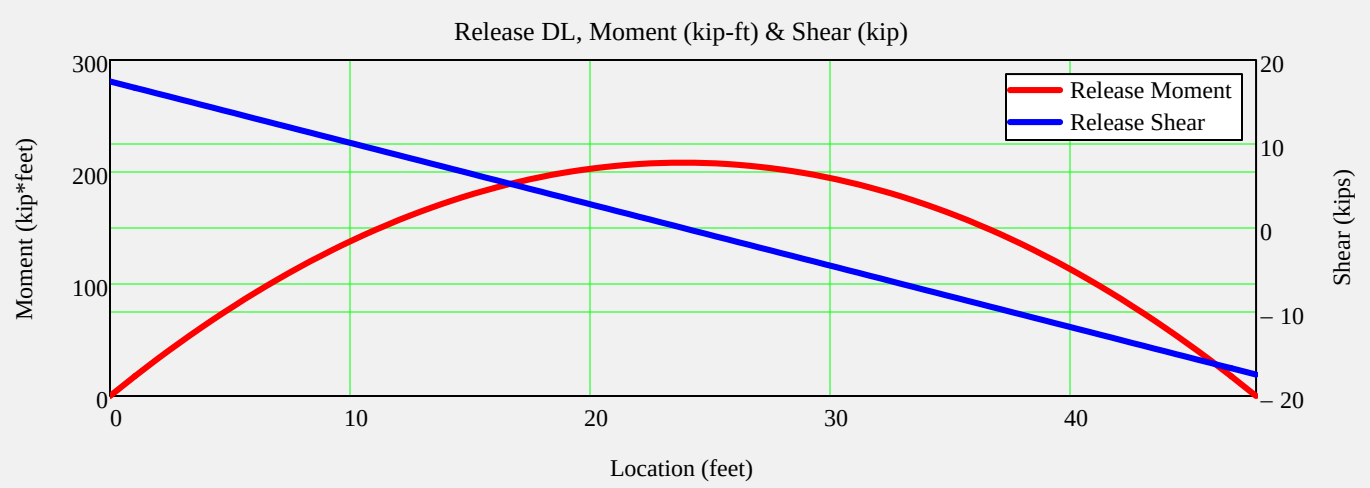
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

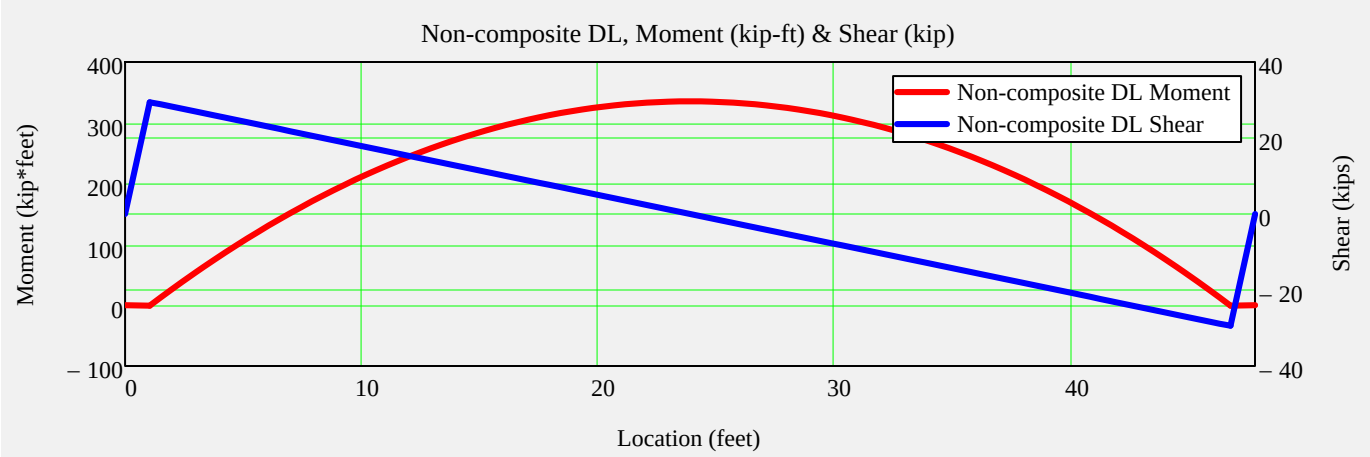
Release Dead Load Moments and Shears

$L_{span} = 45.67\ ft$



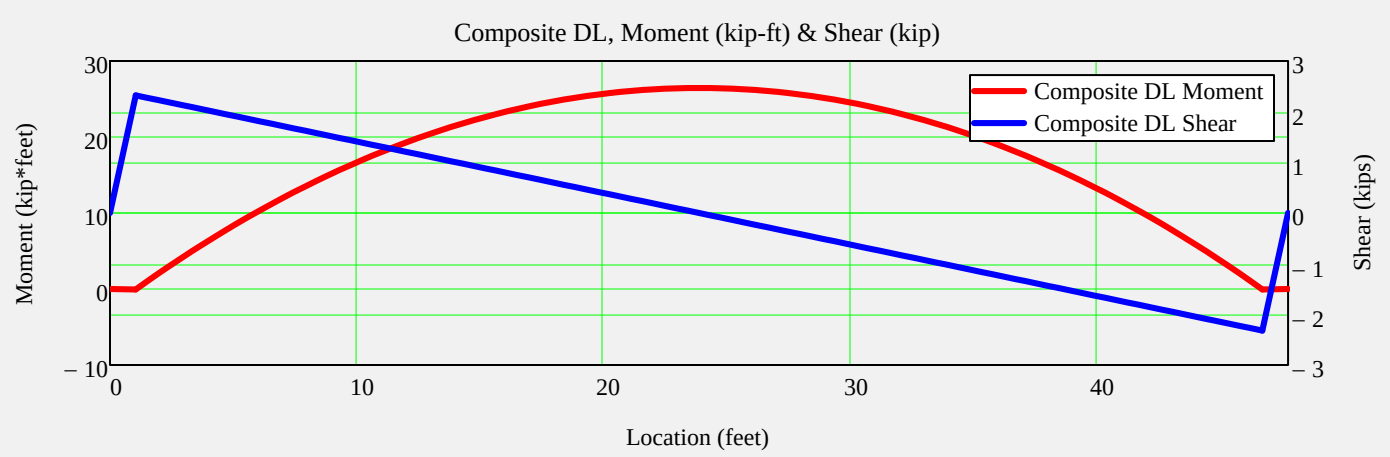
$\max(V_{release}) = 17.5 \cdot kip$ $\max(M_{release}) = 208.3 \cdot kip \cdot ft$ $\min(V_{release}) = -17.5 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 29.4 \cdot kip$ $\max(M_{dl.non.comp}) = 335.3 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -29.4 \cdot kip$

Composite Dead Load Moments and Shear



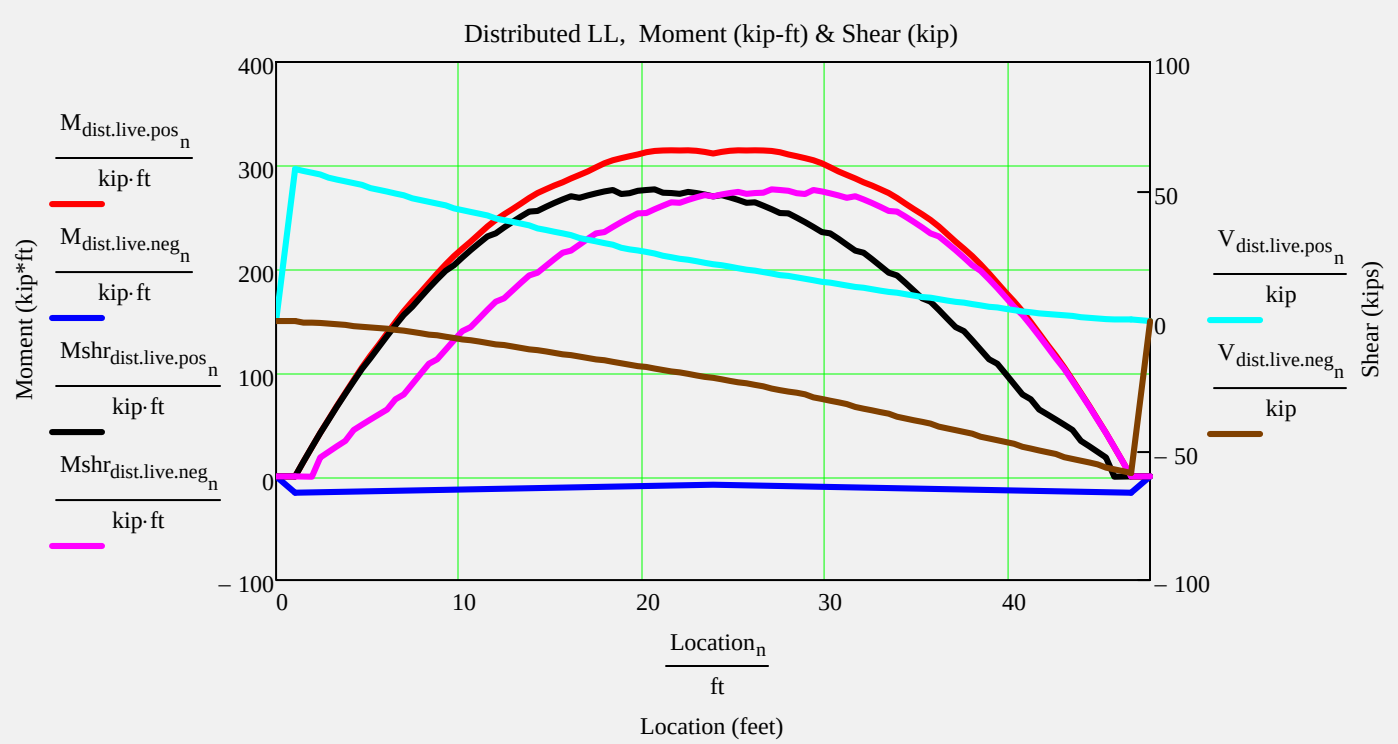
$\max(V_{dl.comp}) = 2.3 \cdot kip$ $\max(M_{dl.comp}) = 26.4 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.3 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 45.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.35$ $g_{mom.fatigue} = 0.21$ $g_{shear} = 0.65$



$\max(V_{dist.live.pos}) = 58.7 \cdot kip$ $\max(M_{dist.live.pos}) = 314.8 \cdot kip \cdot ft$ $\min(V_{dist.live.neg}) = -58.7 \cdot kip$

$Reaction_{LL} = 60.9 \cdot kip$ $\min(M_{dist.live.neg}) = -15.7 \cdot kip \cdot ft$

$Reaction_{DL} = 33.2 \cdot kip$ $\max(Mshr_{dist.live.pos}) = 277 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions... without IM factor for use in estimating Pile numbers and lengths required

$Reaction_{truck} = 58.93 \cdot kip$ $Reaction_{lane} = 15.28 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 48.24 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-48ftSpan-15inx56in_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

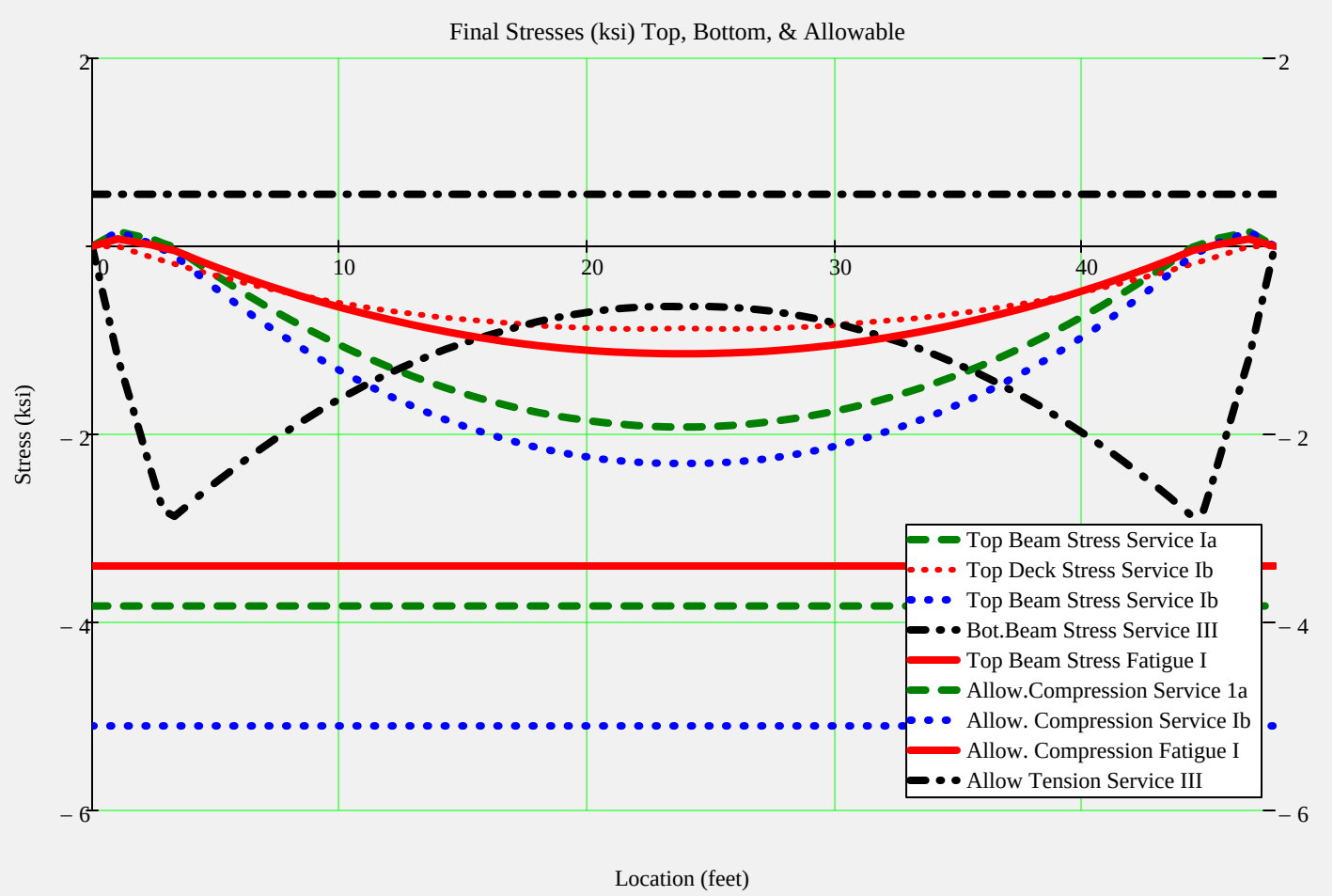
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

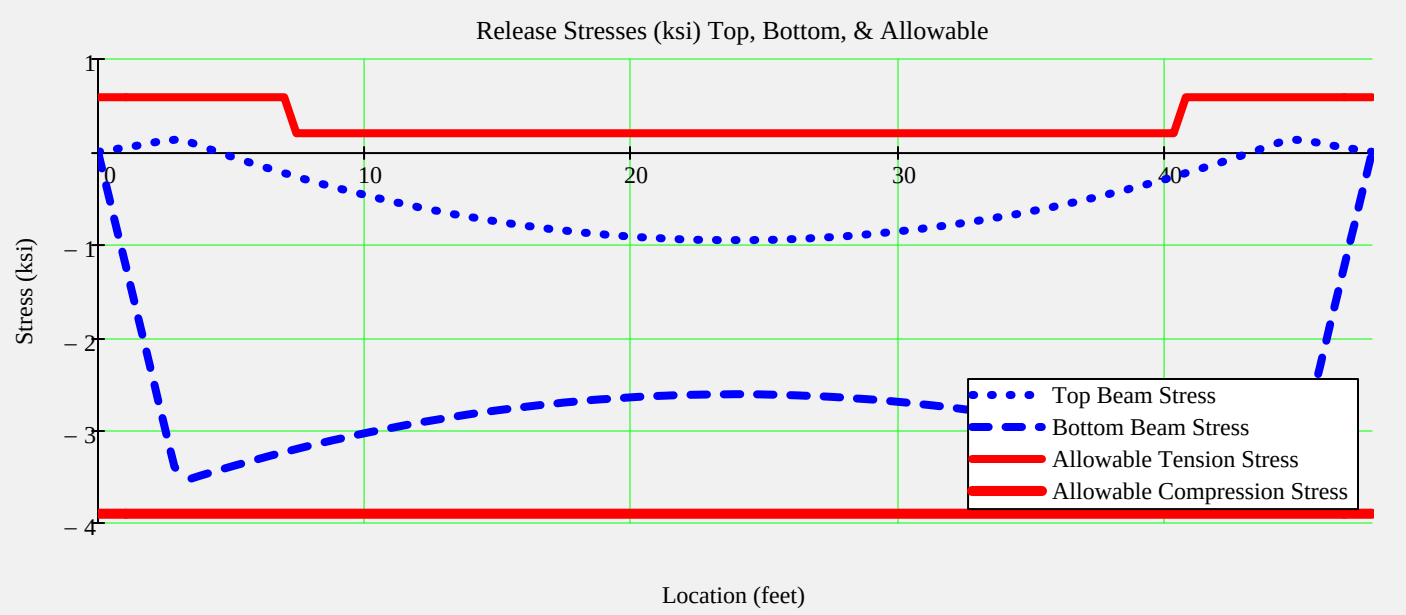
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel} = "OK"$	$\max(DC_f_{tension.rel}) = 0.70$
Release compression	$Check_f_{comp.rel} = "OK"$	$\max(DC_f_{comp.rel}) = 0.91$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII} = "OK"$	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa} = "OK"$	$\max(DC_f_{comp.ServiceIa}) = 0.50$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb} = "OK"$	$\max(DC_f_{comp.ServiceIb}) = 0.45$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI} = "OK"$	$\max(DC_f_{comp.FatigueI}) = 0.34$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.87	0.13	0.59
"Compression @ Release"	3.32	–3.54	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	23.88	–1.92	–3.83
"CompressionIb @ ServiceI"	24.33	–2.31	–5.10
"Compression @ FatigueI"	23.88	–1.14	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

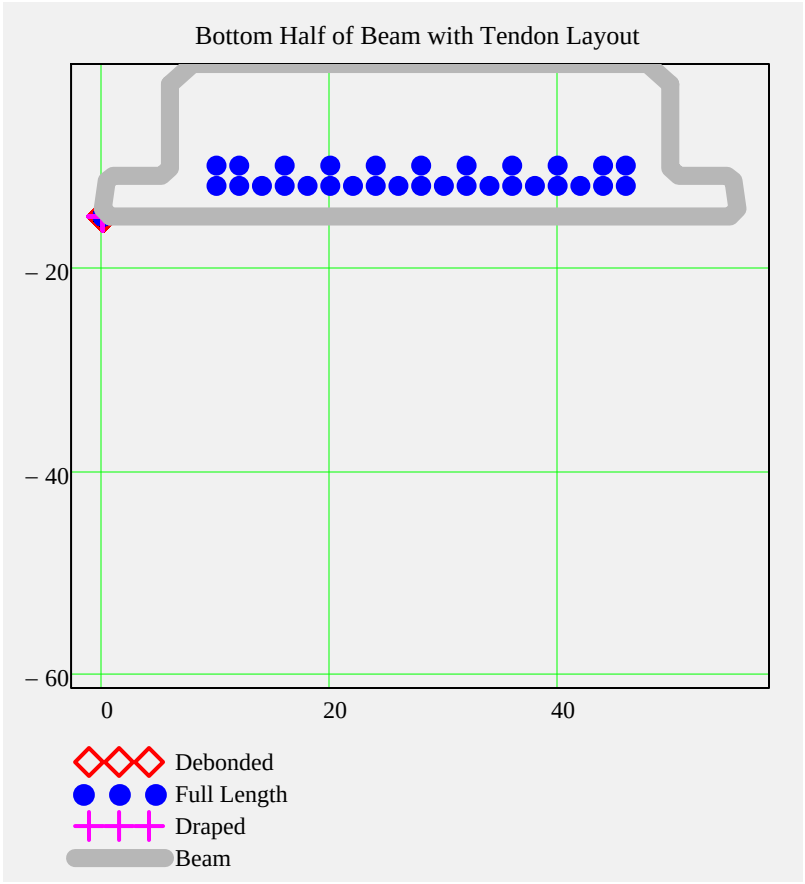
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

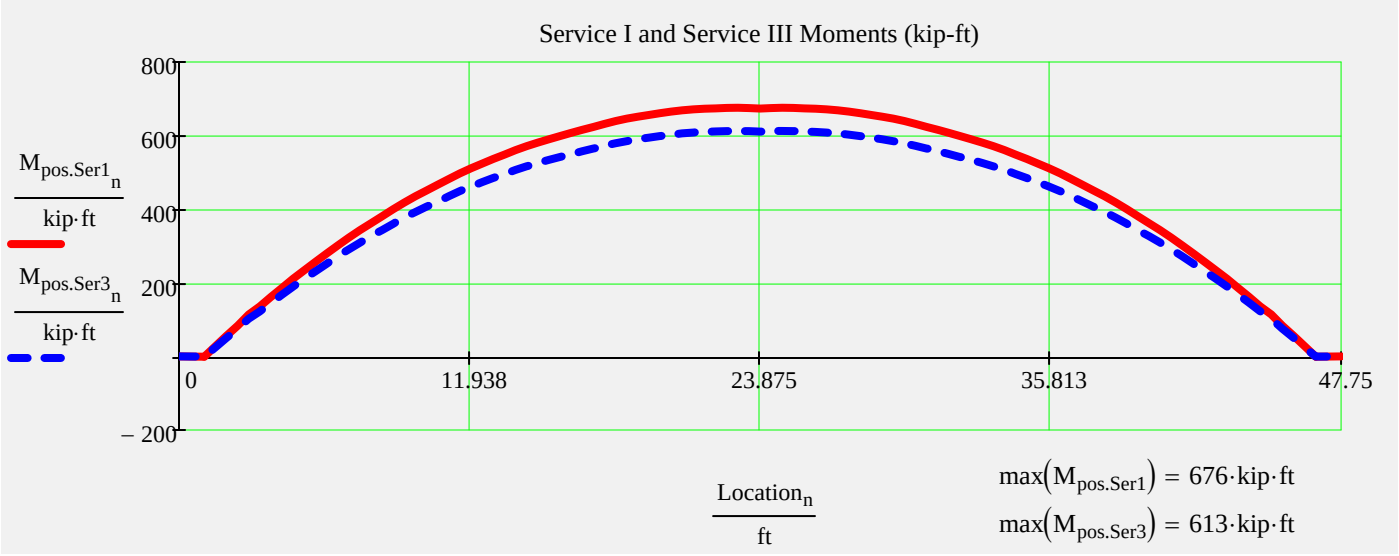
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

Check_f_{pe} = "OK"

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.95	–2.61
"2"	–1.01	–2.17
"4"	–0.88	–2.28
"6"	–1.89	–1.40
"8"	–2.31	–0.64

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1177.2	44990	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	208
"Non-Composite DL (incl. beam wt.)"	335
"Composite Dead Load"	26
"Distributed Live Load"	312

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

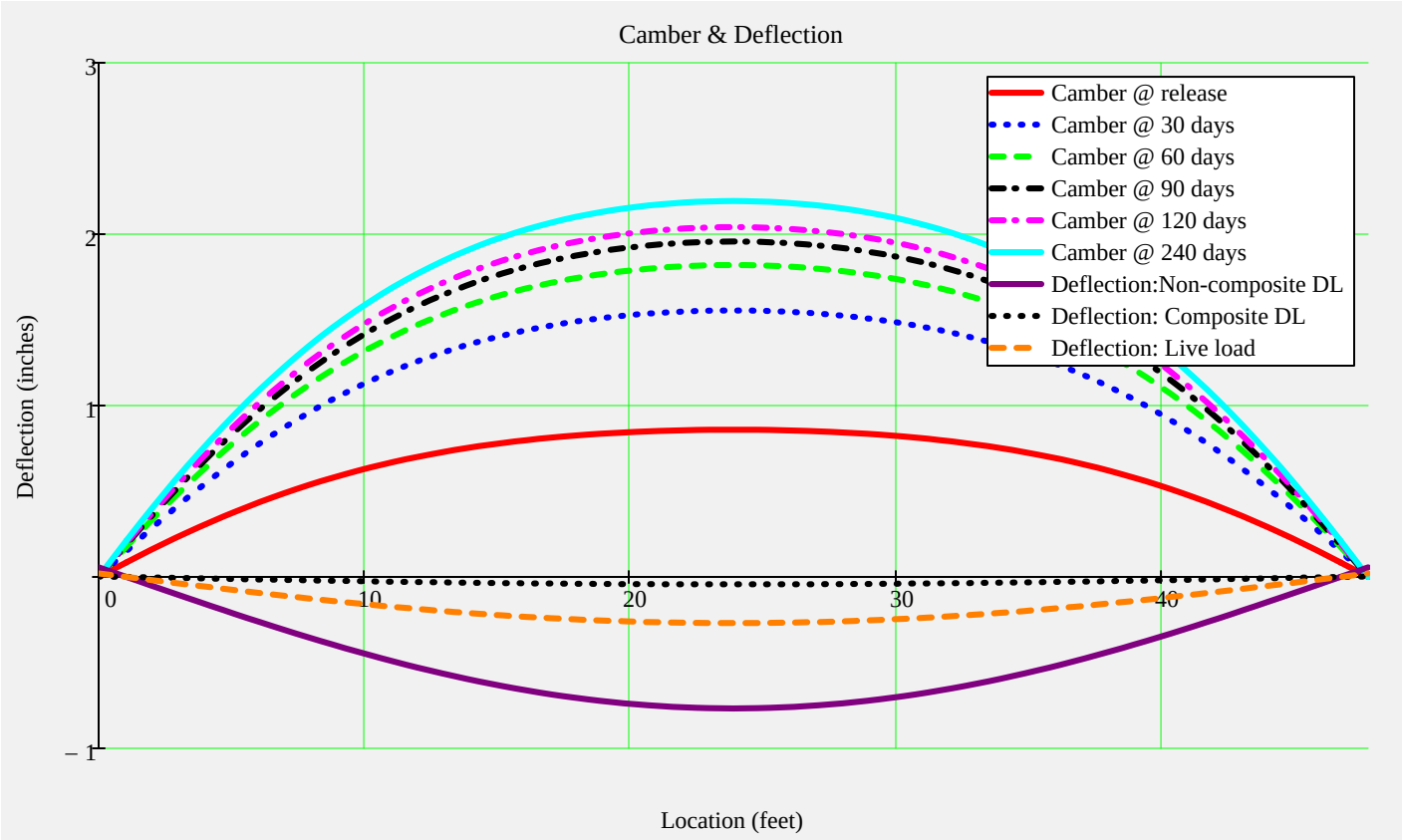
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 45.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.06	–0.35	0.40	0.86
"30 Days"	–0.19	–0.66	0.70	1.55
"60 Days"	–0.23	–0.77	0.82	1.82
"90 Days"	–0.26	–0.83	0.88	1.96
"120 Days"	–0.27	–0.87	0.92	2.04
"240 Days"	–0.30	–0.93	0.99	2.19
"Non-comp DL"	–0.07	0.06	–0.26	–0.77
"Comp DL"	–0.00	0.01	–0.01	–0.04
"LL"	–0.01	0.03	–0.09	–0.27

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.23 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

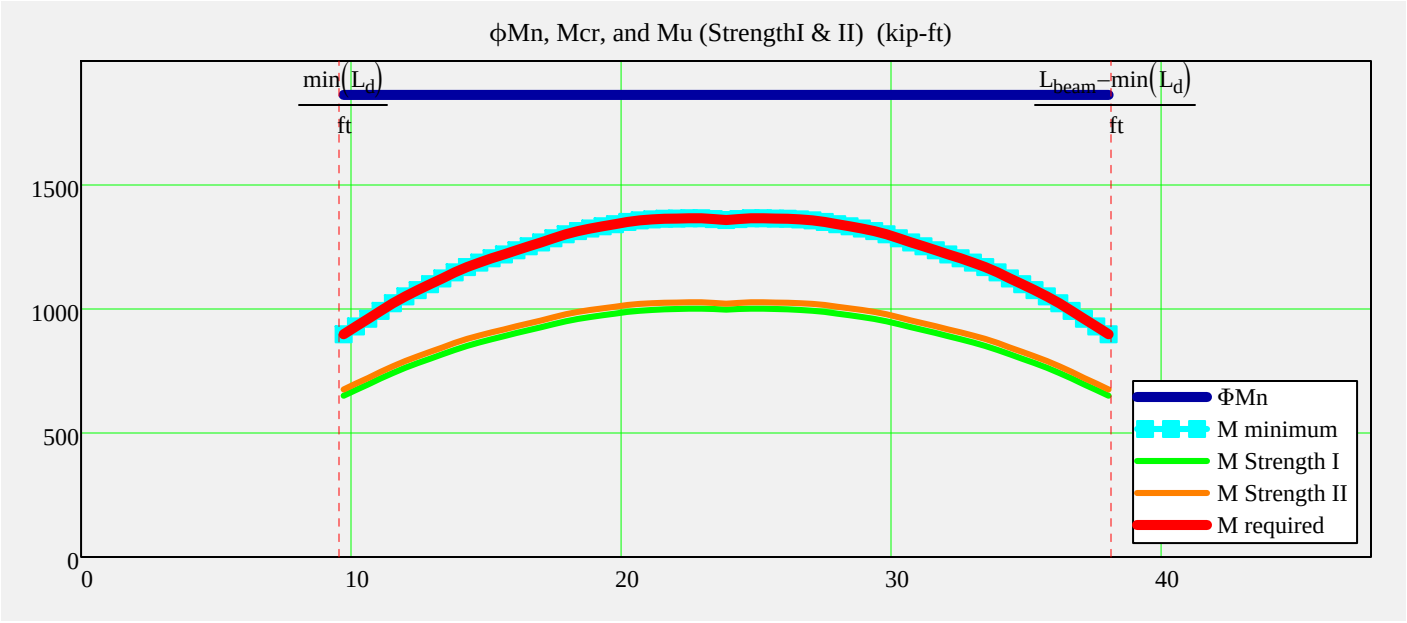
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 1027 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1359 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1359 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1864 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $\quad L_{beam} - \min(L_d) = 38.2\,\text{ft}$

$$DC_{moment_{mn}} := \frac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$$

Demand/Capacity Ratio at locations where all strands are fully developed

$\max(DC_{moment}) = 0.73$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

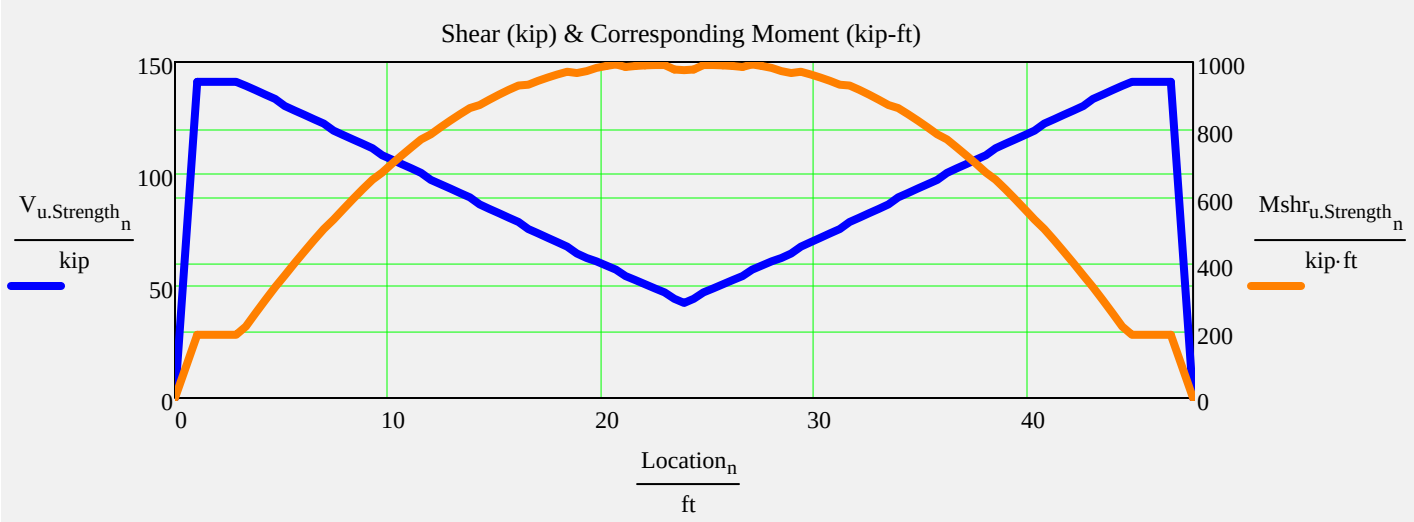
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

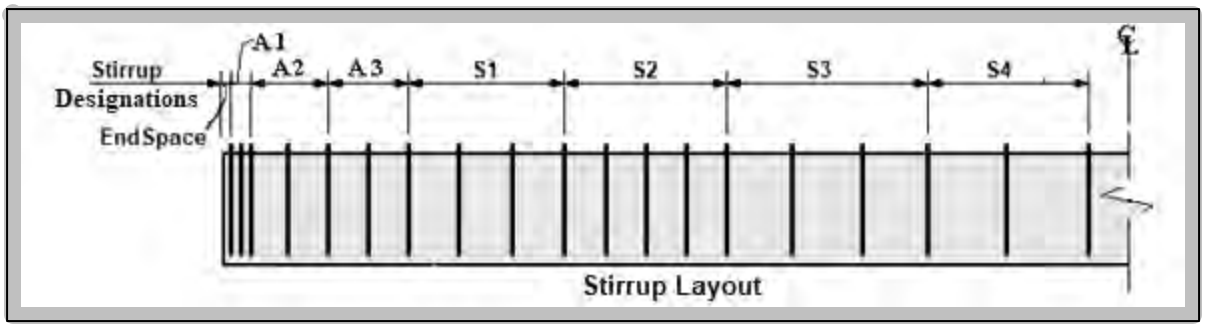
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 142 \\ 150 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 141.1 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 993 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

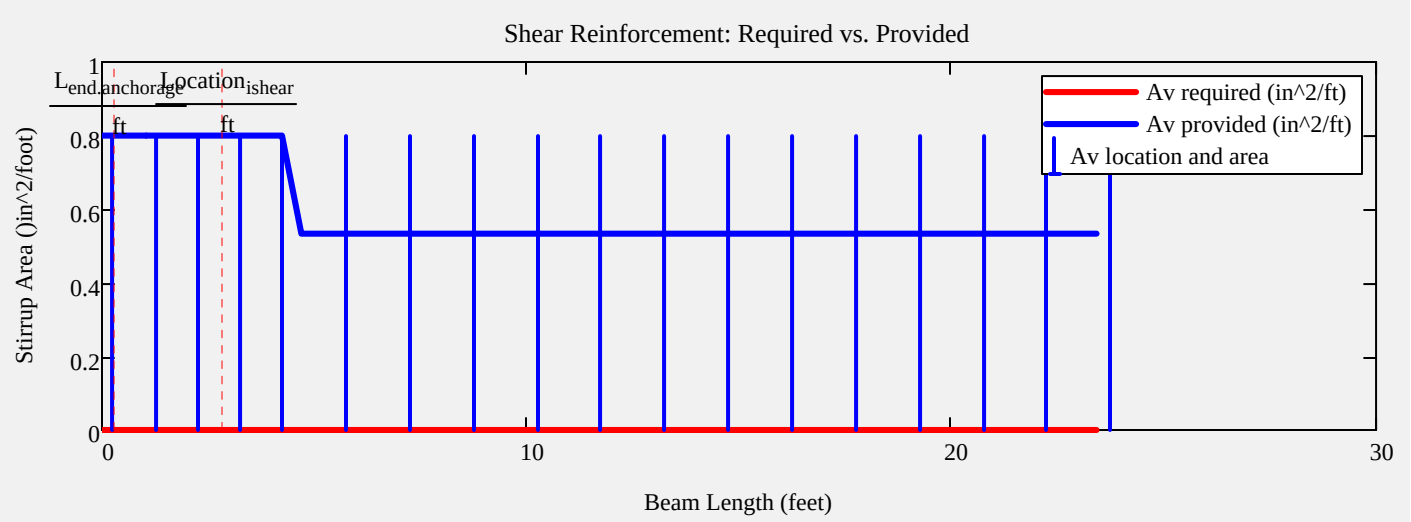
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.87\ ft$

Save Data File

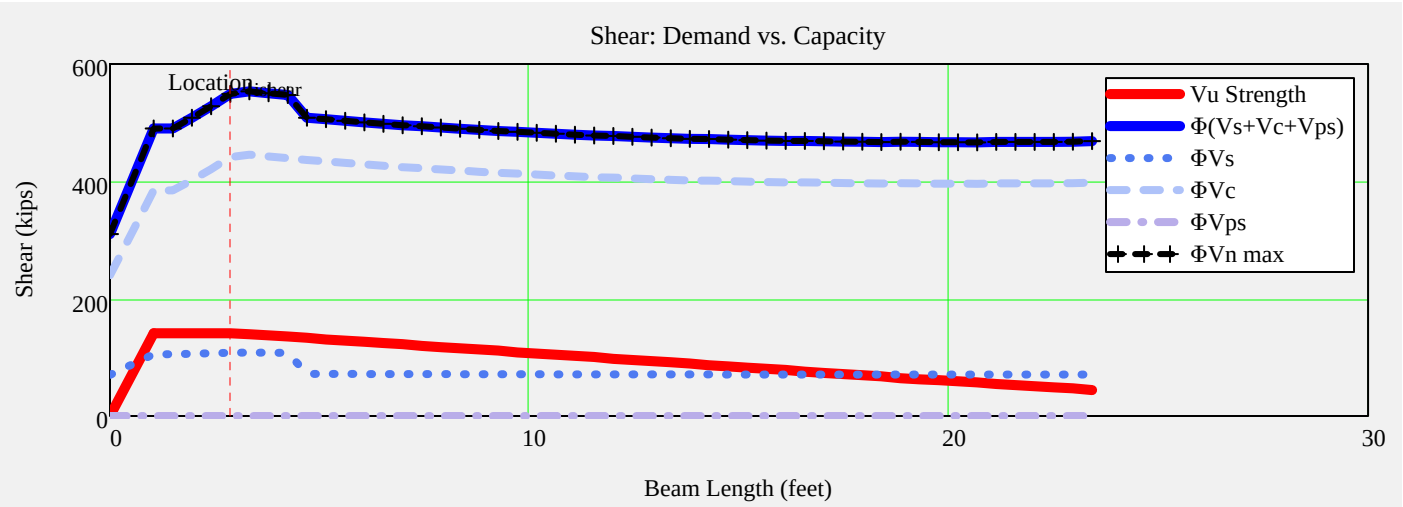
Use current input file

File Name FSB-48ftSpan-15inx56in_ExtBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

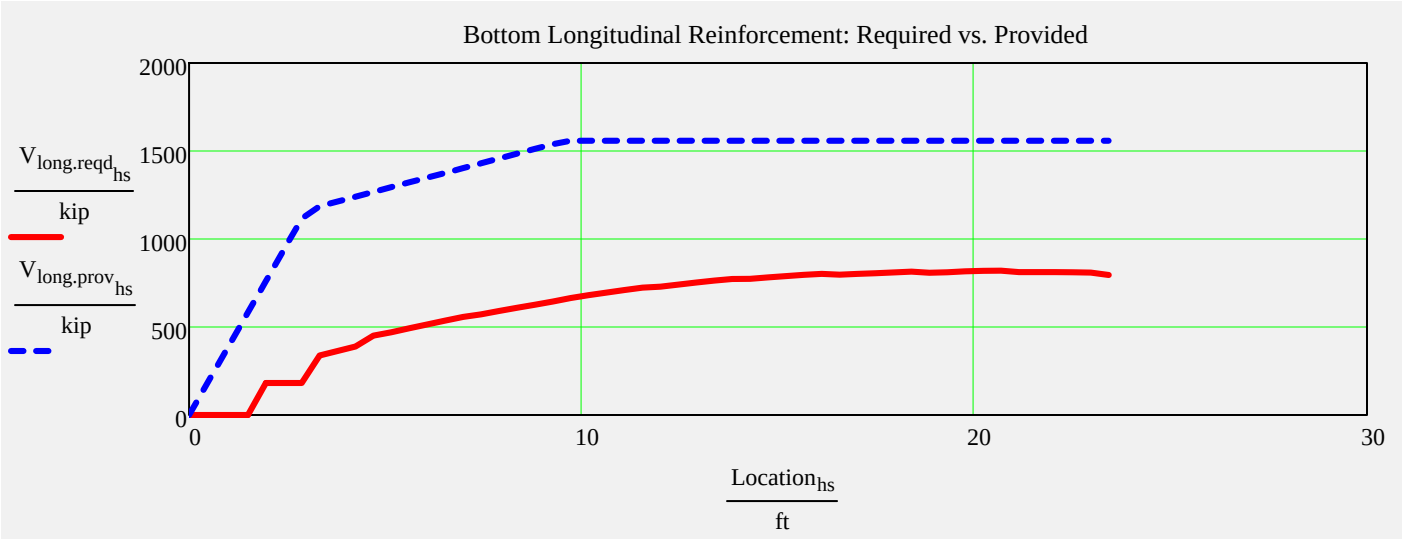
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.70 & 133.48 & 508.26 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.26$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

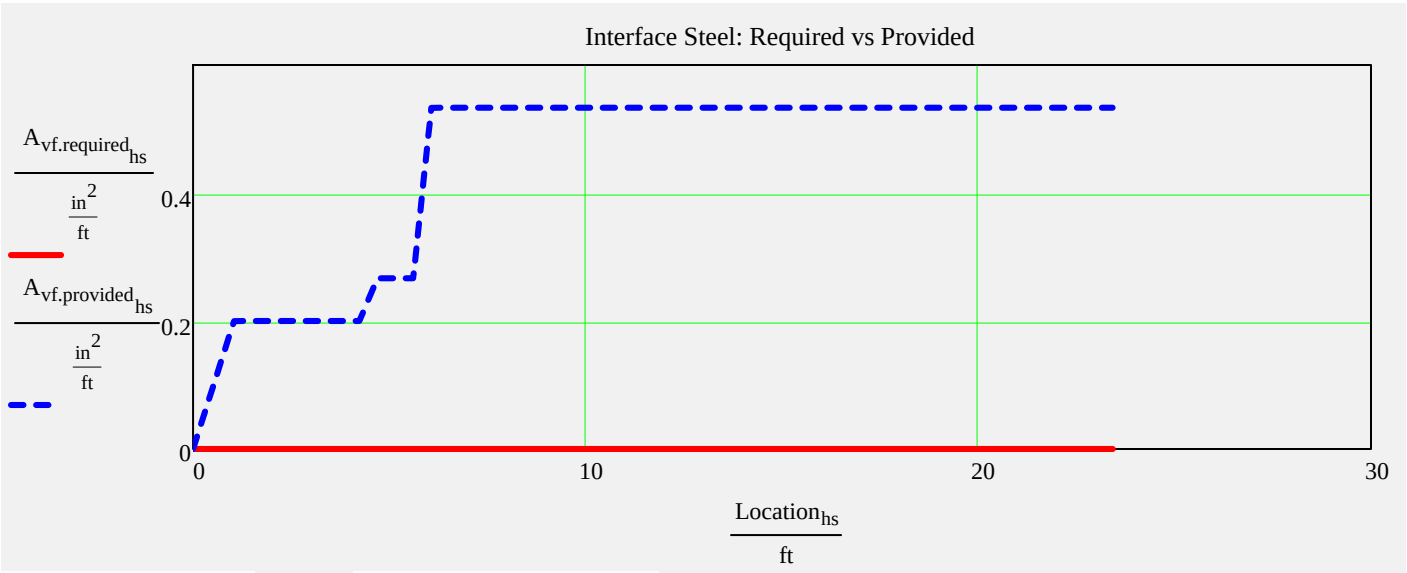


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 20.7 & 820.4 & 1558.2 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.53$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 10.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

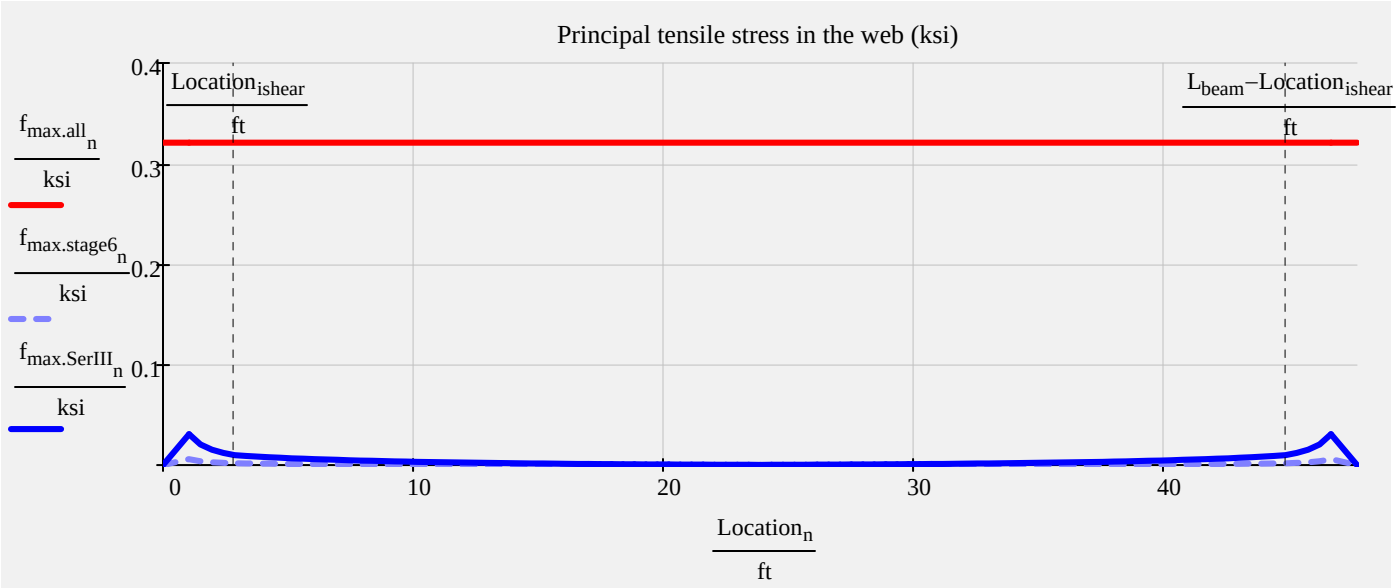
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 34.4 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

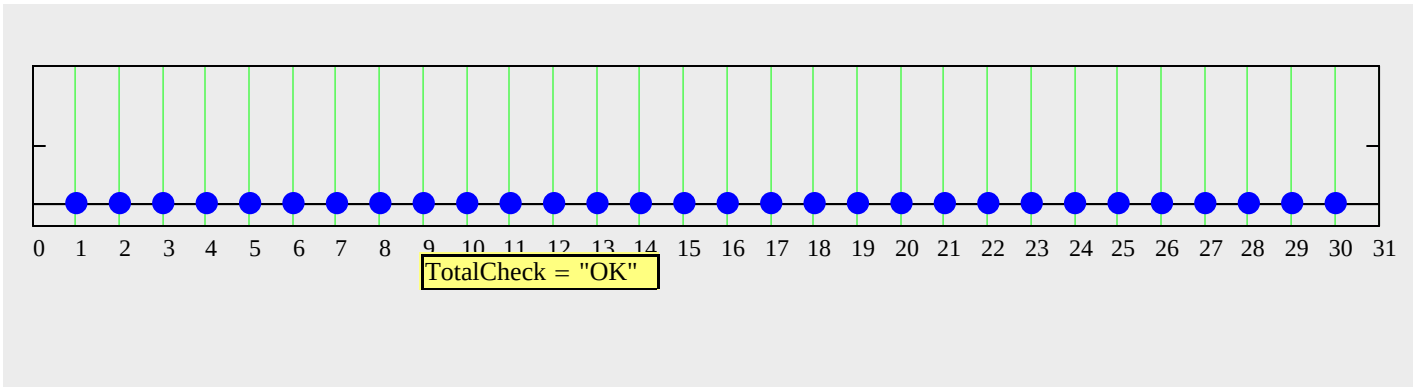
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.35	2.57	"N/A"	24.20	0.65	5.19	"N/A"	3.65	HL-93
"Strength I (Op)"	0.35	3.33	"N/A"	24.20	0.65	6.73	"N/A"	3.65	HL-93
"Service III (Inv)"	0.35	2.72	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.35	2.92	"N/A"	21.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.35	2.45	147.04	24.20	0.65	4.74	284.62	3.65	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.49$ $DC_{LongReinf.Permit} = 0.53$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1864	"factored resistance (kip-ft)...."
"γDL"	451	"factored dead load (kip-ft)...."
"γLL"	425	"factored live load (kip-ft)....."
"RF"	3.33	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	510.5	"factored resistance (kip)....."
"γDL"	33.4	"factored dead load (kip)....."
"γLL"	70.9	"factored live load (kip)....."
"RF"	6.73	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 48 FEET (NO SKEW)
EASTBOUND BRIDGE
(PARKER CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\EB 48' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-48ftSpan-15inx56in_15Skew_ExtBeam.dat
FSB-48ftSpan-15inx56in_15Skew_IntBeam.dat
FSB-48ftSpan-15inx56in_ExtBeam.dat
FSB-48ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

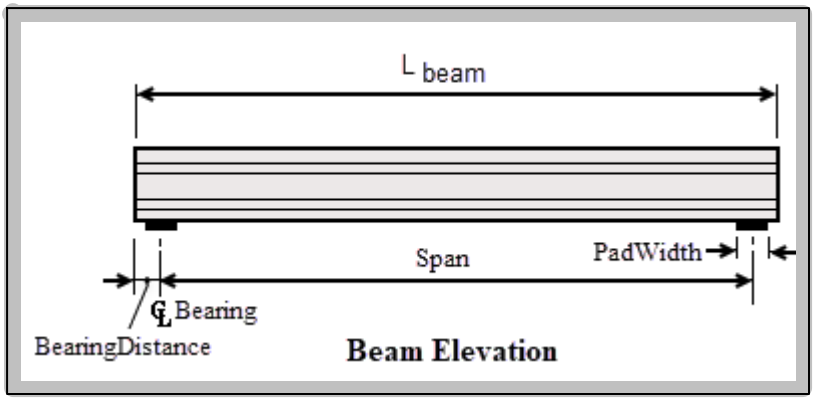
InputDataFile = "FSB-48ftSpan-15inx56in_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

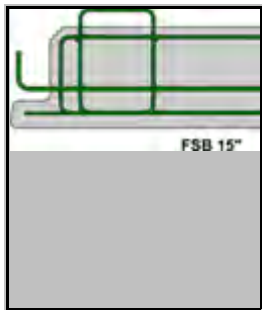
Superstructure Data

InputDataFile = "FSB-48ftSpan-15inx56in_IntBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	47.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

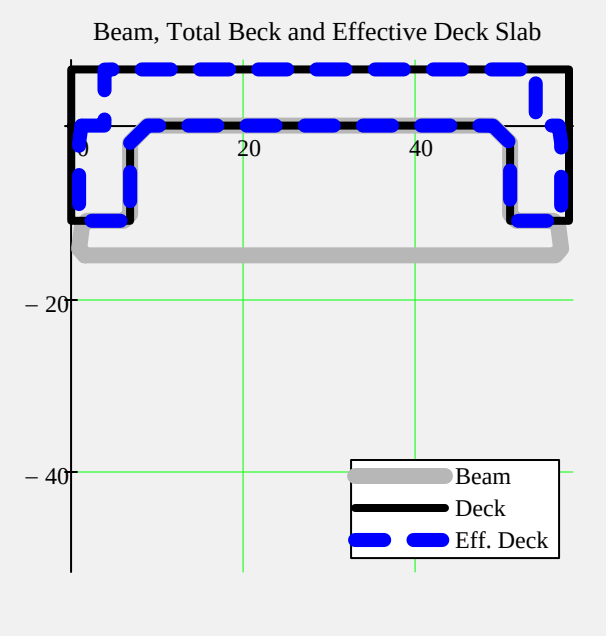
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = 56·in

$b_e = 57.65 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0.03 kip/ft

$w_{deck} = 0.58 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 47.75\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

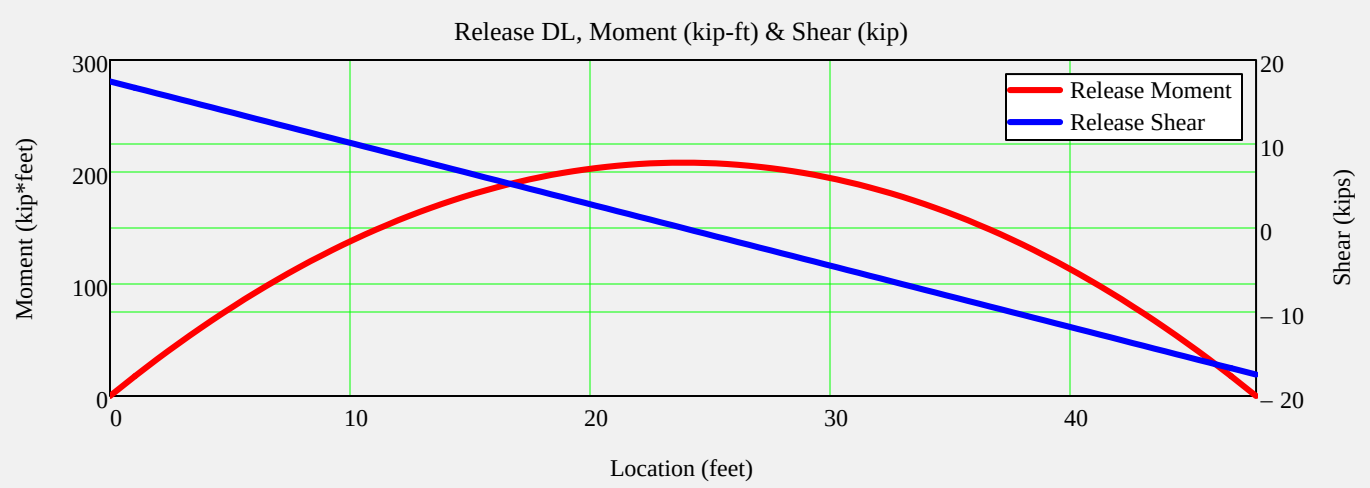
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

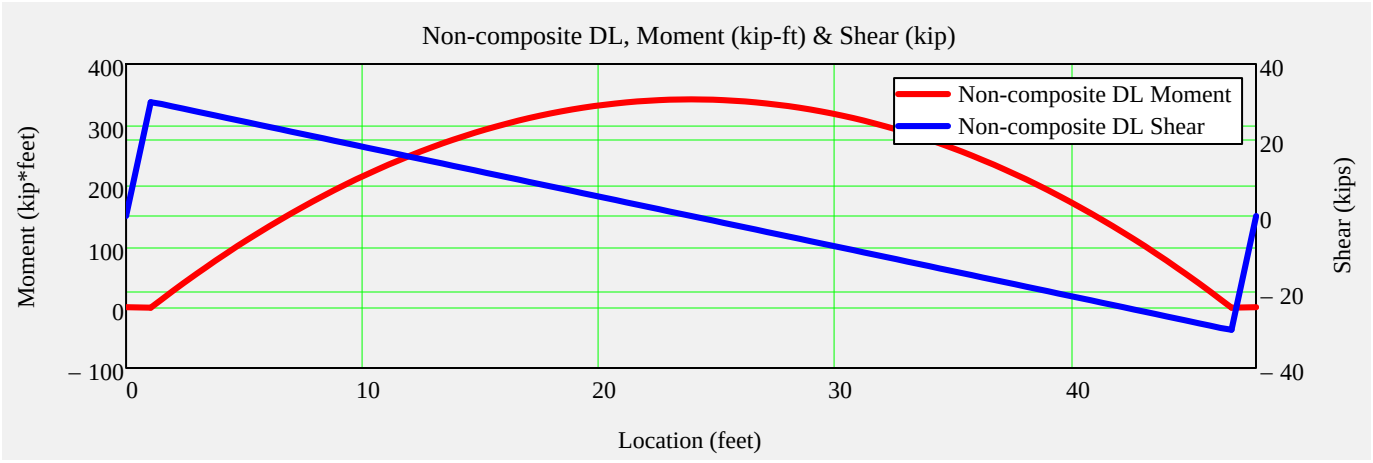
Release Dead Load Moments and Shears

$L_{span} = 45.67\ ft$



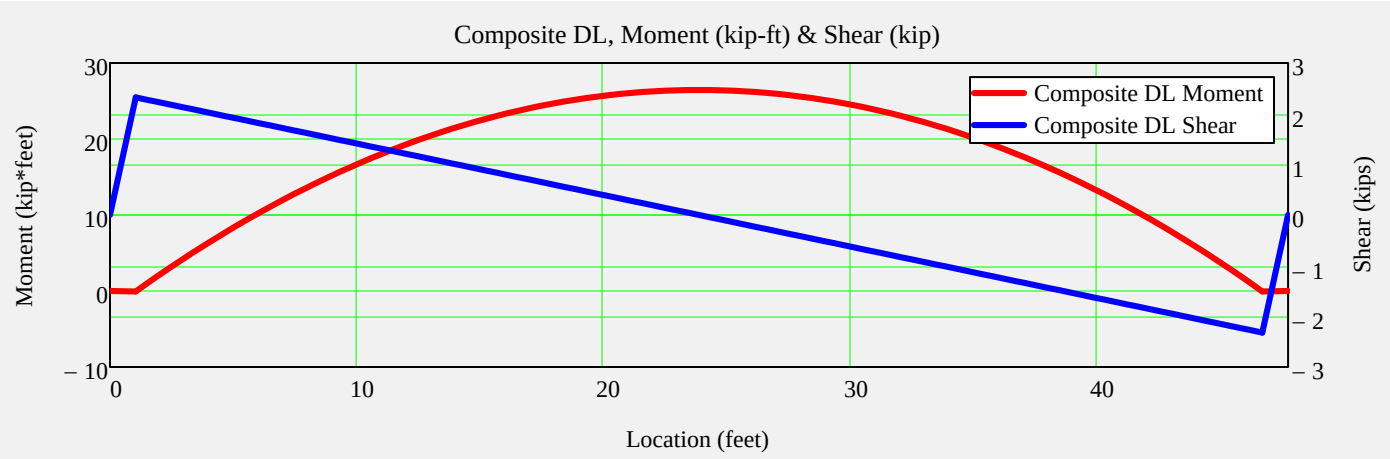
$\max(V_{release}) = 17.5 \cdot kip$ $\max(M_{release}) = 208.3 \cdot kip \cdot ft$ $\min(V_{release}) = -17.5 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 29.9 \cdot kip$ $\max(M_{dl.non.comp}) = 341.7 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -29.9 \cdot kip$

Composite Dead Load Moments and Shear



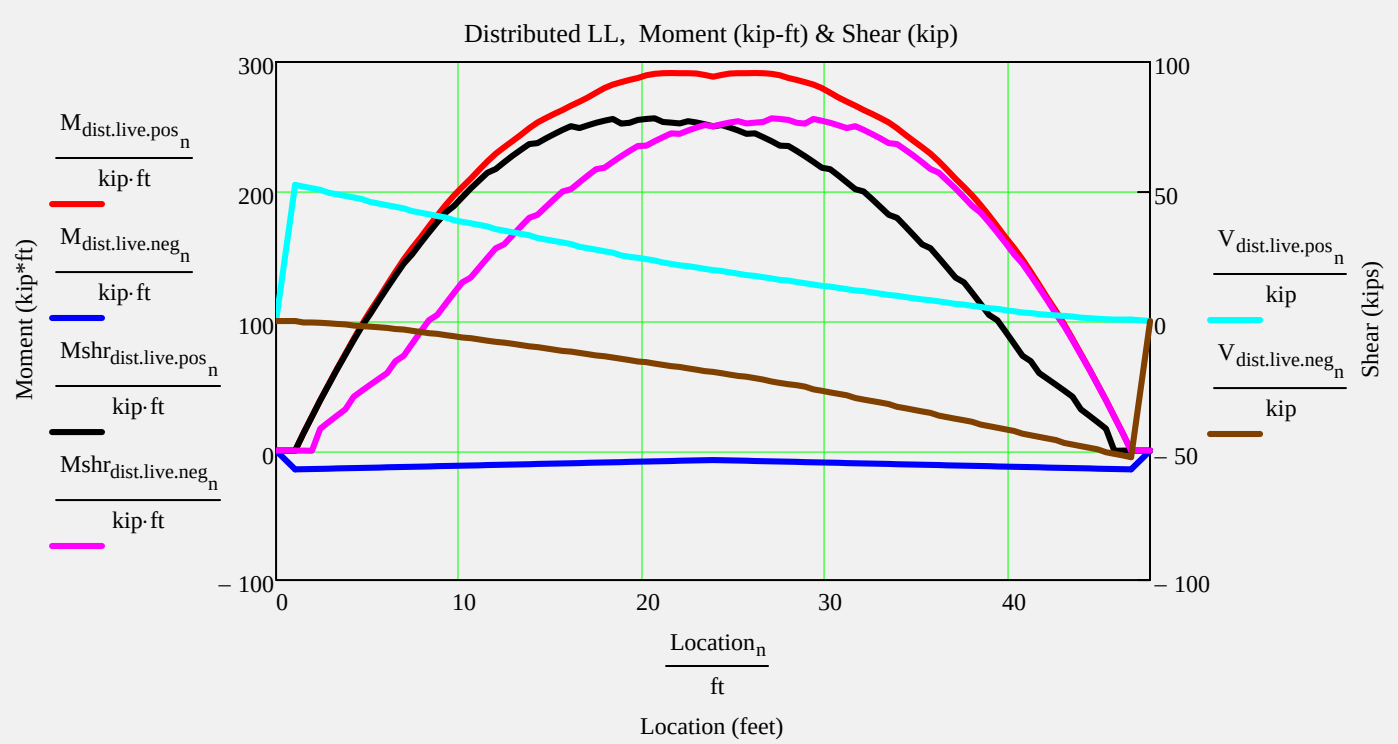
$\max(V_{dl.comp}) = 2.3 \cdot kip$ $\max(M_{dl.comp}) = 26.4 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.3 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 45.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.33$ $g_{mom.fatigue} = 0.18$ $g_{shear} = 0.58$



$\max(V_{dist.live.pos}) = 52.5 \cdot kip$

$\max(M_{dist.live.pos}) = 291.5 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -52.5 \cdot kip$

$Reaction_{LL} = 54.5 \cdot kip$

$\min(M_{dist.live.neg}) = -14.5 \cdot kip \cdot ft$

$Reaction_{DL} = 33.7 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 257 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{truck} = 58.93 \cdot kip$ $Reaction_{lane} = 15.28 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 43.2 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-48ftSpan-15inx56in_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

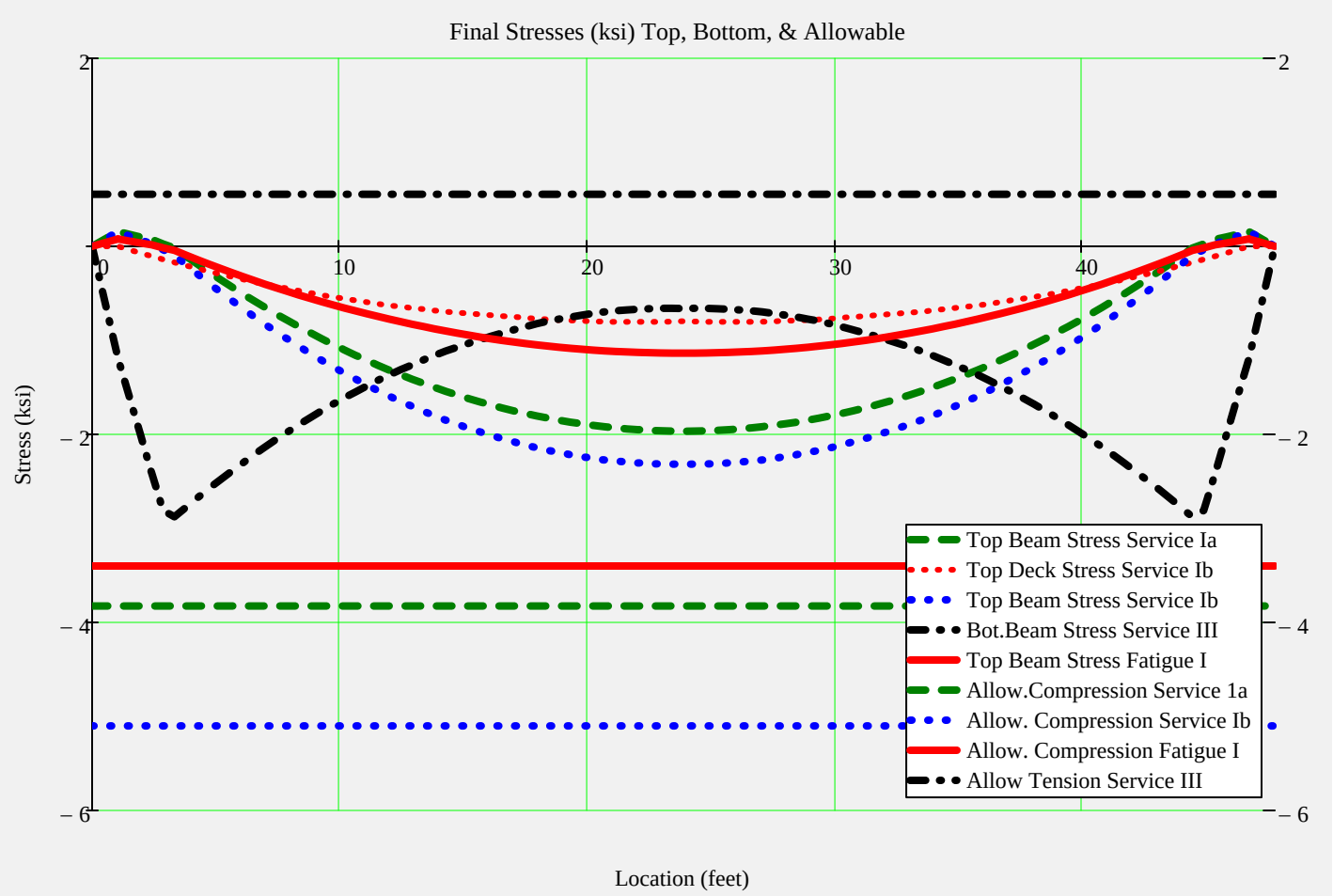
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

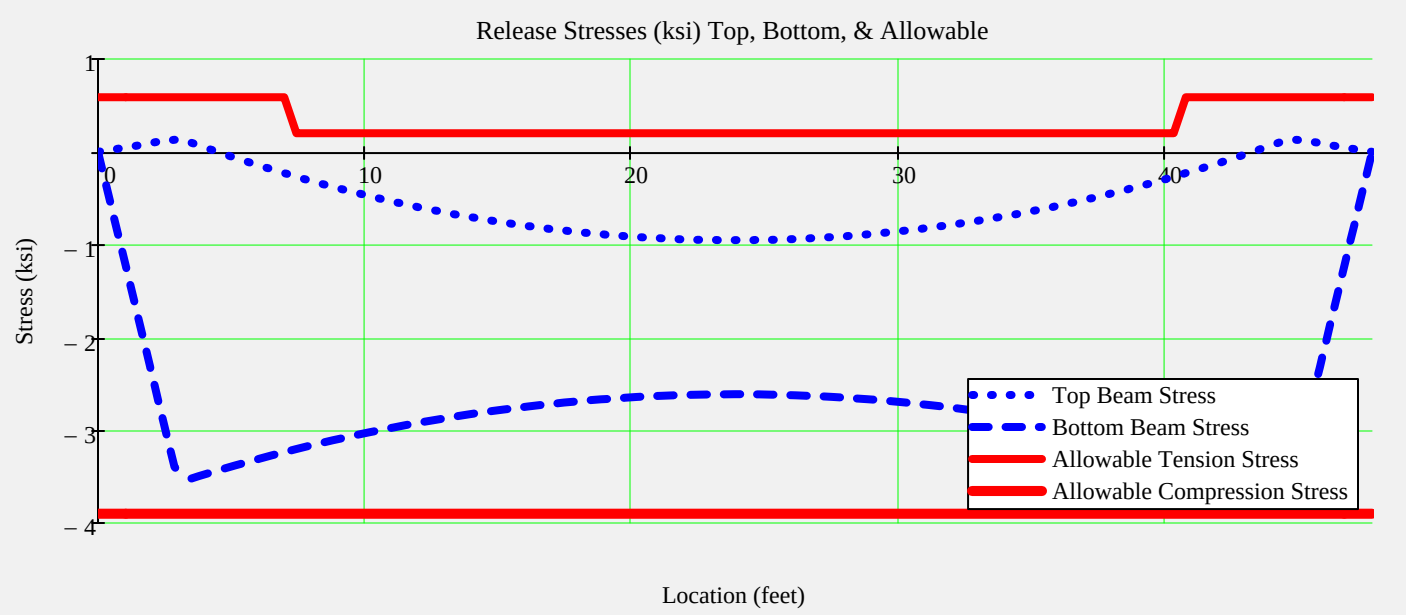
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.70$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.91$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.51$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.45$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.33$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.87	0.13	0.59
"Compression @ Release"	3.32	–3.54	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	23.88	–1.97	–3.83
"CompressionIb @ ServiceI"	24.33	–2.32	–5.10
"Compression @ FatigueI"	23.88	–1.14	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

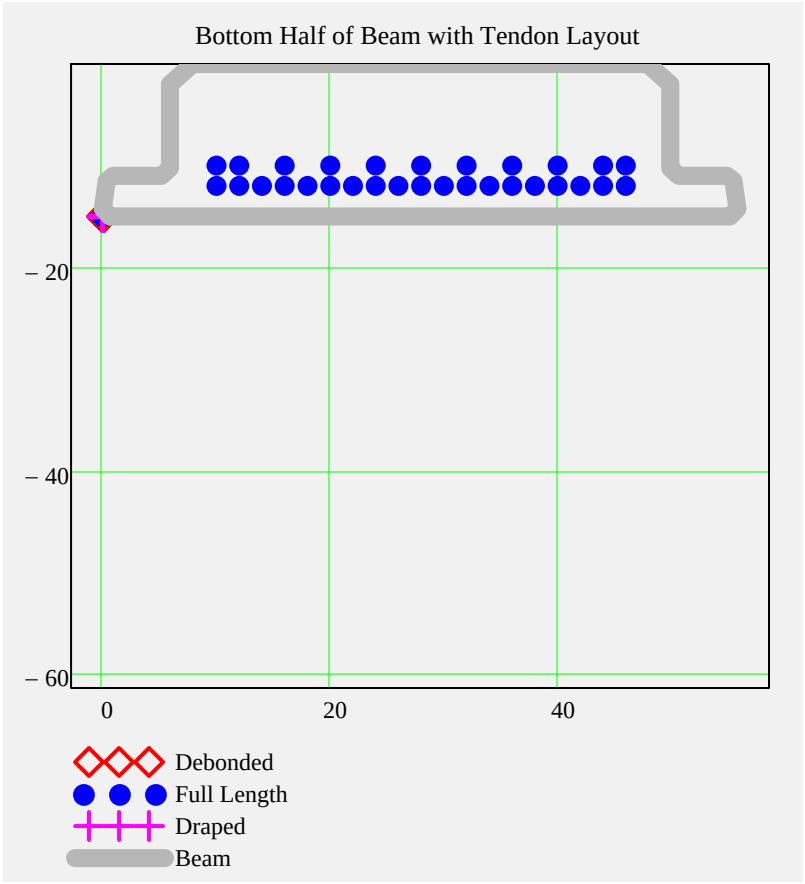
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

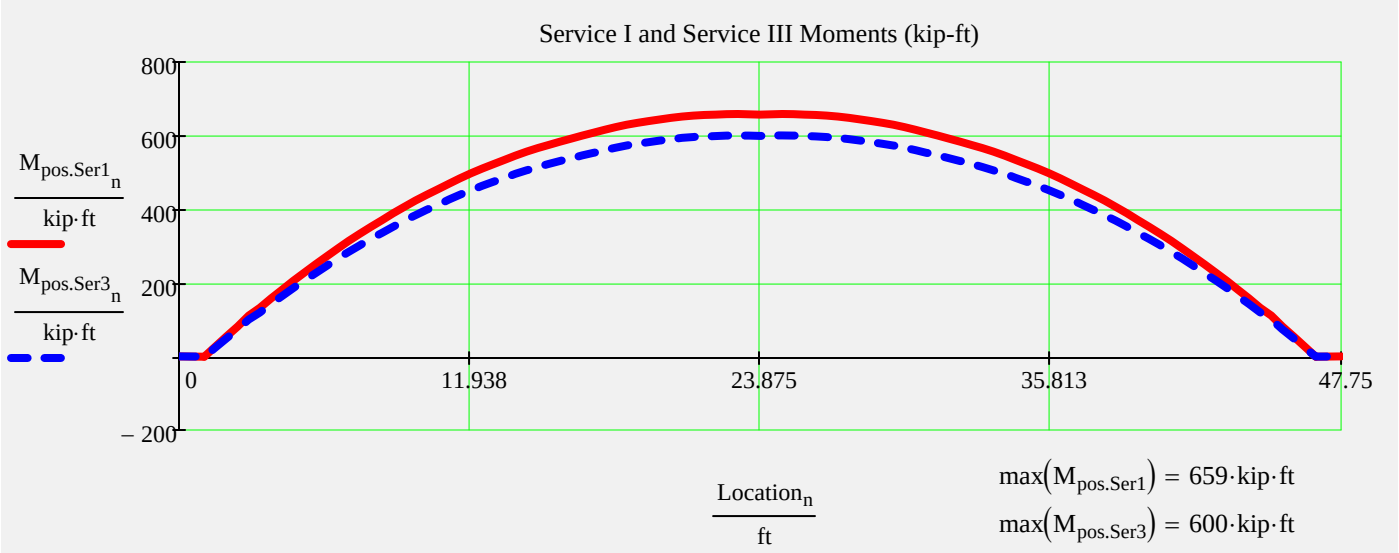
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.95	–2.61
"2"	–1.01	–2.17
"4"	–0.88	–2.28
"6"	–1.93	–1.37
"8"	–2.32	–0.66

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1197.5	45628	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	208
"Non-Composite DL (incl. beam wt.)"	342
"Composite Dead Load"	26
"Distributed Live Load"	289

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

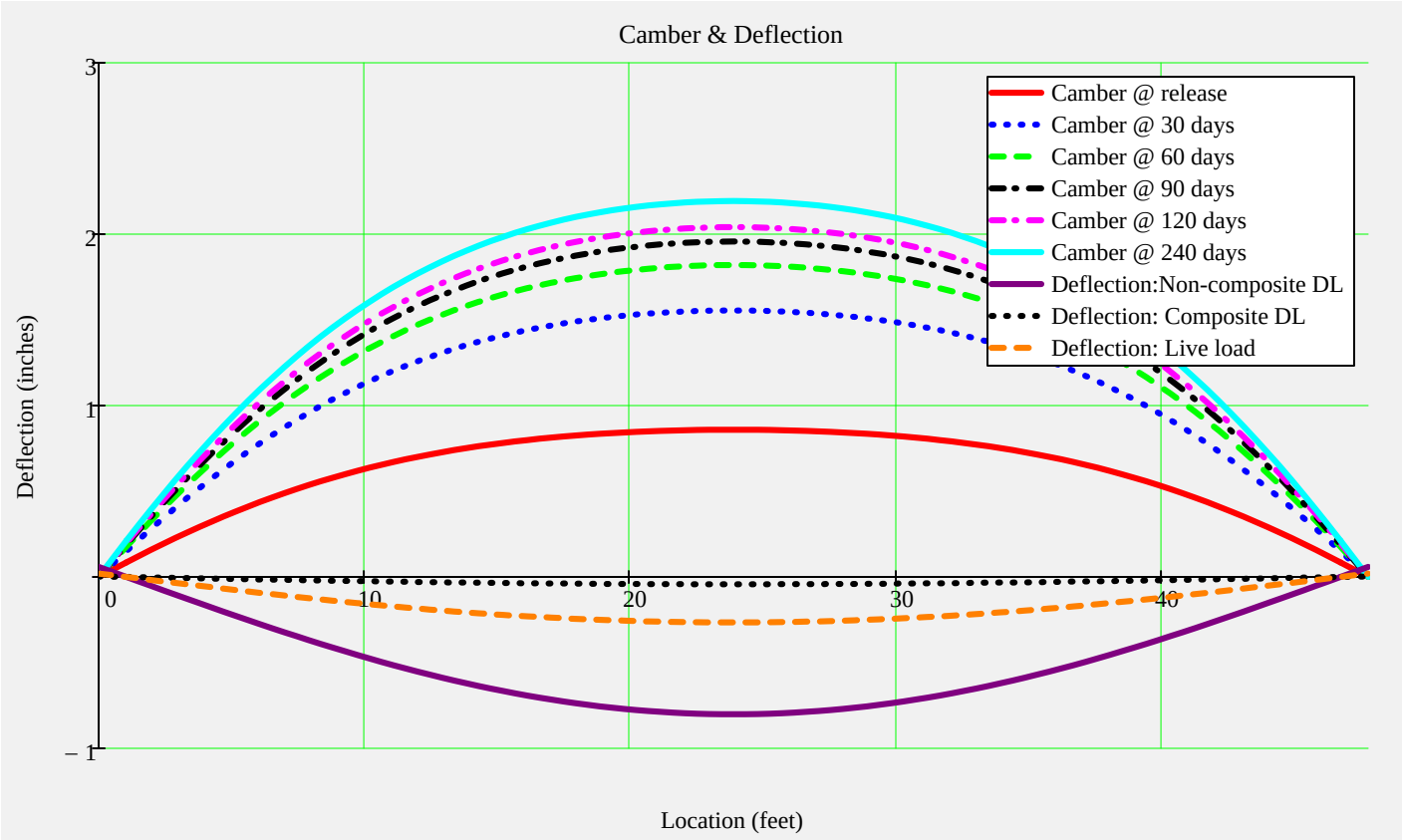
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 45.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.06	–0.35	0.40	0.86
"30 Days"	–0.19	–0.66	0.70	1.55
"60 Days"	–0.23	–0.77	0.82	1.82
"90 Days"	–0.26	–0.83	0.88	1.96
"120 Days"	–0.27	–0.87	0.92	2.04
"240 Days"	–0.30	–0.93	0.99	2.19
"Non-comp DL"	–0.08	0.07	–0.27	–0.80
"Comp DL"	–0.00	0.01	–0.01	–0.04
"LL"	–0.01	0.03	–0.09	–0.27

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.2 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

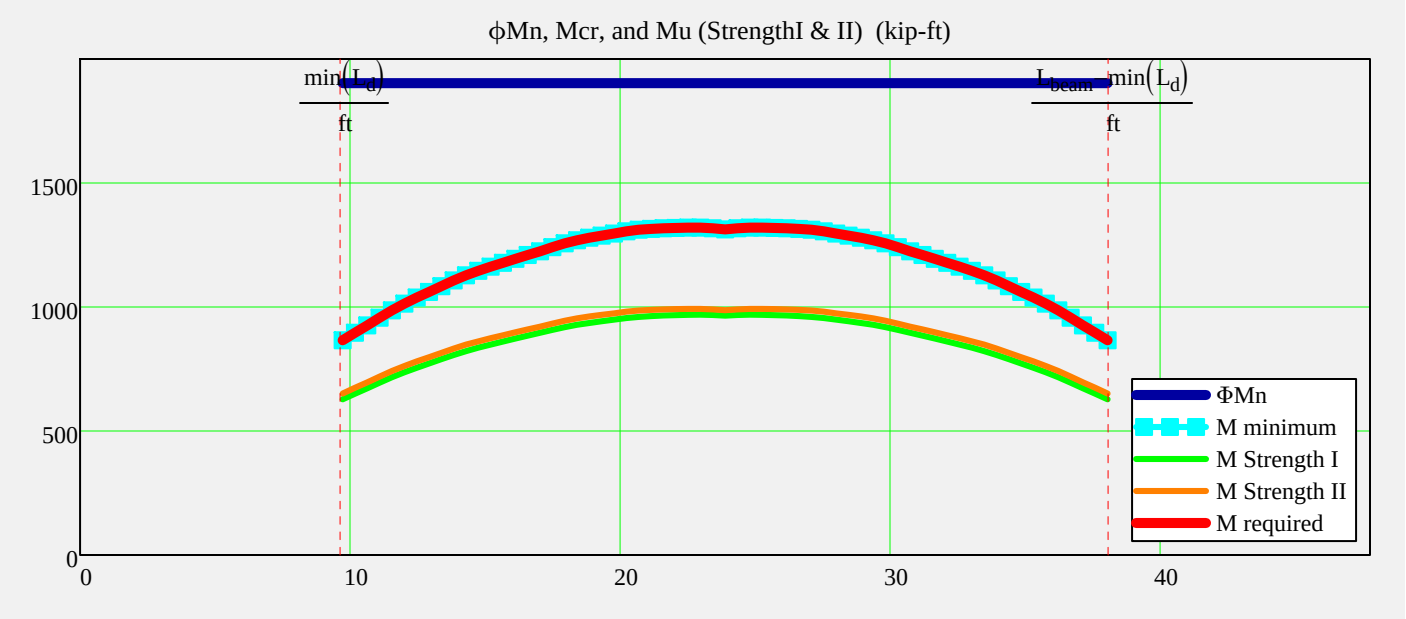
Values at midspan

$LimitStateForMoment_{51} = "Strength\ II"$ $\max(M_{Strength}) = 992 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 1313 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1313 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel - Low\ Lax"$ $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1903 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 38.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.69$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

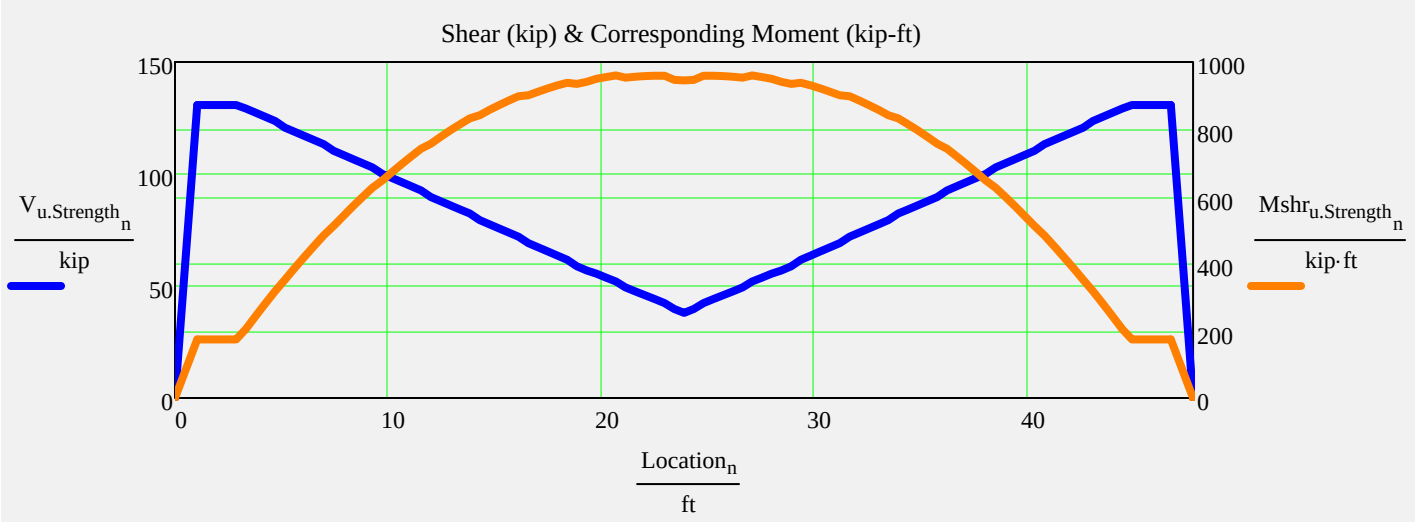
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

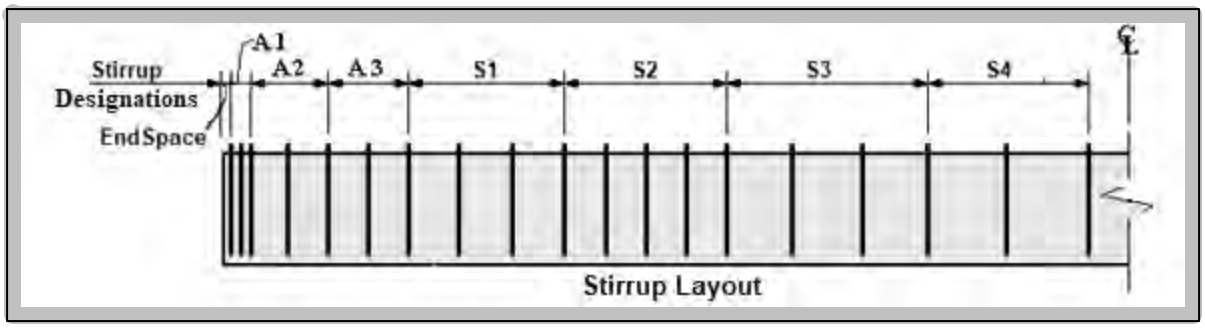
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 132 \\ 139 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 130.8 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 960 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

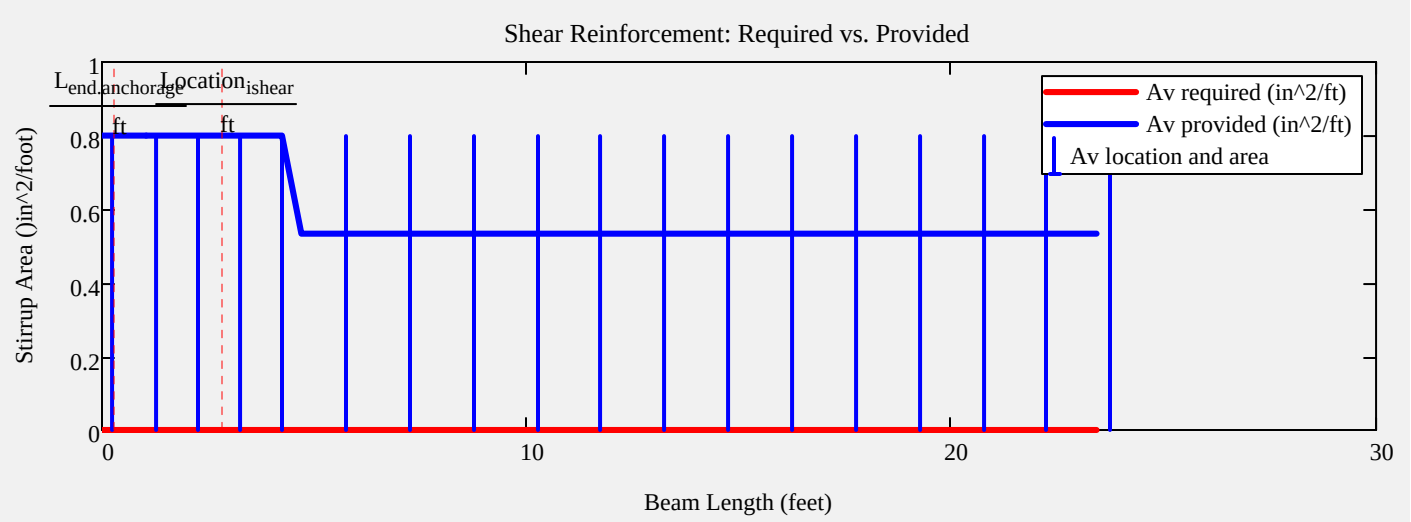
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.87\ ft$

Save Data File

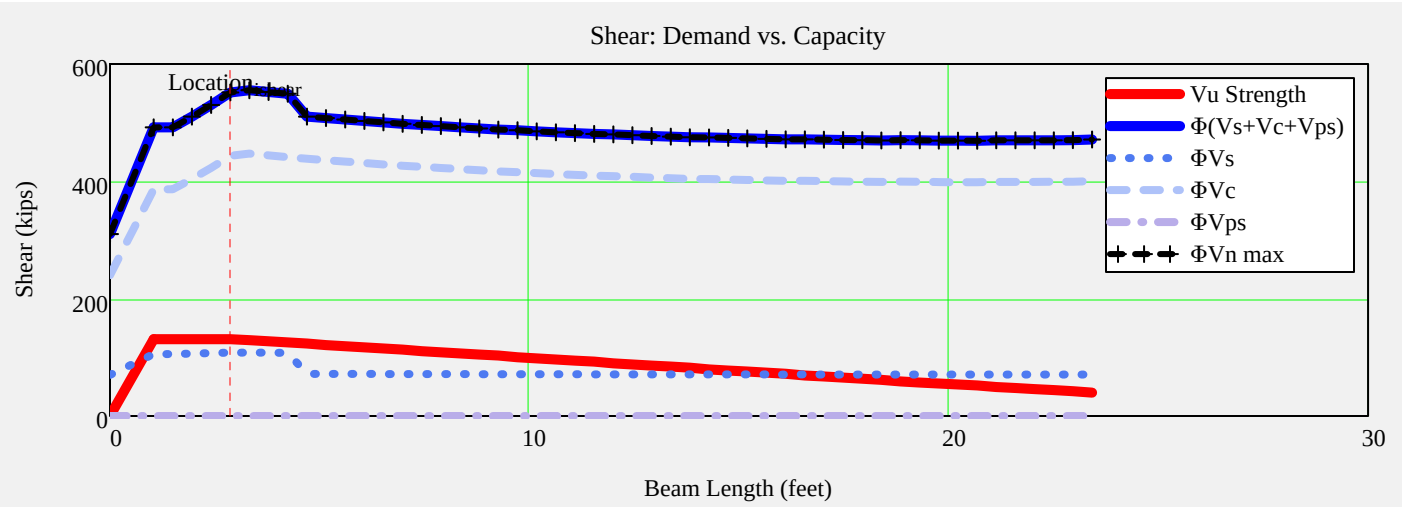
Use current input file

File Name FSB-48ftSpan-15inx56in_IntBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

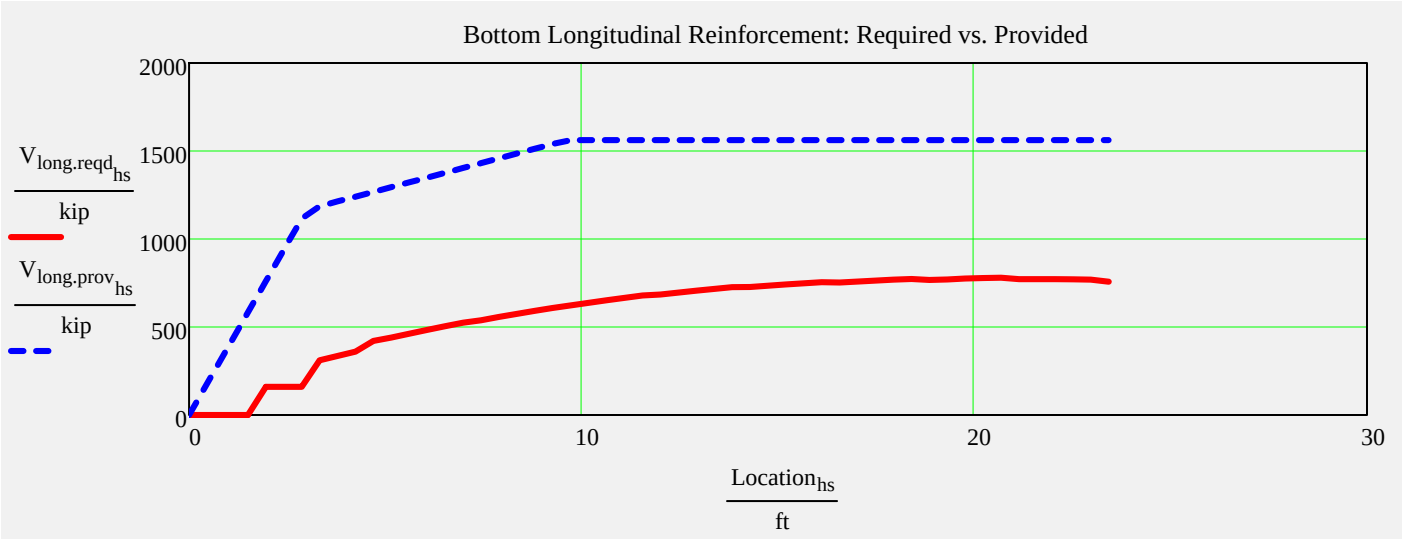
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.70 & 123.62 & 510.36 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.24$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

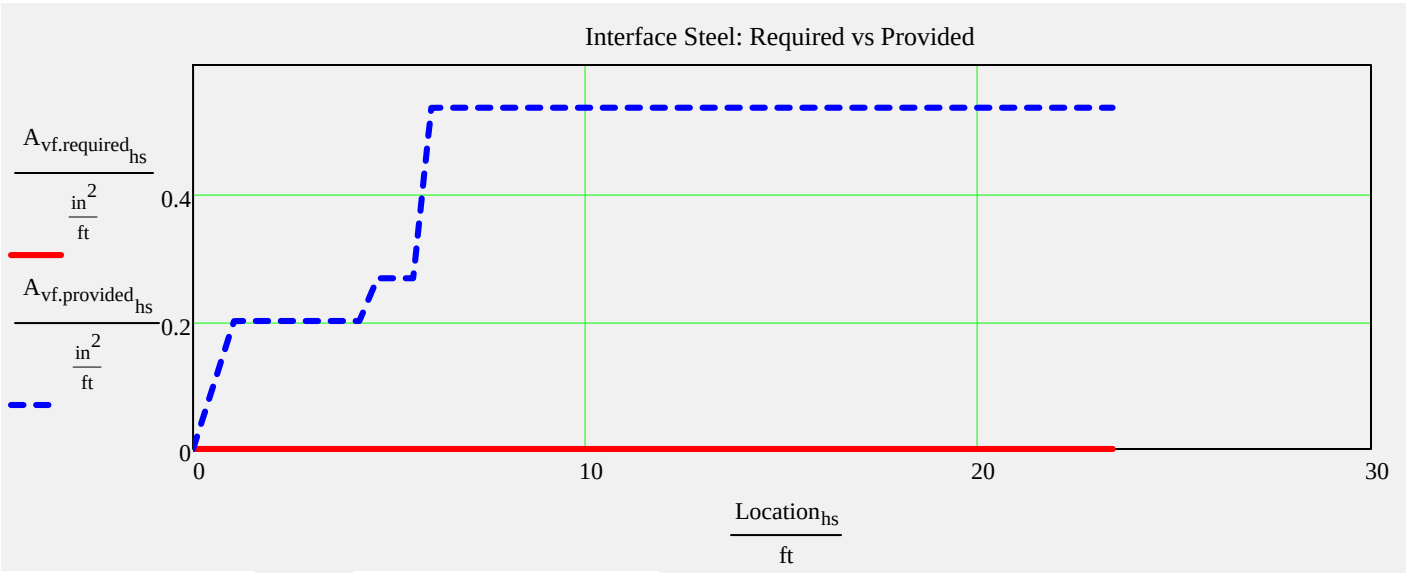


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 20.7 & 779.6 & 1561.9 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.50$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 10.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

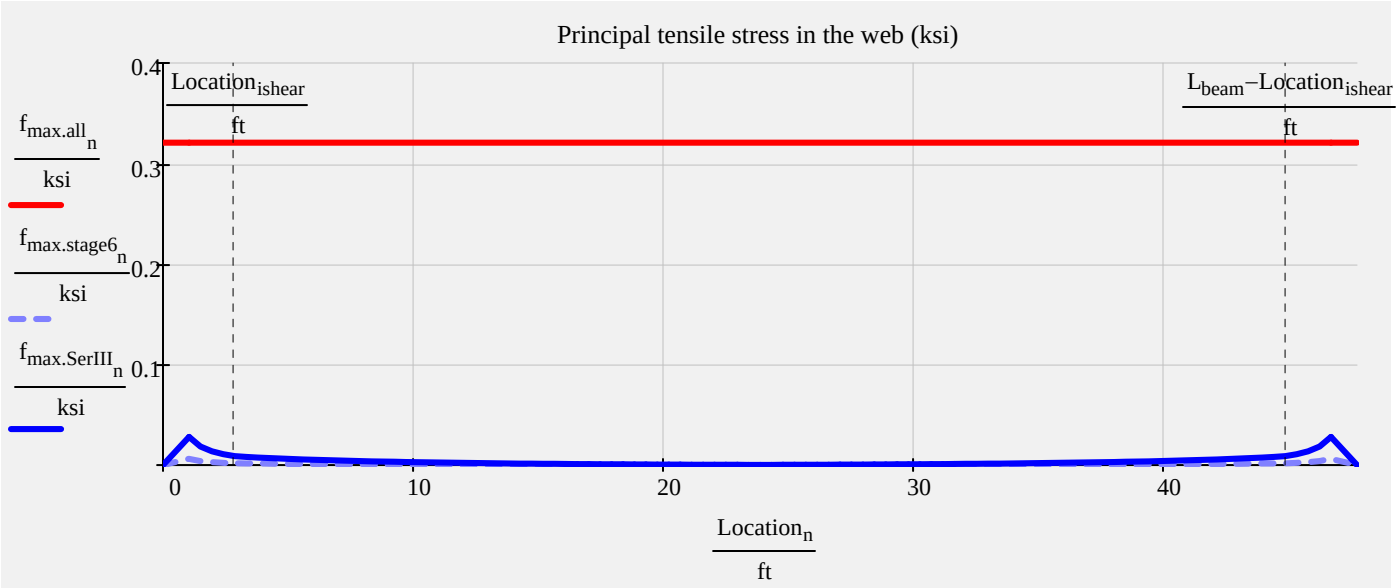
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 34.4 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

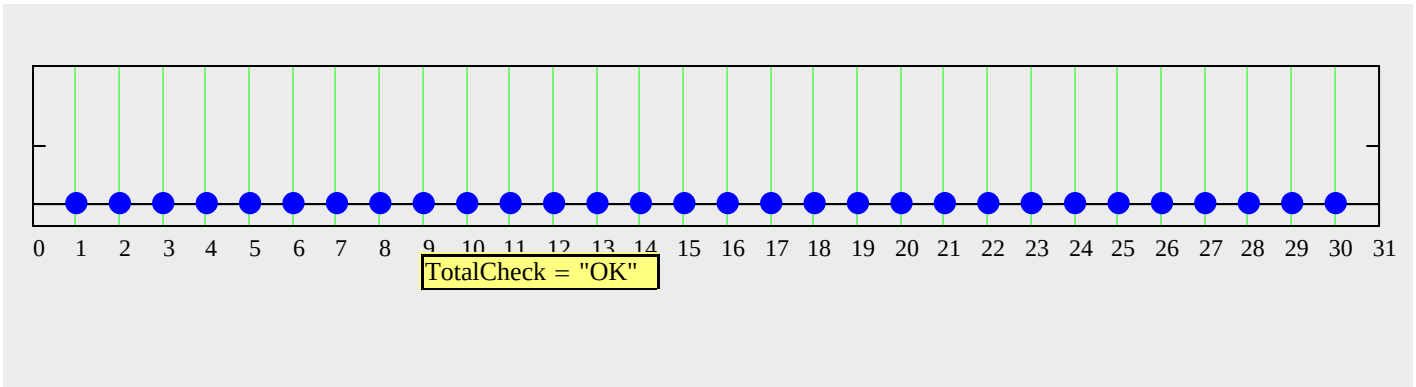
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.33	2.83	"N/A"	21.46	0.58	5.81	"N/A"	3.65	HL-93
"Strength I (Op)"	0.33	3.67	"N/A"	21.46	0.58	7.53	"N/A"	3.65	HL-93
"Service III (Inv)"	0.33	2.91	"N/A"	21.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.33	3.12	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.33	2.71	162.30	24.20	0.58	5.31	318.83	3.65	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.47$ $DC_{LongReinf.Permit} = 0.50$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1903	"factored resistance (kip-ft)...."
"γDL"	459	"factored dead load (kip-ft)...."
"γLL"	393	"factored live load (kip-ft)....."
"RF"	3.67	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	512.4	"factored resistance (kip)....."
"γDL"	34	"factored dead load (kip)....."
"γLL"	63.5	"factored live load (kip)....."
"RF"	7.53	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 48 FEET (15 DEG. SKEW)
EASTBOUND BRIDGE
(MOSSY GULLY & LONG POINT MARSH)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\EB 48' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-48ftSpan-15inx56in_15Skew_ExtBeam.dat
FSB-48ftSpan-15inx56in_15Skew_IntBeam.dat
FSB-48ftSpan-15inx56in_ExtBeam.dat
FSB-48ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

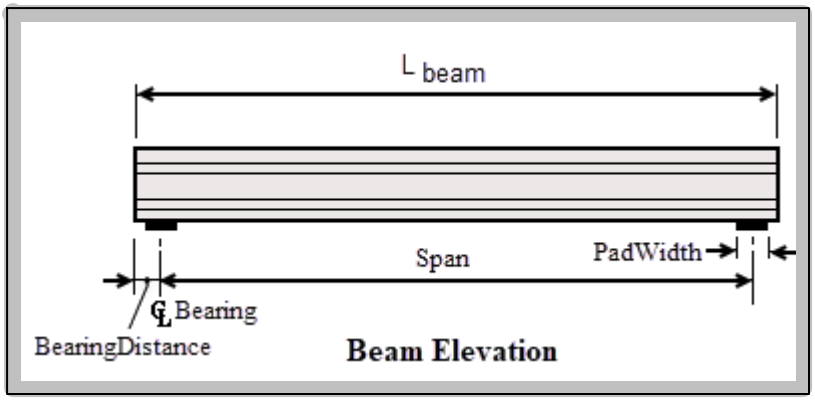
InputDataFile = "FSB-48ftSpan-15inx56in_15Skew_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

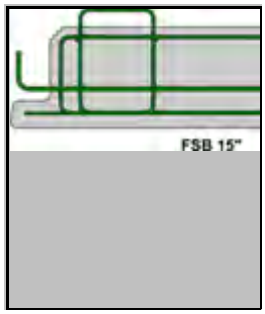
InputDataFile = "FSB-48ftSpan-15inx56in_15Skew_ExtBeam.dat"

Beam Type: FSB12 / **FSB15** / FSB18

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



L_{beam}	47.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

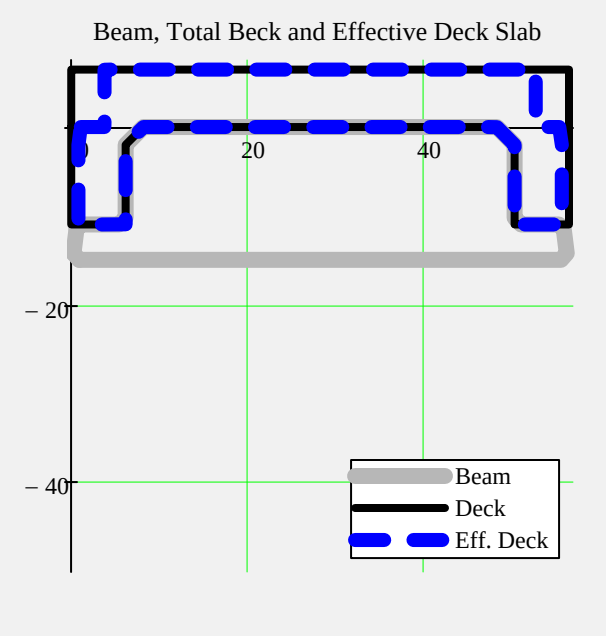
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = 56·in

$b_e = 56.32 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.56 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 47.75$ ft

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

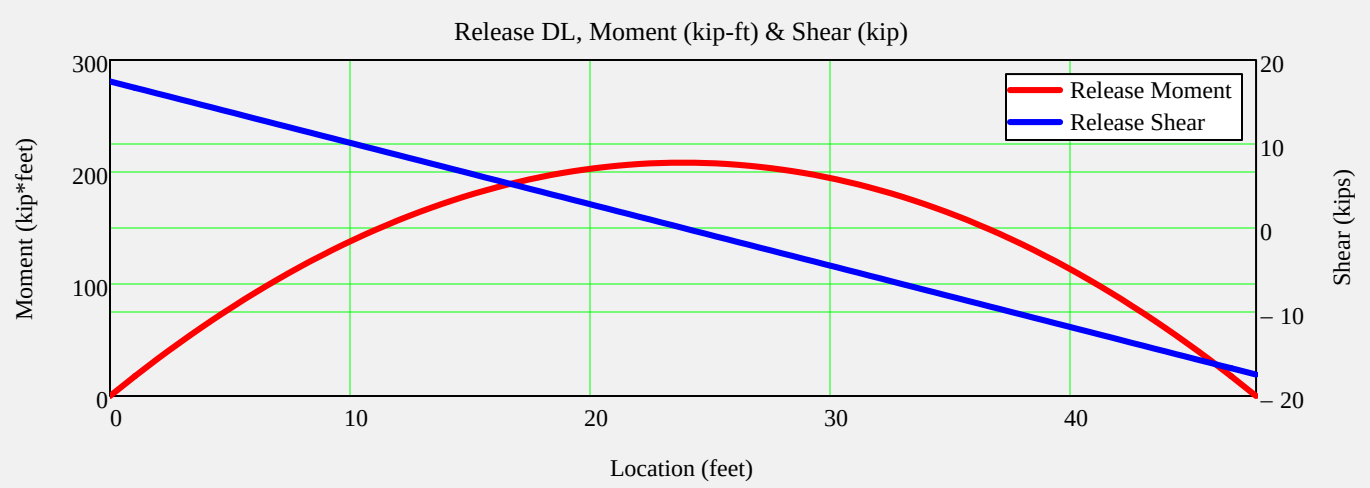
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

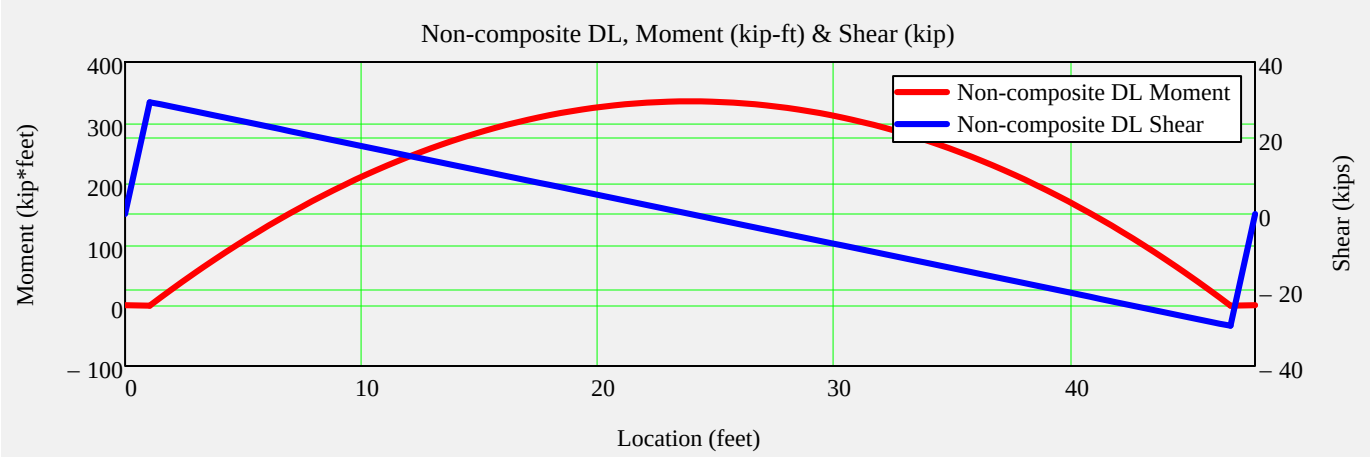
Release Dead Load Moments and Shears

$L_{span} = 45.67\ ft$



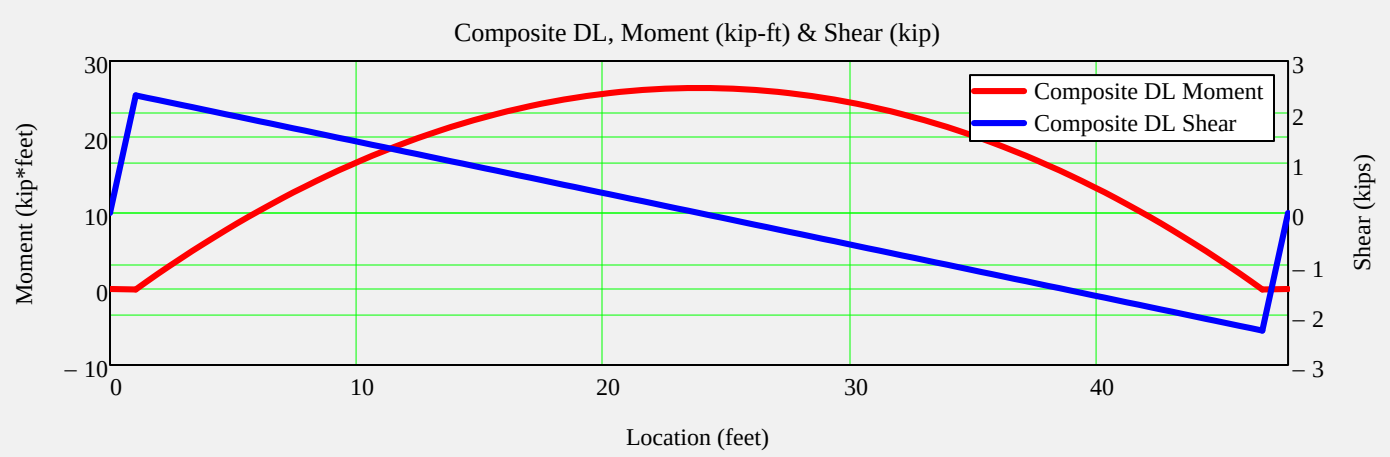
$\max(V_{release}) = 17.5 \cdot kip$ $\max(M_{release}) = 208.3 \cdot kip \cdot ft$ $\min(V_{release}) = -17.5 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 29.4 \cdot kip$ $\max(M_{dl.non.comp}) = 335.3 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -29.4 \cdot kip$

Composite Dead Load Moments and Shear



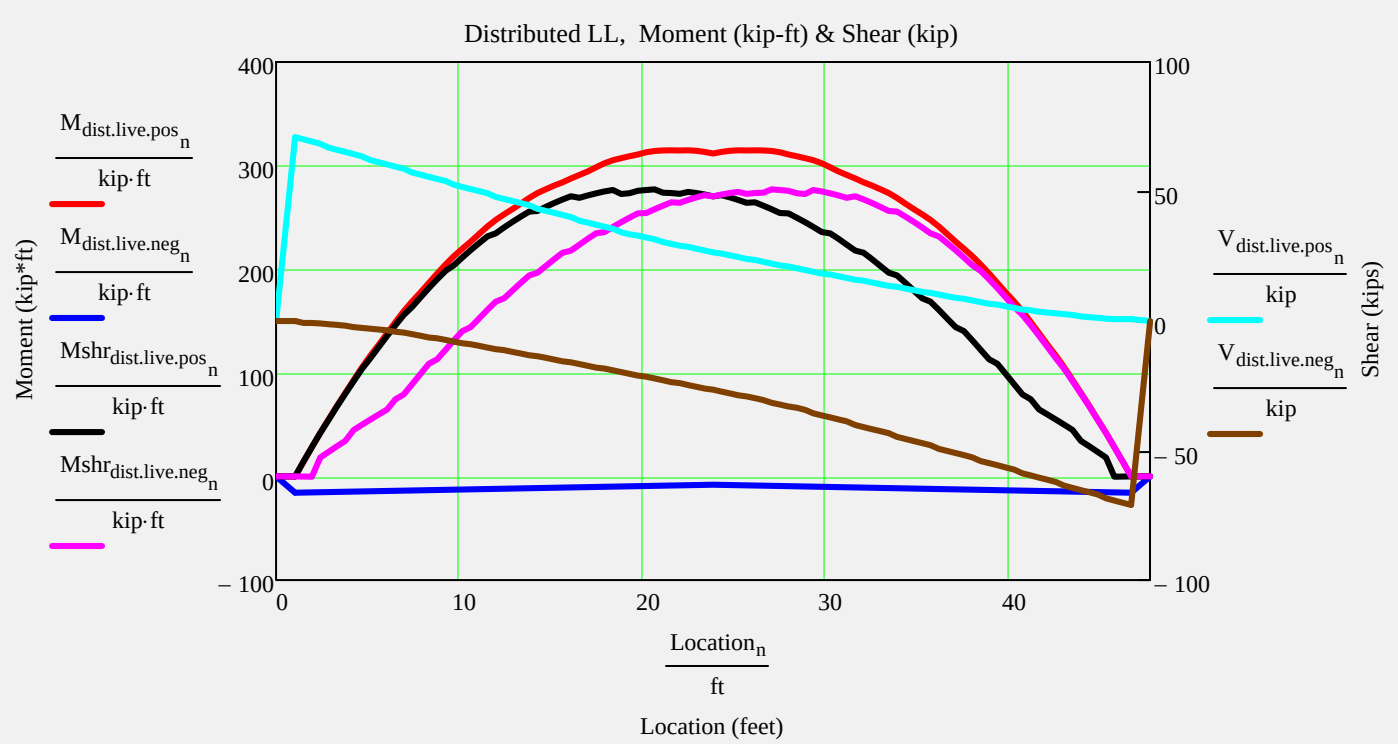
$\max(V_{dl.comp}) = 2.3 \cdot kip$ $\max(M_{dl.comp}) = 26.4 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.3 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 45.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.21$

Final Live Load Distribution Factors: $g_{mom} = 0.35$ $g_{mom.fatigue} = 0.21$ $g_{shear} = 0.79$



$\max(V_{dist.live.pos}) = 71.0 \cdot kip$

$\max(M_{dist.live.pos}) = 314.8 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -71.0 \cdot kip$

$Reaction_{LL} = 73.7 \cdot kip$

$\min(M_{dist.live.neg}) = -15.7 \cdot kip \cdot ft$

$Reaction_{DL} = 33.2 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 277 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{truck} = 58.93 \cdot kip$ $Reaction_{lane} = 15.28 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 58.38 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-48ftSpan-15inx56in_15Skew_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

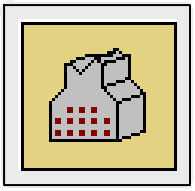
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

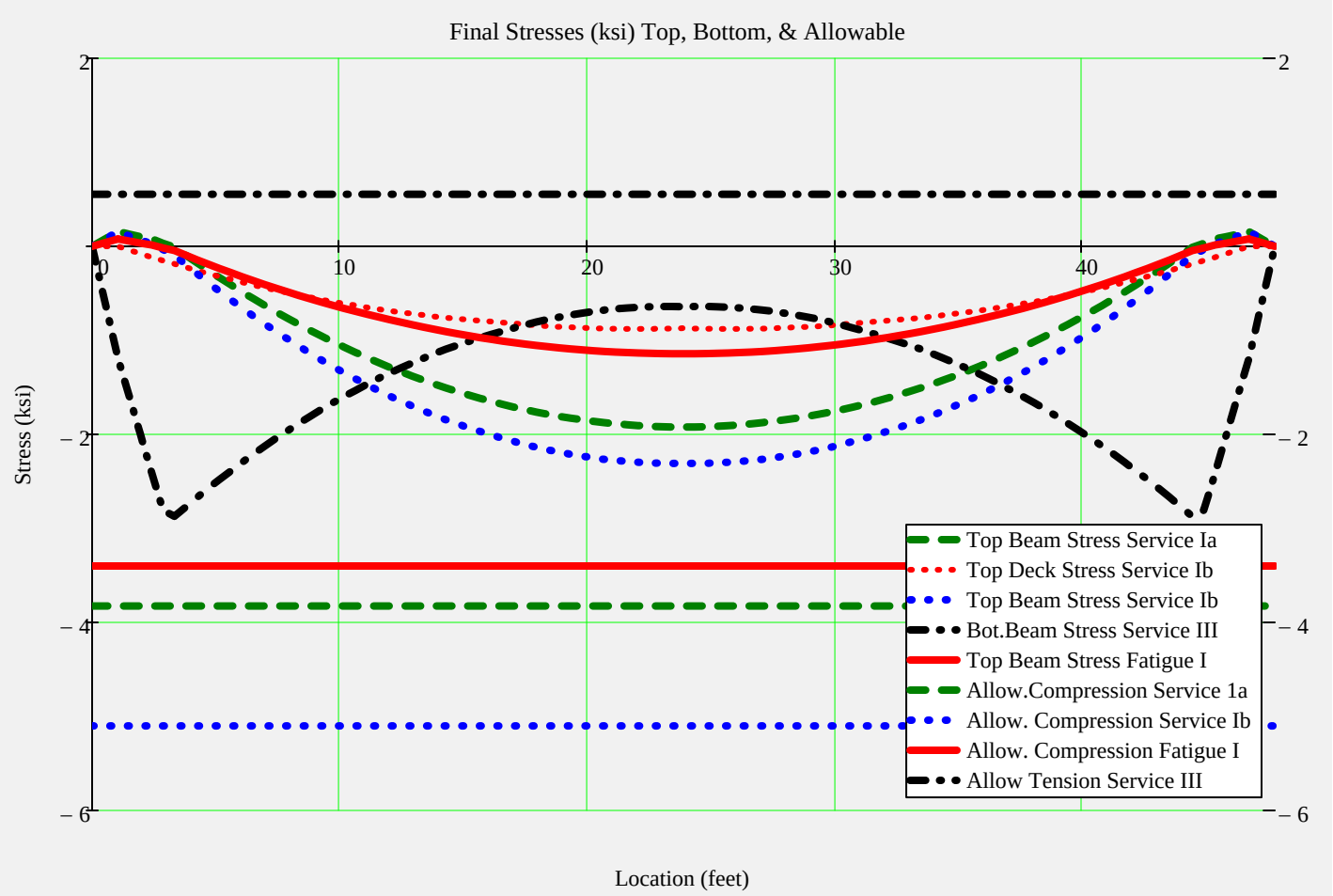
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

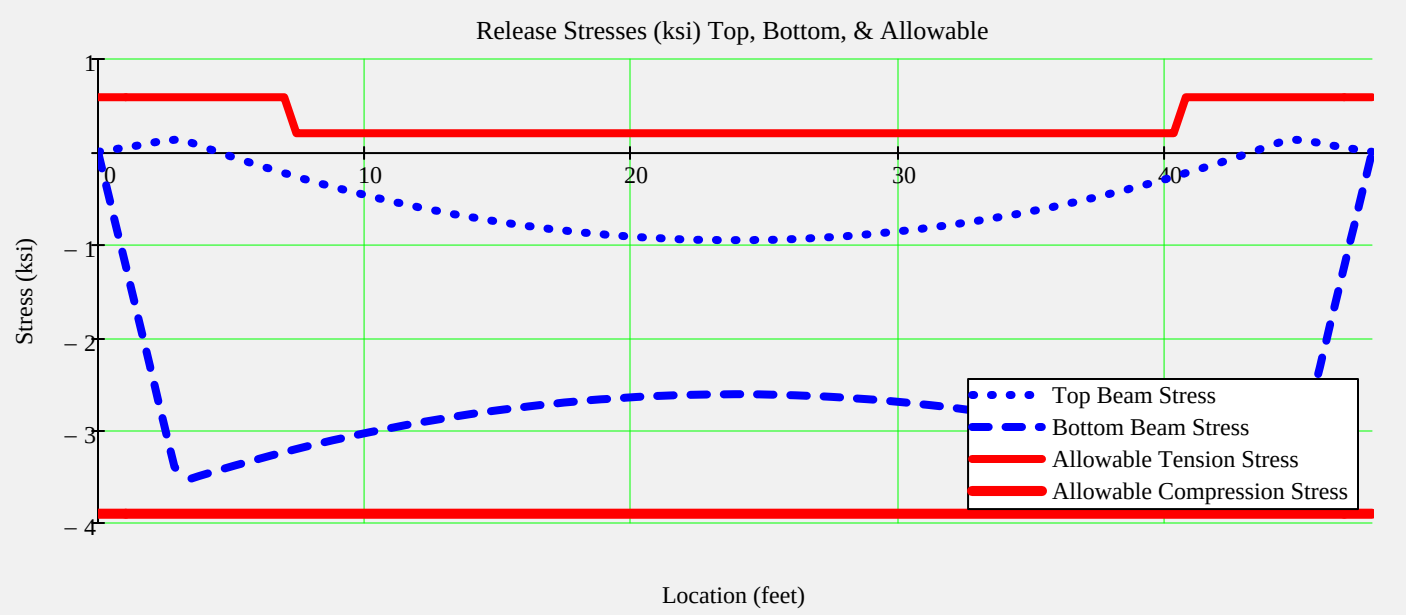
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel} = "OK"$	$\max(DC_f_{tension.rel}) = 0.70$
Release compression	$Check_f_{comp.rel} = "OK"$	$\max(DC_f_{comp.rel}) = 0.91$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII} = "OK"$	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa} = "OK"$	$\max(DC_f_{comp.ServiceIa}) = 0.50$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb} = "OK"$	$\max(DC_f_{comp.ServiceIb}) = 0.45$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI} = "OK"$	$\max(DC_f_{comp.FatigueI}) = 0.34$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.87	0.13	0.59
"Compression @ Release"	3.32	–3.54	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	23.88	–1.92	–3.83
"CompressionIb @ ServiceI"	24.33	–2.31	–5.10
"Compression @ FatigueI"	23.88	–1.14	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

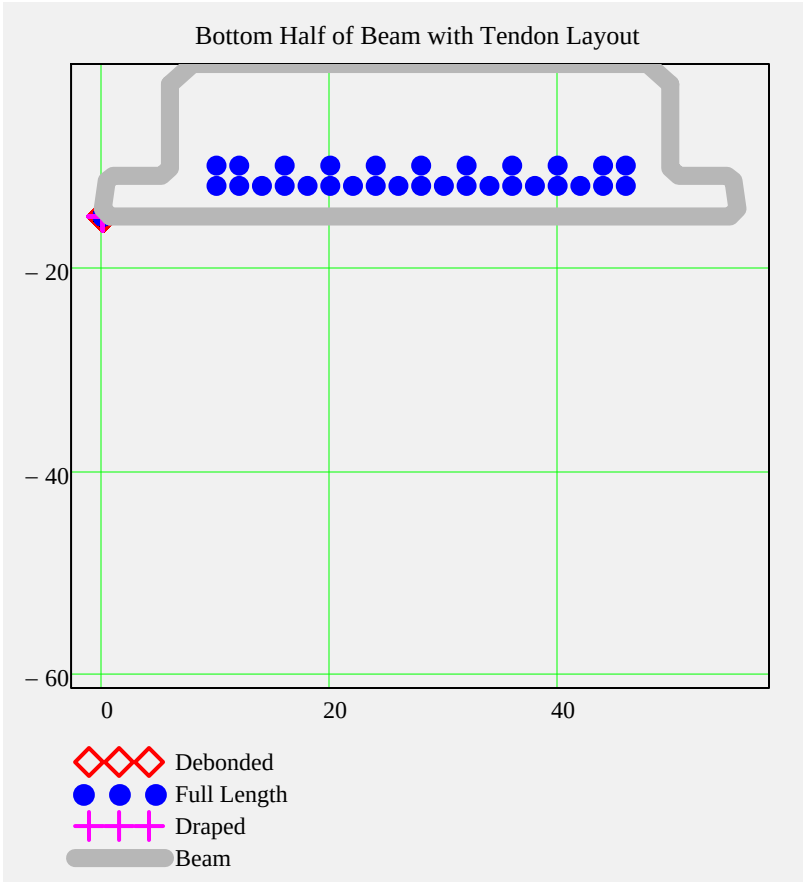
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

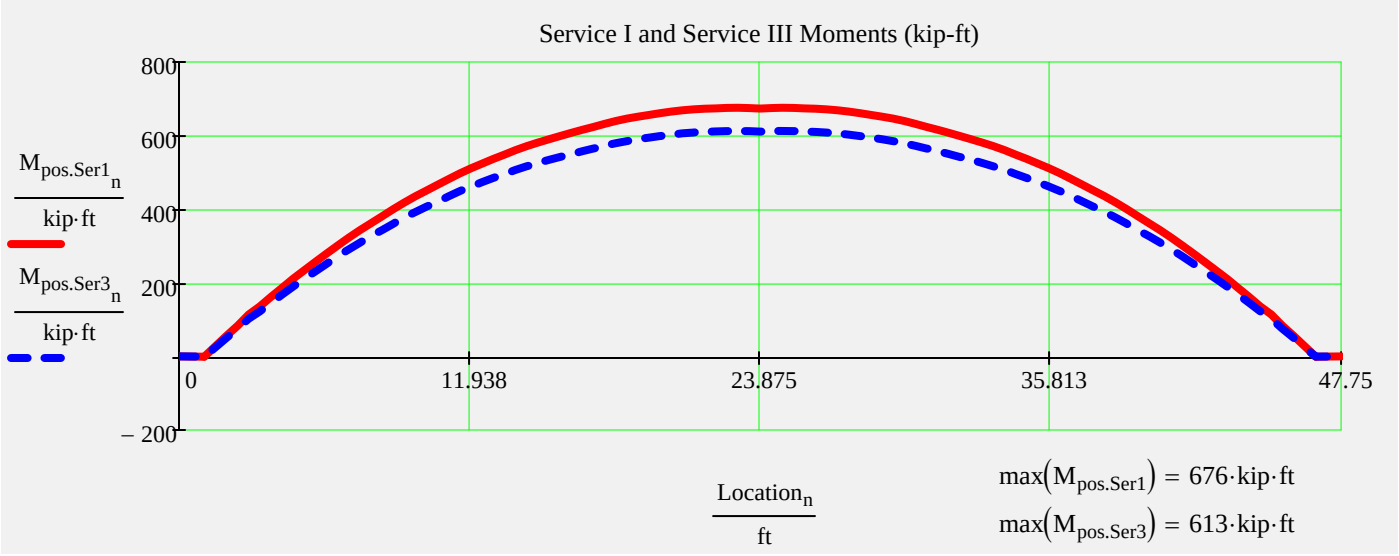
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

Check_f_{pe} = "OK"

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.95	–2.61
"2"	–1.01	–2.17
"4"	–0.88	–2.28
"6"	–1.89	–1.40
"8"	–2.31	–0.64

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1177.2	44990	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	208
"Non-Composite DL (incl. beam wt.)"	335
"Composite Dead Load"	26
"Distributed Live Load"	312

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

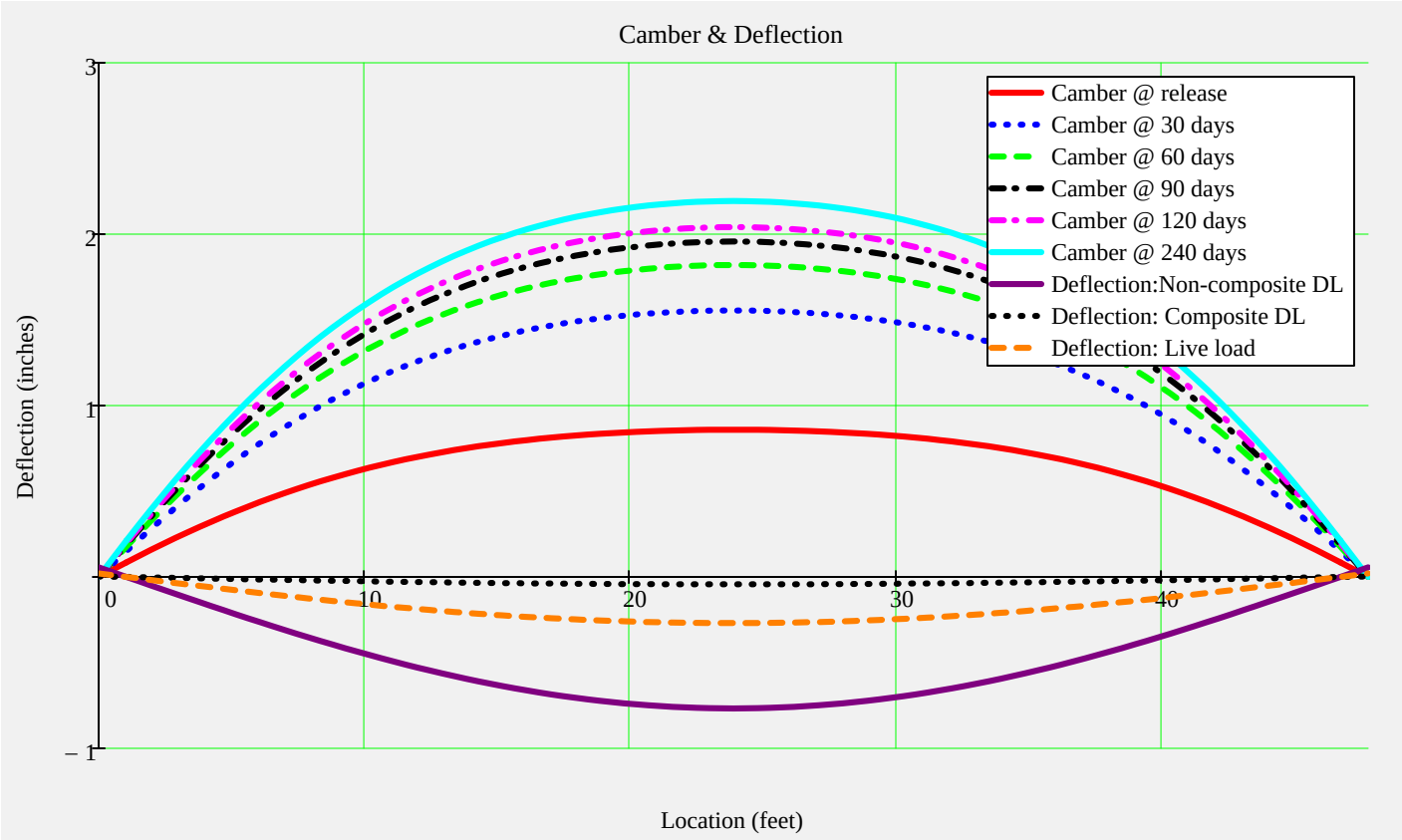
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 45.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.06	–0.35	0.40	0.86
"30 Days"	–0.19	–0.66	0.70	1.55
"60 Days"	–0.23	–0.77	0.82	1.82
"90 Days"	–0.26	–0.83	0.88	1.96
"120 Days"	–0.27	–0.87	0.92	2.04
"240 Days"	–0.30	–0.93	0.99	2.19
"Non-comp DL"	–0.07	0.06	–0.26	–0.77
"Comp DL"	–0.00	0.01	–0.01	–0.04
"LL"	–0.01	0.03	–0.09	–0.27

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.23 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

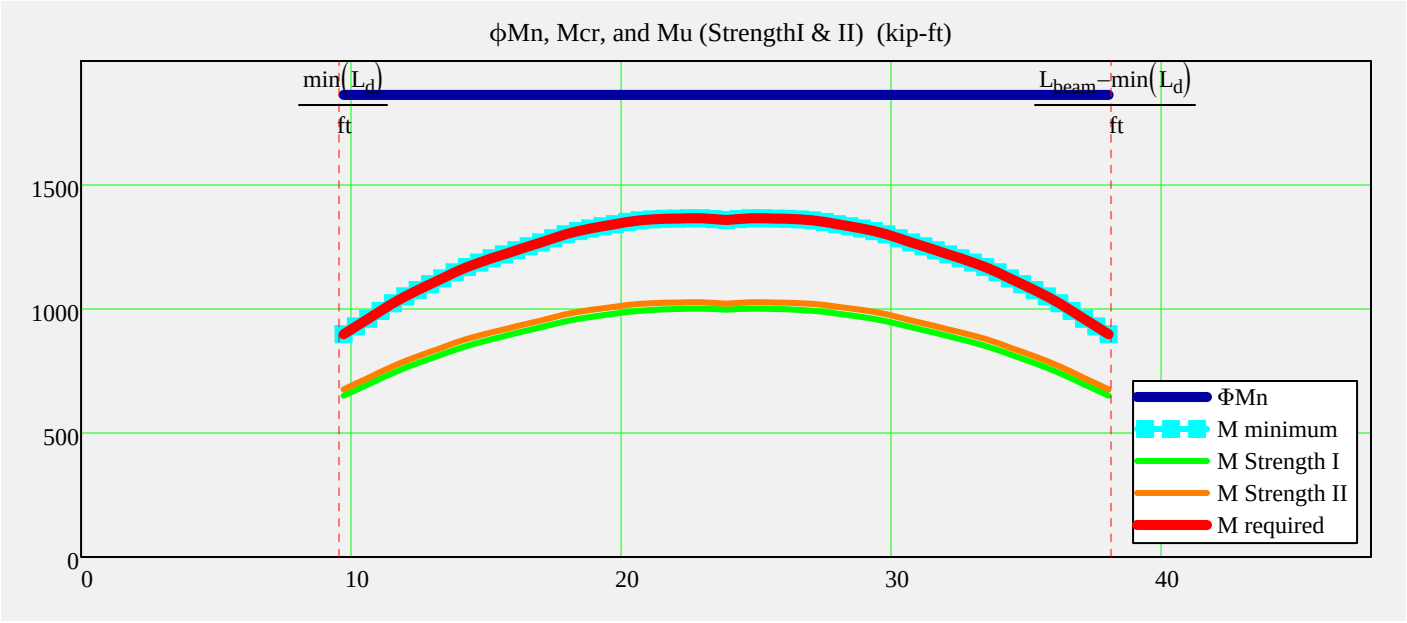
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 1027 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1359 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1359 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1864 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $\quad L_{beam} - \min(L_d) = 38.2\,\text{ft}$

$$DC_{moment_{mn}} := \frac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$$

Demand/Capacity Ratio at locations where all strands are fully developed

$\max(DC_{moment}) = 0.73$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

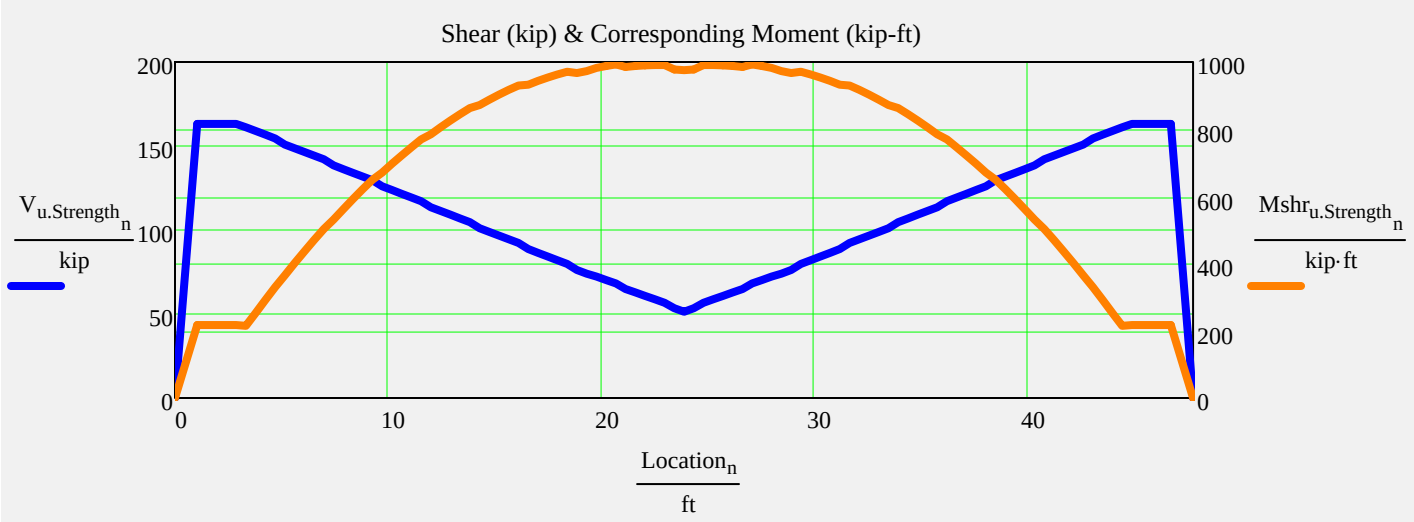
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

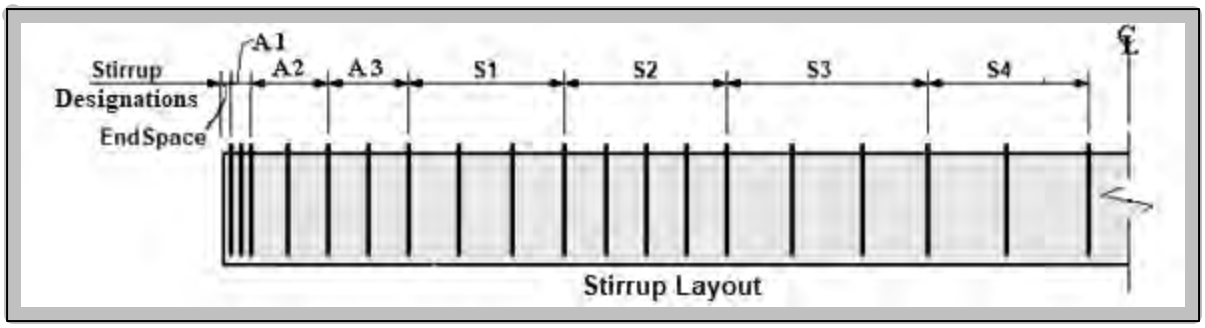
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 164 \\ 173 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 163.1 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 993 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

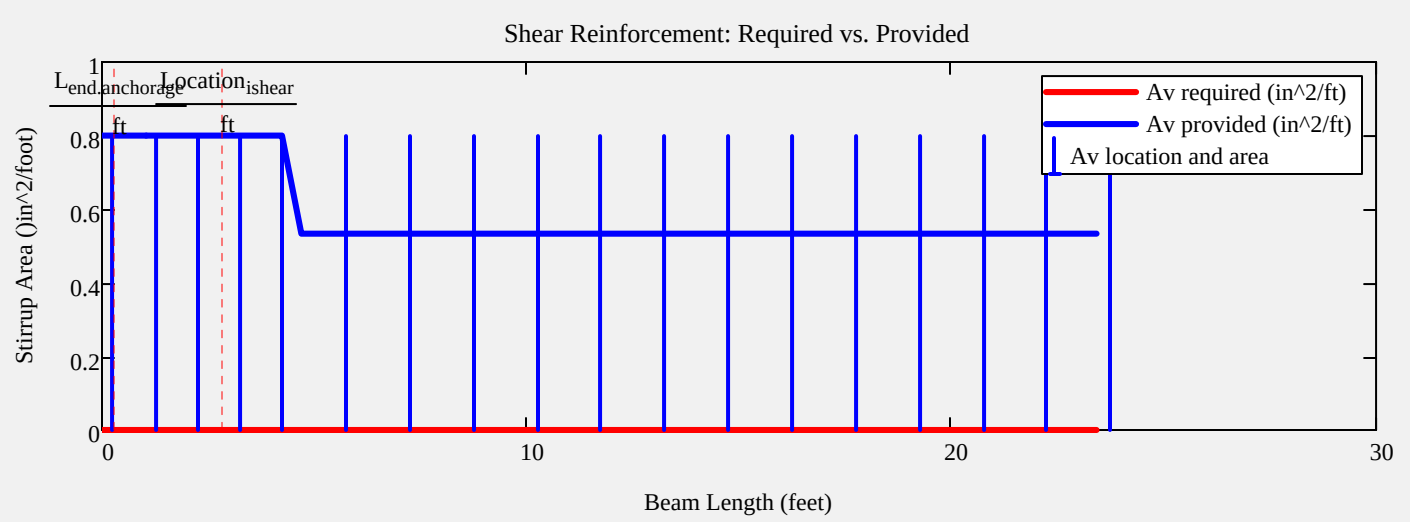
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.87\ ft$

Save Data File

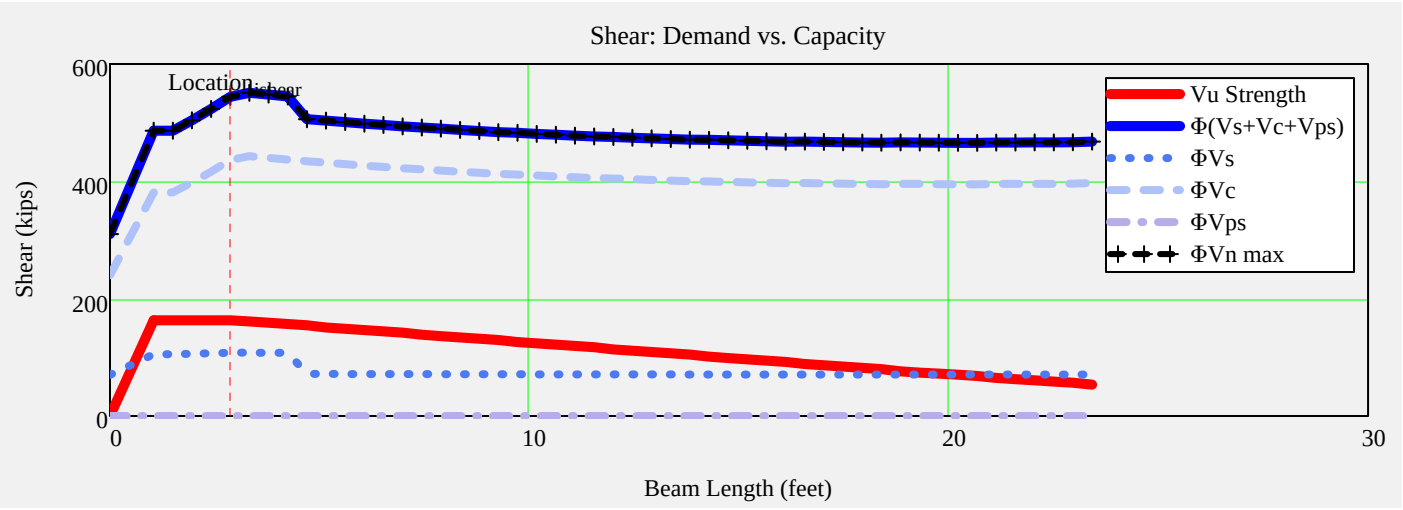
Use current input file

File Name FSB-48ftSpan-15inx56in_15Skew_ExtBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

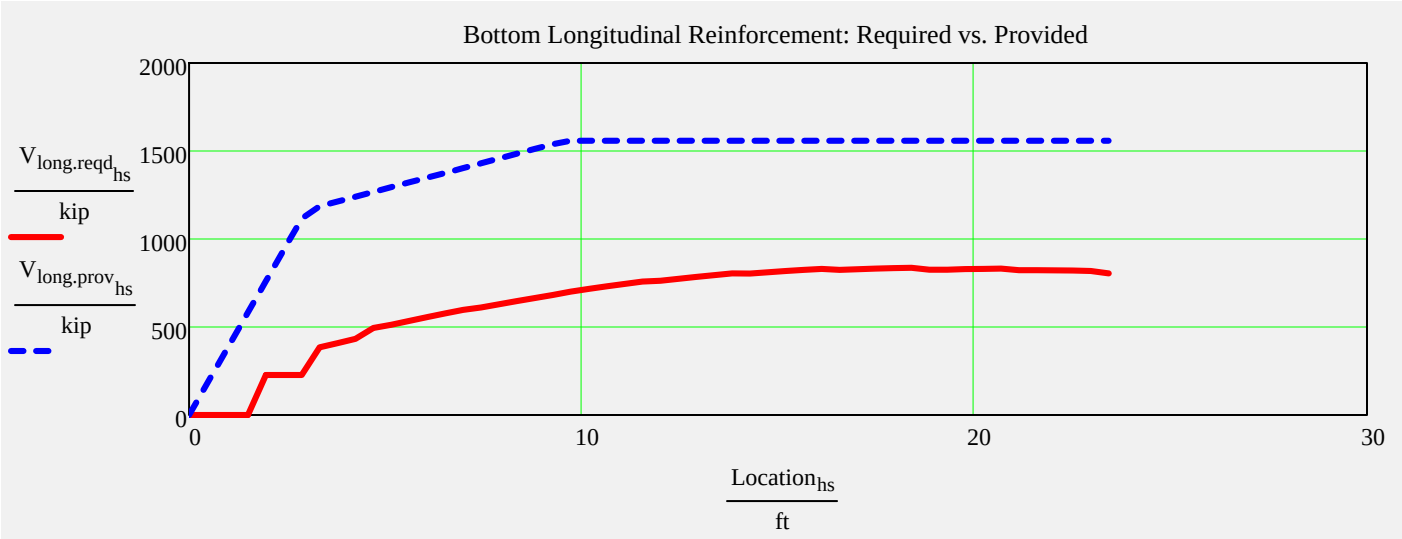
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.70 & 154.52 & 505.97 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.31$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

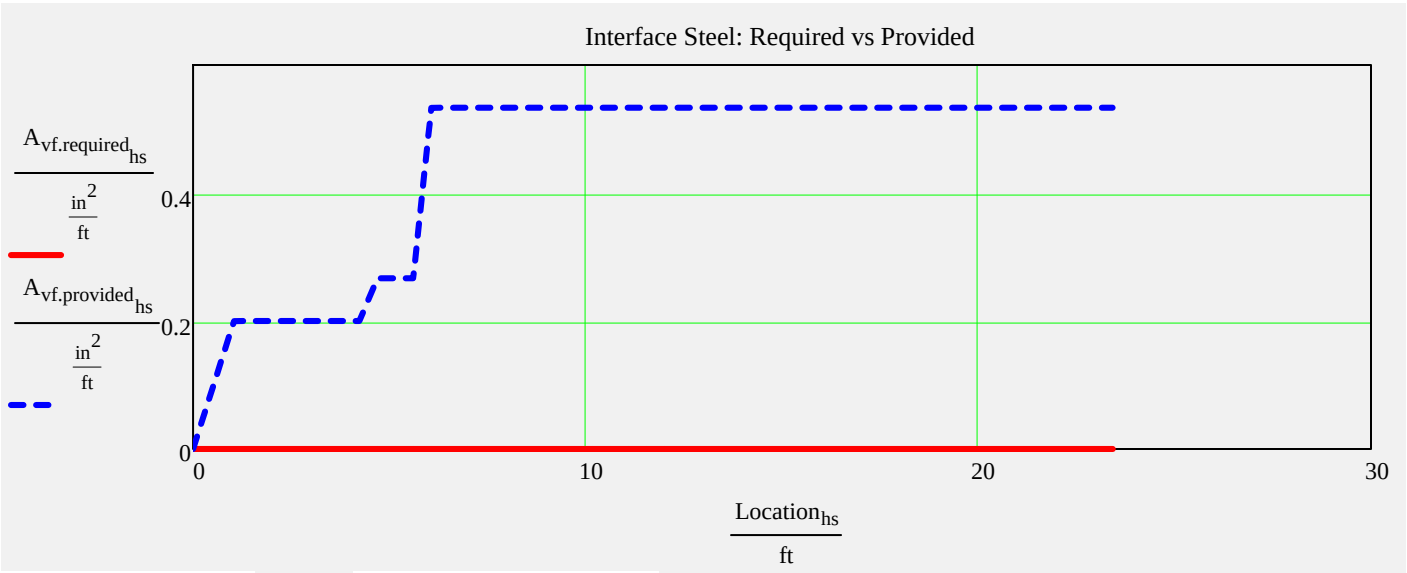


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 18.4 & 836.1 & 1558.2 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.54$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 10.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

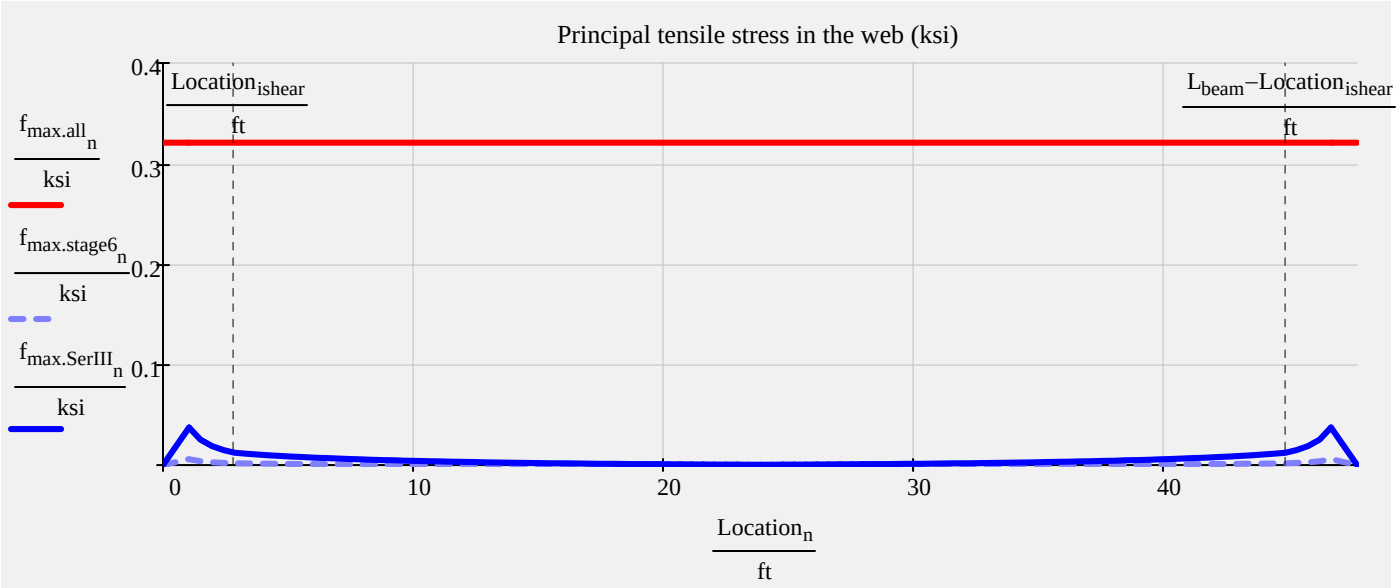
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 34.4 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

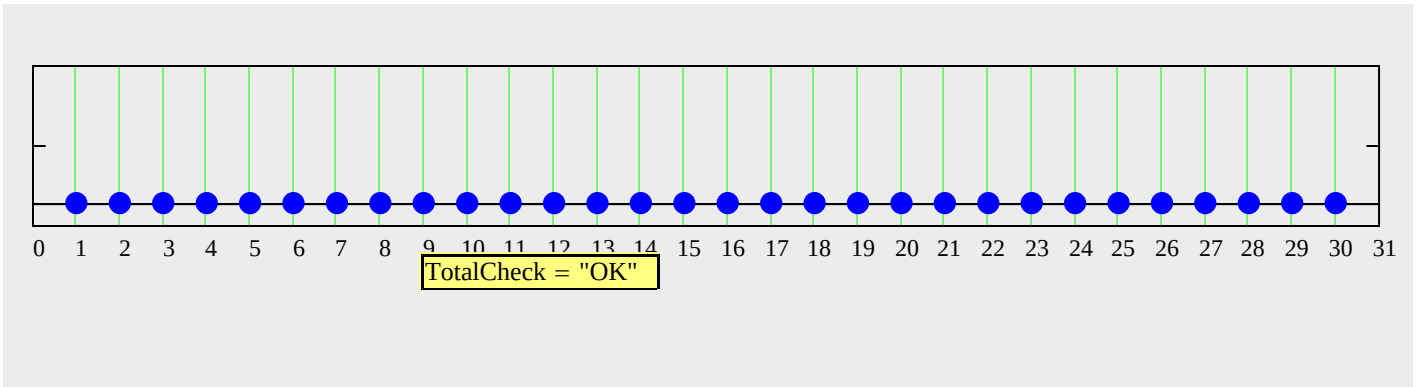
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.35	2.57	"N/A"	24.20	0.79	4.27	"N/A"	3.65	HL-93
"Strength I (Op)"	0.35	3.33	"N/A"	24.20	0.79	5.53	"N/A"	3.65	HL-93
"Service III (Inv)"	0.35	2.72	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.35	2.92	"N/A"	21.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.35	2.45	147.04	24.20	0.79	3.90	234.07	3.65	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.50$ $DC_{LongReinf.Permit} = 0.54$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1864	"factored resistance (kip-ft)...."
"γDL"	451	"factored dead load (kip-ft)...."
"γLL"	425	"factored live load (kip-ft)....."
"RF"	3.33	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	508.4	"factored resistance (kip)....."
"γDL"	33.4	"factored dead load (kip)....."
"γLL"	85.8	"factored live load (kip)....."
"RF"	5.53	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 48 FEET (15 DEG. SKEW)
EASTBOUND BRIDGE
(MOSSY GULLY & LONG POINT MARSH)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Design\Beam Design\FSB's\EB 48' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-48ftSpan-15inx56in_15Skew_ExtBeam.dat
FSB-48ftSpan-15inx56in_15Skew_IntBeam.dat
FSB-48ftSpan-15inx56in_ExtBeam.dat
FSB-48ftSpan-15inx56in_IntBeam.dat

Refresh List
Open File
Reset All Data

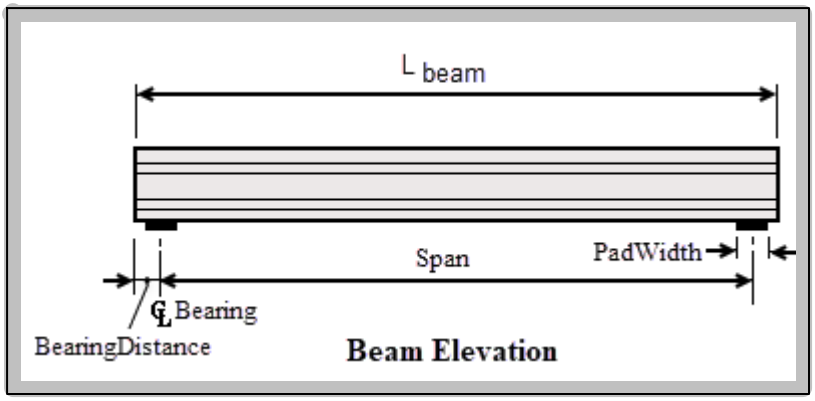
InputDataFile = "FSB-48ftSpan-15inx56in_15Skew_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 19 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

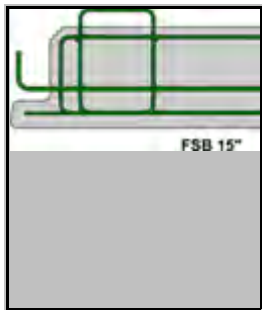
InputDataFile = "FSB-48ftSpan-15inx56in_15Skew_IntBeam.dat"

Beam Type: FSB12 / **FSB15** / FSB18

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



L_{beam}	47.75	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	**Interior** / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

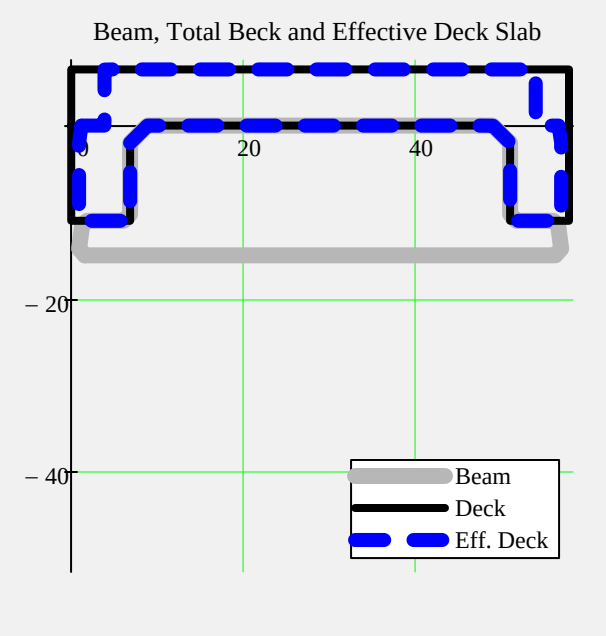
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = 56·in

$b_e = 57.65 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0.03 kip/ft

$w_{deck} = 0.58 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 47.75\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

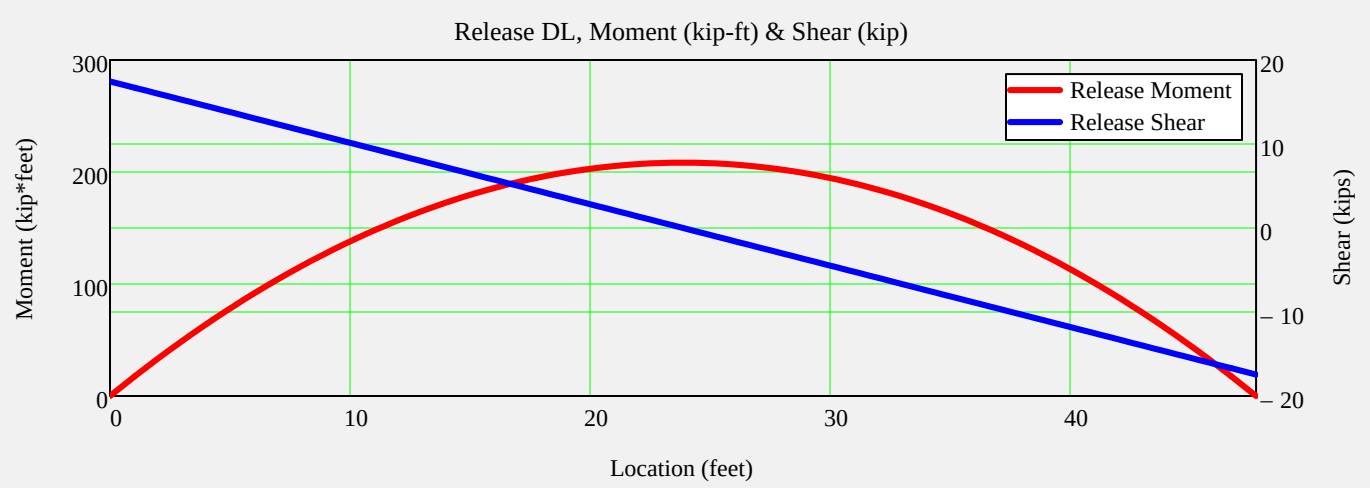
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

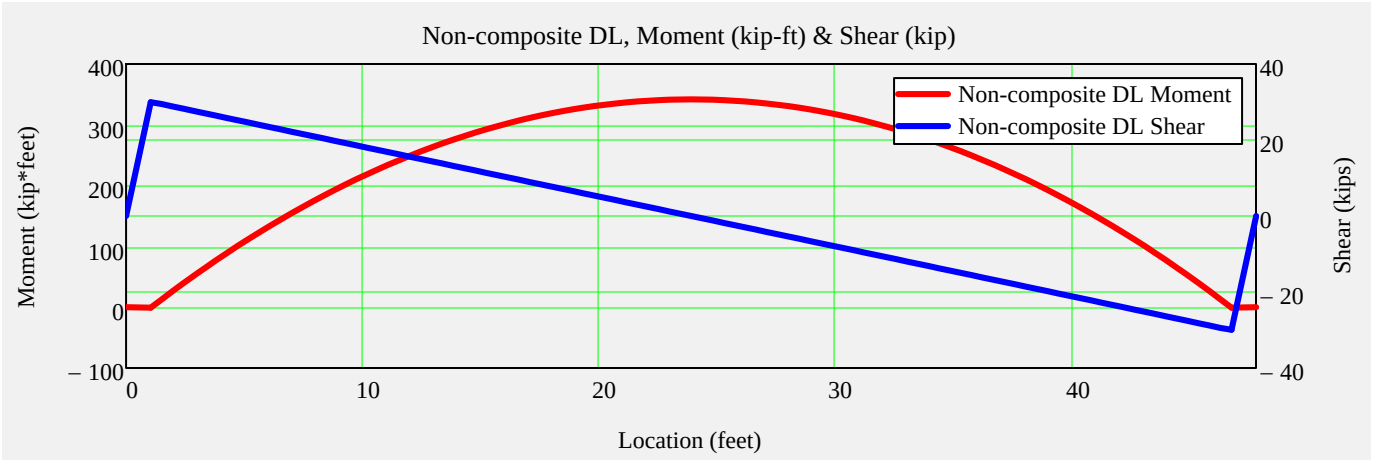
Release Dead Load Moments and Shears

$L_{span} = 45.67\ ft$



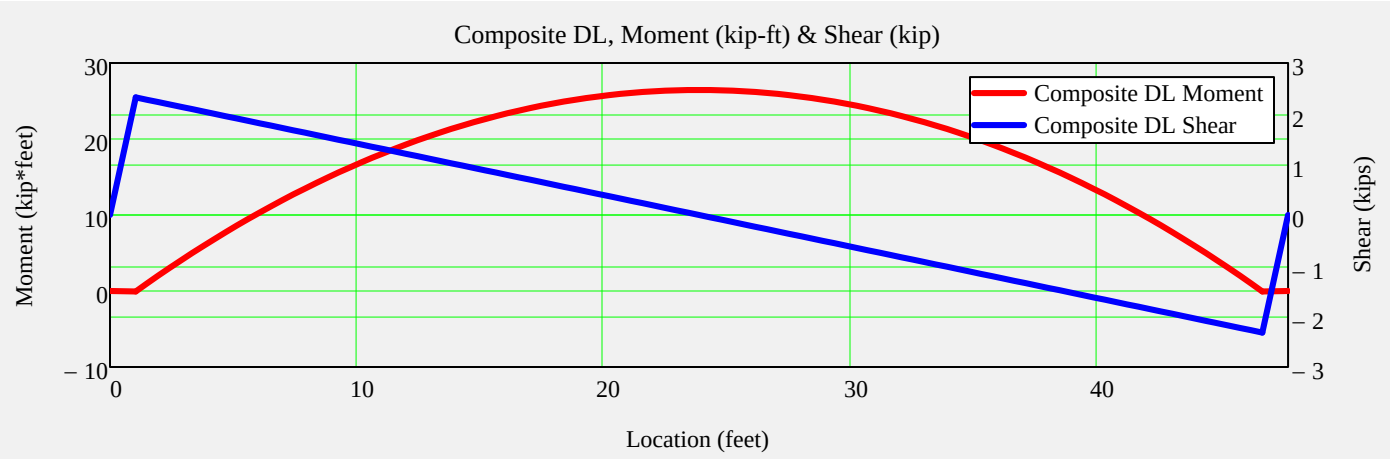
$\max(V_{release}) = 17.5 \cdot kip$ $\max(M_{release}) = 208.3 \cdot kip \cdot ft$ $\min(V_{release}) = -17.5 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 29.9 \cdot kip$ $\max(M_{dl.non.comp}) = 341.7 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -29.9 \cdot kip$

Composite Dead Load Moments and Shear



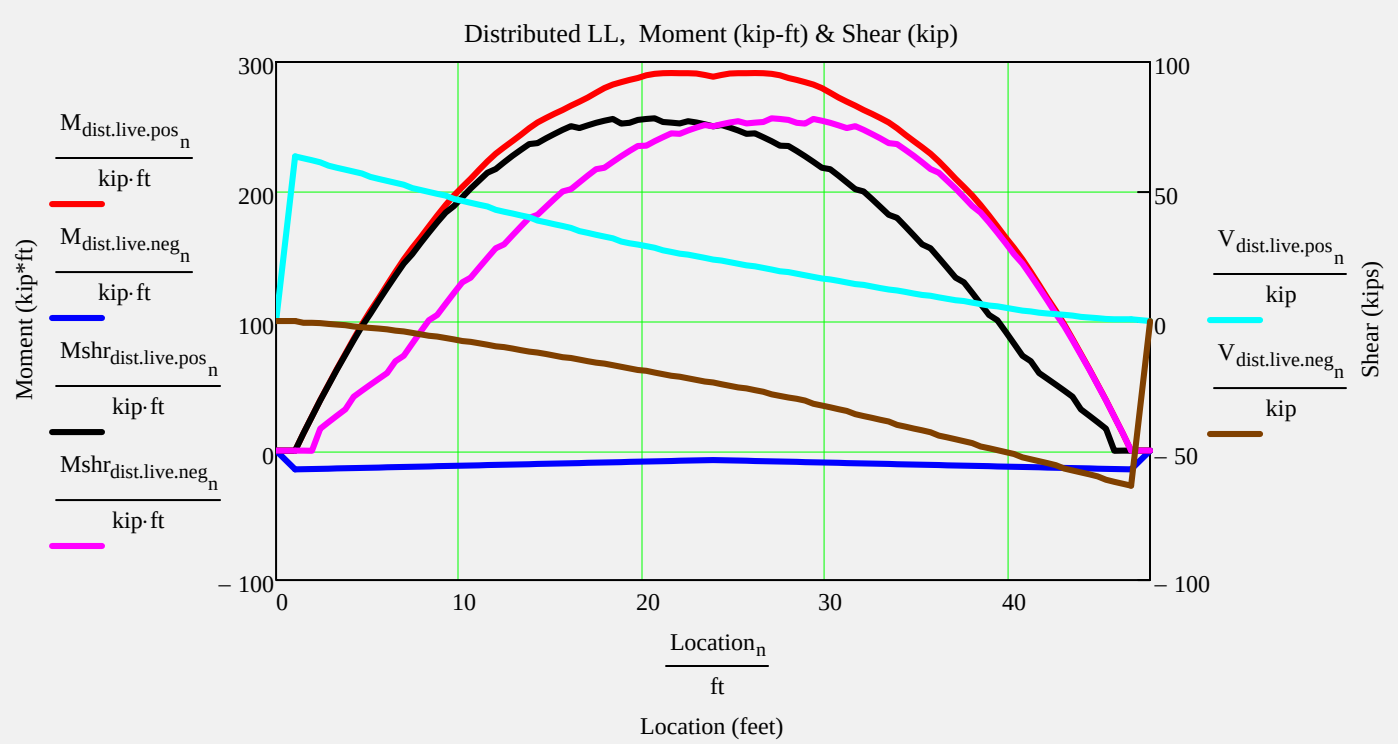
$\max(V_{dl.comp}) = 2.3 \cdot kip$ $\max(M_{dl.comp}) = 26.4 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.3 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 45.67\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.21$

Final Live Load Distribution Factors: $g_{mom} = 0.33$ $g_{mom.fatigue} = 0.18$ $g_{shear} = 0.70$



$\max(V_{dist.live.pos}) = 63.6 \cdot kip$

$\max(M_{dist.live.pos}) = 291.5 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -63.6 \cdot kip$

$Reaction_{LL} = 66.0 \cdot kip$

$\min(M_{dist.live.neg}) = -14.5 \cdot kip \cdot ft$

$Reaction_{DL} = 33.7 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 257 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{truck} = 58.93 \cdot kip$ $Reaction_{lane} = 15.28 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 52.28 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-48ftSpan-15inx56in_15Skew_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

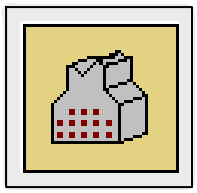
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

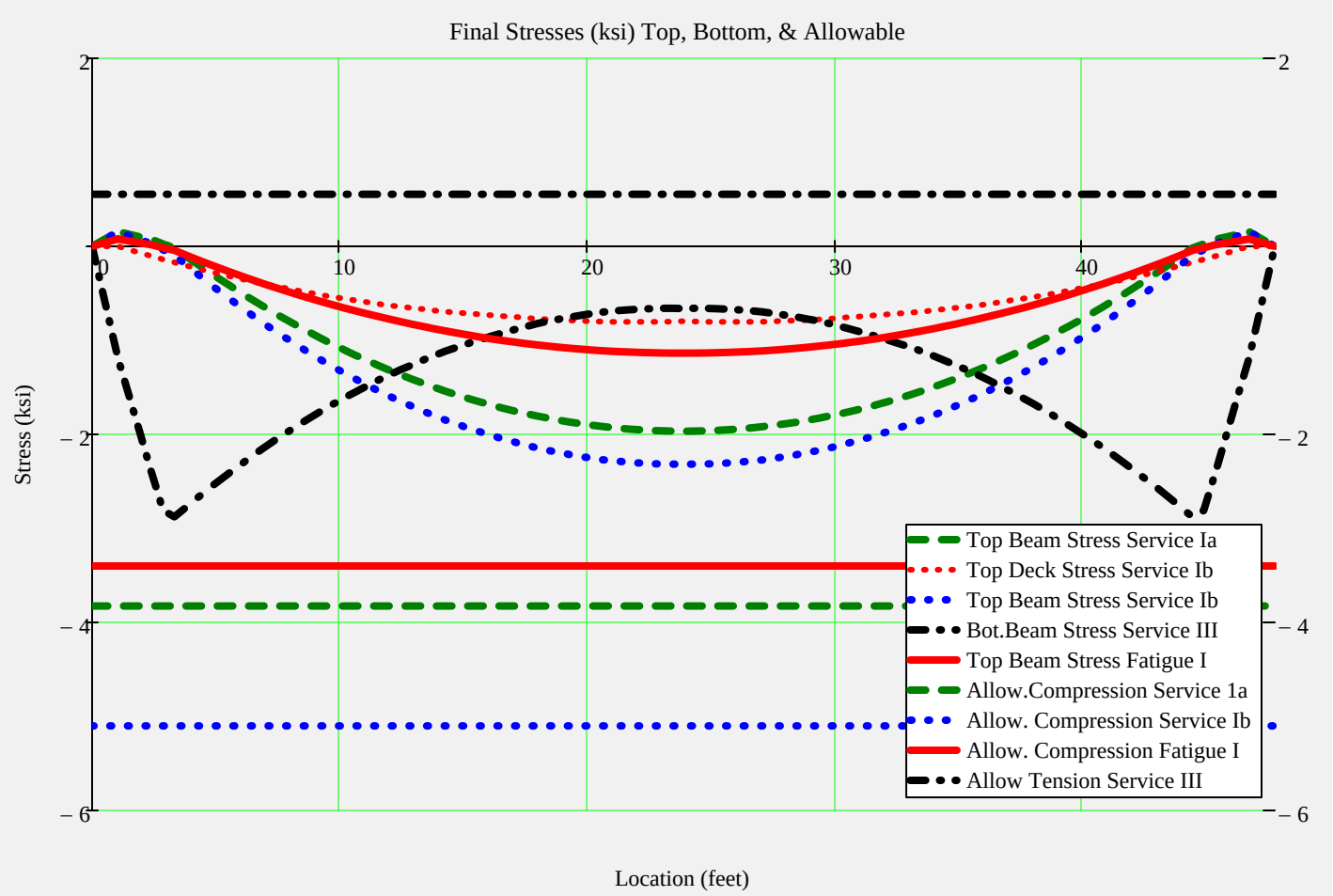
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

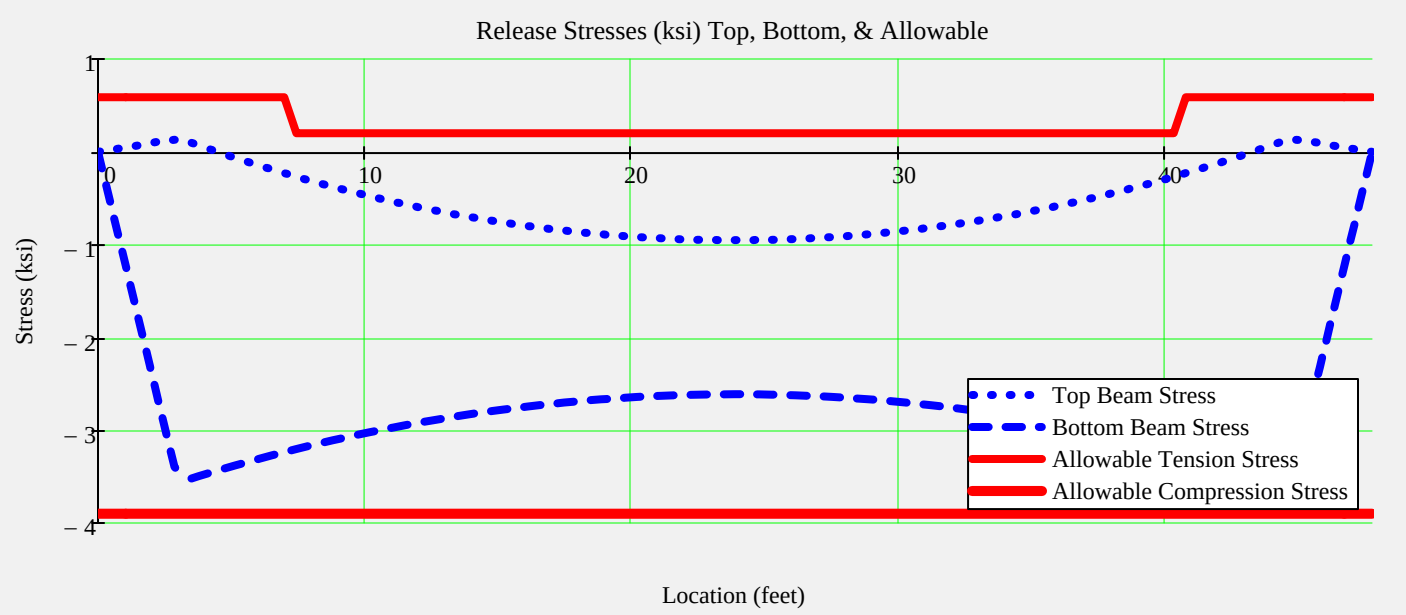
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.70$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.91$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.51$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.45$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.33$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.87	0.13	0.59
"Compression @ Release"	3.32	–3.54	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	23.88	–1.97	–3.83
"CompressionIb @ ServiceI"	24.33	–2.32	–5.10
"Compression @ FatigueI"	23.88	–1.14	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

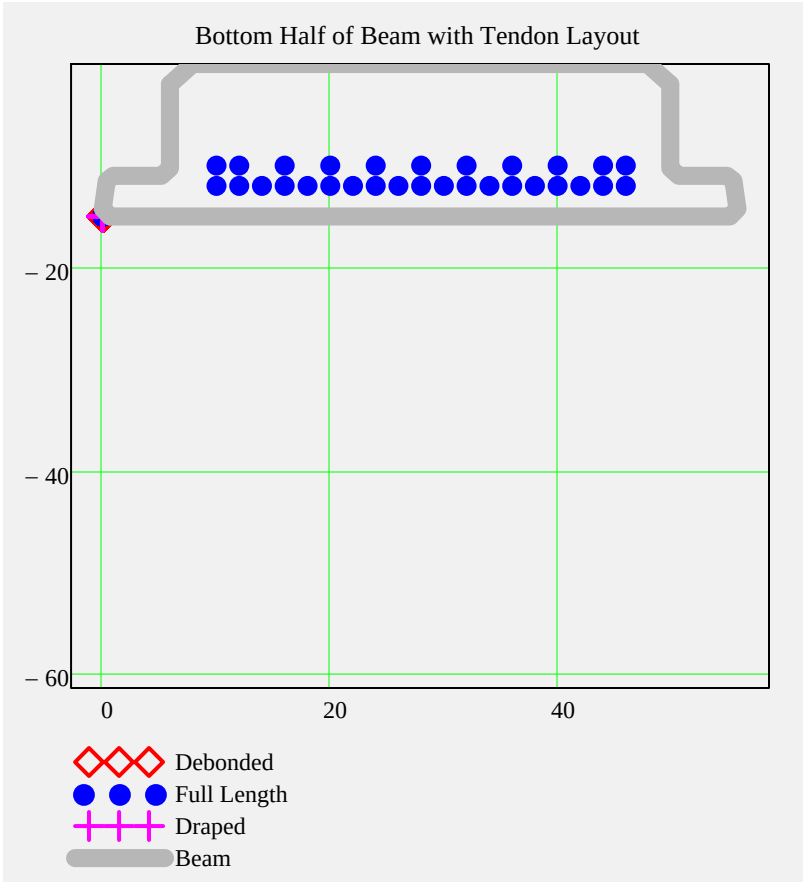
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

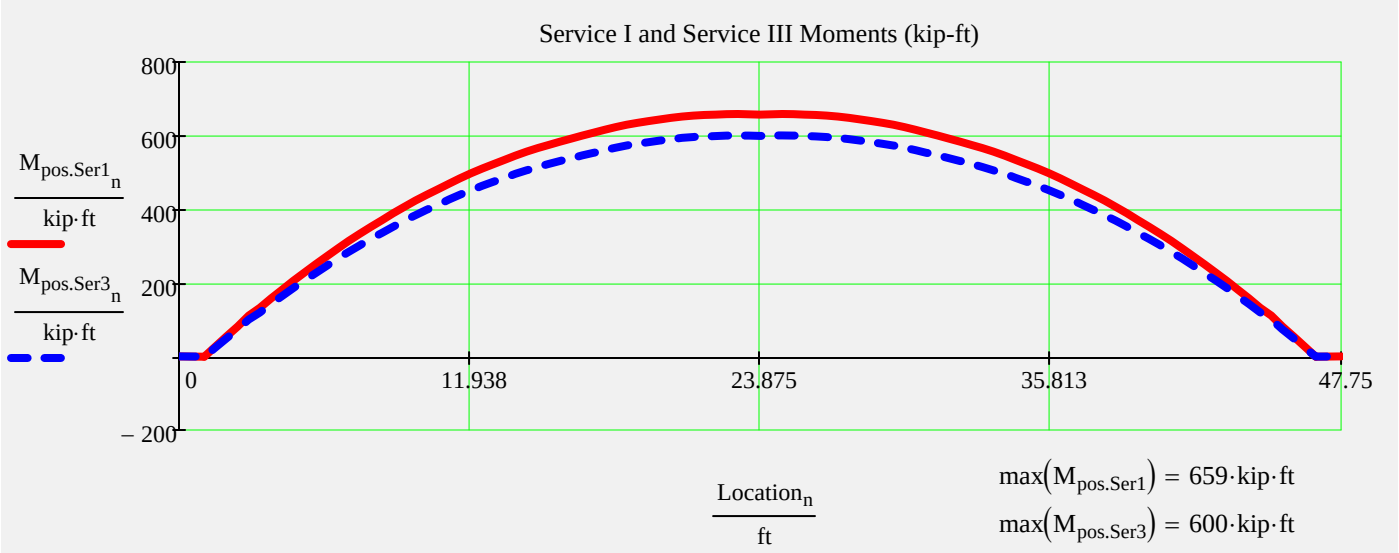
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.95	–2.61
"2"	–1.01	–2.17
"4"	–0.88	–2.28
"6"	–1.93	–1.37
"8"	–2.32	–0.66

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1197.5	45628	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	208
"Non-Composite DL (incl. beam wt.)"	342
"Composite Dead Load"	26
"Distributed Live Load"	289

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

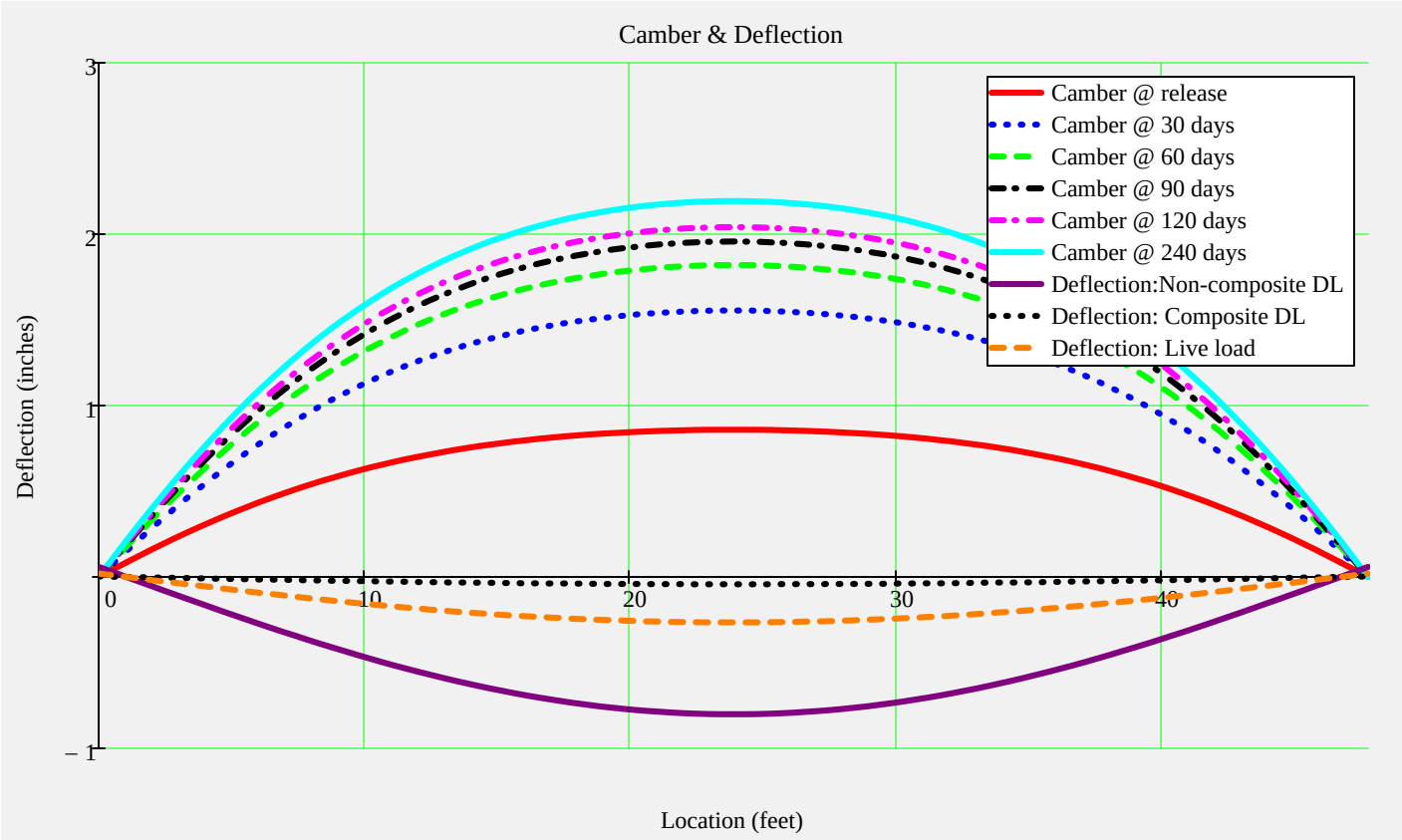
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 45.67 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.06	–0.35	0.40	0.86
"30 Days"	–0.19	–0.66	0.70	1.55
"60 Days"	–0.23	–0.77	0.82	1.82
"90 Days"	–0.26	–0.83	0.88	1.96
"120 Days"	–0.27	–0.87	0.92	2.04
"240 Days"	–0.30	–0.93	0.99	2.19
"Non-comp DL"	–0.08	0.07	–0.27	–0.80
"Comp DL"	–0.00	0.01	–0.01	–0.04
"LL"	–0.01	0.03	–0.09	–0.27

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.2 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

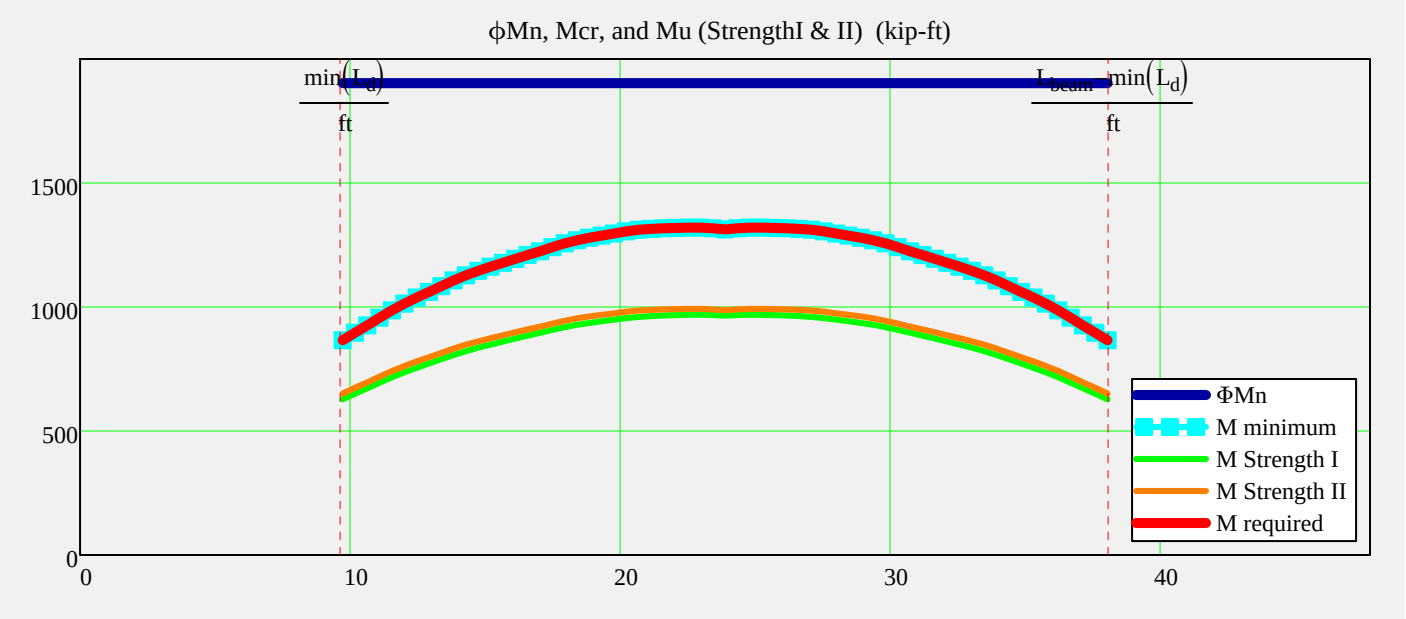
Values at midspan

$LimitStateForMoment_{51} = "Strength\ II"$ $\max(M_{Strength}) = 992 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 1313 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1313 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel - Low\ Lax"$ $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1903 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 38.1\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.69$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

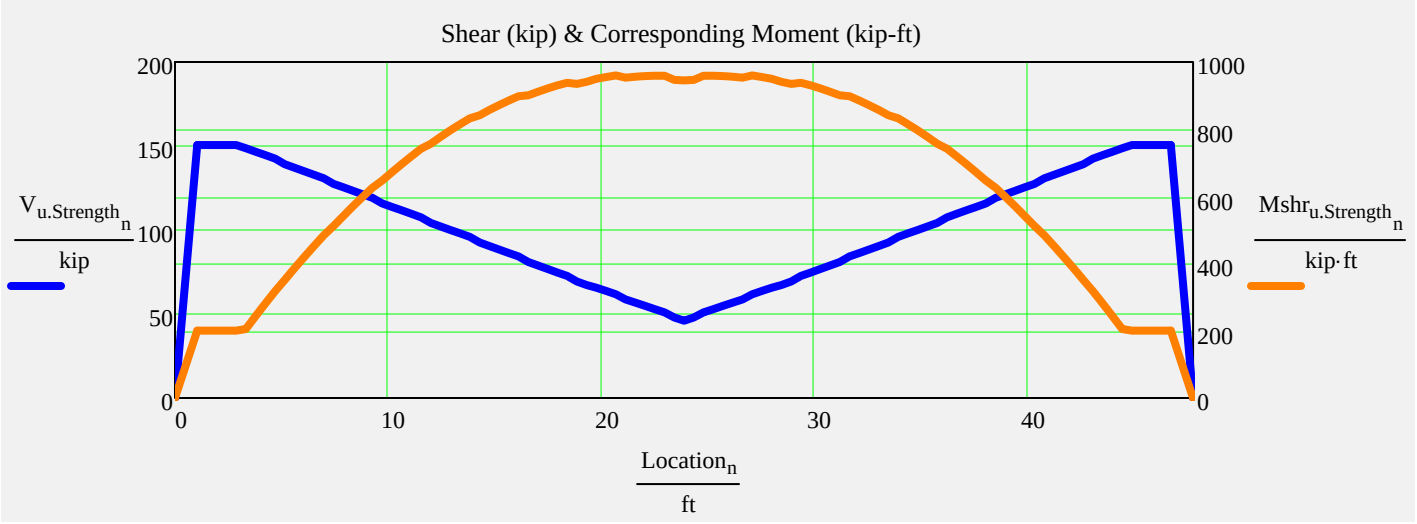
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

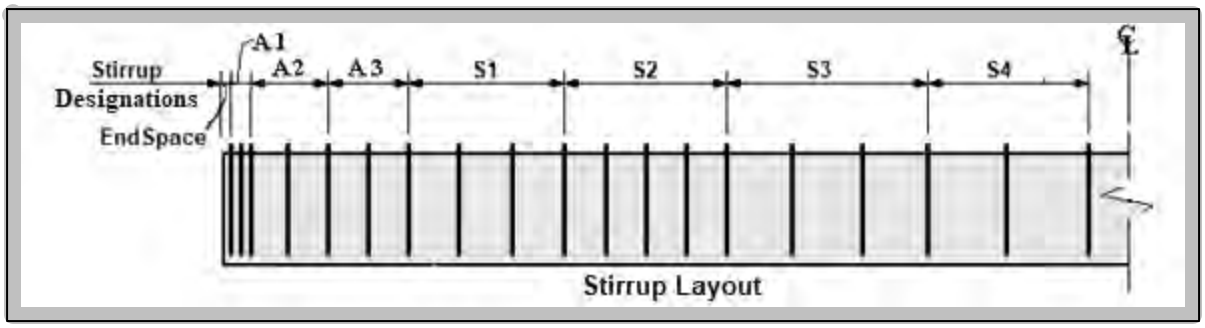
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 152 \\ 160 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 150.5 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 960 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

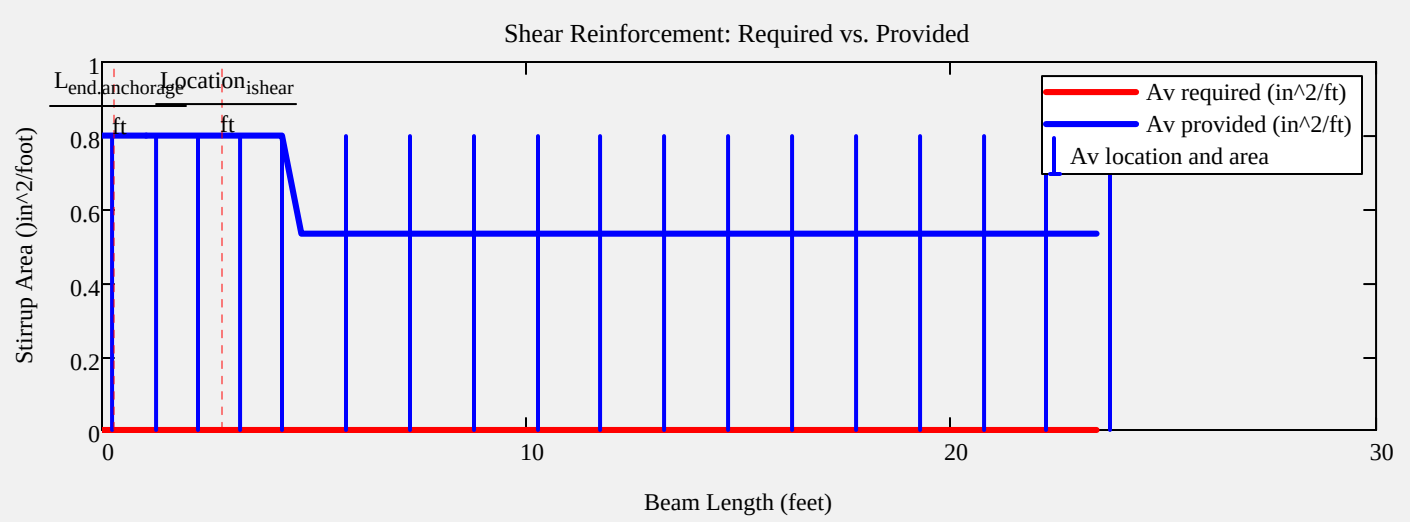
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.87\ ft$

Save Data File

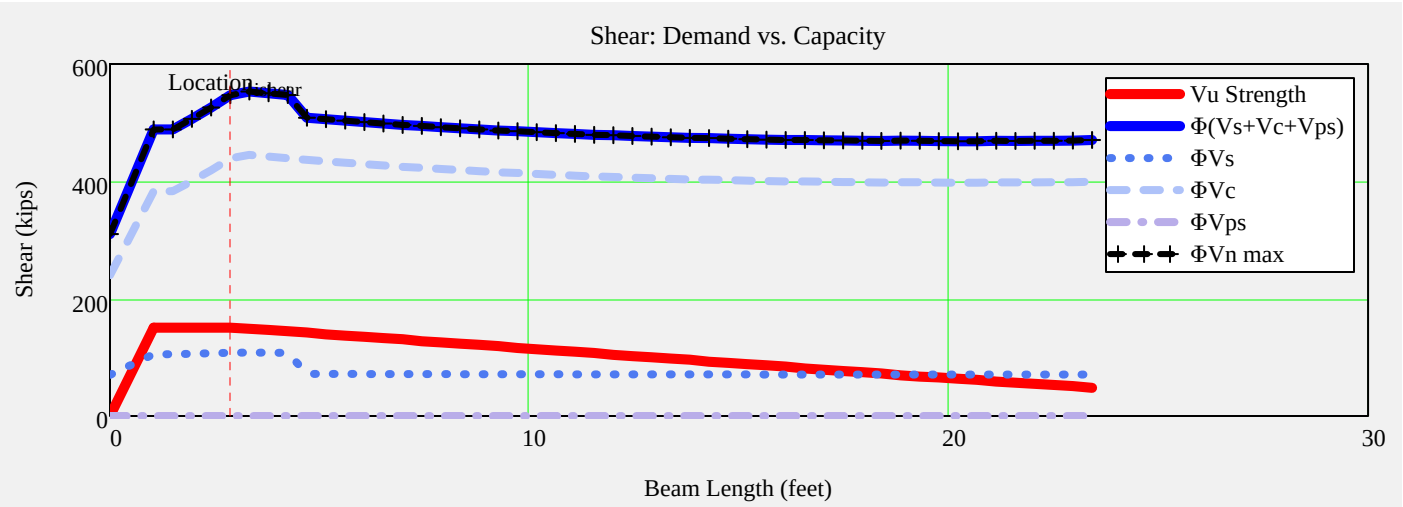
Use current input file

File Name FSB-48ftSpan-15inx56in_15Skew_IntBeam.dat

Save Data

DataFileFolder = "\\tmaw00\jobs\75614 Arterial Corridors Program\TECHPROD\75614-DS-009_Seg_9_10_P32\Structures\BDRs\Des

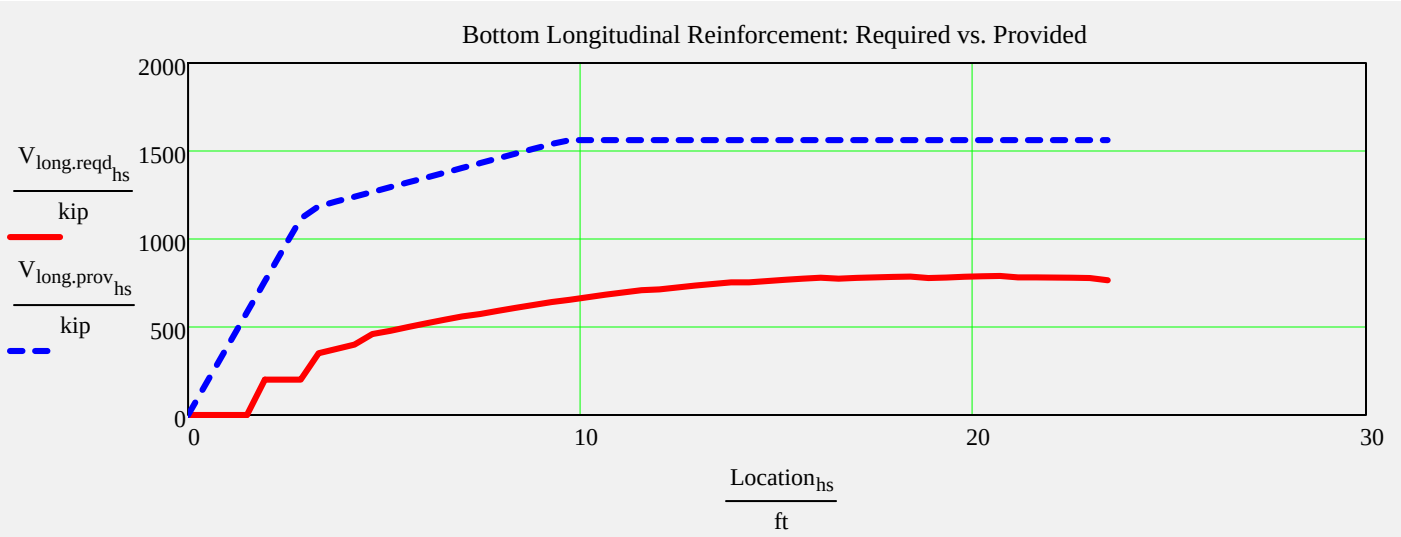
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.70 & 142.46 & 508.29 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.28$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

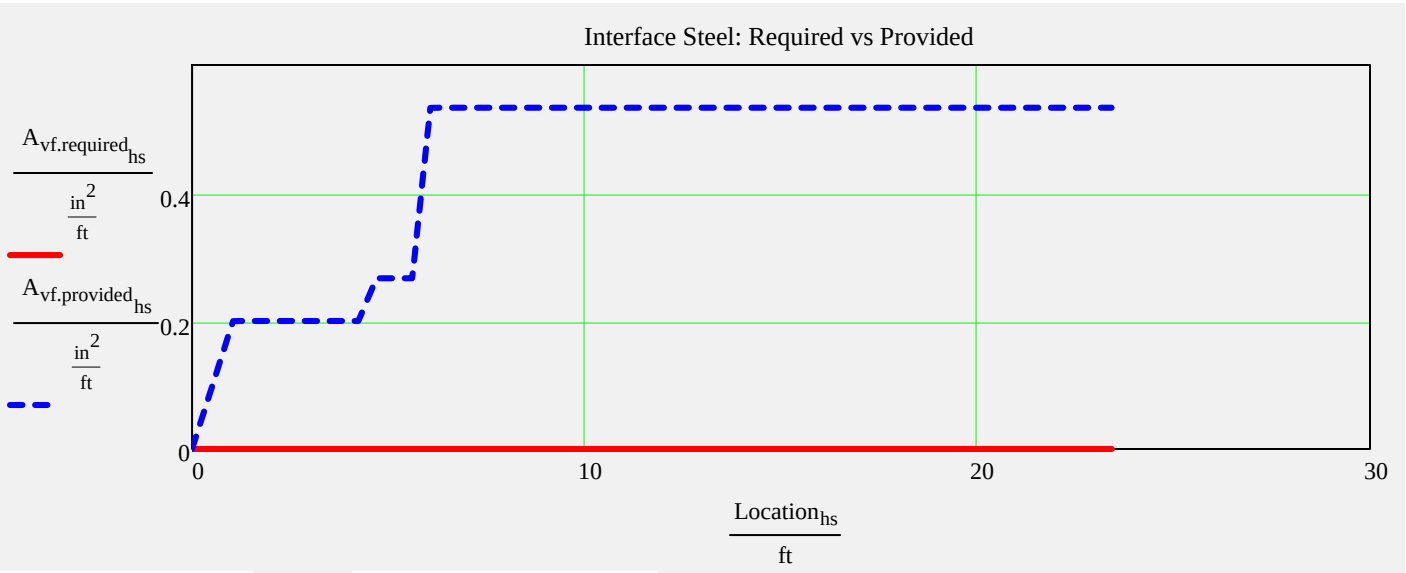


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 20.7 & 789.5 & 1561.9 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.51$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 10.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

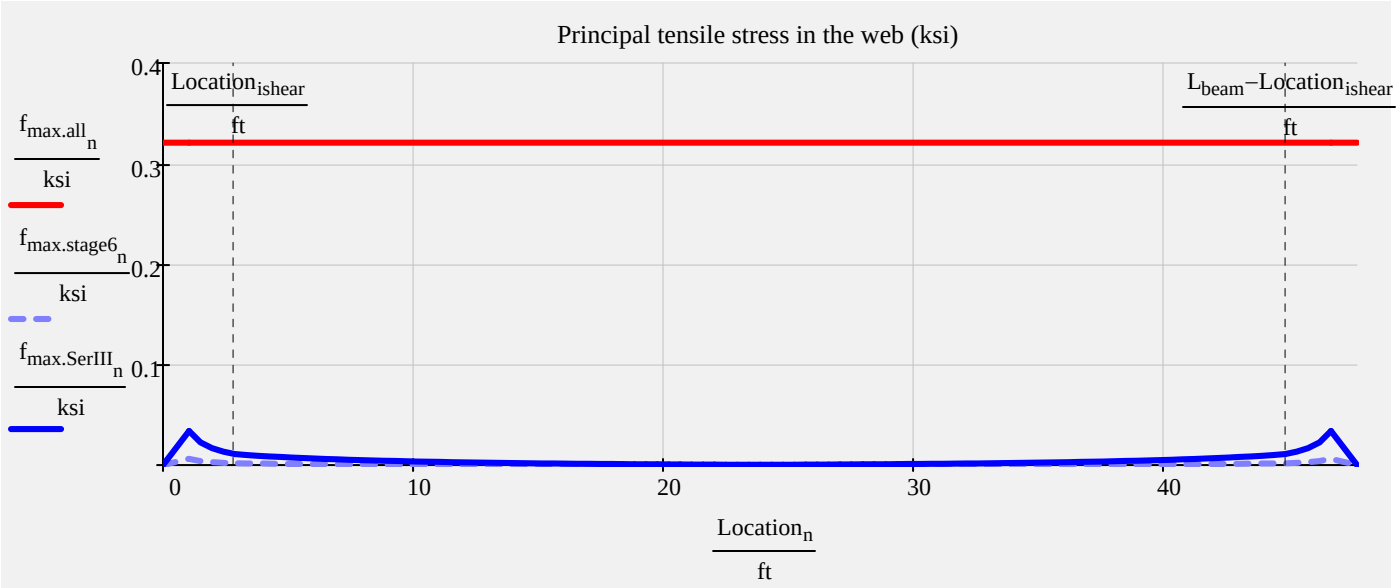
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 34.4 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

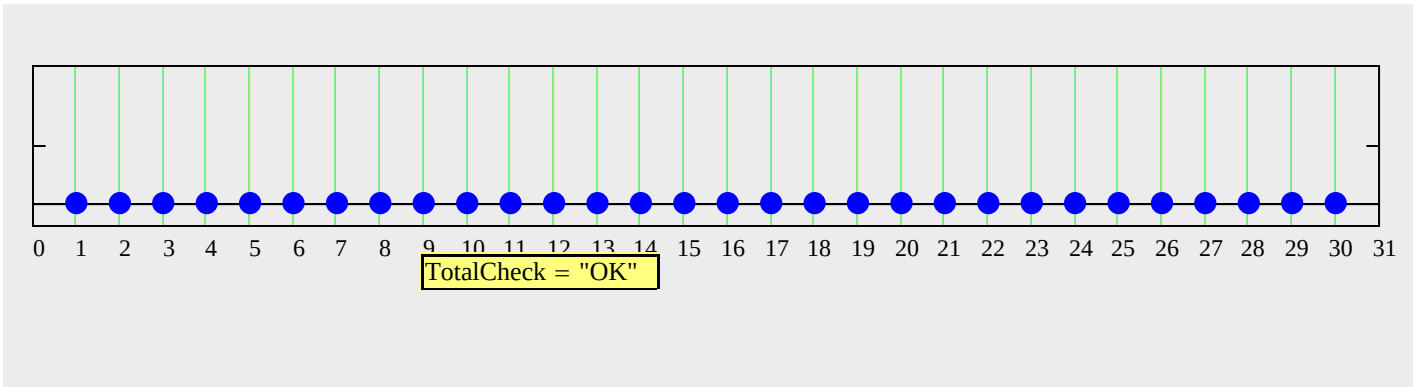
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.33	2.83	"N/A"	21.46	0.70	4.78	"N/A"	3.65	HL-93
"Strength I (Op)"	0.33	3.67	"N/A"	21.46	0.70	6.20	"N/A"	3.65	HL-93
"Service III (Inv)"	0.33	2.91	"N/A"	21.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.33	3.12	"N/A"	23.75	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.33	2.71	162.30	24.20	0.70	4.37	262.32	3.65	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.47$ $DC_{LongReinf.Permit} = 0.51$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1903	"factored resistance (kip-ft)...."
"γDL"	459	"factored dead load (kip-ft)...."
"γLL"	393	"factored live load (kip-ft)....."
"RF"	3.67	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	510.5	"factored resistance (kip)....."
"γDL"	34	"factored dead load (kip)....."
"γLL"	76.9	"factored live load (kip)....."
"RF"	6.2	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM EXTERIOR BEAM DESIGN

SPAN LENGTH = 50 FEET (NO SKEW)

WESTBOUND BRIDGE

(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\WB 50' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-50ftSpan-15inx56in_ExtBeam.dat
FSB-50ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

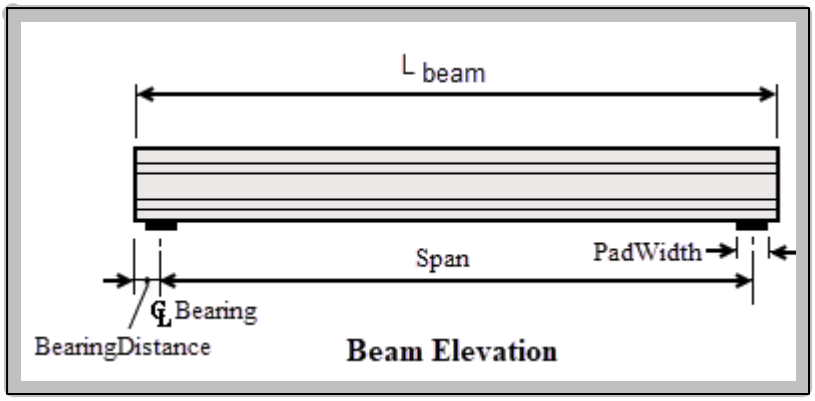
InputDataFile = "FSB-50ftSpan-15inx56in_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



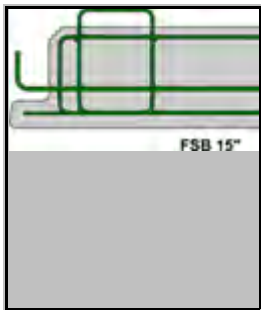
Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-50ftSpan-15inx56in_ExtBeam.dat"

Beam Type	FSB12 / **FSB15** / FSB18		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FSB15.bmp"
L_{beam}	49.8333	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*



Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

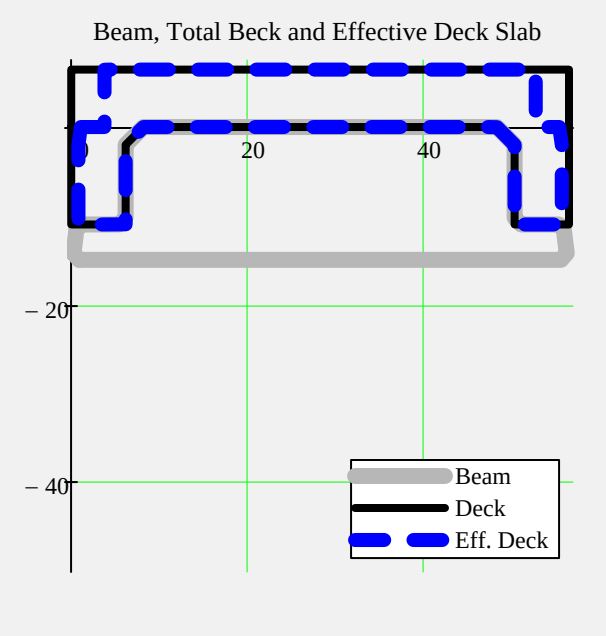
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 56.32 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.56 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 49.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

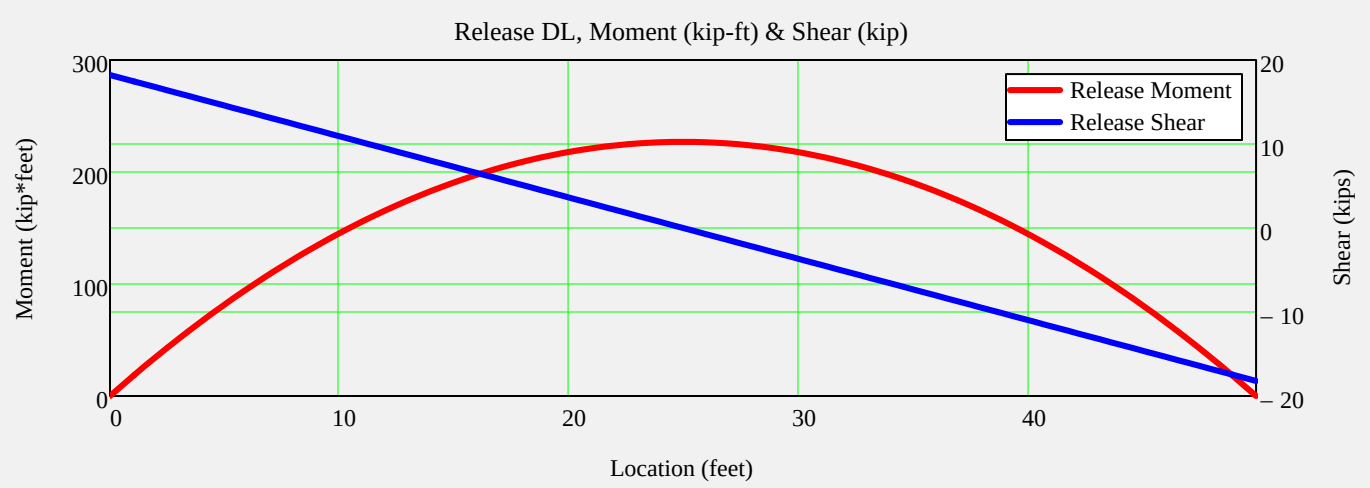
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

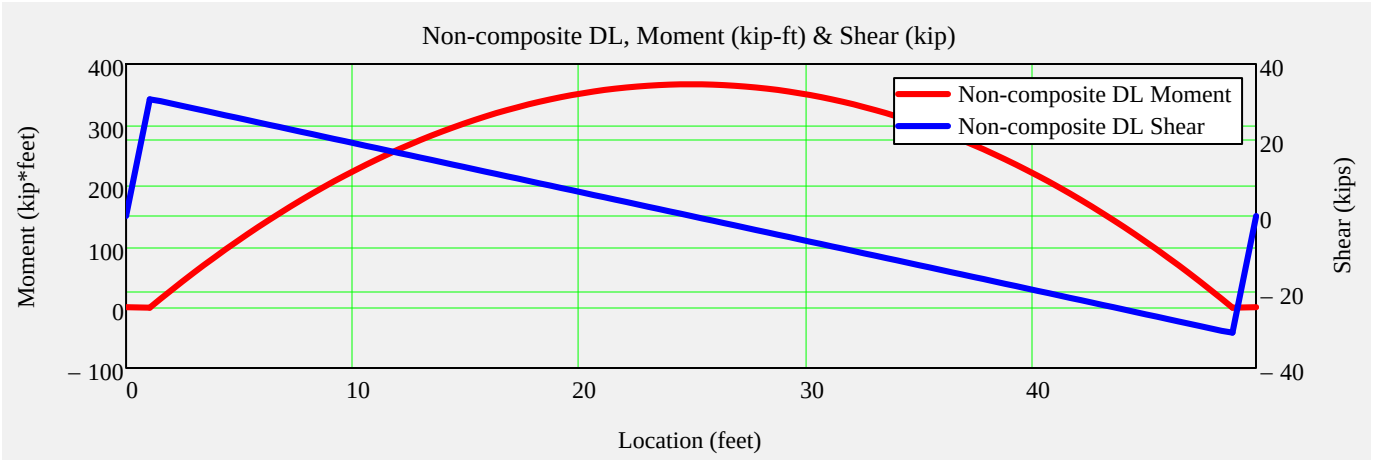
Release Dead Load Moments and Shears

$L_{span} = 47.75\ ft$



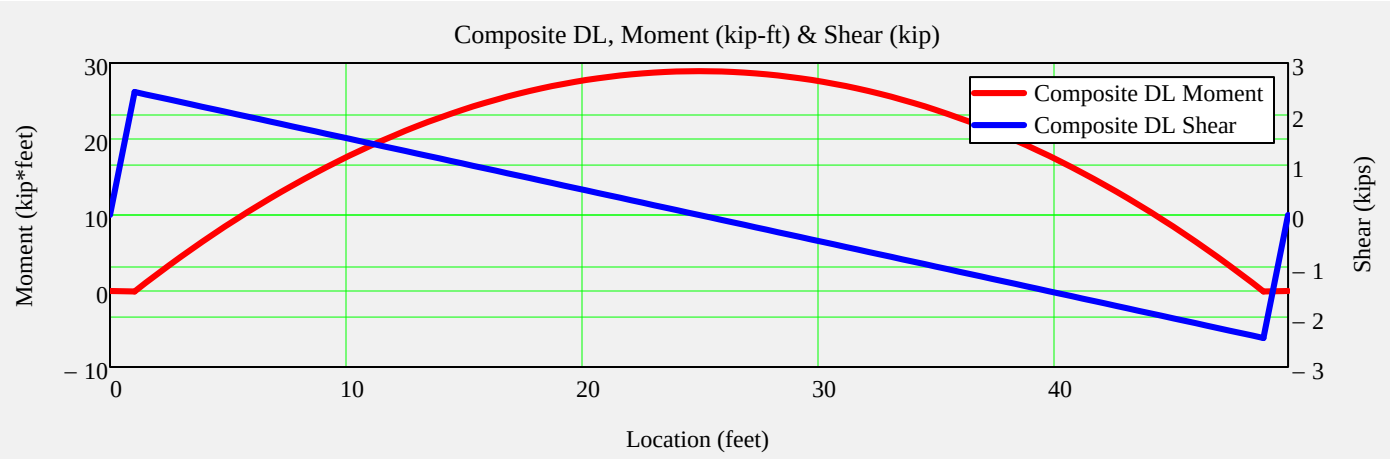
$\max(V_{release}) = 18.2 \cdot kip$ $\max(M_{release}) = 226.9 \cdot kip \cdot ft$ $\min(V_{release}) = -18.2 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 30.7 \cdot kip$ $\max(M_{dl.non.comp}) = 366.6 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -30.7 \cdot kip$

Composite Dead Load Moments and Shear



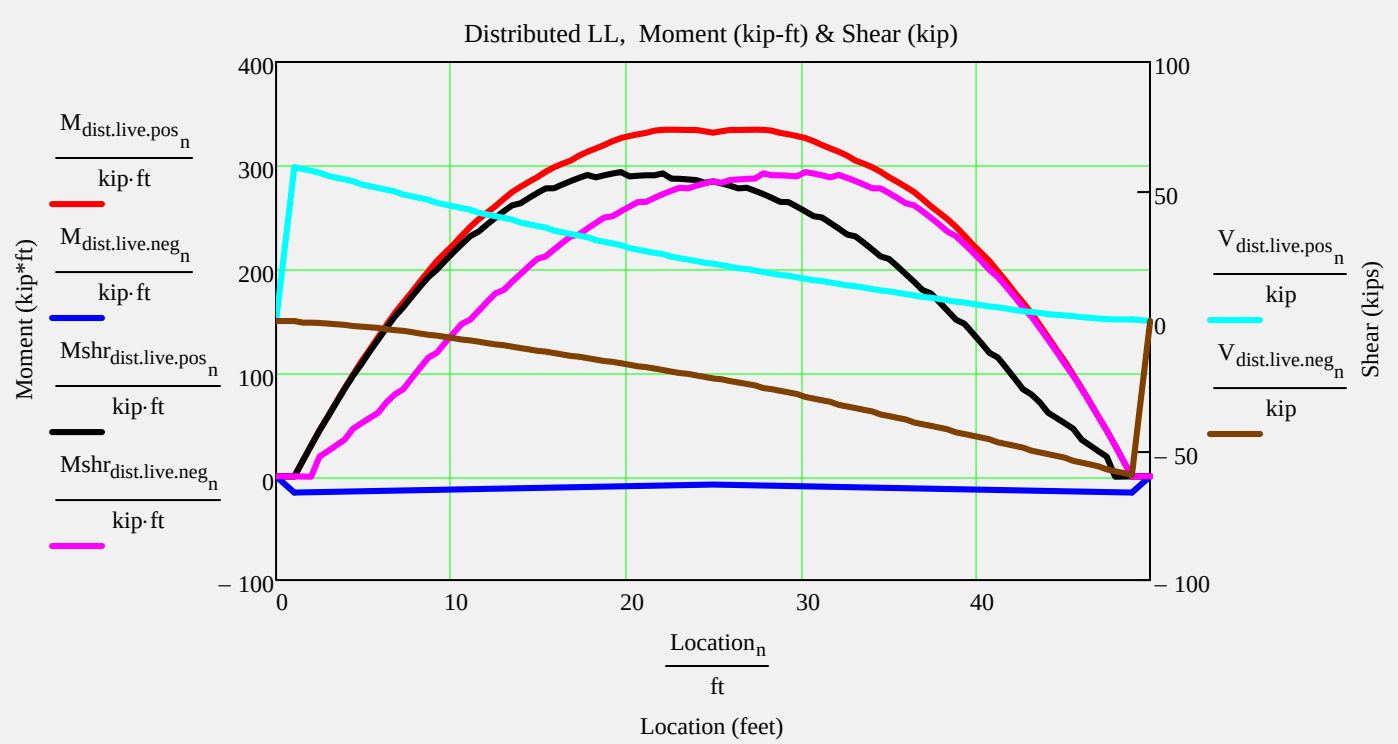
$\max(V_{dl.comp}) = 2.4 \cdot kip$ $\max(M_{dl.comp}) = 28.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.4 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 47.75\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.35$ $g_{mom.fatigue} = 0.21$ $g_{shear} = 0.65$



$\max(V_{dist.live.pos}) = 59.4 \cdot kip$

$\max(M_{dist.live.pos}) = 334.7 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -59.4 \cdot kip$

$Reaction_{LL} = 61.5 \cdot kip$

$\min(M_{dist.live.neg}) = -15.6 \cdot kip \cdot ft$

$Reaction_{DL} = 34.6 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 294 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{truck} = 59.5 \cdot kip$ $Reaction_{lane} = 15.95 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 48.83 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-50ftSpan-15inx56in_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

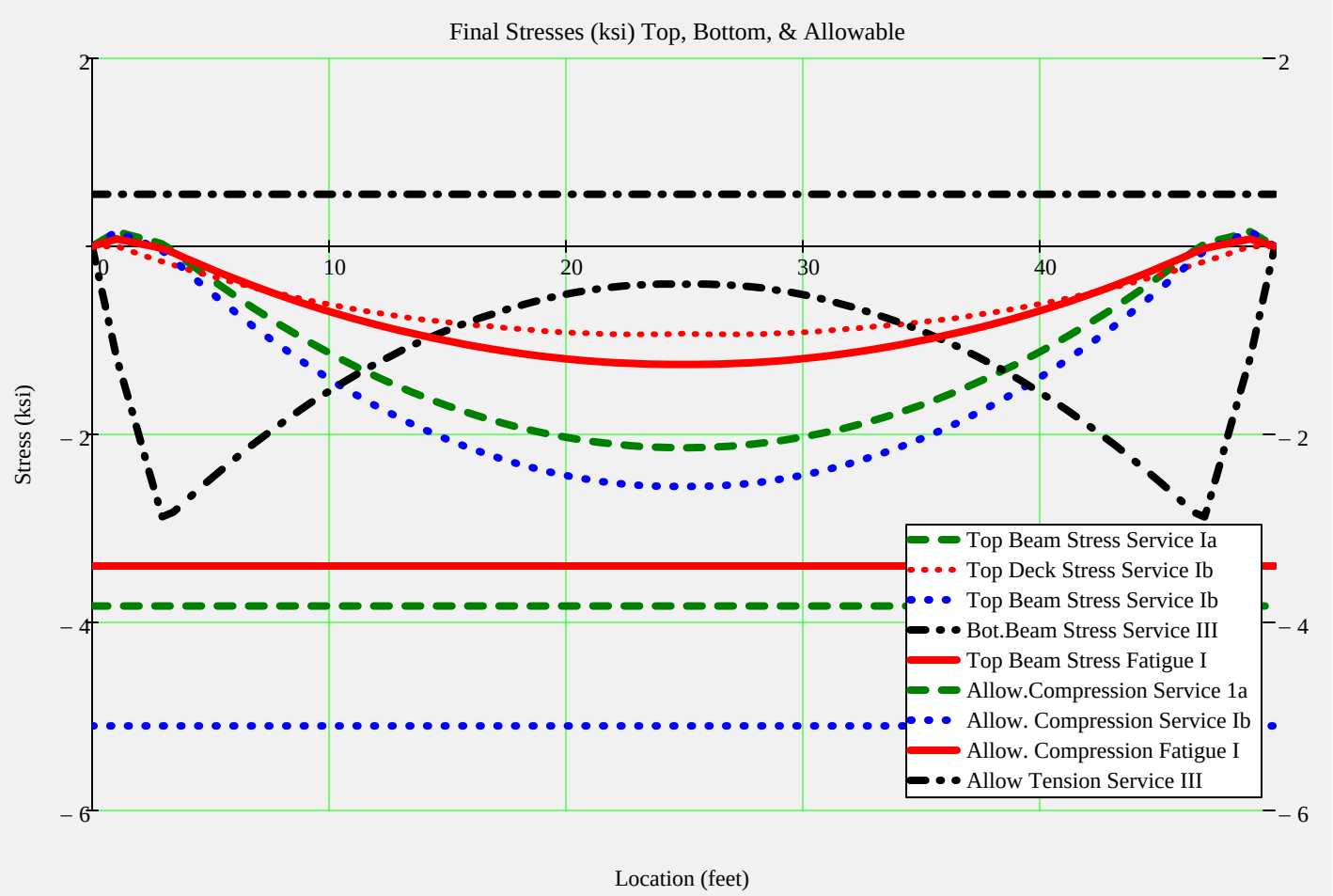
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses

Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.56$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.50$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.37$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.95	0.13	0.59
"Compression @ Release"	3.43	–3.51	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	24.92	–2.14	–3.83
"CompressionIb @ ServiceI"	25.39	–2.55	–5.10
"Compression @ FatigueI"	24.92	–1.26	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

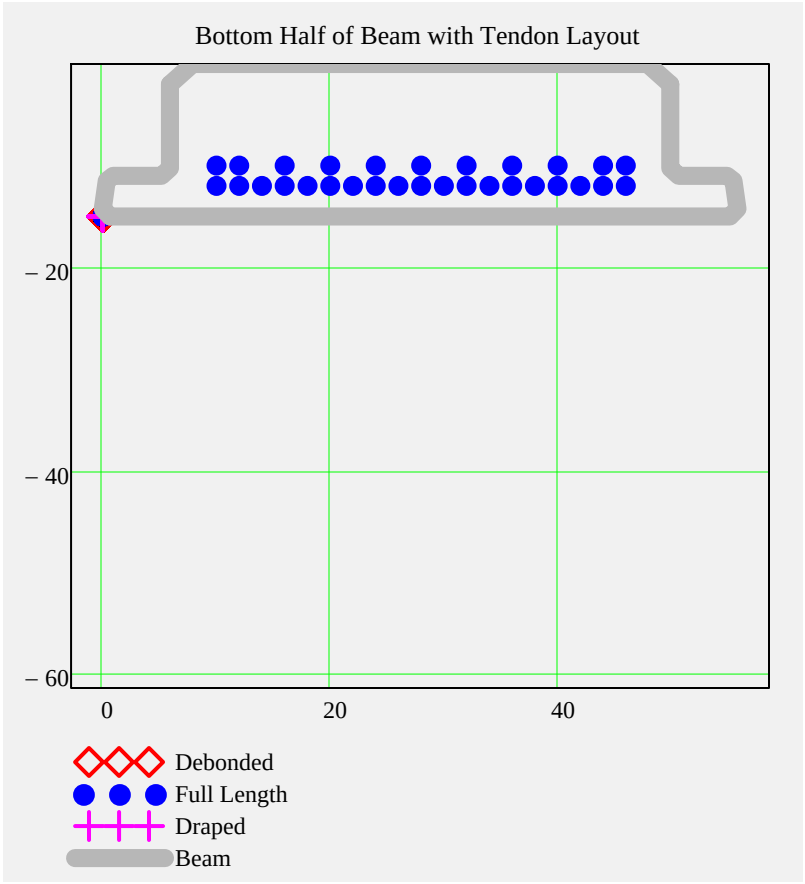
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

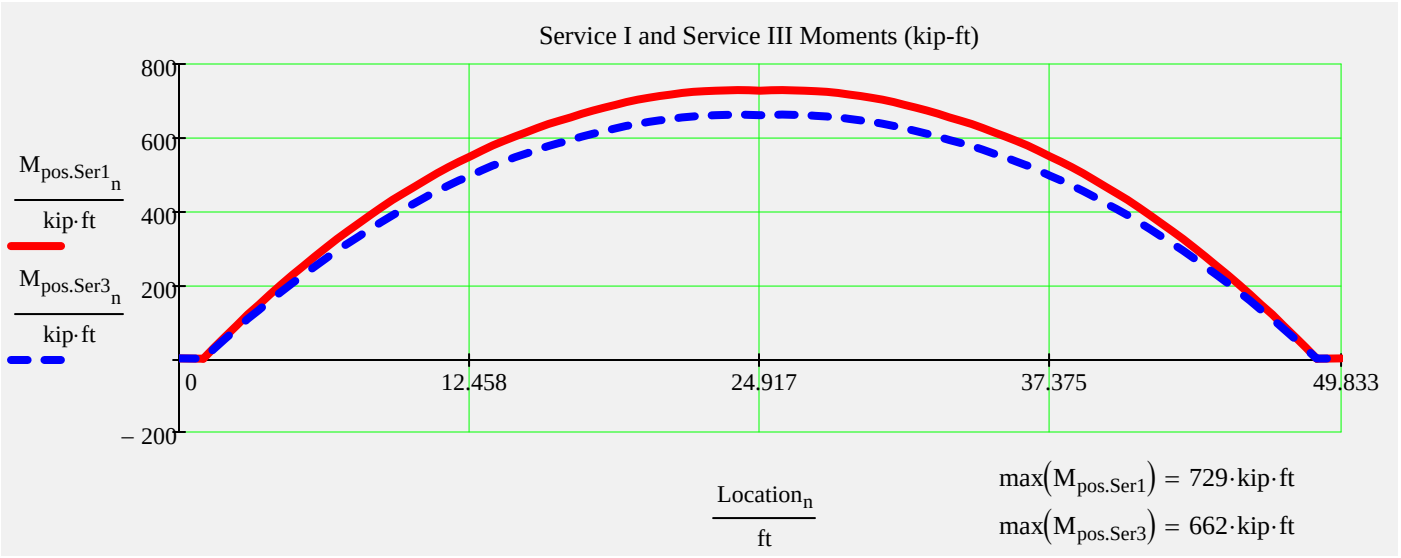
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

Check_f_{pe} = "OK"

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–1.08	–2.50
"2"	–1.14	–2.06
"4"	–1.01	–2.17
"6"	–2.11	–1.22
"8"	–2.55	–0.40

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1177.2	44990	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	227
"Non-Composite DL (incl. beam wt.)"	367
"Composite Dead Load"	29
"Distributed Live Load"	332

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

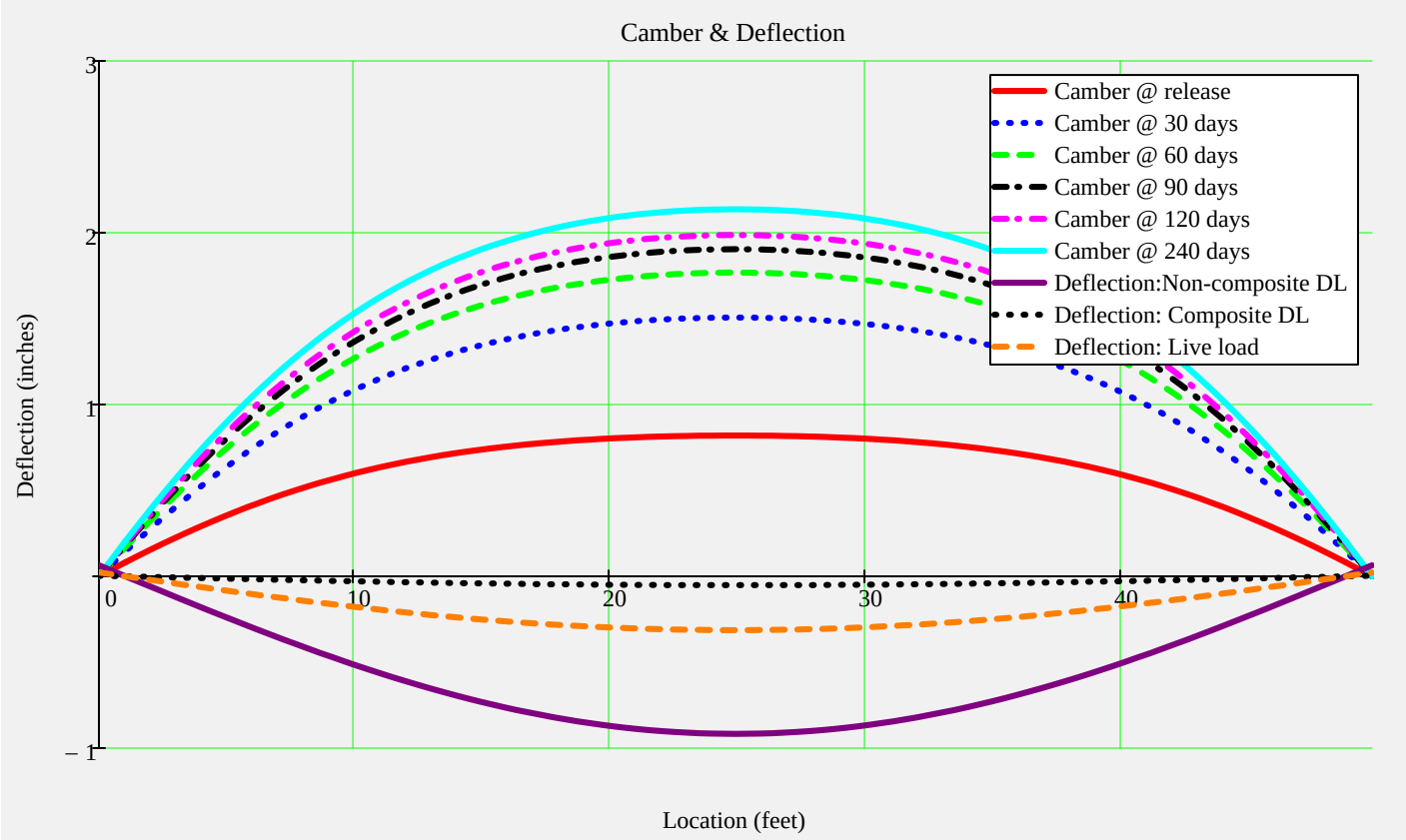
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 47.75 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.08	–0.36	0.38	0.82
"30 Days"	–0.21	–0.67	0.68	1.51
"60 Days"	–0.26	–0.79	0.80	1.77
"90 Days"	–0.29	–0.85	0.85	1.90
"120 Days"	–0.31	–0.89	0.89	1.99
"240 Days"	–0.34	–0.96	0.96	2.14
"Non-comp DL"	–0.08	0.07	–0.29	–0.92
"Comp DL"	–0.00	0.01	–0.02	–0.05
"LL"	–0.02	0.04	–0.10	–0.31

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.02 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

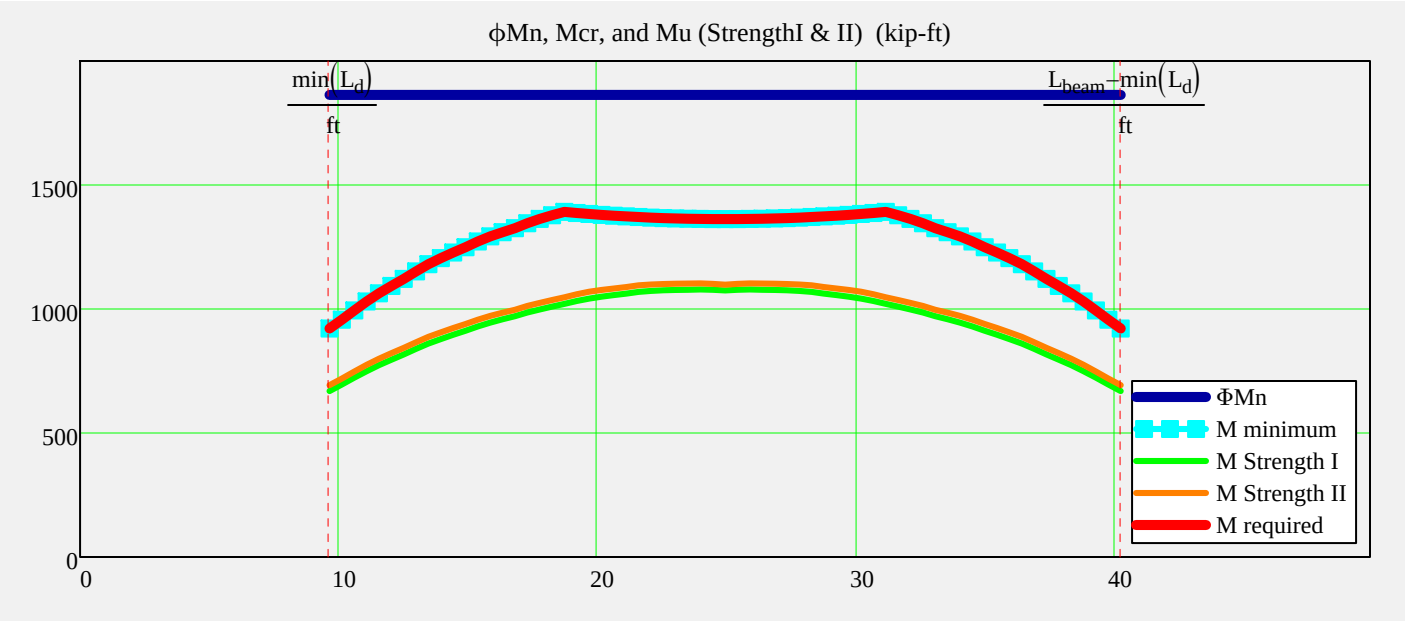
Values at midspan

$LimitStateForMoment_{51}$ = "Strength II" $\max(M_{Strength}) = 1103 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51}$ = "Yes" $M_{minimum_{51}} = 1362 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1362 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1864 \cdot kip \cdot ft$

$FailureMode_{51}$ = "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $\quad L_{beam} - \min(L_d) = 40.2\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.75$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

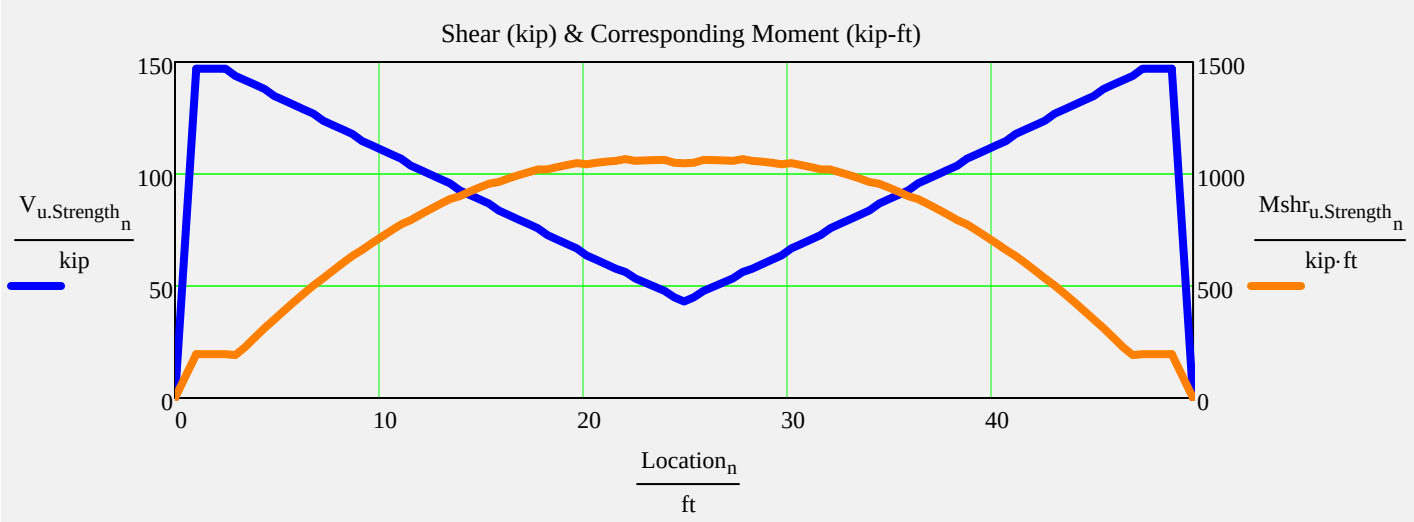
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

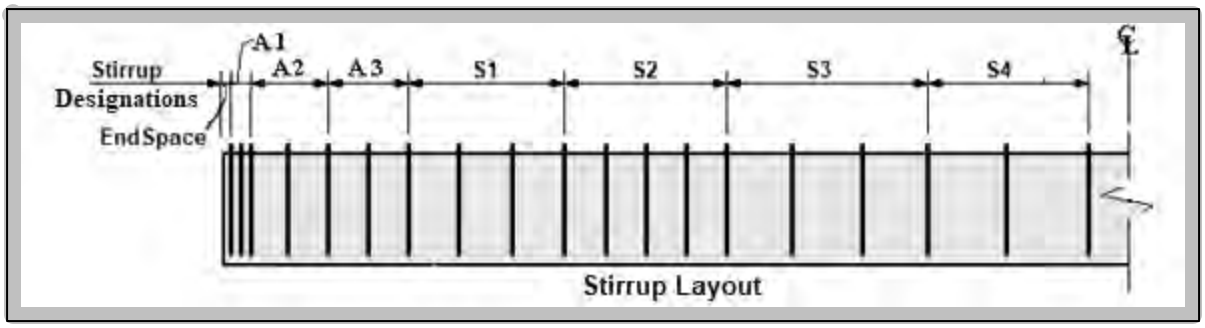
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 145 \\ 153 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 147.0 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 1066 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

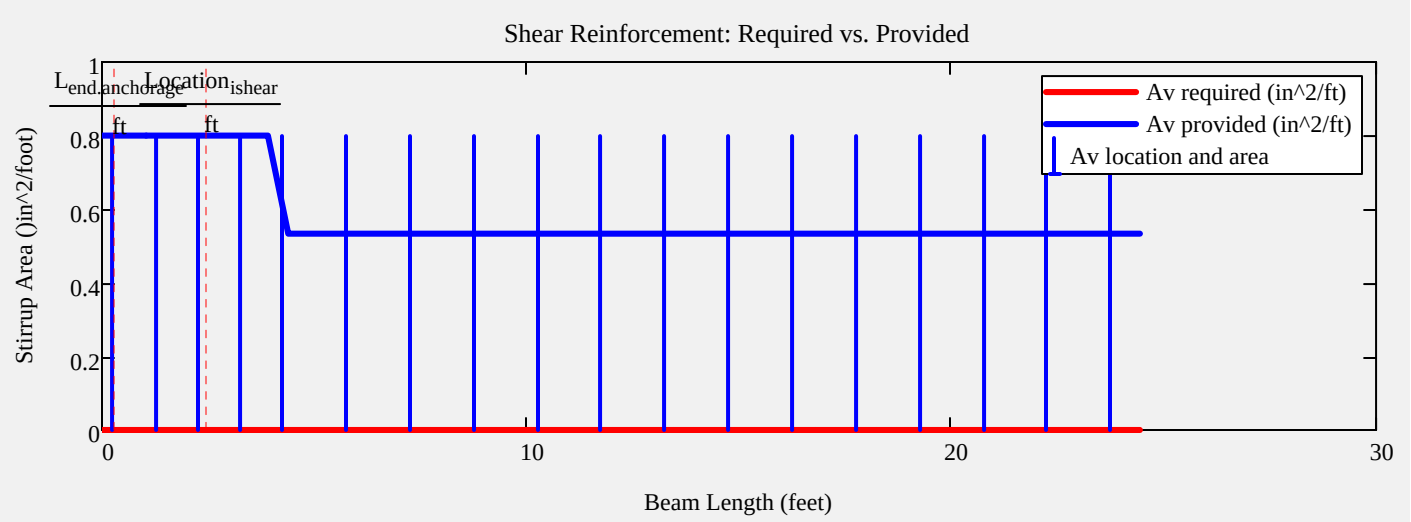
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.47\ ft$

Save Data File

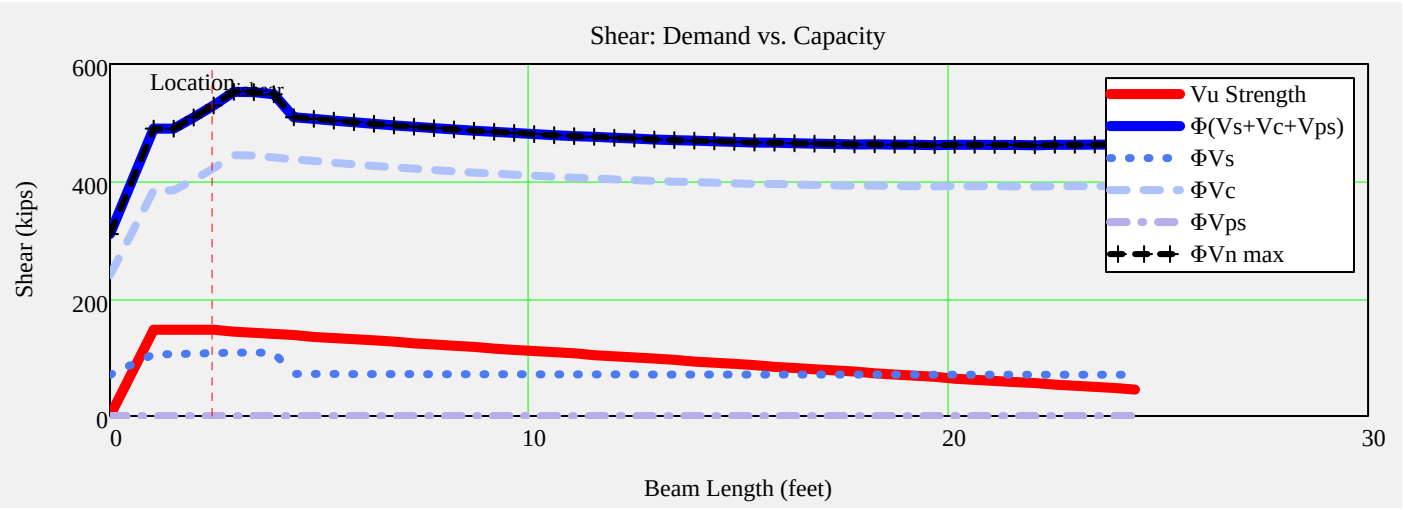
Use current input file

File Name FSB-50ftSpan-15inx56in_ExtBeam.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\WB

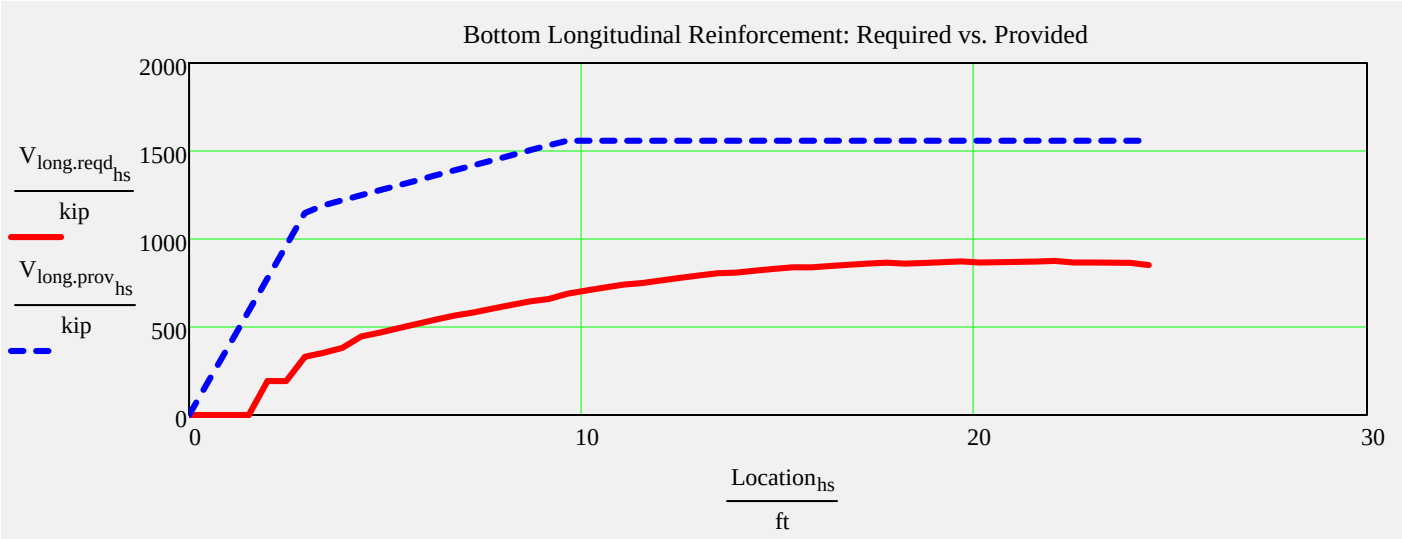
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 2.47 & 146.98 & 529.47 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.28$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

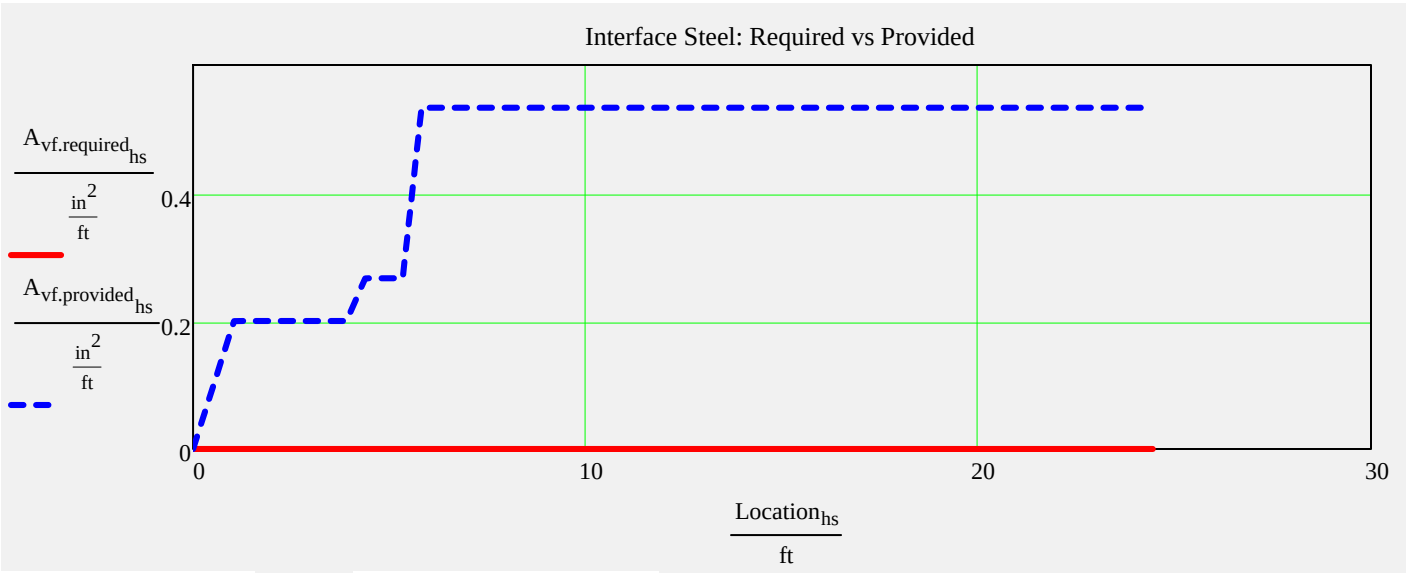


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 22.1 & 875.7 & 1558.2 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.56$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 11.17 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

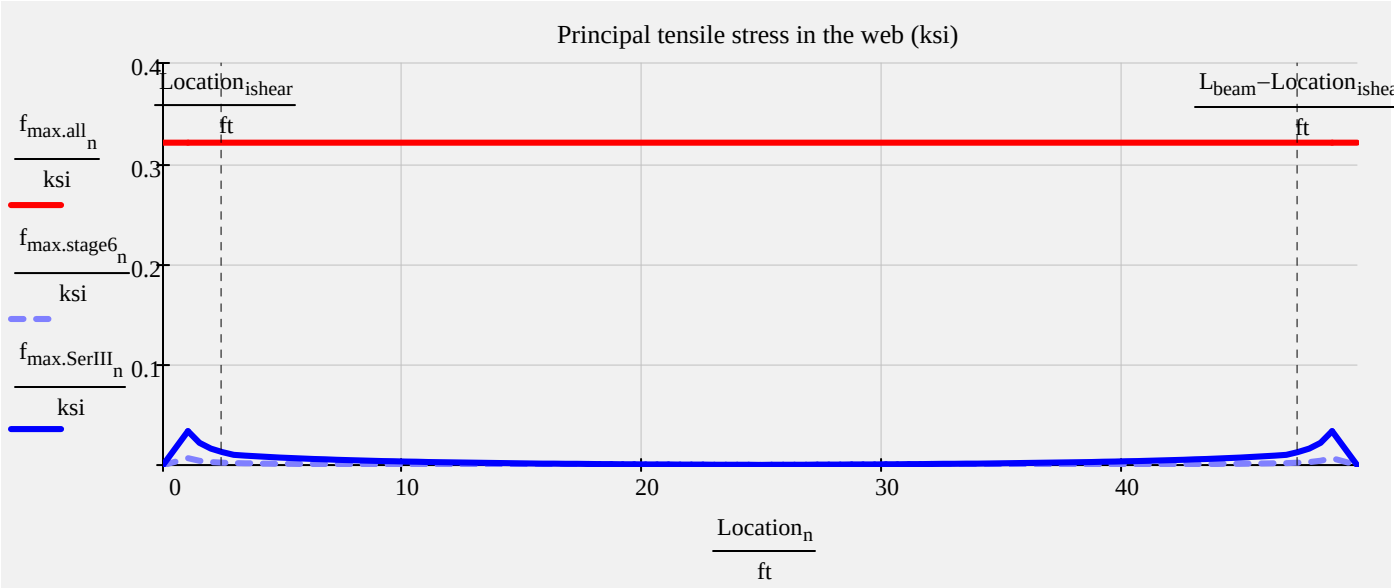
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 29.7 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

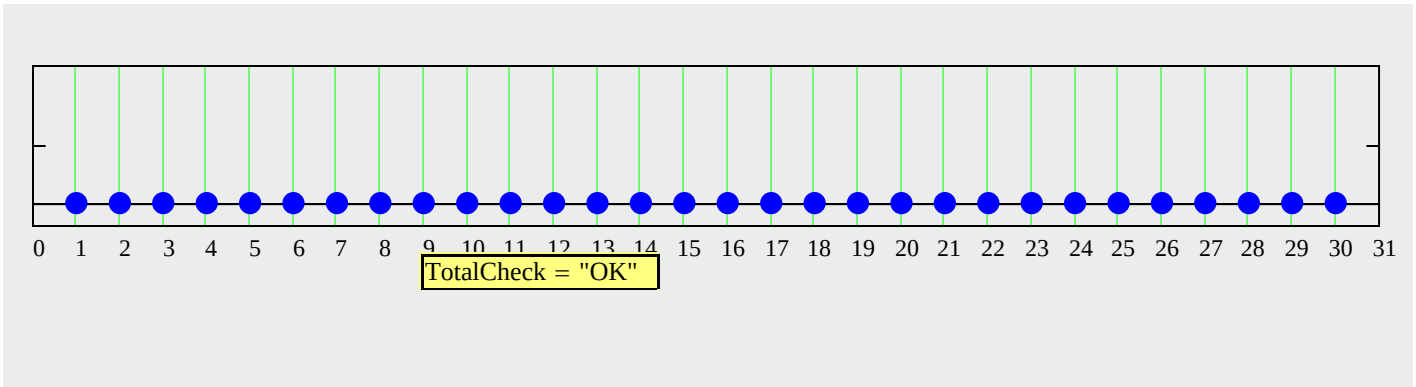
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.35	2.34	"N/A"	22.92	0.65	4.95	"N/A"	1.43	HL-93
"Strength I (Op)"	0.35	3.03	"N/A"	22.92	0.65	6.42	"N/A"	1.43	HL-93
"Service III (Inv)"	0.35	2.29	"N/A"	22.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.35	2.48	"N/A"	22.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.35	2.25	134.82	21.96	0.65	4.59	275.15	1.43	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.53$ $DC_{LongReinf.Permit} = 0.56$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1864	"factored resistance (kip-ft)...."
"γDL"	494	"factored dead load (kip-ft)...."
"γLL"	451	"factored live load (kip-ft)....."
"RF"	3.03	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	535.2	"factored resistance (kip)....."
"γDL"	39.1	"factored dead load (kip)....."
"γLL"	77.3	"factored live load (kip)....."
"RF"	6.42	"HL93 operating rating factor"

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\WB 50' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-50ftSpan-15inx56in_ExtBeam.dat
FSB-50ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

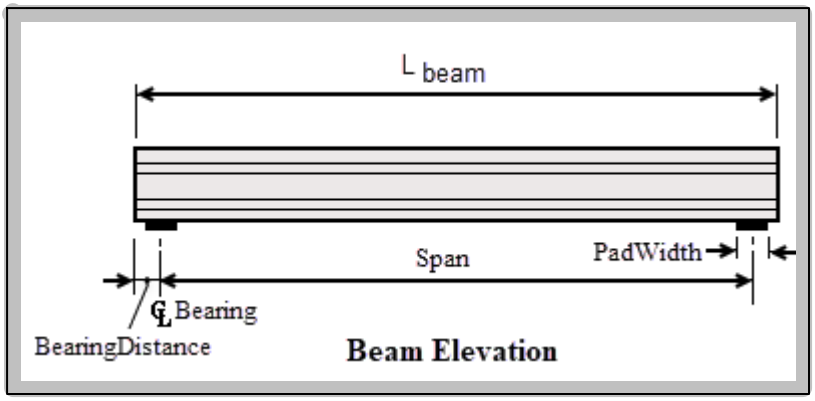
InputDataFile = "FSB-50ftSpan-15inx56in_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	WB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

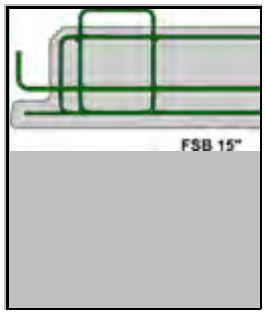
InputDataFile = "FSB-50ftSpan-15inx56in_IntBeam.dat"

Beam Type: FSB12 / **FSB15** / FSB18

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



L_{beam}	49.8333	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.8021	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* (0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	12		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.6489	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

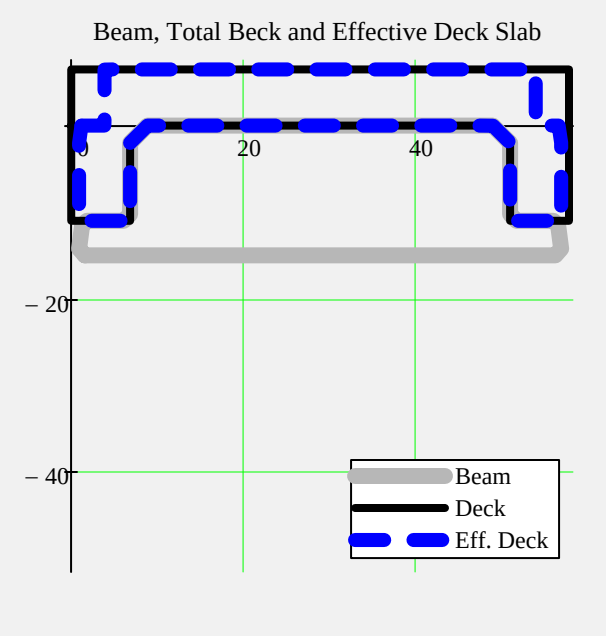
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = 56·in

$b_e = 57.65 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.58 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.07 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 49.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

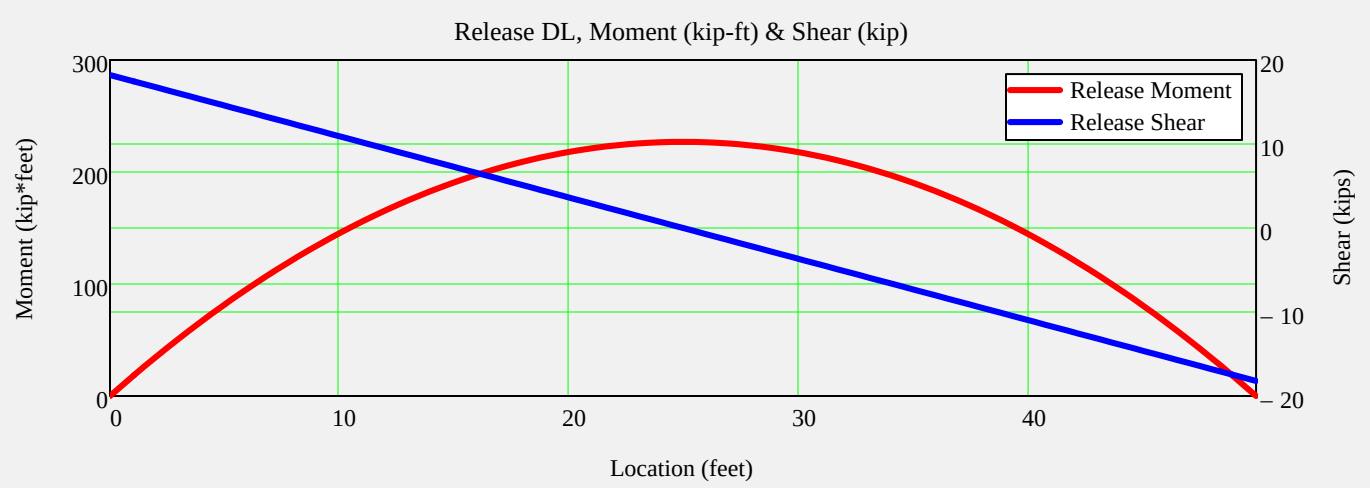
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

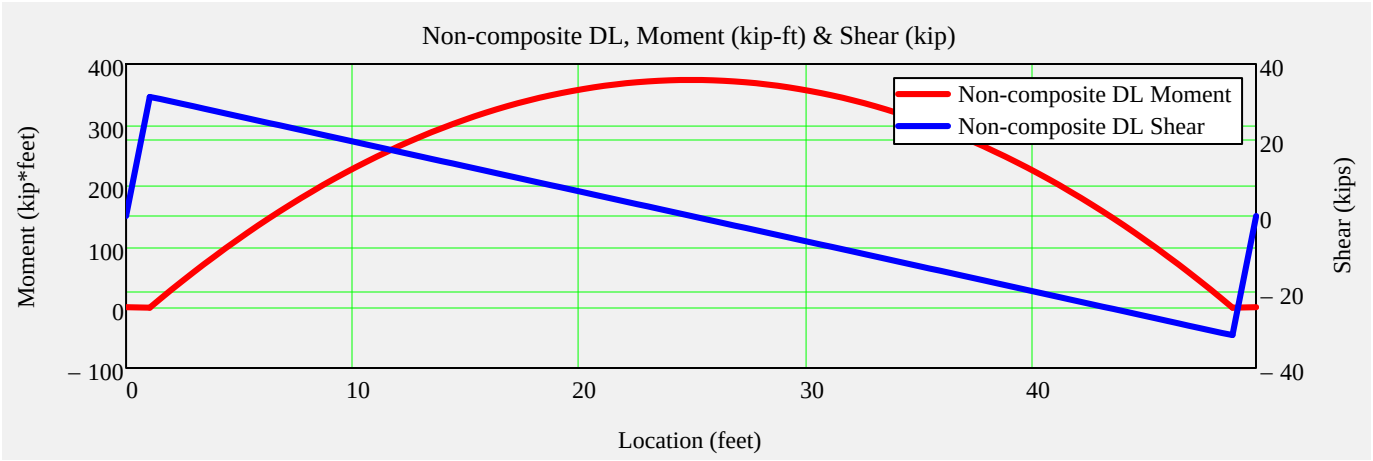
Release Dead Load Moments and Shears

$L_{span} = 47.75\ ft$



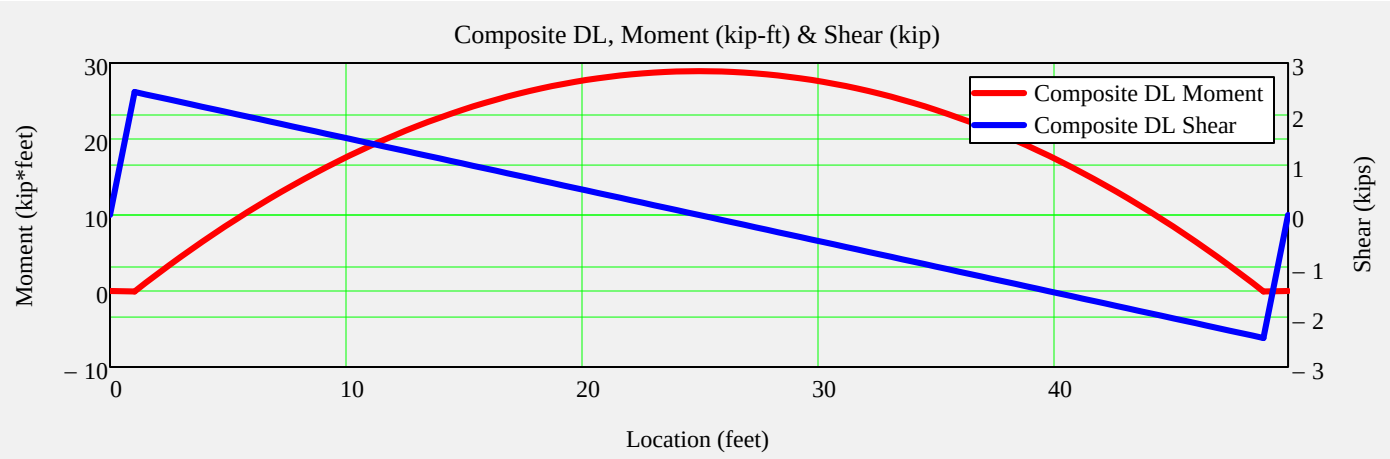
$\max(V_{release}) = 18.2 \cdot kip$ $\max(M_{release}) = 226.9 \cdot kip \cdot ft$ $\min(V_{release}) = -18.2 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 31.3 \cdot kip$ $\max(M_{dl.non.comp}) = 373.7 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -31.3 \cdot kip$

Composite Dead Load Moments and Shear



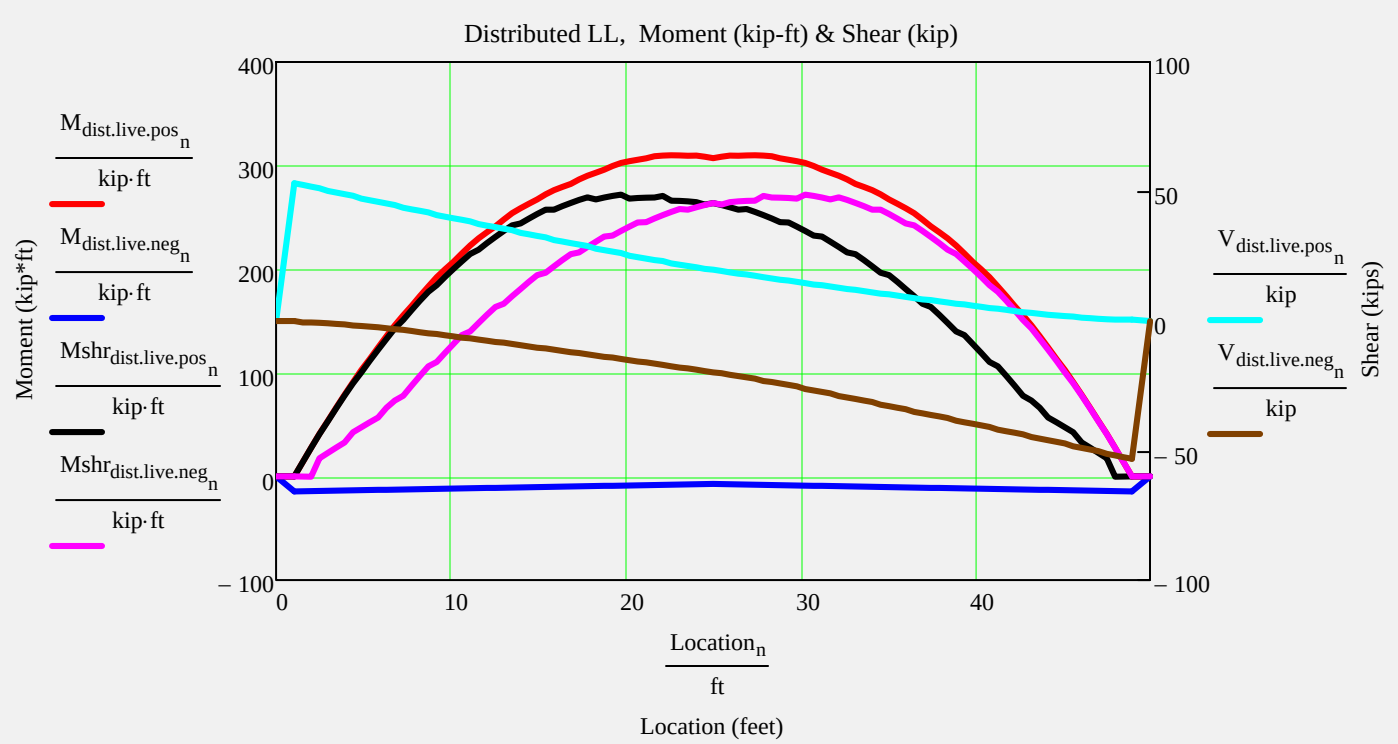
$\max(V_{dl.comp}) = 2.4 \cdot kip$ $\max(M_{dl.comp}) = 28.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.4 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 47.75\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.32$ $g_{mom.fatigue} = 0.18$ $g_{shear} = 0.58$



$\max(V_{dist.live.pos}) = 53.2 \cdot kip$

$\max(M_{dist.live.pos}) = 309.9 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -53.2 \cdot kip$

$Reaction_{LL} = 55.1 \cdot kip$

$\min(M_{dist.live.neg}) = -14.4 \cdot kip \cdot ft$

$Reaction_{DL} = 35.2 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 272 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{truck} = 59.5 \cdot kip$ $Reaction_{lane} = 15.95 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 43.73 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-50ftSpan-15inx56in_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

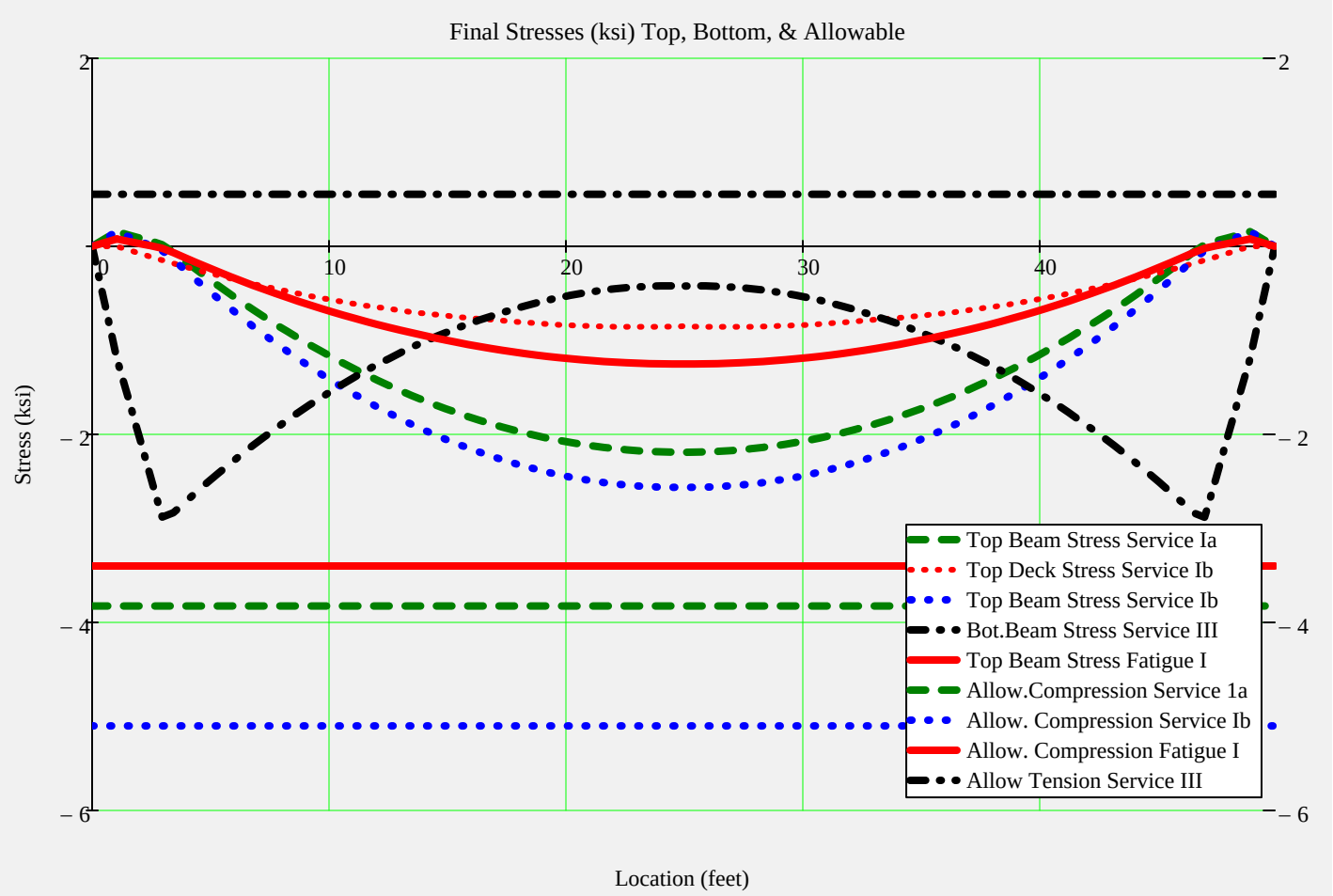
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses

Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.57$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.50$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.37$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.95	0.13	0.59
"Compression @ Release"	3.43	–3.51	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	24.92	–2.19	–3.83
"CompressionIb @ ServiceI"	25.39	–2.56	–5.10
"Compression @ FatigueI"	24.92	–1.25	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

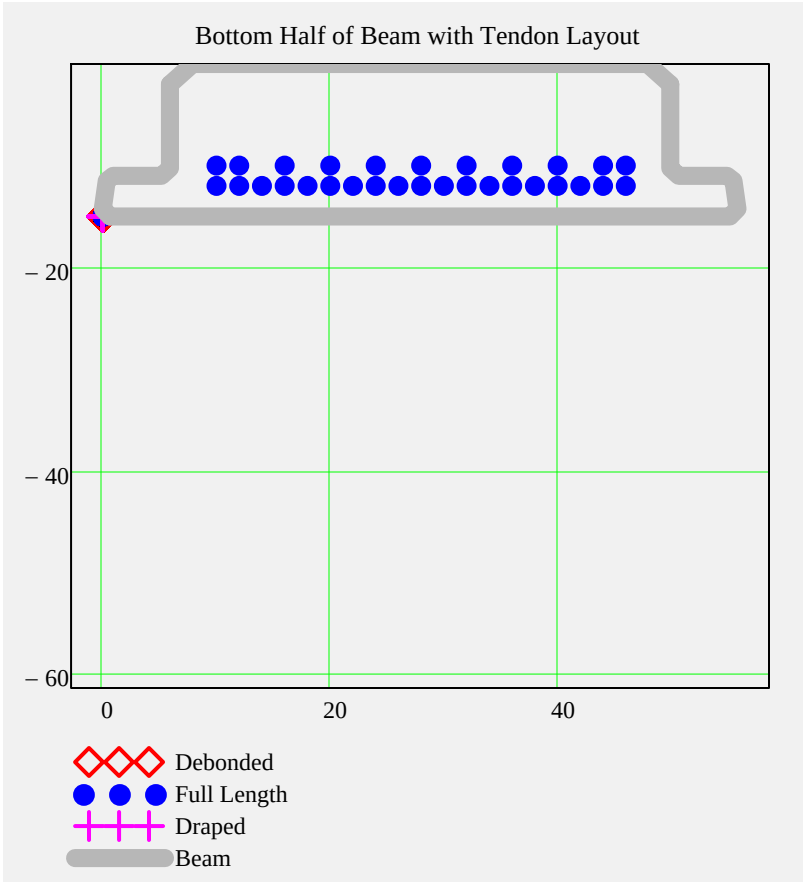
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

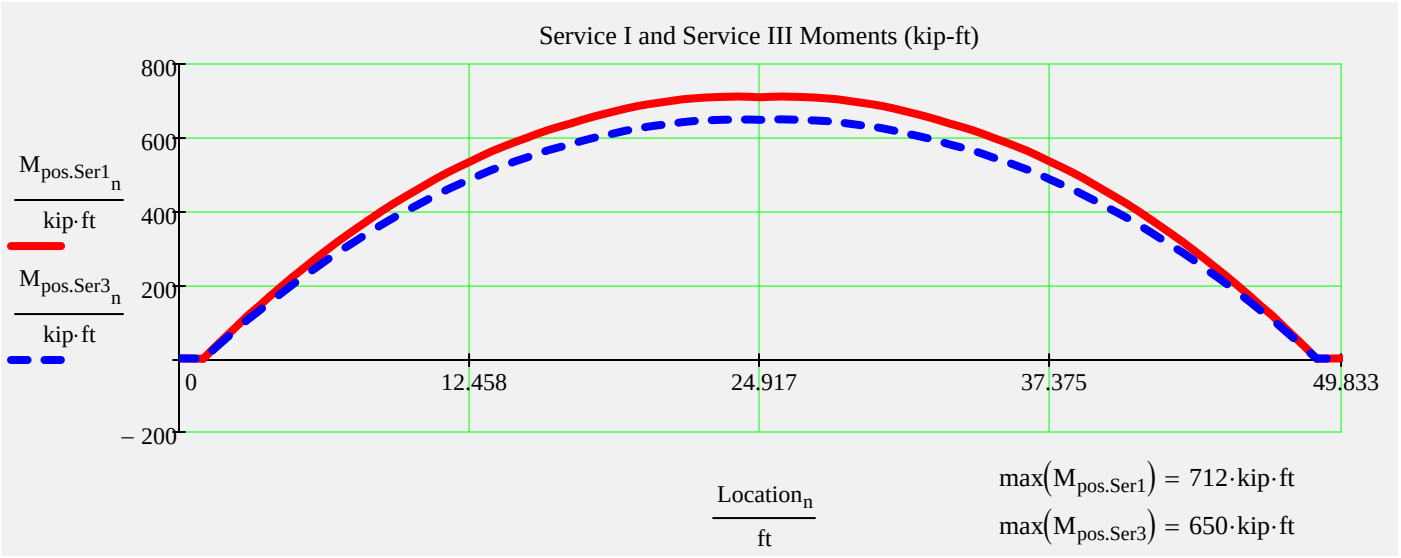
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

Check_f_{pe} = "OK"

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–1.08	–2.50
"2"	–1.14	–2.06
"4"	–1.01	–2.17
"6"	–2.16	–1.17
"8"	–2.56	–0.42

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1197.5	45628	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	227
"Non-Composite DL (incl. beam wt.)"	374
"Composite Dead Load"	29
"Distributed Live Load"	307

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

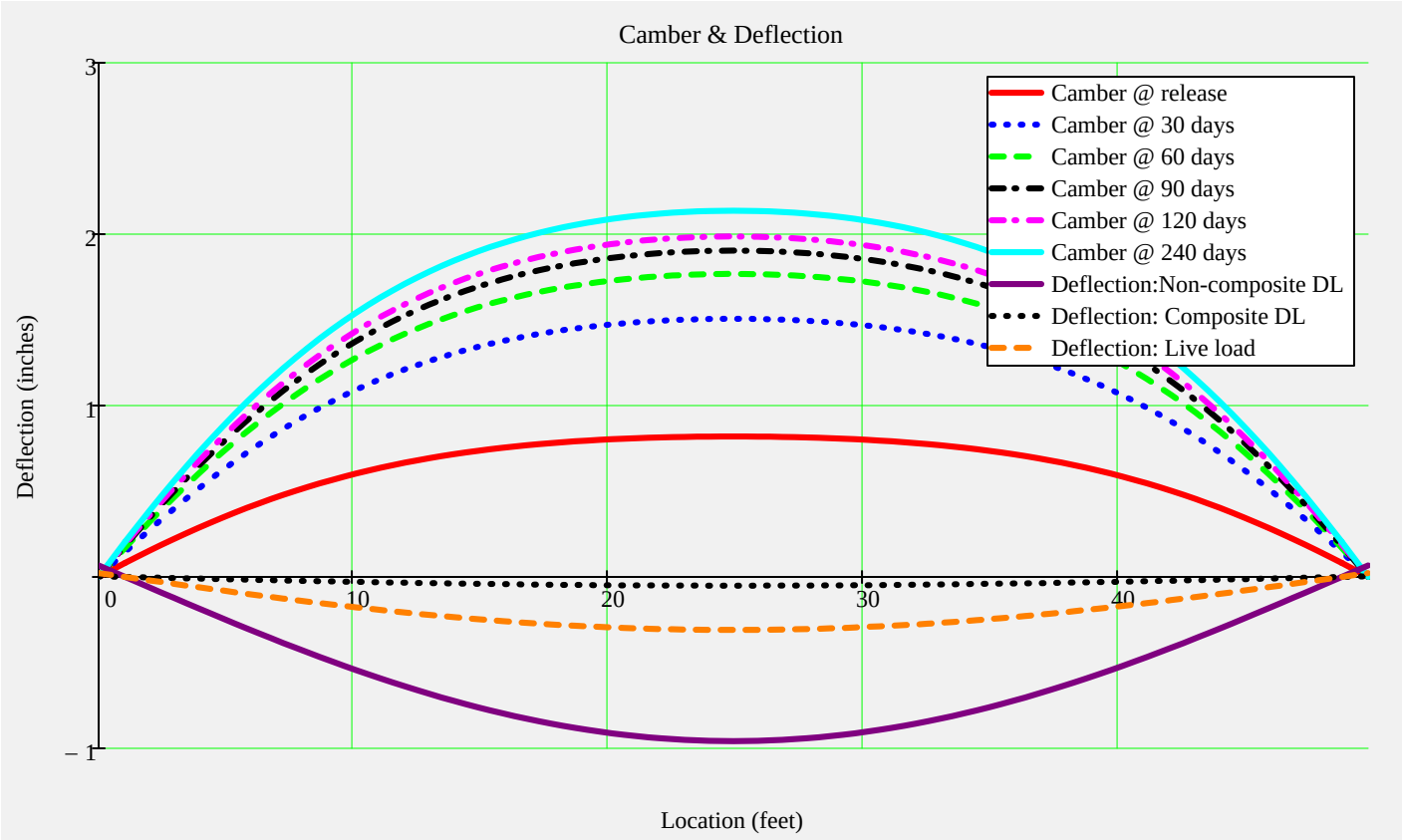
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 47.75 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.08	–0.36	0.38	0.82
"30 Days"	–0.21	–0.67	0.68	1.51
"60 Days"	–0.26	–0.79	0.80	1.77
"90 Days"	–0.29	–0.85	0.85	1.90
"120 Days"	–0.31	–0.89	0.89	1.99
"240 Days"	–0.34	–0.96	0.96	2.14
"Non-comp DL"	–0.09	0.07	–0.31	–0.96
"Comp DL"	–0.00	0.01	–0.02	–0.05
"LL"	–0.02	0.04	–0.10	–0.31

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 0.98 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

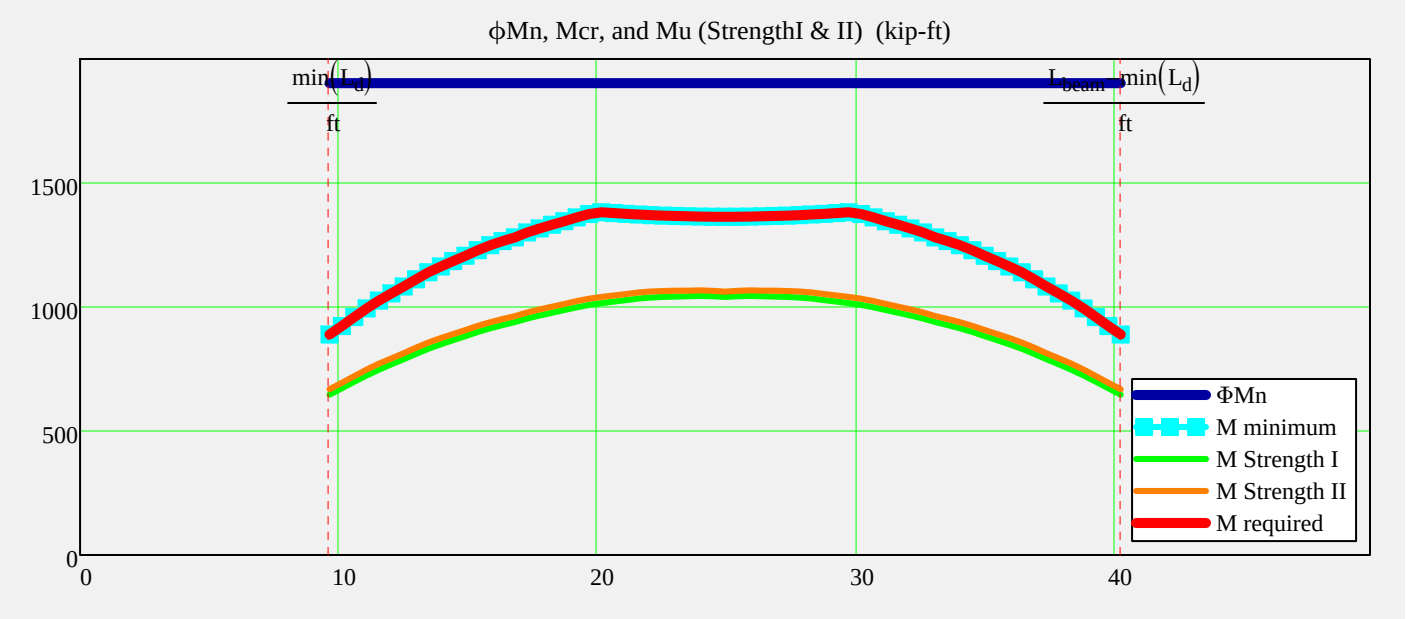
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 1067 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1364 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1364 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1903 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 40.2\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.73$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

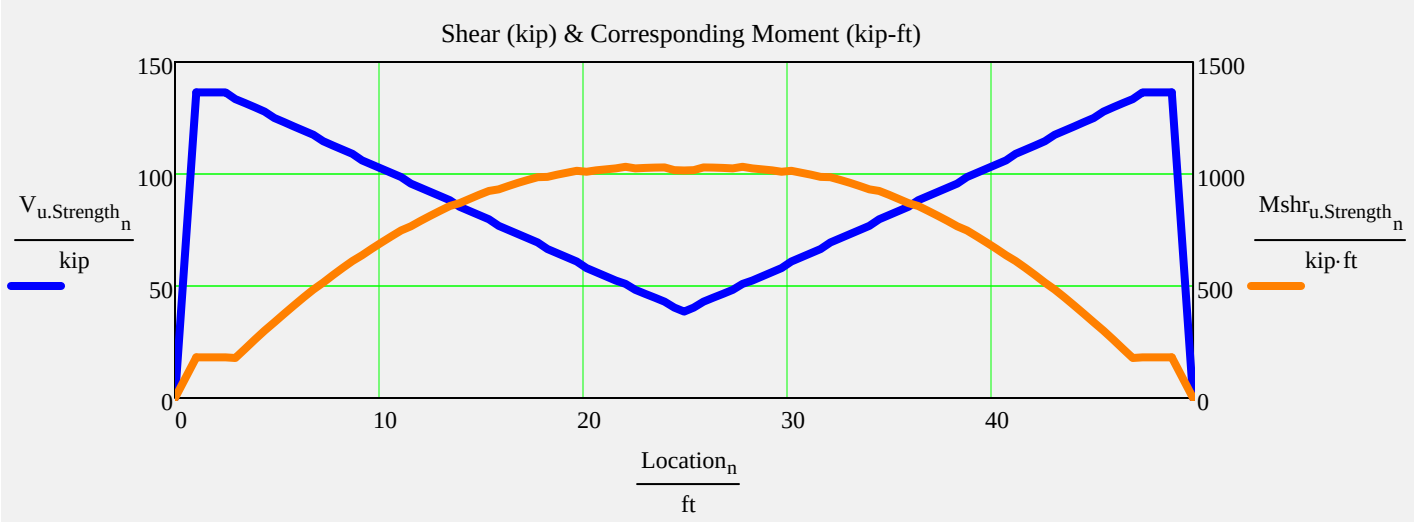
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

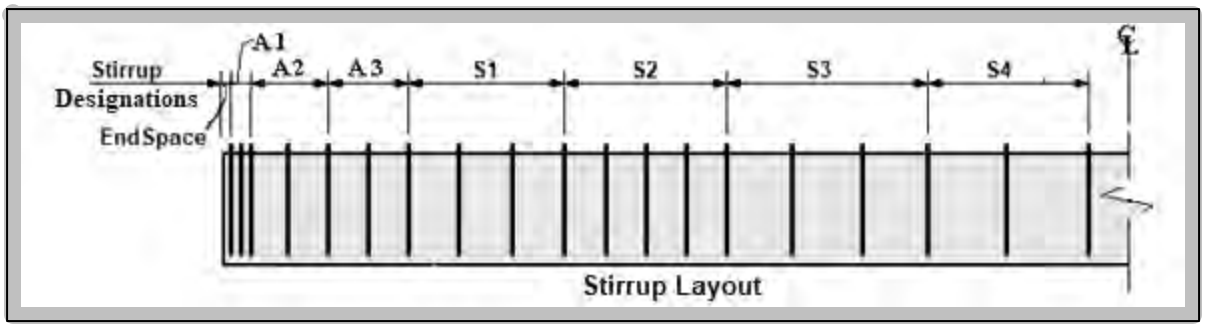
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 135 \\ 142 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 136.4 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 1032 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

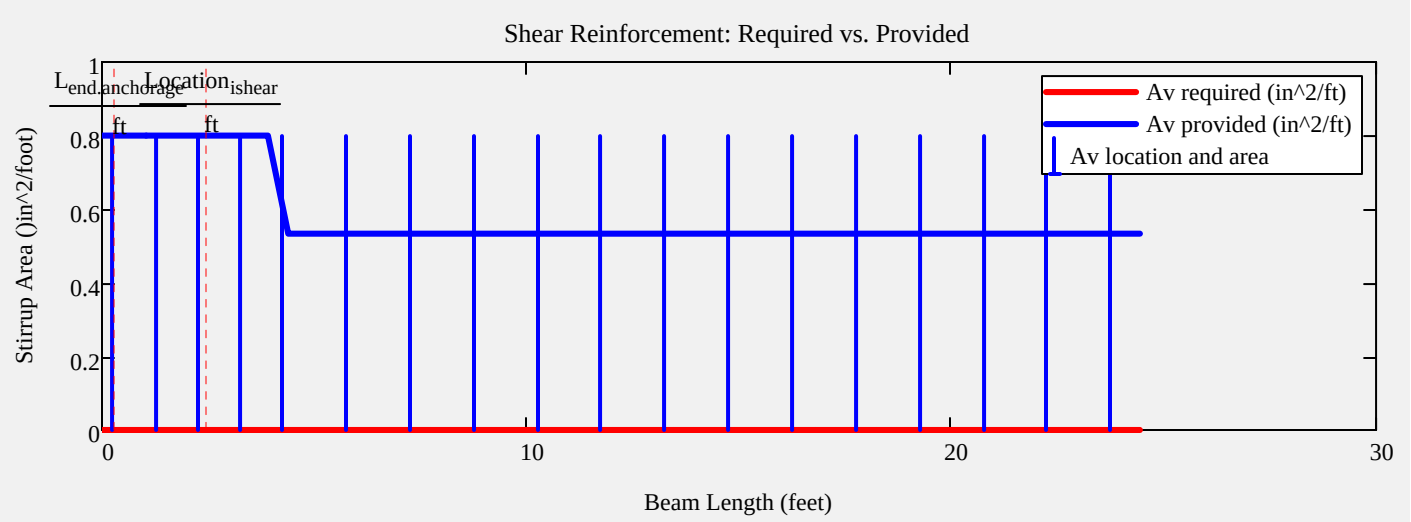
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.47\ ft$

Save Data File

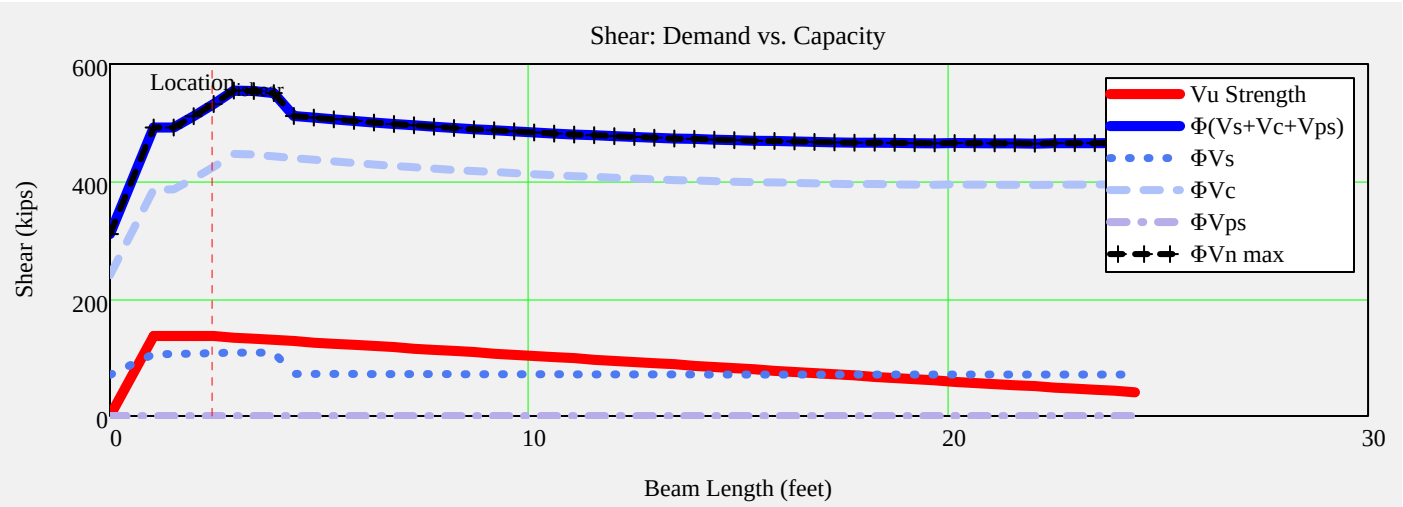
Use current input file

File Name FSB-50ftSpan-15inx56in_IntBeam.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\WB

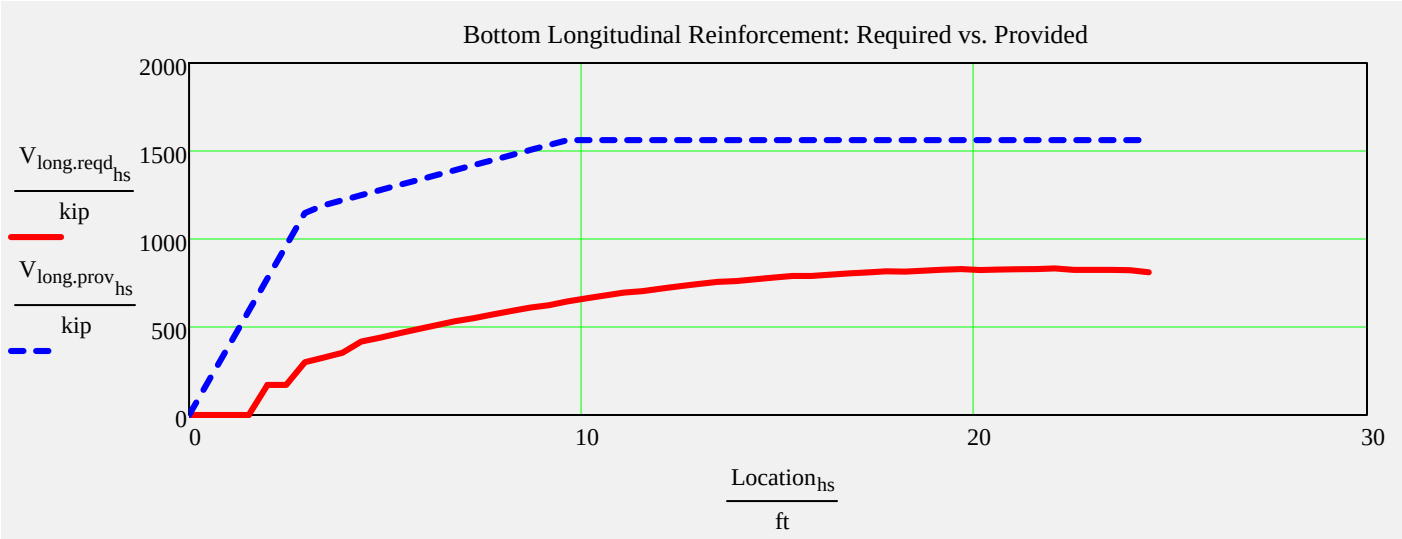
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 2.47 & 136.41 & 531.70 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.26$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

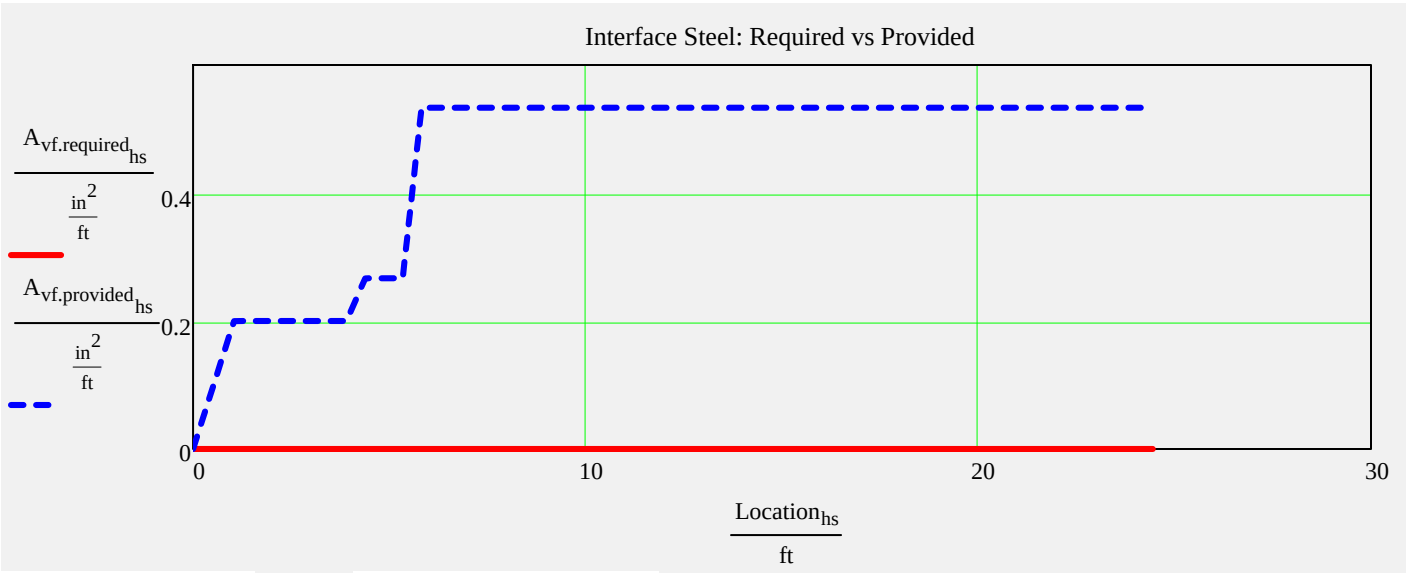


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 22.1 & 833.1 & 1561.9 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.53$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 11.17 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

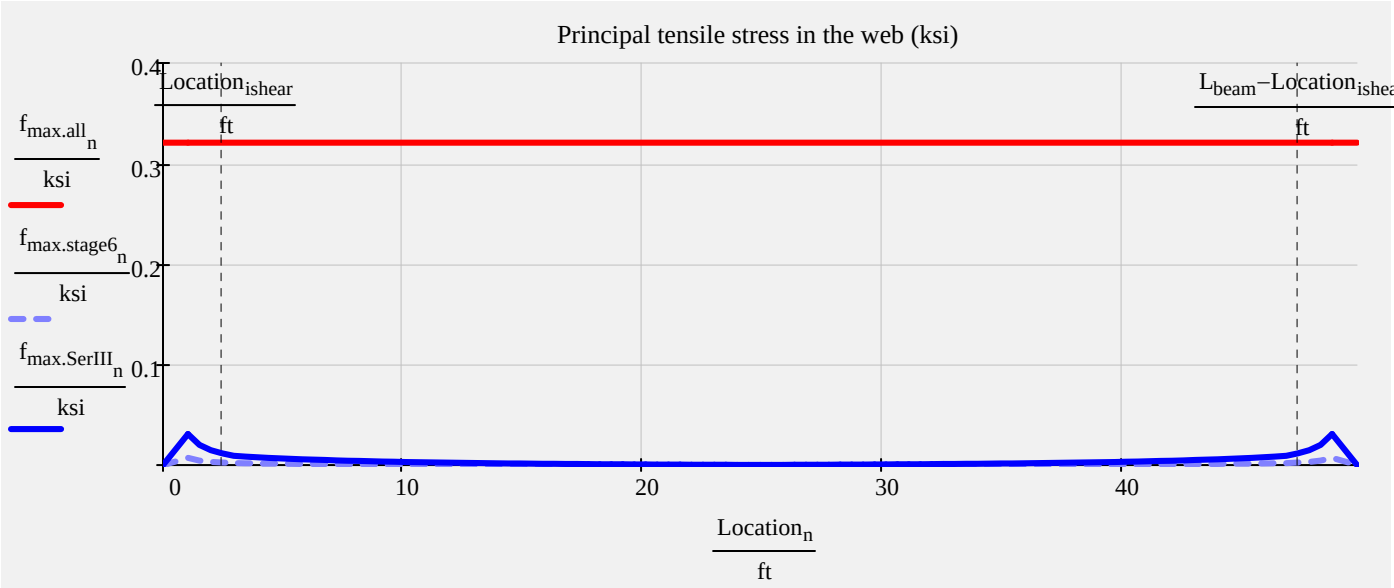
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 29.7 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

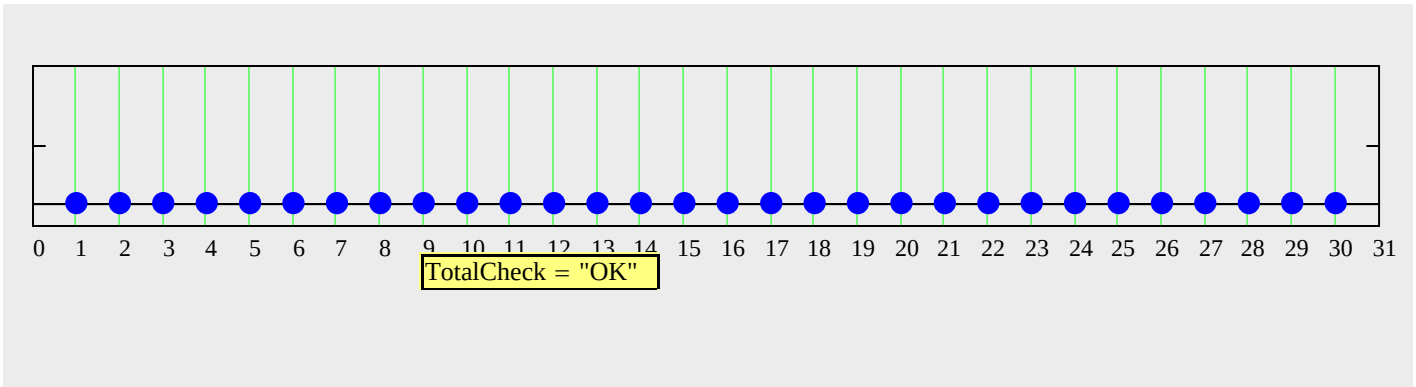
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.32	2.58	"N/A"	22.92	0.58	5.54	"N/A"	1.43	HL-93
"Strength I (Op)"	0.32	3.35	"N/A"	22.92	0.58	7.18	"N/A"	1.43	HL-93
"Service III (Inv)"	0.32	2.44	"N/A"	22.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.32	2.64	"N/A"	22.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.32	2.48	148.83	21.96	0.58	5.13	307.77	1.43	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.50$ $DC_{LongReinf.Permit} = 0.53$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1903	"factored resistance (kip-ft)...."
"γDL"	502	"factored dead load (kip-ft)...."
"γLL"	418	"factored live load (kip-ft)....."
"RF"	3.35	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	536.7	"factored resistance (kip)....."
"γDL"	39.8	"factored dead load (kip)....."
"γLL"	69.2	"factored live load (kip)....."
"RF"	7.18	"HL93 operating rating factor"

15” FLORIDA SLAB BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 50 FEET (NO SKEW)
EASTBOUND BRIDGE
(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\EB 50' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-50ftSpan-15inx56in_ExtBeam.dat
FSB-50ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

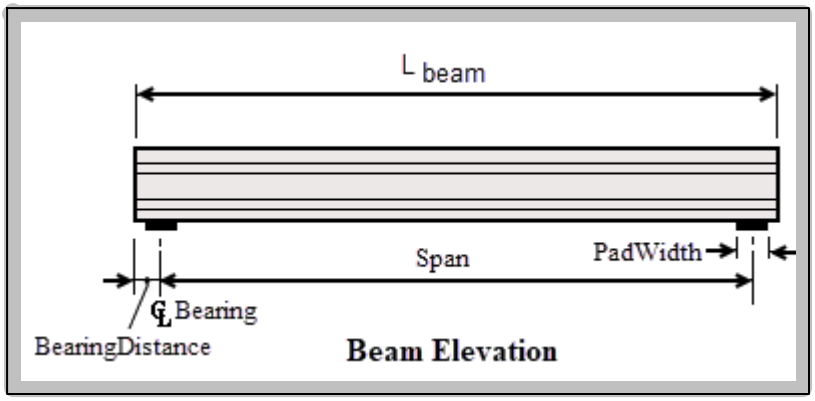
InputDataFile = "FSB-50ftSpan-15inx56in_ExtBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

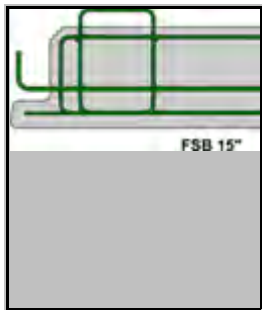
InputDataFile = "FSB-50ftSpan-15inx56in_ExtBeam.dat"

Beam Type: FSB12 / **FSB15** / FSB18

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



L_{beam}	49.8333	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / **Exterior**		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

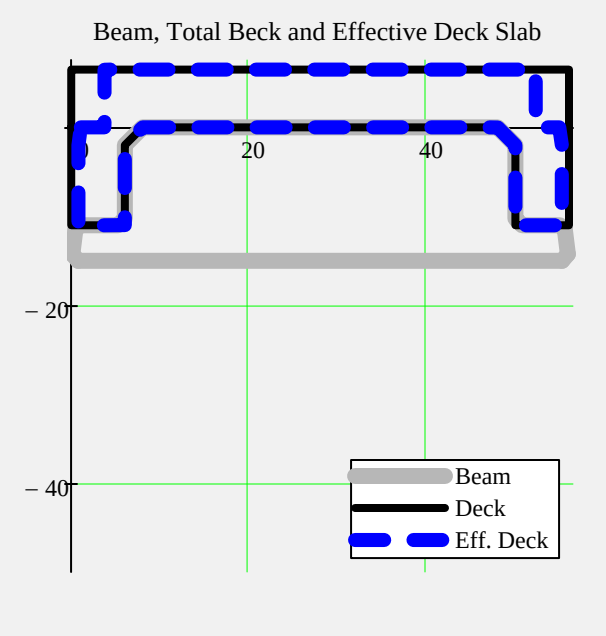
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = $56 \cdot in$

$b_e = 56.07 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 0.55 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 49.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

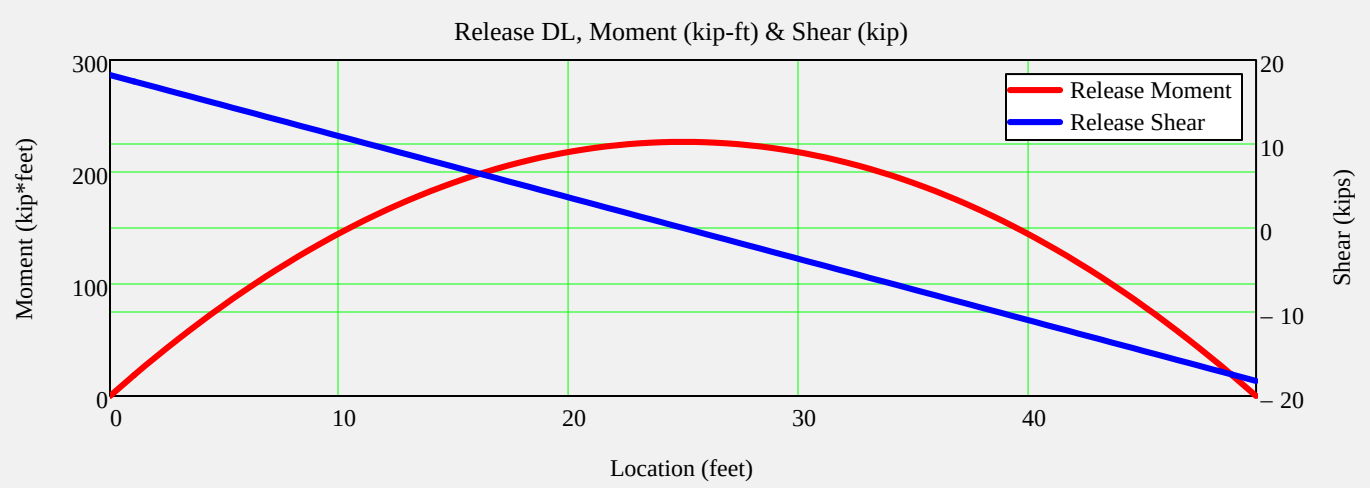
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

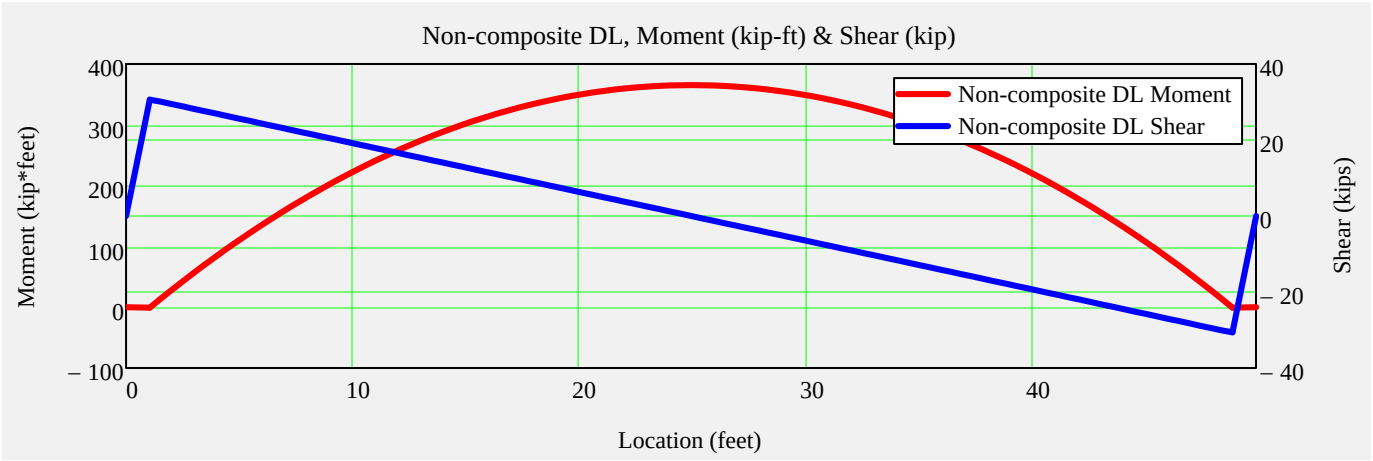
Release Dead Load Moments and Shears

$L_{span} = 47.75\ ft$



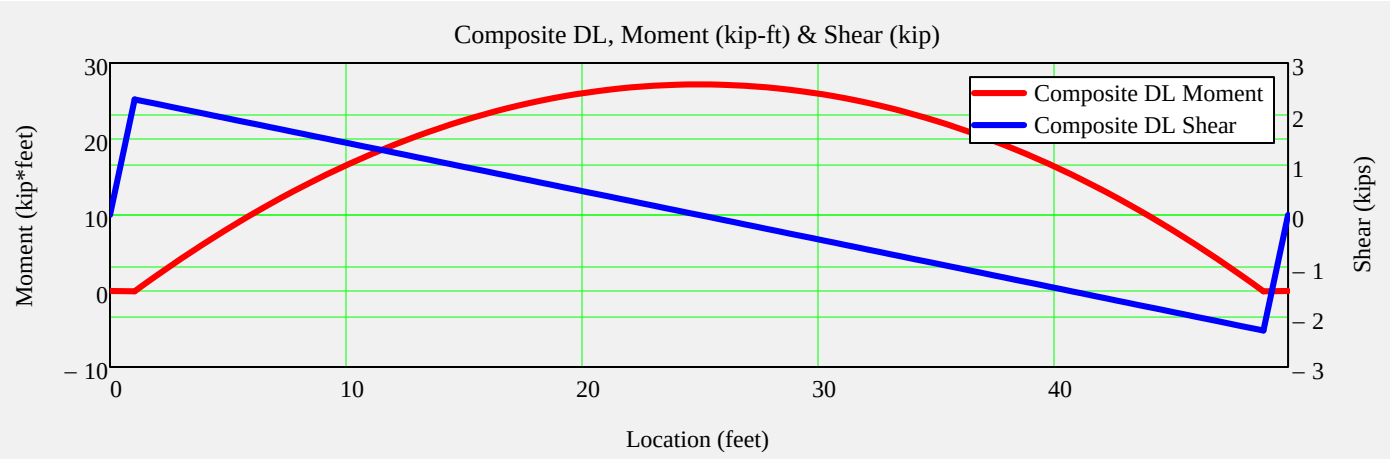
$\max(V_{release}) = 18.2 \cdot kip$ $\max(M_{release}) = 226.9 \cdot kip \cdot ft$ $\min(V_{release}) = -18.2 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 30.6 \cdot kip$ $\max(M_{dl.non.comp}) = 365.3 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -30.6 \cdot kip$

Composite Dead Load Moments and Shear



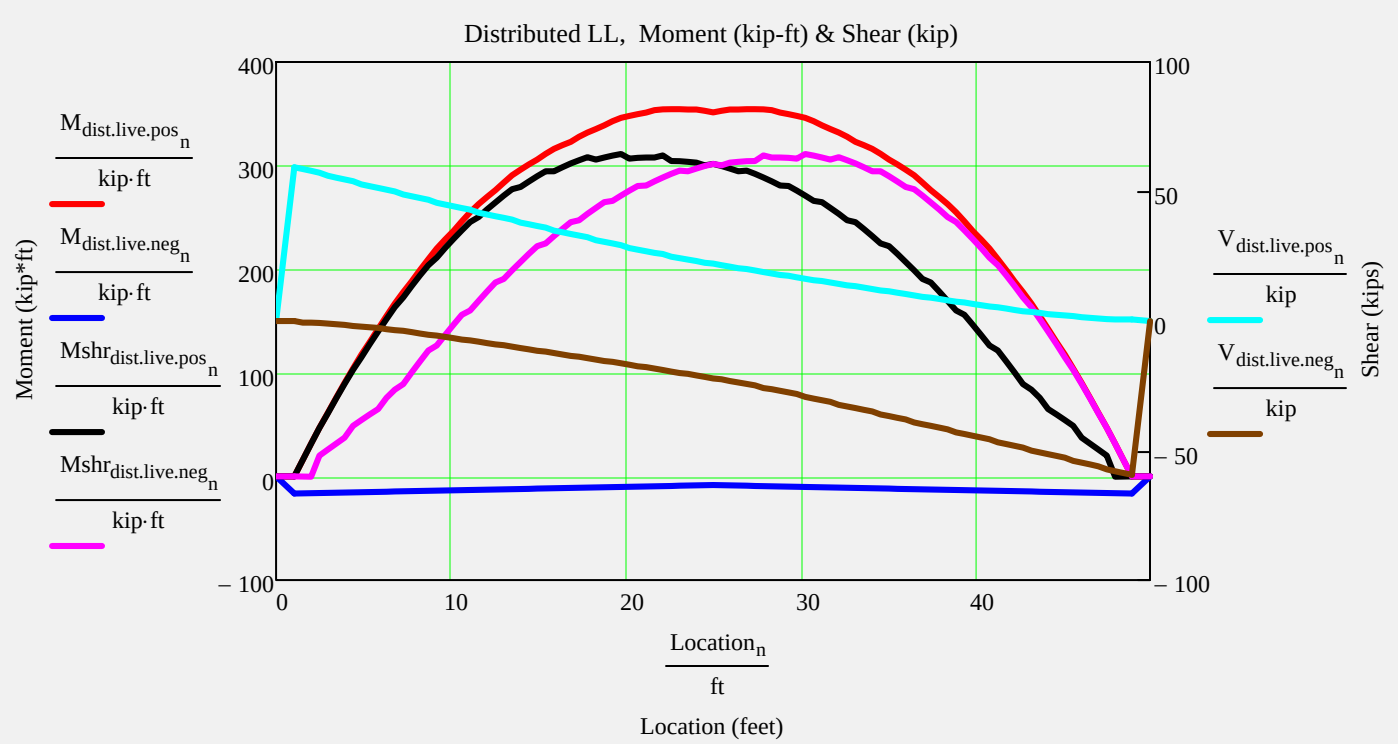
$\max(V_{dl.comp}) = 2.3 \cdot kip$ $\max(M_{dl.comp}) = 27.2 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.3 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 47.75\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.37$ $g_{mom.fatigue} = 0.22$ $g_{shear} = 0.65$



$\max(V_{dist.live.pos}) = 59.4 \cdot kip$

$\max(M_{dist.live.pos}) = 354.5 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -59.4 \cdot kip$

$Reaction_{LL} = 61.5 \cdot kip$

$\min(M_{dist.live.neg}) = -16.5 \cdot kip \cdot ft$

$Reaction_{DL} = 34.3 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 311 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{truck} = 59.5 \cdot kip$ $Reaction_{lane} = 15.95 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 48.83 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-50ftSpan-15inx56in_ExtBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

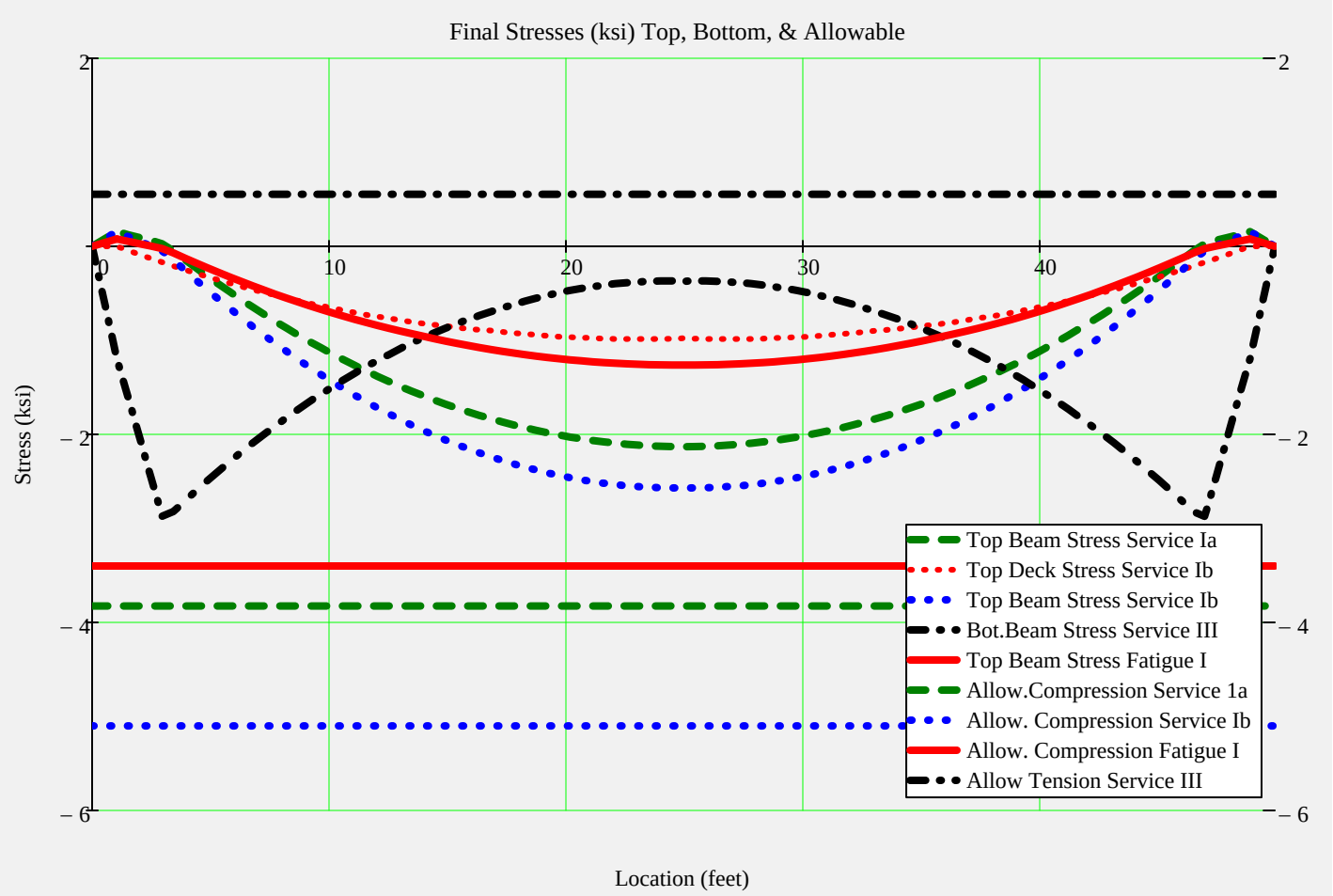
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses

Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.56$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.50$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.37$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.95	0.13	0.59
"Compression @ Release"	3.43	–3.51	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	24.92	–2.13	–3.83
"CompressionIb @ ServiceI"	25.39	–2.57	–5.10
"Compression @ FatigueI"	24.92	–1.26	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

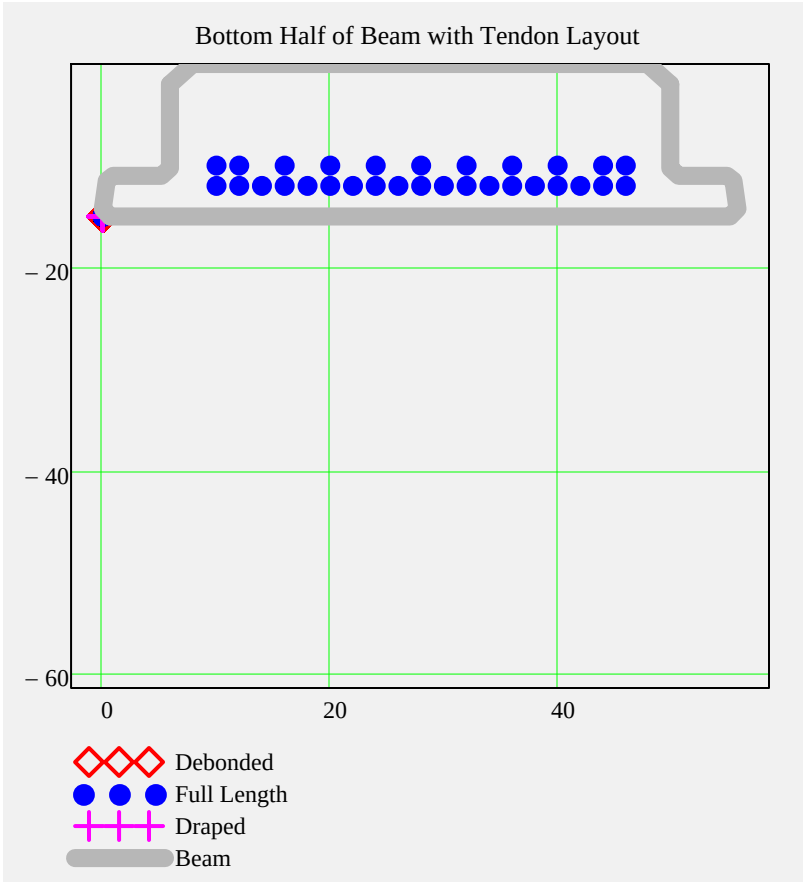
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

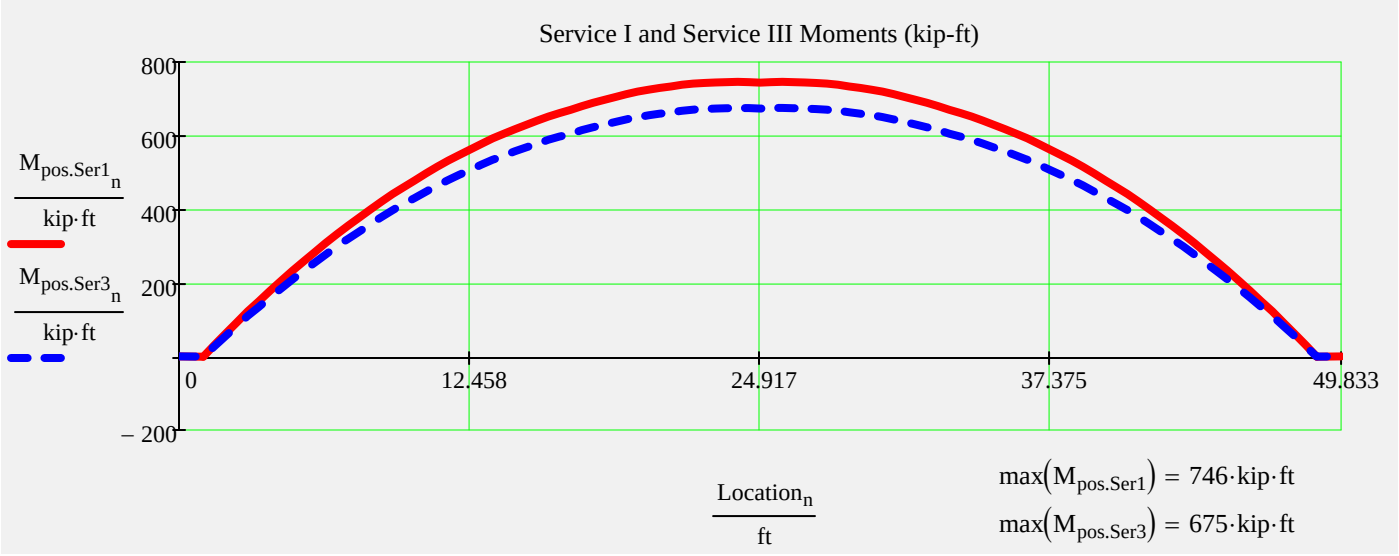
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–1.08	–2.50
"2"	–1.14	–2.06
"4"	–1.01	–2.17
"6"	–2.10	–1.22
"8"	–2.57	–0.37

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1173.3	44867	–4.7

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	227
"Non-Composite DL (incl. beam wt.)"	365
"Composite Dead Load"	27
"Distributed Live Load"	351

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

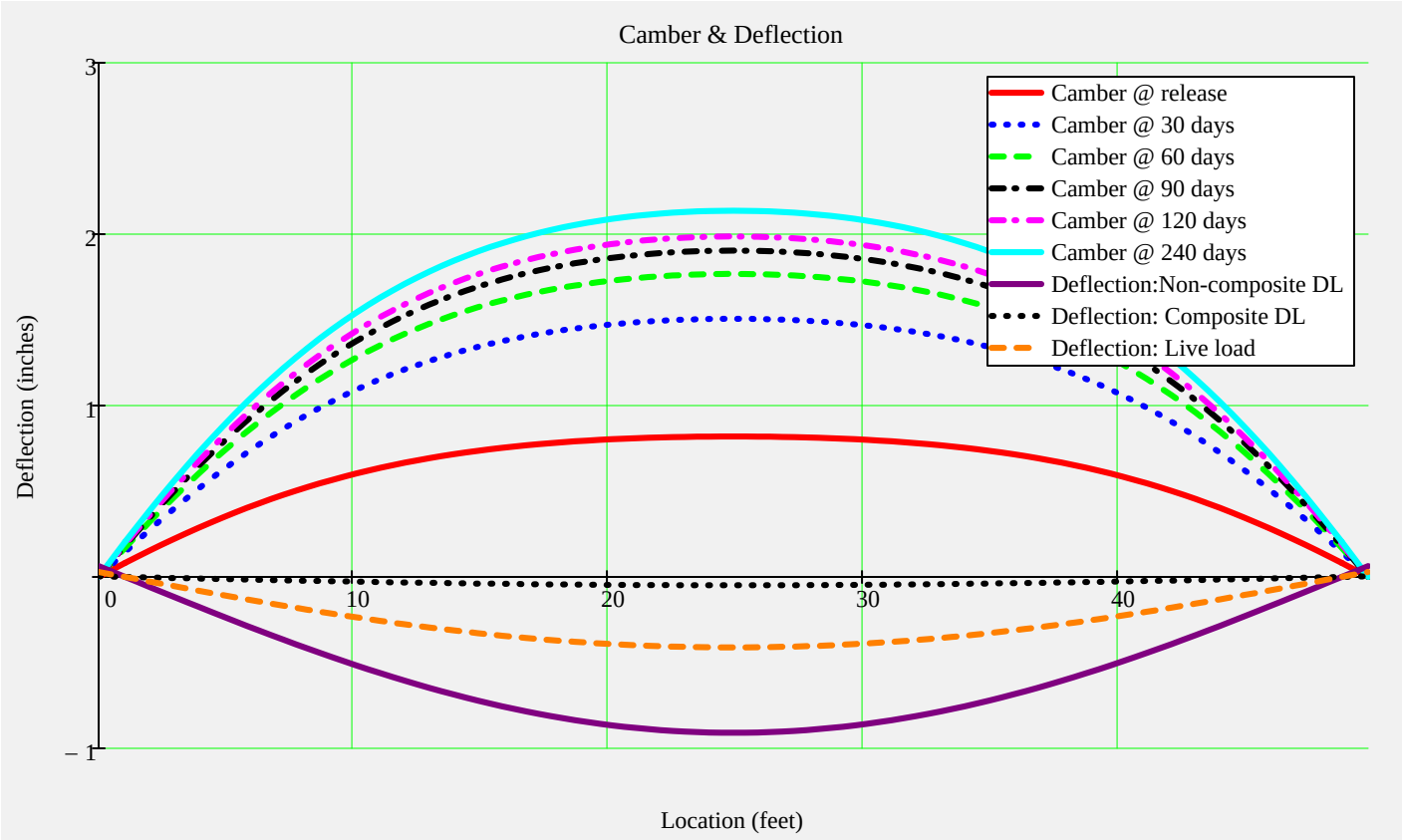
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 47.75 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.08	–0.36	0.38	0.82
"30 Days"	–0.21	–0.67	0.68	1.51
"60 Days"	–0.26	–0.79	0.80	1.77
"90 Days"	–0.29	–0.85	0.85	1.90
"120 Days"	–0.31	–0.89	0.89	1.99
"240 Days"	–0.34	–0.96	0.96	2.14
"Non-comp DL"	–0.08	0.07	–0.29	–0.91
"Comp DL"	–0.00	0.01	–0.02	–0.05
"LL"	–0.02	0.05	–0.13	–0.41

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.03 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

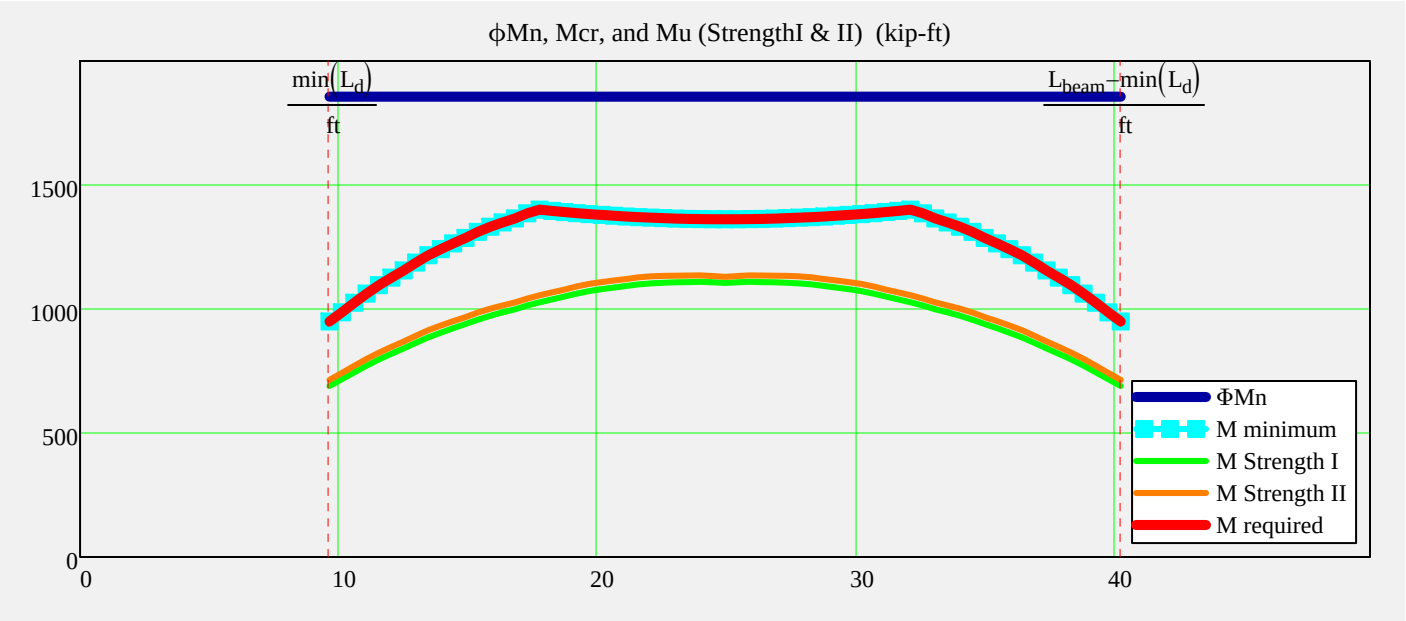
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 1135 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 1362 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1362 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 0.98$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1856 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 9.6\,\text{ft}$ $L_{beam} - \min(L_d) = 40.3\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.75$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

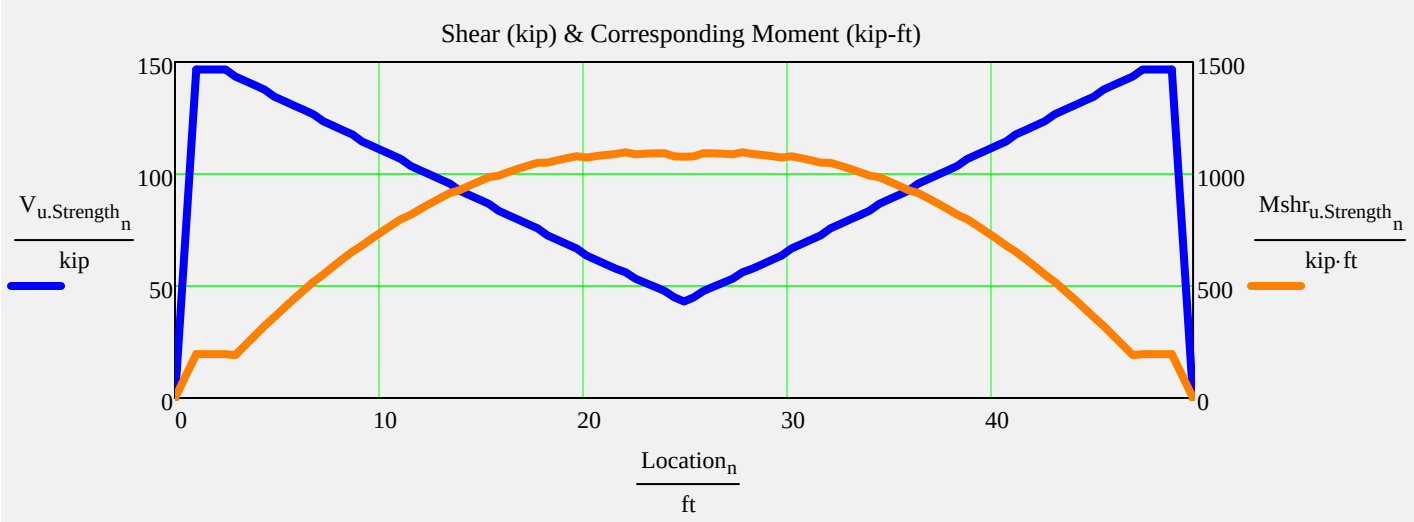
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

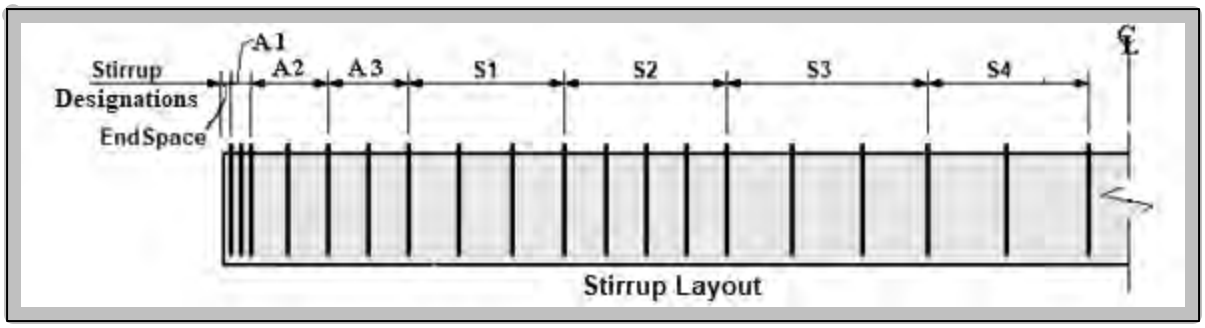
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 145 \\ 152 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 146.7 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 1097 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

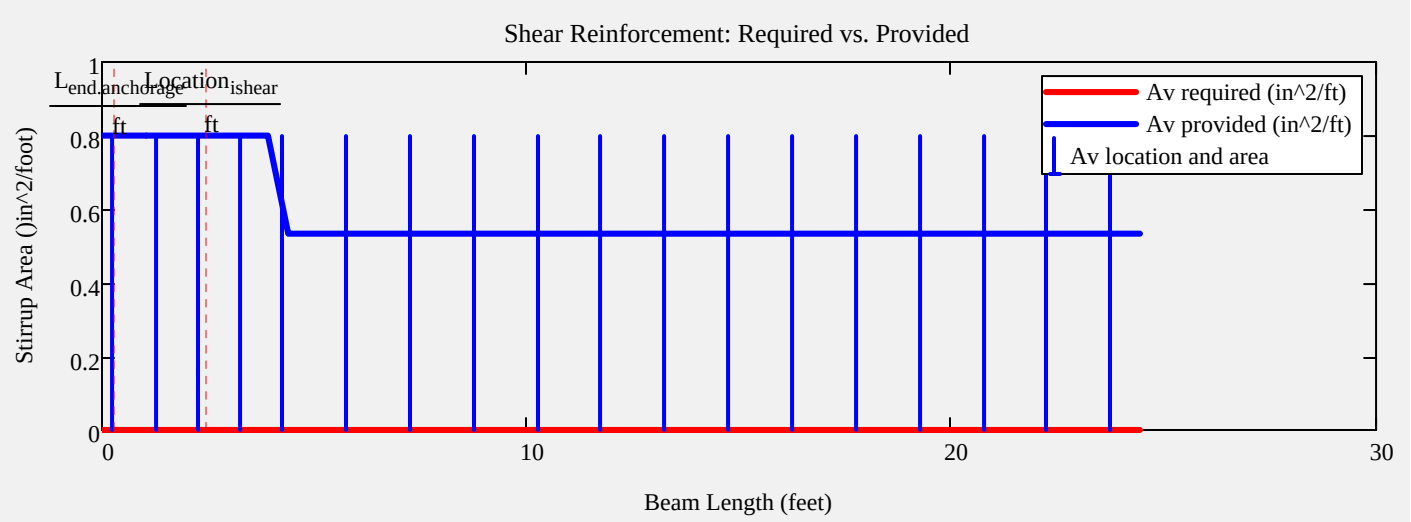
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.47\ ft$

Save Data File

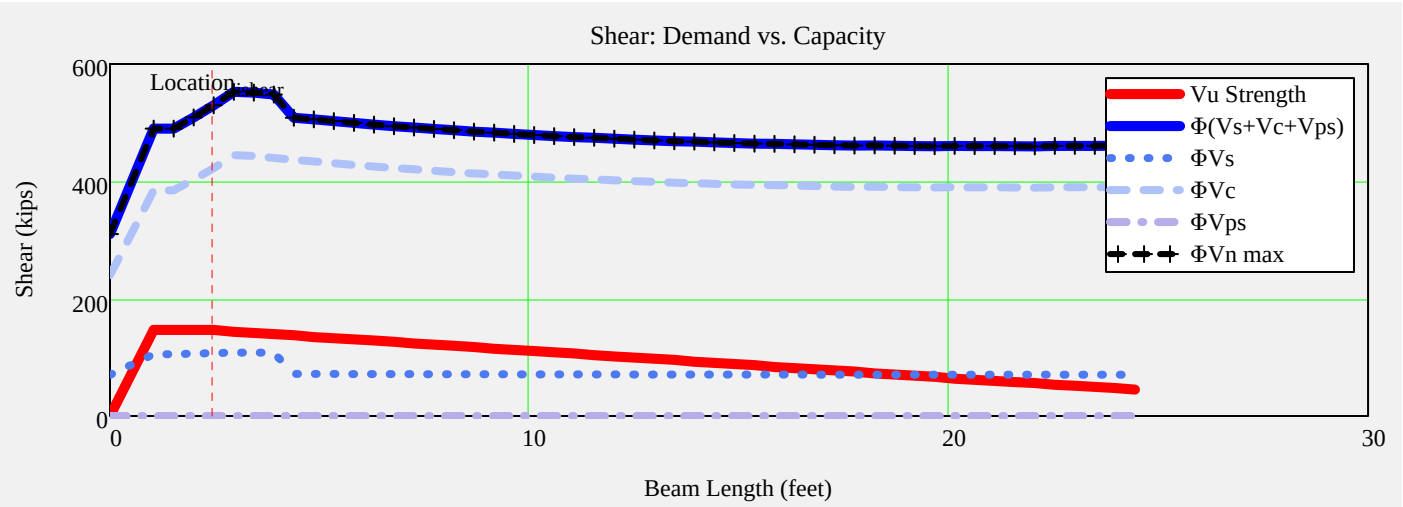
Use current input file

File Name FSB-50ftSpan-15inx56in_ExtBeam.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\EB

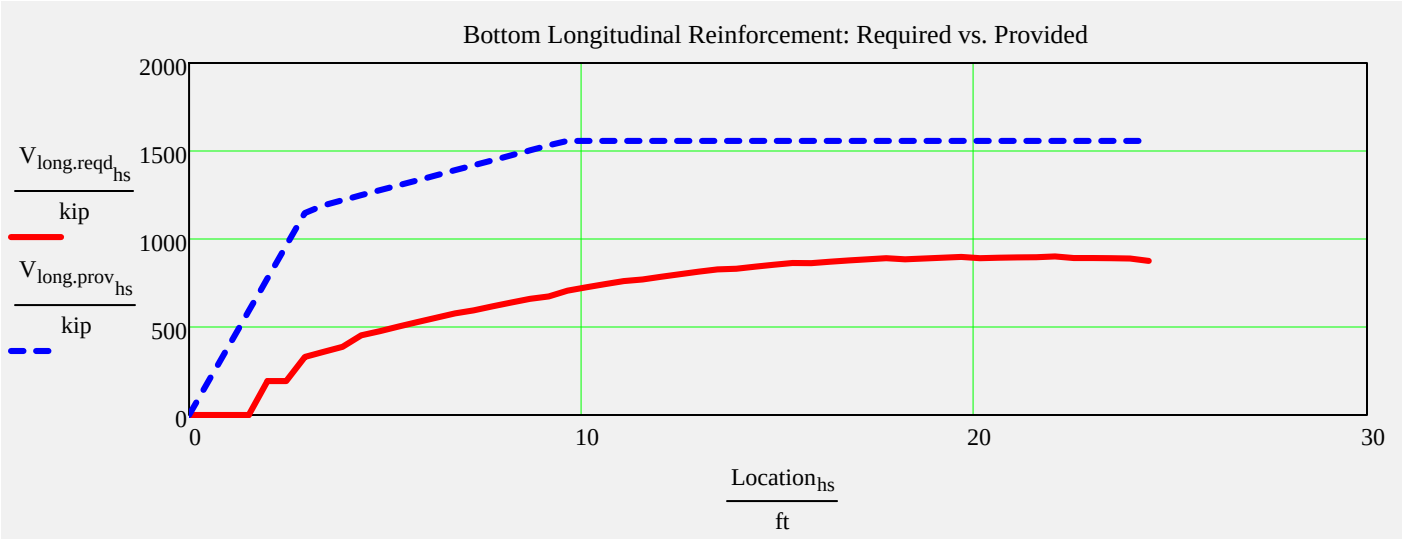
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 2.47 & 146.67 & 529.53 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.28$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

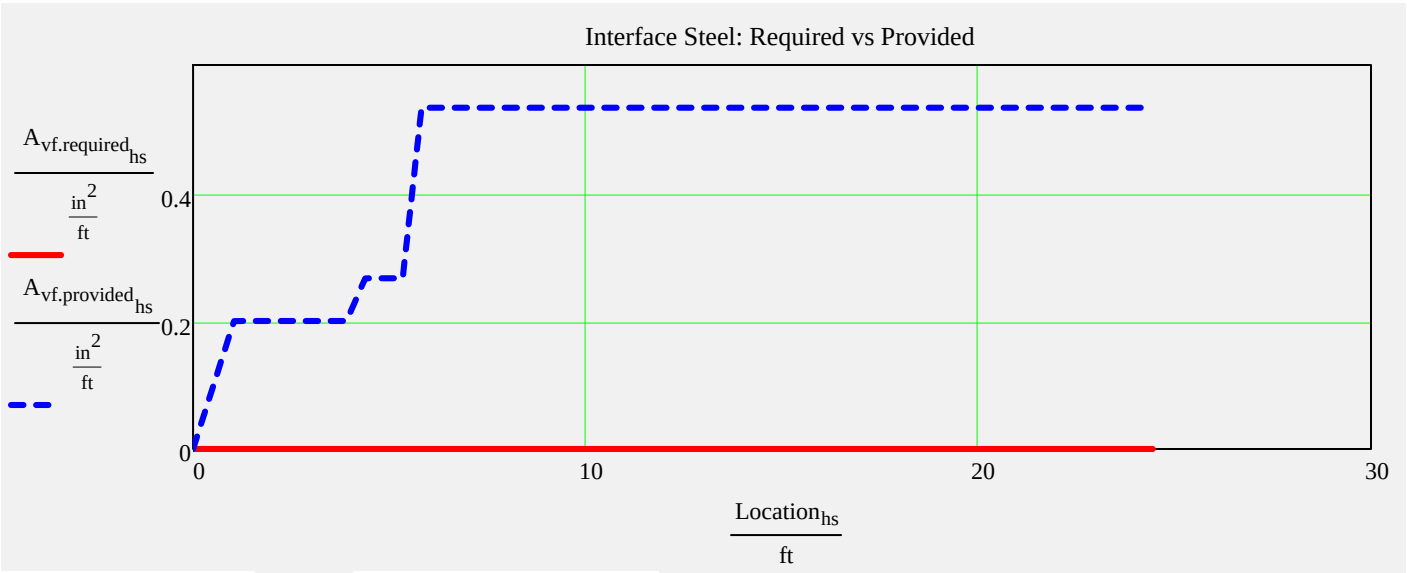


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 22.1 & 901.3 & 1557.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.58$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 11.17 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

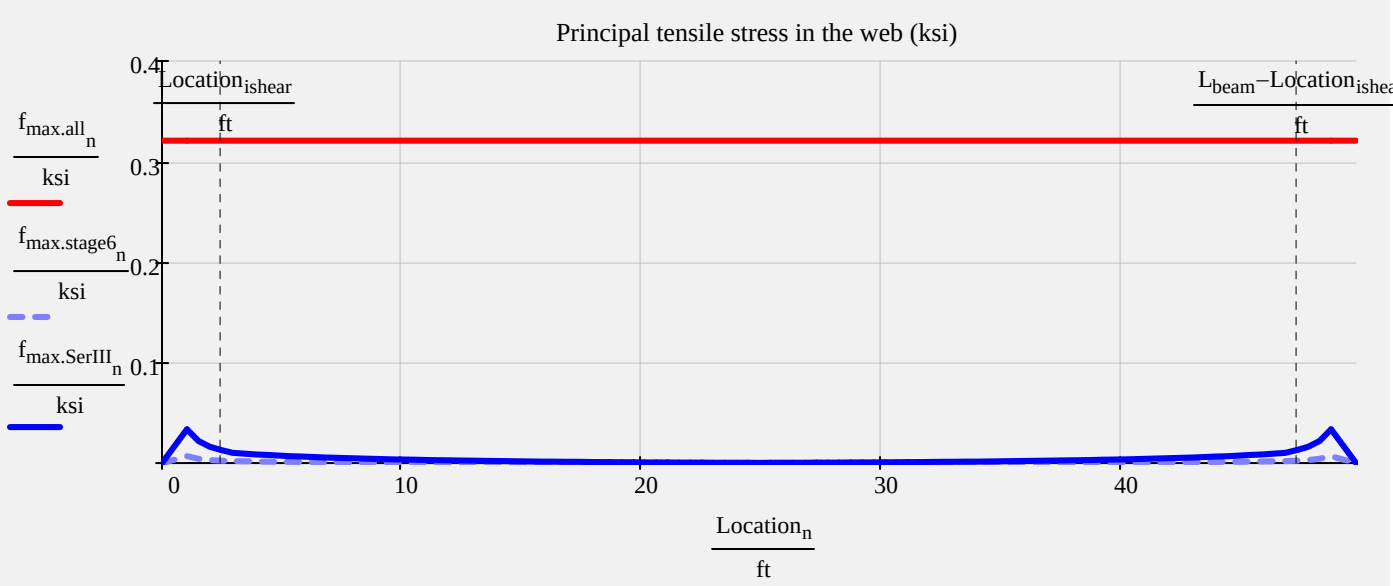
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 29.7 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

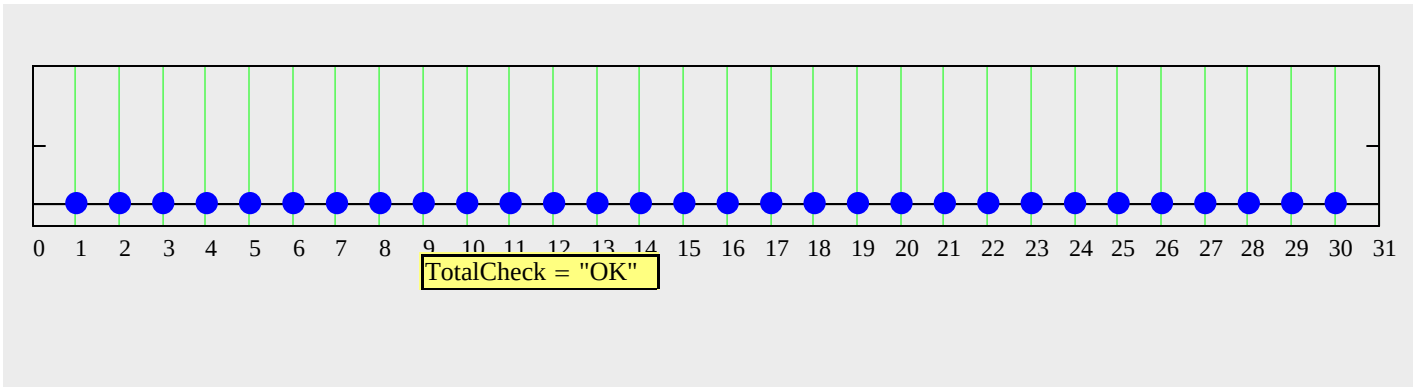
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.37	2.20	"N/A"	24.83	0.65	4.95	"N/A"	1.43	HL-93
"Strength I (Op)"	0.37	2.86	"N/A"	22.92	0.65	6.42	"N/A"	1.43	HL-93
"Service III (Inv)"	0.37	2.18	"N/A"	22.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.37	2.35	"N/A"	22.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.37	2.12	126.94	21.96	0.65	4.59	275.14	1.43	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.54$ $DC_{LongReinf.Permit} = 0.58$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1856	"factored resistance (kip-ft)...."
"γDL"	490	"factored dead load (kip-ft)...."
"γLL"	478	"factored live load (kip-ft)....."
"RF"	2.86	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	534.9	"factored resistance (kip)....."
"γDL"	38.8	"factored dead load (kip)....."
"γLL"	77.3	"factored live load (kip)....."
"RF"	6.42	"HL93 operating rating factor"

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\EB 50' Span\prestressedbeamv6-2\DataFiles-FSB

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FSB-50ftSpan-15inx56in_ExtBeam.dat
FSB-50ftSpan-15inx56in_IntBeam.dat

Refresh List

Open File

Reset All Data

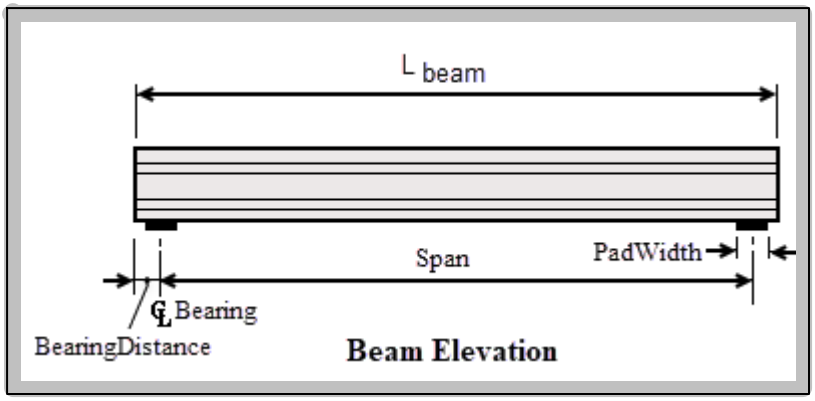
InputDataFile = "FSB-50ftSpan-15inx56in_IntBeam.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FSB-50ftSpan-15inx56in_IntBeam.dat"

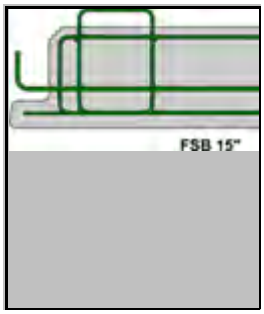
Beam Type

FSB12
FSB15
FSB18

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FSB15.bmp"



L_{beam}	49.8333	ft	*See Beam Elevation above.*
Bearing Distance	12.5	in	*See Beam Elevation above.*
Pad Width	8	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	4.7604	ft	*Measured from beam centerline to centerline.*
Overhang	2.3333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	6.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\leq$ 100 ft, *SDG 4.2.2)*
d_e	1	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths $\leq$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	9		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$		in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width	56	in	*Width of the slab unit (not including Gap width)*
$Slab\ Beam_{Thickness}$	15	in	*Thickness of the slab unit.*
$t_{deck.delta}$	0.25	in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap	1.1378	in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
$Depth_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

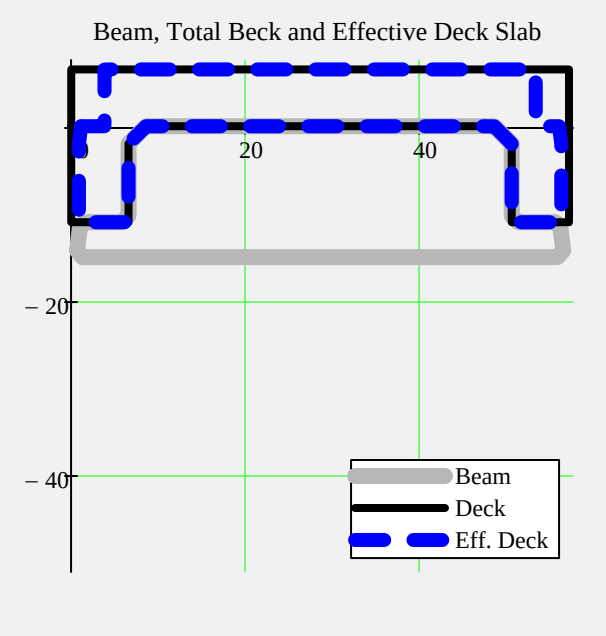
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FSB15"

$t_{deck} = 6.5 \cdot in$

$h_{buildup} = 0 \cdot in$

$h_{beam} = 15 \cdot in$

BeamSpacing = 56·in

$b_e = 57.14 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 0.57 \cdot \frac{kip}{ft}$ $w_{beam} = 0.73 \cdot \frac{kip}{ft}$ $w_{forms} = 0.00 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.1 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 49.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

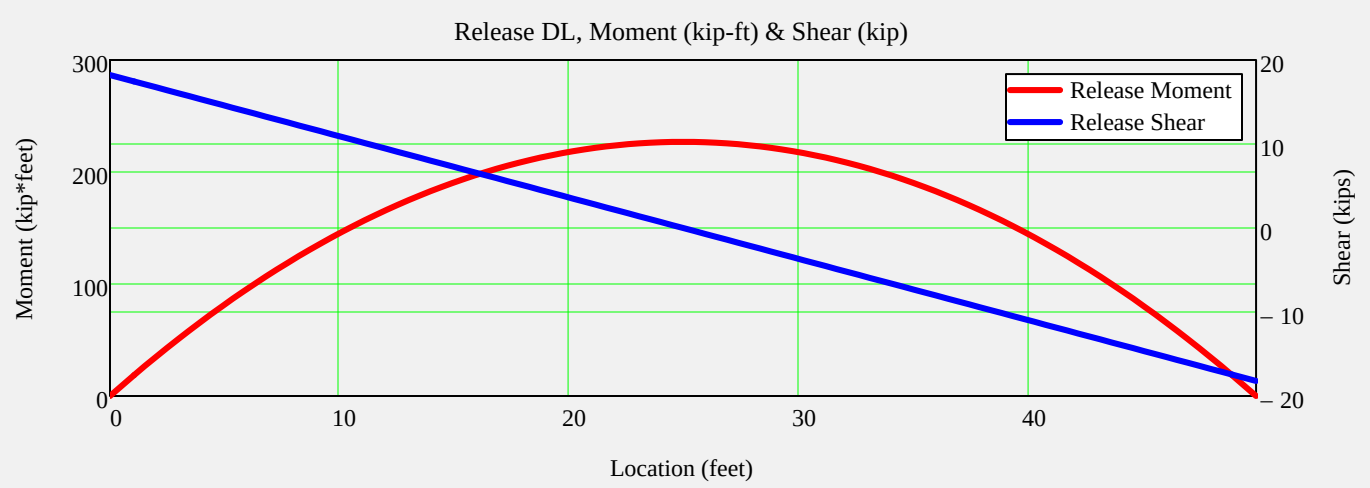
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

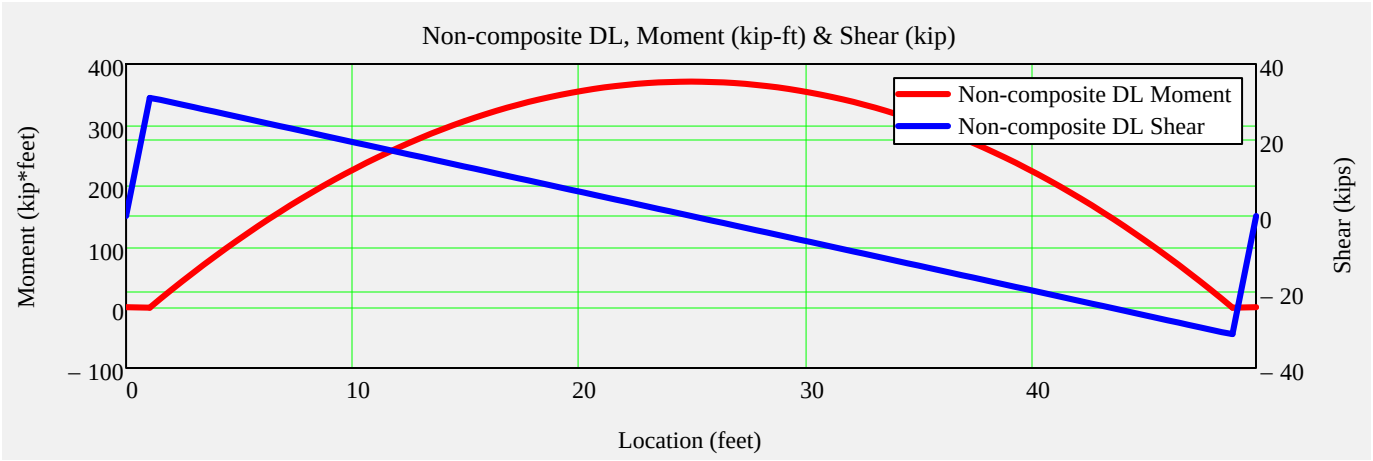
Release Dead Load Moments and Shears

$L_{span} = 47.75\ ft$



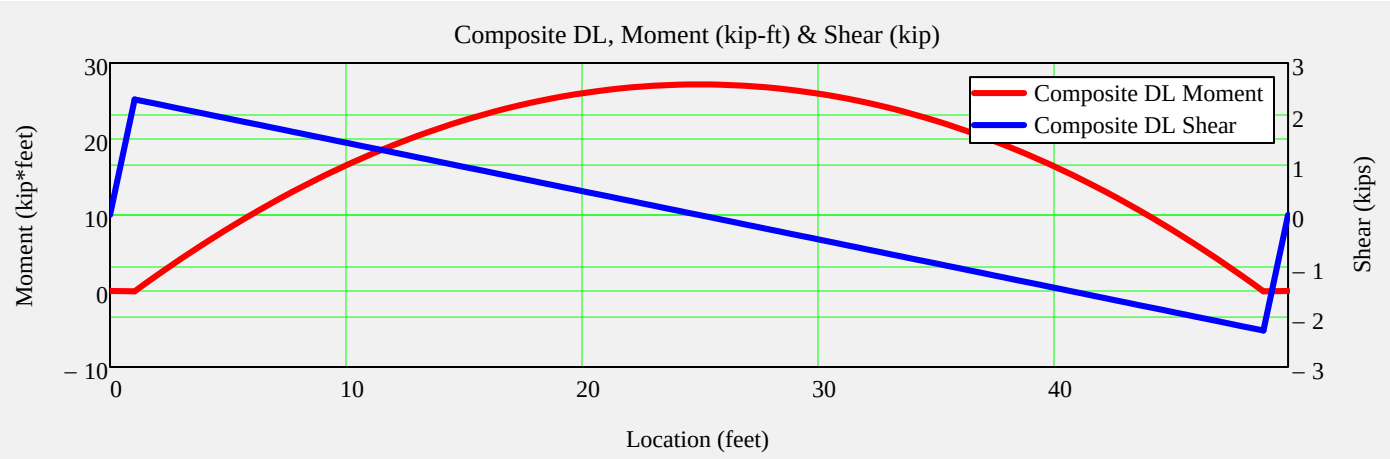
$\max(V_{release}) = 18.2 \cdot kip$ $\max(M_{release}) = 226.9 \cdot kip \cdot ft$ $\min(V_{release}) = -18.2 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 31.1 \cdot kip$ $\max(M_{dl.non.comp}) = 371.0 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -31.1 \cdot kip$

Composite Dead Load Moments and Shear



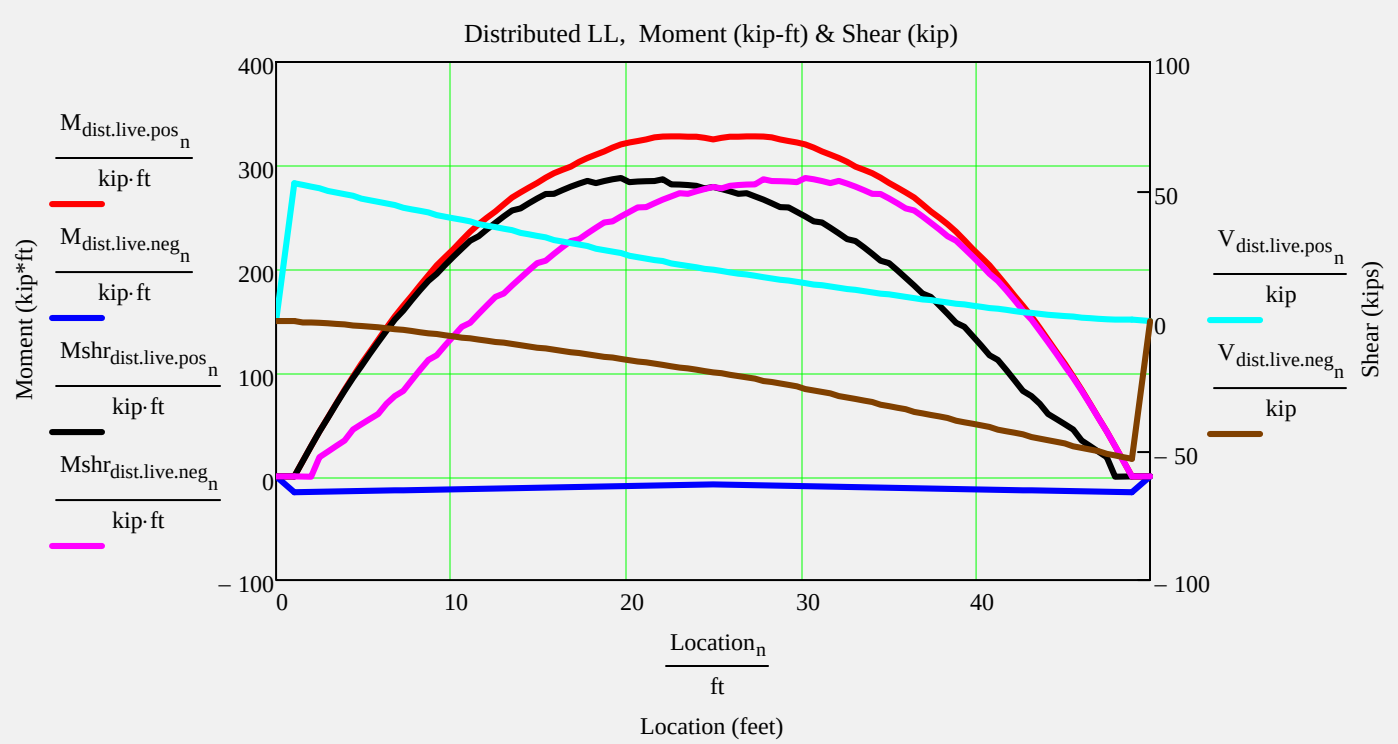
$\max(V_{dl.comp}) = 2.3 \cdot kip$ $\max(M_{dl.comp}) = 27.2 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -2.3 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 47.75\ ft$ BeamSpacing $= 4.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.34$ $g_{mom.fatigue} = 0.19$ $g_{shear} = 0.58$



$\max(V_{dist.live.pos}) = 53.2 \cdot kip$

$\max(M_{dist.live.pos}) = 328.3 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -53.2 \cdot kip$

$Reaction_{LL} = 55.1 \cdot kip$

$\min(M_{dist.live.neg}) = -15.3 \cdot kip \cdot ft$

$Reaction_{DL} = 34.8 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 288 \cdot kip \cdot ft$

Beam End Reactions...
with IM factor only

*Reaction LL = (Reaction.truck *1.33+Reaction.lane)*g.shear*
LL reactions for pile loads do not require IM factor.

Beam End Reactions...
without IM factor for use in
estimating Pile numbers
and lengths required

$Reaction_{truck} = 59.5 \cdot kip$ $Reaction_{lane} = 15.95 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 43.73 \cdot kip$

Reinforcement Properties

InputDataFile = "FSB-50ftSpan-15inx56in_IntBeam.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.31 *1	0	0	0
Distance (in)	2.5 *2	0 *3		
Length (ft)			0	0
Bar Size		0 *4	0 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	3
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 0.75 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

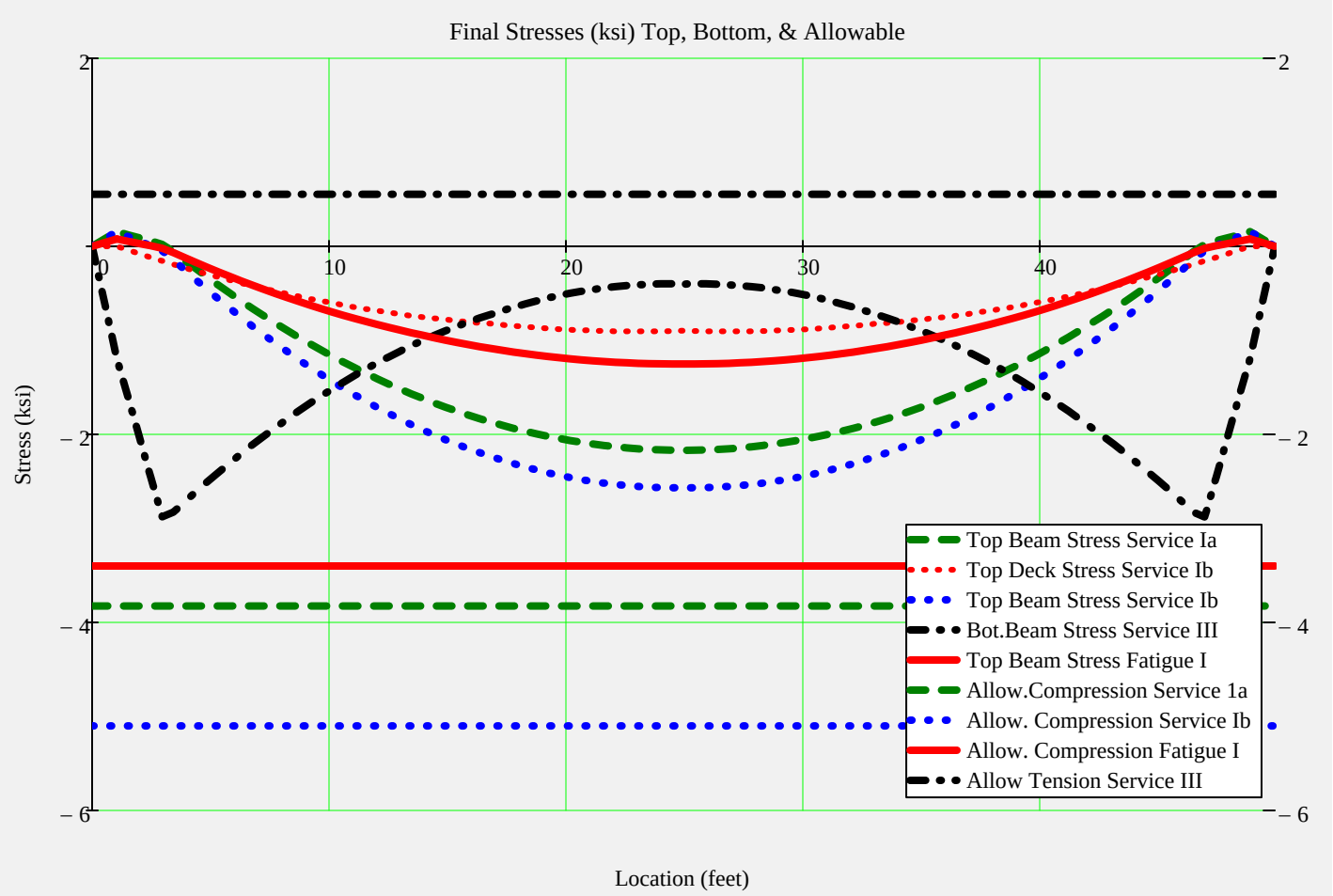
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

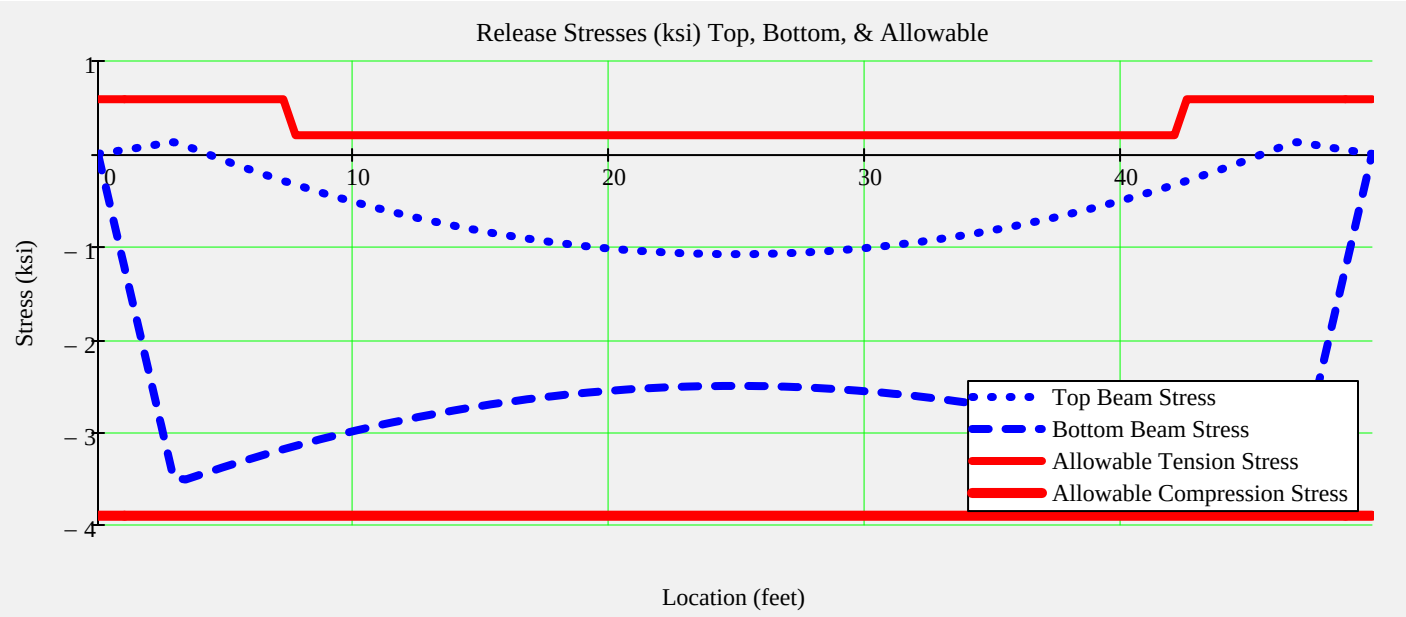
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.72$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.57$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.50$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.37$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.95	0.13	0.59
"Compression @ Release"	3.43	–3.51	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	24.92	–2.17	–3.83
"CompressionIb @ ServiceI"	25.39	–2.57	–5.10
"Compression @ FatigueI"	24.92	–1.25	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

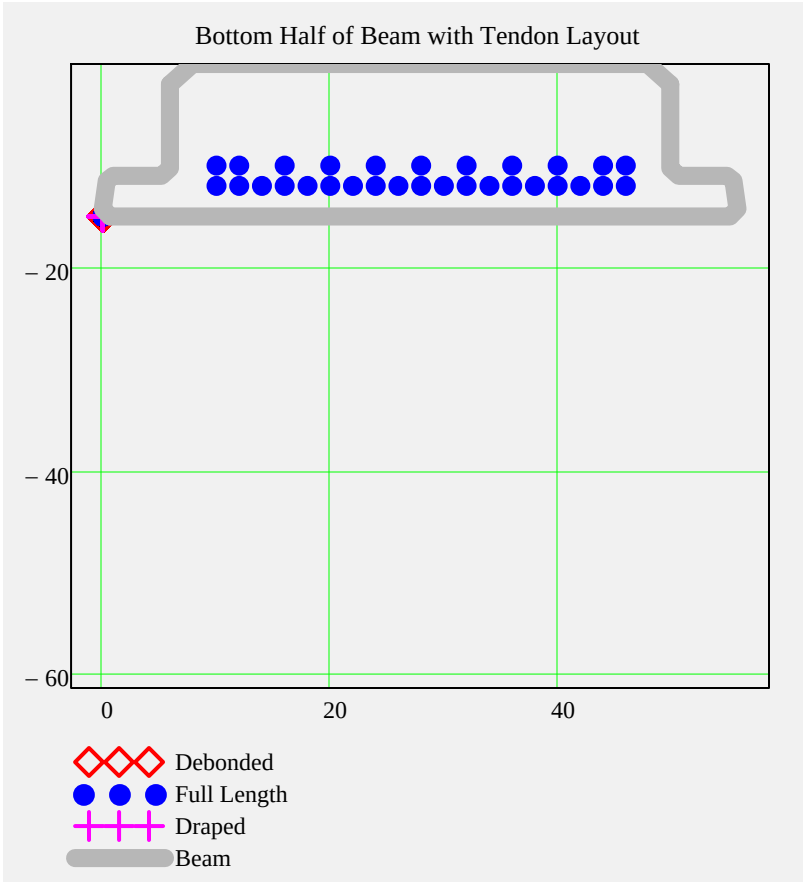
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FSB15"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FSB15"}$

$h_{beam} = 15 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 30$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -23 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.5 \cdot \%$

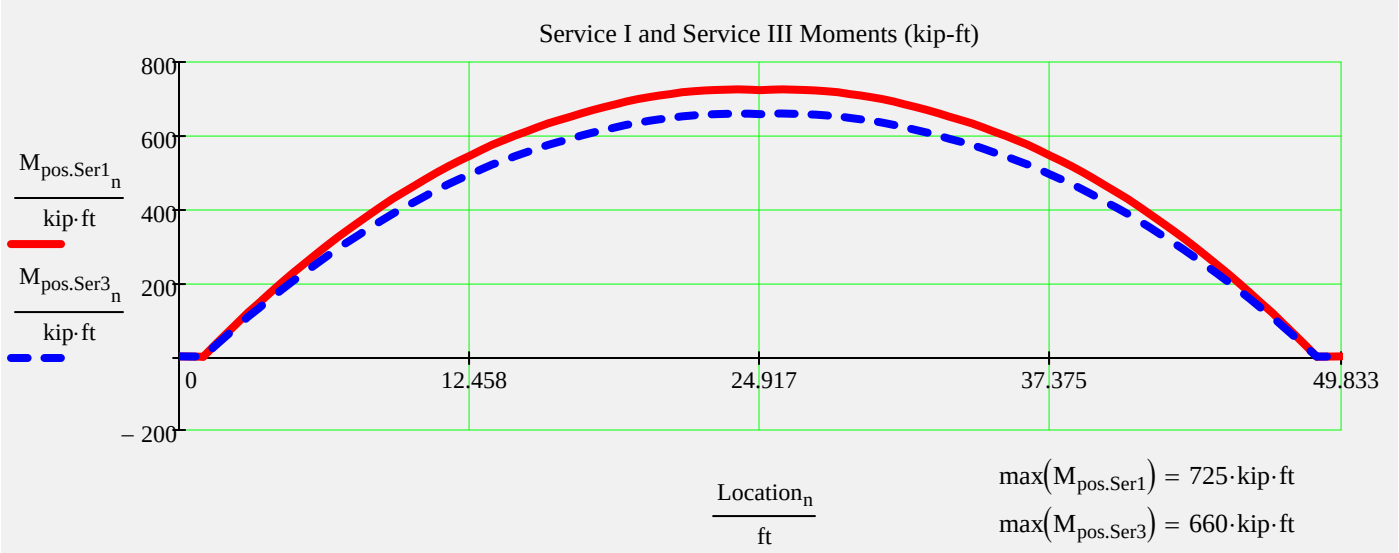
$f_{pe} = 179 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.5 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–1.08	–2.50
"2"	–1.14	–2.06
"4"	–1.01	–2.17
"6"	–2.14	–1.19
"8"	–2.57	–0.40

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1358	–357
"@Final (about composite centroid)"	–1202	–300

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	695	13432	–7.9
"Transformed Beam (initial)"	737	13946	–8
"Transformed Beam (final)"	732.4	13892	–8
"Composite Section"	1189.7	45382	–4.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	227
"Non-Composite DL (incl. beam wt.)"	371
"Composite Dead Load"	27
"Distributed Live Load"	325

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

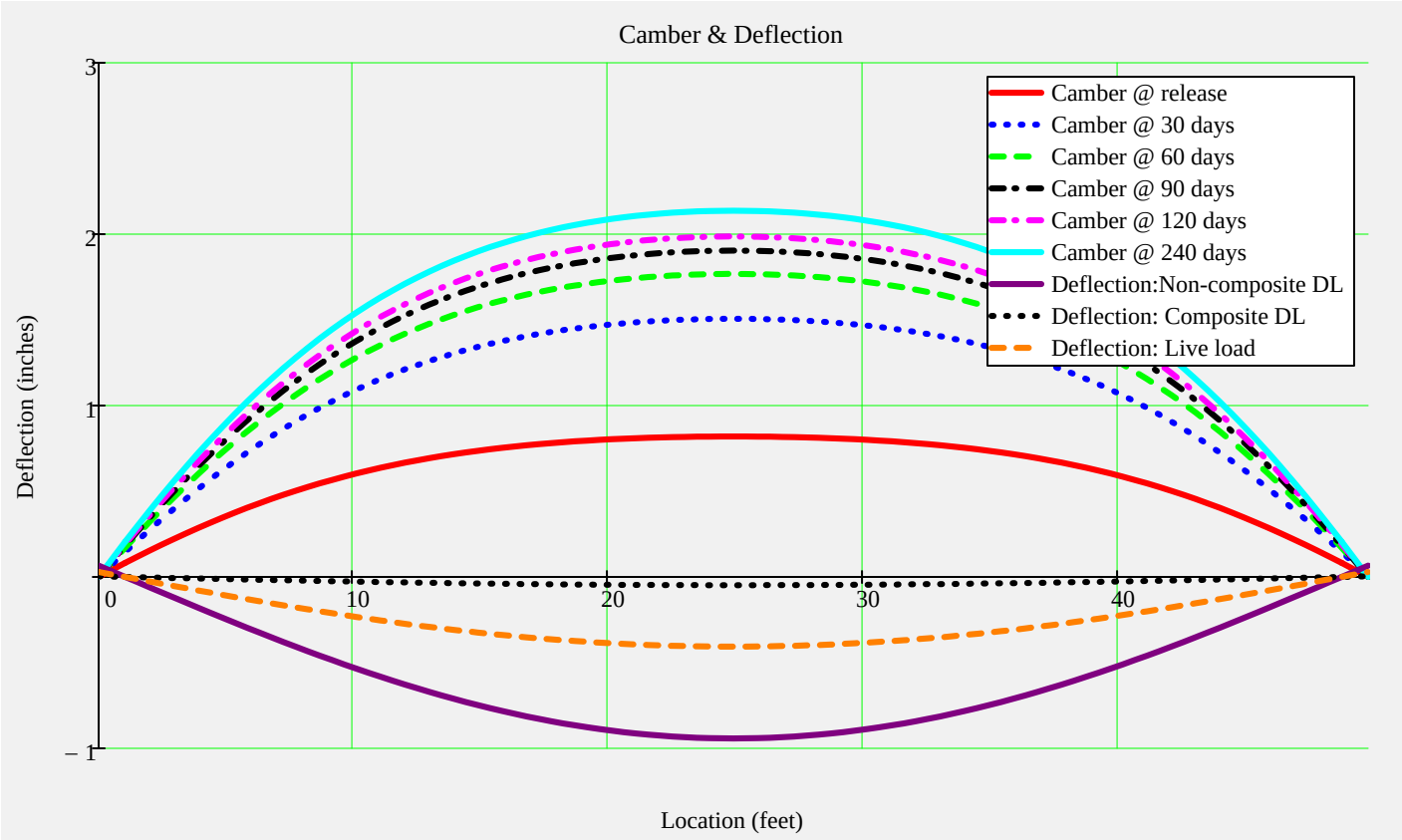
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 47.75 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.08	–0.36	0.38	0.82
"30 Days"	–0.21	–0.67	0.68	1.51
"60 Days"	–0.26	–0.79	0.80	1.77
"90 Days"	–0.29	–0.85	0.85	1.90
"120 Days"	–0.31	–0.89	0.89	1.99
"240 Days"	–0.34	–0.96	0.96	2.14
"Non-comp DL"	–0.08	0.07	–0.30	–0.94
"Comp DL"	–0.00	0.01	–0.02	–0.05
"LL"	–0.02	0.05	–0.13	–0.41

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

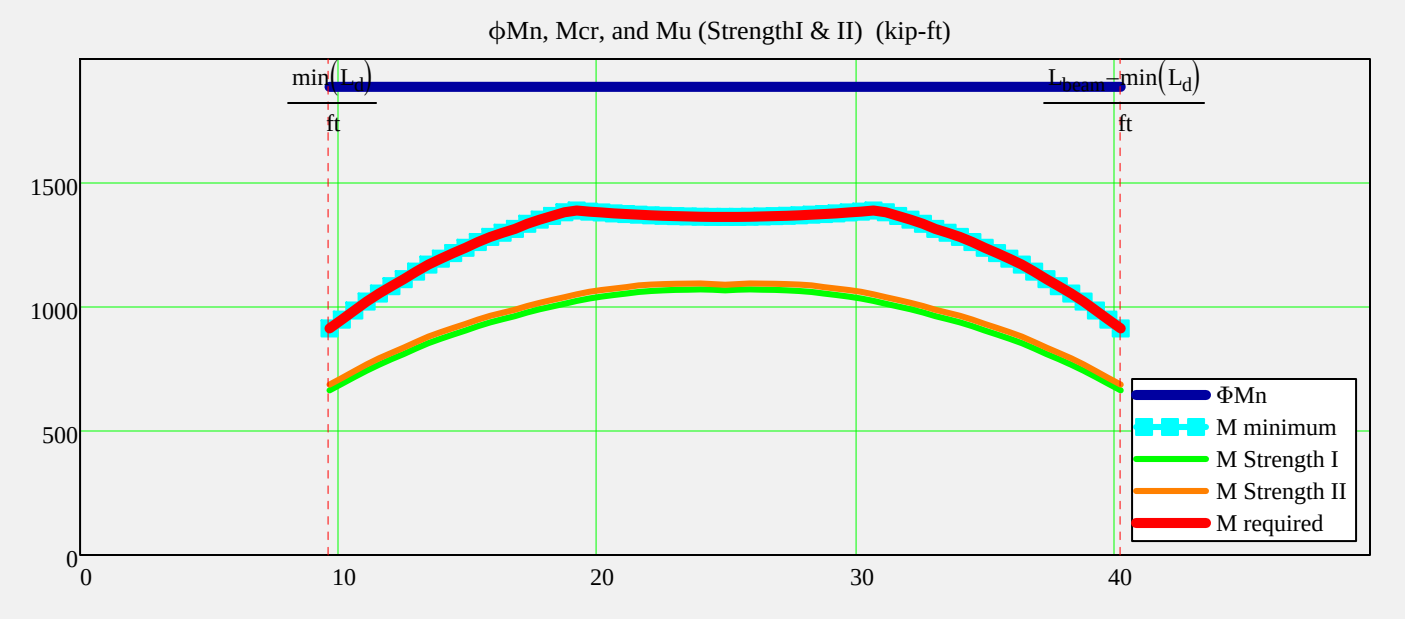
Values at midspan

$LimitStateForMoment_{51} = "Strength\ II"$ $\max(M_{Strength}) = 1095 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 1363 \cdot kip \cdot ft$ $M_{reqd_{51}} = 1363 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 0.99$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 1888 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 9.6\,\text{ft}$ $\quad L_{beam} - \min(L_d) = 40.2\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.74$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

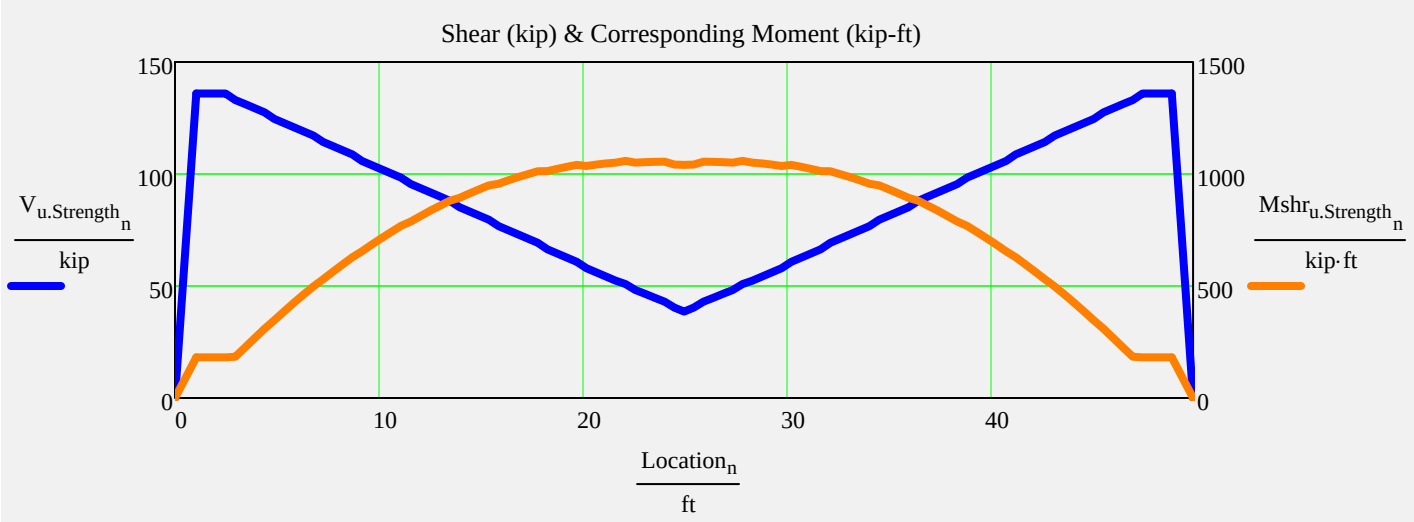
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

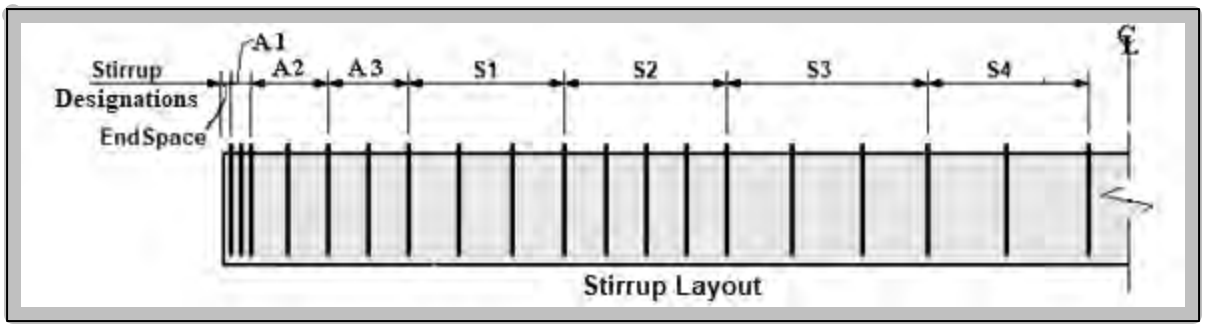
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 135 \\ 141 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 136.0 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 1059 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	12	18	18	18	18	18	18
# of Spaces	4	1	1	1	1	1	Calculated
Area (in^2)	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

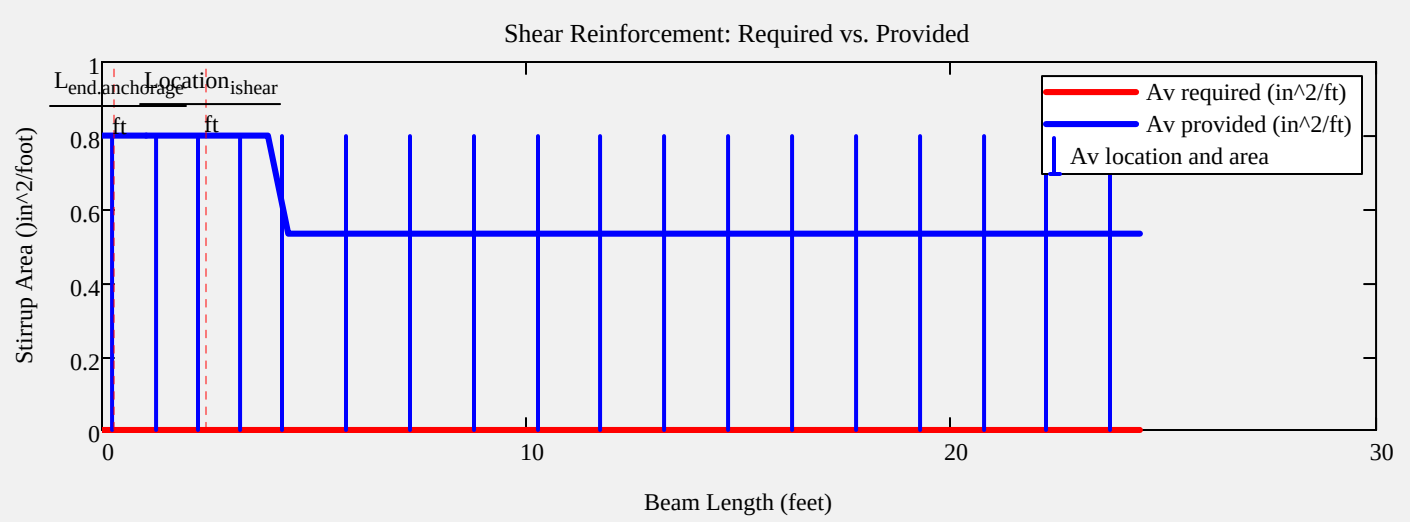
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 2.47\ ft$

Save Data File

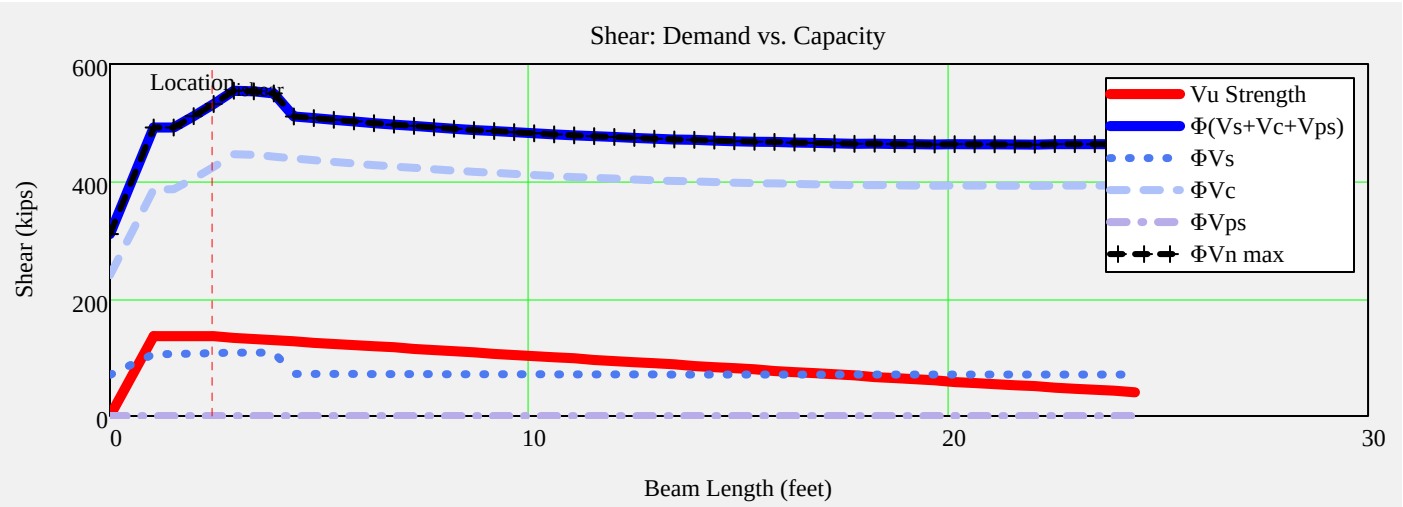
Use current input file

File Name FSB-50ftSpan-15inx56in_IntBeam.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FSB's\EB

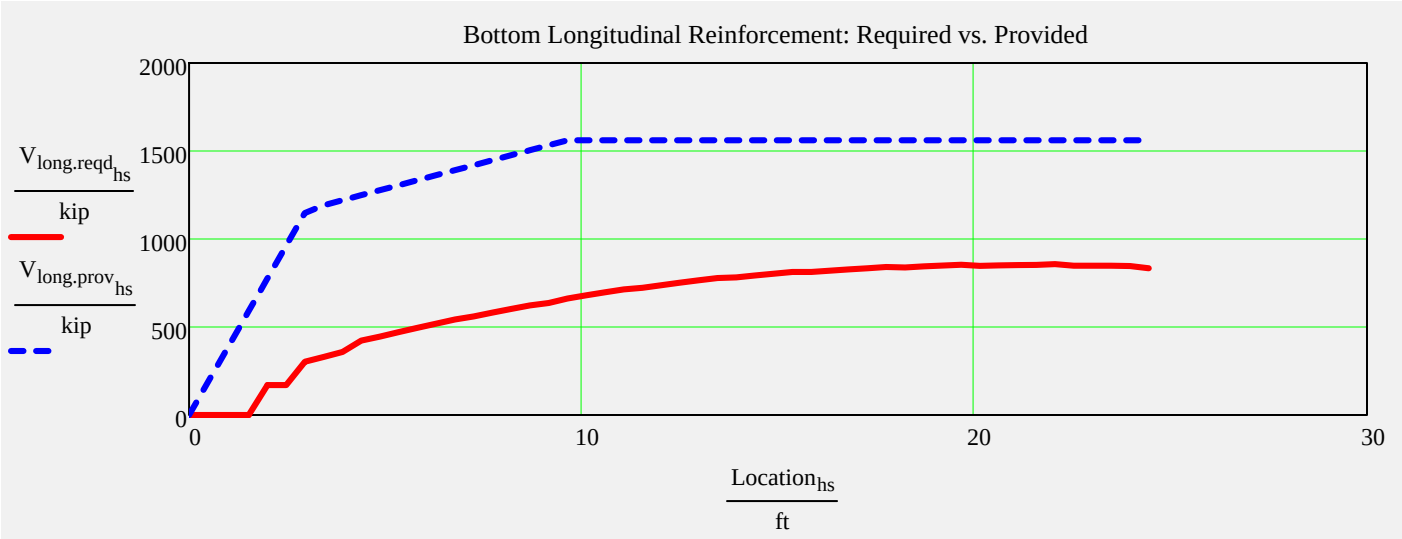
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 2.47 & 135.96 & 531.79 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.26$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

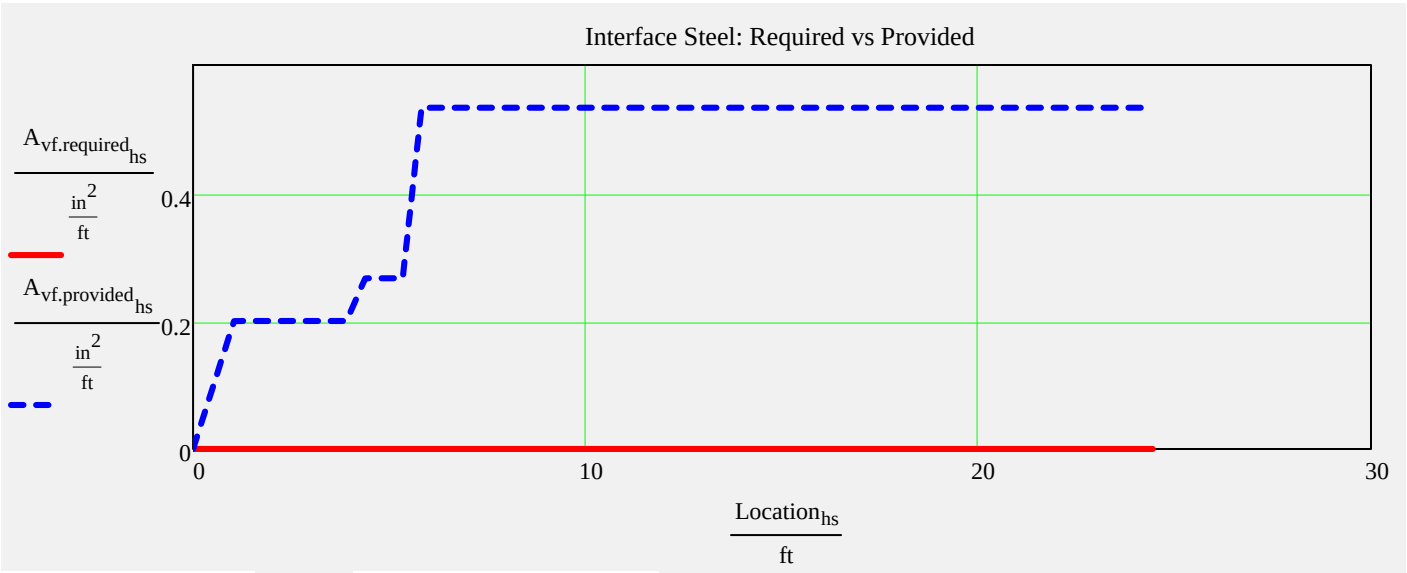


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 22.1 & 857.2 & 1560.5 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.55$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 11.17 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

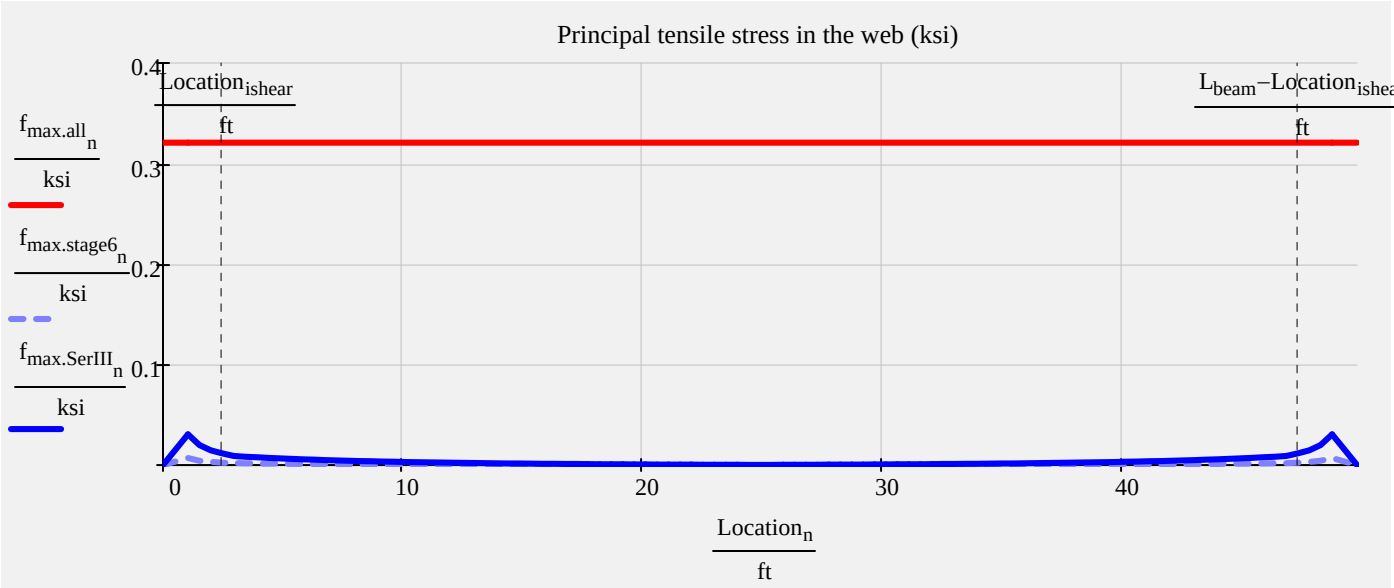
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 29.7 \cdot in$ $\max(DC_f_{max.web}) = 0.1$ $Check_f_{max.web} = "OK"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1460 \cdot kip$ $P_{prestress} = 1318 \cdot kip$ $D/C_{splitting.FDOT} = 0.9$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 10$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

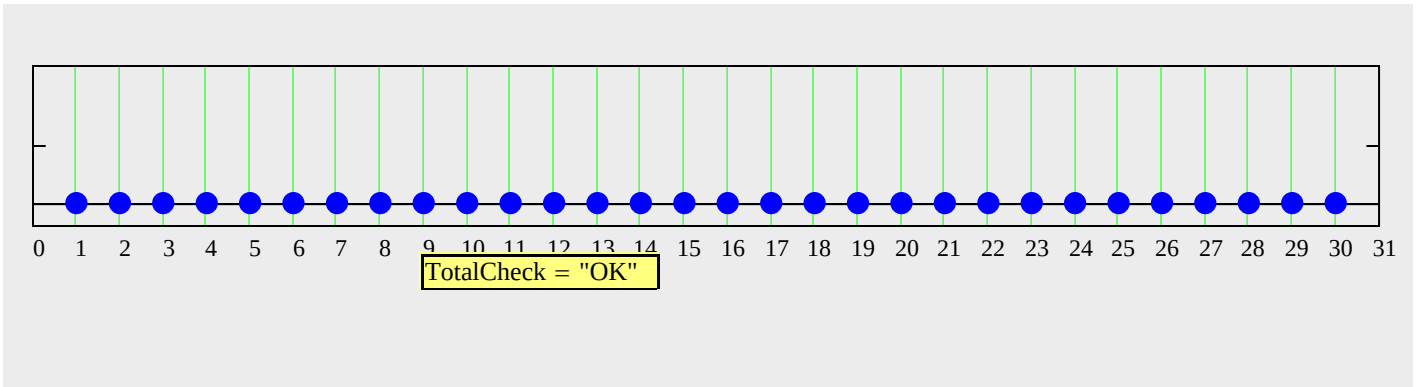
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.34	2.42	"N/A"	22.92	0.58	5.54	"N/A"	1.43	HL-93
"Strength I (Op)"	0.34	3.14	"N/A"	24.83	0.58	7.18	"N/A"	1.43	HL-93
"Service III (Inv)"	0.34	2.32	"N/A"	22.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.34	2.51	"N/A"	22.92	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.34	2.33	139.56	25.78	0.58	5.13	307.88	1.43	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.51$ $DC_{LongReinf.Permit} = 0.55$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	1888	"factored resistance (kip-ft)...."
"γDL"	497	"factored dead load (kip-ft)...."
"γLL"	443	"factored live load (kip-ft)....."
"RF"	3.14	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	536.4	"factored resistance (kip)....."
"γDL"	39.3	"factored dead load (kip)....."
"γLL"	69.2	"factored live load (kip)....."
"RF"	7.18	"HL93 operating rating factor"

FLORIDA-I BEAM DESIGN ALTERNATIVE

HNTB

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 64 FEET (NO SKEW)
WESTBOUND BRIDGE
(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\WB 64' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-64ftSpan_NoSkew_Exterior.dat
FIB36-64ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

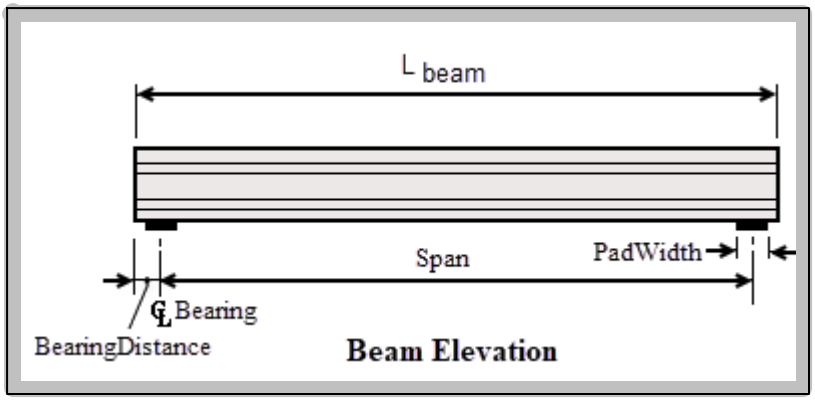
InputDataFile = "FIB36-64ftSpan_NoSkew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 20 / 2025
Structure Name	SR 70		
Structure No.	WB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-64ftSpan_NoSkew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	63.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	10	ft	*Measured from beam centerline to centerline.*
Overhang	3.7083	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.375	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

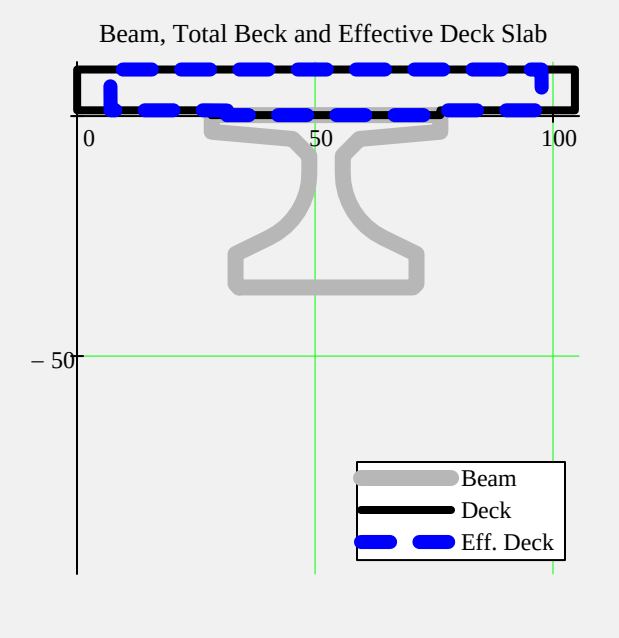
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8.5 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $120 \cdot in$

$b_e = 104.5 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 1.03 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.06 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.111 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 63.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

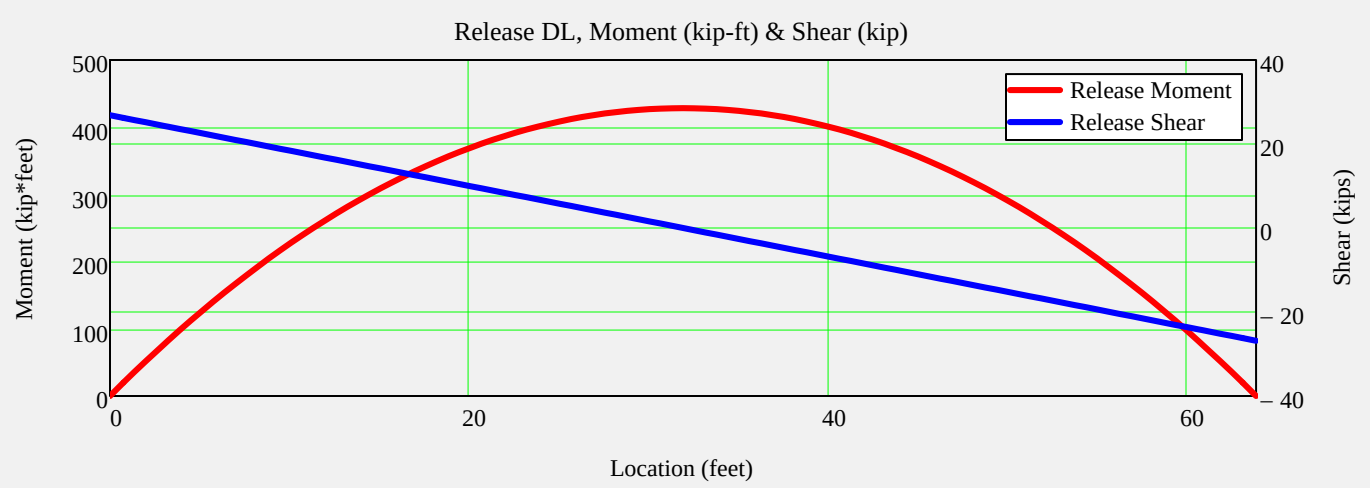
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

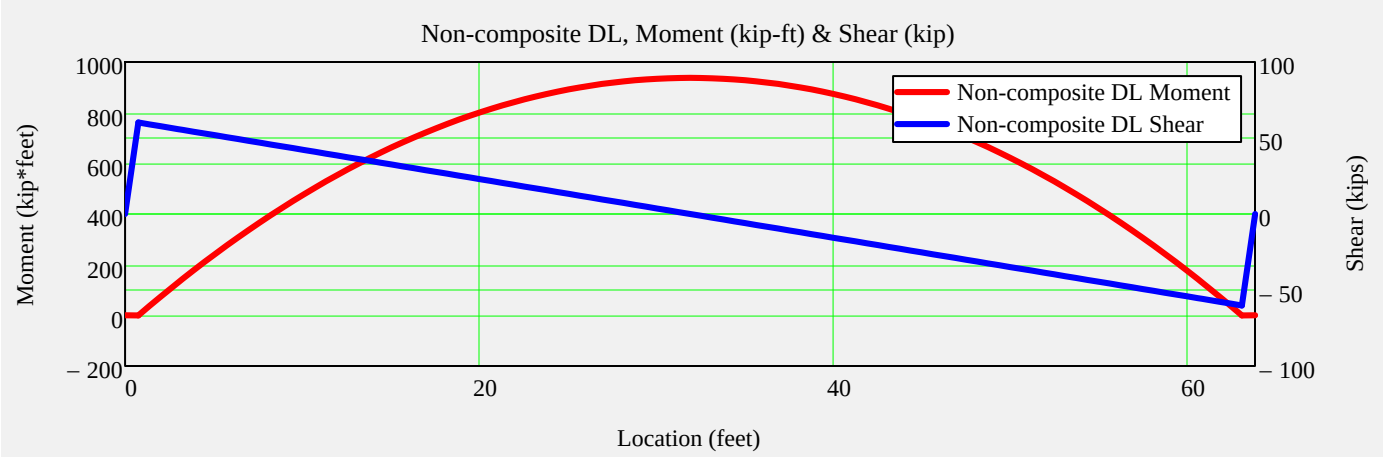
Release Dead Load Moments and Shears

$L_{span} = 62.33\ ft$



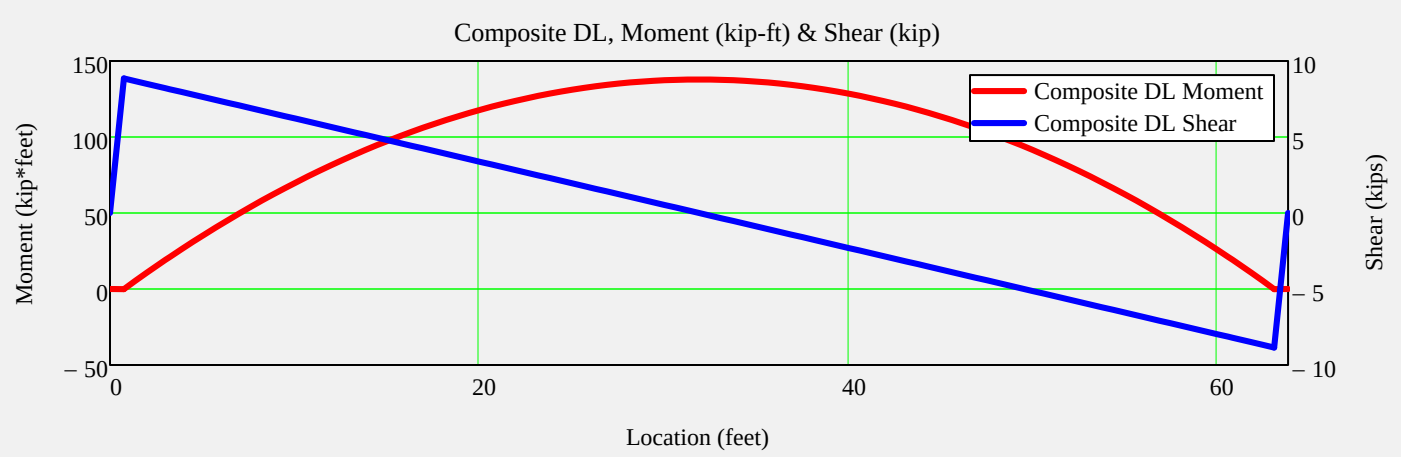
$\max(V_{release}) = 26.8 \cdot kip$ $\max(M_{release}) = 428.4 \cdot kip \cdot ft$ $\min(V_{release}) = -26.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 60.2 \cdot kip$ $\max(M_{dl.non.comp}) = 937.2 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -60.2 \cdot kip$

Composite Dead Load Moments and Shear



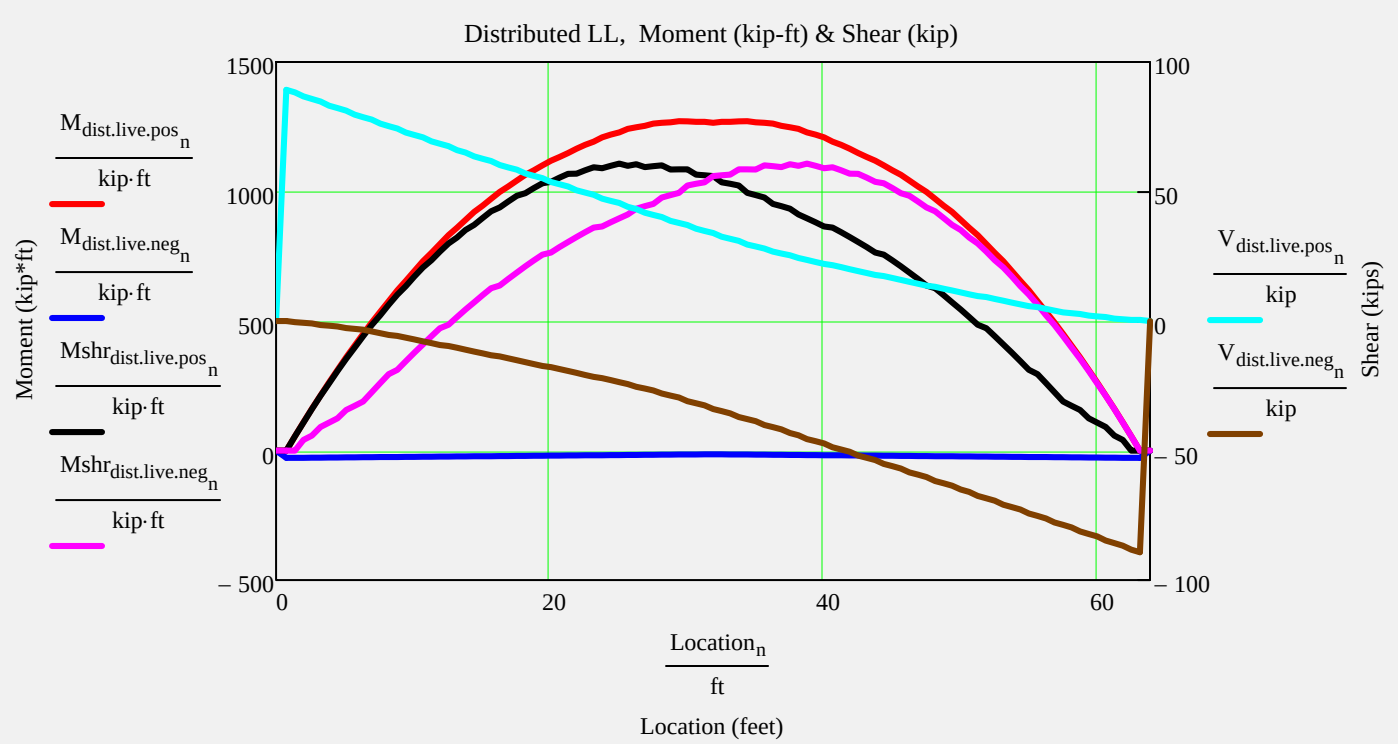
$\max(V_{dl.comp}) = 8.9 \cdot kip$ $\max(M_{dl.comp}) = 137.8 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -8.9 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 62.33\ ft$ BeamSpacing $= 10\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.89$ $g_{mom.fatigue} = 0.74$ $g_{shear} = 0.89$



$\max(V_{dist.live.pos}) = 89.3 \cdot kip$

$\max(M_{dist.live.pos}) = 1271.4 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -89.3 \cdot kip$

$Reaction_{LL} = 91.2 \cdot kip$

$Reaction_{DL} = 70.7 \cdot kip$

$\min(M_{dist.live.neg}) = -28.4 \cdot kip \cdot ft$

$\max(Mshr_{dist.live.pos}) = 1108 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 62.1 \cdot kip$ $Reaction_{lane} = 20.4 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 73 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-64ftSpan_NoSkew_Exterior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.24	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		0 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

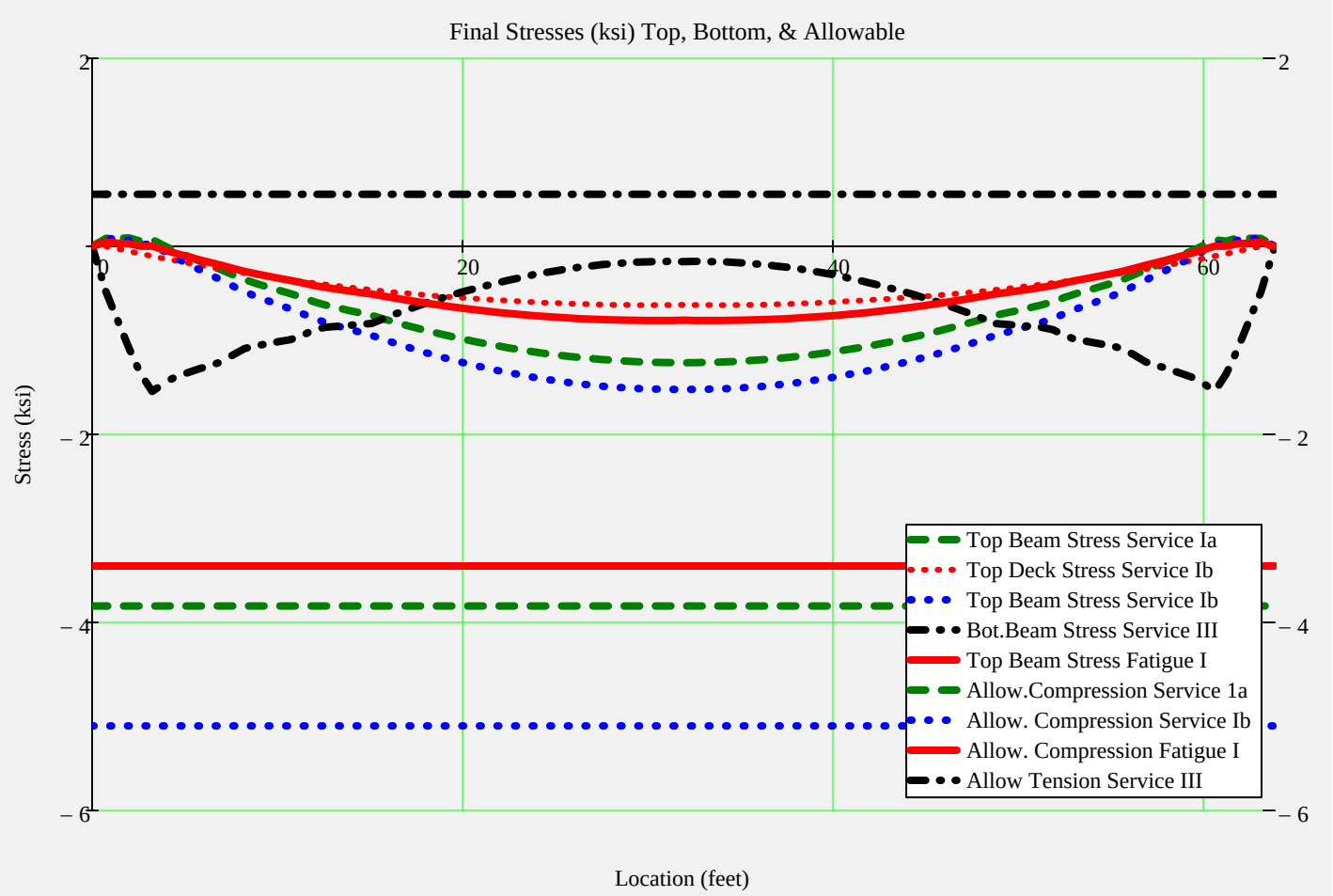
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

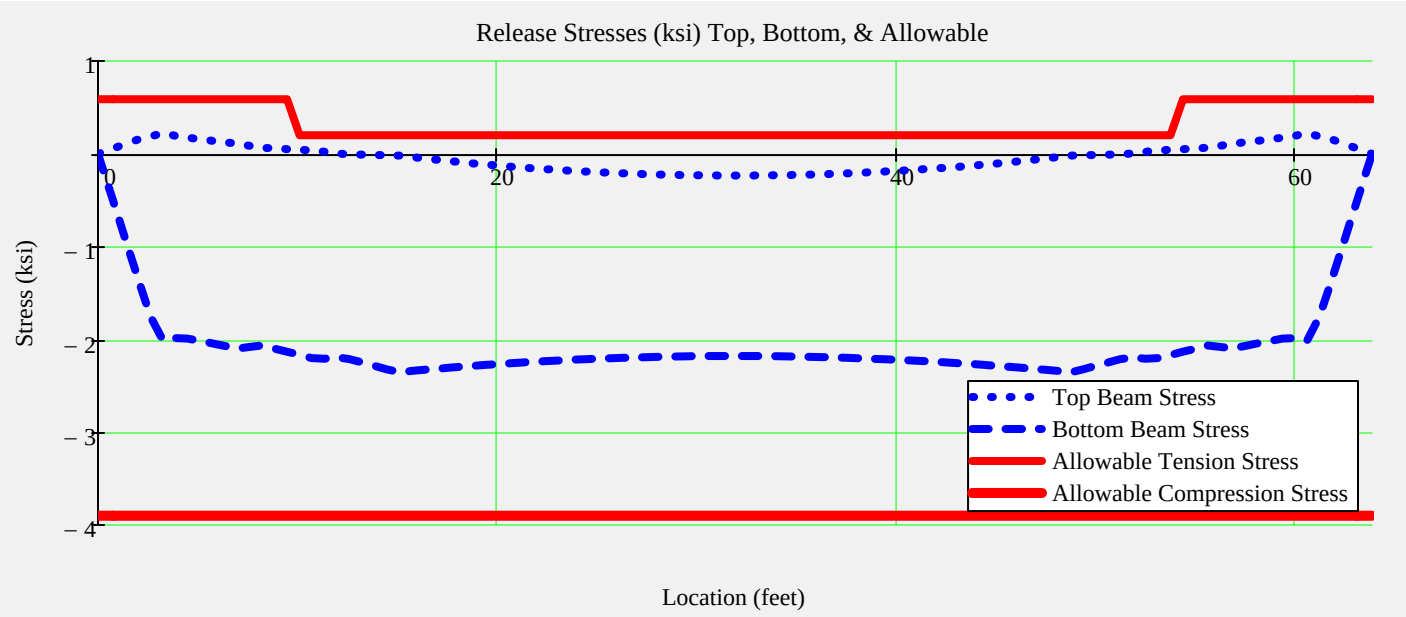
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel} = "OK"$	$\max(DC_f_{tension.rel}) = 0.64$
Release compression	$Check_f_{comp.rel} = "OK"$	$\max(DC_f_{comp.rel}) = 0.60$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII} = "OK"$	$\max(DC_f_{tension.ServiceIII}) = 0.74$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa} = "OK"$	$\max(DC_f_{comp.ServiceIa}) = 0.32$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb} = "OK"$	$\max(DC_f_{comp.ServiceIb}) = 0.30$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI} = "OK"$	$\max(DC_f_{comp.FatigueI}) = 0.23$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.24	0.22	0.59
"Compression @ Release"	15.09	–2.35	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	31.92	–1.24	–3.83
"CompressionIb @ ServiceI"	32.54	–1.52	–5.10
"Compression @ FatigueI"	30.67	–0.79	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

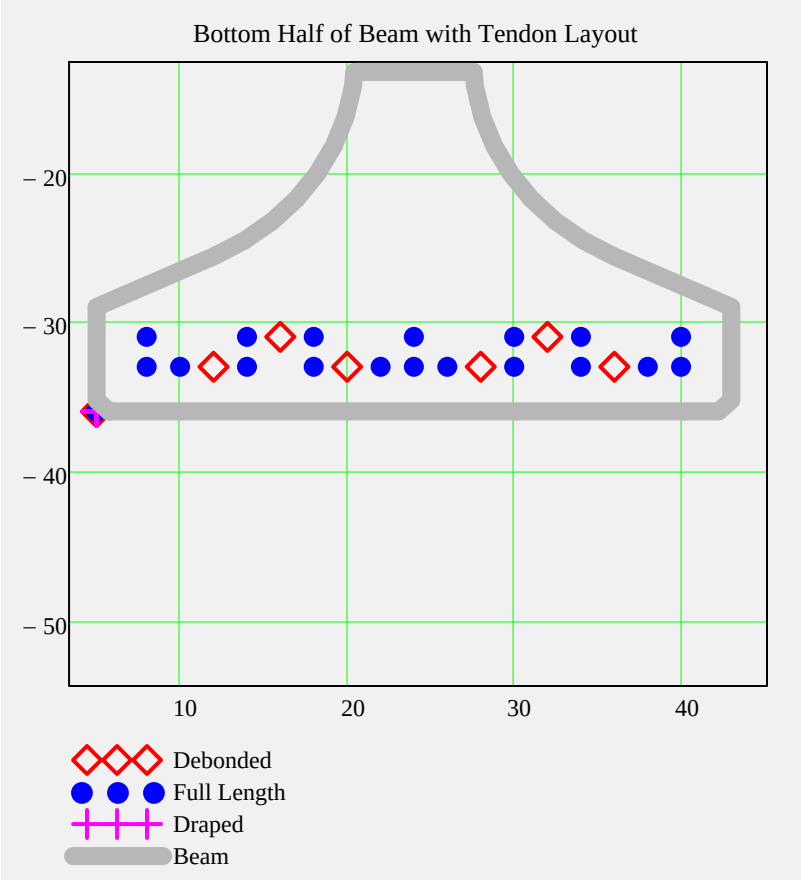
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 24$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -19 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -9.58 \cdot \%$

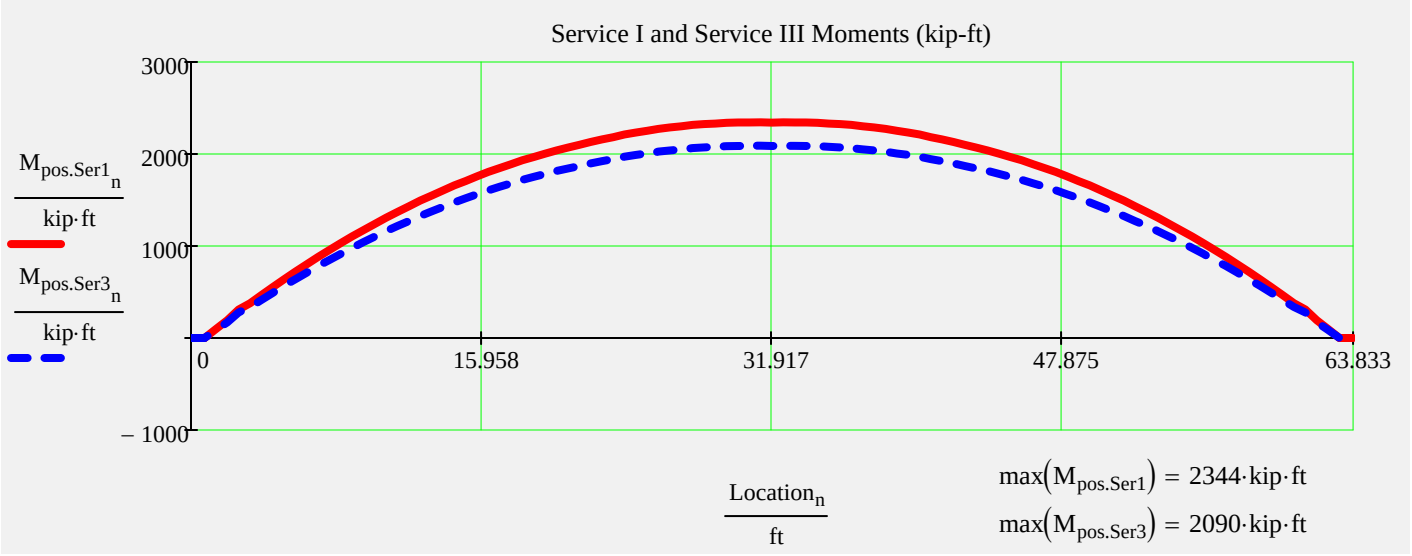
$f_{pe} = 183 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 90.42 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 2344 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2090 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.23 & -2.18 \\ \text{"2"} & -0.29 & -1.91 \\ \text{"4"} & -0.25 & -1.94 \\ \text{"6"} & -1.21 & -1.16 \\ \text{"8"} & -1.52 & -0.16 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1095 & -1067 \\ \text{"@Final (about composite centroid)"} & -990 & -930 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	802	126639	–19.4
"Transformed Beam (initial)"	835.8	132231	–19.9
"Transformed Beam (final)"	832.1	131641	–19.9
"Composite Section"	1668.3	395286	–7.4

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	428
"Non-Composite DL (incl. beam wt.)"	937
"Composite Dead Load"	138
"Distributed Live Load"	1265

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

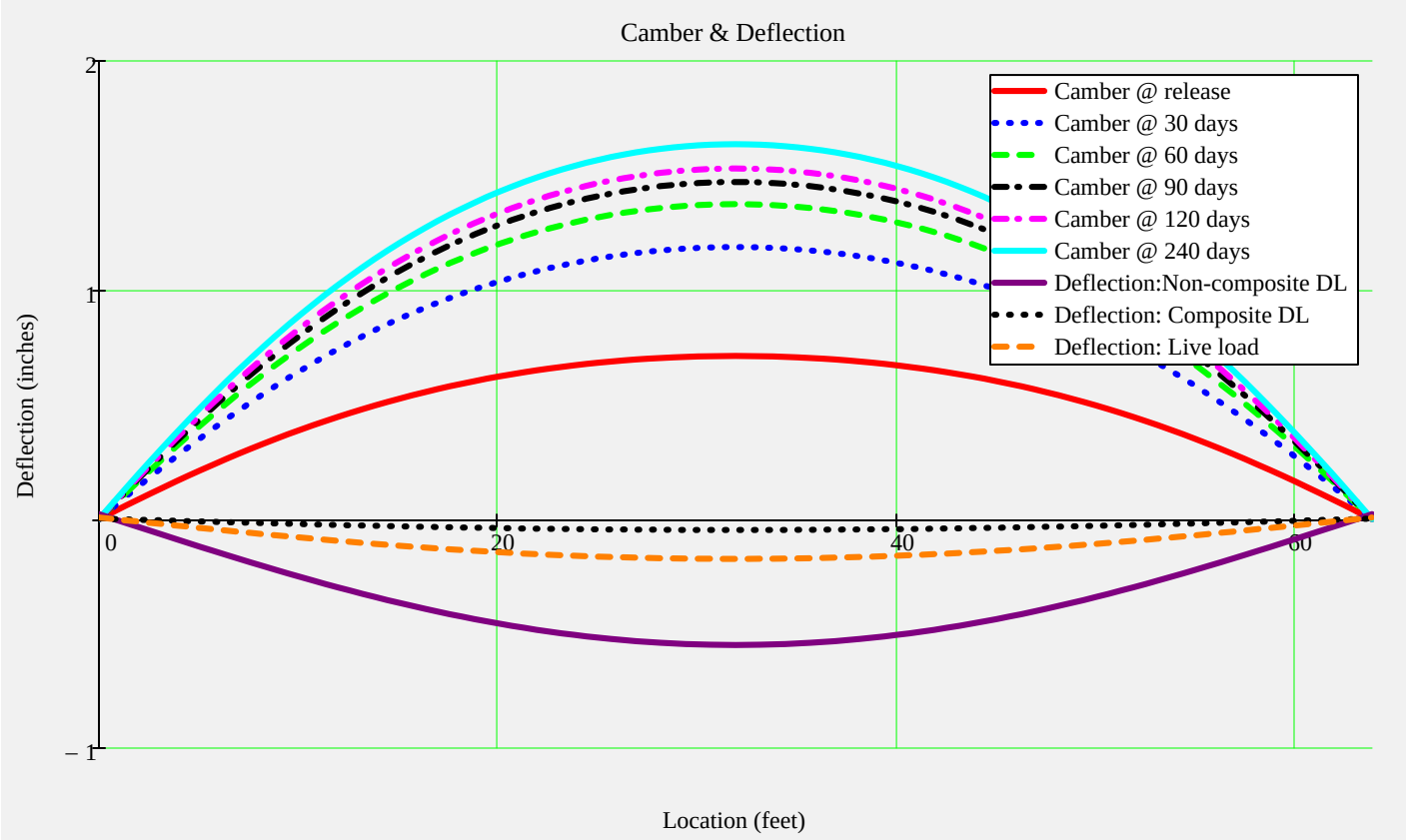
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 62.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.35	0.21	0.71
"30 Days"	–0.13	–0.66	0.35	1.19
"60 Days"	–0.17	–0.78	0.40	1.37
"90 Days"	–0.19	–0.85	0.43	1.47
"120 Days"	–0.21	–0.88	0.45	1.53
"240 Days"	–0.23	–0.95	0.48	1.64
"Non-comp DL"	–0.09	0.08	–0.13	–0.55
"Comp DL"	–0.00	0.01	–0.01	–0.05
"LL"	–0.01	0.04	–0.04	–0.17

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 0.93 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

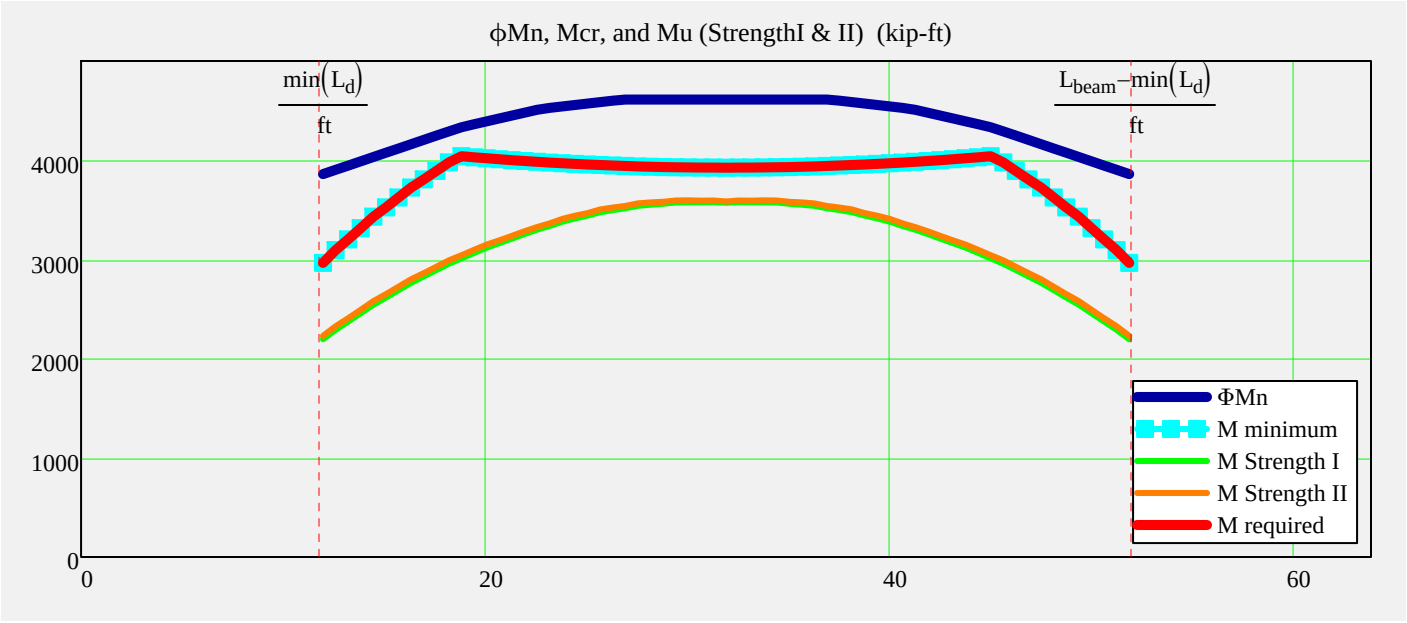
Values at midspan

$LimitStateForMoment_{51} = "Strength\ II"$ $\max(M_{Strength}) = 3595 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 3925 \cdot kip \cdot ft$ $M_{reqd_{51}} = 3925 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 4612 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.8\ \text{ft}$ $L_{beam} - \min(L_d) = 52\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.93$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

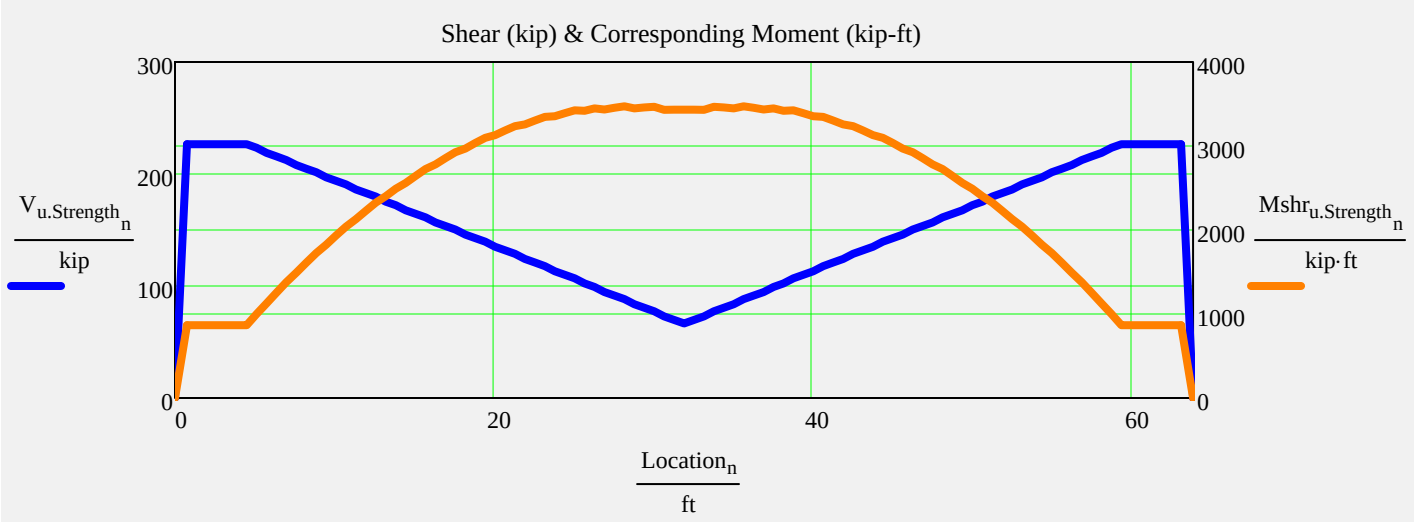
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

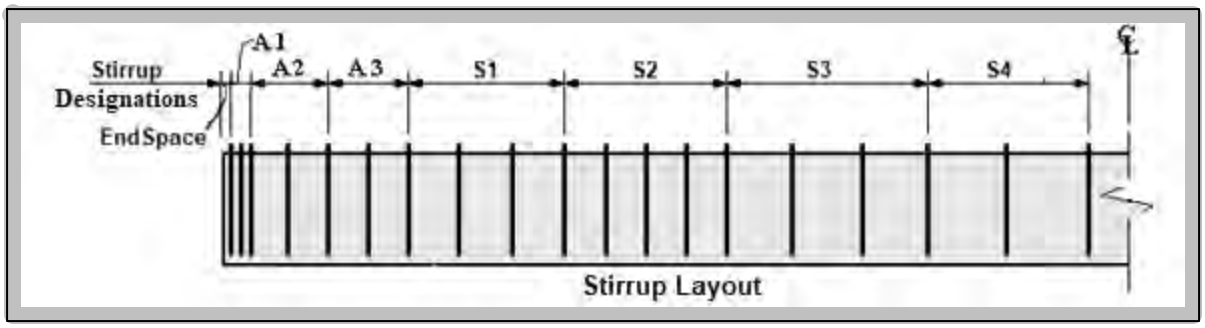
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 243 \\ 248 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 226.5 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 3473 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	26	16	2	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

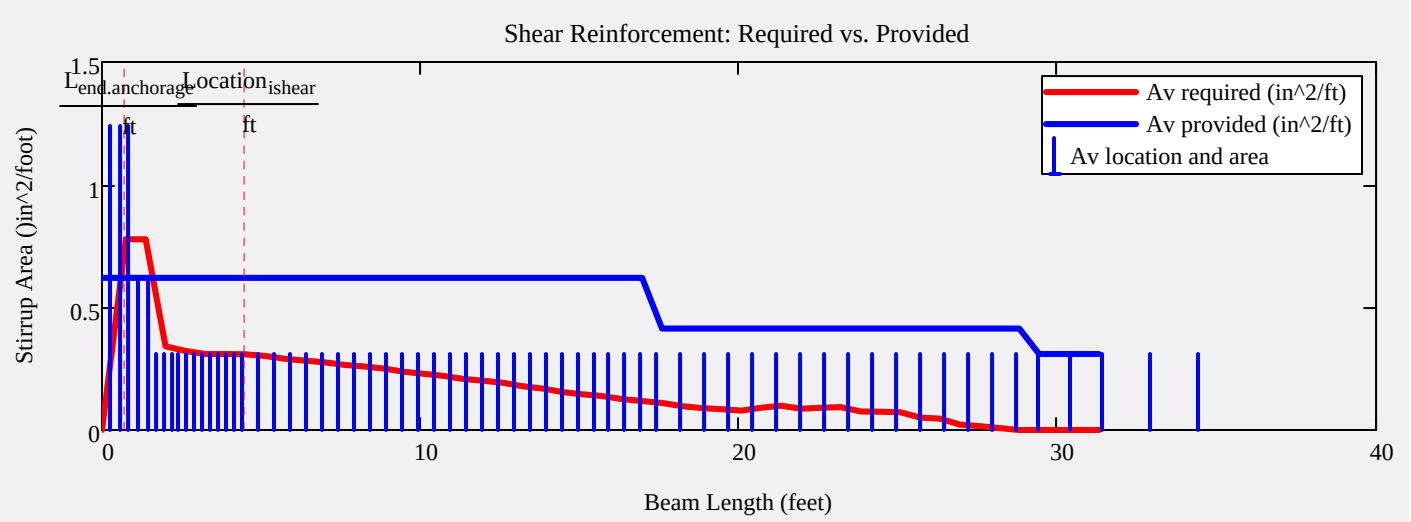
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.49\ ft$

Save Data File

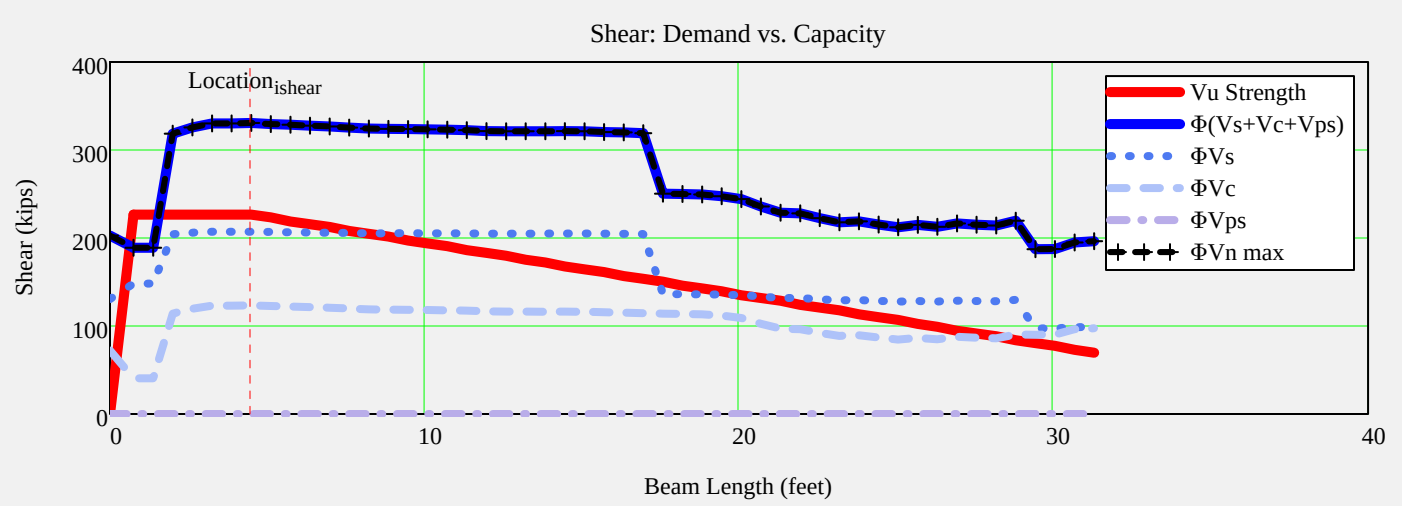
Use current input file

File Name FIB36-64ftSpan_NoSkew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\WB

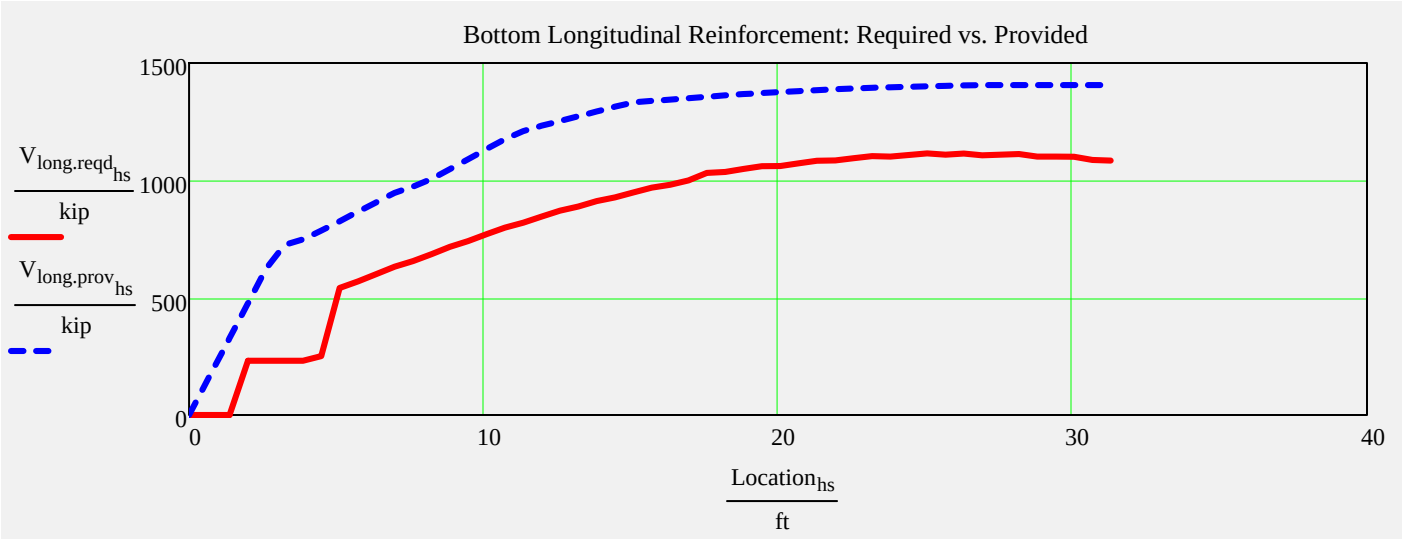
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.49 & 226.53 & 330.64 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.69$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

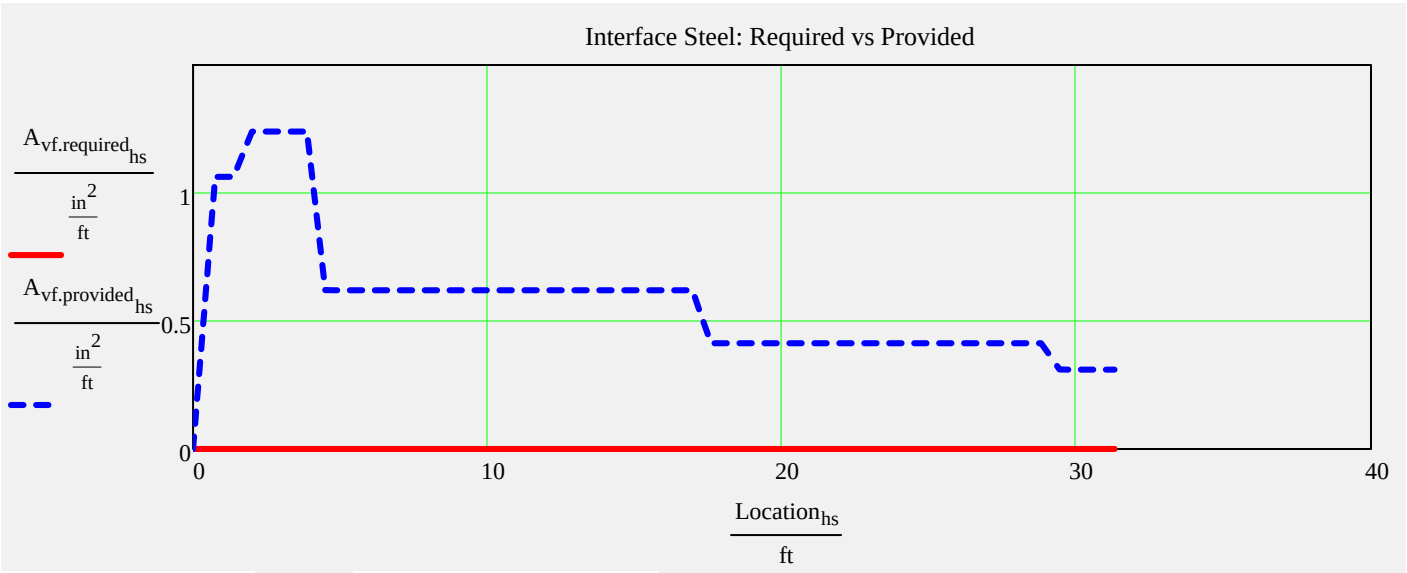


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 25.1 & 1114.5 & 1400.6 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.80$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.17 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

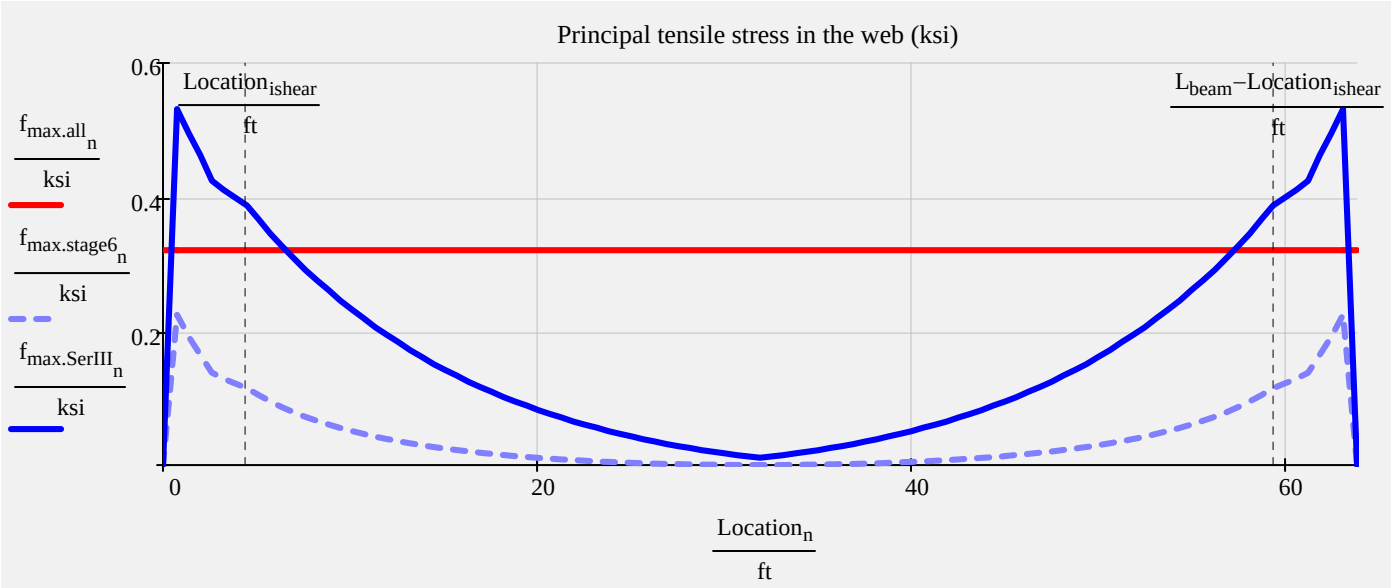
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.9 \cdot in$ $\max(DC_f_{max.web}) = 1.21$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 791 \cdot kip$ $D/C_{splitting.FDOT} = 0.55$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

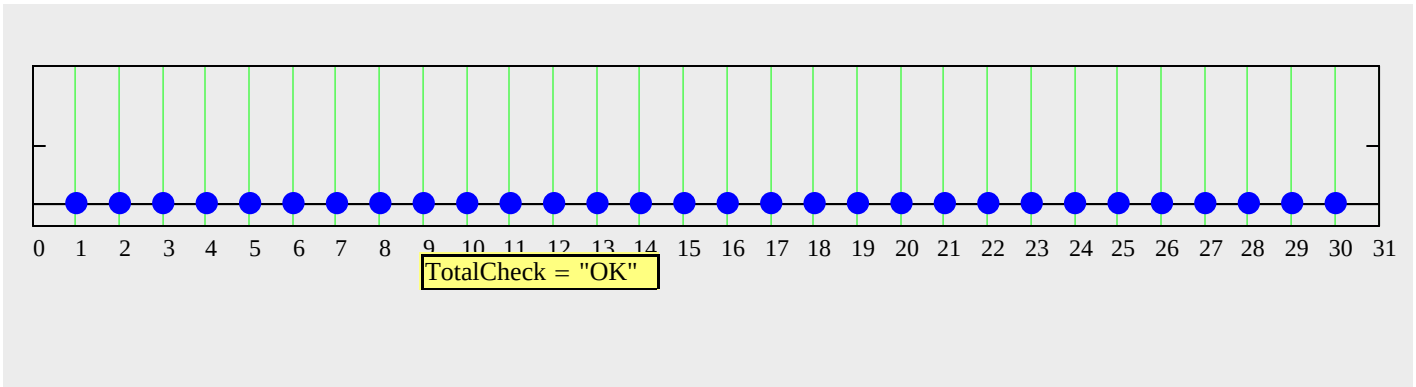
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.89	1.47	"N/A"	30.54	0.89	1.77	"N/A"	3.74	HL-93
"Strength I (Op)"	0.89	1.90	"N/A"	29.30	0.89	2.29	"N/A"	3.74	HL-93
"Service III (Inv)"	0.89	1.81	"N/A"	30.54	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.89	1.97	"N/A"	30.54	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.89	1.45	87.19	33.66	0.89	1.69	101.69	3.74	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.75$ $DC_{LongReinf.Permit} = 0.80$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	4612	"factored resistance (kip-ft)...."
"γDL"	1352	"factored dead load (kip-ft)...."
"γLL"	1716	"factored live load (kip-ft)....."
"RF"	1.9	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	331.2	"factored resistance (kip)....."
"γDL"	76.7	"factored dead load (kip)....."
"γLL"	111	"factored live load (kip)....."
"RF"	2.29	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 64 FEET (NO SKEW)
WESTBOUND BRIDGE
(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\WB 64' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-64ftSpan_NoSkew_Exterior.dat
FIB36-64ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

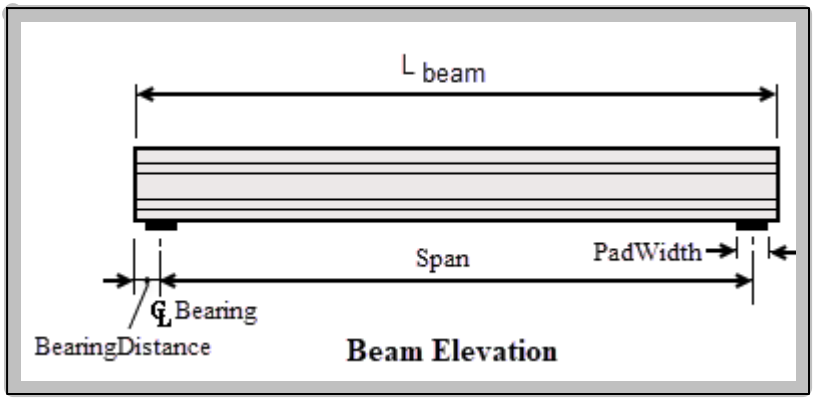
InputDataFile = "FIB36-64ftSpan_NoSkew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	WB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-64ftSpan_NoSkew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	63.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	10	ft	*Measured from beam centerline to centerline.*
Overhang	3.7083	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.375	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(* 0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

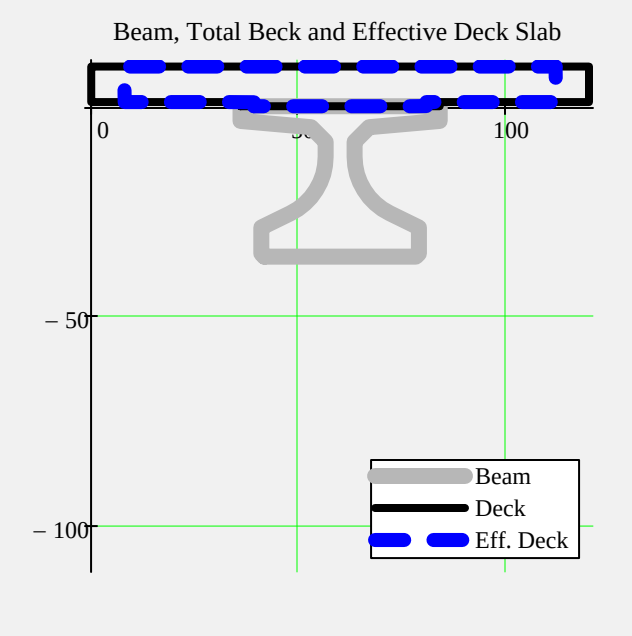
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8.5 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $120 \cdot in$

$b_e = 120 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	$\frac{kip}{ft}$
Additional Uniform Composite DL	0.03	$\frac{kip}{ft}$

$w_{deck} = 1.17 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.12 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.15 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 63.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

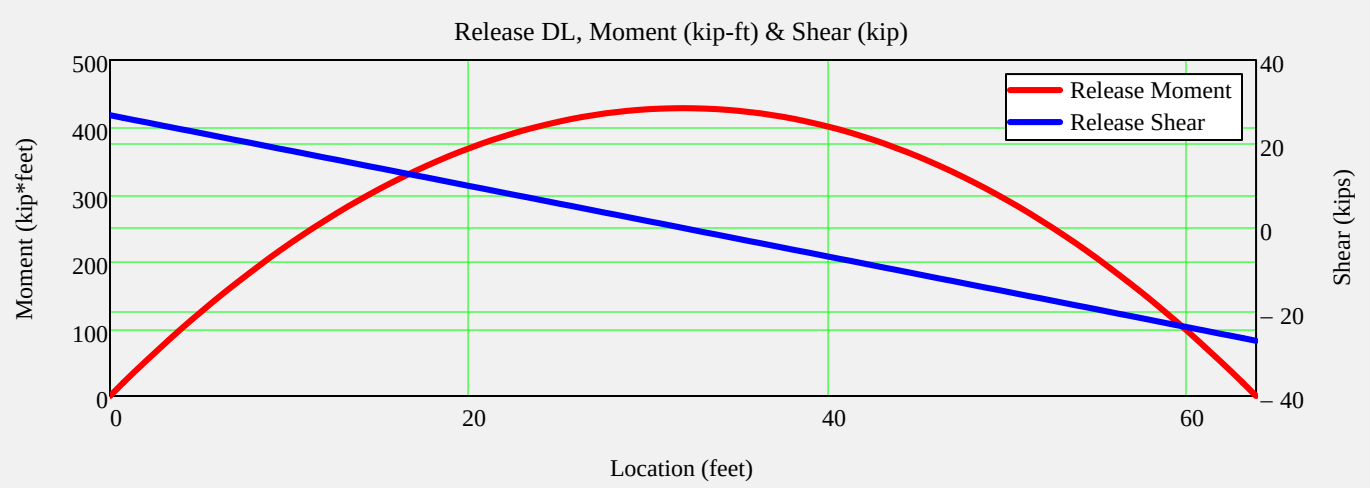
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

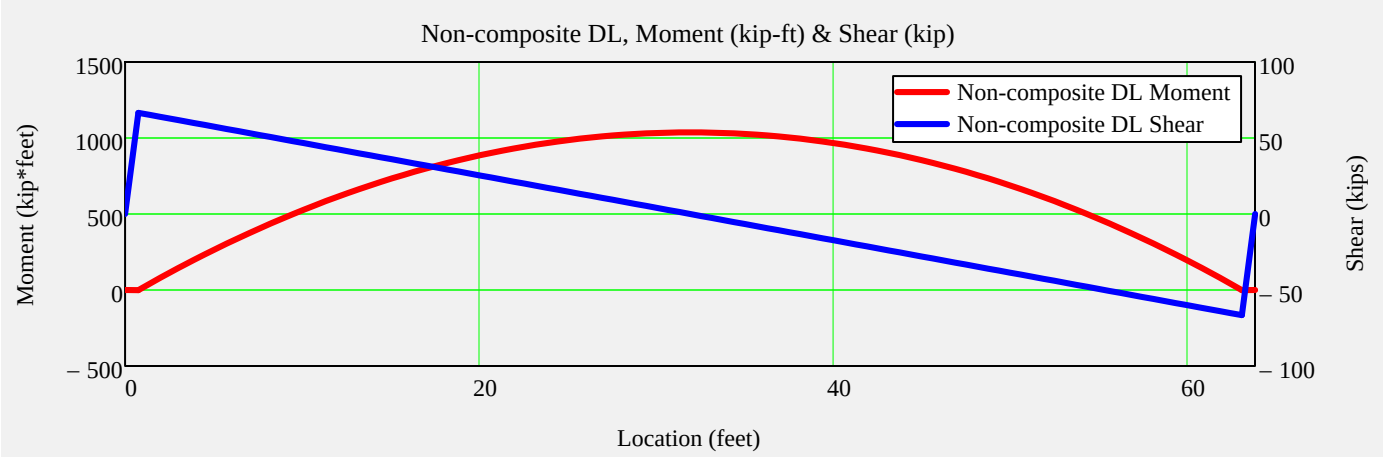
Release Dead Load Moments and Shears

$L_{span} = 62.33\ ft$



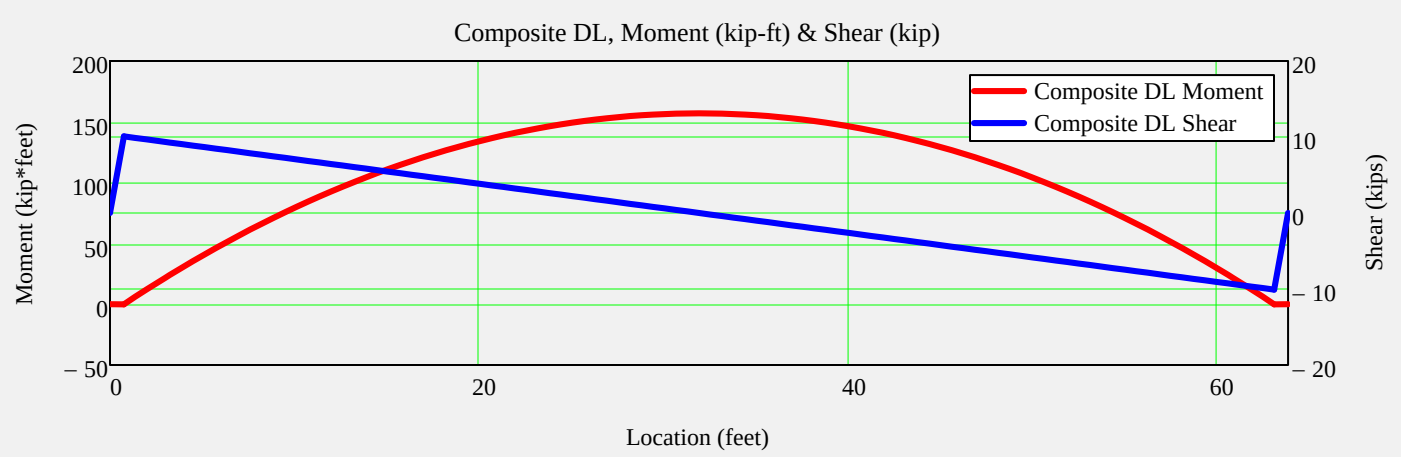
$\max(V_{release}) = 26.8 \cdot kip$ $\max(M_{release}) = 428.4 \cdot kip \cdot ft$ $\min(V_{release}) = -26.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 66.6 \cdot kip$ $\max(M_{dl.non.comp}) = 1036.8 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -66.6 \cdot kip$

Composite Dead Load Moments and Shear



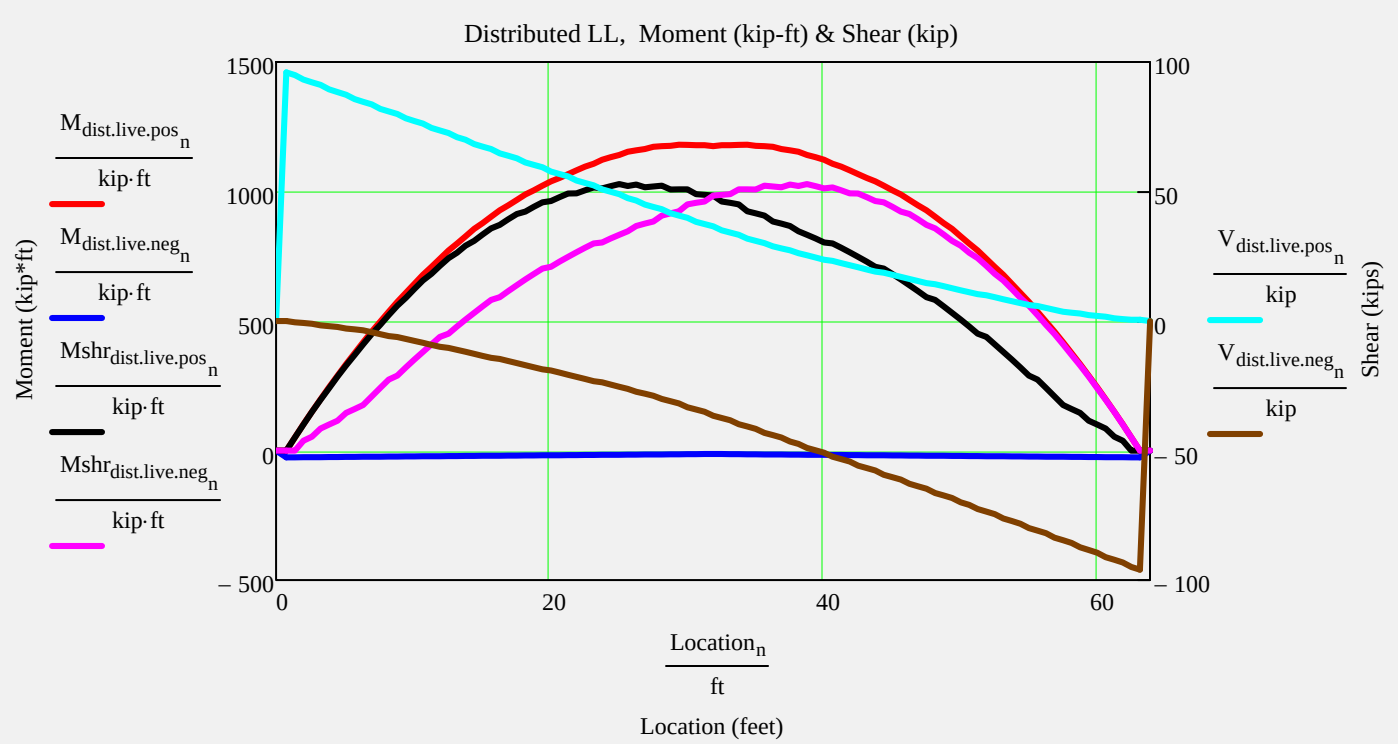
$\max(V_{dl.comp}) = 10.1 \cdot kip$ $\max(M_{dl.comp}) = 156.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -10.1 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 62.33\ ft$ BeamSpacing $= 10\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.82$ $g_{mom.fatigue} = 0.49$ $g_{shear} = 0.95$



$\max(V_{dist.live.pos}) = 96.0 \cdot kip$

$\max(M_{dist.live.pos}) = 1180.8 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -96.0 \cdot kip$

$Reaction_{LL} = 98.0 \cdot kip$

$\min(M_{dist.live.neg}) = -26.4 \cdot kip \cdot ft$

$Reaction_{DL} = 78.5 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1029 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 62.1 \cdot kip$ $Reaction_{lane} = 20.4 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 78.5 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-64ftSpan_NoSkew_Interior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.24	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		0 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity	75	%	*% relative humidity (75% typical)*
Time: jacking to transfer	1.5	days	*Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

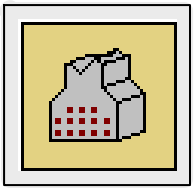
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

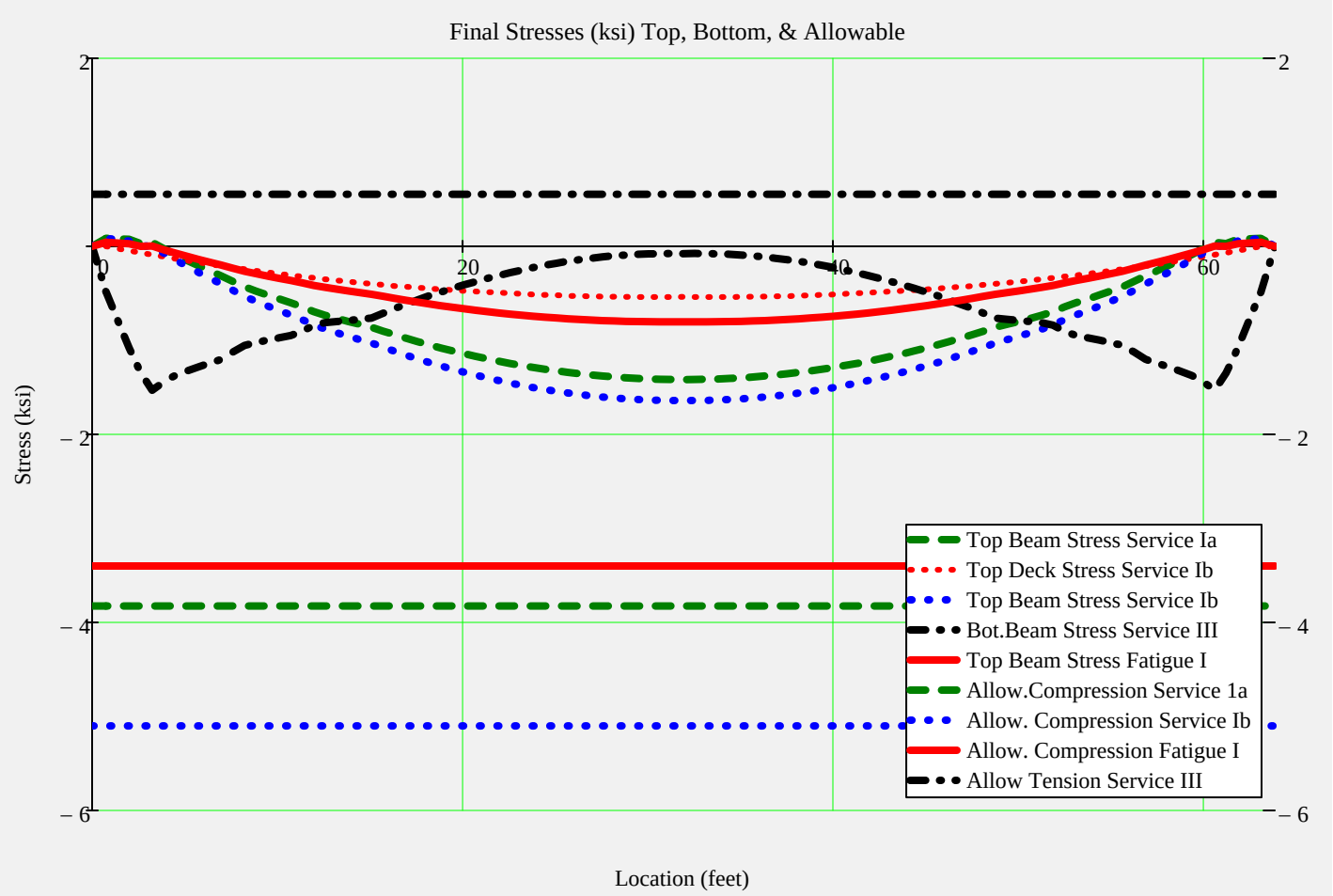
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

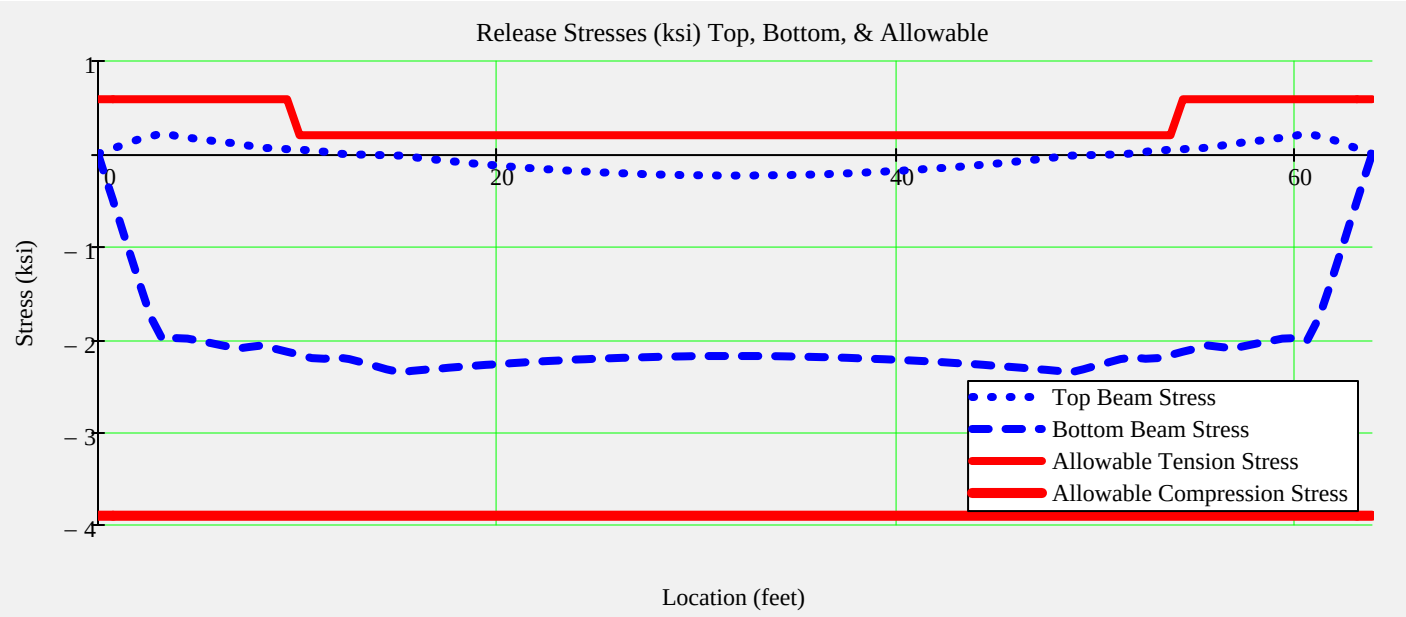
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$\text{Check_f}_{\text{tension.rel}} = \text{"OK"}$	$\max(\text{DC_f}_{\text{tension.rel}}) = 0.64$
Release compression	$\text{Check_f}_{\text{comp.rel}} = \text{"OK"}$	$\max(\text{DC_f}_{\text{comp.rel}}) = 0.60$
*Service III , PS+DL+0.8*LL*	$\text{Check_f}_{\text{tension.ServiceIII}} = \text{"OK"}$	$\max(\text{DC_f}_{\text{tension.ServiceIII}}) = 0.73$
Service Ia , PS+DL	$\text{Check_f}_{\text{comp.ServiceIa}} = \text{"OK"}$	$\max(\text{DC_f}_{\text{comp.ServiceIa}}) = 0.37$
Service Ib , PS+DL+LL	$\text{Check_f}_{\text{comp.ServiceIb}} = \text{"OK"}$	$\max(\text{DC_f}_{\text{comp.ServiceIb}}) = 0.32$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$\text{Check_f}_{\text{comp.FatigueI}} = \text{"OK"}$	$\max(\text{DC_f}_{\text{comp.FatigueI}}) = 0.24$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.24	0.22	0.59
"Compression @ Release"	15.09	–2.35	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	31.92	–1.42	–3.83
"CompressionIb @ ServiceI"	31.92	–1.64	–5.10
"Compression @ FatigueI"	32.54	–0.80	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

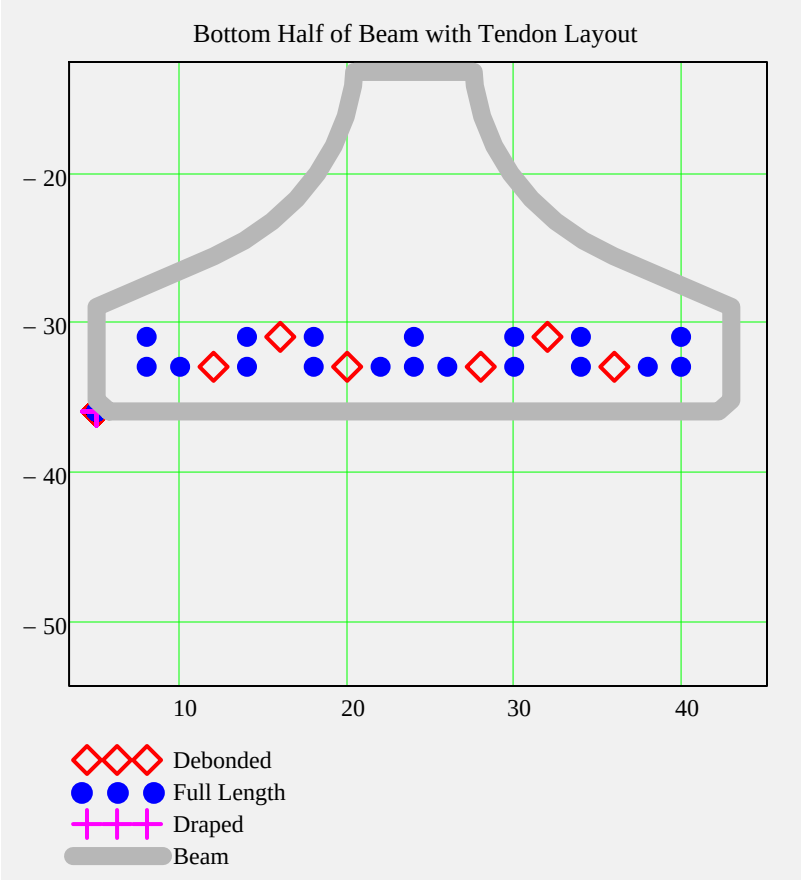
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 24$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -19 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -9.58 \cdot \%$

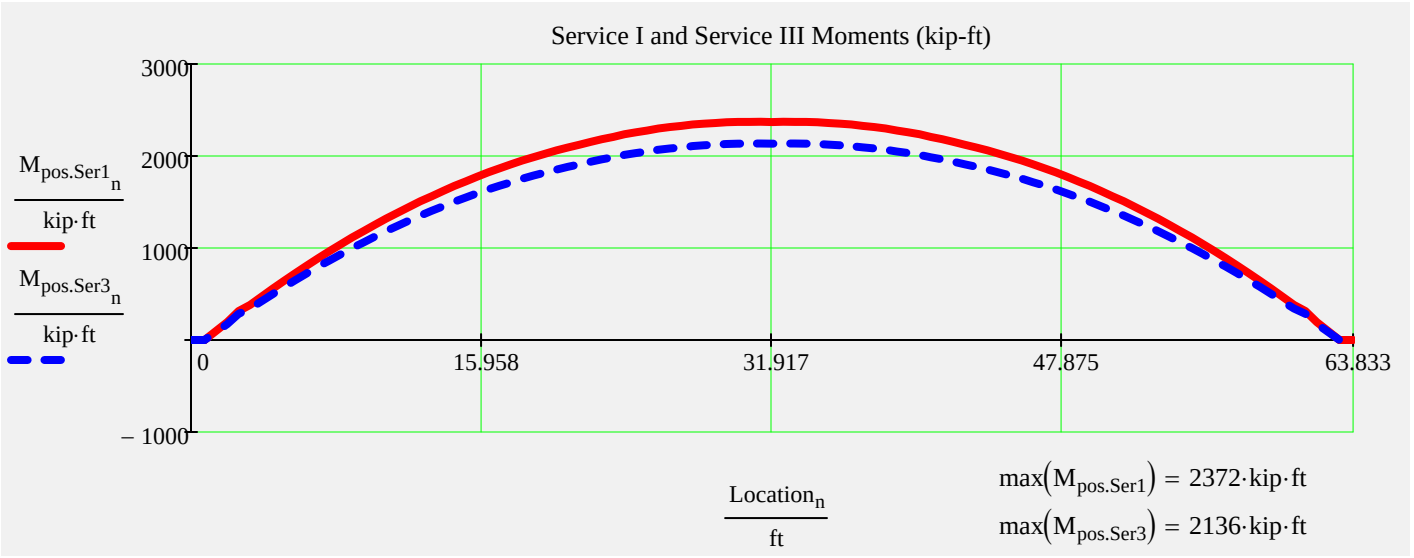
$f_{pe} = 183 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 90.42 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 2372 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2136 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.23 & -2.18 \\ \text{"2"} & -0.29 & -1.91 \\ \text{"4"} & -0.25 & -1.94 \\ \text{"6"} & -1.39 & -1.01 \\ \text{"8"} & -1.64 & -0.08 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1095 & -1067 \\ \text{"@Final (about composite centroid)"} & -990 & -930 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	802	126639	–19.4
"Transformed Beam (initial)"	835.8	132231	–19.9
"Transformed Beam (final)"	832.1	131641	–19.9
"Composite Section"	1786.2	413575	–6.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	428
"Non-Composite DL (incl. beam wt.)"	1037
"Composite Dead Load"	157
"Distributed Live Load"	1175

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

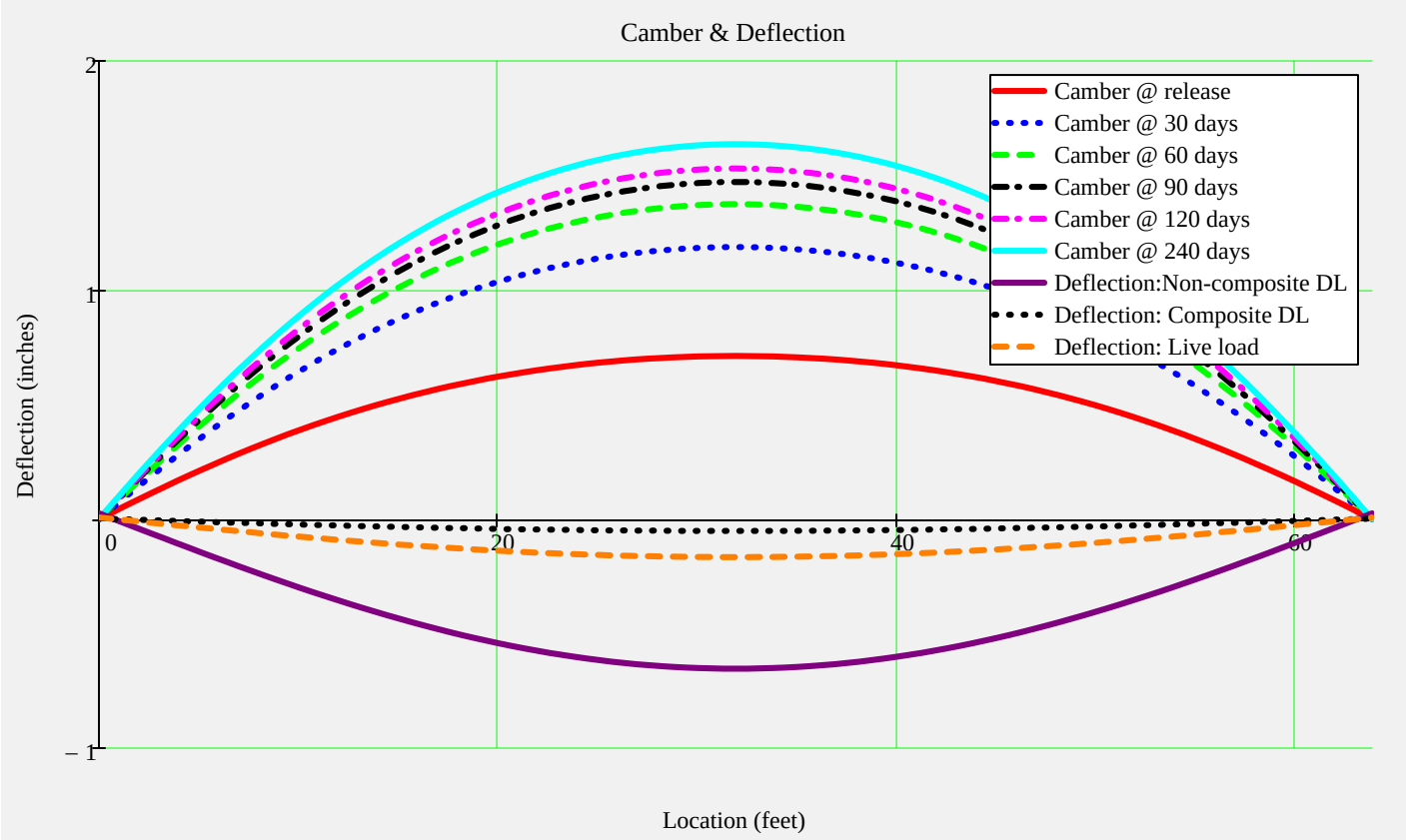
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 62.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.35	0.21	0.71
"30 Days"	–0.13	–0.66	0.35	1.19
"60 Days"	–0.17	–0.78	0.40	1.37
"90 Days"	–0.19	–0.85	0.43	1.47
"120 Days"	–0.21	–0.88	0.45	1.53
"240 Days"	–0.23	–0.95	0.48	1.64
"Non-comp DL"	–0.11	0.09	–0.16	–0.65
"Comp DL"	–0.00	0.01	–0.01	–0.05
"LL"	–0.01	0.04	–0.04	–0.17

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 0.82 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

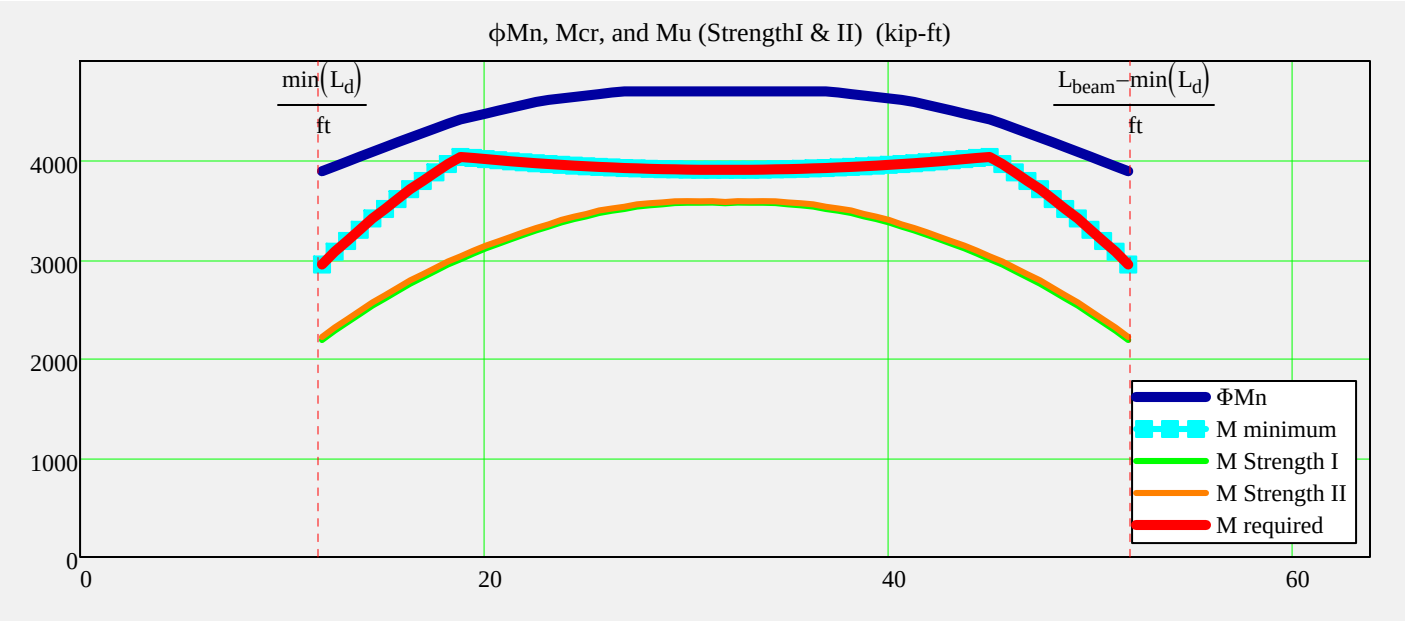
Values at midspan

$LimitStateForMoment_{51} =$ "Strength II" $\max(M_{Strength}) = 3588 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 3903 \cdot kip \cdot ft$ $M_{reqd_{51}} = 3903 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 4693 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 11.8\ \text{ft}$ $L_{beam} - \min(L_d) = 52\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.91$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

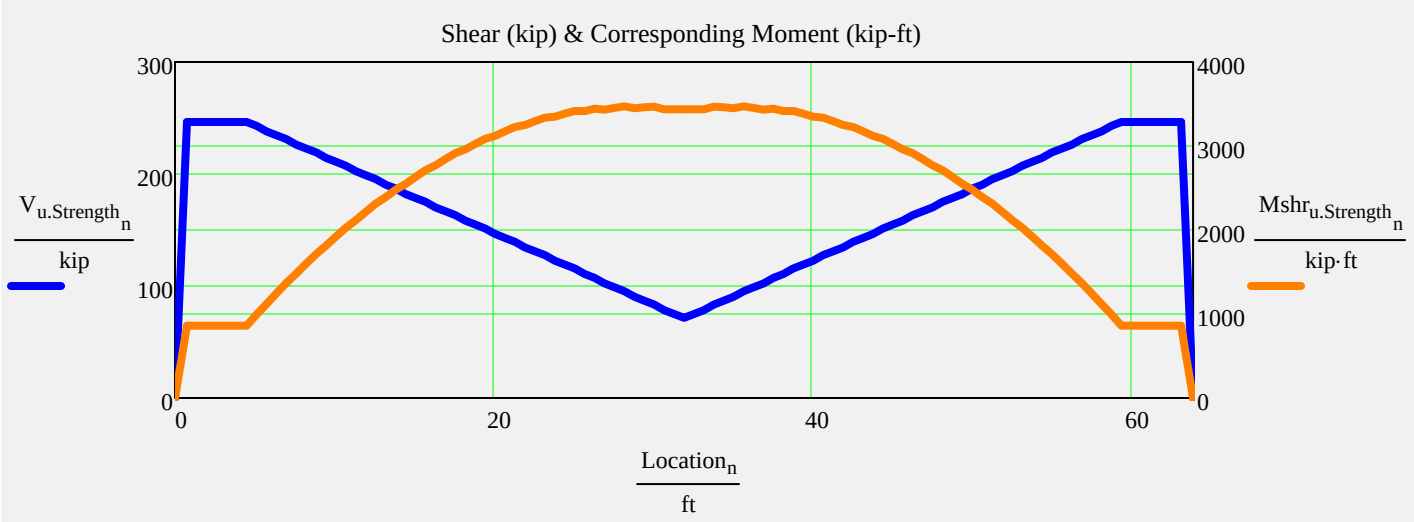
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

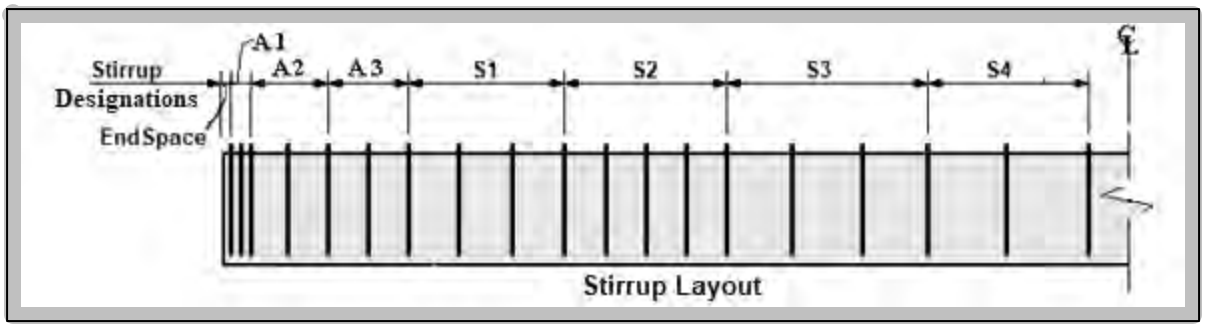
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 265 \\ 270 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 246.5 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 3472 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	26	16	2	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

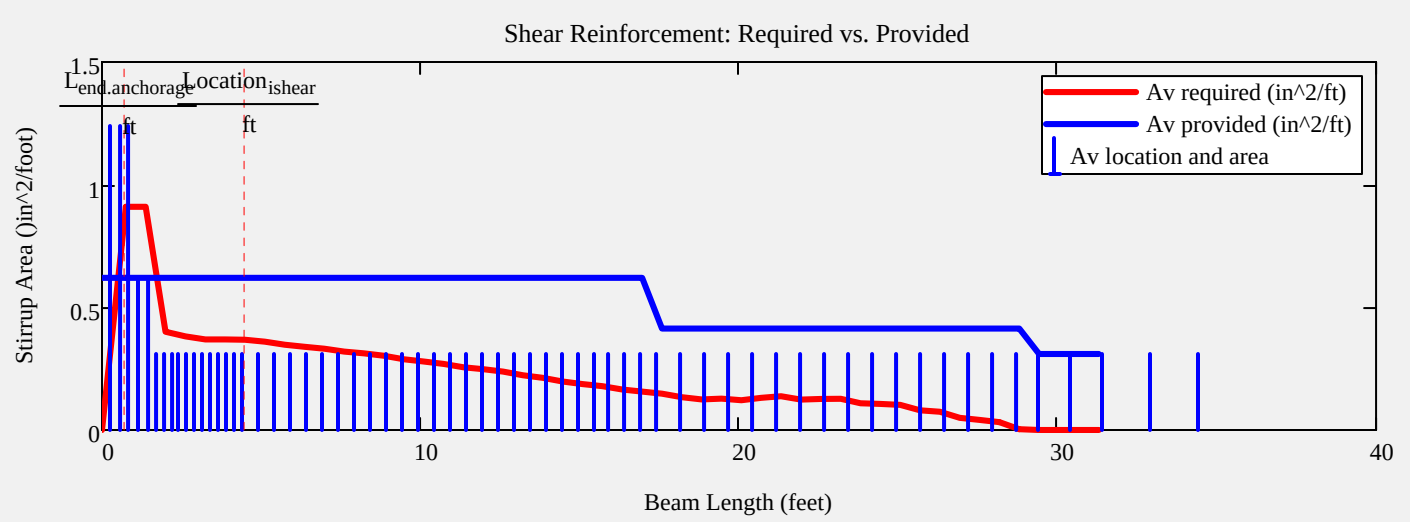
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.49\ ft$

Save Data File

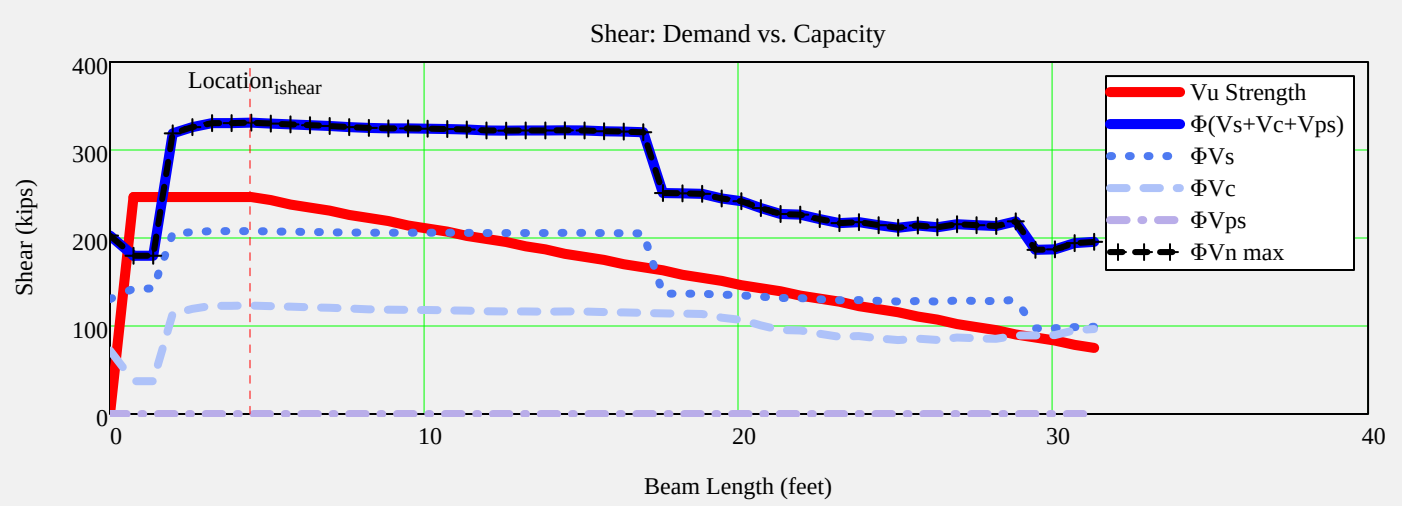
Use current input file

File Name FIB36-64ftSpan_NoSkew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\WB

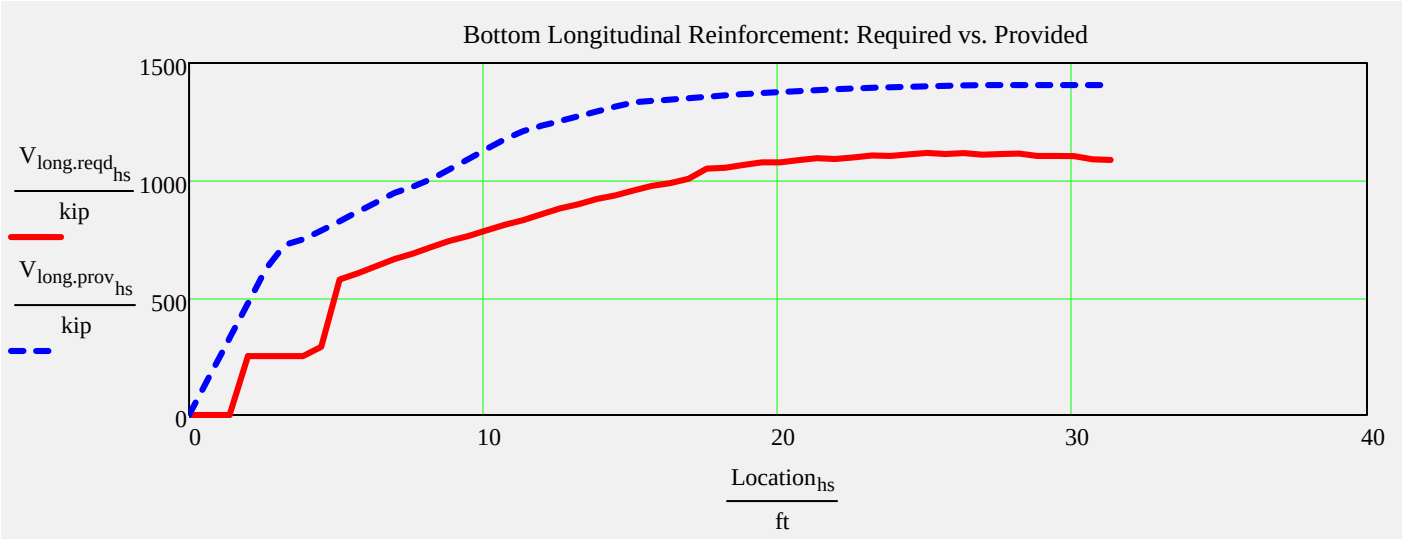
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.49 & 246.48 & 331.08 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.74$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

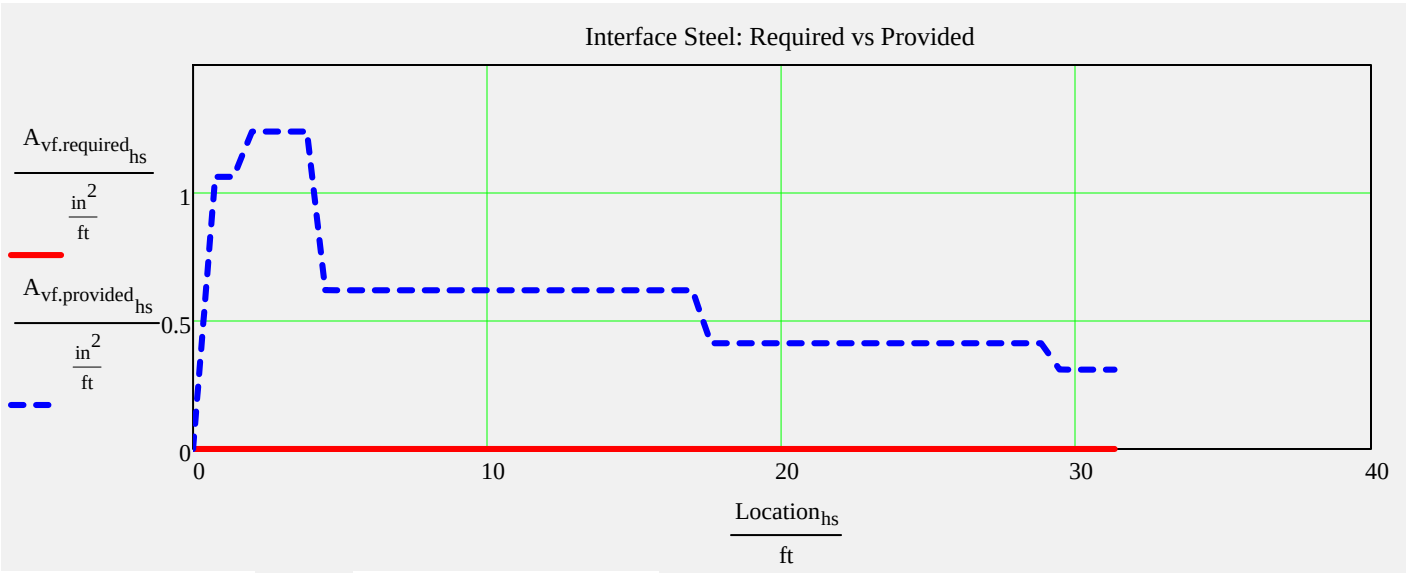


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 25.1 & 1116.8 & 1400.6 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.80$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.17 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

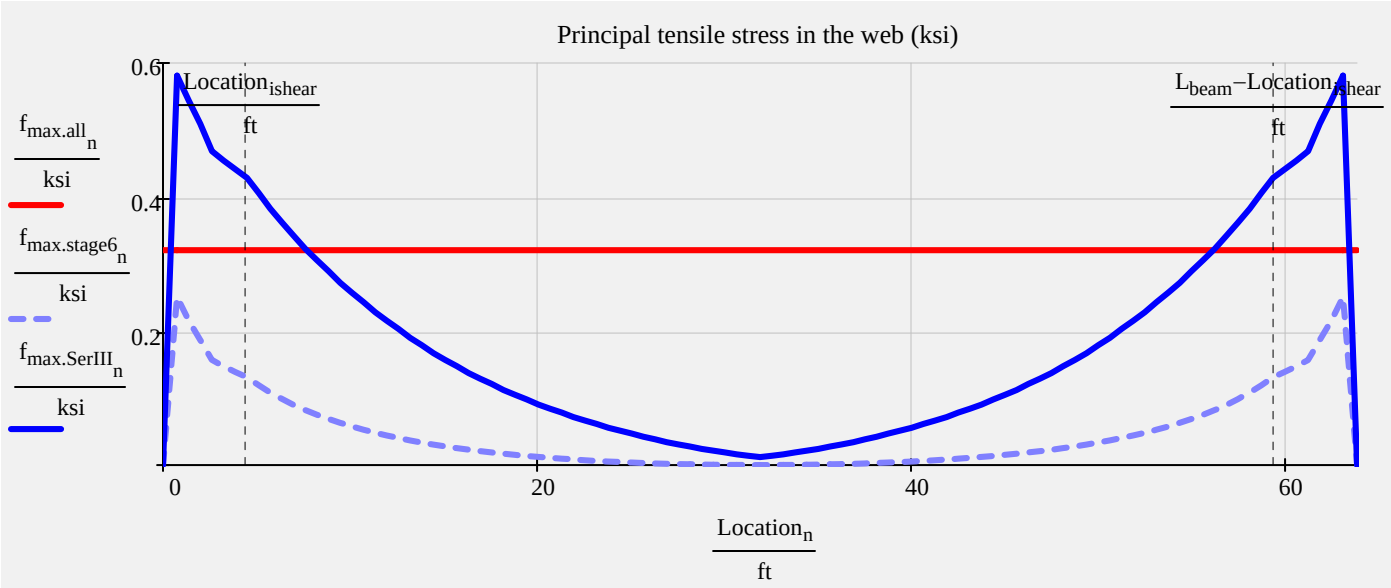
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.9 \cdot in$ $\max(DC_f_{max.web}) = 1.34$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 791 \cdot kip$ $D/C_{splitting.FDOT} = 0.55$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

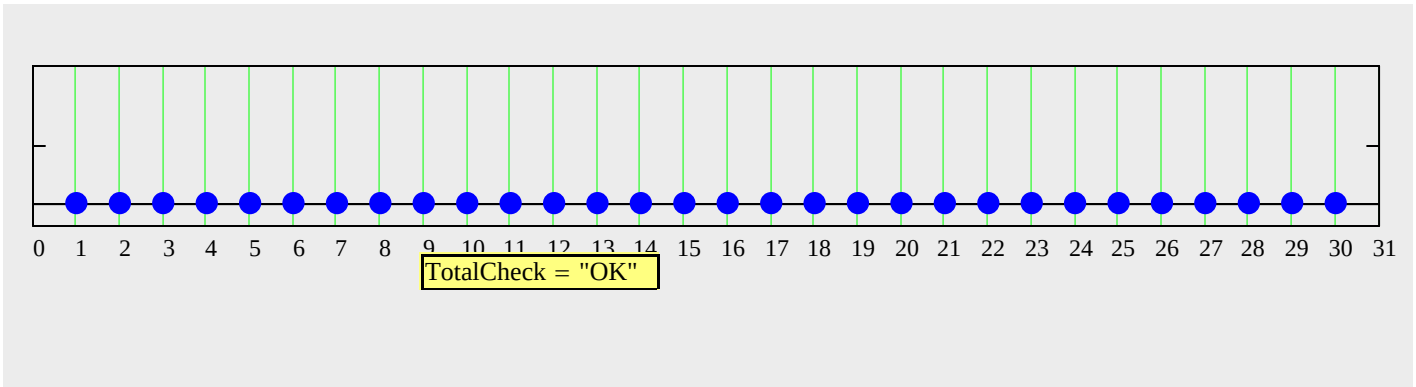
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.82	1.54	"N/A"	30.54	0.95	1.59	"N/A"	3.74	HL-93
"Strength I (Op)"	0.82	2.00	"N/A"	31.79	0.95	2.06	"N/A"	3.74	HL-93
"Service III (Inv)"	0.82	1.78	"N/A"	31.79	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.82	1.95	"N/A"	30.54	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.82	1.53	91.84	28.67	0.95	1.53	91.50	3.74	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.76$ $DC_{LongReinf.Permit} = 0.80$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	4693	"factored resistance (kip-ft)...."
"γDL"	1510	"factored dead load (kip-ft)...."
"γLL"	1591	"factored live load (kip-ft)....."
"RF"	2	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	331.7	"factored resistance (kip)....."
"γDL"	85.3	"factored dead load (kip)....."
"γLL"	119.3	"factored live load (kip)....."
"RF"	2.06	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 64 FEET (NO SKEW)
EASTBOUND BRIDGE
(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 64' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-64ftSpan_NoSkew_Exterior.dat
FIB36-64ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

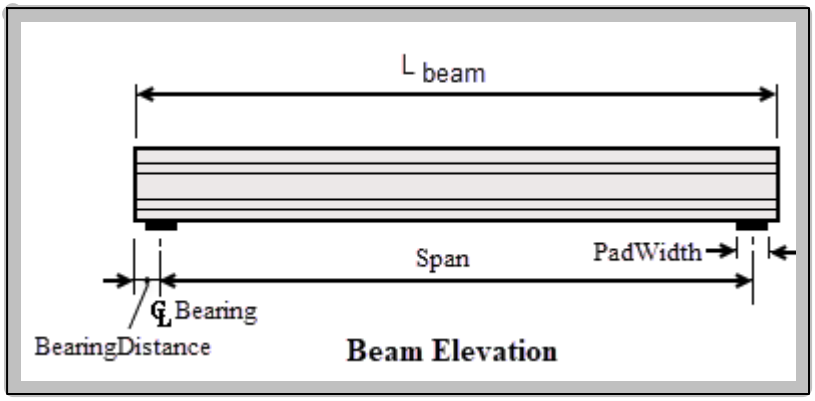
InputDataFile = "FIB36-64ftSpan_NoSkew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 20 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-64ftSpan_NoSkew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FIB36.bmp"
L_{beam}	63.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	11.6667	ft	*Measured from beam centerline to centerline.*
Overhang	3.8333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	4		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

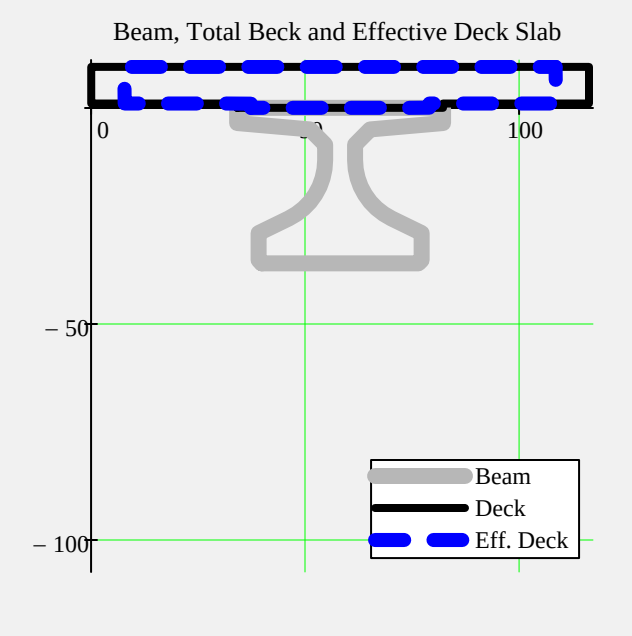
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8.5 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $140 \cdot in$

$b_e = 116 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 1.14 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.08 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.125 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.22 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 63.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

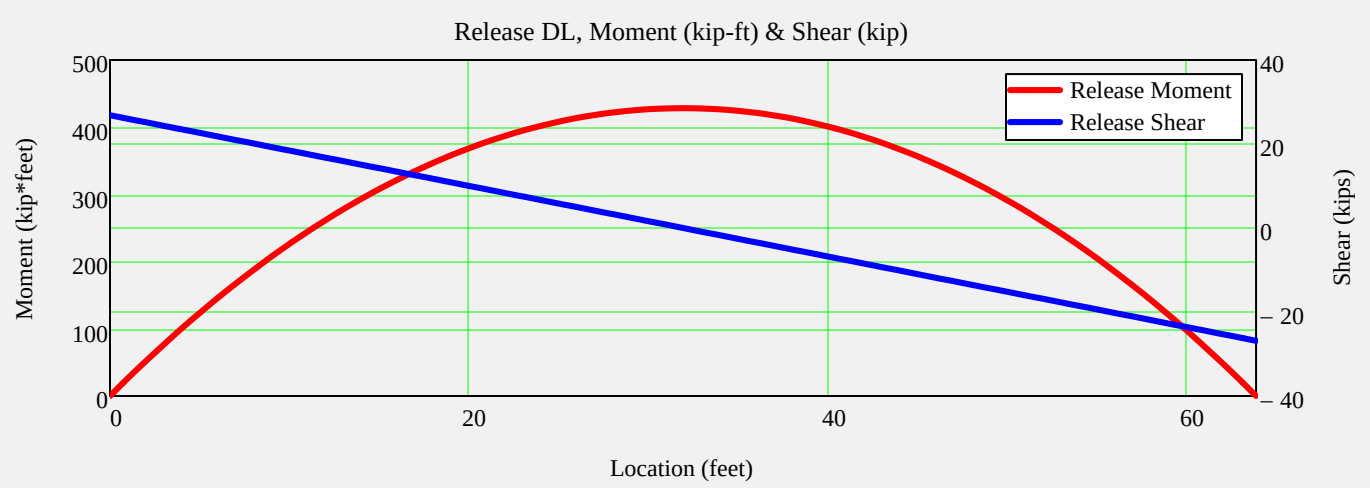
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

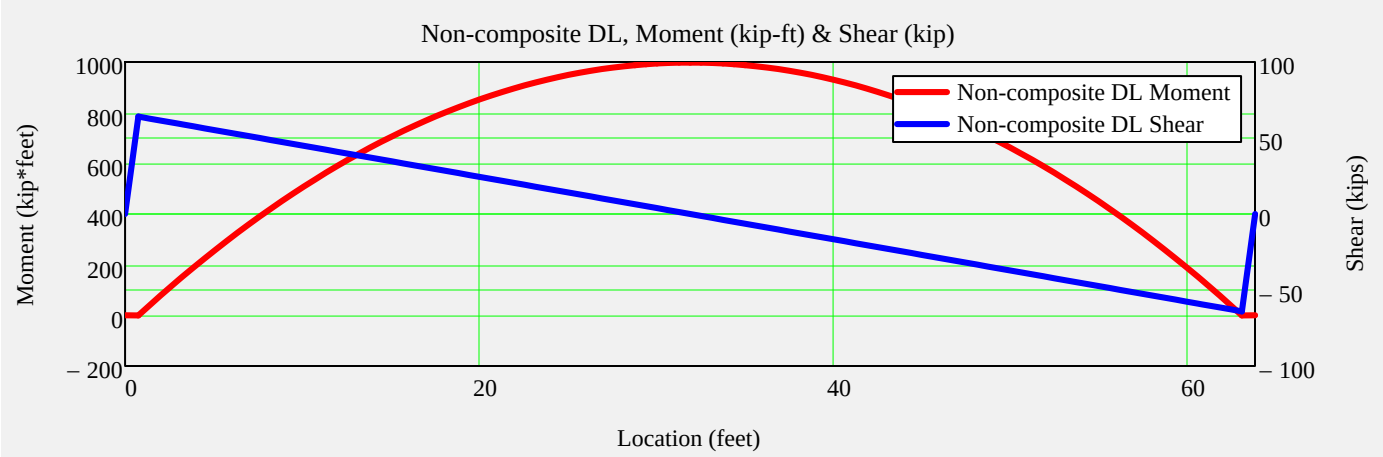
Release Dead Load Moments and Shears

$L_{span} = 62.33\ ft$



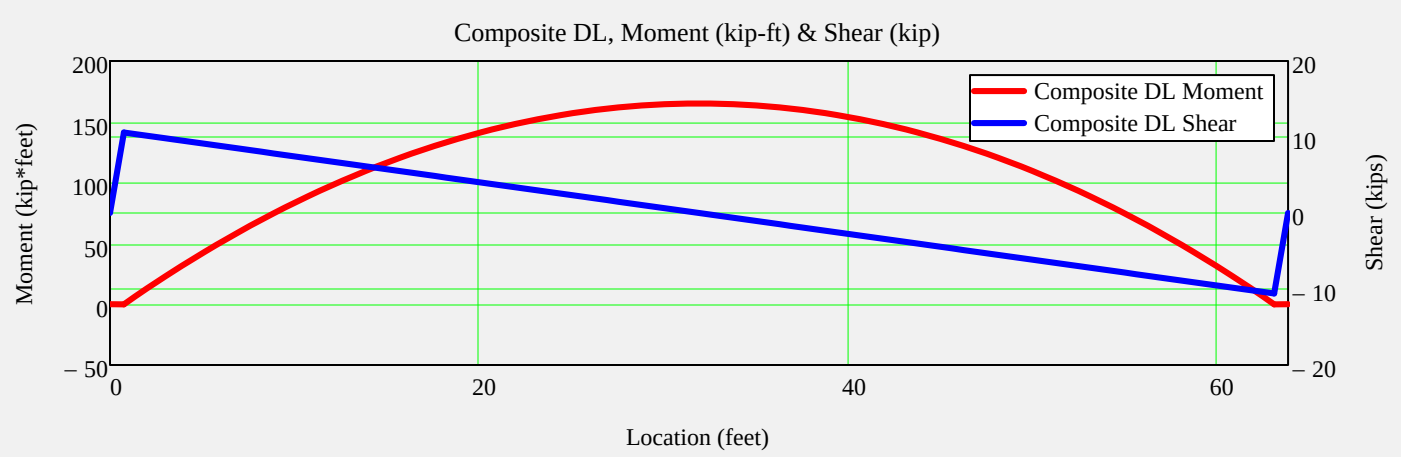
$\max(V_{release}) = 26.8 \cdot kip$ $\max(M_{release}) = 428.4 \cdot kip \cdot ft$ $\min(V_{release}) = -26.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 64.1 \cdot kip$ $\max(M_{dl.non.comp}) = 997.6 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -64.1 \cdot kip$

Composite Dead Load Moments and Shear



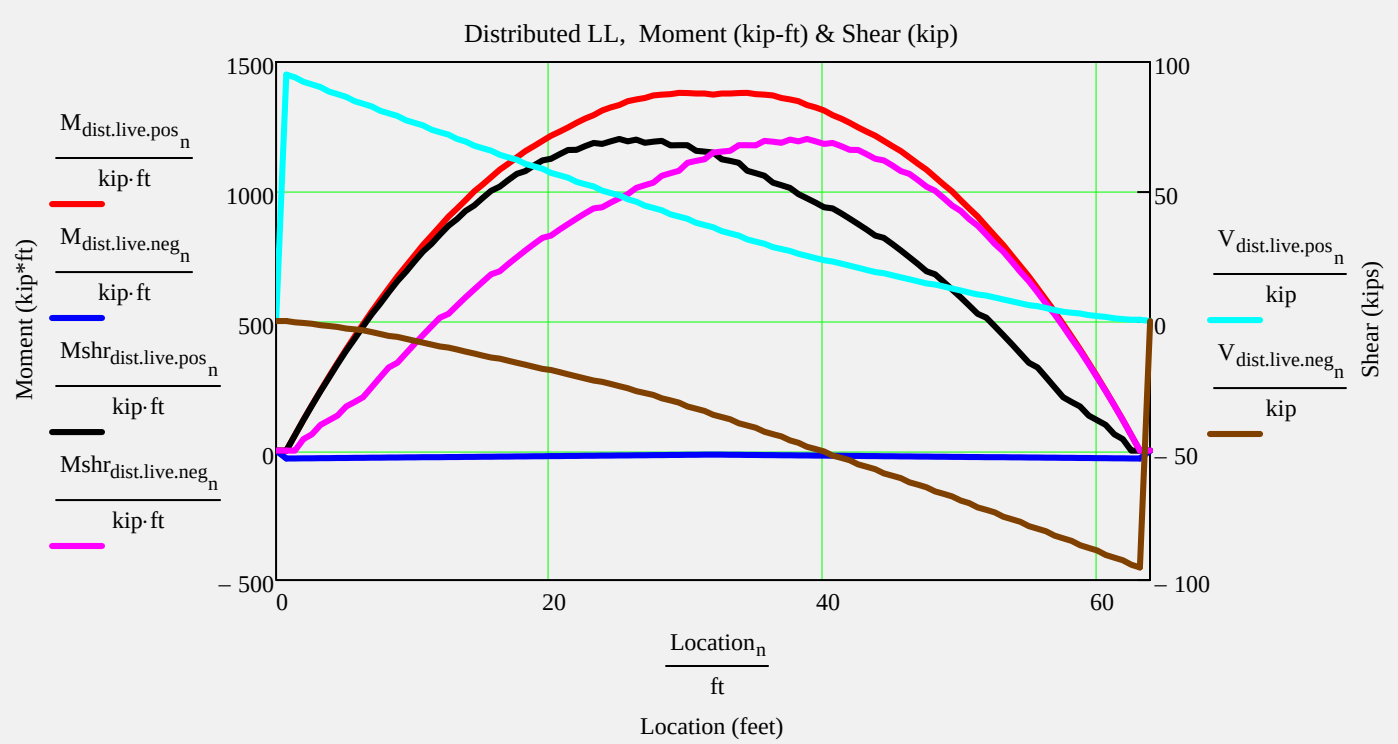
$\max(V_{dl.comp}) = 10.6 \cdot kip$ $\max(M_{dl.comp}) = 165.0 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -10.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 62.33\ ft$ BeamSpacing $= 11.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.96$ $g_{mom.fatigue} = 0.79$ $g_{shear} = 0.94$



$\max(V_{dist.live.pos}) = 95.1 \cdot kip$

$\max(M_{dist.live.pos}) = 1380.7 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -95.1 \cdot kip$

$Reaction_{LL} = 97.1 \cdot kip$

$Reaction_{DL} = 76.4 \cdot kip$

$\min(M_{dist.live.neg}) = -30.8 \cdot kip \cdot ft$

$\max(Mshr_{dist.live.pos}) = 1203 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 62.1 \cdot kip$ $Reaction_{lane} = 20.4 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 77.8 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-64ftSpan_NoSkew_Exterior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.24	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		0 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

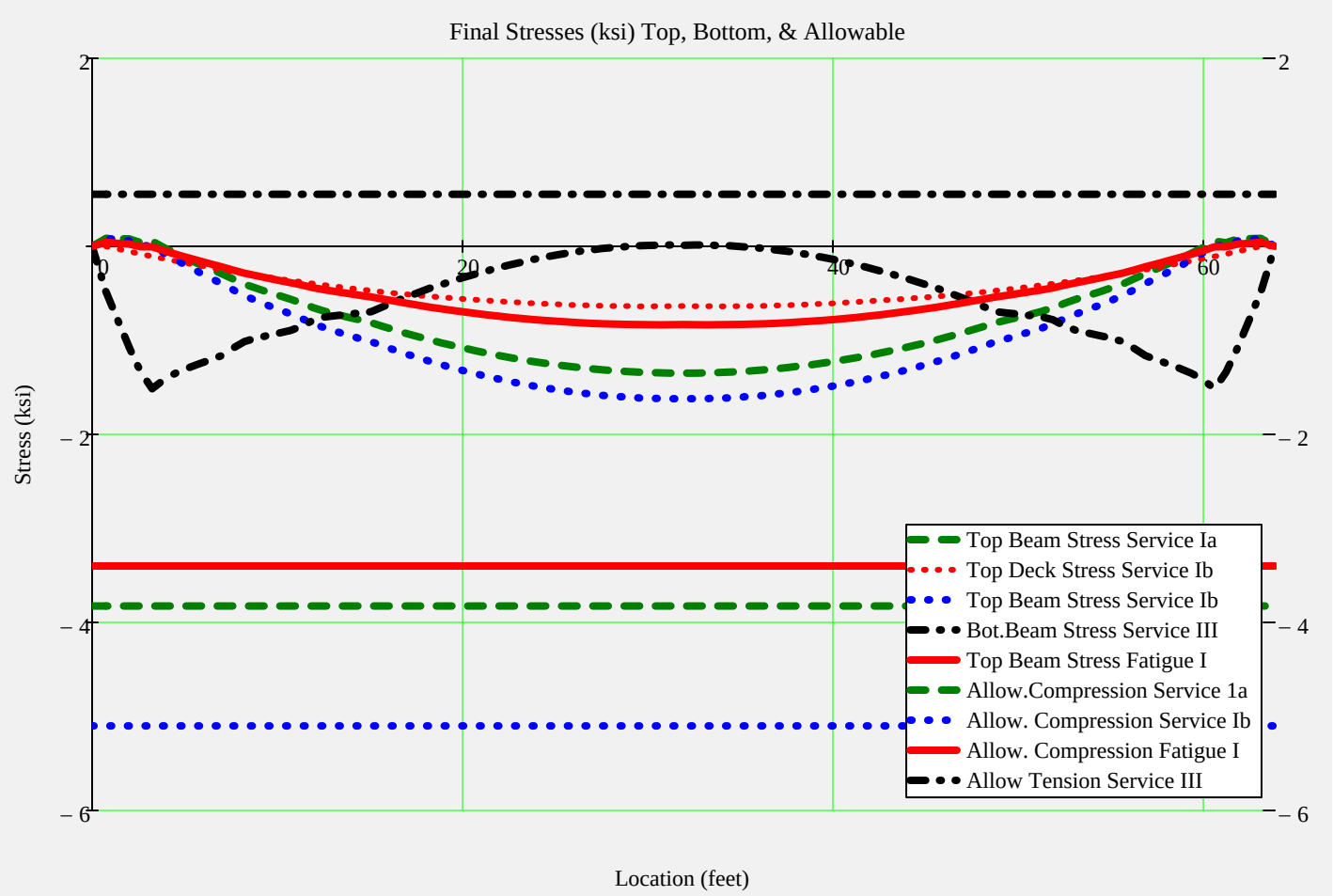
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

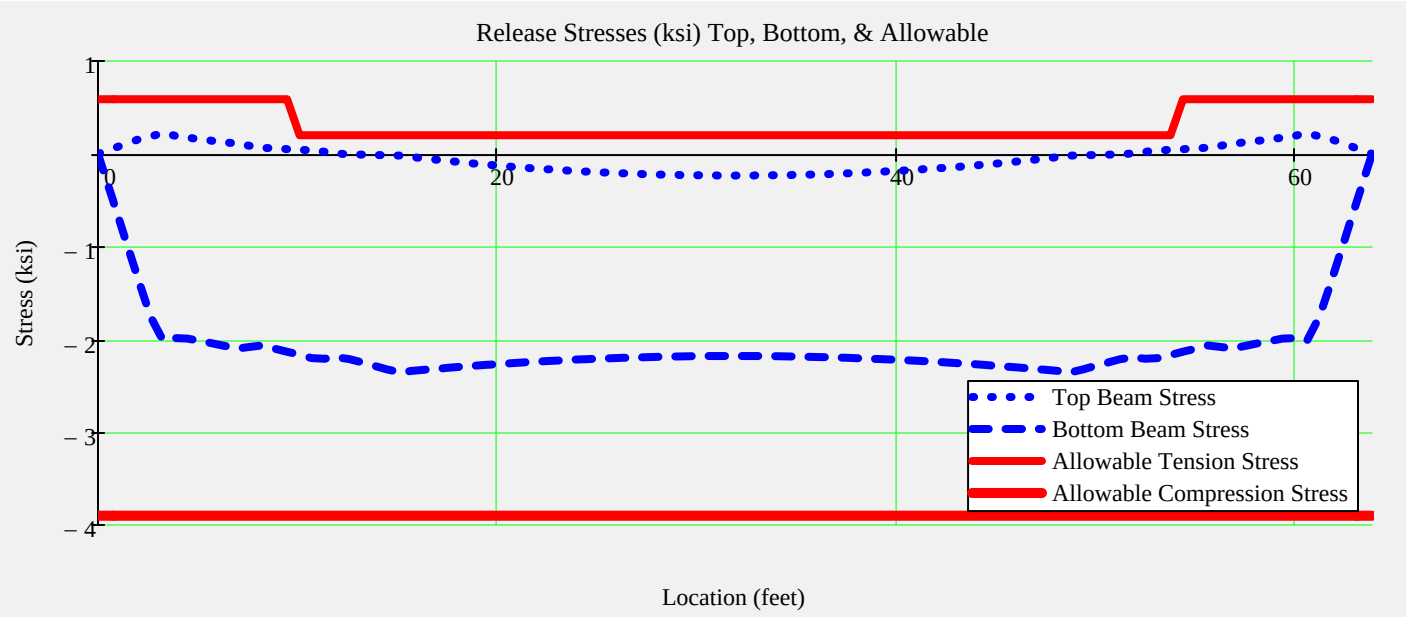
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.64$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.60$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.74$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.35$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.32$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.25$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.24	0.22	0.59
"Compression @ Release"	15.09	–2.35	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	31.92	–1.35	–3.83
"CompressionIb @ ServiceI"	32.54	–1.62	–5.10
"Compression @ FatigueI"	30.67	–0.83	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

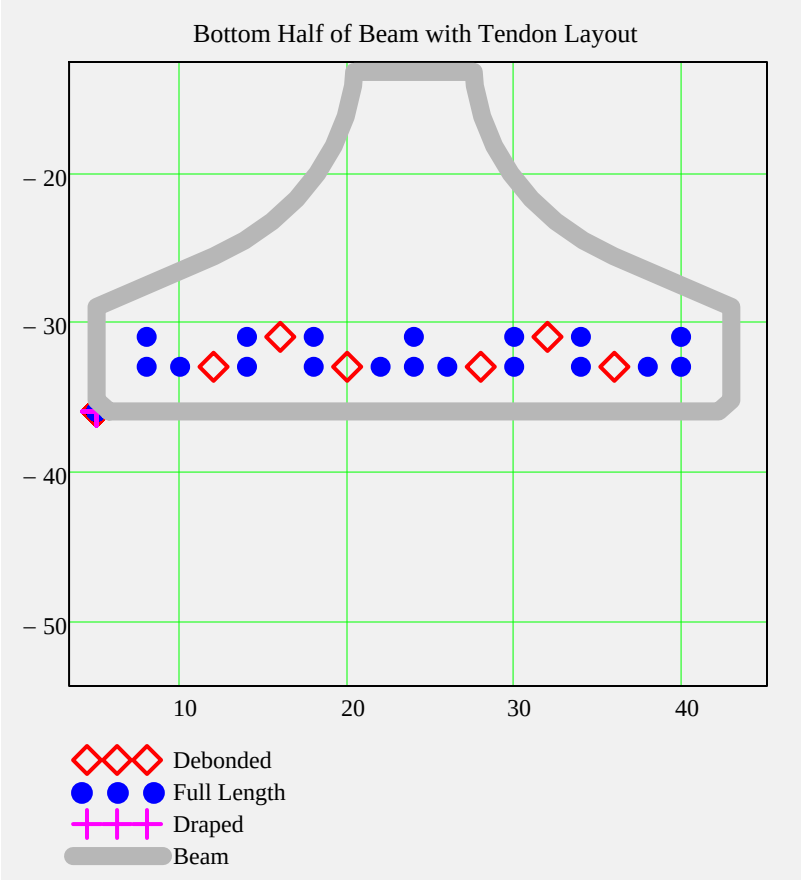
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 24$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -19 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -9.58 \cdot \%$

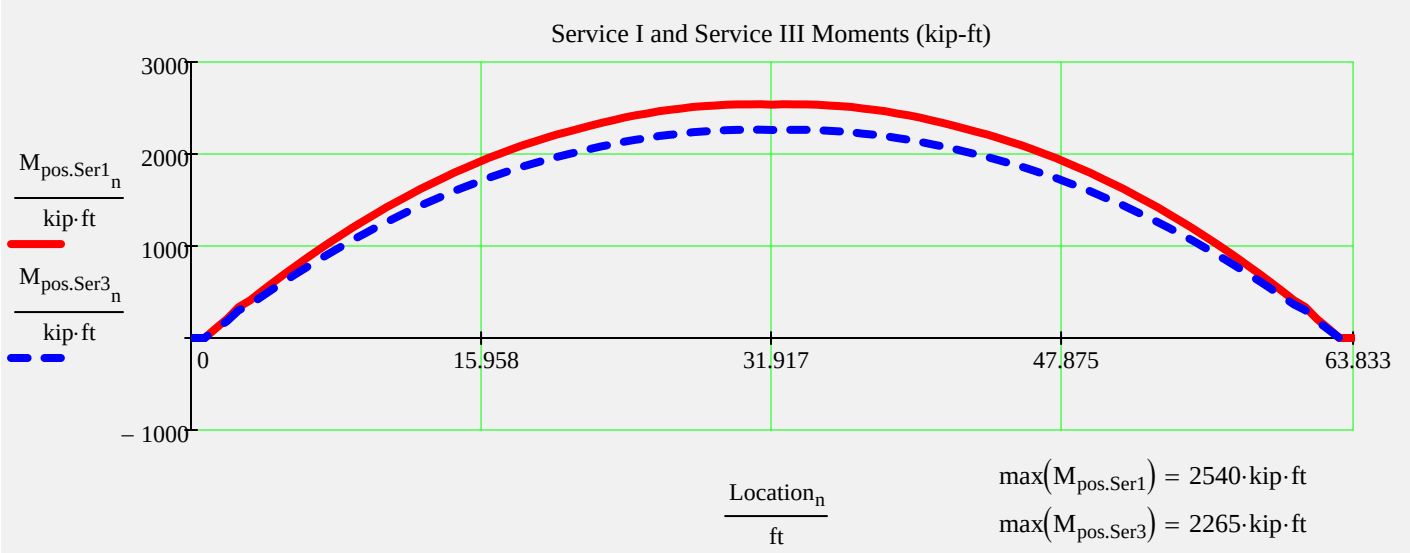
$f_{pe} = 183 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 90.42 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 2540 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2265 \cdot kip \cdot ft$

Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.23	–2.18
"2"	–0.29	–1.91
"4"	–0.25	–1.94
"6"	–1.32	–1.07
"8"	–1.62	0.01

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1095	–1067
"@Final (about composite centroid)"	–990	–930

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	802	126639	–19.4
"Transformed Beam (initial)"	835.8	132231	–19.9
"Transformed Beam (final)"	832.1	131641	–19.9
"Composite Section"	1755.8	409081	–6.8

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	428
"Non-Composite DL (incl. beam wt.)"	998
"Composite Dead Load"	165
"Distributed Live Load"	1374

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

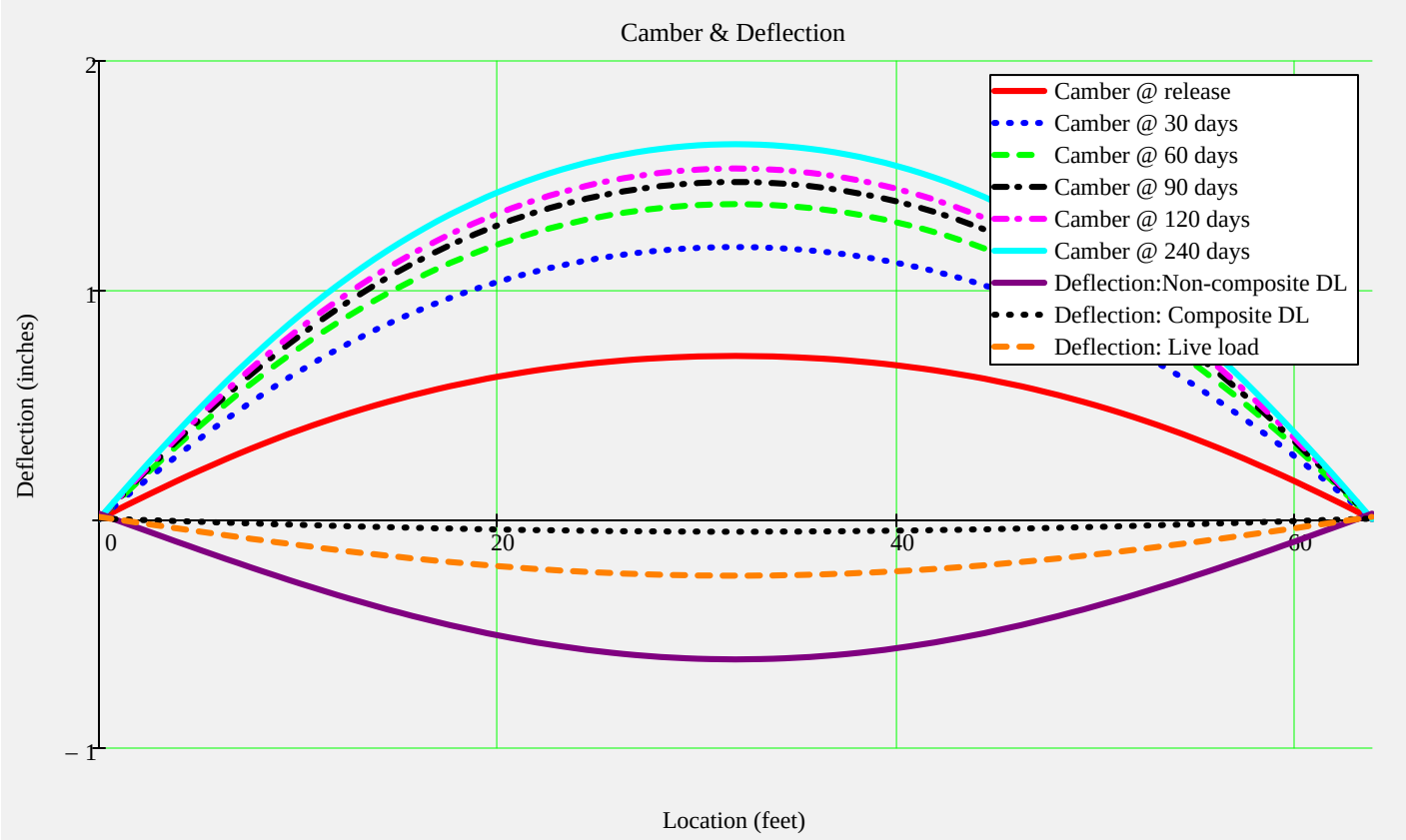
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 62.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.35	0.21	0.71
"30 Days"	–0.13	–0.66	0.35	1.19
"60 Days"	–0.17	–0.78	0.40	1.37
"90 Days"	–0.19	–0.85	0.43	1.47
"120 Days"	–0.21	–0.88	0.45	1.53
"240 Days"	–0.23	–0.95	0.48	1.64
"Non-comp DL"	–0.10	0.08	–0.15	–0.61
"Comp DL"	–0.00	0.01	–0.01	–0.06
"LL"	–0.01	0.06	–0.06	–0.25

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 0.86 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

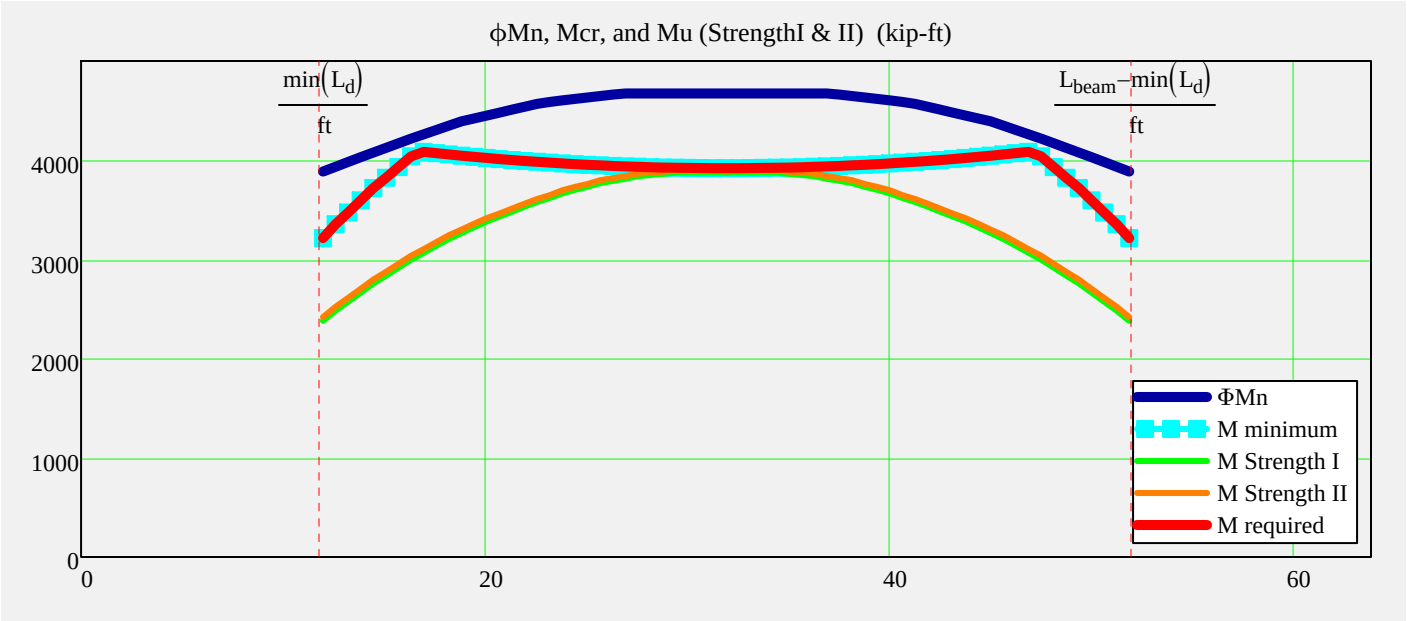
Values at midspan

$LimitStateForMoment_{51} = "Strength\ II"$ $\max(M_{Strength}) = 3898 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 3919 \cdot kip \cdot ft$ $M_{reqd_{51}} = 3919 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel - Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 4673 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.8\ \text{ft}$ $L_{beam} - \min(L_d) = 52\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.96$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

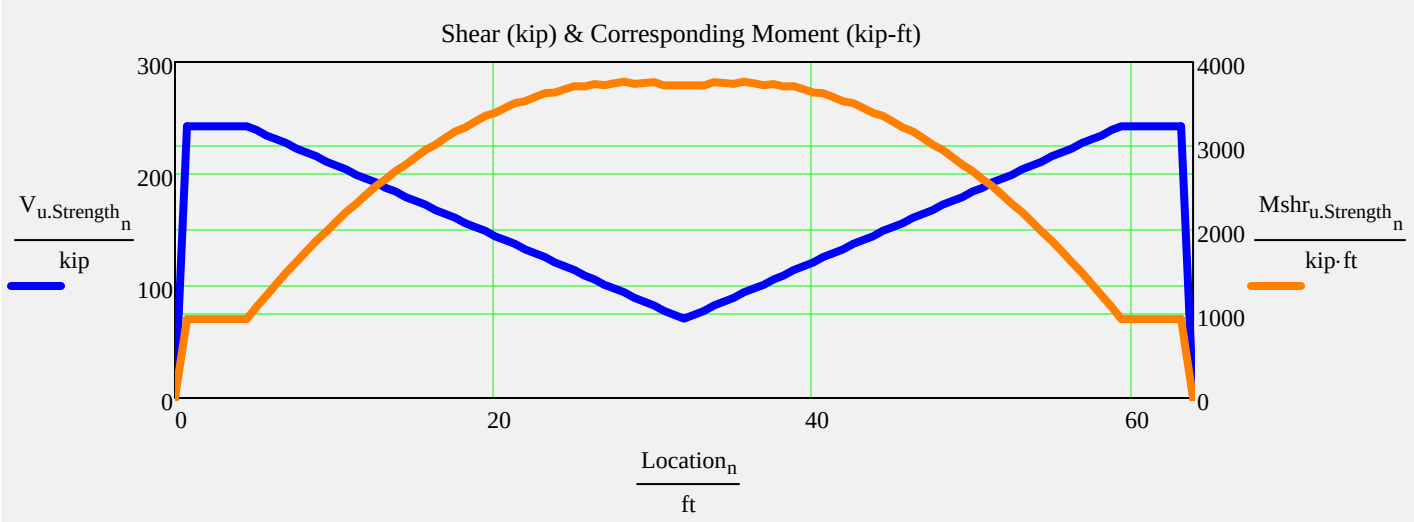
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

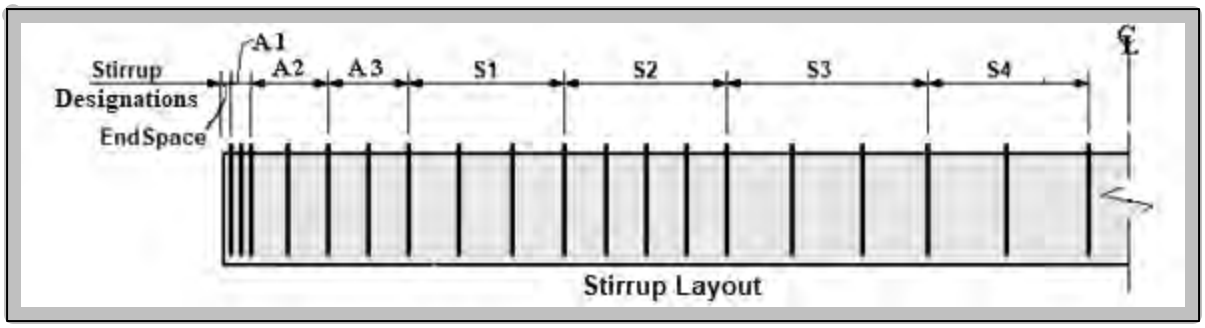
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 261 \\ 266 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 242.6 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 3766 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar # 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	26	16	2	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

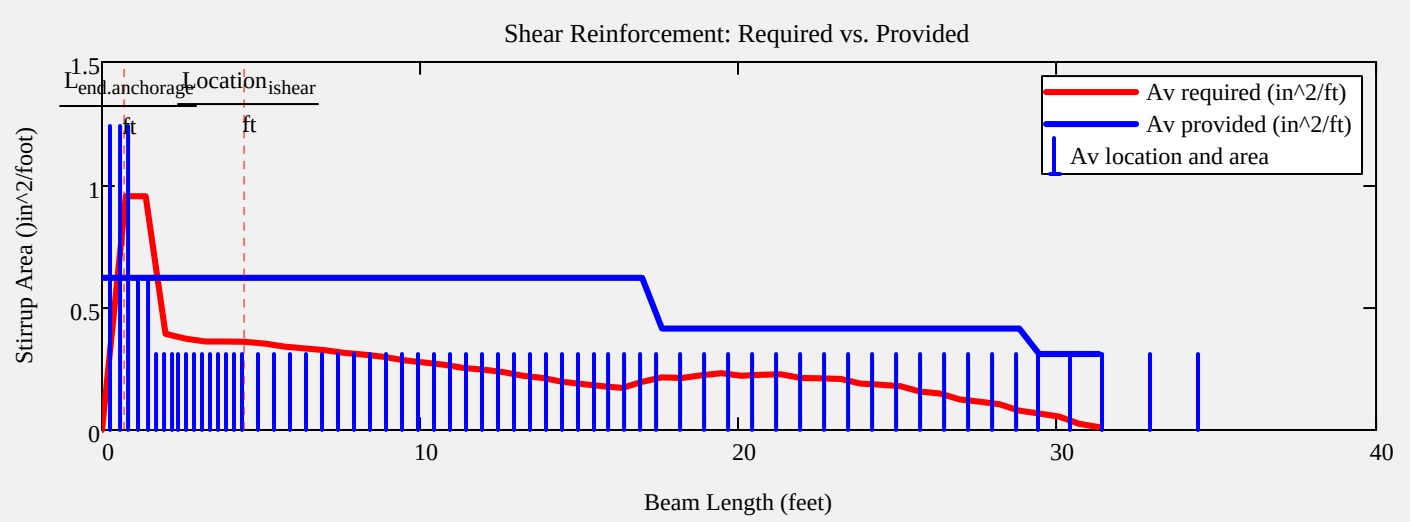
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.49\ ft$

Save Data File

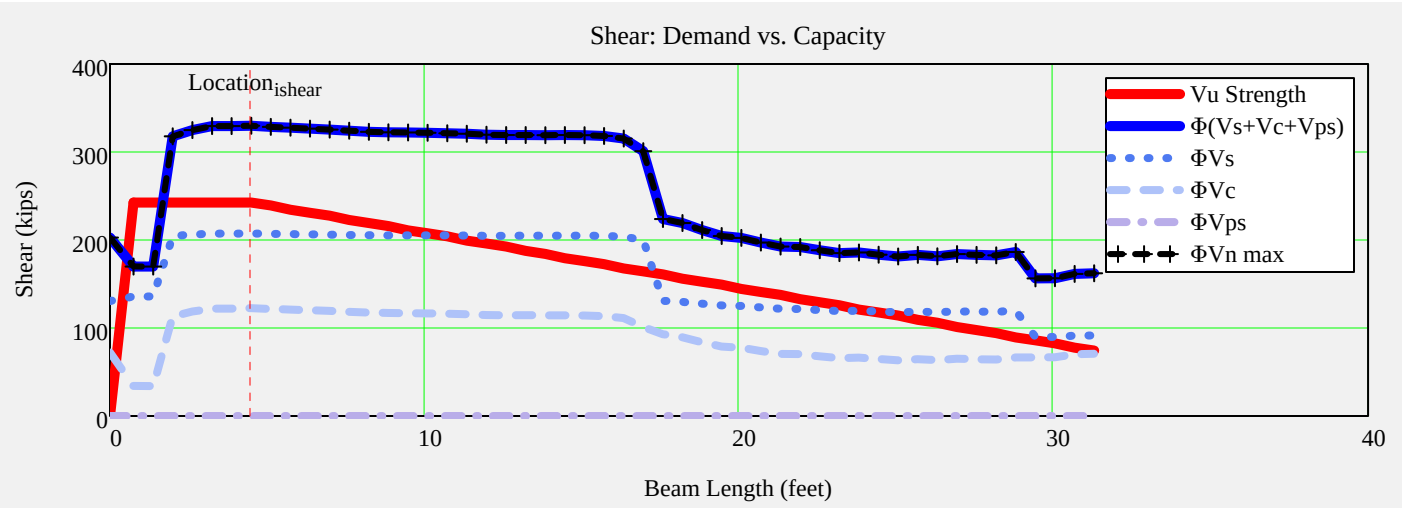
Use current input file

File Name FIB36-64ftSpan_NoSkew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 6

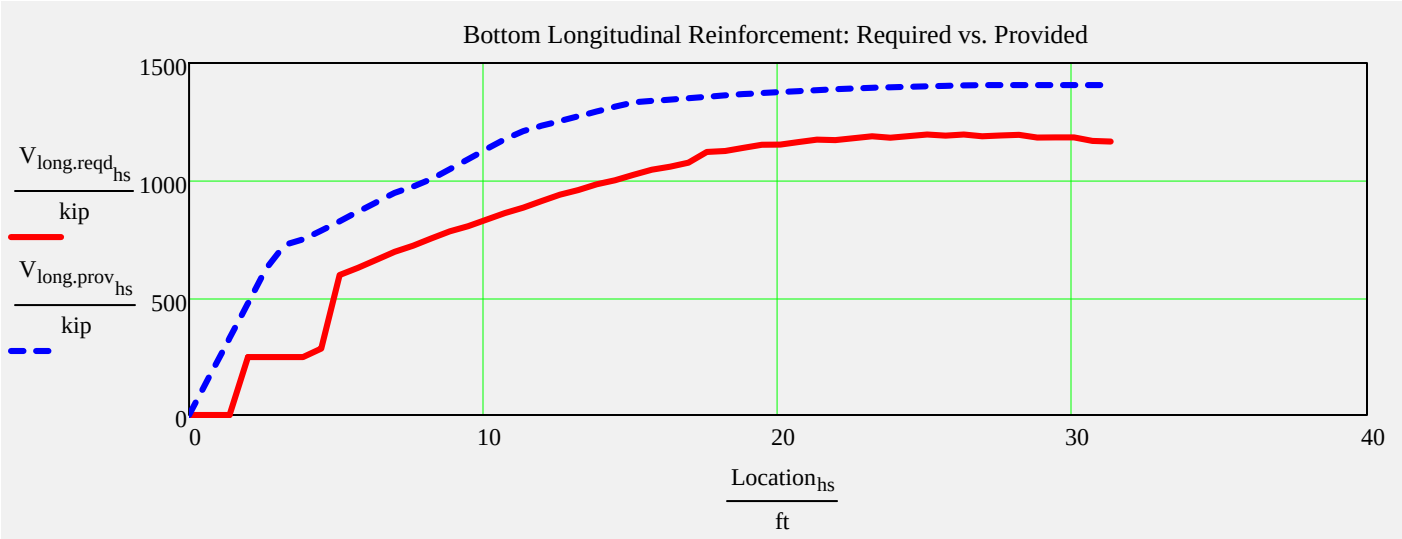
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 4.49 & 242.61 & 329.86 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.74$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

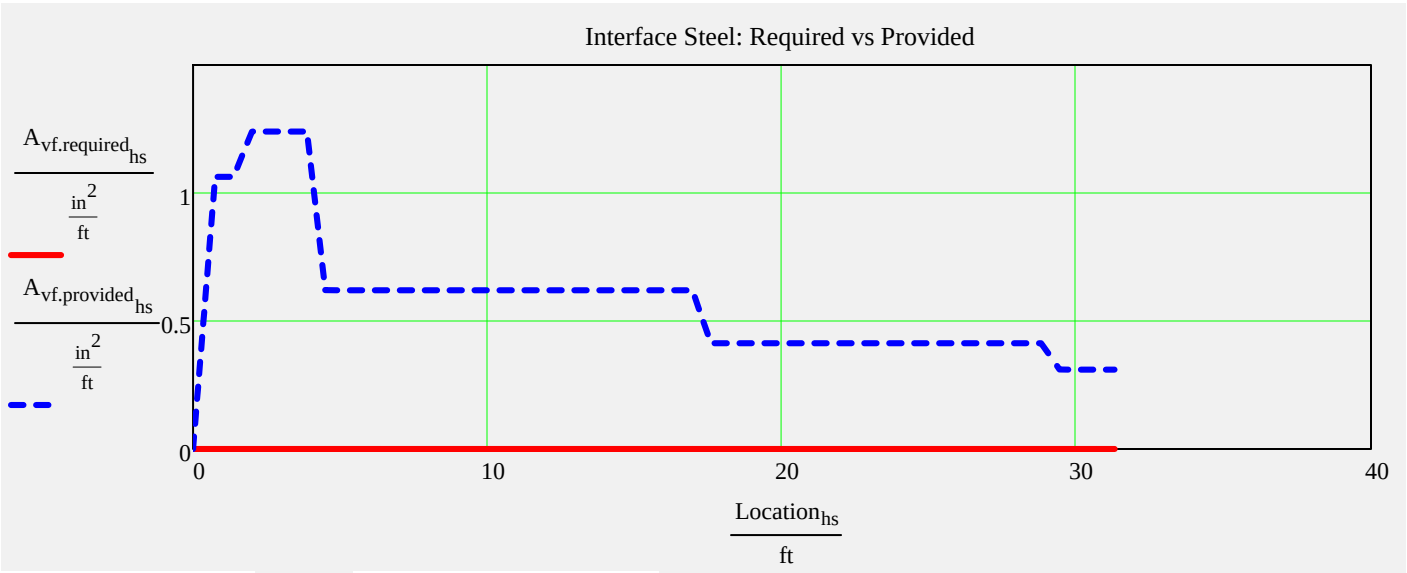


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 25.1 & 1195.3 & 1400.6 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.85$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.17 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

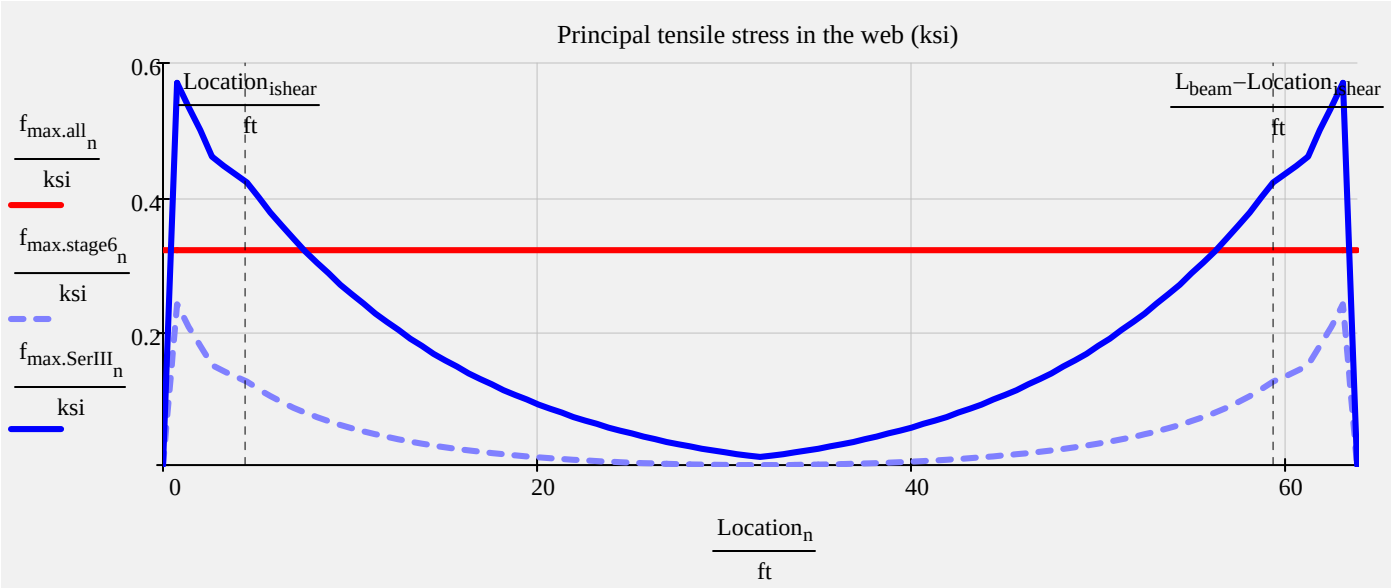
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.9 \cdot in$ $\max(DC_f_{max.web}) = 1.31$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 791 \cdot kip$ $D/C_{splitting.FDOT} = 0.55$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

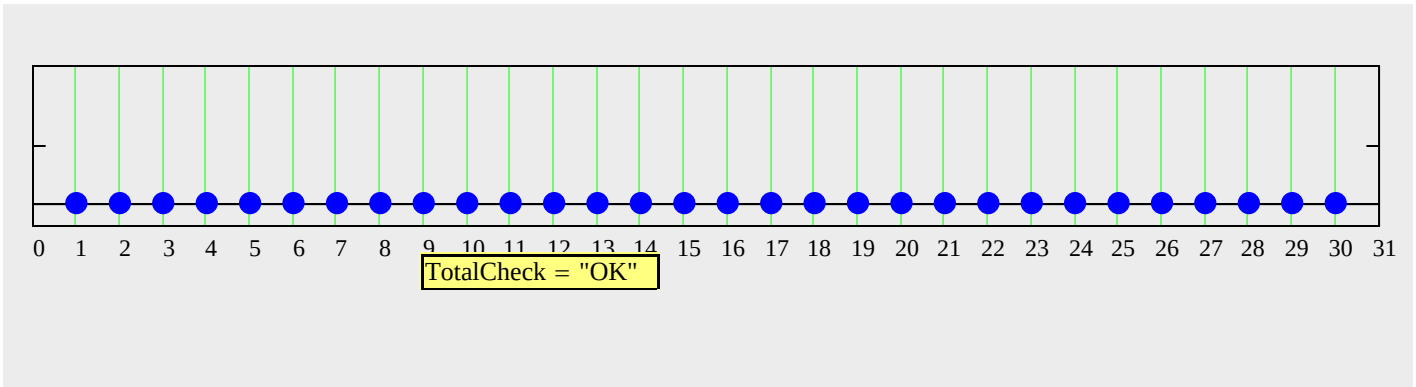
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.96	1.33	"N/A"	30.54	0.94	1.62	"N/A"	3.74	HL-93
"Strength I (Op)"	0.96	1.72	"N/A"	31.79	0.94	2.09	"N/A"	3.74	HL-93
"Service III (Inv)"	0.96	1.57	"N/A"	30.54	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.96	1.72	"N/A"	30.54	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.96	1.32	79.07	33.66	0.94	1.50	89.73	18.70	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.81$ $DC_{LongReinf.Permit} = 0.85$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	4673	"factored resistance (kip-ft)...."
"γDL"	1468	"factored dead load (kip-ft)...."
"γLL"	1860	"factored live load (kip-ft)....."
"RF"	1.72	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	330.5	"factored resistance (kip)....."
"γDL"	83	"factored dead load (kip)....."
"γLL"	118.2	"factored live load (kip)....."
"RF"	2.09	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 64 FEET (NO SKEW)

EASTBOUND BRIDGE

(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 64' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-64ftSpan_NoSkew_Exterior.dat
FIB36-64ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

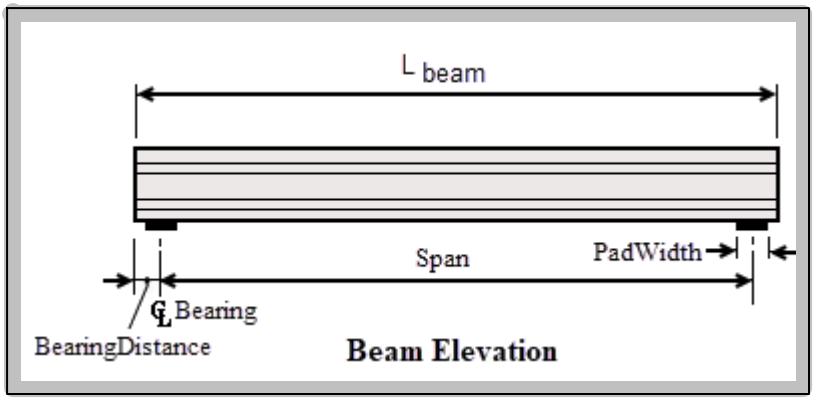
InputDataFile = "FIB36-64ftSpan_NoSkew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	CEB	*Date*	03 / 20 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-64ftSpan_NoSkew_Interior.dat"

Beam Type	FIB36 (FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FIB36.bmp"
L_{beam}	63.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	11.6667	ft	*Measured from beam centerline to centerline.*
Overhang	3.8333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	4		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

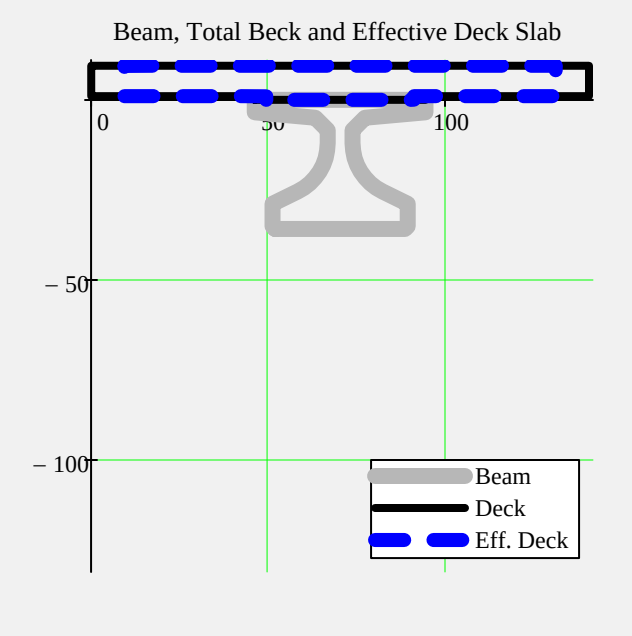
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8.5 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $140 \cdot in$

$b_e = 140 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	$\frac{kip}{ft}$
Additional Uniform Composite DL	0	$\frac{kip}{ft}$

$w_{deck} = 1.36 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.15 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.175 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.22 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 63.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

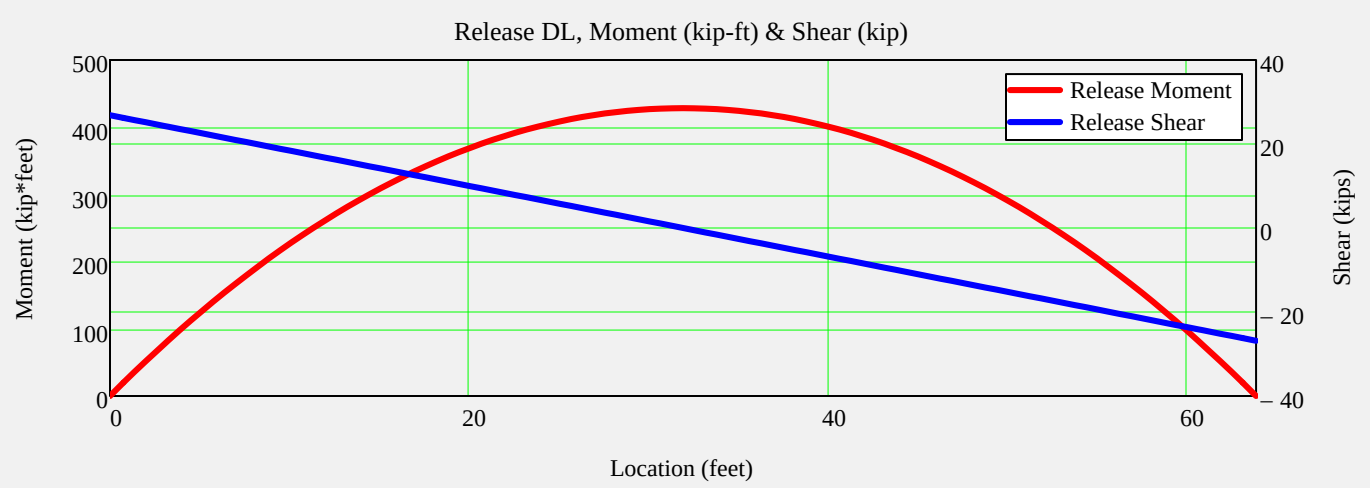
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

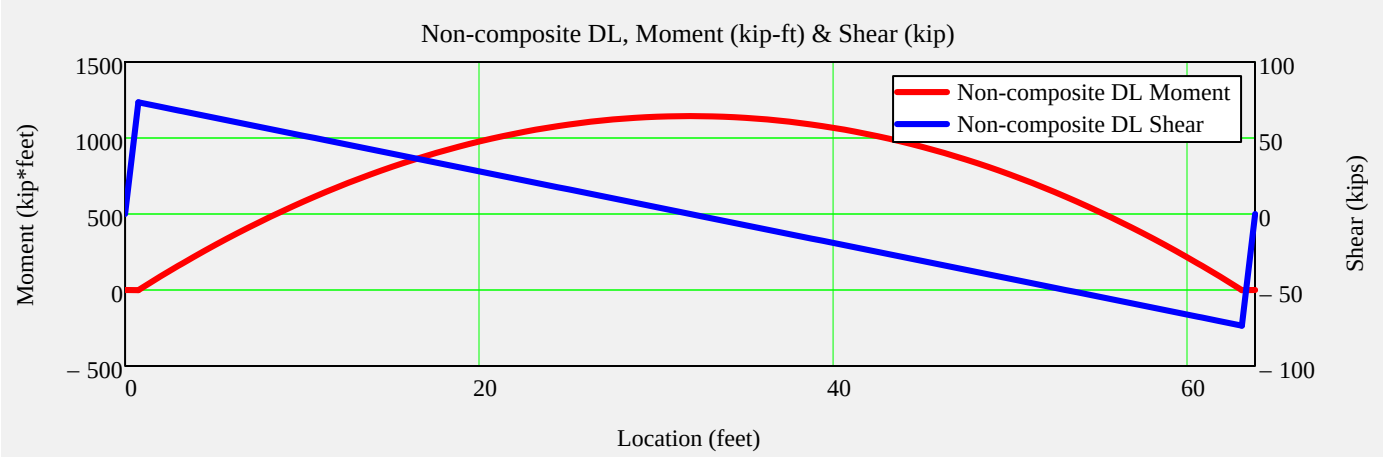
Release Dead Load Moments and Shears

$L_{span} = 62.33\ ft$



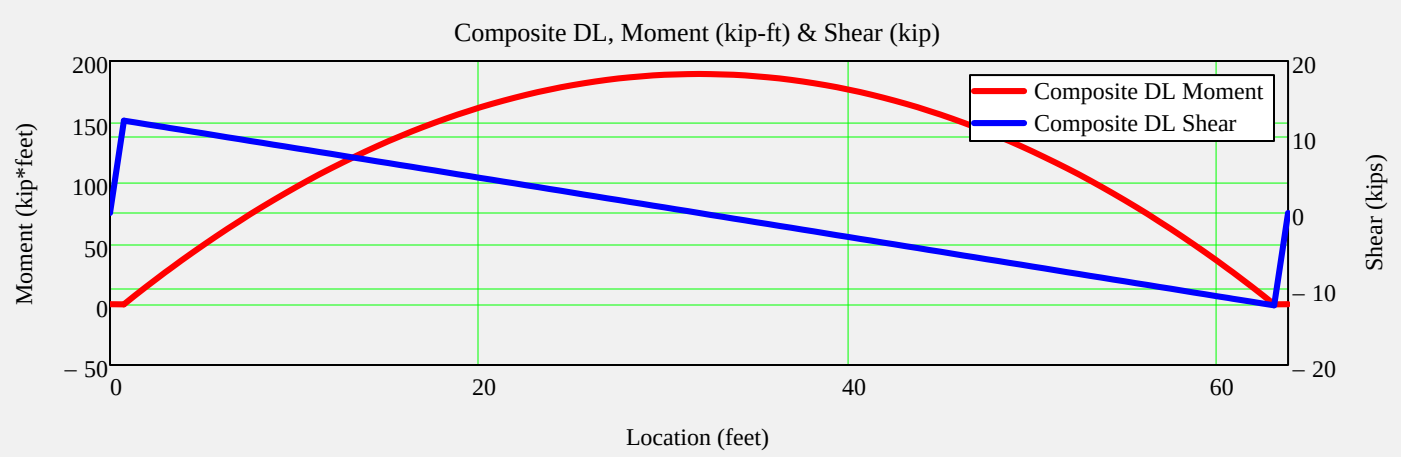
$\max(V_{release}) = 26.8 \cdot kip$ $\max(M_{release}) = 428.4 \cdot kip \cdot ft$ $\min(V_{release}) = -26.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 73.5 \cdot kip$ $\max(M_{dl.non.comp}) = 1144.0 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -73.5 \cdot kip$

Composite Dead Load Moments and Shear



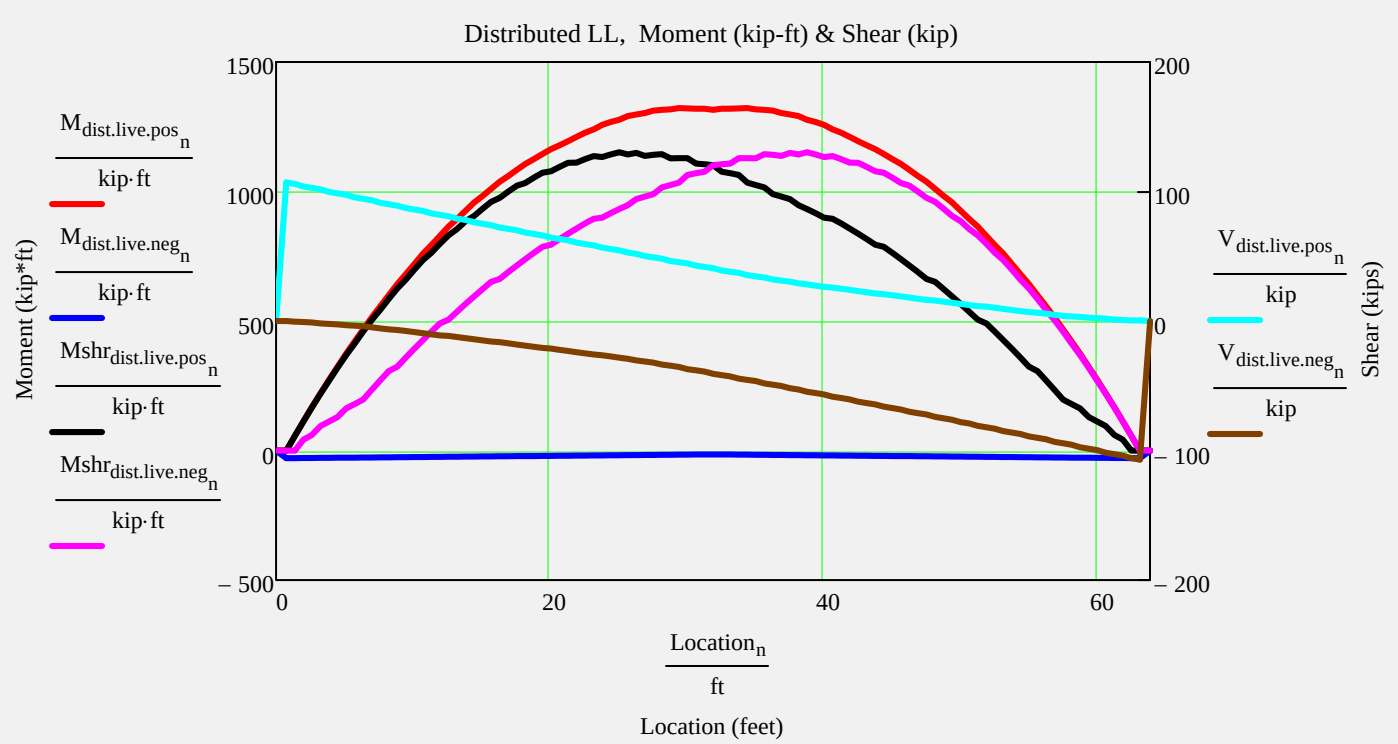
$\max(V_{dl.comp}) = 12.2 \cdot kip$ $\max(M_{dl.comp}) = 189.3 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -12.2 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 62.33\ ft$ BeamSpacing $= 11.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.92$ $g_{mom.fatigue} = 0.54$ $g_{shear} = 1.06$



$\max(V_{dist.live.pos}) = 107.0 \cdot kip$

$\max(M_{dist.live.pos}) = 1321.8 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -107.0 \cdot kip$

$Reaction_{LL} = 109.3 \cdot kip$

$\min(M_{dist.live.neg}) = -29.5 \cdot kip \cdot ft$

$Reaction_{DL} = 87.7 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1152 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 62.1 \cdot kip$ $Reaction_{lane} = 20.4 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 87.6 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-64ftSpan_NoSkew_Interior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.24	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		0 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity	75	%	*% relative humidity (75% typical)*
Time: jacking to transfer	1.5	days	*Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

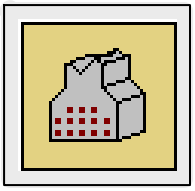
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

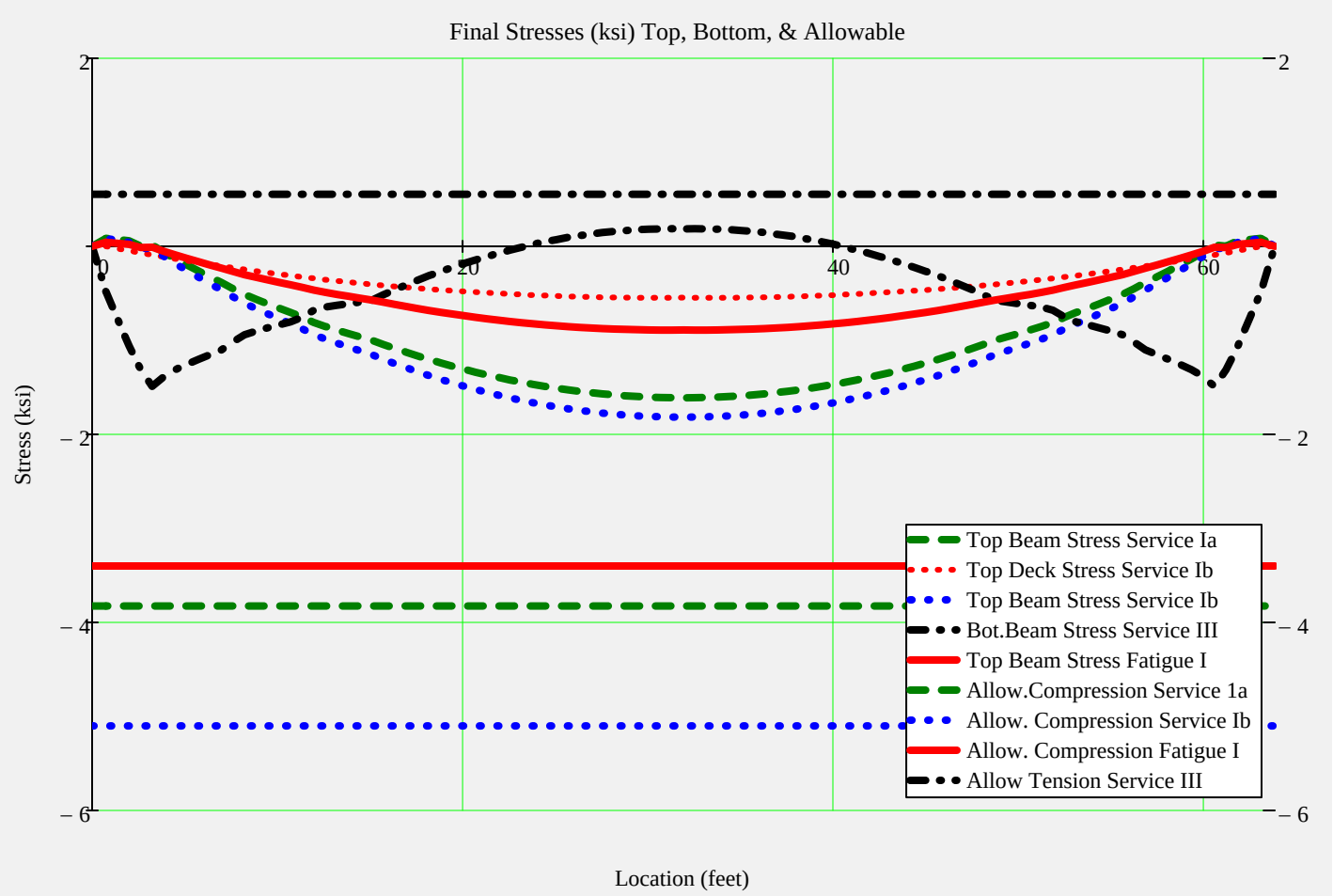
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

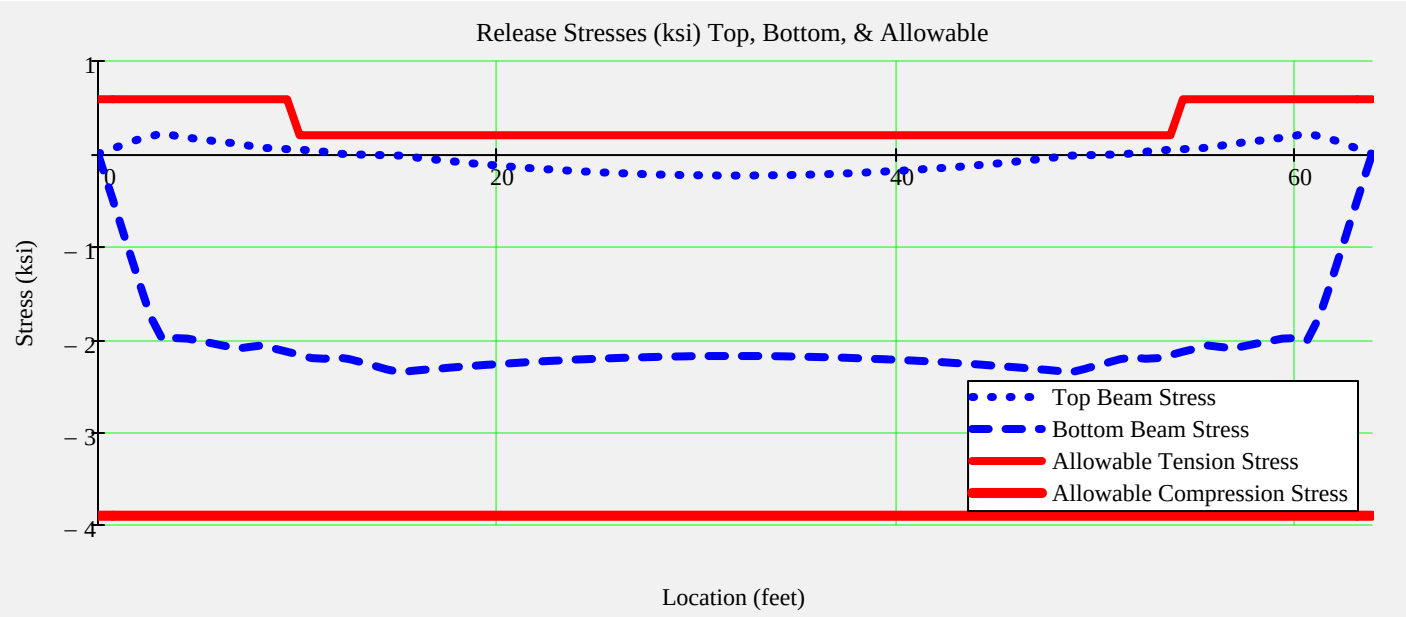
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.64$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.60$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.82$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.42$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.36$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.26$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.24	0.22	0.59
"Compression @ Release"	15.09	–2.35	–3.90
"Tension @ ServiceIII"	32.54	0.19	0.55
"CompressionIa @ ServiceI"	31.92	–1.61	–3.83
"CompressionIb @ ServiceI"	31.92	–1.82	–5.10
"Compression @ FatigueI"	32.54	–0.89	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

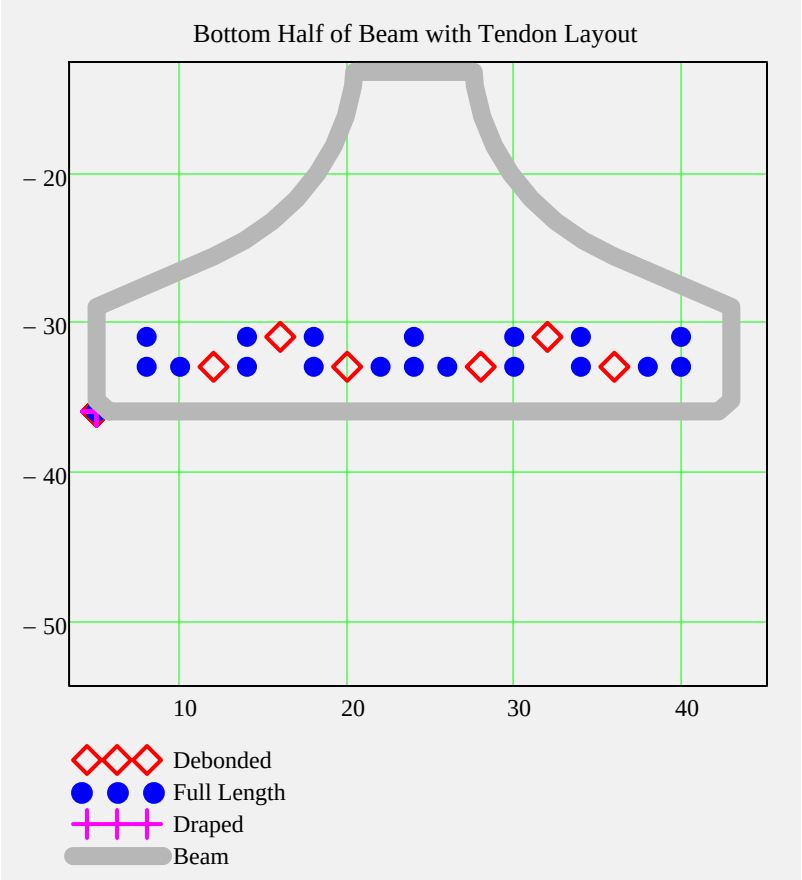
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

$\#\text{Strands} = 24$

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -19 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -9.58 \cdot \%$

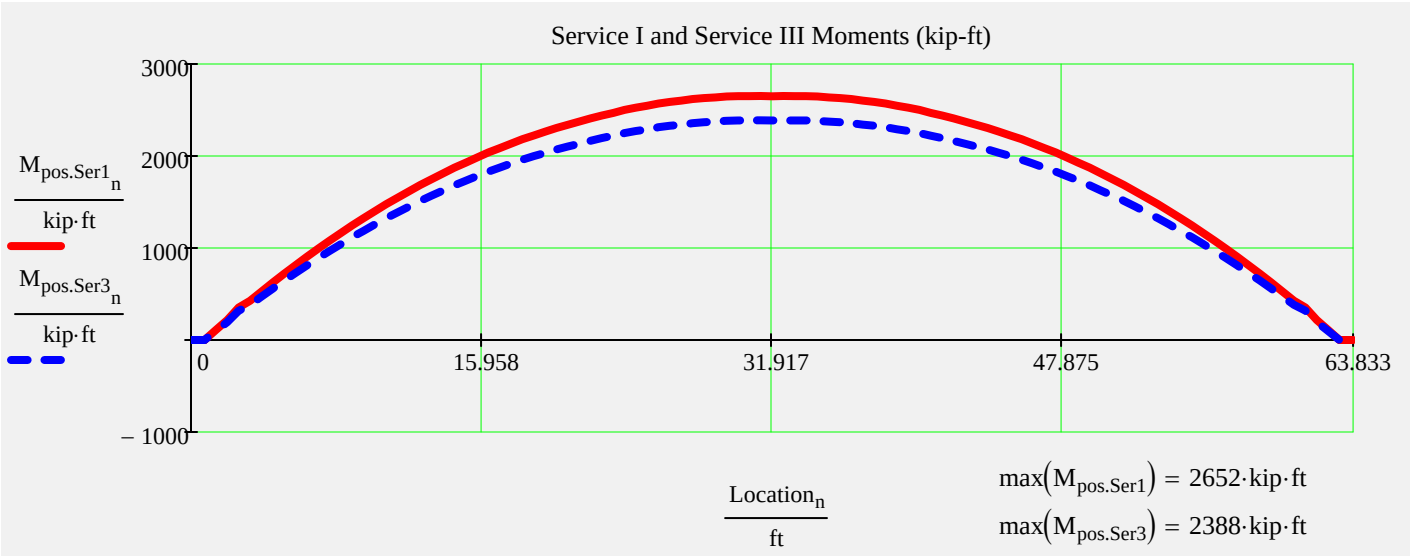
$f_{pe} = 183 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 90.42 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 2652 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2388 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses =$

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.23	–2.18
"2"	–0.29	–1.91
"4"	–0.25	–1.94
"6"	–1.58	–0.86
"8"	–1.82	0.19

$PrestressForce =$

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1095	–1067
"@Final (about composite centroid)"	–990	–930

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	802	126639	–19.4
"Transformed Beam (initial)"	835.8	132231	–19.9
"Transformed Beam (final)"	832.1	131641	–19.9
"Composite Section"	1938.3	434011	–5.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	428
"Non-Composite DL (incl. beam wt.)"	1144
"Composite Dead Load"	189
"Distributed Live Load"	1315

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

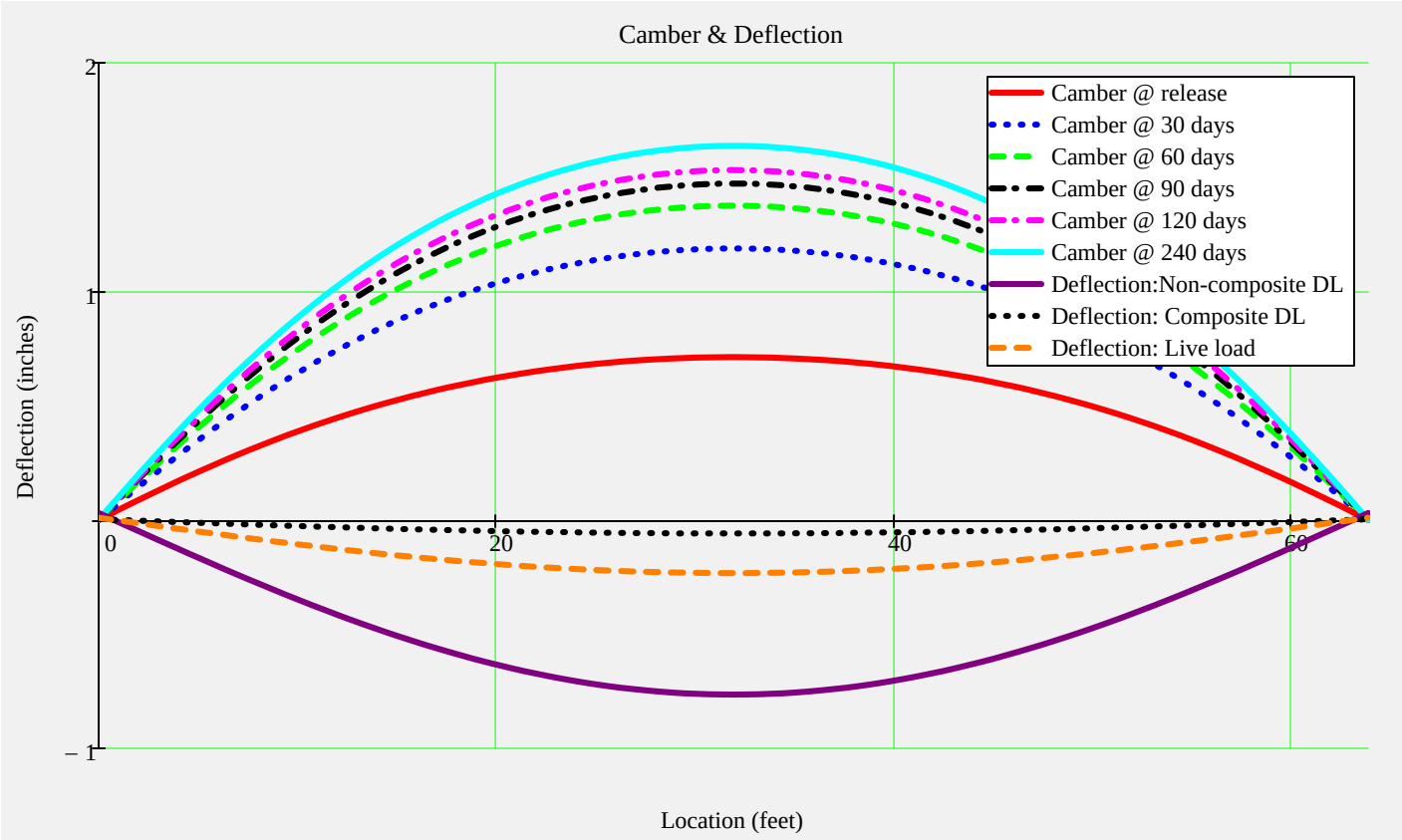
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 62.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.35	0.21	0.71
"30 Days"	–0.13	–0.66	0.35	1.19
"60 Days"	–0.17	–0.78	0.40	1.37
"90 Days"	–0.19	–0.85	0.43	1.47
"120 Days"	–0.21	–0.88	0.45	1.53
"240 Days"	–0.23	–0.95	0.48	1.64
"Non-comp DL"	–0.13	0.11	–0.19	–0.76
"Comp DL"	–0.00	0.02	–0.01	–0.06
"LL"	–0.01	0.06	–0.06	–0.23

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 0.71 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

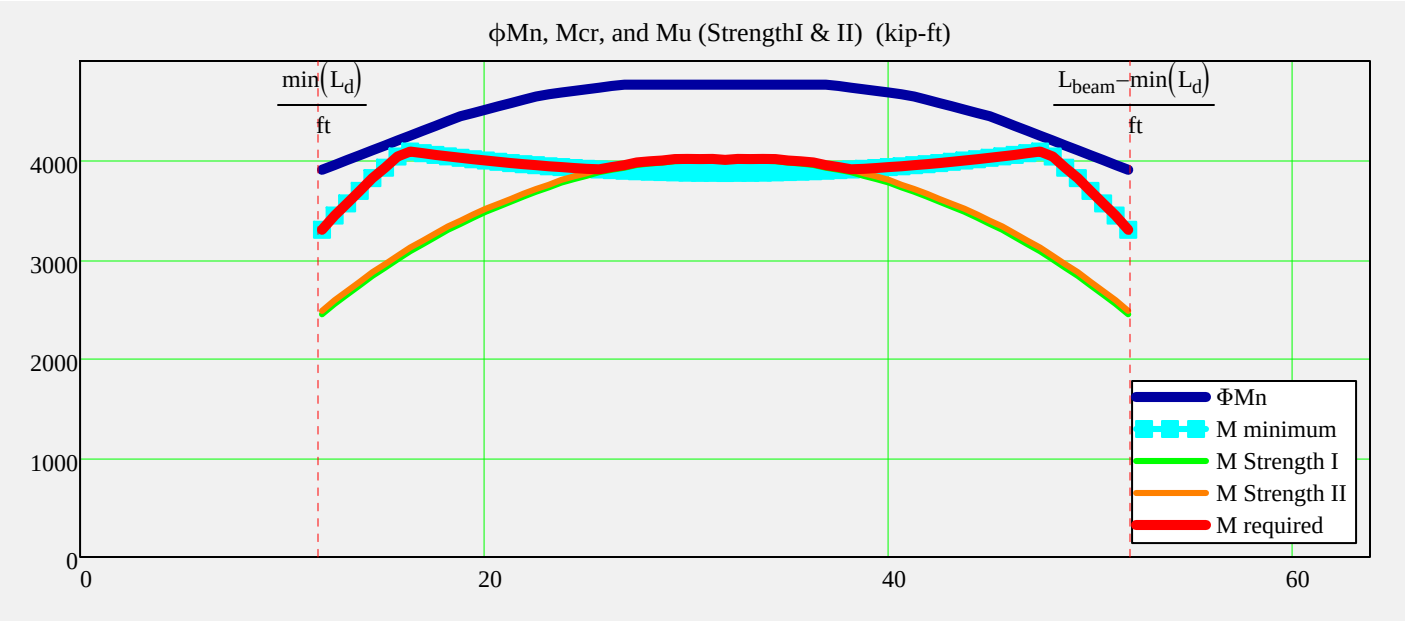
Values at midspan

$LimitStateForMoment_{51}$ = "Strength II" $\max(M_{Strength}) = 4013 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51}$ = "Yes" $M_{minimum_{51}} = 3872 \cdot kip \cdot ft$ $M_{reqd_{51}} = 4004 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 4761 \cdot kip \cdot ft$

$FailureMode_{51}$ = "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 11.8\ \text{ft}$ $L_{beam} - \min(L_d) = 52\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.96$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

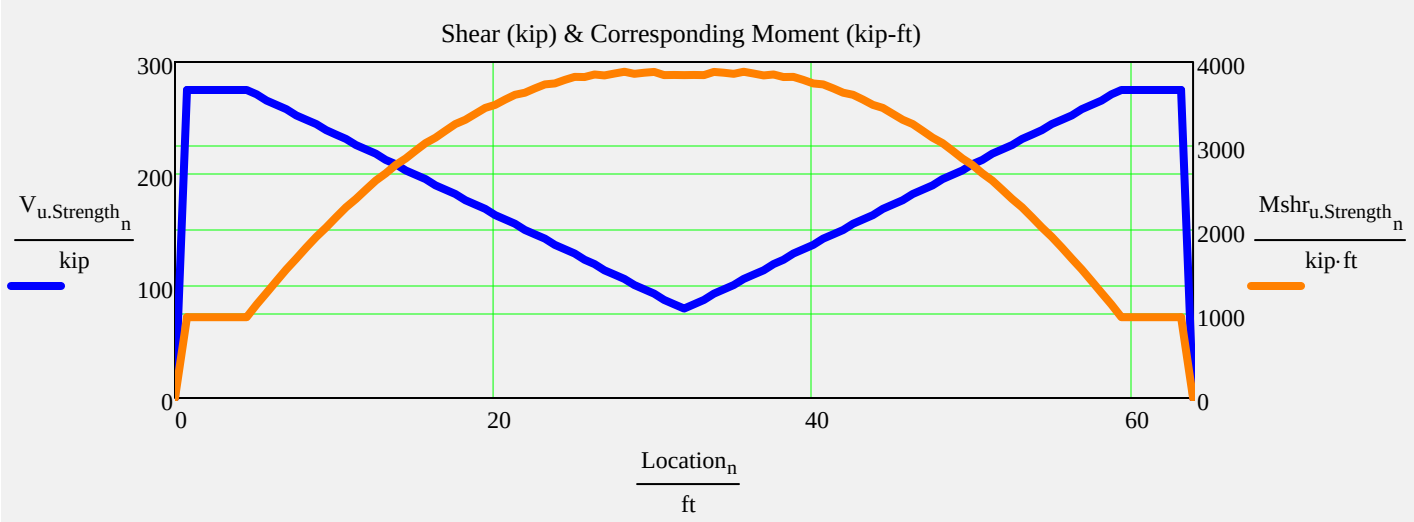
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

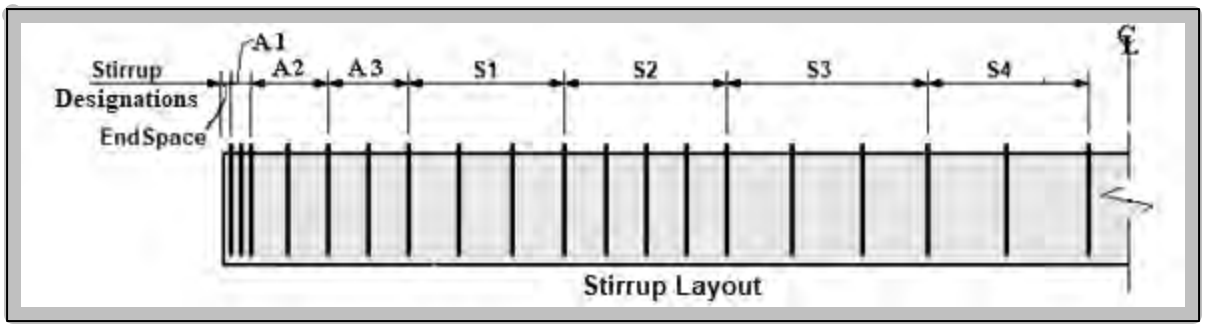
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 296 \\ 302 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 275.0 \cdot kip$ ControllingShearLimitState = "Strength II" $\max(Mshr_{u.Strength}) = 3883 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar # 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	26	16	2	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

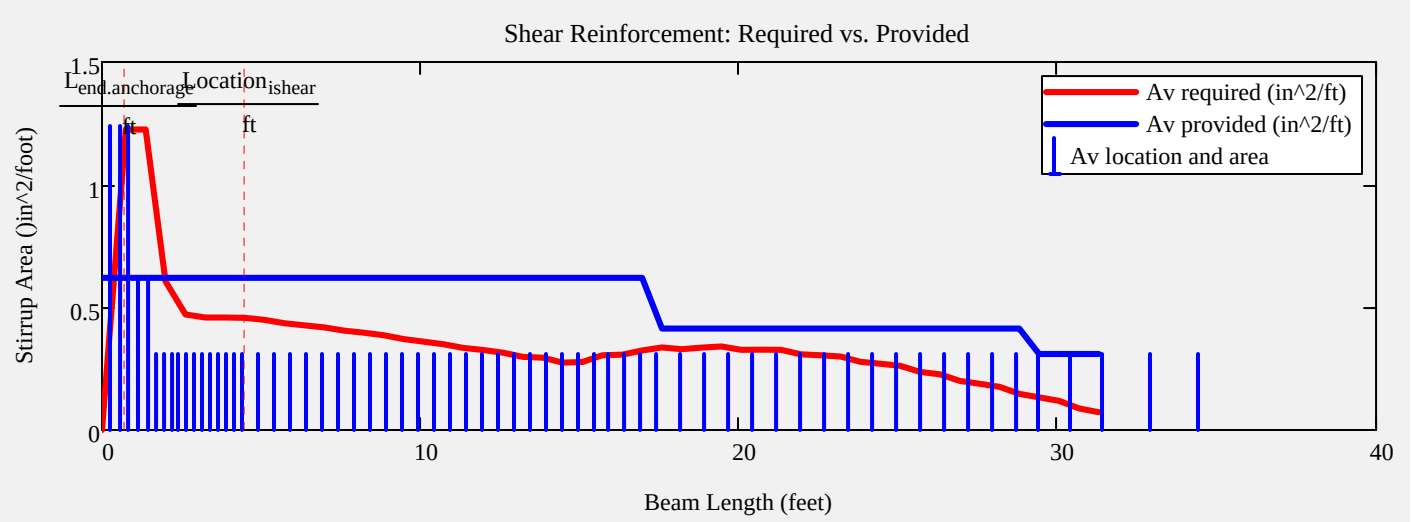
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.49\ ft$

Save Data File

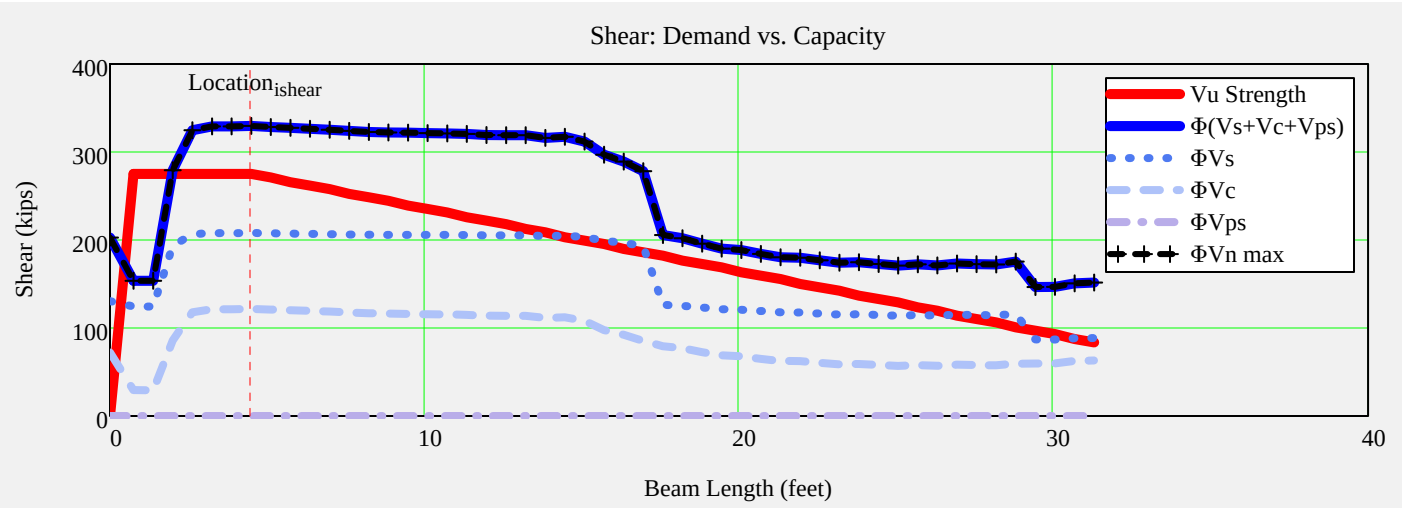
Use current input file

File Name FIB36-64ftSpan_NoSkew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 6

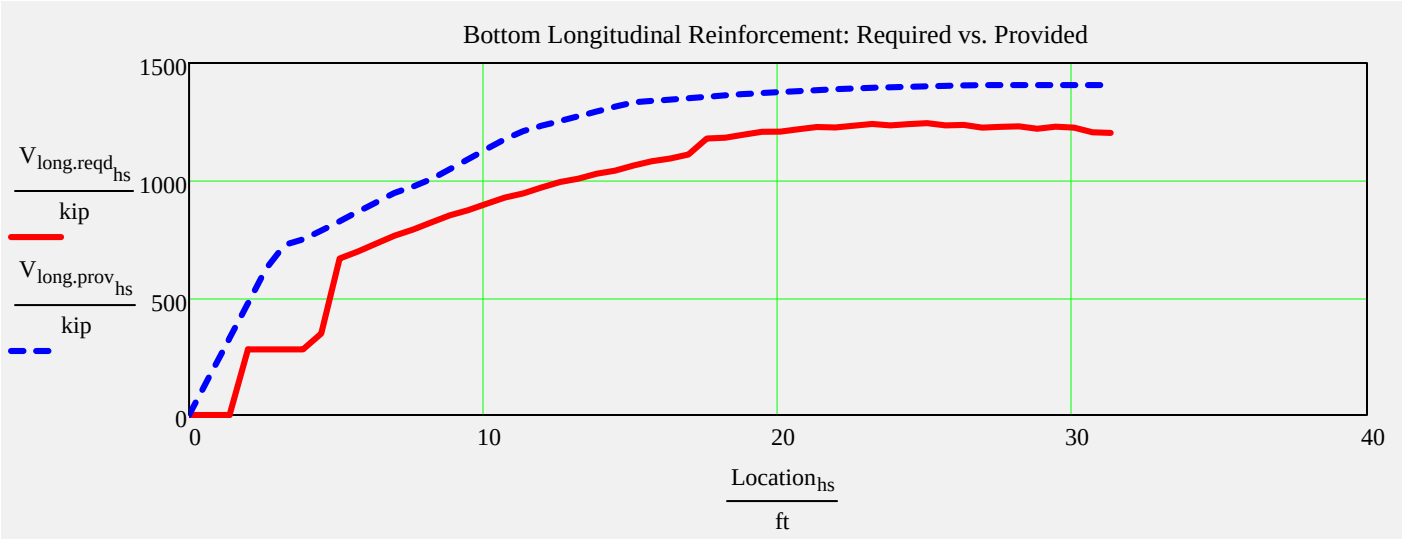
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 19.45 & 168.85 & 190.26 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.89$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

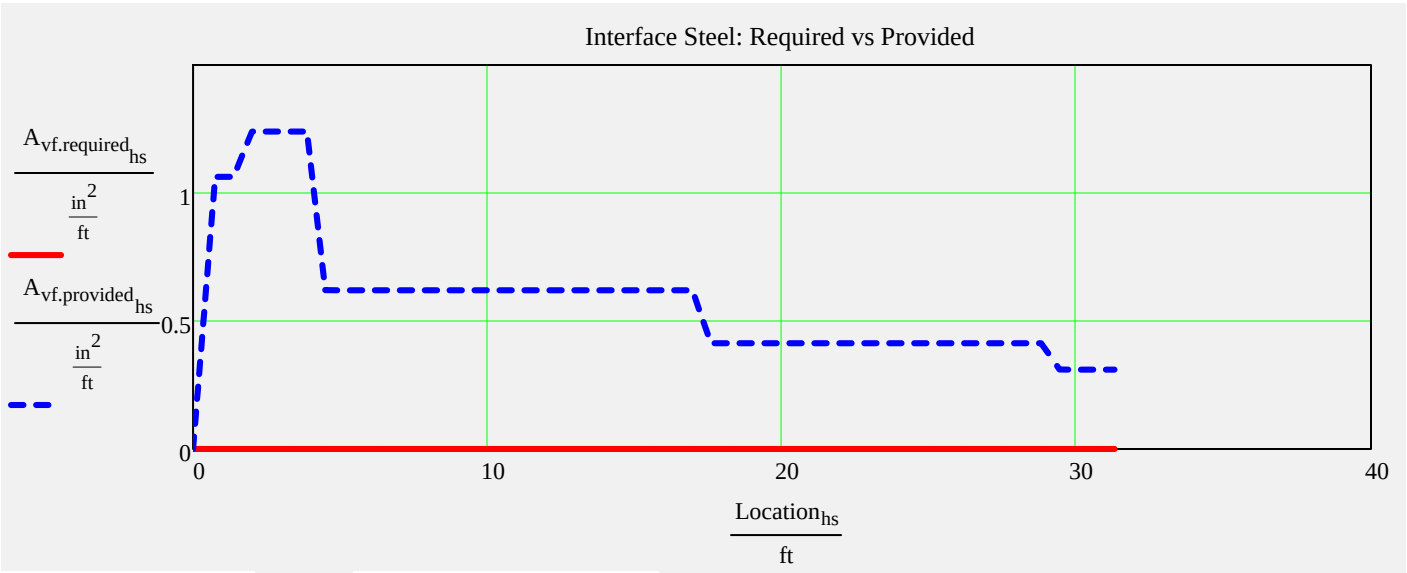


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 23.2 & 1240.1 & 1394.6 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.89$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.17 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

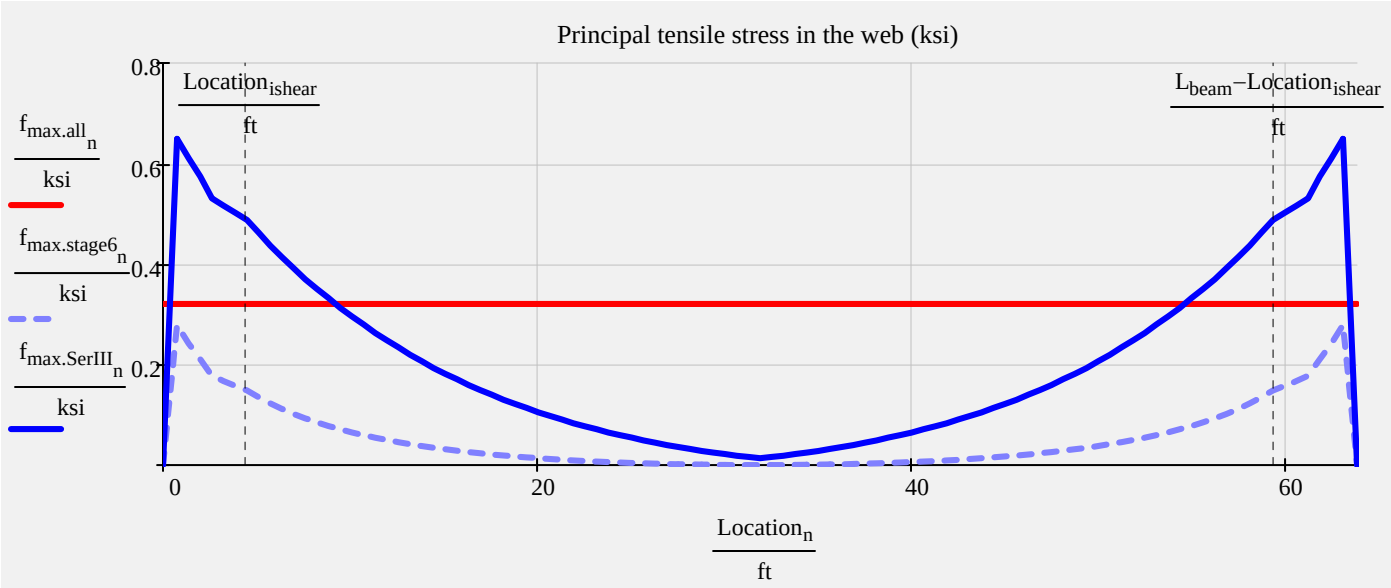
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.9 \cdot in$ $\max(DC_f_{max.web}) = 1.52$ $Check_f_{max.web} = "No\ Good!"$

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 791 \cdot kip$ $D/C_{splitting.FDOT} = 0.55$

$CheckD/C_{splitting} = "OK"$

Confinement Bars:

$TotalNoConfineBars = 20$

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

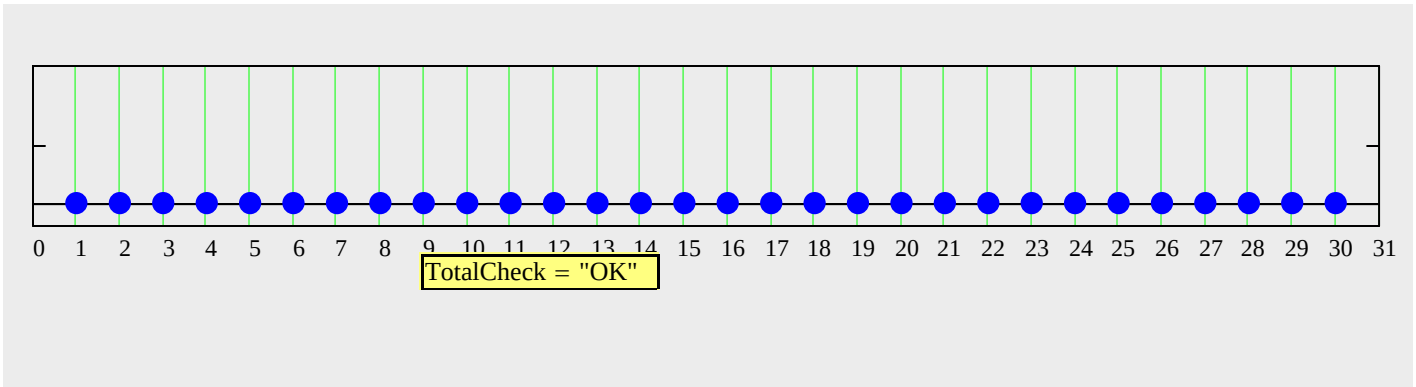
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.92	1.33	"N/A"	31.79	1.06	1.36	"N/A"	3.74	HL-93
"Strength I (Op)"	0.92	1.73	"N/A"	30.54	1.06	1.77	"N/A"	3.74	HL-93
"Service III (Inv)"	0.92	1.41	"N/A"	31.79	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.92	1.57	"N/A"	31.79	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.92	1.32	79.24	29.30	1.06	1.17	70.23	18.70	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.84$ $DC_{LongReinf.Permit} = 0.89$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	4761	"factored resistance (kip-ft)...."
"γDL"	1687	"factored dead load (kip-ft)...."
"γLL"	1781	"factored live load (kip-ft)....."
"RF"	1.73	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	330.3	"factored resistance (kip)....."
"γDL"	95.4	"factored dead load (kip)....."
"γLL"	133	"factored live load (kip)....."
"RF"	1.77	"HL93 operating rating factor"

FLORIDA-I 36 BEAM EXTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (NO SKEW)

WESTBOUND BRIDGE

(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\2. Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior_DCI.dat
FIB36-76ftSpan_15Skew_Interior_DCI.dat
FIB36-76ftSpan_NoSkew_Exterior_Tiger.dat
FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat
FIB36-76ftSpan_NoSkew_Interior_Tiger.dat
FIB36-76ftSpan_NoSkew_Interior_Whidden.dat

Refresh List

Open File

Reset All Data

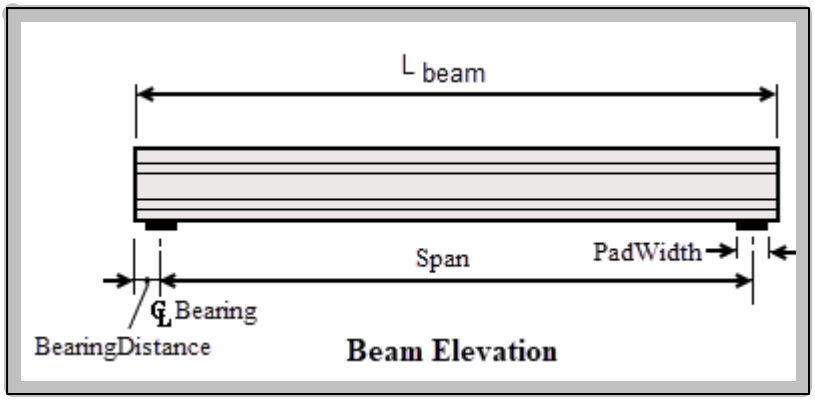
InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	WB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat"

Beam Type	FIB36 (FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FIB36.bmp"
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	10	ft	*Measured from beam centerline to centerline.*
Overhang	3.7083	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.375	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

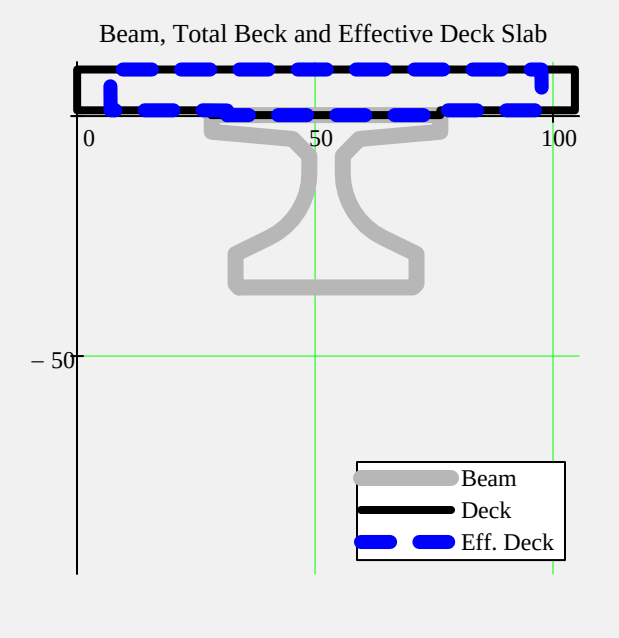
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8.5 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $120 \cdot in$

$b_e = 104.5 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0.03 kip/ft

$w_{deck} = 1.03 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.06 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

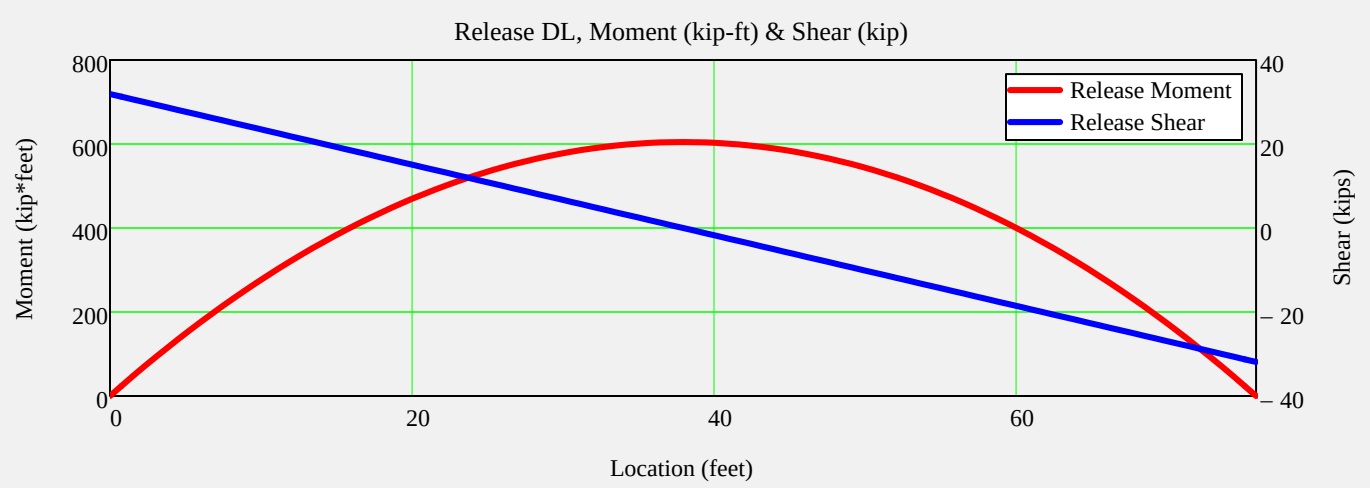
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

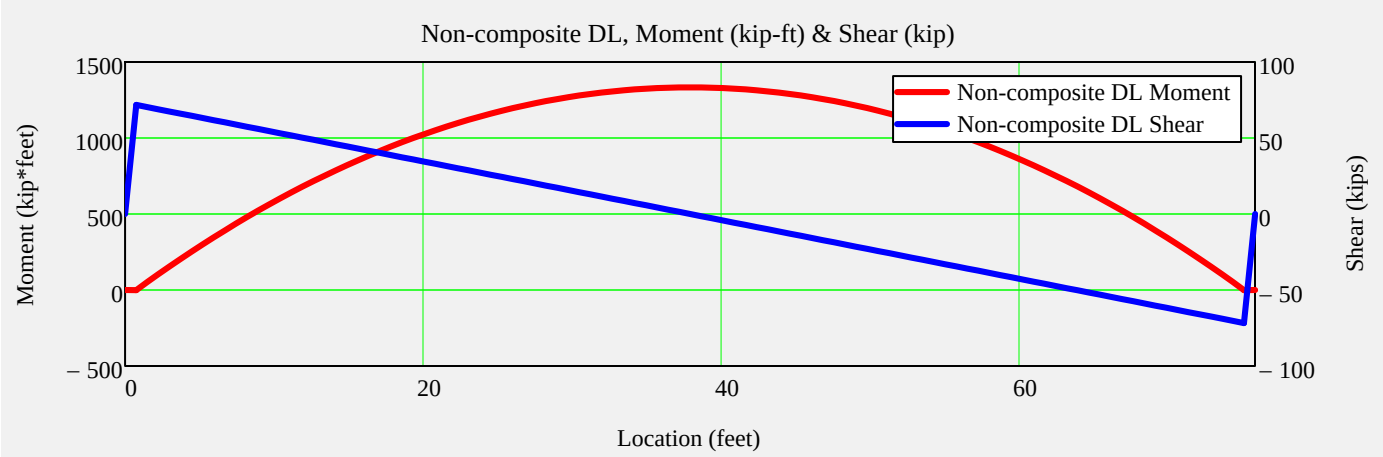
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



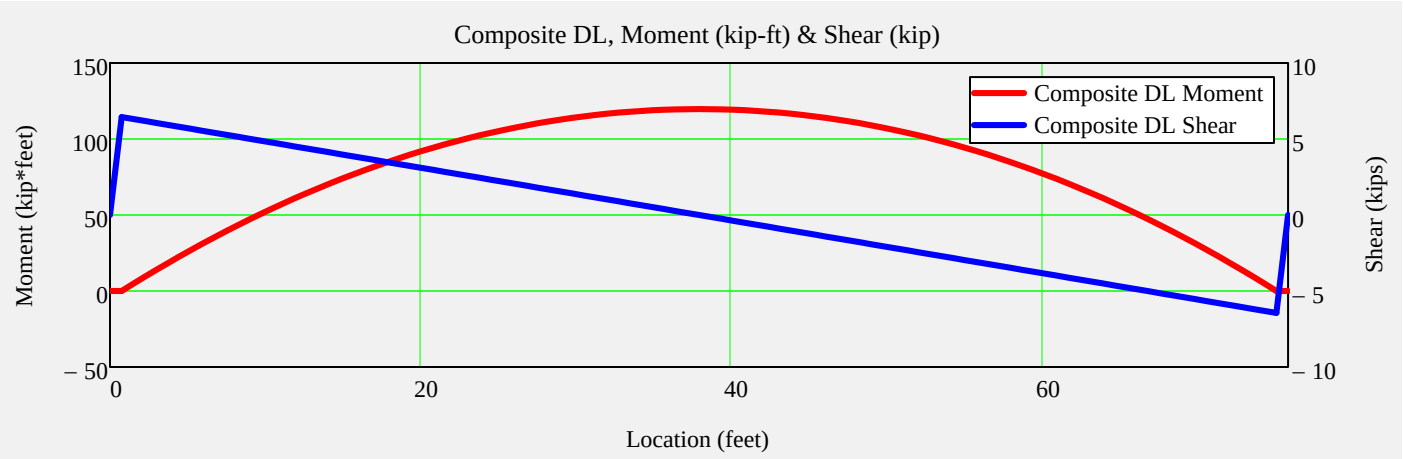
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 71.8 \cdot kip$ $\max(M_{dl.non.comp}) = 1333.0 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -71.8 \cdot kip$

Composite Dead Load Moments and Shear



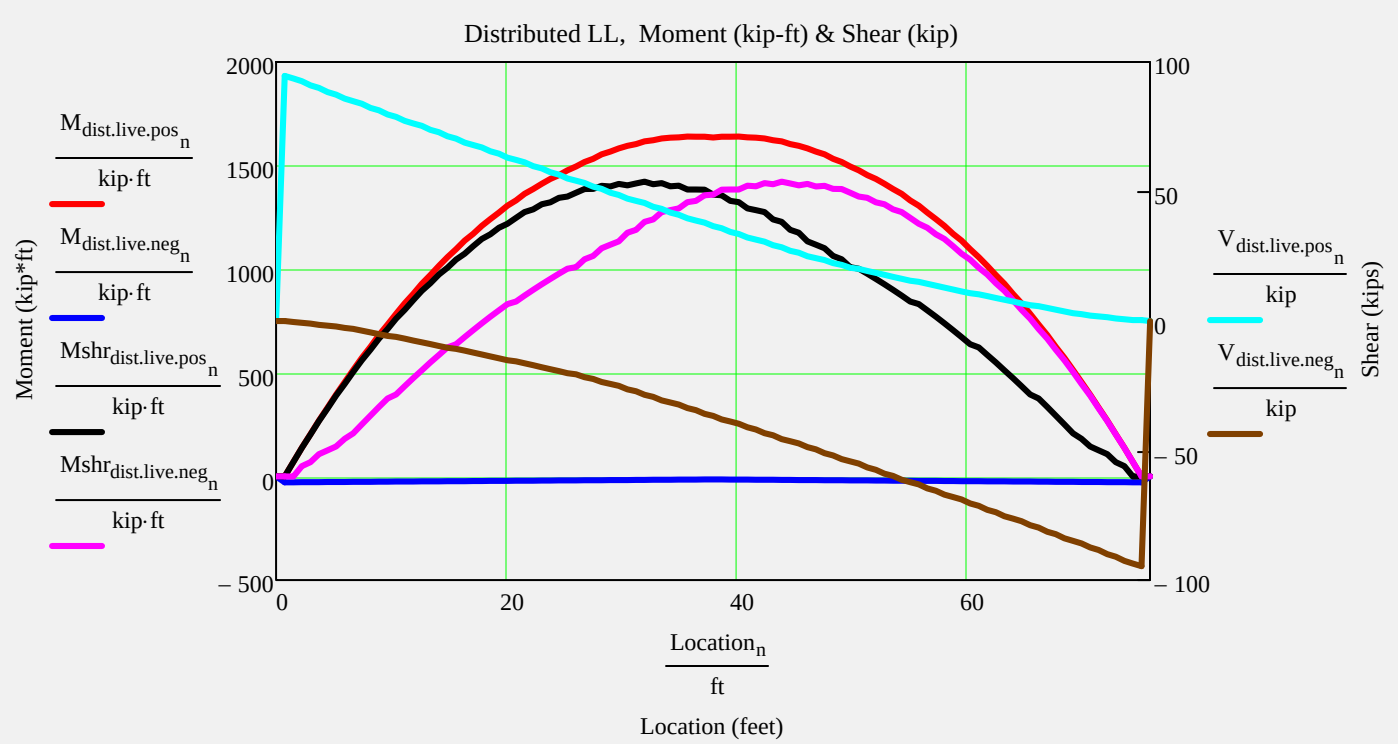
$\max(V_{dl.comp}) = 6.4 \cdot kip$ $\max(M_{dl.comp}) = 119.7 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -6.4 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 10\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.89$ $g_{mom.fatigue} = 0.74$ $g_{shear} = 0.89$



$\max(V_{dist.live.pos}) = 94.6 \cdot kip$ $\max(M_{dist.live.pos}) = 1640.5 \cdot kip \cdot ft$ $\min(V_{dist.live.neg}) = -94.6 \cdot kip$

$Reaction_{LL} = 96.4 \cdot kip$ $\min(M_{dist.live.neg}) = -28.4 \cdot kip \cdot ft$

$Reaction_{DL} = 79.8 \cdot kip$ $\max(Mshr_{dist.live.pos}) = 1422 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 77.8 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.58	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		5 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

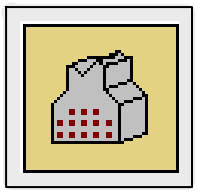
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

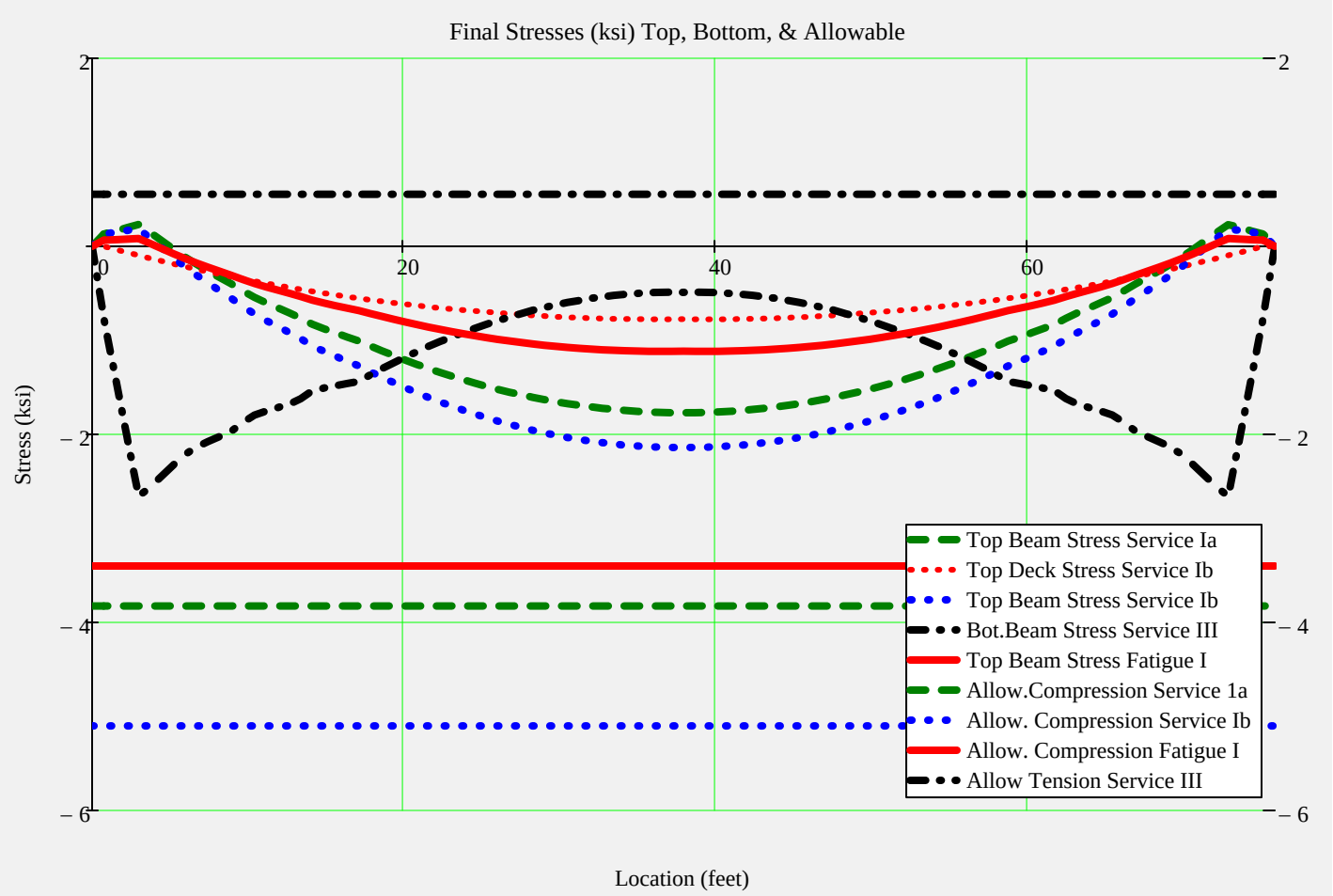
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

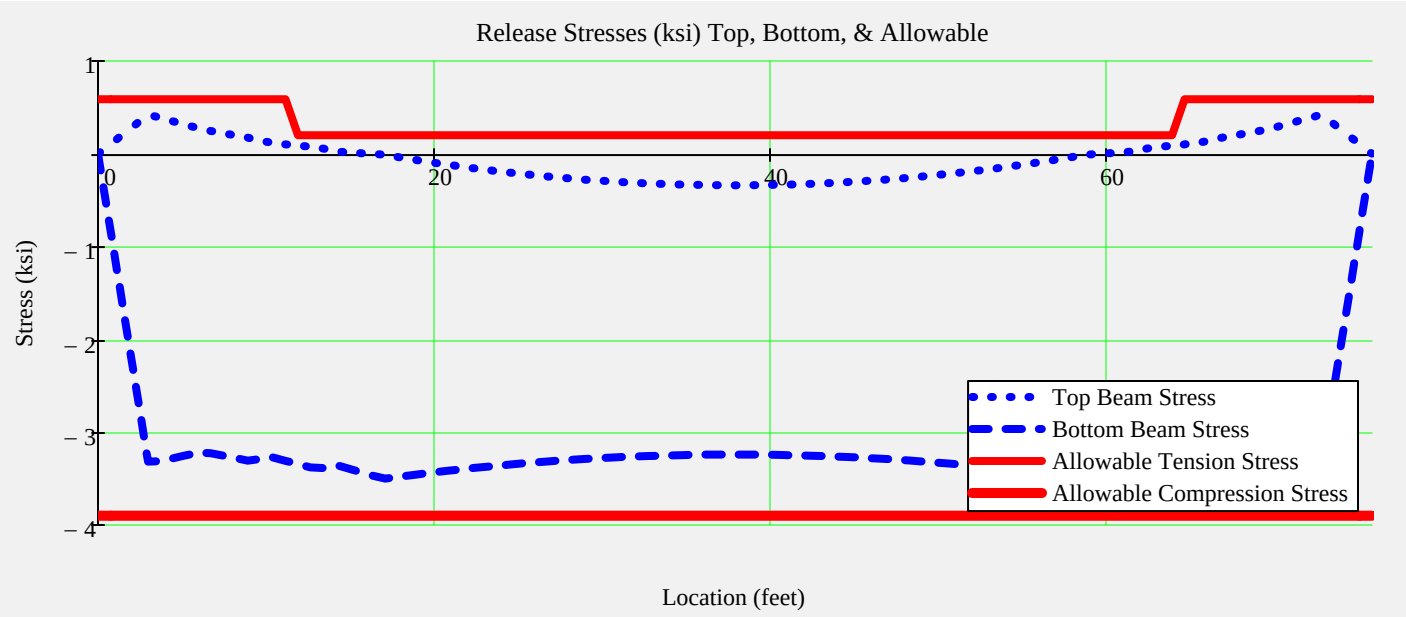
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.46$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.42$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.33$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–1.77	–3.83
"CompressionIb @ ServiceI"	37.92	–2.14	–5.10
"Compression @ FatigueI"	39.40	–1.12	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

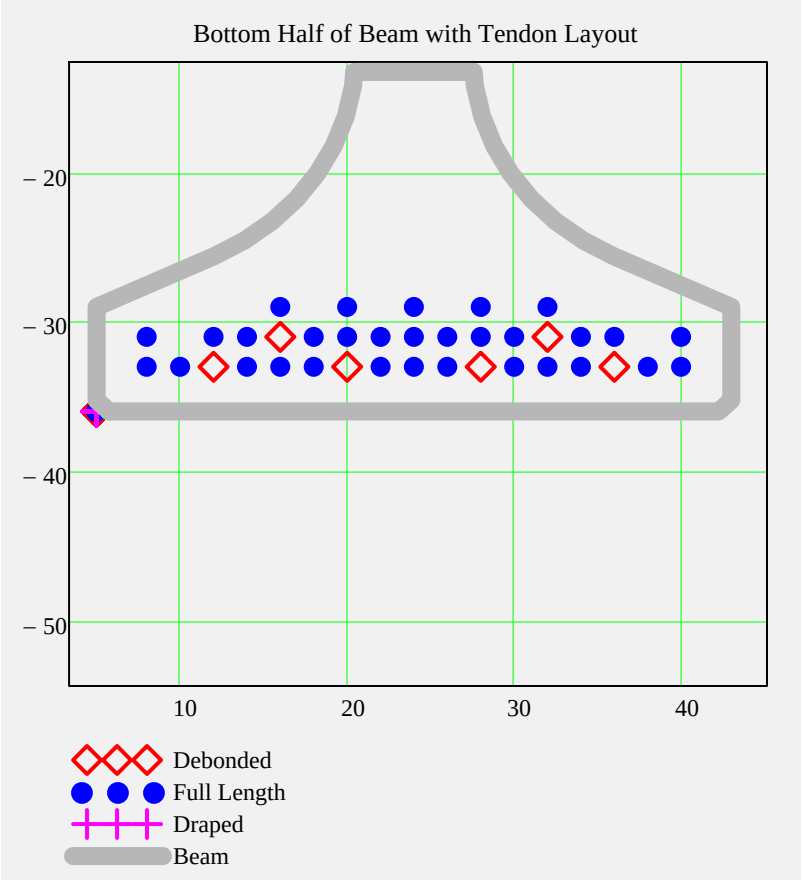
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

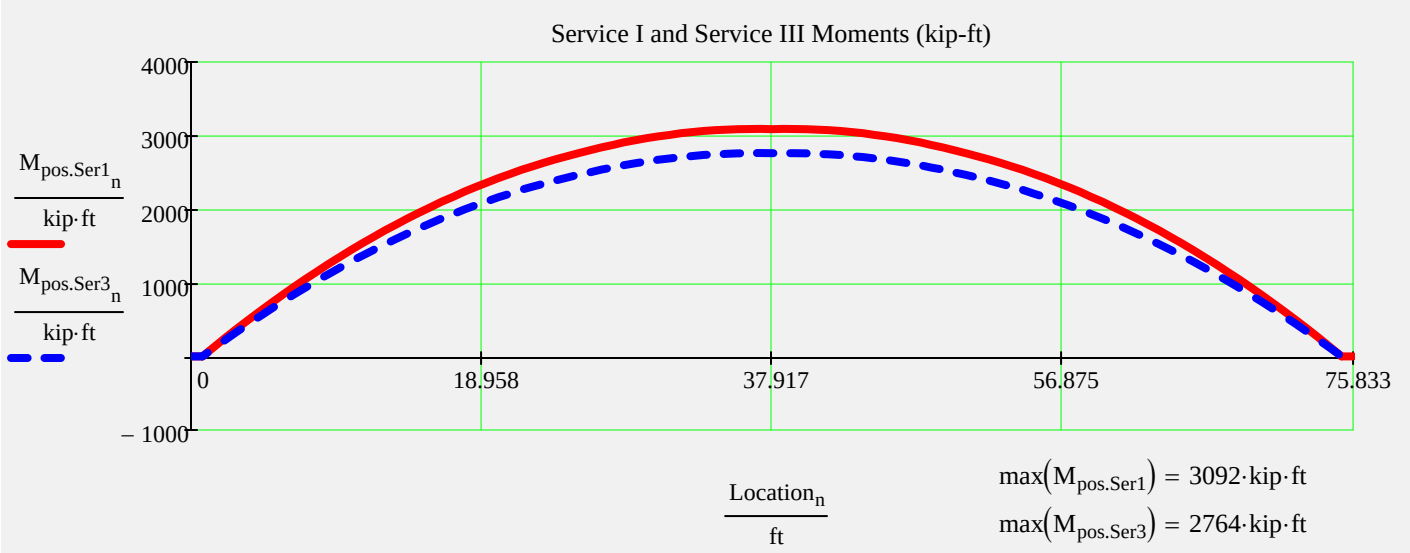
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3092 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2764 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.34 & -3.24 \\ \text{"2"} & -0.43 & -2.75 \\ \text{"4"} & -0.39 & -2.78 \\ \text{"6"} & -1.74 & -1.70 \\ \text{"8"} & -2.14 & -0.49 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1666 & -1601 \\ \text{"@Final (about composite centroid)"} & -1467 & -1333 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1681.2	402175	–7.6

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1333
"Composite Dead Load"	120
"Distributed Live Load"	1635

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

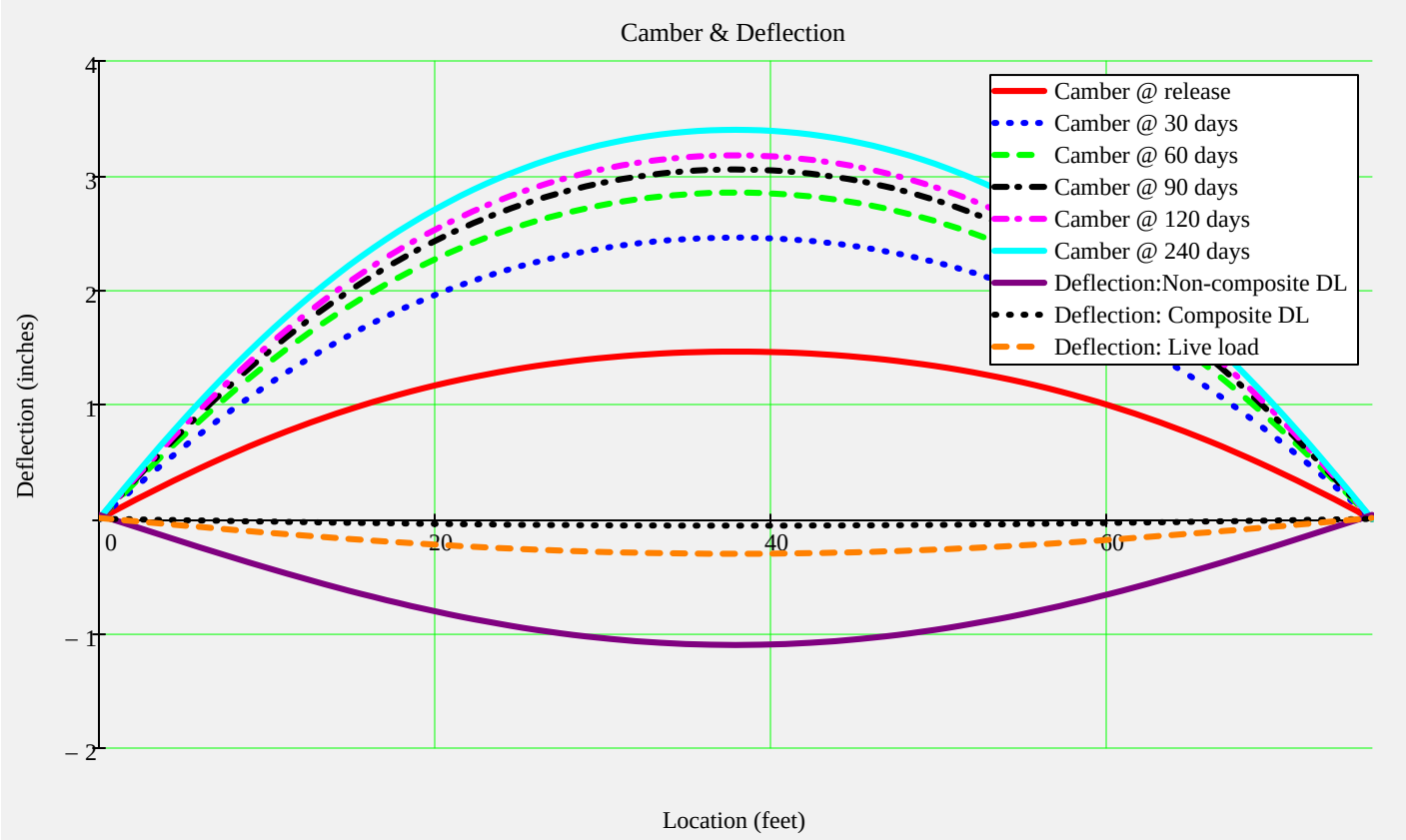
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.16	0.13	–0.23	–1.10
"Comp DL"	–0.00	0.01	–0.01	–0.06
"LL"	–0.02	0.06	–0.06	–0.30

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 2.02 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

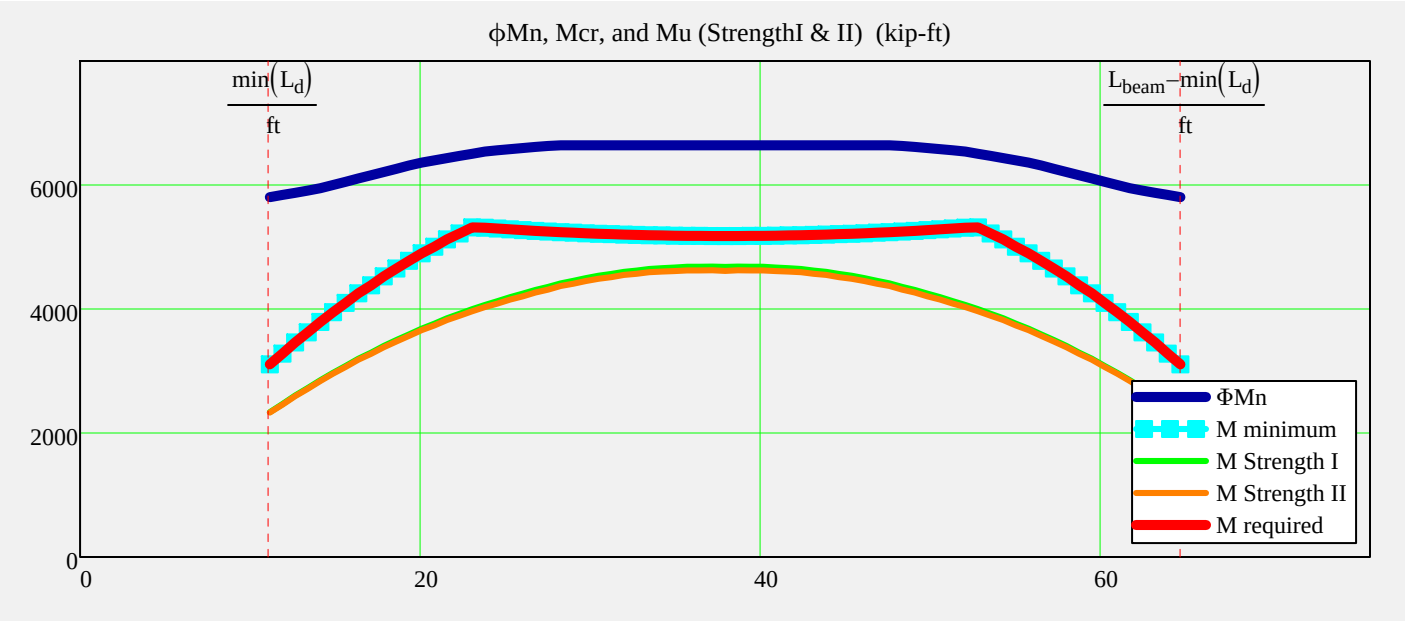
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 4684 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5177 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5177 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6640 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.1\ \text{ft}$ $\quad L_{beam} - \min(L_d) = 64.7\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.82$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

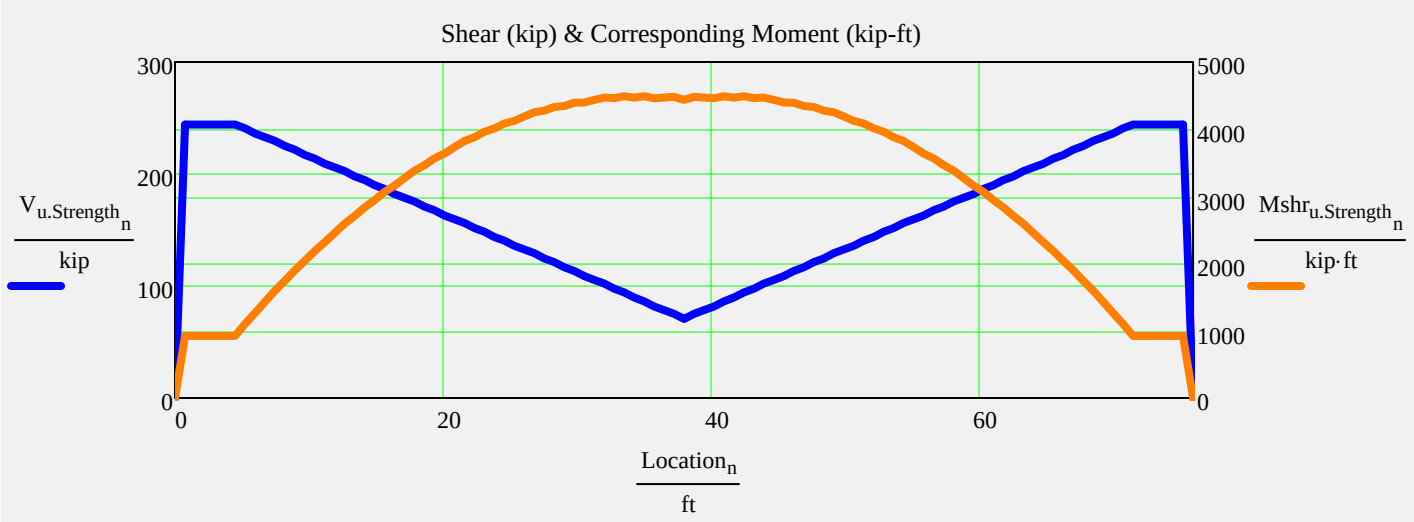
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

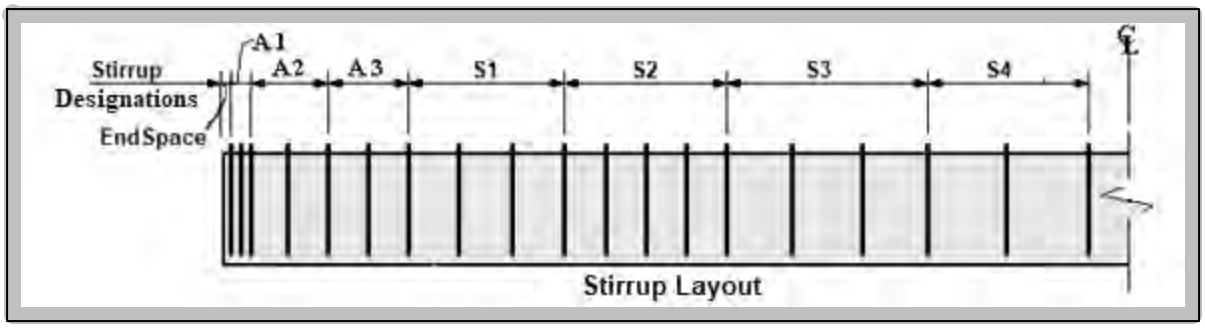
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 263 \\ 263 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 244.1 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4489 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

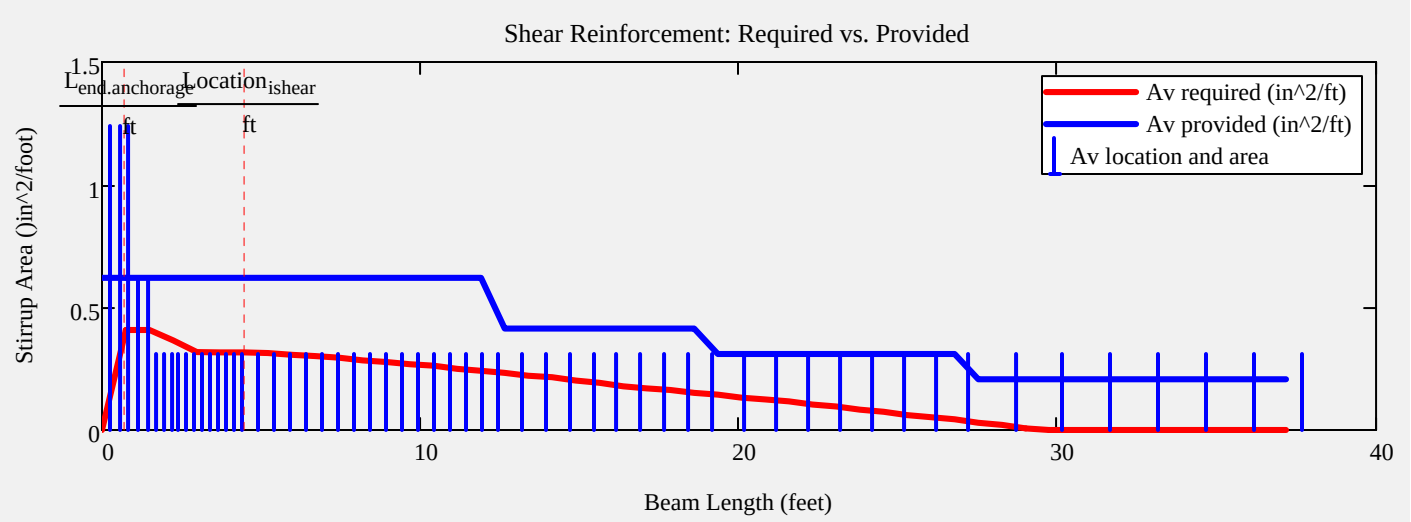
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

Save Data File

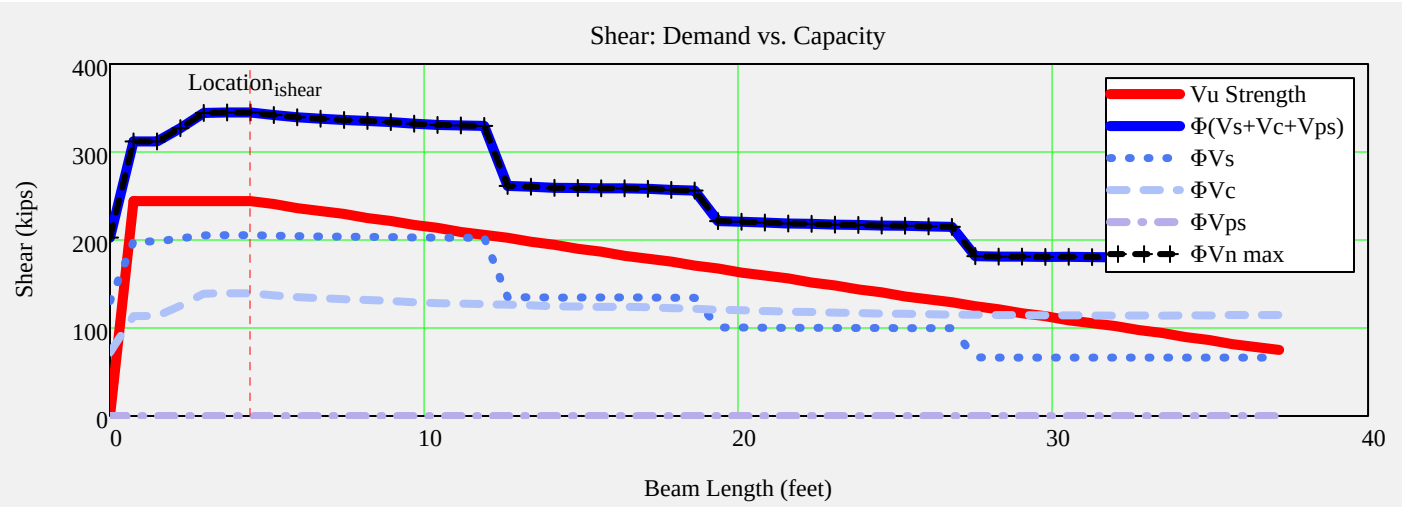
Use current input file

File Name FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\2. Beam Design\FIB's\WB 76' Span\prestressedbeamv

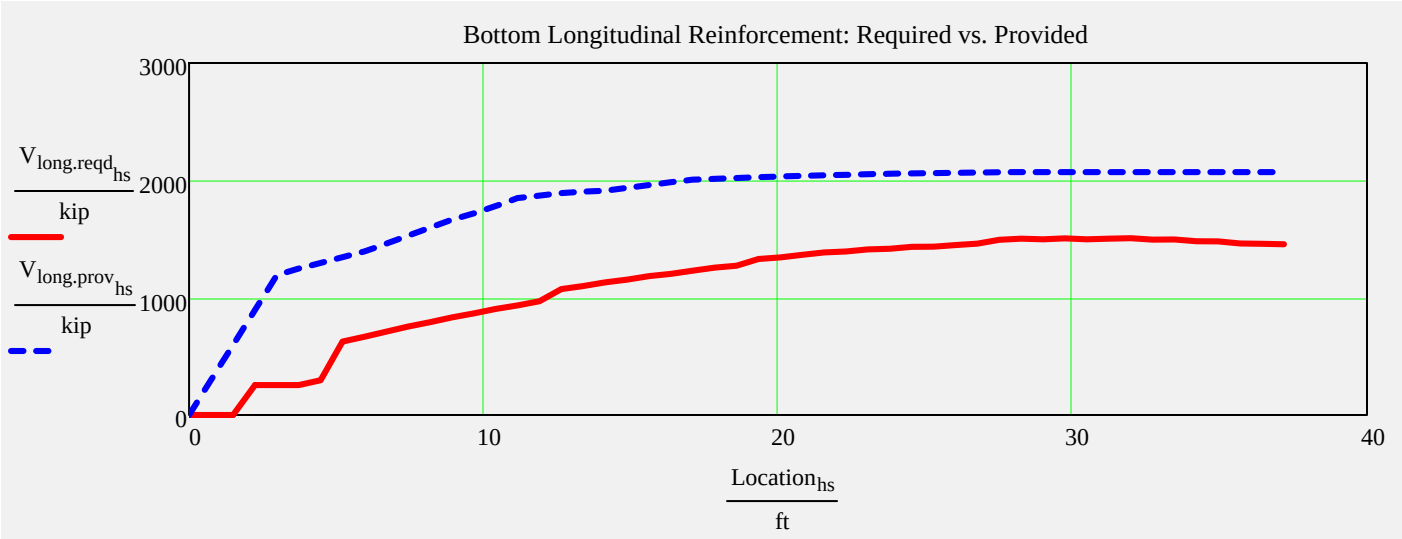
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 202.55 & 261.45 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.77$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

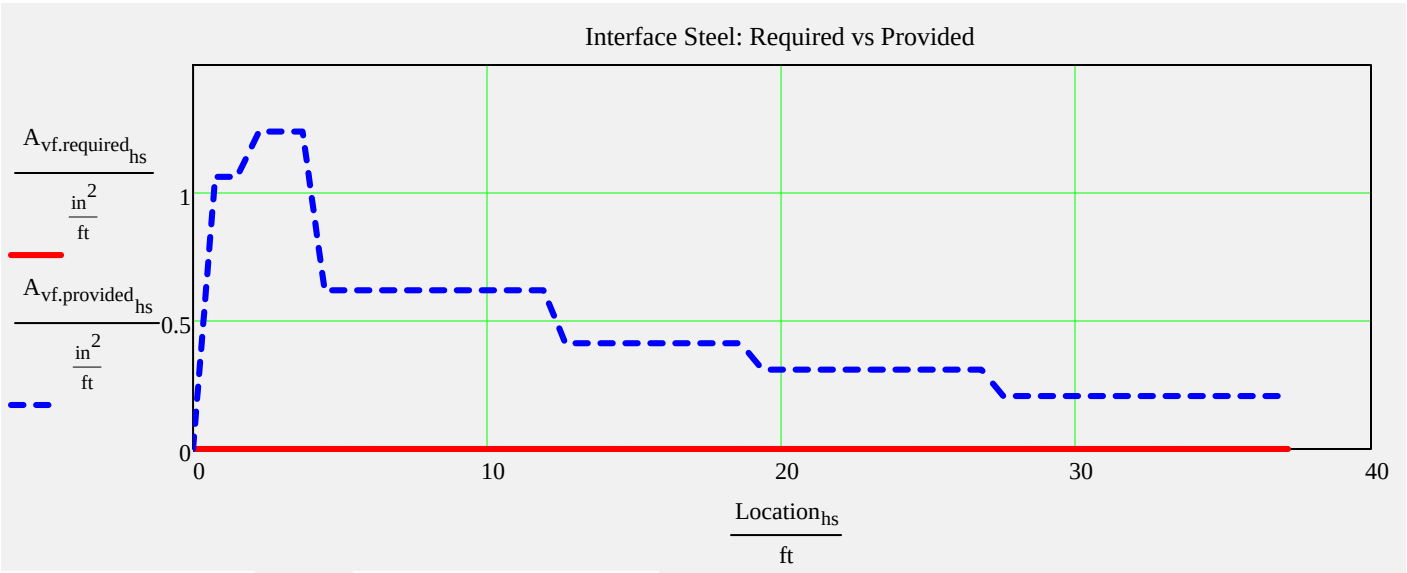


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 32.0 & 1506.7 & 2070.1 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.73$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

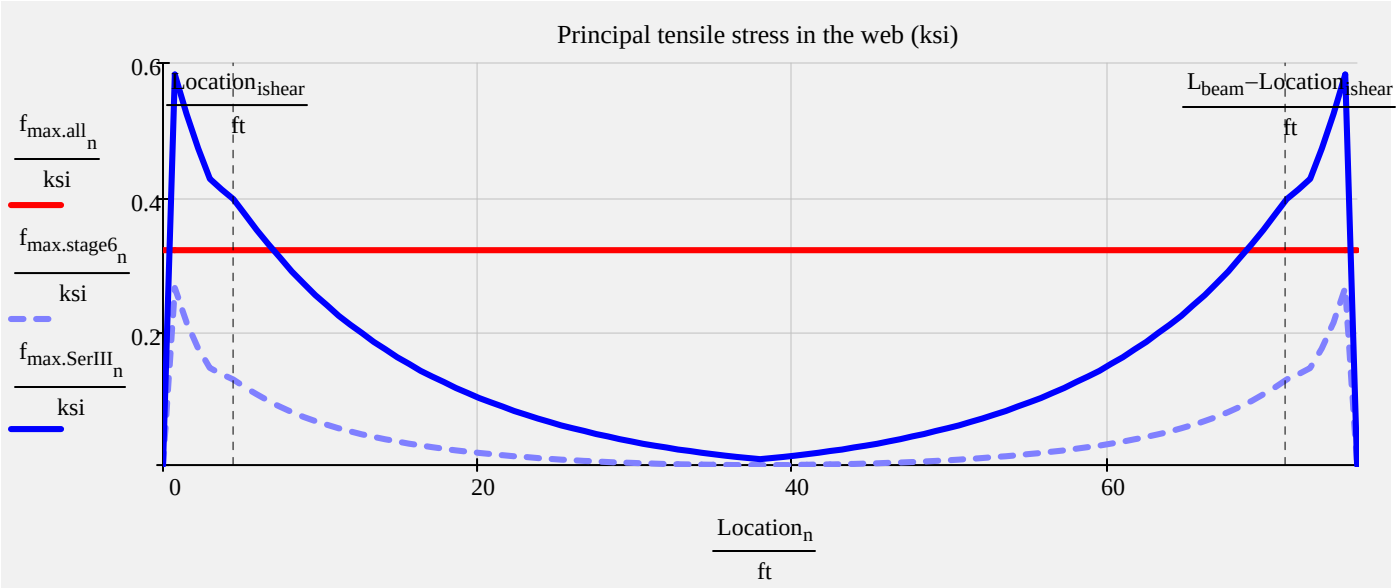
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6 \cdot in$ $\max(DC_f_{max.web}) = 1.24$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

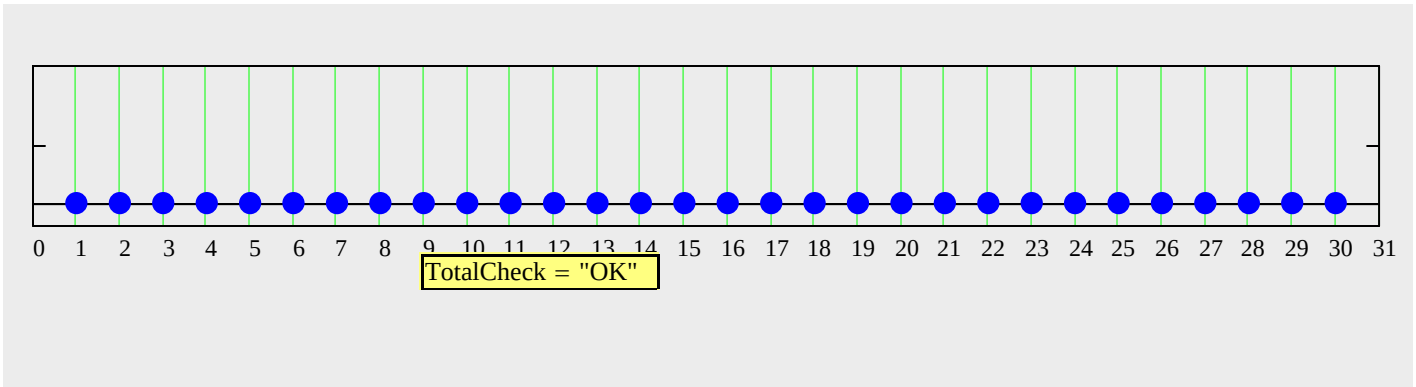
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.89	1.68	"N/A"	36.42	0.89	1.49	"N/A"	11.89	HL-93
"Strength I (Op)"	0.89	2.18	"N/A"	37.91	0.89	1.93	"N/A"	11.89	HL-93
"Service III (Inv)"	0.89	1.94	"N/A"	36.42	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.89	2.06	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.89	1.72	103.00	39.40	0.89	1.43	85.97	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.69$ $DC_{LongReinf.Permit} = 0.73$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6640	"factored resistance (kip-ft)...."
"γDL"	1815	"factored dead load (kip-ft)...."
"γLL"	2213	"factored live load (kip-ft)....."
"RF"	2.18	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	262.3	"factored resistance (kip)....."
"γDL"	66.5	"factored dead load (kip)....."
"γLL"	101.7	"factored live load (kip)....."
"RF"	1.93	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (NO SKEW)
WESTBOUND BRIDGE
(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam	
FSB	
FUB	
FlatSlab	
InvertedT	
DoubleT	

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\2. Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior_DCI.dat
FIB36-76ftSpan_15Skew_Interior_DCI.dat
FIB36-76ftSpan_NoSkew_Exterior_Tiger.dat
FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat
FIB36-76ftSpan_NoSkew_Interior_Tiger.dat
FIB36-76ftSpan_NoSkew_Interior_Whidden.dat

Refresh List

Open File

Reset All Data

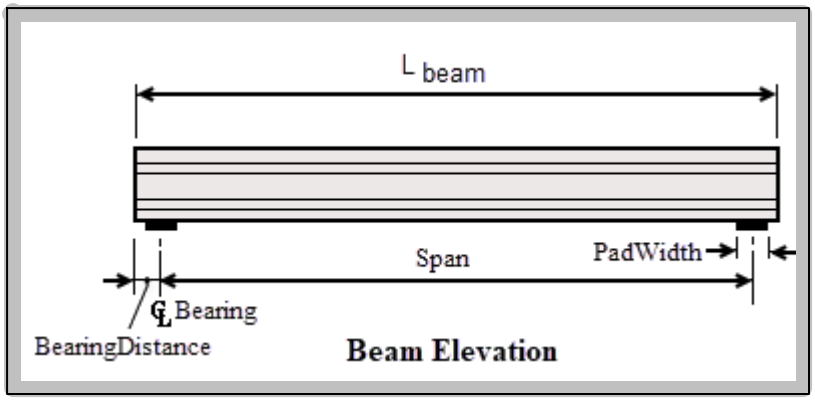
InputDataFile = "FIB36-76ftSpan_NoSkew_Interior_Whidden.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	WB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_NoSkew_Interior_Whidden.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeH)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	10	ft	*Measured from beam centerline to centerline.*
Overhang	3.7083	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.375	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

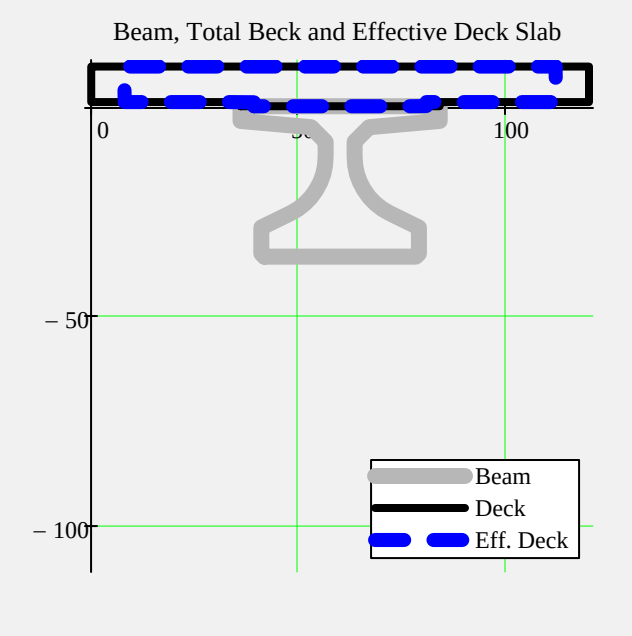
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8.5 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 120·in

$b_e = 120 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 1.17 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.12 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

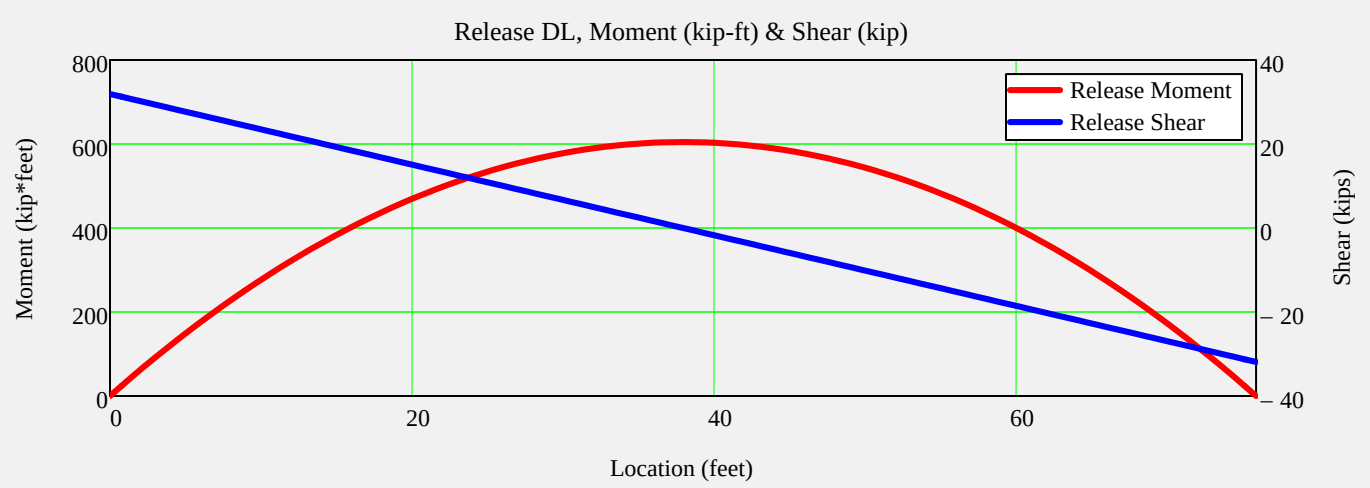
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

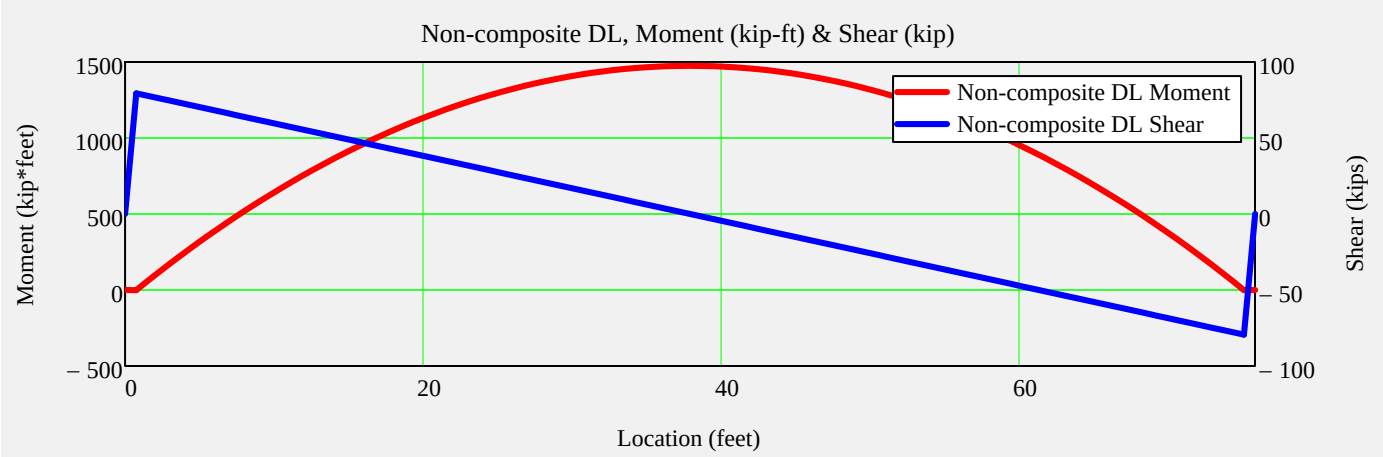
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



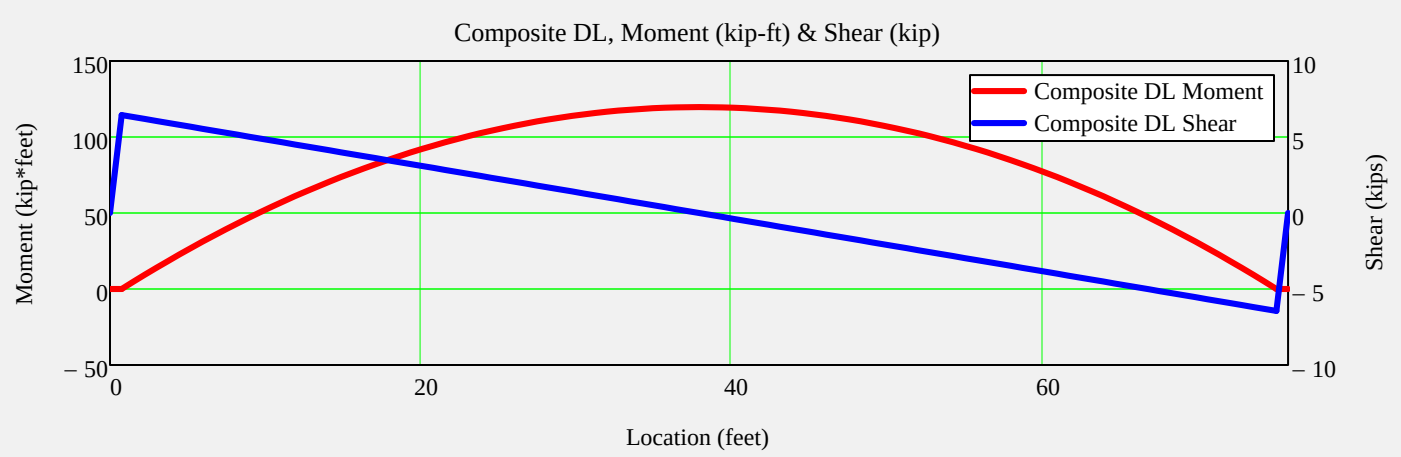
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 79.4 \cdot kip$ $\max(M_{dl.non.comp}) = 1474.7 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -79.4 \cdot kip$

Composite Dead Load Moments and Shear



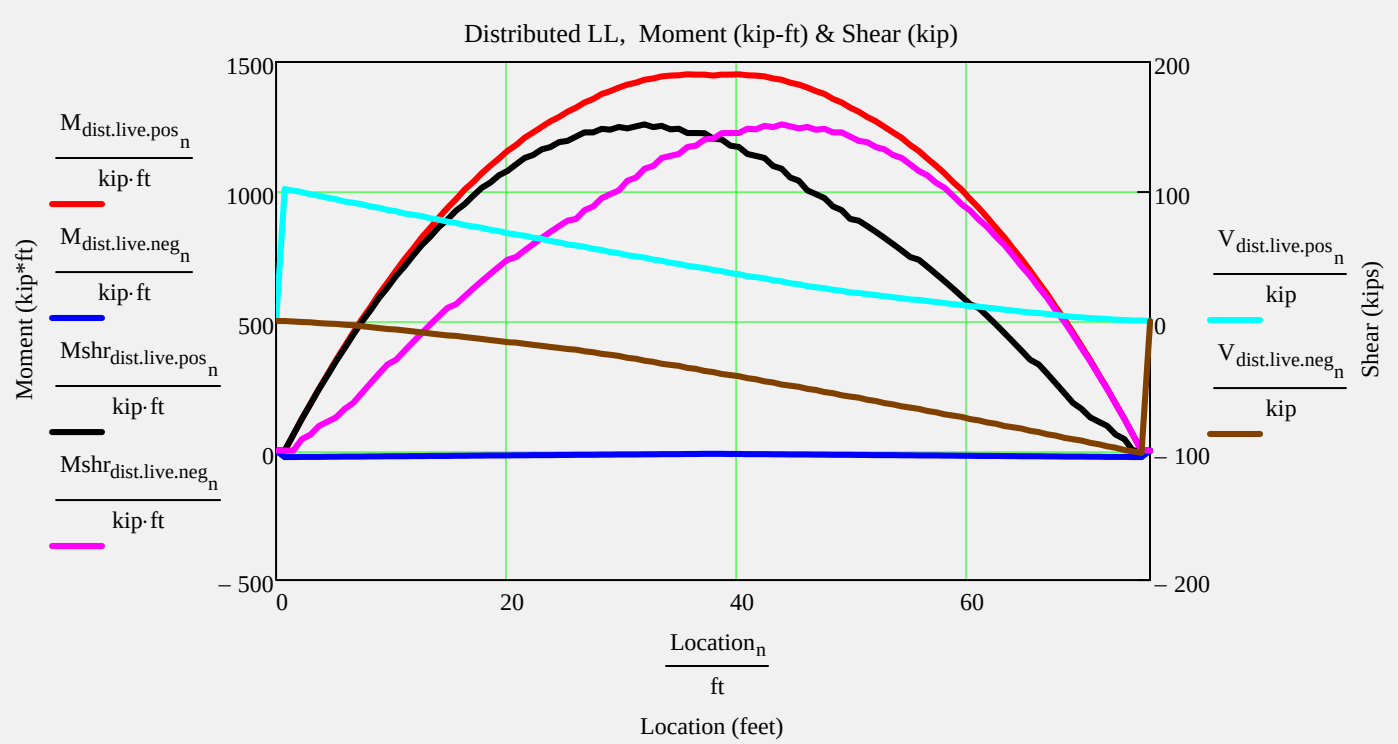
$\max(V_{dl.comp}) = 6.4 \cdot kip$ $\max(M_{dl.comp}) = 119.7 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -6.4 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 10\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.78$ $g_{mom.fatigue} = 0.46$ $g_{shear} = 0.95$



$\max(V_{dist.live.pos}) = 101.8 \cdot kip$

$\max(M_{dist.live.pos}) = 1452.3 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -101.8 \cdot kip$

$Reaction_{LL} = 103.7 \cdot kip$

$\min(M_{dist.live.neg}) = -25.1 \cdot kip \cdot ft$

$Reaction_{DL} = 87.6 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1259 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 83.7 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_NoSkew_Interior_Whidden.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.62 *1	0	1.58	0
Distance (in)	4 *2	0 *3		
Length (ft)			16	0
Bar Size		5 *4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

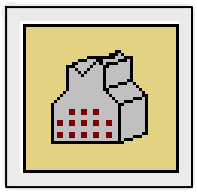
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

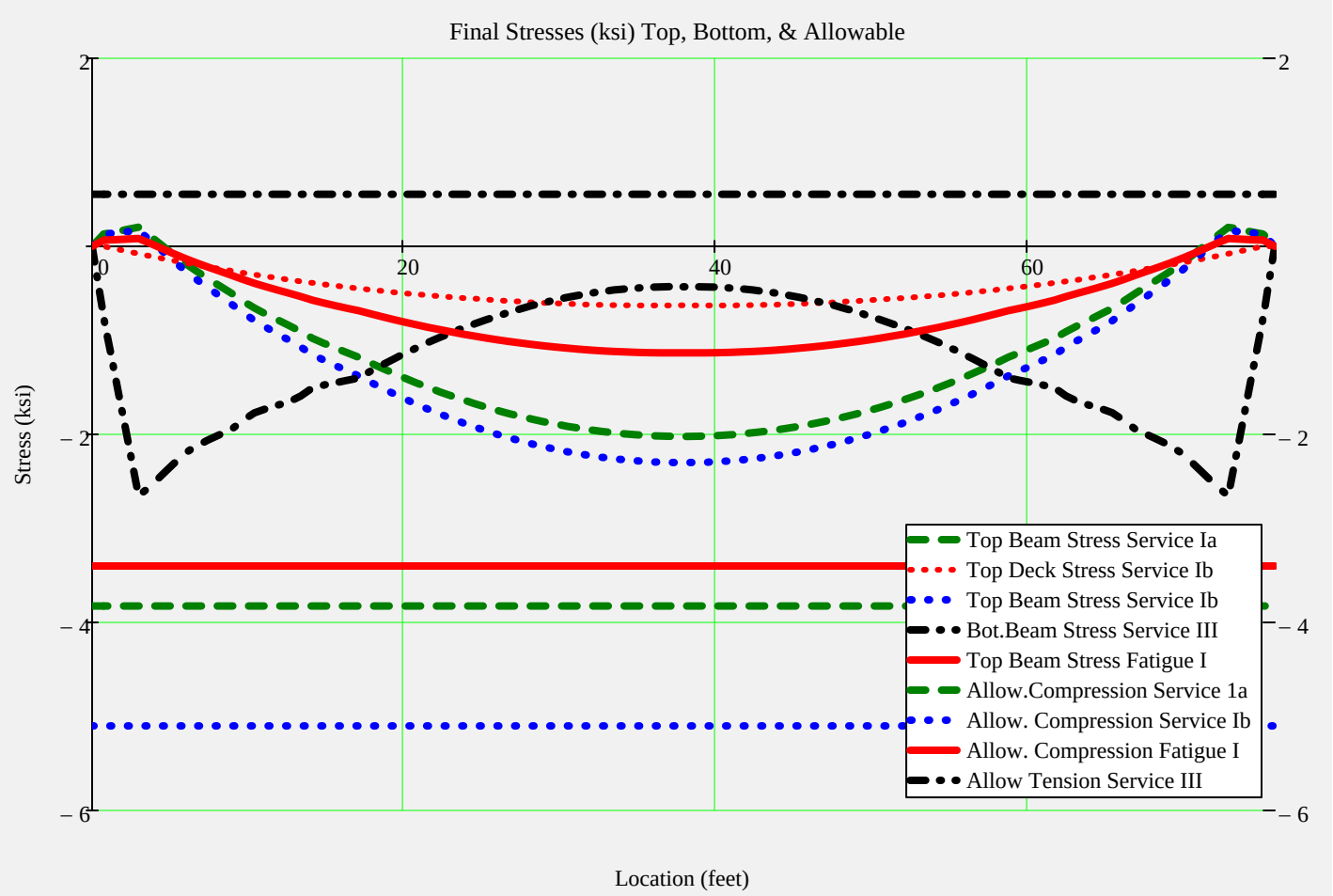
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

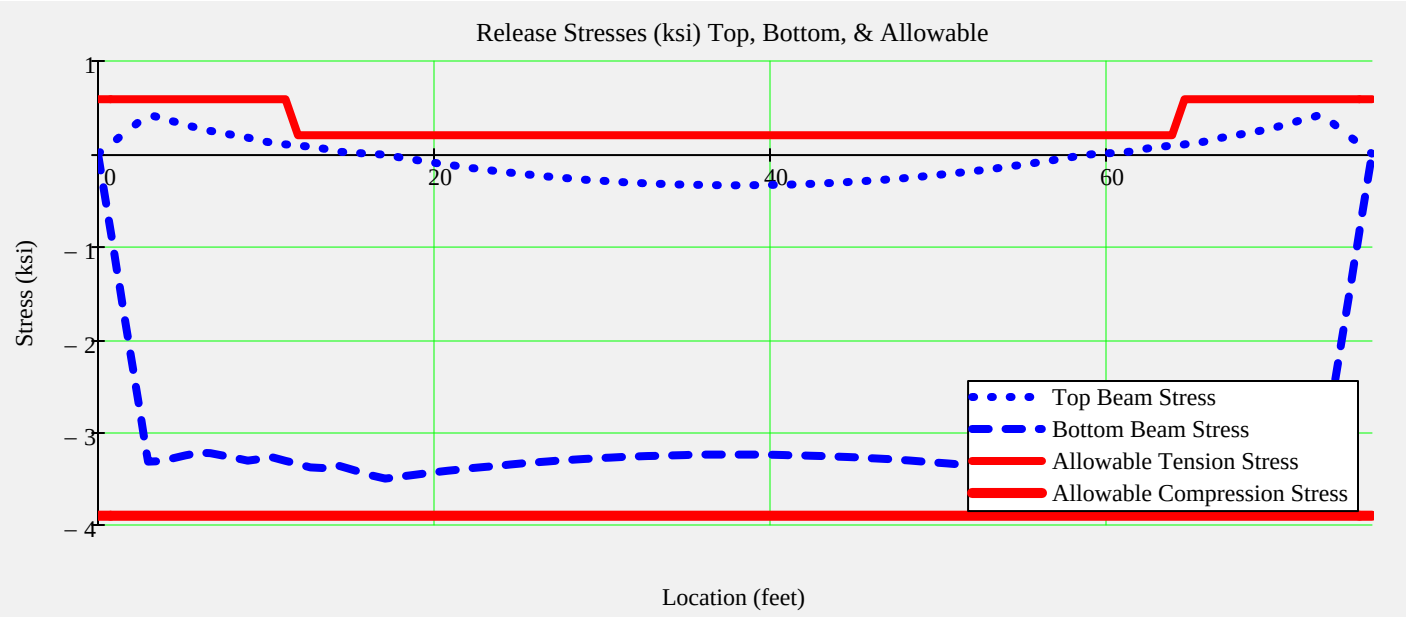
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.53$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.45$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.33$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–2.02	–3.83
"CompressionIb @ ServiceI"	37.92	–2.30	–5.10
"Compression @ FatigueI"	38.66	–1.13	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

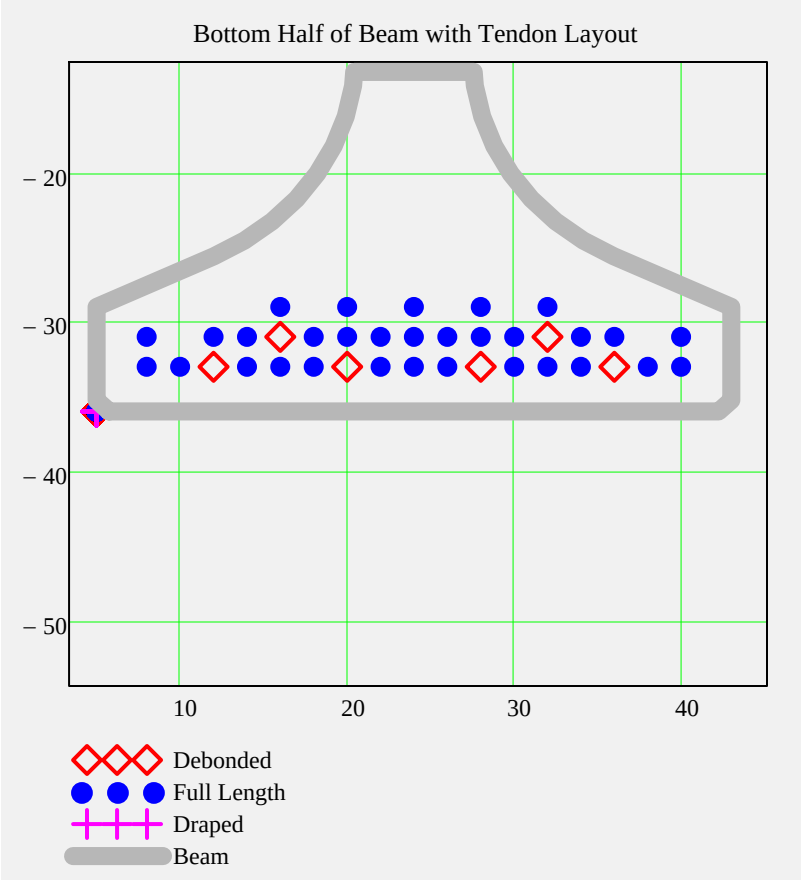
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

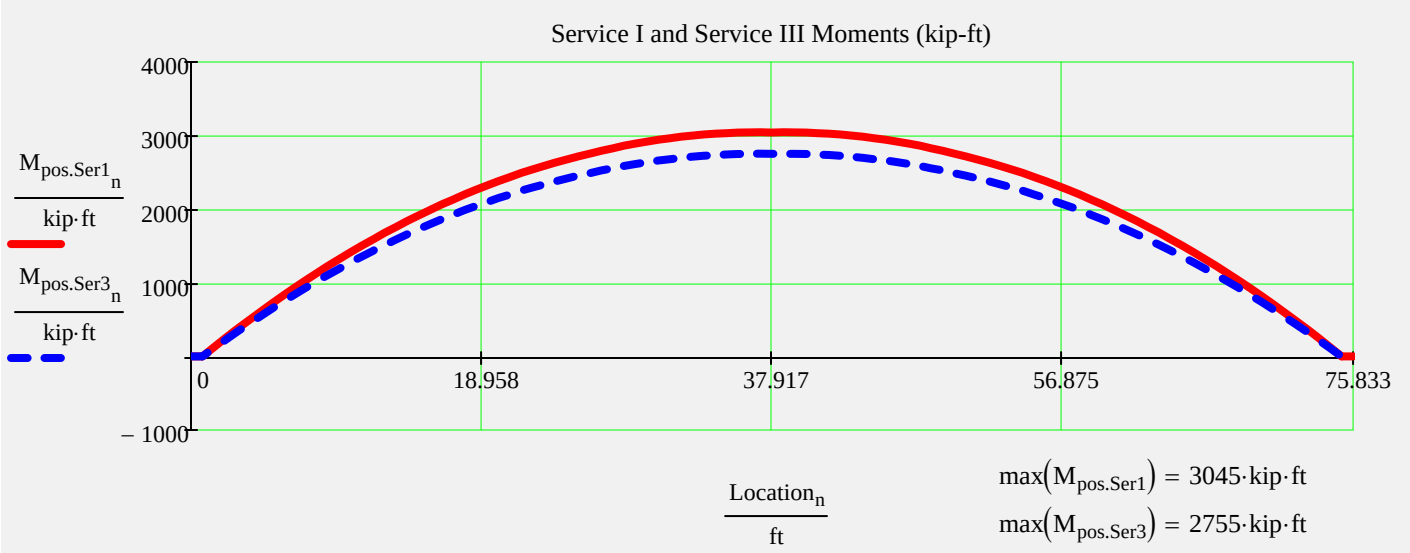
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3045 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2755 \cdot kip \cdot ft$

Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.34	–3.24
"2"	–0.43	–2.75
"4"	–0.39	–2.78
"6"	–2.00	–1.50
"8"	–2.30	–0.43

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1666	–1601
"@Final (about composite centroid)"	–1467	–1333

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1799.1	420971	–6.7

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1475
"Composite Dead Load"	120
"Distributed Live Load"	1448

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

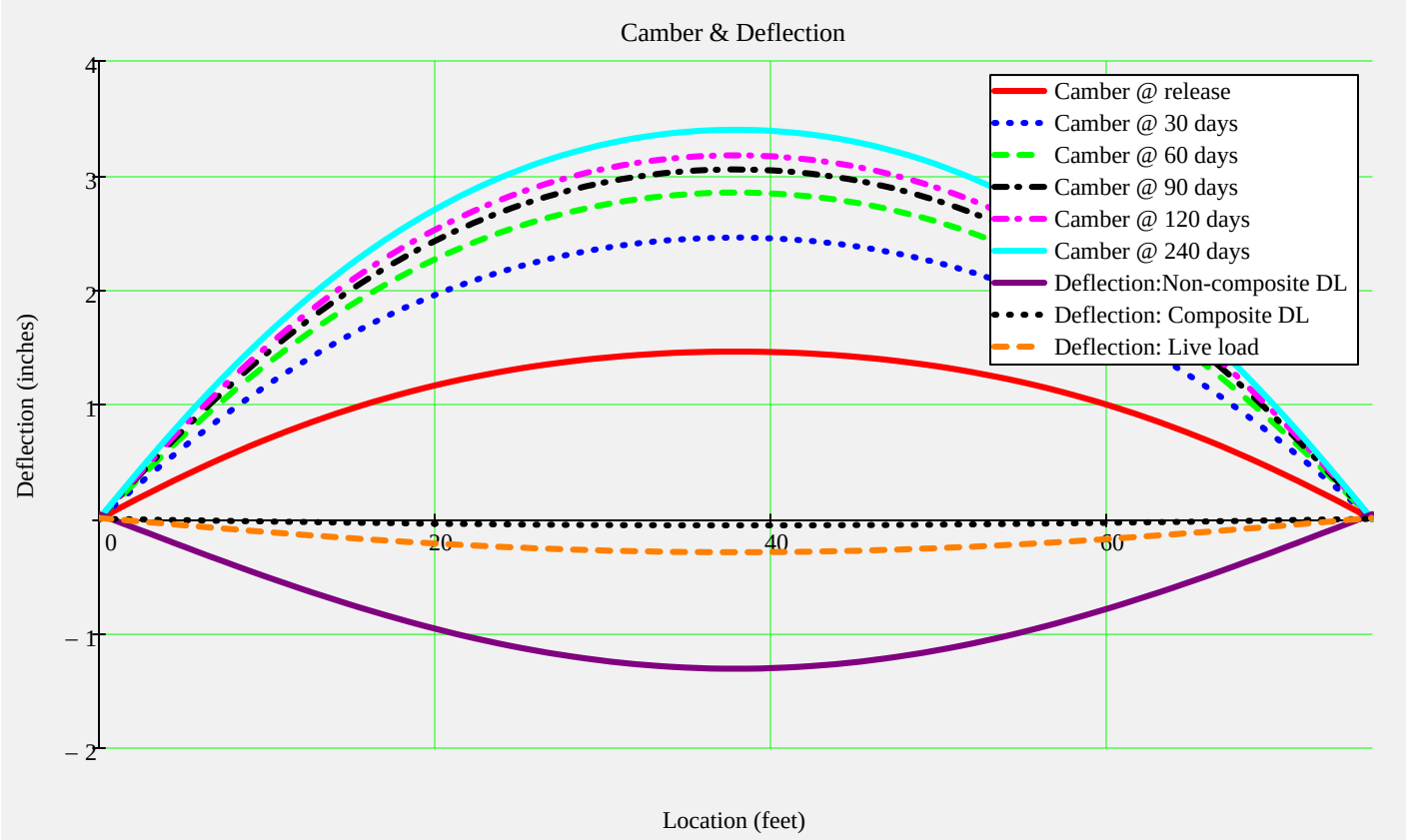
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.19	0.15	–0.27	–1.31
"Comp DL"	–0.00	0.01	–0.01	–0.06
"LL"	–0.01	0.06	–0.06	–0.29

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.81 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

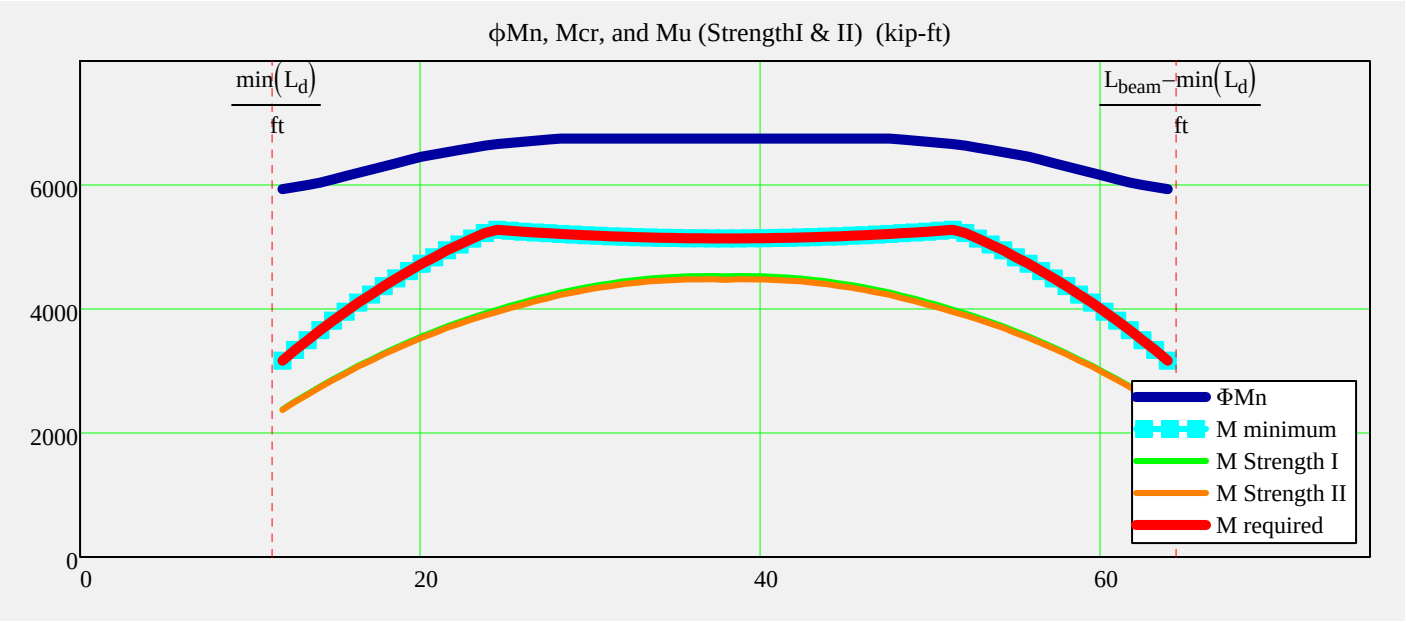
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 4532 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5138 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5138 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6748 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.3\,\text{ft}$ $L_{beam} - \min(L_d) = 64.5\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.79$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

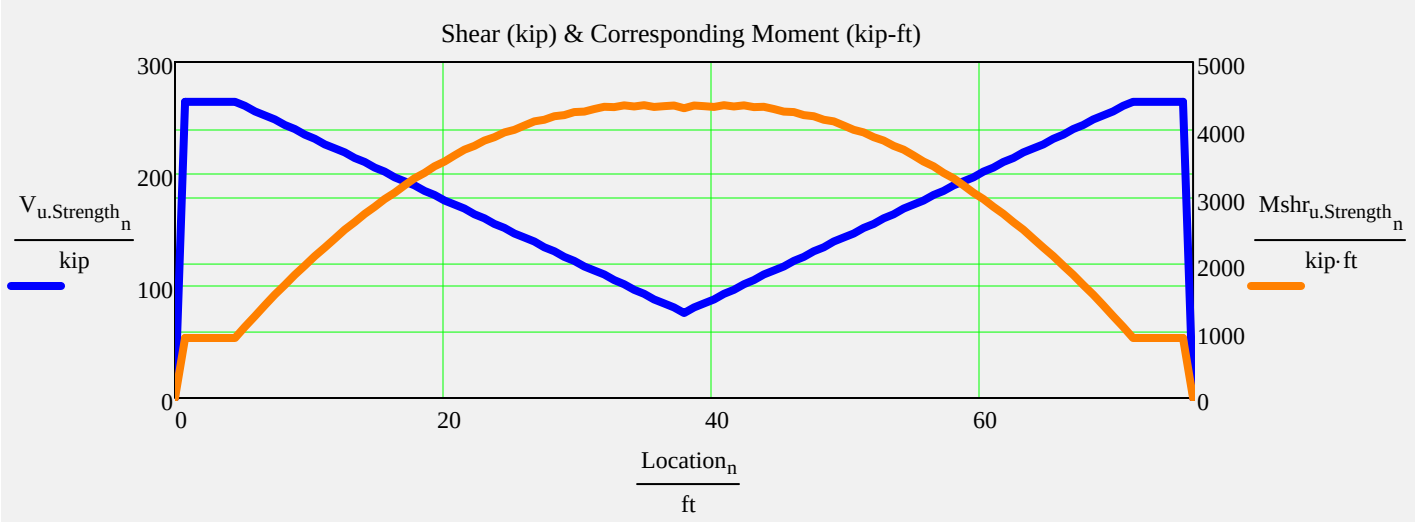
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

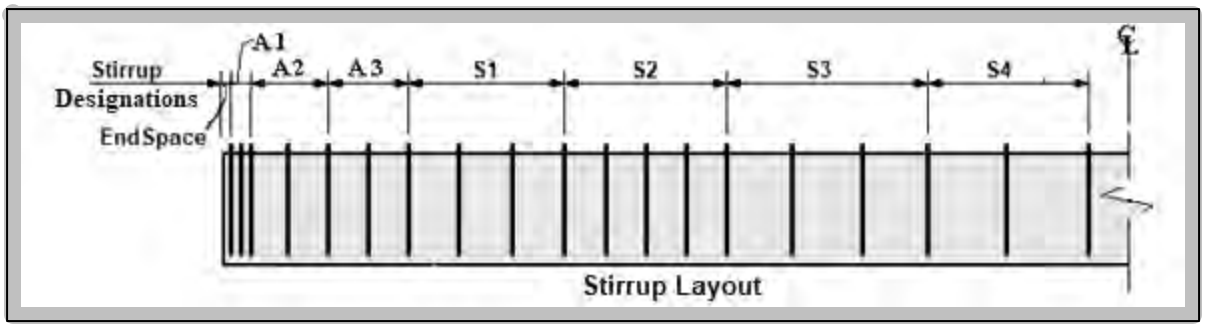
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 285 \\ 285 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 264.5 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4357 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

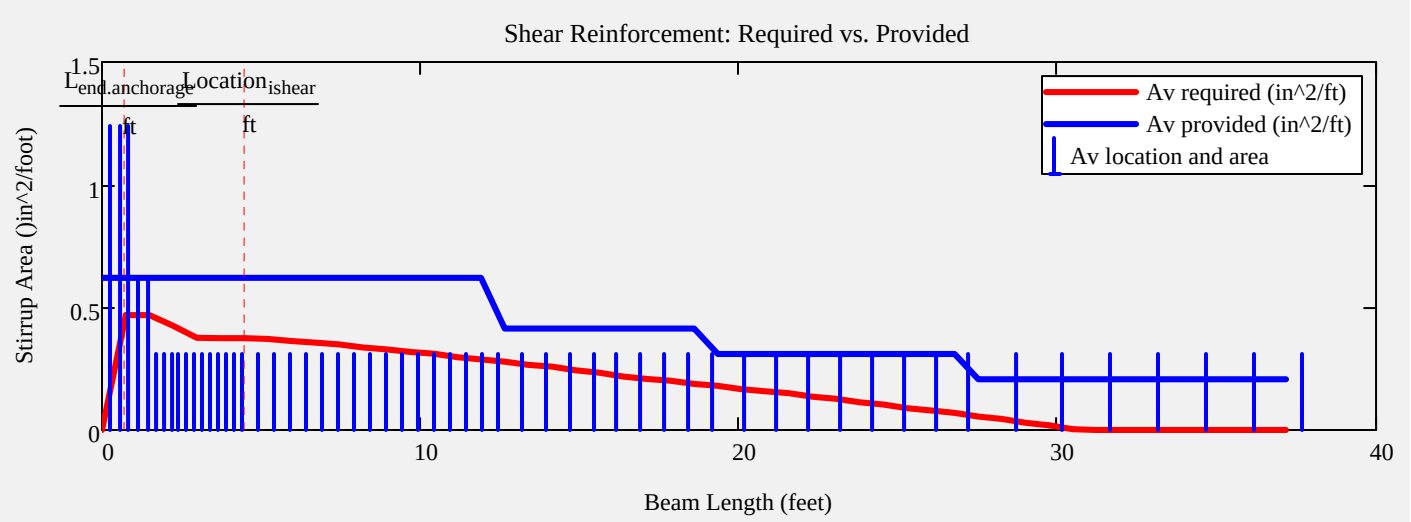
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

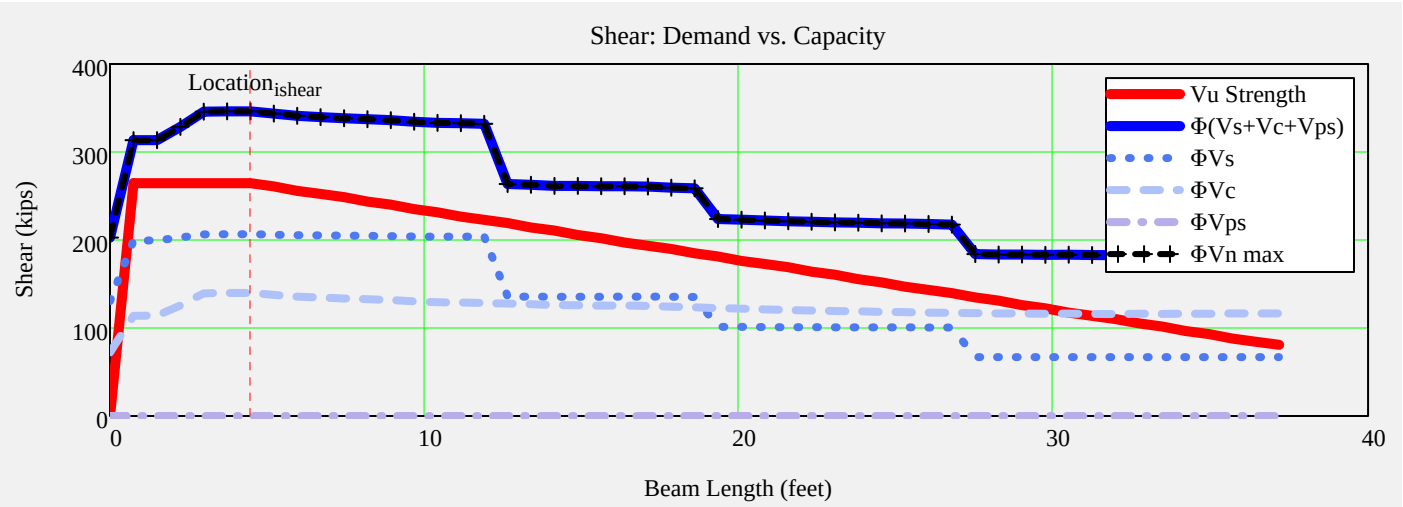
Save Data File ☑ Use current input file

File Name FIB36-76ftSpan_NoSkew_Interior_Whidden.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\2. Beam Design\FIB's\WB 76' Span\prestressedbeamv

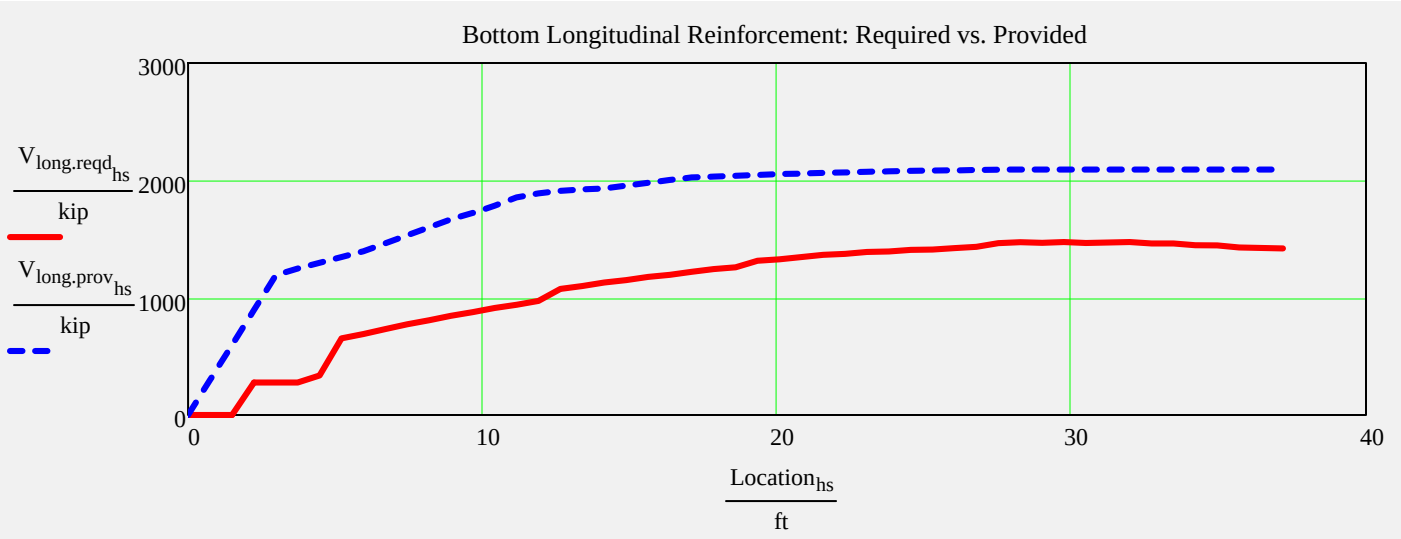
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 219.30 & 263.61 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.83$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

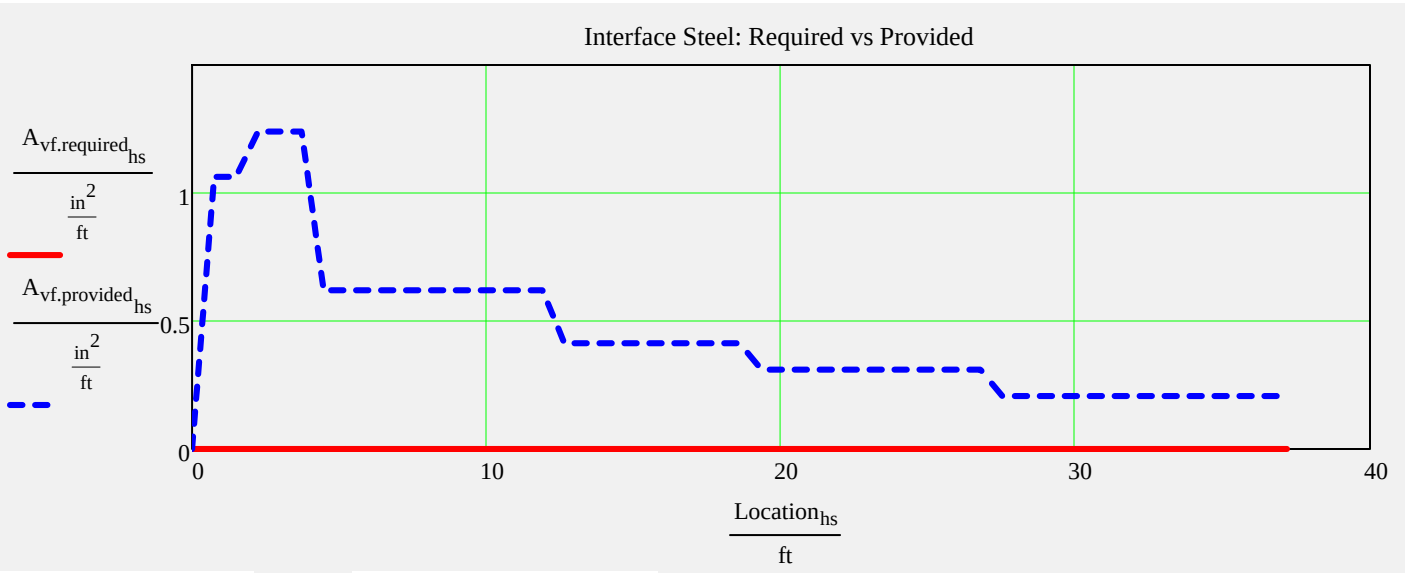


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 29.7 & 1474.2 & 2092.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.70$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

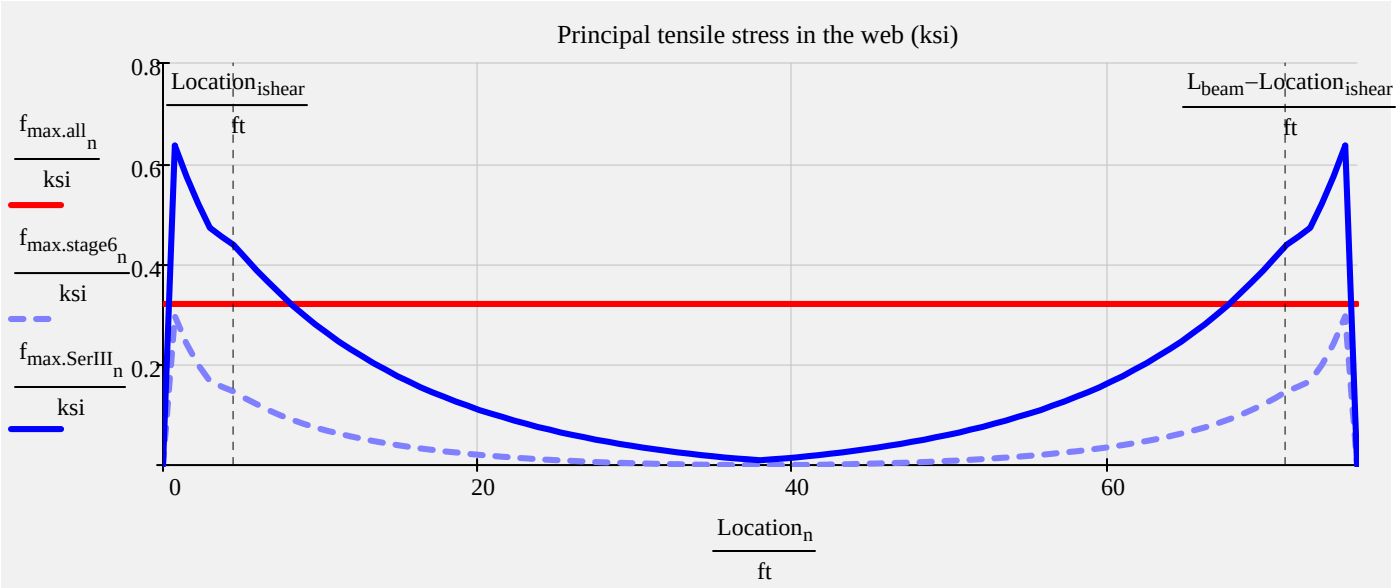
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6\cdot in$ $\max(DC_f_{max.web}) = 1.37$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450\cdot kip$ $P_{prestress} = 1362\cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

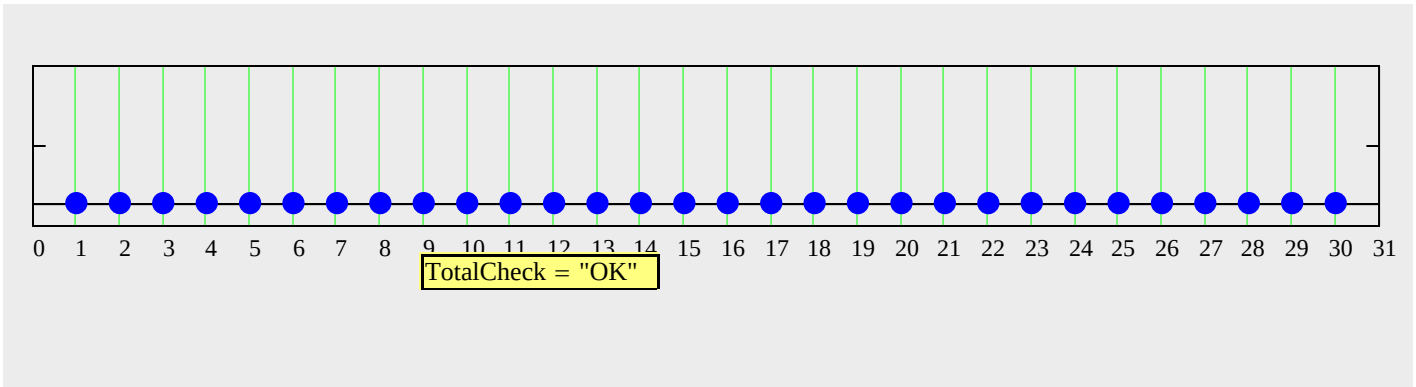
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.78	1.87	"N/A"	36.42	0.95	1.35	"N/A"	11.89	HL-93
"Strength I (Op)"	0.78	2.43	"N/A"	37.91	0.95	1.75	"N/A"	11.89	HL-93
"Service III (Inv)"	0.78	2.01	"N/A"	36.42	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.78	2.16	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.78	1.91	114.69	34.94	0.95	1.30	78.17	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.67$ $DC_{LongReinf.Permit} = 0.70$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6748	"factored resistance (kip-ft)...."
"γDL"	1992	"factored dead load (kip-ft)...."
"γLL"	1959	"factored live load (kip-ft)....."
"RF"	2.43	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	264.4	"factored resistance (kip)....."
"γDL"	73	"factored dead load (kip)....."
"γLL"	109.4	"factored live load (kip)....."
"RF"	1.75	"HL93 operating rating factor"

FLORIDA-I 36 BEAM EXTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (NO SKEW)

WESTBOUND BRIDGE

(TIGER BAY)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior.dat
FIB36-76ftSpan_15Skew_Interior.dat
FIB36-76ftSpan_NoSkew_Exterior.dat
FIB36-76ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

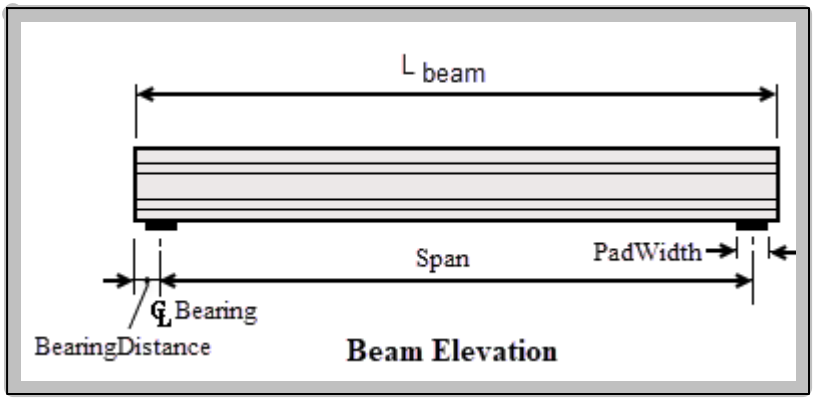
InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	Westbound Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	11.6667	ft	*Measured from beam centerline to centerline.*
Overhang	3.8333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(* 0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	4		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

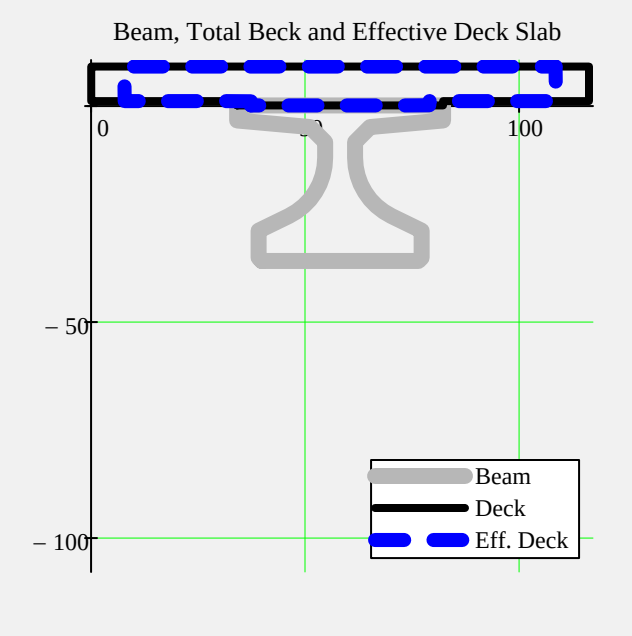
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 140·in

$b_e = 116 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 1.02 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.08 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.125 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.22 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

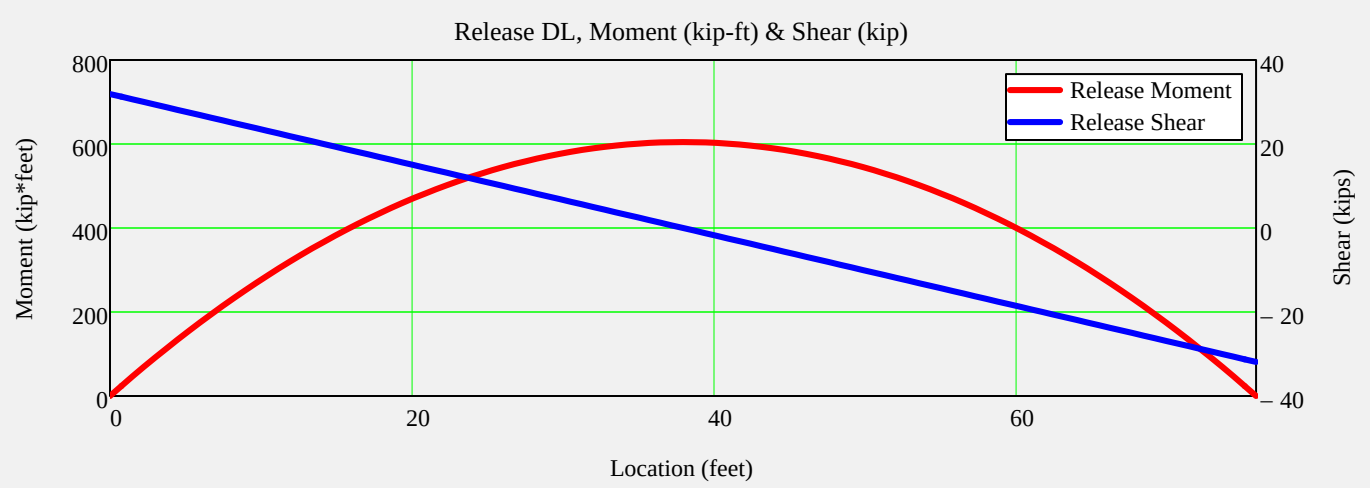
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

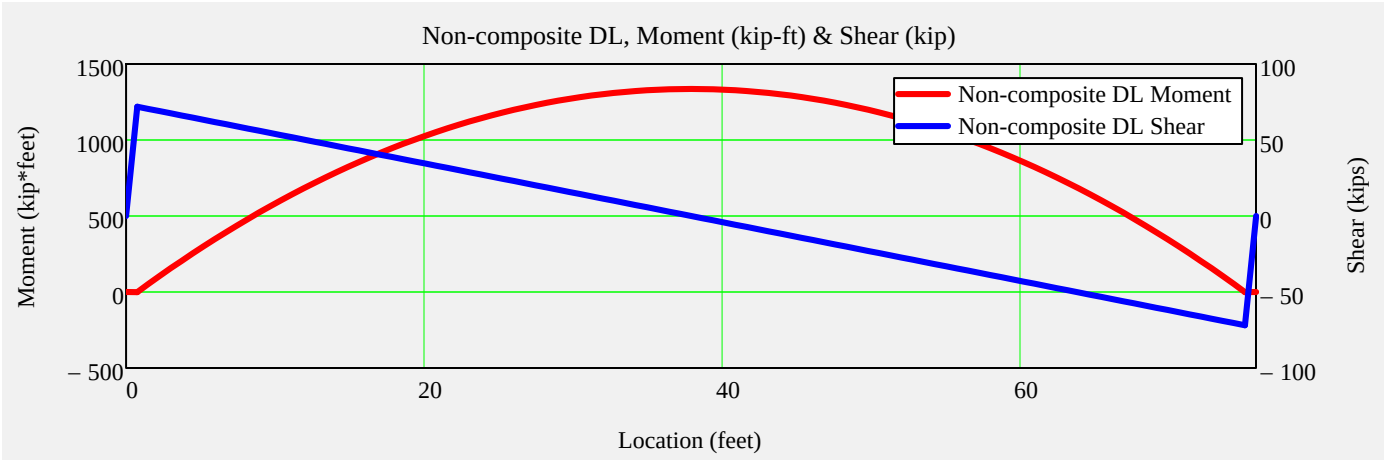
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



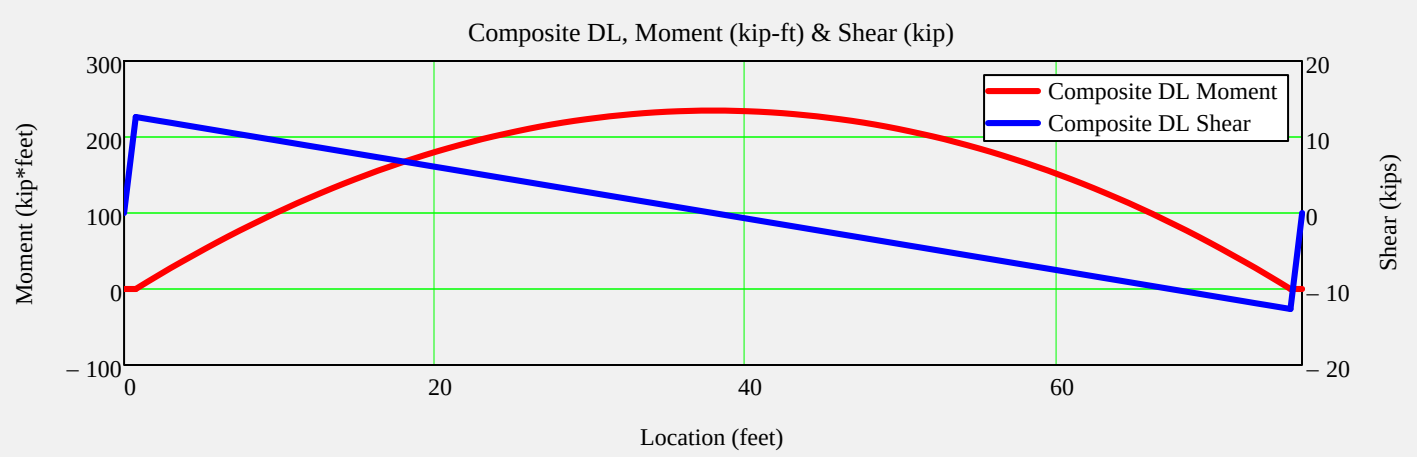
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 71.9 \cdot kip$ $\max(M_{dl.non.comp}) = 1335.5 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -71.9 \cdot kip$

Composite Dead Load Moments and Shear



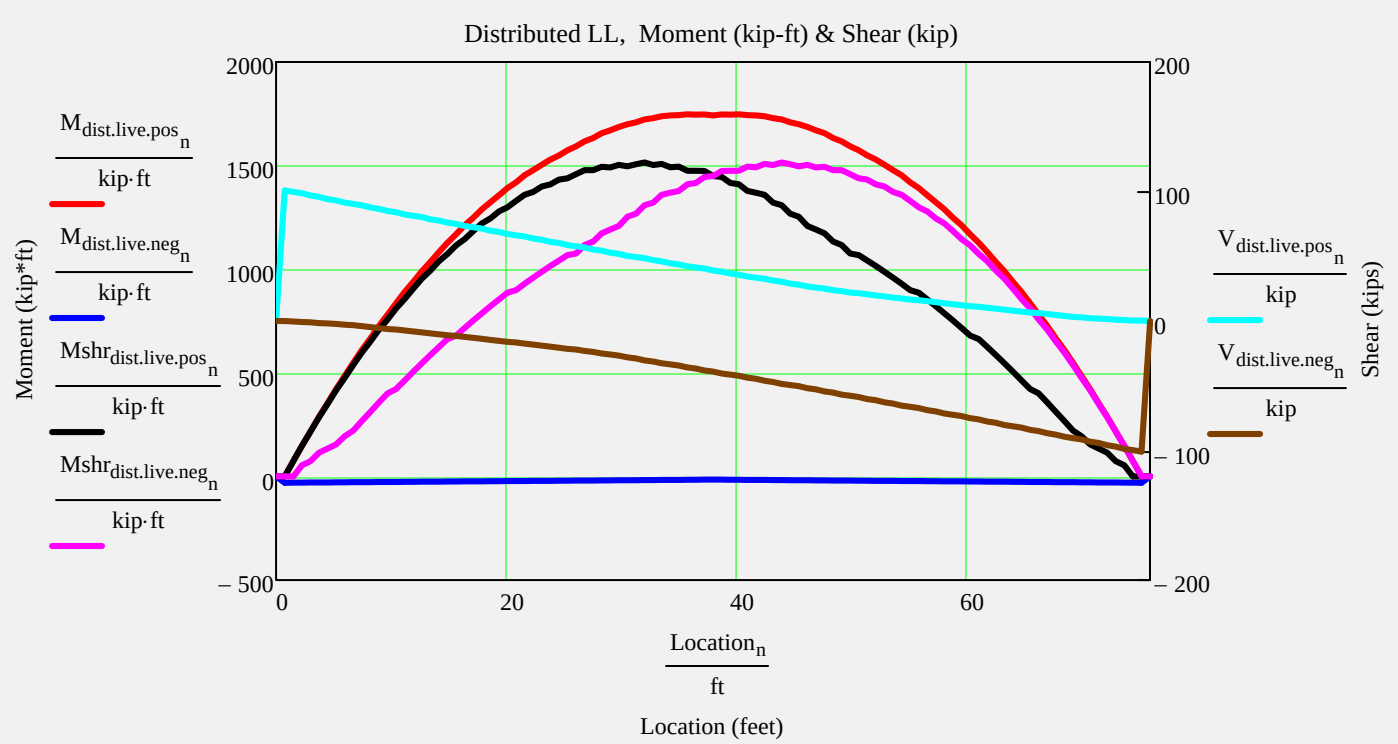
$\max(V_{dl.comp}) = 12.6 \cdot kip$ $\max(M_{dl.comp}) = 234.7 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -12.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 11.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.94$ $g_{mom.fatigue} = 0.79$ $g_{shear} = 0.94$



$\max(V_{dist.live.pos}) = 100.8 \cdot kip$

$\max(M_{dist.live.pos}) = 1747.7 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -100.8 \cdot kip$

$Reaction_{LL} = 102.7 \cdot kip$

$\min(M_{dist.live.neg}) = -30.3 \cdot kip \cdot ft$

$Reaction_{DL} = 86.2 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1515 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 82.9 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.58	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		5 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

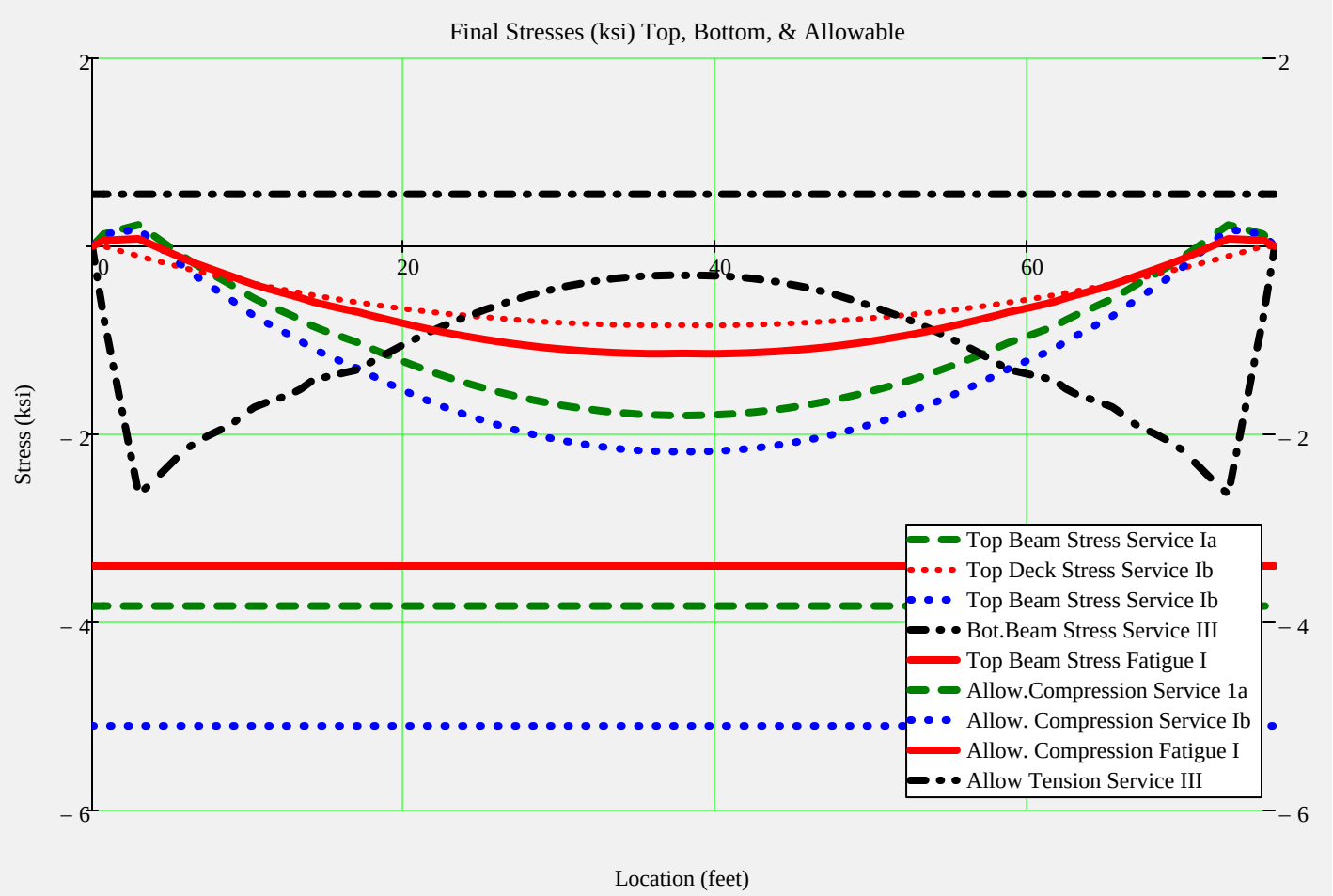
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

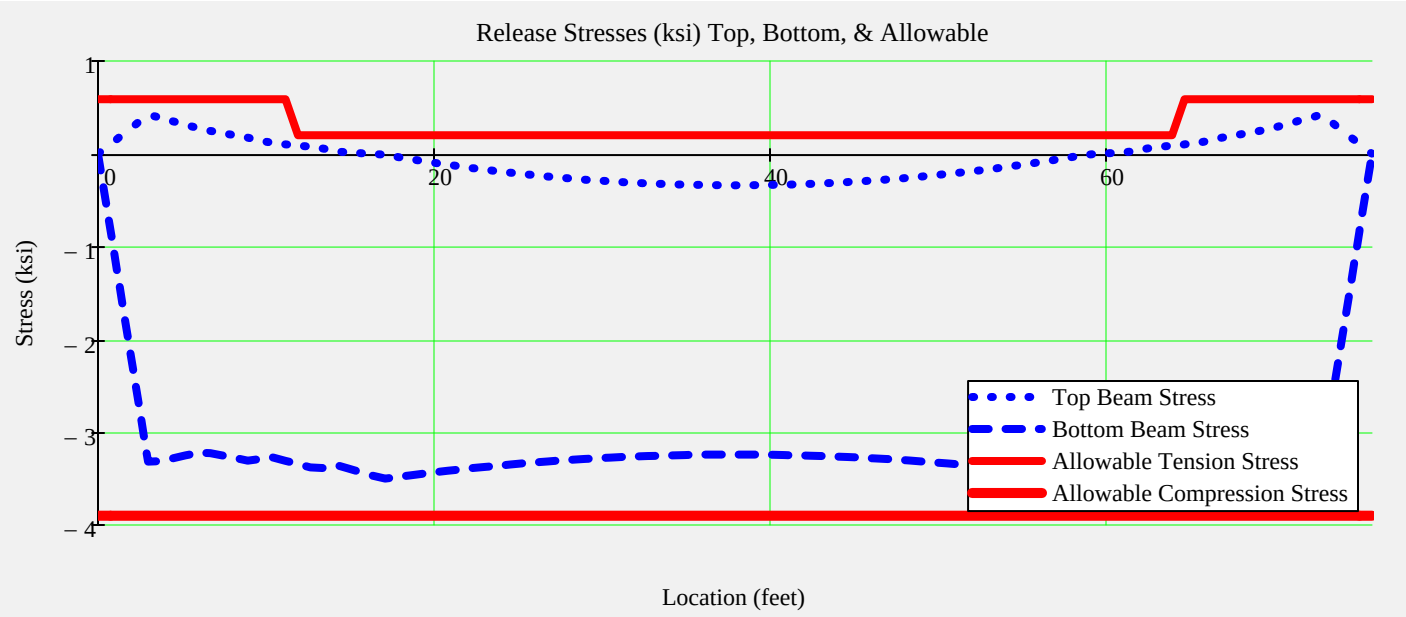
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.47$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.43$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.34$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–1.80	–3.83
"CompressionIb @ ServiceI"	37.92	–2.18	–5.10
"Compression @ FatigueI"	39.40	–1.14	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

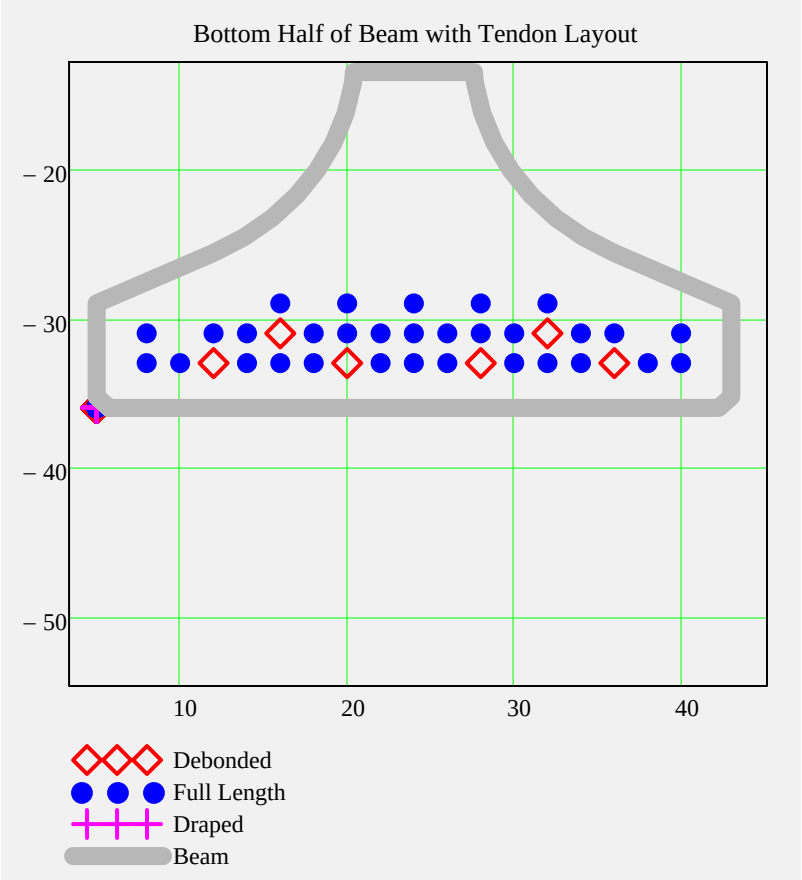
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

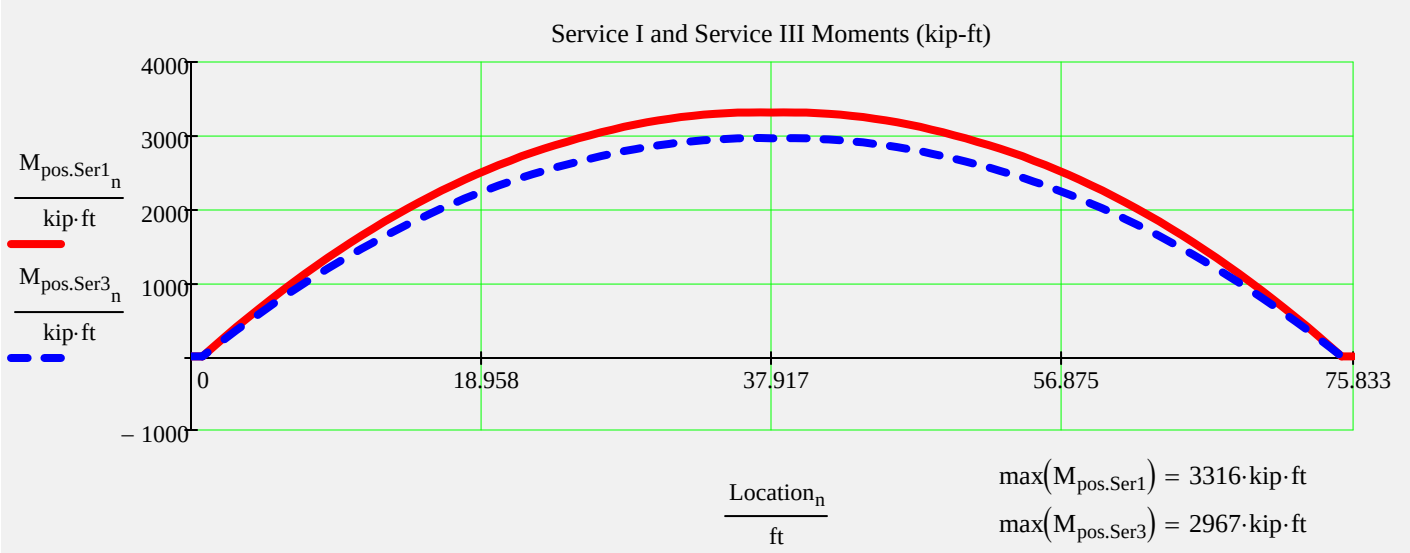
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3316 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2967 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.34 & -3.24 \\ \text{"2"} & -0.43 & -2.75 \\ \text{"4"} & -0.39 & -2.78 \\ \text{"6"} & -1.75 & -1.70 \\ \text{"8"} & -2.18 & -0.31 \end{pmatrix}$

$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1666 & -1601 \\ \text{"@Final (about composite centroid)"} & -1467 & -1333 \end{pmatrix}$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1718.4	402459	–7.4

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1335
"Composite Dead Load"	235
"Distributed Live Load"	1742

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

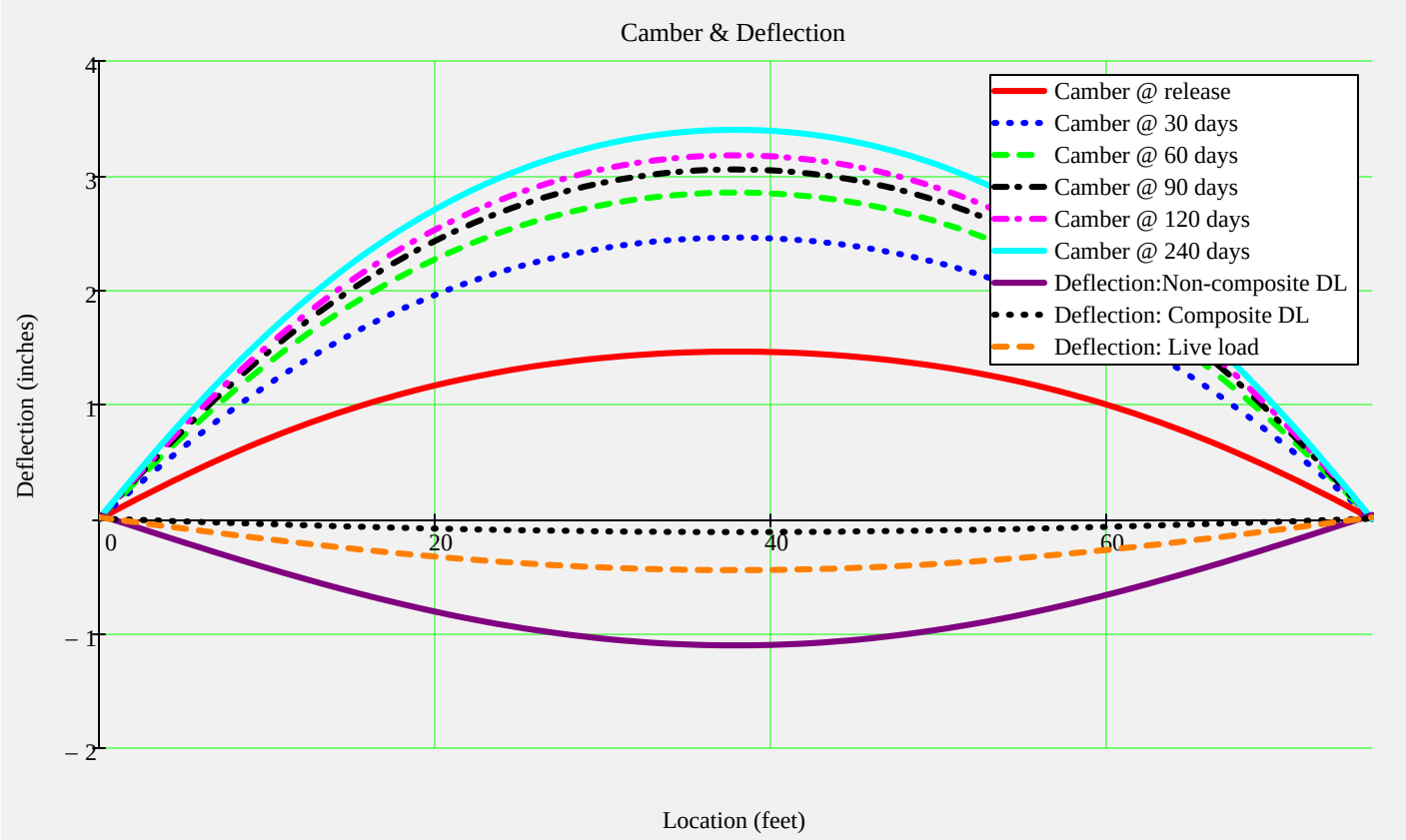
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.16	0.13	–0.23	–1.10
"Comp DL"	–0.01	0.02	–0.02	–0.11
"LL"	–0.02	0.09	–0.09	–0.45

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.96 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

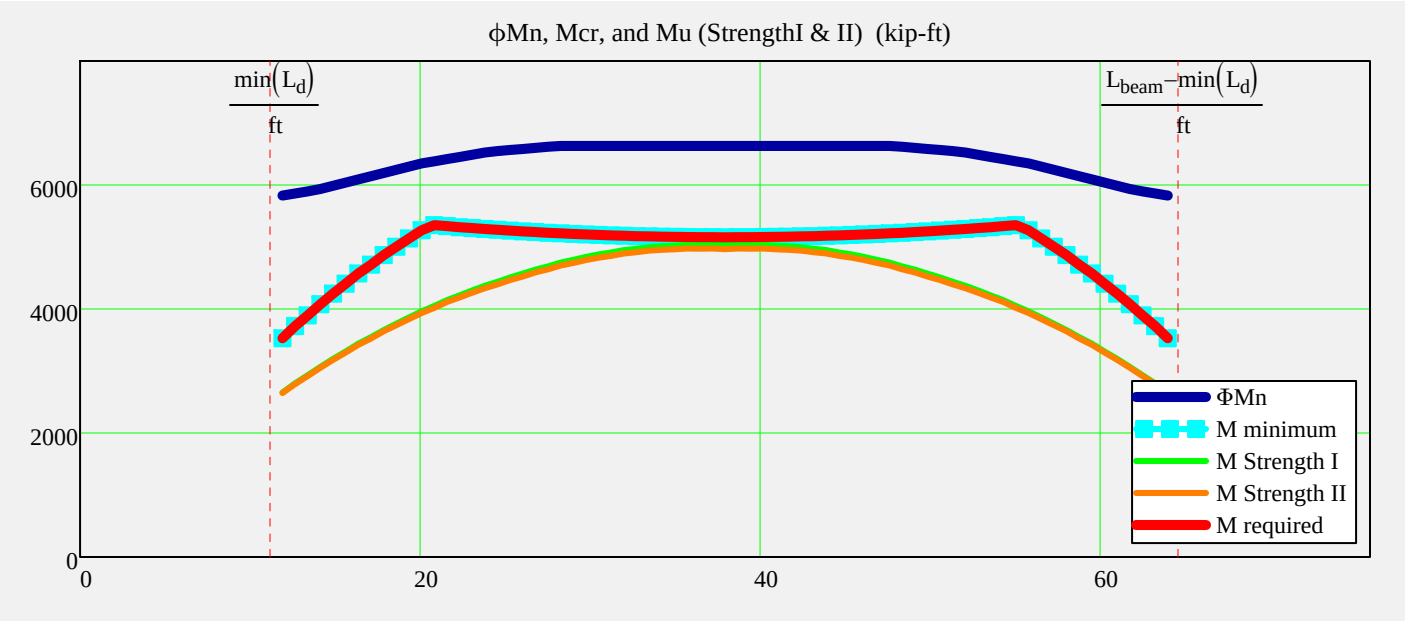
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5040 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5157 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5157 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6630 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.3\ \text{ft}$ $L_{beam} - \min(L_d) = 64.6\ \text{ft}$

$$DC_{moment_{mn}} := \frac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$$

Demand/Capacity Ratio at locations where all strands are fully developed

$\max(DC_{moment}) = 0.84$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

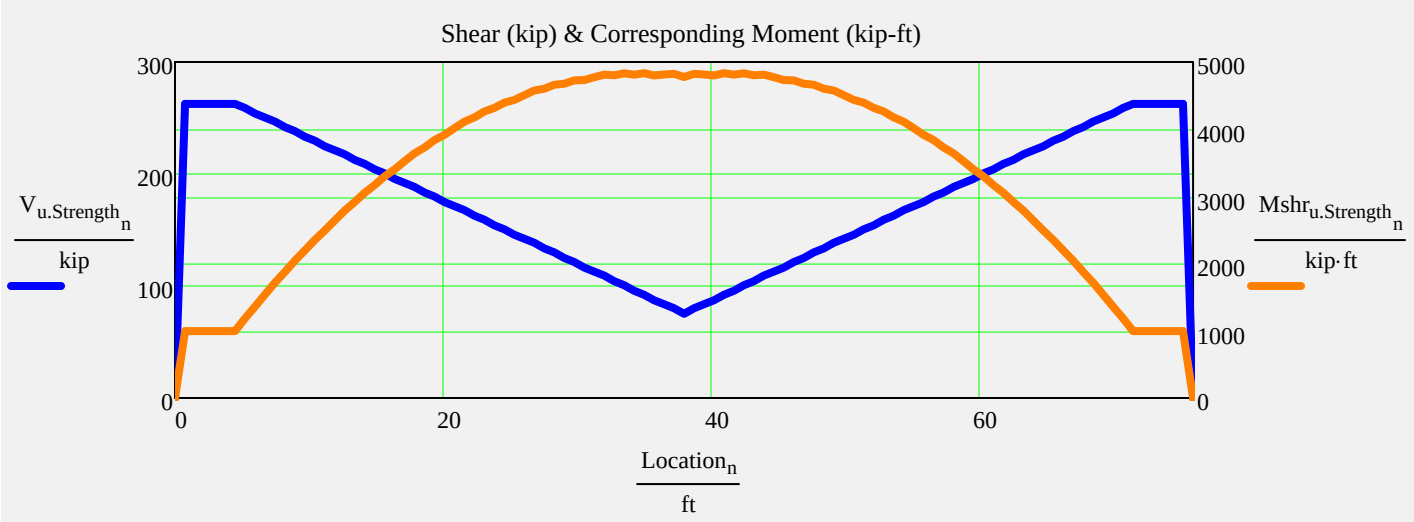
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

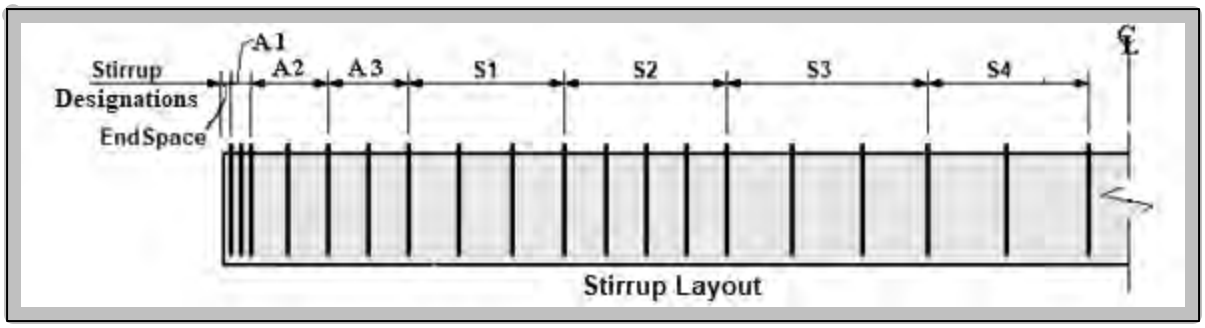
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 283 \\ 283 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 262.5 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4832 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

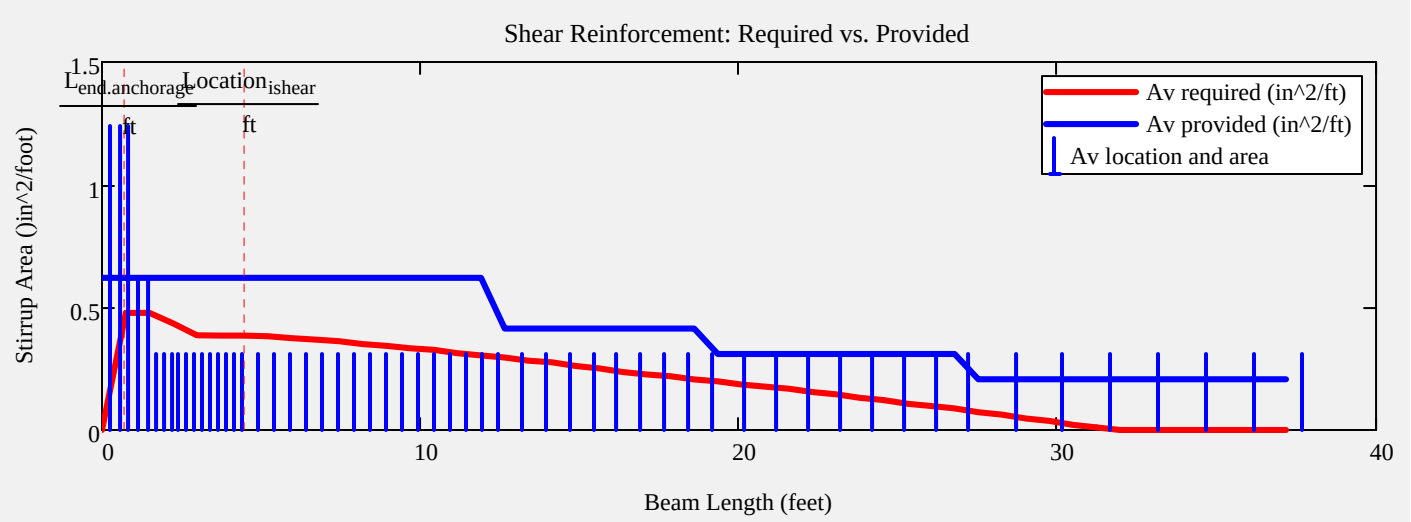
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



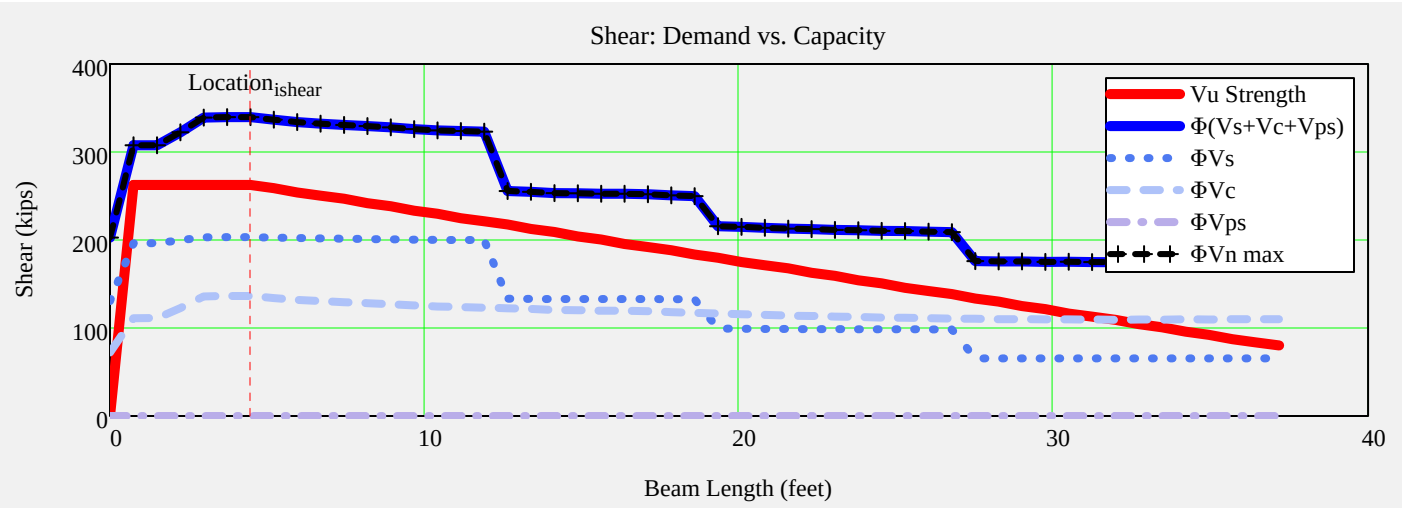
$Location_{ishear} = 4.47\ ft$

Save Data File ☑ Use current input file

File Name FIB36-76ftSpan_NoSkew_Exterior.dat Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam"

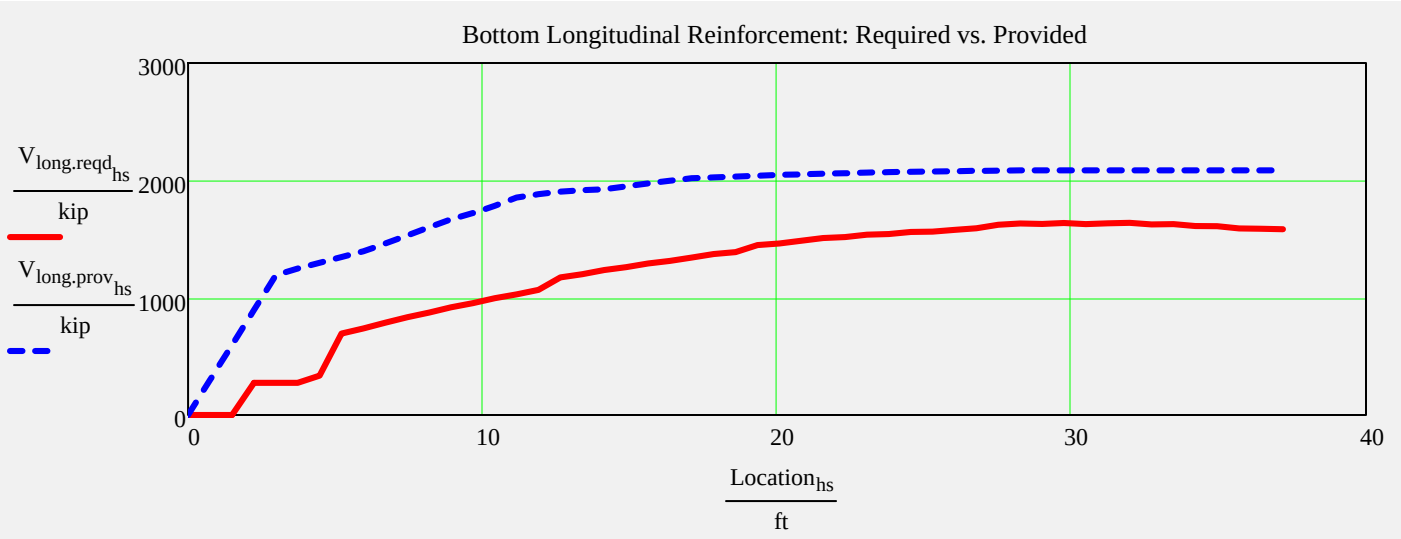
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 217.62 & 255.69 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.85$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

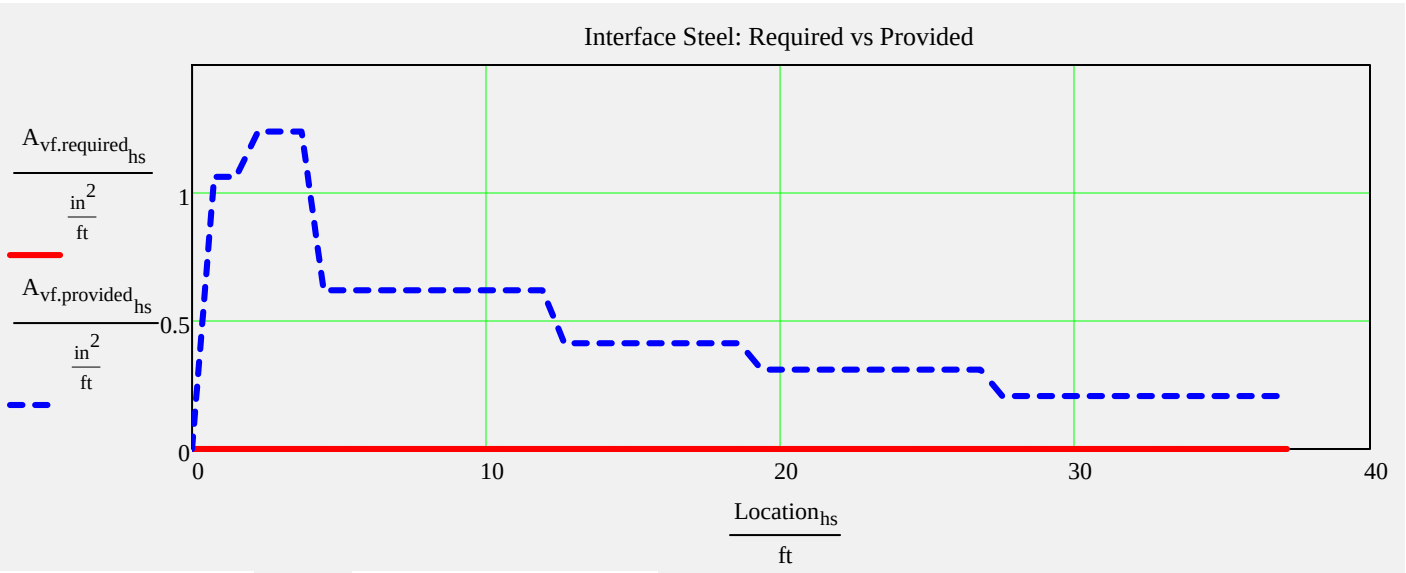


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 32.0 & 1638.0 & 2084.7 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.79$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

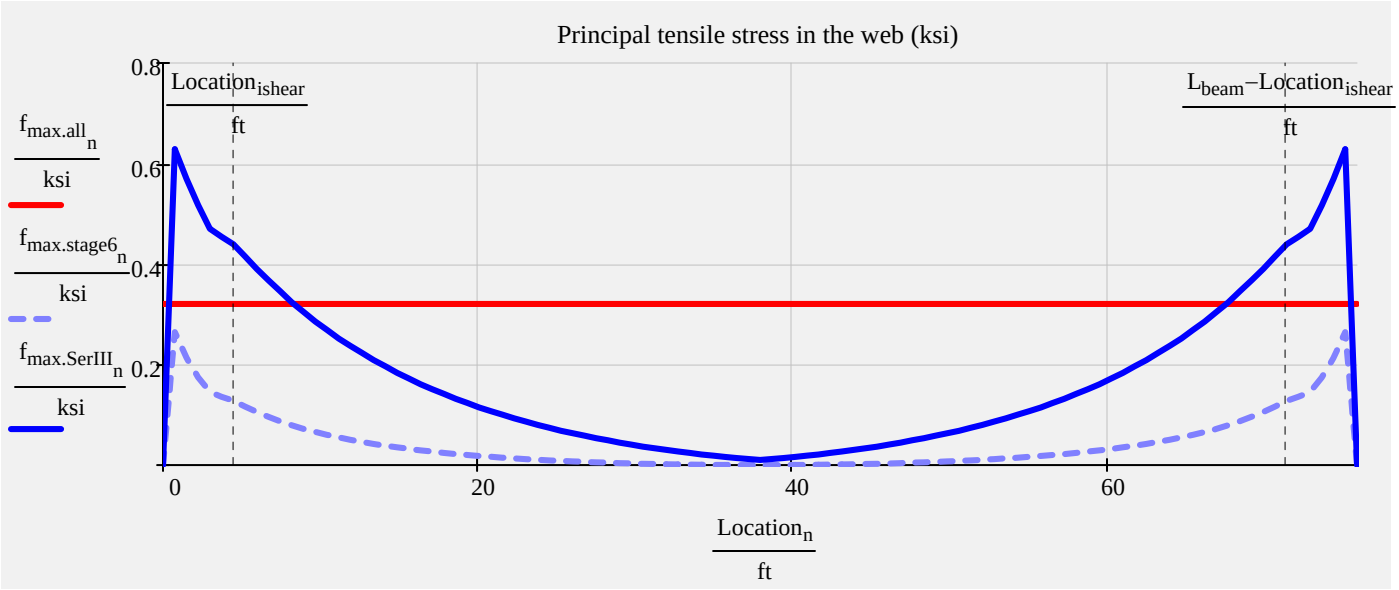
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6 \cdot in$ $\max(DC_f_{max.web}) = 1.37$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

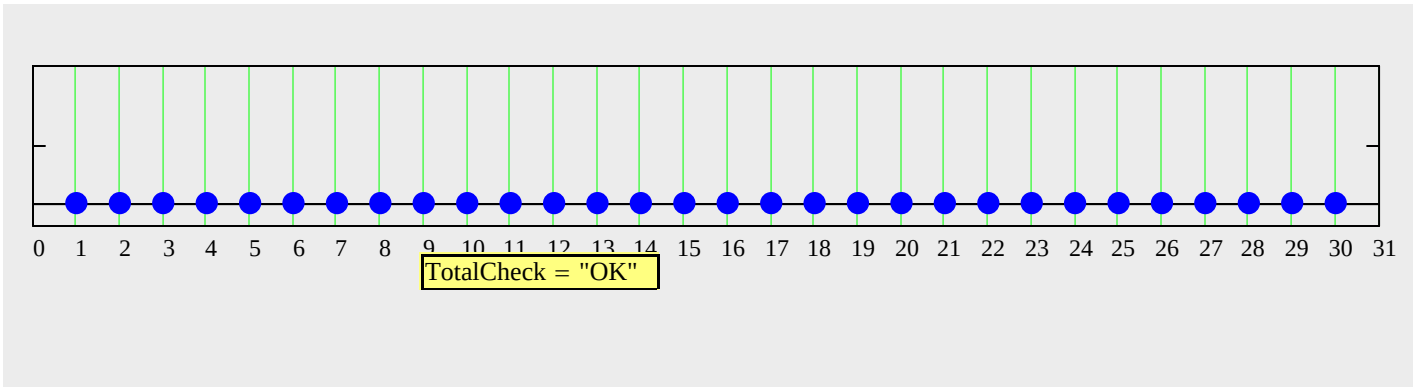
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.94	1.52	"N/A"	36.42	0.94	1.31	"N/A"	11.89	HL-93
"Strength I (Op)"	0.94	1.97	"N/A"	36.42	0.94	1.70	"N/A"	11.89	HL-93
"Service III (Inv)"	0.94	1.72	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.94	1.84	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.94	1.55	93.12	39.40	0.94	1.26	75.75	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.75$ $DC_{LongReinf.Permit} = 0.79$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6630	"factored resistance (kip-ft)...."
"γDL"	1984	"factored dead load (kip-ft)...."
"γLL"	2358	"factored live load (kip-ft)....."
"RF"	1.97	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	256.6	"factored resistance (kip)....."
"γDL"	72.6	"factored dead load (kip)....."
"γLL"	108.4	"factored live load (kip)....."
"RF"	1.7	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (NO SKEW)
WESTBOUND BRIDGE
(TIGER BAY)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior.dat
FIB36-76ftSpan_15Skew_Interior.dat
FIB36-76ftSpan_NoSkew_Exterior.dat
FIB36-76ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

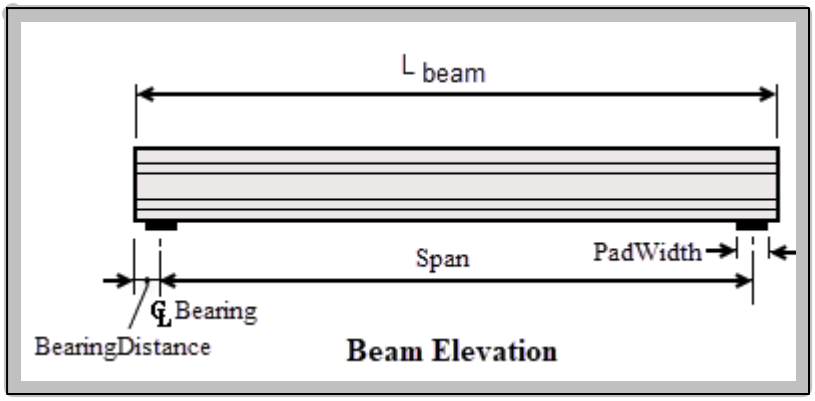
InputDataFile = "FIB36-76ftSpan_NoSkew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	Westbound Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_NoSkew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	11.6667	ft	*Measured from beam centerline to centerline.*
Overhang	3.8333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	4		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

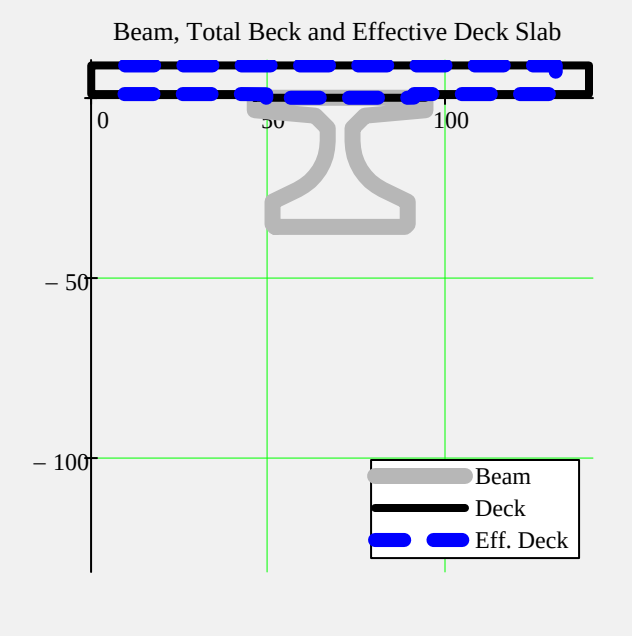
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 140·in

$b_e = 140 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 1.22 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.15 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.175 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.22 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

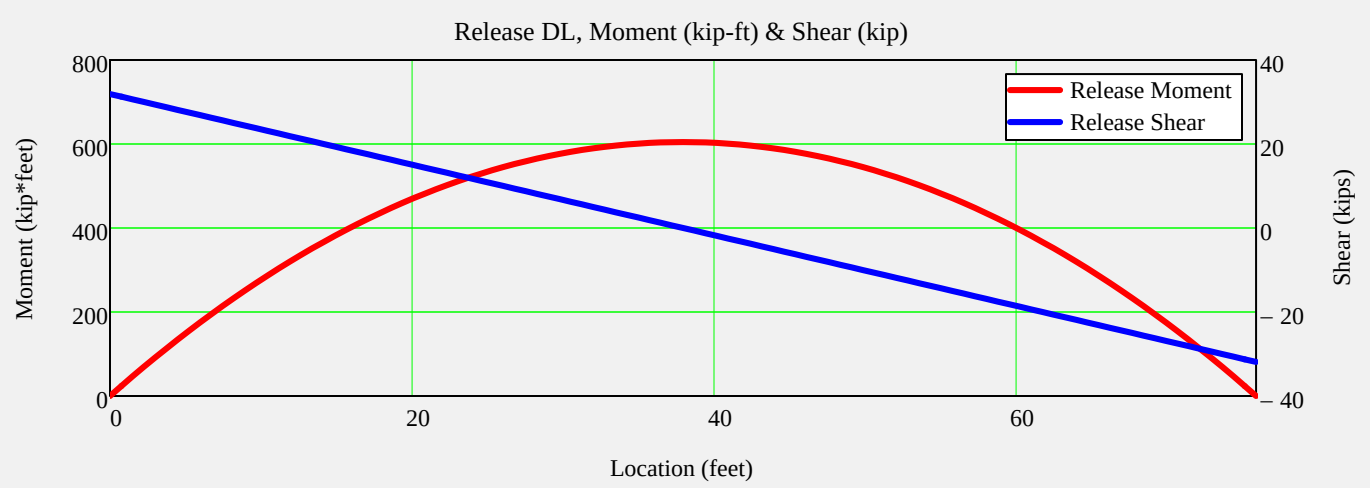
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

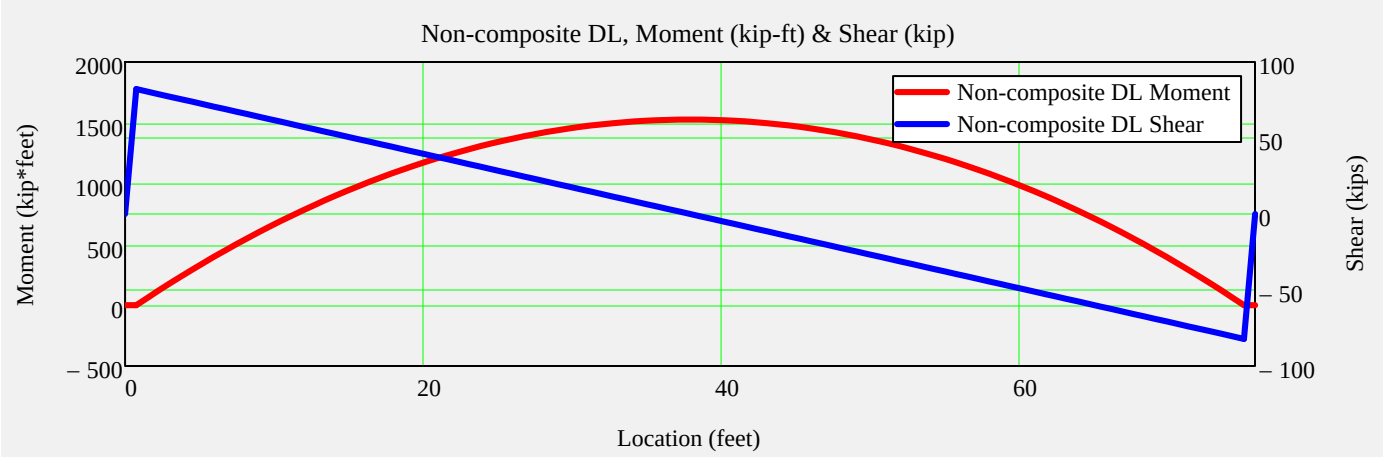
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



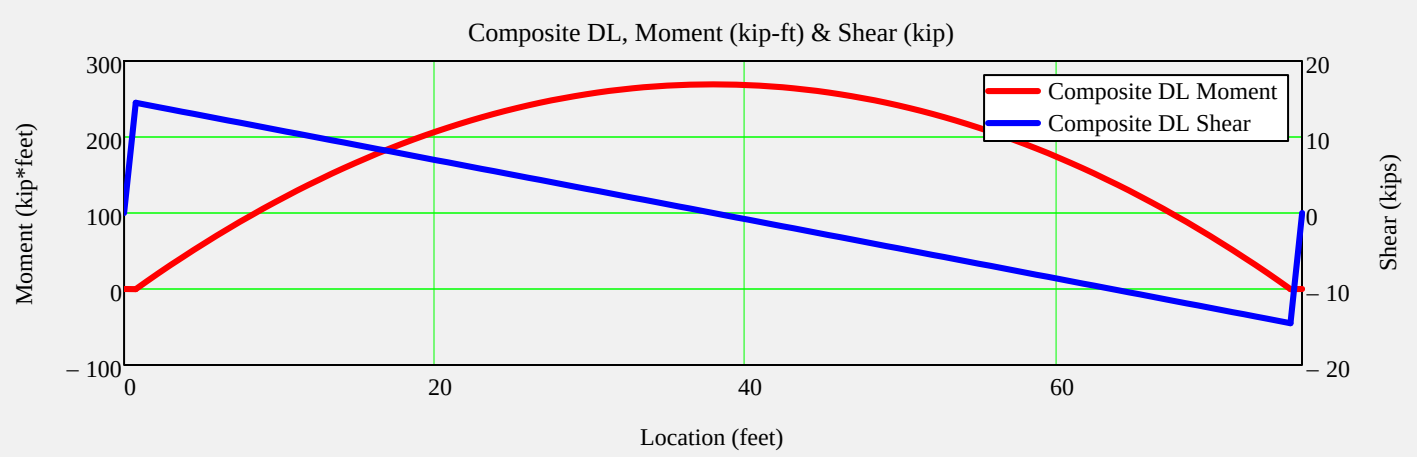
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 82.2 \cdot kip$ $\max(M_{dl.non.comp}) = 1526.5 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -82.2 \cdot kip$

Composite Dead Load Moments and Shear



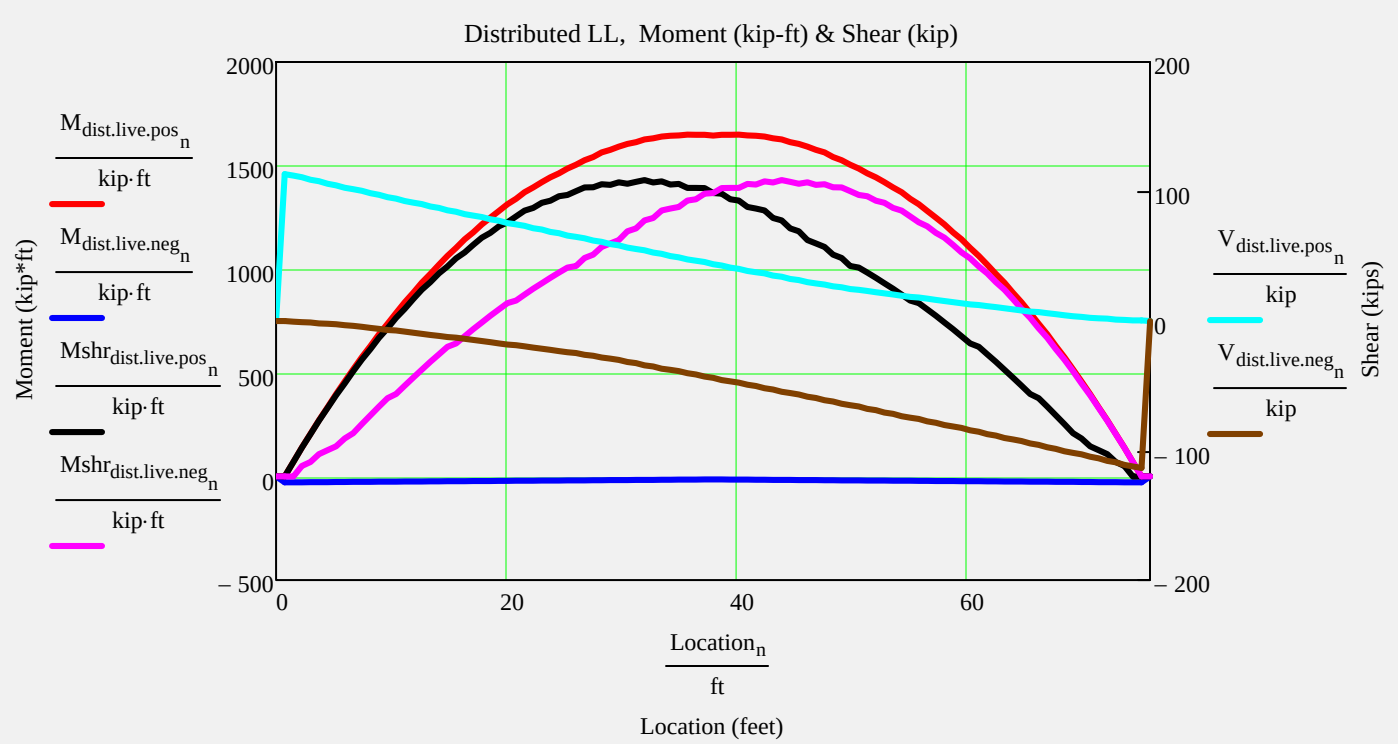
$\max(V_{dl.comp}) = 14.5 \cdot kip$ $\max(M_{dl.comp}) = 269.3 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -14.5 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 11.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.89$ $g_{mom.fatigue} = 0.51$ $g_{shear} = 1.06$



$\max(V_{dist.live.pos}) = 113.5 \cdot kip$

$\max(M_{dist.live.pos}) = 1649.7 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -113.5 \cdot kip$

$Reaction_{LL} = 115.6 \cdot kip$

$\min(M_{dist.live.neg}) = -28.6 \cdot kip \cdot ft$

$Reaction_{DL} = 98.6 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1430 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 93.3 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_NoSkew_Interior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement							*Partial PS (Dormant) Strand*	
Location	Deck		Bottom of Beam	Beam End: Top		Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62	*1	0	1.58		0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4	*2	0		*3		*Distance (in)*	1.5
Length (ft)				16		0	*# Strands*	4
Bar Size			5	5	*4	0	*4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity	75	%	*% relative humidity (75% typical)*
Time: jacking to transfer	1.5	days	*Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

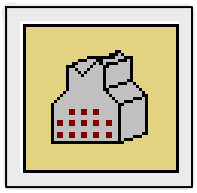
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

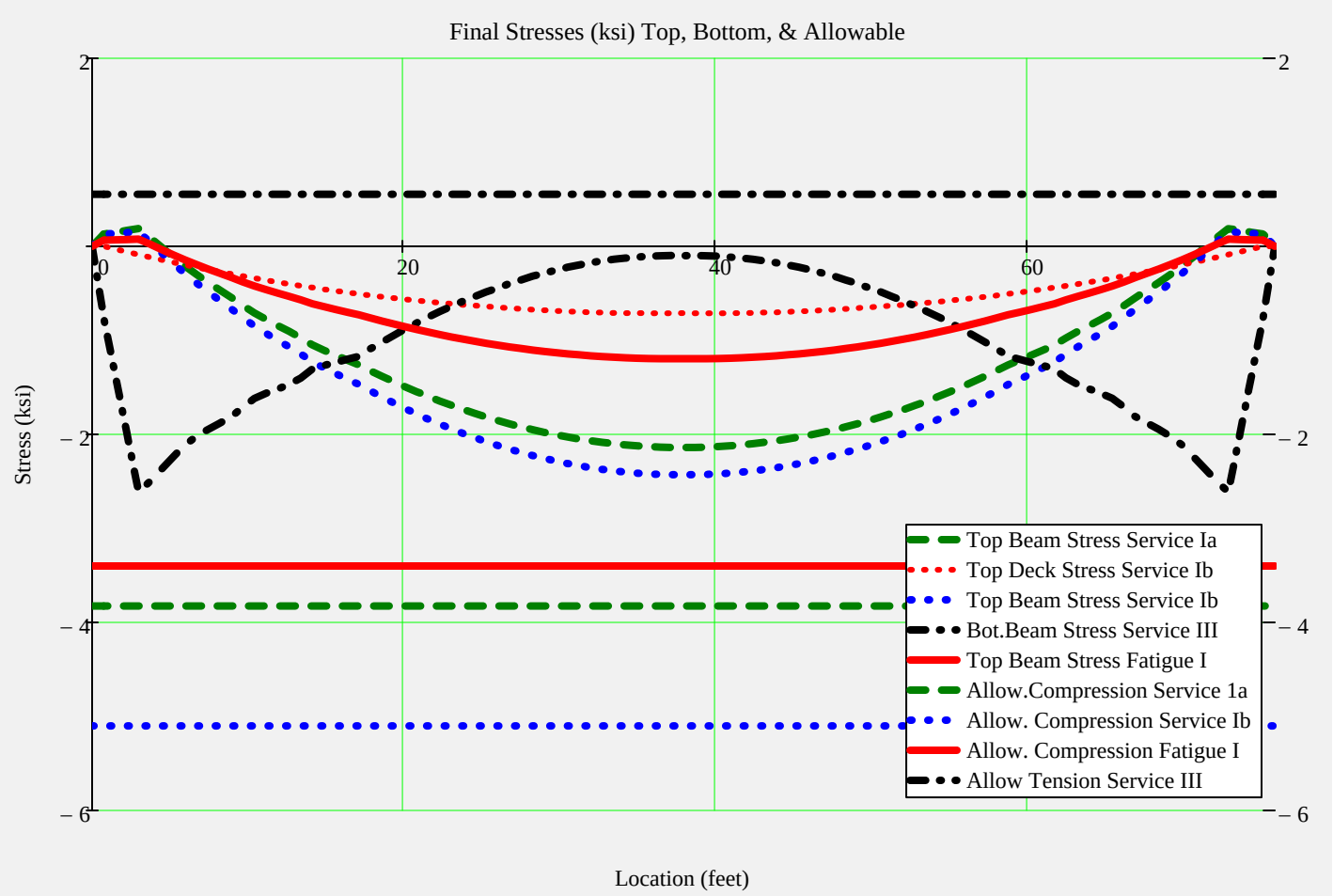
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

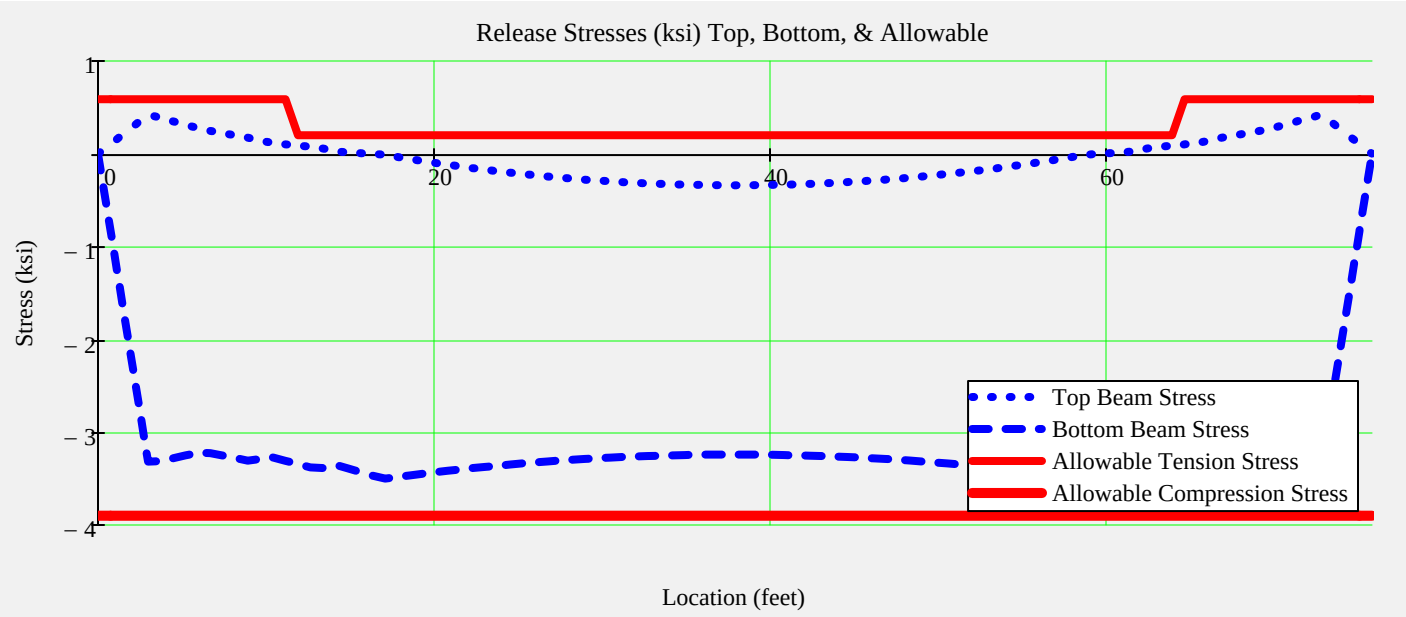
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.56$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.48$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.35$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–2.14	–3.83
"CompressionIb @ ServiceI"	37.92	–2.43	–5.10
"Compression @ FatigueI"	38.66	–1.20	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

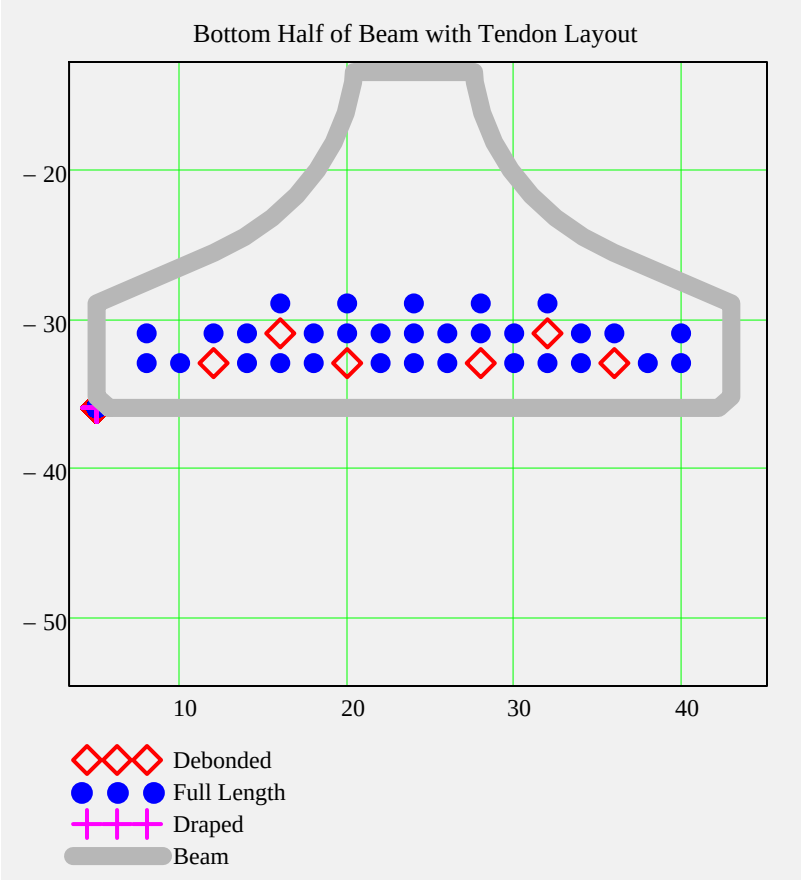
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

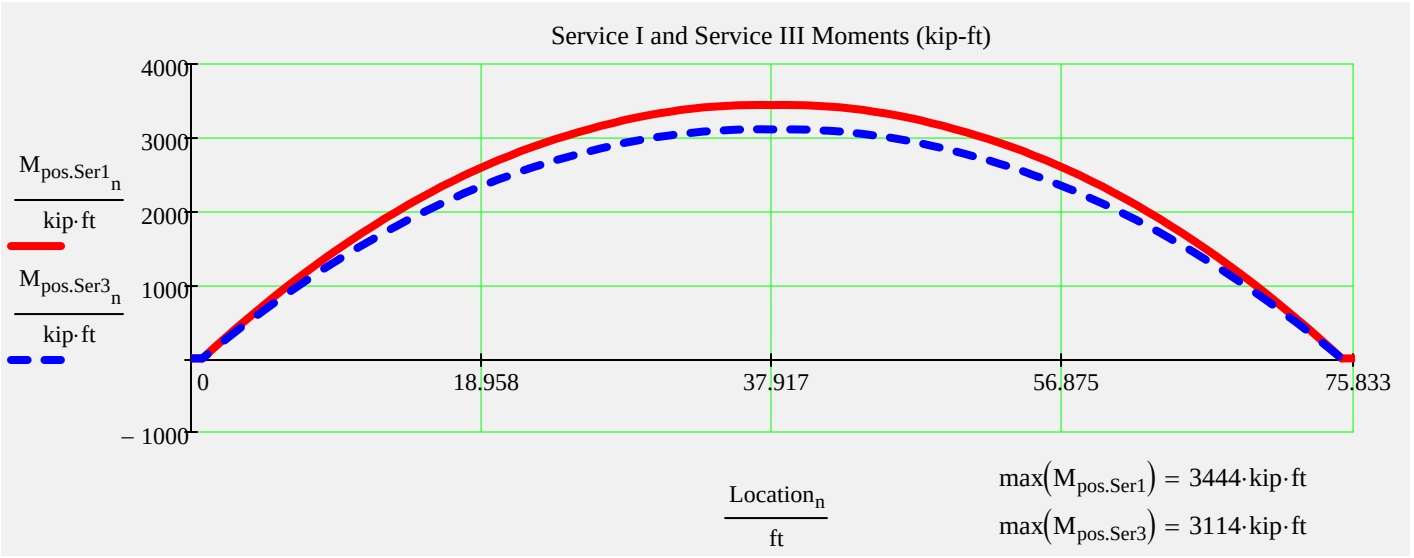
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3444 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3114 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.34 & -3.24 \\ \text{"2"} & -0.43 & -2.75 \\ \text{"4"} & -0.39 & -2.78 \\ \text{"6"} & -2.09 & -1.42 \\ \text{"8"} & -2.43 & -0.10 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1666 & -1601 \\ \text{"@Final (about composite centroid)"} & -1467 & -1333 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1890.5	427445	–6.3

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1527
"Composite Dead Load"	269
"Distributed Live Load"	1645

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

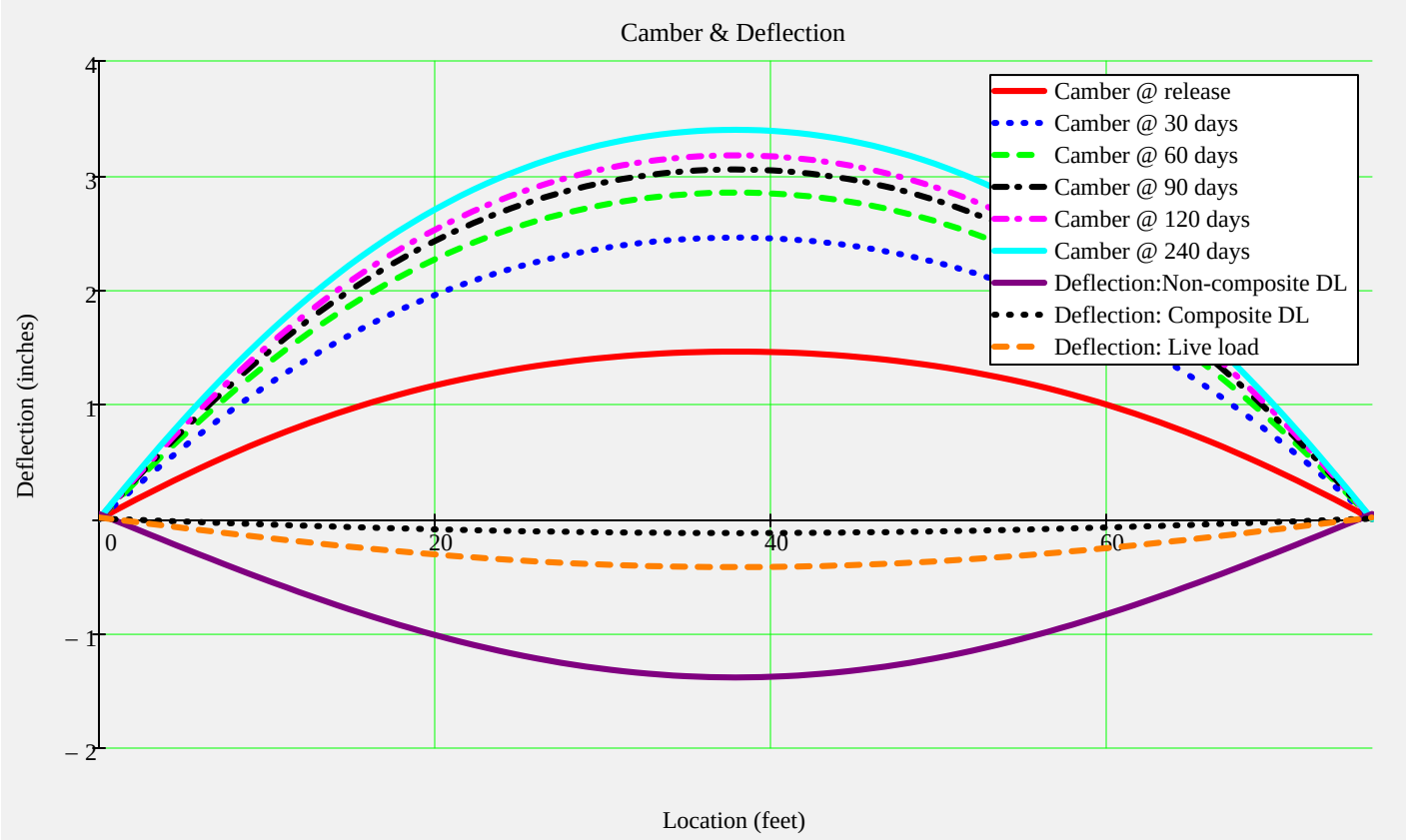
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.20	0.16	–0.28	–1.38
"Comp DL"	–0.01	0.03	–0.03	–0.12
"LL"	–0.02	0.09	–0.09	–0.42

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.67 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

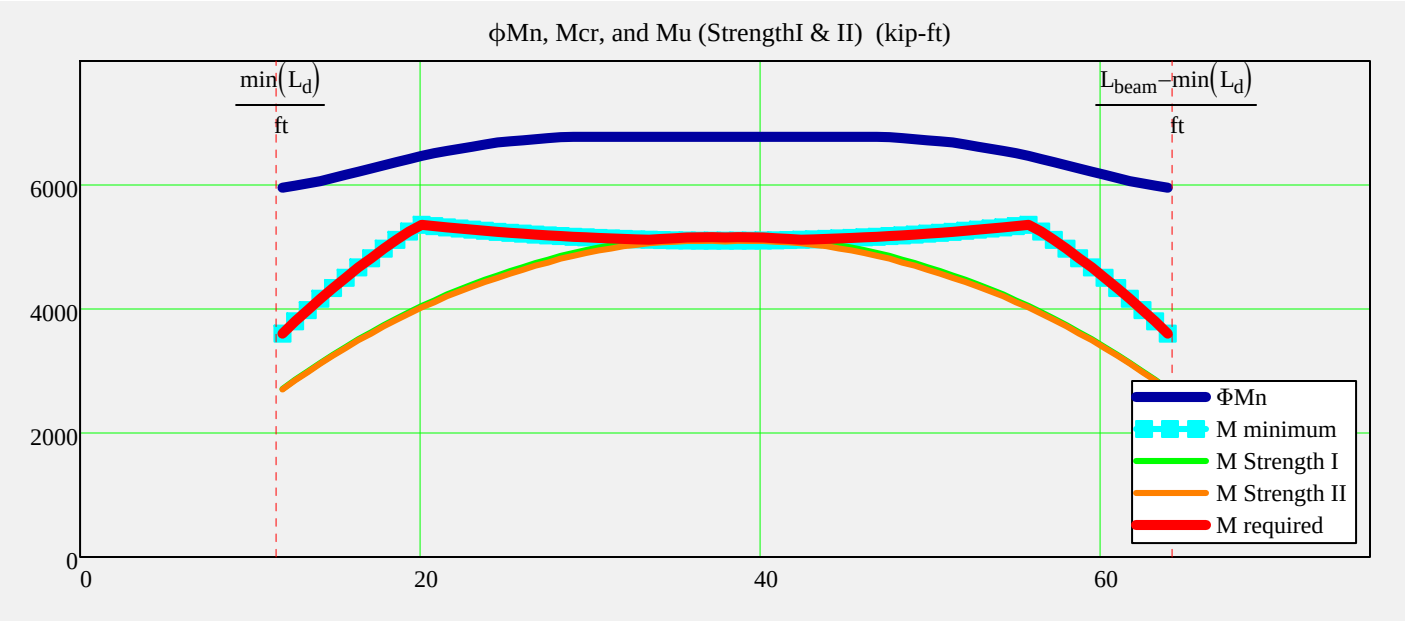
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5159 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5101 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5153 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6778 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.6\ \text{ft}$ $L_{beam} - \min(L_d) = 64.2\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.83$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

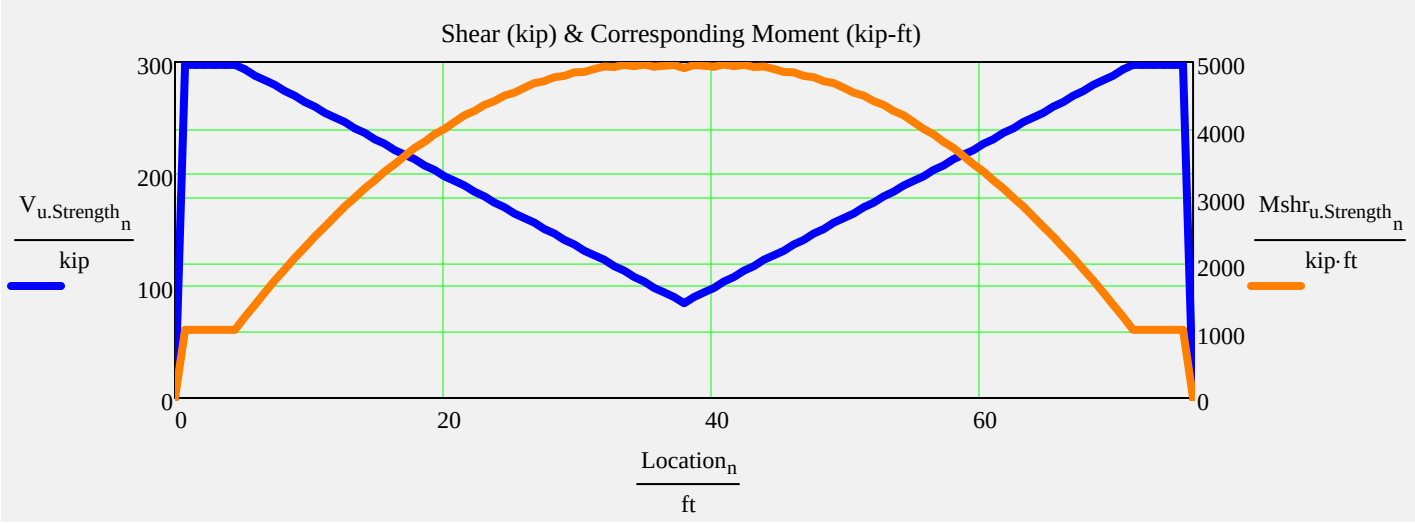
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

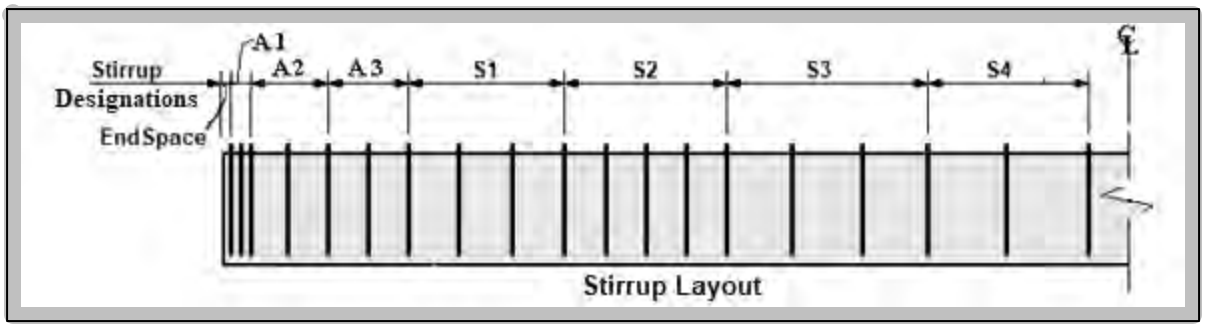
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 321 \\ 321 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 297.5 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4961 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

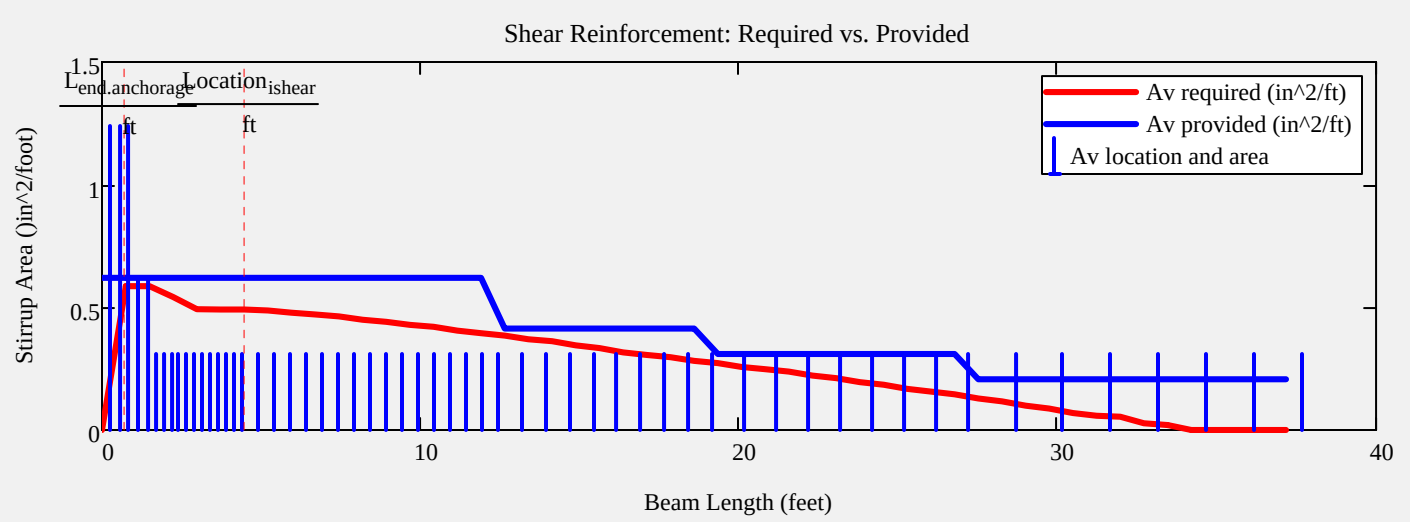
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

Save Data File

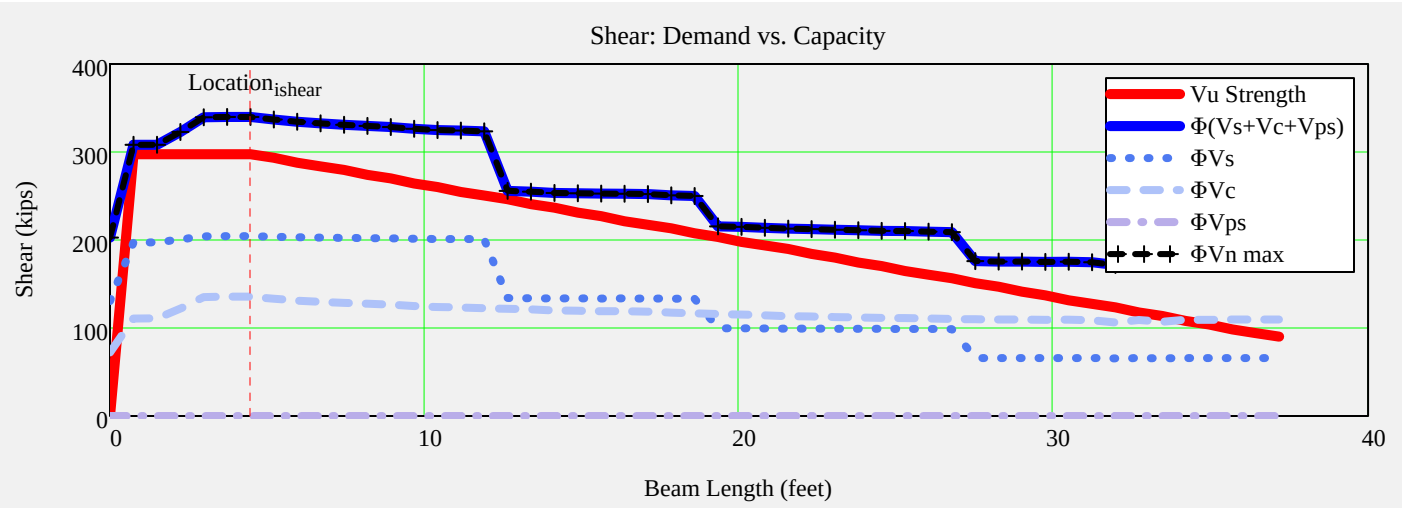
Use current input file

File Name FIB36-76ftSpan_NoSkew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam"

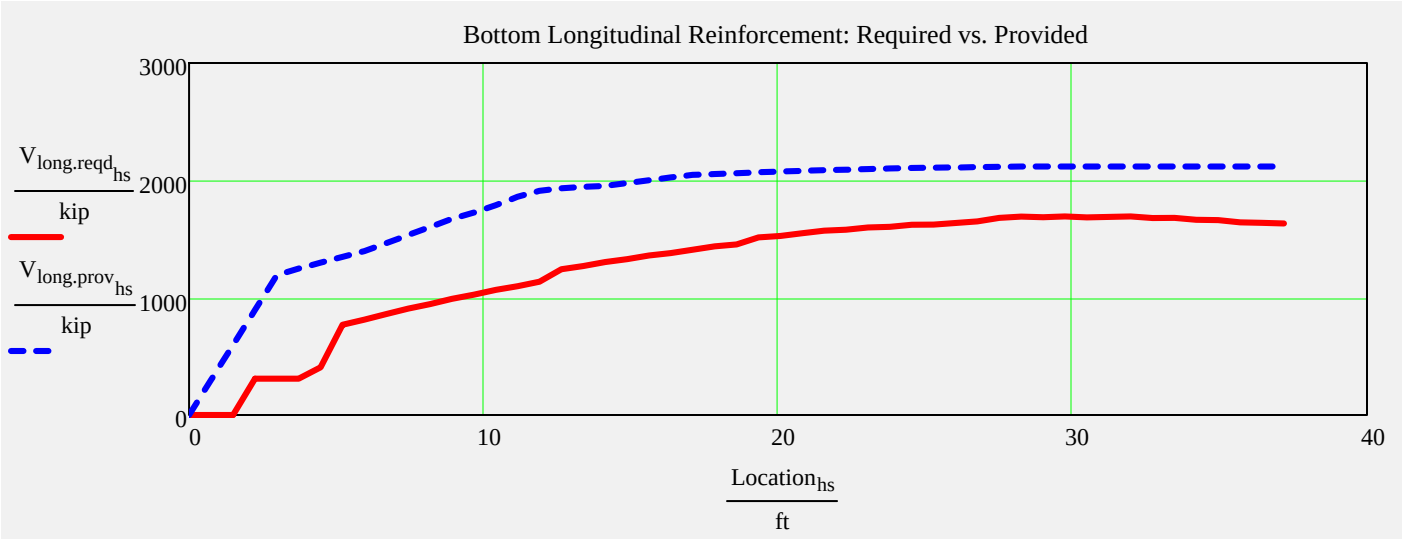
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 246.44 & 255.76 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.96$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

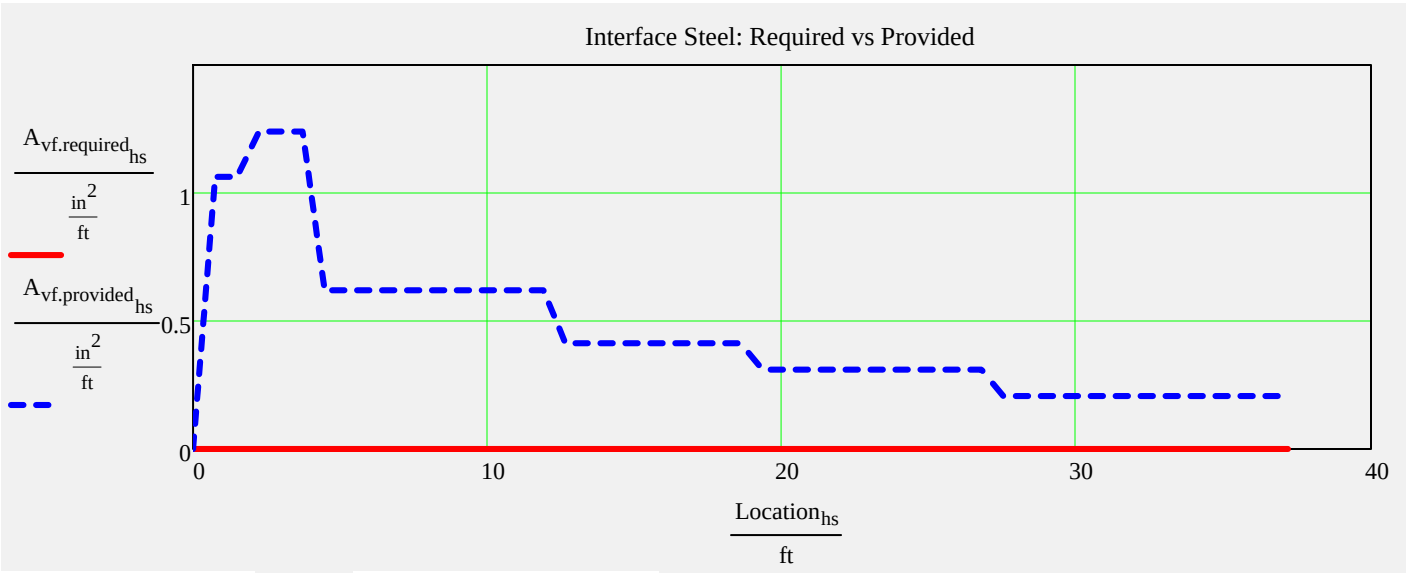


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 29.7 & 1692.5 & 2118.1 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.80$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

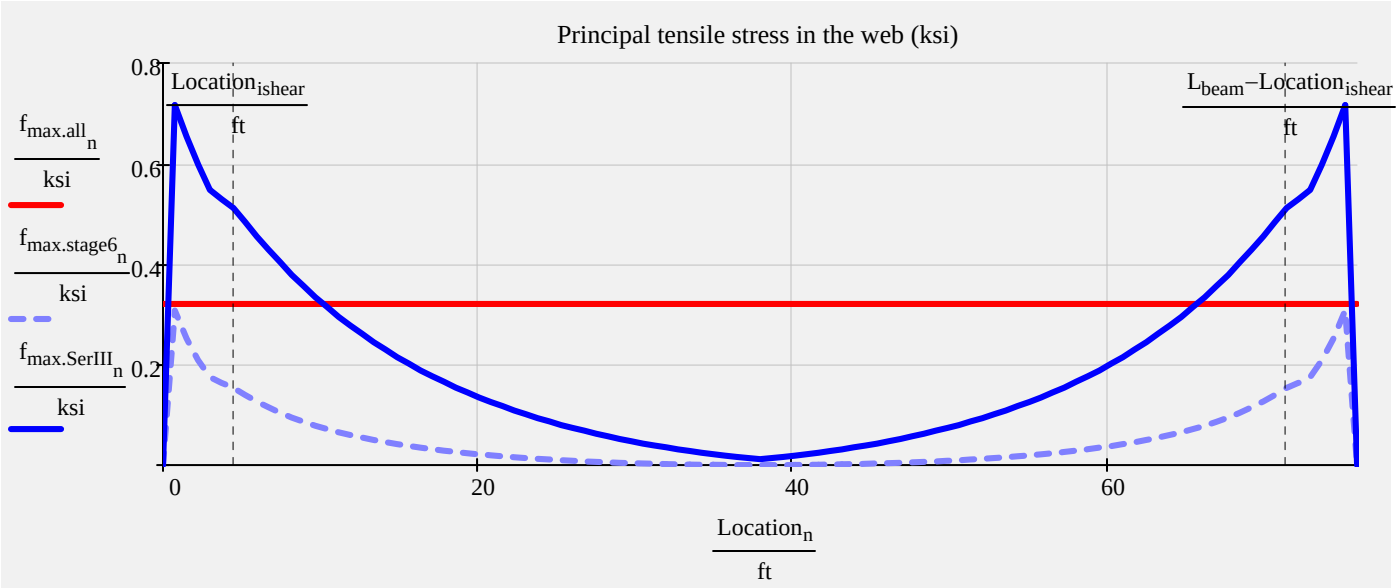
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6 \cdot in$ $\max(DC_f_{max.web}) = 1.6$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

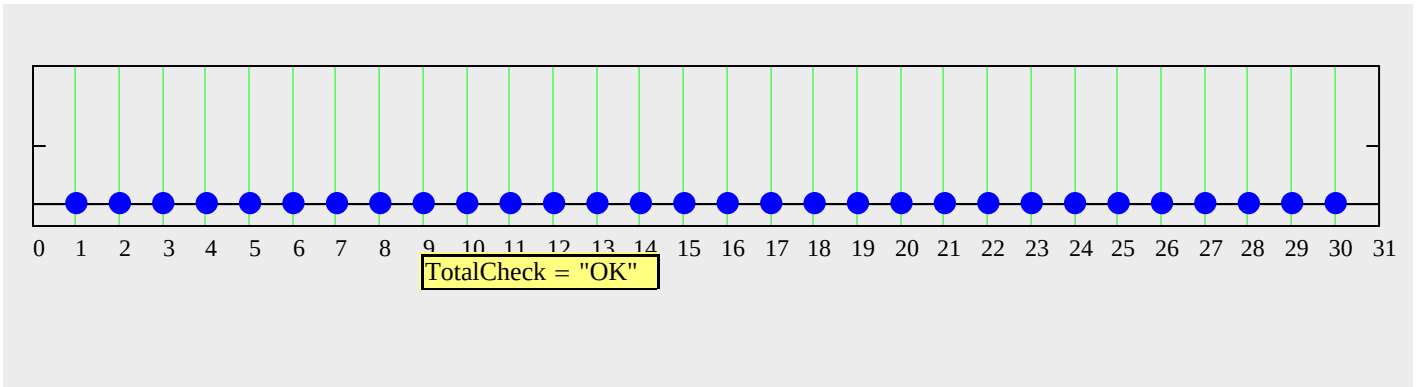
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.89	1.56	"N/A"	37.91	1.06	1.10	"N/A"	11.89	HL-93
"Strength I (Op)"	0.89	2.02	"N/A"	36.42	1.06	1.42	"N/A"	11.89	HL-93
"Service III (Inv)"	0.89	1.59	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.89	1.72	"N/A"	36.42	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.89	1.59	95.65	39.40	1.06	1.06	63.43	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.76$ $DC_{LongReinf.Permit} = 0.80$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6778	"factored resistance (kip-ft)...."
"γDL"	2274	"factored dead load (kip-ft)...."
"γLL"	2226	"factored live load (kip-ft)....."
"RF"	2.02	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	256.6	"factored resistance (kip)....."
"γDL"	83.3	"factored dead load (kip)....."
"γLL"	121.9	"factored live load (kip)....."
"RF"	1.42	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (15 DEG. SKEW)
WESTBOUND BRIDGE
(D.C.I CANAL)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam	
FSB	
FUB	
FlatSlab	
InvertedT	
DoubleT	

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior.dat
FIB36-76ftSpan_15Skew_Interior.dat
FIB36-76ftSpan_NoSkew_Exterior.dat
FIB36-76ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

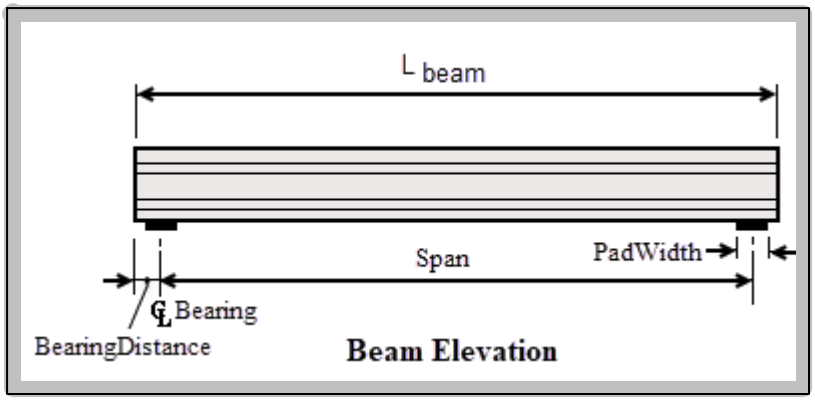
InputDataFile = "FIB36-76ftSpan_15Skew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	Westbound Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_15Skew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeH)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	11.6667	ft	*Measured from beam centerline to centerline.*
Overhang	3.8333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(* 0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	4		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

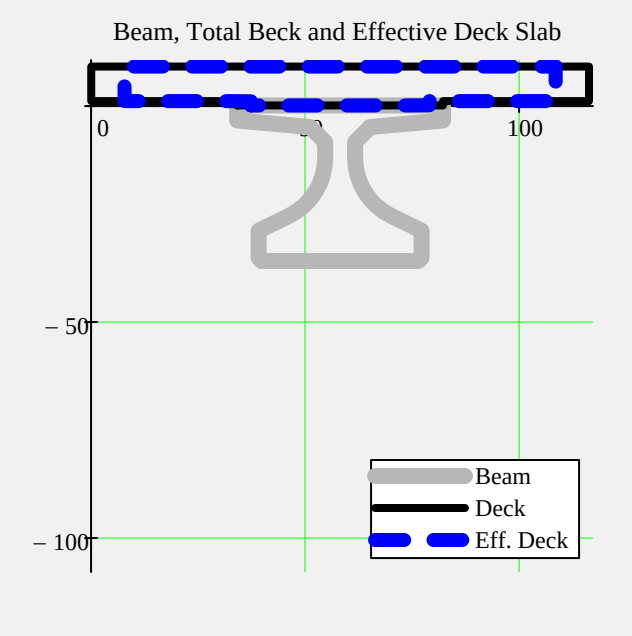
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 140·in

$b_e = 116 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 1.02 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.08 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.125 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.22 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

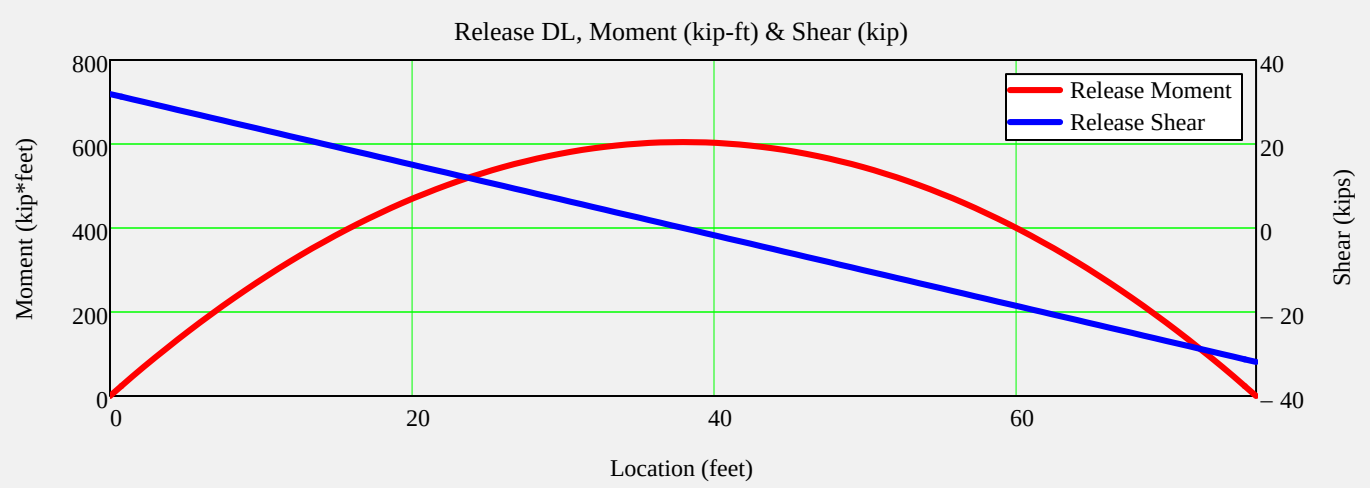
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

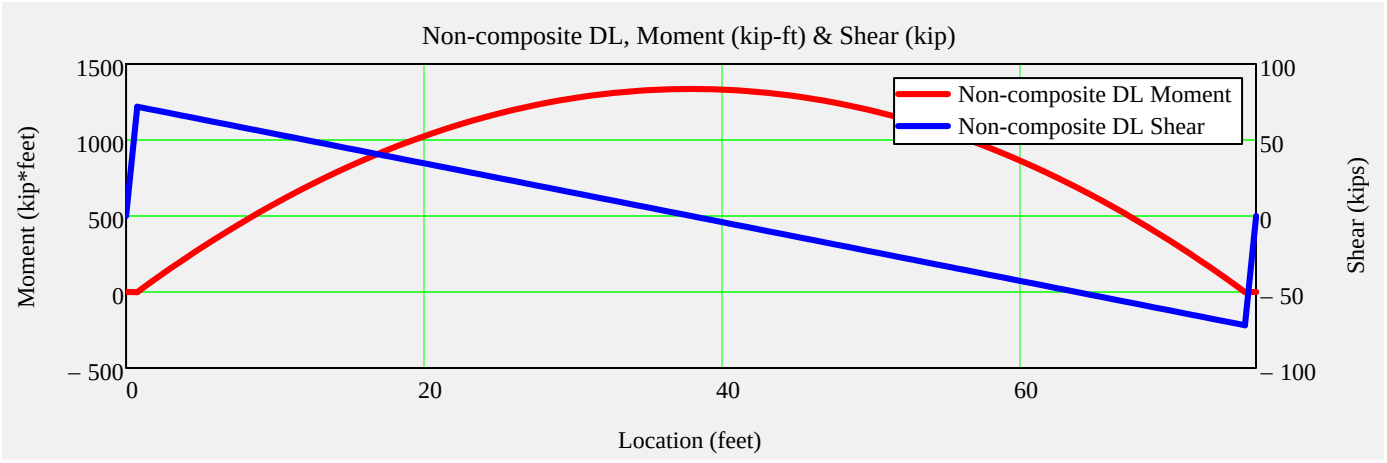
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



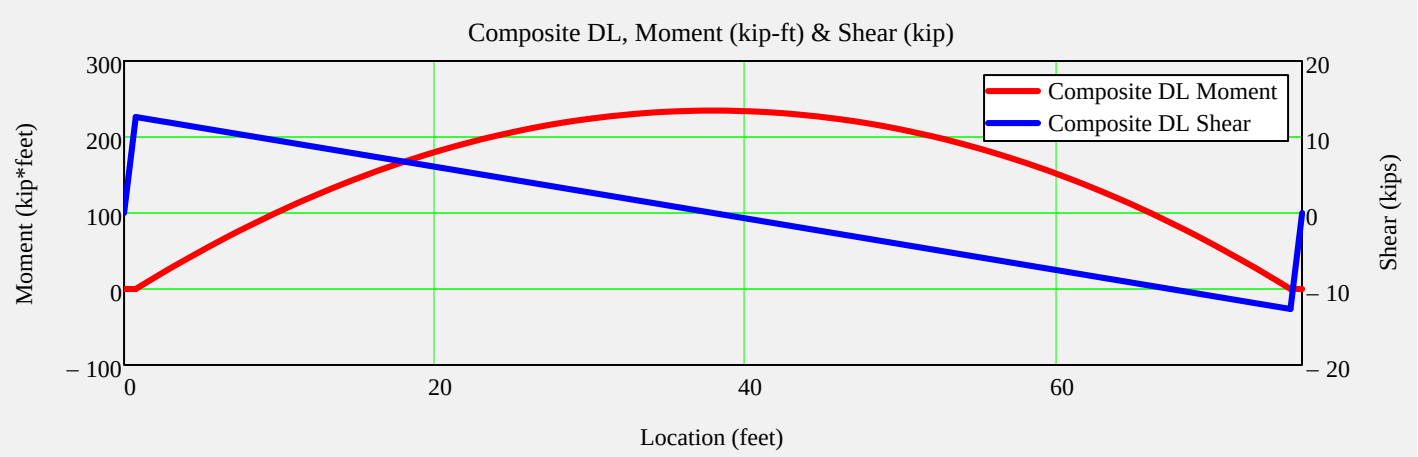
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 71.9 \cdot kip$ $\max(M_{dl.non.comp}) = 1335.5 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -71.9 \cdot kip$

Composite Dead Load Moments and Shear



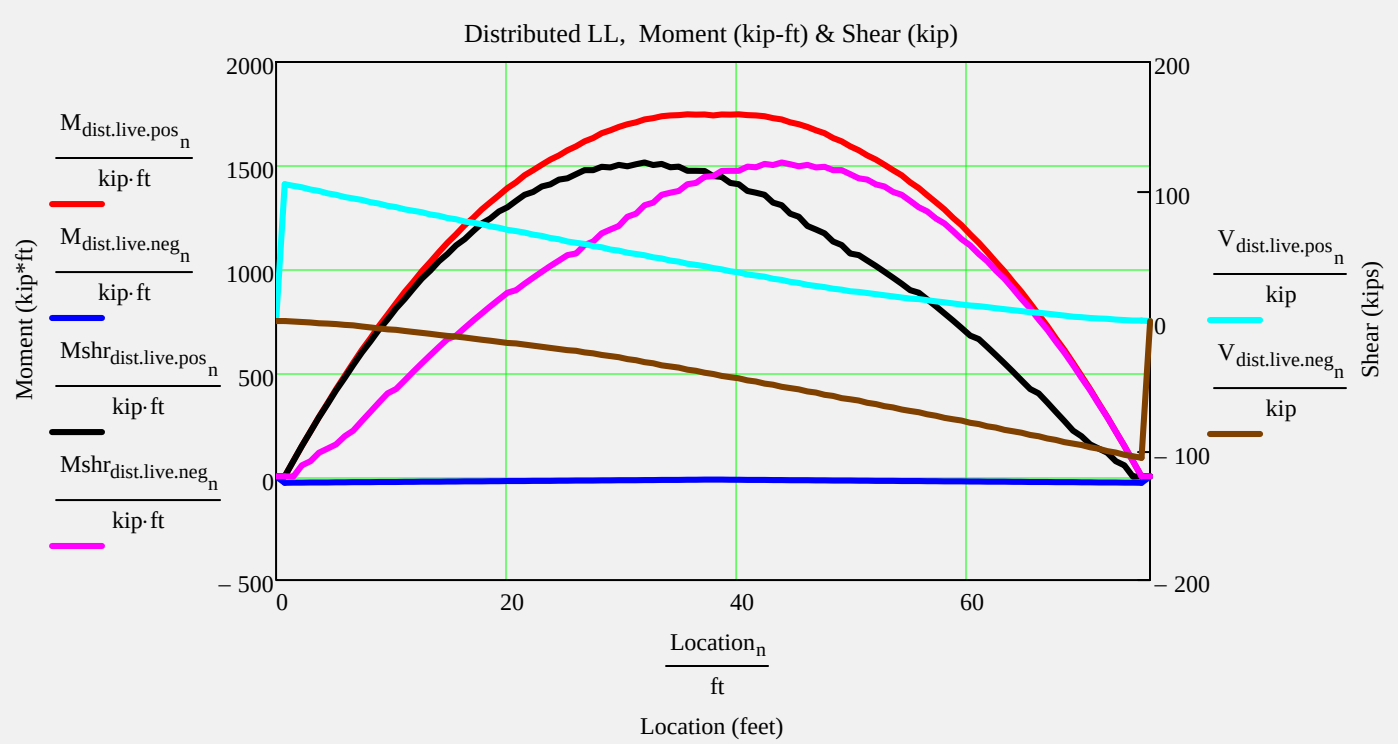
$\max(V_{dl.comp}) = 12.6 \cdot kip$ $\max(M_{dl.comp}) = 234.7 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -12.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 11.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.05$

Final Live Load Distribution Factors: $g_{mom} = 0.94$ $g_{mom.fatigue} = 0.79$ $g_{shear} = 0.99$



$\max(V_{dist.live.pos}) = 105.6 \cdot kip$

$\max(M_{dist.live.pos}) = 1747.7 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -105.6 \cdot kip$

$Reaction_{LL} = 107.6 \cdot kip$

$\min(M_{dist.live.neg}) = -30.3 \cdot kip \cdot ft$

$Reaction_{DL} = 86.2 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1515 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 86.8 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_15Skew_Exterior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck		Bottom of Beam		Beam End: Top	Beam End: Bottom
Area (in^2)	0.62	*1	0		1.58	0
Distance (in)	4	*2	0	*3		
Length (ft)					16	0
Bar Size			5	*4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

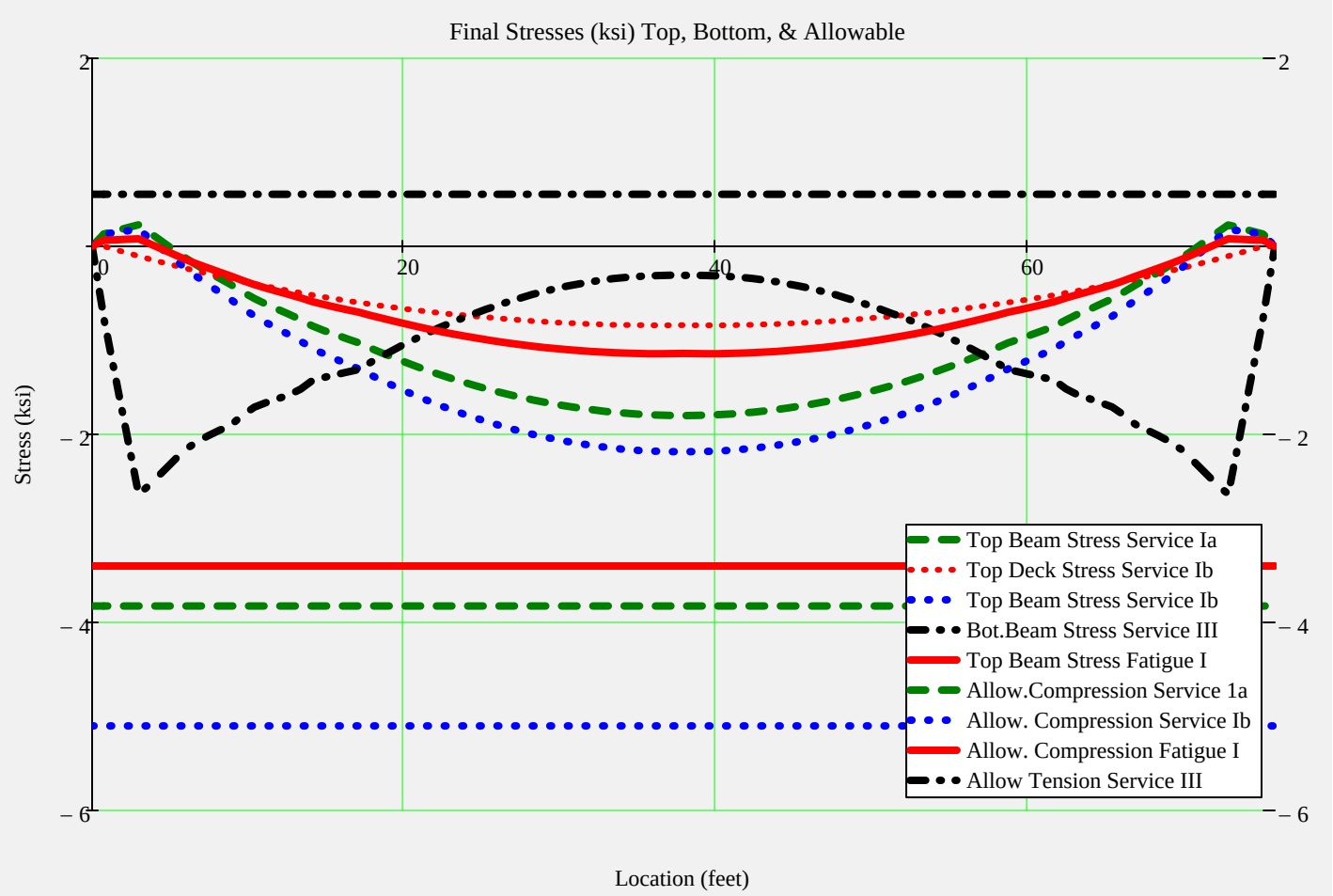
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

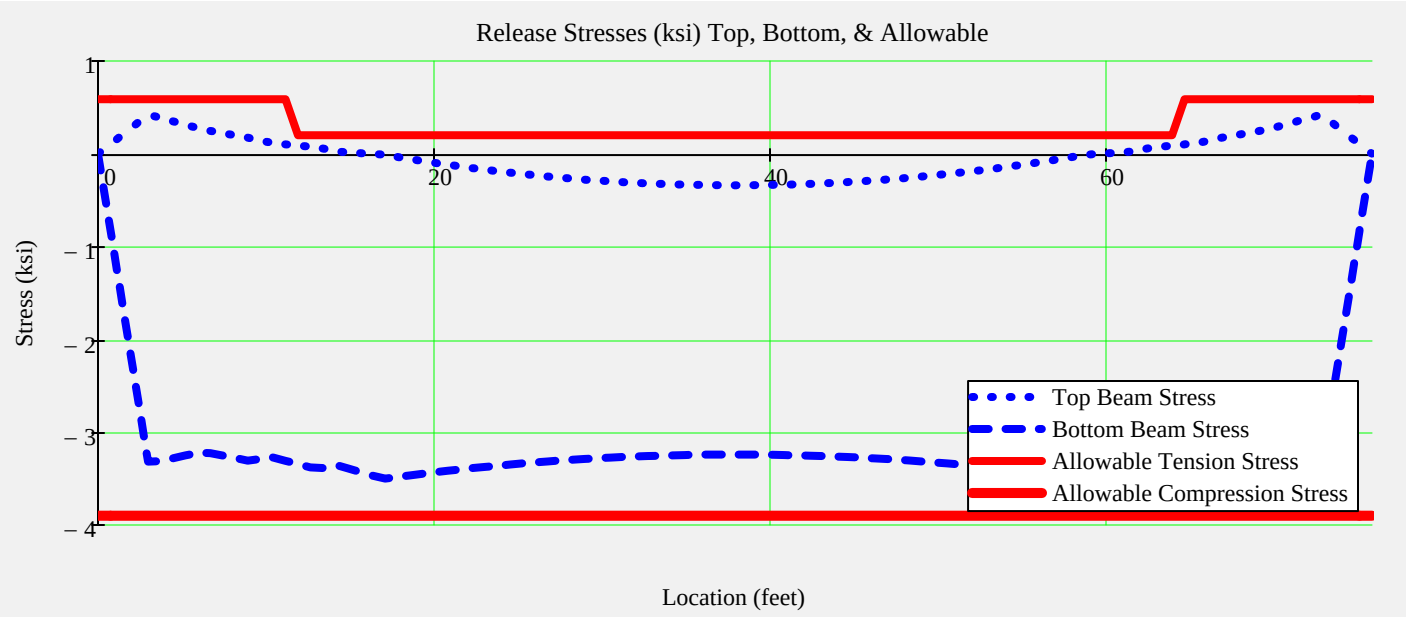
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.47$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.43$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.34$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–1.80	–3.83
"CompressionIb @ ServiceI"	37.92	–2.18	–5.10
"Compression @ FatigueI"	39.40	–1.14	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

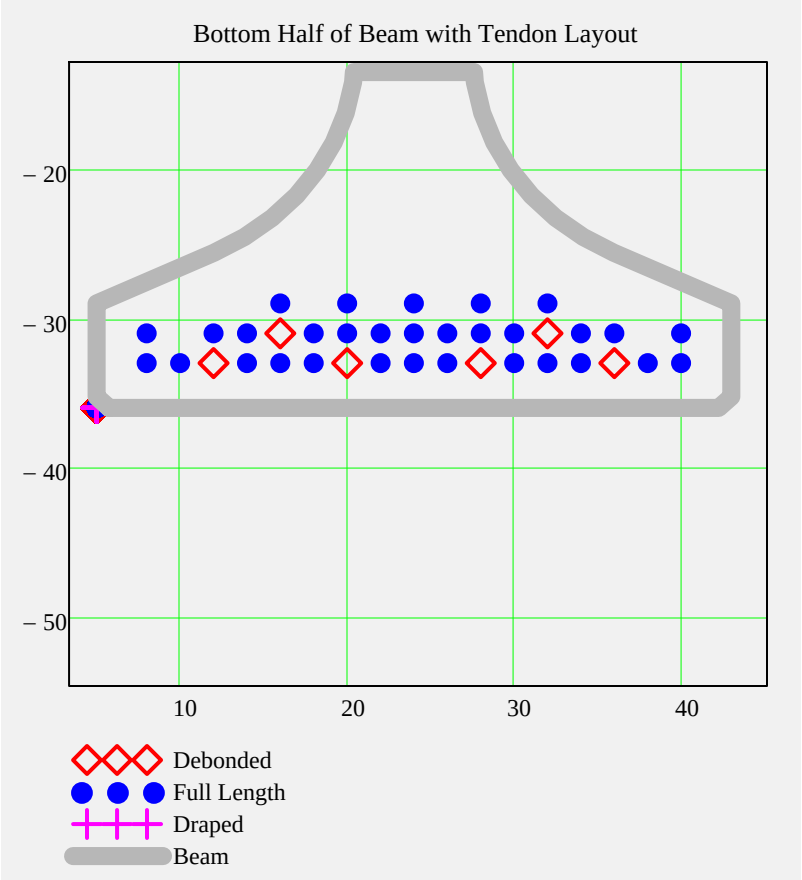
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

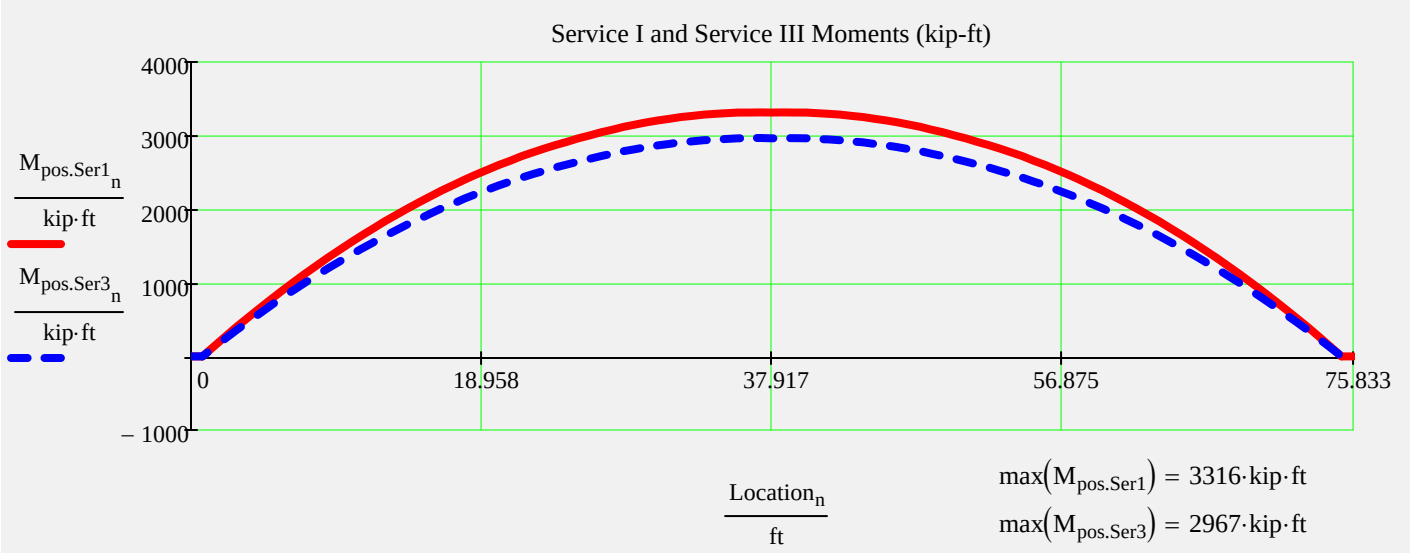
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3316 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2967 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.34 & -3.24 \\ \text{"2"} & -0.43 & -2.75 \\ \text{"4"} & -0.39 & -2.78 \\ \text{"6"} & -1.75 & -1.70 \\ \text{"8"} & -2.18 & -0.31 \end{pmatrix}$

$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1666 & -1601 \\ \text{"@Final (about composite centroid)"} & -1467 & -1333 \end{pmatrix}$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1718.4	402459	–7.4

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1335
"Composite Dead Load"	235
"Distributed Live Load"	1742

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

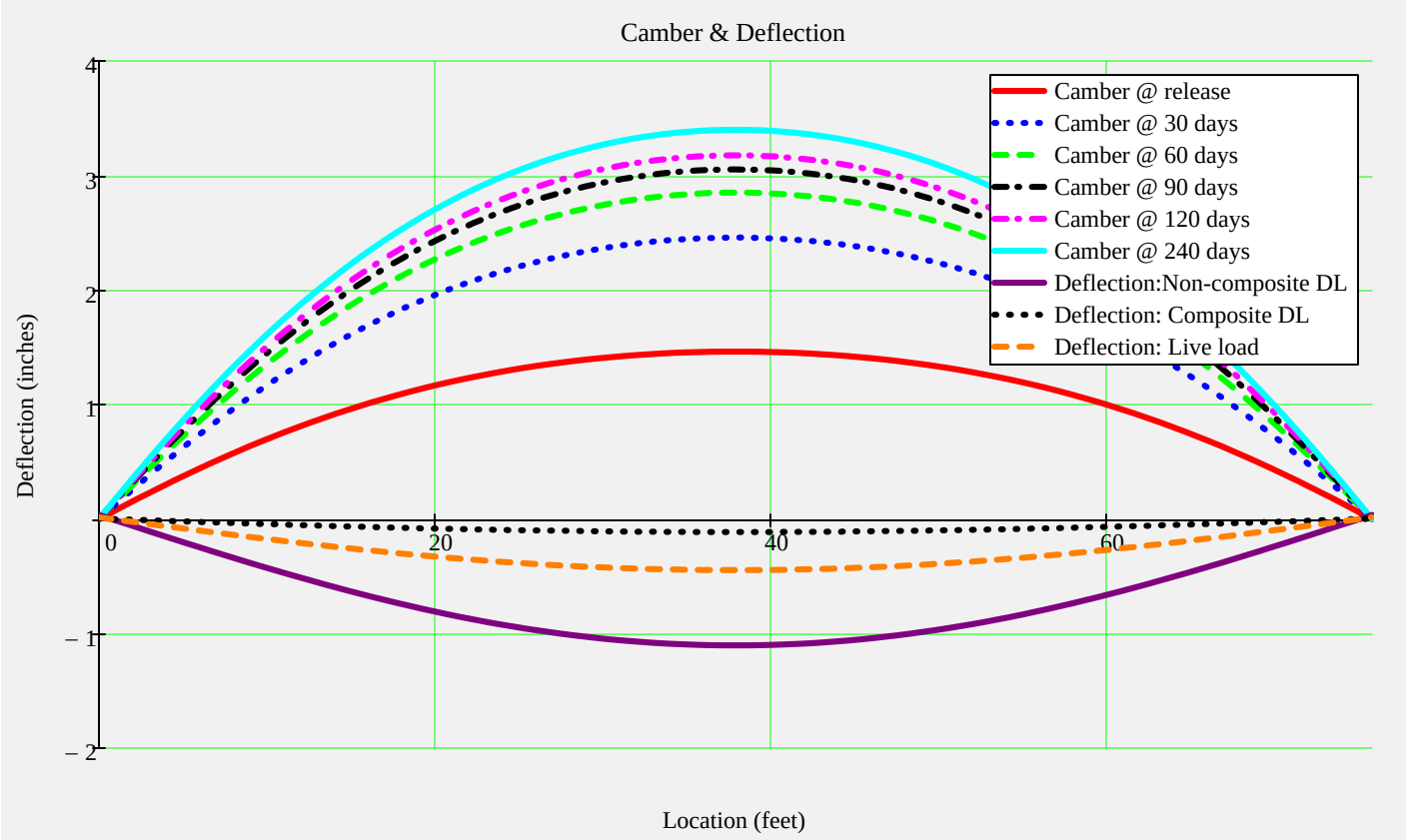
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.16	0.13	–0.23	–1.10
"Comp DL"	–0.01	0.02	–0.02	–0.11
"LL"	–0.02	0.09	–0.09	–0.45

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.96 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

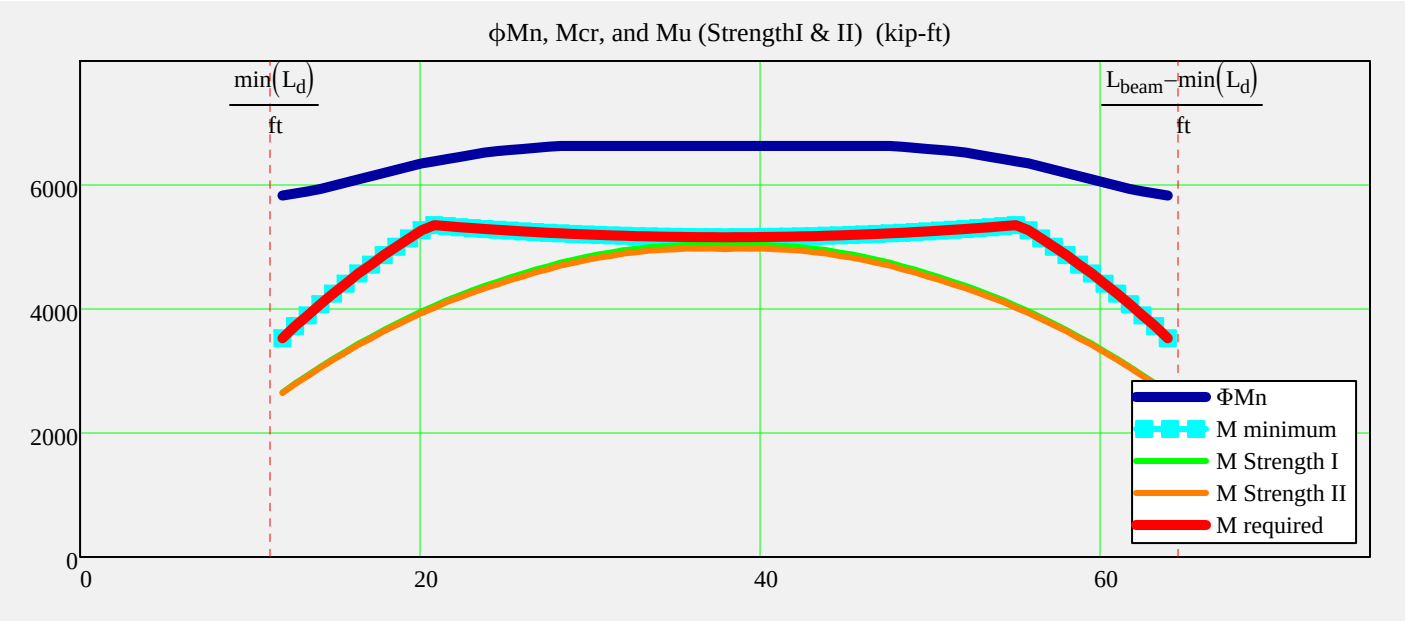
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5040 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5157 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5157 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6630 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.3\ \text{ft}$ $L_{beam} - \min(L_d) = 64.6\ \text{ft}$

$$DC_{moment_{mn}} := \frac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$$

Demand/Capacity Ratio at locations where all strands are fully developed

$\max(DC_{moment}) = 0.84$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

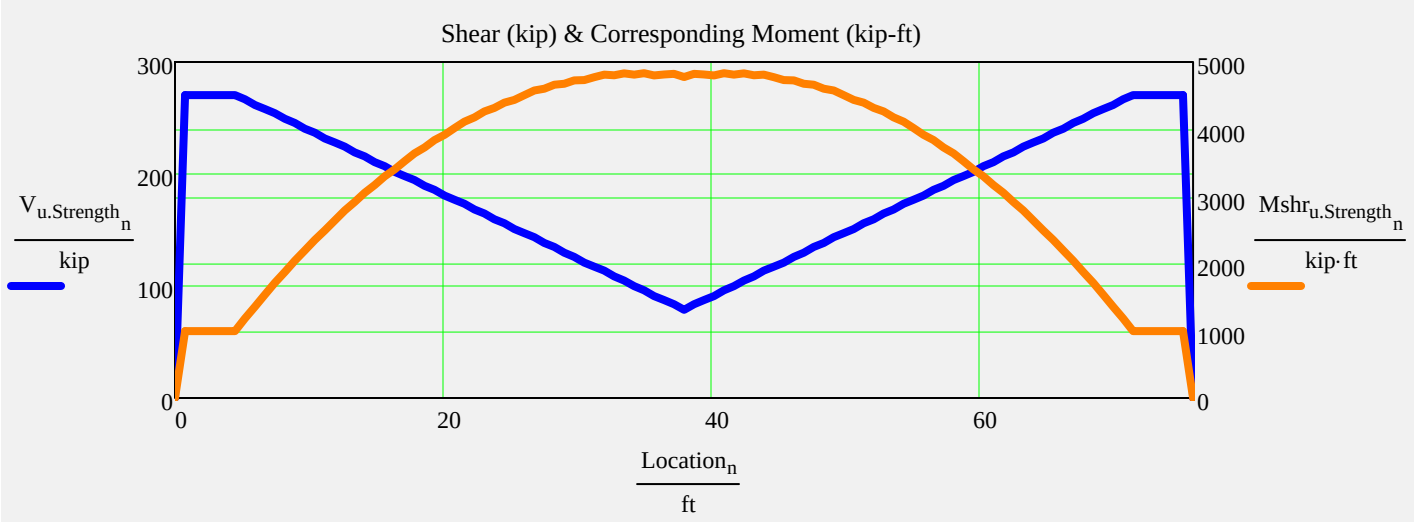
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

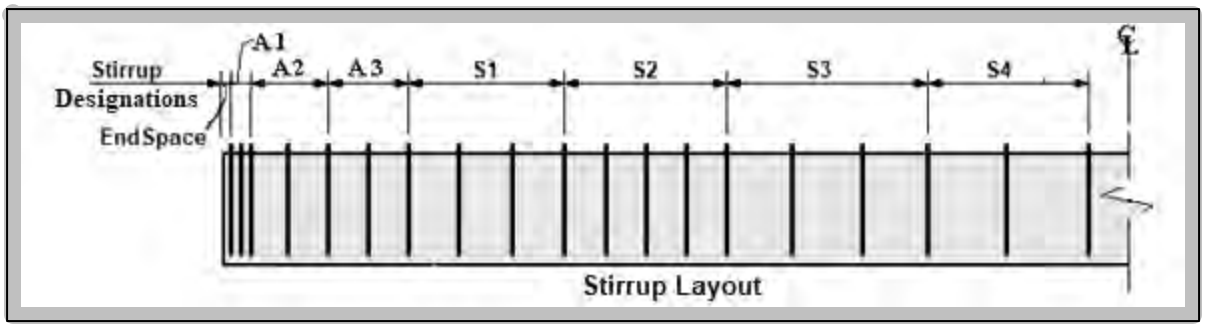
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 292 \\ 291 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 270.4 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4832 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

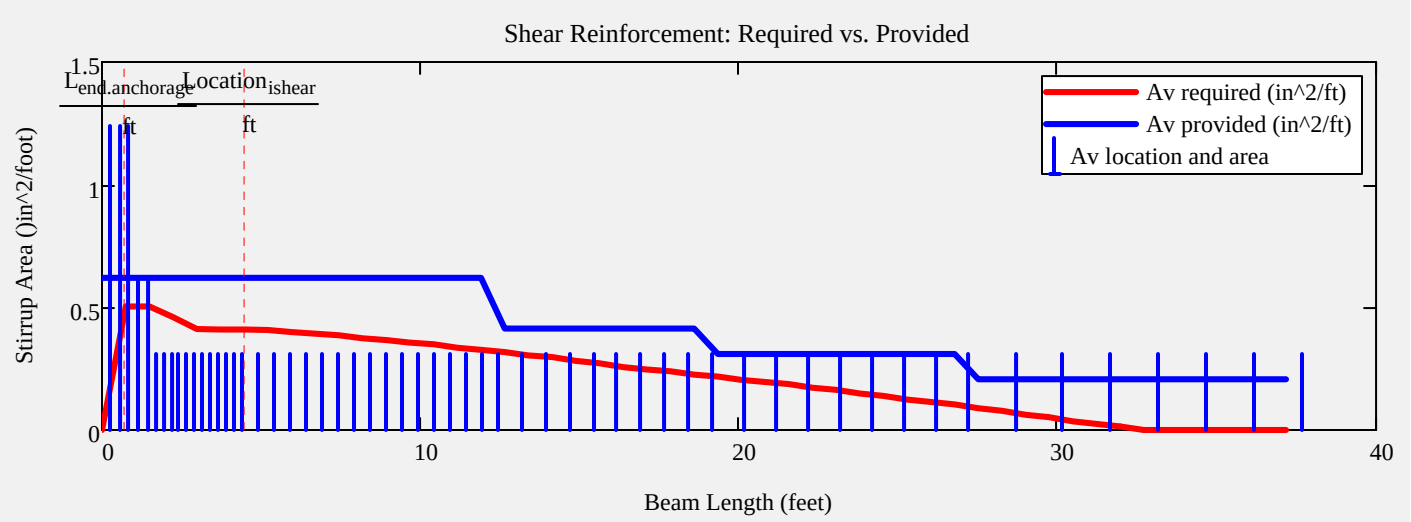
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

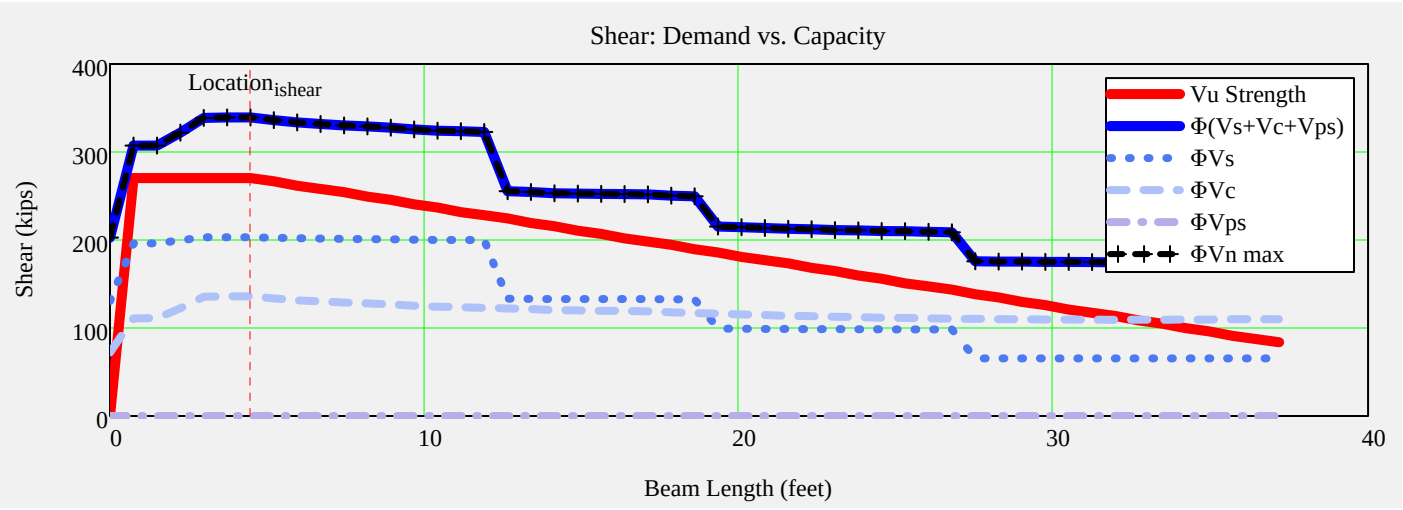
Save Data File ☑ Use current input file

File Name FIB36-76ftSpan_15Skew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam"

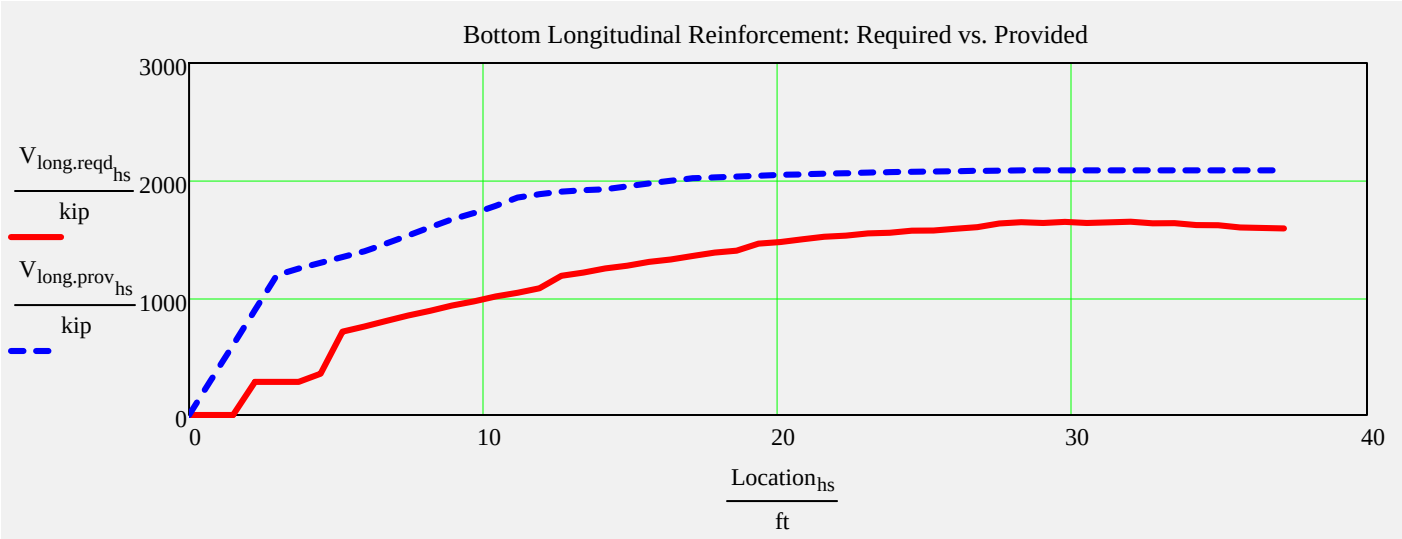
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 224.46 & 255.39 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.88$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

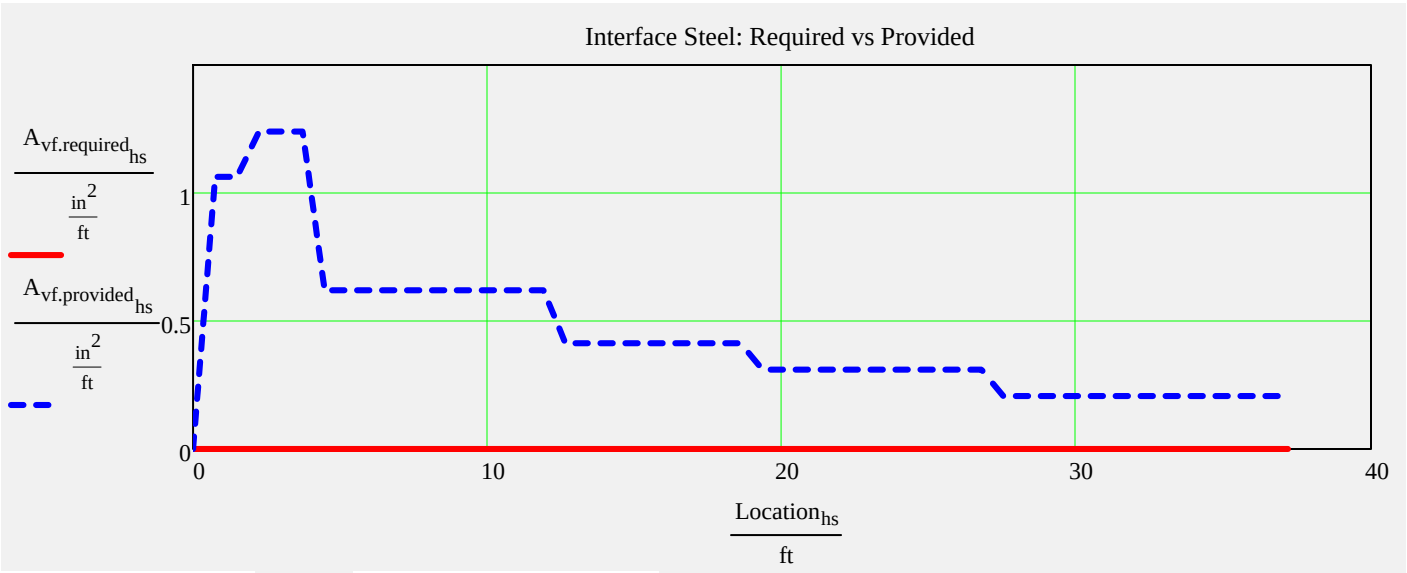


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 32.0 & 1646.7 & 2084.7 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.79$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

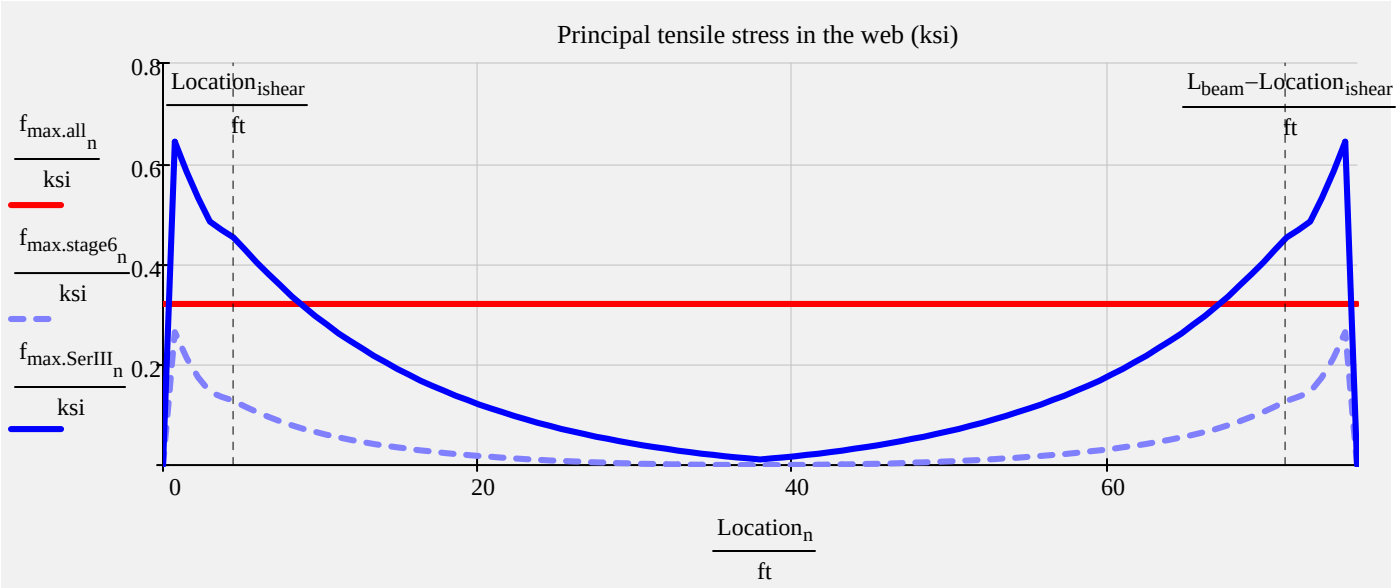
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6 \cdot in$ $\max(DC_f_{max.web}) = 1.41$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

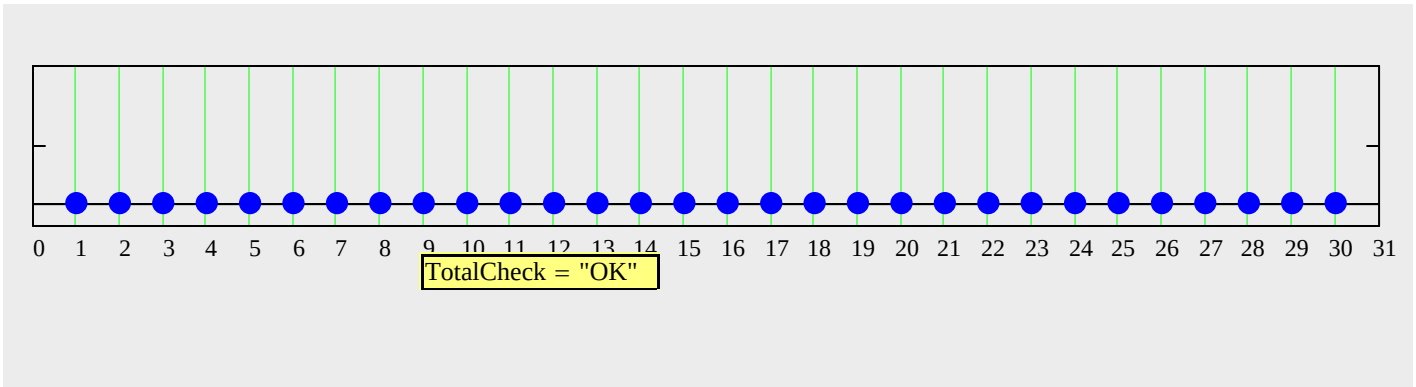
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.94	1.52	"N/A"	36.42	0.99	1.25	"N/A"	11.89	HL-93
"Strength I (Op)"	0.94	1.97	"N/A"	36.42	0.99	1.62	"N/A"	11.89	HL-93
"Service III (Inv)"	0.94	1.72	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.94	1.84	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.94	1.55	93.12	39.40	0.99	1.20	72.22	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.75$ $DC_{LongReinf.Permit} = 0.79$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6630	"factored resistance (kip-ft)...."
"γDL"	1984	"factored dead load (kip-ft)...."
"γLL"	2358	"factored live load (kip-ft)....."
"RF"	1.97	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	256.3	"factored resistance (kip)....."
"γDL"	72.6	"factored dead load (kip)....."
"γLL"	113.5	"factored live load (kip)....."
"RF"	1.62	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (15 DEG. SKEW)
WESTBOUND BRIDGE
(D.C.I CANAL)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior.dat
FIB36-76ftSpan_15Skew_Interior.dat
FIB36-76ftSpan_NoSkew_Exterior.dat
FIB36-76ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

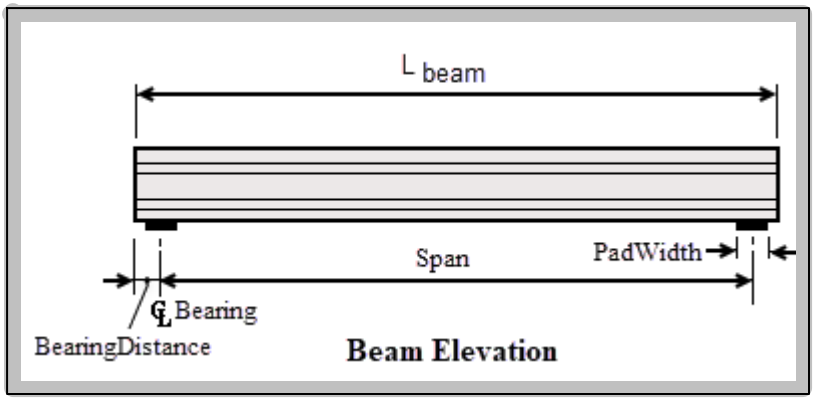
InputDataFile = "FIB36-76ftSpan_15Skew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	Westbound Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_15Skew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FIB36.bmp"
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	11.6667	ft	*Measured from beam centerline to centerline.*
Overhang	3.8333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	4		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

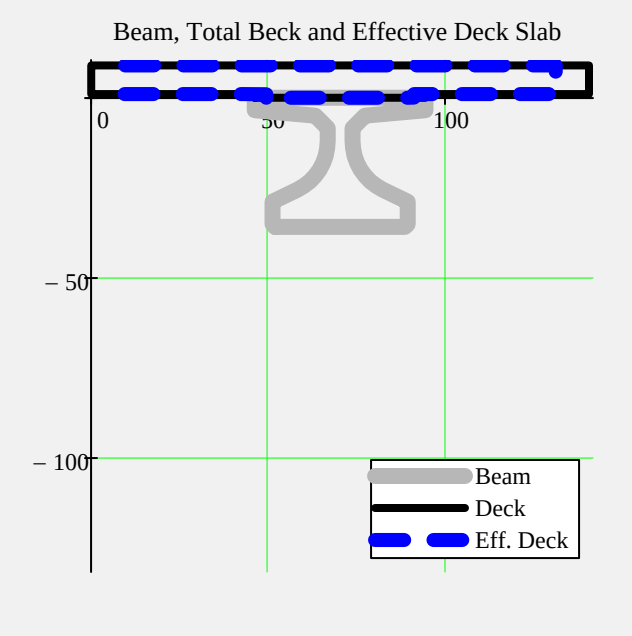
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 140·in

$b_e = 140 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 1.22 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.15 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.175 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.22 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

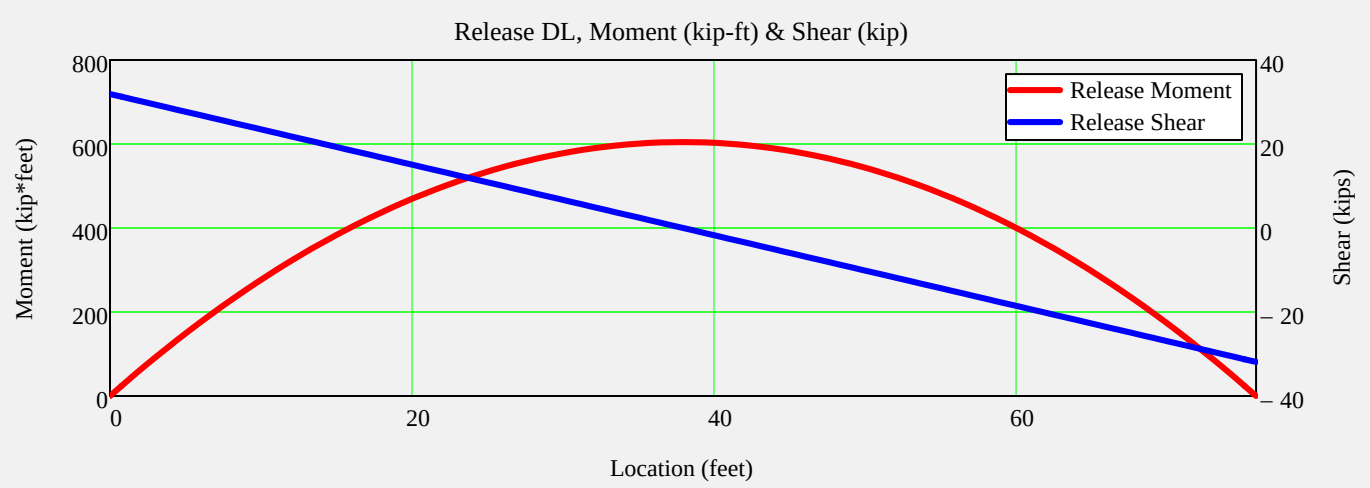
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

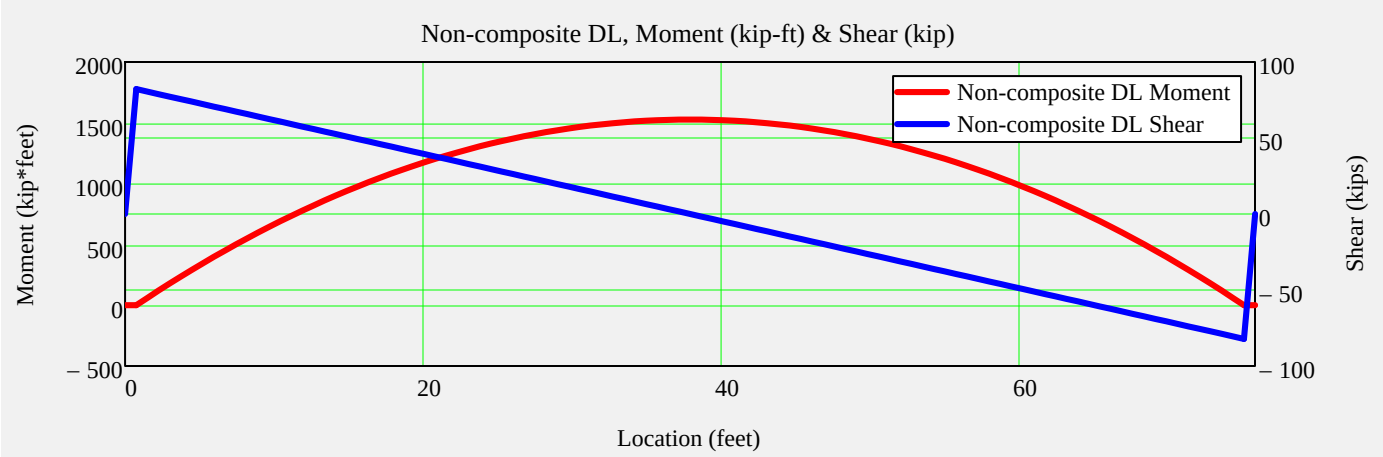
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



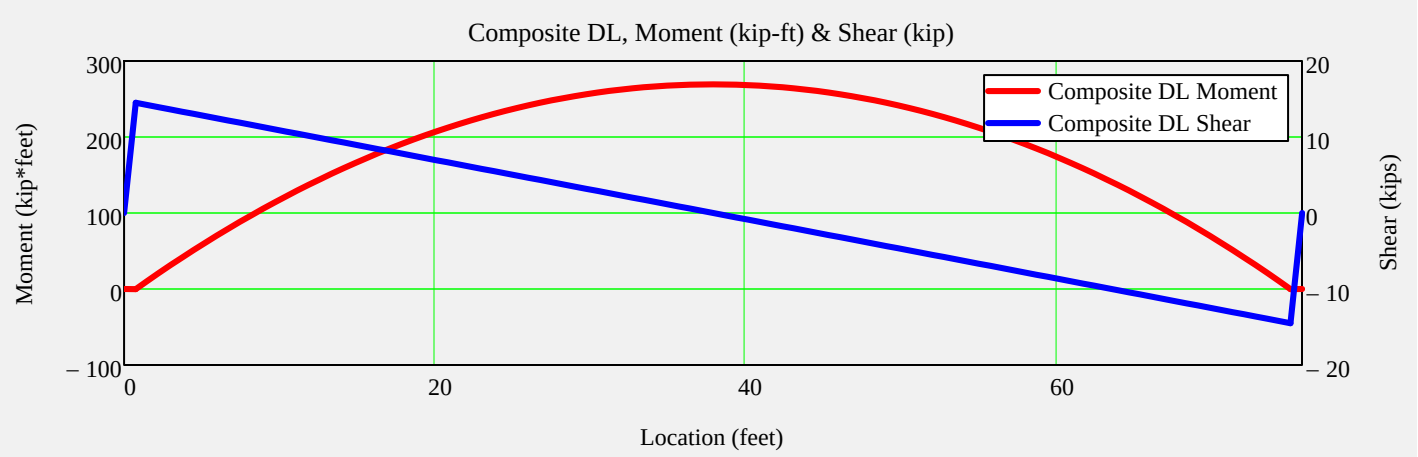
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 82.2 \cdot kip$ $\max(M_{dl.non.comp}) = 1526.5 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -82.2 \cdot kip$

Composite Dead Load Moments and Shear



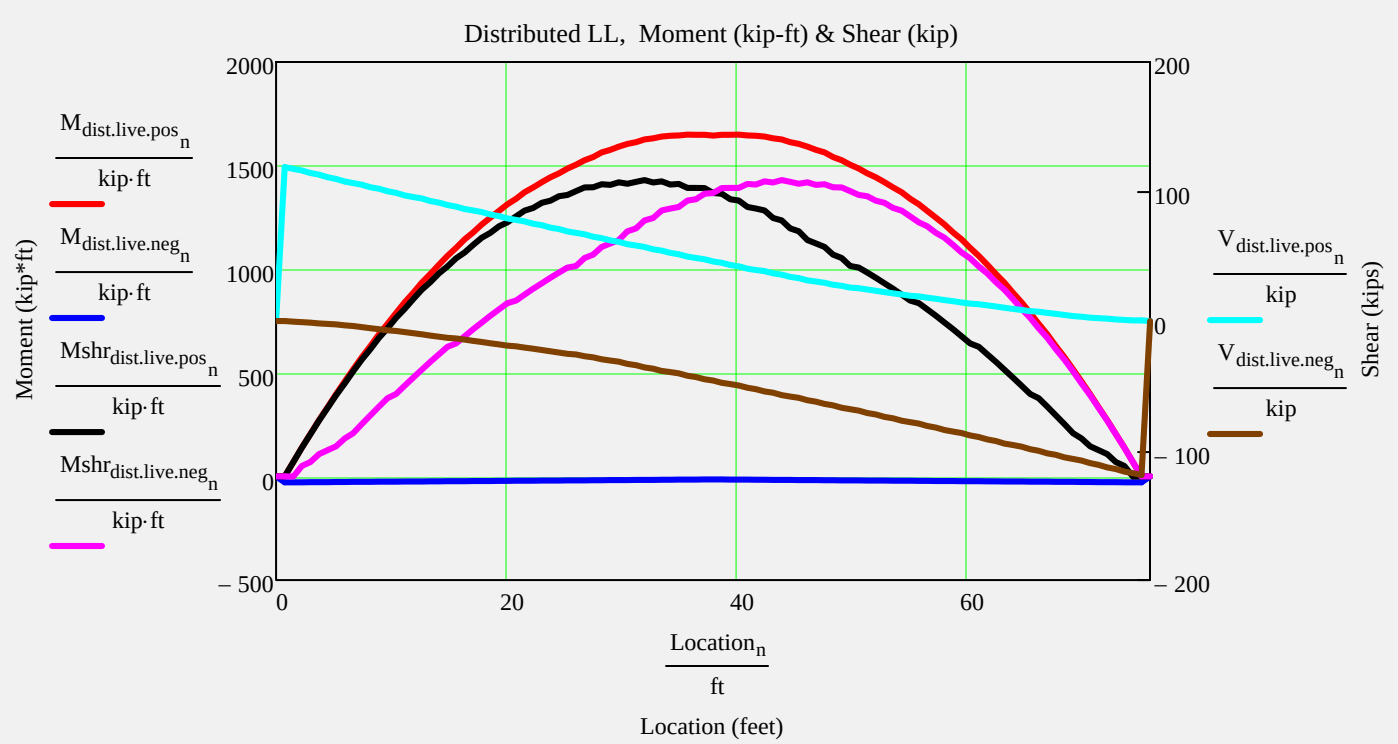
$\max(V_{dl.comp}) = 14.5 \cdot kip$ $\max(M_{dl.comp}) = 269.3 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -14.5 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 11.67\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.05$

Final Live Load Distribution Factors: $g_{mom} = 0.89$ $g_{mom.fatigue} = 0.51$ $g_{shear} = 1.11$



$\max(V_{dist.live.pos}) = 118.8 \cdot kip$

$\max(M_{dist.live.pos}) = 1649.7 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -118.8 \cdot kip$

$Reaction_{LL} = 121.1 \cdot kip$

$\min(M_{dist.live.neg}) = -28.6 \cdot kip \cdot ft$

$Reaction_{DL} = 98.6 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1430 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 97.7 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_15Skew_Interior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck		Bottom of Beam		Beam End: Top	Beam End: Bottom
Area (in^2)	0.62	*1	0		1.58	0
Distance (in)	4	*2	0	*3		
Length (ft)					16	0
Bar Size			5	*4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

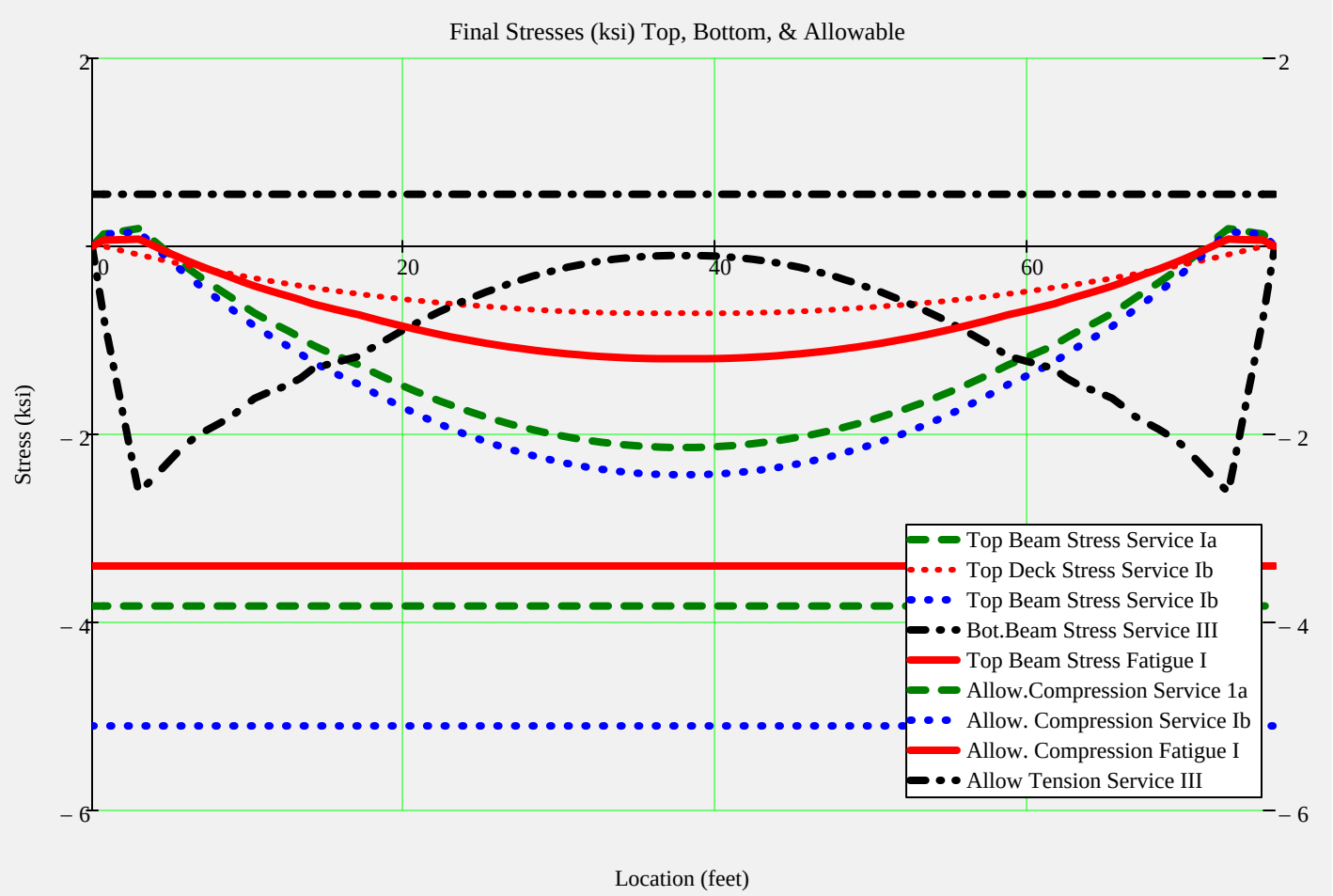
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

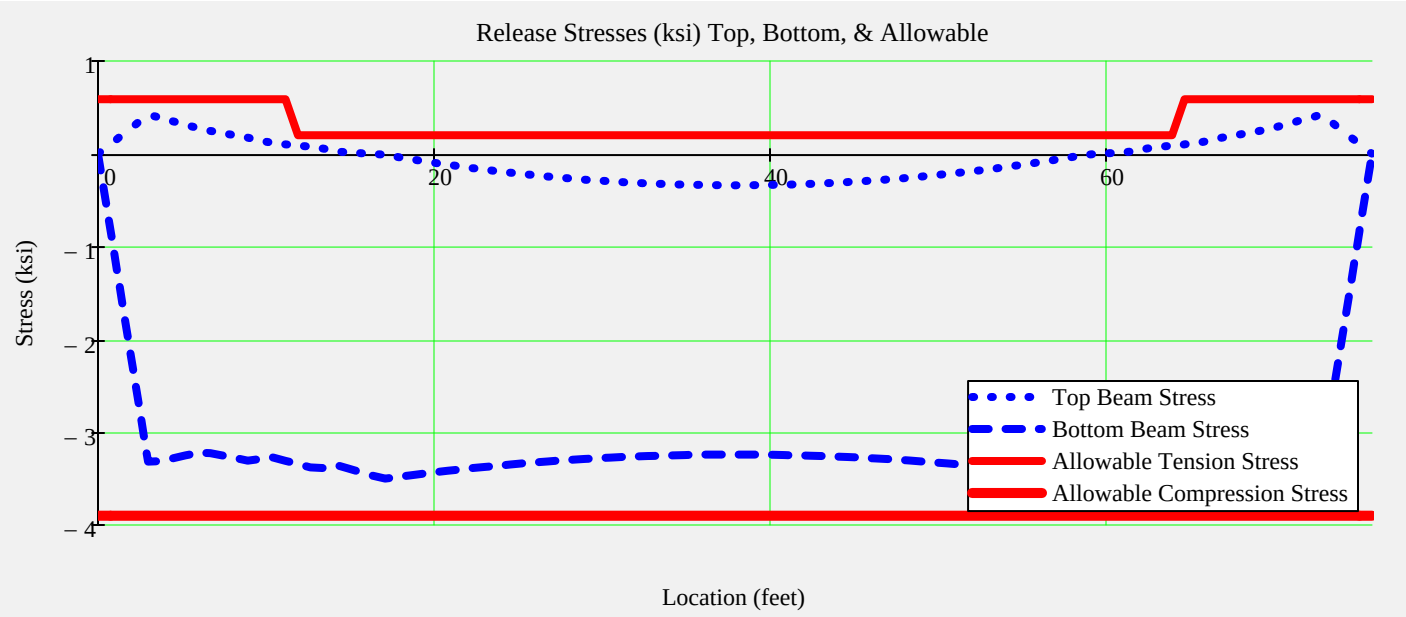
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.56$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.48$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.35$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–2.14	–3.83
"CompressionIb @ ServiceI"	37.92	–2.43	–5.10
"Compression @ FatigueI"	38.66	–1.20	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

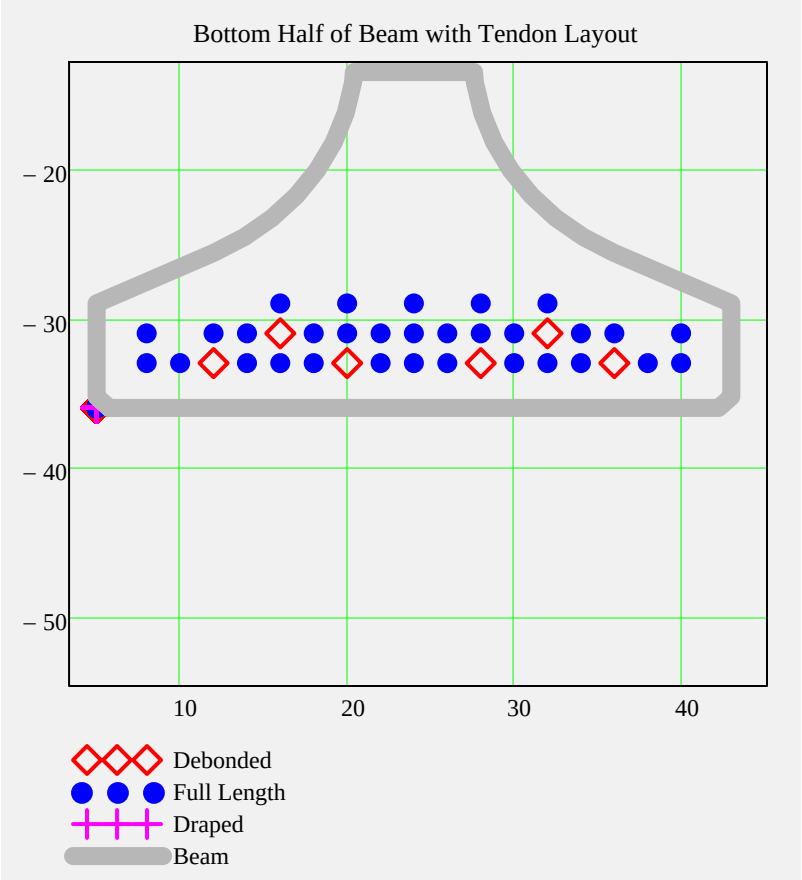
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

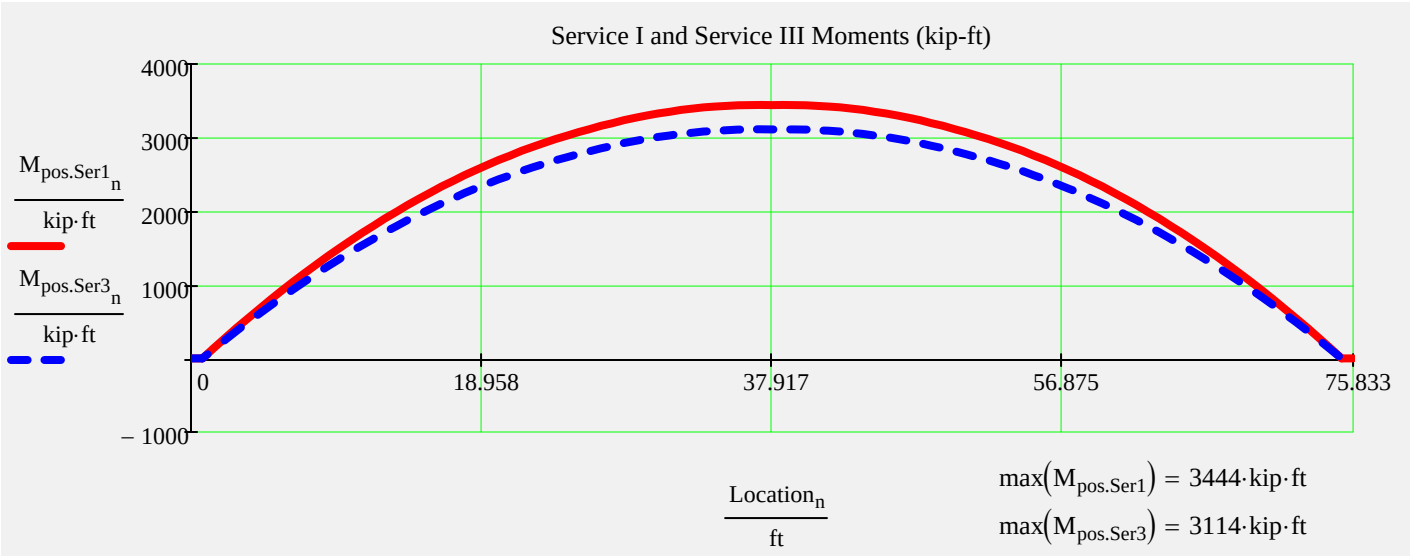
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3444 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3114 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.34 & -3.24 \\ \text{"2"} & -0.43 & -2.75 \\ \text{"4"} & -0.39 & -2.78 \\ \text{"6"} & -2.09 & -1.42 \\ \text{"8"} & -2.43 & -0.10 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1666 & -1601 \\ \text{"@Final (about composite centroid)"} & -1467 & -1333 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1890.5	427445	–6.3

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1527
"Composite Dead Load"	269
"Distributed Live Load"	1645

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

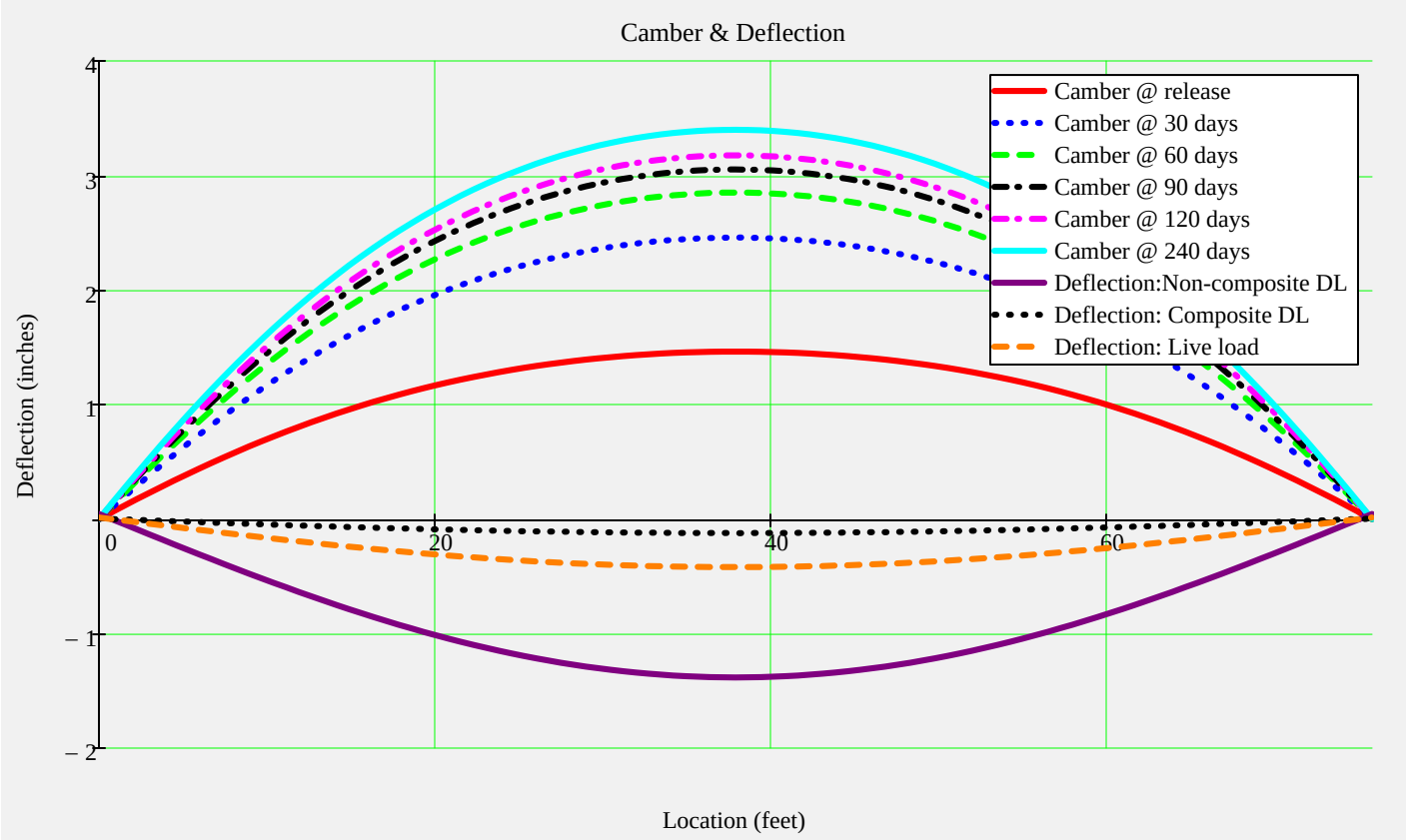
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.20	0.16	–0.28	–1.38
"Comp DL"	–0.01	0.03	–0.03	–0.12
"LL"	–0.02	0.09	–0.09	–0.42

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.67 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

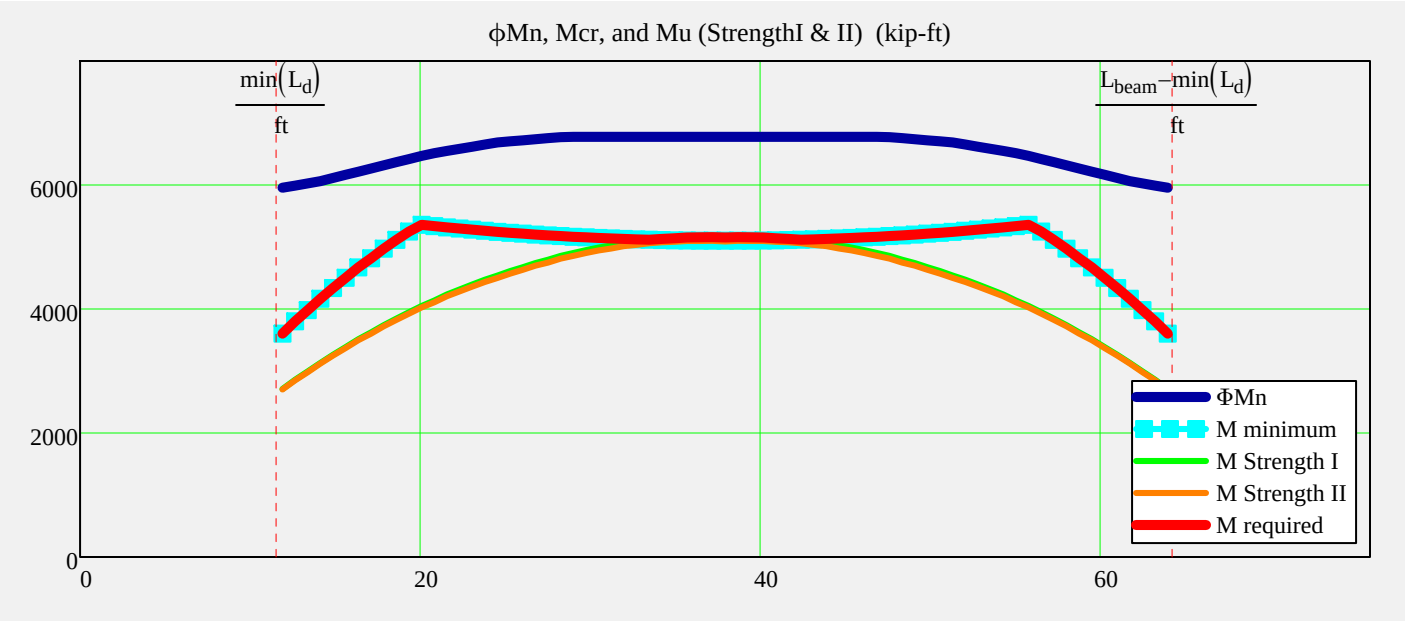
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5159 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5101 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5153 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6778 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.6\ \text{ft}$ $L_{beam} - \min(L_d) = 64.2\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.83$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

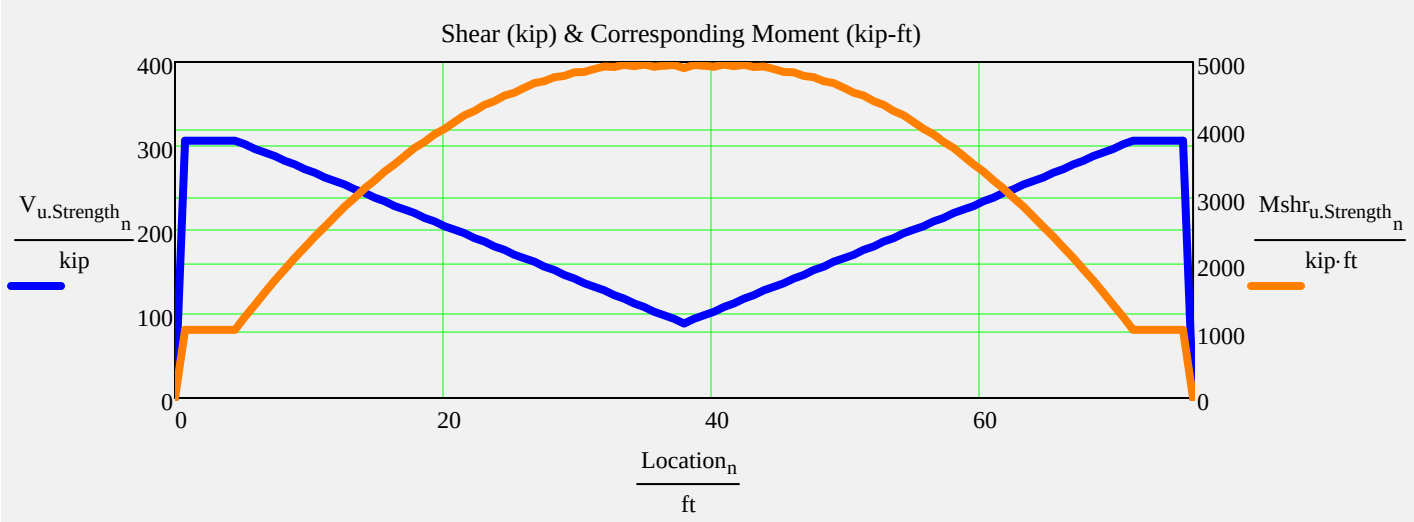
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

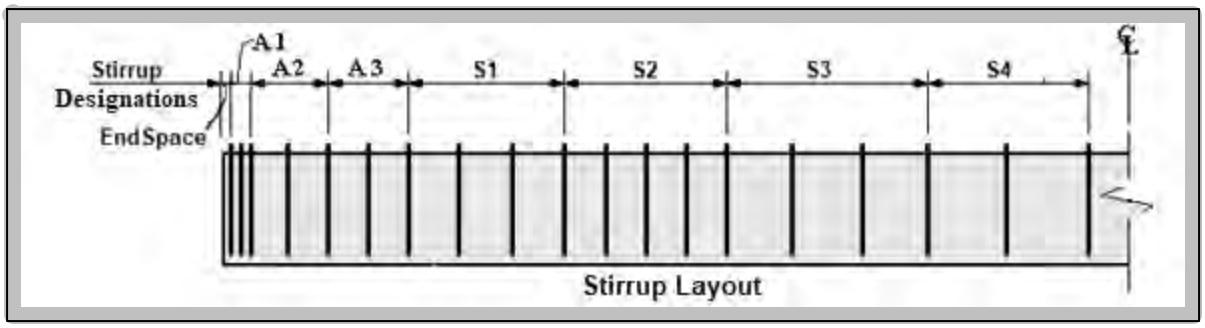
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 330 \\ 330 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 306.3 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4961 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

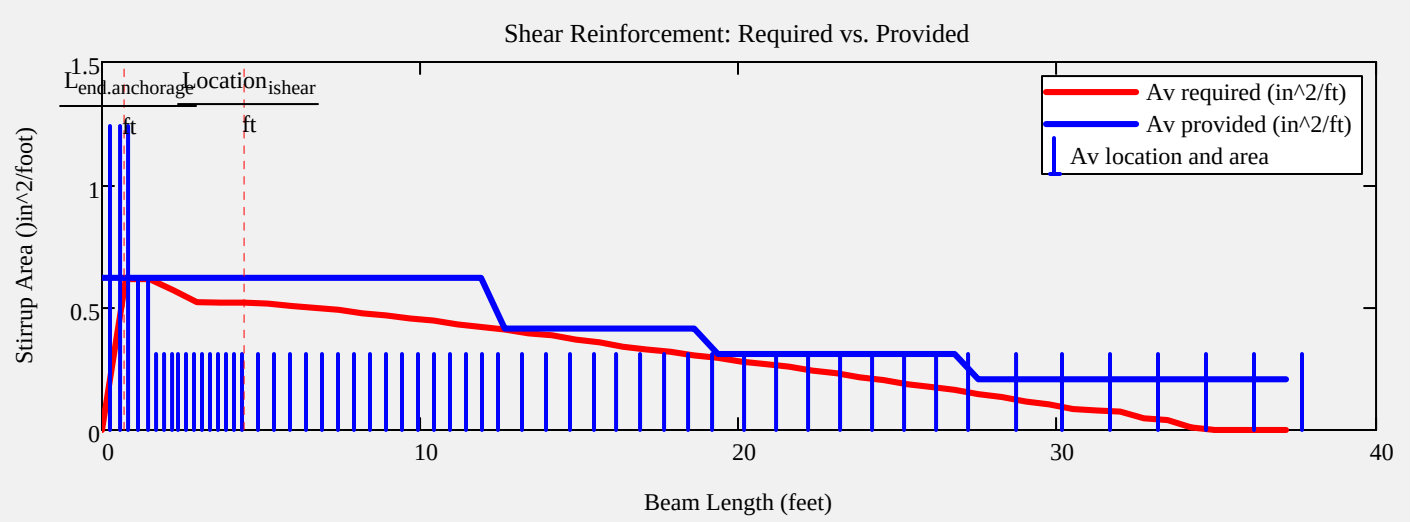
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

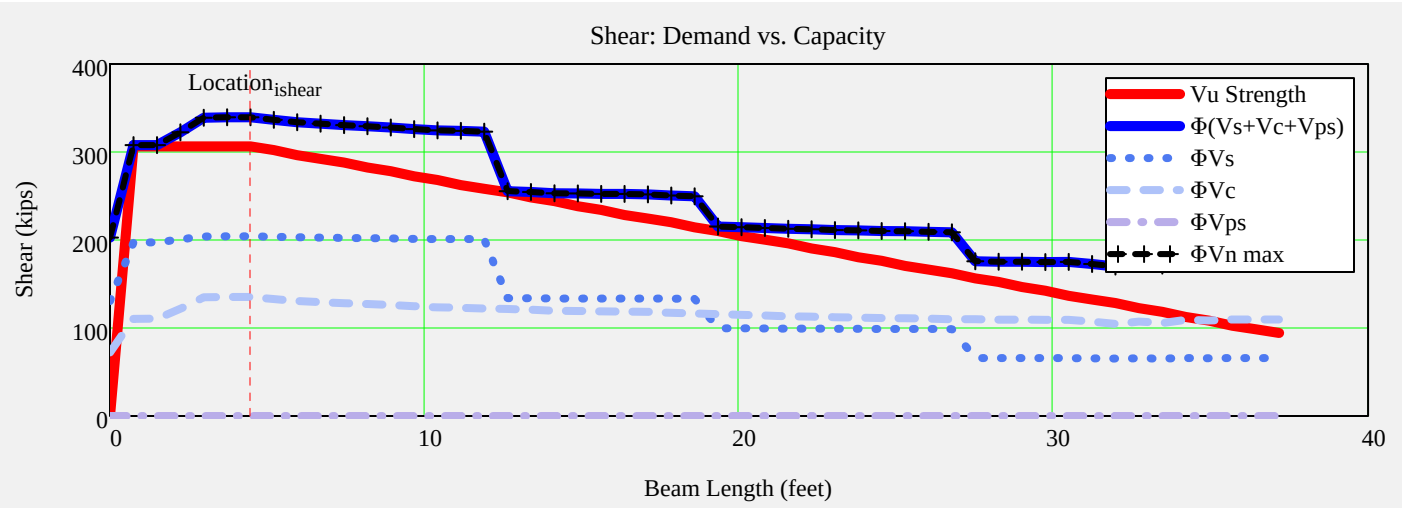
Save Data File ☑ Use current input file

File Name FIB36-76ftSpan_15Skew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\WB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam"

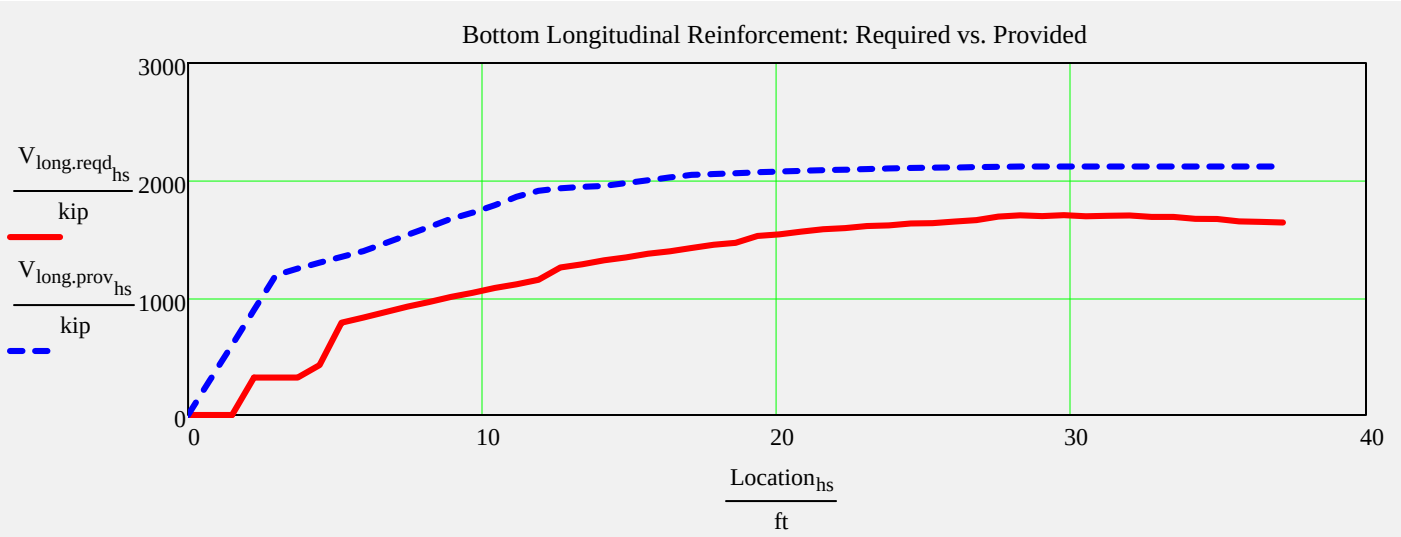
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 254.14 & 255.43 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.99$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

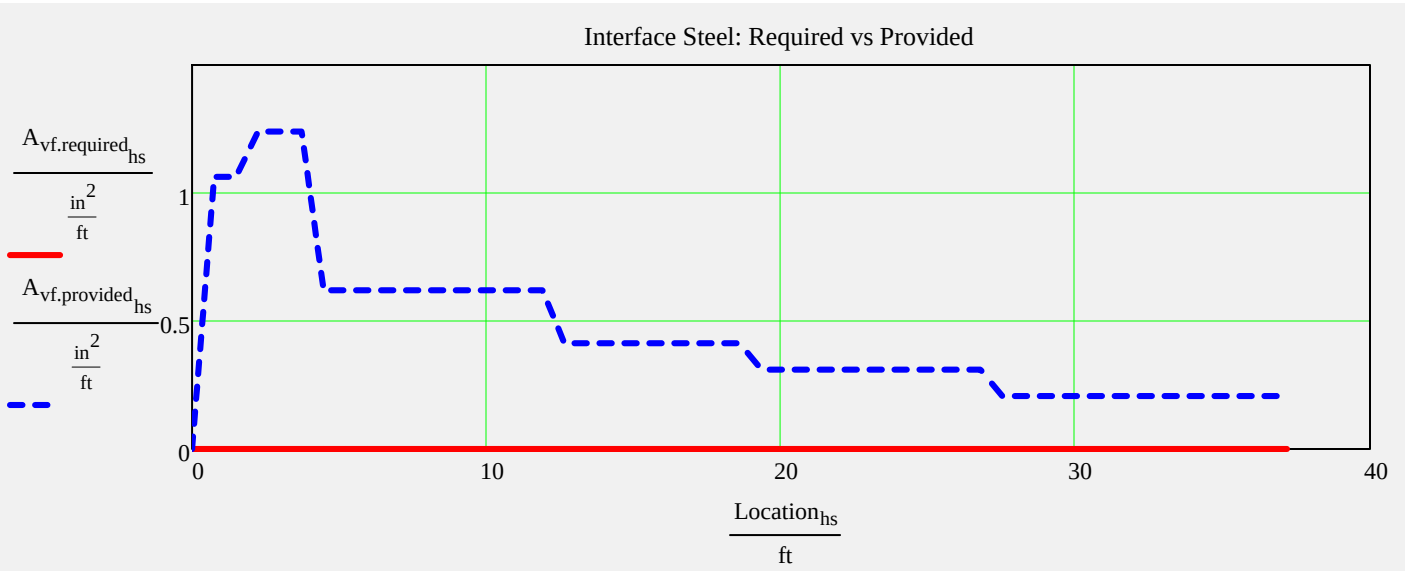


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 29.7 & 1702.8 & 2118.1 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.80$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

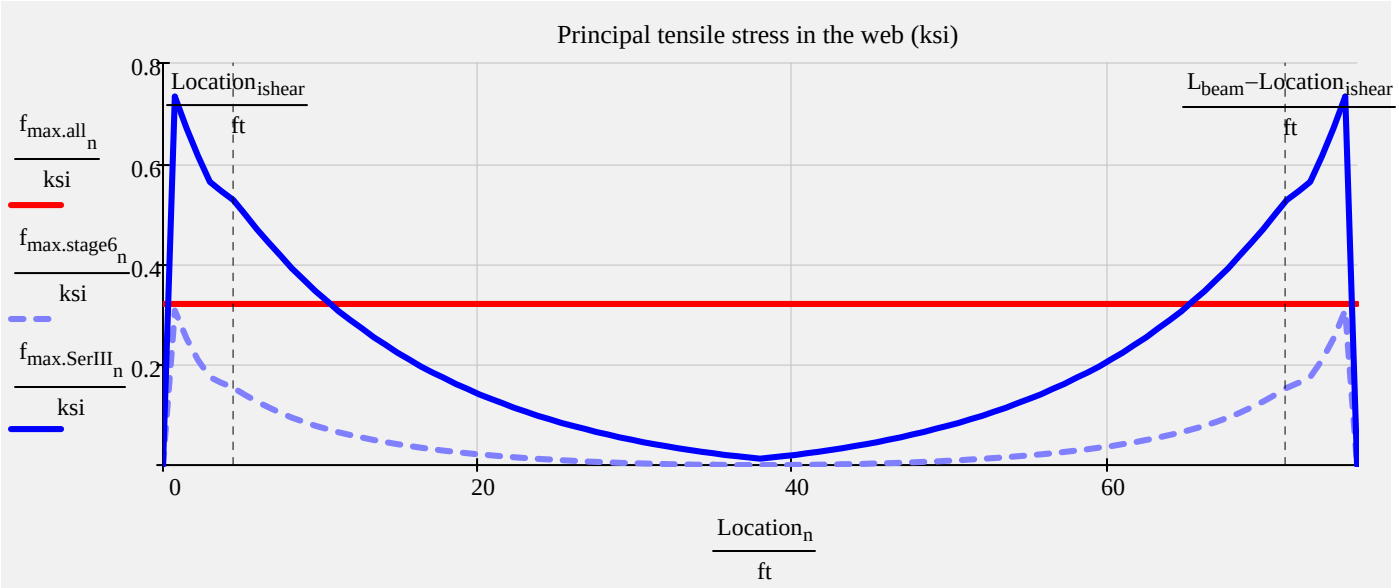
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6\cdot in$ $\max(DC_f_{max.web}) = 1.64$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450\cdot kip$ $P_{prestress} = 1362\cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

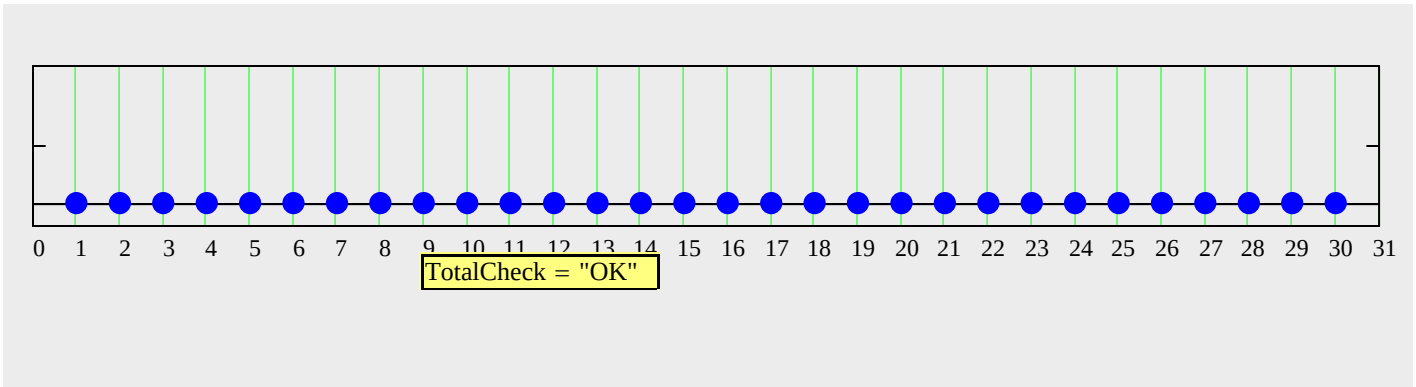
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.89	1.56	"N/A"	37.91	1.11	1.05	"N/A"	11.89	HL-93
"Strength I (Op)"	0.89	2.02	"N/A"	36.42	1.11	1.36	"N/A"	11.89	HL-93
"Service III (Inv)"	0.89	1.59	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.89	1.72	"N/A"	36.42	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.89	1.59	95.65	39.40	1.11	1.01	60.46	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.77$ $DC_{LongReinf.Permit} = 0.80$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6778	"factored resistance (kip-ft)...."
"γDL"	2274	"factored dead load (kip-ft)...."
"γLL"	2226	"factored live load (kip-ft)....."
"RF"	2.02	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	256.3	"factored resistance (kip)....."
"γDL"	83.3	"factored dead load (kip)....."
"γLL"	127.7	"factored live load (kip)....."
"RF"	1.36	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (NO SKEW)
EASTBOUND BRIDGE
(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior_DCI.dat
FIB36-76ftSpan_15Skew_Interior_DCI.dat
FIB36-76ftSpan_NoSkew_Exterior_Tiger.dat
FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat
FIB36-76ftSpan_NoSkew_Interior_Tiger.dat

Refresh List

Open File

Reset All Data

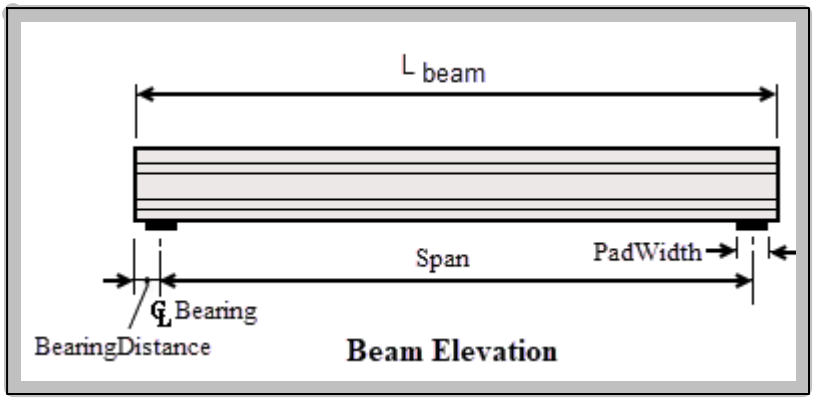
InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FIB36.bmp"
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	11.6667	ft	*Measured from beam centerline to centerline.*
Overhang	3.8333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	4		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

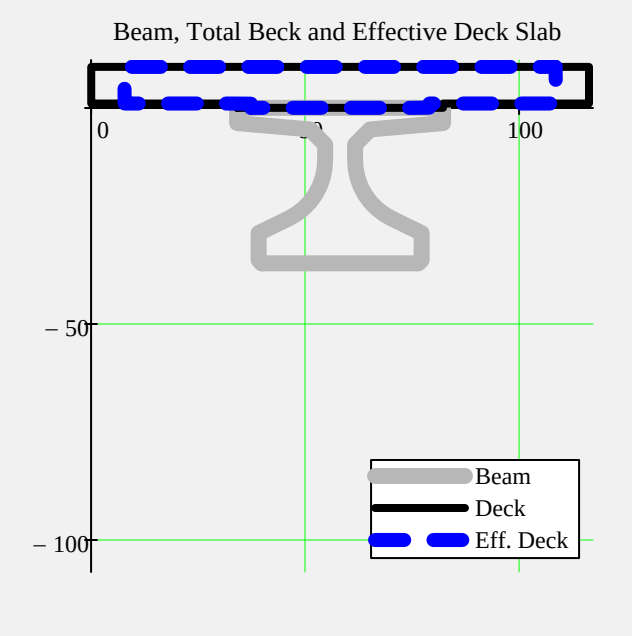
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8.5 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $140 \cdot in$

$b_e = 116 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 1.14 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.08 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.22 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

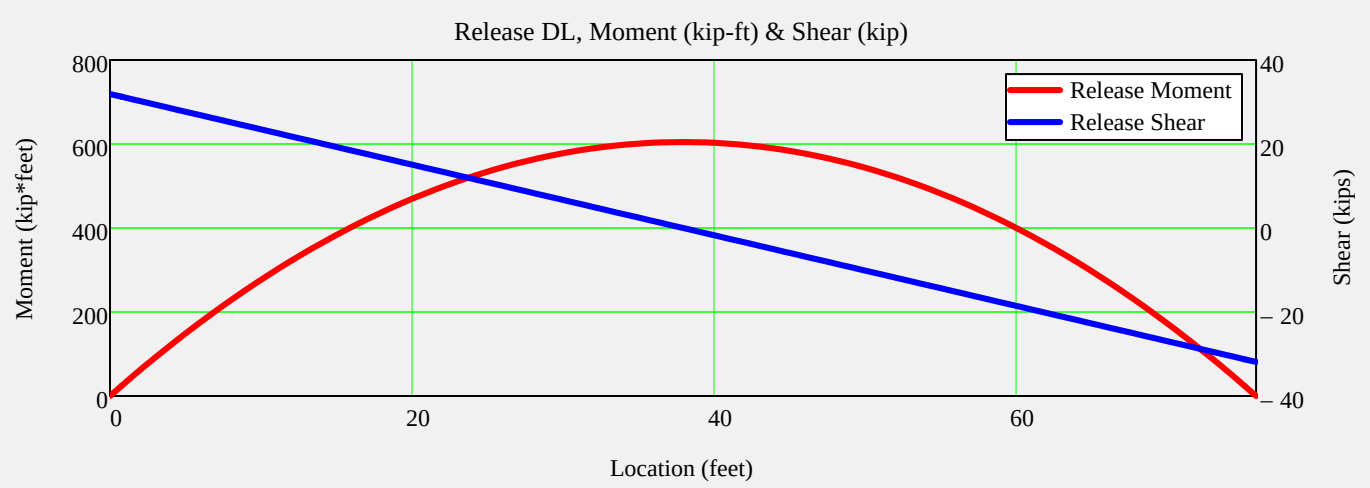
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

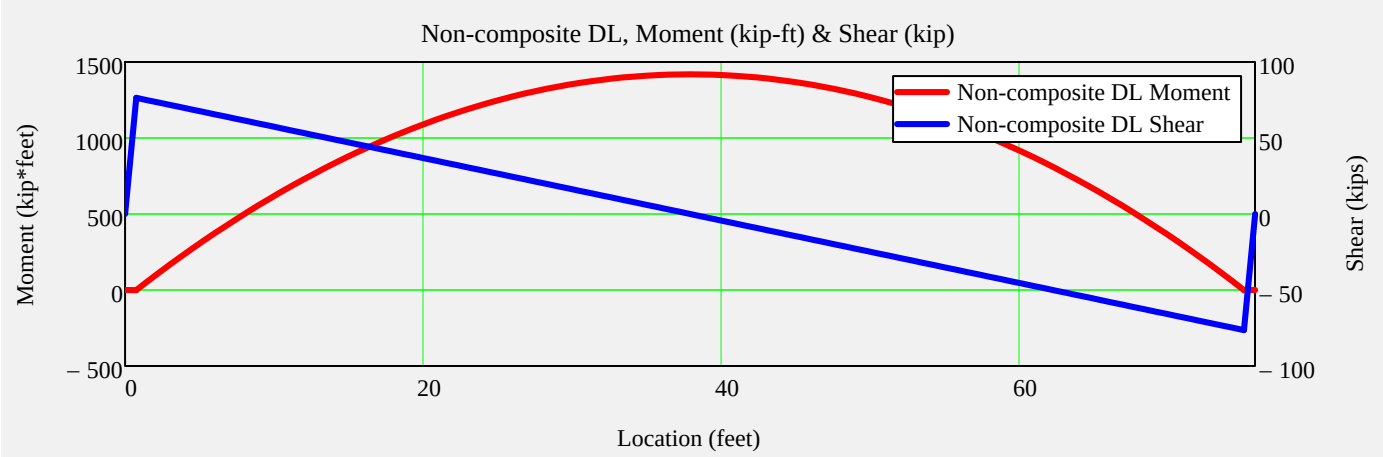
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



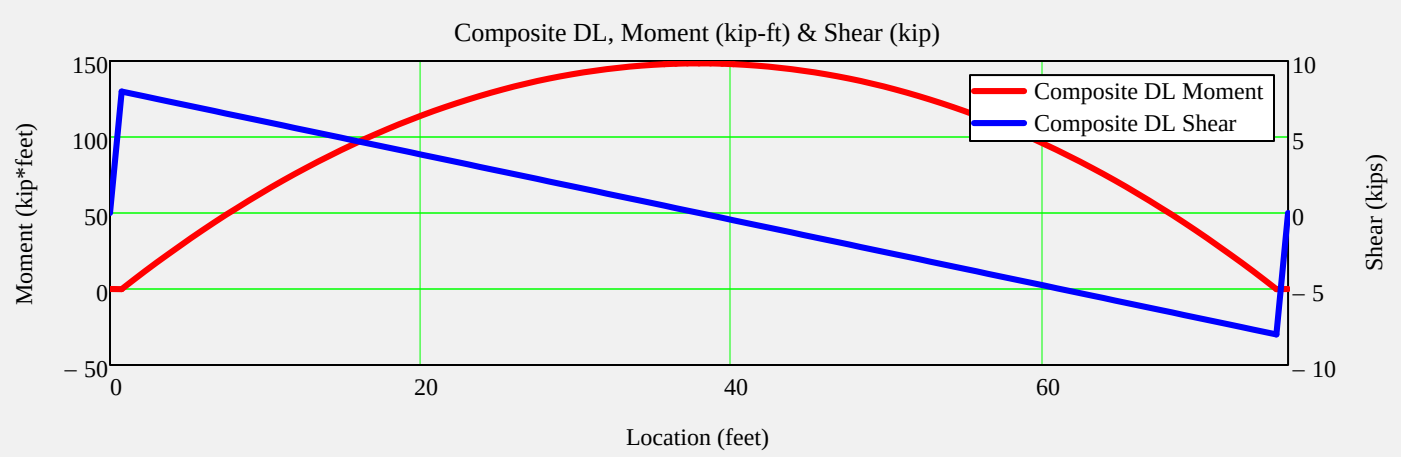
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 76.4 \cdot kip$ $\max(M_{dl.non.comp}) = 1418.9 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -76.4 \cdot kip$

Composite Dead Load Moments and Shear



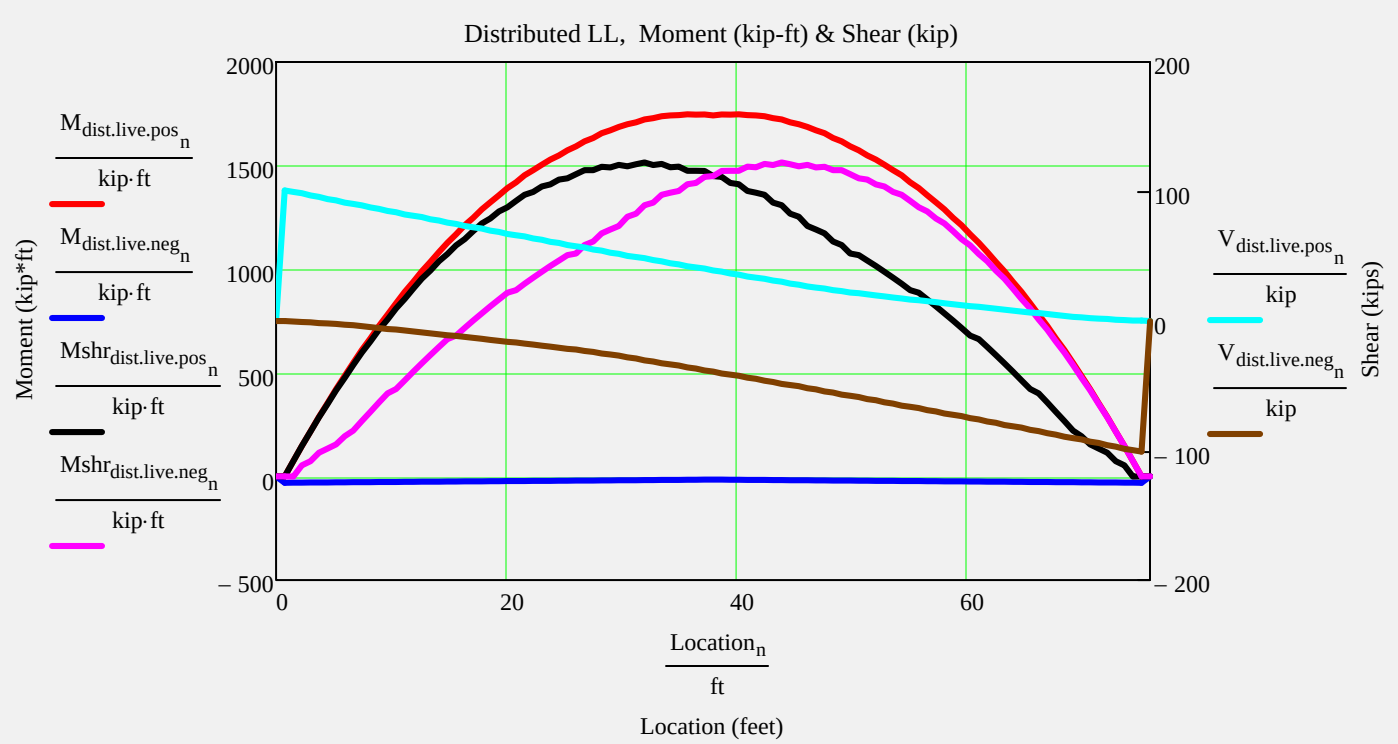
$\max(V_{dl.comp}) = 8.0 \cdot kip$ $\max(M_{dl.comp}) = 148.4 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -8.0 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 11.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.94$ $g_{mom.fatigue} = 0.79$ $g_{shear} = 0.94$



$\max(V_{dist.live.pos}) = 100.8 \cdot kip$

$\max(M_{dist.live.pos}) = 1747.7 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -100.8 \cdot kip$

$Reaction_{LL} = 102.7 \cdot kip$

$\min(M_{dist.live.neg}) = -30.3 \cdot kip \cdot ft$

$Reaction_{DL} = 86.1 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1515 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 82.9 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.62 *1	0	1.58	0
Distance (in)	4 *2	0 *3		
Length (ft)			16	0
Bar Size		5 *4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

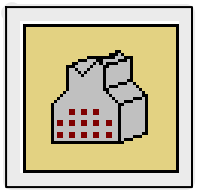
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

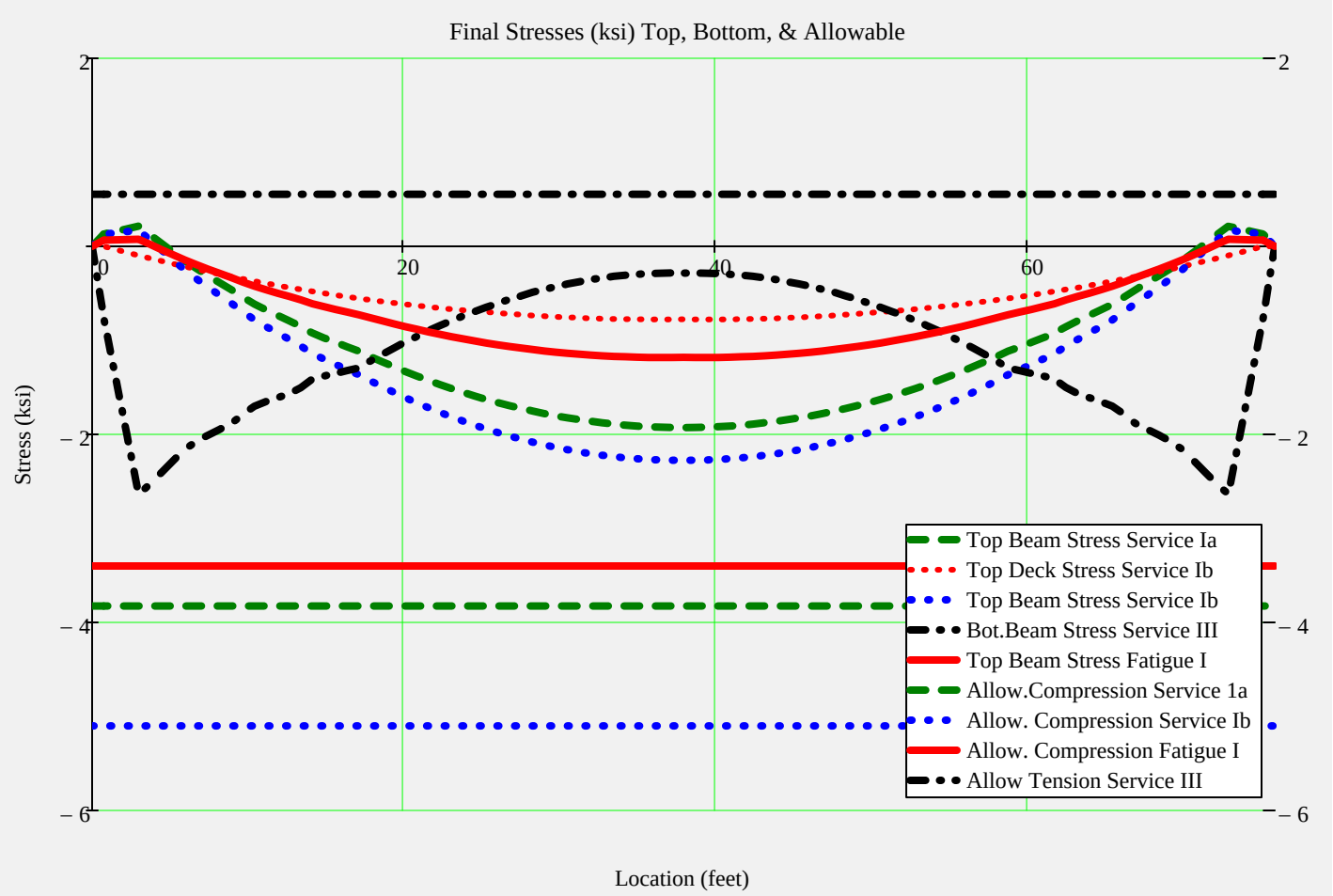
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

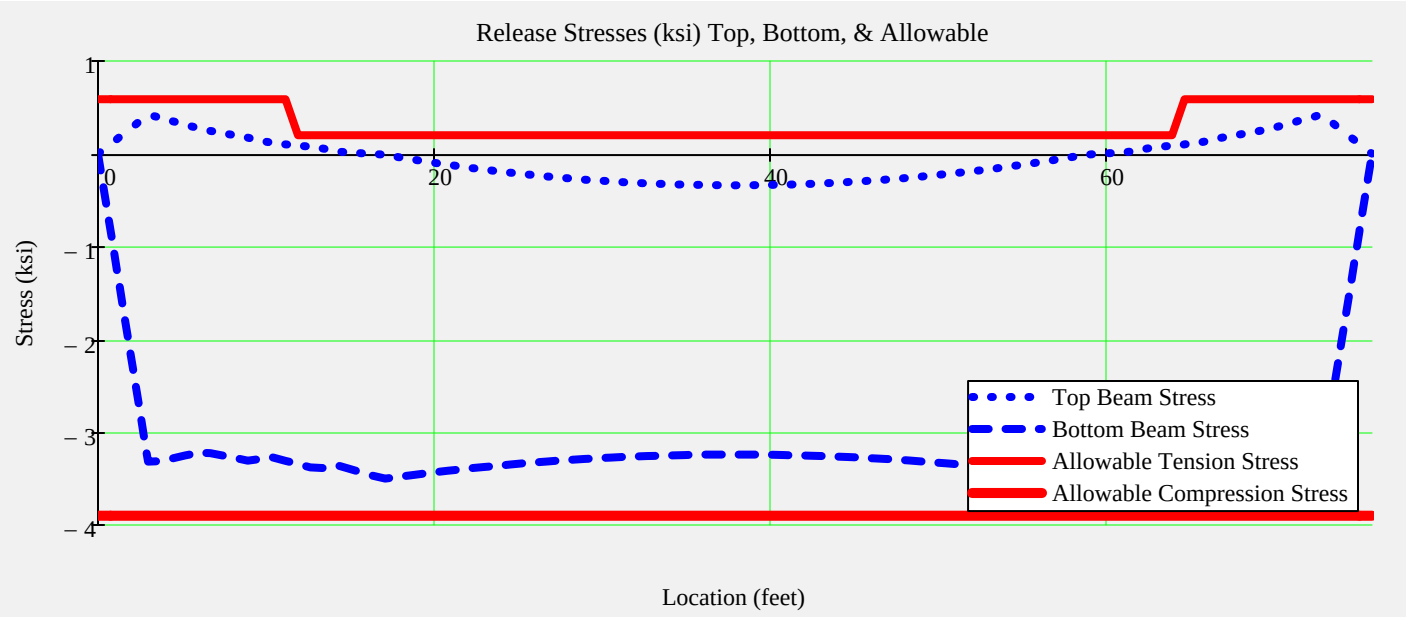
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.50$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.45$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.35$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–1.93	–3.83
"CompressionIb @ ServiceI"	37.92	–2.28	–5.10
"Compression @ FatigueI"	39.40	–1.18	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

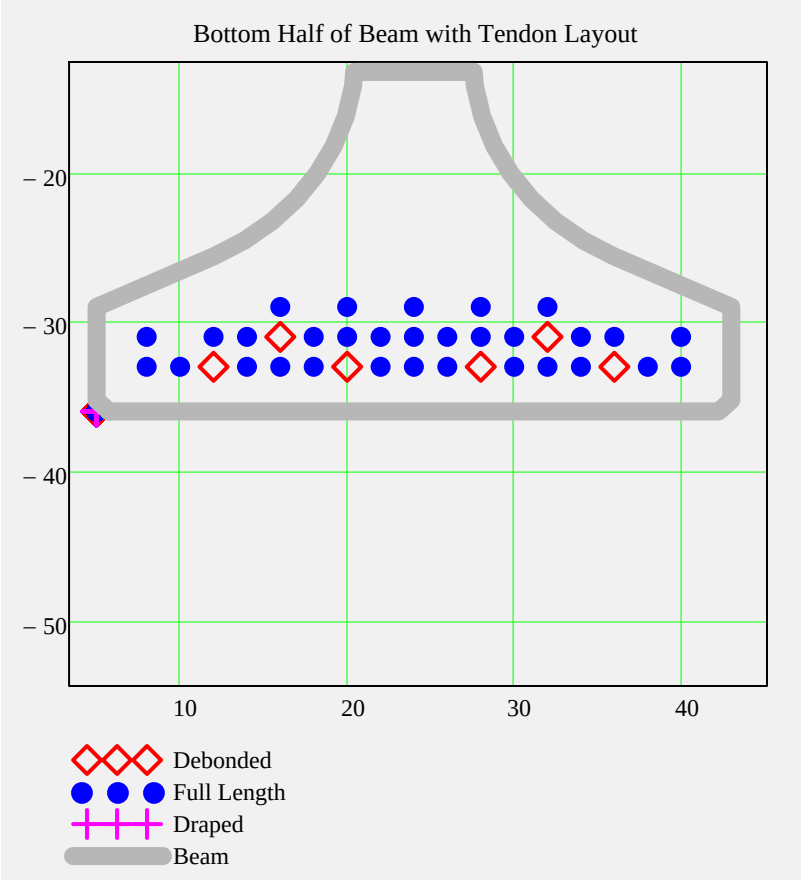
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

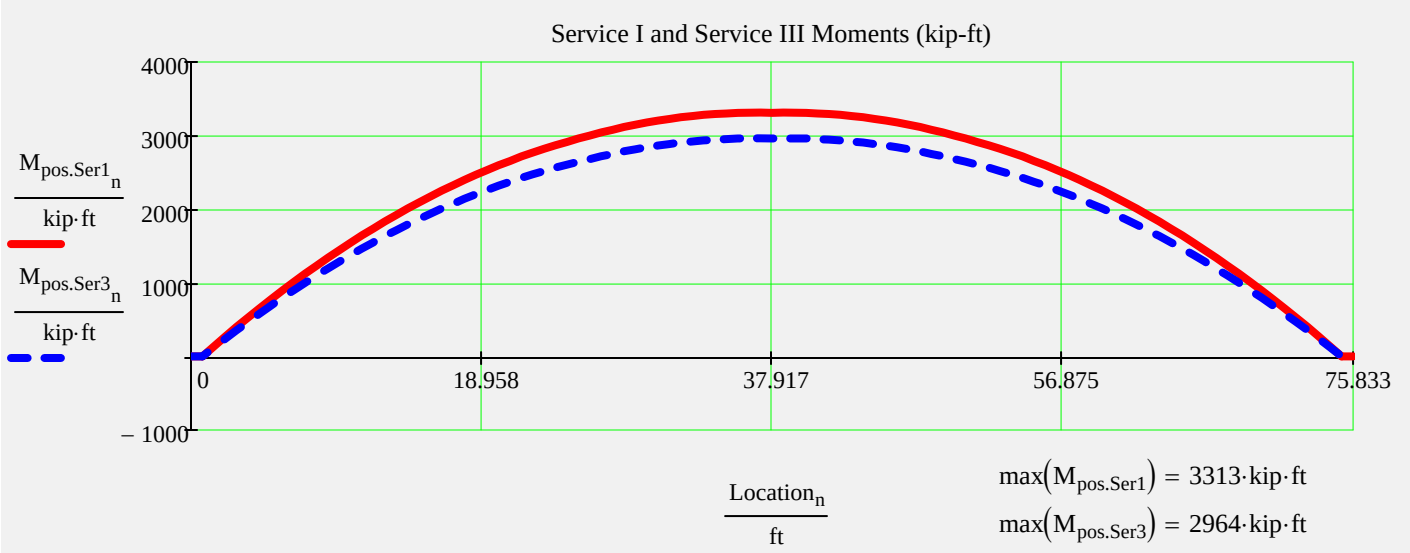
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3313 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2964 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.34 & -3.24 \\ \text{"2"} & -0.43 & -2.75 \\ \text{"4"} & -0.39 & -2.78 \\ \text{"6"} & -1.90 & -1.58 \\ \text{"8"} & -2.28 & -0.29 \end{pmatrix}$

$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1666 & -1601 \\ \text{"@Final (about composite centroid)"} & -1467 & -1333 \end{pmatrix}$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1768.7	416352	–6.9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1419
"Composite Dead Load"	148
"Distributed Live Load"	1742

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

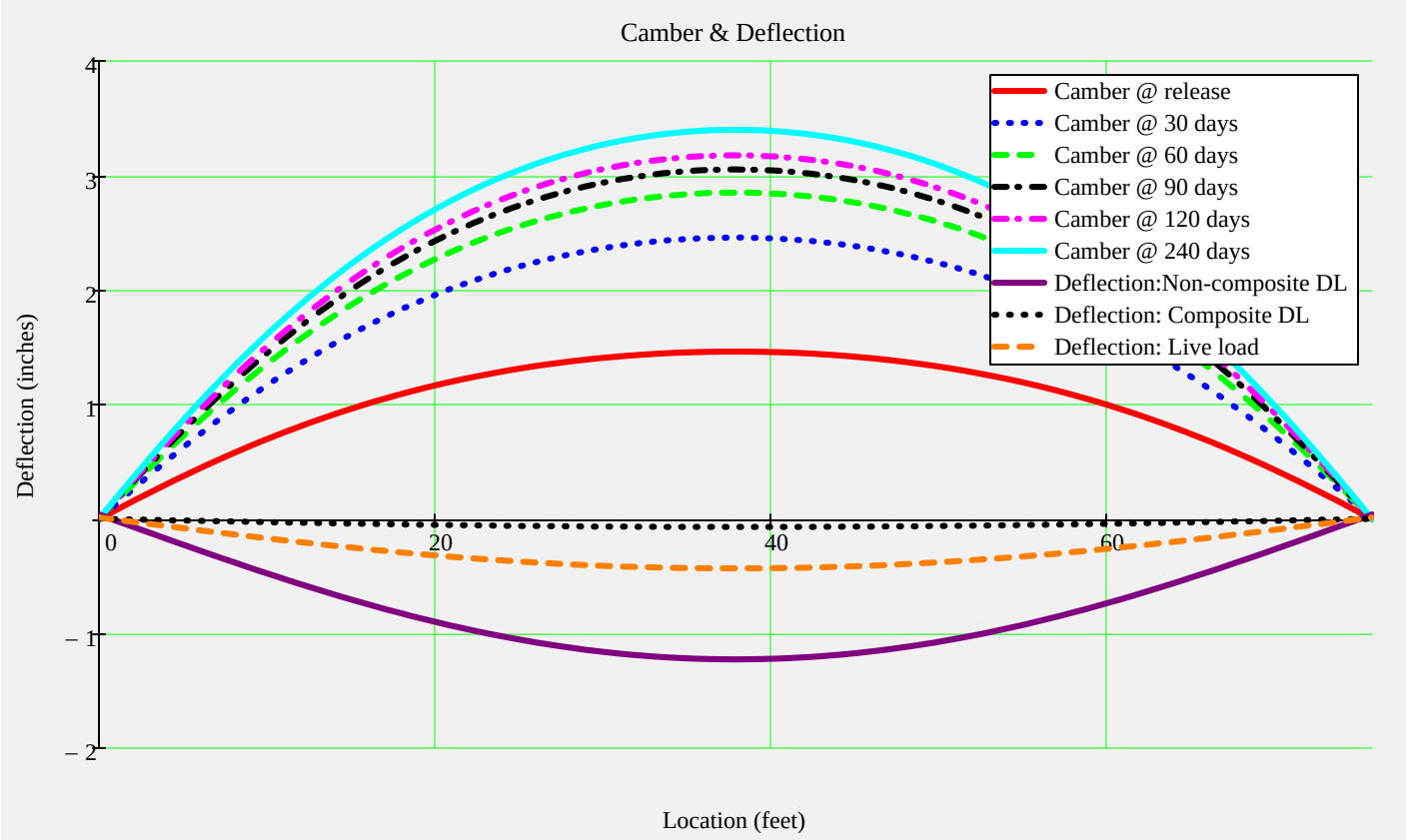
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.18	0.14	–0.25	–1.23
"Comp DL"	–0.00	0.01	–0.01	–0.07
"LL"	–0.02	0.09	–0.09	–0.43

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.88 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

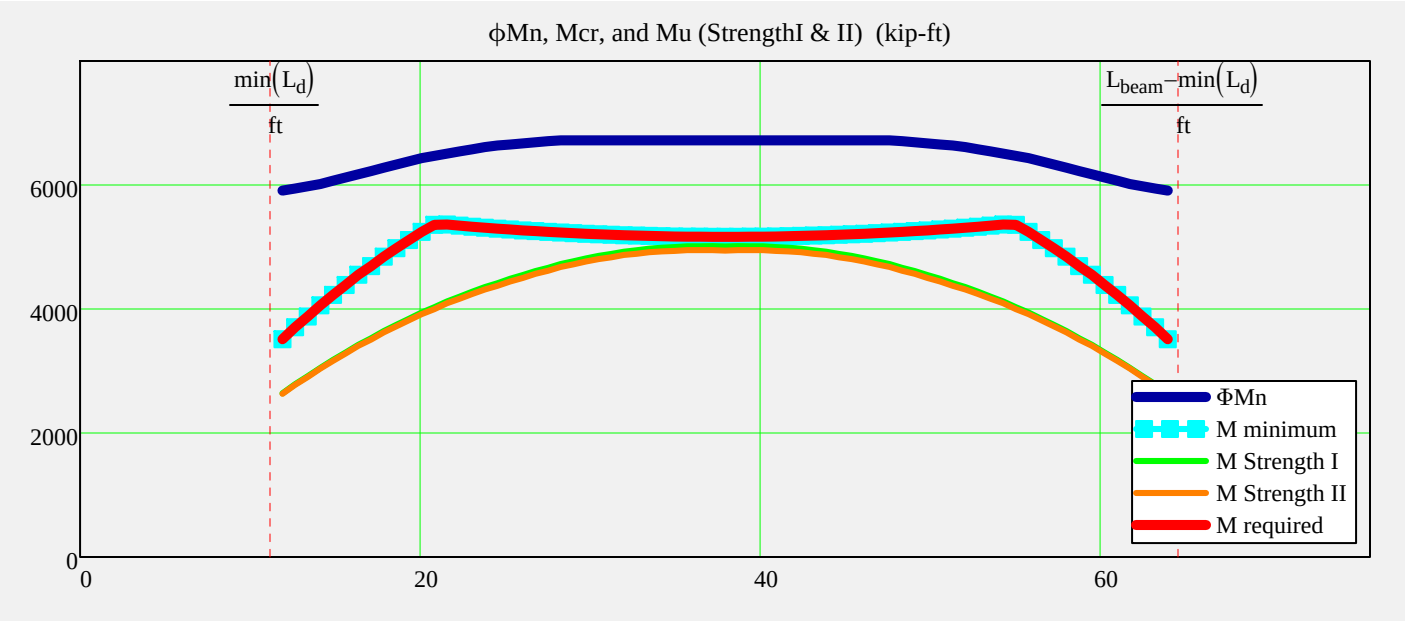
Values at midspan

$LimitStateForMoment_{51} =$ "Strength I" $\max(M_{Strength}) = 5015 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 5164 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5164 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6721 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 11.3\,\text{ft}$ $L_{beam} - \min(L_d) = 64.6\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.83$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

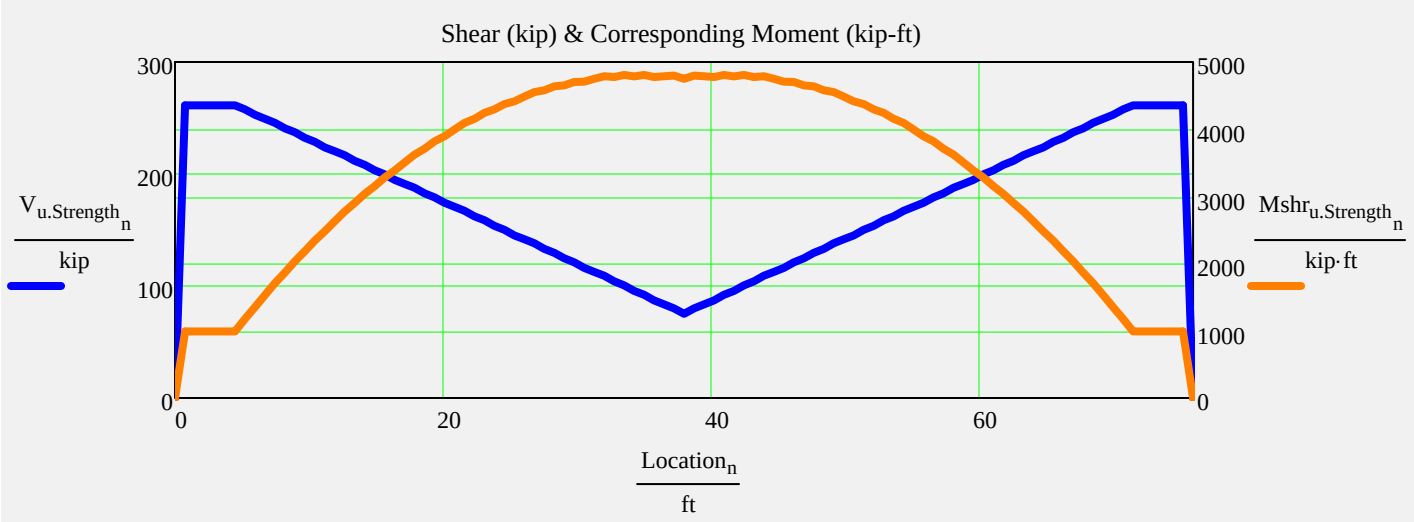
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

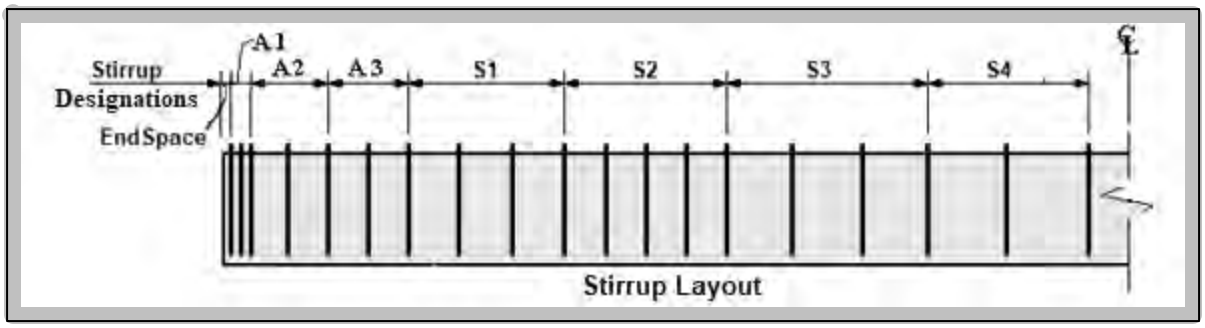
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 282 \\ 282 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 261.3 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4807 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

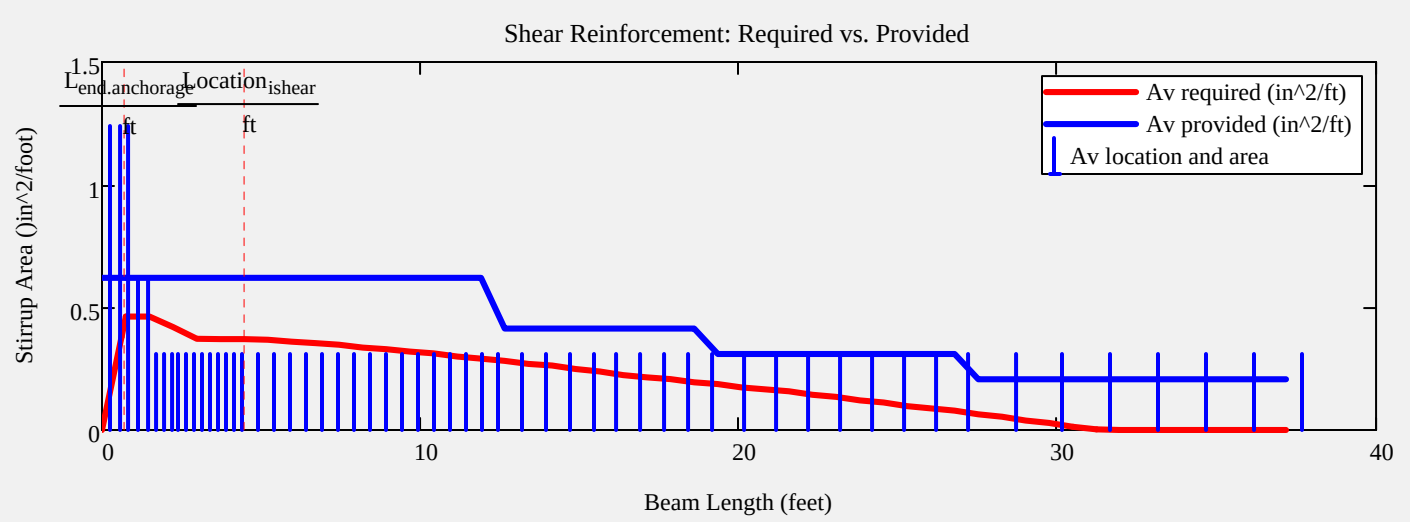
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

Save Data File

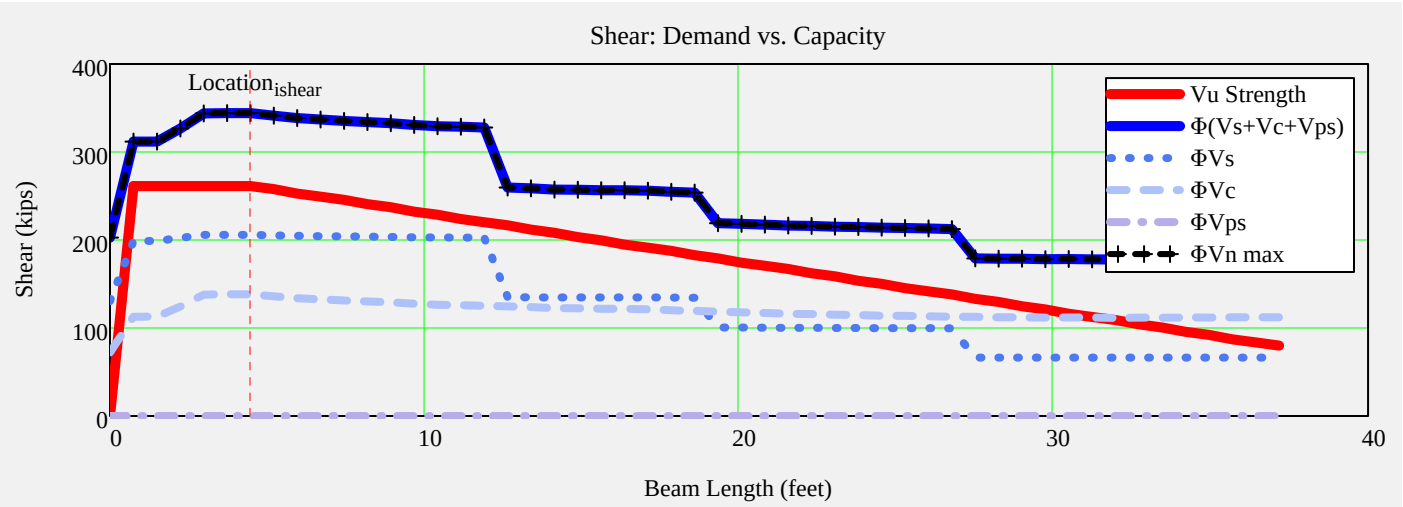
Use current input file

File Name FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 7

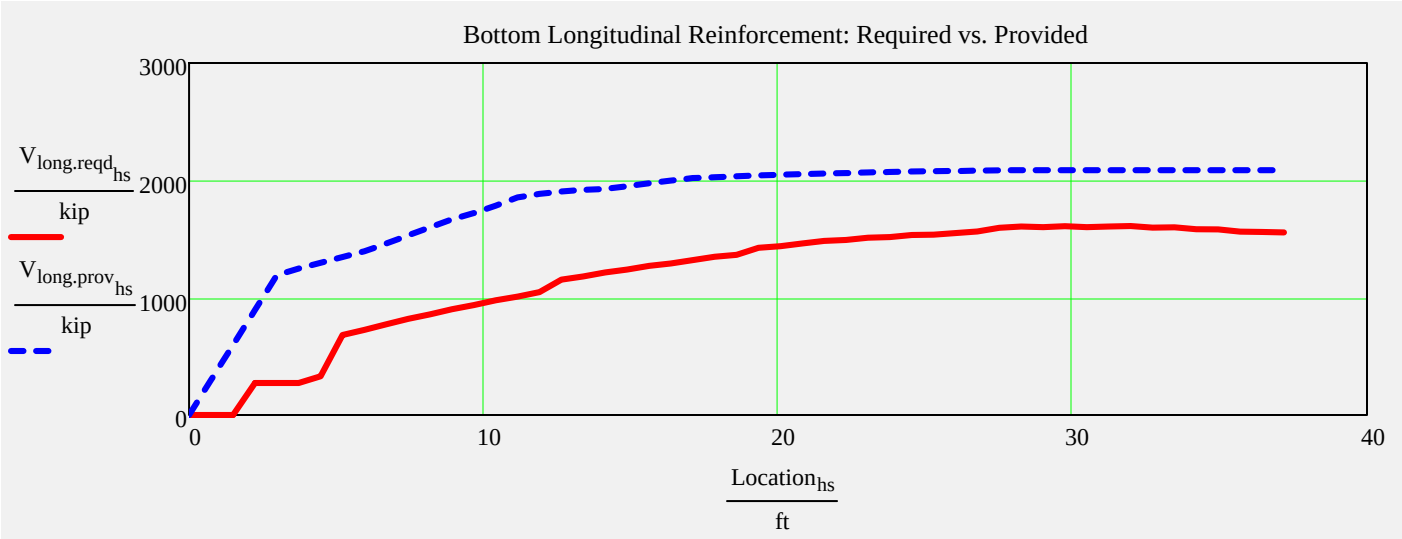
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 216.70 & 259.60 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.83$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

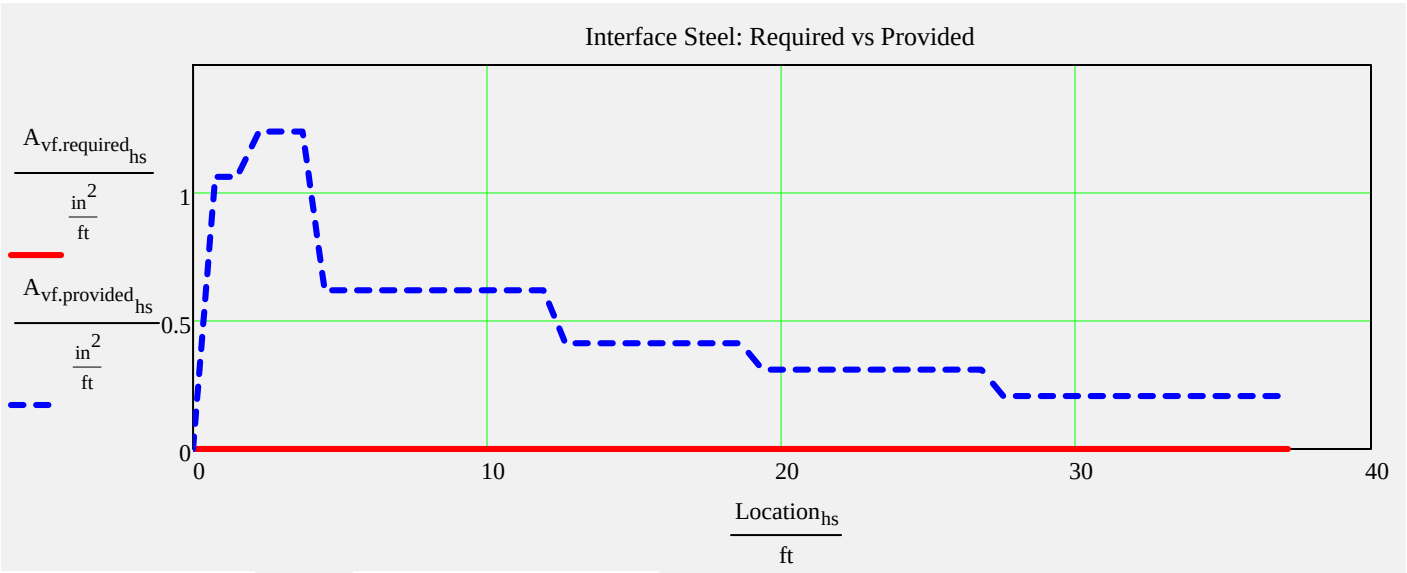


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 32.0 & 1610.6 & 2086.7 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.77$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

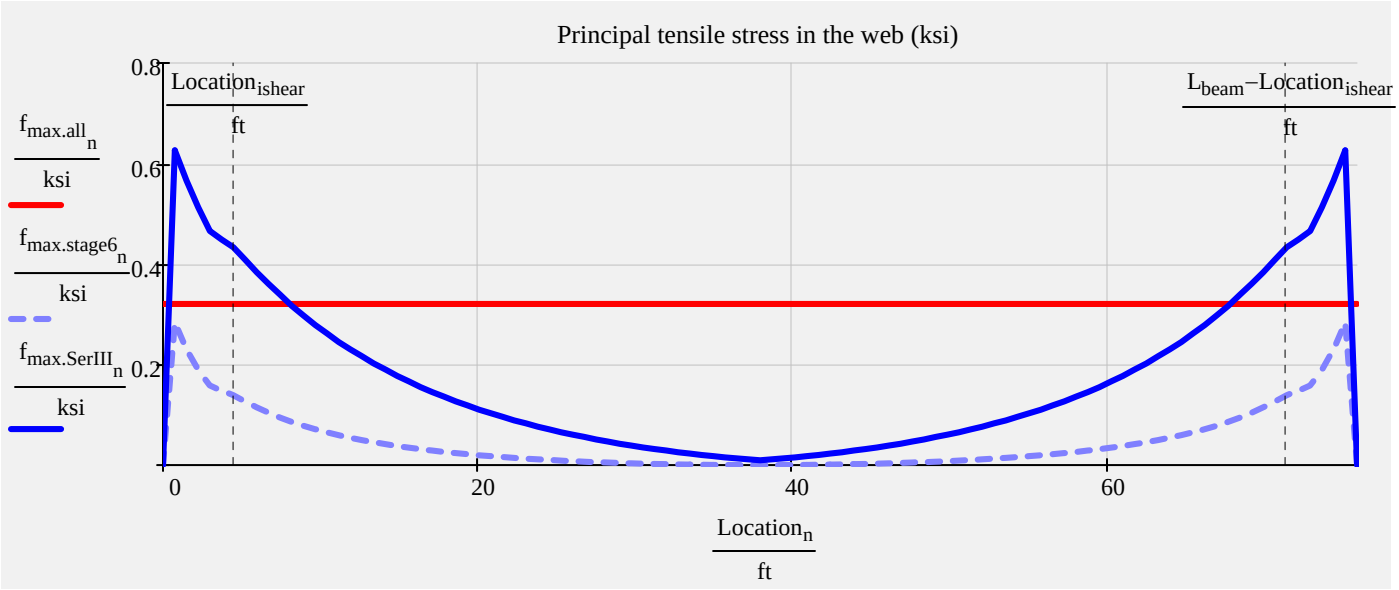
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6 \cdot in$ $\max(DC_f_{max.web}) = 1.35$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

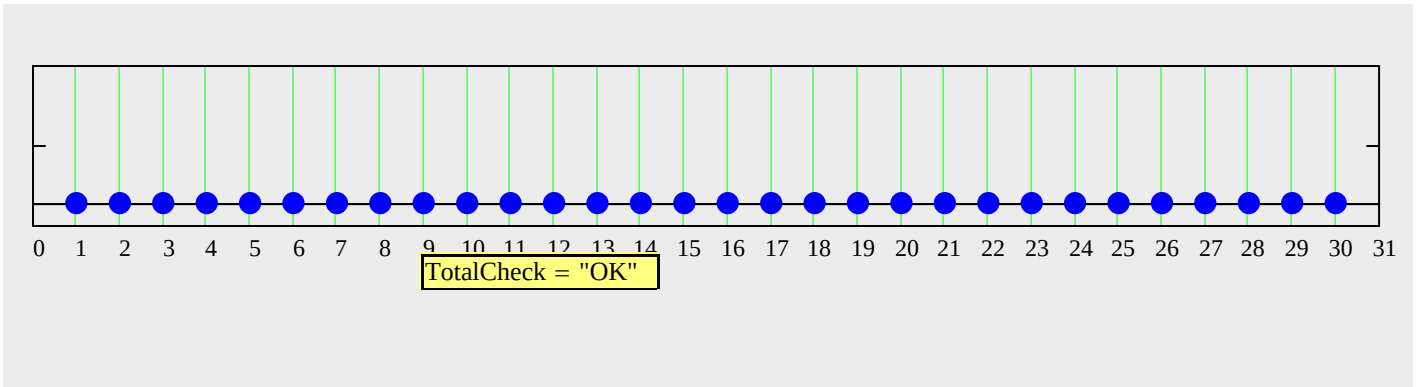
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.94	1.56	"N/A"	37.91	0.94	1.34	"N/A"	11.89	HL-93
"Strength I (Op)"	0.94	2.02	"N/A"	36.42	0.94	1.74	"N/A"	11.89	HL-93
"Service III (Inv)"	0.94	1.71	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.94	1.83	"N/A"	36.42	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.94	1.59	95.45	34.94	0.94	1.30	77.76	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.73$ $DC_{LongReinf.Permit} = 0.77$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6721	"factored resistance (kip-ft)...."
"γDL"	1958	"factored dead load (kip-ft)...."
"γLL"	2358	"factored live load (kip-ft)....."
"RF"	2.02	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	260.5	"factored resistance (kip)....."
"γDL"	71.7	"factored dead load (kip)....."
"γLL"	108.4	"factored live load (kip)....."
"RF"	1.74	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (NO SKEW)
EASTBOUND BRIDGE
(WHIDDEN CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior_DCI.dat
FIB36-76ftSpan_15Skew_Interior_DCI.dat
FIB36-76ftSpan_NoSkew_Exterior_Tiger.dat
FIB36-76ftSpan_NoSkew_Exterior_Whidden.dat
FIB36-76ftSpan_NoSkew_Interior_Tiger.dat
FIB36-76ftSpan_NoSkew_Interior_Whidden.dat

Refresh List

Open File

Reset All Data

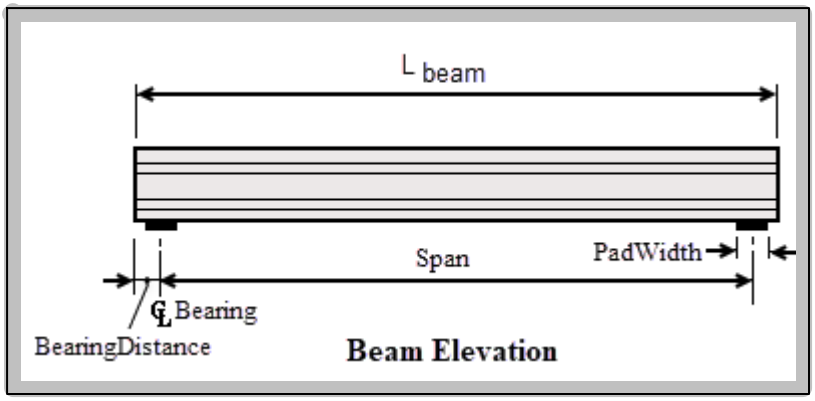
InputDataFile = "FIB36-76ftSpan_NoSkew_Interior_Whidden.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_NoSkew_Interior_Whidden.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	11.6667	ft	*Measured from beam centerline to centerline.*
Overhang	3.8333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8.5	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	4		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

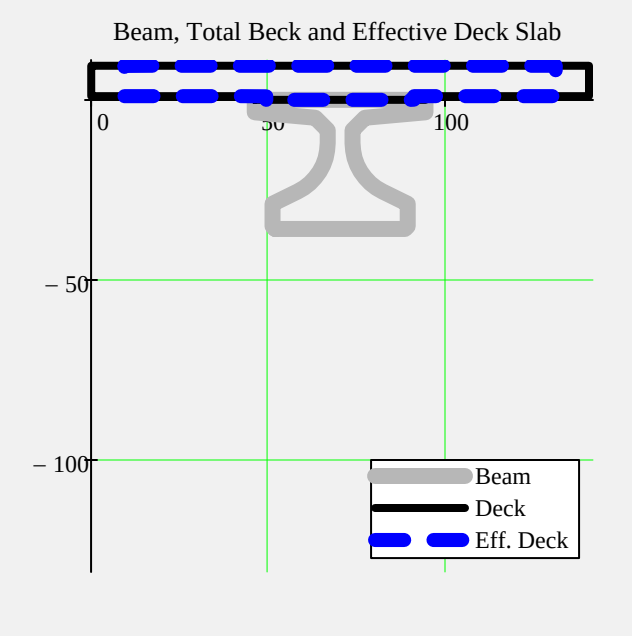
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8.5 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $140 \cdot in$

$b_e = 140 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 1.36 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.15 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.22 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

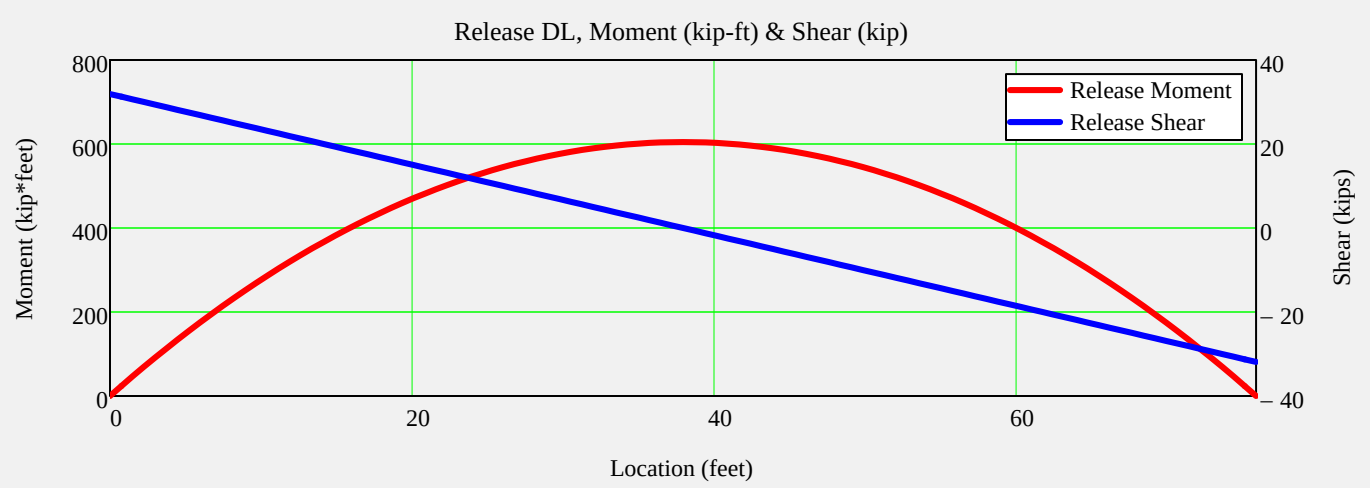
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

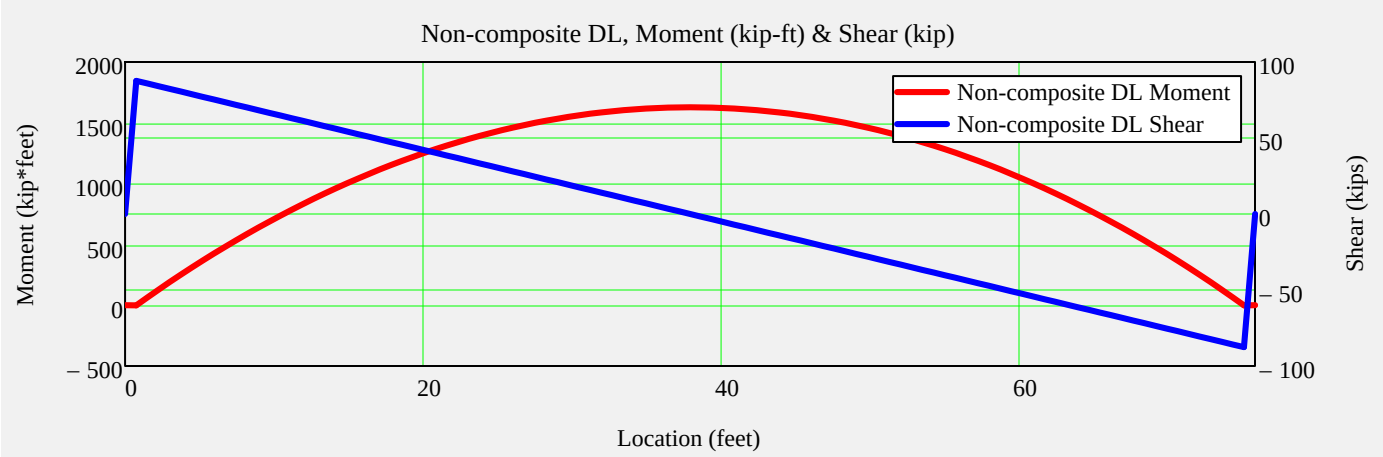
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



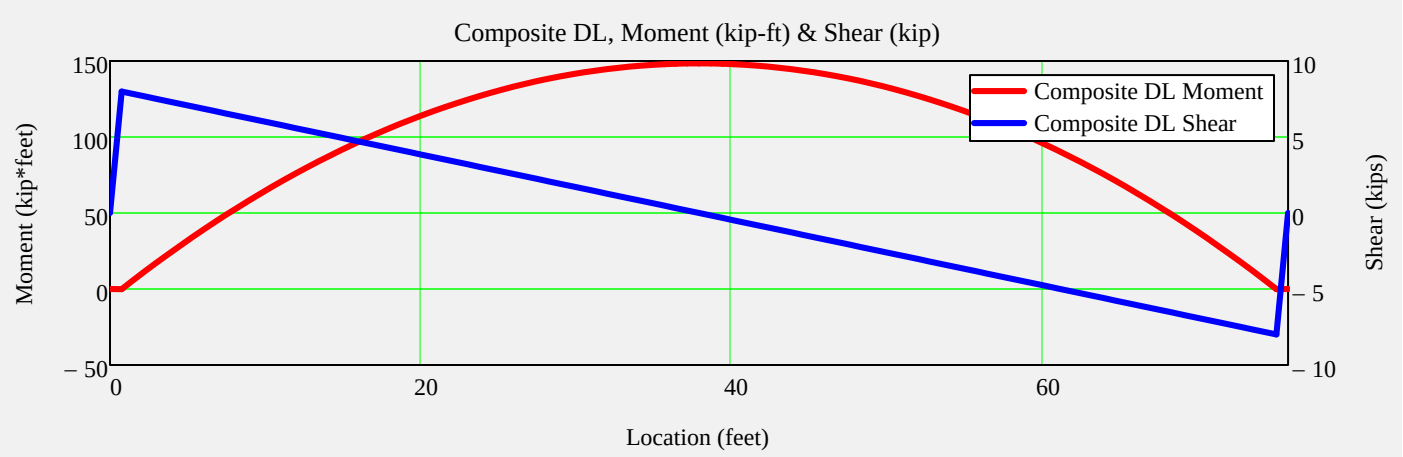
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 87.6 \cdot kip$ $\max(M_{dl.non.comp}) = 1627.2 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -87.6 \cdot kip$

Composite Dead Load Moments and Shear



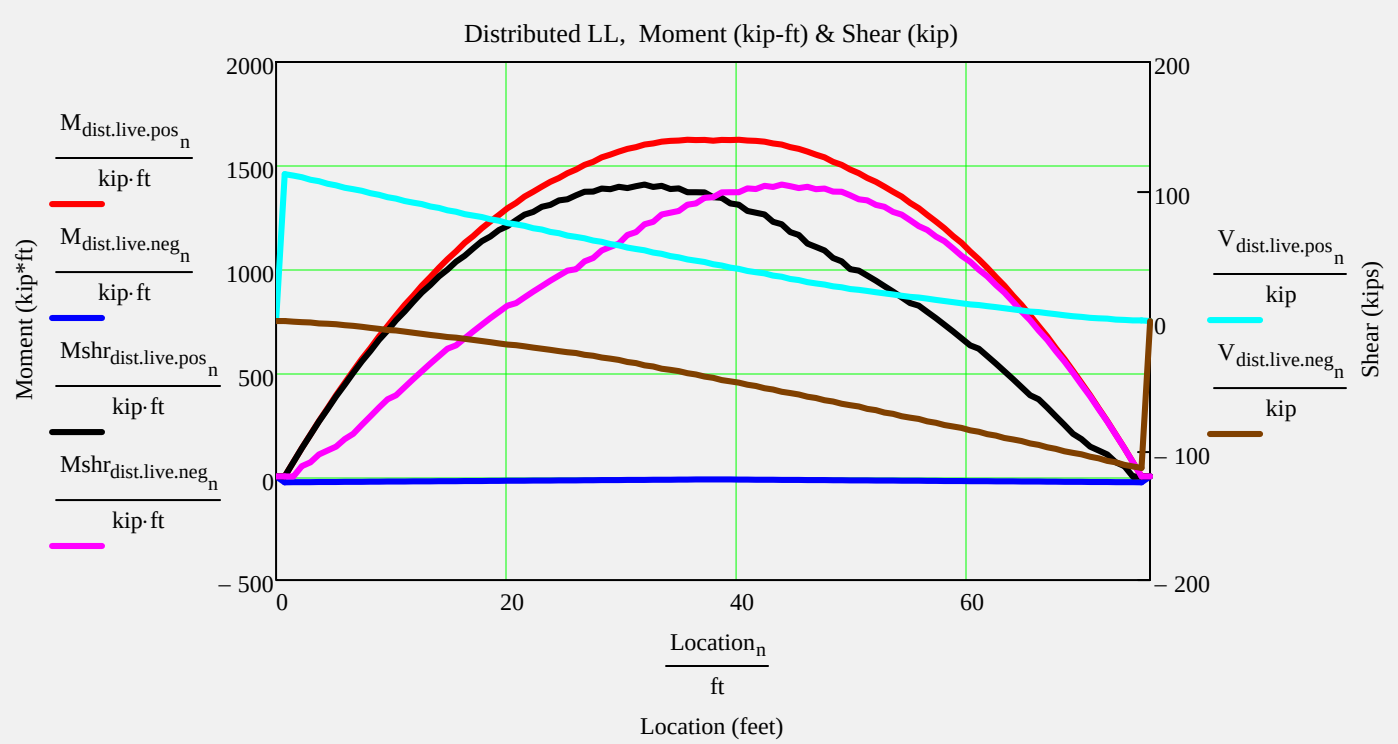
$\max(V_{dl.comp}) = 8.0 \cdot kip$ $\max(M_{dl.comp}) = 148.4 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -8.0 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 11.67\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.88$ $g_{mom.fatigue} = 0.51$ $g_{shear} = 1.06$



$\max(V_{dist.live.pos}) = 113.5 \cdot kip$

$\max(M_{dist.live.pos}) = 1624.9 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -113.5 \cdot kip$

$Reaction_{LL} = 115.6 \cdot kip$

$\min(M_{dist.live.neg}) = -28.1 \cdot kip \cdot ft$

$Reaction_{DL} = 97.5 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1409 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 93.3 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_NoSkew_Interior_Whidden.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.62 *1	0	1.58	0
Distance (in)	4 *2	0 *3		
Length (ft)			16	0
Bar Size		5 *4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

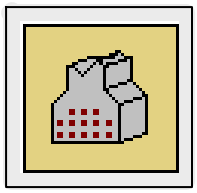
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

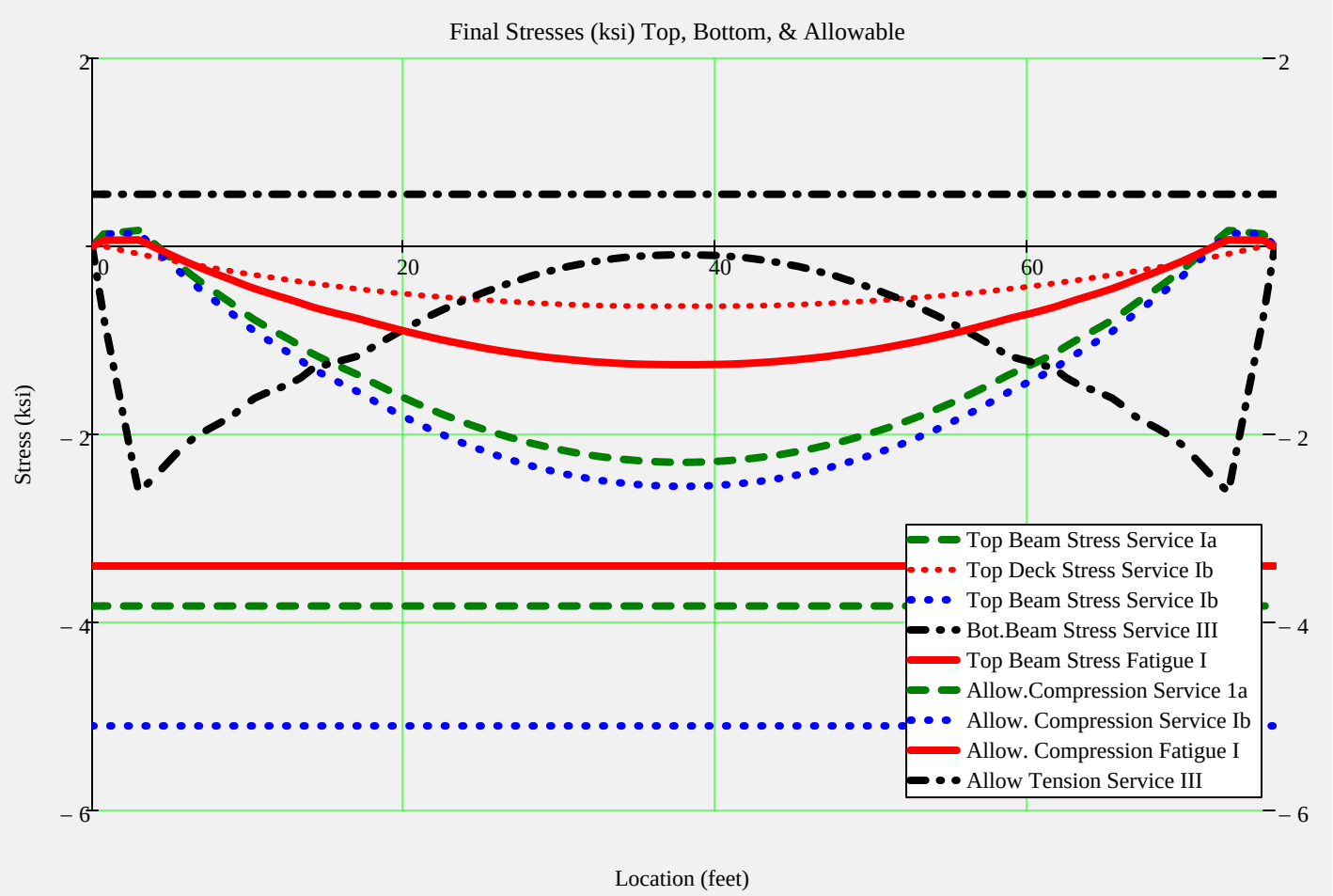
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

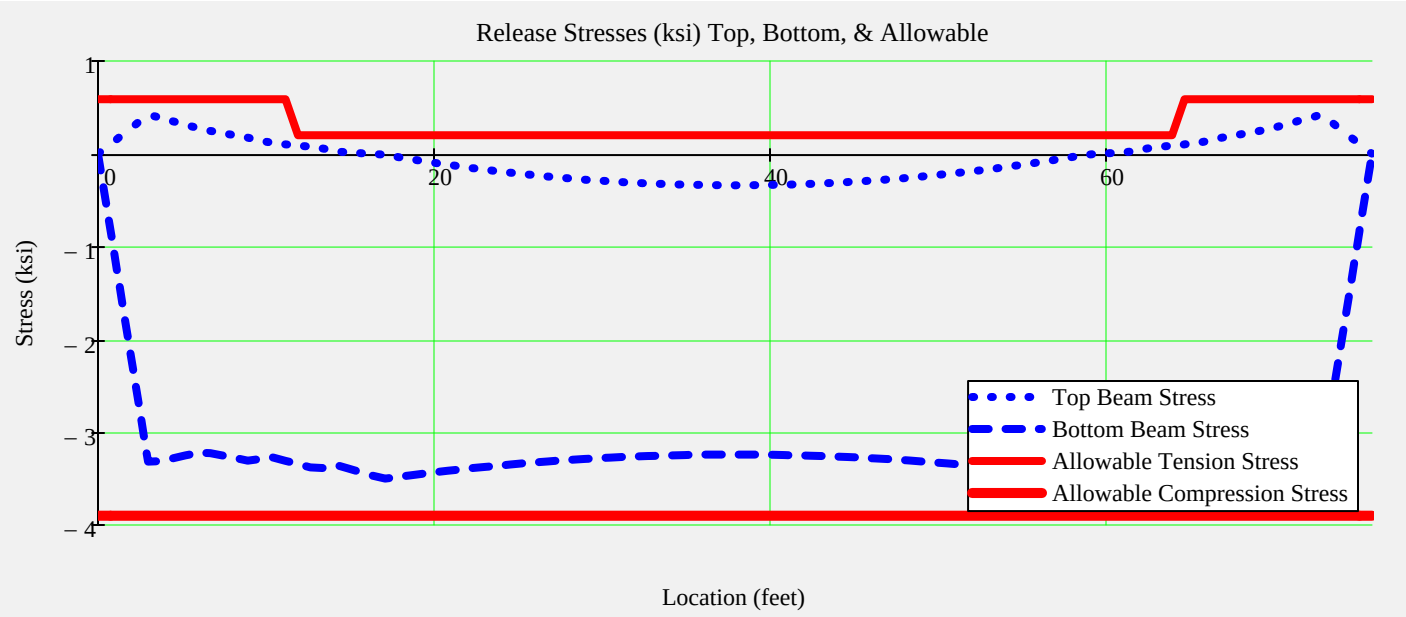
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.60$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.50$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.37$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–2.30	–3.83
"CompressionIb @ ServiceI"	37.92	–2.55	–5.10
"Compression @ FatigueI"	38.66	–1.26	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

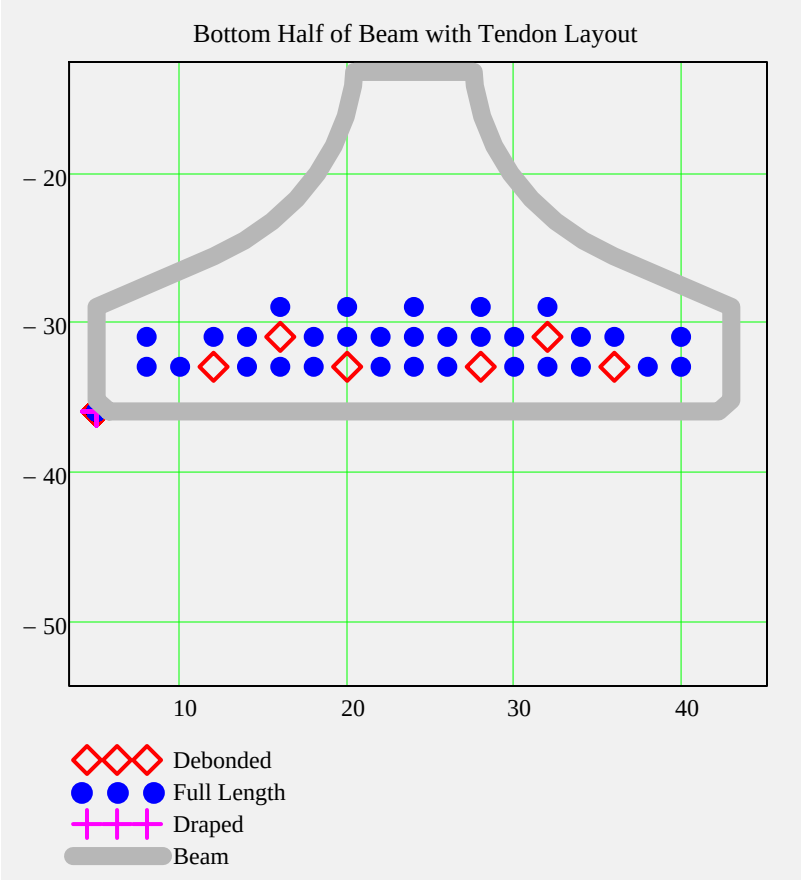
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

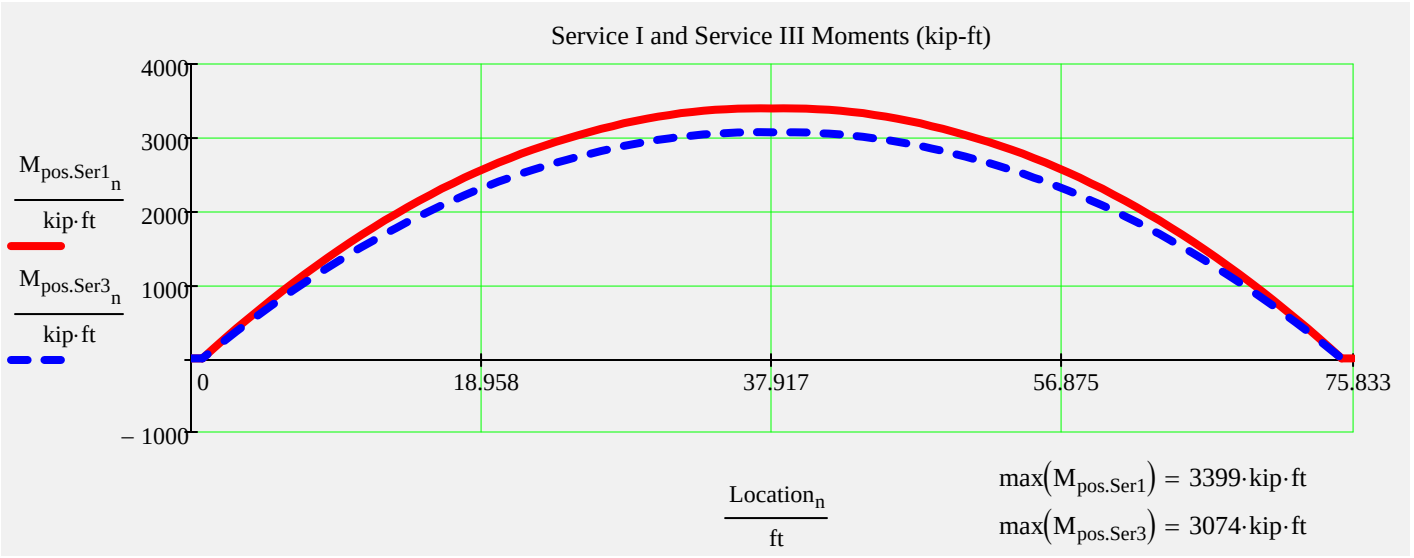
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.34	–3.24
"2"	–0.43	–2.75
"4"	–0.39	–2.78
"6"	–2.27	–1.28
"8"	–2.55	–0.09

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1666	–1601
"@Final (about composite centroid)"	–1467	–1333

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1951.2	441992	–5.8

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1627
"Composite Dead Load"	148
"Distributed Live Load"	1620

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

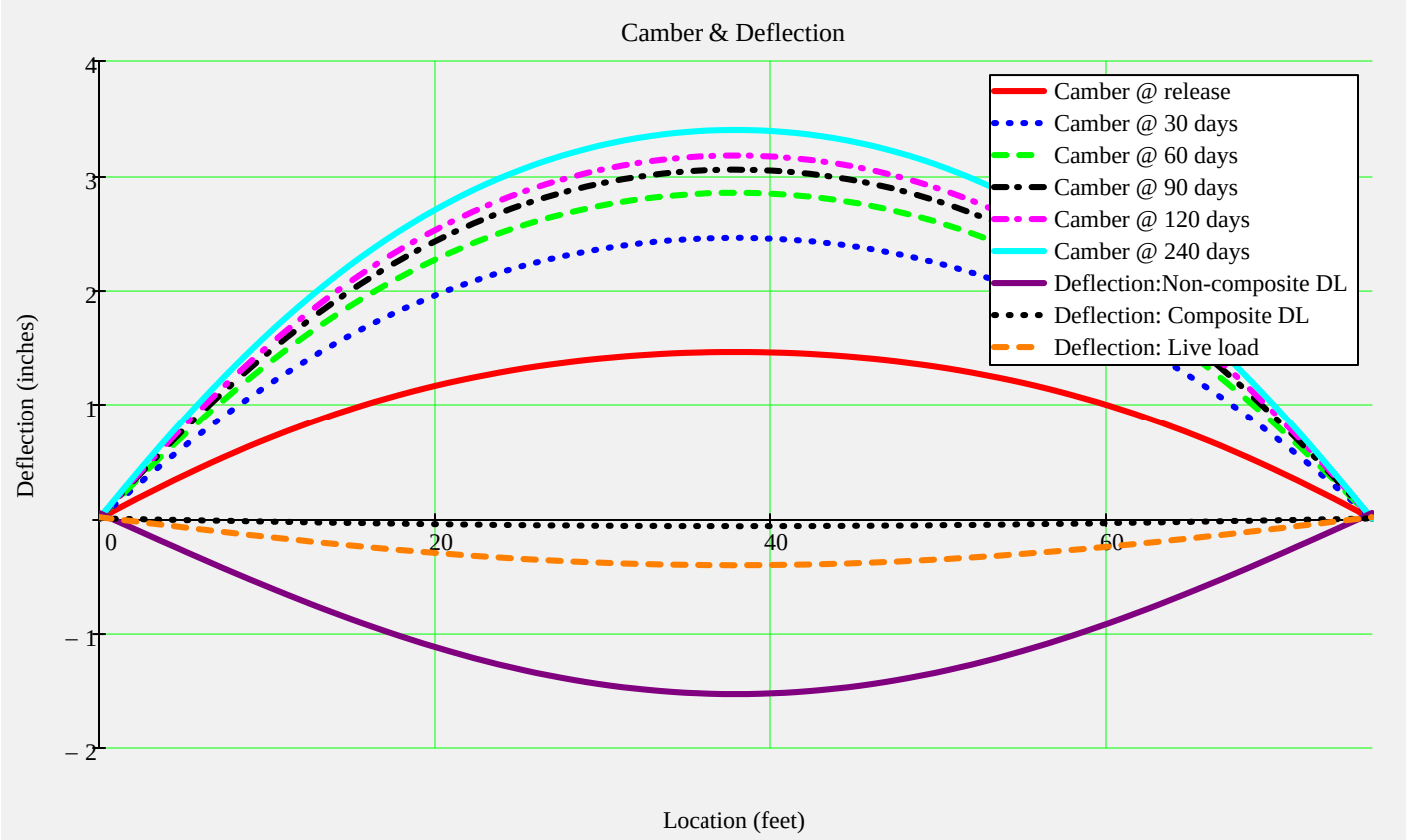
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.22	0.18	–0.31	–1.53
"Comp DL"	–0.00	0.01	–0.01	–0.07
"LL"	–0.02	0.09	–0.08	–0.41

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.58 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

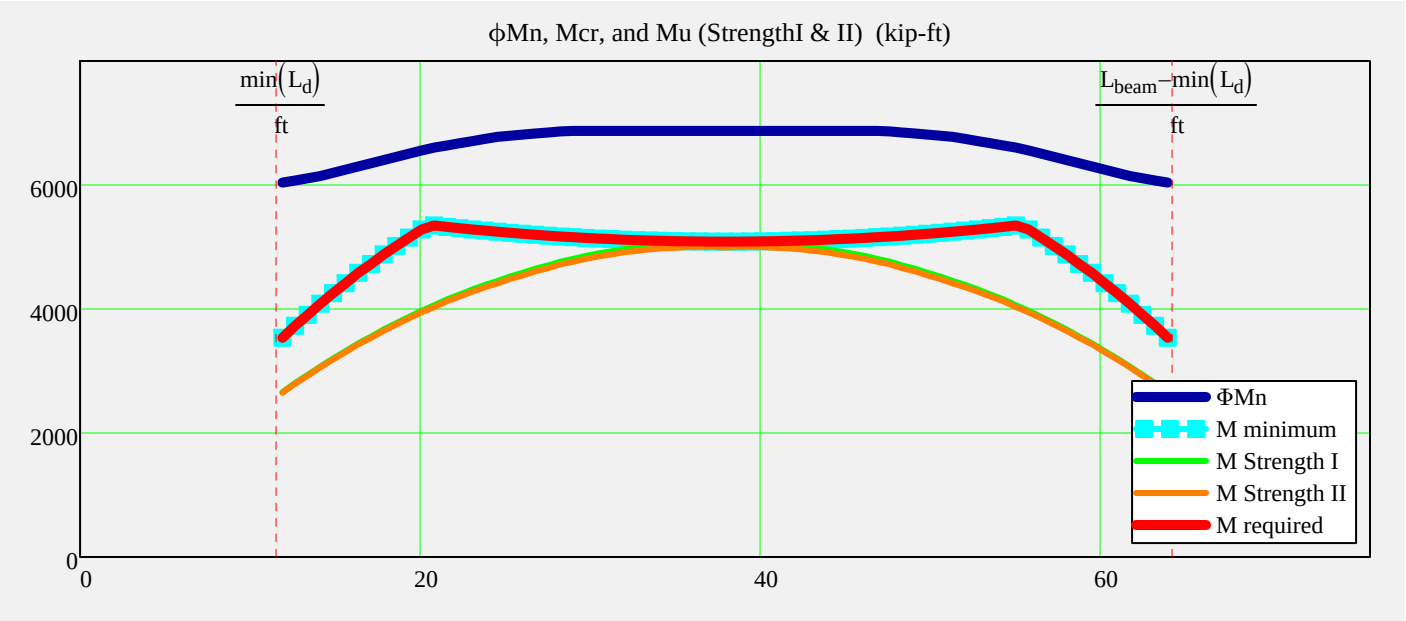
Values at midspan

$LimitStateForMoment_{51} =$ "Strength I" $\max(M_{Strength}) = 5061 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 5087 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5087 \cdot kip \cdot ft$

StrandType = "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6871 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 11.6\ \text{ft}$ $L_{beam} - \min(L_d) = 64.2\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.81$

$\text{CheckMomentCapacity} := \text{if}(\max(DC_{moment}) < 1.0, \text{"OK"}, \text{"No Good!"}) = \text{"OK"}$

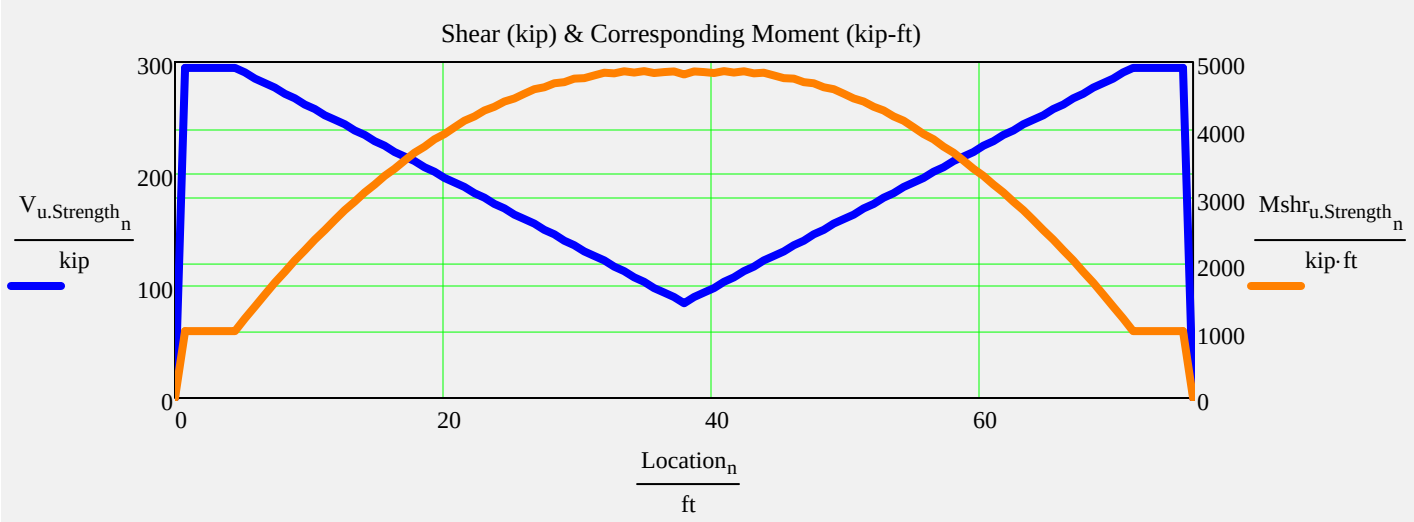
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

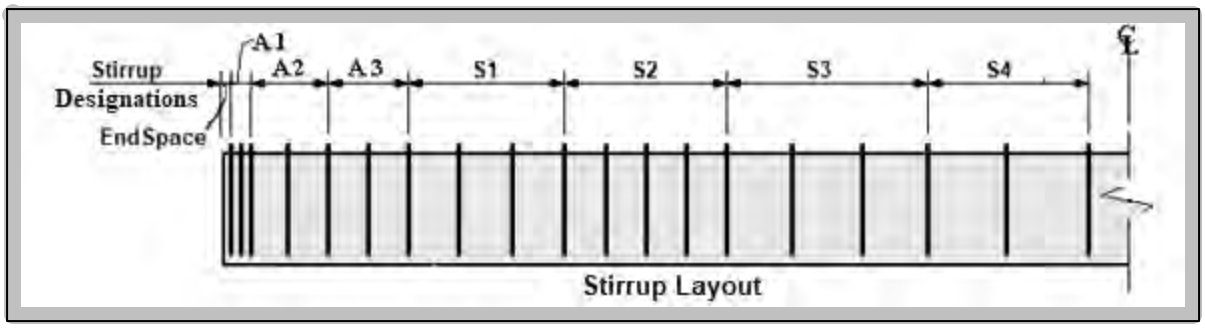
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 318 \\ 318 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 294.8 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4865 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

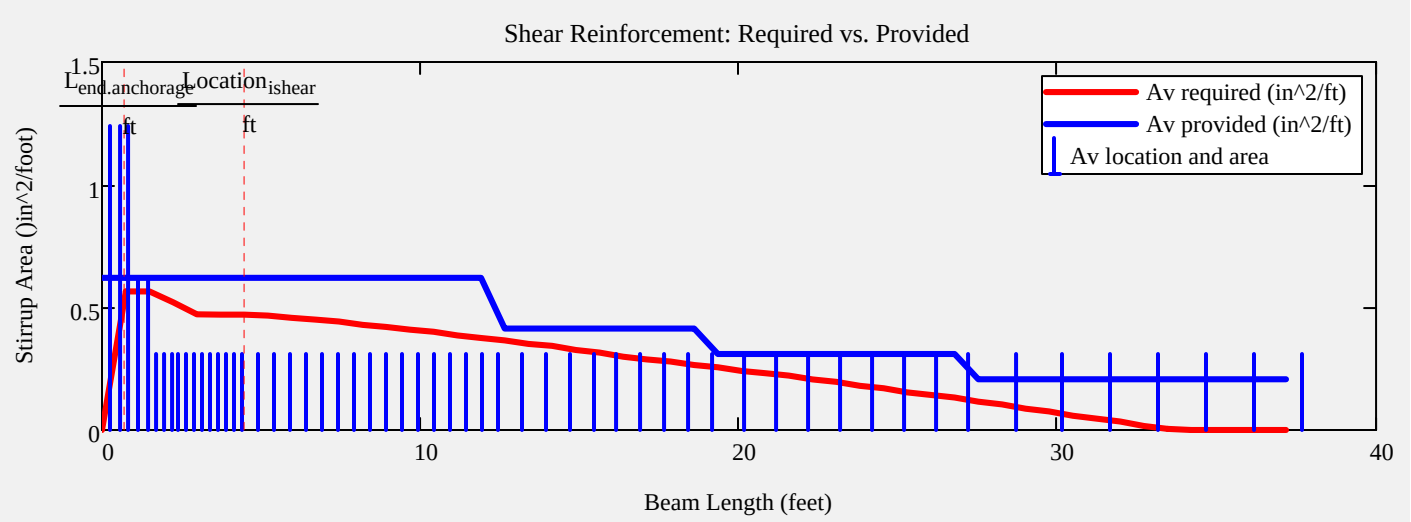
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

Save Data File

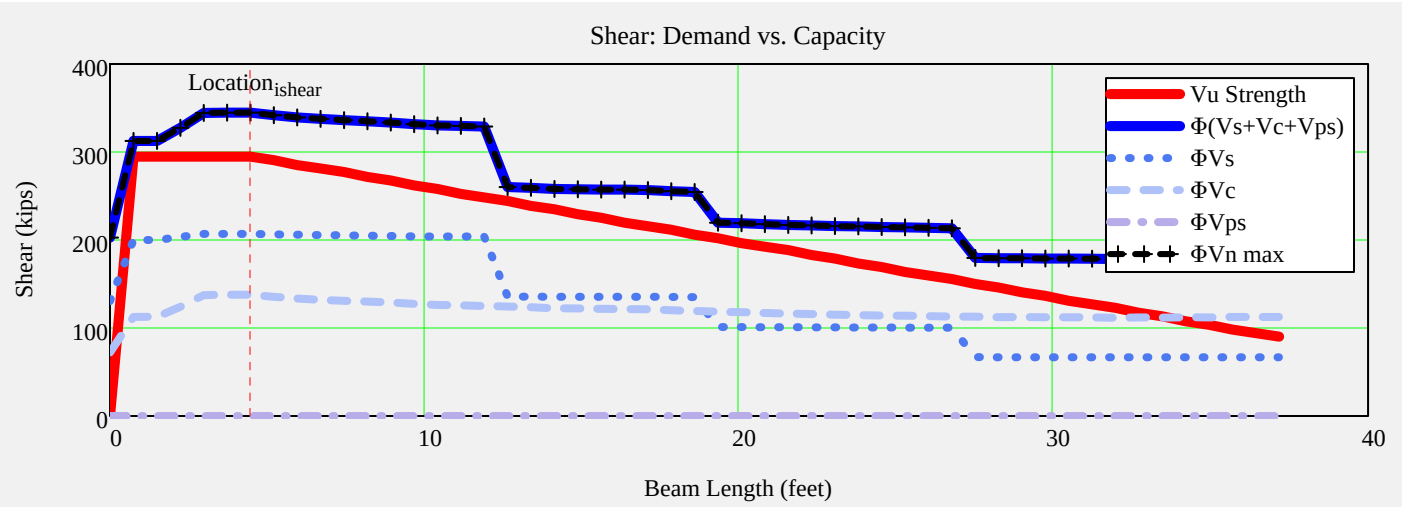
Use current input file

File Name FIB36-76ftSpan_NoSkew_Interior_Whidden.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 7

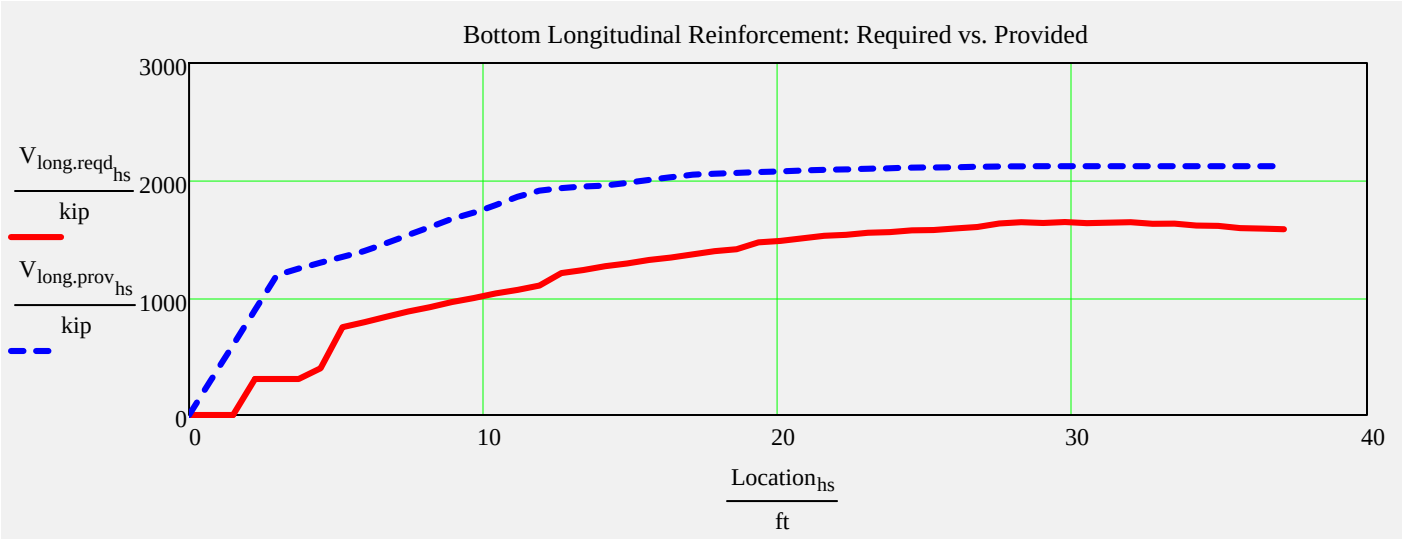
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 244.41 & 260.23 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.94$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

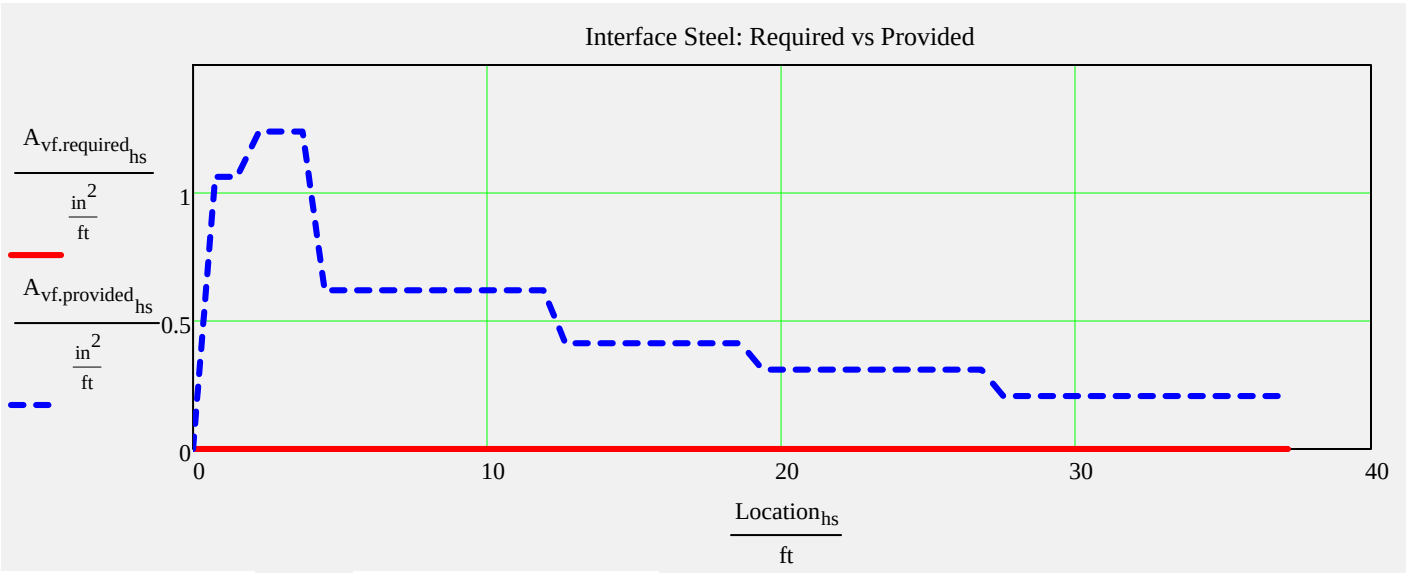


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 29.7 & 1643.9 & 2120.5 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.78$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

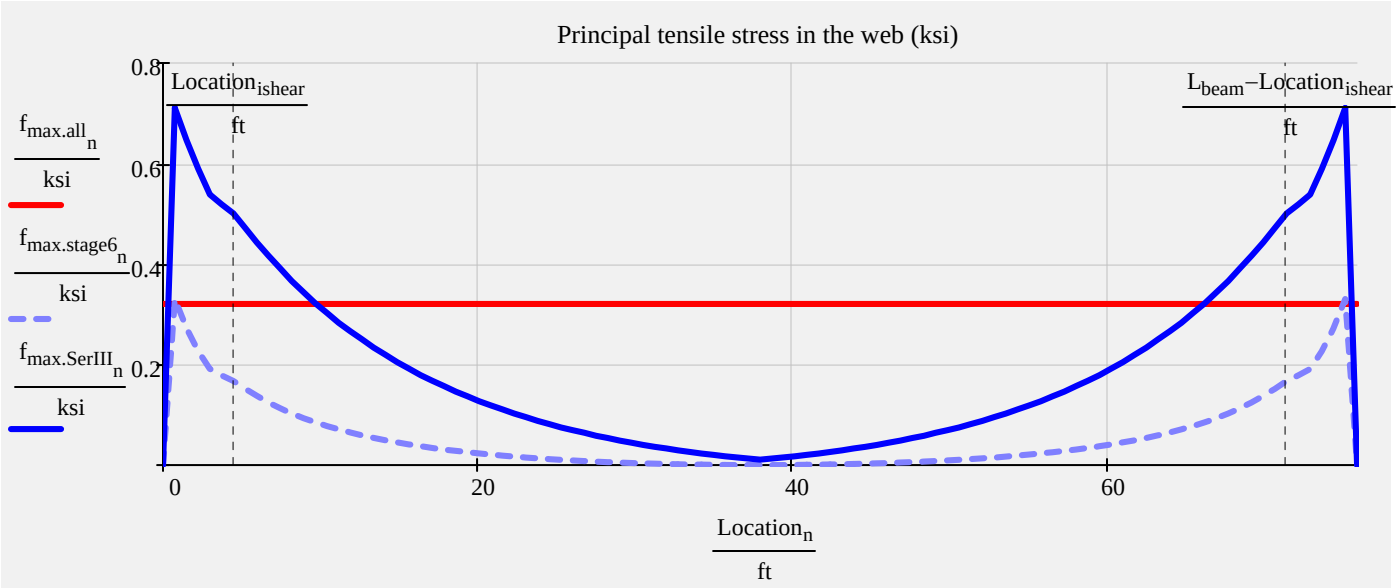
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6 \cdot in$ $\max(DC_f_{max.web}) = 1.56$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

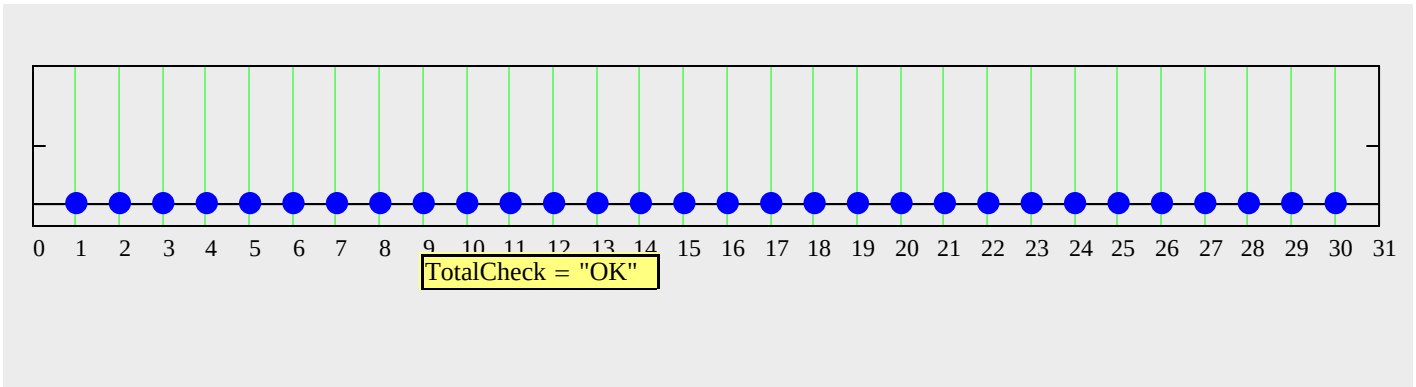
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.88	1.64	"N/A"	37.91	1.06	1.14	"N/A"	11.89	HL-93
"Strength I (Op)"	0.88	2.12	"N/A"	37.91	1.06	1.47	"N/A"	11.89	HL-93
"Service III (Inv)"	0.88	1.60	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.88	1.73	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.88	1.67	100.31	34.94	1.06	1.10	65.82	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.74$ $DC_{LongReinf.Permit} = 0.78$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6871	"factored resistance (kip-ft)...."
"γDL"	2219	"factored dead load (kip-ft)...."
"γLL"	2192	"factored live load (kip-ft)....."
"RF"	2.12	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	261.1	"factored resistance (kip)....."
"γDL"	81.2	"factored dead load (kip)....."
"γLL"	121.9	"factored live load (kip)....."
"RF"	1.47	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (NO SKEW)

EASTBOUND BRIDGE

(TIGER BAY)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam	
FSB	
FUB	
FlatSlab	
InvertedT	
DoubleT	

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior.dat
FIB36-76ftSpan_15Skew_Interior.dat
FIB36-76ftSpan_NoSkew_Exterior.dat
FIB36-76ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

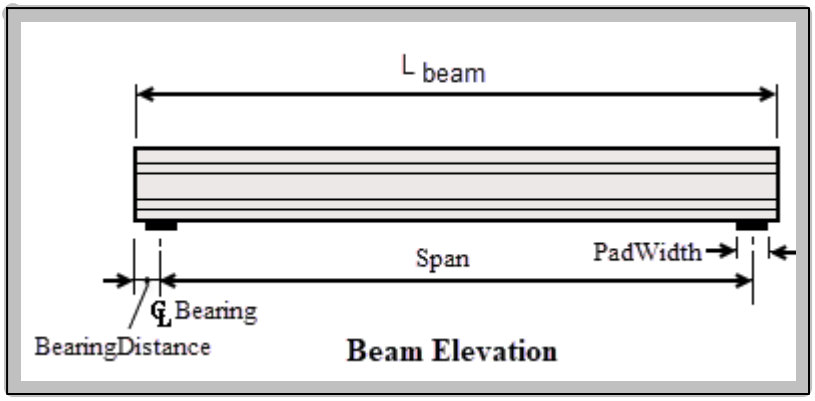
InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	10	ft	*Measured from beam centerline to centerline.*
Overhang	3.7083	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(* 0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

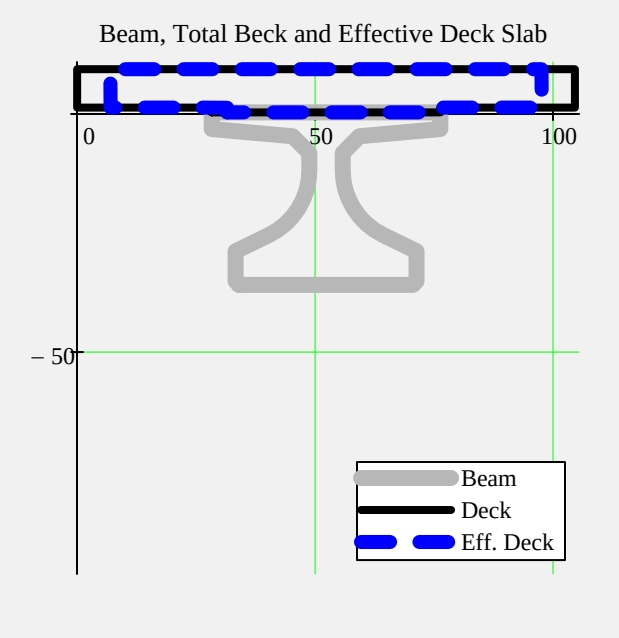
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $120 \cdot in$

$b_e = 104.5 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	$\frac{kip}{ft}$
Additional Uniform Composite DL	0.03	$\frac{kip}{ft}$

$w_{deck} = 0.92 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.06 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.112 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

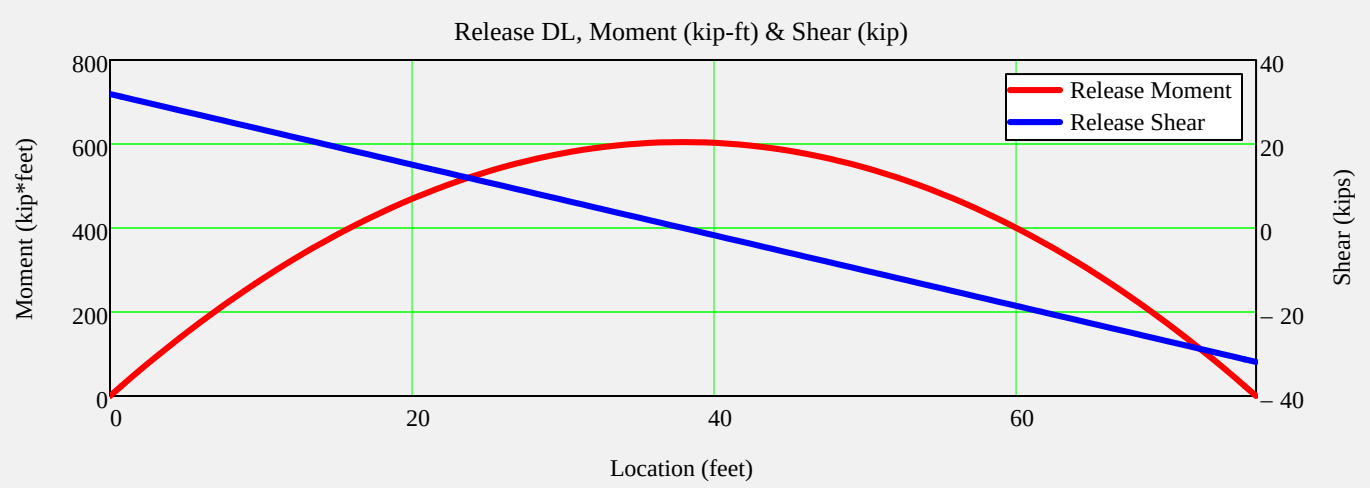
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

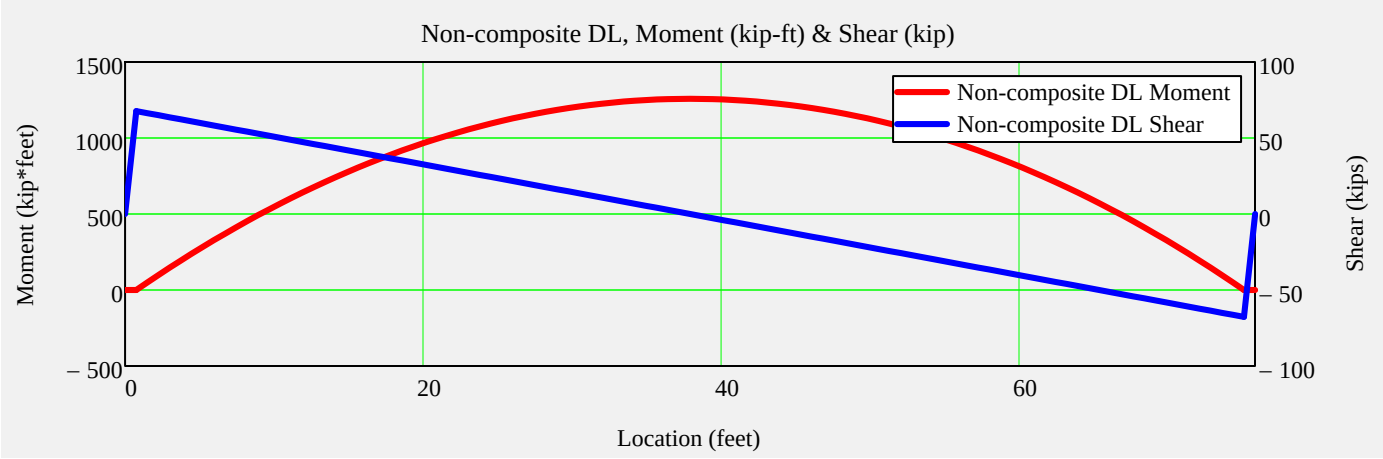
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



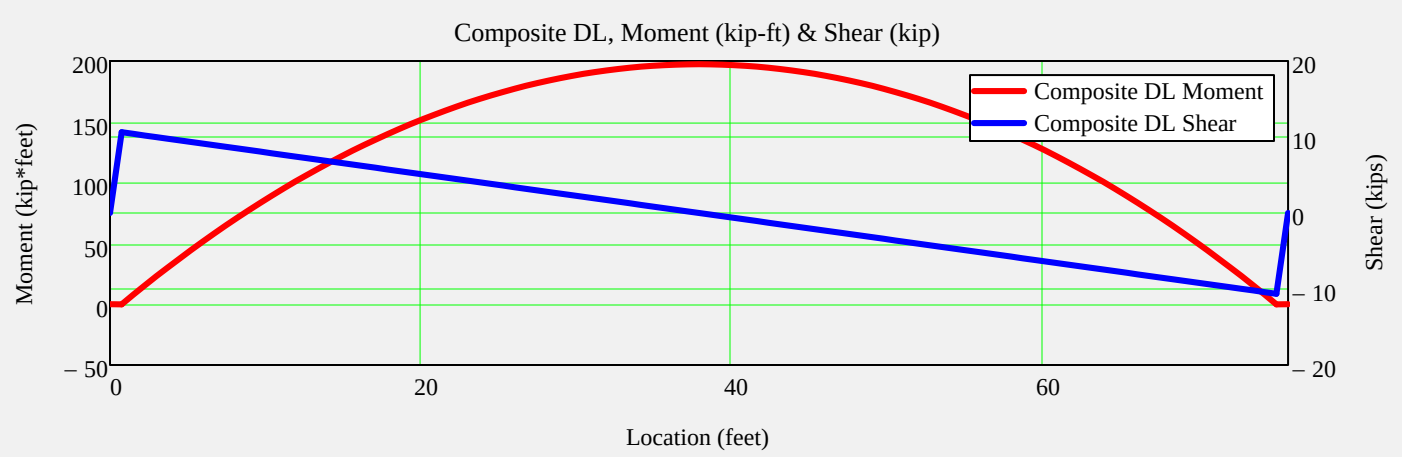
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 67.7 \cdot kip$ $\max(M_{dl.non.comp}) = 1257.8 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -67.7 \cdot kip$

Composite Dead Load Moments and Shear



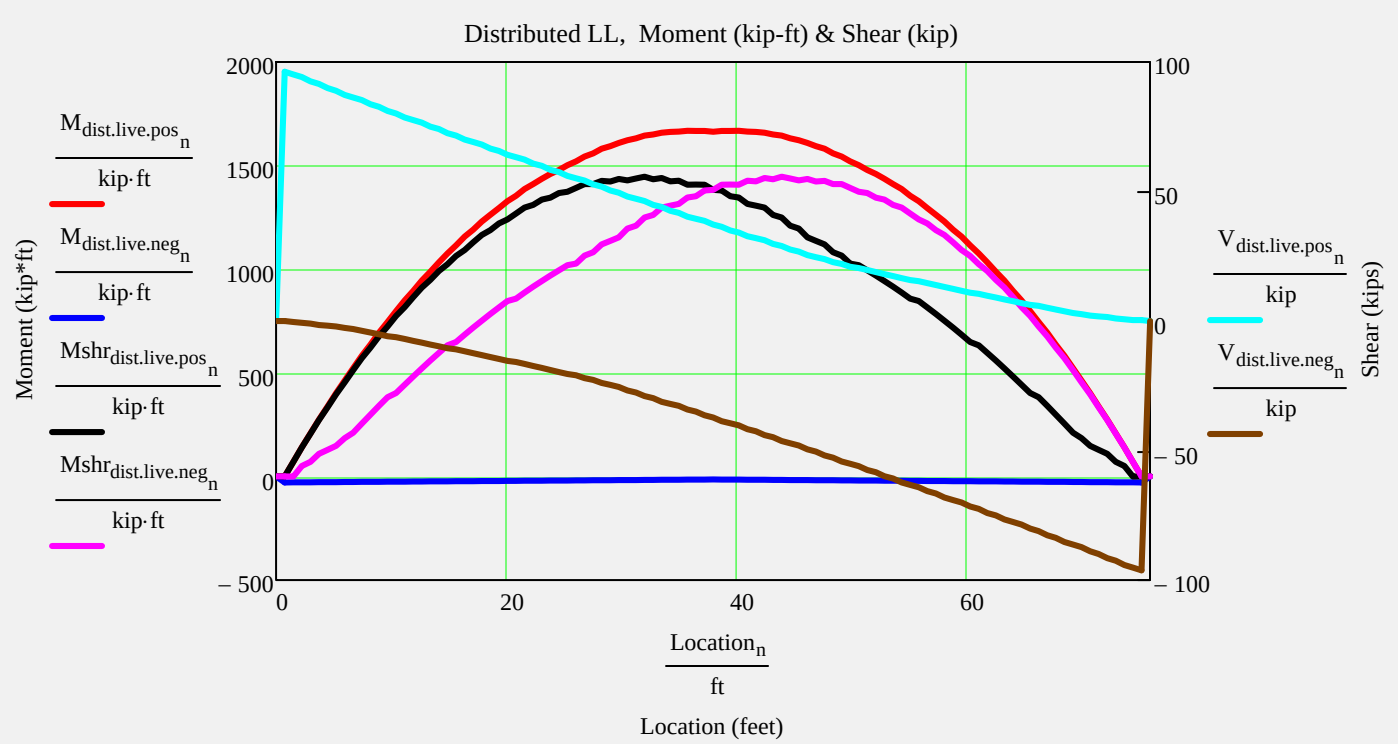
$\max(V_{dl.comp}) = 10.6 \cdot kip$ $\max(M_{dl.comp}) = 197.3 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -10.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 10\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.9$ $g_{mom.fatigue} = 0.75$ $g_{shear} = 0.90$



$\max(V_{dist.live.pos}) = 96.2 \cdot kip$

$\max(M_{dist.live.pos}) = 1668.3 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -96.2 \cdot kip$

$Reaction_{LL} = 98.1 \cdot kip$

$\min(M_{dist.live.neg}) = -28.9 \cdot kip \cdot ft$

$Reaction_{DL} = 79.9 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1446 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 79.2 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_NoSkew_Exterior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.58	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		5 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

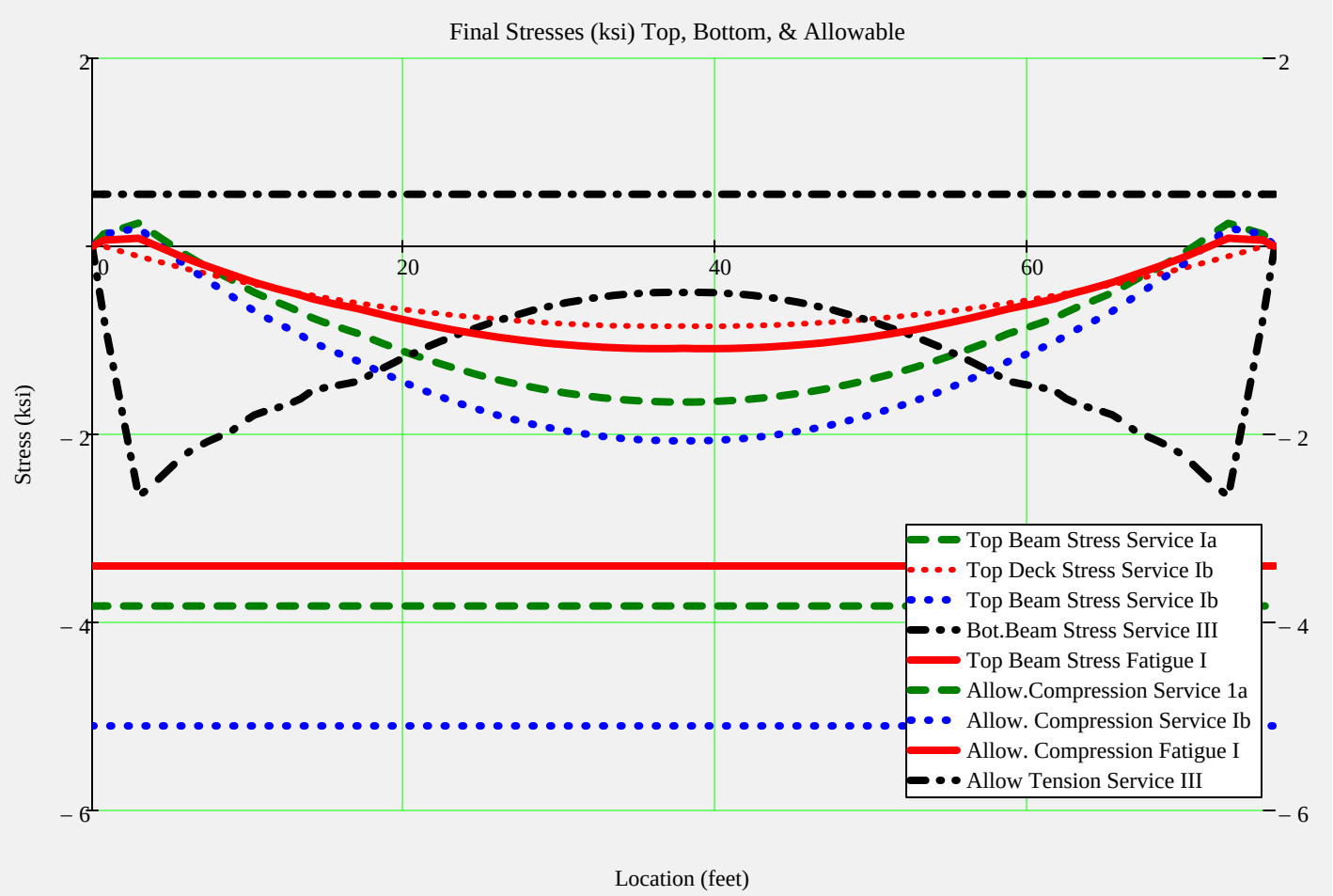
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

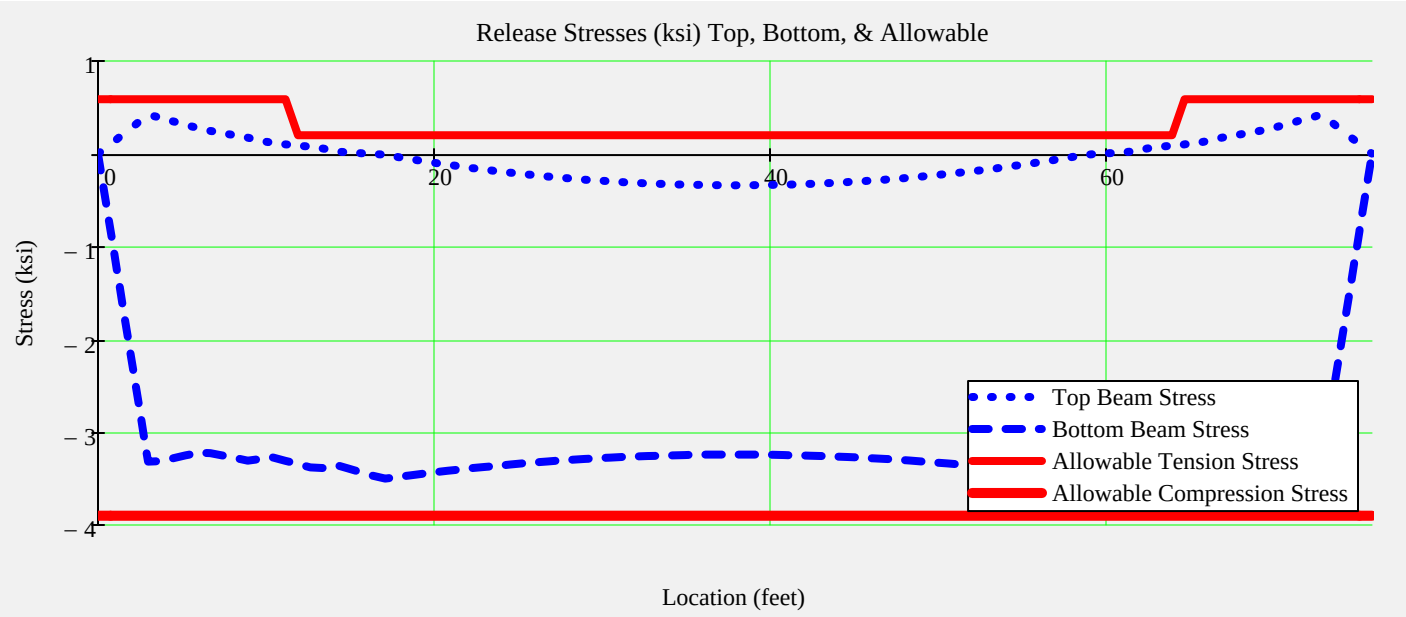
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.43$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.41$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.32$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–1.66	–3.83
"CompressionIb @ ServiceI"	38.66	–2.07	–5.10
"Compression @ FatigueI"	39.40	–1.09	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

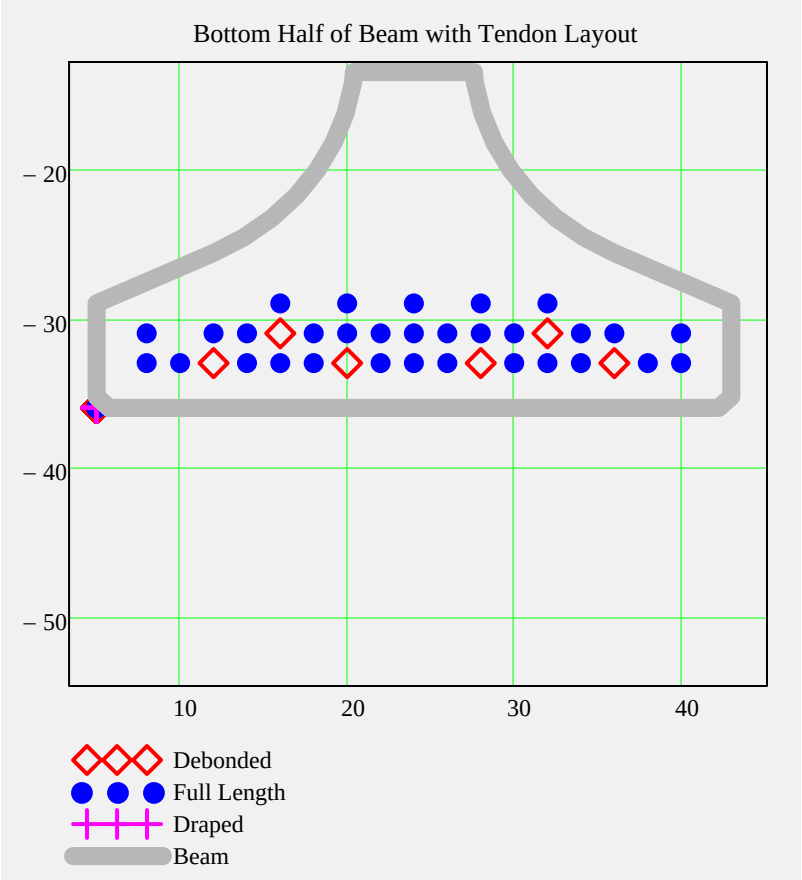
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

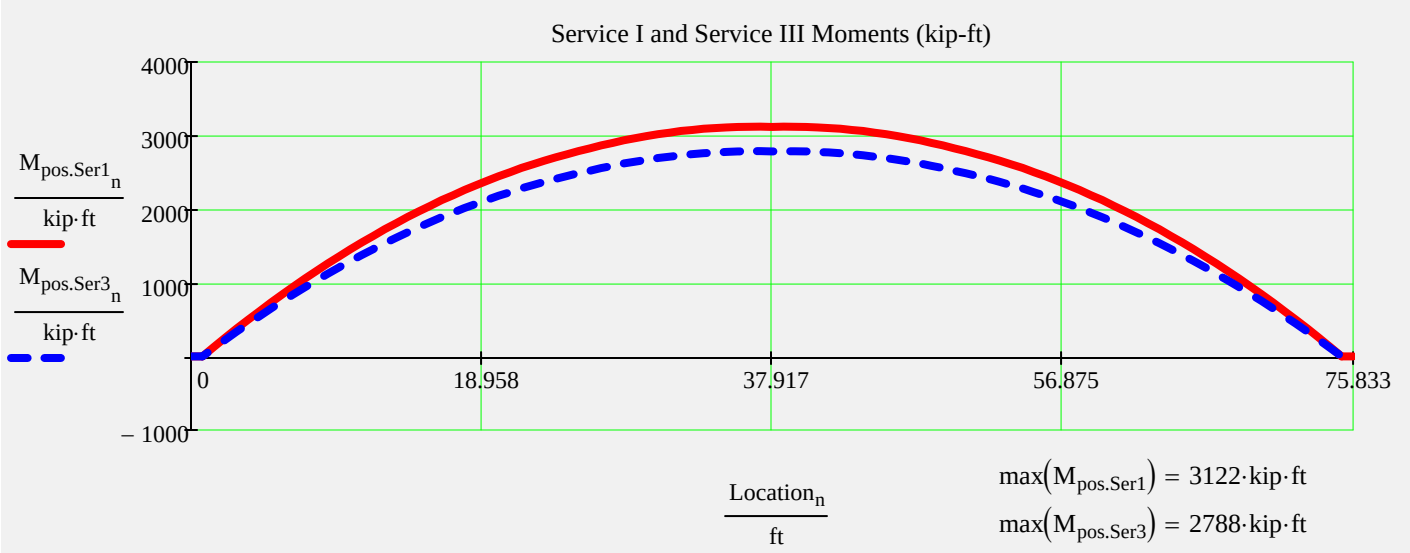
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$Stresses =$

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.34	–3.24
"2"	–0.43	–2.75
"4"	–0.39	–2.78
"6"	–1.61	–1.81
"8"	–2.07	–0.49

$PrestressForce =$

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1666	–1601
"@Final (about composite centroid)"	–1467	–1333

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1636	388689	–8

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1258
"Composite Dead Load"	197
"Distributed Live Load"	1663

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

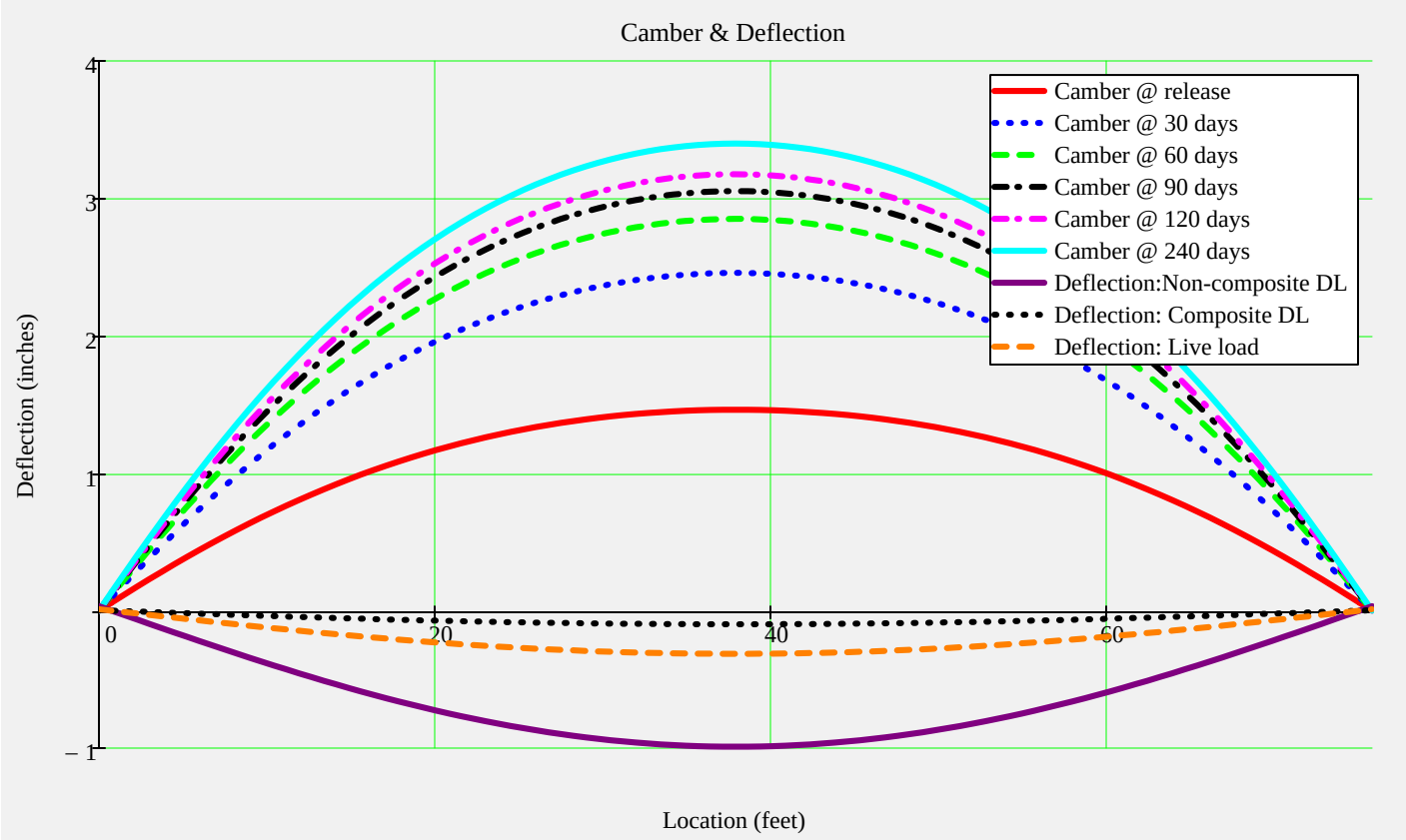
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.14	0.11	–0.20	–0.99
"Comp DL"	–0.01	0.02	–0.02	–0.10
"LL"	–0.02	0.06	–0.07	–0.31

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 2.09 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

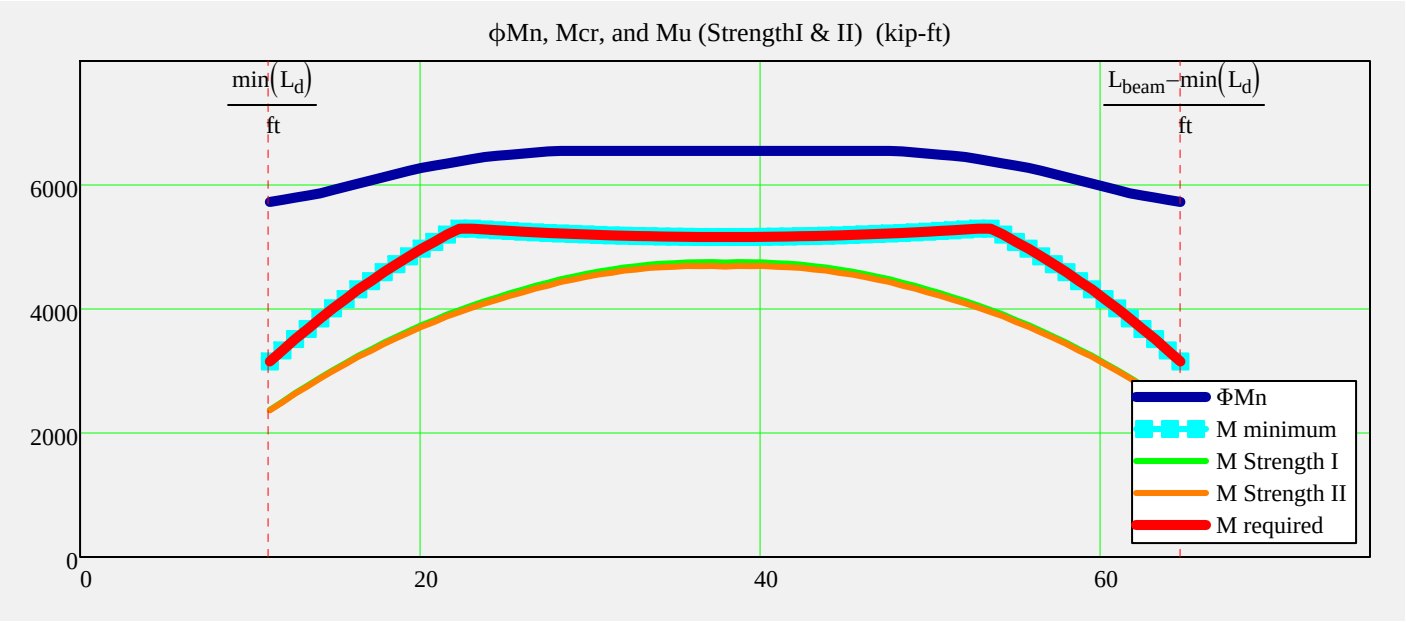
Values at midspan

$LimitStateForMoment_{51} =$ "Strength I" $\max(M_{Strength}) = 4755 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 5161 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5161 \cdot kip \cdot ft$

$StrandType =$ "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6550 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 11.1\ \text{ft}$ $L_{beam} - \min(L_d) = 64.7\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.83$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

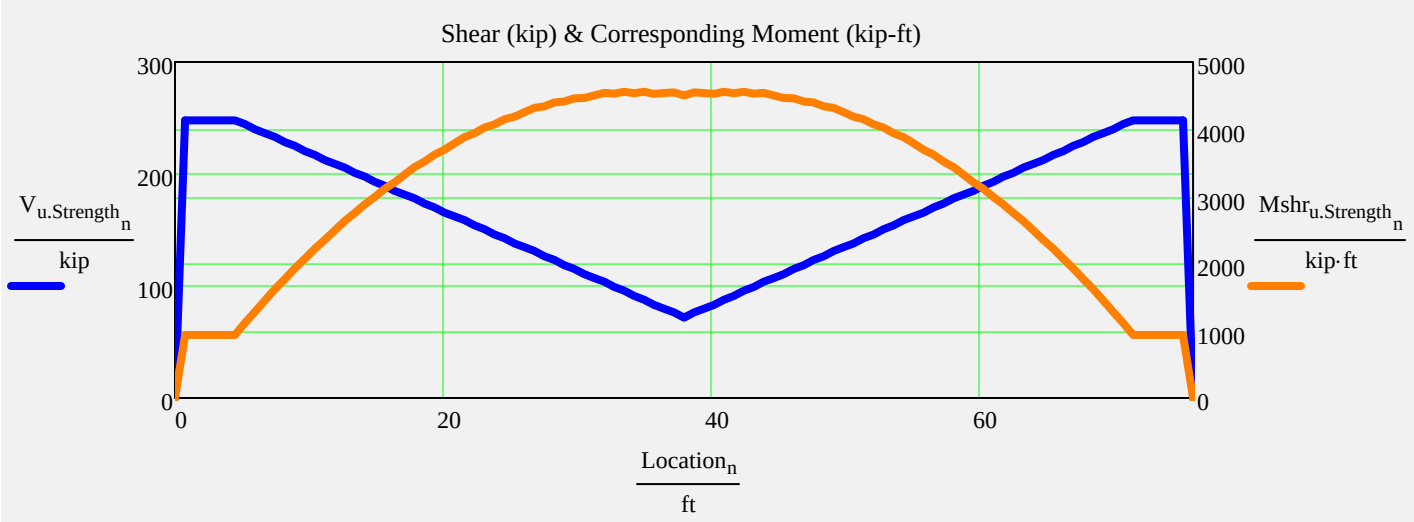
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

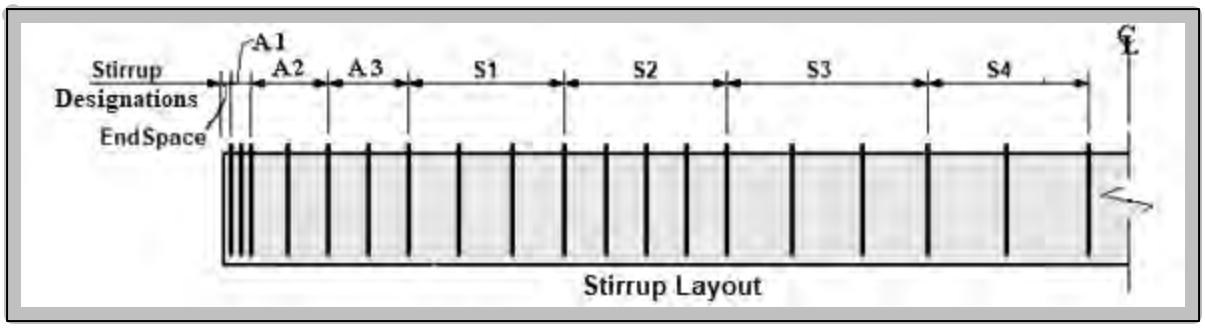
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 267 \\ 267 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 247.9 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4557 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

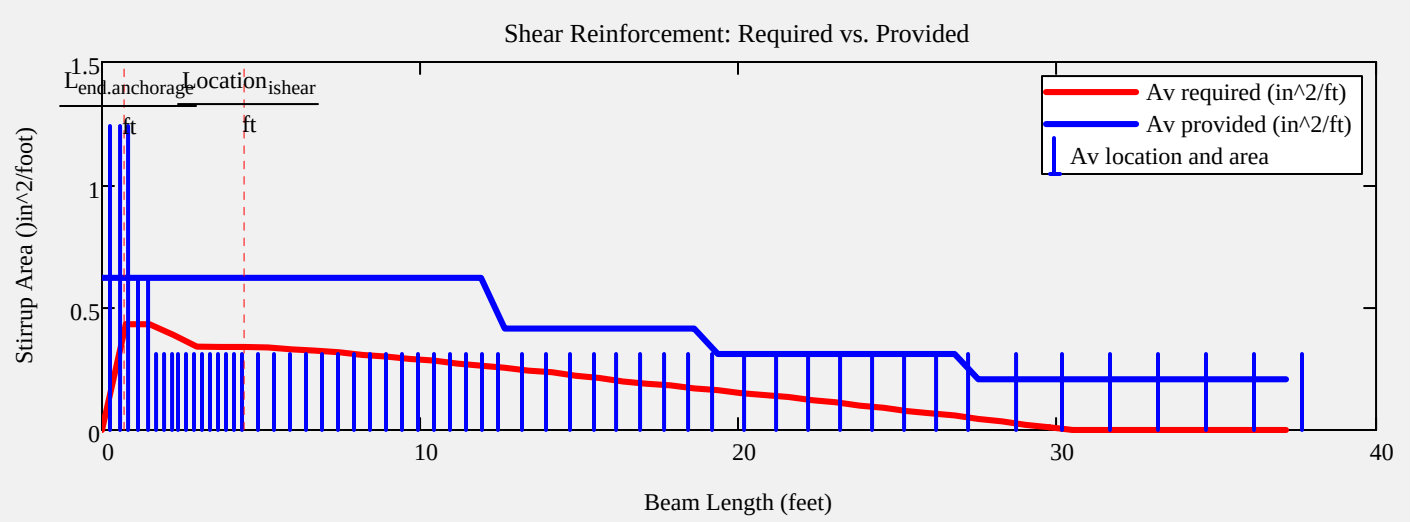
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

Save Data File

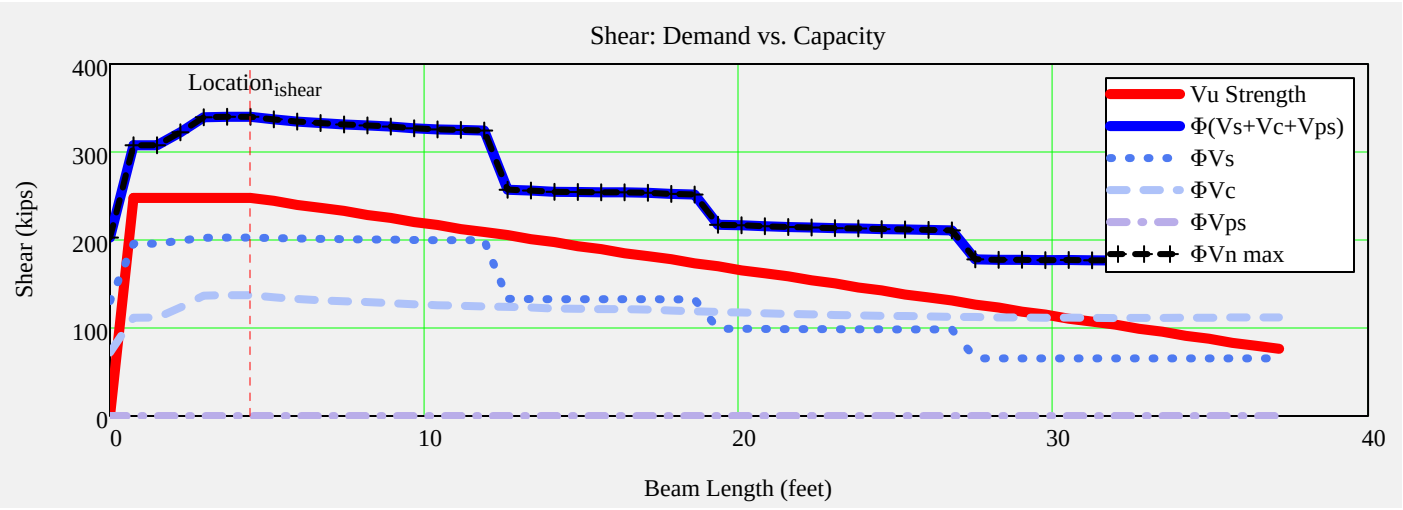
Use current input file

File Name FIB36-76ftSpan_NoSkew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam"

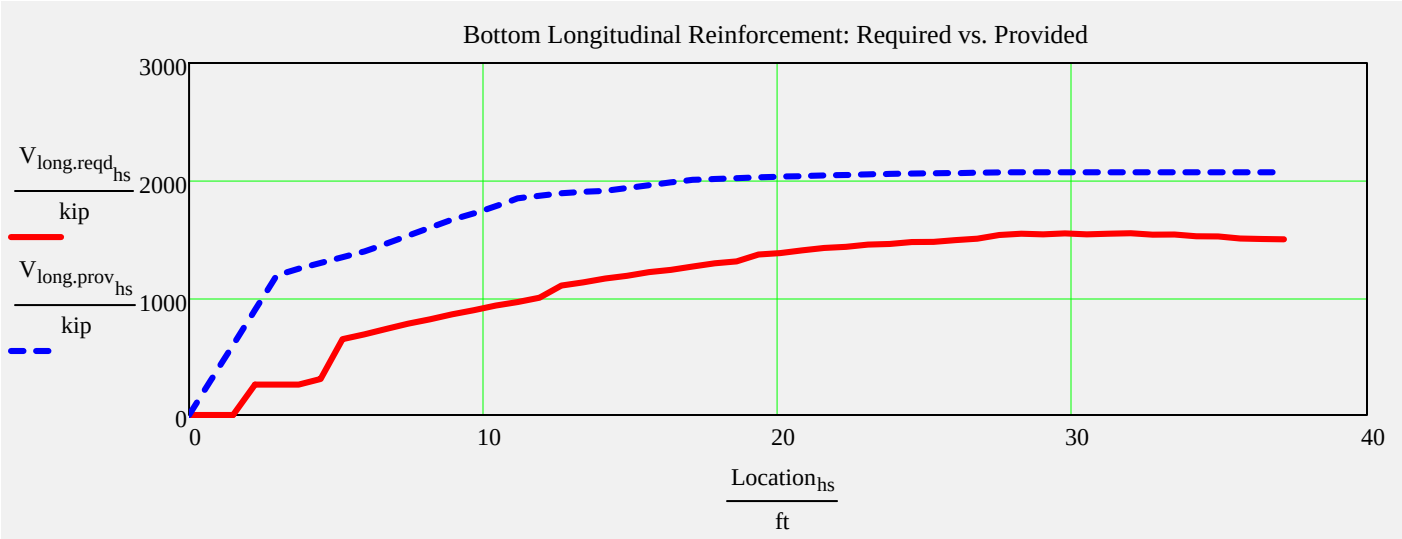
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 205.69 & 257.06 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.80$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

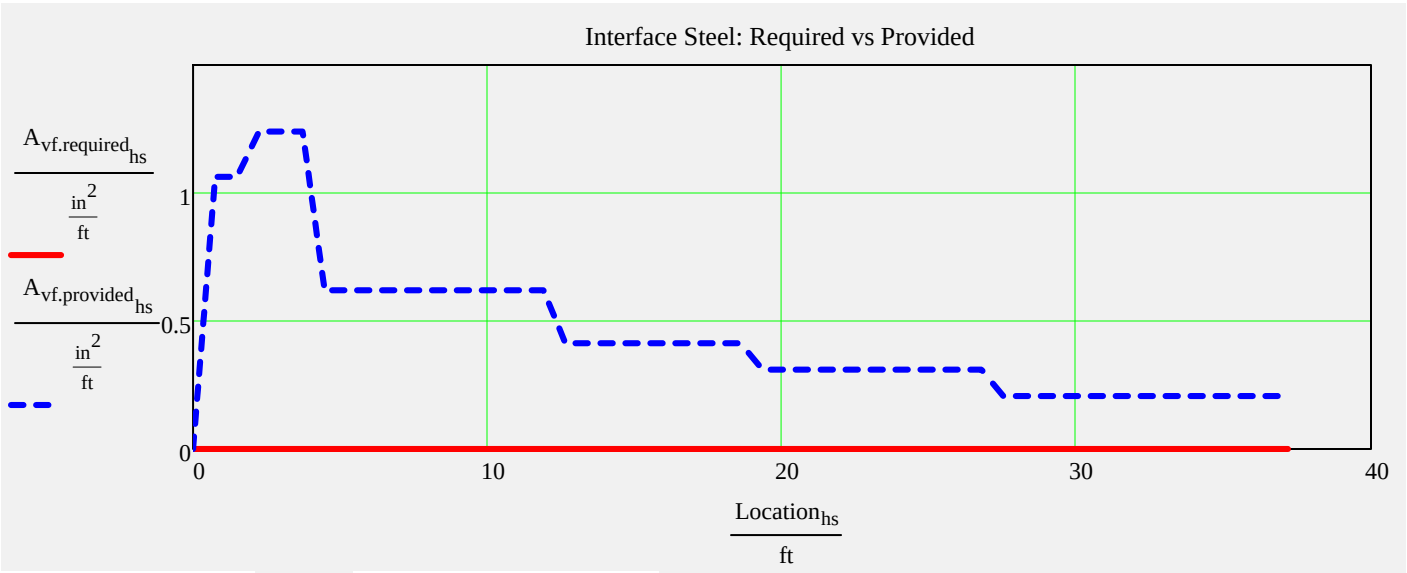


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 32.0 & 1549.4 & 2068.3 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.75$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

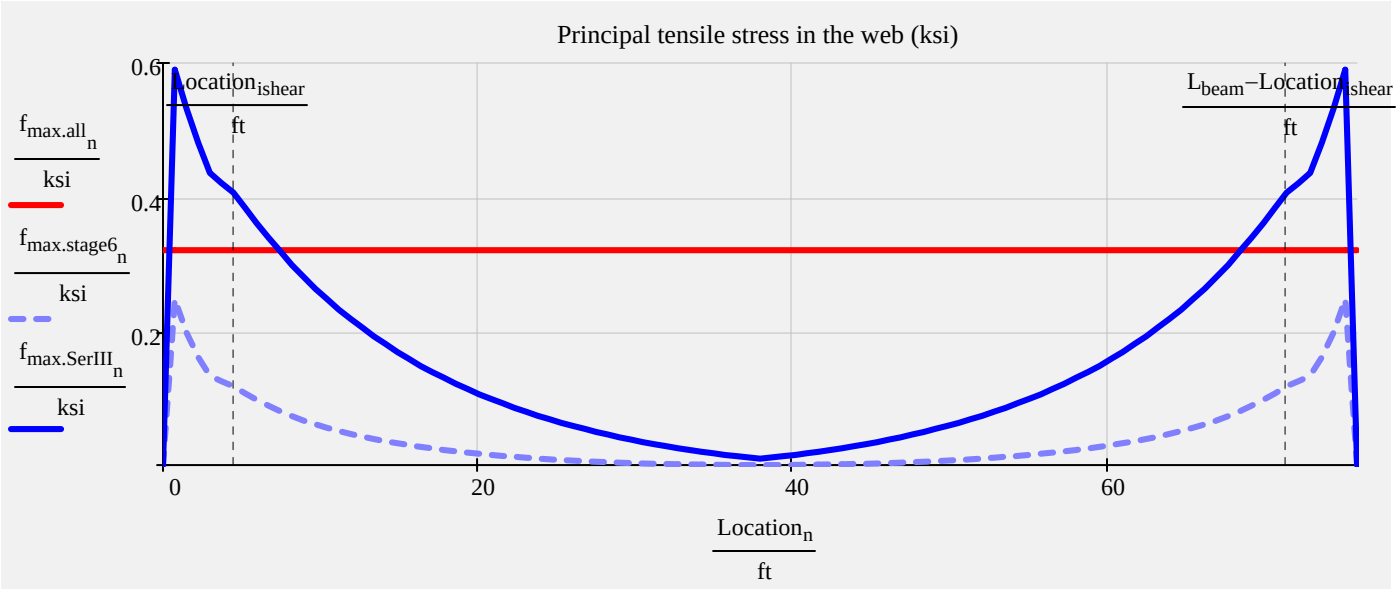
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6 \cdot in$ $\max(DC_f_{max.web}) = 1.27$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

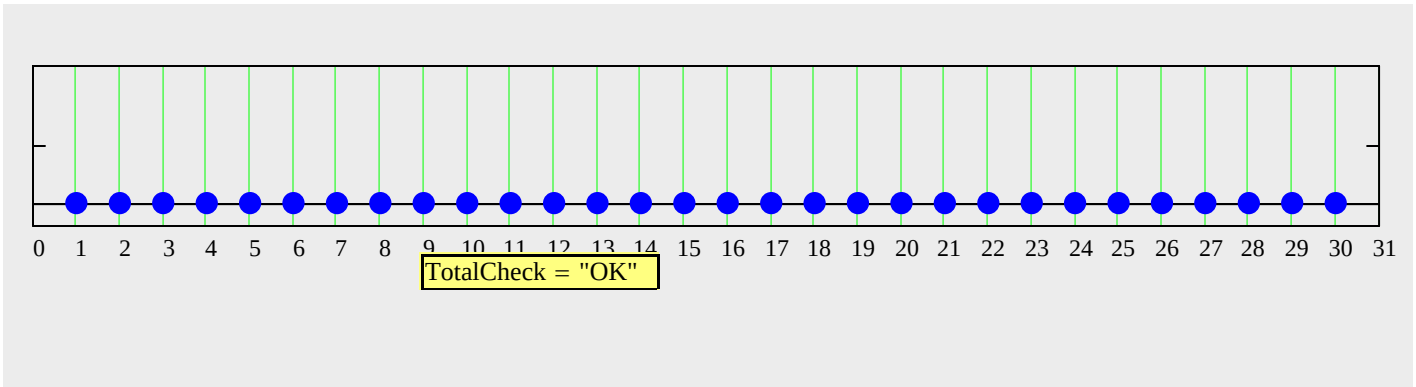
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.90	1.62	"N/A"	36.42	0.90	1.42	"N/A"	11.89	HL-93
"Strength I (Op)"	0.90	2.09	"N/A"	36.42	0.90	1.84	"N/A"	11.89	HL-93
"Service III (Inv)"	0.90	1.90	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.90	2.02	"N/A"	36.42	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.90	1.65	98.93	39.40	0.90	1.37	82.28	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.71$ $DC_{LongReinf.Permit} = 0.75$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6550	"factored resistance (kip-ft)...."
"γDL"	1838	"factored dead load (kip-ft)...."
"γLL"	2251	"factored live load (kip-ft)....."
"RF"	2.09	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	258	"factored resistance (kip)....."
"γDL"	67.3	"factored dead load (kip)....."
"γLL"	103.4	"factored live load (kip)....."
"RF"	1.84	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (NO SKEW)
EASTBOUND BRIDGE
(TIGER BAY)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior.dat
FIB36-76ftSpan_15Skew_Interior.dat
FIB36-76ftSpan_NoSkew_Exterior.dat
FIB36-76ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

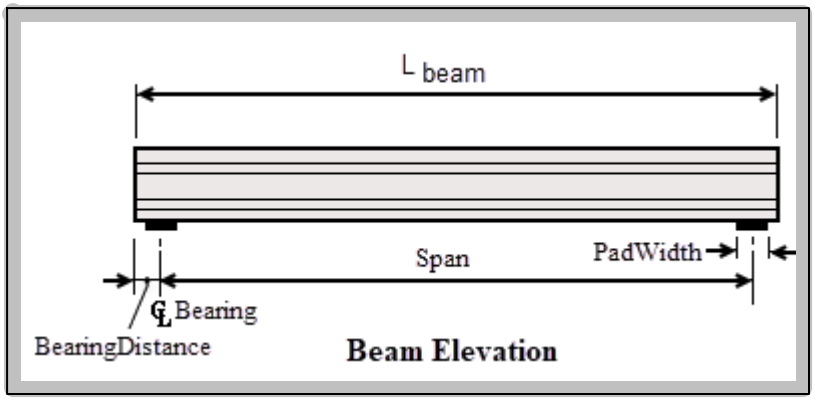
InputDataFile = "FIB36-76ftSpan_NoSkew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_NoSkew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	10	ft	*Measured from beam centerline to centerline.*
Overhang	3.7083	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

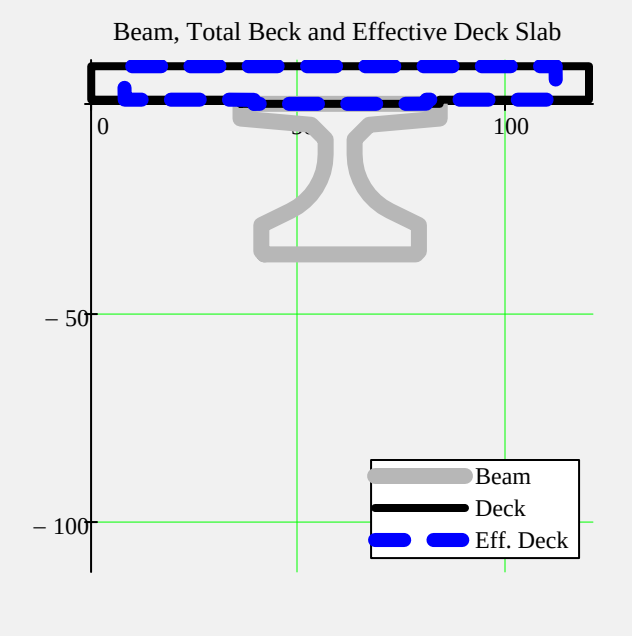
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 120·in

$b_e = 120 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 1.05 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.12 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.15 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

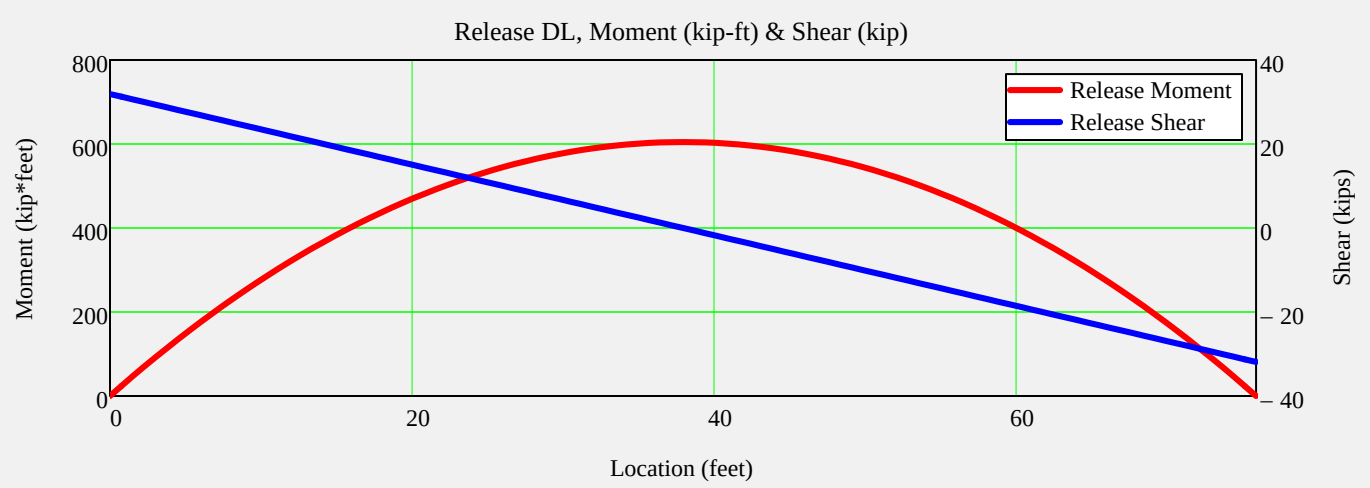
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

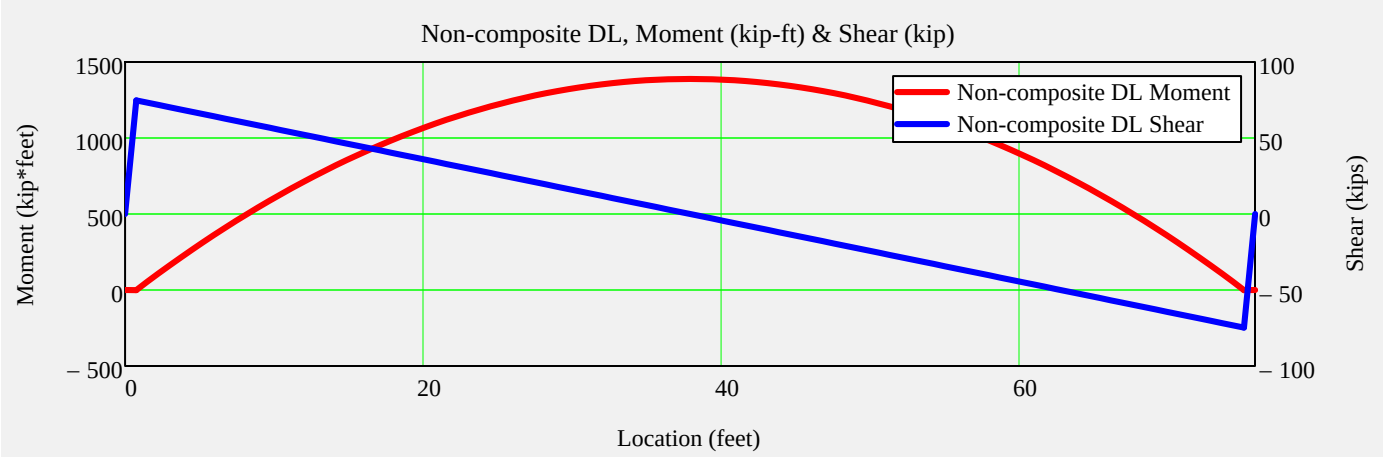
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



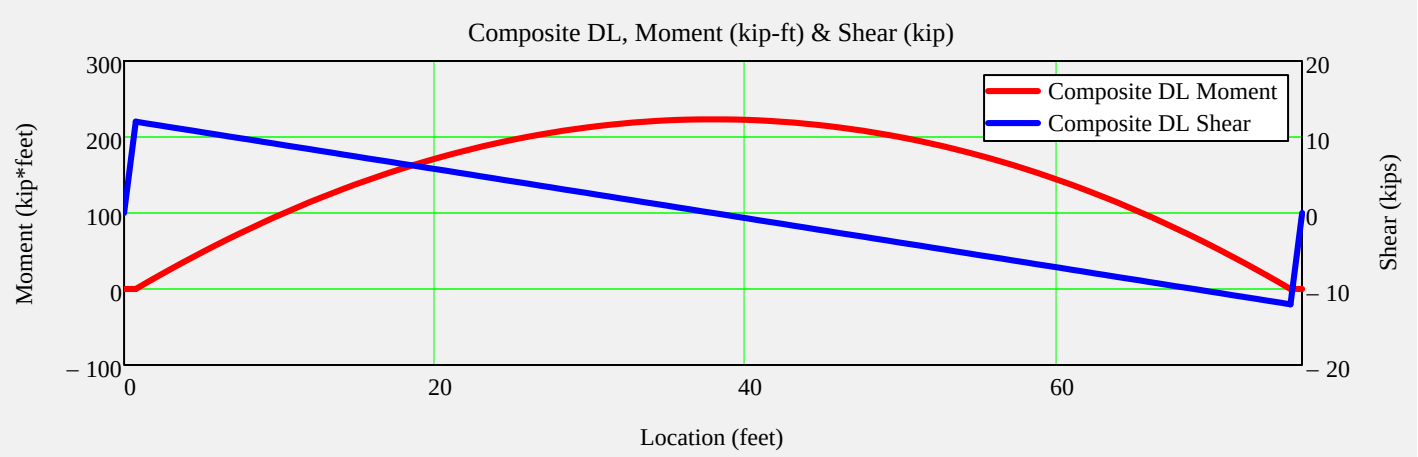
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 74.7 \cdot kip$ $\max(M_{dl.non.comp}) = 1388.4 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -74.7 \cdot kip$

Composite Dead Load Moments and Shear



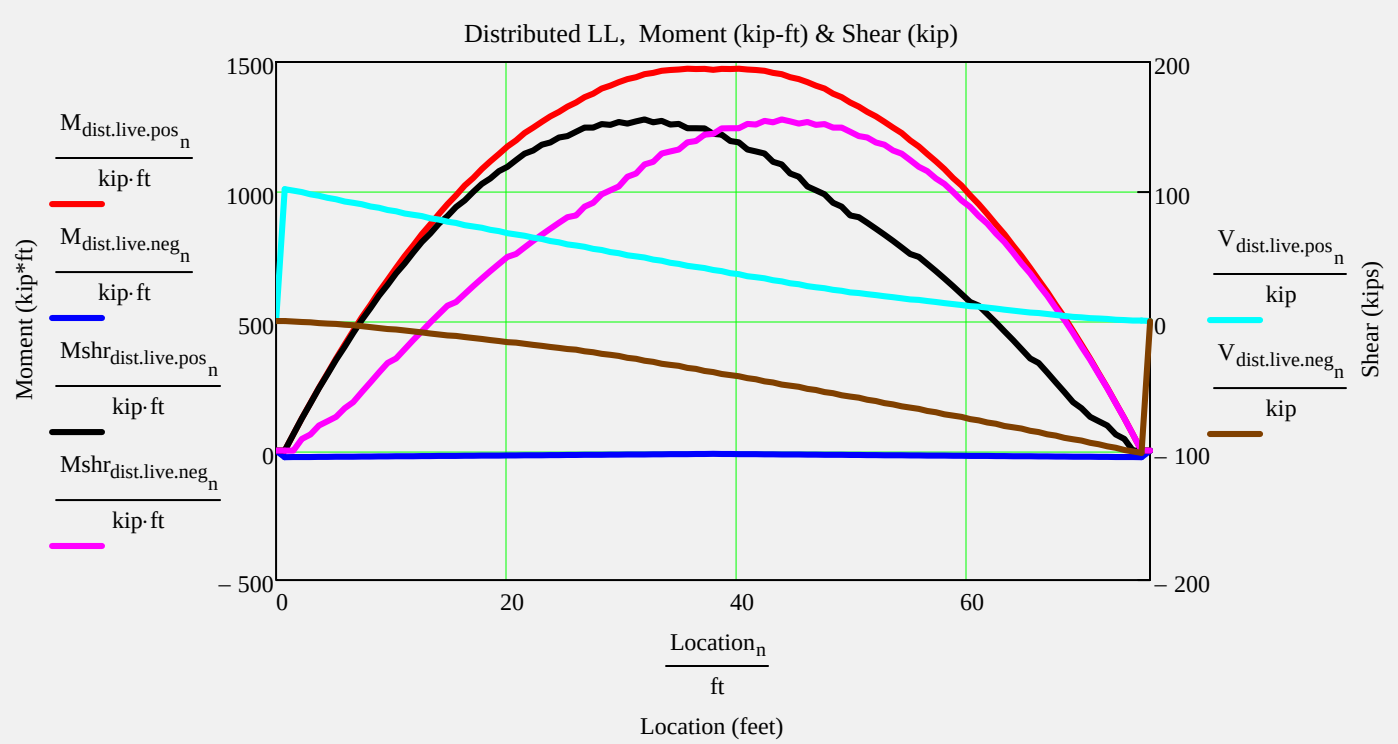
$\max(V_{dl.comp}) = 12.0 \cdot kip$ $\max(M_{dl.comp}) = 223.2 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -12.0 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 10\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.8$ $g_{mom.fatigue} = 0.47$ $g_{shear} = 0.95$



$\max(V_{dist.live.pos}) = 101.8 \cdot kip$

$\max(M_{dist.live.pos}) = 1474.2 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -101.8 \cdot kip$

$Reaction_{LL} = 103.7 \cdot kip$

$Reaction_{DL} = 88.5 \cdot kip$

$\min(M_{dist.live.neg}) = -25.5 \cdot kip \cdot ft$

$\max(Mshr_{dist.live.pos}) = 1278 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 83.7 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_NoSkew_Interior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement							*Partial PS (Dormant) Strand*	
Location	Deck		Bottom of Beam	Beam End: Top		Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62	*1	0	1.58		0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4	*2	0		*3		*Distance (in)*	1.5
Length (ft)				16		0	*# Strands*	4
Bar Size			5	5	*4	0	*4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity	75	%	*% relative humidity (75% typical)*
Time: jacking to transfer	1.5	days	*Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

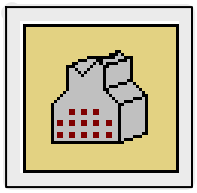
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

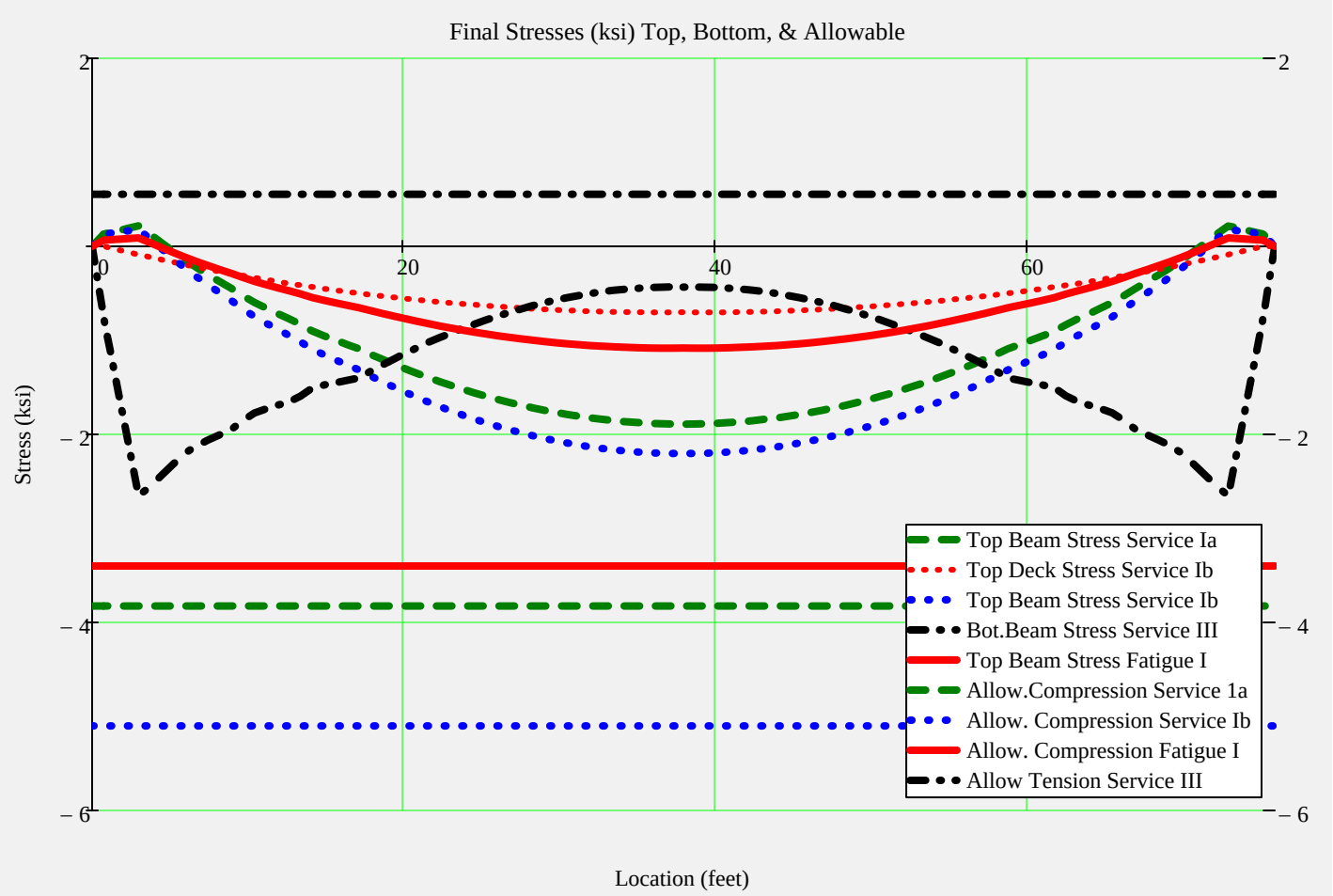
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

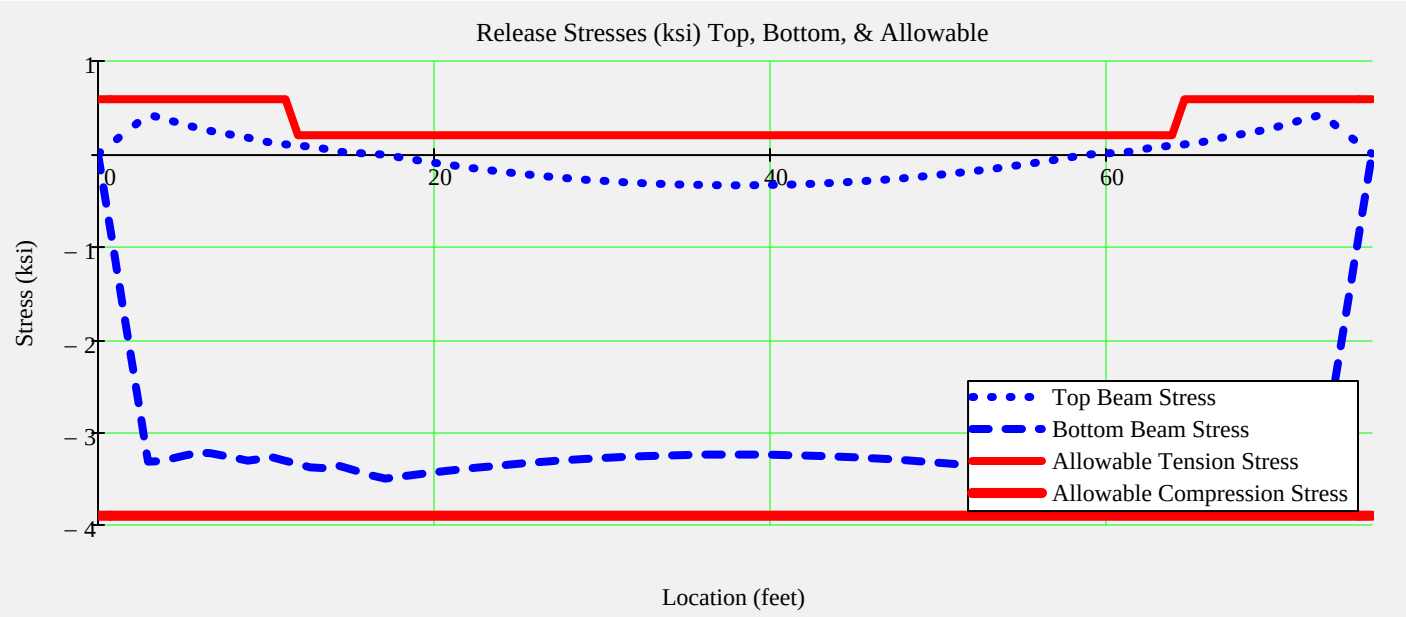
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.49$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.43$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.32$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–1.89	–3.83
"CompressionIb @ ServiceI"	37.92	–2.20	–5.10
"Compression @ FatigueI"	38.66	–1.08	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

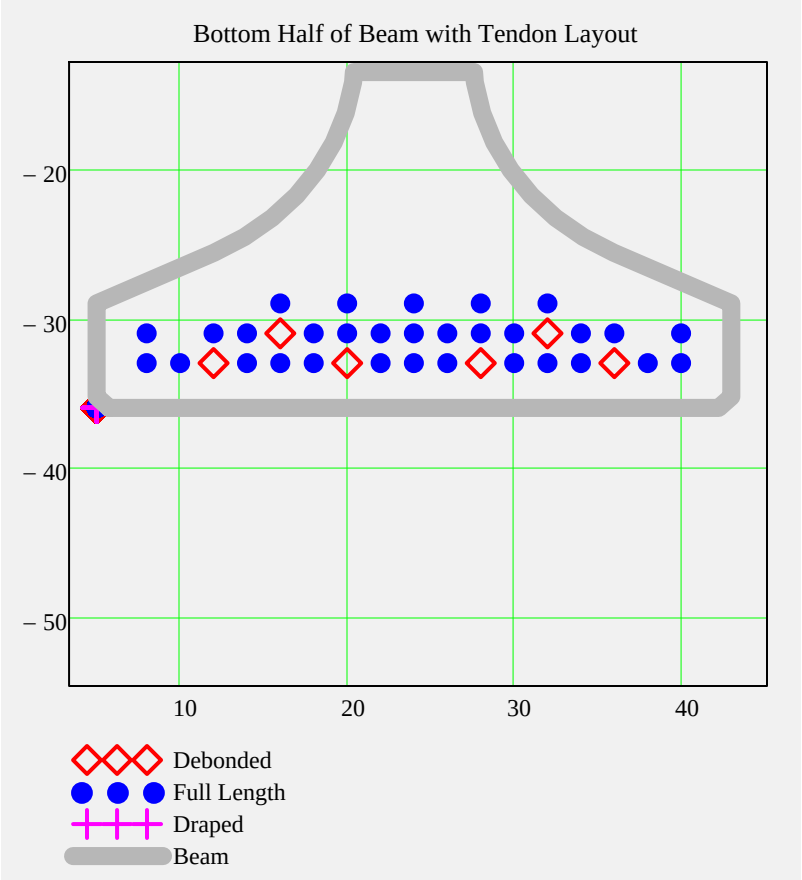
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

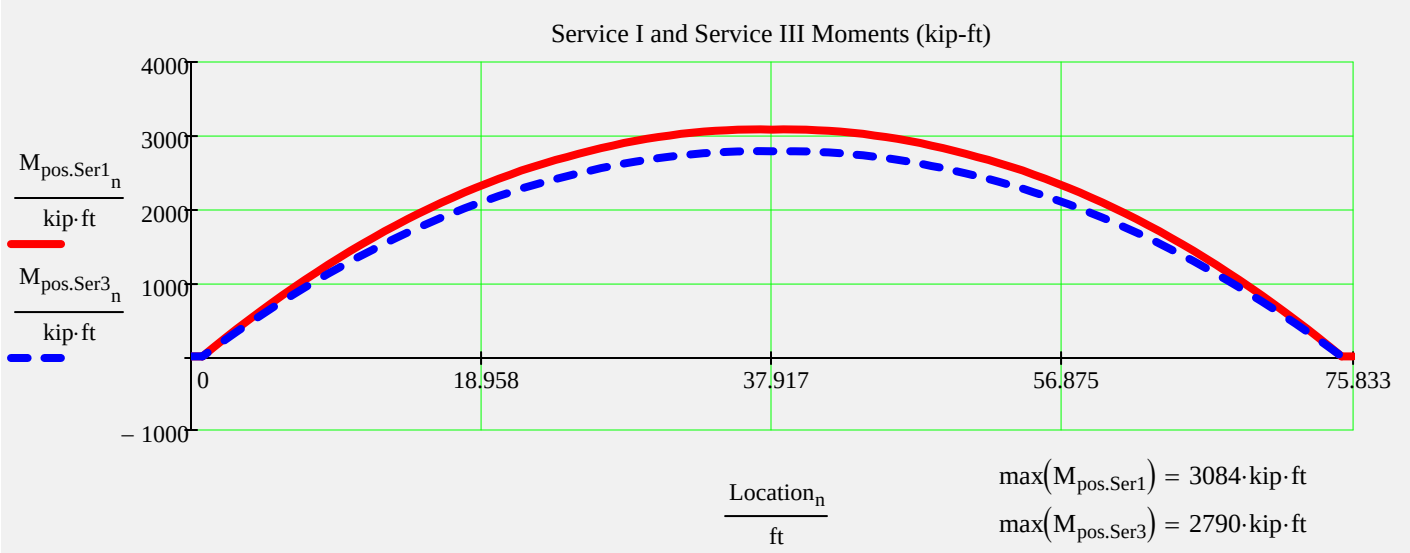
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3084 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2790 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses =$

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.34	–3.24
"2"	–0.43	–2.75
"4"	–0.39	–2.78
"6"	–1.84	–1.62
"8"	–2.20	–0.43

$PrestressForce =$

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1666	–1601
"@Final (about composite centroid)"	–1467	–1333

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1747.1	406953	–7.2

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1388
"Composite Dead Load"	223
"Distributed Live Load"	1470

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

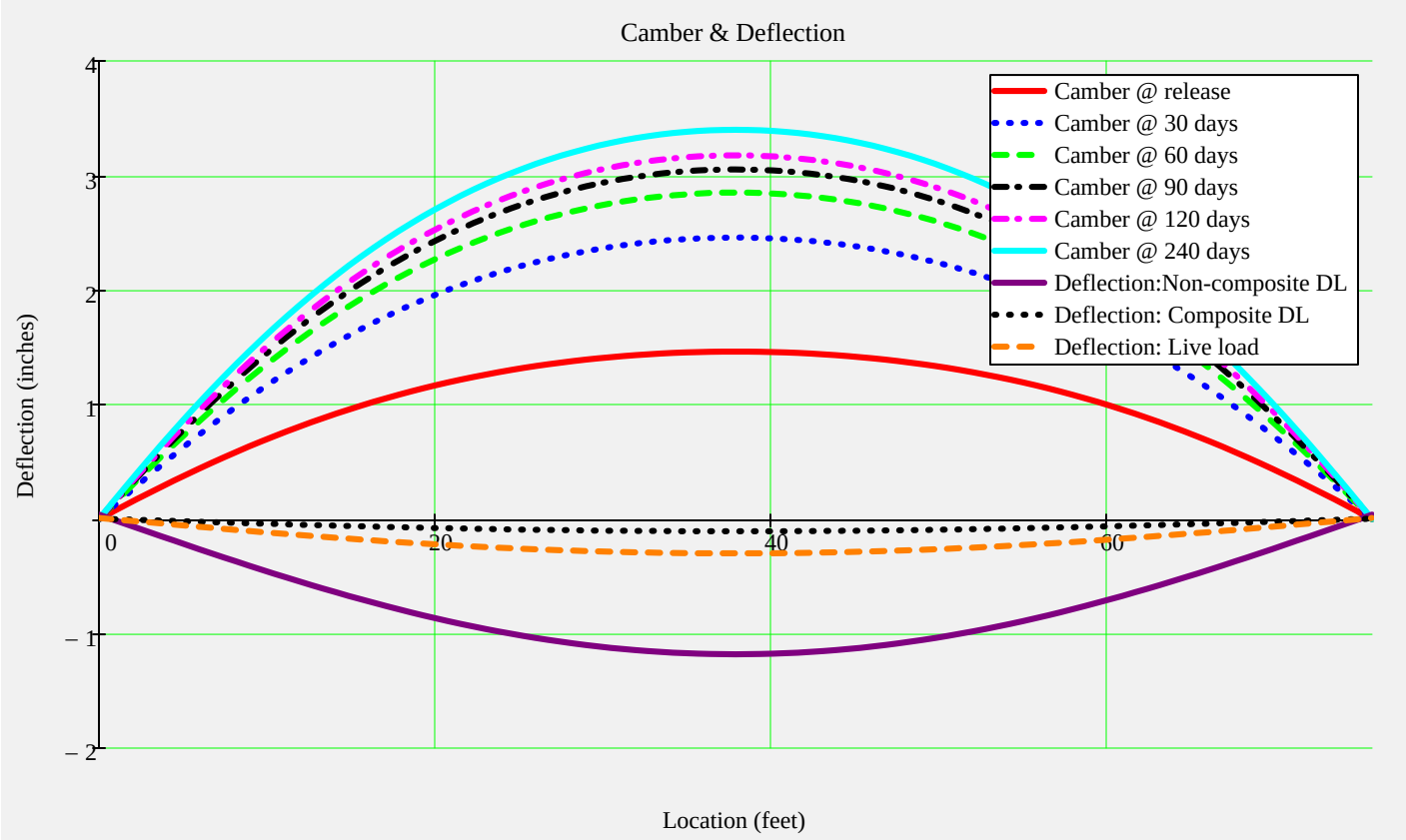
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.17	0.14	–0.24	–1.18
"Comp DL"	–0.01	0.02	–0.02	–0.11
"LL"	–0.02	0.06	–0.06	–0.30

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.89 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

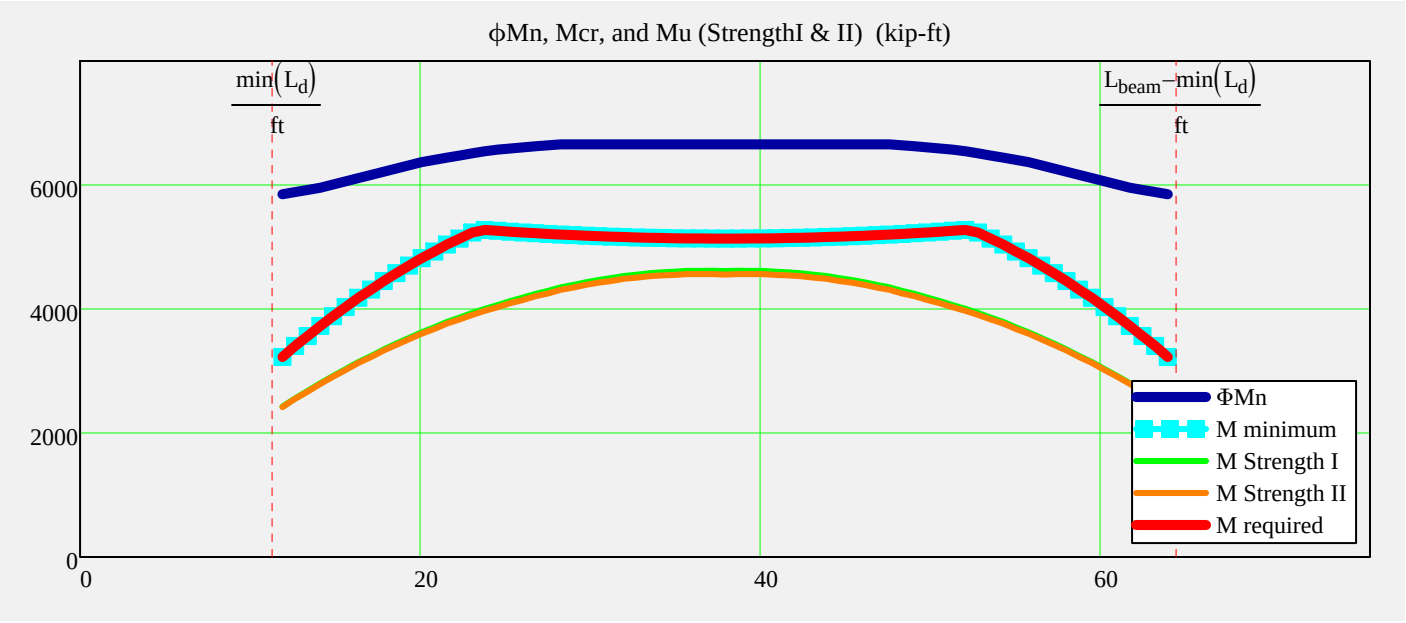
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 4618 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5136 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5136 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6656 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.3\,\text{ft}$ $L_{beam} - \min(L_d) = 64.5\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.81$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

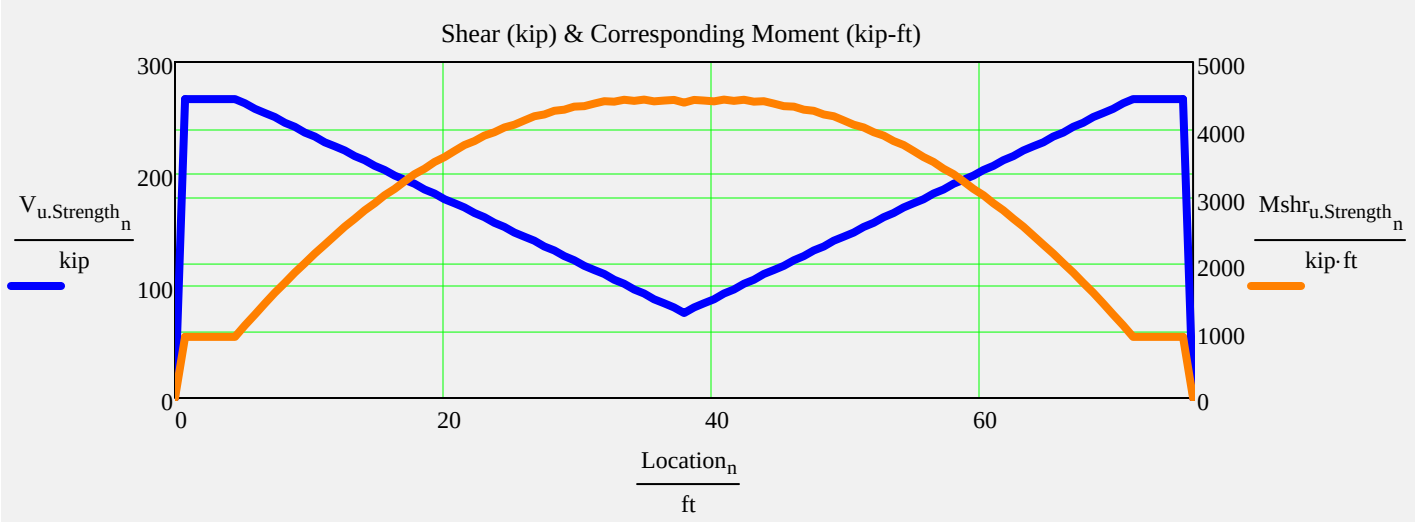
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

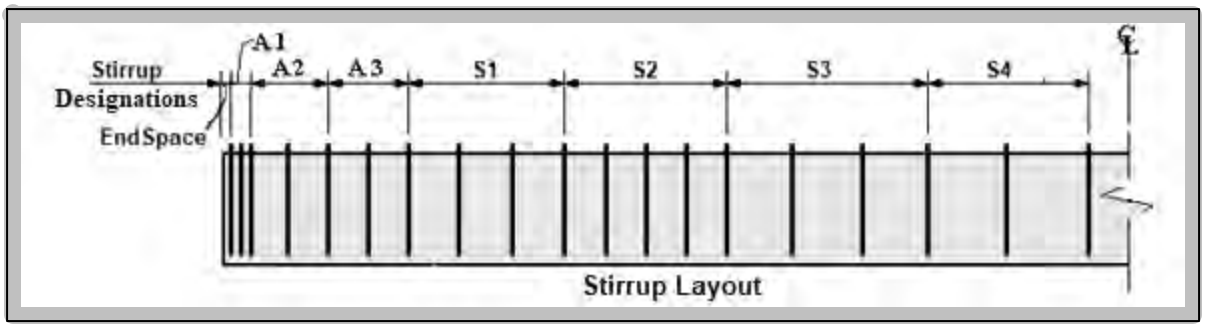
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 288 \\ 288 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 266.8 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4440 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

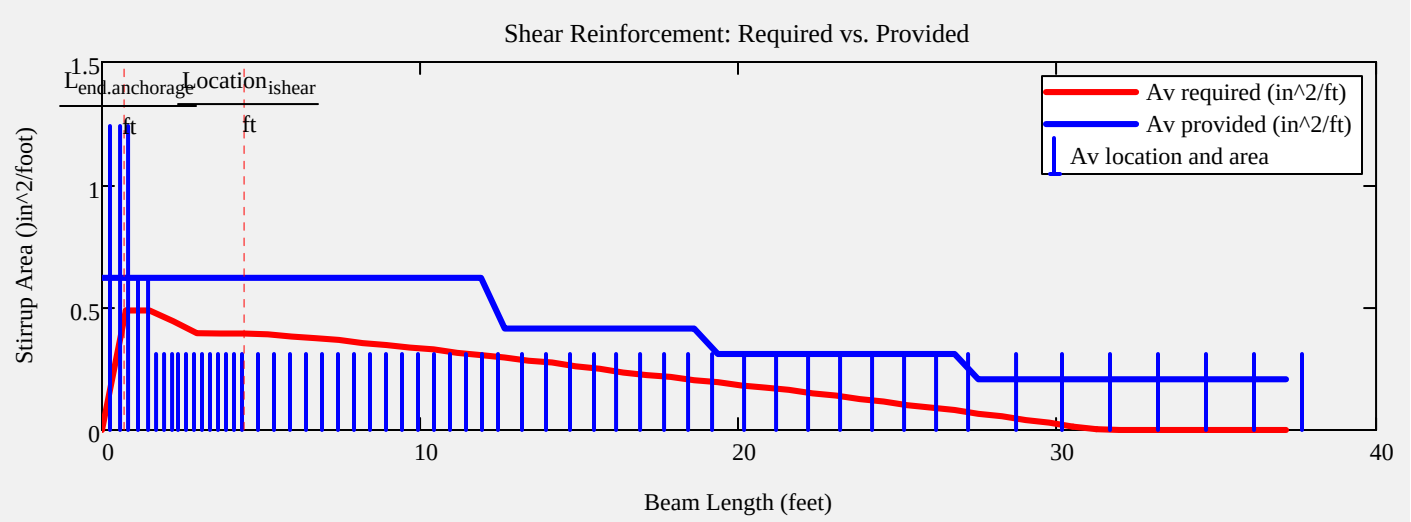
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



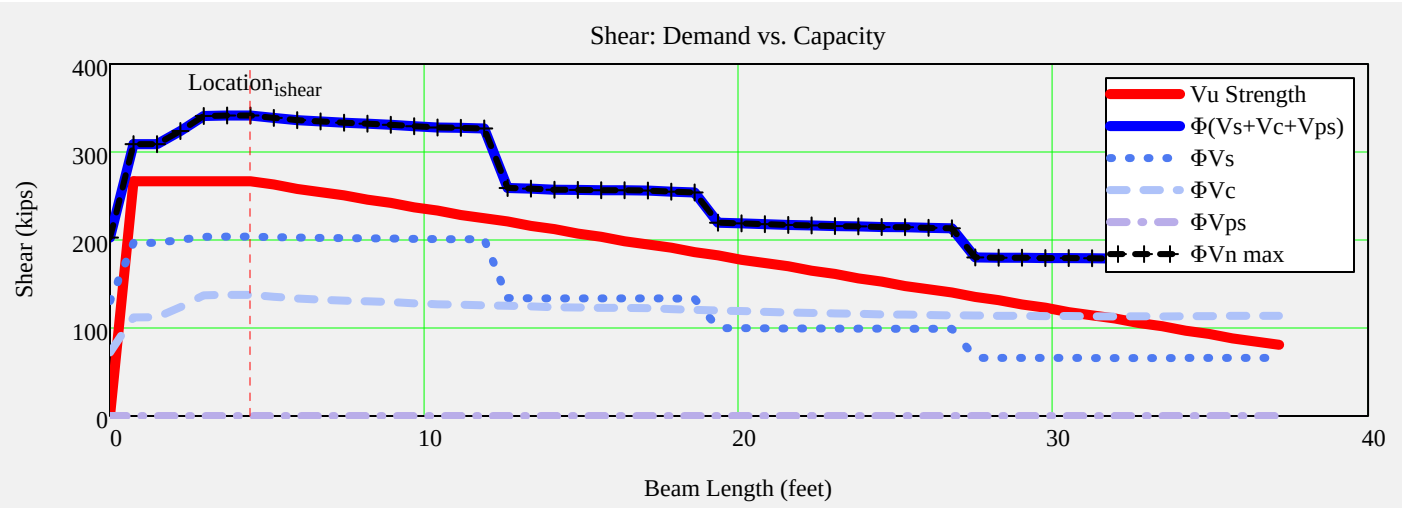
$Location_{ishear} = 4.47\ ft$

Save Data File ☑ Use current input file

File Name FIB36-76ftSpan_NoSkew_Interior.dat Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam"

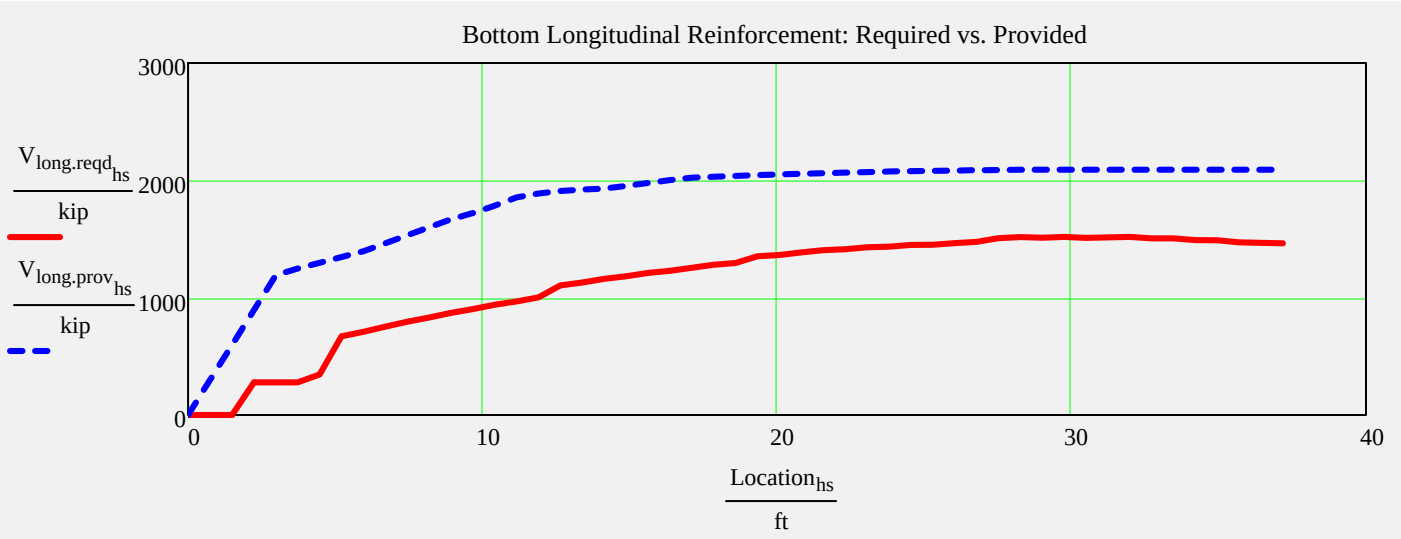
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 221.03 & 259.18 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.85$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

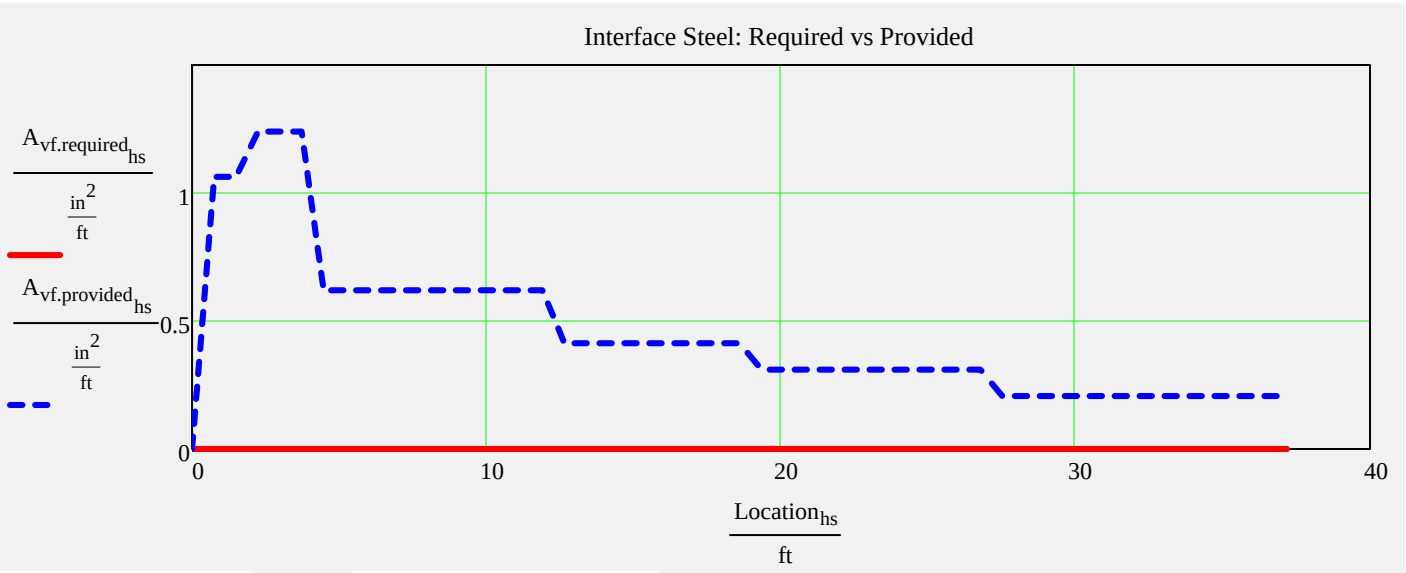


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 29.7 & 1517.4 & 2090.3 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.73$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

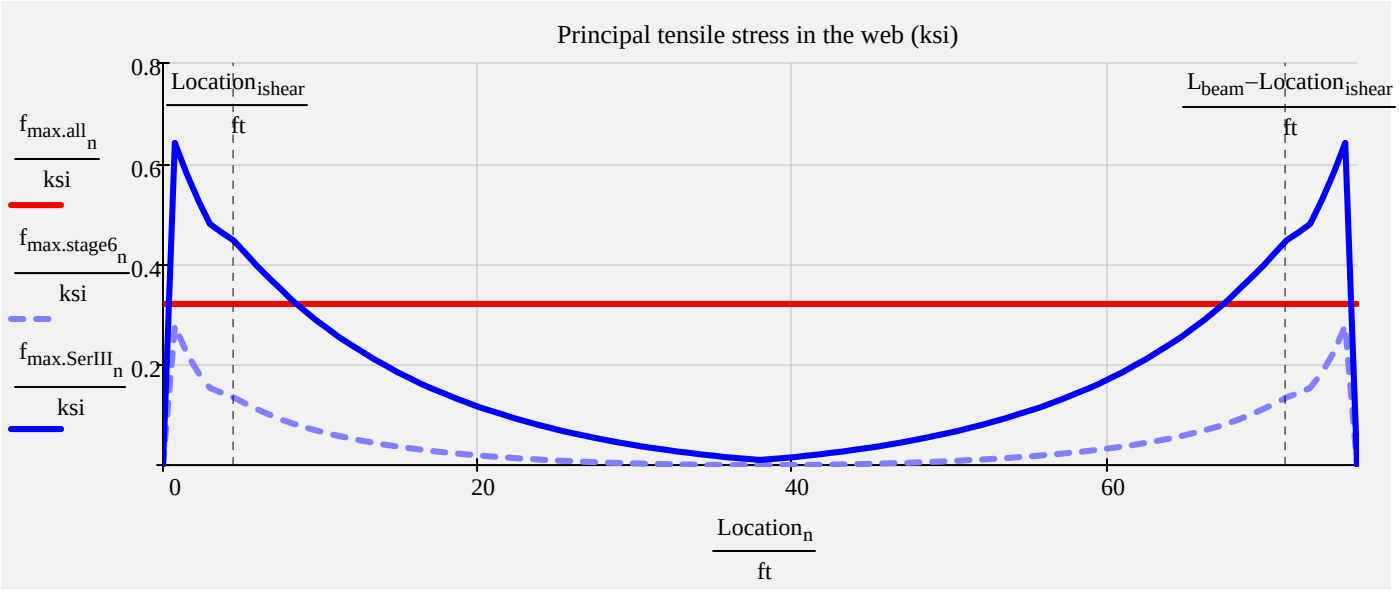
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6\cdot in$ $\max(DC_f_{max.web}) = 1.39$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450\cdot kip$ $P_{prestress} = 1362\cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

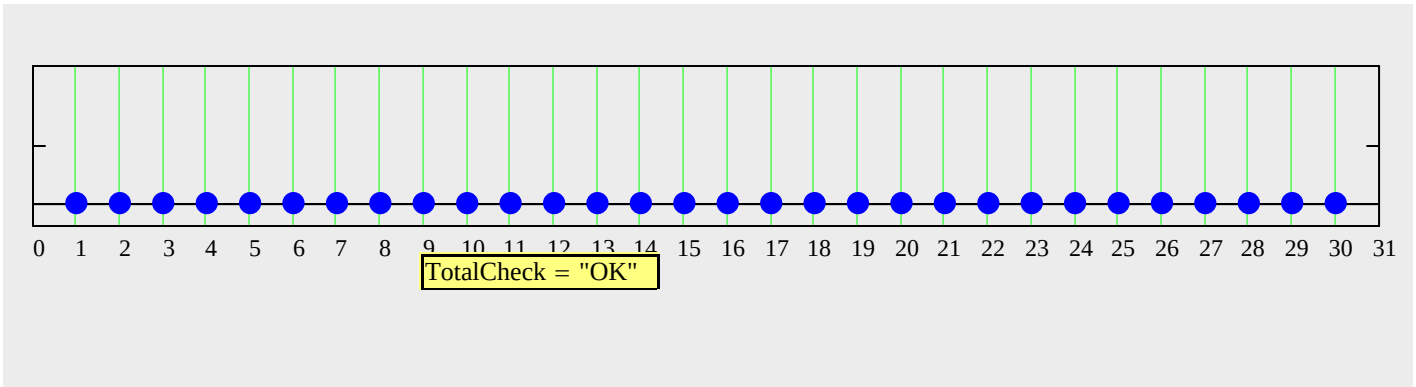
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.80	1.79	"N/A"	37.91	0.95	1.31	"N/A"	11.89	HL-93
"Strength I (Op)"	0.80	2.32	"N/A"	37.91	0.95	1.69	"N/A"	11.89	HL-93
"Service III (Inv)"	0.80	1.98	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.80	2.12	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.80	1.83	109.69	39.40	0.95	1.26	75.64	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.69$ $DC_{LongReinf.Permit} = 0.73$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6656	"factored resistance (kip-ft)...."
"γDL"	2040	"factored dead load (kip-ft)...."
"γLL"	1989	"factored live load (kip-ft)....."
"RF"	2.32	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	260	"factored resistance (kip)....."
"γDL"	74.7	"factored dead load (kip)....."
"γLL"	109.4	"factored live load (kip)....."
"RF"	1.69	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (15 DEG. SKEW)

EASTBOUND BRIDGE

(D.C.I CANAL)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior.dat
FIB36-76ftSpan_15Skew_Interior.dat
FIB36-76ftSpan_NoSkew_Exterior.dat
FIB36-76ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

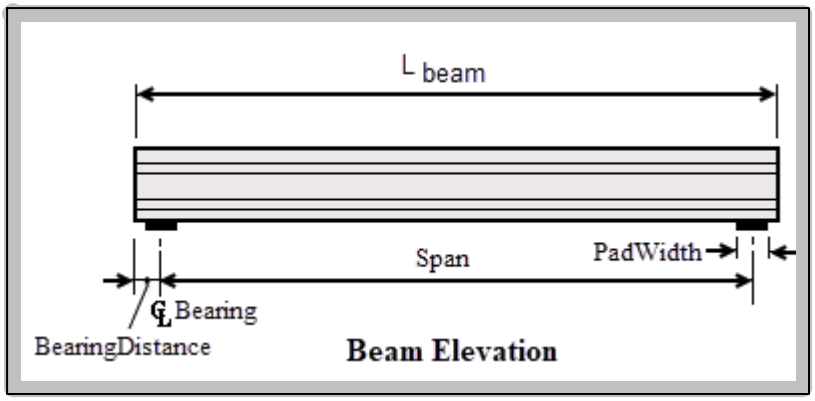
InputDataFile = "FIB36-76ftSpan_15Skew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_15Skew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	10	ft	*Measured from beam centerline to centerline.*
Overhang	3.7083	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

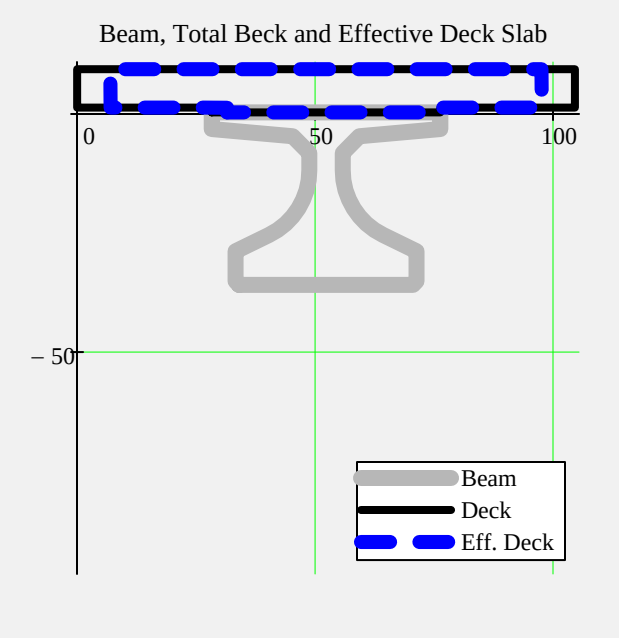
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $120 \cdot in$

$b_e = 104.5 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	$\frac{kip}{ft}$
Additional Uniform Composite DL	0.03	$\frac{kip}{ft}$

$w_{deck} = 0.92 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.06 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.112 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

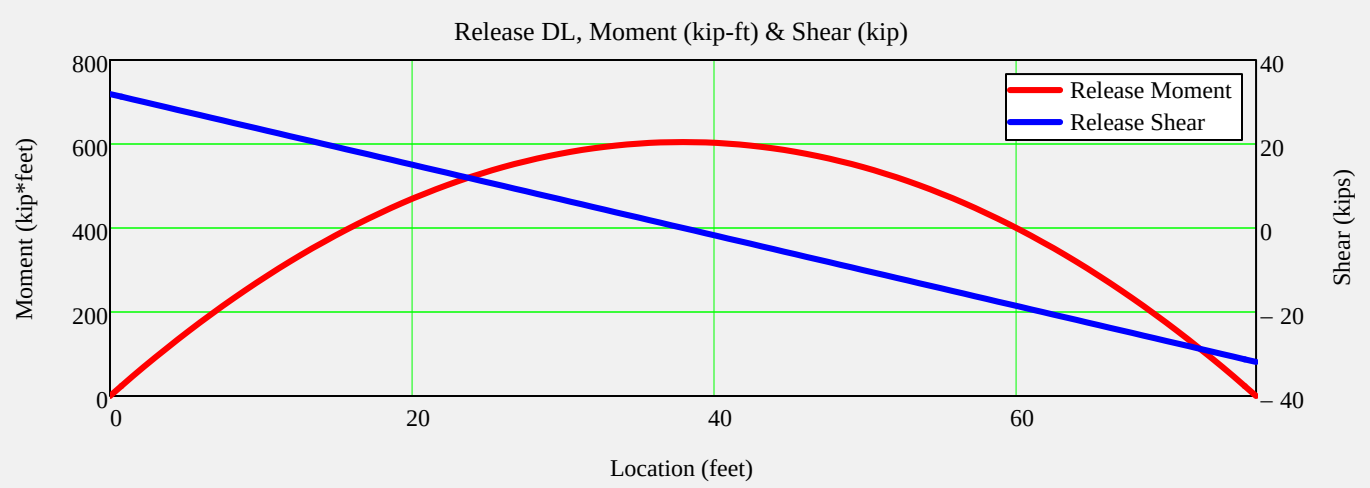
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

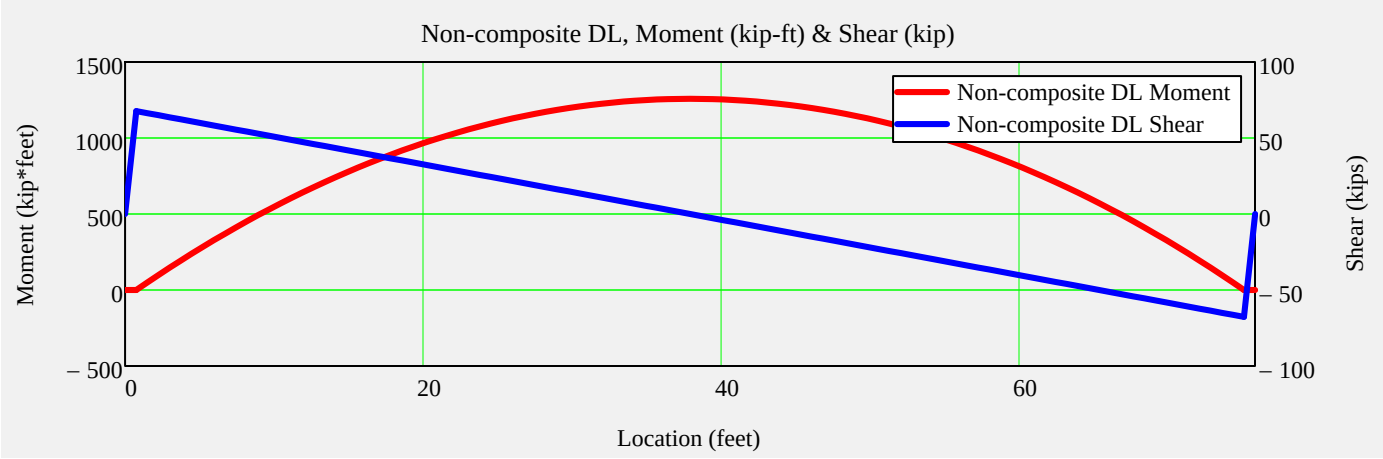
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



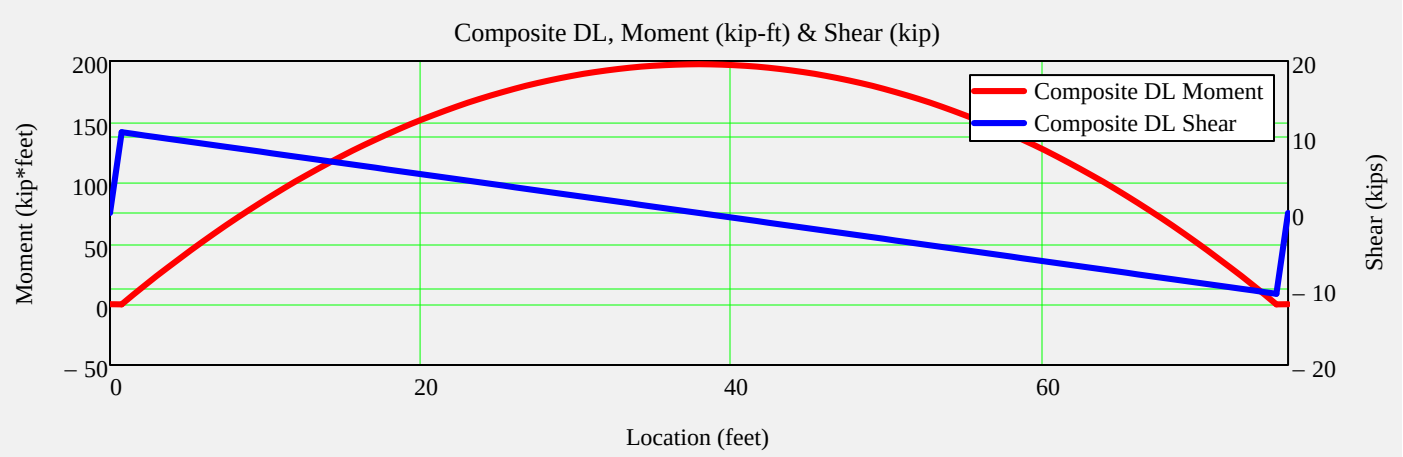
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 67.7 \cdot kip$ $\max(M_{dl.non.comp}) = 1257.8 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -67.7 \cdot kip$

Composite Dead Load Moments and Shear



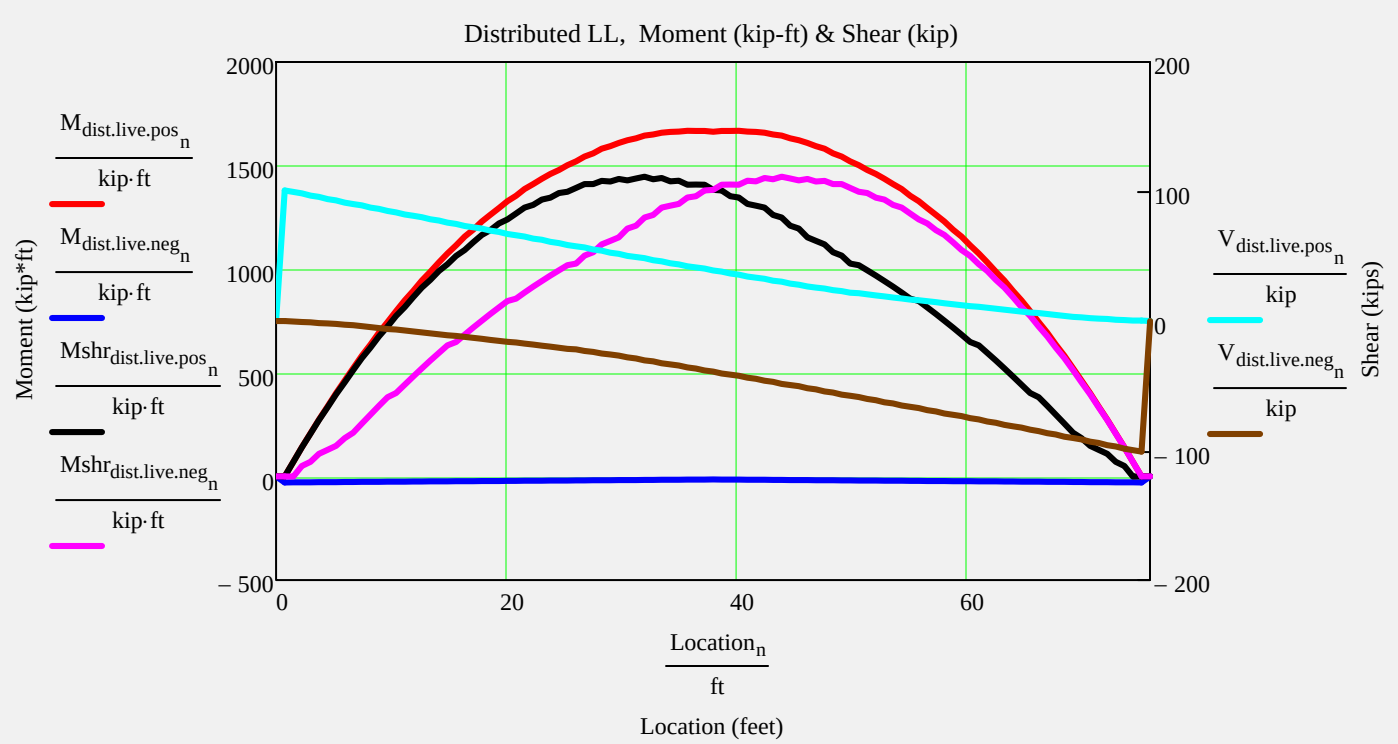
$\max(V_{dl.comp}) = 10.6 \cdot kip$ $\max(M_{dl.comp}) = 197.3 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -10.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 10\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.05$

Final Live Load Distribution Factors: $g_{mom} = 0.9$ $g_{mom.fatigue} = 0.75$ $g_{shear} = 0.94$



$\max(V_{dist.live.pos}) = 100.8 \cdot kip$ $\max(M_{dist.live.pos}) = 1668.3 \cdot kip \cdot ft$ $\min(V_{dist.live.neg}) = -100.8 \cdot kip$

$Reaction_{LL} = 102.7 \cdot kip$ $\min(M_{dist.live.neg}) = -28.9 \cdot kip \cdot ft$

$Reaction_{DL} = 79.9 \cdot kip$ $\max(Mshr_{dist.live.pos}) = 1446 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 82.9 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_15Skew_Exterior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck		Bottom of Beam		Beam End: Top	Beam End: Bottom
Area (in^2)	0.62	*1	0		1.58	0
Distance (in)	4	*2	0	*3		
Length (ft)					16	0
Bar Size			5	*4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

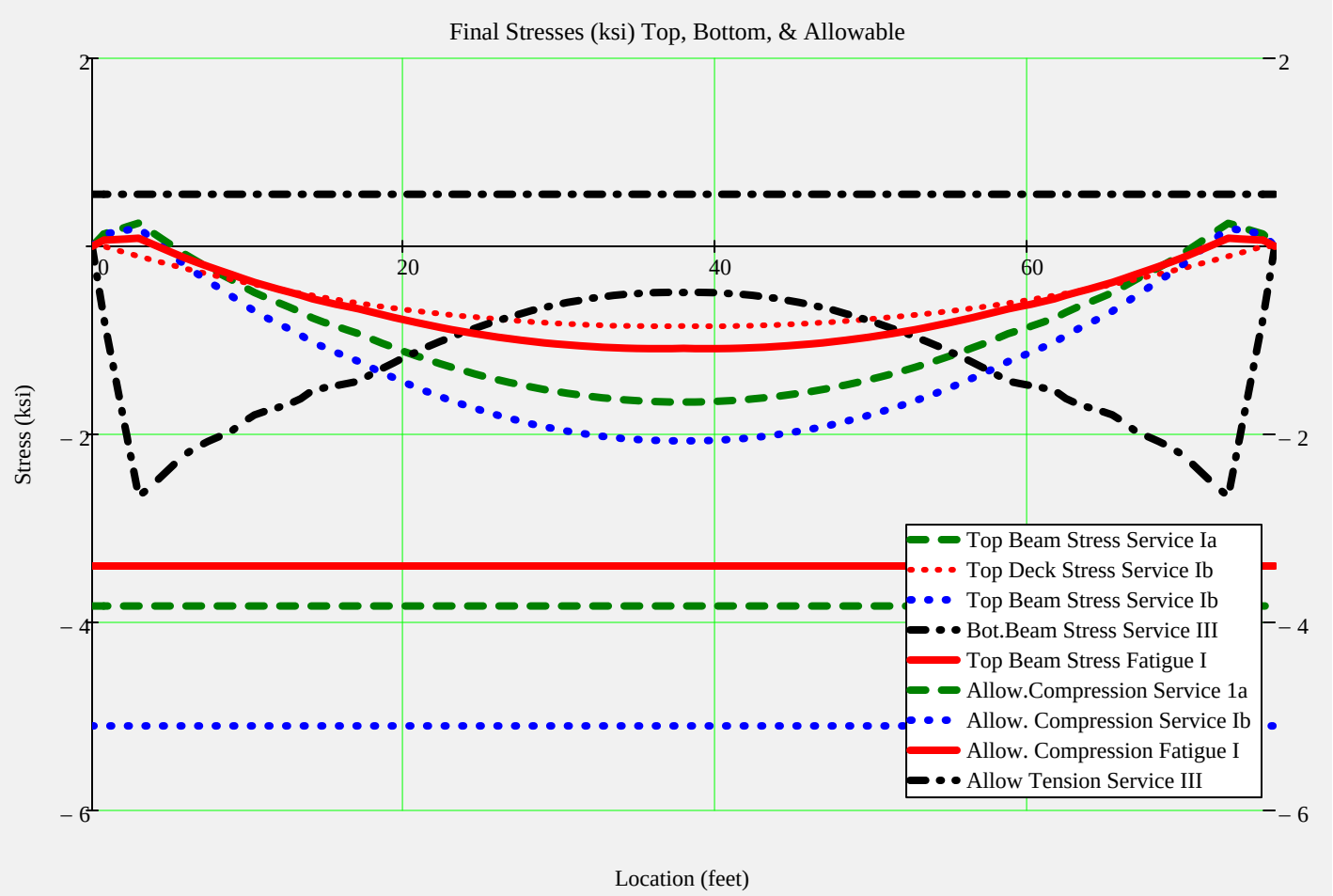
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

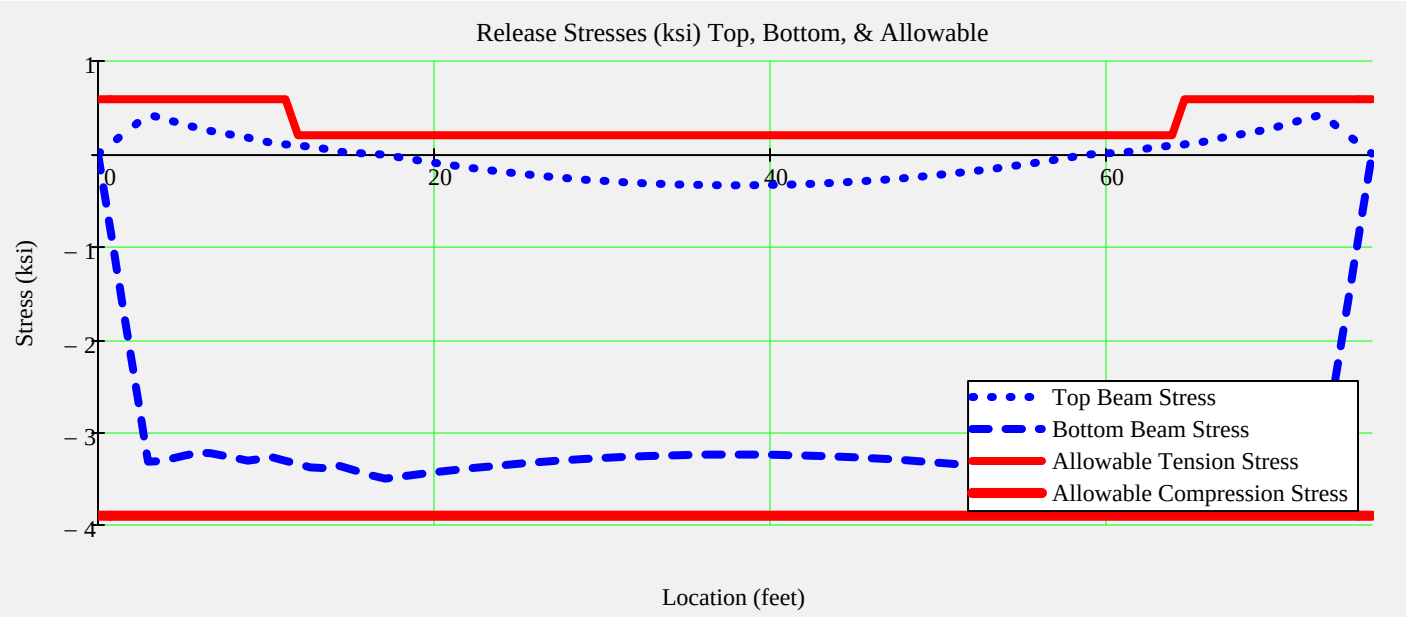
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.43$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.41$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.32$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–1.66	–3.83
"CompressionIb @ ServiceI"	38.66	–2.07	–5.10
"Compression @ FatigueI"	39.40	–1.09	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

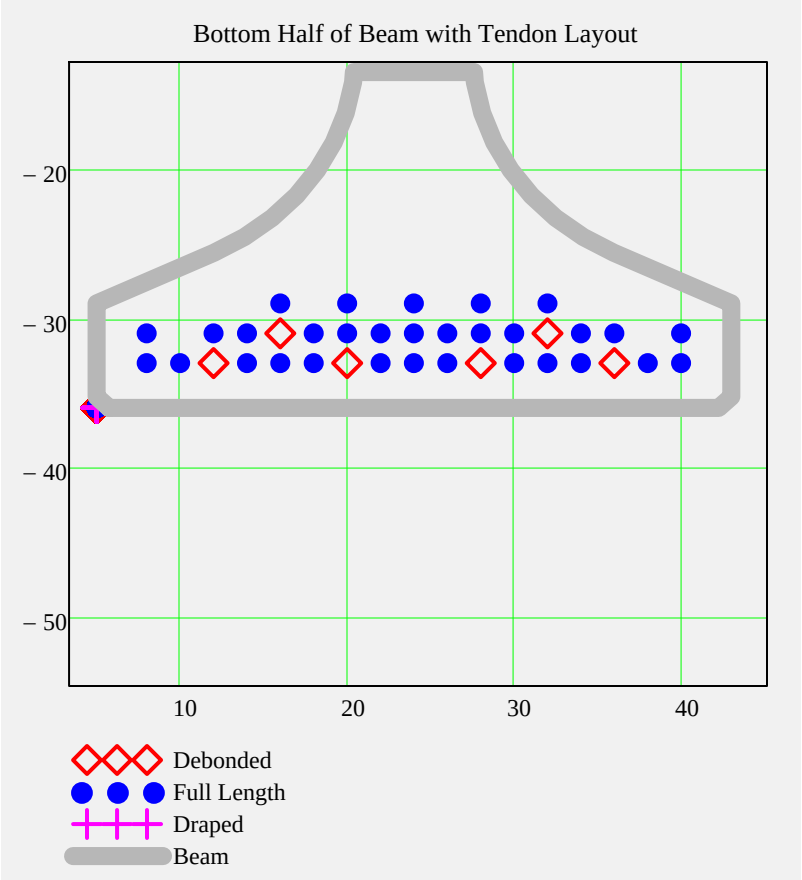
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

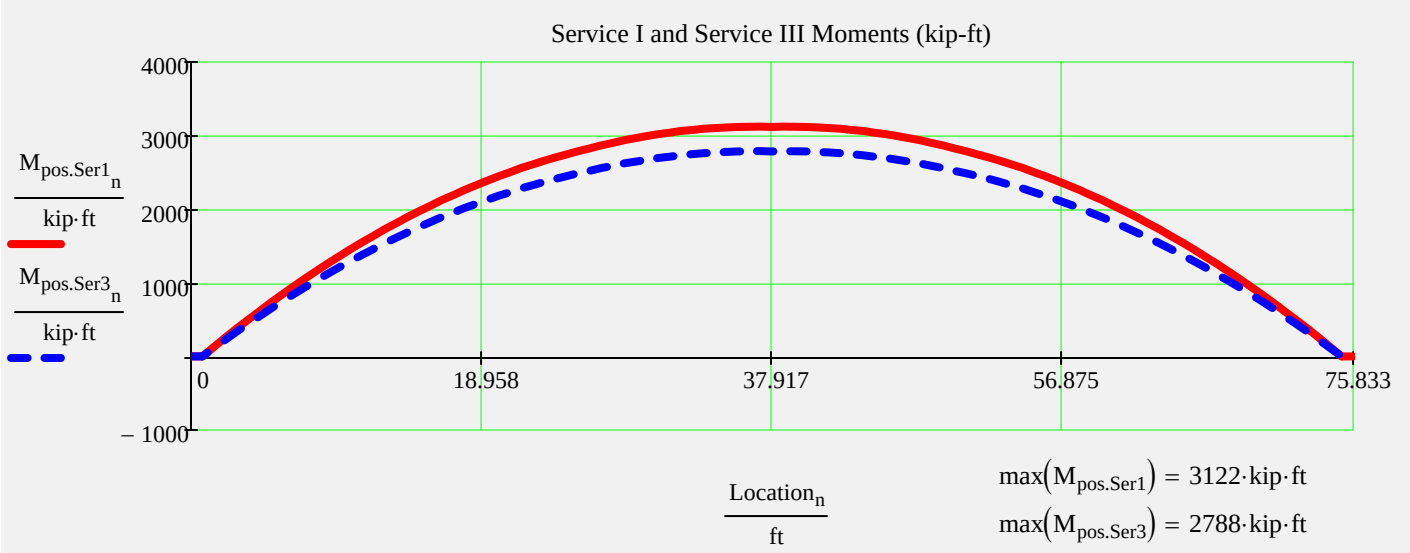
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$Stresses =$

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.34	–3.24
"2"	–0.43	–2.75
"4"	–0.39	–2.78
"6"	–1.61	–1.81
"8"	–2.07	–0.49

$PrestressForce =$

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1666	–1601
"@Final (about composite centroid)"	–1467	–1333

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1636	388689	–8

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1258
"Composite Dead Load"	197
"Distributed Live Load"	1663

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

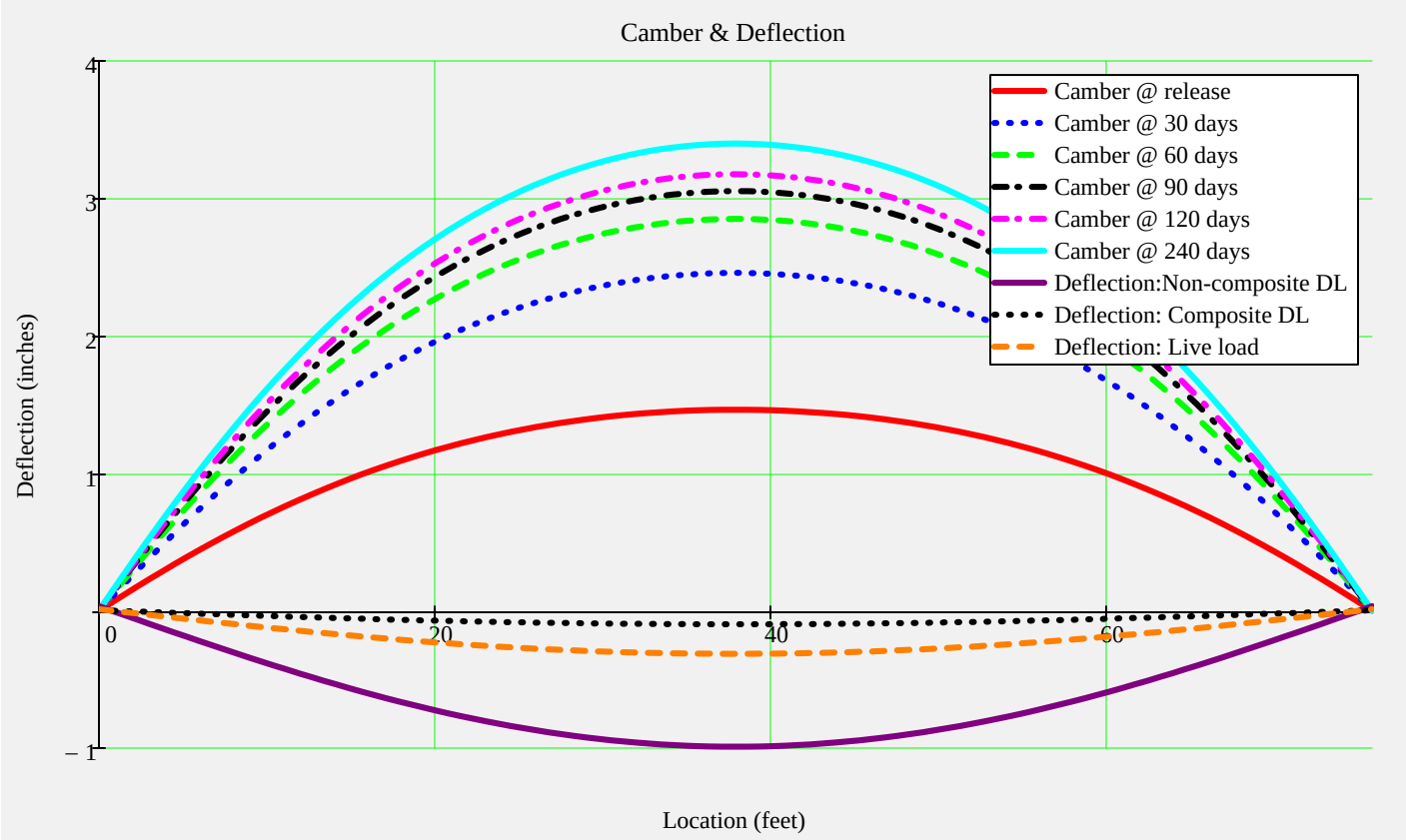
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.14	0.11	–0.20	–0.99
"Comp DL"	–0.01	0.02	–0.02	–0.10
"LL"	–0.02	0.06	–0.07	–0.31

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 2.09 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ CheckNetCamber = "OK"

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

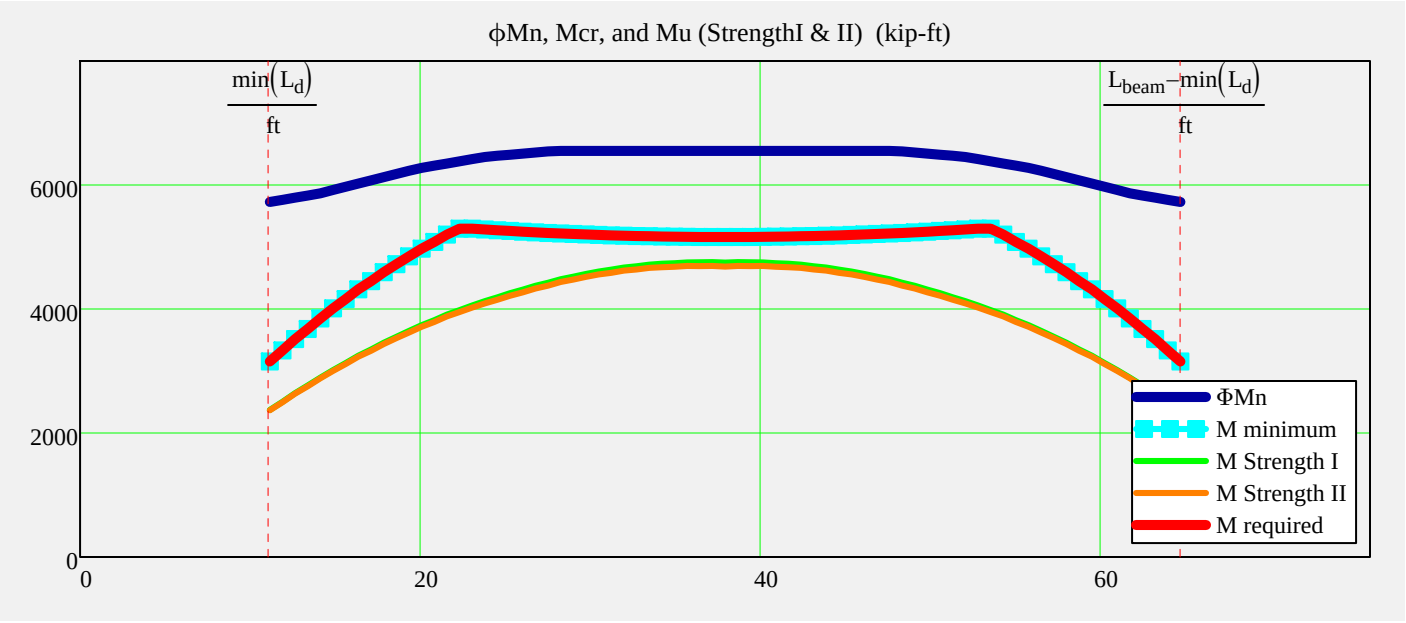
Values at midspan

$LimitStateForMoment_{51} =$ "Strength I" $\max(M_{Strength}) = 4755 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} =$ "Yes" $M_{minimum_{51}} = 5161 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5161 \cdot kip \cdot ft$

$StrandType =$ "Carbon Steel - Low Lax" $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6550 \cdot kip \cdot ft$

$FailureMode_{51} =$ "N.A." CheckMinSSLimit = "N.A."



$\min(L_d) = 11.1\ \text{ft}$ $L_{beam} - \min(L_d) = 64.7\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.83$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

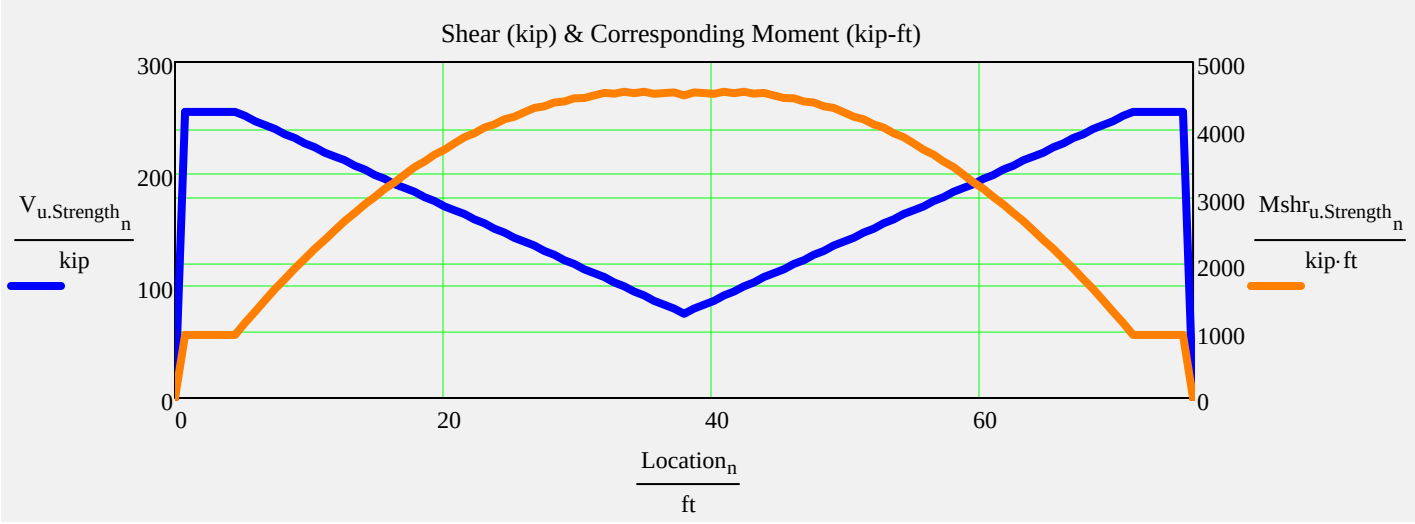
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

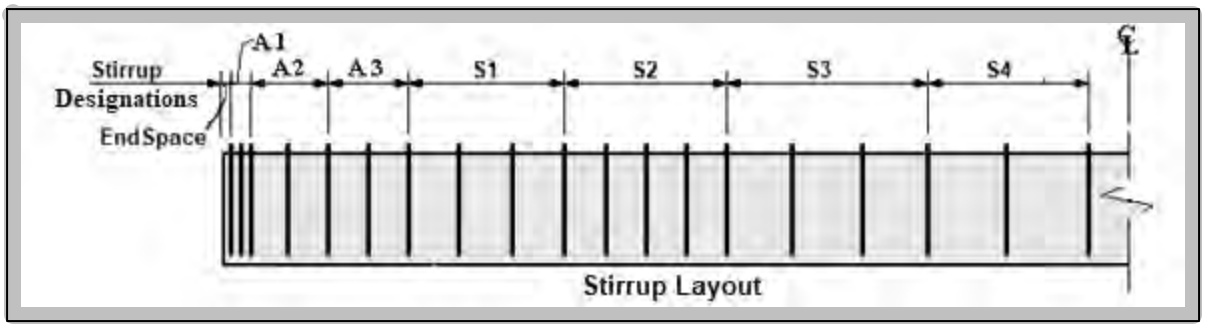
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 275 \\ 275 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 255.4 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4557 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

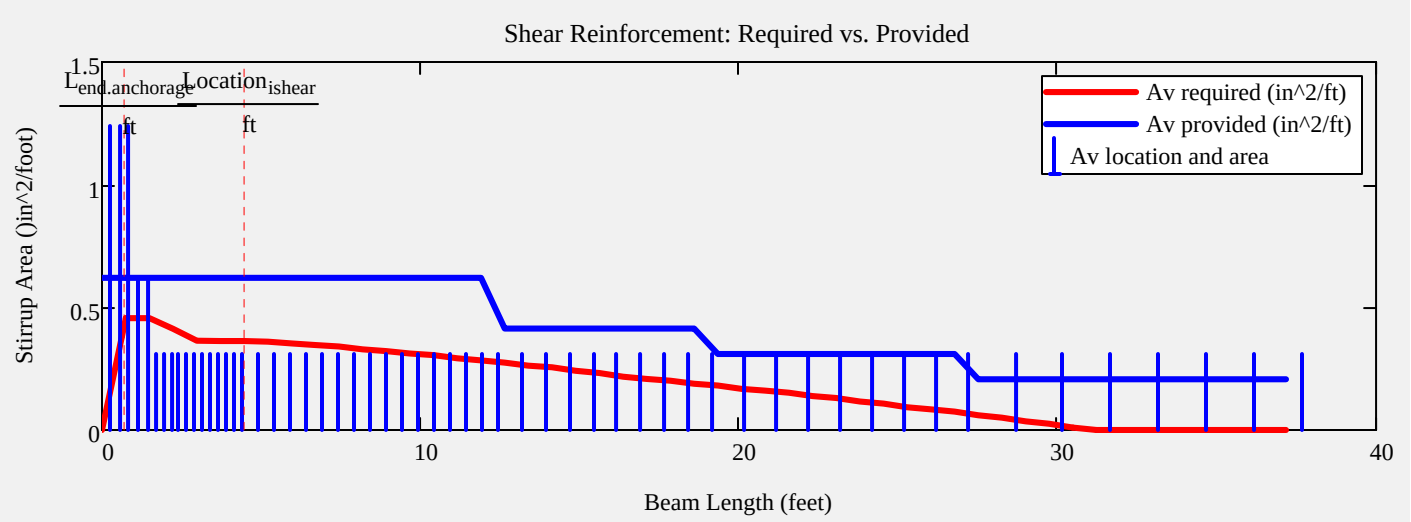
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

Save Data File

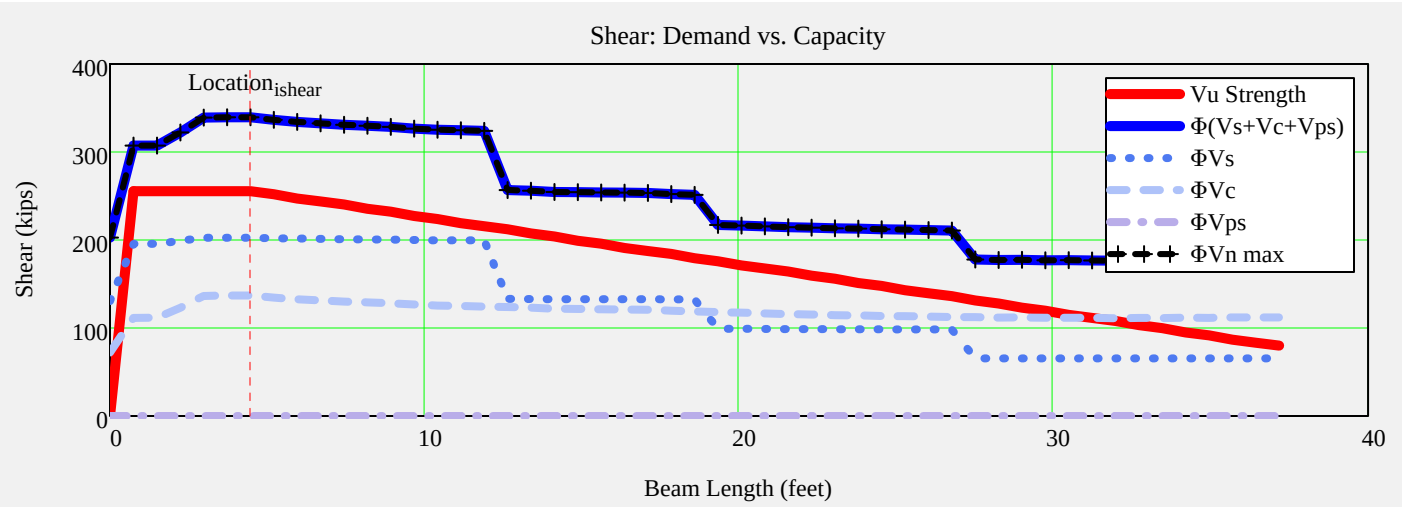
Use current input file

File Name FIB36-76ftSpan_15Skew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam"

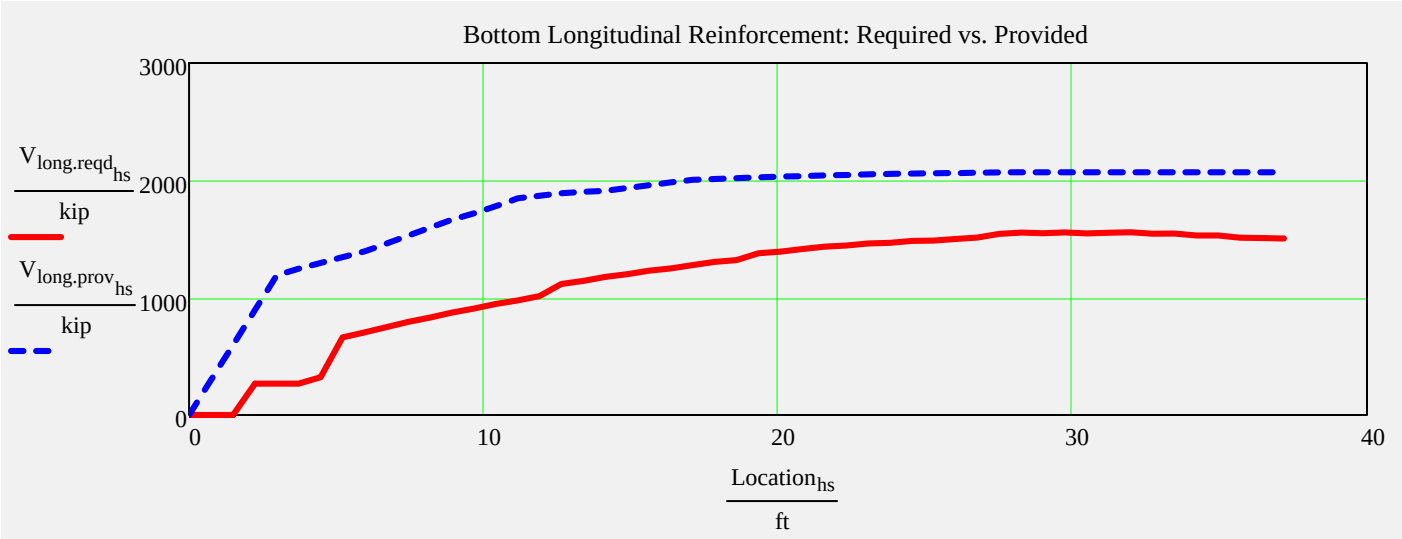
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 212.22 & 256.78 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.83$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

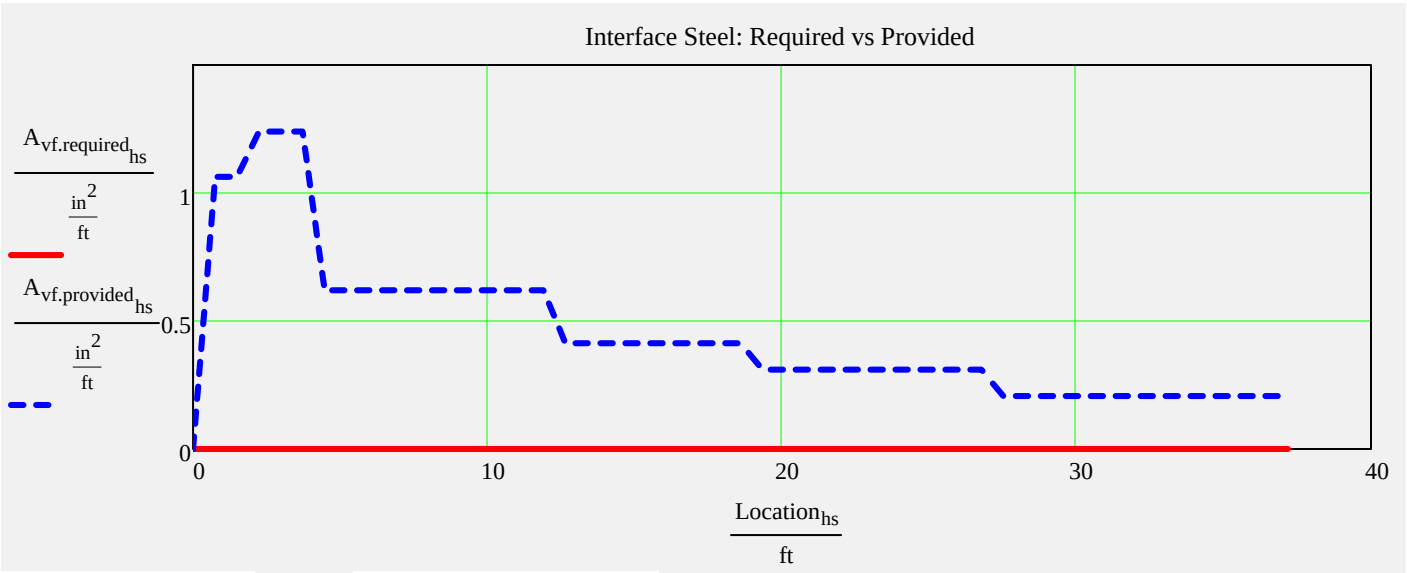


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 32.0 & 1557.7 & 2068.3 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.75$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

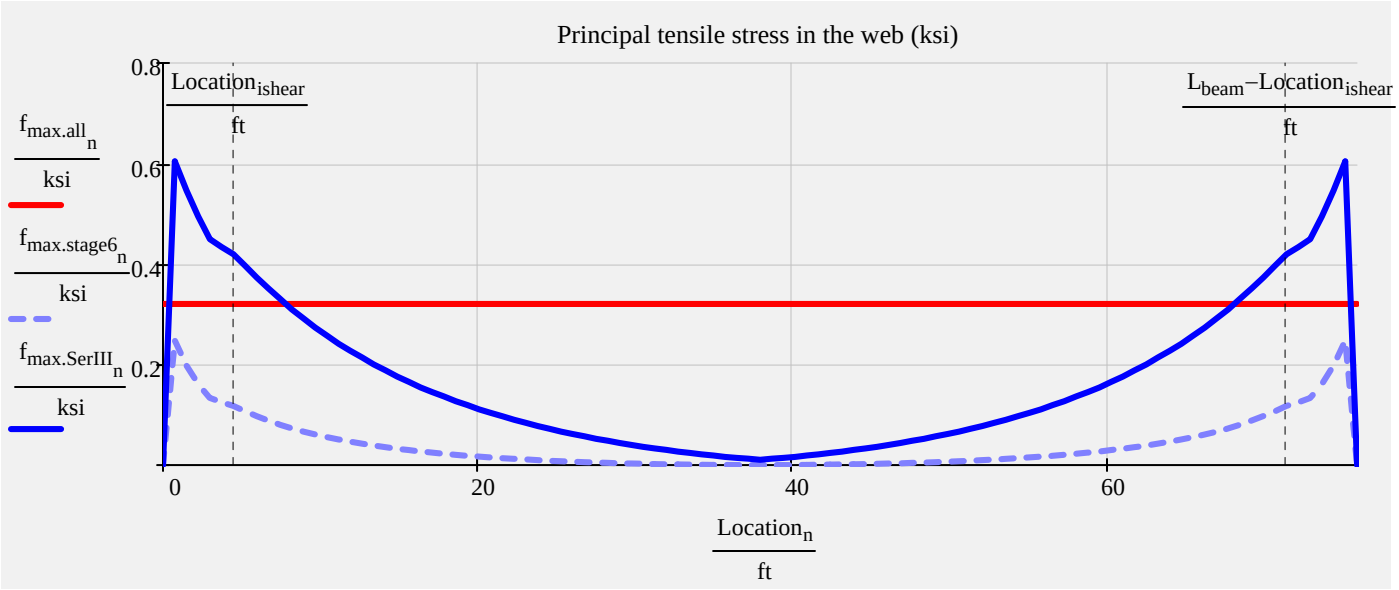
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6 \cdot in$ $\max(DC_f_{max.web}) = 1.31$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

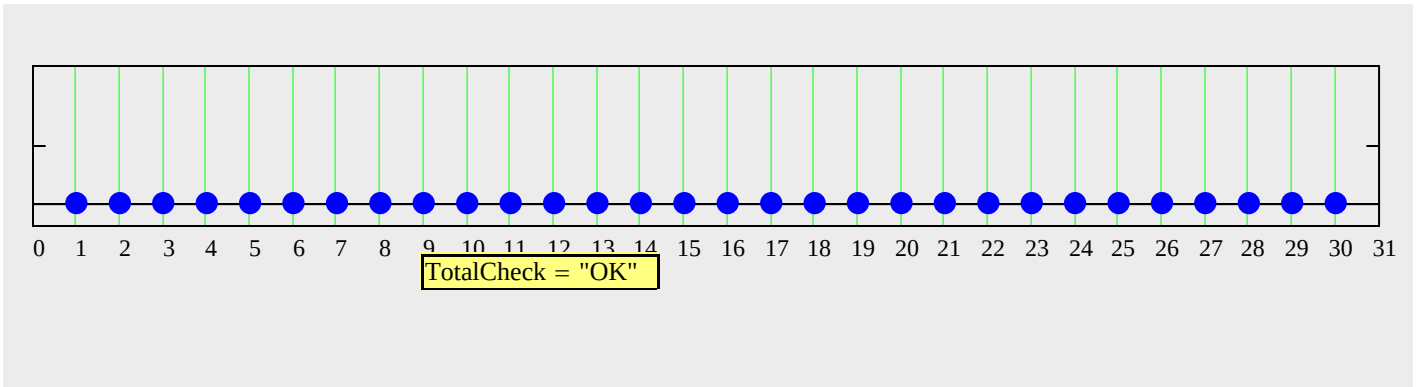
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.90	1.62	"N/A"	36.42	0.94	1.36	"N/A"	11.89	HL-93
"Strength I (Op)"	0.90	2.09	"N/A"	36.42	0.94	1.76	"N/A"	11.89	HL-93
"Service III (Inv)"	0.90	1.90	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.90	2.02	"N/A"	36.42	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.90	1.65	98.93	39.40	0.94	1.31	78.45	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.72$ $DC_{LongReinf.Permit} = 0.75$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6550	"factored resistance (kip-ft)...."
"γDL"	1838	"factored dead load (kip-ft)...."
"γLL"	2251	"factored live load (kip-ft)....."
"RF"	2.09	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	257.7	"factored resistance (kip)....."
"γDL"	67.3	"factored dead load (kip)....."
"γLL"	108.3	"factored live load (kip)....."
"RF"	1.76	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 76 FEET (15 DEG. SKEW)

EASTBOUND BRIDGE

(D.C.I CANAL)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-76ftSpan_15Skew_Exterior.dat
FIB36-76ftSpan_15Skew_Interior.dat
FIB36-76ftSpan_NoSkew_Exterior.dat
FIB36-76ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

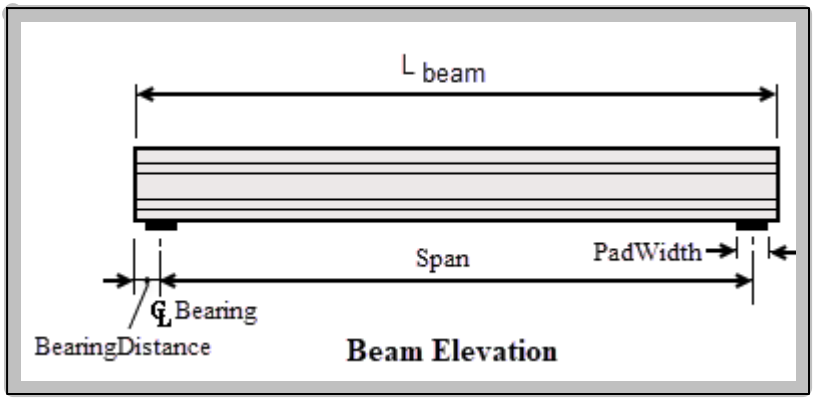
InputDataFile = "FIB36-76ftSpan_15Skew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 06 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-76ftSpan_15Skew_Interior.dat"

Beam Type: FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)

Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

L_{beam}	75.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	10	ft	*Measured from beam centerline to centerline.*
Overhang	3.7083	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100·ft*, SDG 4.2.2)*
d_e	2.5	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100·ft*, SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

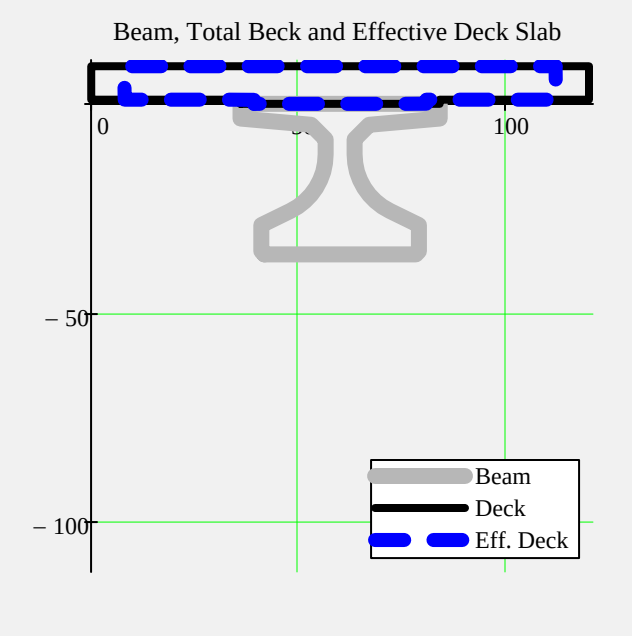
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 120·in

$b_e = 120 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 1.05 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.12 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.15 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 75.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

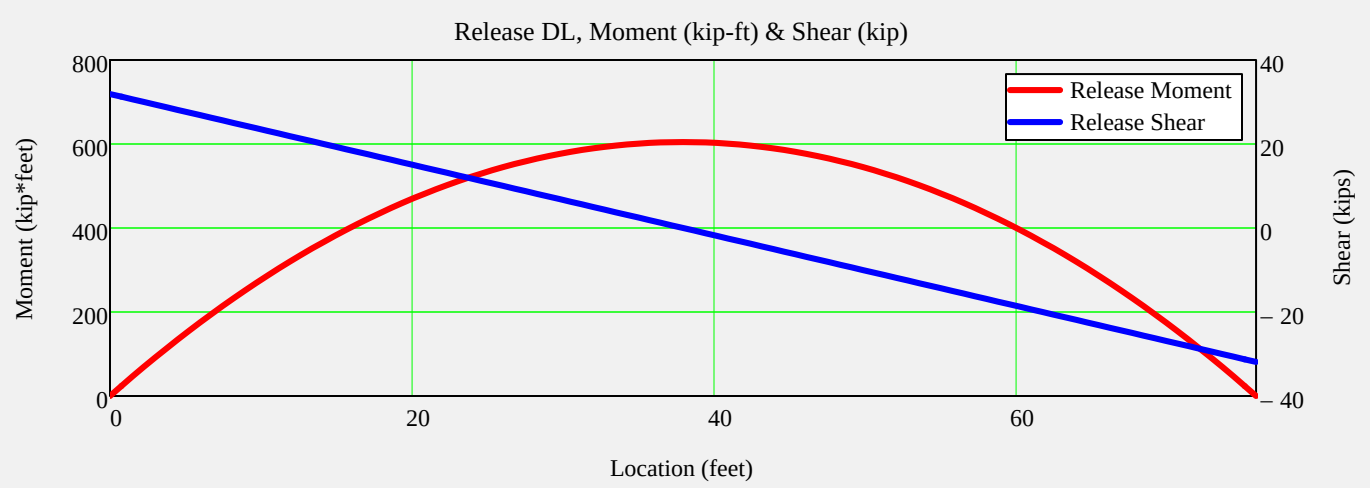
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

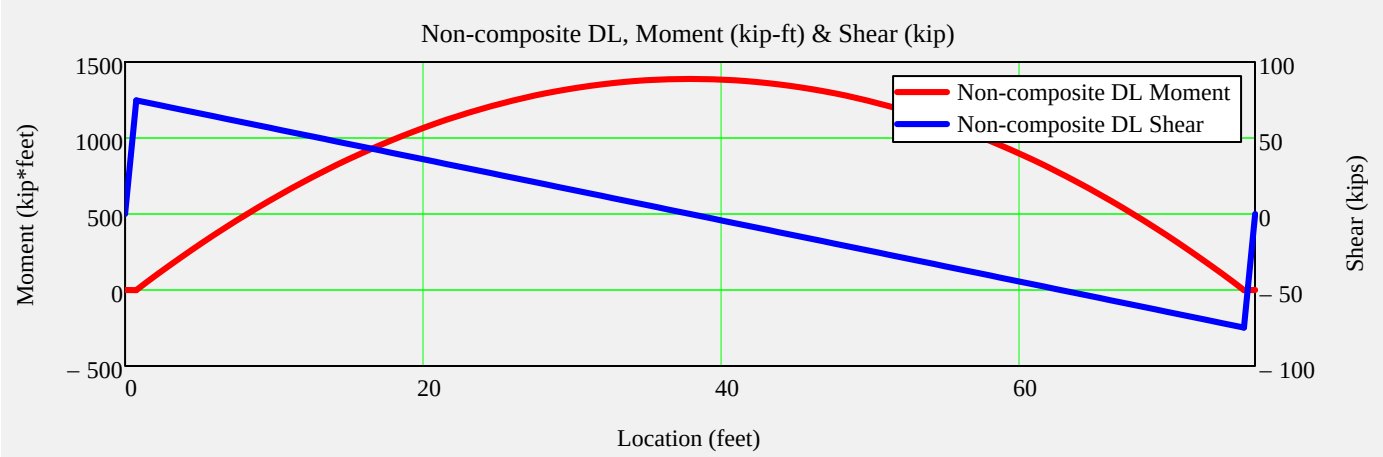
Release Dead Load Moments and Shears

$L_{span} = 74.33\ ft$



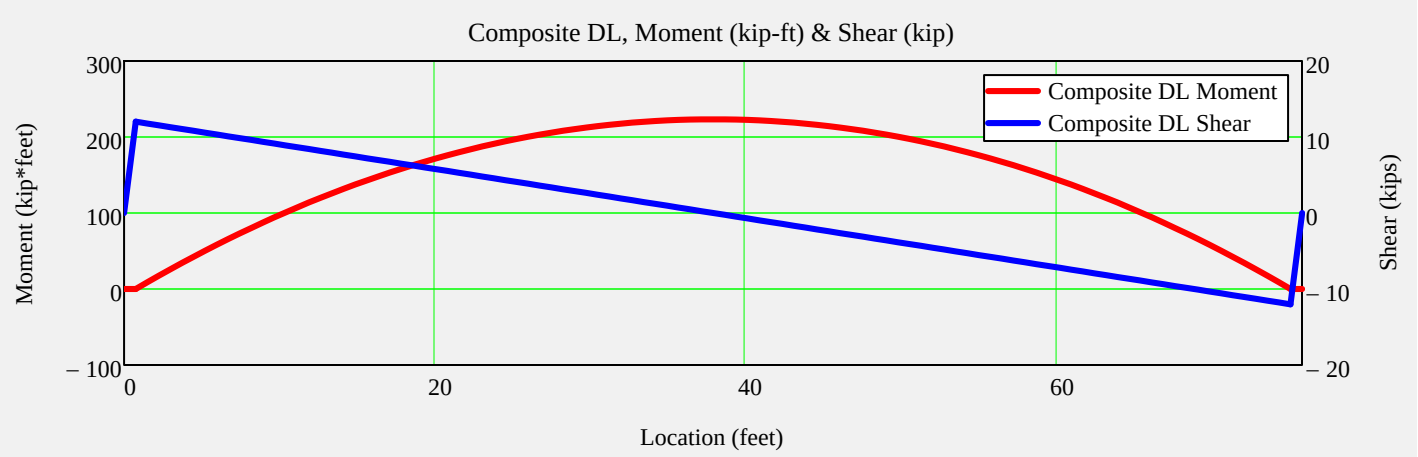
$\max(V_{release}) = 31.9 \cdot kip$ $\max(M_{release}) = 604.6 \cdot kip \cdot ft$ $\min(V_{release}) = -31.9 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 74.7 \cdot kip$ $\max(M_{dl.non.comp}) = 1388.4 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -74.7 \cdot kip$

Composite Dead Load Moments and Shear



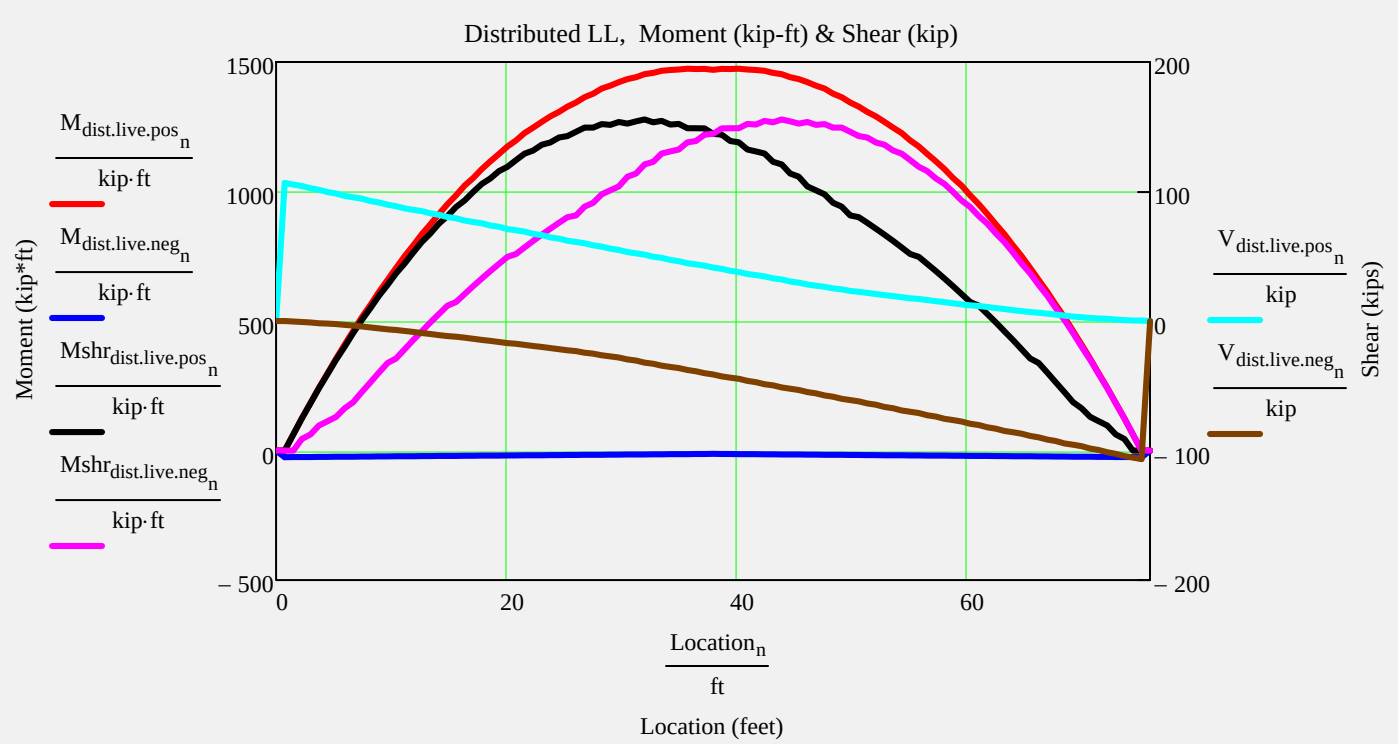
$\max(V_{dl.comp}) = 12.0 \cdot kip$ $\max(M_{dl.comp}) = 223.2 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -12.0 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 74.33\ ft$ BeamSpacing $= 10\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.05$

Final Live Load Distribution Factors: $g_{mom} = 0.8$ $g_{mom.fatigue} = 0.47$ $g_{shear} = 1.00$



$\max(V_{dist.live.pos}) = 106.6 \cdot kip$

$\max(M_{dist.live.pos}) = 1474.2 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -106.6 \cdot kip$

$Reaction_{LL} = 108.6 \cdot kip$

$\min(M_{dist.live.neg}) = -25.5 \cdot kip \cdot ft$

$Reaction_{DL} = 88.5 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1278 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 63.7 \cdot kip$ $Reaction_{lane} = 24.3 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 87.7 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-76ftSpan_15Skew_Interior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck		Bottom of Beam		Beam End: Top	Beam End: Bottom
Area (in^2)	0.62	*1	0		1.58	0
Distance (in)	4	*2	0	*3		
Length (ft)					16	0
Bar Size			5	*4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

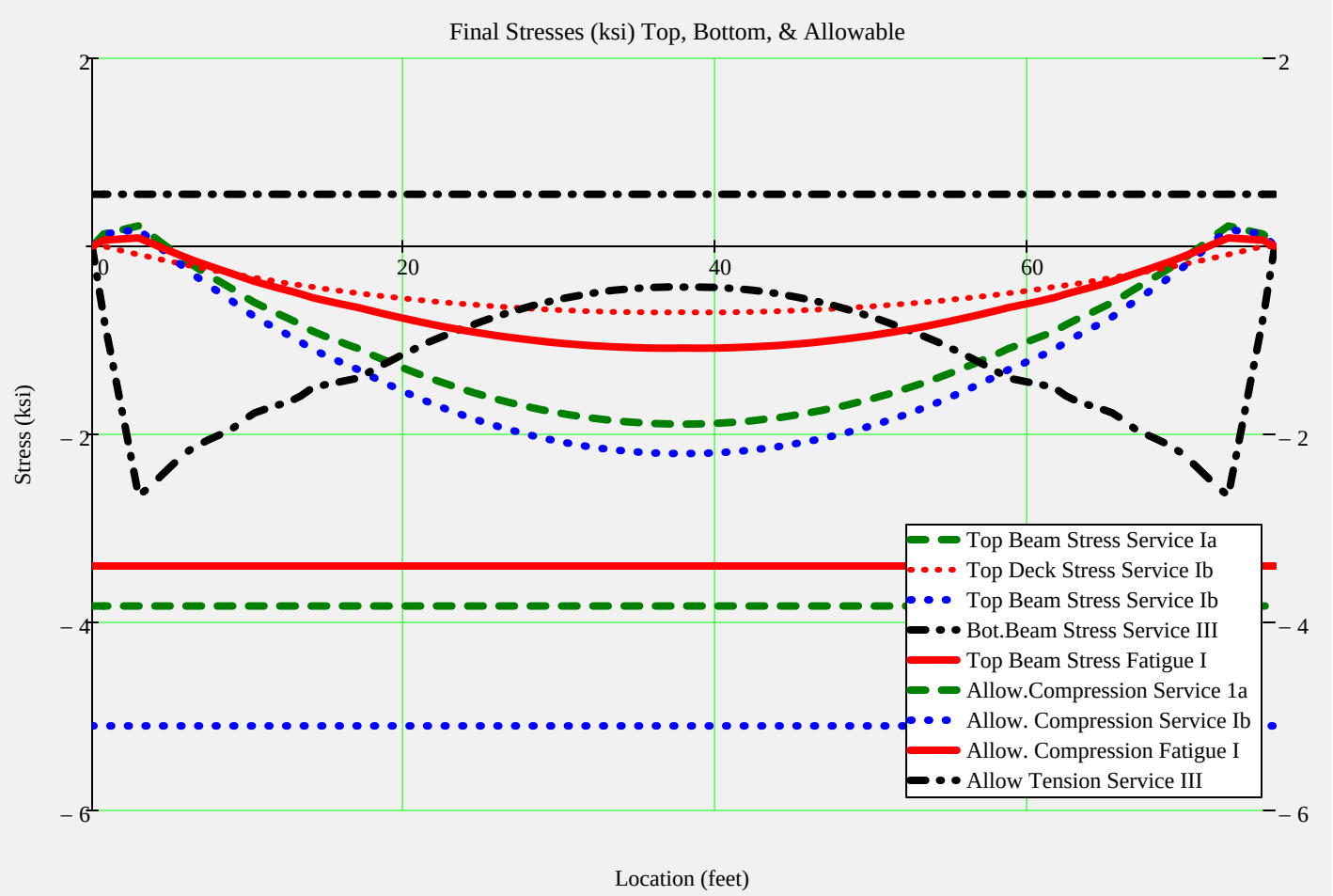
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

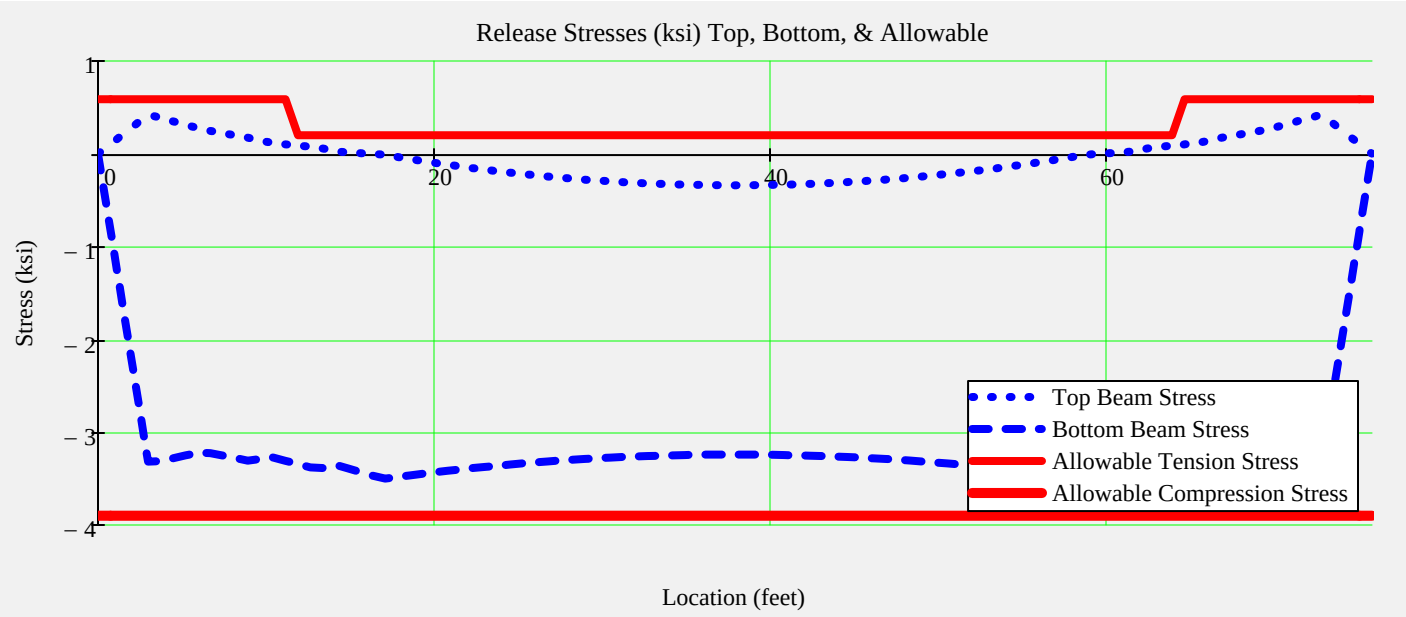
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.82$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.49$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.43$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.32$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	2.98	0.42	0.59
"Compression @ Release"	17.10	–3.50	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	37.92	–1.89	–3.83
"CompressionIb @ ServiceI"	37.92	–2.20	–5.10
"Compression @ FatigueI"	38.66	–1.08	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

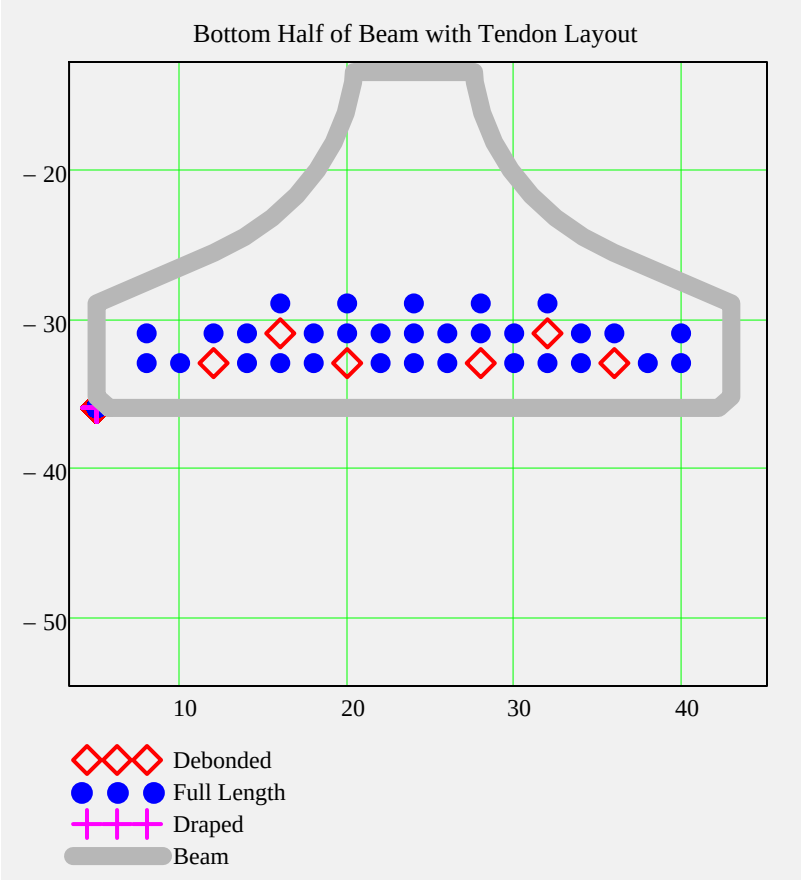
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 37

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -24 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -11.95 \cdot \%$

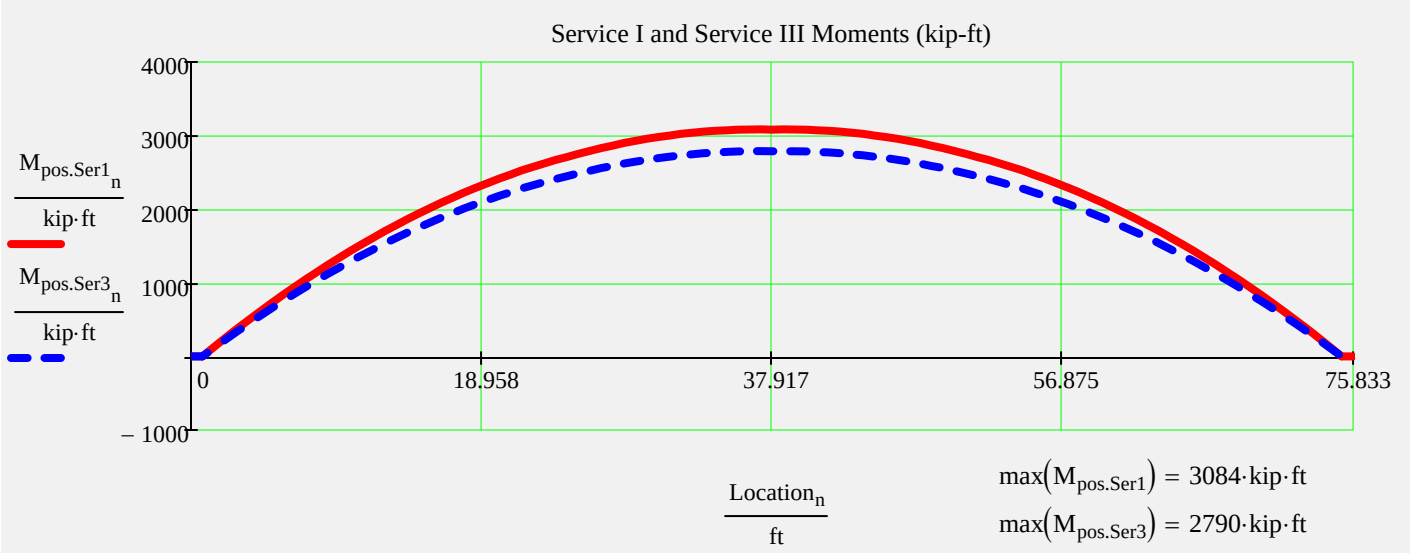
$f_{pe} = 178 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 88.05 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3084 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 2790 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses =$

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.34	–3.24
"2"	–0.43	–2.75
"4"	–0.39	–2.78
"6"	–1.84	–1.62
"8"	–2.20	–0.43

$PrestressForce =$

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1666	–1601
"@Final (about composite centroid)"	–1467	–1333

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	799.2	126284	–19.4
"Transformed Beam (initial)"	850.6	133906	–20.1
"Transformed Beam (final)"	845	133116	–20
"Composite Section"	1747.1	406953	–7.2

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	605
"Non-Composite DL (incl. beam wt.)"	1388
"Composite Dead Load"	223
"Distributed Live Load"	1470

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

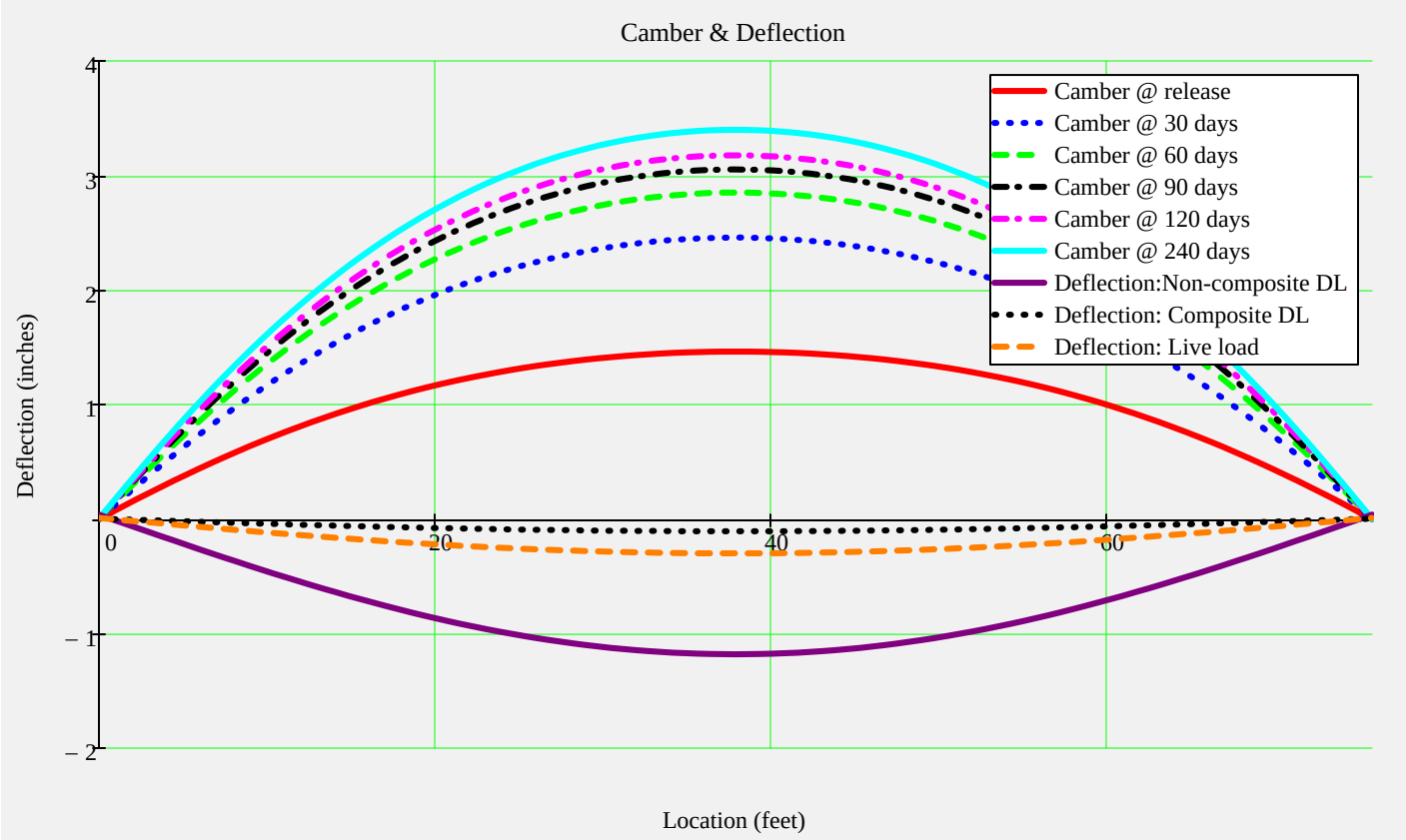
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 74.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.01	–0.65	0.37	1.46
"30 Days"	–0.15	–1.14	0.62	2.46
"60 Days"	–0.20	–1.33	0.72	2.85
"90 Days"	–0.23	–1.43	0.77	3.05
"120 Days"	–0.25	–1.49	0.81	3.18
"240 Days"	–0.28	–1.60	0.86	3.40
"Non-comp DL"	–0.17	0.14	–0.24	–1.18
"Comp DL"	–0.01	0.02	–0.02	–0.11
"LL"	–0.02	0.06	–0.06	–0.30

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.89 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

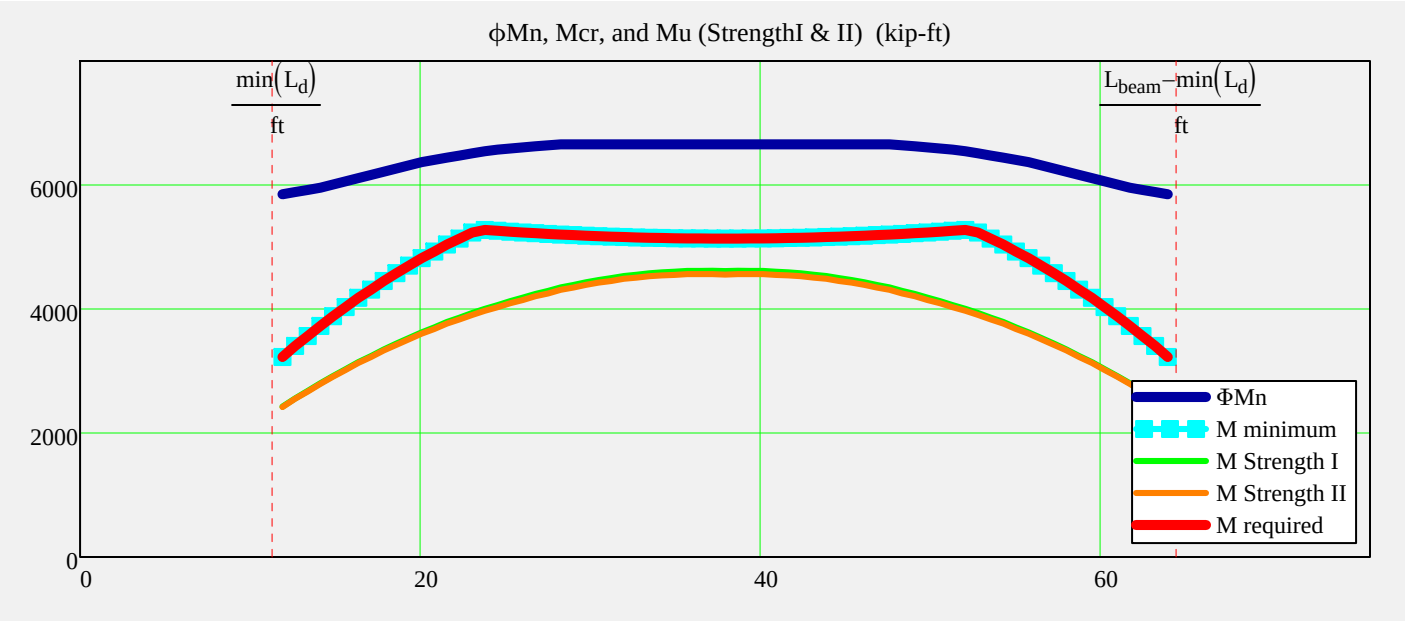
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 4618 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5136 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5136 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 6656 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.3\,\text{ft}$ $L_{beam} - \min(L_d) = 64.5\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.81$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

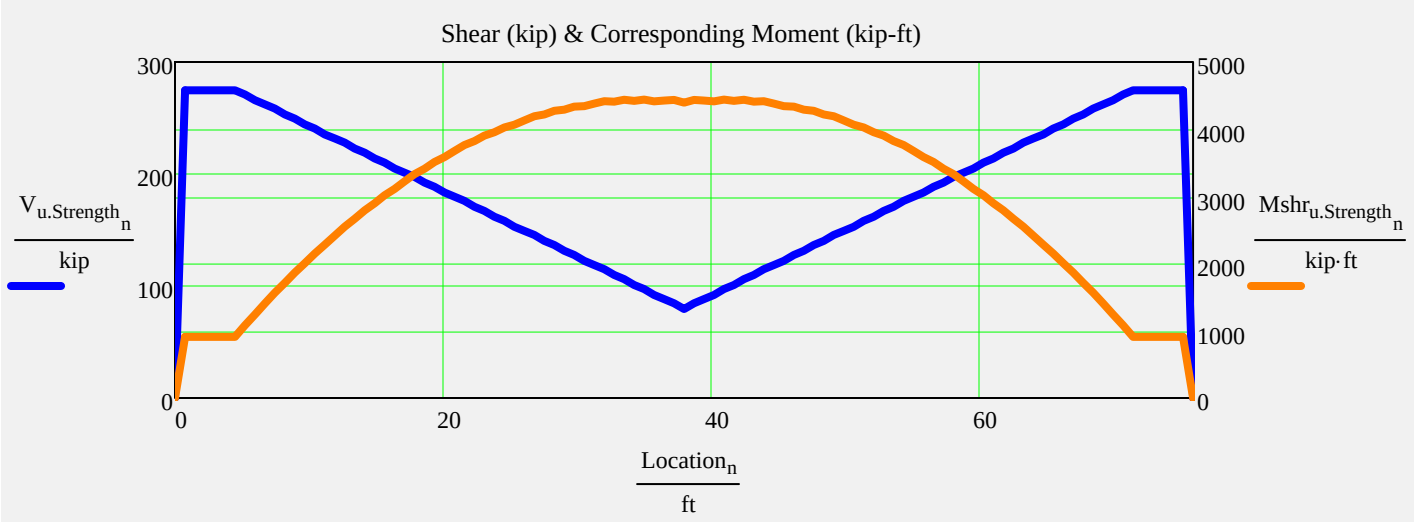
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

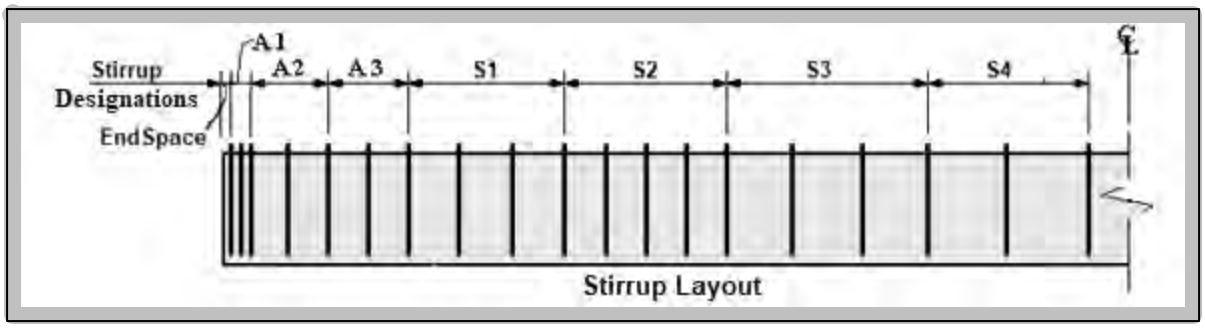
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 296 \\ 296 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 274.7 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4440 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

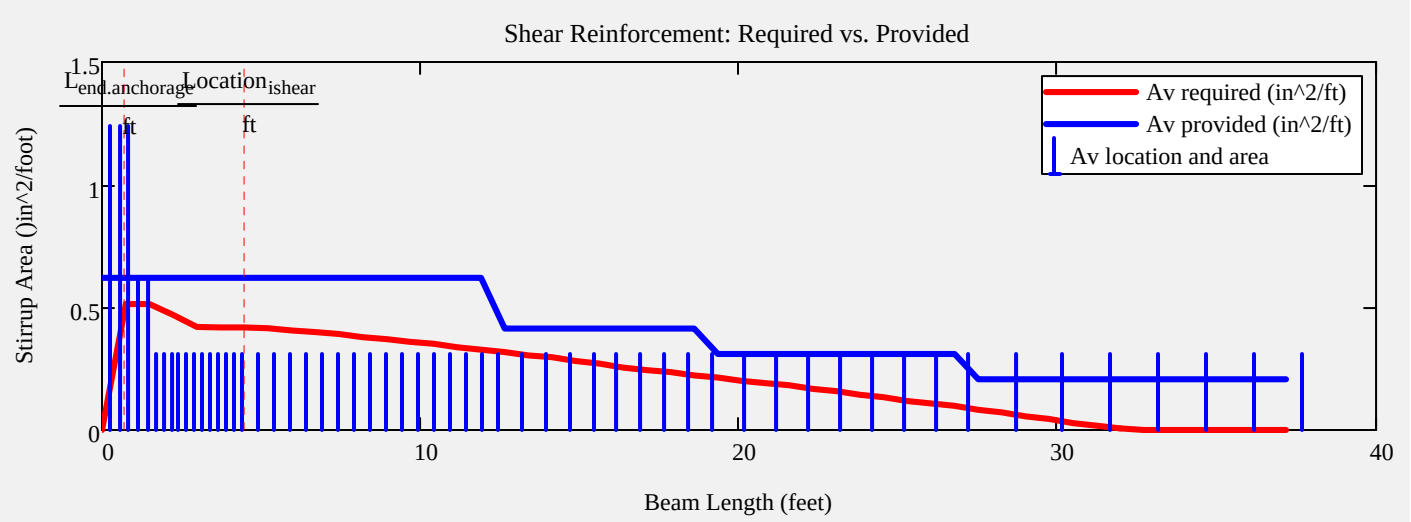
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.47\ ft$

Save Data File

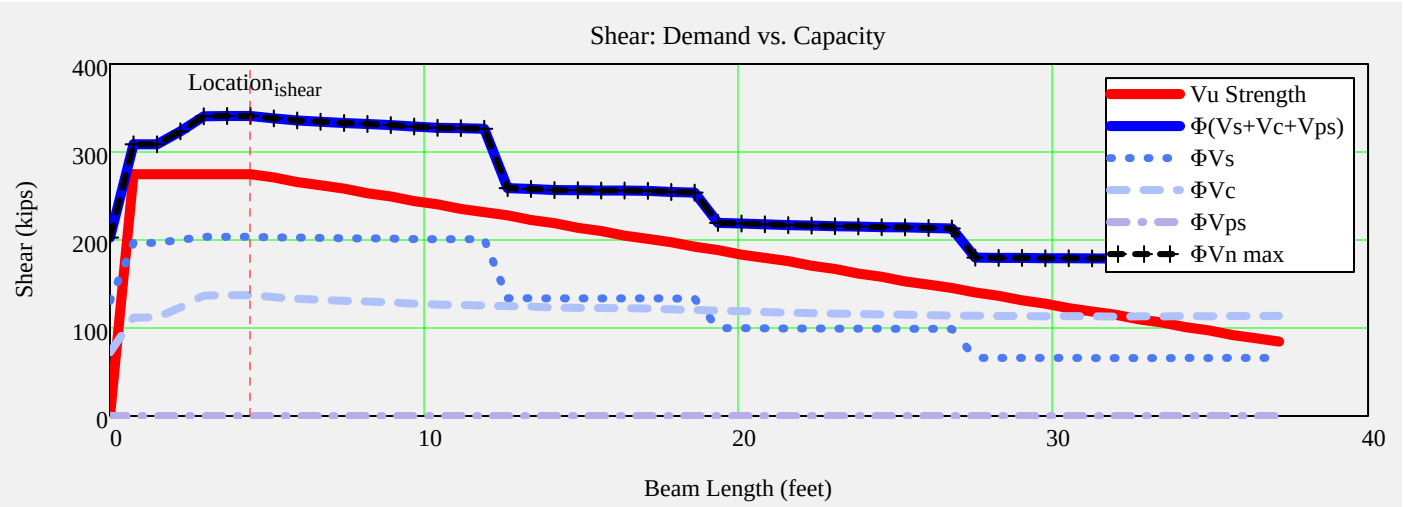
Use current input file

File Name FIB36-76ftSpan_15Skew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\EB 76' Span\prestressedbeamv6-2\DataFiles-I-Beam"

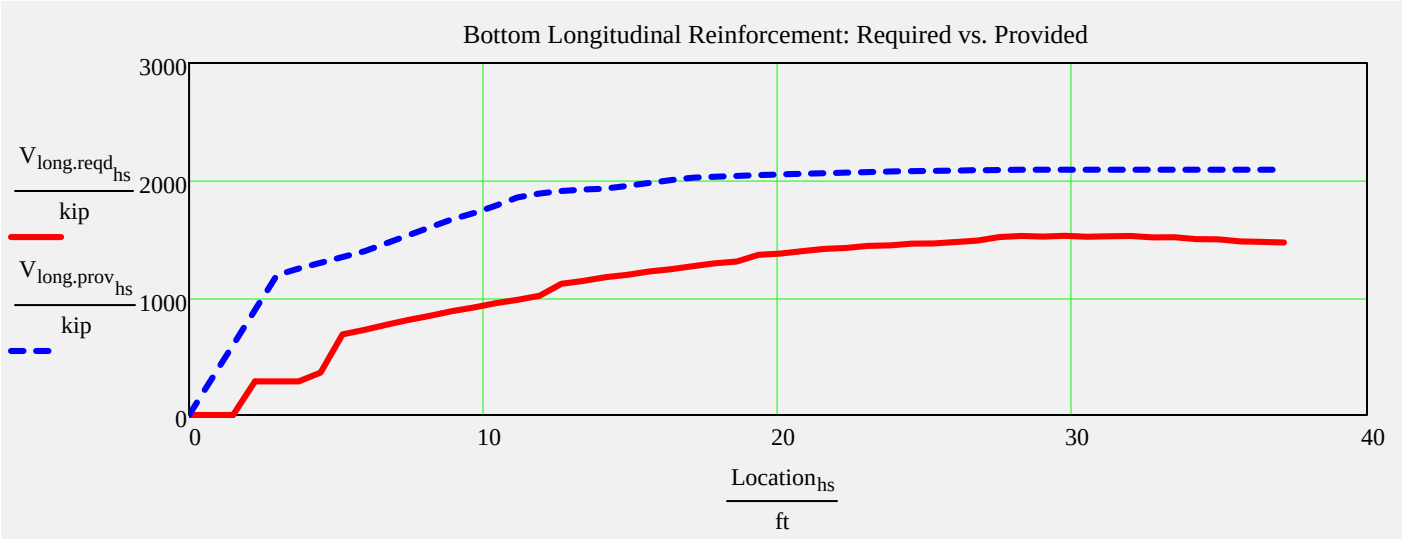
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 12.64 & 227.94 & 258.87 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.88$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

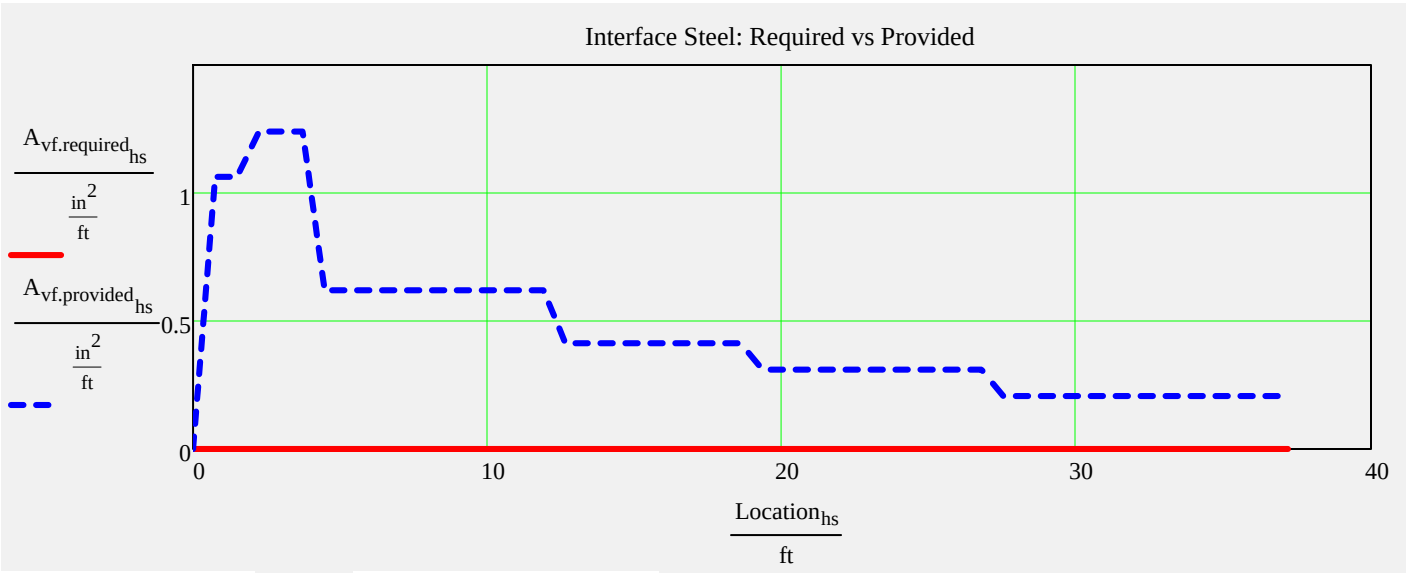


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 29.7 & 1526.8 & 2090.3 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.73$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 16.79 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

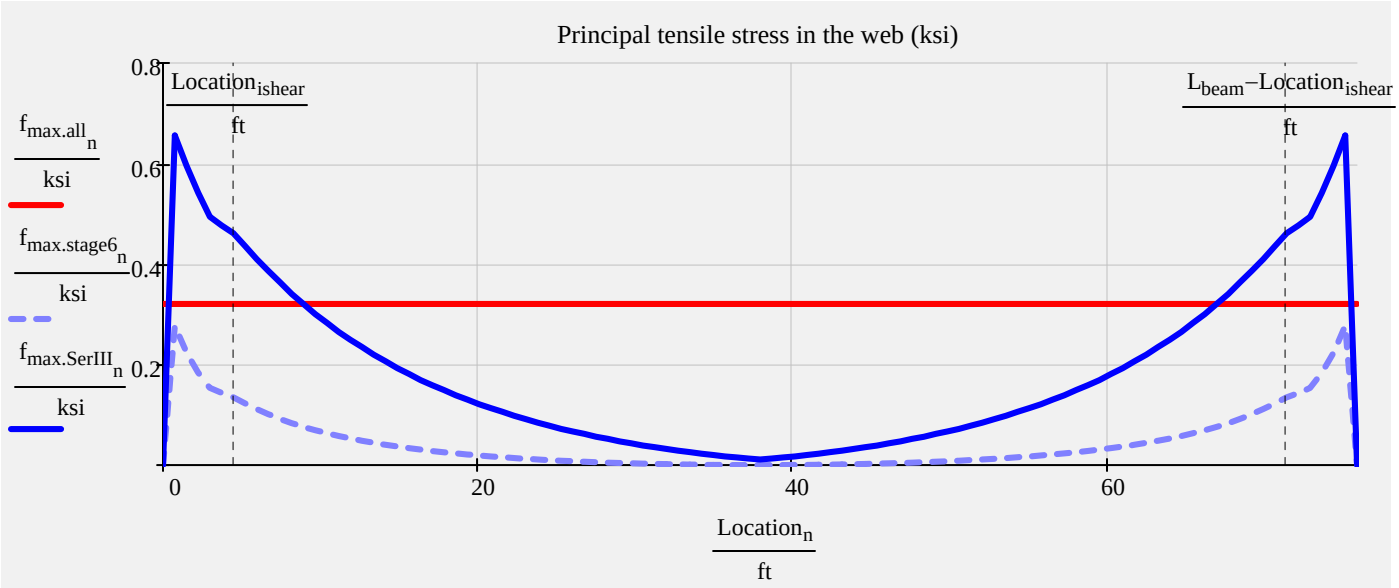
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 53.6 \cdot in$ $\max(DC_f_{max.web}) = 1.44$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

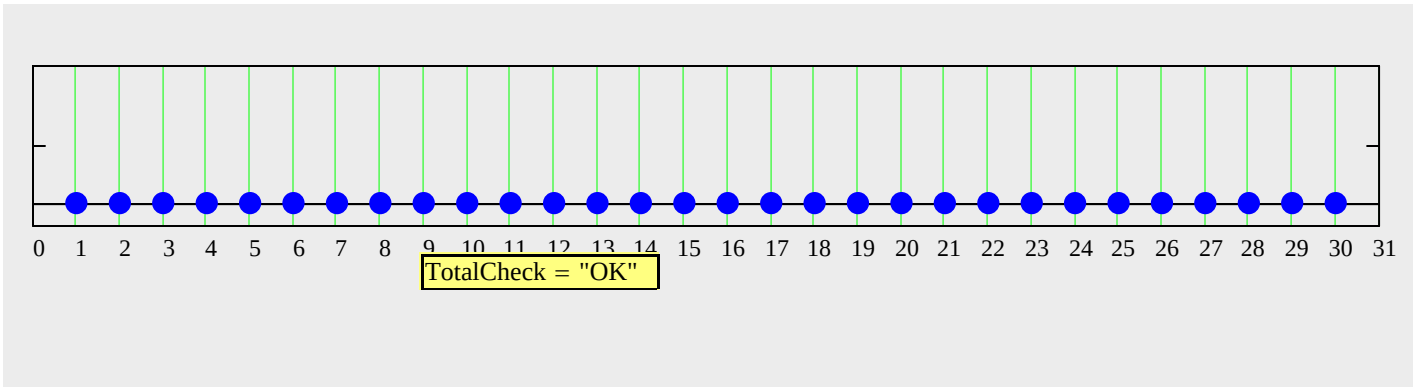
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.80	1.79	"N/A"	37.91	1.00	1.25	"N/A"	11.89	HL-93
"Strength I (Op)"	0.80	2.32	"N/A"	37.91	1.00	1.62	"N/A"	11.89	HL-93
"Service III (Inv)"	0.80	1.98	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.80	2.12	"N/A"	37.91	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.80	1.83	109.69	39.40	1.00	1.20	72.11	11.89	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.70$ $DC_{LongReinf.Permit} = 0.73$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	6656	"factored resistance (kip-ft)...."
"γDL"	2040	"factored dead load (kip-ft)...."
"γLL"	1989	"factored live load (kip-ft)....."
"RF"	2.32	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	259.7	"factored resistance (kip)....."
"γDL"	74.7	"factored dead load (kip)....."
"γLL"	114.5	"factored live load (kip)....."
"RF"	1.62	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 90 FEET (NO SKEW)
WESTBOUND BRIDGE
(JOSHUA CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\WB 90' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-90ftSpan_NoSkew_Exterior.dat
FIB36-90ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

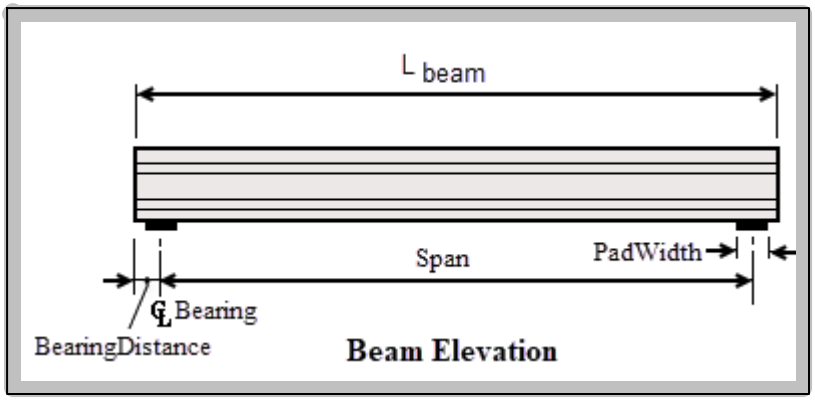
InputDataFile = "FIB36-90ftSpan_NoSkew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	WB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-90ftSpan_NoSkew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	89.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	8.3333	ft	*Measured from beam centerline to centerline.*
Overhang	3.708333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.375	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	7		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

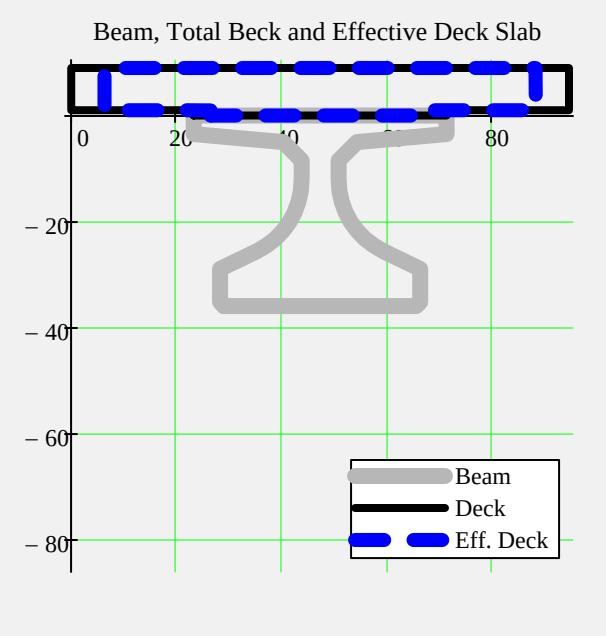
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $100 \cdot in$

$b_e = 94.5 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.89 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.04 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.12 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 89.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

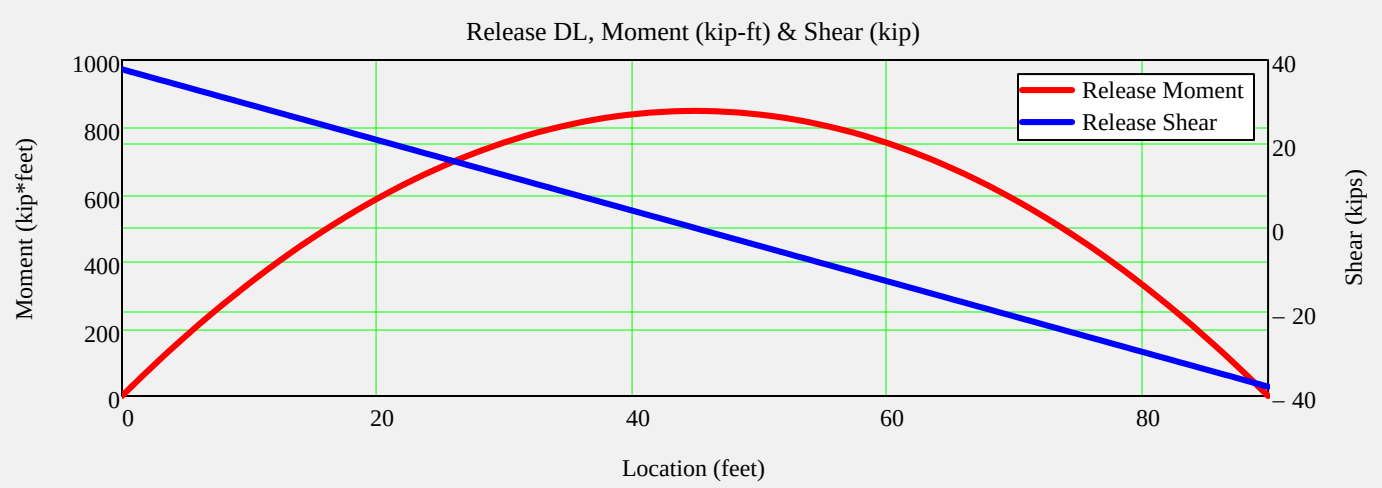
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

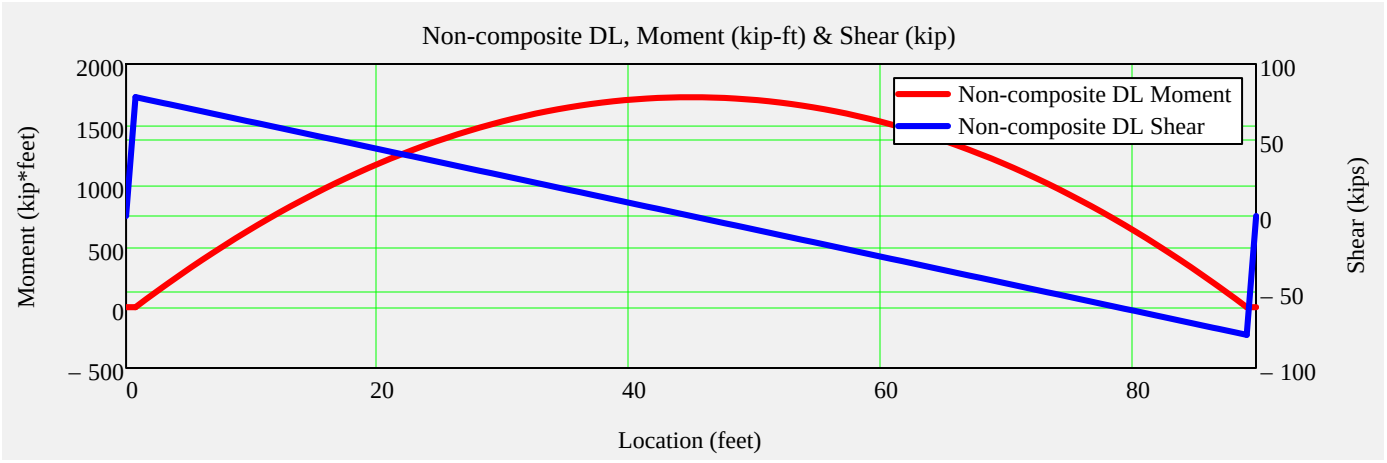
Release Dead Load Moments and Shears

$L_{span} = 88.33\ ft$



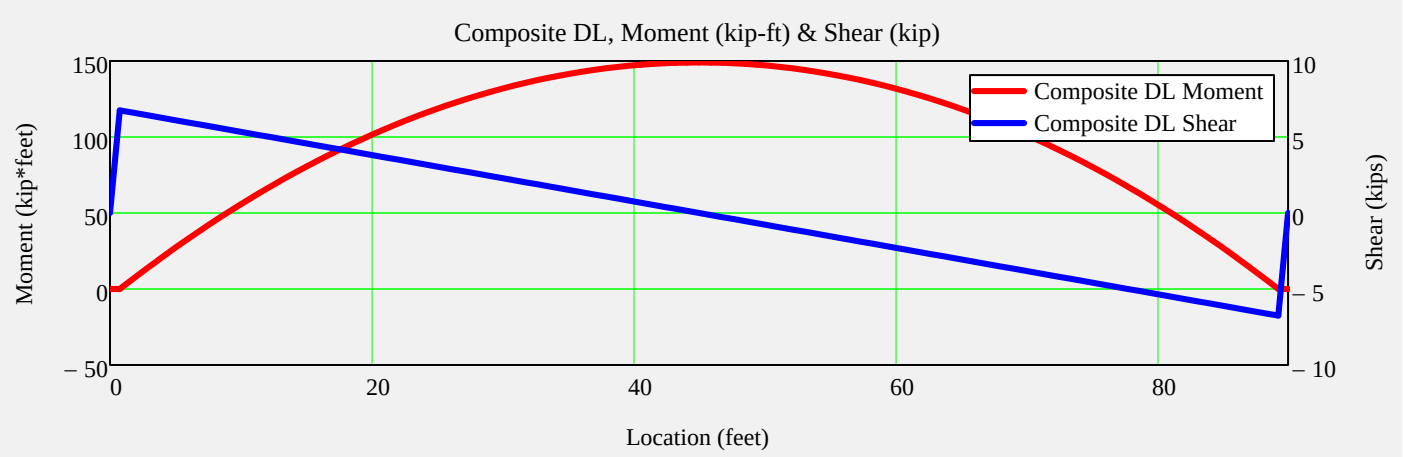
$\max(V_{release}) = 37.8 \cdot kip$ $\max(M_{release}) = 848.4 \cdot kip \cdot ft$ $\min(V_{release}) = -37.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 78.2 \cdot kip$ $\max(M_{dl.non.comp}) = 1726.9 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -78.2 \cdot kip$

Composite Dead Load Moments and Shear



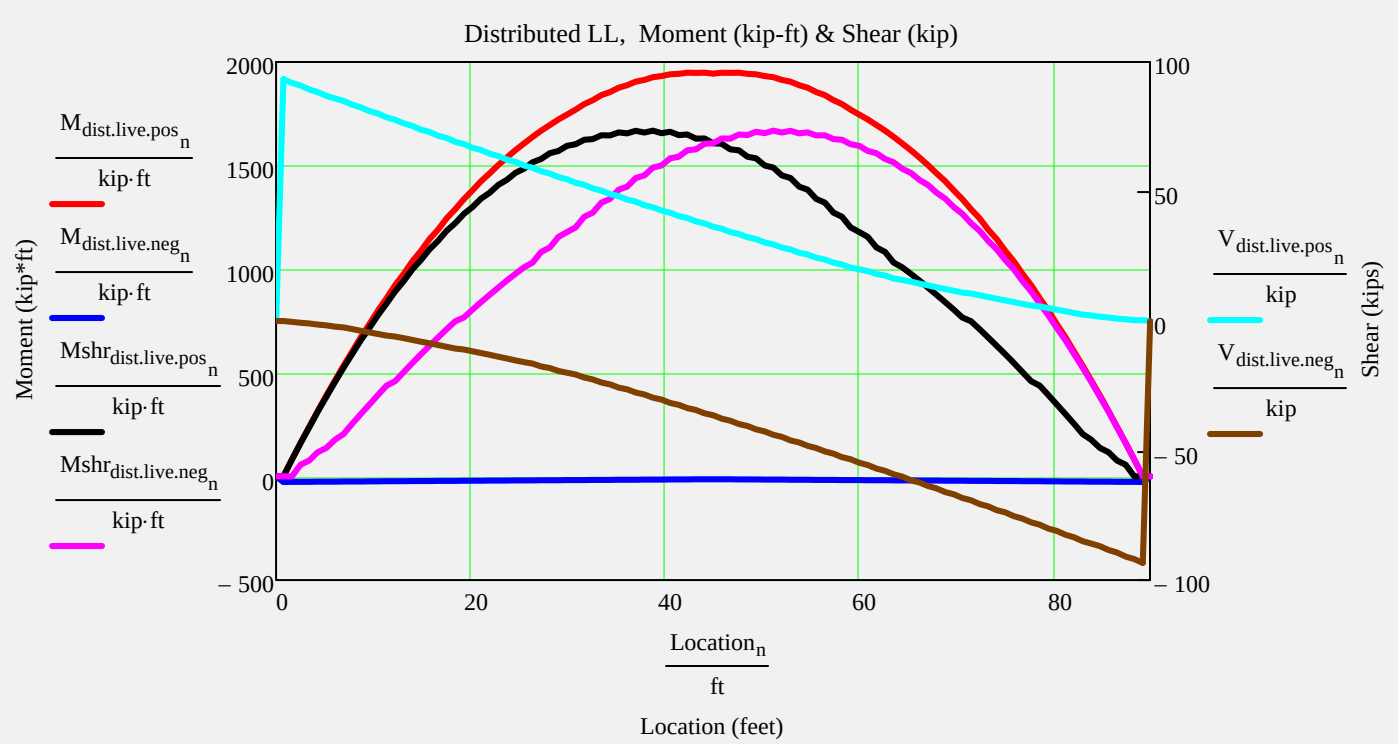
$\max(V_{dl.comp}) = 6.8 \cdot kip$ $\max(M_{dl.comp}) = 149.0 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -6.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 88.33\ ft$ BeamSpacing $= 8.33\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.82$ $g_{mom.fatigue} = 0.68$ $g_{shear} = 0.82$



$\max(V_{dist.live.pos}) = 93.4 \cdot kip$

$\max(M_{dist.live.pos}) = 1948.1 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -93.4 \cdot kip$

$Reaction_{LL} = 94.7 \cdot kip$

$Reaction_{DL} = 86.4 \cdot kip$

$\min(M_{dist.live.neg}) = -26.4 \cdot kip \cdot ft$

$\max(Mshr_{dist.live.pos}) = 1669 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.0 \cdot kip$ $Reaction_{lane} = 28.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 77.1 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-90ftSpan_NoSkew_Exterior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.58	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		5 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

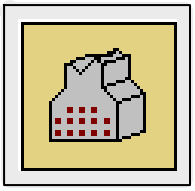
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

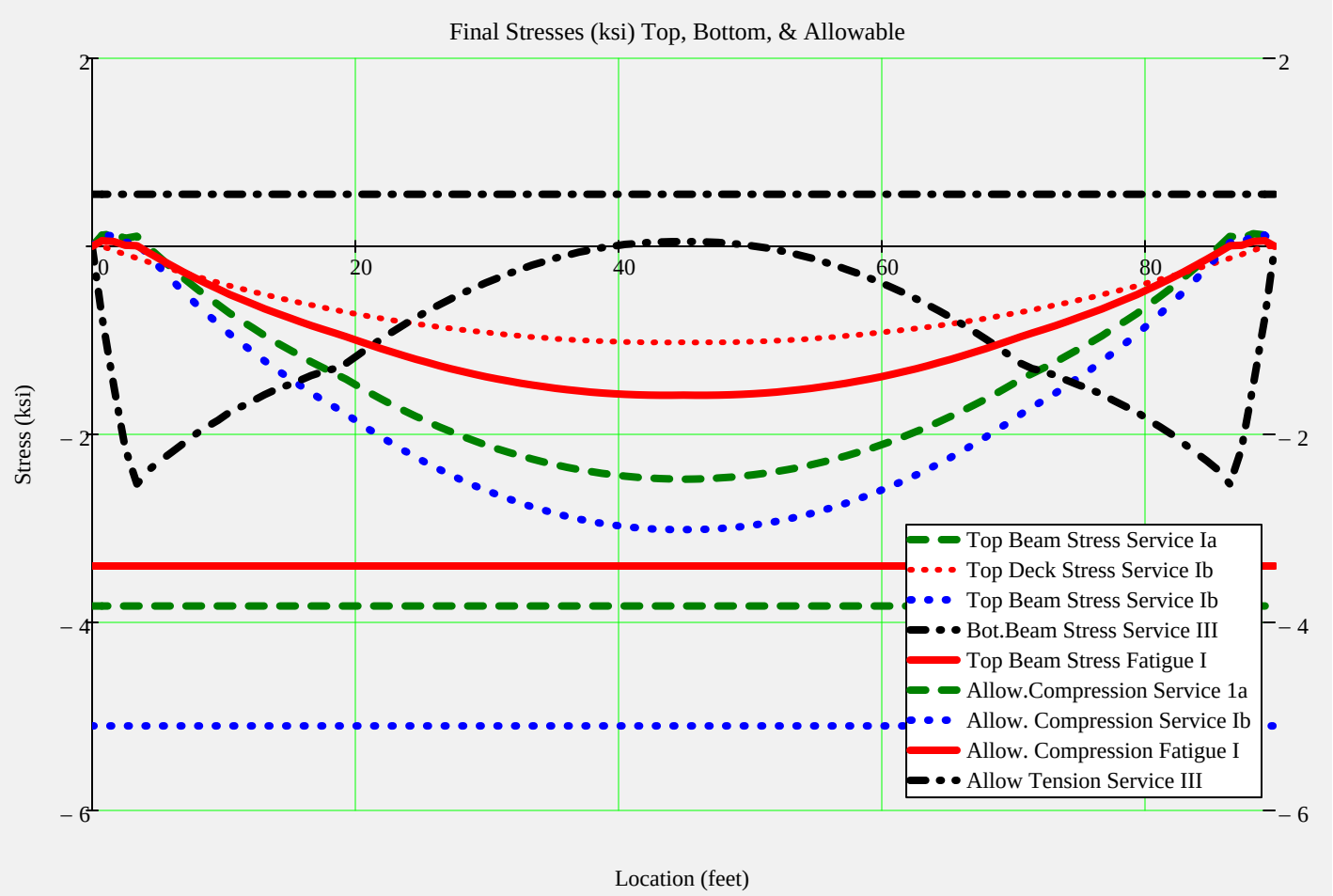
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

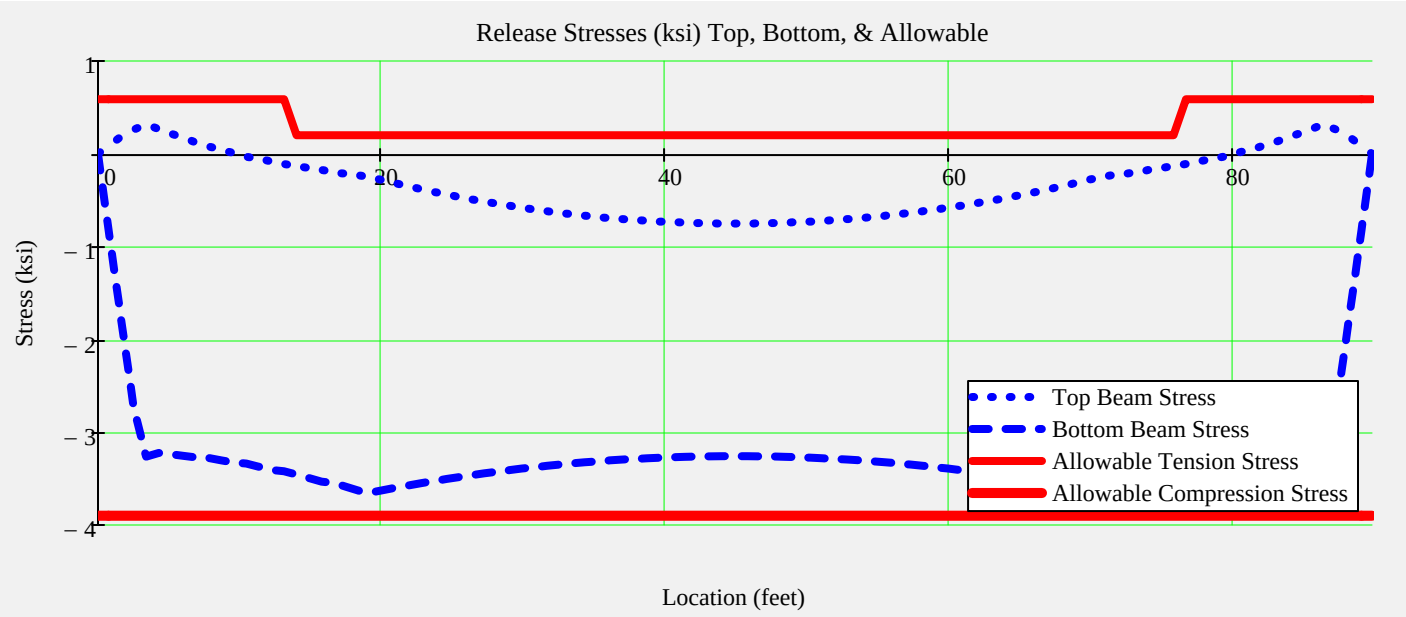
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.80$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.94$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.84$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.65$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.59$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.47$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.40	0.32	0.59
"Compression @ Release"	19.30	–3.65	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	44.92	–2.48	–3.83
"CompressionIb @ ServiceI"	44.92	–3.01	–5.10
"Compression @ FatigueI"	45.80	–1.58	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

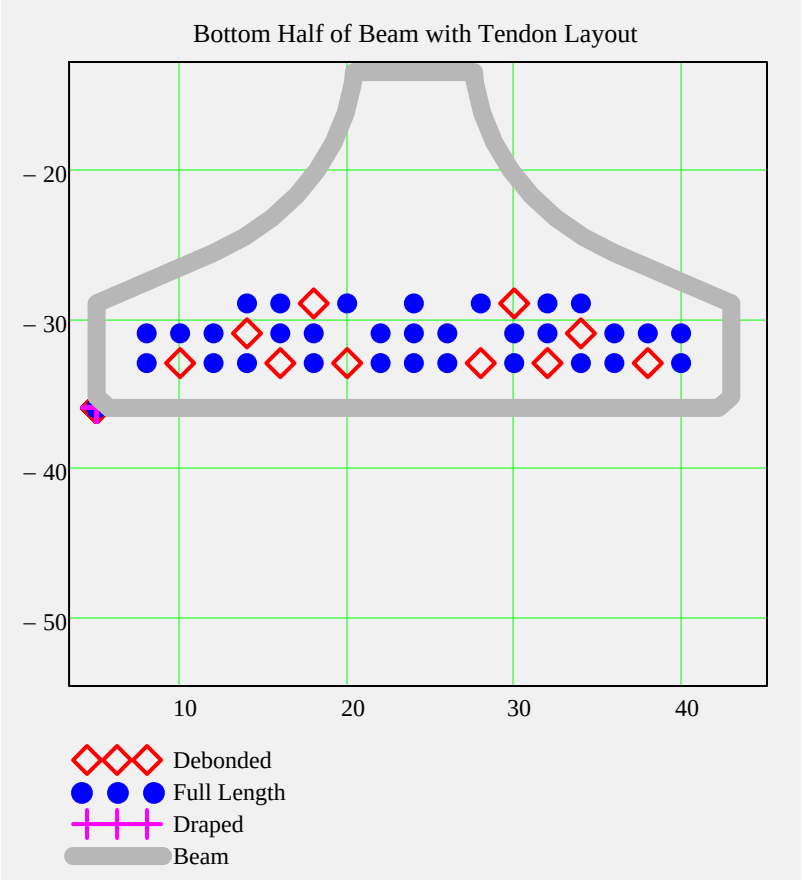
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

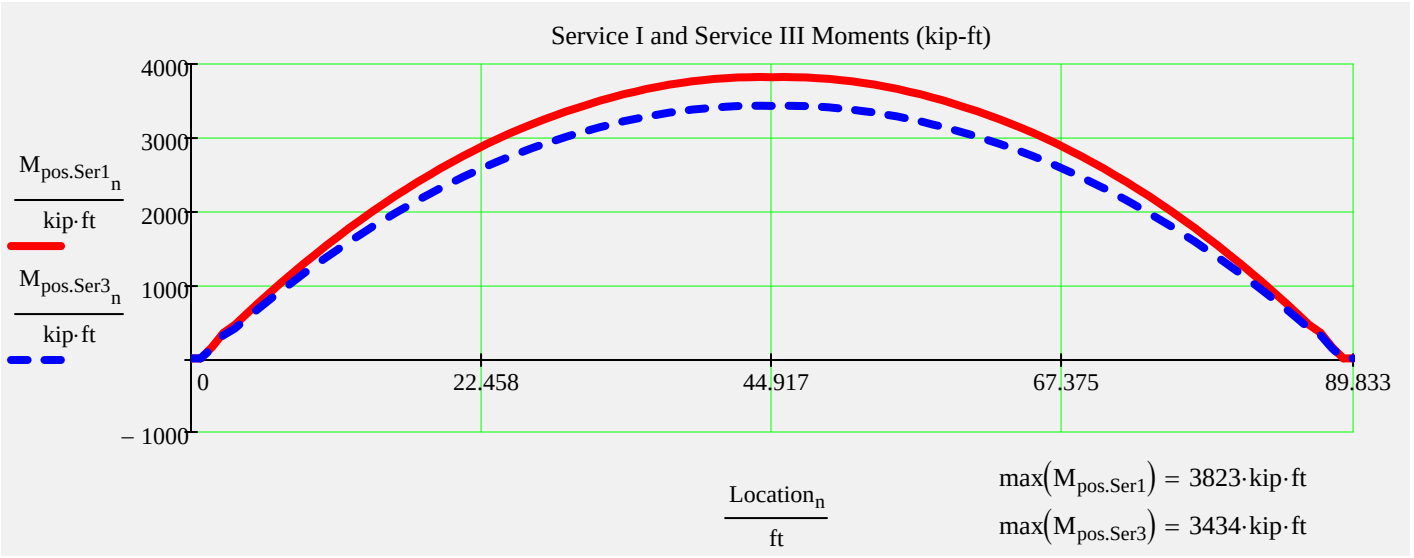
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3823 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3434 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.75 & -3.26 \\ \text{"2"} & -0.85 & -2.69 \\ \text{"4"} & -0.80 & -2.73 \\ \text{"6"} & -2.43 & -1.43 \\ \text{"8"} & -3.01 & 0.05 \end{pmatrix}$

$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1842 & -1743 \\ \text{"@Final (about composite centroid)"} & -1608 & -1431 \end{pmatrix}$

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1568.2	377215	–8.7

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	848
"Non-Composite DL (incl. beam wt.)"	1727
"Composite Dead Load"	149
"Distributed Live Load"	1944

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

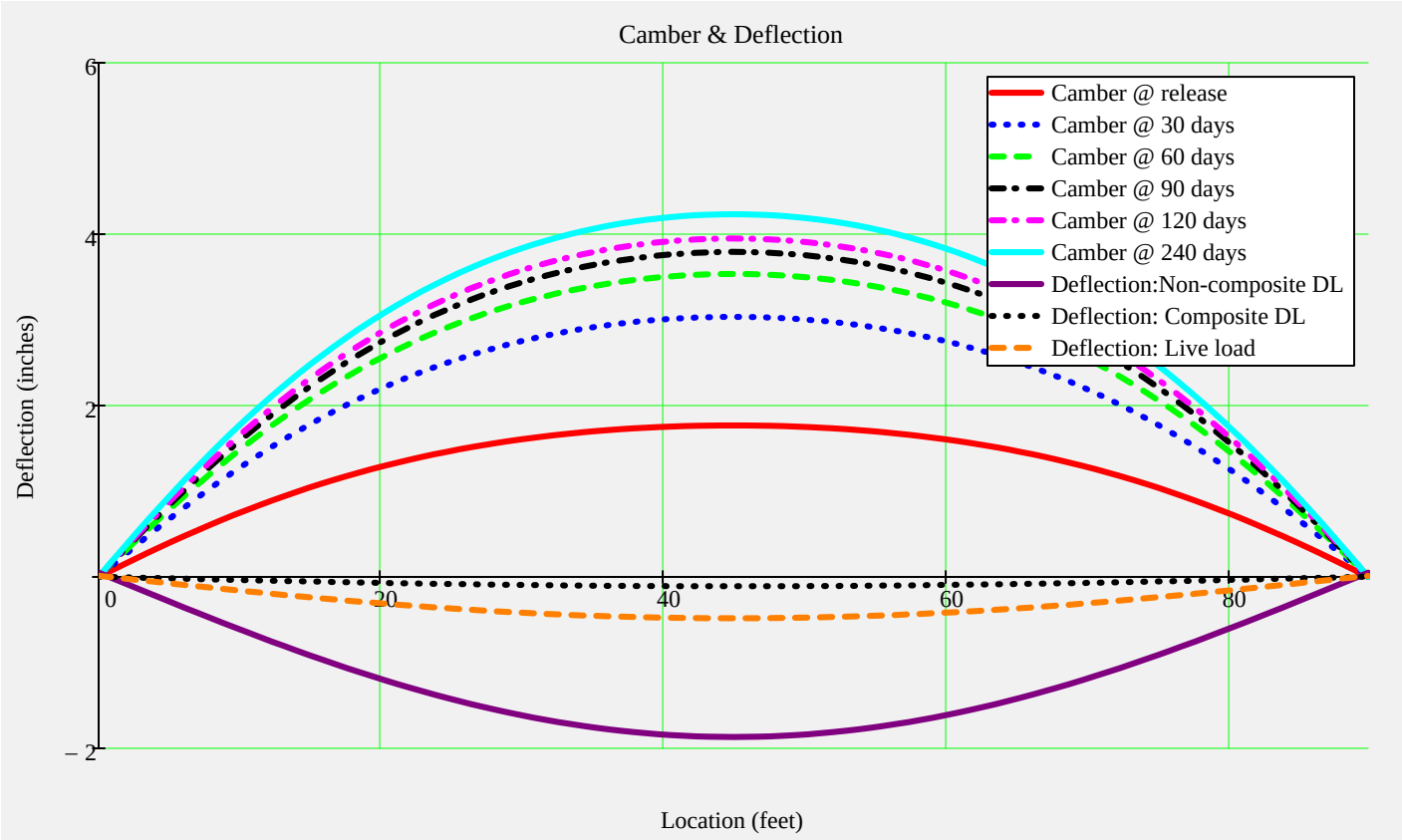
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 88.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.08	–0.78	0.40	1.77
"30 Days"	–0.28	–1.38	0.67	3.04
"60 Days"	–0.36	–1.61	0.78	3.54
"90 Days"	–0.40	–1.73	0.84	3.79
"120 Days"	–0.42	–1.81	0.87	3.95
"240 Days"	–0.46	–1.94	0.93	4.23
"Non-comp DL"	–0.23	0.18	–0.32	–1.87
"Comp DL"	–0.01	0.02	–0.02	–0.11
"LL"	–0.03	0.08	–0.08	–0.48

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.97 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

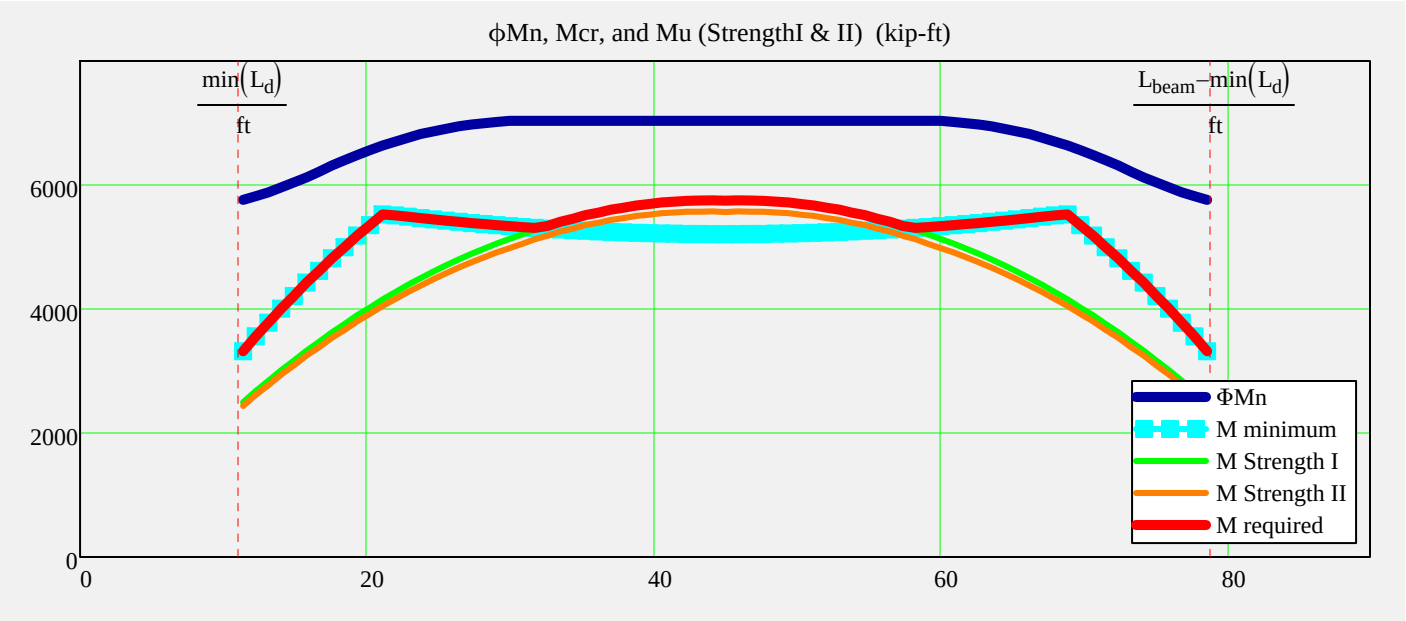
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5753 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5207 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5747 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7035 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11\ \text{ft}$ $L_{beam} - \min(L_d) = 78.8\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.83$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

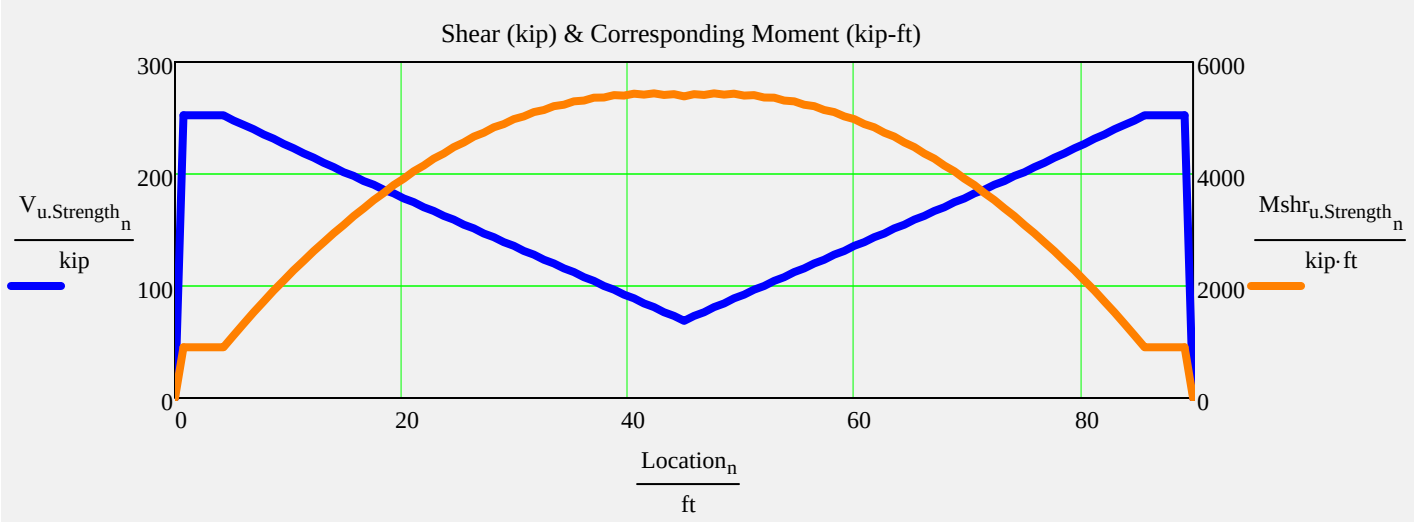
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

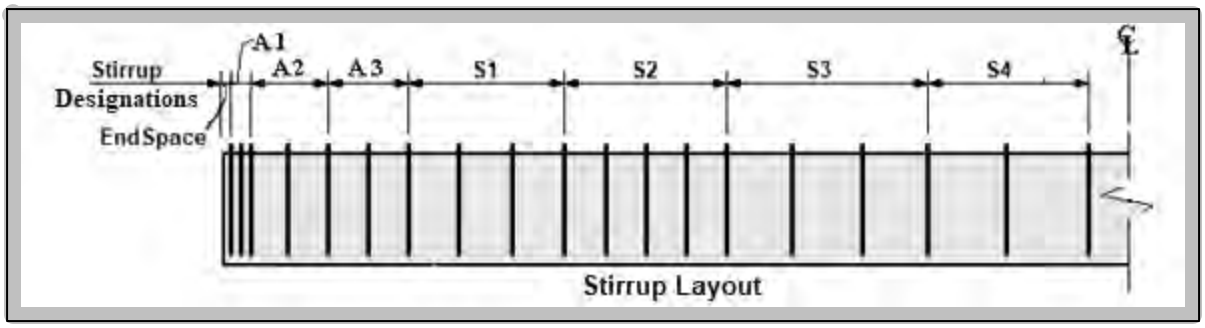
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 270 \\ 264 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 252.4 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5440 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	28	20	5	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

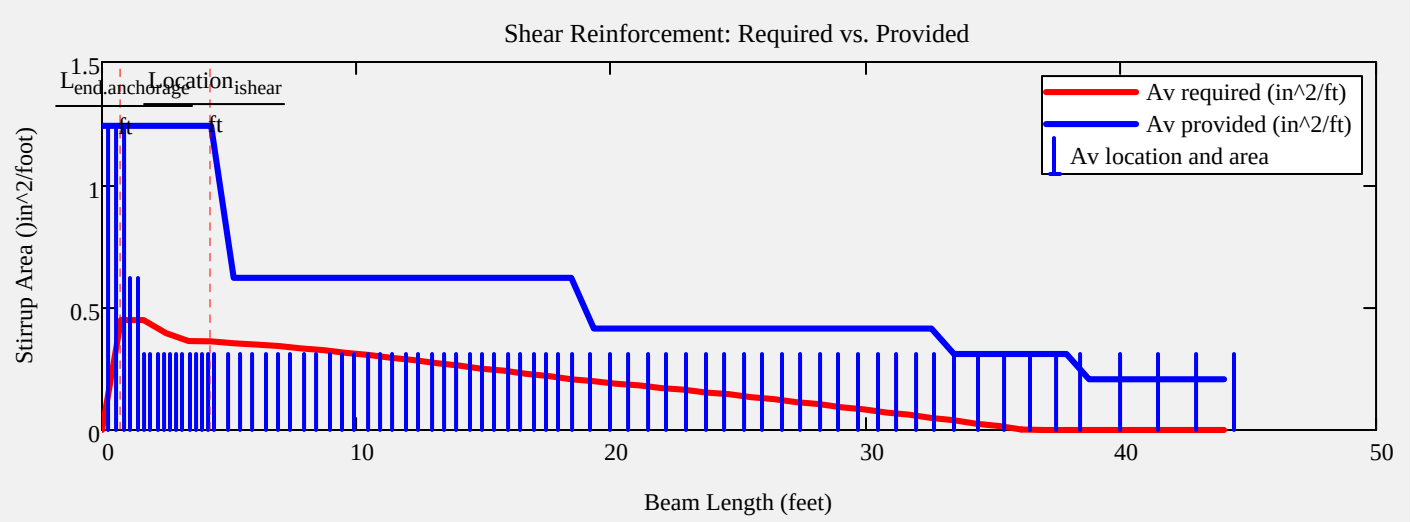
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.28\ ft$

Save Data File

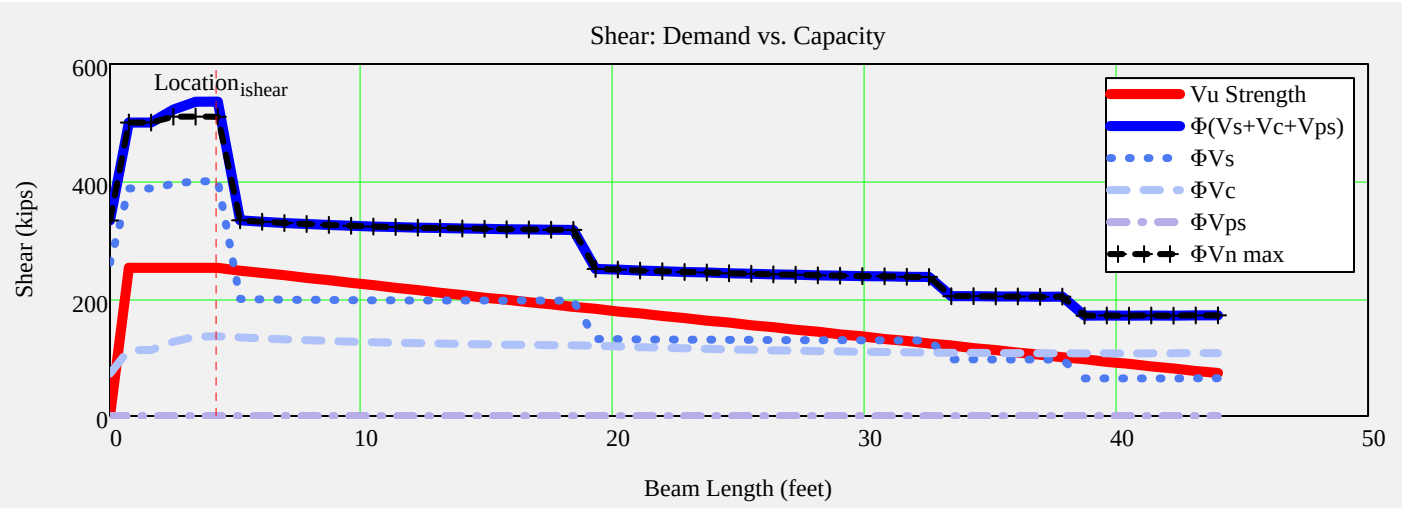
Use current input file

File Name FIB36-90ftSpan_NoSkew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\WB

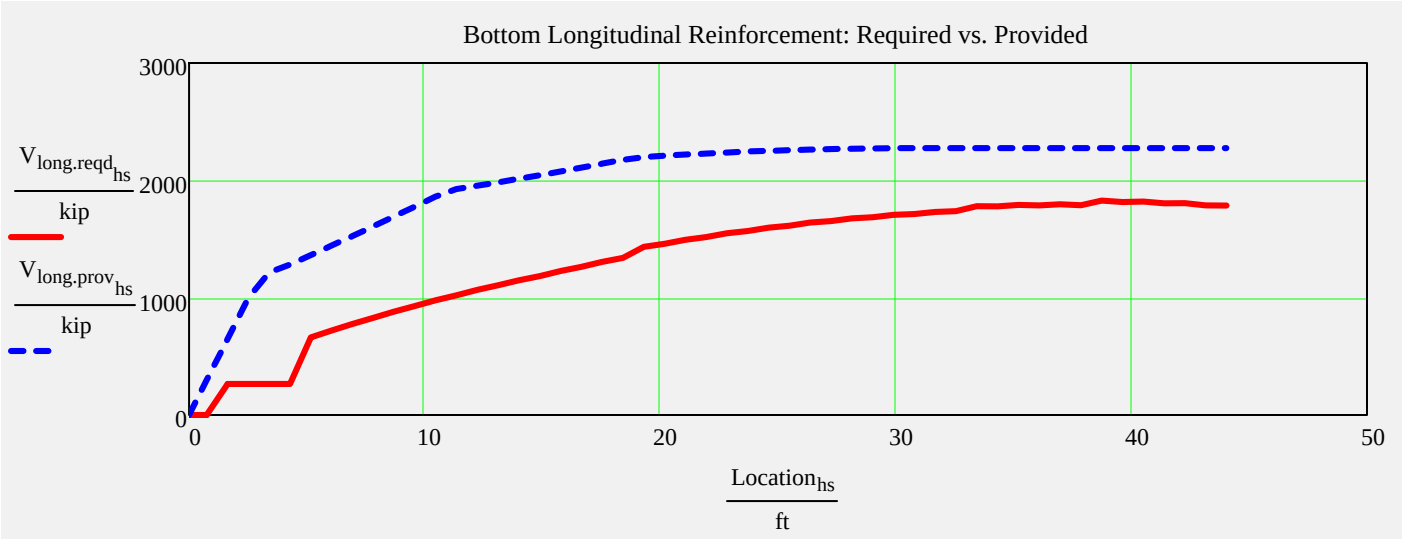
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 5.17 & 247.69 & 333.49 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.74$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

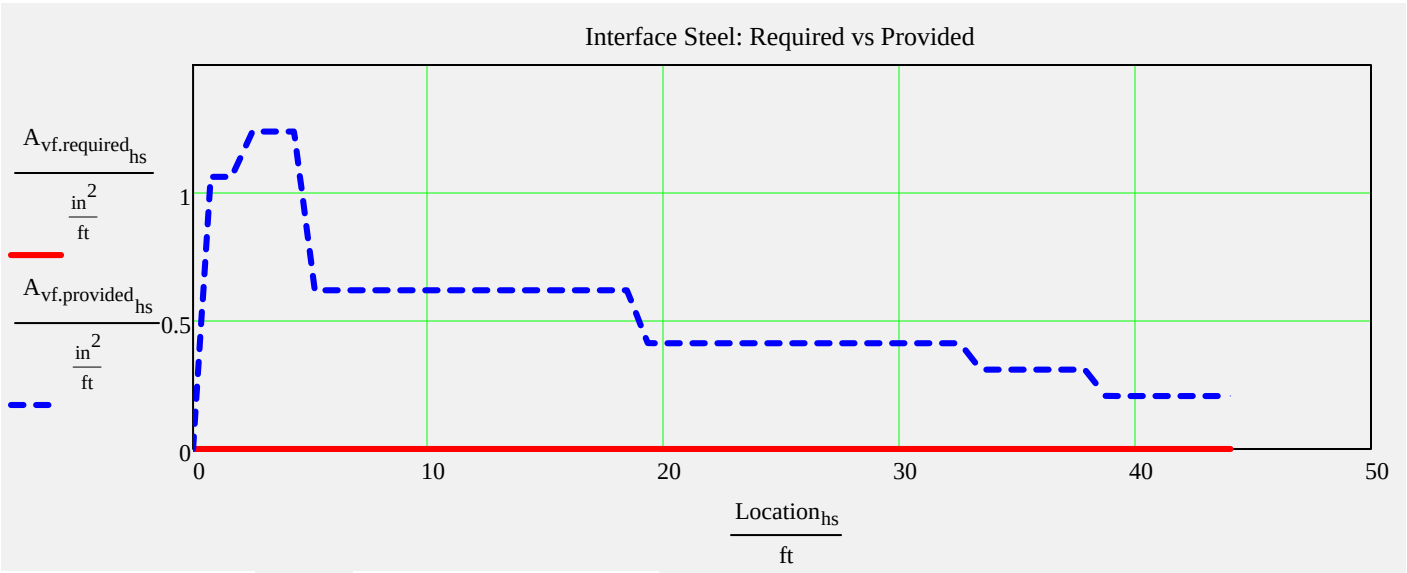


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 38.7 & 1826.9 & 2274.6 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.80$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 22.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

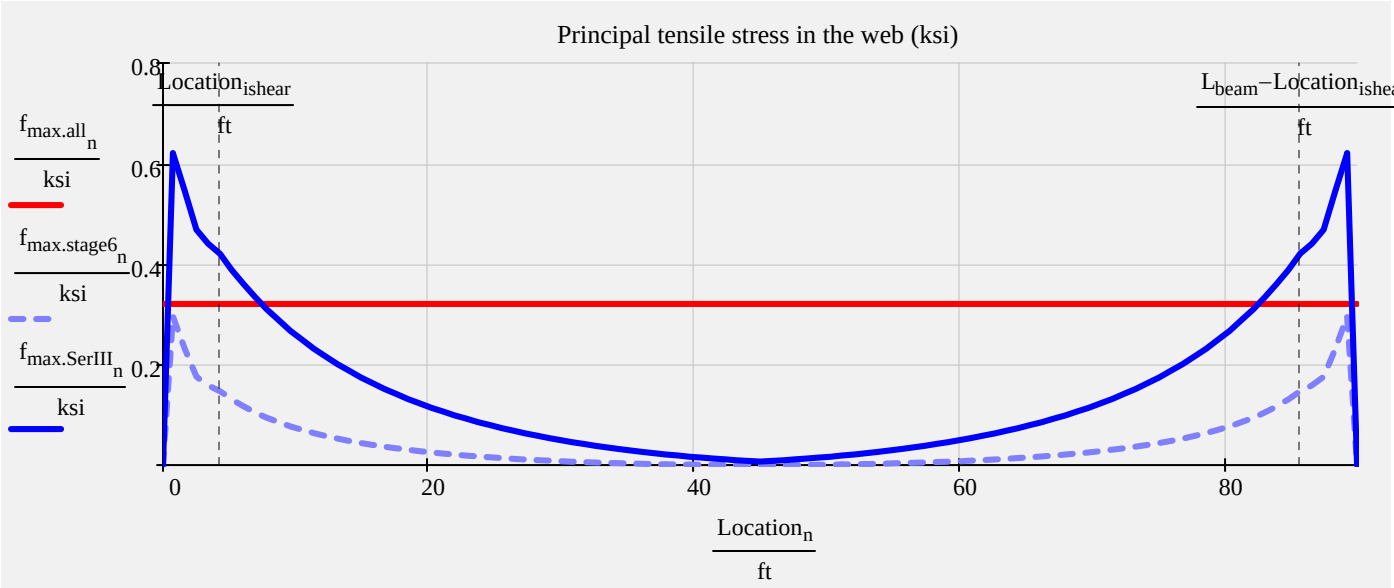
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 51.4 \cdot in$ $\max(DC_f_{max.web}) = 1.31$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

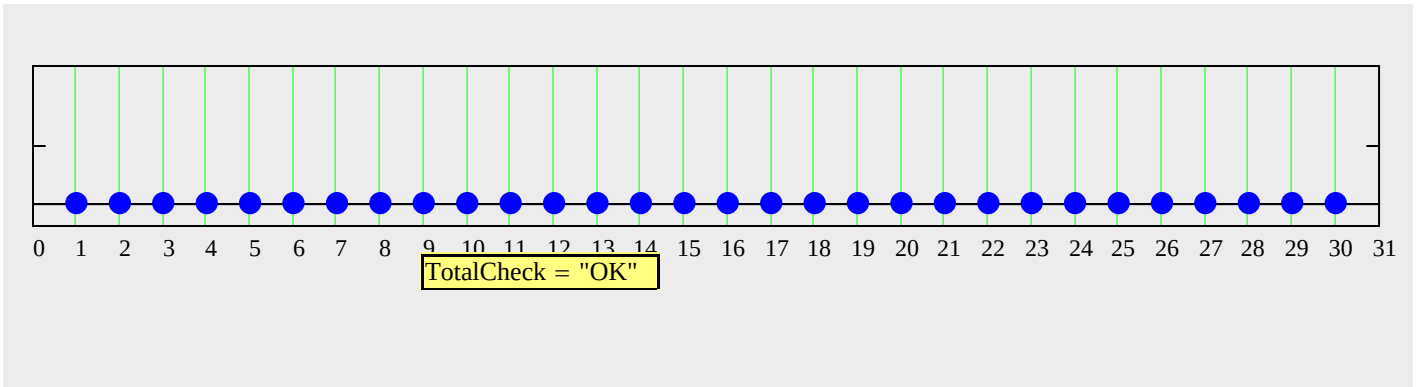
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.82	1.38	"N/A"	45.05	0.82	1.56	"N/A"	4.42	HL-93
"Strength I (Op)"	0.82	1.78	"N/A"	43.28	0.82	2.03	"N/A"	4.42	HL-93
"Service III (Inv)"	0.82	1.37	"N/A"	45.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.82	1.47	"N/A"	43.28	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.82	1.45	87.16	43.28	0.82	1.56	93.74	18.55	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.77$ $DC_{LongReinf.Permit} = 0.80$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7035	"factored resistance (kip-ft)...."
"γDL"	2344	"factored dead load (kip-ft)...."
"γLL"	2630	"factored live load (kip-ft)....."
"RF"	1.78	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	333.5	"factored resistance (kip)....."
"γDL"	95.6	"factored dead load (kip)....."
"γLL"	117.3	"factored live load (kip)....."
"RF"	2.03	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 90 FEET (NO SKEW)
WESTBOUND BRIDGE
(JOSHUA CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam	
FSB	
FUB	
FlatSlab	
InvertedT	
DoubleT	

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\WB 90' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-90ftSpan_NoSkew_Exterior.dat
FIB36-90ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

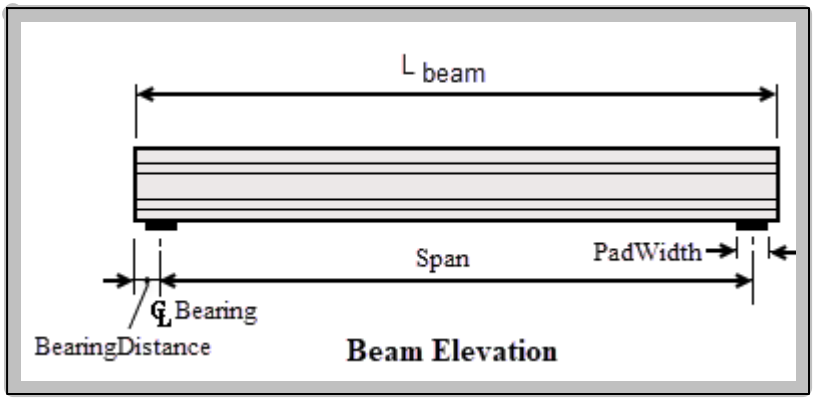
InputDataFile = "FIB36-90ftSpan_NoSkew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	WB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-90ftSpan_NoSkew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	89.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	8.3333	ft	*Measured from beam centerline to centerline.*
Overhang	3.708333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.375	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(*0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	7		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

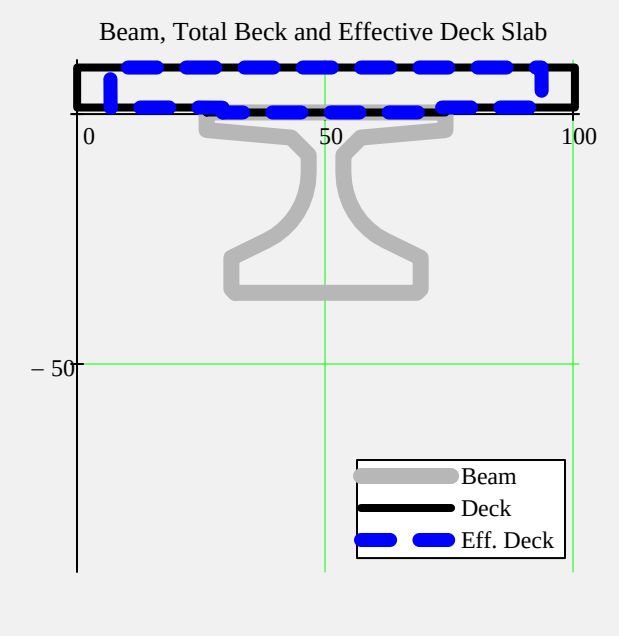
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 100·in

$b_e = 100 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.94 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.09 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.12 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 89.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

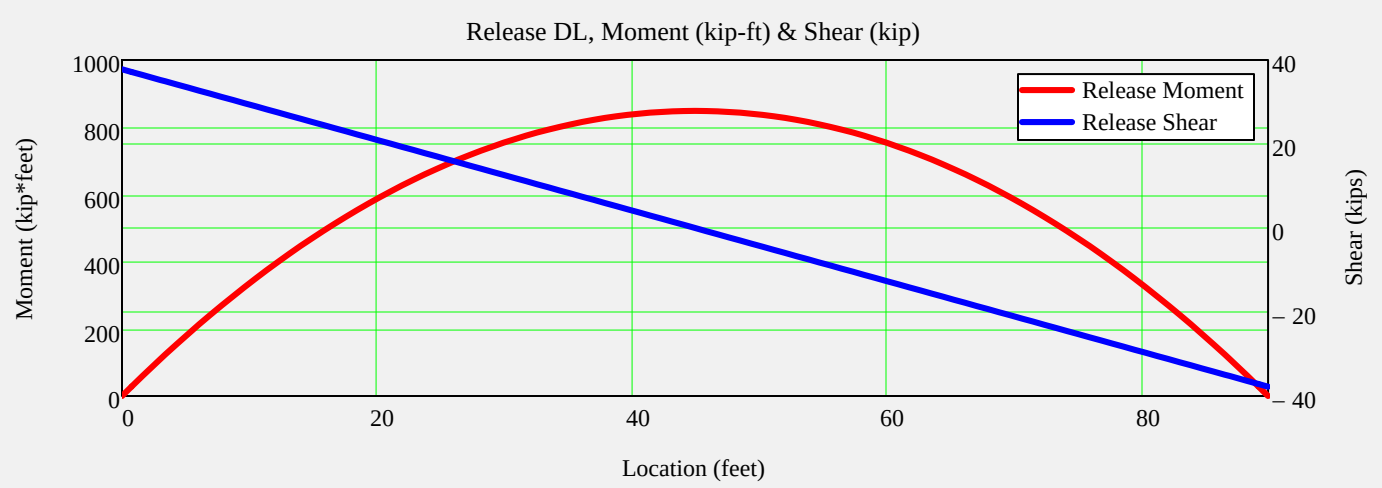
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

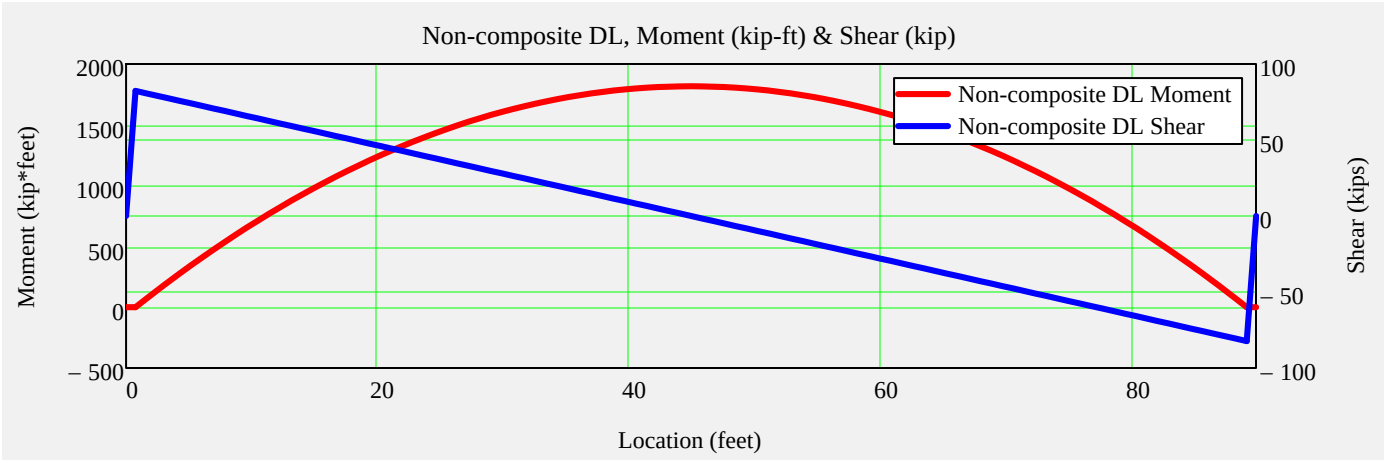
Release Dead Load Moments and Shears

$L_{span} = 88.33\ ft$



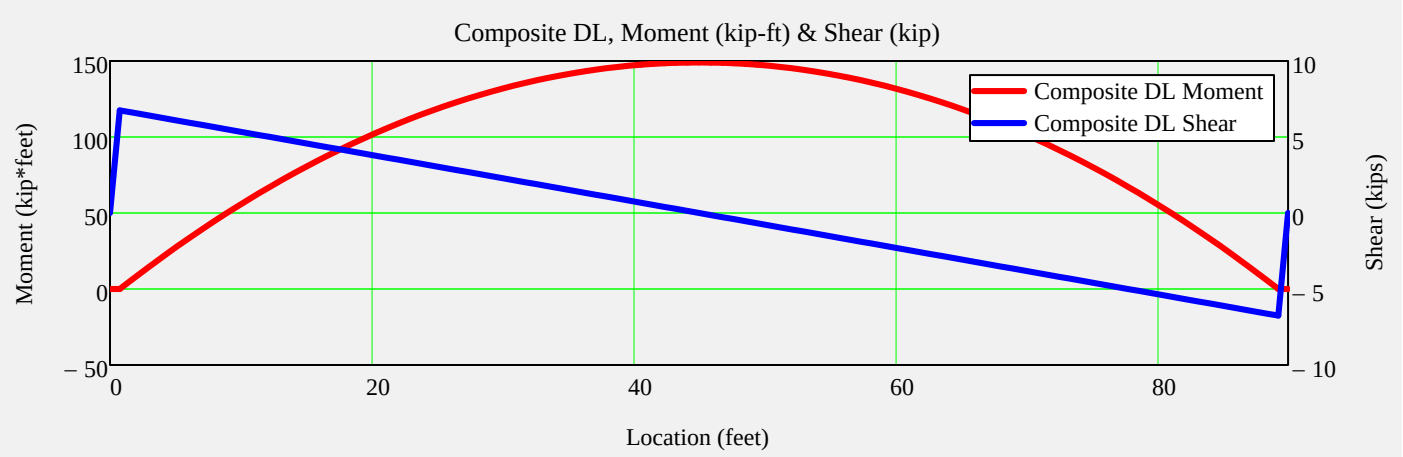
$\max(V_{release}) = 37.8 \cdot kip$ $\max(M_{release}) = 848.4 \cdot kip \cdot ft$ $\min(V_{release}) = -37.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 82.3 \cdot kip$ $\max(M_{dl.non.comp}) = 1816.7 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -82.3 \cdot kip$

Composite Dead Load Moments and Shear



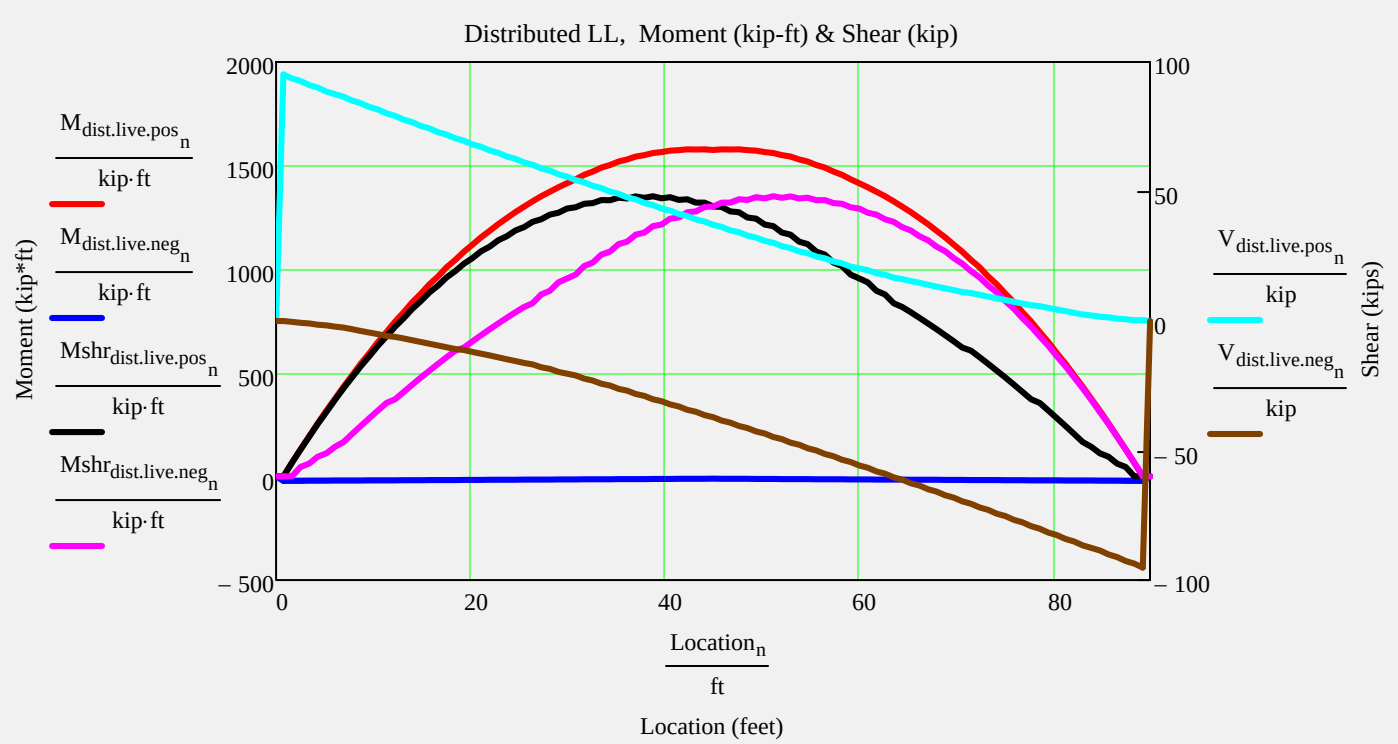
$\max(V_{dl.comp}) = 6.8 \cdot kip$ $\max(M_{dl.comp}) = 149.0 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -6.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 88.33\ ft$ BeamSpacing $= 8.33\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.67$ $g_{mom.fatigue} = 0.39$ $g_{shear} = 0.84$



$\max(V_{dist.live.pos}) = 95.2 \cdot kip$

$\max(M_{dist.live.pos}) = 1578.4 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -95.2 \cdot kip$

$Reaction_{LL} = 96.5 \cdot kip$

$Reaction_{DL} = 90.6 \cdot kip$

$\min(M_{dist.live.neg}) = -21.4 \cdot kip \cdot ft$

$\max(Mshr_{dist.live.pos}) = 1352 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.0 \cdot kip$ $Reaction_{lane} = 28.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 78.5 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-90ftSpan_NoSkew_Interior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.58	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		5 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity	75	%	*% relative humidity (75% typical)*
Time: jacking to transfer	1.5	days	*Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

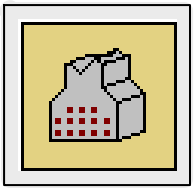
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

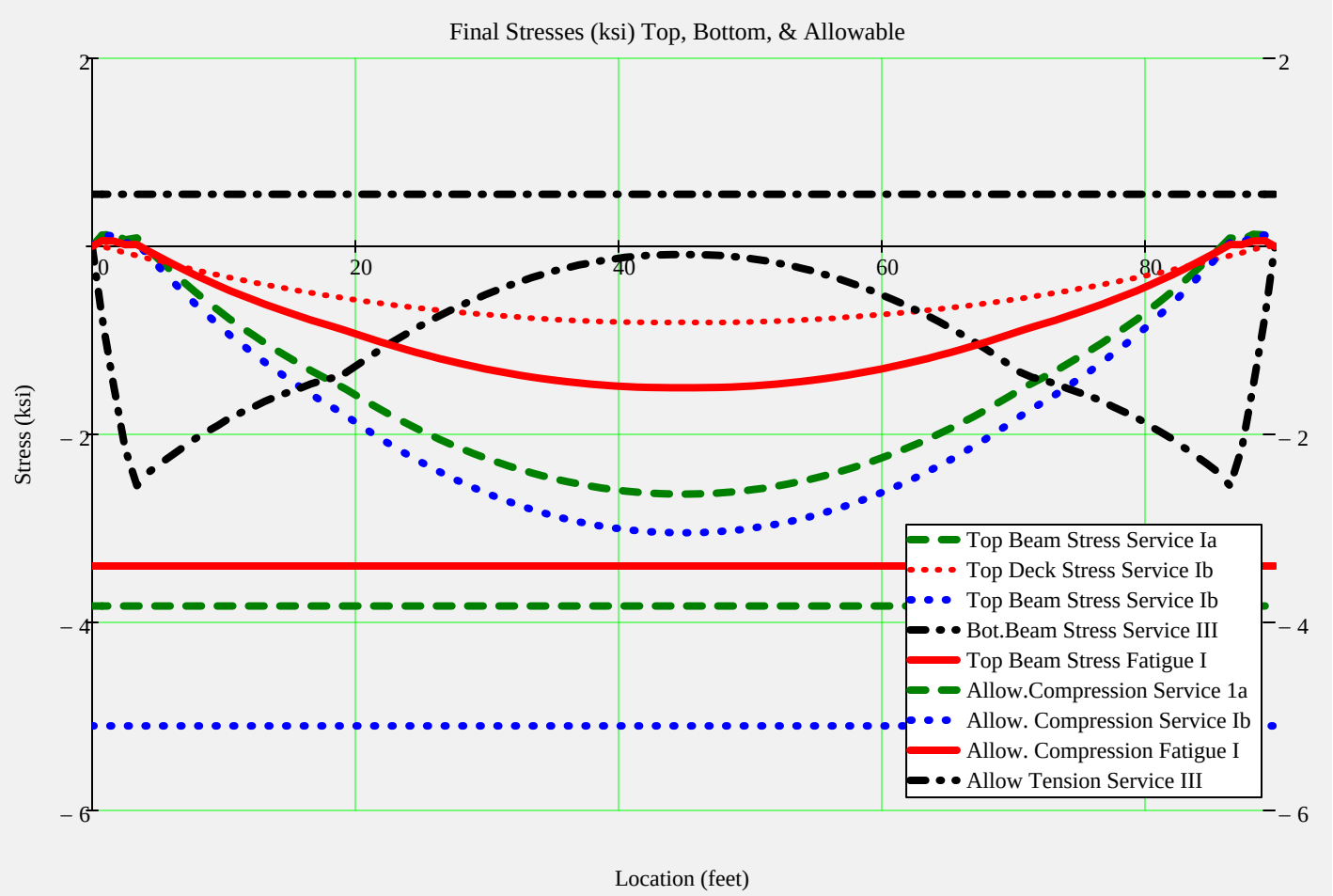
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

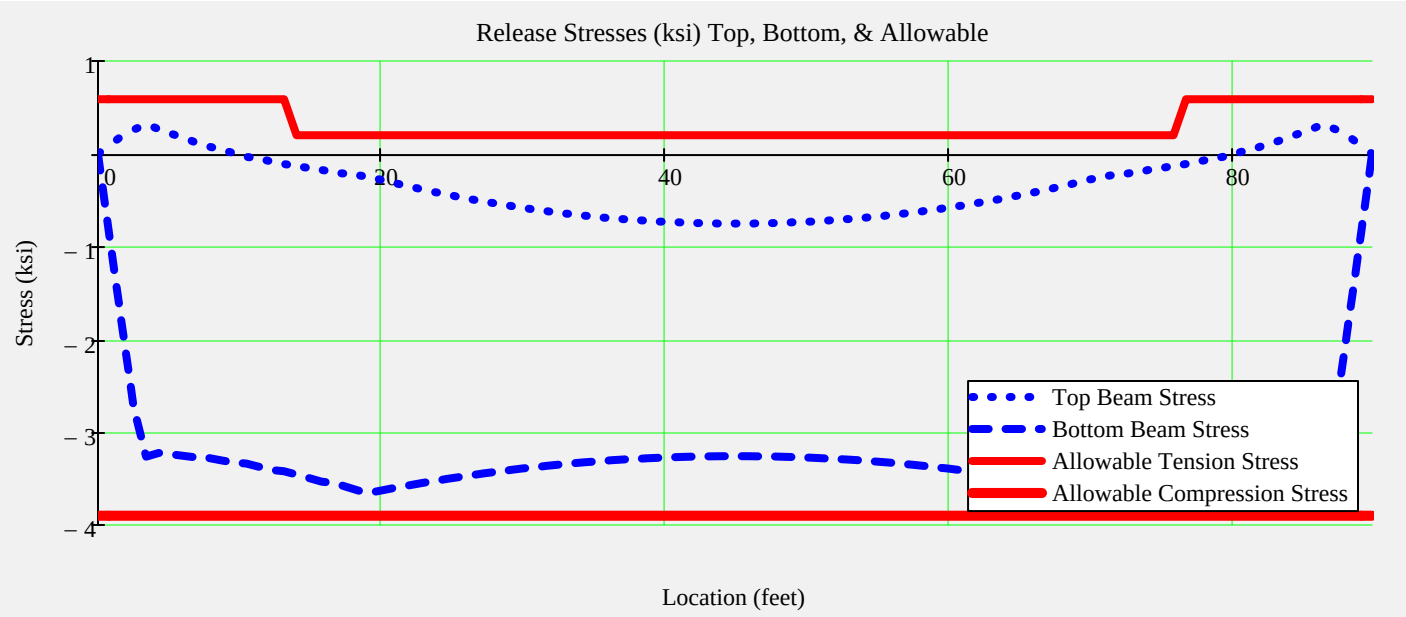
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.80$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.94$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.82$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.69$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.60$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.44$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.40	0.32	0.59
"Compression @ Release"	19.30	–3.65	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	44.92	–2.64	–3.83
"CompressionIb @ ServiceI"	44.92	–3.05	–5.10
"Compression @ FatigueI"	45.80	–1.50	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

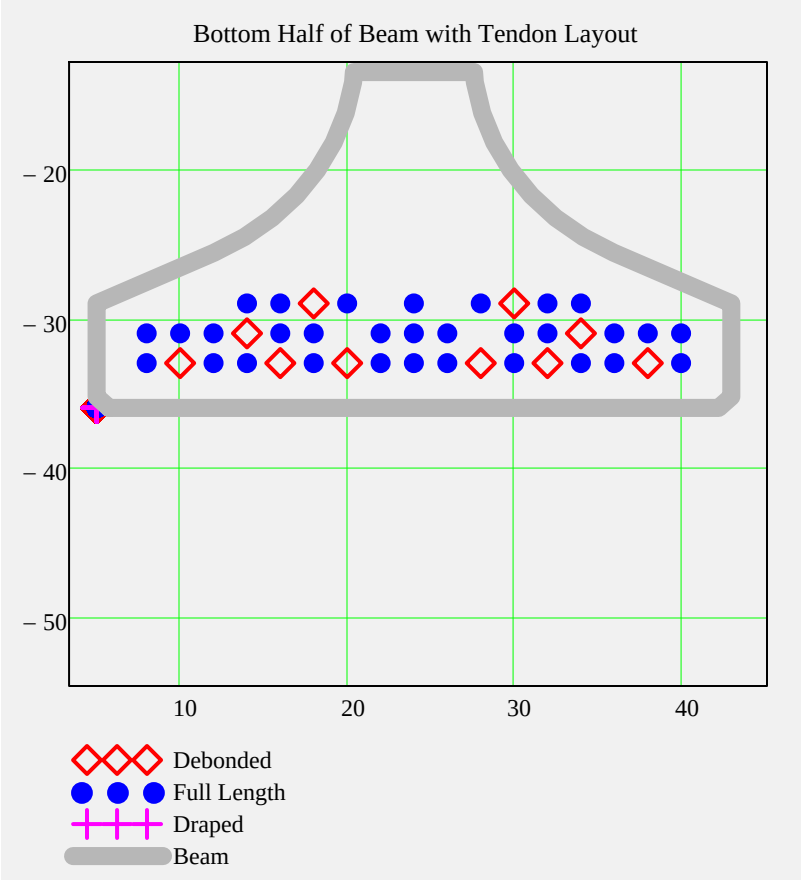
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

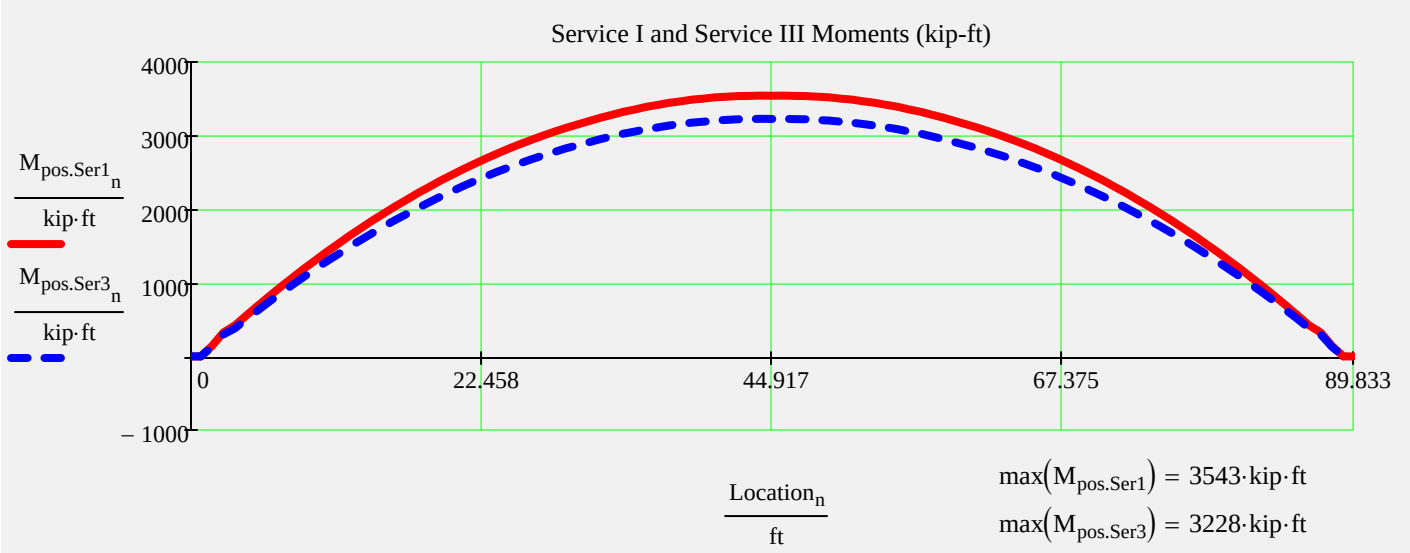
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.75 & -3.26 \\ \text{"2"} & -0.85 & -2.69 \\ \text{"4"} & -0.80 & -2.73 \\ \text{"6"} & -2.60 & -1.30 \\ \text{"8"} & -3.05 & -0.09 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1842 & -1743 \\ \text{"@Final (about composite centroid)"} & -1608 & -1431 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1607.7	384625	–8.4

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	848
"Non-Composite DL (incl. beam wt.)"	1817
"Composite Dead Load"	149
"Distributed Live Load"	1575

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

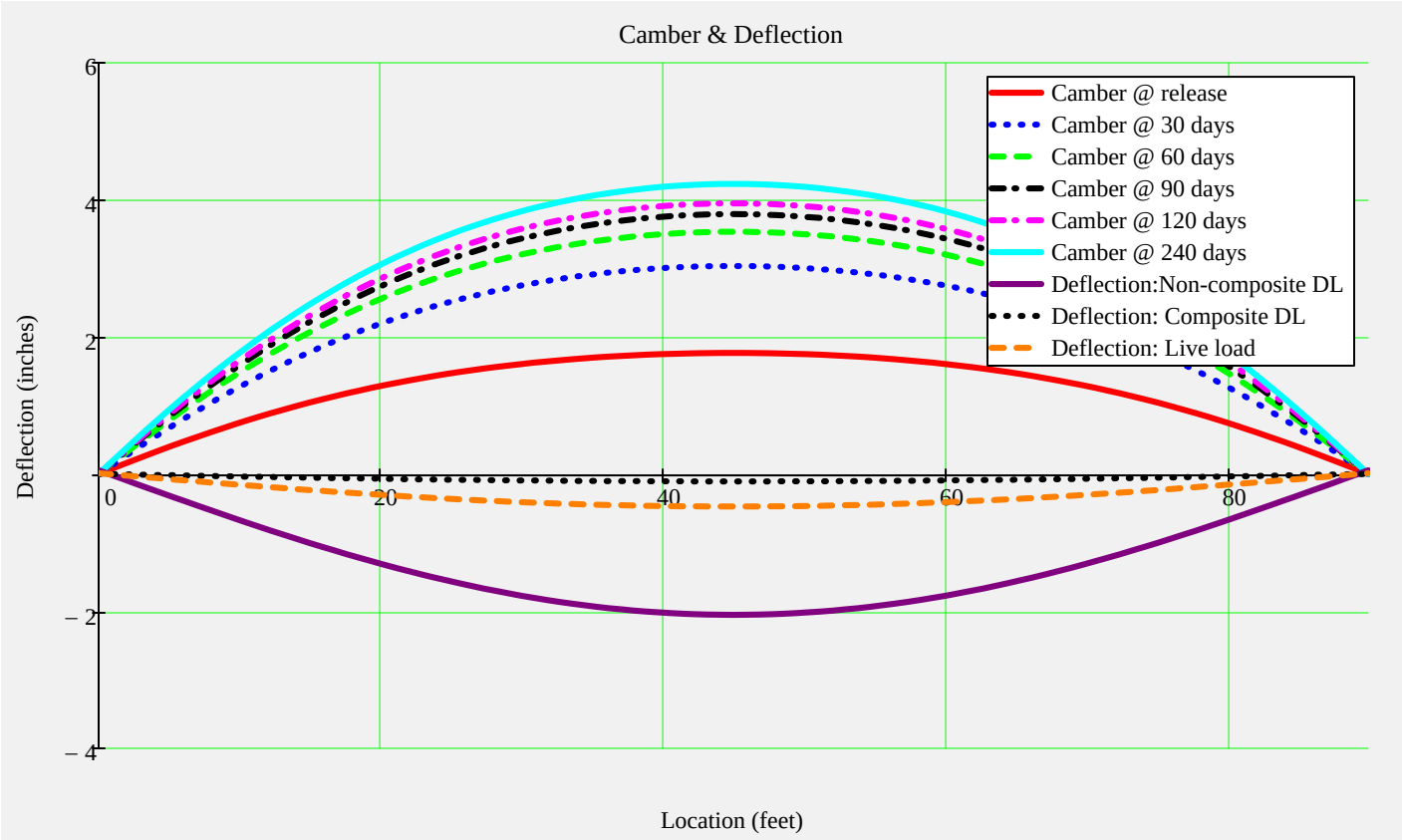
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 88.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.08	–0.78	0.40	1.77
"30 Days"	–0.28	–1.38	0.67	3.04
"60 Days"	–0.36	–1.61	0.78	3.54
"90 Days"	–0.40	–1.73	0.84	3.79
"120 Days"	–0.42	–1.81	0.87	3.95
"240 Days"	–0.46	–1.94	0.93	4.23
"Non-comp DL"	–0.25	0.20	–0.36	–2.05
"Comp DL"	–0.01	0.02	–0.02	–0.11
"LL"	–0.02	0.08	–0.08	–0.47

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.79 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

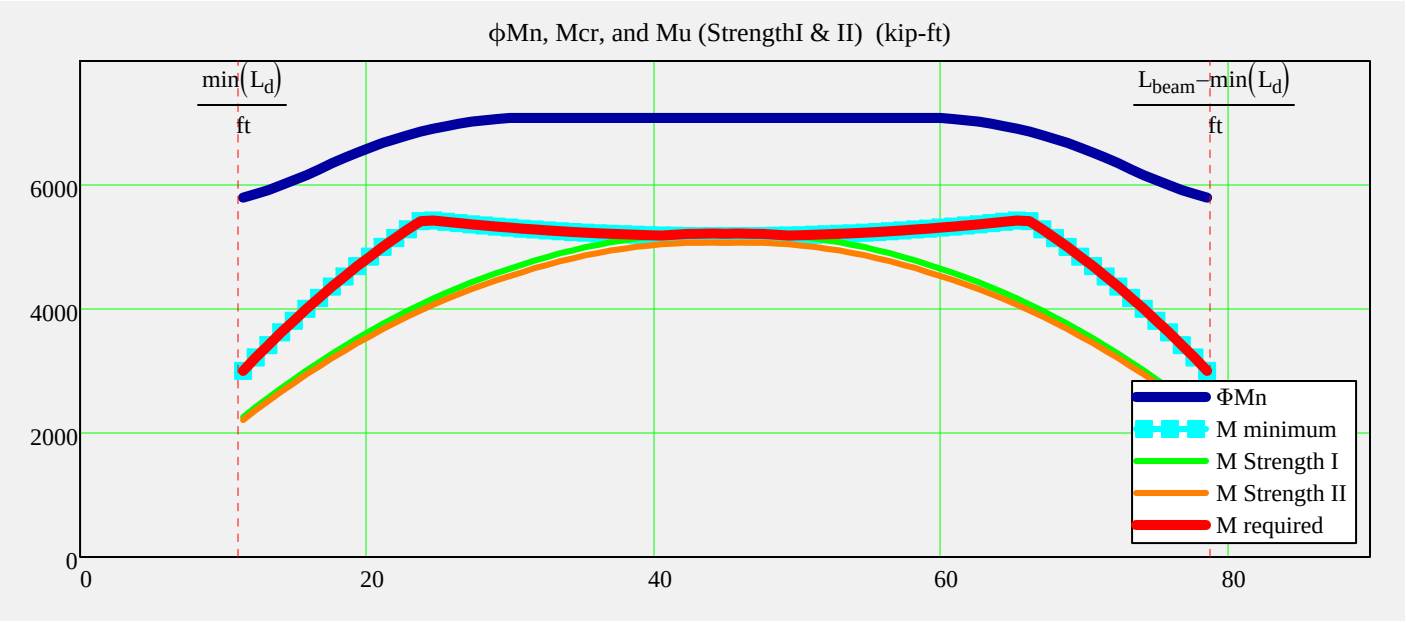
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5218 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5173 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5213 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7082 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.1\ \text{ft}$ $L_{beam} - \min(L_d) = 78.7\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.79$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

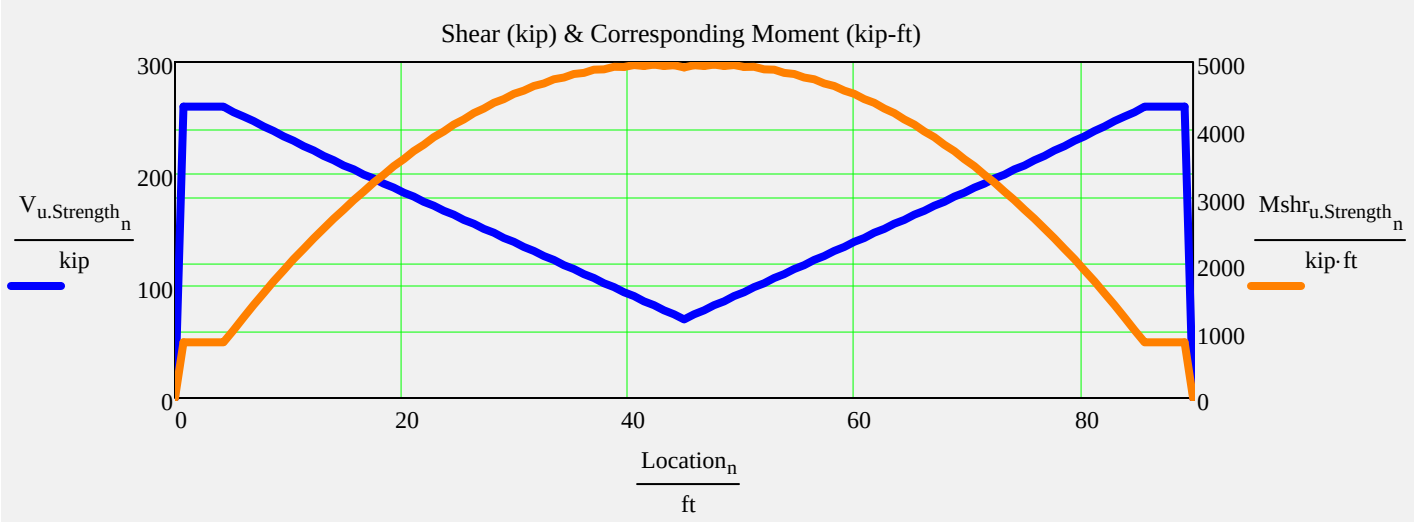
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

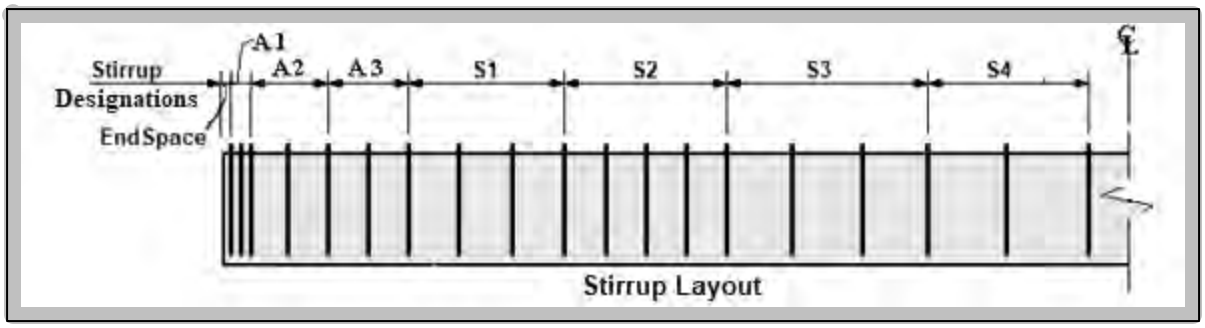
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 278 \\ 272 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 260.1 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 4963 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	28	20	5	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

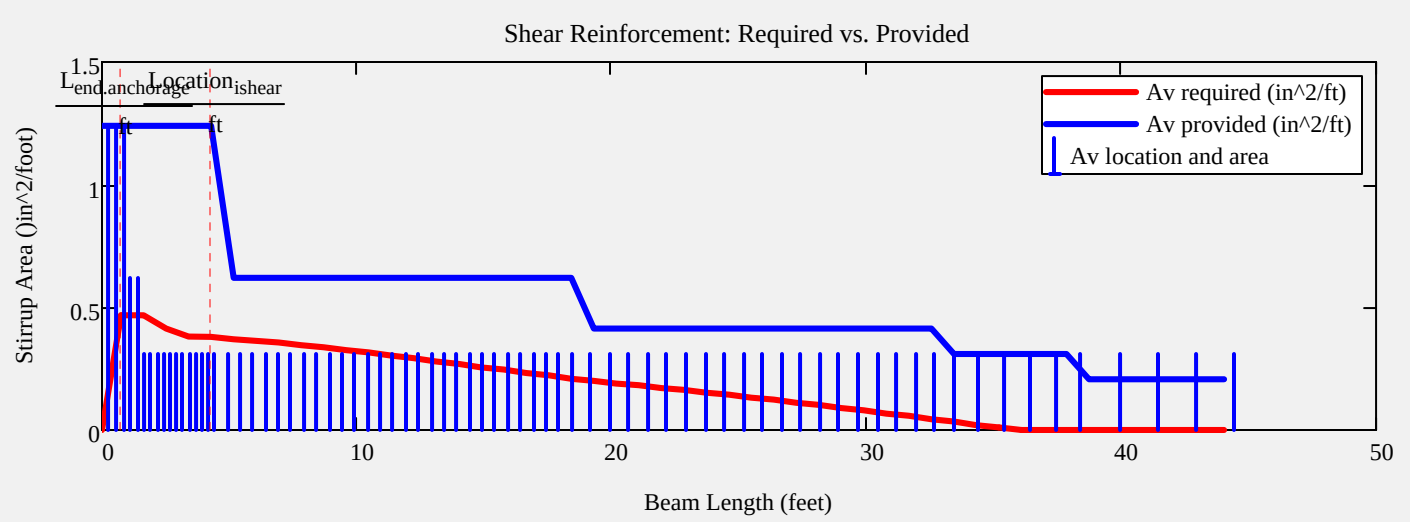
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.28\ ft$

Save Data File

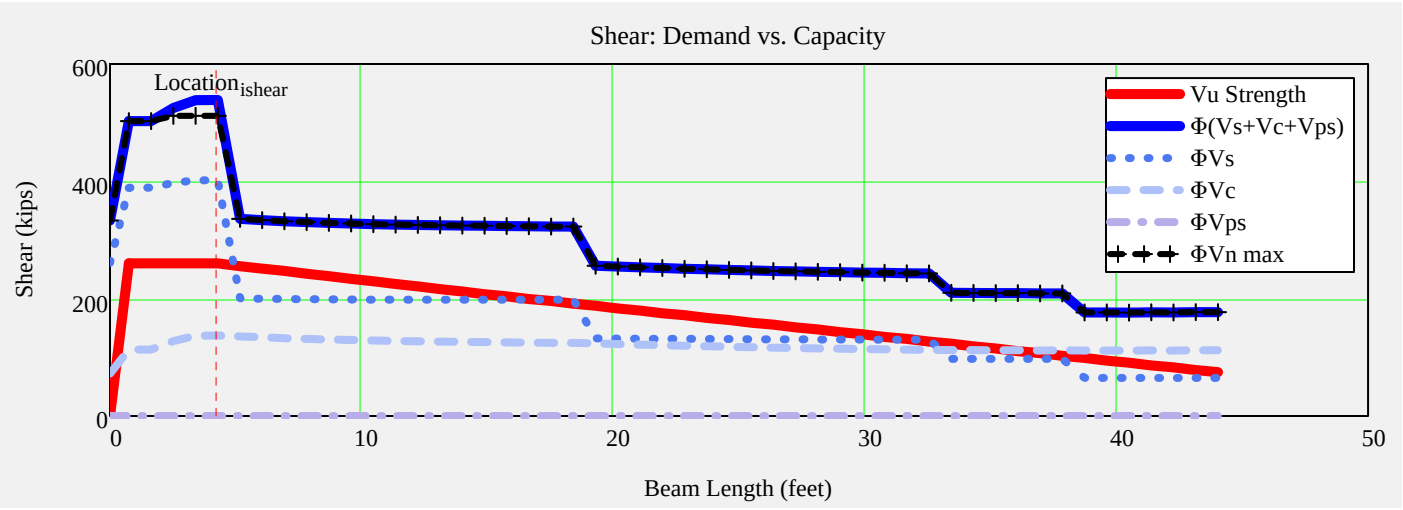
Use current input file

File Name FIB36-90ftSpan_NoSkew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\WB

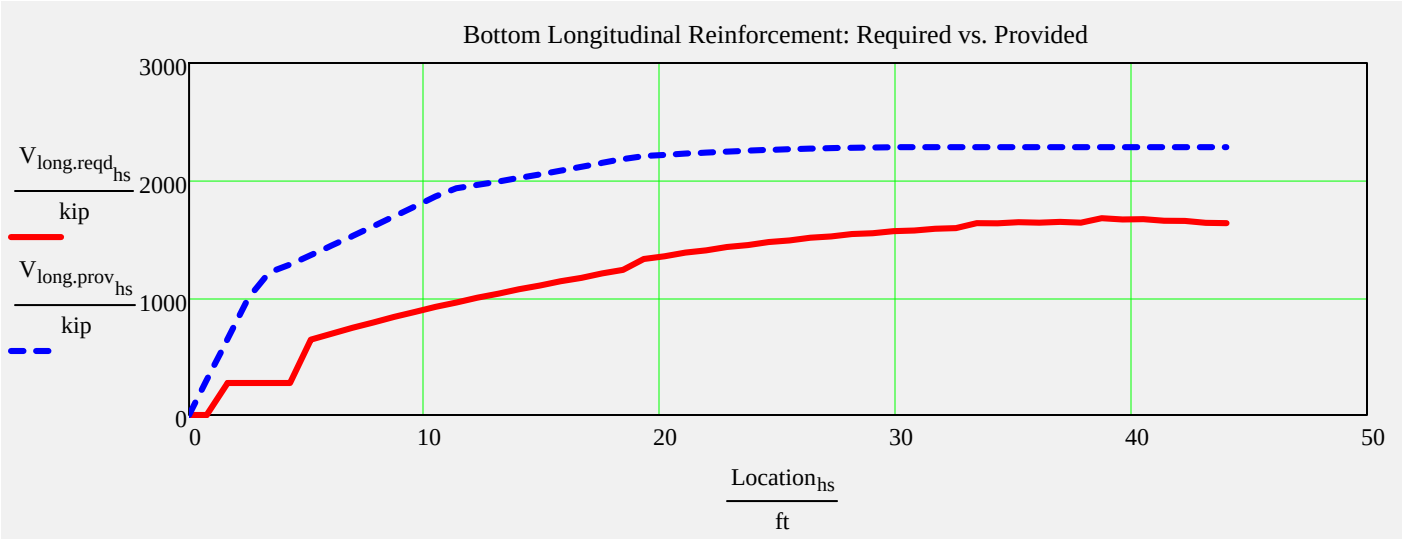
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 5.17 & 255.18 & 335.96 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.76$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

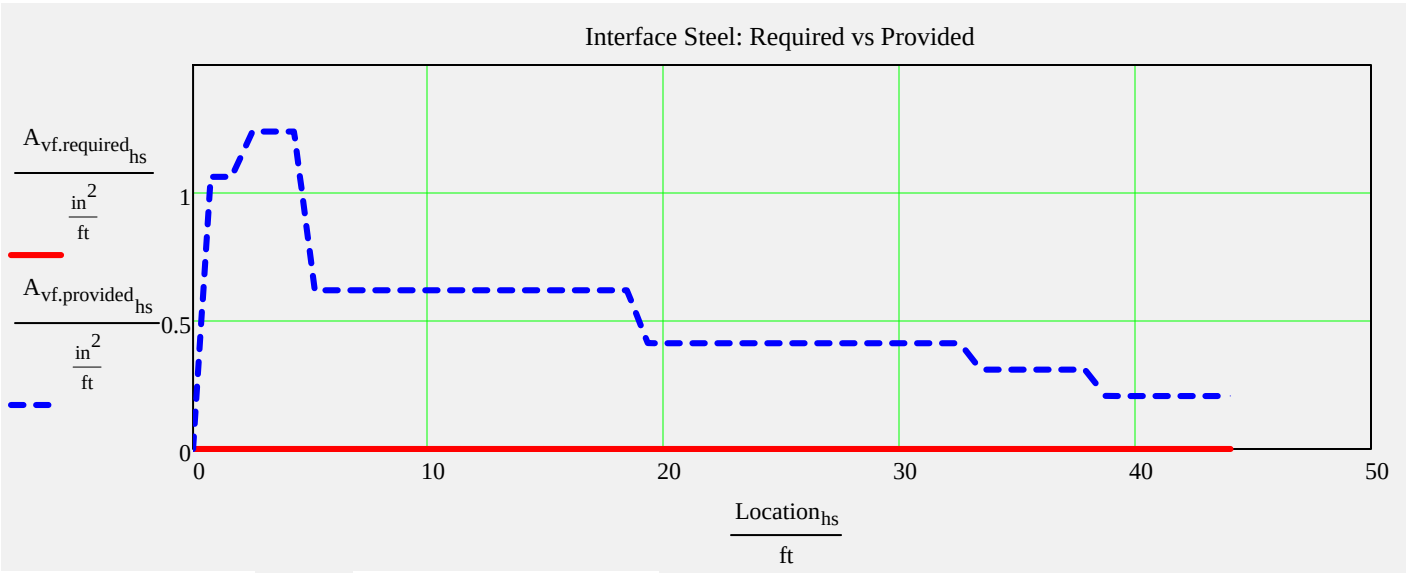


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 38.7 & 1676.6 & 2283.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.73$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 22.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

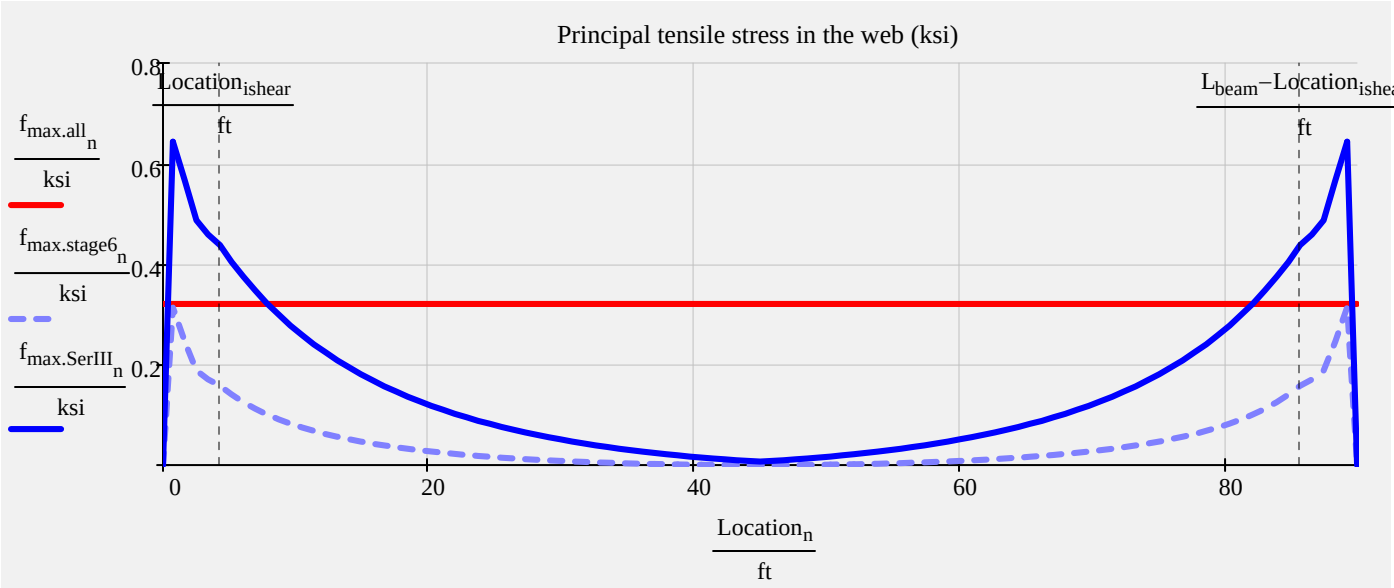
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $\text{Location}_{ishear} = 51.4\cdot in$ $\max(DC_f_{max.web}) = 1.36$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450\cdot kip$ $P_{prestress} = 1362\cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

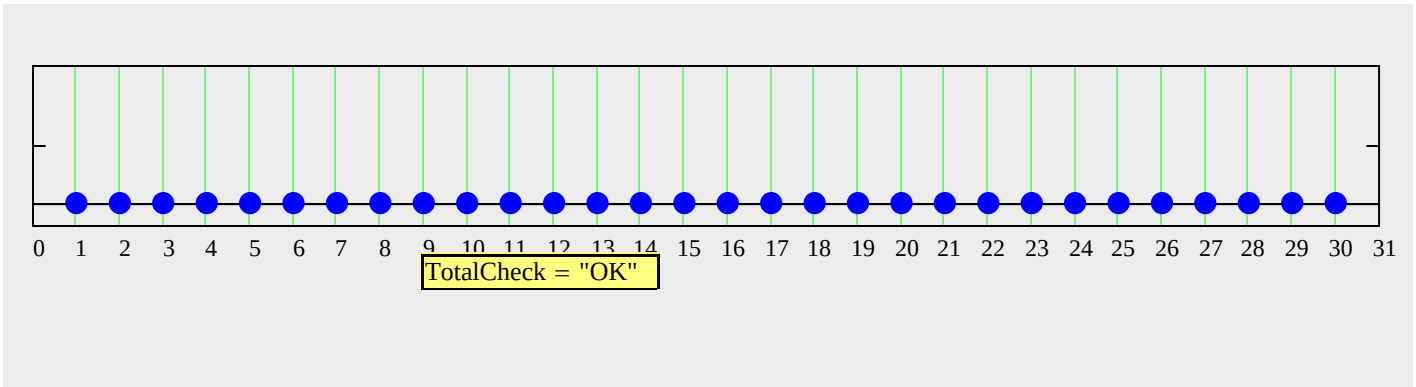
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.67	1.67	"N/A"	43.28	0.84	1.52	"N/A"	4.42	HL-93
"Strength I (Op)"	0.67	2.17	"N/A"	45.05	0.84	1.97	"N/A"	4.42	HL-93
"Service III (Inv)"	0.67	1.59	"N/A"	45.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.67	1.72	"N/A"	45.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.67	1.77	106.09	45.05	0.84	1.55	93.12	18.55	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.71$ $DC_{LongReinf.Permit} = 0.73$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7082	"factored resistance (kip-ft)...."
"γDL"	2456	"factored dead load (kip-ft)...."
"γLL"	2131	"factored live load (kip-ft)....."
"RF"	2.17	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	336	"factored resistance (kip)....."
"γDL"	100.2	"factored dead load (kip)....."
"γLL"	119.6	"factored live load (kip)....."
"RF"	1.97	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 90 FEET (NO SKEW)
EASTBOUND BRIDGE
(JOSHUA CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 90' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-90ftSpan_NoSkew_Exterior.dat
FIB36-90ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

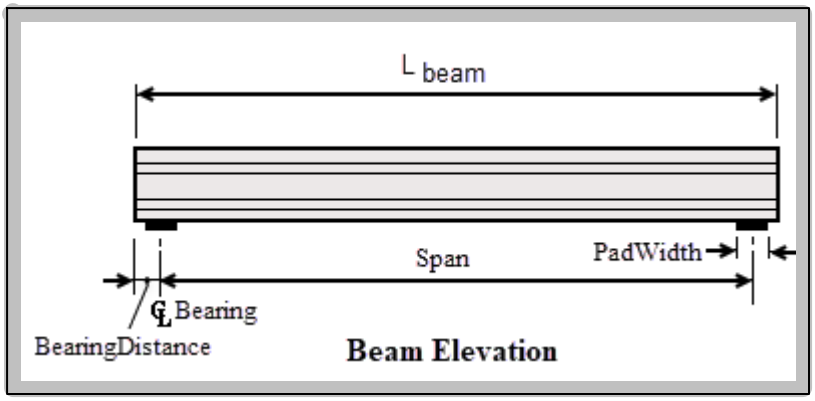
InputDataFile = "FIB36-90ftSpan_NoSkew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-90ftSpan_NoSkew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	89.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	9	ft	*Measured from beam centerline to centerline.*
Overhang	3.33333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	2.0	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	5		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

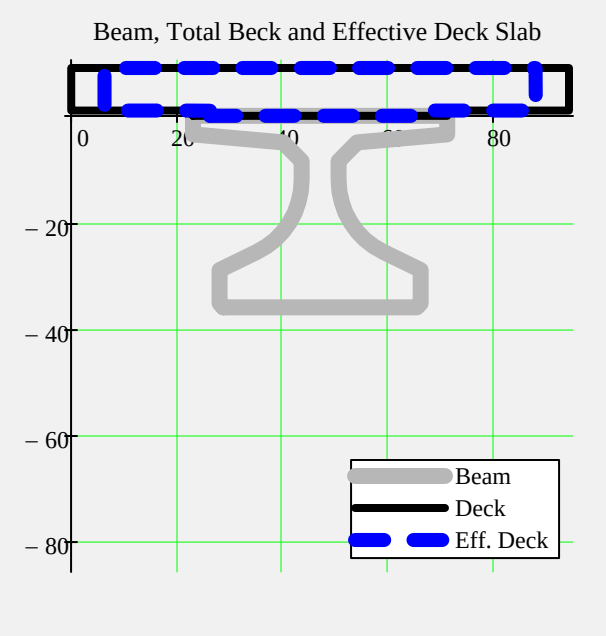
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = $108 \cdot in$

$b_e = 94 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.88 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.05 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.17 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 89.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

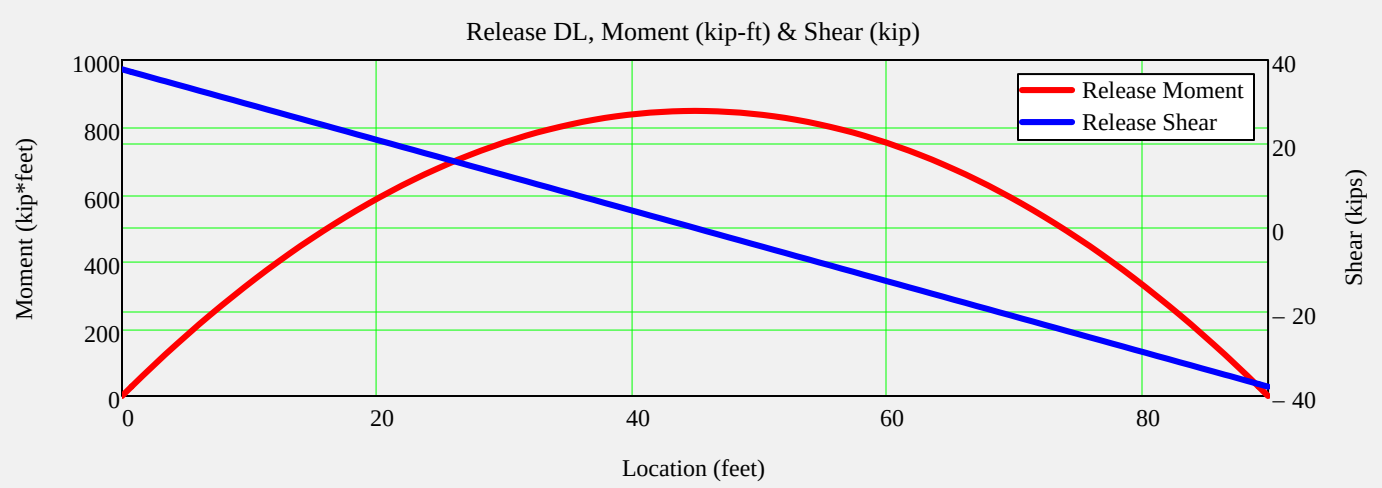
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

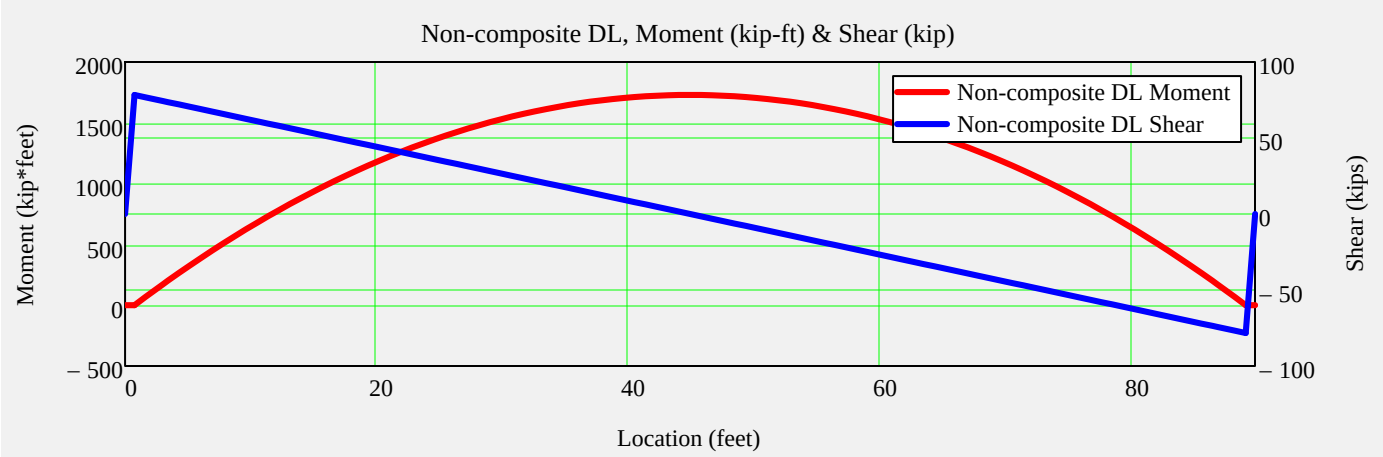
Release Dead Load Moments and Shears

$L_{span} = 88.33\ ft$



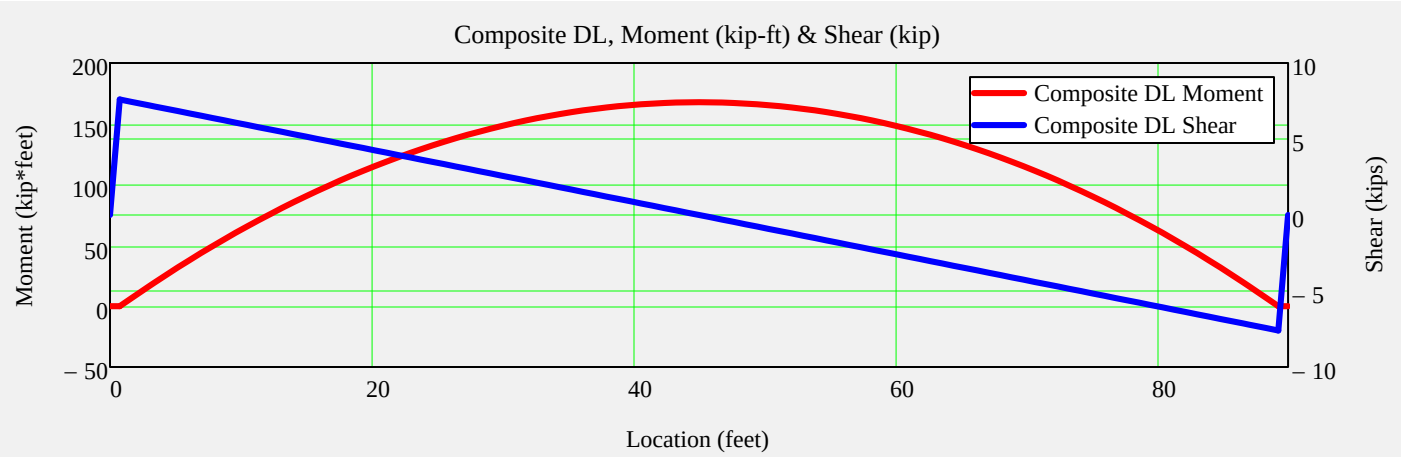
$\max(V_{release}) = 37.8 \cdot kip$ $\max(M_{release}) = 848.4 \cdot kip \cdot ft$ $\min(V_{release}) = -37.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 78.3 \cdot kip$ $\max(M_{dl.non.comp}) = 1729.1 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -78.3 \cdot kip$

Composite Dead Load Moments and Shear



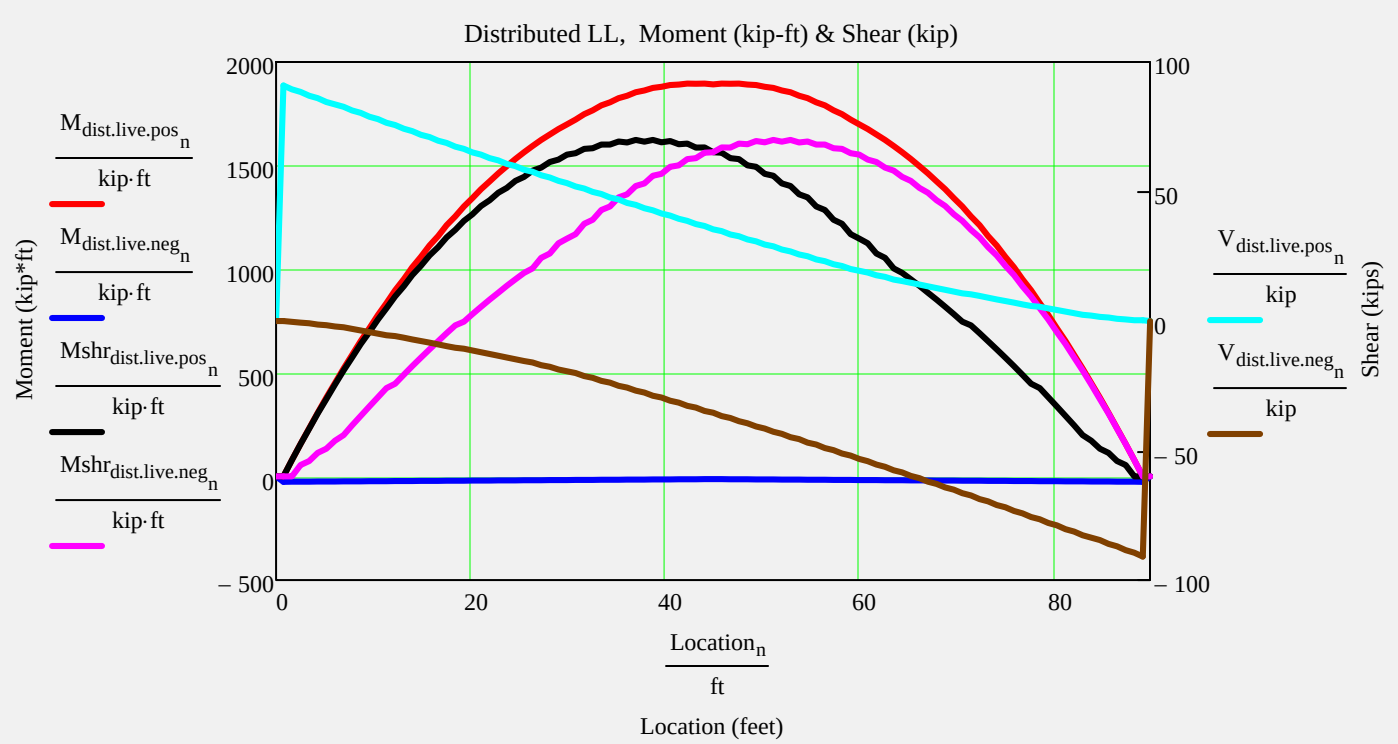
$\max(V_{dl.comp}) = 7.6 \cdot kip$ $\max(M_{dl.comp}) = 167.7 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -7.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 88.33\ ft$ BeamSpacing = 9 ft Skew = 0·deg

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor = 1.00

Final Live Load Distribution Factors: $g_{mom} = 0.8$ $g_{mom.fatigue} = 0.67$ $g_{shear} = 0.80$



$\max(V_{dist.live.pos}) = 90.9\cdot kip$

$\max(M_{dist.live.pos}) = 1896.0\cdot kip\cdot ft$

$\min(V_{dist.live.neg}) = -90.9\cdot kip$

$Reaction_{LL} = 92.2\cdot kip$

$\min(M_{dist.live.neg}) = -25.7\cdot kip\cdot ft$

$Reaction_{DL} = 87.4\cdot kip$

$\max(Mshr_{dist.live.pos}) = 1624\cdot kip\cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.0\cdot kip$ $Reaction_{lane} = 28.7\cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane})\cdot g_{shear}$

$Reaction_{LL.without.IM} = 75\cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-90ftSpan_NoSkew_Exterior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.58	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		5 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

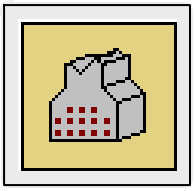
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

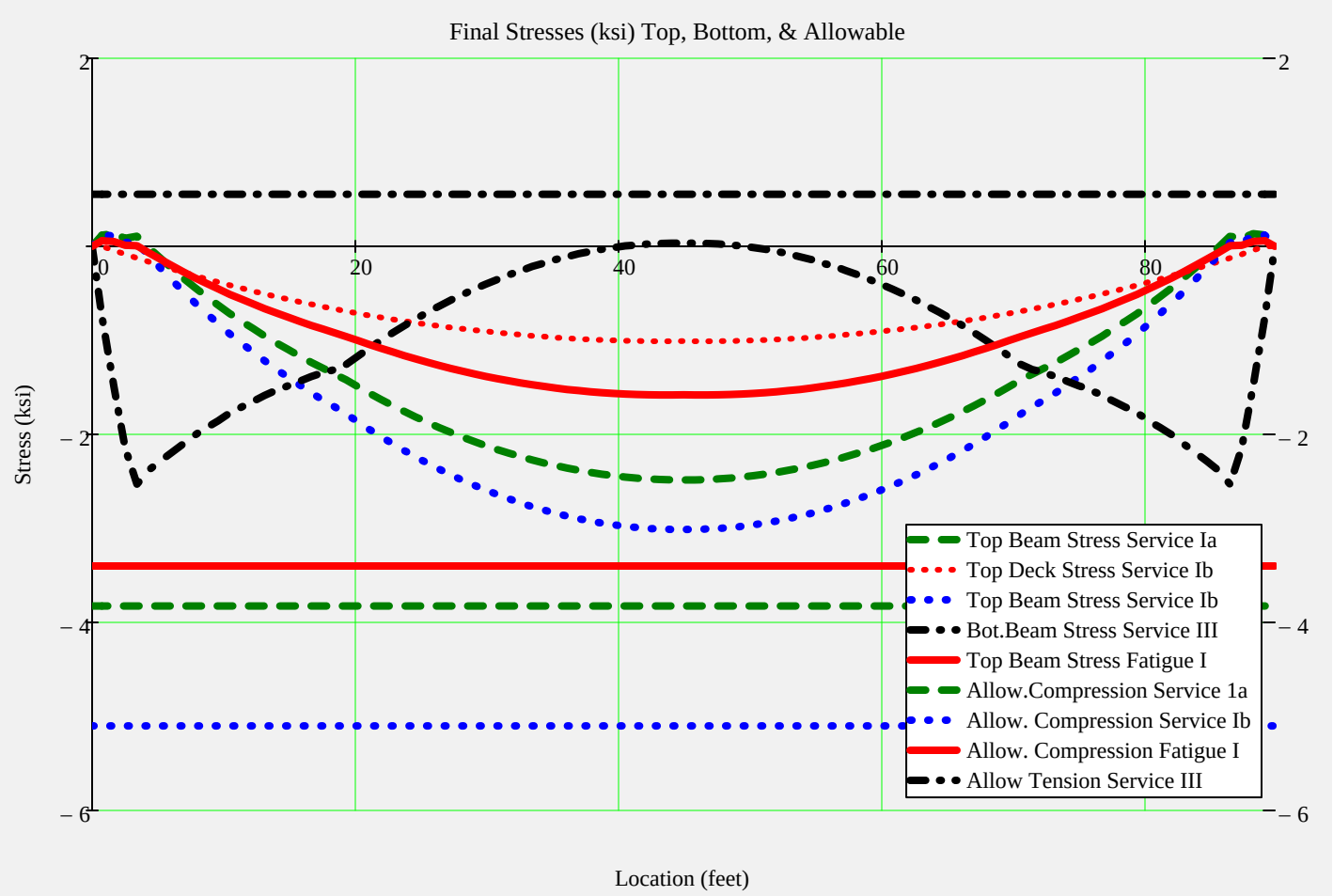
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

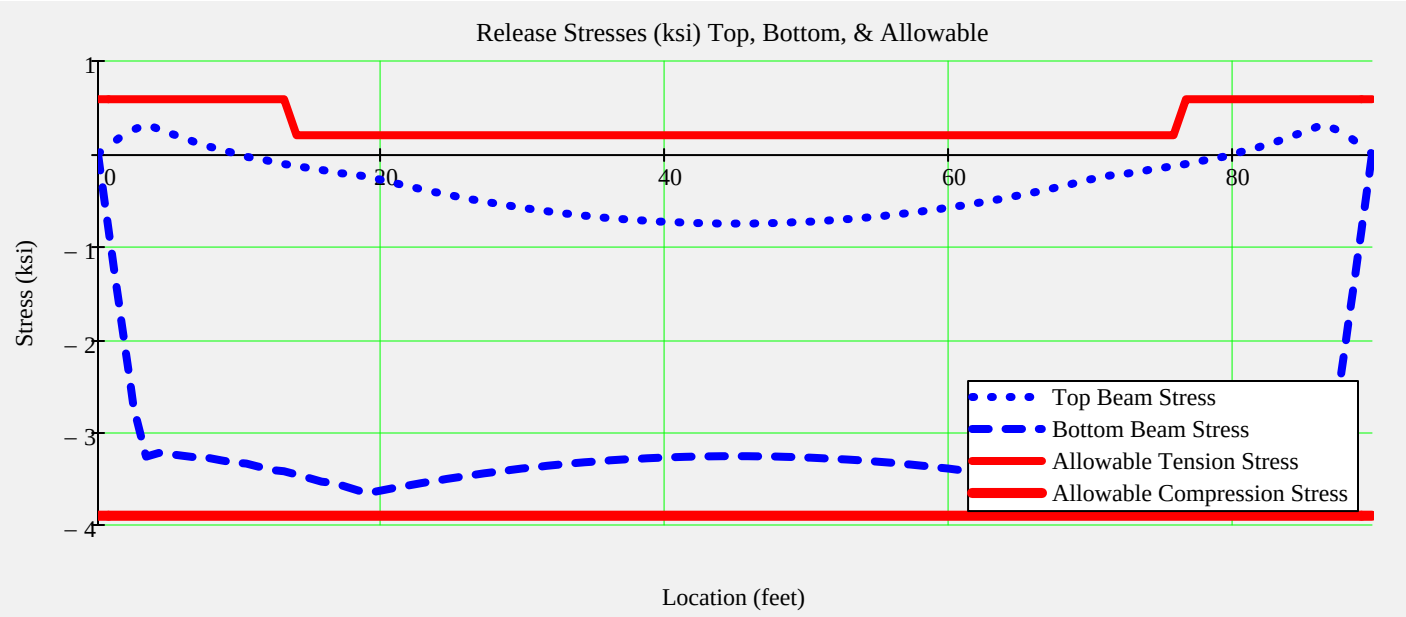
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.80$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.94$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.83$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.65$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.59$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.47$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.40	0.32	0.59
"Compression @ Release"	19.30	–3.65	–3.90
"Tension @ ServiceIII"	0.00	0.00	0.55
"CompressionIa @ ServiceI"	44.92	–2.49	–3.83
"CompressionIb @ ServiceI"	44.92	–3.01	–5.10
"Compression @ FatigueI"	45.80	–1.58	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

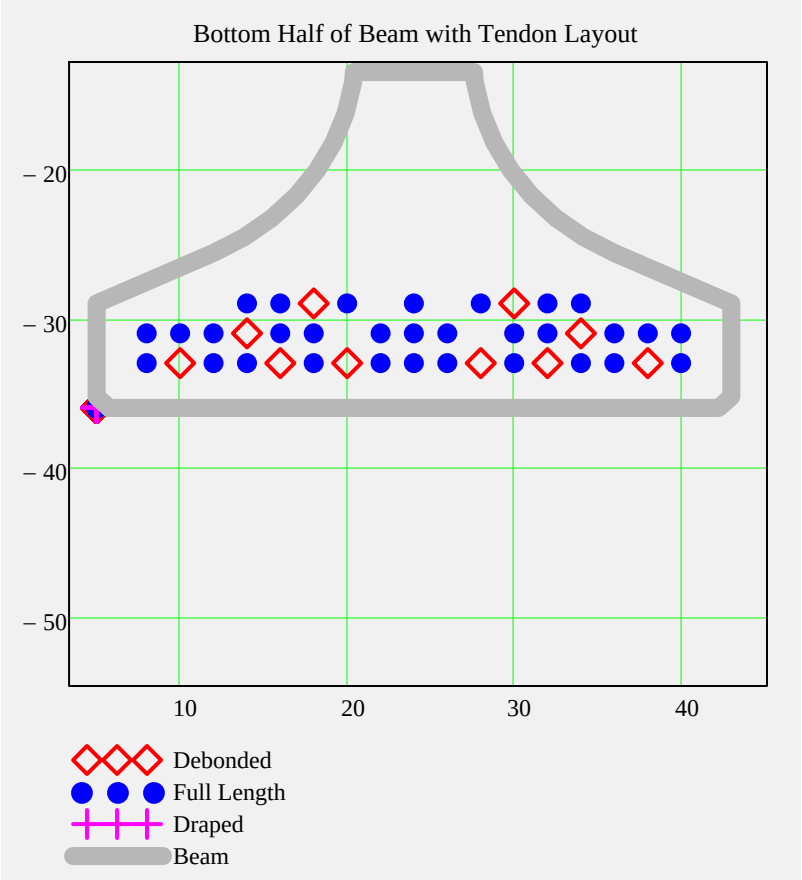
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

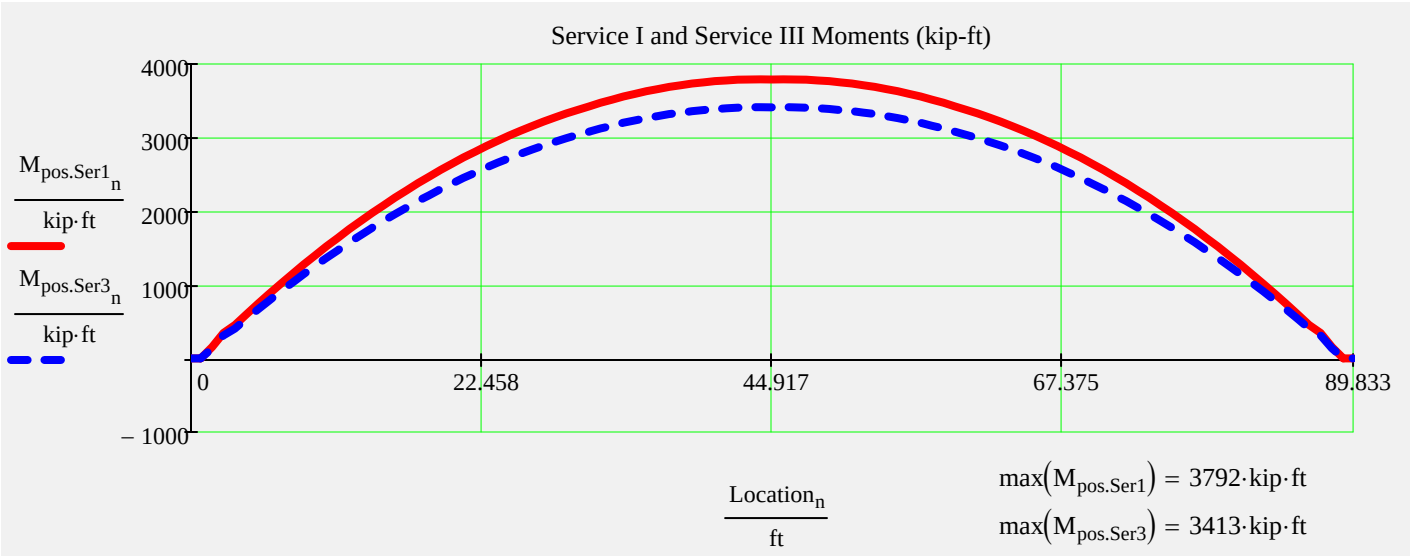
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

$Stresses =$

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.75	–3.26
"2"	–0.85	–2.69
"4"	–0.80	–2.73
"6"	–2.44	–1.43
"8"	–3.01	0.03

$PrestressForce =$

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1842	–1743
"@Final (about composite centroid)"	–1608	–1431

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1564.6	376524	–8.7

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	848
"Non-Composite DL (incl. beam wt.)"	1729
"Composite Dead Load"	168
"Distributed Live Load"	1892

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

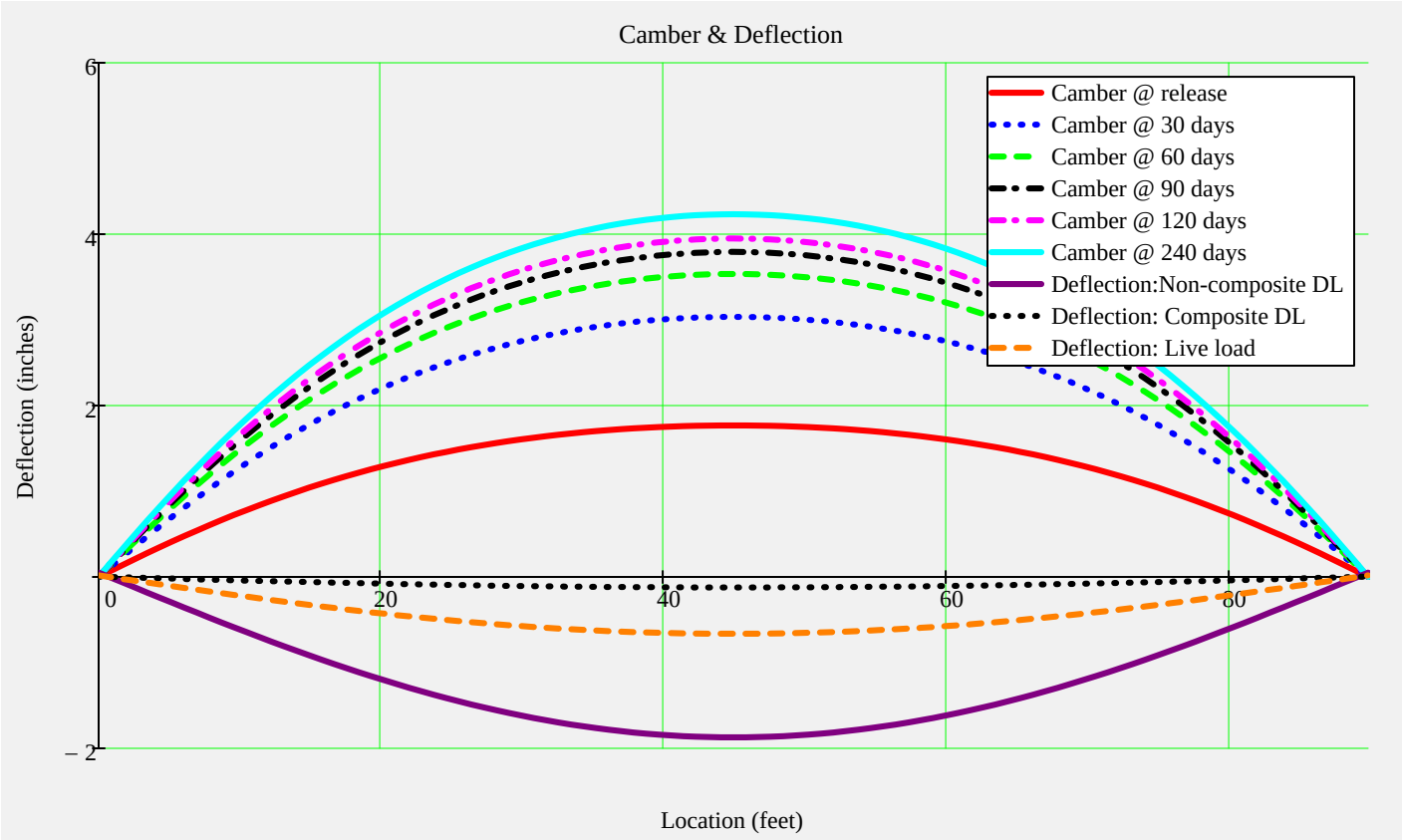
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 88.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.08	–0.78	0.40	1.77
"30 Days"	–0.28	–1.38	0.67	3.04
"60 Days"	–0.36	–1.61	0.78	3.54
"90 Days"	–0.40	–1.73	0.84	3.79
"120 Days"	–0.42	–1.81	0.87	3.95
"240 Days"	–0.46	–1.94	0.93	4.23
"Non-comp DL"	–0.23	0.18	–0.32	–1.87
"Comp DL"	–0.01	0.02	–0.02	–0.12
"LL"	–0.04	0.11	–0.12	–0.66

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.95 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

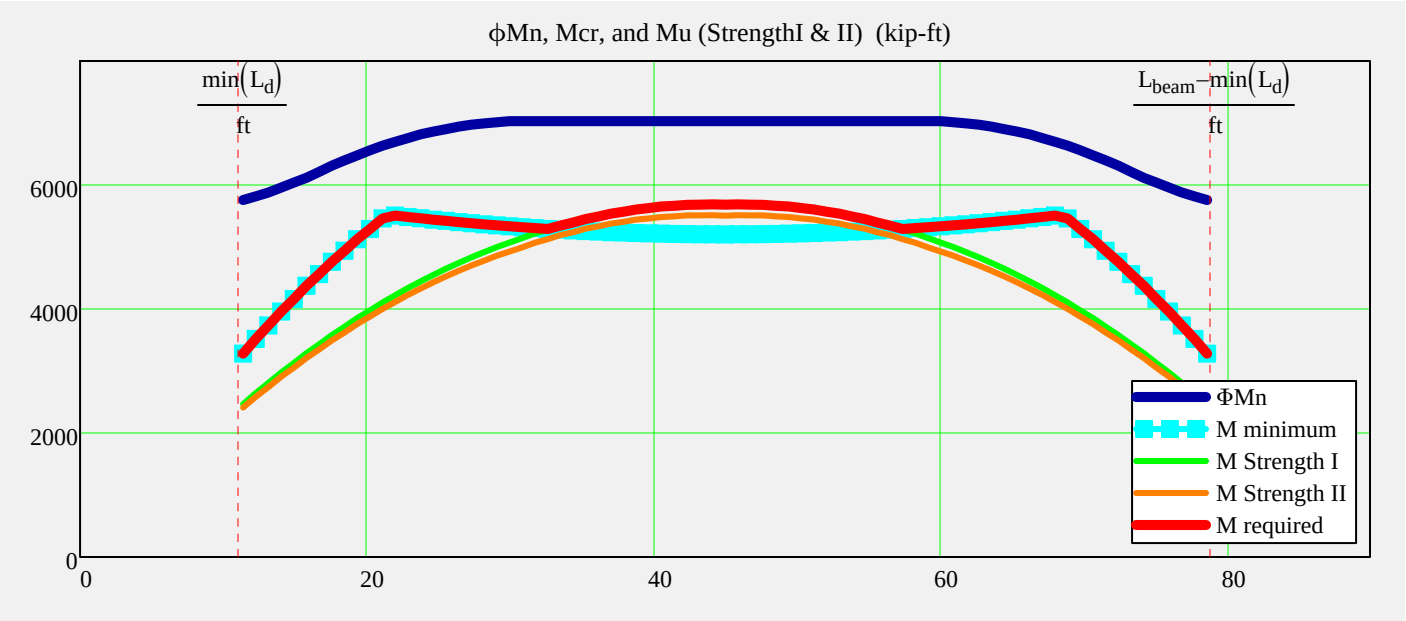
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5688 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5204 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5682 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7030 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11\ \text{ft}$ $L_{beam} - \min(L_d) = 78.8\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.82$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

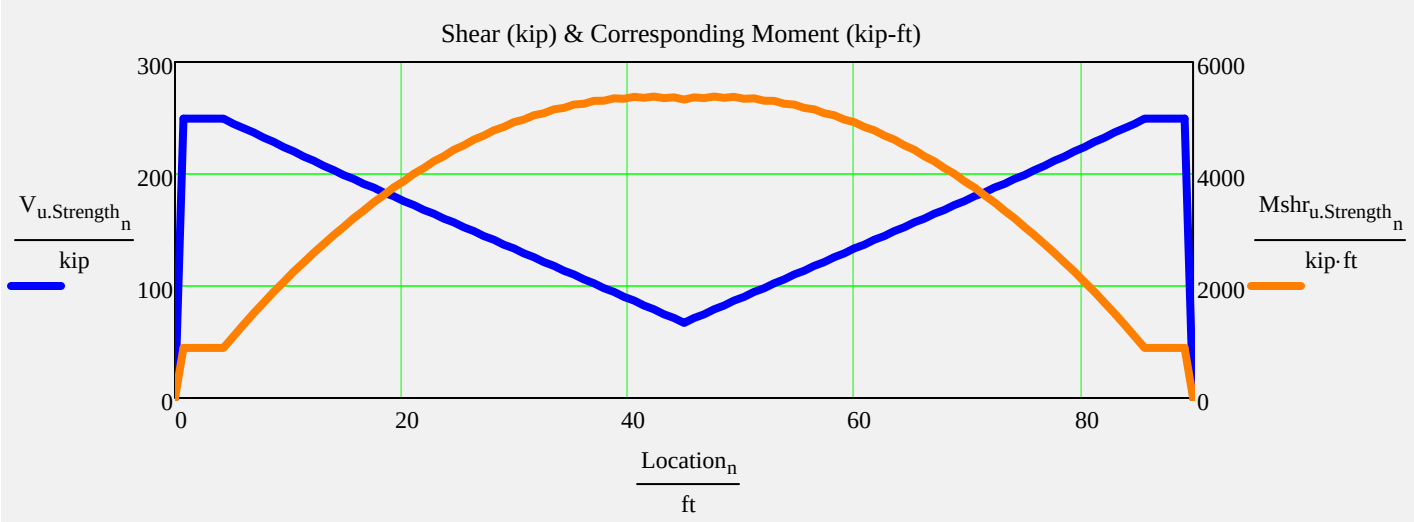
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

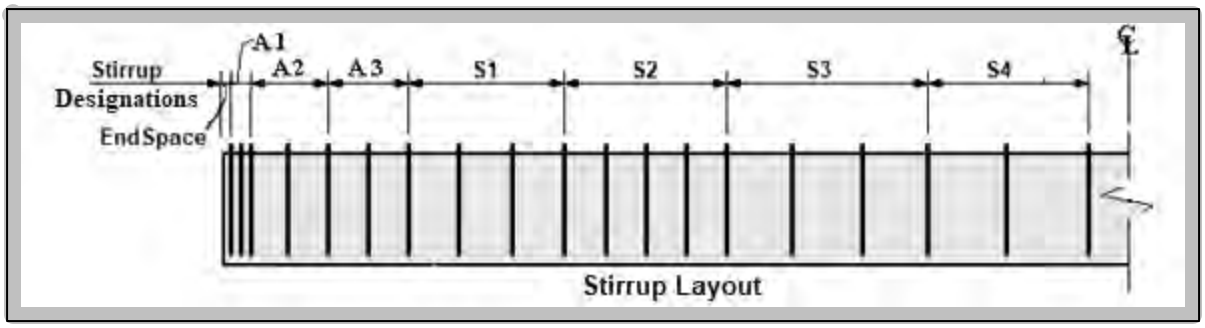
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 266 \\ 261 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 249.4 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5383 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	28	20	5	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

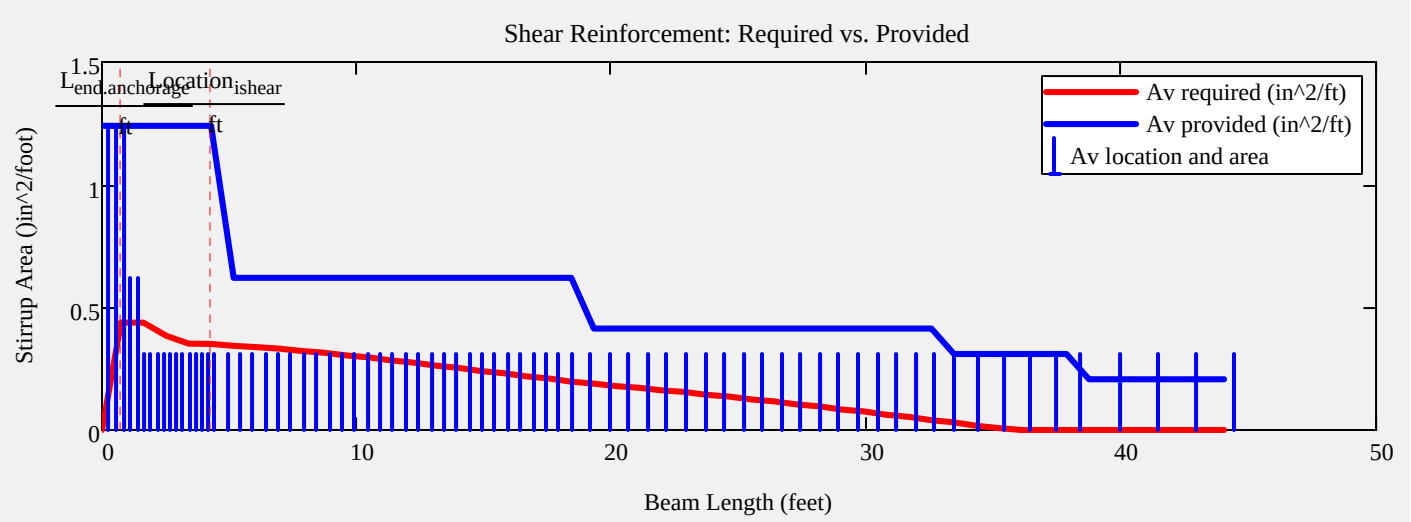
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.28\ ft$

Save Data File

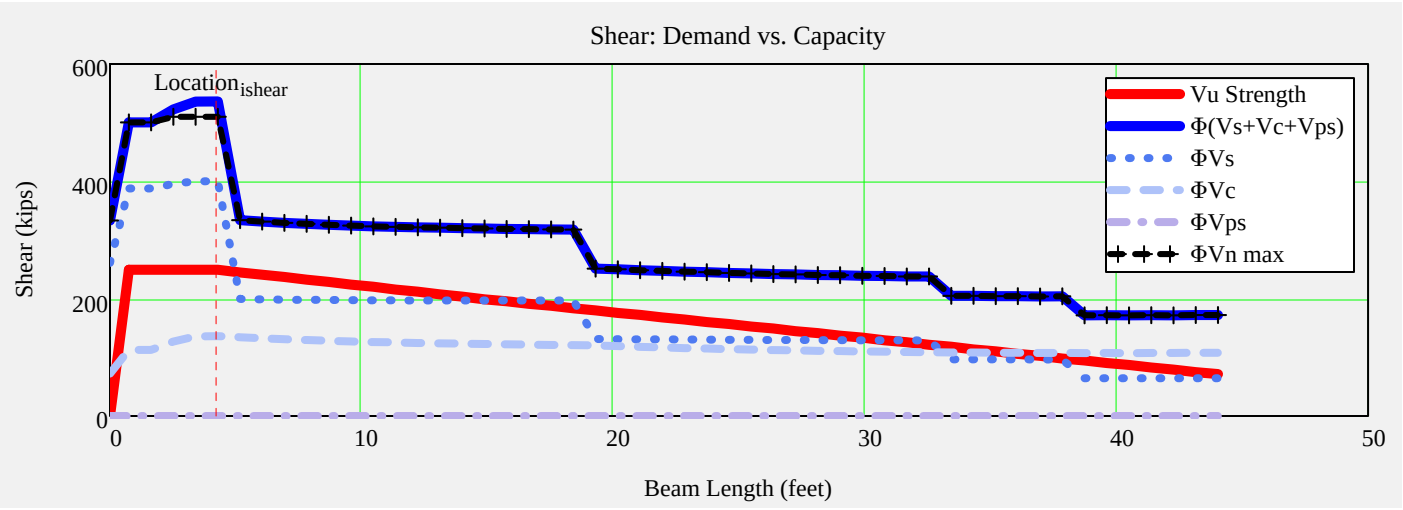
Use current input file

File Name FIB36-90ftSpan_NoSkew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 9

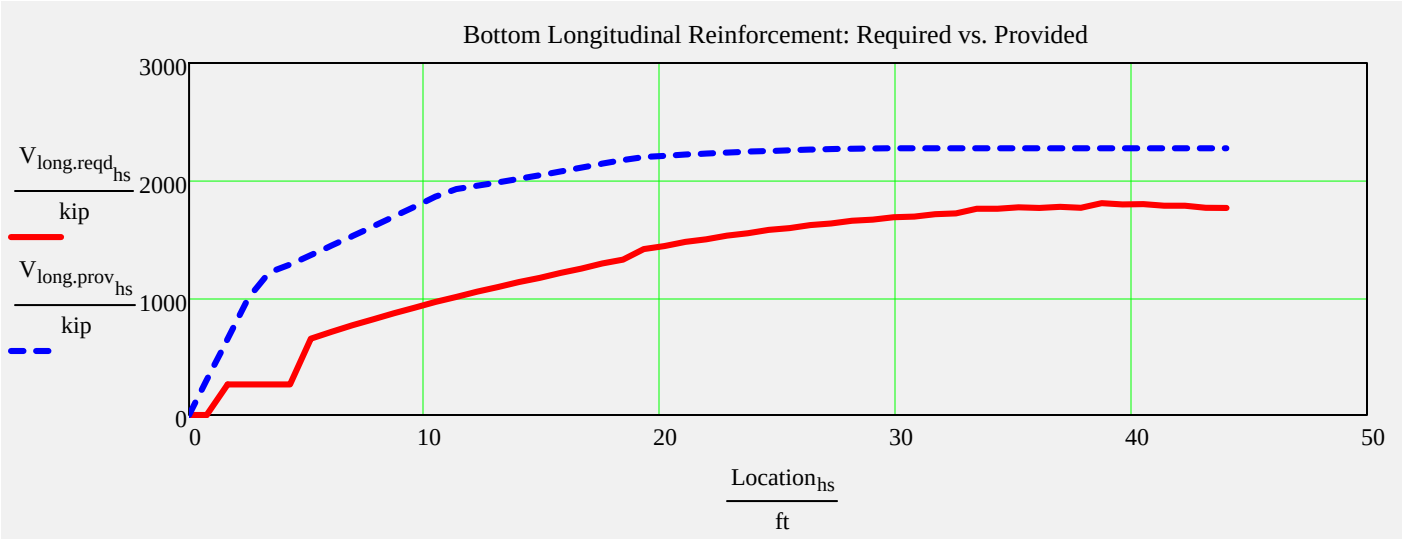
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 5.17 & 244.68 & 333.78 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.73$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

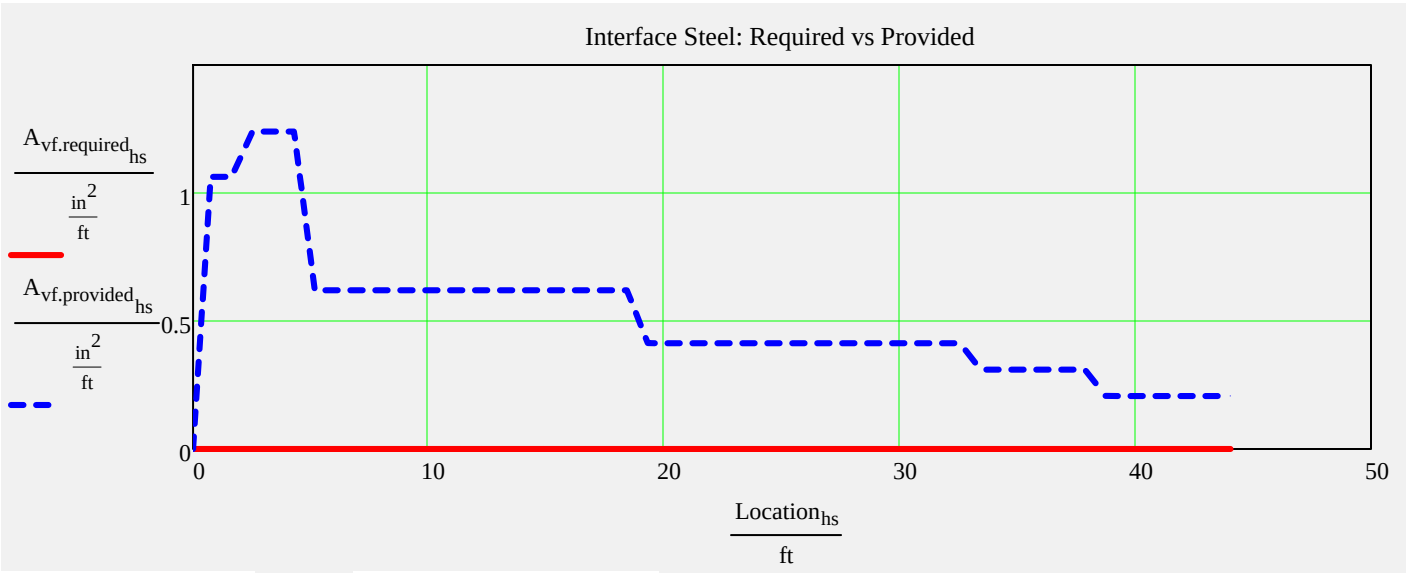


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 38.7 & 1805.3 & 2273.8 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.79$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 22.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

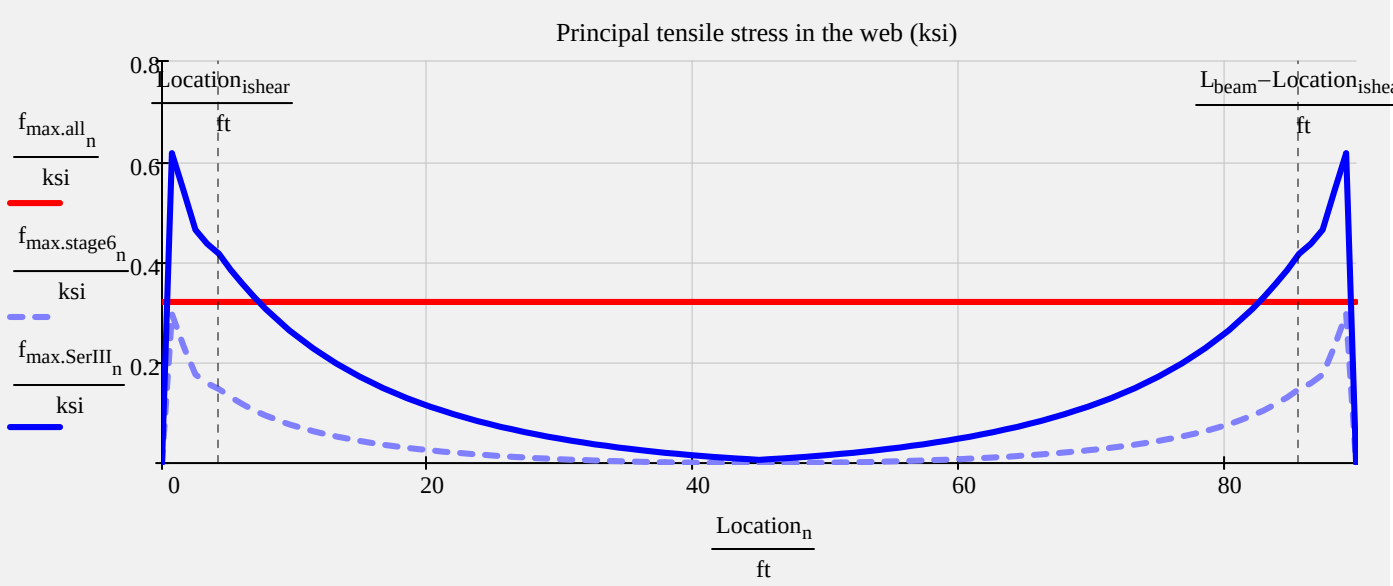
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $\text{Location}_{ishear} = 51.4\cdot\text{in}$ $\max(DC_f_{max.web}) = 1.3$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450\cdot\text{kip}$ $P_{prestress} = 1362\cdot\text{kip}$ $D/C_{splitting.FDOT} = 0.94$

CheckD/$C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

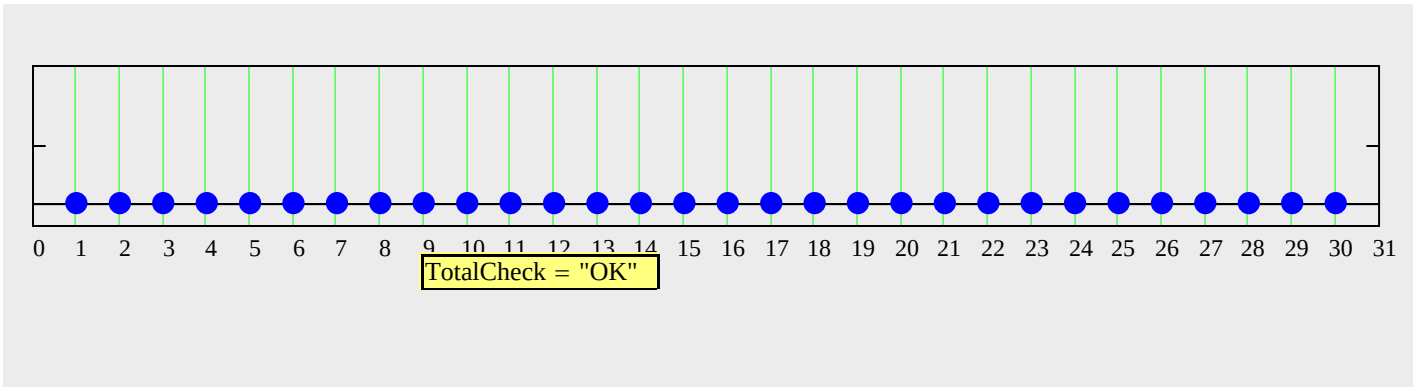
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.80	1.40	"N/A"	45.05	0.80	1.60	"N/A"	4.42	HL-93
"Strength I (Op)"	0.80	1.82	"N/A"	43.28	0.80	2.08	"N/A"	4.42	HL-93
"Service III (Inv)"	0.80	1.39	"N/A"	45.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.80	1.50	"N/A"	45.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.80	1.48	88.97	45.05	0.80	1.60	96.26	18.55	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.76$ $DC_{LongReinf.Permit} = 0.79$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7030	"factored resistance (kip-ft)...."
"γDL"	2370	"factored dead load (kip-ft)...."
"γLL"	2559	"factored live load (kip-ft)....."
"RF"	1.82	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	333.8	"factored resistance (kip)....."
"γDL"	96.7	"factored dead load (kip)....."
"γLL"	114.2	"factored live load (kip)....."
"RF"	2.08	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 90 FEET (NO SKEW)
EASTBOUND BRIDGE
(JOSHUA CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 90' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-90ftSpan_NoSkew_Exterior.dat
FIB36-90ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

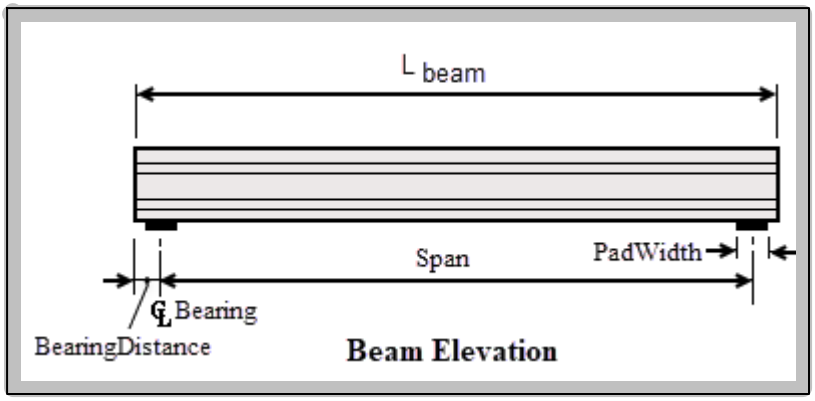
InputDataFile = "FIB36-90ftSpan_NoSkew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	06 / 23 / 2025
Checked by	CEB	*Date*	06 / 27 / 2025
Structure Name	SR 70		
Structure No.	EB Bridges		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-90ftSpan_NoSkew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	89.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	9	ft	*Measured from beam centerline to centerline.*
Overhang	3.33333	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0.5	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.0	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	5		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

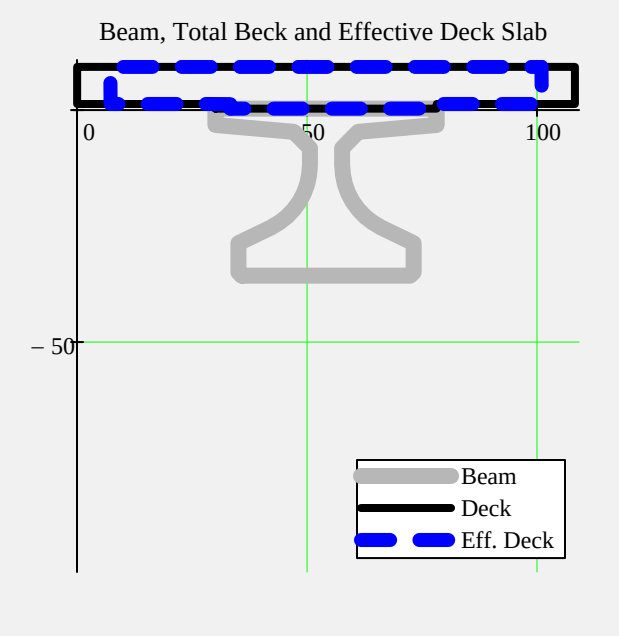
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 108·in

$b_e = 108 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL 0 kip/ft

Additional Uniform Composite DL 0 kip/ft

$w_{deck} = 1.01 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.10 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.17 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 89.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

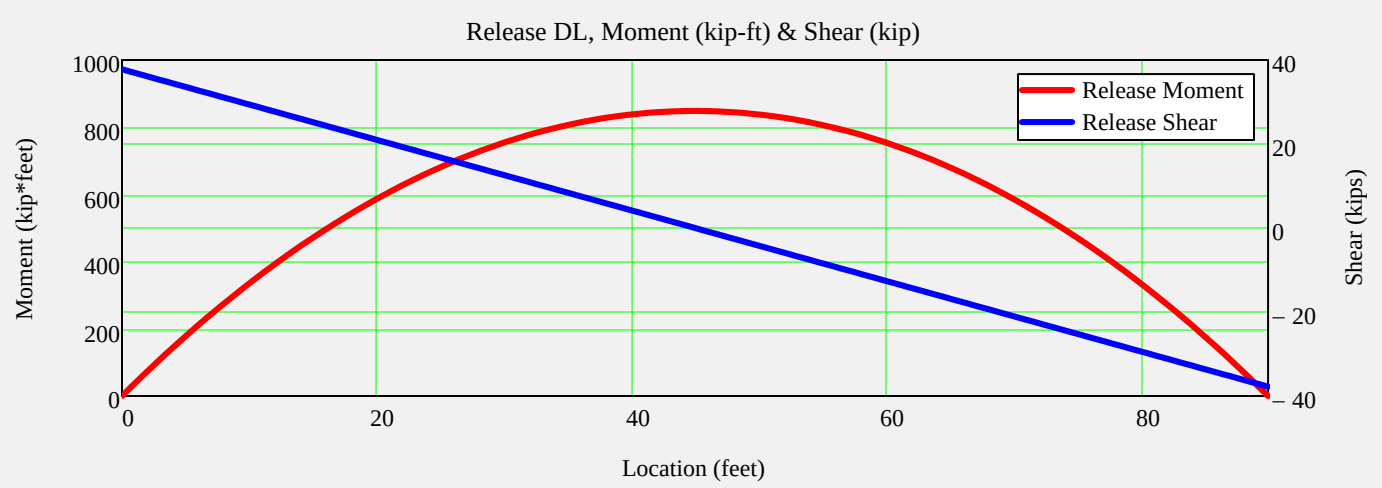
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

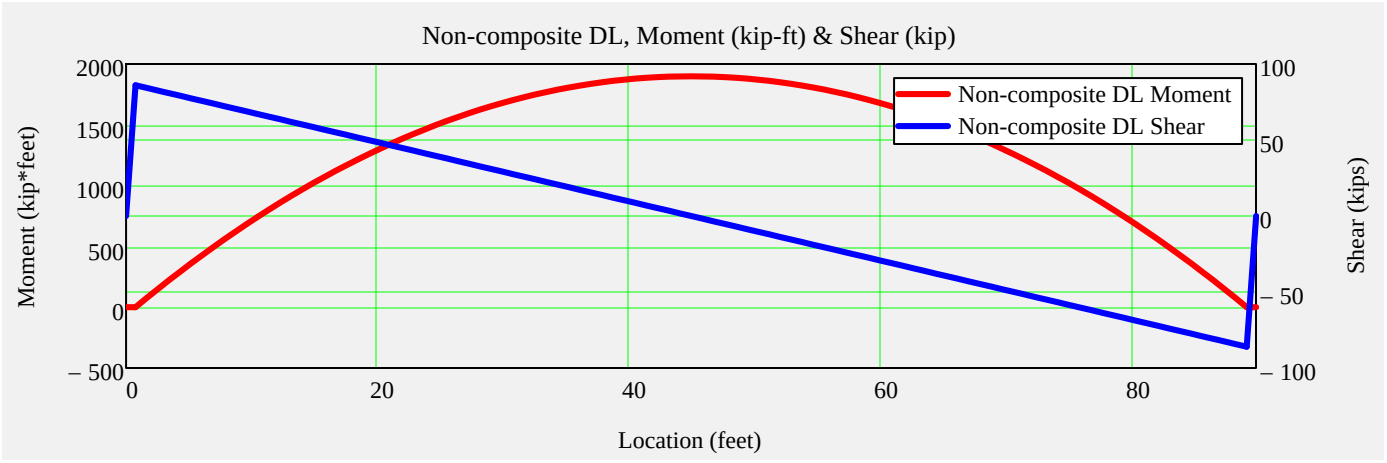
Release Dead Load Moments and Shears

$L_{span} = 88.33\ ft$



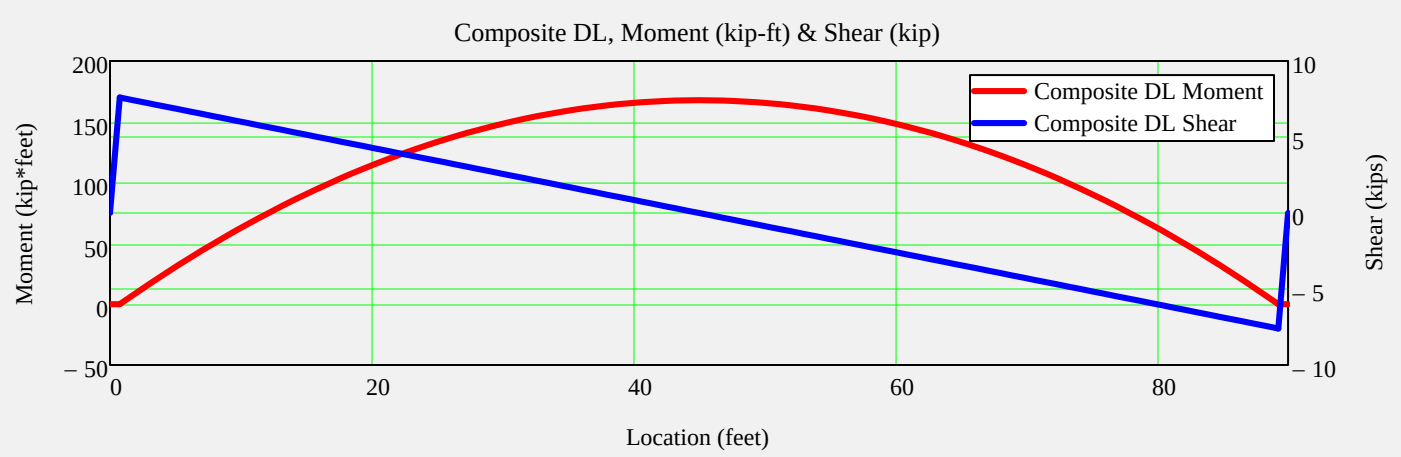
$\max(V_{release}) = 37.8 \cdot kip$ $\max(M_{release}) = 848.4 \cdot kip \cdot ft$ $\min(V_{release}) = -37.8 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 86.0 \cdot kip$ $\max(M_{dl.non.comp}) = 1898.7 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -86.0 \cdot kip$

Composite Dead Load Moments and Shear



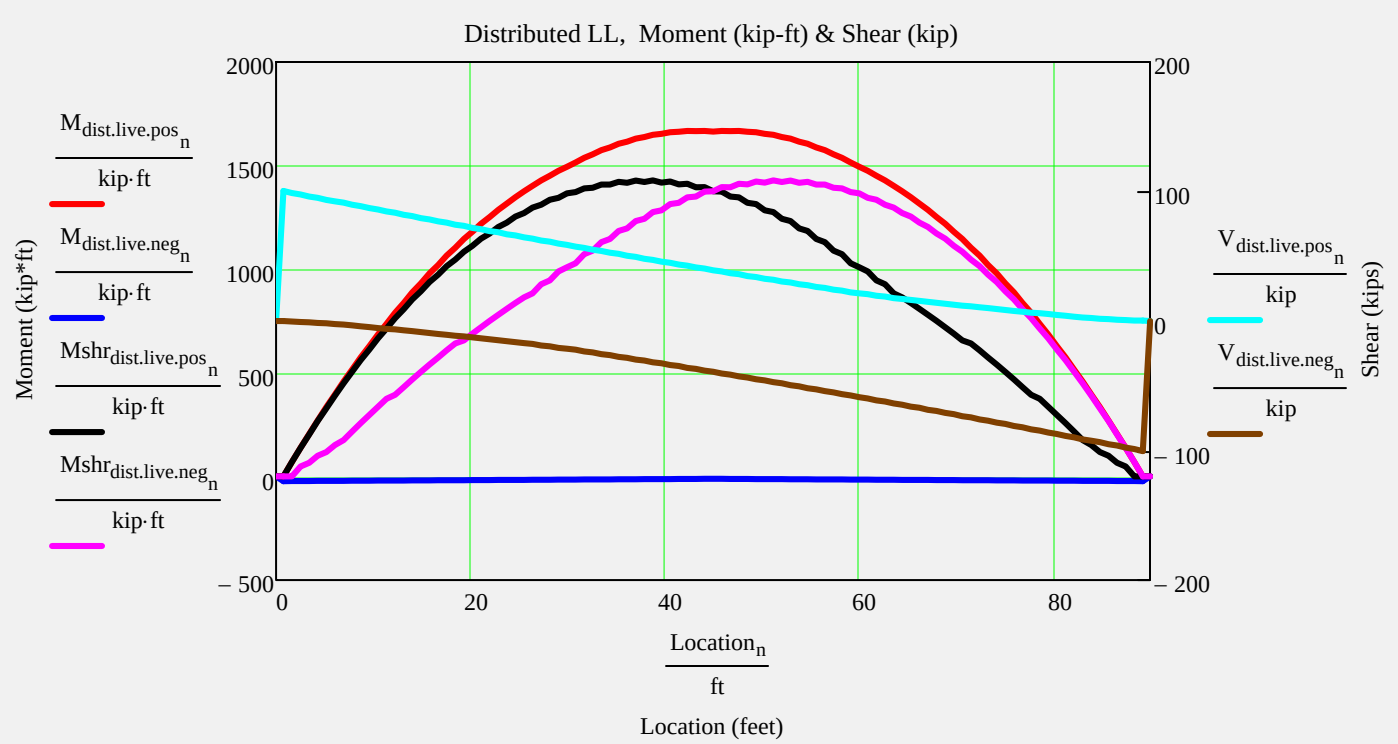
$\max(V_{dl.comp}) = 7.6 \cdot kip$ $\max(M_{dl.comp}) = 167.7 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -7.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 88.33\ ft$ BeamSpacing = 9 ft Skew = 0·deg

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor = 1.00

Final Live Load Distribution Factors: $g_{mom} = 0.7$ $g_{mom.fatigue} = 0.41$ $g_{shear} = 0.88$



$\max(V_{dist.live.pos}) = 100.4\cdot kip$

$\max(M_{dist.live.pos}) = 1667.5\cdot kip\cdot ft$

$\min(V_{dist.live.neg}) = -100.4\cdot kip$

$Reaction_{LL} = 101.8\cdot kip$

$\min(M_{dist.live.neg}) = -22.6\cdot kip\cdot ft$

$Reaction_{DL} = 95.2\cdot kip$

$\max(Mshr_{dist.live.pos}) = 1429\cdot kip\cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.0\cdot kip$ $Reaction_{lane} = 28.7\cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane})\cdot g_{shear}$

$Reaction_{LL.without.IM} = 82.9\cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-90ftSpan_NoSkew_Interior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.58	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		5 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity	75	%	*% relative humidity (75% typical)*
Time: jacking to transfer	1.5	days	*Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

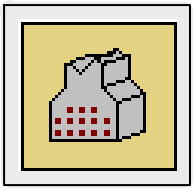
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

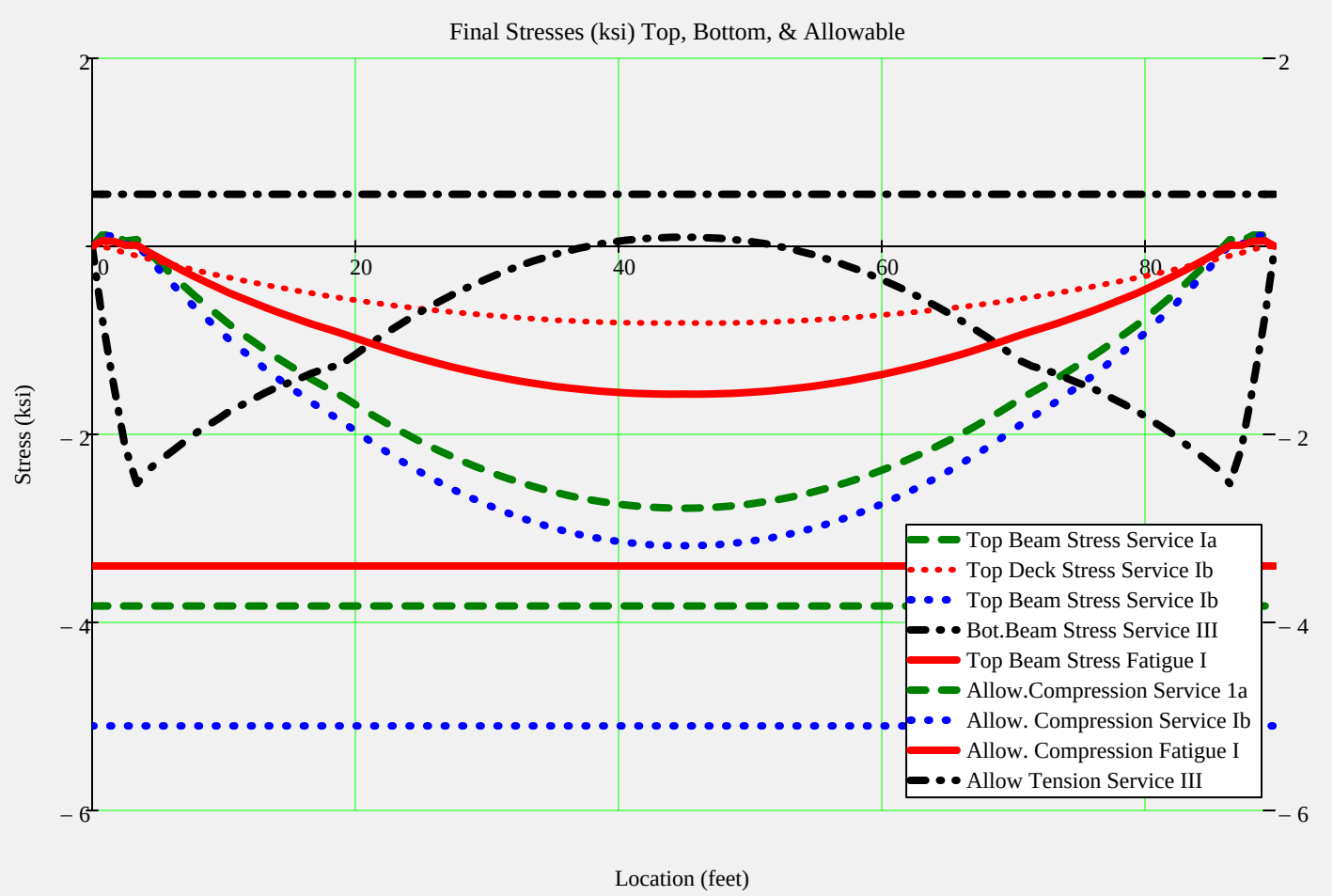
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

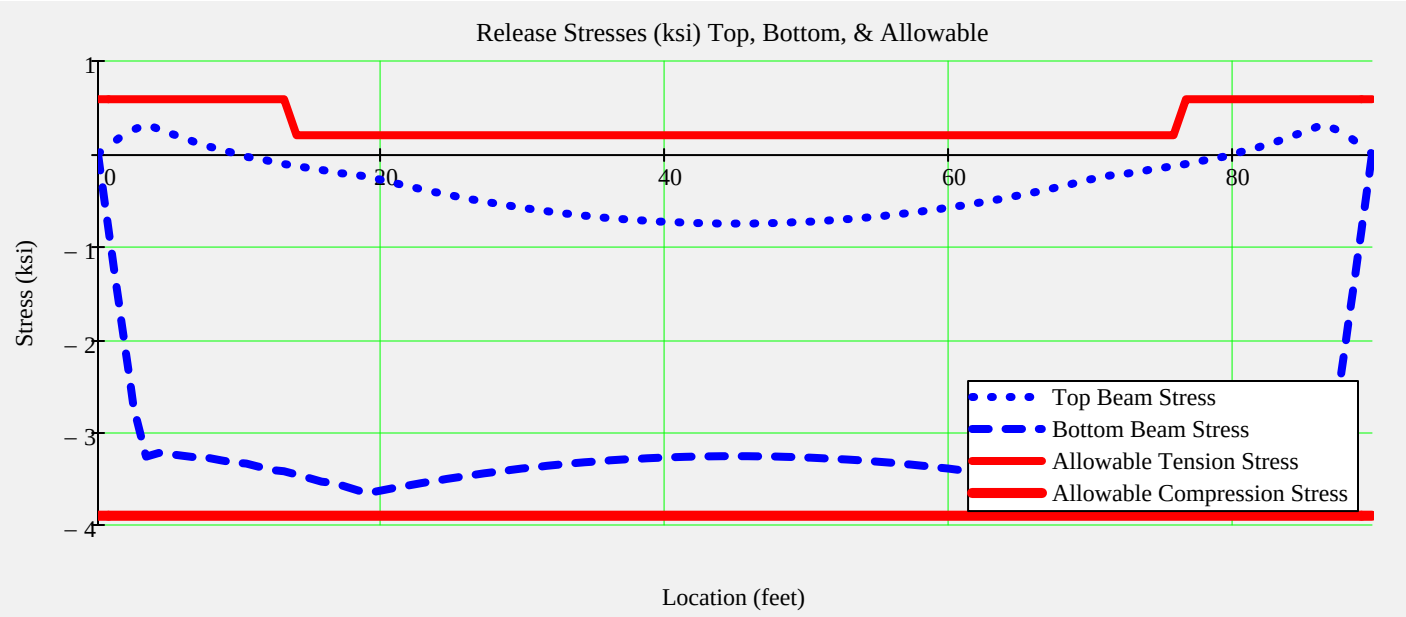
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	Check_$f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.80$
Release compression	Check_$f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.94$
*Service III , PS+DL+0.8*LL*	Check_$f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.85$
Service Ia , PS+DL	Check_$f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.73$
Service Ib , PS+DL+LL	Check_$f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.62$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	Check_$f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.46$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.40	0.32	0.59
"Compression @ Release"	19.30	–3.65	–3.90
"Tension @ ServiceIII"	45.80	0.10	0.55
"CompressionIa @ ServiceI"	44.92	–2.79	–3.83
"CompressionIb @ ServiceI"	44.92	–3.18	–5.10
"Compression @ FatigueI"	45.80	–1.57	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

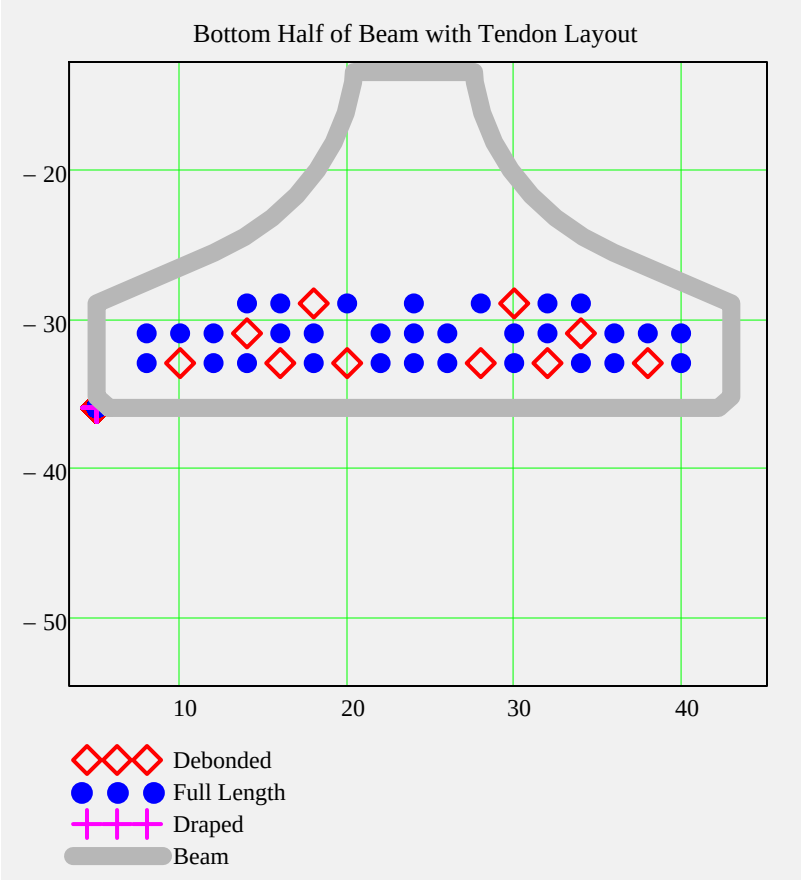
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

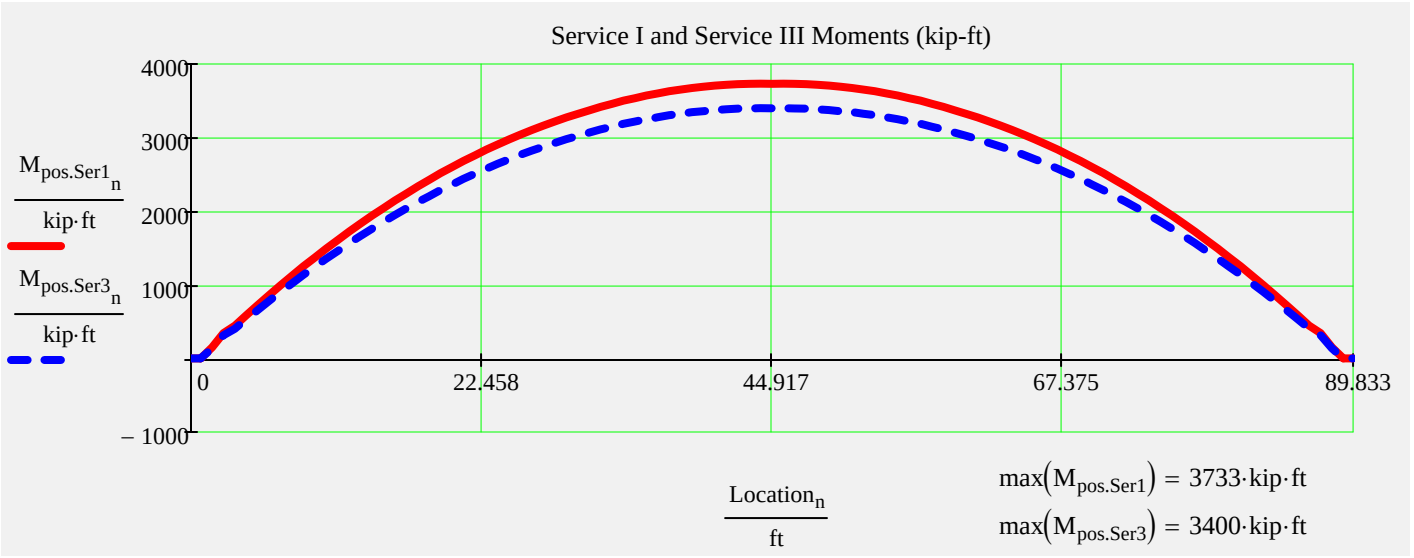
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.75	–3.26
"2"	–0.85	–2.69
"4"	–0.80	–2.73
"6"	–2.74	–1.19
"8"	–3.18	0.09

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1842	–1743
"@Final (about composite centroid)"	–1608	–1431

Properties =

"Section"	"Area (in^2) "	"Inertia (in^4) "	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1665	394794	–7.9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	848
"Non-Composite DL (incl. beam wt.)"	1899
"Composite Dead Load"	168
"Distributed Live Load"	1664

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

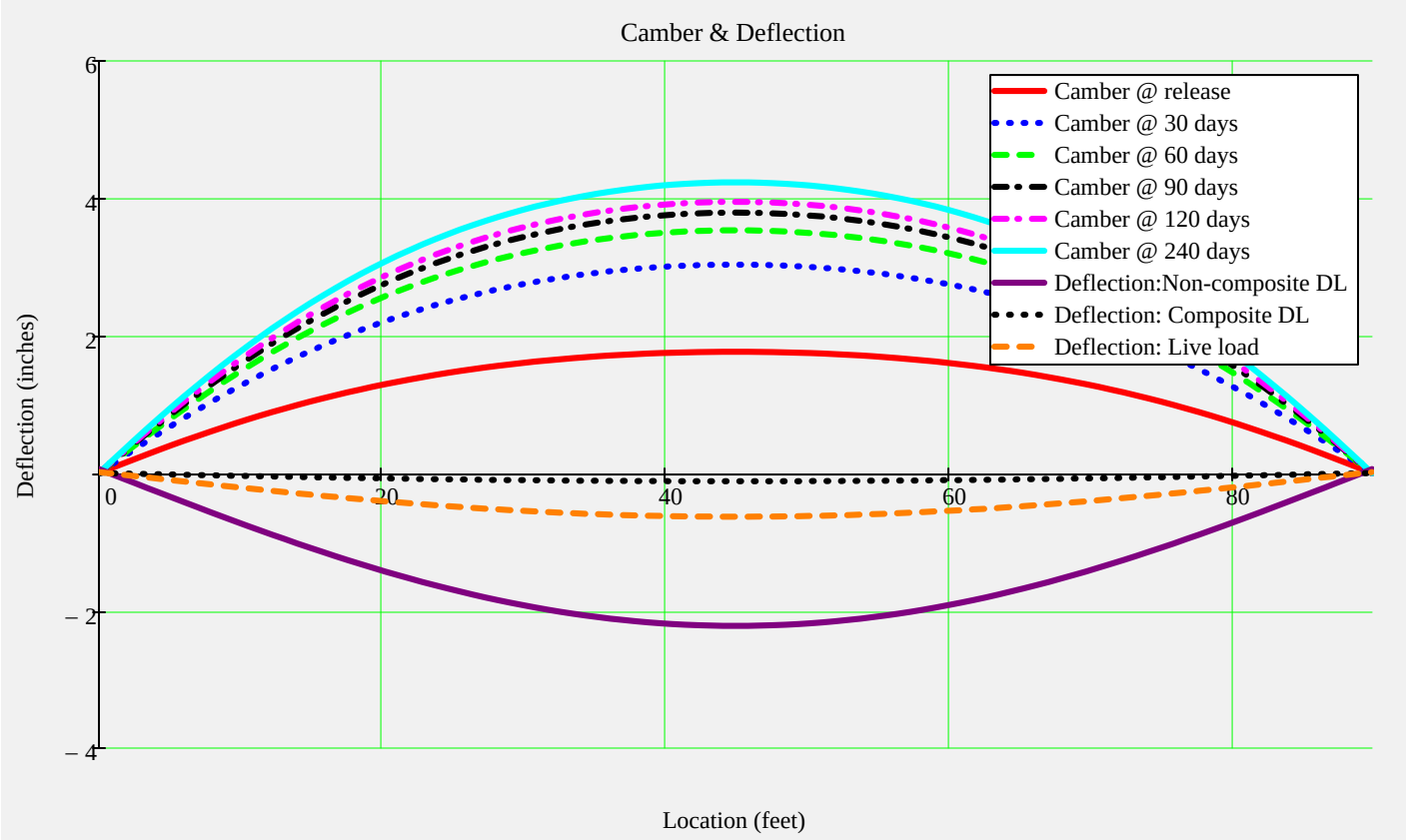
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 88.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.08	–0.78	0.40	1.77
"30 Days"	–0.28	–1.38	0.67	3.04
"60 Days"	–0.36	–1.61	0.78	3.54
"90 Days"	–0.40	–1.73	0.84	3.79
"120 Days"	–0.42	–1.81	0.87	3.95
"240 Days"	–0.46	–1.94	0.93	4.23
"Non-comp DL"	–0.27	0.21	–0.38	–2.22
"Comp DL"	–0.01	0.02	–0.02	–0.12
"LL"	–0.03	0.11	–0.11	–0.63

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.61 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

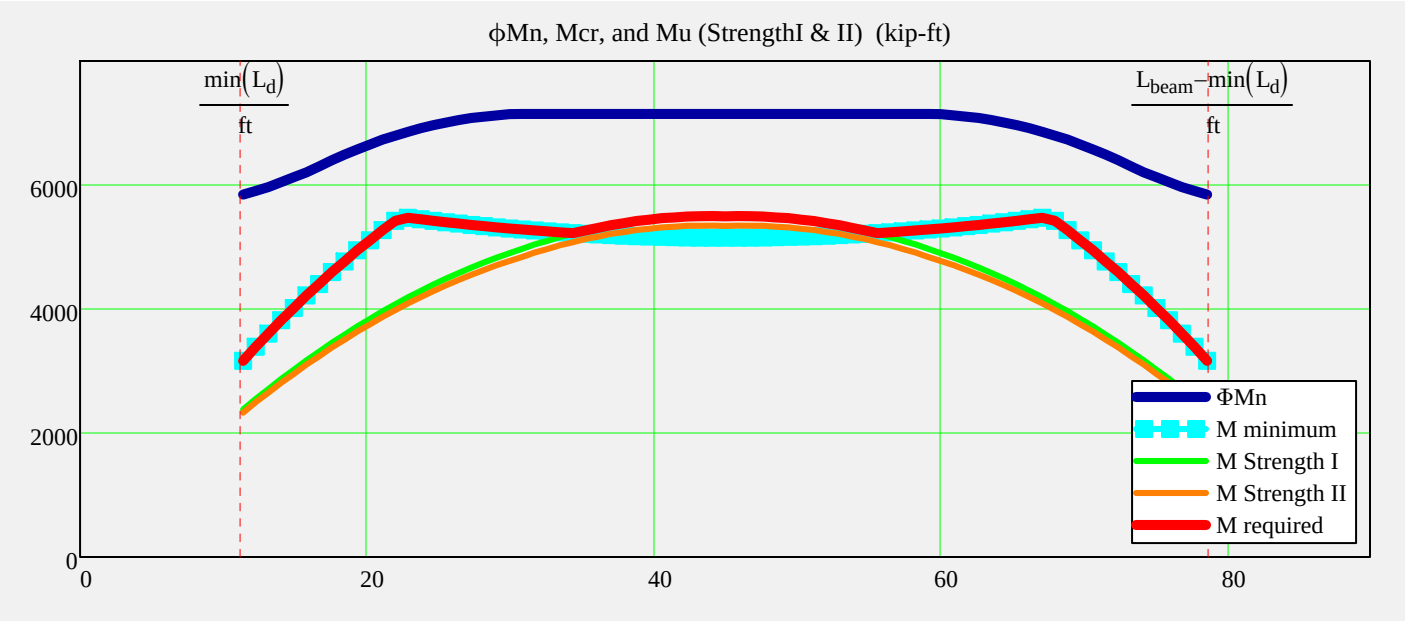
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5500 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5150 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5495 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7146 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 11.2\ \text{ft}$ $L_{beam} - \min(L_d) = 78.6\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.80$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

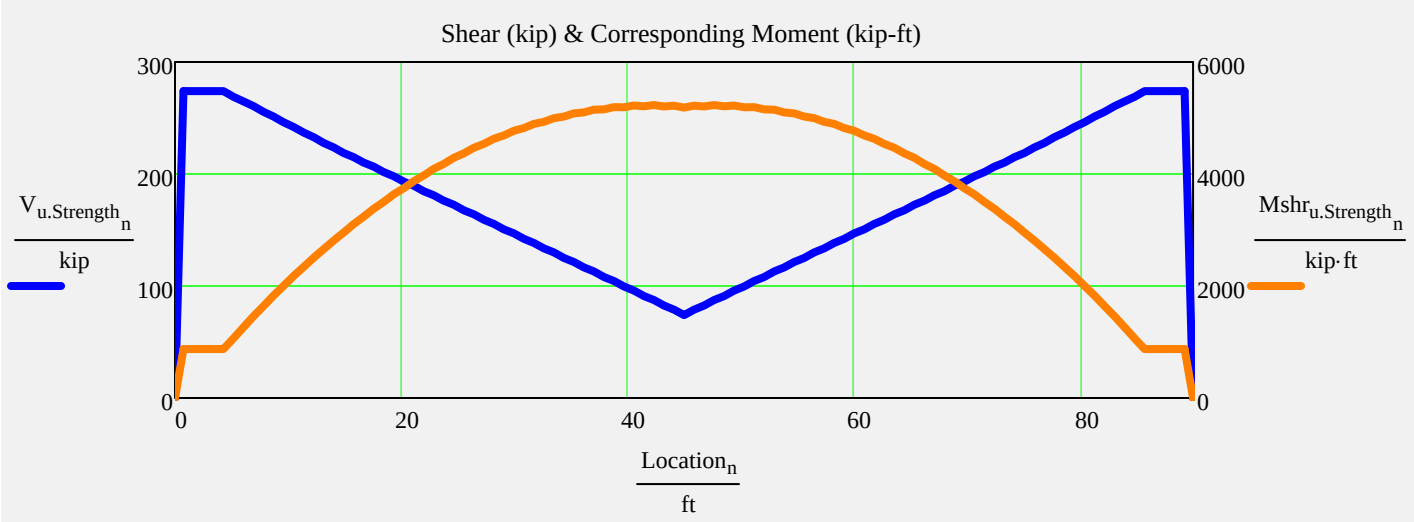
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

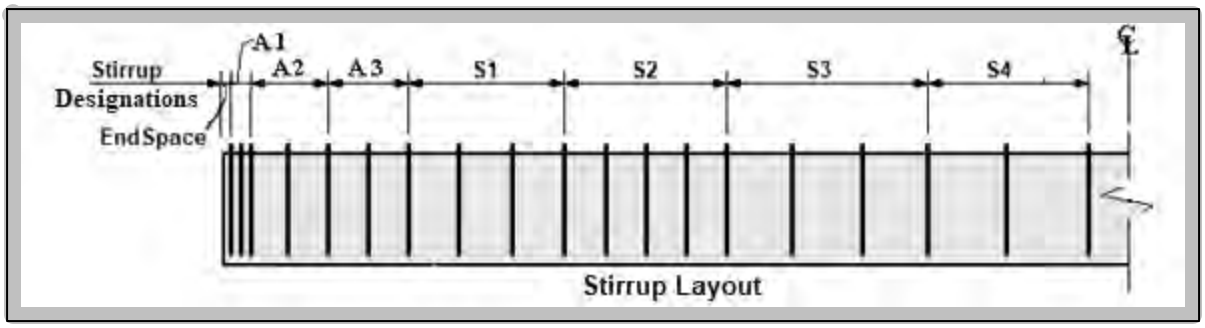
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 293 \\ 287 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 274.0 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5230 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	28	20	5	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

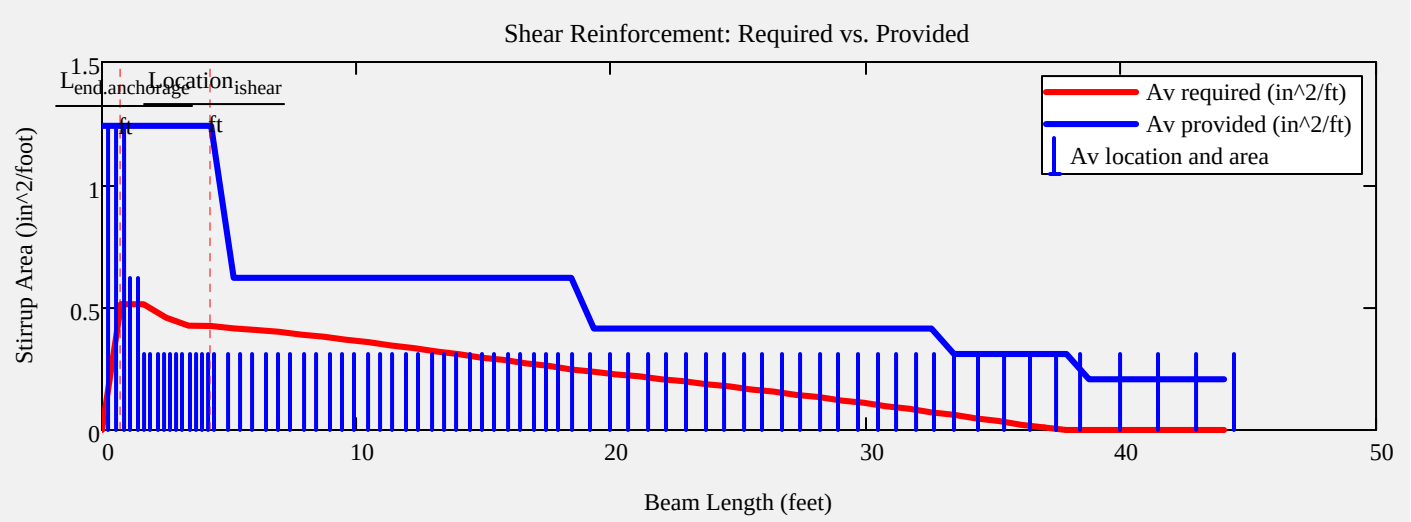
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.28\ ft$

Save Data File

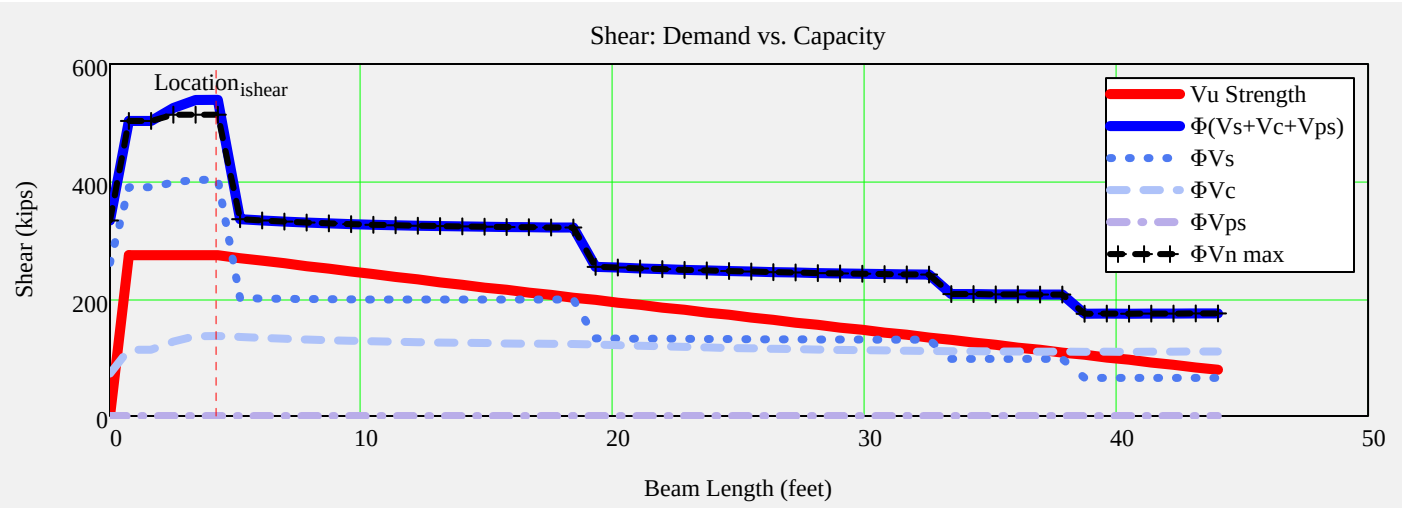
Use current input file

File Name FIB36-90ftSpan_NoSkew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Appendix D_Bridge Design Calculations\Calculations\2. Beam Design\Beam Design\FIB's\EB 9

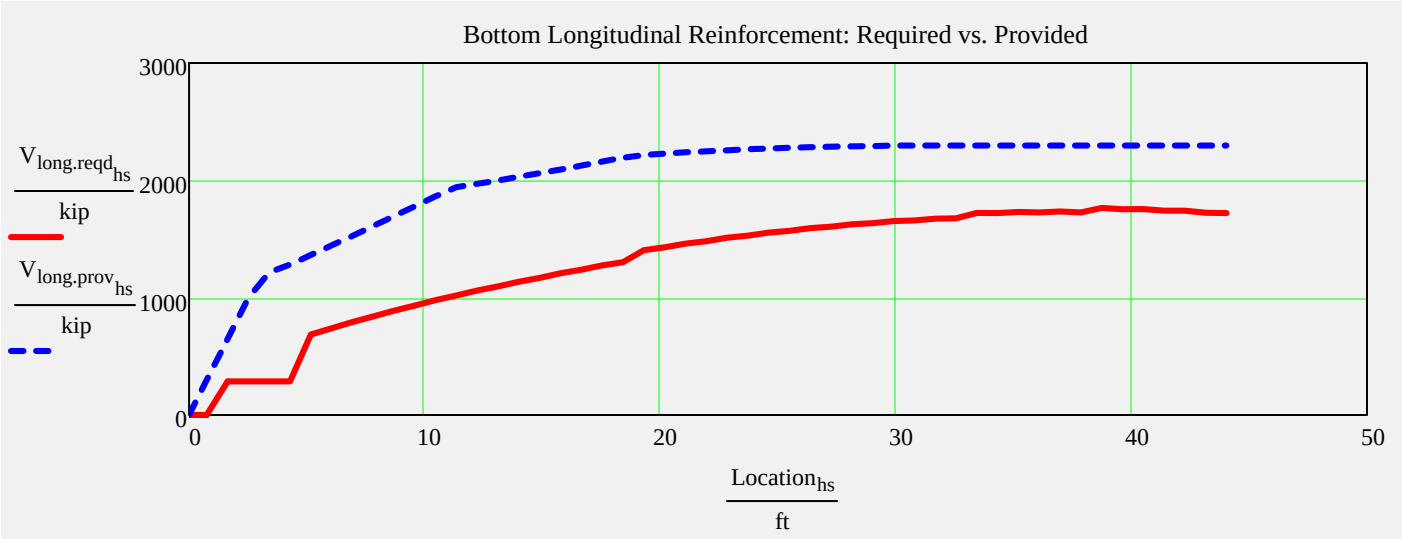
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 5.17 & 268.85 & 335.56 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.80$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

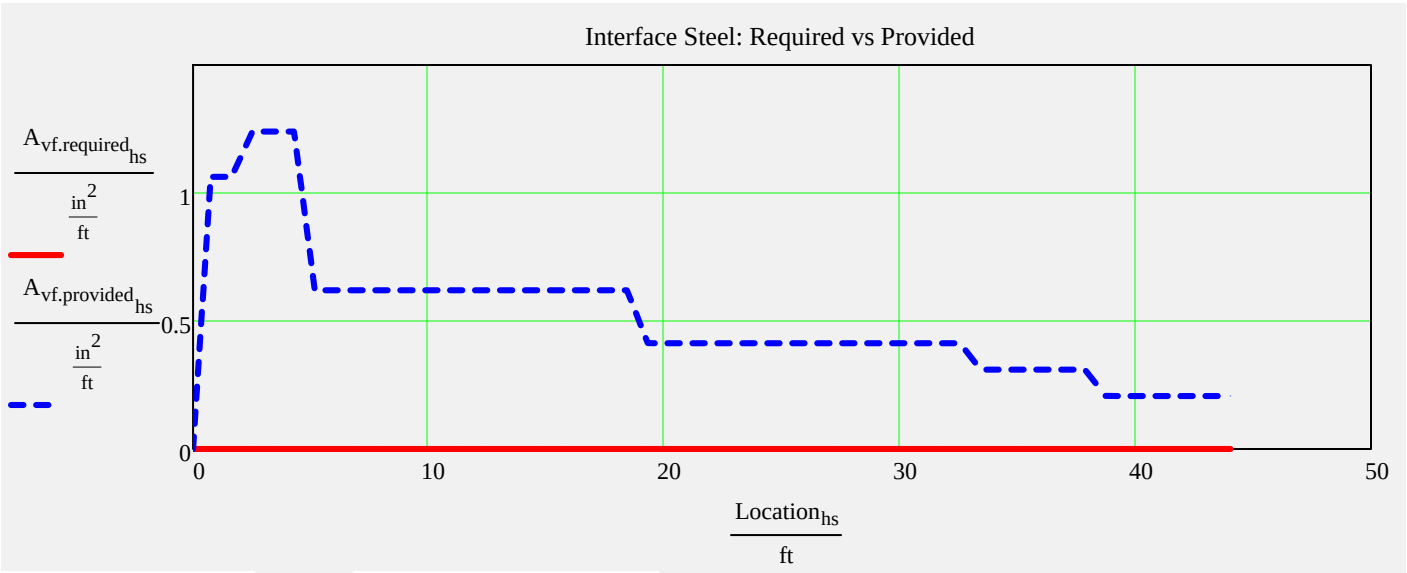


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 38.7 & 1764.1 & 2296.1 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.77$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 22.53 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

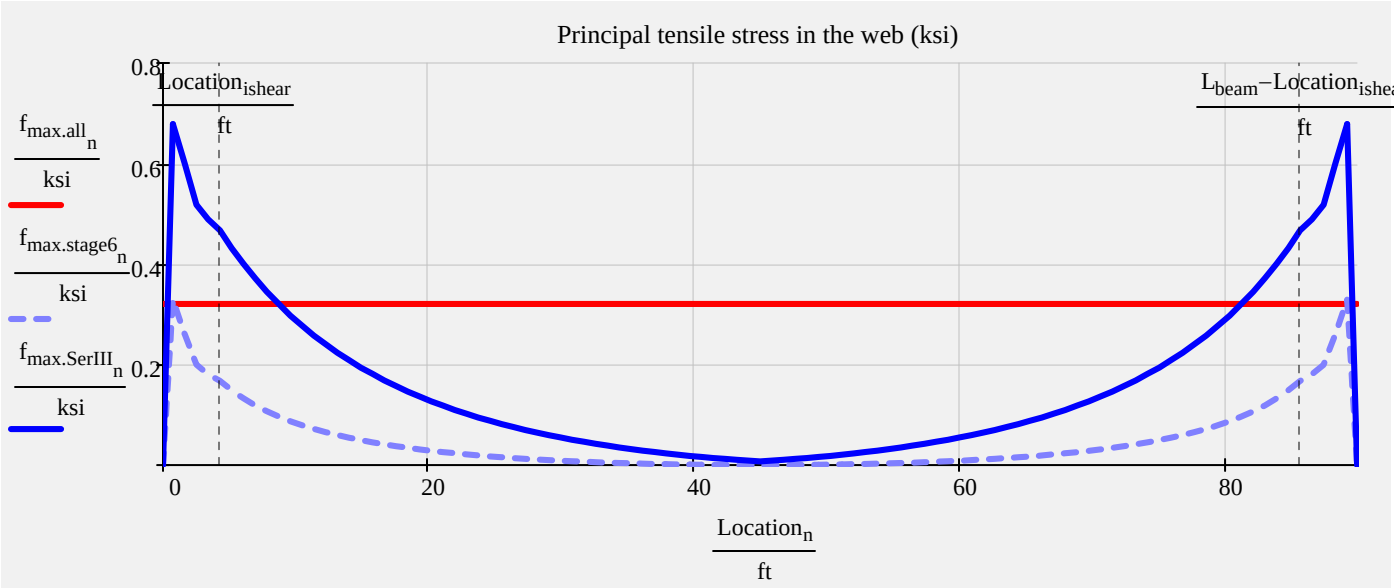
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 51.4 \cdot in$ $\max(DC_f_{max.web}) = 1.46$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

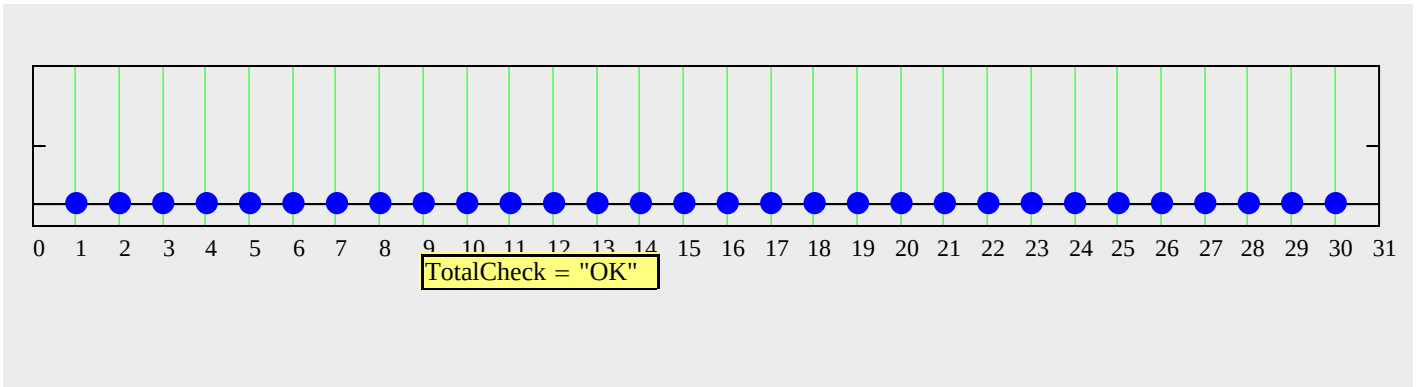
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.70	1.56	"N/A"	43.28	0.88	1.41	"N/A"	4.42	HL-93
"Strength I (Op)"	0.70	2.03	"N/A"	43.28	0.88	1.83	"N/A"	4.42	HL-93
"Service III (Inv)"	0.70	1.40	"N/A"	43.28	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.70	1.52	"N/A"	45.05	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.70	1.65	99.09	43.28	0.88	1.43	85.90	18.55	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.74$ $DC_{LongReinf.Permit} = 0.77$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7146	"factored resistance (kip-ft)...."
"γDL"	2582	"factored dead load (kip-ft)...."
"γLL"	2251	"factored live load (kip-ft)....."
"RF"	2.03	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	335.6	"factored resistance (kip)....."
"γDL"	105.3	"factored dead load (kip)....."
"γLL"	126.2	"factored live load (kip)....."
"RF"	1.83	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 96 FEET (NO SKEW)
WESTBOUND BRIDGE
(PARKER CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\WB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-96ftSpan_15Skew_Exterior.dat
FIB36-96ftSpan_15Skew_Interior.dat
FIB36-96ftSpan_NoSkew_Exterior.dat
FIB36-96ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

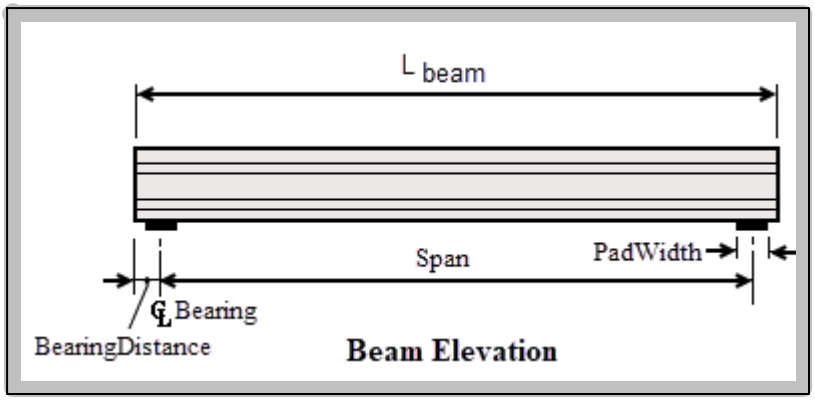
InputDataFile = "FIB36-96ftSpan_NoSkew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 05 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70 over Parker Creek		
Structure No.	Westbound Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-96ftSpan_NoSkew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	95.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	7.1667	ft	*Measured from beam centerline to centerline.*
Overhang	3.4167	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.1667	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1.5	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

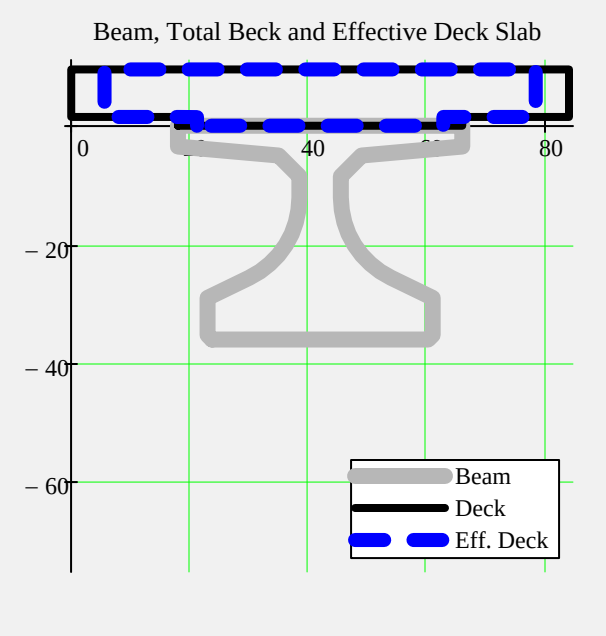
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1.5 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 86·in

$b_e = 84 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.78 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.03 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.086 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 95.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

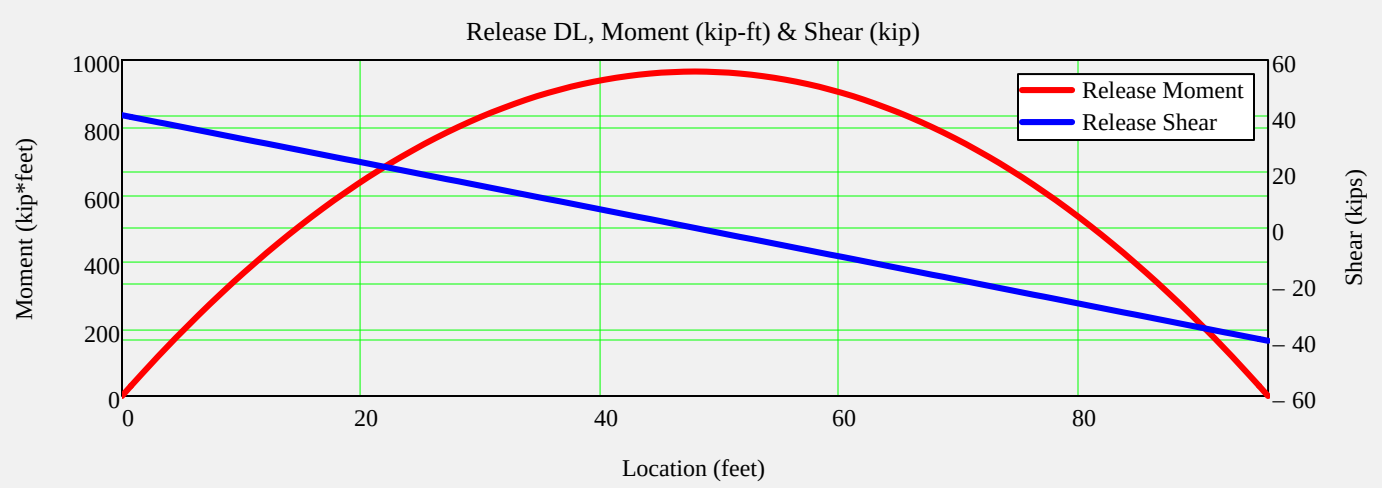
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

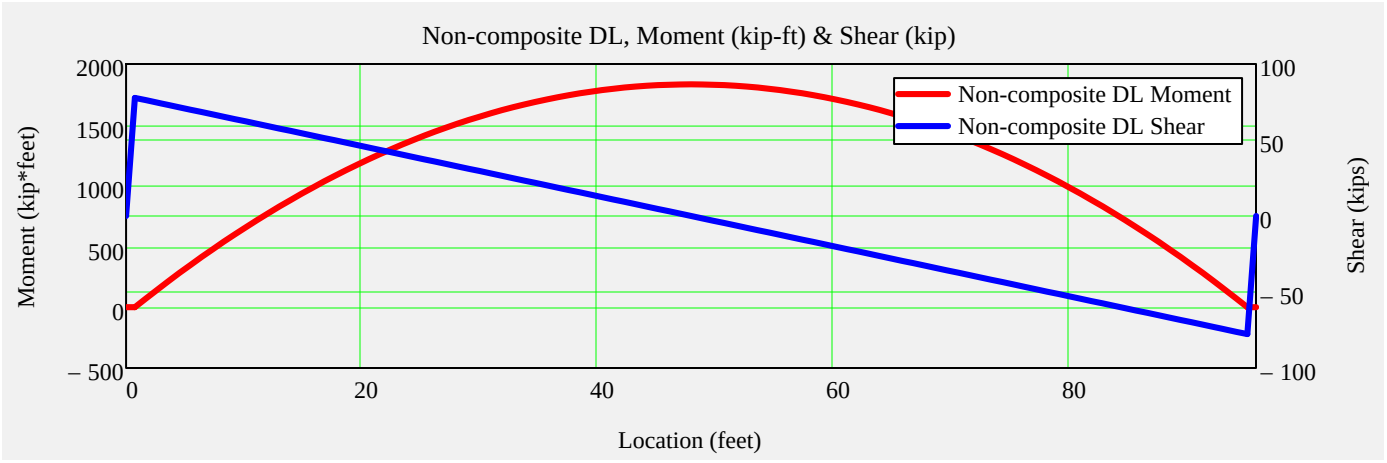
Release Dead Load Moments and Shears

$L_{span} = 94.33\ ft$



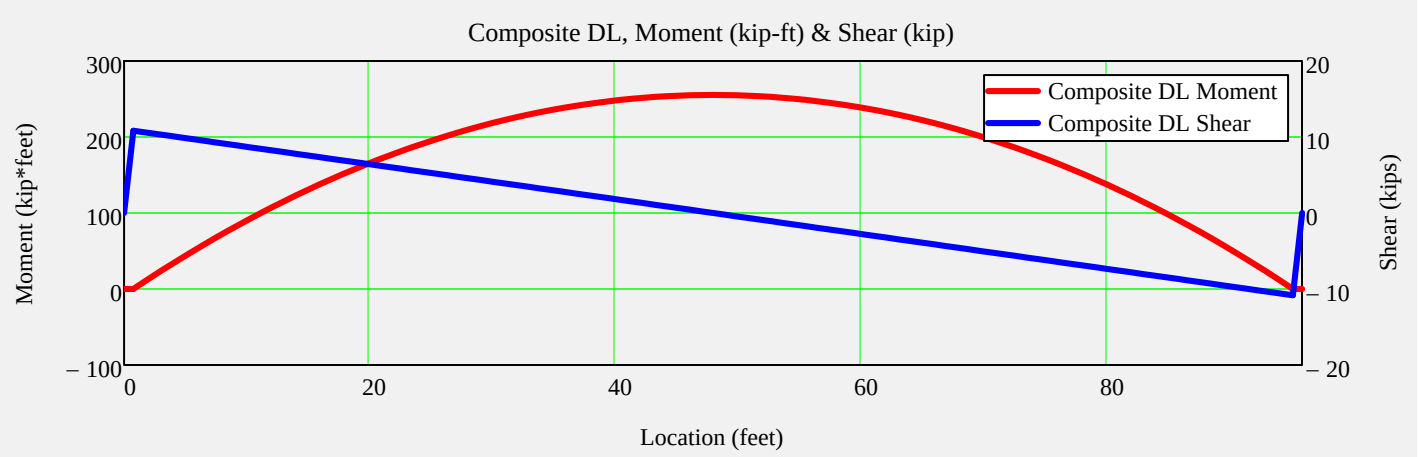
$\max(V_{release}) = 40.3 \cdot kip$ $\max(M_{release}) = 965.5 \cdot kip \cdot ft$ $\min(V_{release}) = -40.3 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 77.7 \cdot kip$ $\max(M_{dl.non.comp}) = 1832.4 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -77.7 \cdot kip$

Composite Dead Load Moments and Shear



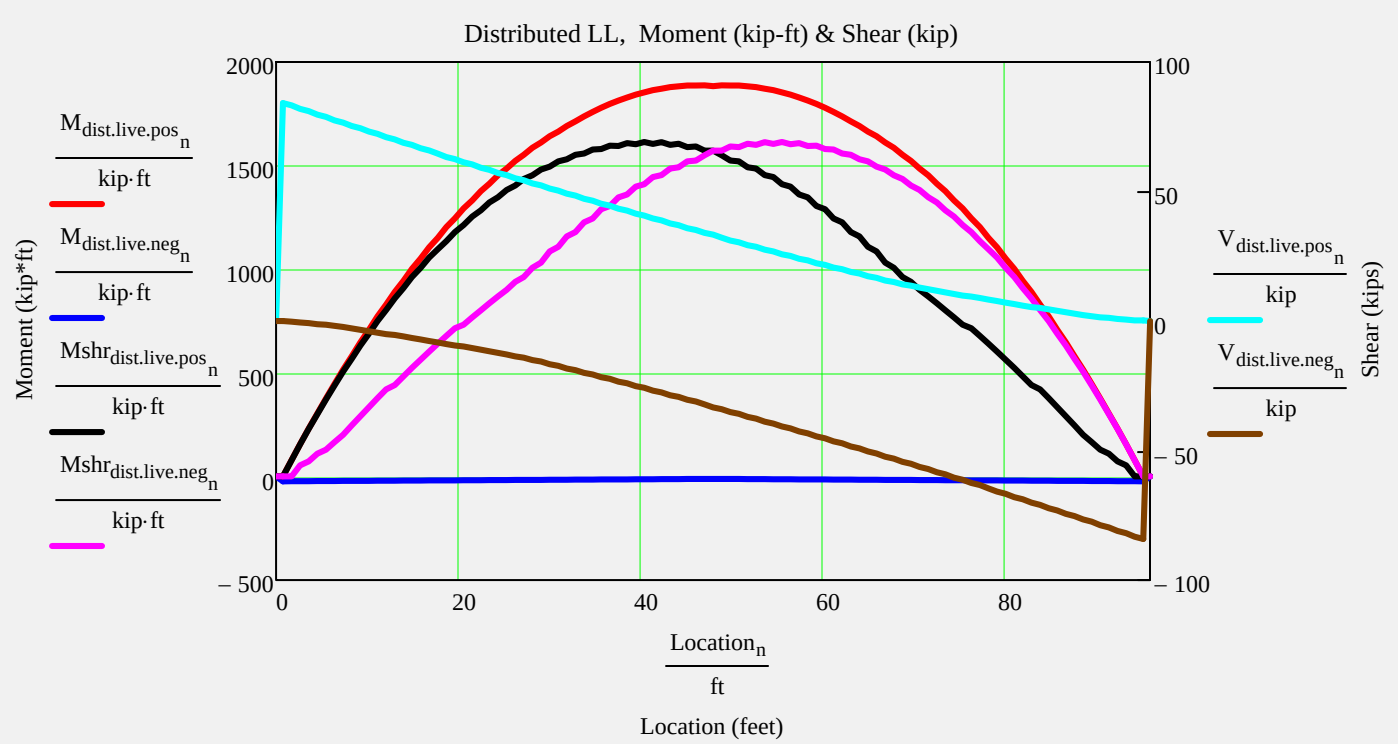
$\max(V_{dl.comp}) = 10.8 \cdot kip$ $\max(M_{dl.comp}) = 255.3 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -10.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 94.33\ ft$ BeamSpacing $= 7.17\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.73$ $g_{mom.fatigue} = 0.6$ $g_{shear} = 0.73$



$\max(V_{dist.live.pos}) = 84.1 \cdot kip$

$\max(M_{dist.live.pos}) = 1887.1 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -84.1 \cdot kip$

$Reaction_{LL} = 85.4 \cdot kip$

$\min(M_{dist.live.neg}) = -23.3 \cdot kip \cdot ft$

$Reaction_{DL} = 90.0 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1614 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.4 \cdot kip$ $Reaction_{lane} = 30.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 69.7 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-96ftSpan_NoSkew_Exterior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck		Bottom of Beam		Beam End: Top	Beam End: Bottom
Area (in^2)	0.62	*1	0		1.58	0
Distance (in)	4	*2	0	*3		
Length (ft)					16	0
Bar Size			5	*4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

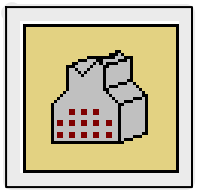
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

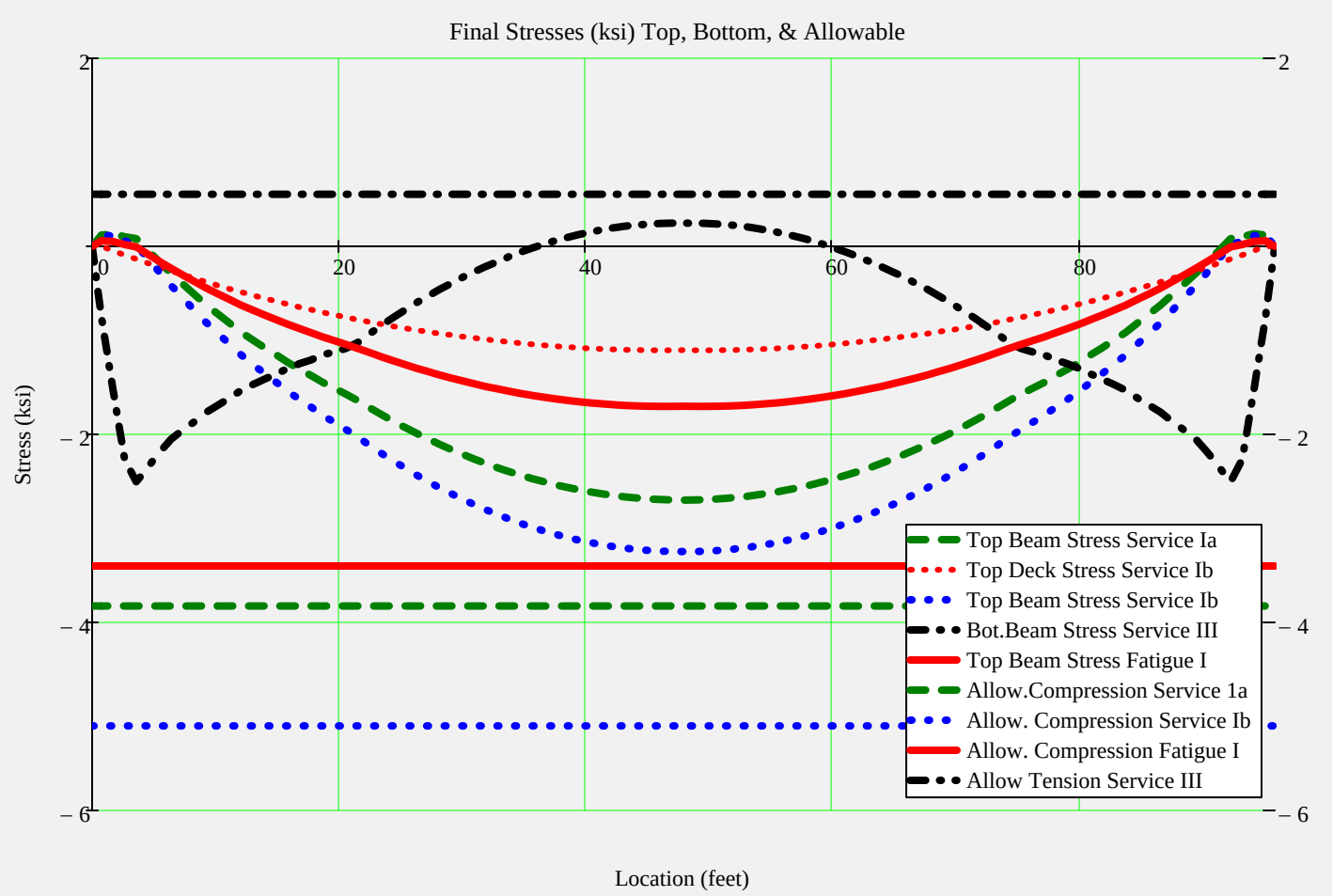
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

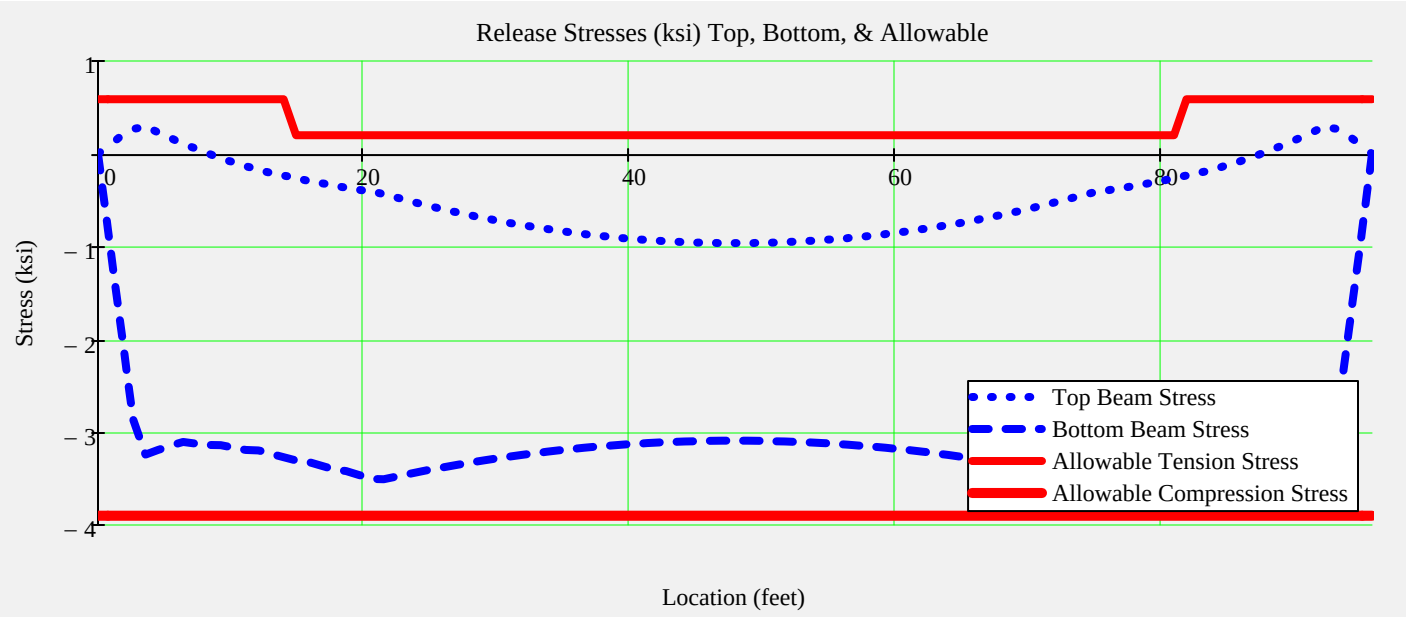
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.81$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.90$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.71$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.64$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.50$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.58	0.29	0.59
"Compression @ Release"	21.50	–3.51	–3.90
"Tension @ ServiceIII"	46.97	0.25	0.55
"CompressionIa @ ServiceI"	47.92	–2.70	–3.83
"CompressionIb @ ServiceI"	47.92	–3.25	–5.10
"Compression @ FatigueI"	49.80	–1.70	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

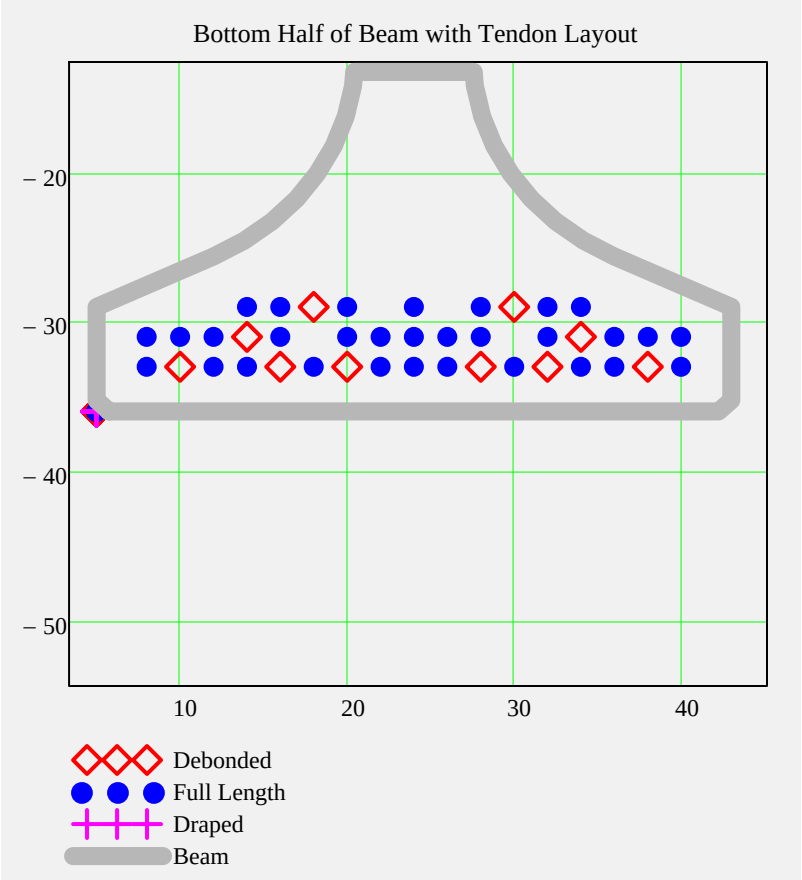
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

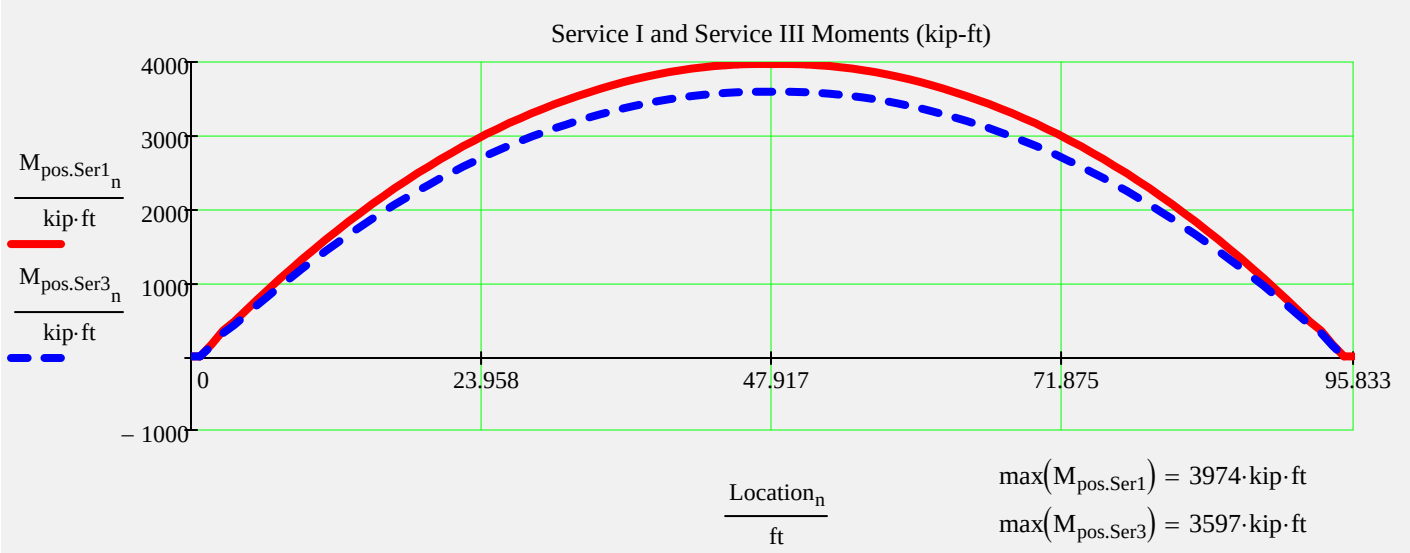
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3974 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3597 \cdot kip \cdot ft$

Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.96	–3.09
"2"	–1.06	–2.53
"4"	–1.01	–2.57
"6"	–2.62	–1.28
"8"	–3.25	0.25

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1842	–1743
"@Final (about composite centroid)"	–1608	–1431

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1513.7	372991	–9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	966
"Non-Composite DL (incl. beam wt.)"	1832
"Composite Dead Load"	255
"Distributed Live Load"	1884

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

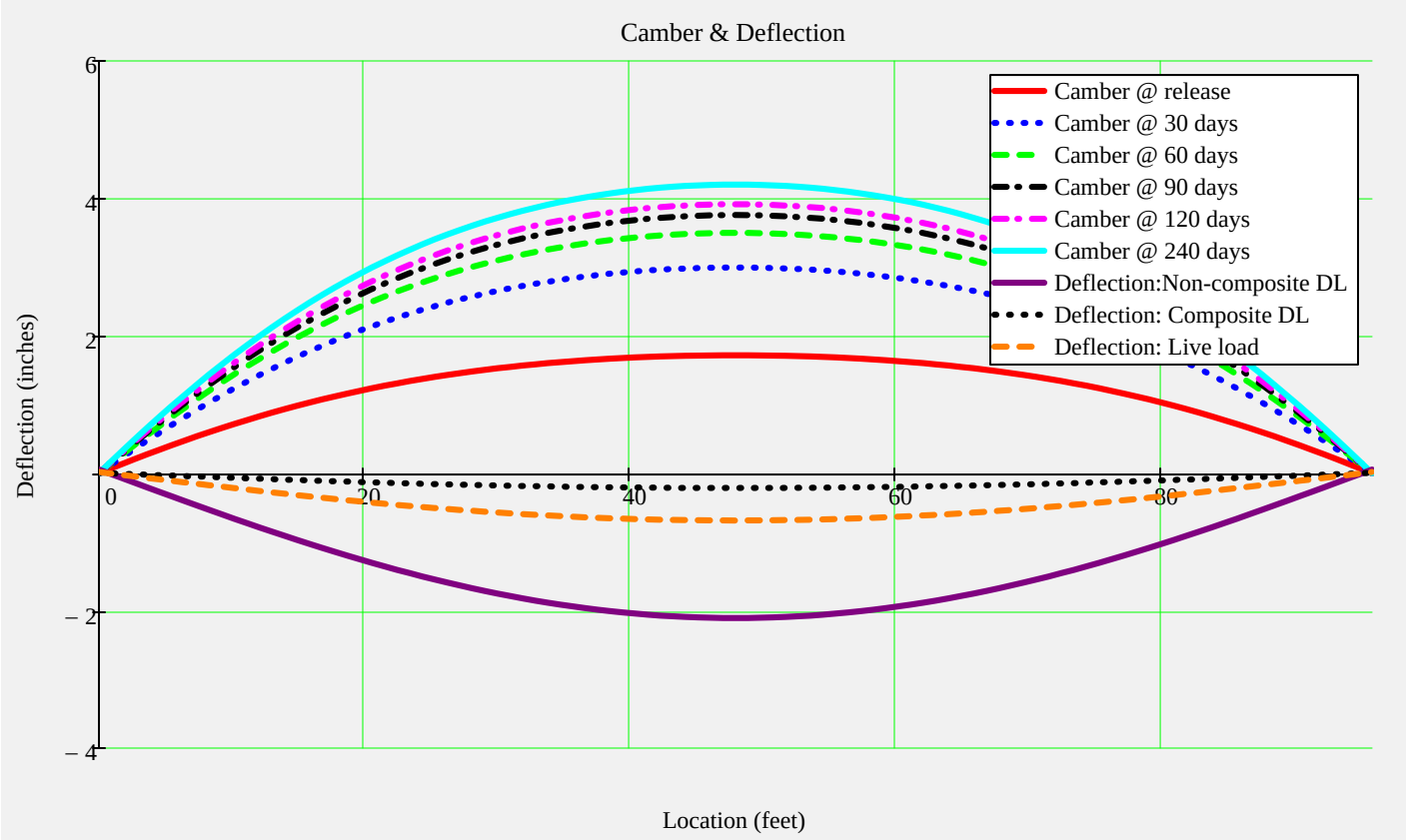
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 94.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.12	–0.80	0.37	1.72
"30 Days"	–0.36	–1.42	0.64	2.99
"60 Days"	–0.45	–1.66	0.75	3.50
"90 Days"	–0.49	–1.79	0.80	3.76
"120 Days"	–0.52	–1.86	0.83	3.92
"240 Days"	–0.57	–2.00	0.89	4.20
"Non-comp DL"	–0.24	0.19	–0.34	–2.11
"Comp DL"	–0.01	0.03	–0.03	–0.21
"LL"	–0.04	0.11	–0.11	–0.69

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.59 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

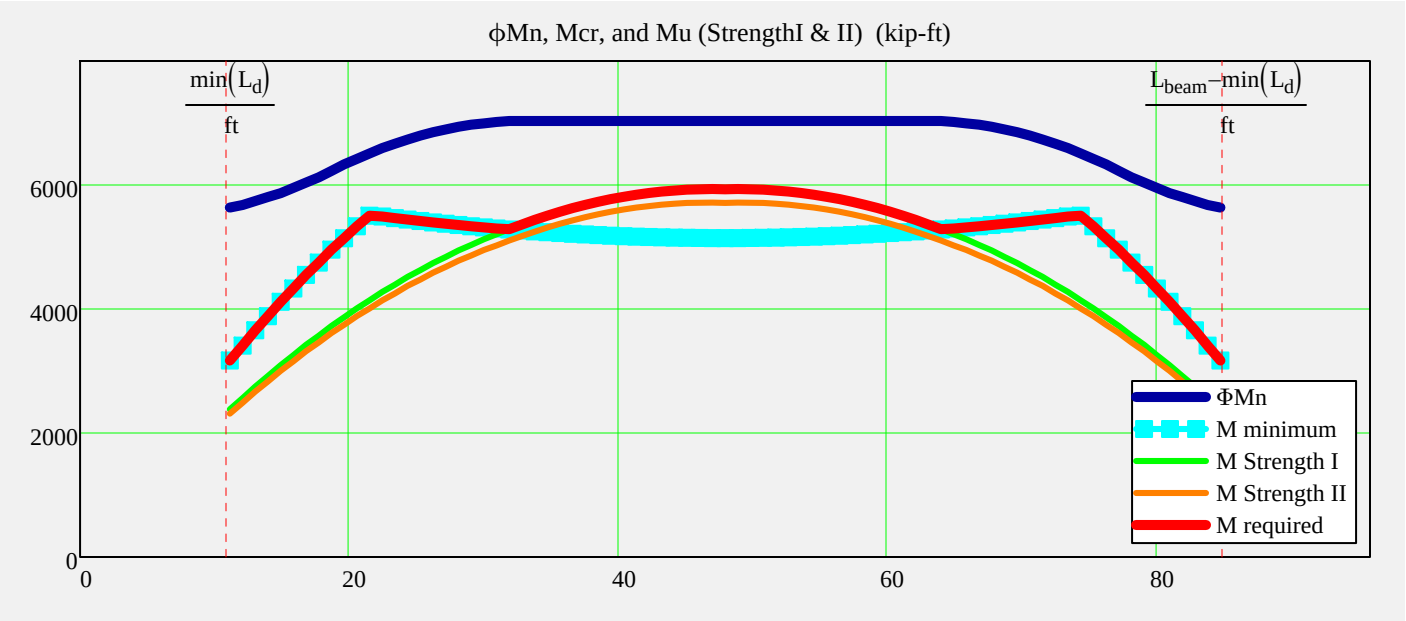
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5935 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5144 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5930 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7031 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 10.9\,\text{ft}$ $\qquad L_{beam} - \min(L_d) = 84.9\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.85$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

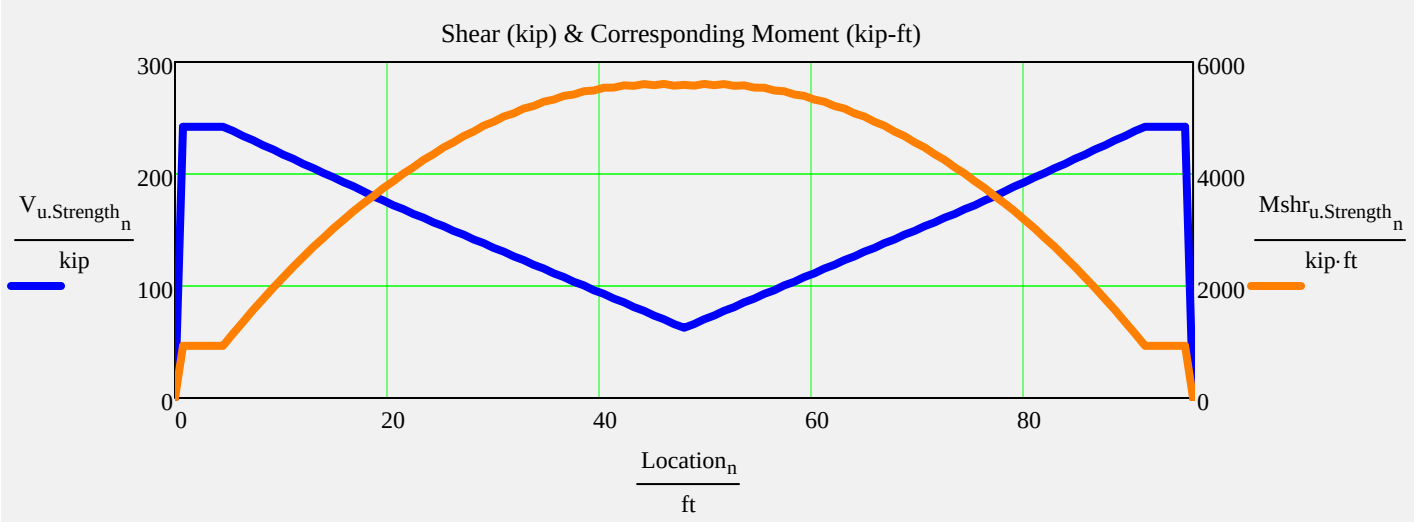
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

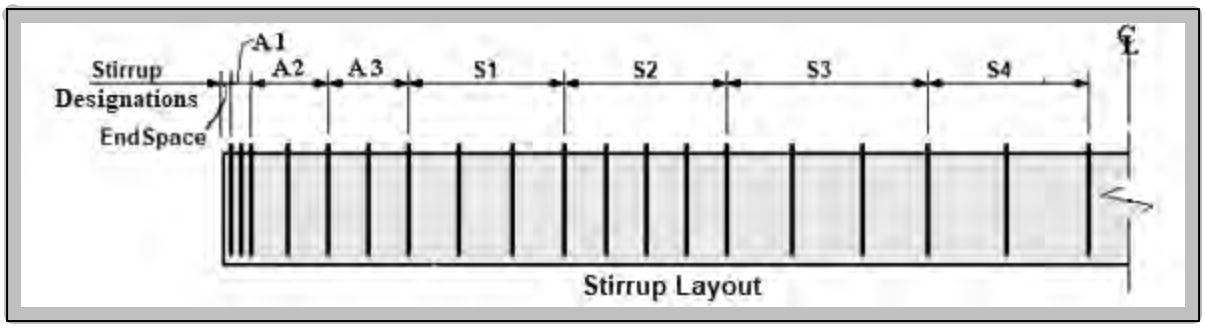
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 259 \\ 252 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 242.2 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5608 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

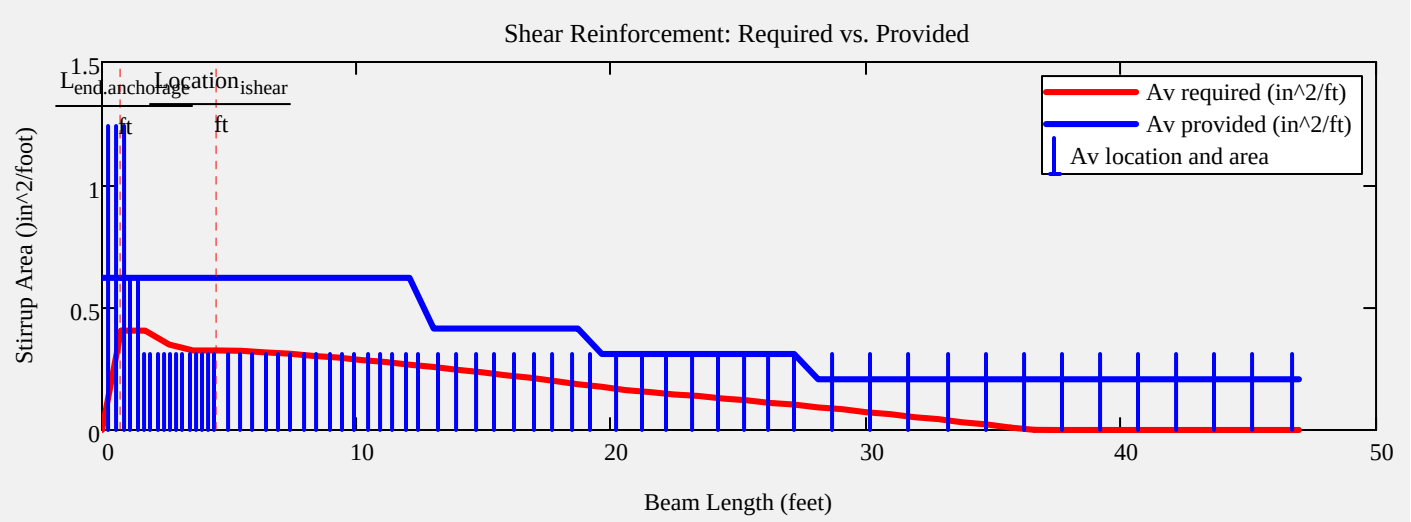
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.52\ ft$

Save Data File

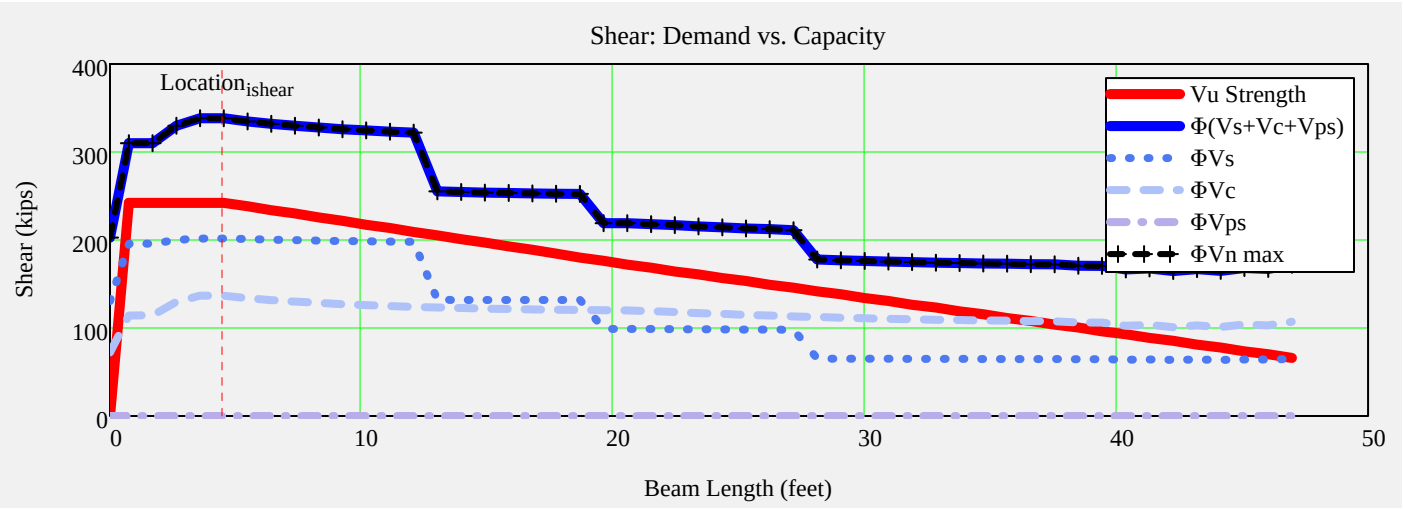
Use current input file

File Name FIB36-96ftSpan_NoSkew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\WB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam"

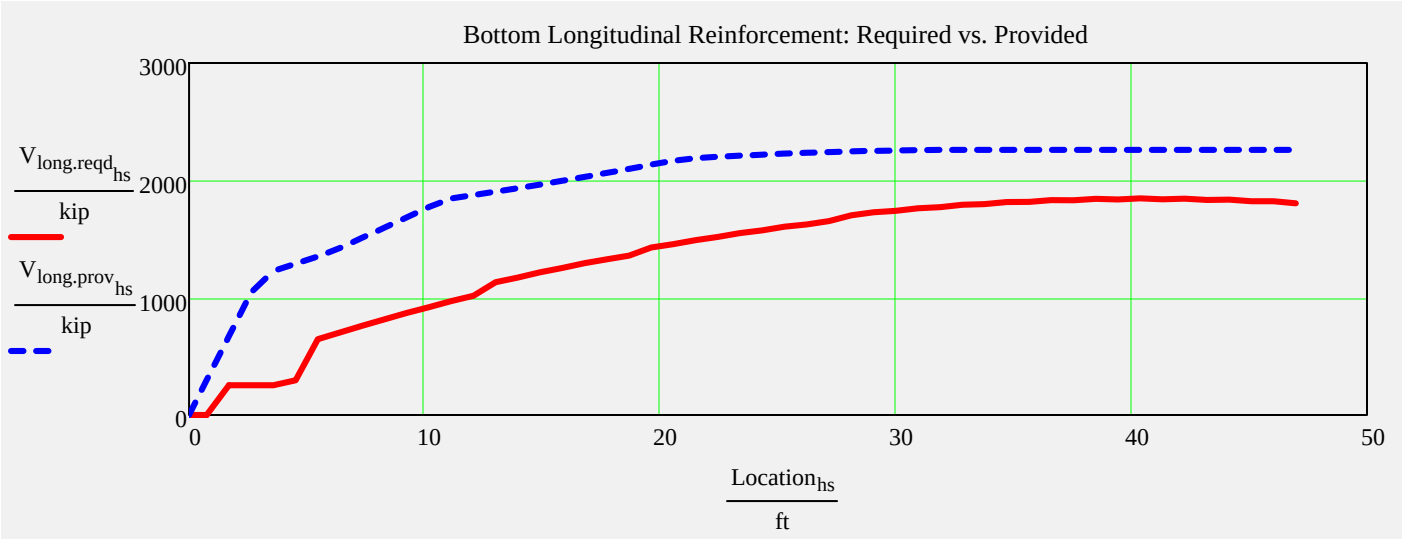
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 19.62 & 176.41 & 219.07 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.81$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

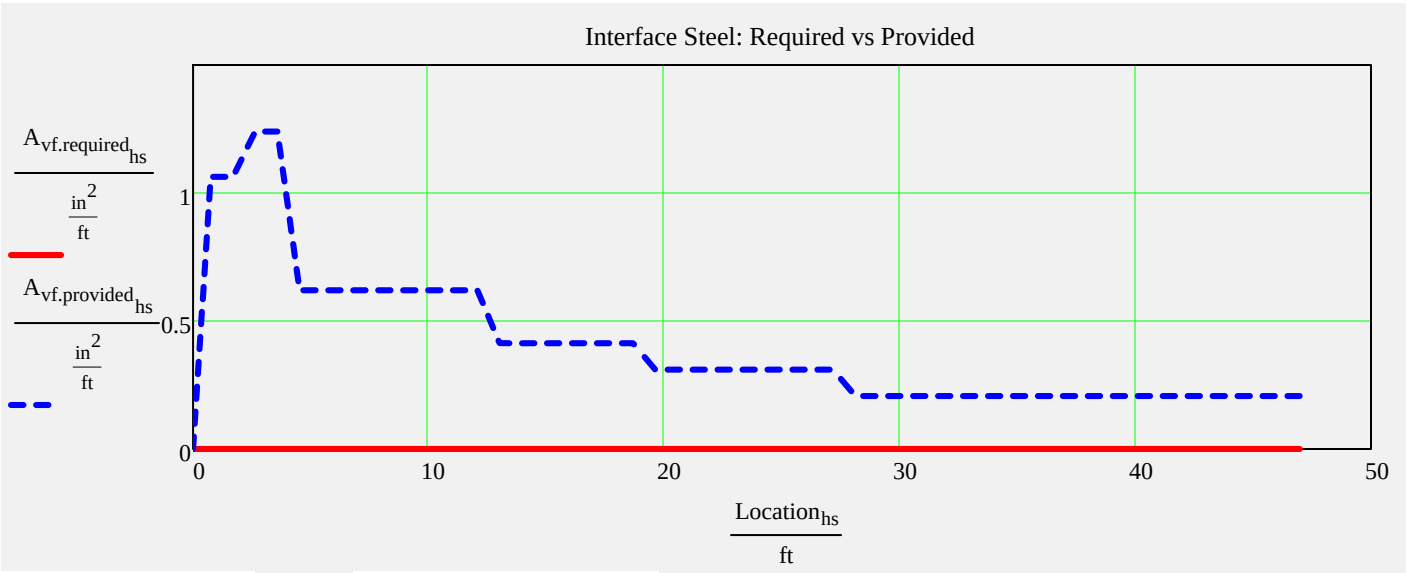


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 40.4 & 1845.7 & 2259.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.82$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 18.86 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

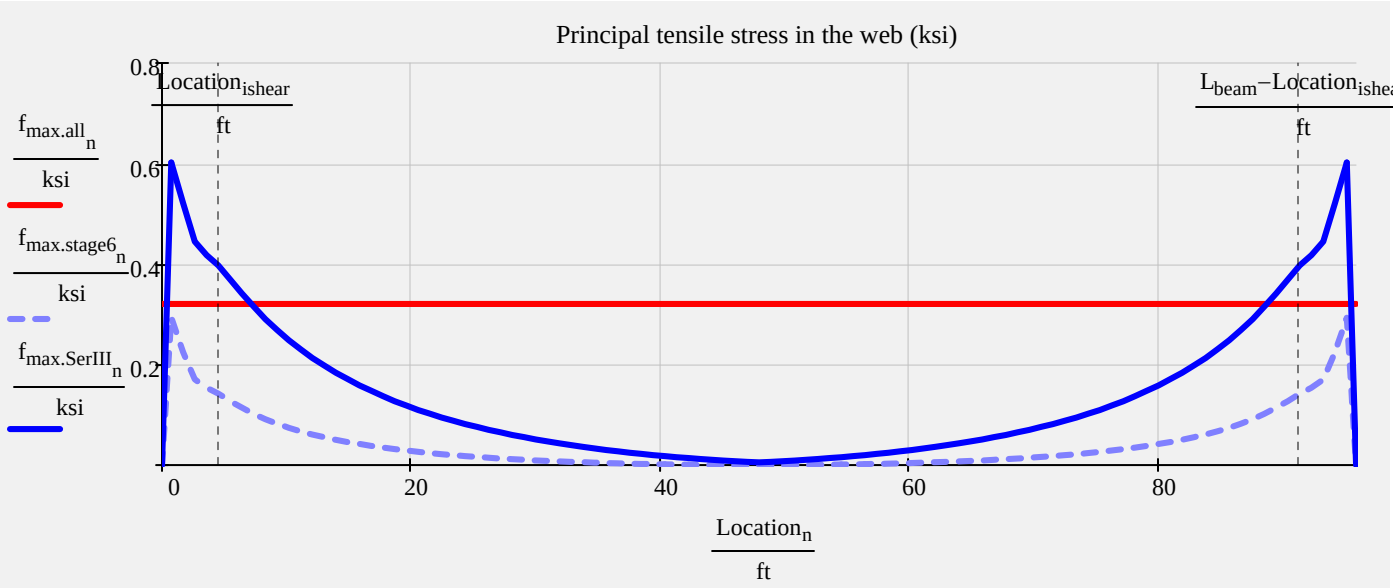
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 54.3 \cdot in$ $\max(DC_f_{max.web}) = 1.24$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

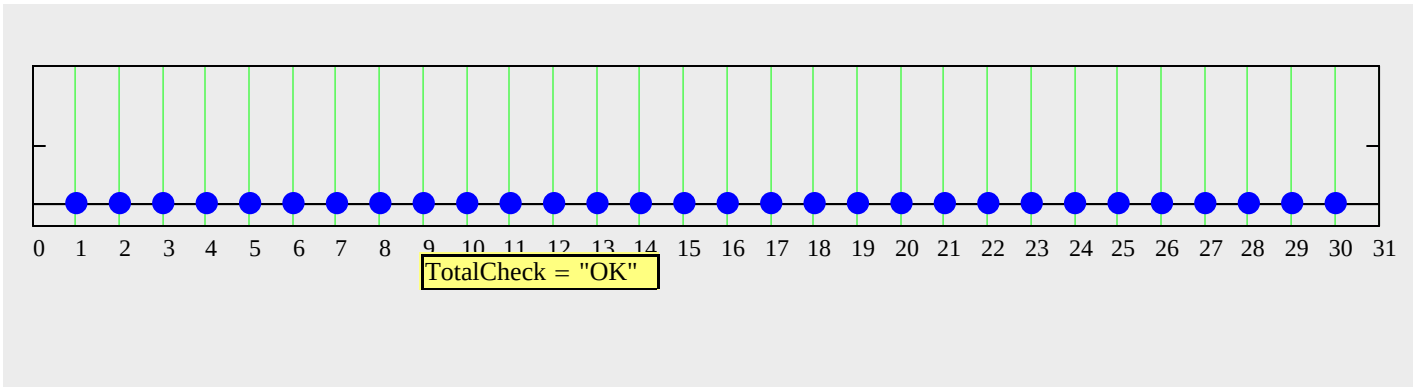
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.73	1.33	"N/A"	46.22	0.73	1.39	"N/A"	18.87	HL-93
"Strength I (Op)"	0.73	1.73	"N/A"	46.22	0.73	1.80	"N/A"	18.87	HL-93
"Service III (Inv)"	0.73	1.23	"N/A"	48.11	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.73	1.34	"N/A"	48.11	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.73	1.43	85.58	48.11	0.73	1.38	82.95	27.36	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.79$ $DC_{LongReinf.Permit} = 0.82$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7031	"factored resistance (kip-ft)...."
"γDL"	2633	"factored dead load (kip-ft)...."
"γLL"	2548	"factored live load (kip-ft)....."
"RF"	1.73	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	219.1	"factored resistance (kip)....."
"γDL"	67	"factored dead load (kip)....."
"γLL"	84.4	"factored live load (kip)....."
"RF"	1.8	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 96 FEET (NO SKEW)
WESTBOUND BRIDGE
(PARKER CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\WB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-96ftSpan_15Skew_Exterior.dat
FIB36-96ftSpan_15Skew_Interior.dat
FIB36-96ftSpan_NoSkew_Exterior.dat
FIB36-96ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

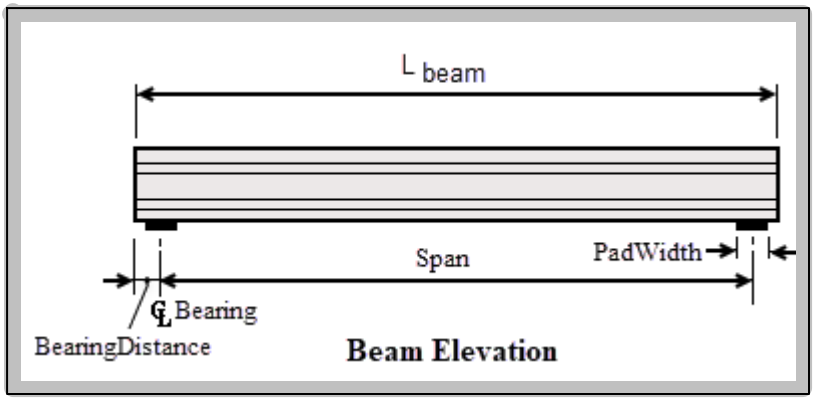
InputDataFile = "FIB36-96ftSpan_NoSkew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 05 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70 over Parker Creek		
Structure No.	Westbound Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-96ftSpan_NoSkew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	95.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	7.1667	ft	*Measured from beam centerline to centerline.*
Overhang	3.4167	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.1667	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1.5	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

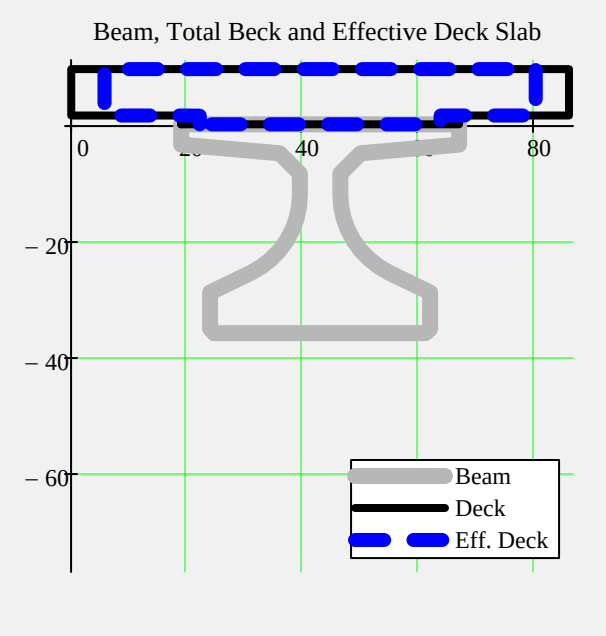
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1.5 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 86·in

$b_e = 86 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.79 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.06 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.108 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 95.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

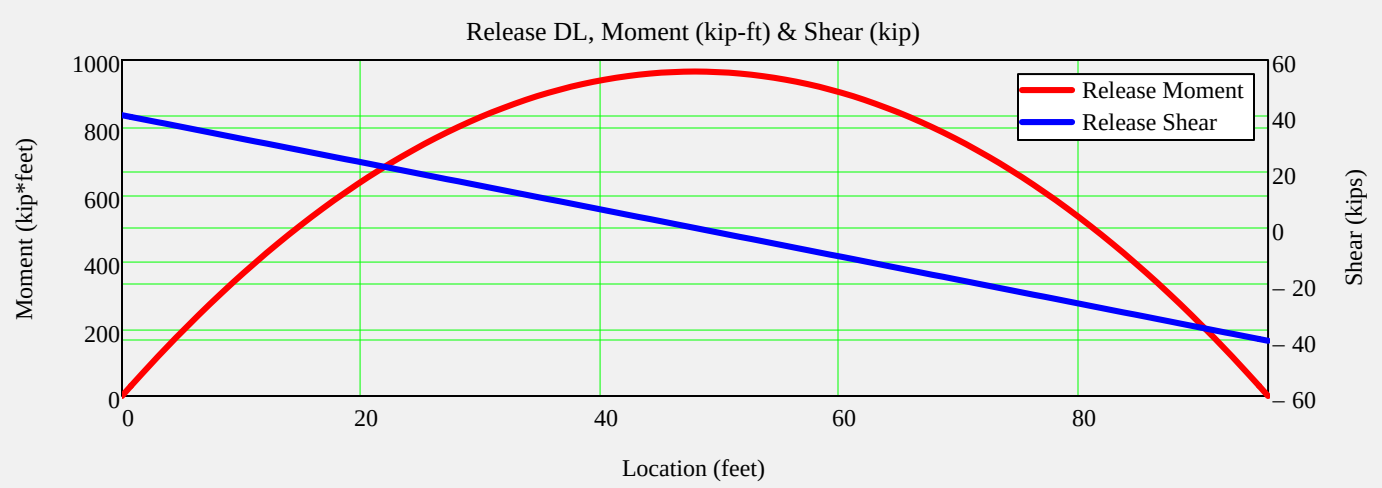
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

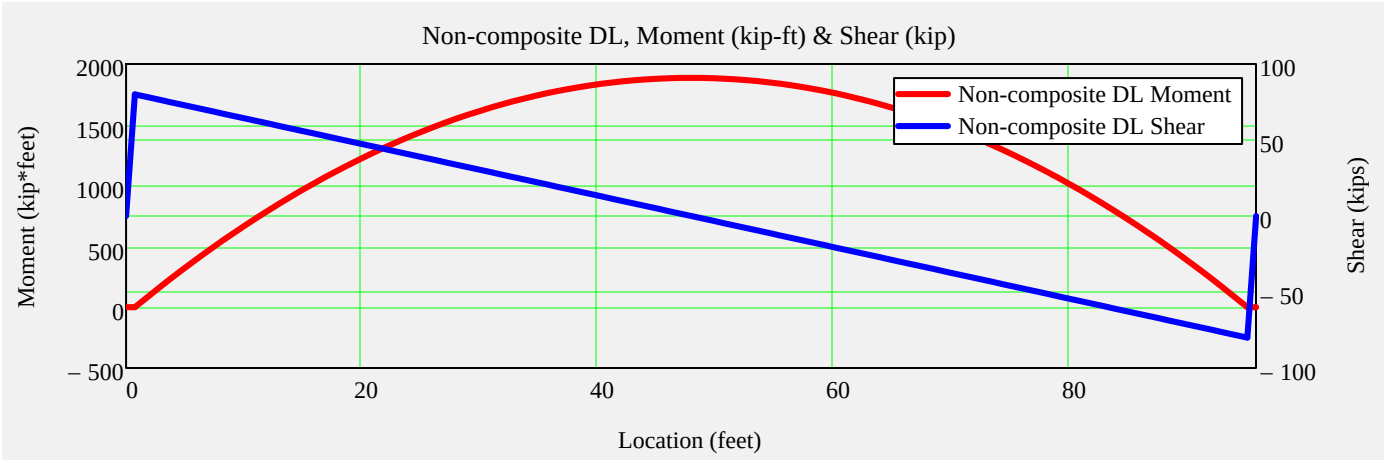
Release Dead Load Moments and Shears

$L_{span} = 94.33\ ft$



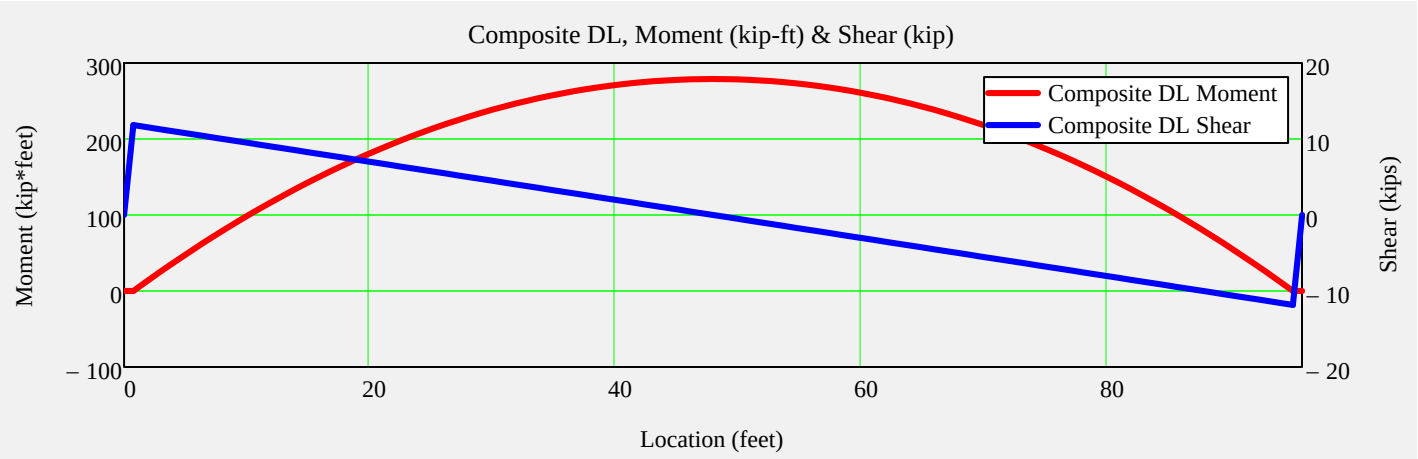
$\max(V_{release}) = 40.3 \cdot kip$ $\max(M_{release}) = 965.5 \cdot kip \cdot ft$ $\min(V_{release}) = -40.3 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 80.0 \cdot kip$ $\max(M_{dl.non.comp}) = 1886.1 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -80.0 \cdot kip$

Composite Dead Load Moments and Shear



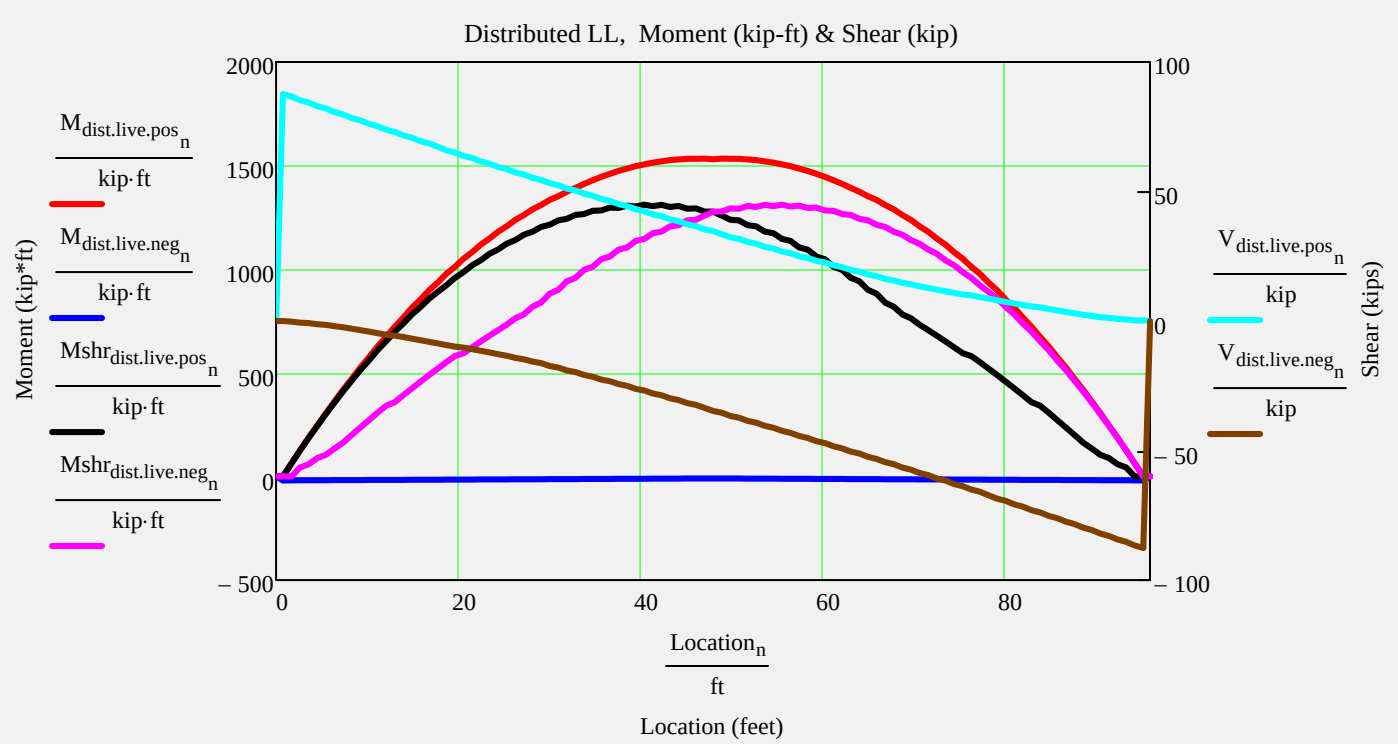
$\max(V_{dl.comp}) = 11.8 \cdot kip$ $\max(M_{dl.comp}) = 278.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -11.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 94.33\ ft$ BeamSpacing $= 7.17\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.59$ $g_{mom.fatigue} = 0.35$ $g_{shear} = 0.76$



$\max(V_{dist.live.pos}) = 87.6 \cdot kip$

$\max(M_{dist.live.pos}) = 1533.4 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -87.6 \cdot kip$

$Reaction_{LL} = 88.9 \cdot kip$

$\min(M_{dist.live.neg}) = -18.9 \cdot kip \cdot ft$

$Reaction_{DL} = 93.3 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1311 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.4 \cdot kip$ $Reaction_{lane} = 30.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 72.6 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-96ftSpan_NoSkew_Interior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.62 *1	0	1.58	0
Distance (in)	4 *2	0 *3		
Length (ft)			16	0
Bar Size		5 *4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

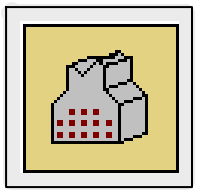
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

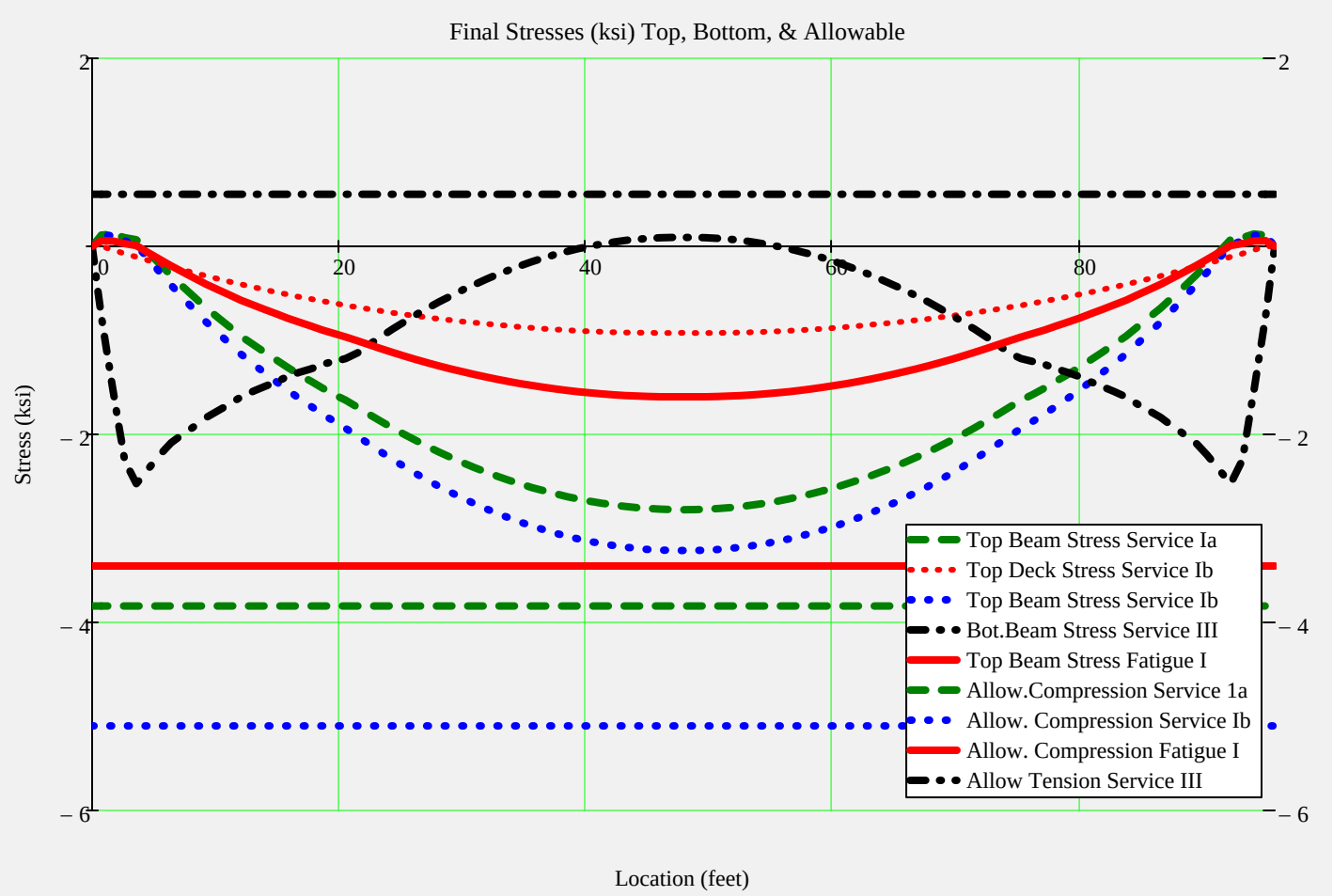
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

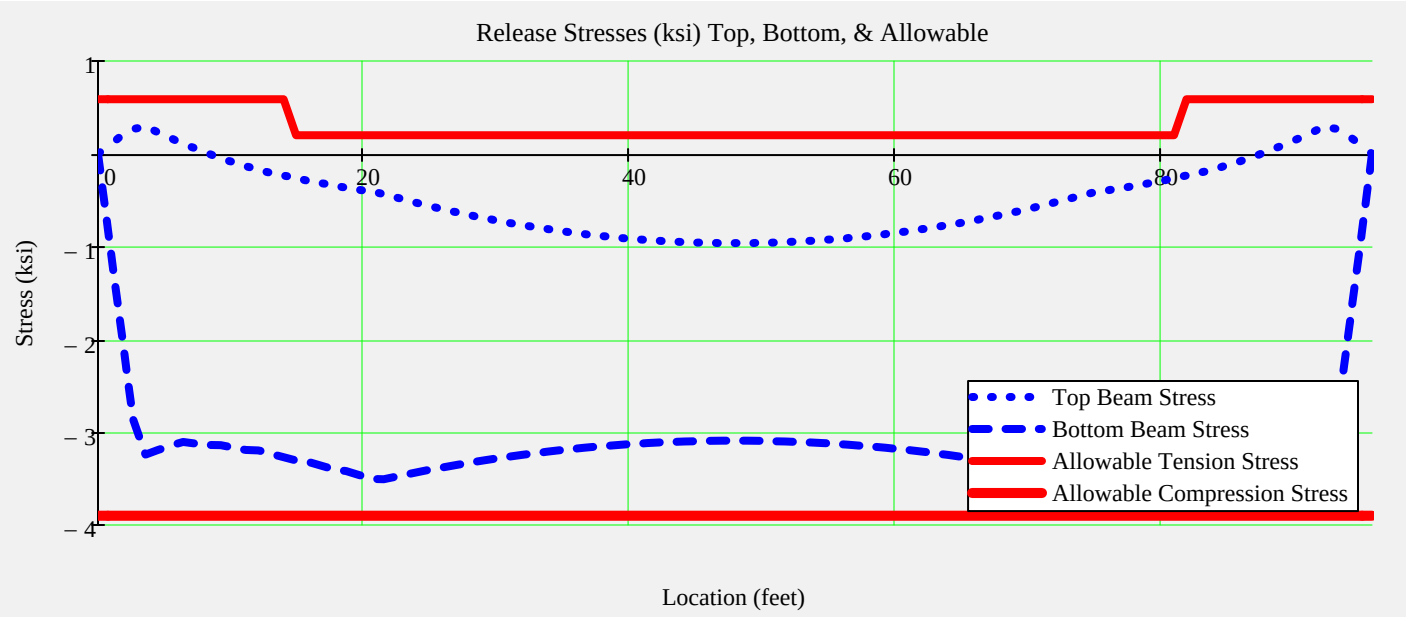
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel} = "OK"$	$\max(DC_f_{tension.rel}) = 0.81$
Release compression	$Check_f_{comp.rel} = "OK"$	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII} = "OK"$	$\max(DC_f_{tension.ServiceIII}) = 0.85$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa} = "OK"$	$\max(DC_f_{comp.ServiceIa}) = 0.73$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb} = "OK"$	$\max(DC_f_{comp.ServiceIb}) = 0.63$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI} = "OK"$	$\max(DC_f_{comp.FatigueI}) = 0.47$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.58	0.29	0.59
"Compression @ Release"	21.50	–3.51	–3.90
"Tension @ ServiceIII"	46.97	0.09	0.55
"CompressionIa @ ServiceI"	47.92	–2.80	–3.83
"CompressionIb @ ServiceI"	47.92	–3.24	–5.10
"Compression @ FatigueI"	48.86	–1.60	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

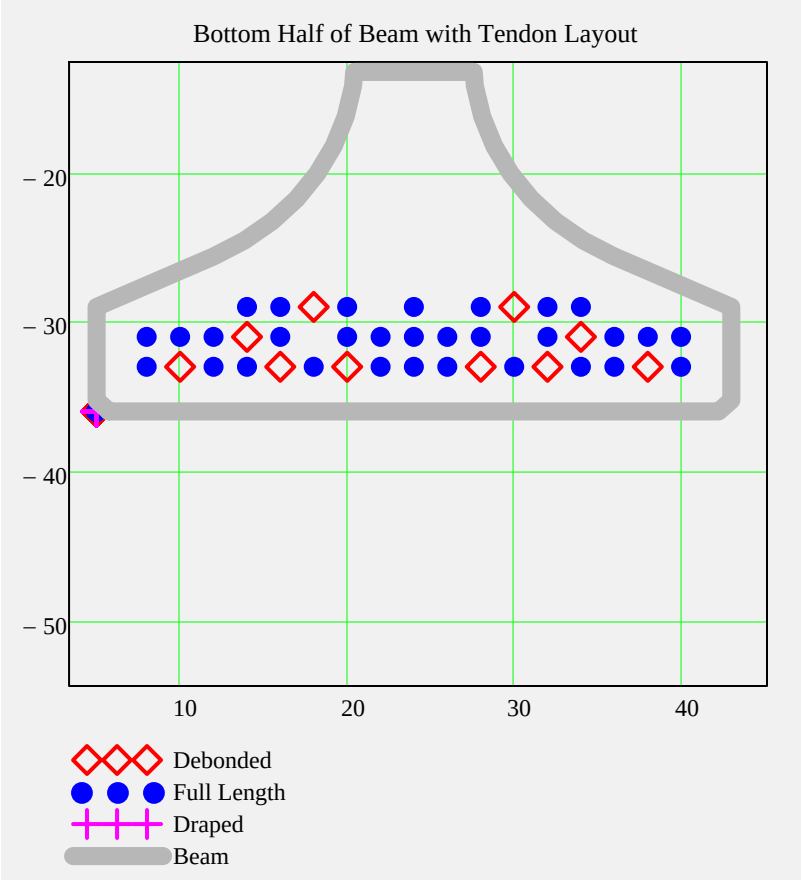
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

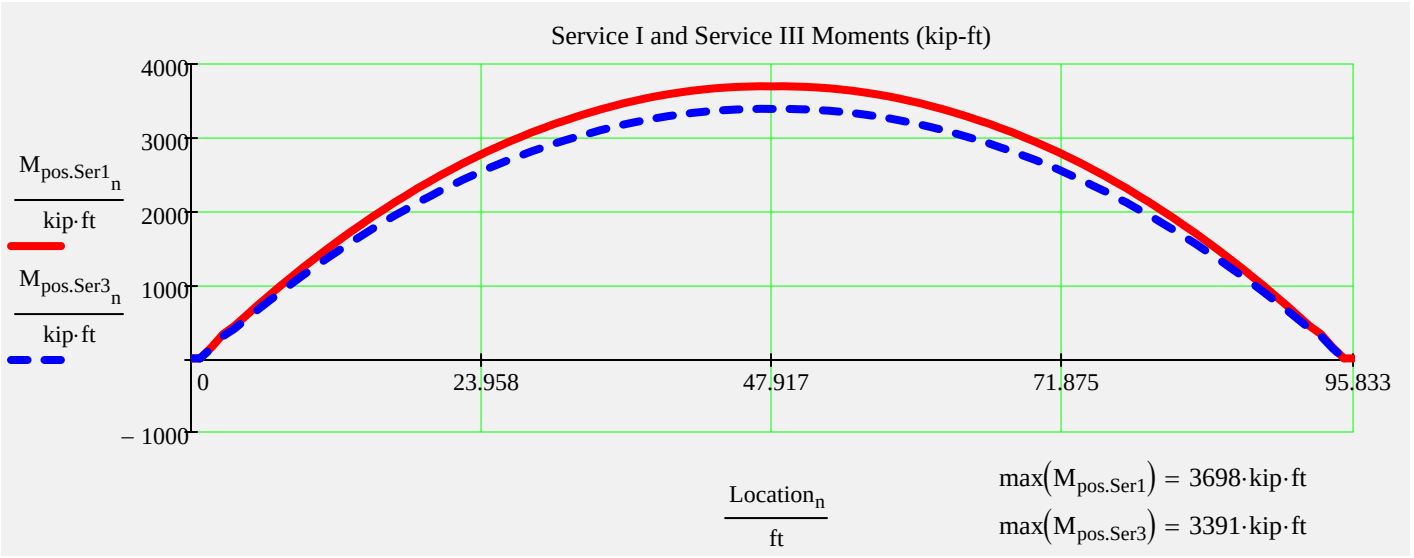
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3698 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3391 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses =$

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.96	–3.09
"2"	–1.06	–2.53
"4"	–1.01	–2.57
"6"	–2.72	–1.21
"8"	–3.24	0.09

$PrestressForce =$

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1842	–1743
"@Final (about composite centroid)"	–1608	–1431

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1528.1	376065	–8.9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	966
"Non-Composite DL (incl. beam wt.)"	1886
"Composite Dead Load"	279
"Distributed Live Load"	1531

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

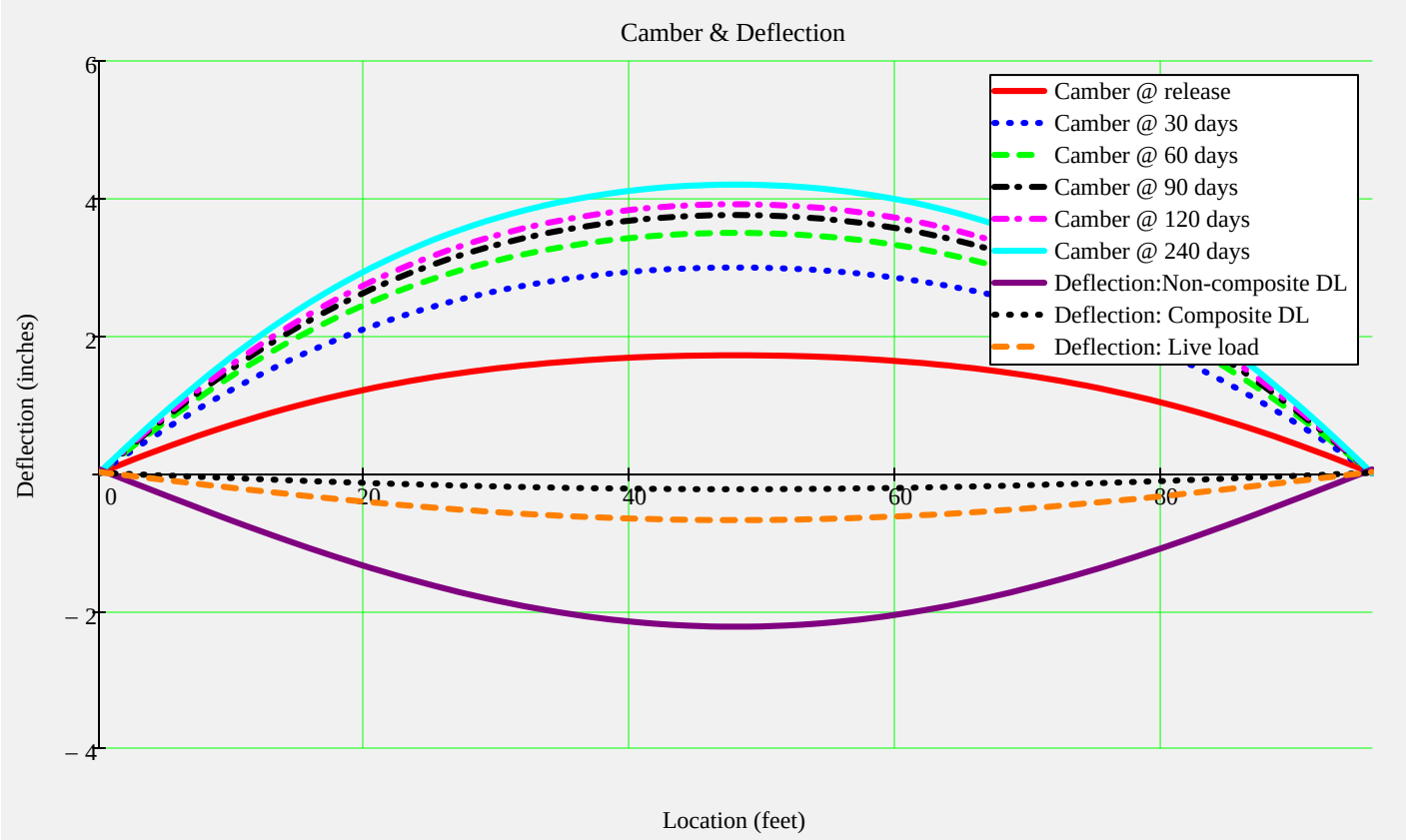
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 94.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.12	–0.80	0.37	1.72
"30 Days"	–0.36	–1.42	0.64	2.99
"60 Days"	–0.45	–1.66	0.75	3.50
"90 Days"	–0.49	–1.79	0.80	3.76
"120 Days"	–0.52	–1.86	0.83	3.92
"240 Days"	–0.57	–2.00	0.89	4.20
"Non-comp DL"	–0.25	0.20	–0.36	–2.23
"Comp DL"	–0.01	0.04	–0.04	–0.23
"LL"	–0.03	0.11	–0.11	–0.68

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.45 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

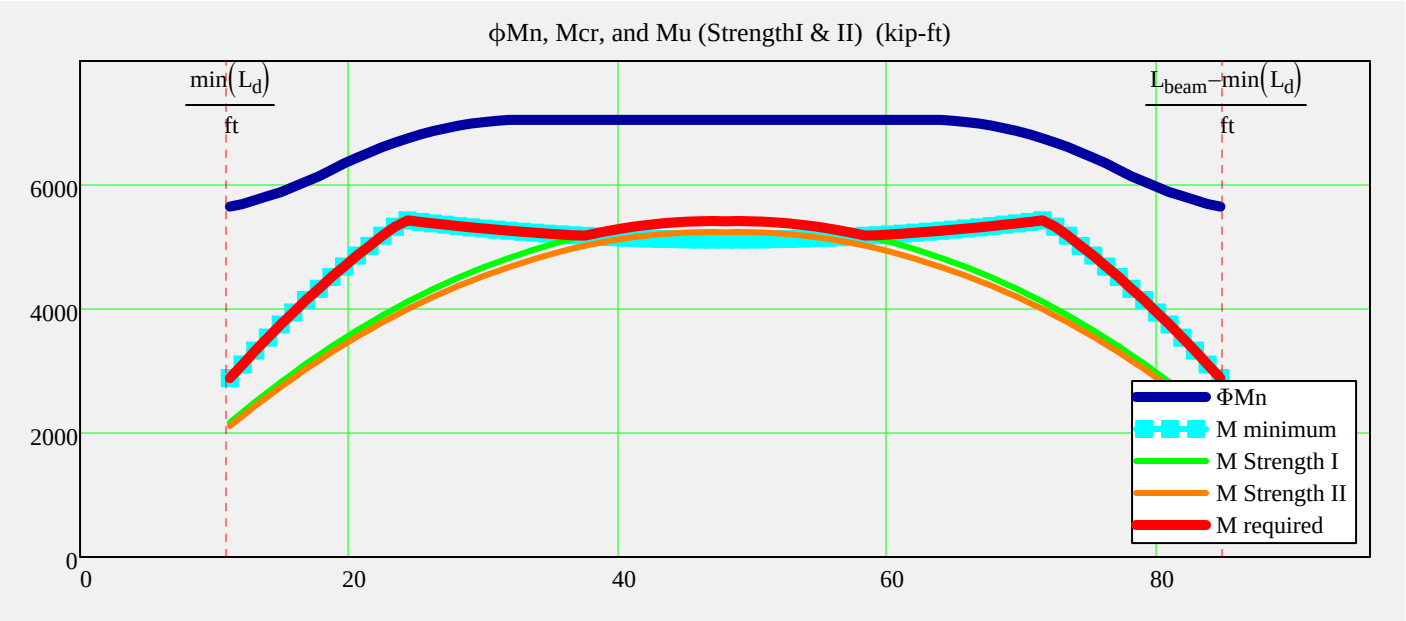
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5419 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5119 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5415 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7052 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 10.9\ \text{ft}$ $L_{beam} - \min(L_d) = 84.9\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.80$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

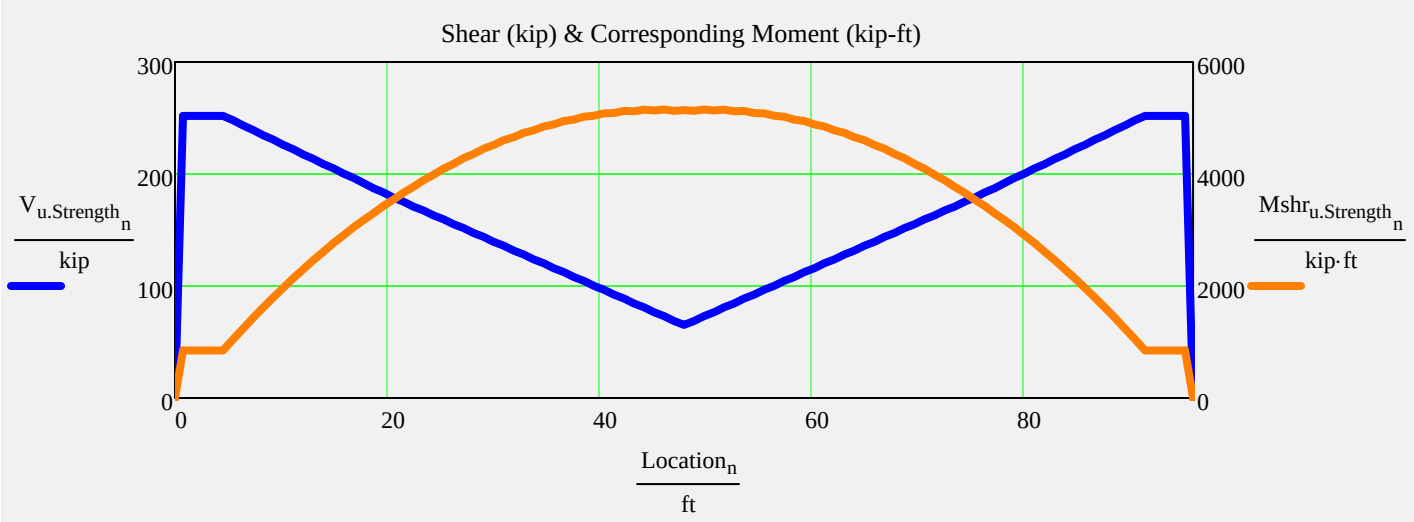
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

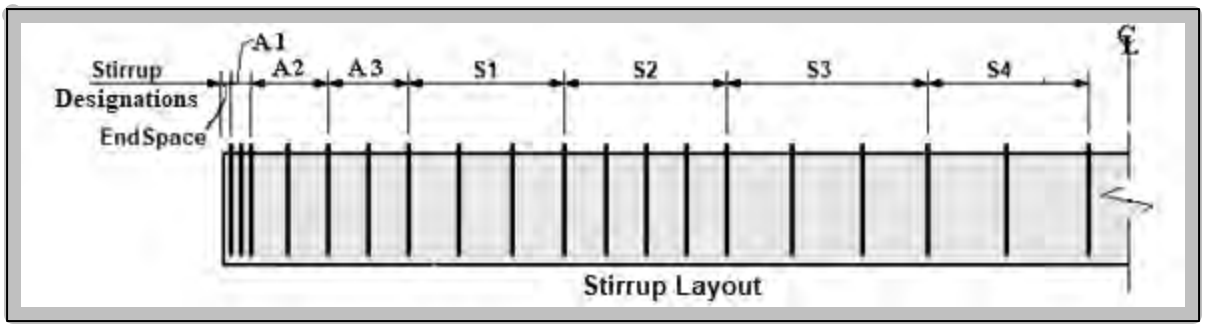
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 269 \\ 262 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 251.9 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5152 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

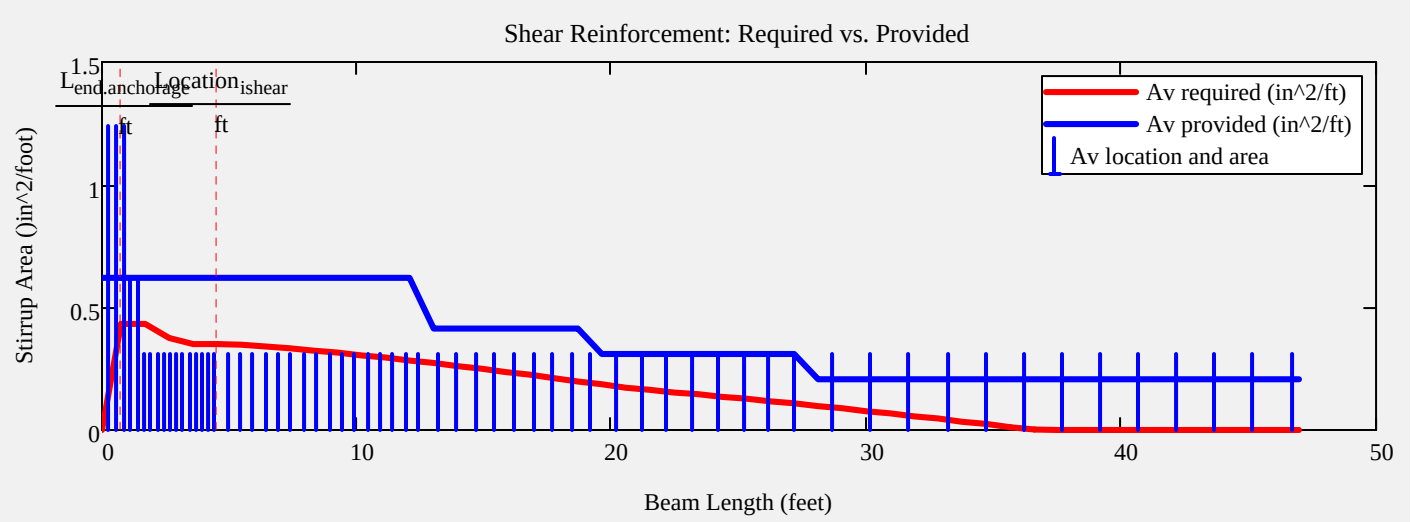
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.52\ ft$

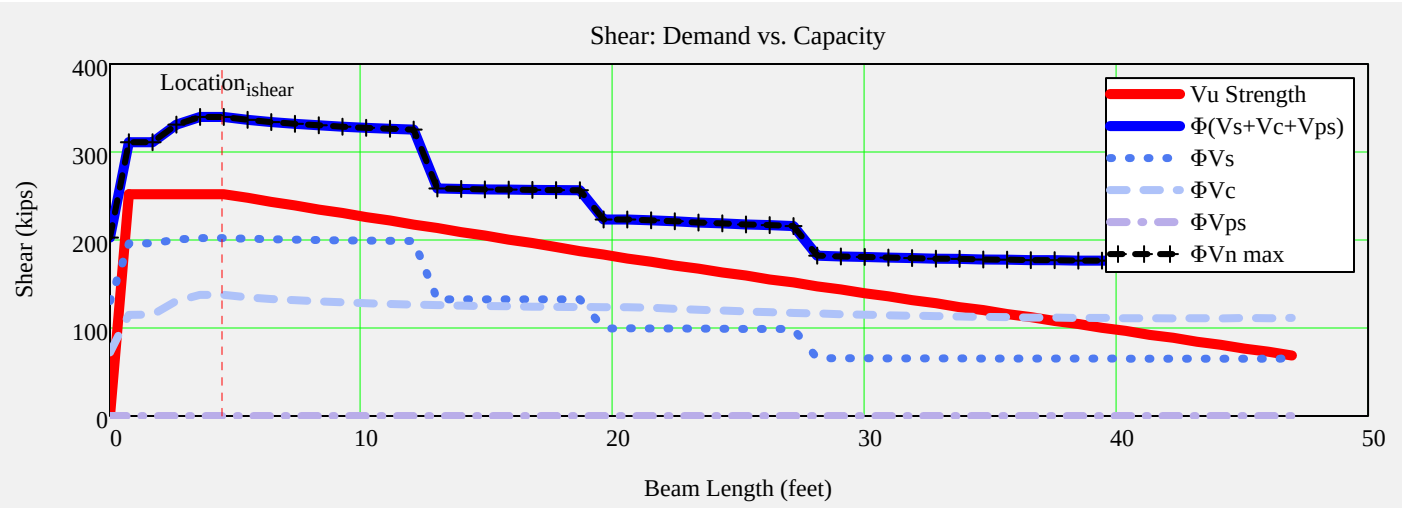
Save Data File ☑ Use current input file

File Name FIB36-96ftSpan_NoSkew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\WB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam"

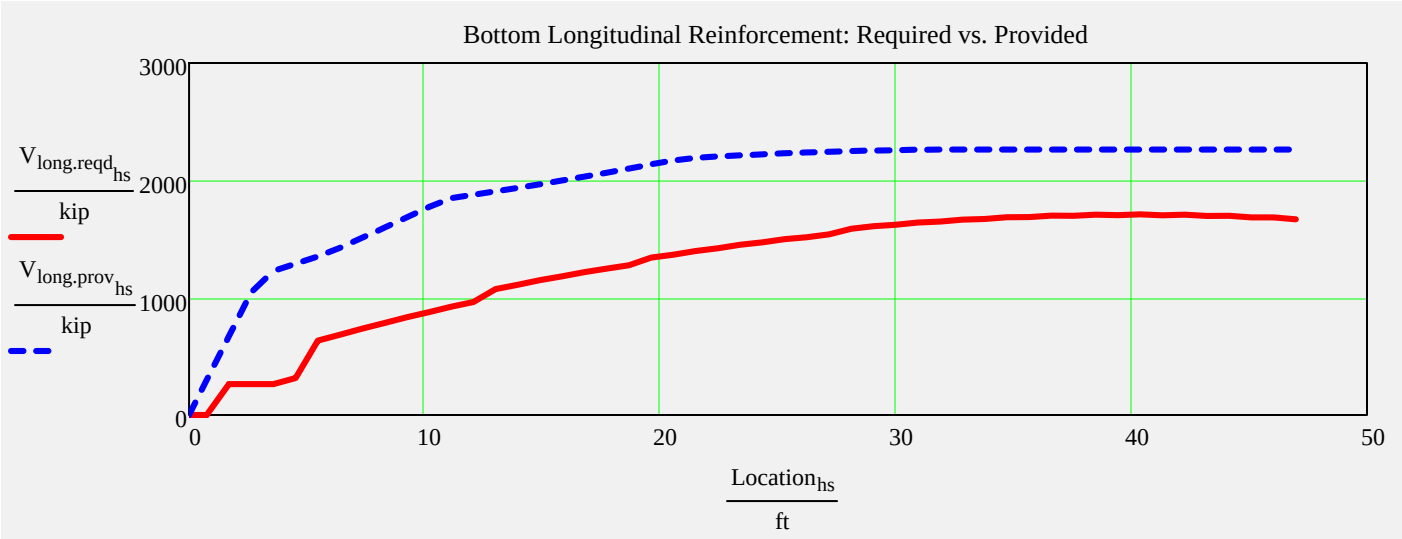
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 13.01 & 213.60 & 258.49 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.83$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

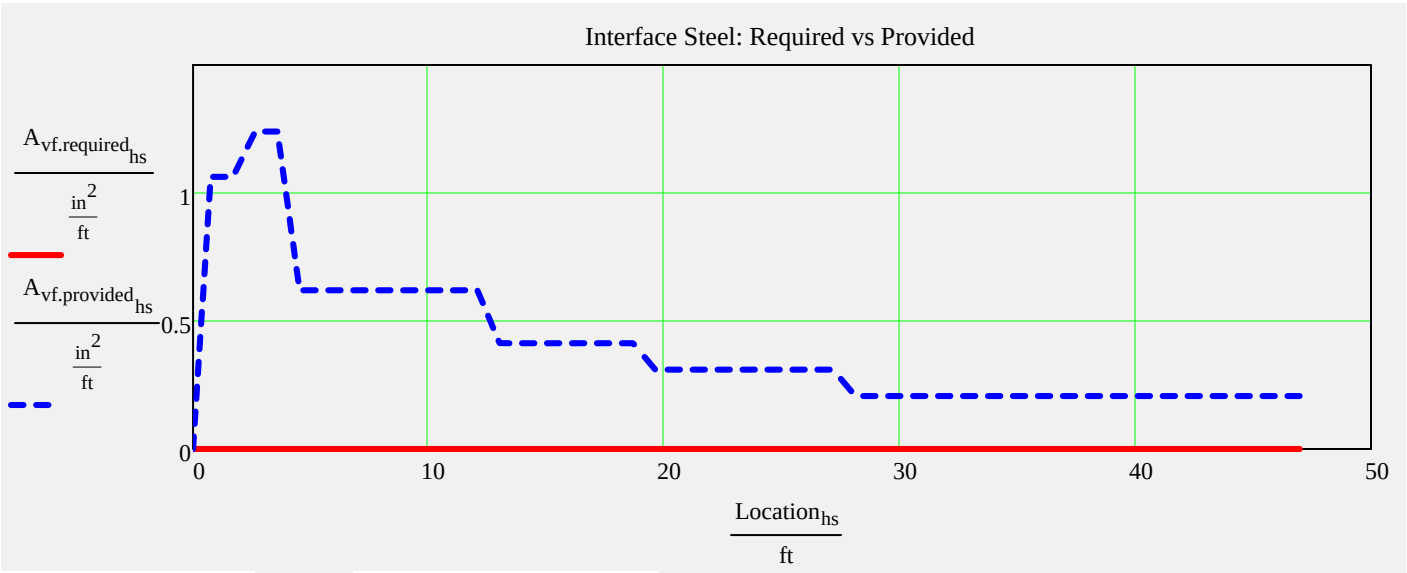


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 40.4 & 1709.6 & 2262.6 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.76$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.86 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

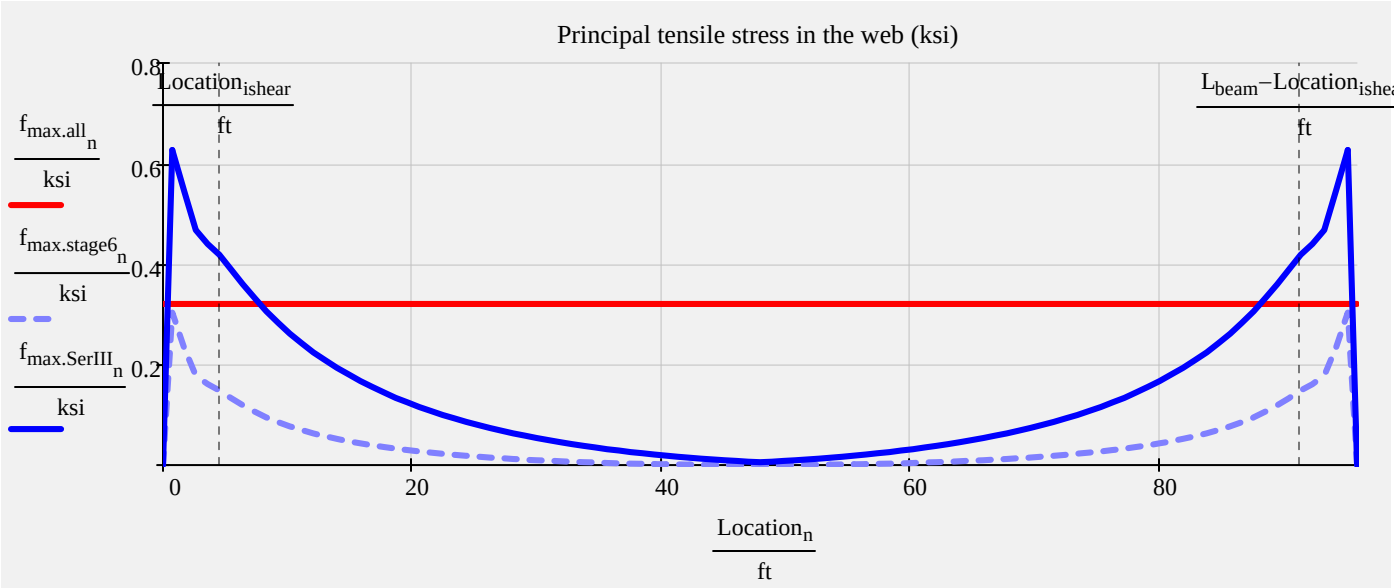
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 54.3 \cdot in$ $\max(DC_f_{max.web}) = 1.31$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

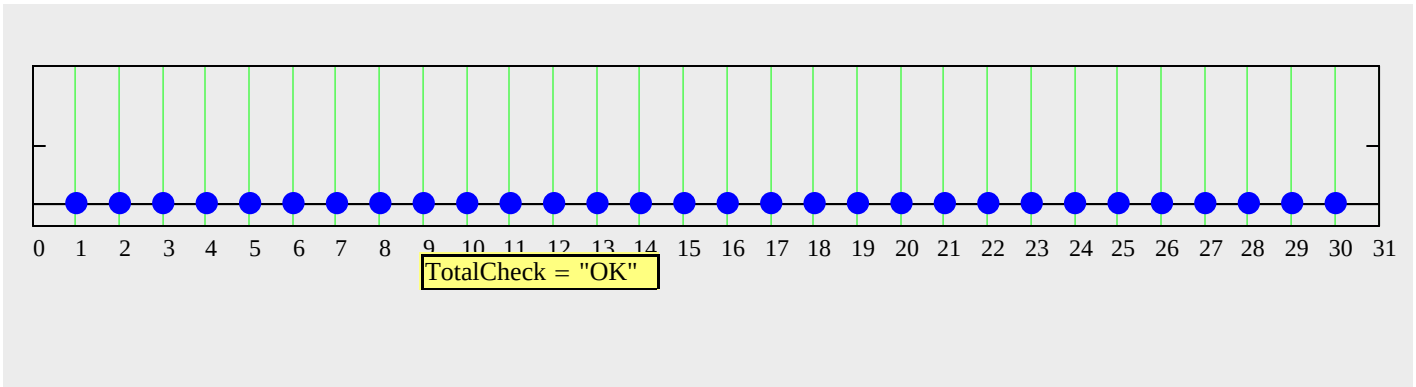
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.59	1.61	"N/A"	48.11	0.76	1.35	"N/A"	18.87	HL-93
"Strength I (Op)"	0.59	2.09	"N/A"	48.11	0.76	1.75	"N/A"	18.87	HL-93
"Service III (Inv)"	0.59	1.43	"N/A"	48.11	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.59	1.56	"N/A"	46.22	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.59	1.72	103.34	48.11	0.76	1.35	81.17	18.87	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.74$ $DC_{LongReinf.Permit} = 0.76$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7052	"factored resistance (kip-ft)...."
"γDL"	2735	"factored dead load (kip-ft)...."
"γLL"	2070	"factored live load (kip-ft)....."
"RF"	2.09	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	223.2	"factored resistance (kip)....."
"γDL"	69.6	"factored dead load (kip)....."
"γLL"	87.8	"factored live load (kip)....."
"RF"	1.75	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 96 FEET (15 DEG. SKEW)
WESTBOUND BRIDGE
(MOSSY GULLY & LONG POINT MARSH)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam	
FSB	
FUB	
FlatSlab	
InvertedT	
DoubleT	

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\WB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-96ftSpan_15Skew_Exterior.dat
FIB36-96ftSpan_15Skew_Interior.dat
FIB36-96ftSpan_NoSkew_Exterior.dat
FIB36-96ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

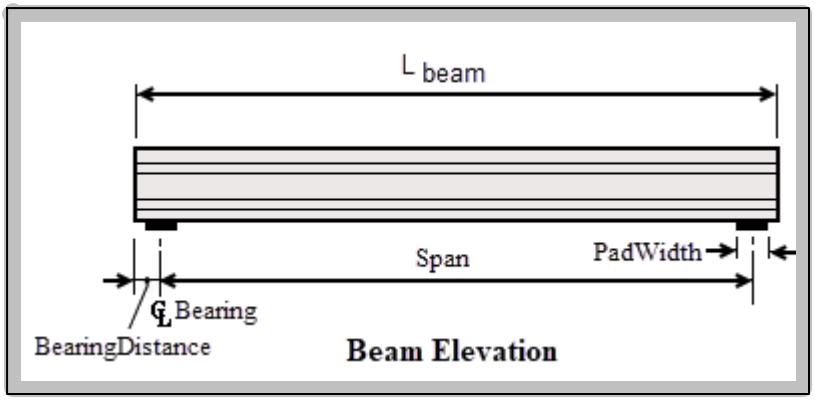
InputDataFile = "FIB36-96ftSpan_15Skew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 05 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70 over Parker Creek		
Structure No.	Westbound Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-96ftSpan_15Skew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FIB36.bmp"
L_{beam}	95.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	7.1667	ft	*Measured from beam centerline to centerline.*
Overhang	3.4167	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.1667	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1.5	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

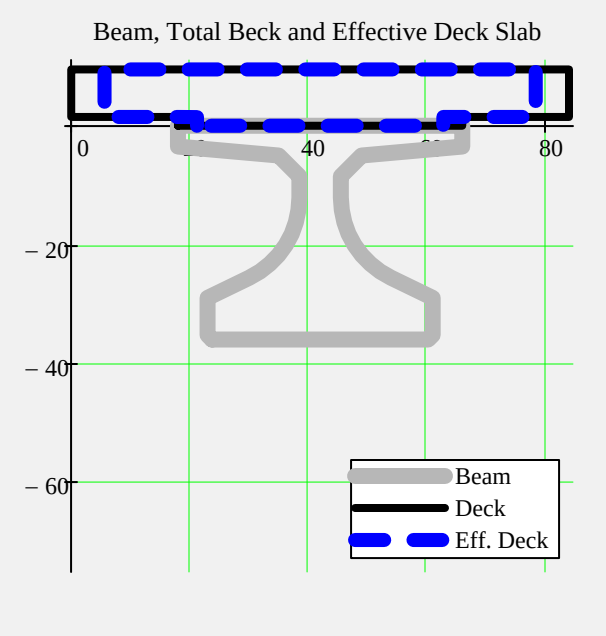
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1.5 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 86·in

$b_e = 84 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.78 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.03 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.086 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 95.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

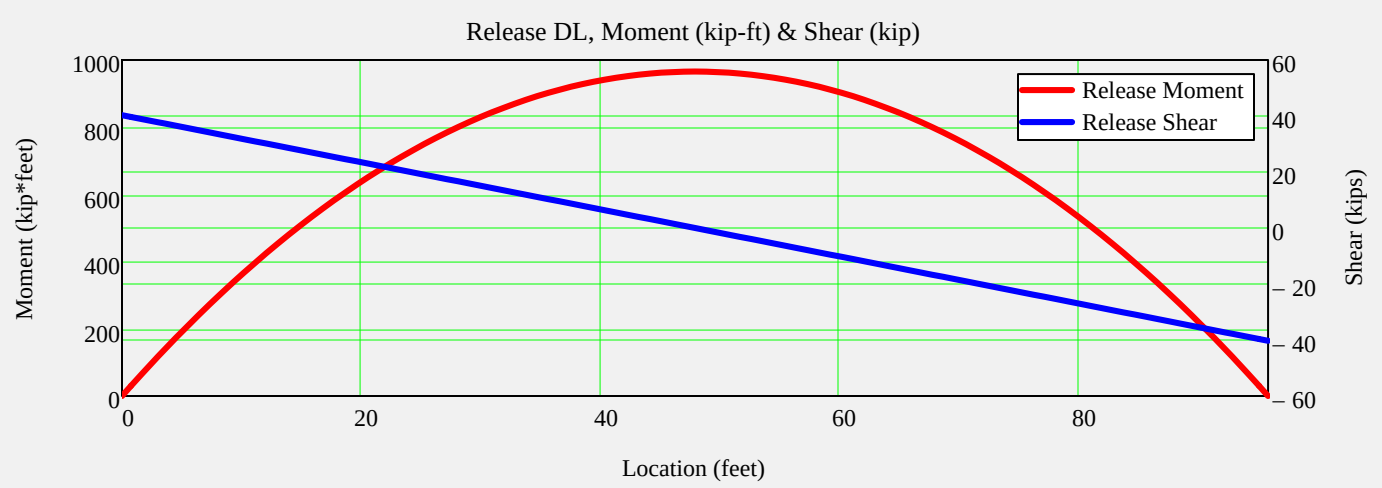
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

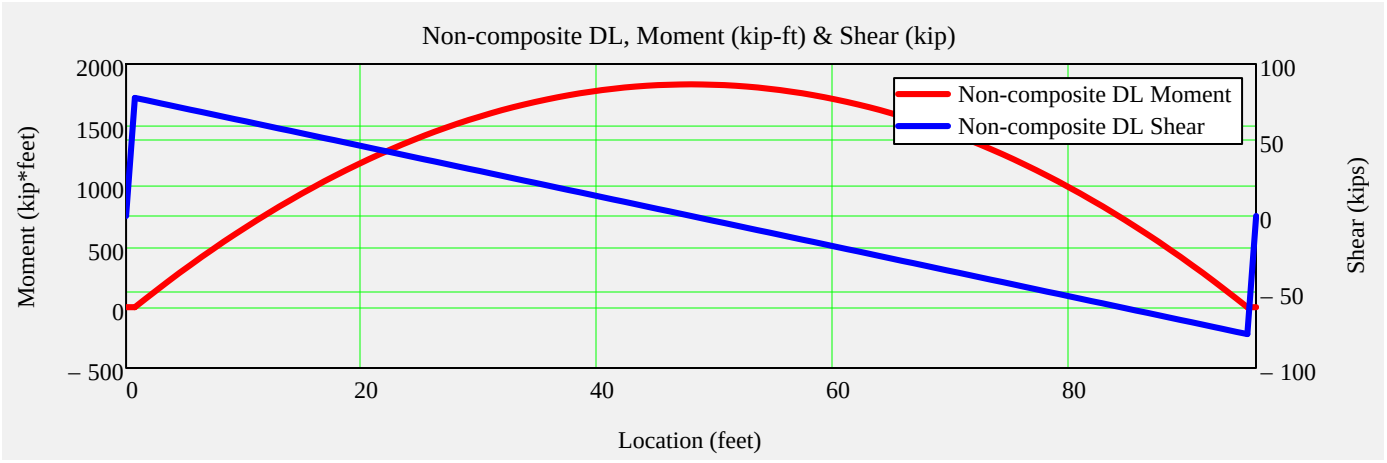
Release Dead Load Moments and Shears

$L_{span} = 94.33\ ft$



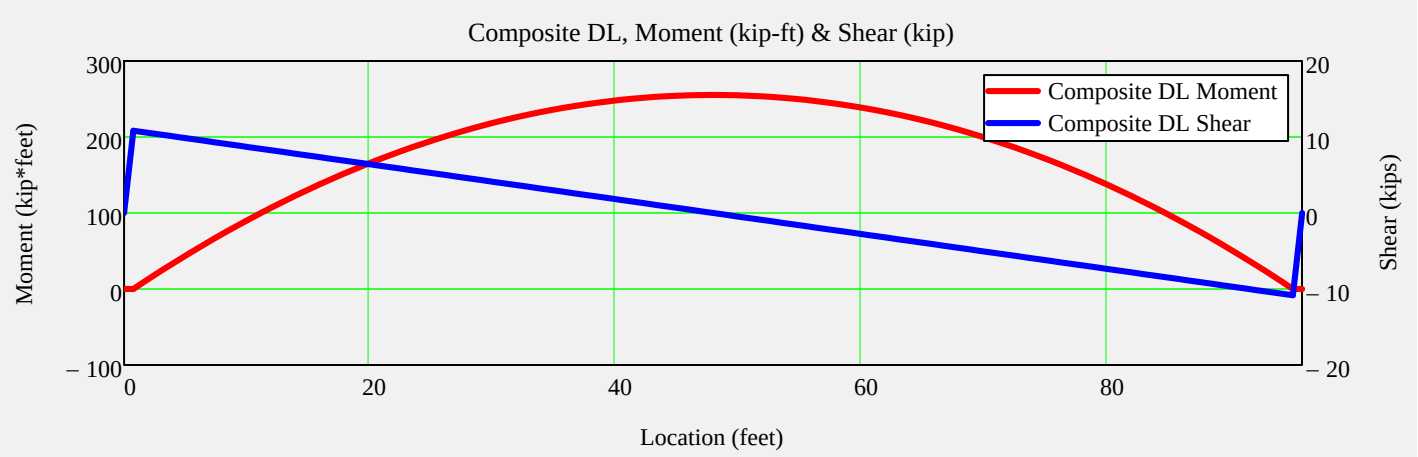
$\max(V_{release}) = 40.3 \cdot kip$ $\max(M_{release}) = 965.5 \cdot kip \cdot ft$ $\min(V_{release}) = -40.3 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 77.7 \cdot kip$ $\max(M_{dl.non.comp}) = 1832.4 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -77.7 \cdot kip$

Composite Dead Load Moments and Shear



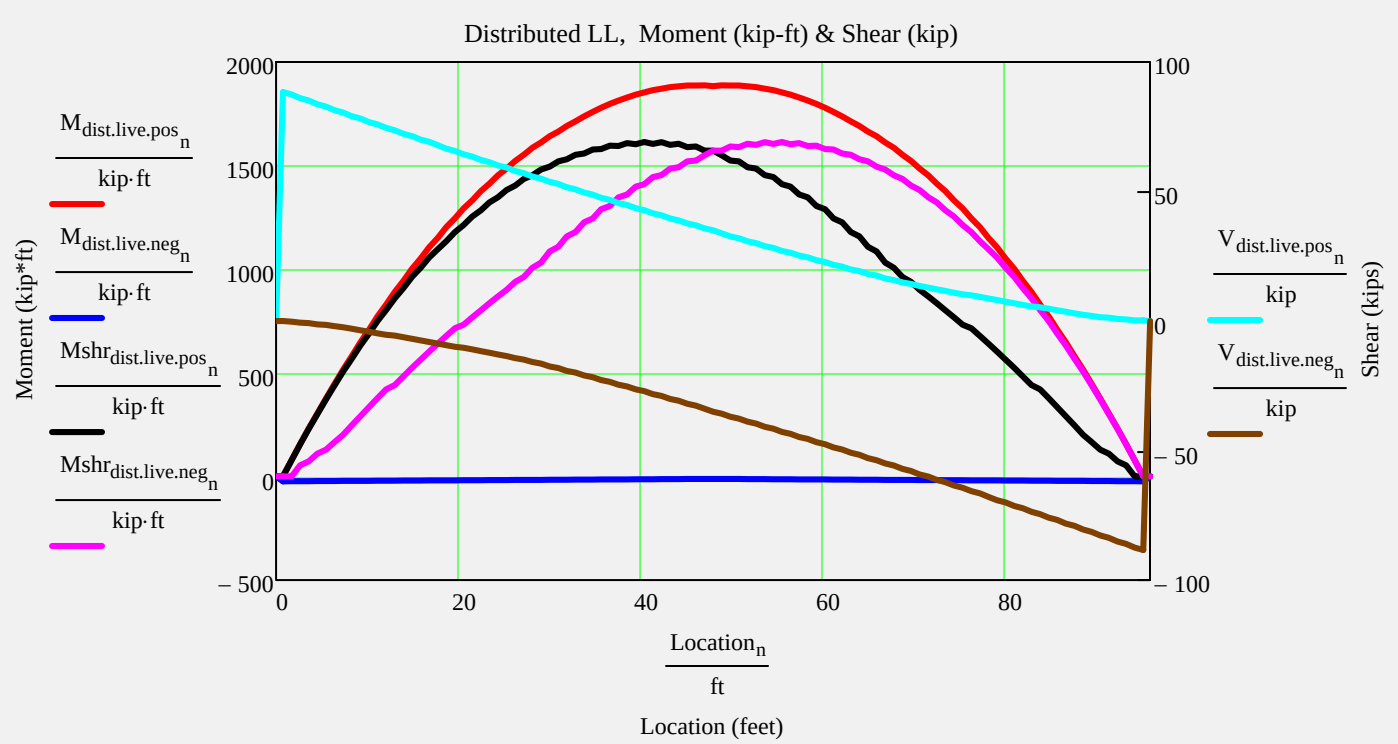
$\max(V_{dl.comp}) = 10.8 \cdot kip$ $\max(M_{dl.comp}) = 255.3 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -10.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 94.33\ ft$ BeamSpacing $= 7.17\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.05$

Final Live Load Distribution Factors: $g_{mom} = 0.73$ $g_{mom.fatigue} = 0.6$ $g_{shear} = 0.76$



$\max(V_{dist.live.pos}) = 88.4 \cdot kip$

$\max(M_{dist.live.pos}) = 1887.1 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -88.4 \cdot kip$

$Reaction_{LL} = 89.7 \cdot kip$

$\min(M_{dist.live.neg}) = -23.3 \cdot kip \cdot ft$

$Reaction_{DL} = 90.0 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1614 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.4 \cdot kip$ $Reaction_{lane} = 30.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 73.3 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-96ftSpan_15Skew_Exterior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck		Bottom of Beam		Beam End: Top	Beam End: Bottom
Area (in^2)	0.62	*1	0		1.58	0
Distance (in)	4	*2	0	*3		
Length (ft)					16	0
Bar Size			5	*4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

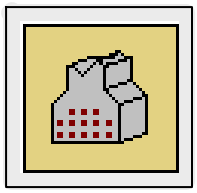
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

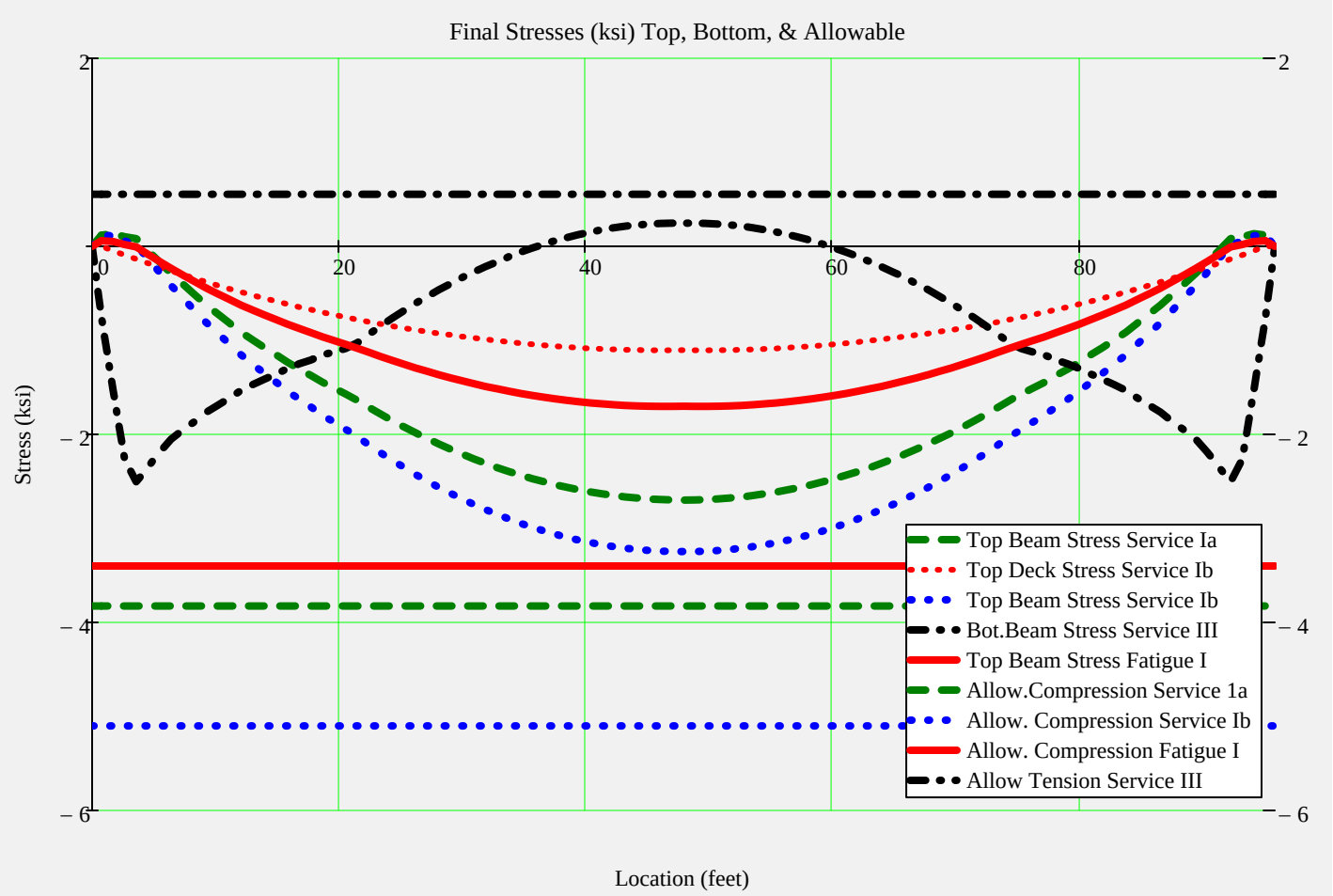
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

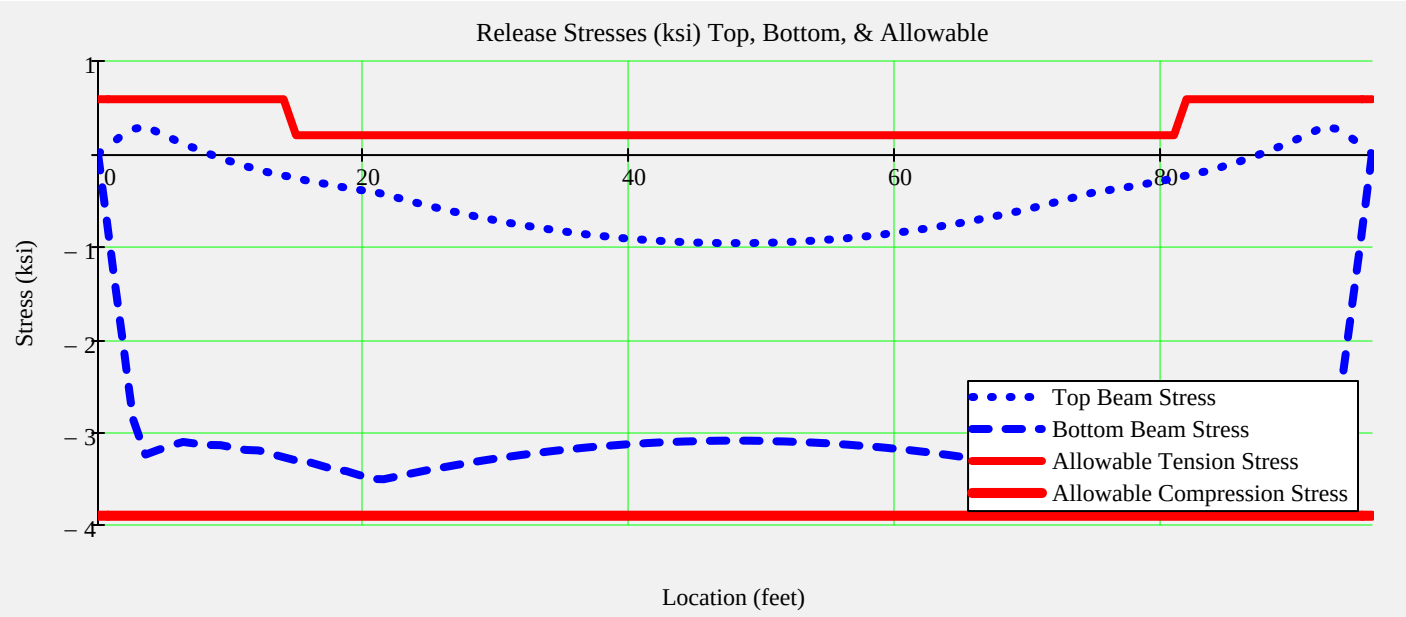
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.81$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.90$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.71$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.64$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.50$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.58	0.29	0.59
"Compression @ Release"	21.50	–3.51	–3.90
"Tension @ ServiceIII"	46.97	0.25	0.55
"CompressionIa @ ServiceI"	47.92	–2.70	–3.83
"CompressionIb @ ServiceI"	47.92	–3.25	–5.10
"Compression @ FatigueI"	49.80	–1.70	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

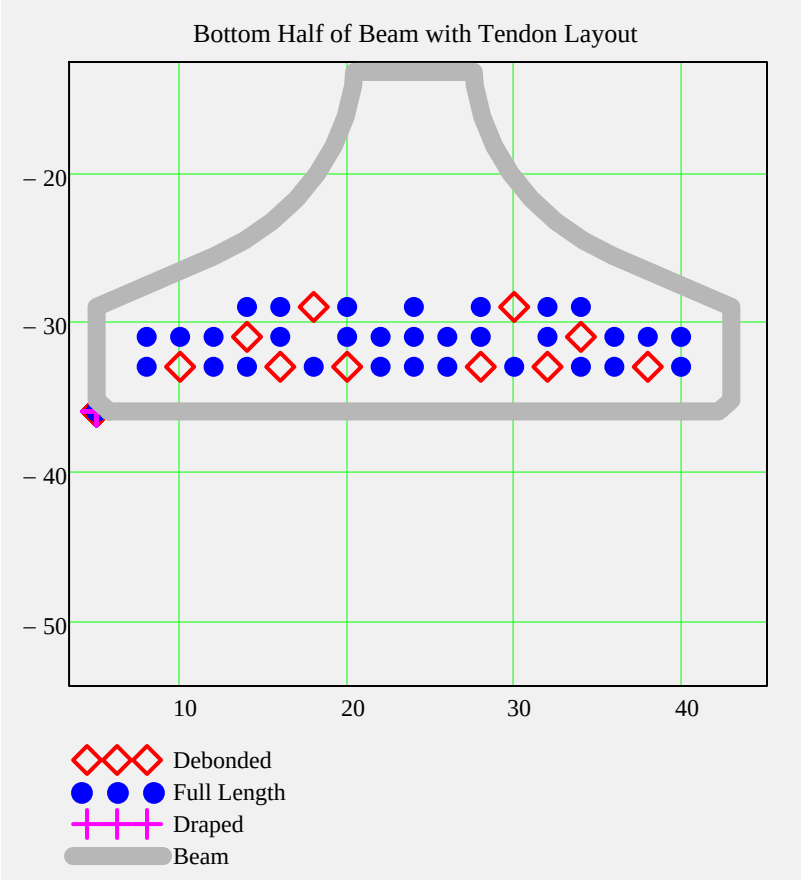
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

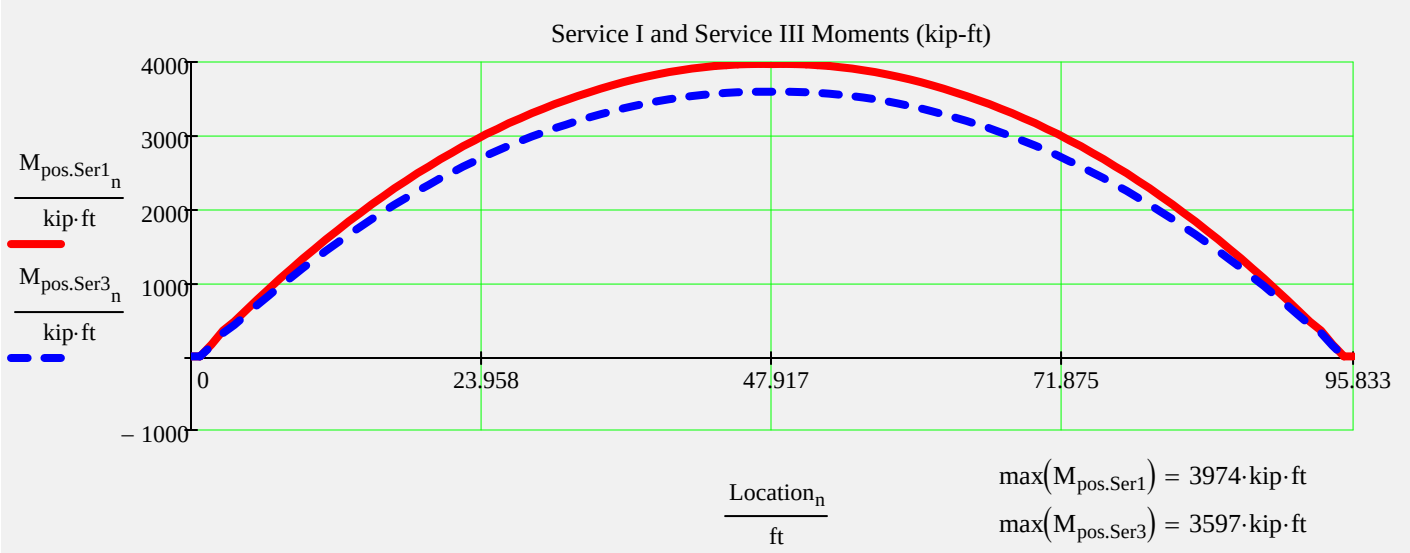
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3974 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3597 \cdot kip \cdot ft$

Summary of Values at Midspan

Stresses =

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.96	–3.09
"2"	–1.06	–2.53
"4"	–1.01	–2.57
"6"	–2.62	–1.28
"8"	–3.25	0.25

PrestressForce =

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1842	–1743
"@Final (about composite centroid)"	–1608	–1431

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1513.7	372991	–9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	966
"Non-Composite DL (incl. beam wt.)"	1832
"Composite Dead Load"	255
"Distributed Live Load"	1884

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

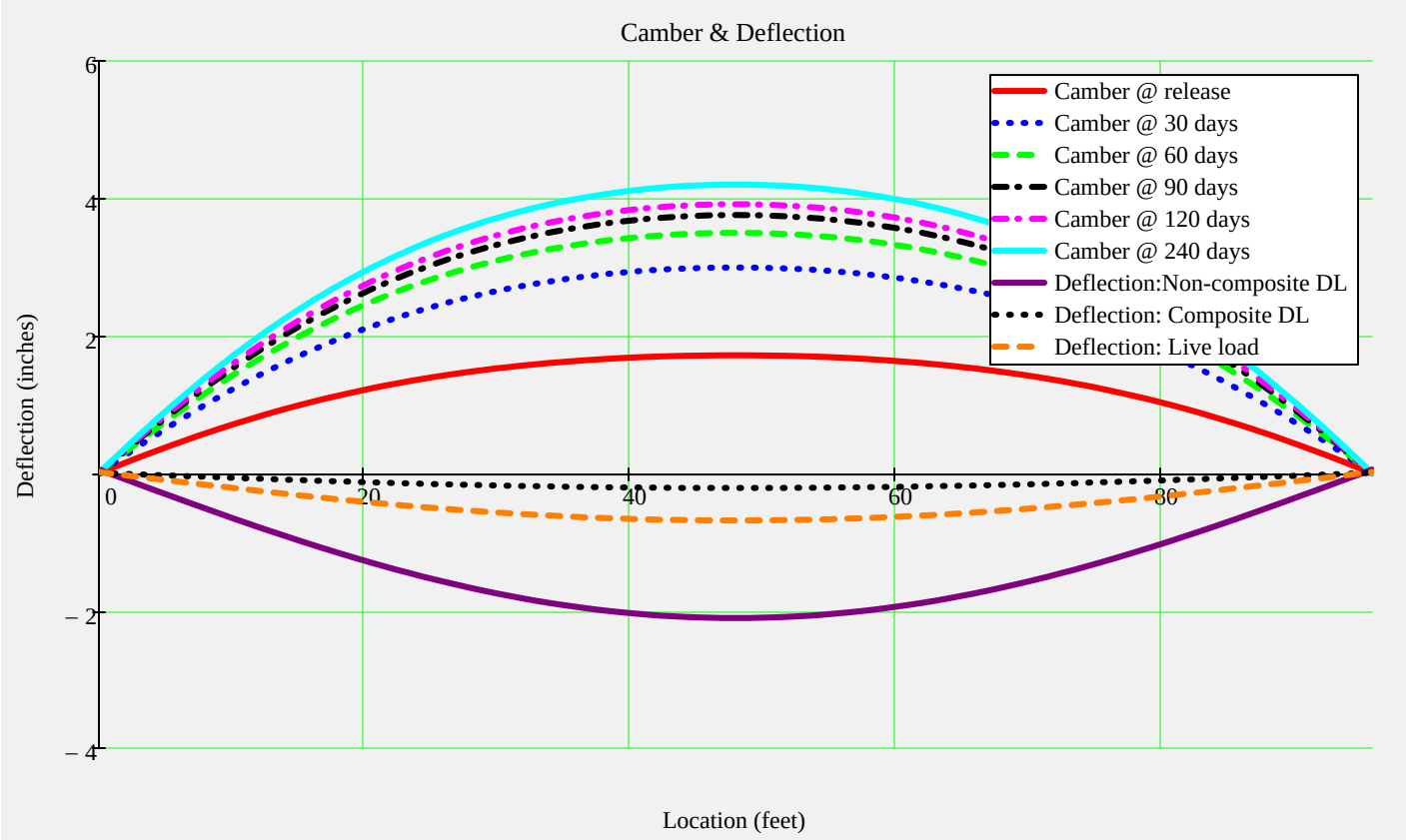
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 94.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.12	–0.80	0.37	1.72
"30 Days"	–0.36	–1.42	0.64	2.99
"60 Days"	–0.45	–1.66	0.75	3.50
"90 Days"	–0.49	–1.79	0.80	3.76
"120 Days"	–0.52	–1.86	0.83	3.92
"240 Days"	–0.57	–2.00	0.89	4.20
"Non-comp DL"	–0.24	0.19	–0.34	–2.11
"Comp DL"	–0.01	0.03	–0.03	–0.21
"LL"	–0.04	0.11	–0.11	–0.69

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.59 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

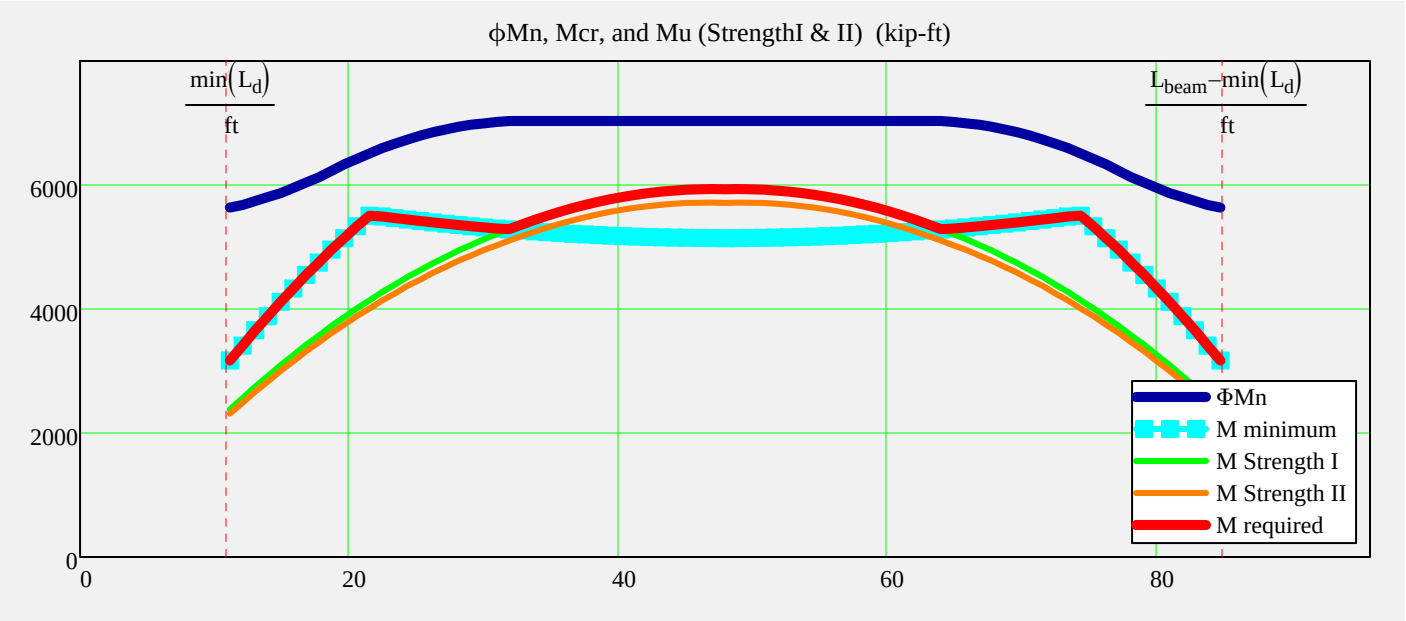
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5935 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5144 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5930 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7031 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 10.9\,\text{ft}$ $\qquad L_{beam} - \min(L_d) = 84.9\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.85$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

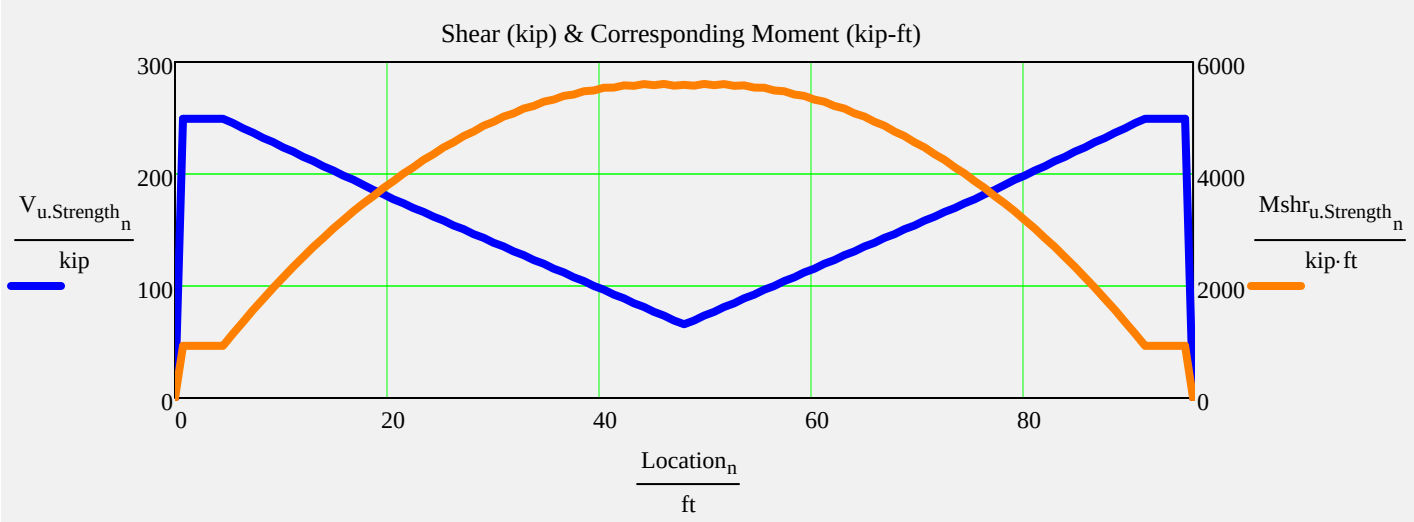
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

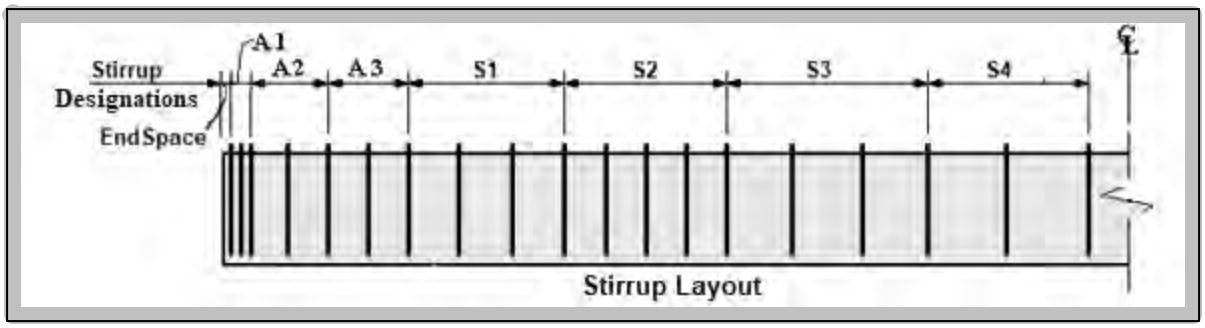
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 266 \\ 259 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 249.2 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5608 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

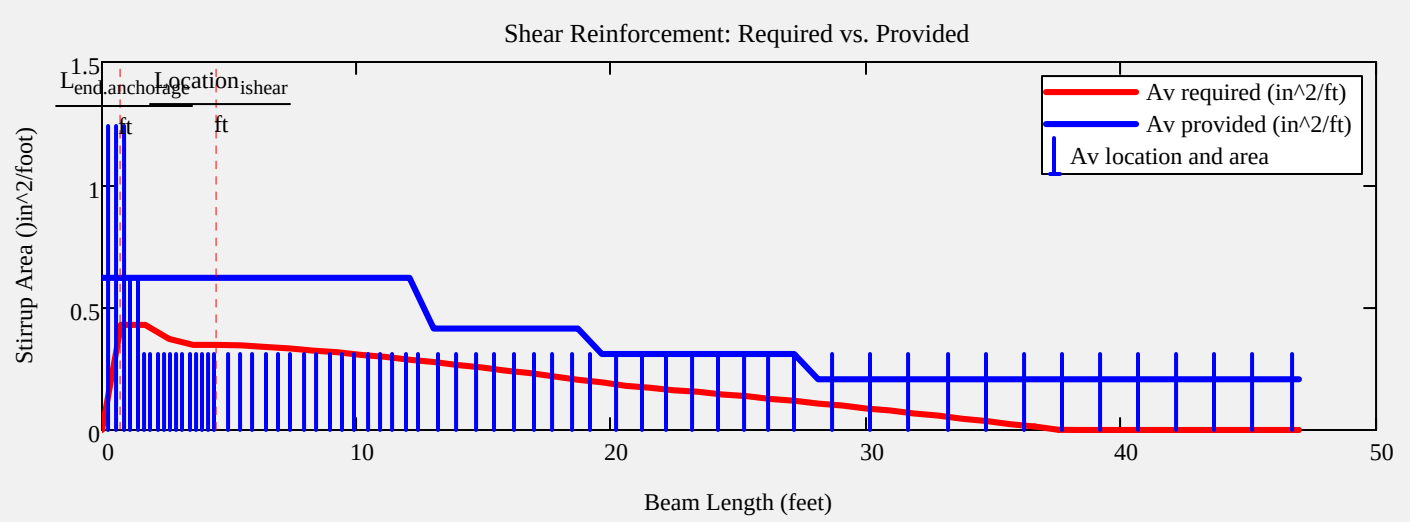
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.52\ ft$

Save Data File

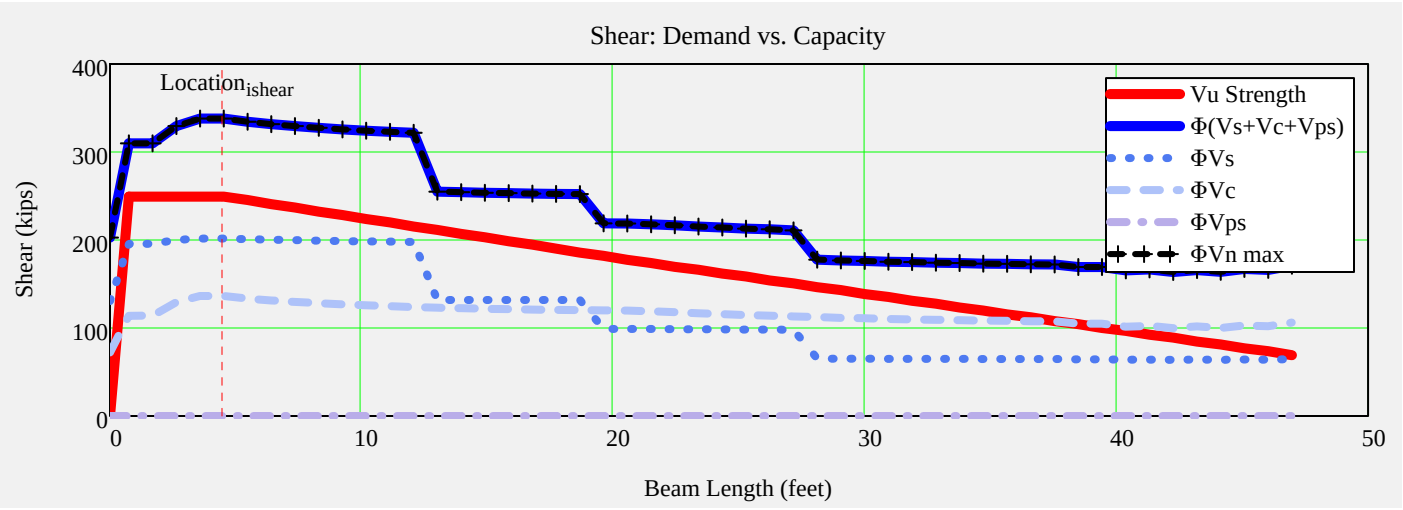
Use current input file

File Name FIB36-96ftSpan_15Skew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\WB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam"

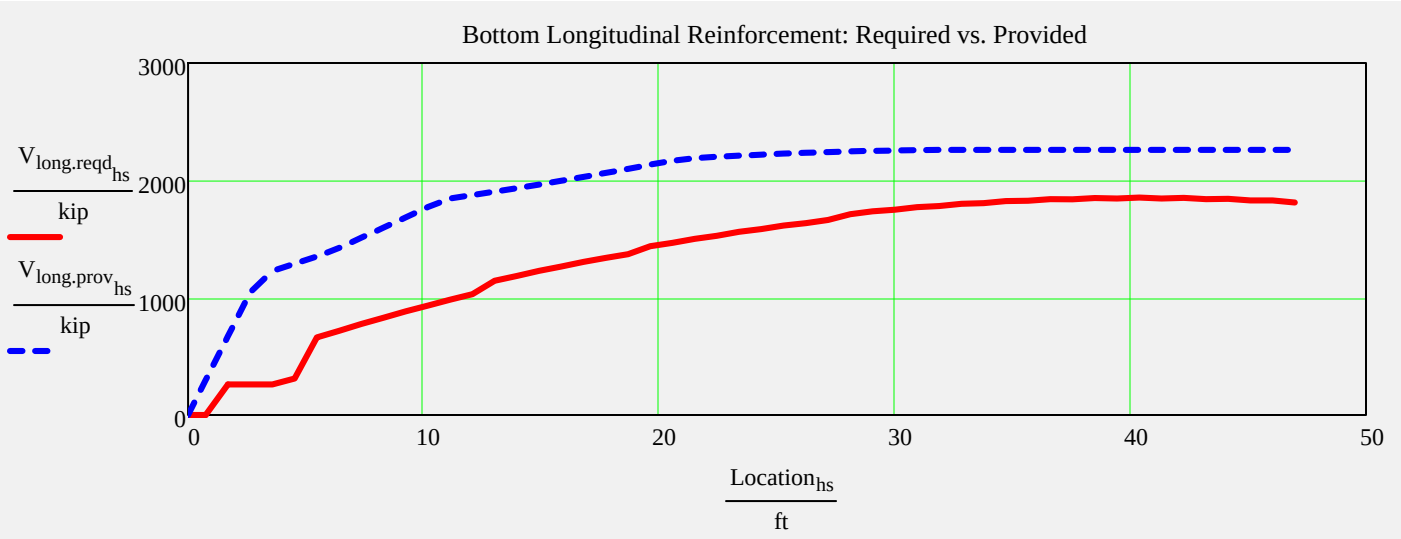
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 19.62 & 181.93 & 218.86 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.83$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

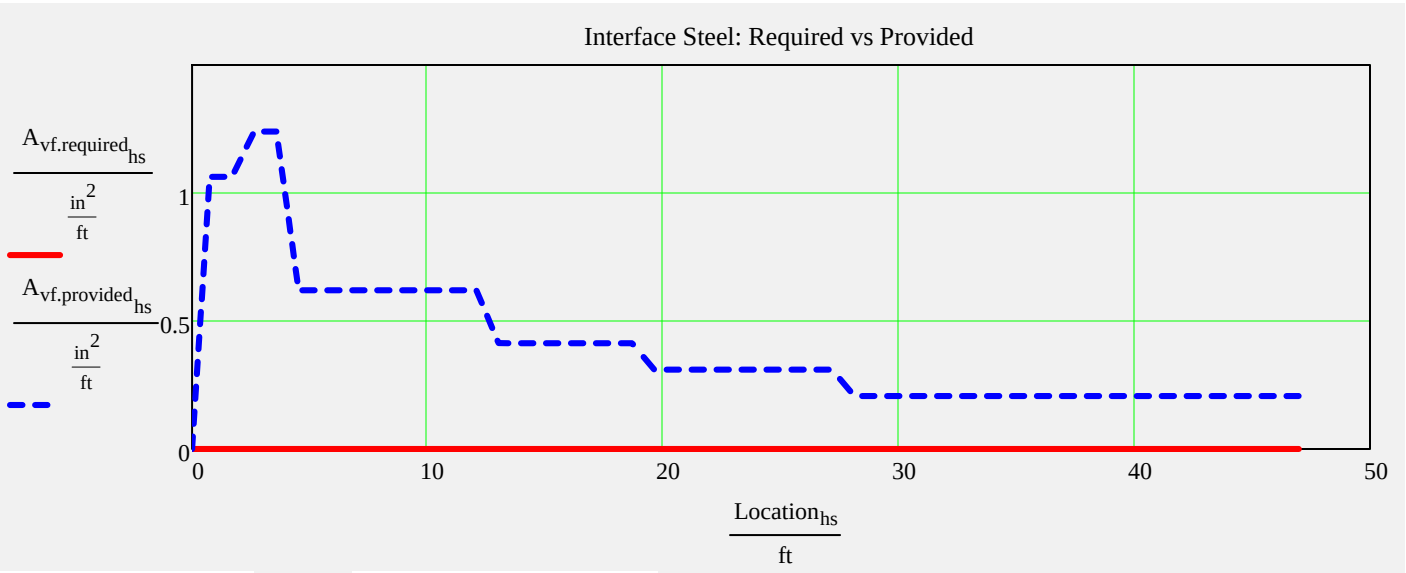


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 40.4 & 1853.1 & 2259.4 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.82$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.86 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

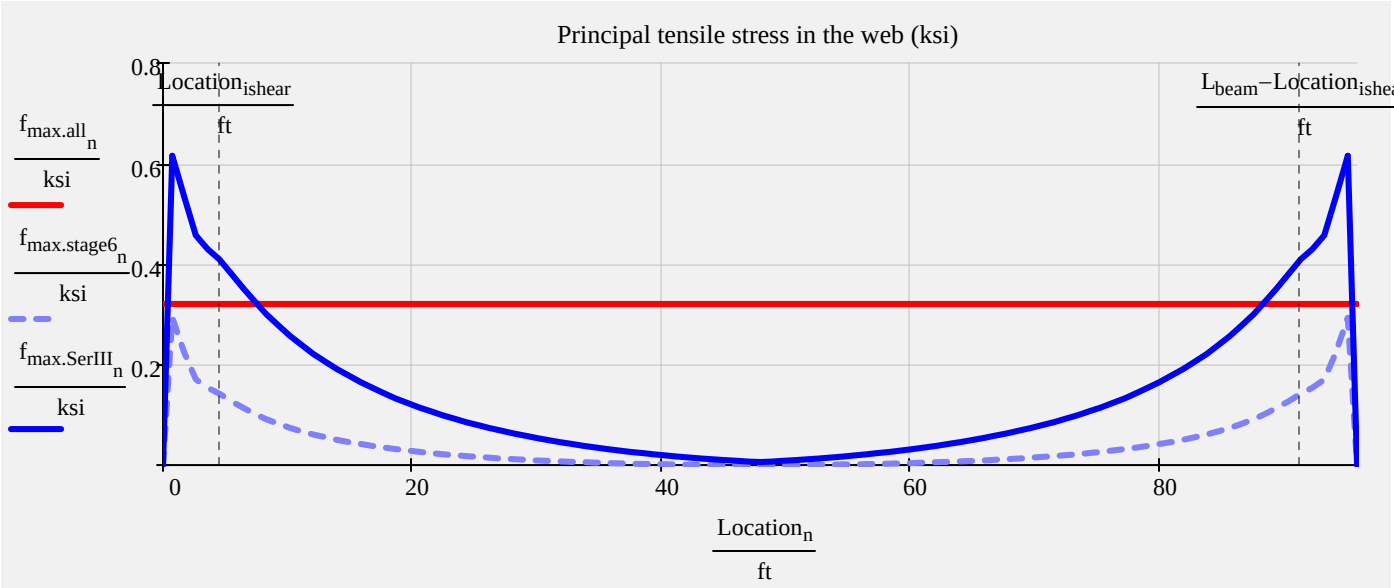
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $\text{Location}_{ishear} = 54.3 \cdot \text{in}$ $\max(\text{DC_f}_{max.web}) = 1.28$ Check_f$_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot \text{kip}$ $P_{prestress} = 1362 \cdot \text{kip}$ $D/C_{splitting.FDOT} = 0.94$

CheckD/C$_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

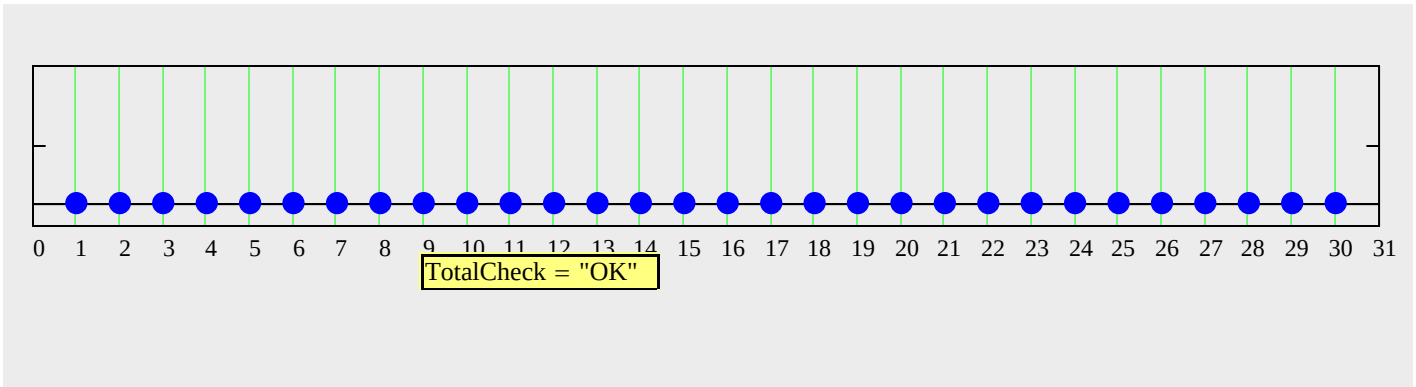
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.73	1.33	"N/A"	46.22	0.76	1.32	"N/A"	18.87	HL-93
"Strength I (Op)"	0.73	1.73	"N/A"	46.22	0.76	1.71	"N/A"	18.87	HL-93
"Service III (Inv)"	0.73	1.23	"N/A"	48.11	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.73	1.34	"N/A"	48.11	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.73	1.43	85.58	48.11	0.76	1.31	78.87	27.36	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.80$ $DC_{LongReinf.Permit} = 0.82$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7031	"factored resistance (kip-ft)...."
"γDL"	2633	"factored dead load (kip-ft)...."
"γLL"	2548	"factored live load (kip-ft)....."
"RF"	1.73	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	218.9	"factored resistance (kip)....."
"γDL"	67	"factored dead load (kip)....."
"γLL"	88.6	"factored live load (kip)....."
"RF"	1.71	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 96 FEET (15 DEG. SKEW)
WESTBOUND BRIDGE
(MOSSY GULLY & LONG POINT MARSH)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam	
FSB	
FUB	
FlatSlab	
InvertedT	
DoubleT	

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\WB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-96ftSpan_15Skew_Exterior.dat
FIB36-96ftSpan_15Skew_Interior.dat
FIB36-96ftSpan_NoSkew_Exterior.dat
FIB36-96ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

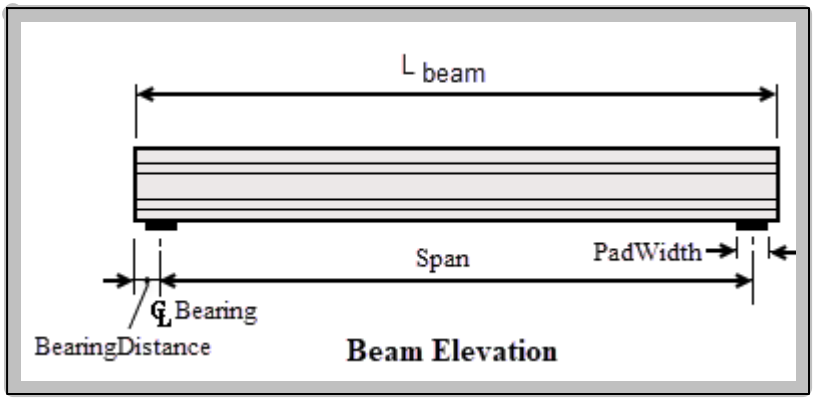
InputDataFile = "FIB36-96ftSpan_15Skew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 05 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70 over Parker Creek		
Structure No.	Westbound Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-96ftSpan_15Skew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
			BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")
			BMPfile = "FIB36.bmp"
L_{beam}	95.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	7.1667	ft	*Measured from beam centerline to centerline.*
Overhang	3.4167	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths $\le$ 100 ft, *SDG 4.2.2)*
d_e	2.1667	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths $\le$ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	6		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1.5	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

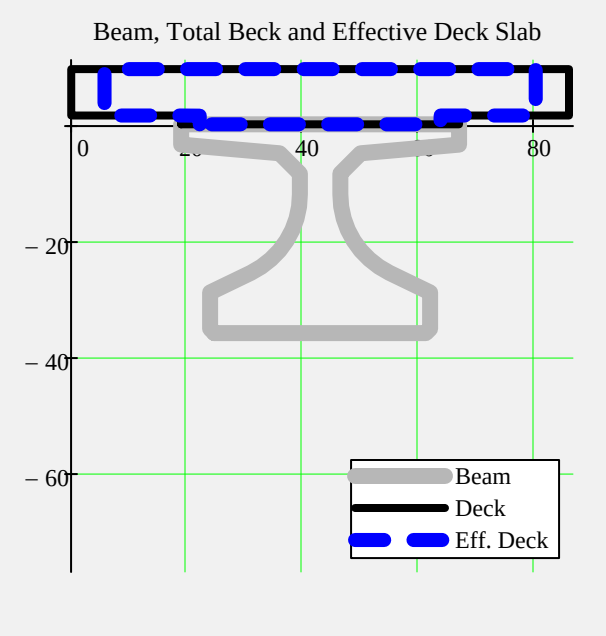
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1.5 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 86·in

$b_e = 86 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0	kip/ft

$w_{deck} = 0.79 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.06 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.108 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.14 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 95.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

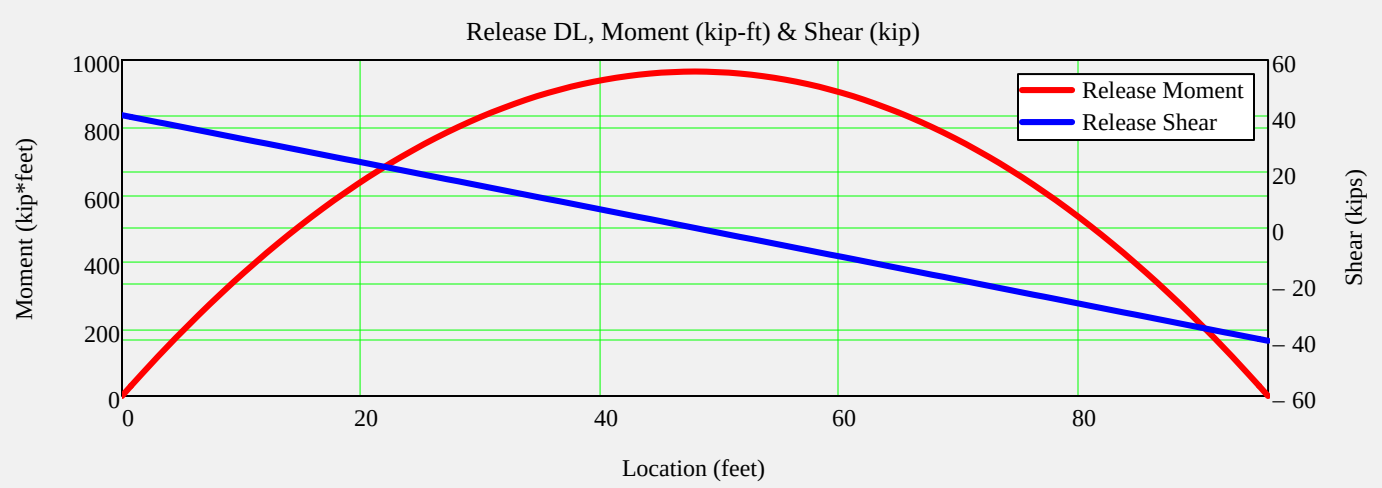
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

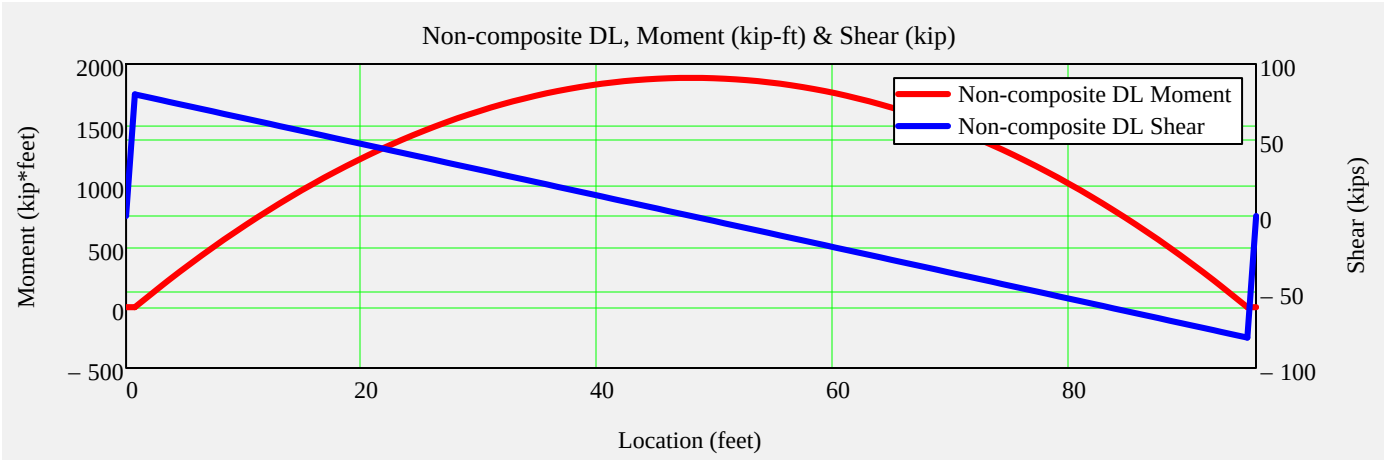
Release Dead Load Moments and Shears

$L_{span} = 94.33\ ft$



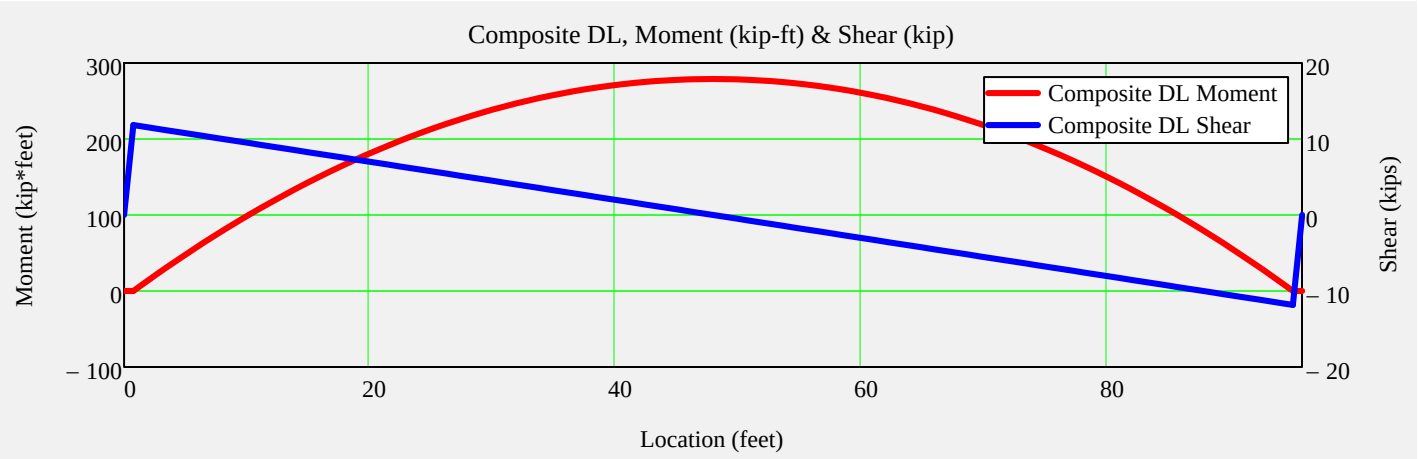
$\max(V_{release}) = 40.3 \cdot kip$ $\max(M_{release}) = 965.5 \cdot kip \cdot ft$ $\min(V_{release}) = -40.3 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 80.0 \cdot kip$ $\max(M_{dl.non.comp}) = 1886.1 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -80.0 \cdot kip$

Composite Dead Load Moments and Shear



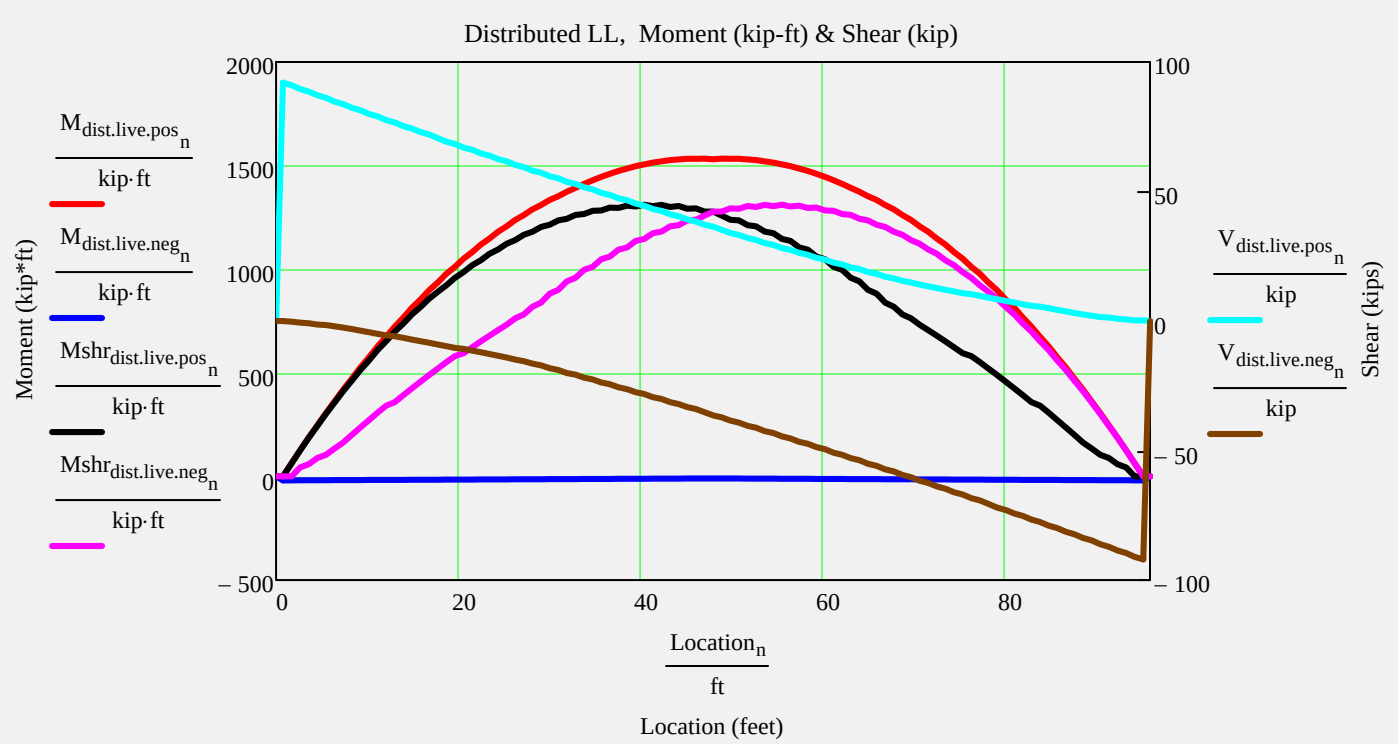
$\max(V_{dl.comp}) = 11.8 \cdot kip$ $\max(M_{dl.comp}) = 278.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -11.8 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 94.33\ ft$ BeamSpacing $= 7.17\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.05$

Final Live Load Distribution Factors: $g_{mom} = 0.59$ $g_{mom.fatigue} = 0.35$ $g_{shear} = 0.79$



$\max(V_{dist.live.pos}) = 92.0 \cdot kip$

$\max(M_{dist.live.pos}) = 1533.4 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -92.0 \cdot kip$

$Reaction_{LL} = 93.4 \cdot kip$

$\min(M_{dist.live.neg}) = -18.9 \cdot kip \cdot ft$

$Reaction_{DL} = 93.3 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1311 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.4 \cdot kip$ $Reaction_{lane} = 30.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 76.3 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-96ftSpan_15Skew_Interior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck		Bottom of Beam		Beam End: Top	Beam End: Bottom
Area (in^2)	0.62	*1	0		1.58	0
Distance (in)	4	*2	0	*3		
Length (ft)					16	0
Bar Size			5	*4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

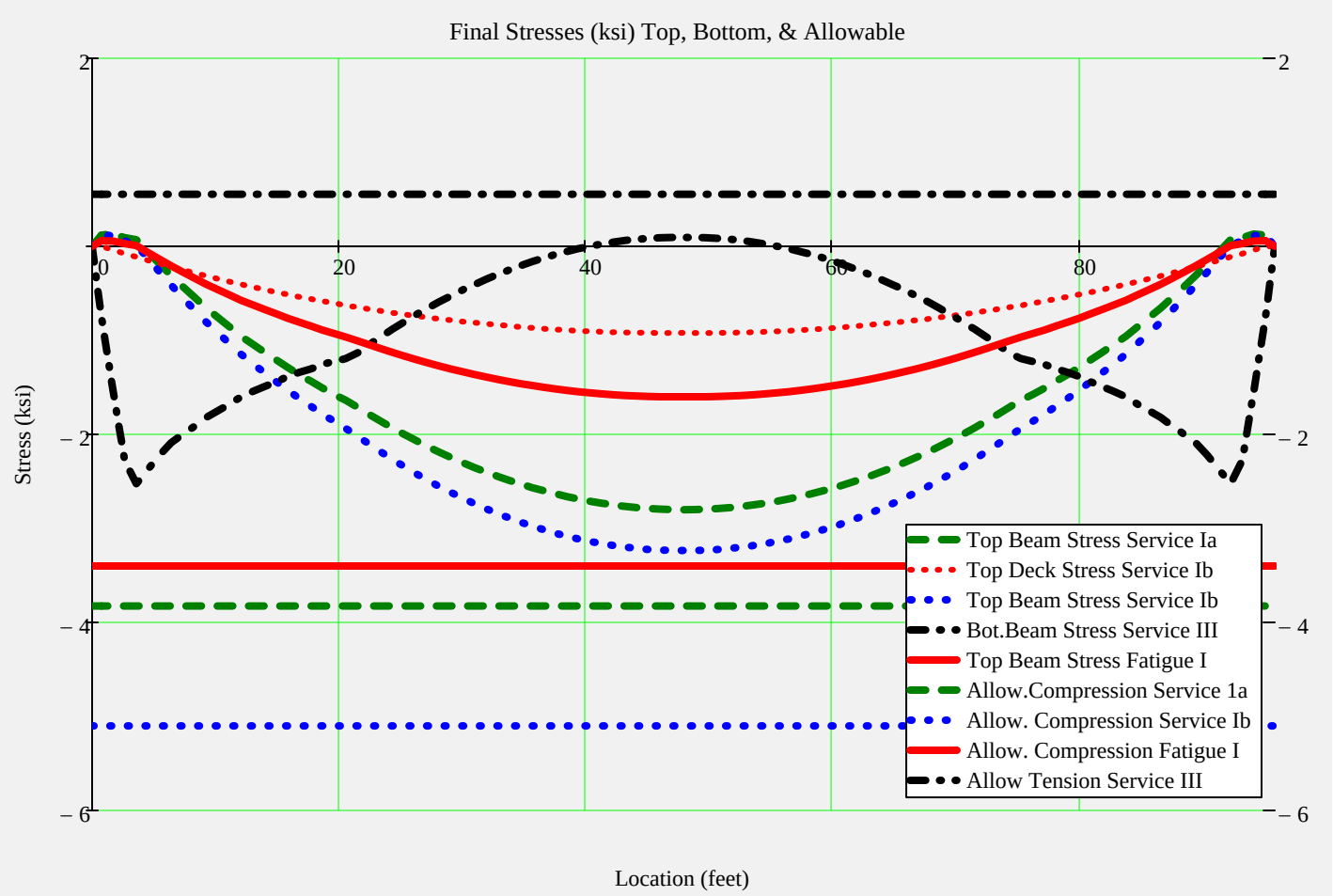
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

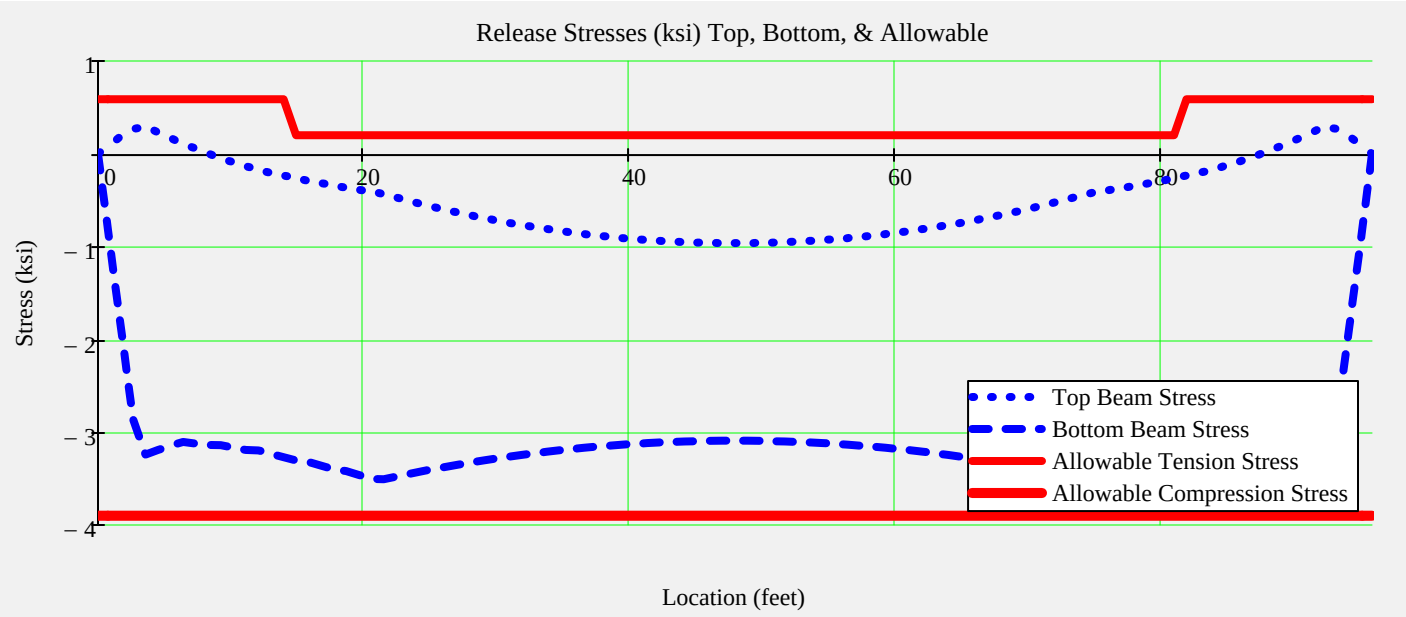
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel} = "OK"$	$\max(DC_f_{tension.rel}) = 0.81$
Release compression	$Check_f_{comp.rel} = "OK"$	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII} = "OK"$	$\max(DC_f_{tension.ServiceIII}) = 0.85$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa} = "OK"$	$\max(DC_f_{comp.ServiceIa}) = 0.73$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb} = "OK"$	$\max(DC_f_{comp.ServiceIb}) = 0.63$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI} = "OK"$	$\max(DC_f_{comp.FatigueI}) = 0.47$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.58	0.29	0.59
"Compression @ Release"	21.50	–3.51	–3.90
"Tension @ ServiceIII"	46.97	0.09	0.55
"CompressionIa @ ServiceI"	47.92	–2.80	–3.83
"CompressionIb @ ServiceI"	47.92	–3.24	–5.10
"Compression @ FatigueI"	48.86	–1.60	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

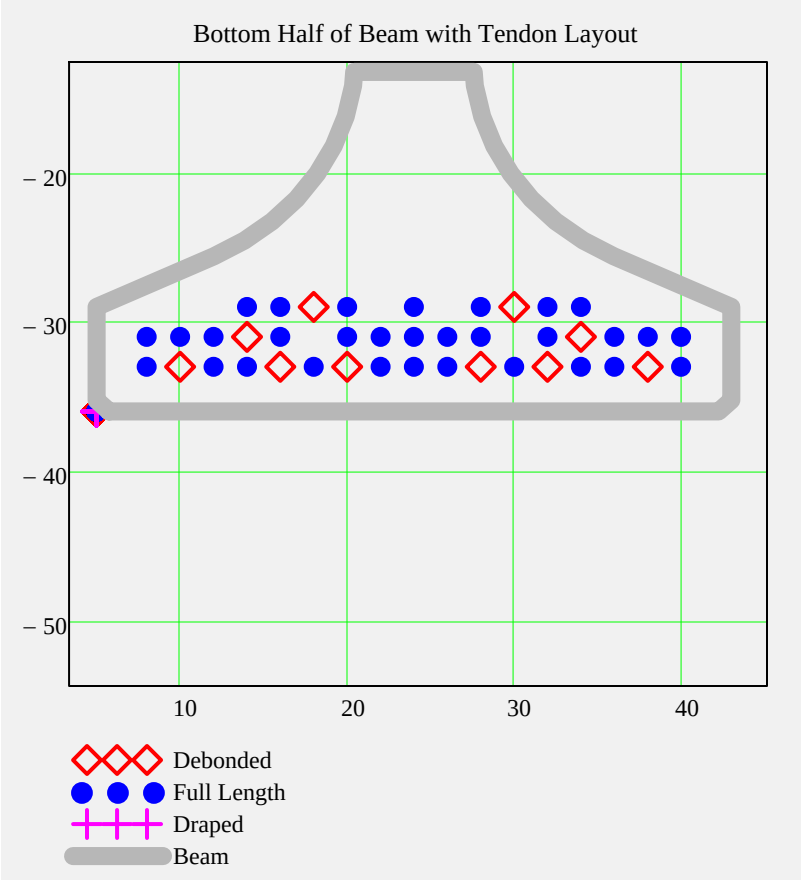
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

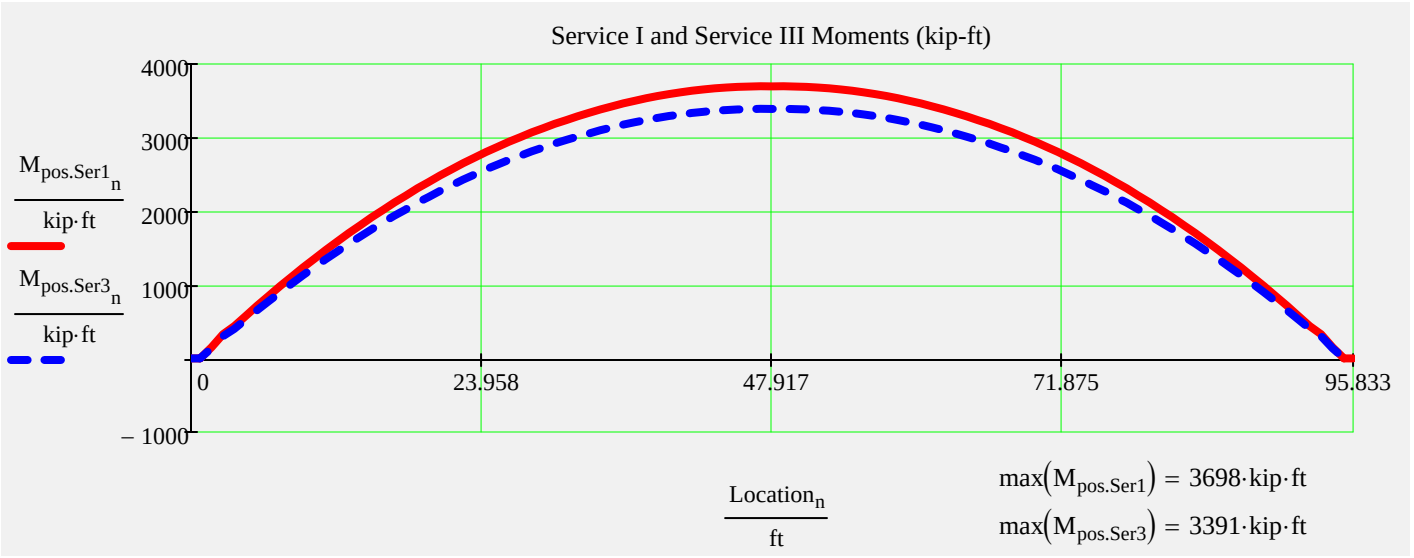
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3698 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3391 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses =$

"Stage"	"Top of Beam (ksi)"	"Bottom of Beam (ksi)"
"1"	–0.96	–3.09
"2"	–1.06	–2.53
"4"	–1.01	–2.57
"6"	–2.72	–1.21
"8"	–3.24	0.09

$PrestressForce =$

"Time"	"Axial (kip)"	"Moment (kip*ft)"
"@Release"	–1842	–1743
"@Final (about composite centroid)"	–1608	–1431

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1528.1	376065	–8.9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	966
"Non-Composite DL (incl. beam wt.)"	1886
"Composite Dead Load"	279
"Distributed Live Load"	1531

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

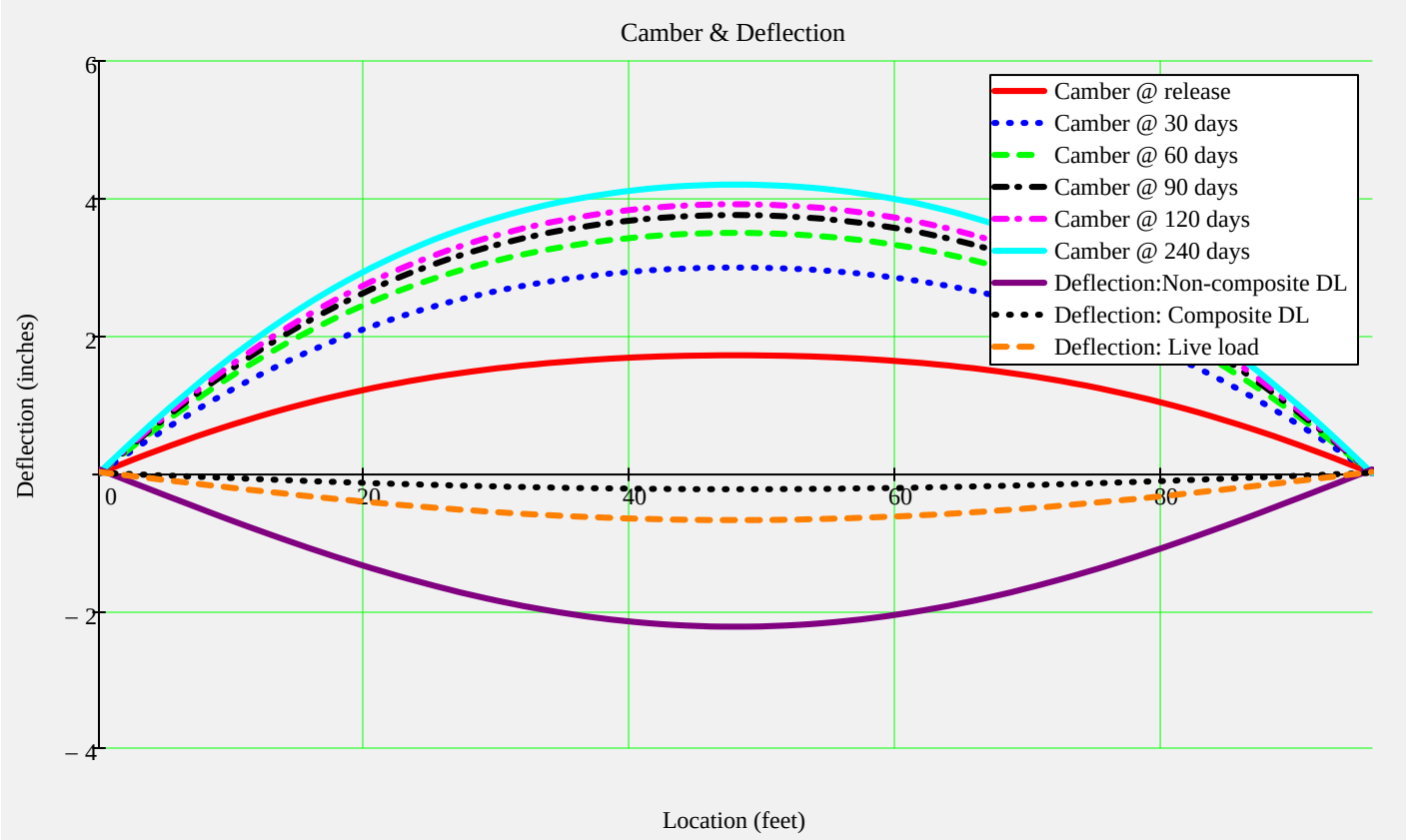
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 94.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.12	–0.80	0.37	1.72
"30 Days"	–0.36	–1.42	0.64	2.99
"60 Days"	–0.45	–1.66	0.75	3.50
"90 Days"	–0.49	–1.79	0.80	3.76
"120 Days"	–0.52	–1.86	0.83	3.92
"240 Days"	–0.57	–2.00	0.89	4.20
"Non-comp DL"	–0.25	0.20	–0.36	–2.23
"Comp DL"	–0.01	0.04	–0.04	–0.23
"LL"	–0.03	0.11	–0.11	–0.68

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.45 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

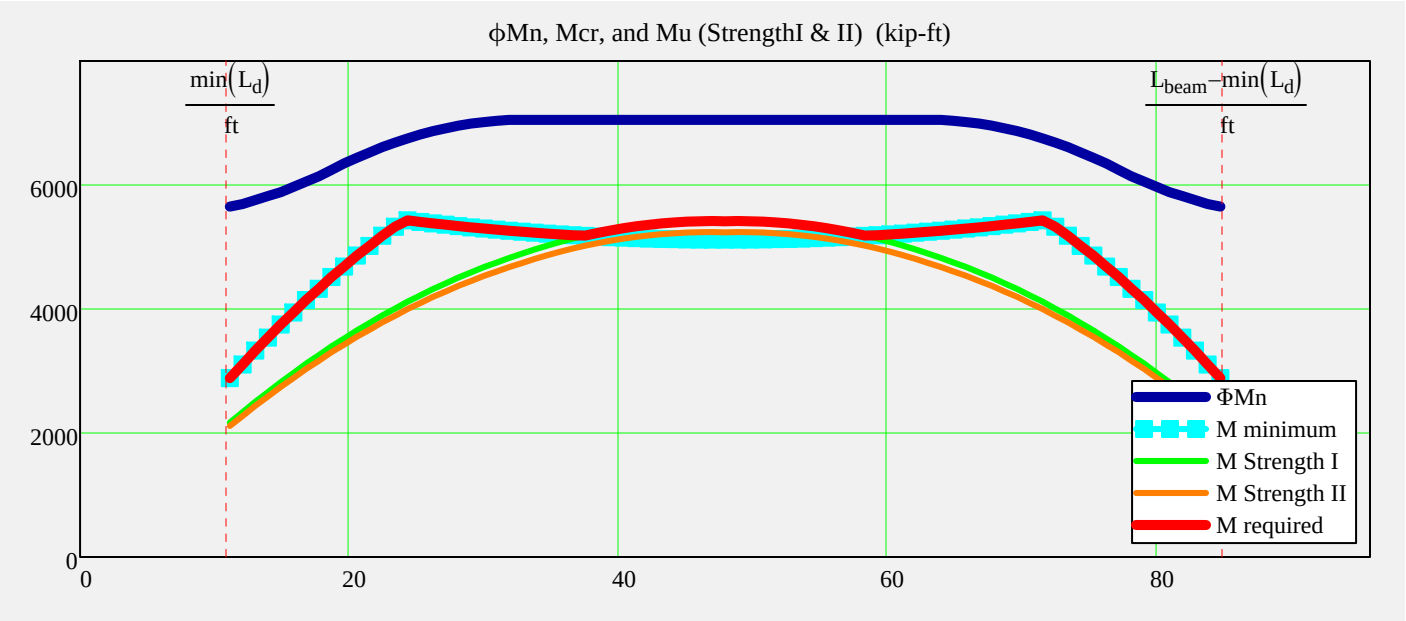
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5419 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5119 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5415 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7052 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 10.9\ \text{ft}$ $L_{beam} - \min(L_d) = 84.9\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.80$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

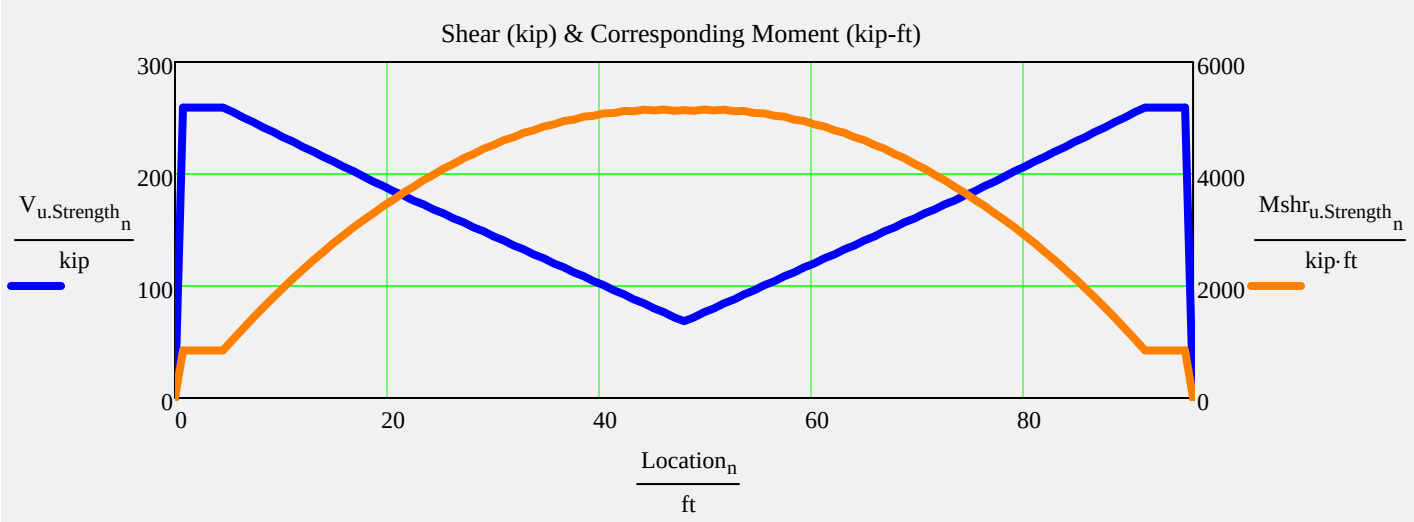
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

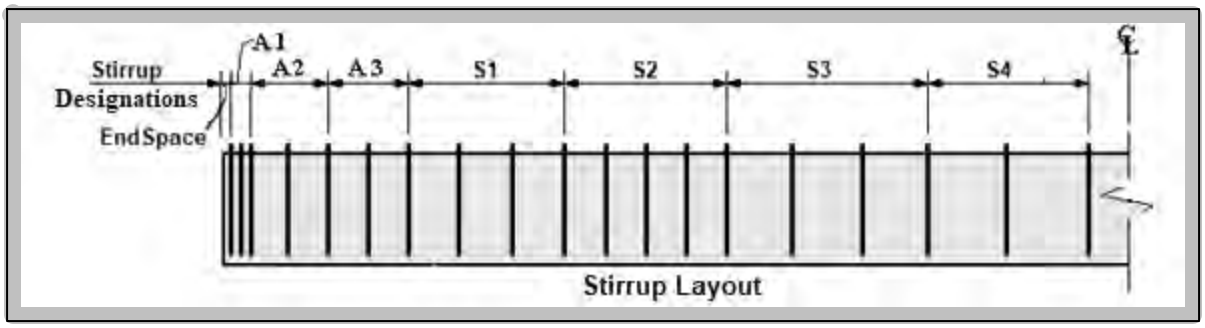
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 277 \\ 269 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 259.2 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5152 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar # 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

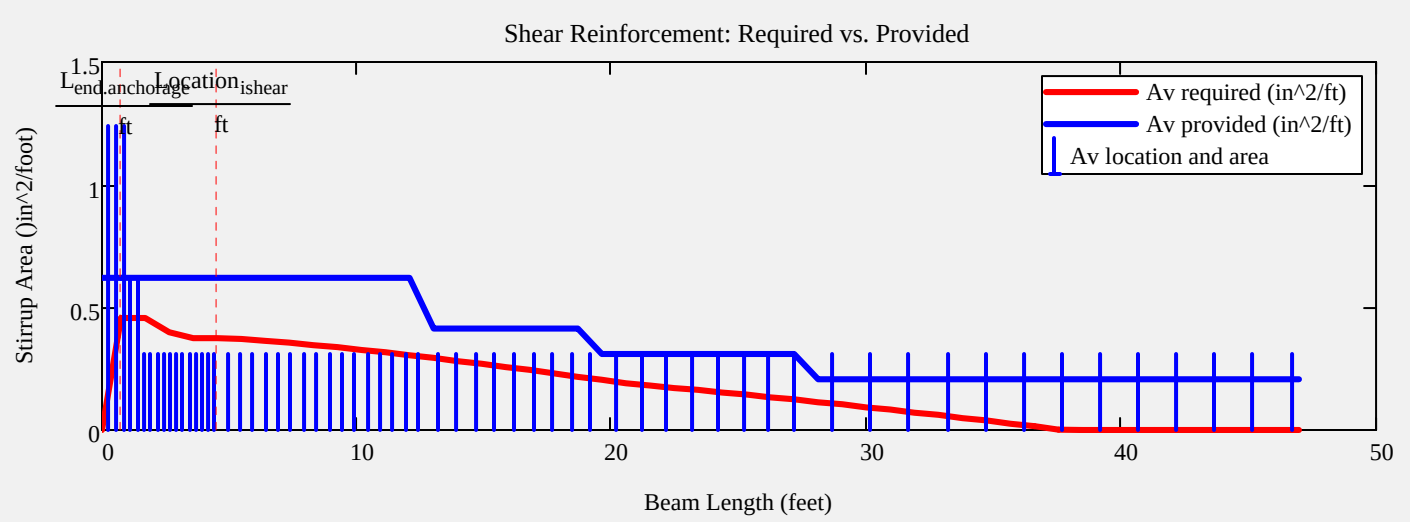
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.52\ ft$

Save Data File

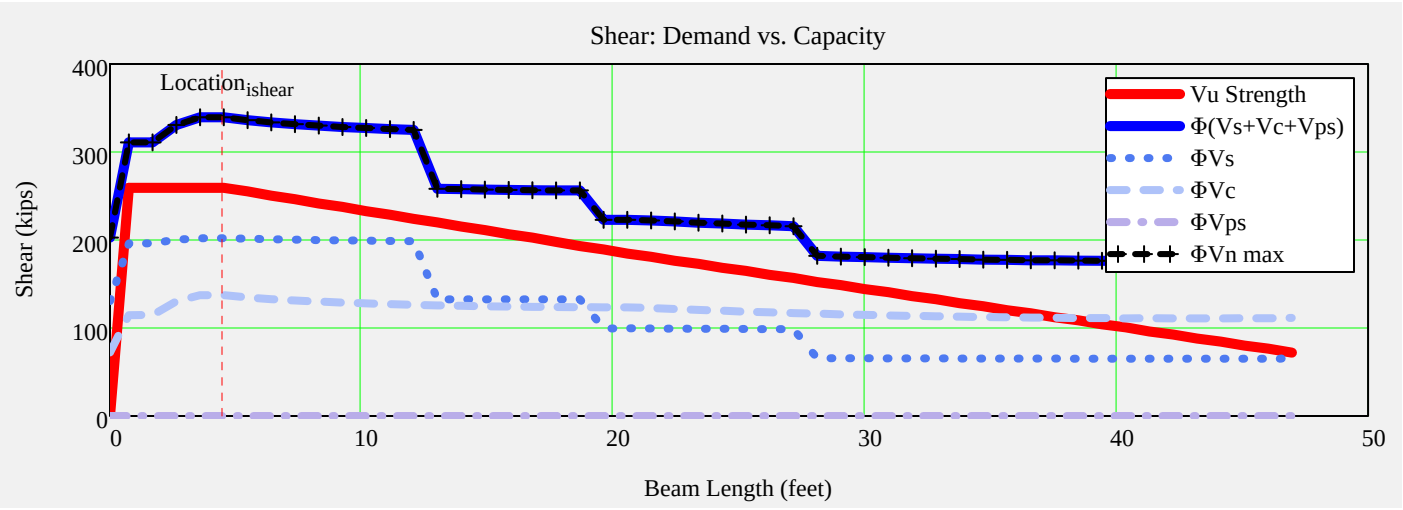
Use current input file

File Name FIB36-96ftSpan_15Skew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\WB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam"

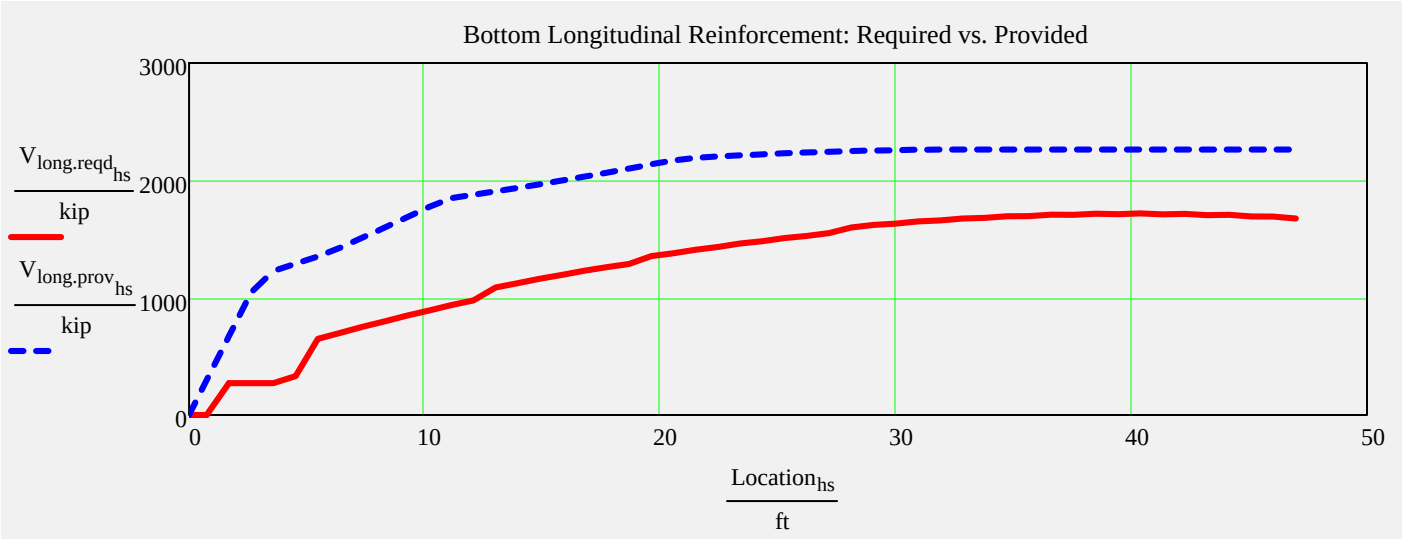
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 13.01 & 220.04 & 258.20 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.85$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

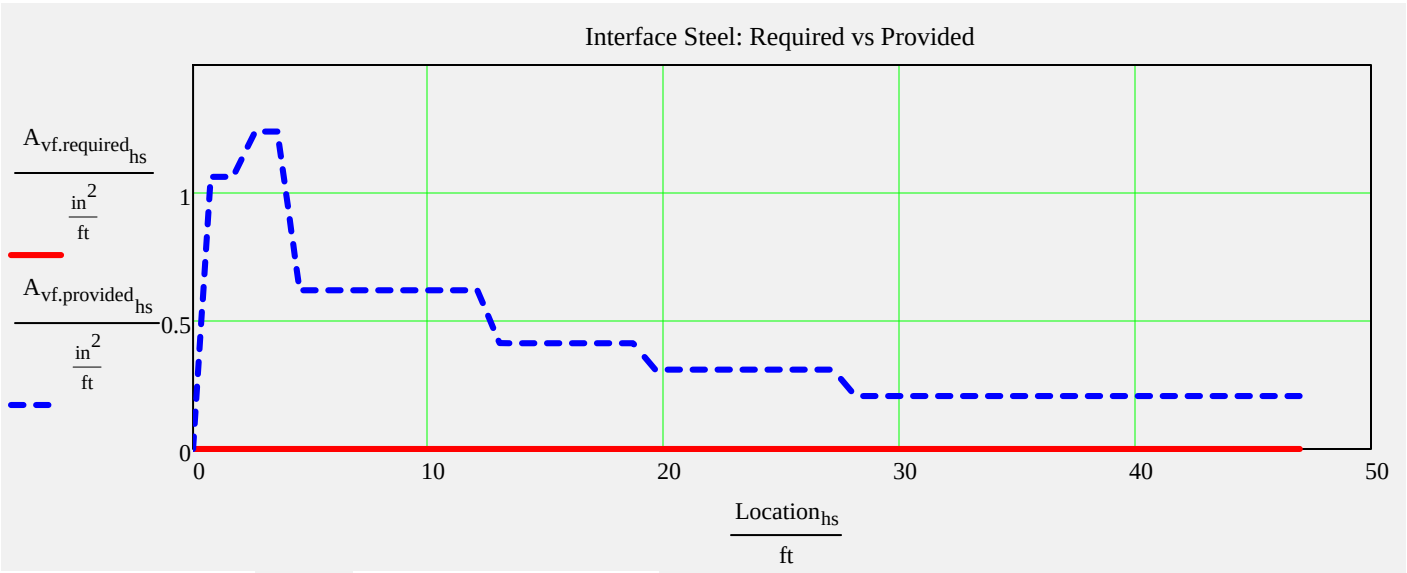


$$\text{CheckD/CLong} = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 40.4 & 1717.5 & 2262.6 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.76$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$\text{TotalA}_{vf.required} = 0 \cdot in^2$ $\text{TotalA}_{vf.provided} = 18.86 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

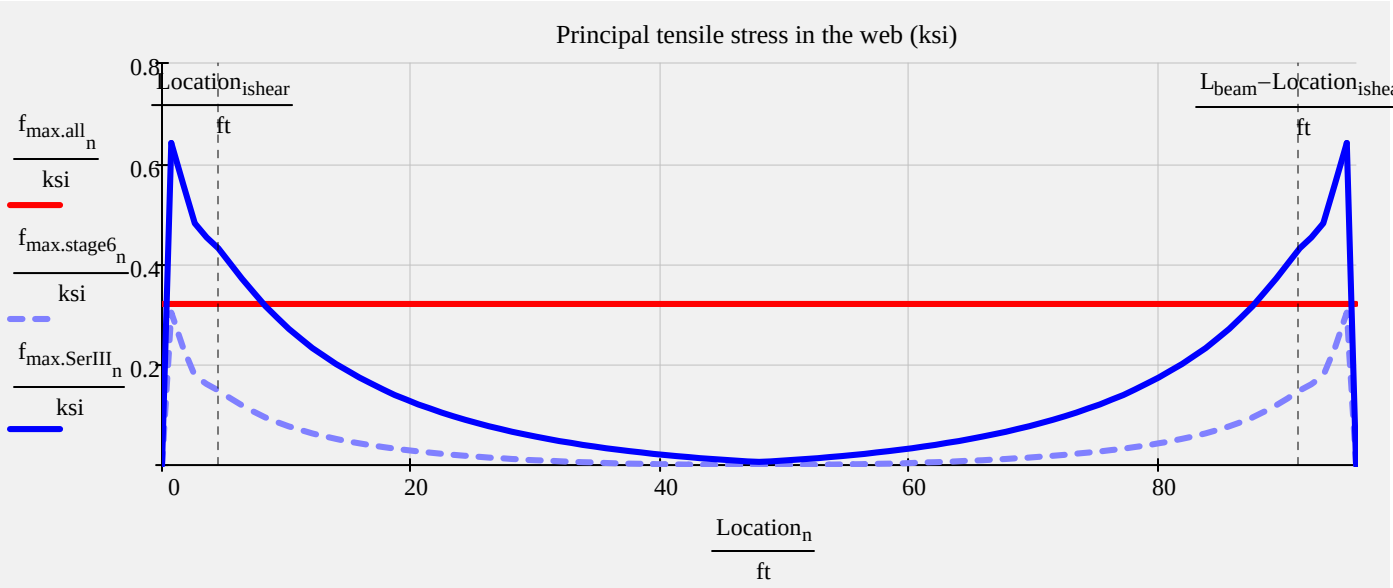
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 54.3 \cdot in$ $\max(DC_f_{max.web}) = 1.34$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

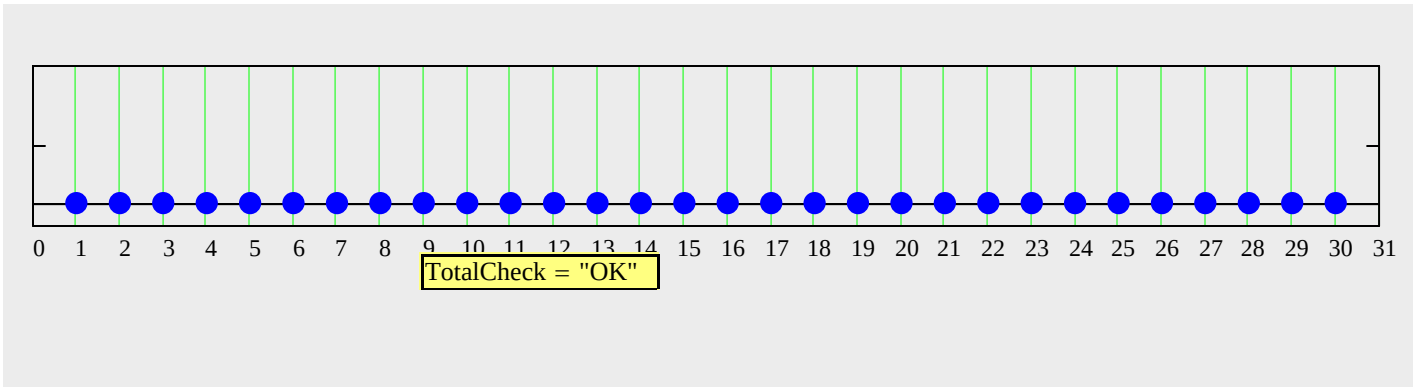
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.59	1.61	"N/A"	48.11	0.79	1.28	"N/A"	18.87	HL-93
"Strength I (Op)"	0.59	2.09	"N/A"	48.11	0.79	1.66	"N/A"	18.87	HL-93
"Service III (Inv)"	0.59	1.43	"N/A"	48.11	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.59	1.56	"N/A"	46.22	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.59	1.72	103.34	48.11	0.79	1.29	77.15	18.87	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)"*is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.74$ $DC_{LongReinf.Permit} = 0.76$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7052	"factored resistance (kip-ft)...."
"γDL"	2735	"factored dead load (kip-ft)...."
"γLL"	2070	"factored live load (kip-ft)....."
"RF"	2.09	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	223	"factored resistance (kip)....."
"γDL"	69.6	"factored dead load (kip)....."
"γLL"	92.3	"factored live load (kip)....."
"RF"	1.66	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 96 FEET (NO SKEW)

EASTBOUND BRIDGE

(PARKER CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\EB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-96ftSpan_15Skew_Exterior.dat
FIB36-96ftSpan_15Skew_Interior.dat
FIB36-96ftSpan_NoSkew_Exterior.dat
FIB36-96ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

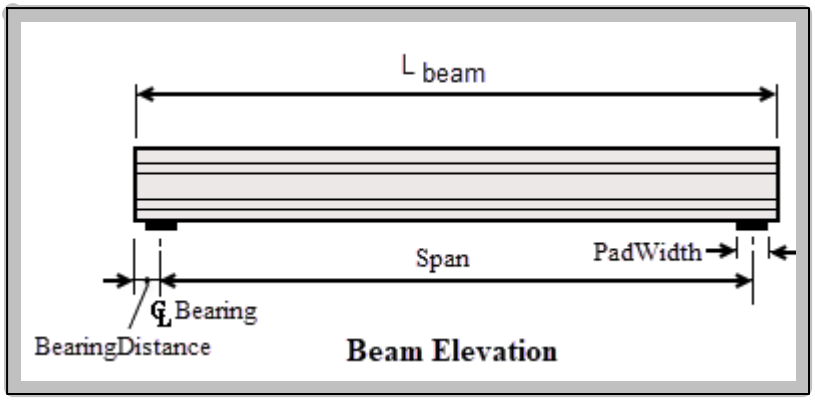
InputDataFile = "FIB36-96ftSpan_NoSkew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 05 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-96ftSpan_NoSkew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	95.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	7.1667	ft	*Measured from beam centerline to centerline.*
Overhang	3.625	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.2916	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	8		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1.5	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

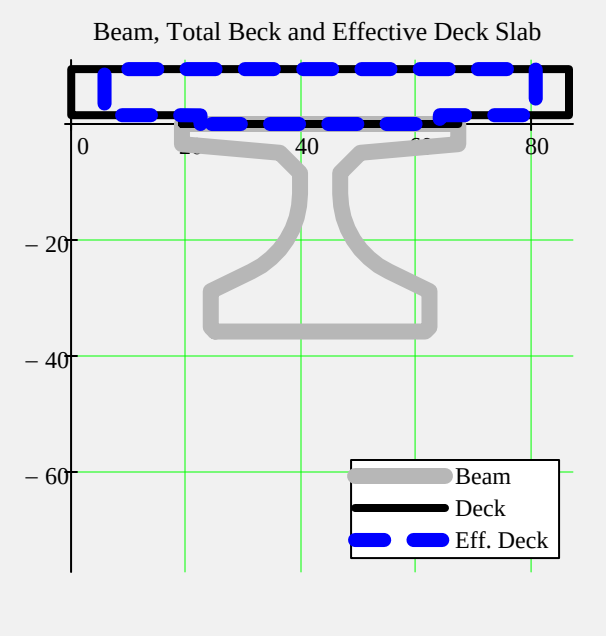
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1.5 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 86·in

$b_e = 86.5 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.80 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.03 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.088 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.11 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 95.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

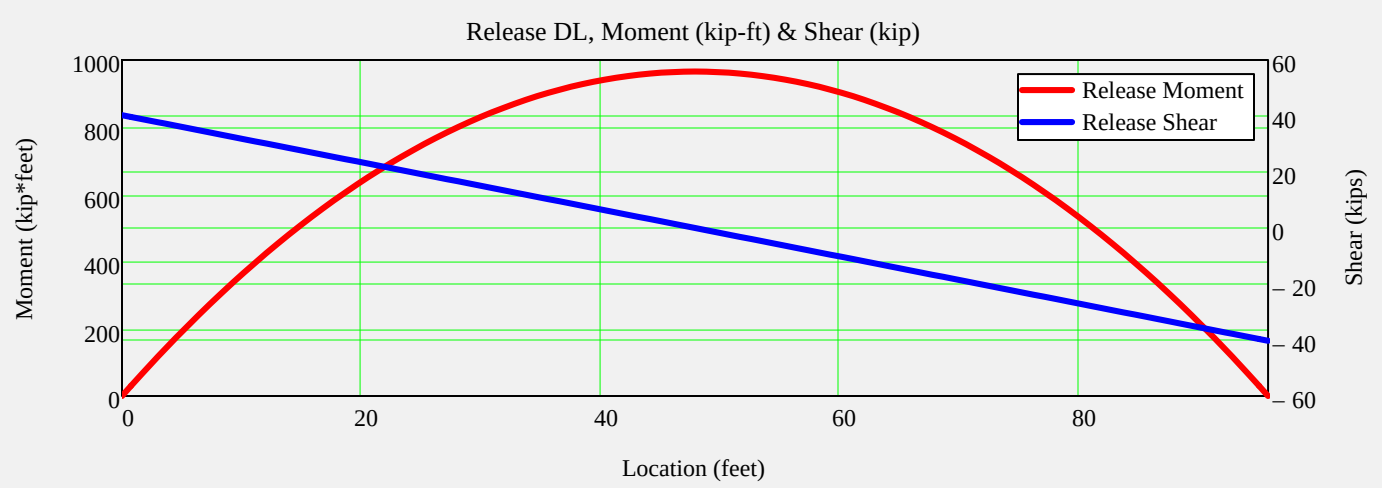
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

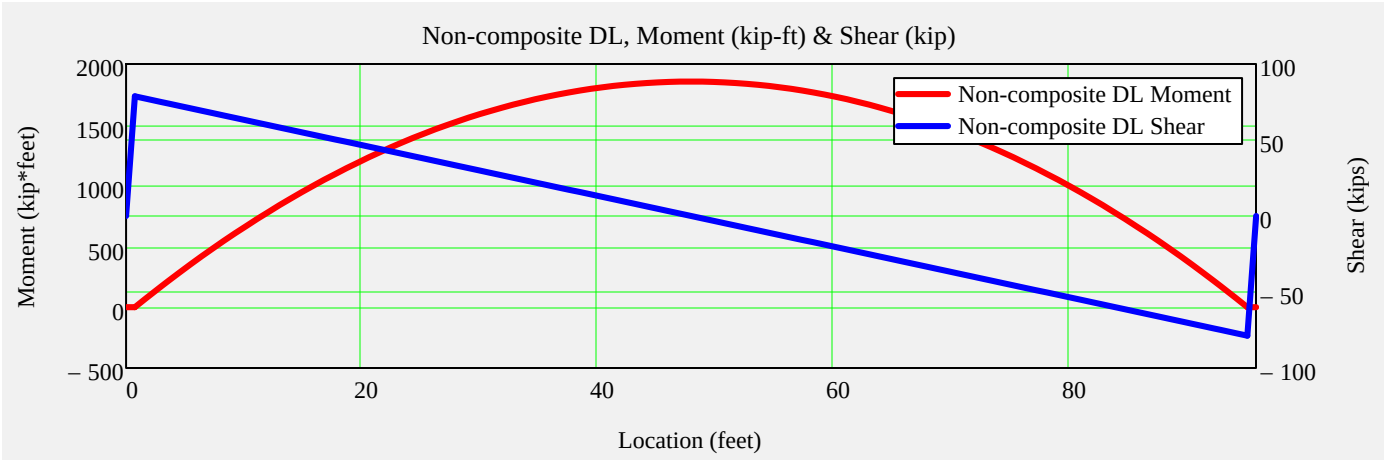
Release Dead Load Moments and Shears

$L_{span} = 94.33\ ft$



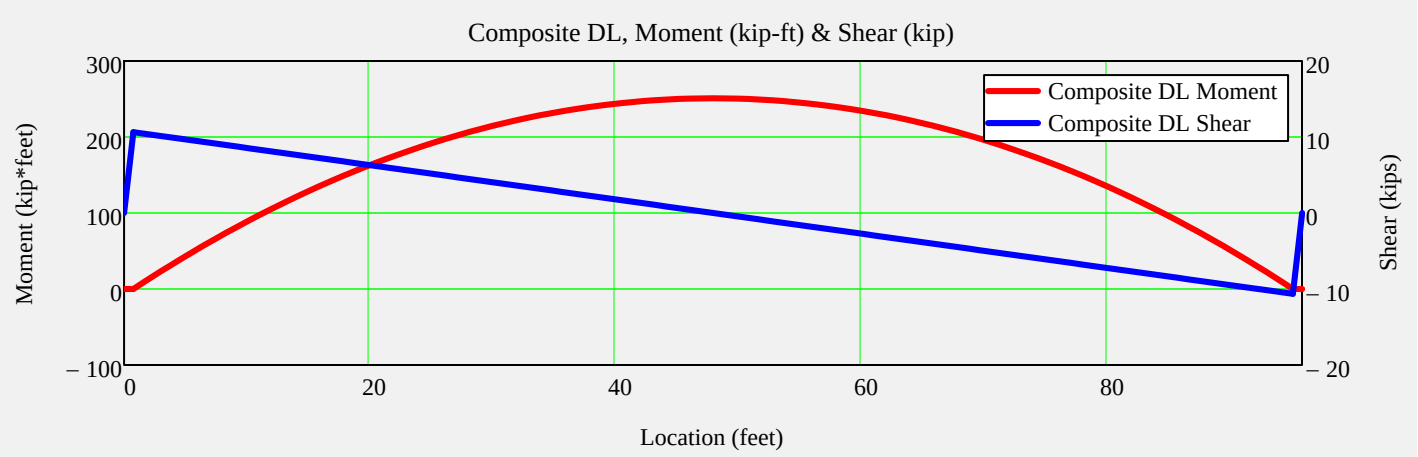
$\max(V_{release}) = 40.3 \cdot kip$ $\max(M_{release}) = 965.5 \cdot kip \cdot ft$ $\min(V_{release}) = -40.3 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 78.7 \cdot kip$ $\max(M_{dl.non.comp}) = 1855.5 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -78.7 \cdot kip$

Composite Dead Load Moments and Shear



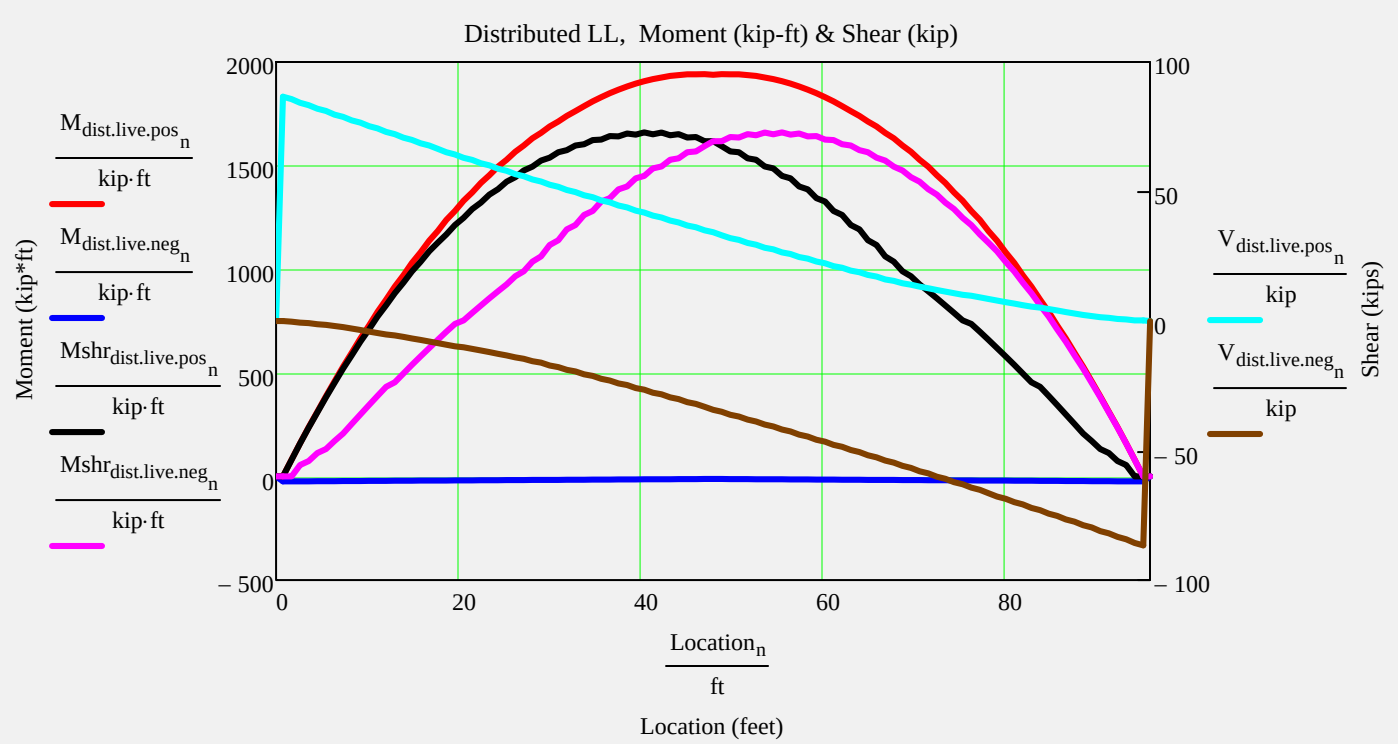
$\max(V_{dl.comp}) = 10.6 \cdot kip$ $\max(M_{dl.comp}) = 250.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -10.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 94.33\ ft$ BeamSpacing $= 7.17\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.75$ $g_{mom.fatigue} = 0.62$ $g_{shear} = 0.75$



$\max(V_{dist.live.pos}) = 86.6 \cdot kip$

$\max(M_{dist.live.pos}) = 1941.5 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -86.6 \cdot kip$

$Reaction_{LL} = 87.9 \cdot kip$

$\min(M_{dist.live.neg}) = -24.0 \cdot kip \cdot ft$

$Reaction_{DL} = 90.8 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1660 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.4 \cdot kip$ $Reaction_{lane} = 30.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 71.8 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-96ftSpan_NoSkew_Exterior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck		Bottom of Beam		Beam End: Top	Beam End: Bottom
Area (in^2)	0.62	*1	0		1.58	0
Distance (in)	4	*2	0	*3		
Length (ft)					16	0
Bar Size			5	*4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

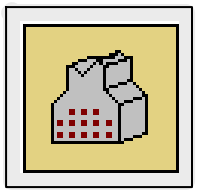
Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

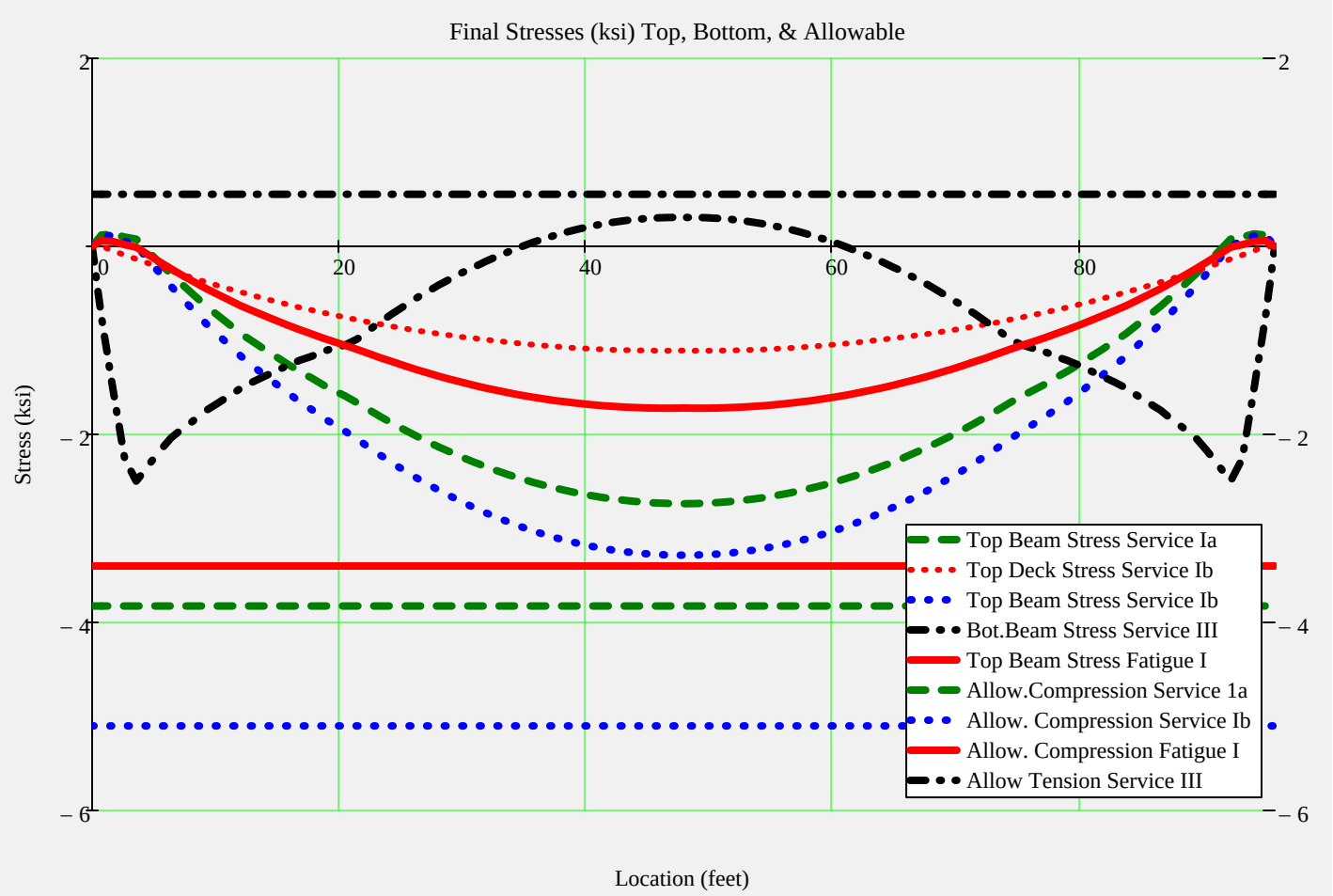
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses

Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.81$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.92$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.72$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.64$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.51$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.58	0.29	0.59
"Compression @ Release"	21.50	–3.51	–3.90
"Tension @ ServiceIII"	46.97	0.31	0.55
"CompressionIa @ ServiceI"	47.92	–2.74	–3.83
"CompressionIb @ ServiceI"	47.92	–3.28	–5.10
"Compression @ FatigueI"	49.80	–1.72	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

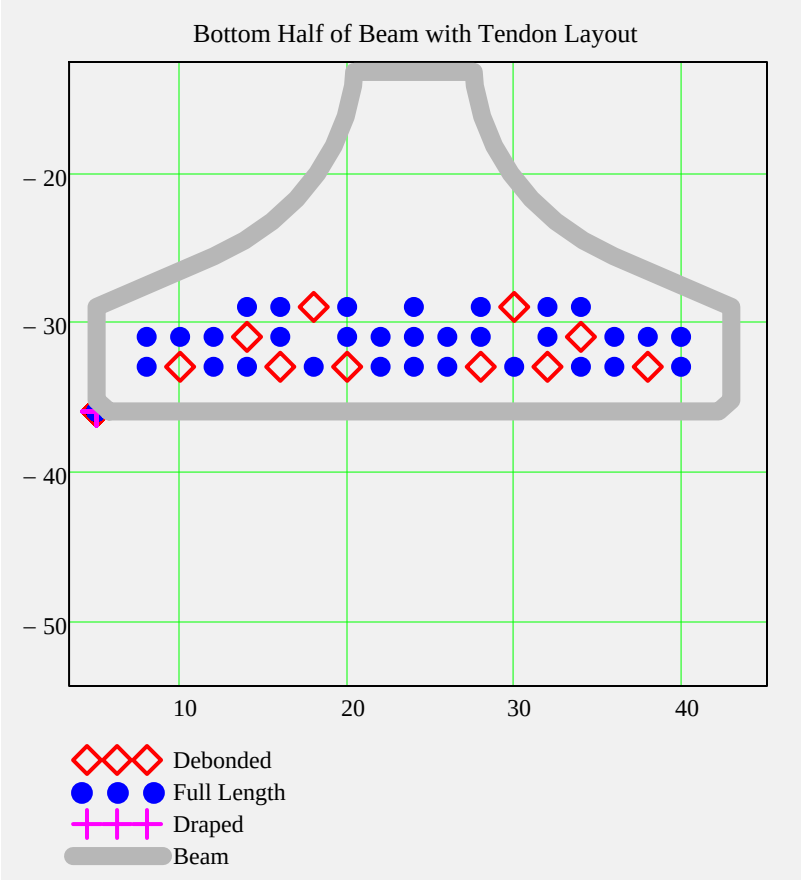
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

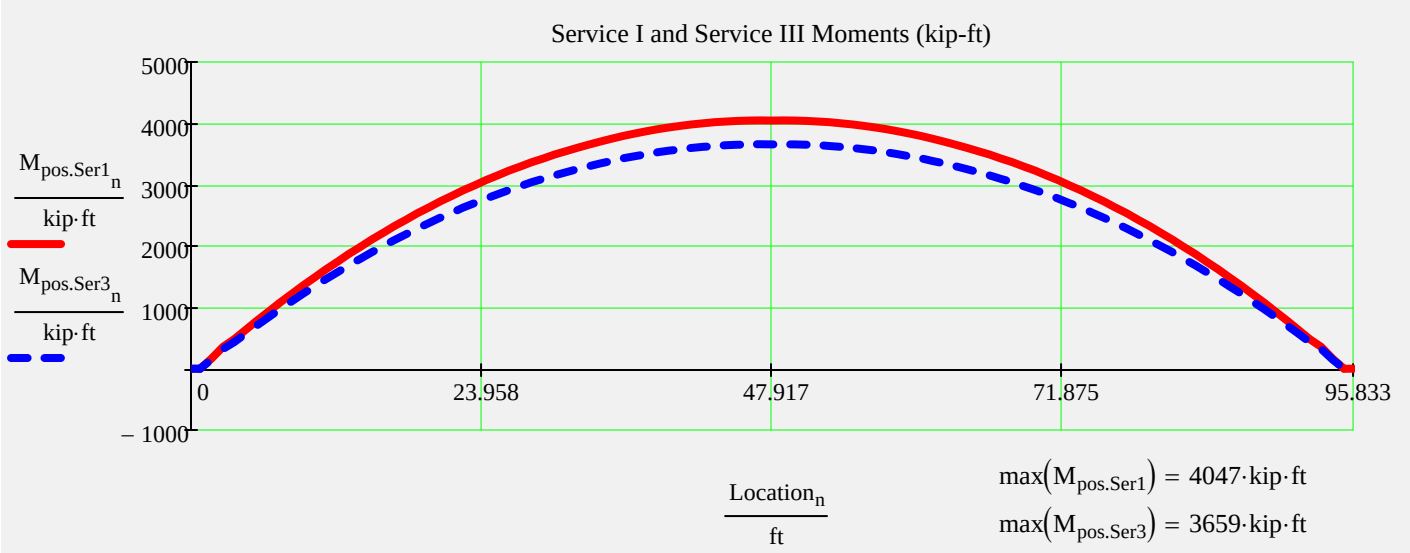
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 4047 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3659 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.96 & -3.09 \\ \text{"2"} & -1.06 & -2.53 \\ \text{"4"} & -1.01 & -2.57 \\ \text{"6"} & -2.67 & -1.25 \\ \text{"8"} & -3.28 & 0.31 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1842 & -1743 \\ \text{"@Final (about composite centroid)"} & -1608 & -1431 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1531.7	376824	–8.9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	966
"Non-Composite DL (incl. beam wt.)"	1856
"Composite Dead Load"	251
"Distributed Live Load"	1938

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

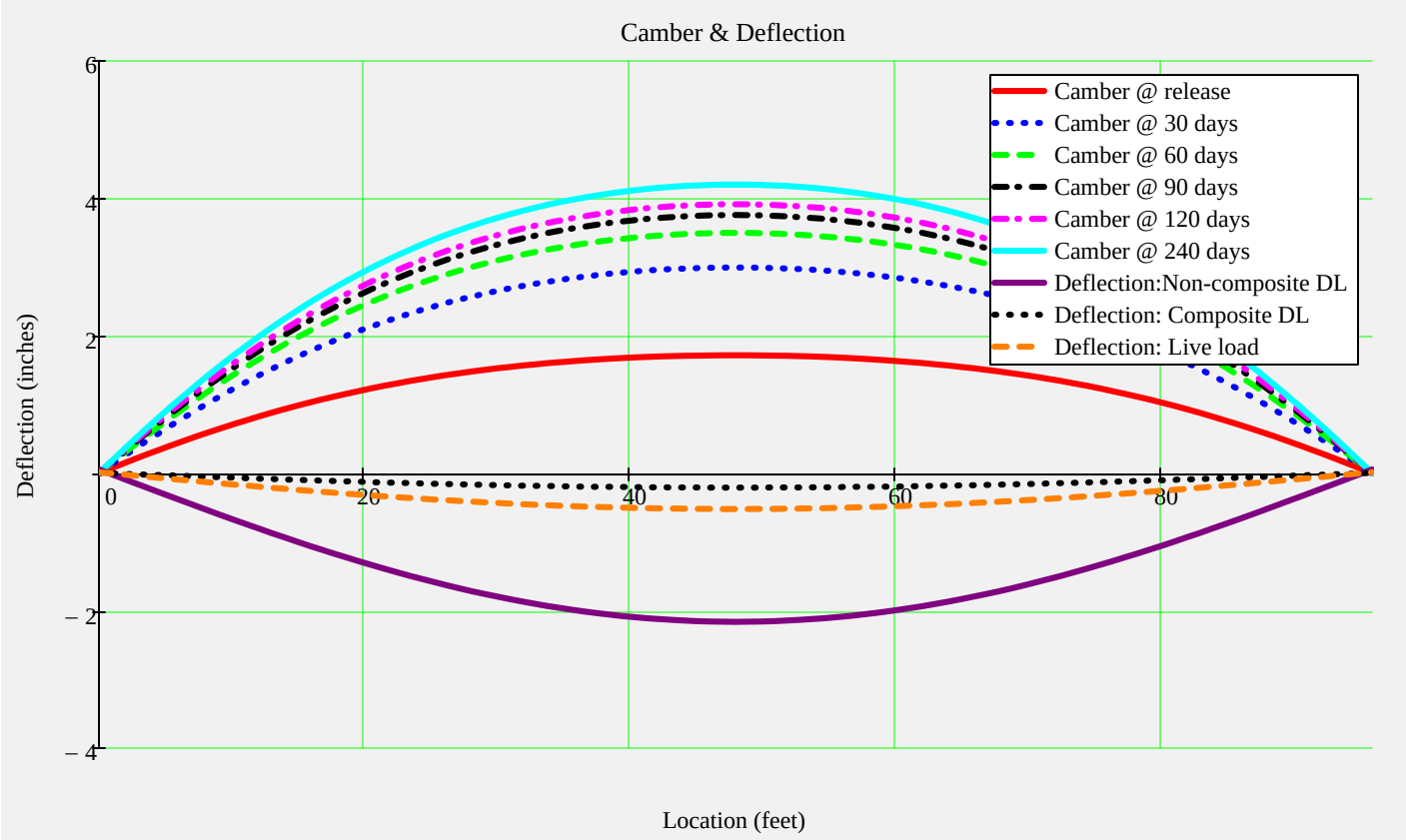
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 94.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.12	–0.80	0.37	1.72
"30 Days"	–0.36	–1.42	0.64	2.99
"60 Days"	–0.45	–1.66	0.75	3.50
"90 Days"	–0.49	–1.79	0.80	3.76
"120 Days"	–0.52	–1.86	0.83	3.92
"240 Days"	–0.57	–2.00	0.89	4.20
"Non-comp DL"	–0.25	0.20	–0.35	–2.16
"Comp DL"	–0.01	0.03	–0.03	–0.21
"LL"	–0.03	0.08	–0.09	–0.52

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.54 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

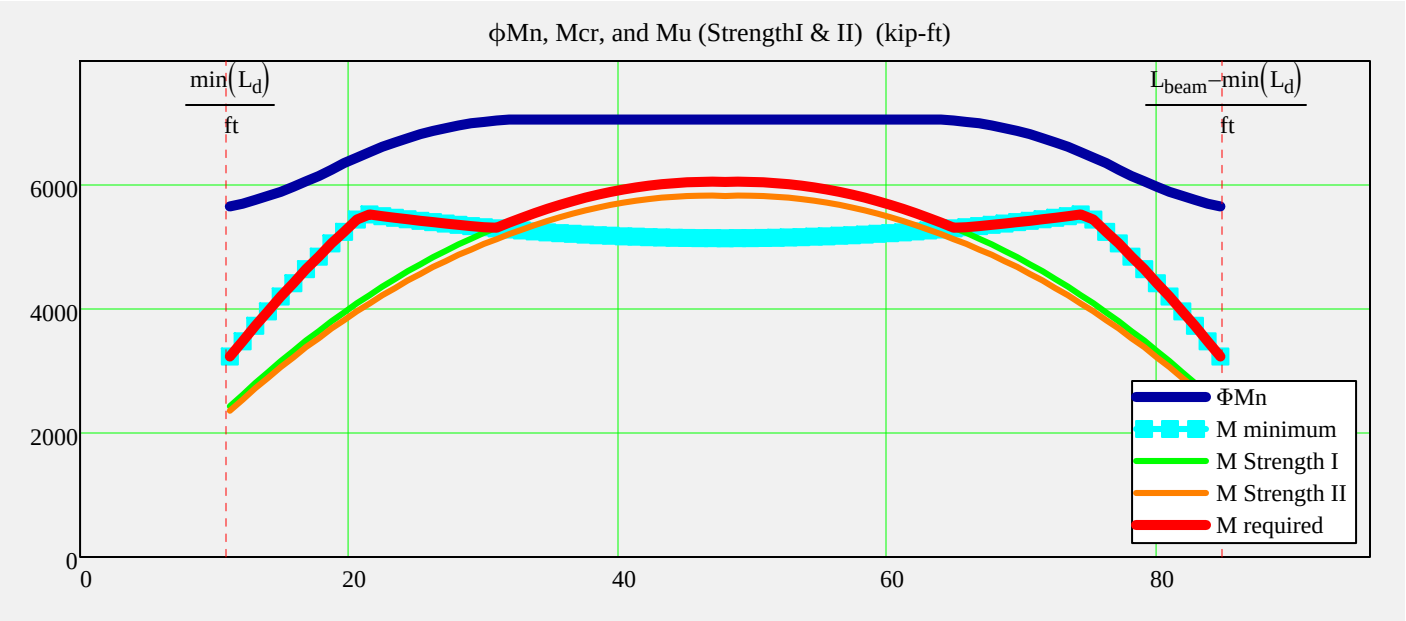
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 6054 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5142 \cdot kip \cdot ft$ $M_{reqd_{51}} = 6049 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7057 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 10.9\ \text{ft}$ $L_{beam} - \min(L_d) = 84.9\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.86$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

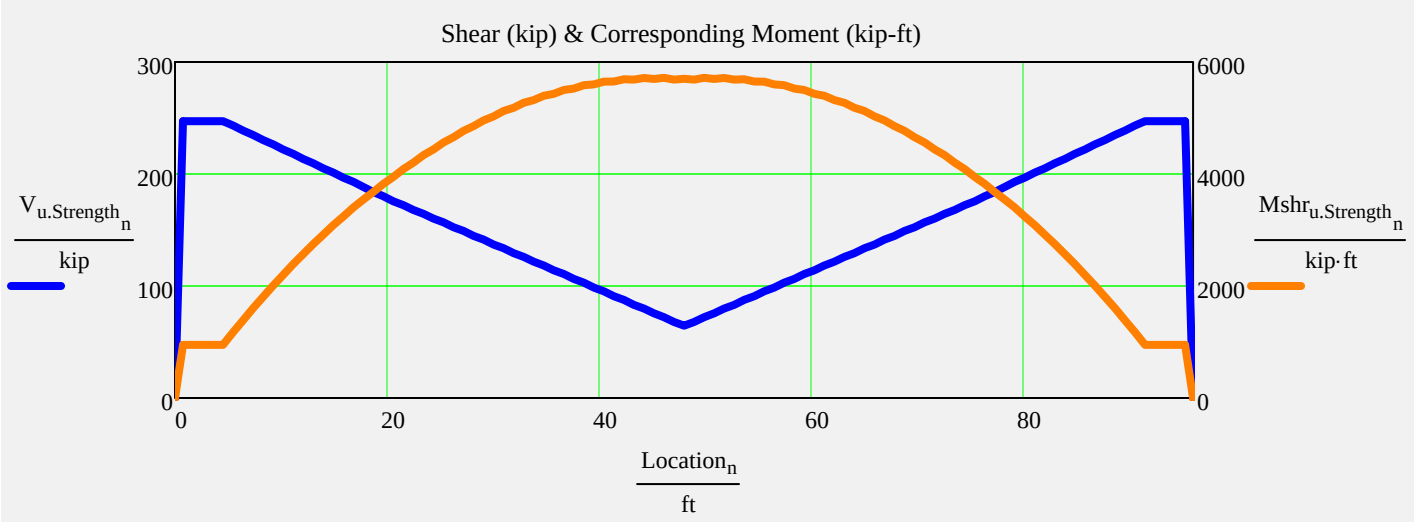
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

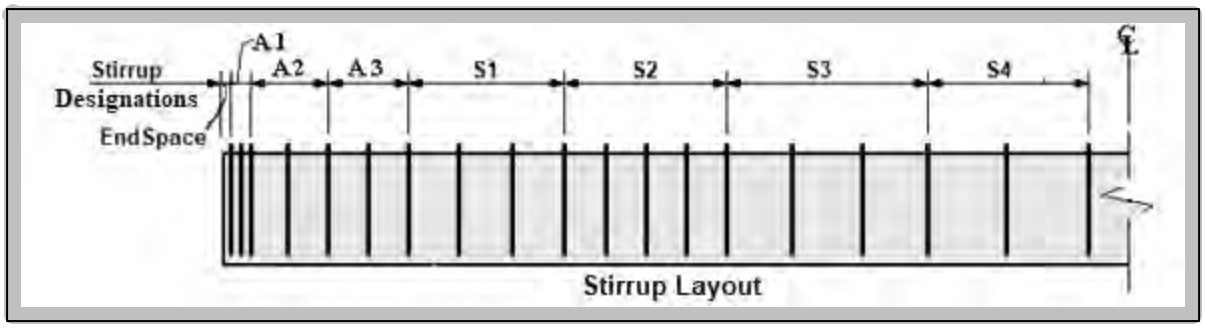
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 264 \\ 257 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 247.2 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5718 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

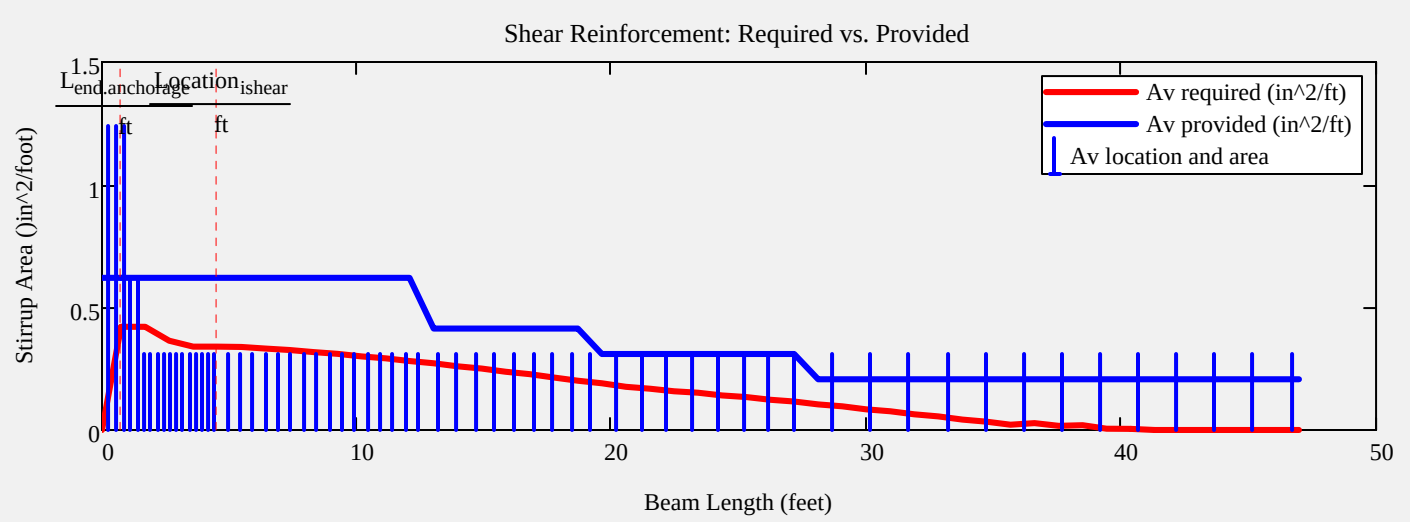
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.52\ ft$

Save Data File

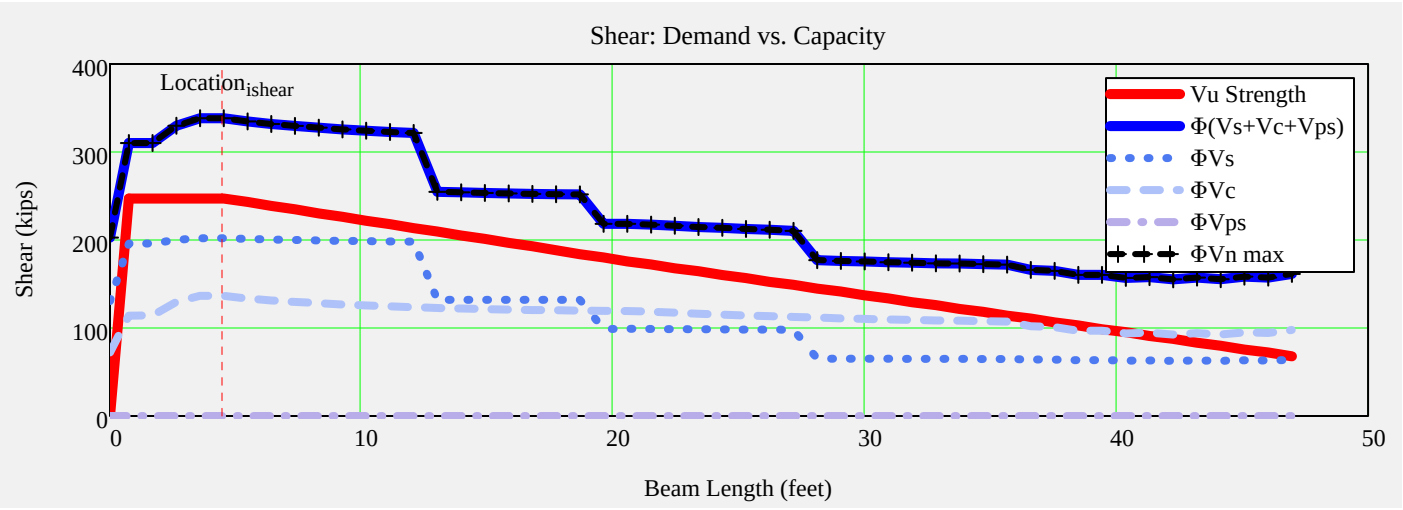
Use current input file

File Name FIB36-96ftSpan_NoSkew_Exterior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\EB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam"

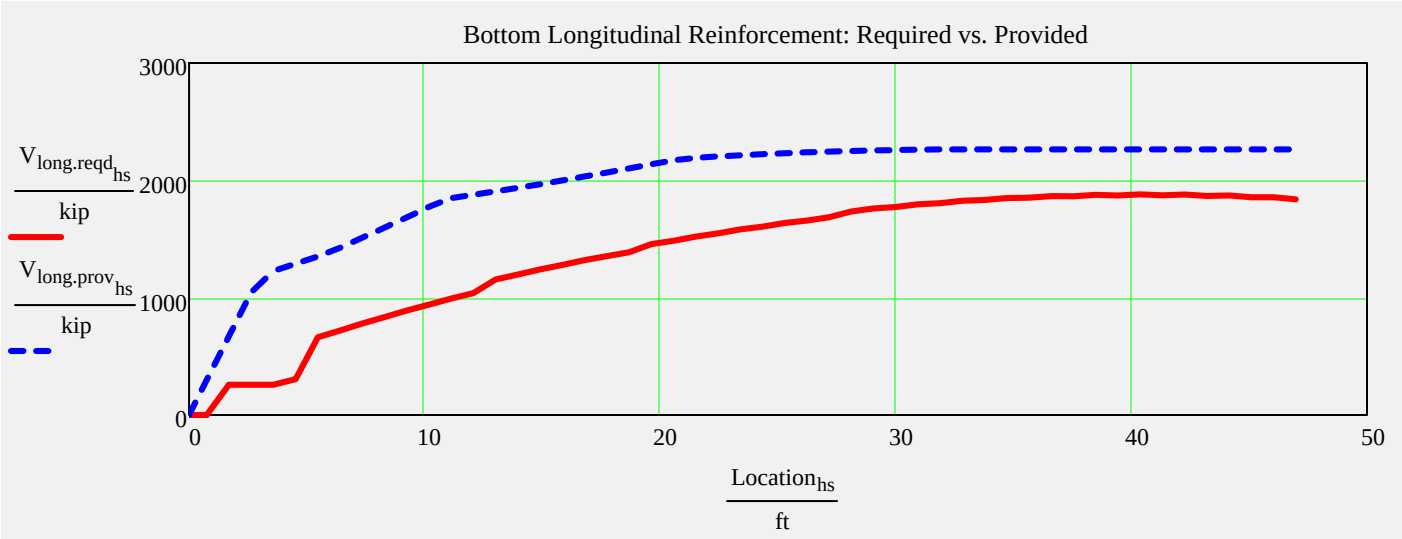
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 19.62 & 180.17 & 218.45 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.82$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

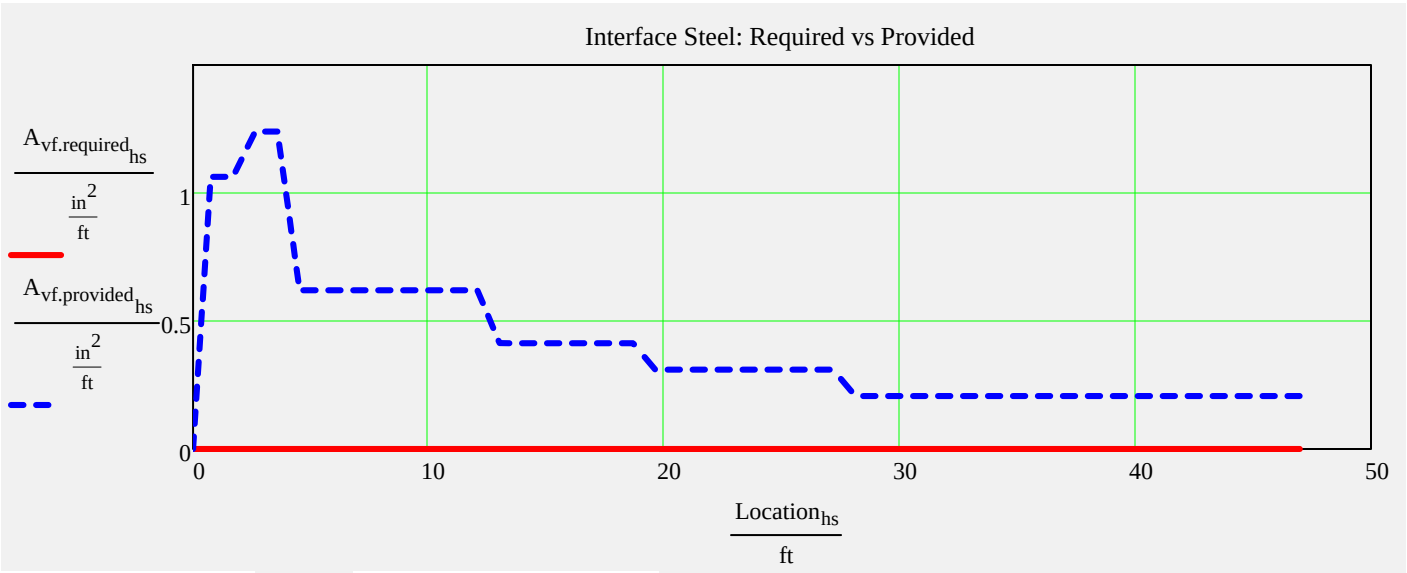


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 40.4 & 1880.1 & 2263.5 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.83$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.86 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

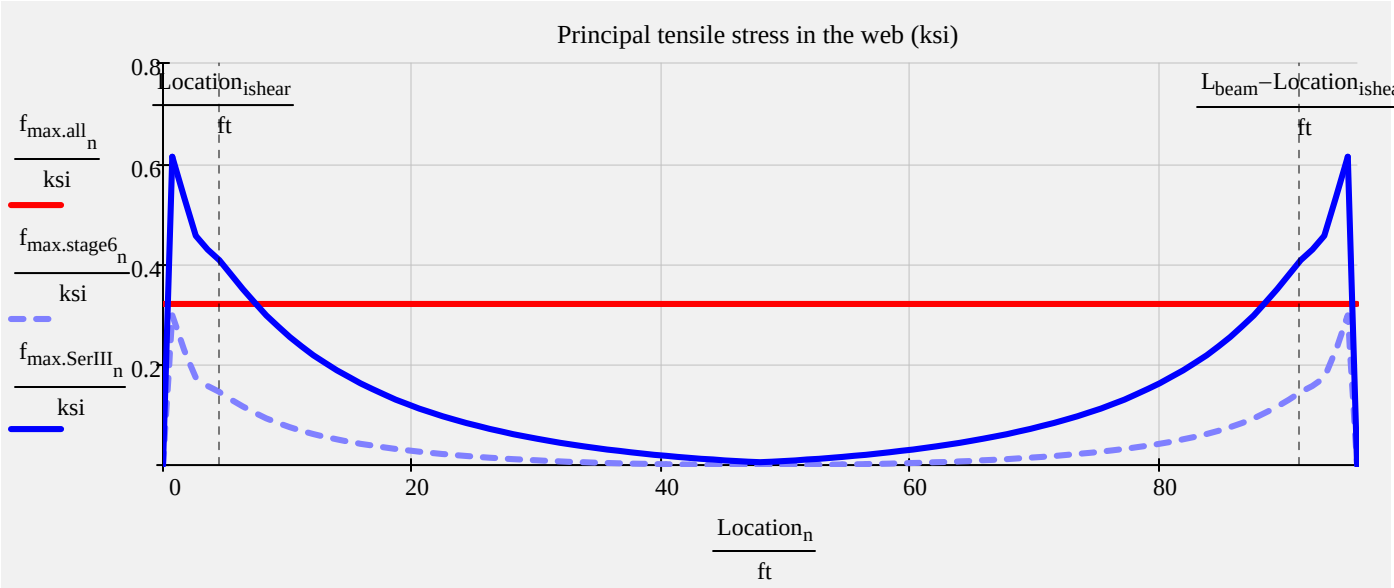
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 54.3 \cdot in$ $\max(DC_f_{max.web}) = 1.27$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$D/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

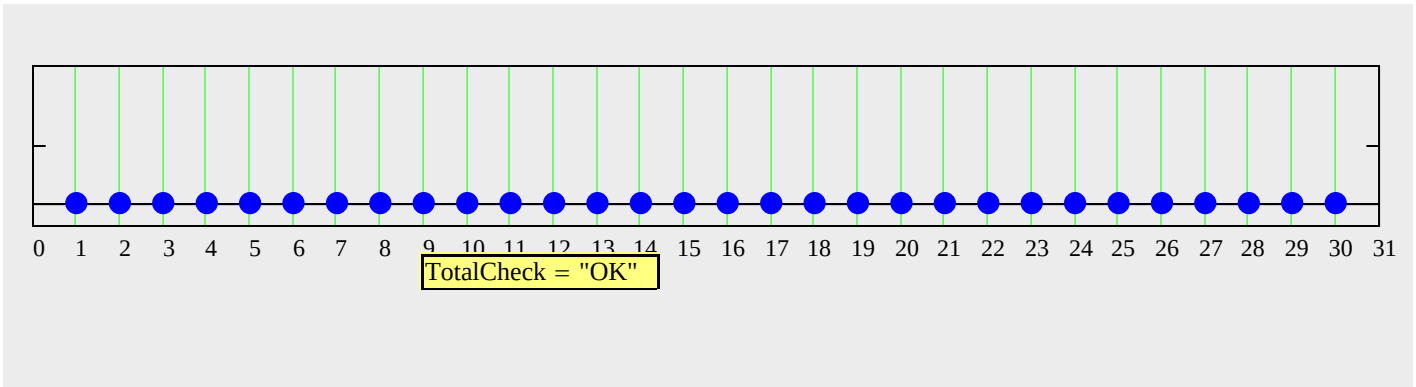
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.75	1.30	"N/A"	46.22	0.75	1.34	"N/A"	18.87	HL-93
"Strength I (Op)"	0.75	1.68	"N/A"	46.22	0.75	1.74	"N/A"	18.87	HL-93
"Service III (Inv)"	0.75	1.18	"N/A"	46.22	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.75	1.29	"N/A"	46.22	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.75	1.39	83.21	46.22	0.75	1.33	79.93	27.36	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)" *is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.81$ $DC_{LongReinf.Permit} = 0.83$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7057	"factored resistance (kip-ft)...."
"γDL"	2656	"factored dead load (kip-ft)...."
"γLL"	2621	"factored live load (kip-ft)....."
"RF"	1.68	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	218.5	"factored resistance (kip)....."
"γDL"	67.6	"factored dead load (kip)....."
"γLL"	86.8	"factored live load (kip)....."
"RF"	1.74	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 96 FEET (NO SKEW)
EASTBOUND BRIDGE
(PARKER CREEK)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\EB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-96ftSpan_15Skew_Exterior.dat
FIB36-96ftSpan_15Skew_Interior.dat
FIB36-96ftSpan_NoSkew_Exterior.dat
FIB36-96ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

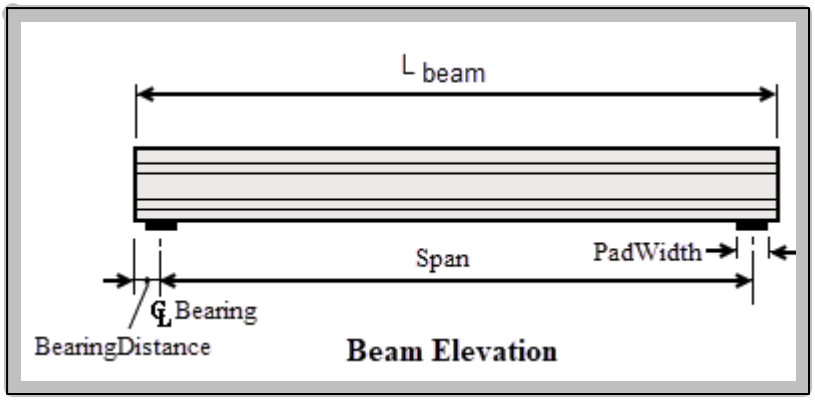
InputDataFile = "FIB36-96ftSpan_NoSkew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 05 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-96ftSpan_NoSkew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	95.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	7.1667	ft	*Measured from beam centerline to centerline.*
Overhang	3.625	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.2916	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(* 0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	8		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	0	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1.5	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

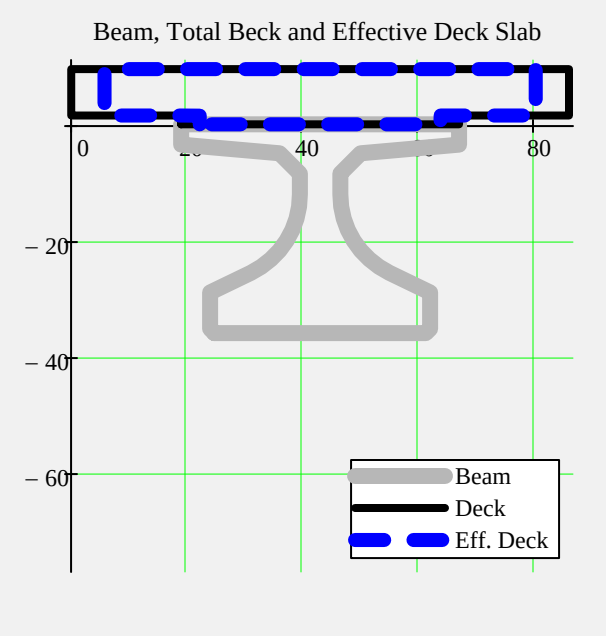
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1.5 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 86·in

$b_e = 86 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.79 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.06 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.108 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.11 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 95.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

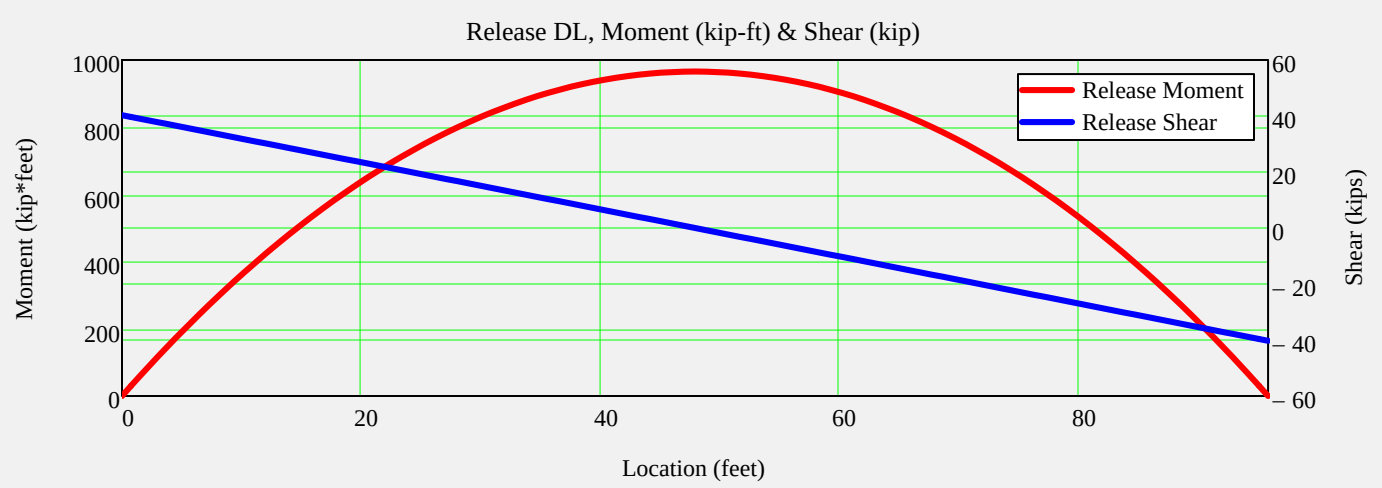
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

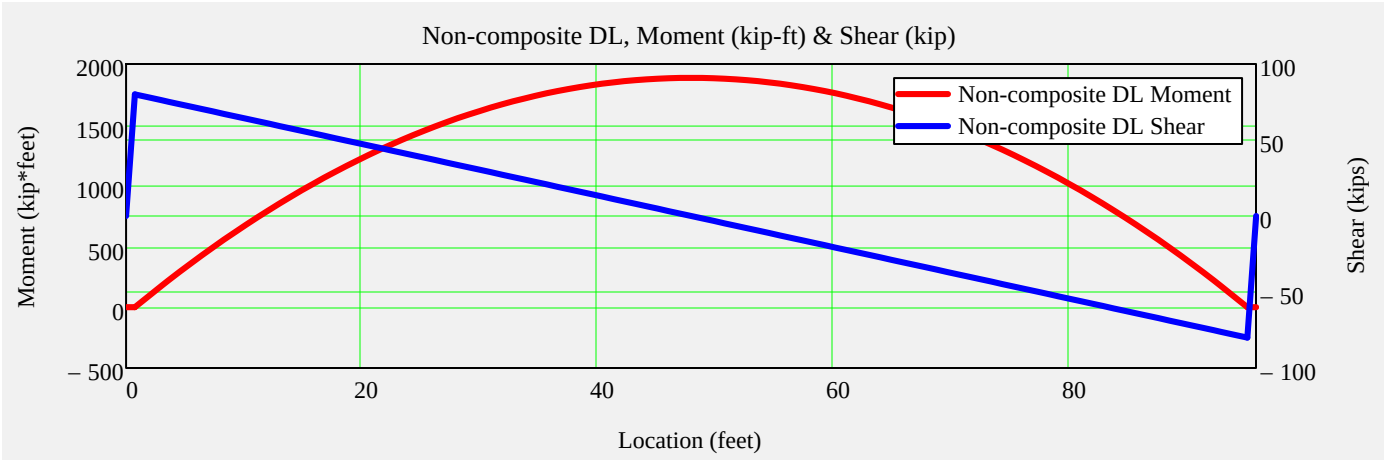
Release Dead Load Moments and Shears

$L_{span} = 94.33\ ft$



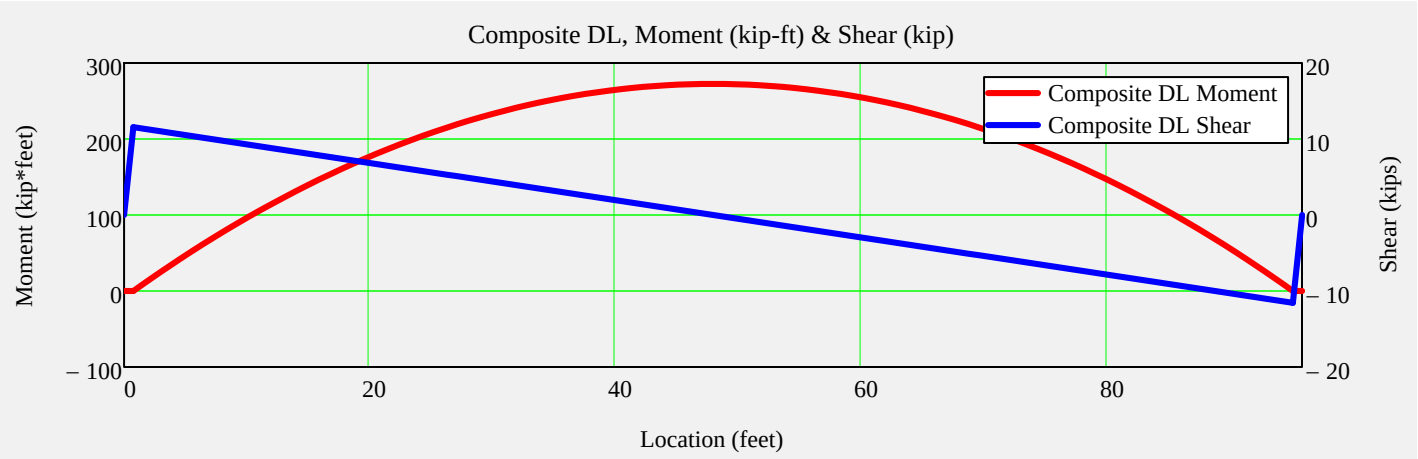
$\max(V_{release}) = 40.3 \cdot kip$ $\max(M_{release}) = 965.5 \cdot kip \cdot ft$ $\min(V_{release}) = -40.3 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 80.0 \cdot kip$ $\max(M_{dl.non.comp}) = 1886.1 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -80.0 \cdot kip$

Composite Dead Load Moments and Shear



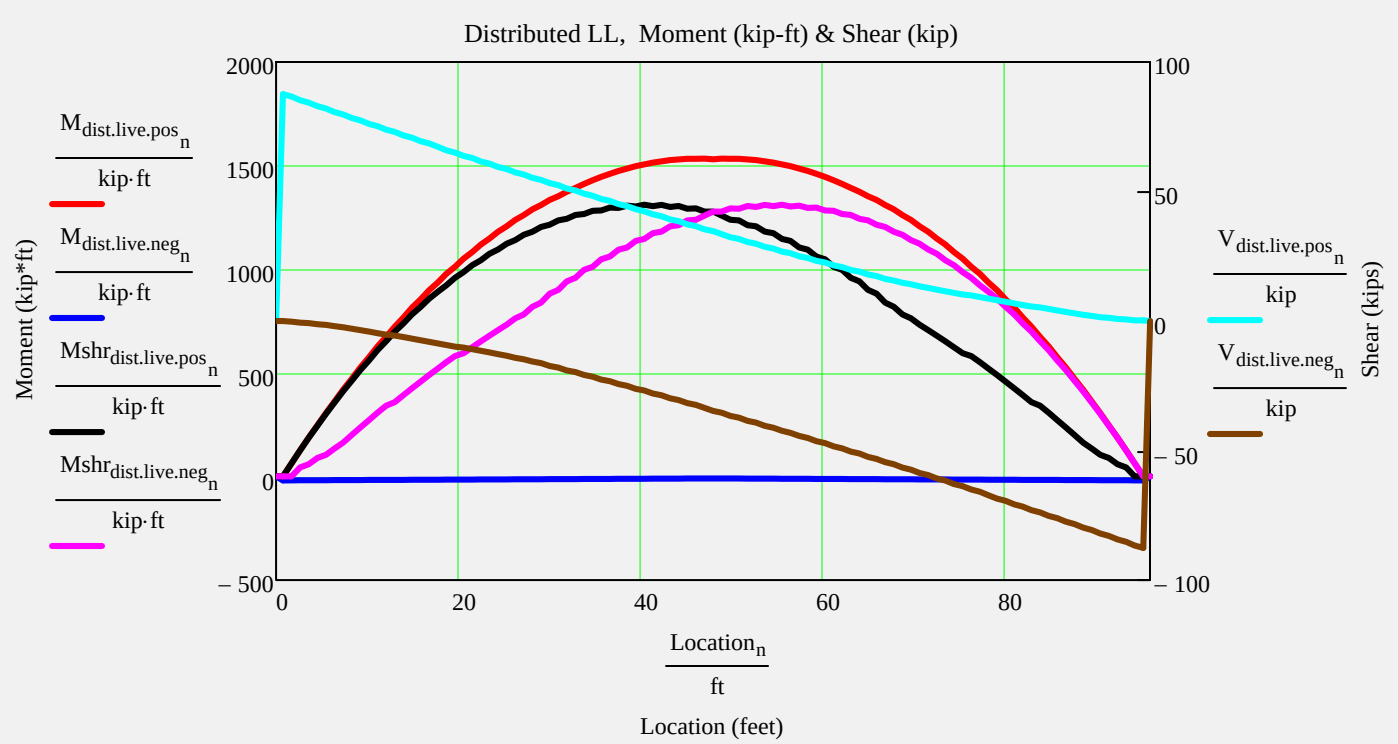
$\max(V_{dl.comp}) = 11.6 \cdot kip$ $\max(M_{dl.comp}) = 272.5 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -11.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 94.33\ ft$ BeamSpacing $= 7.17\ ft$ Skew $= 0 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.00$

Final Live Load Distribution Factors: $g_{mom} = 0.59$ $g_{mom.fatigue} = 0.35$ $g_{shear} = 0.76$



$\max(V_{dist.live.pos}) = 87.6 \cdot kip$

$\max(M_{dist.live.pos}) = 1533.4 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -87.6 \cdot kip$

$Reaction_{LL} = 88.9 \cdot kip$

$\min(M_{dist.live.neg}) = -18.9 \cdot kip \cdot ft$

$Reaction_{DL} = 93.0 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1311 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.4 \cdot kip$ $Reaction_{lane} = 30.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 72.6 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-96ftSpan_NoSkew_Interior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom
Area (in^2)	0.62 *1	0	1.58	0
Distance (in)	4 *2	0 *3		
Length (ft)			16	0
Bar Size		5 *4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch / 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

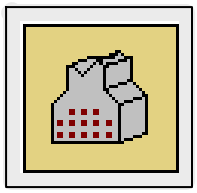
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

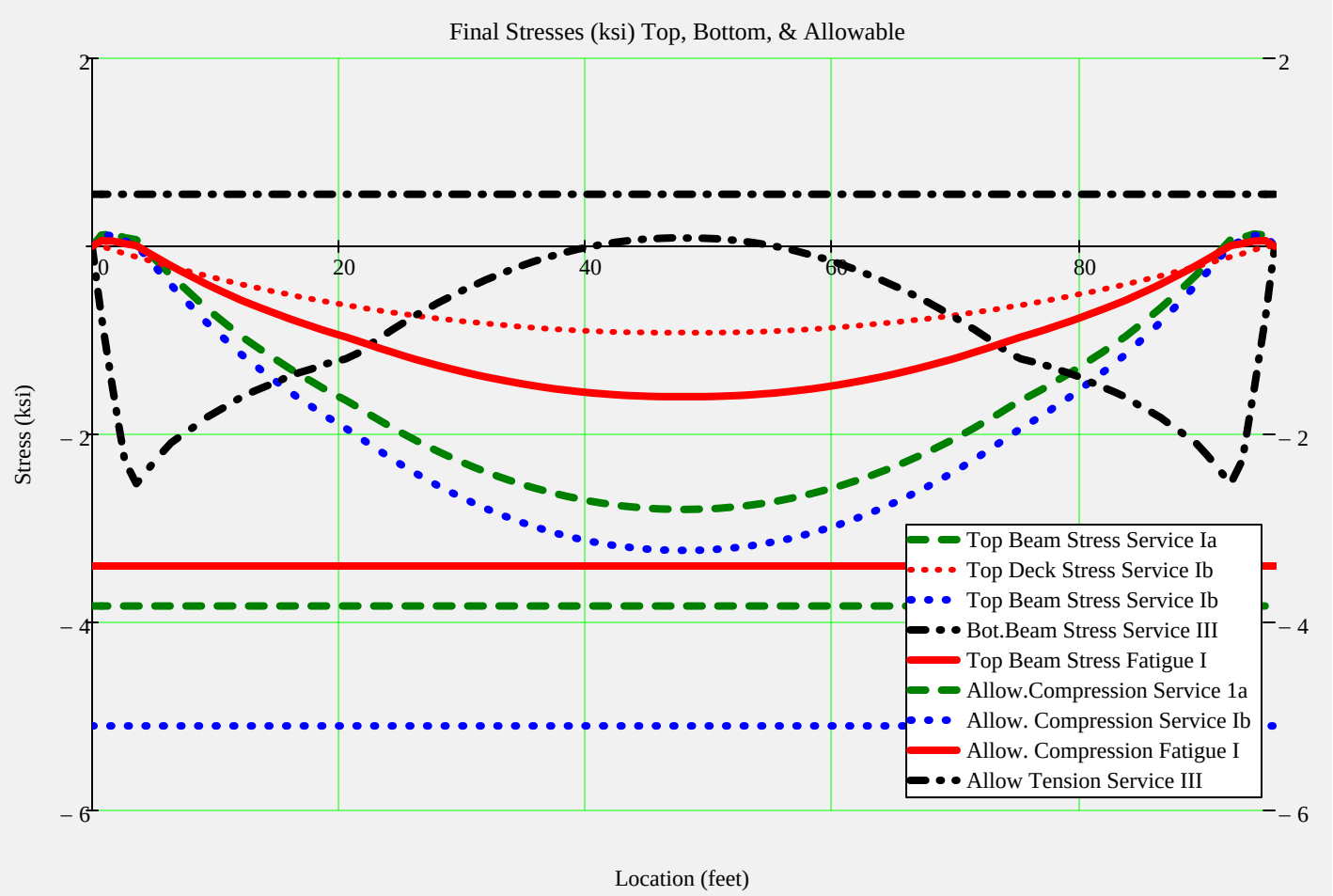
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

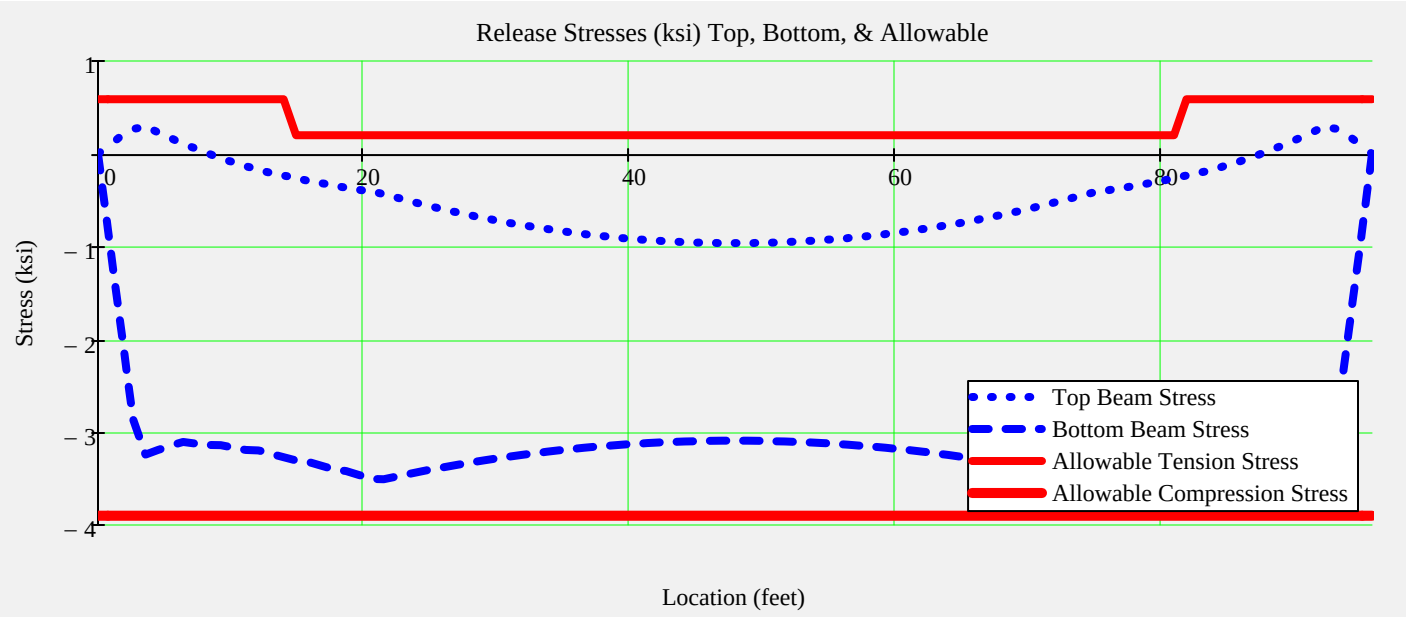
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.81$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.85$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.73$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.63$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.47$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.58	0.29	0.59
"Compression @ Release"	21.50	–3.51	–3.90
"Tension @ ServiceIII"	46.97	0.09	0.55
"CompressionIa @ ServiceI"	47.92	–2.80	–3.83
"CompressionIb @ ServiceI"	47.92	–3.23	–5.10
"Compression @ FatigueI"	48.86	–1.60	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

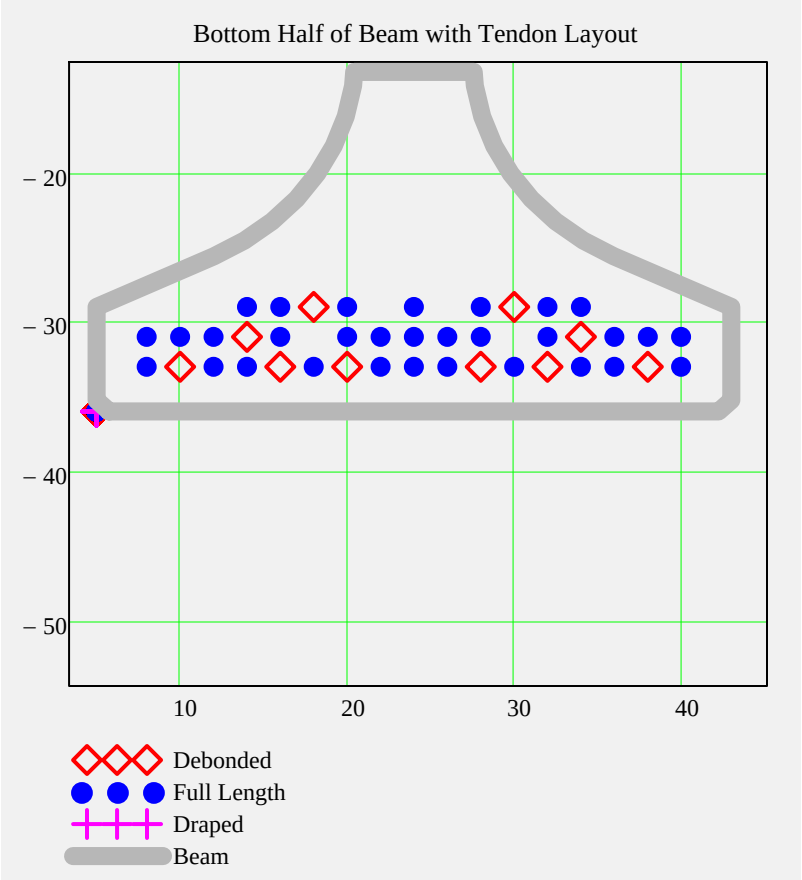
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

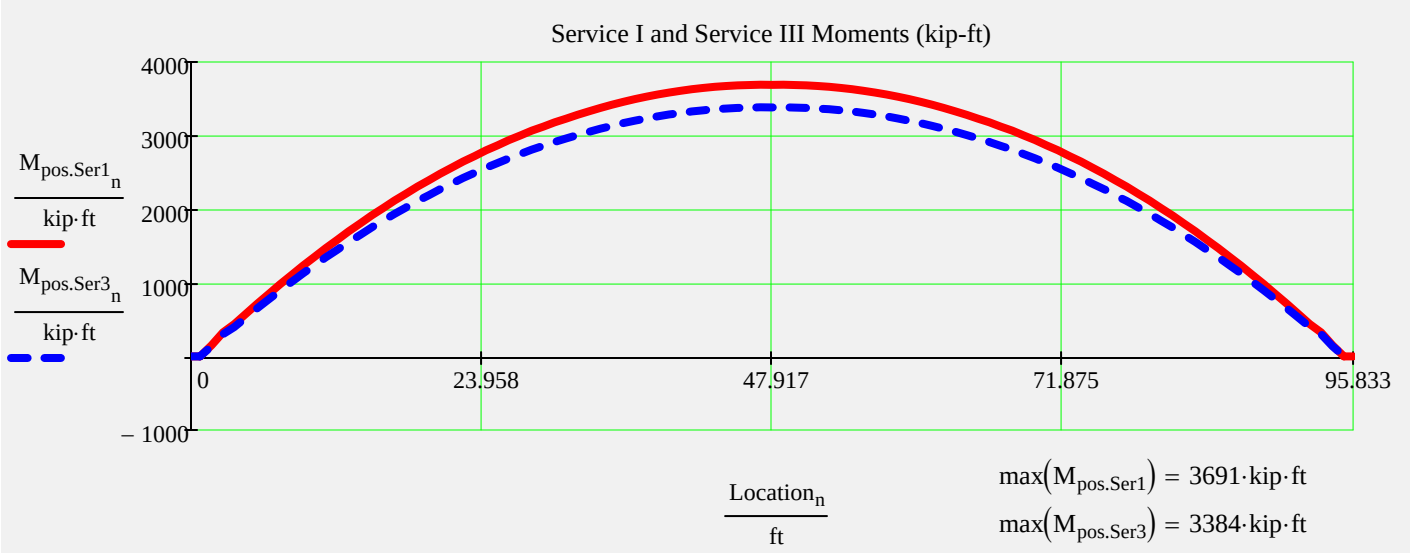
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3691 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3384 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.96 & -3.09 \\ \text{"2"} & -1.06 & -2.53 \\ \text{"4"} & -1.01 & -2.57 \\ \text{"6"} & -2.72 & -1.21 \\ \text{"8"} & -3.23 & 0.09 \end{pmatrix}$

$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1842 & -1743 \\ \text{"@Final (about composite centroid)"} & -1608 & -1431 \end{pmatrix}$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1528.1	376065	–8.9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	966
"Non-Composite DL (incl. beam wt.)"	1886
"Composite Dead Load"	272
"Distributed Live Load"	1531

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

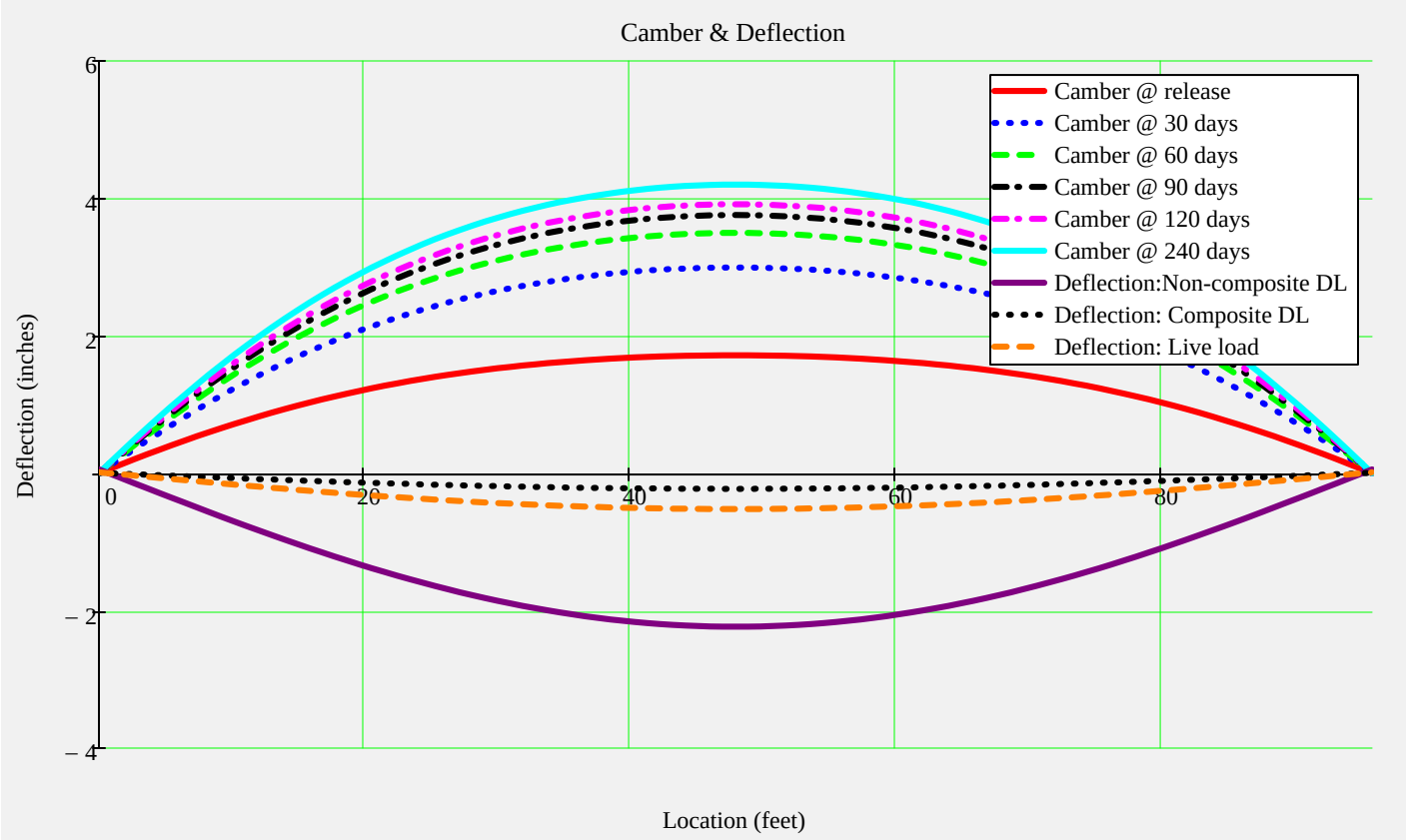
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 94.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.12	–0.80	0.37	1.72
"30 Days"	–0.36	–1.42	0.64	2.99
"60 Days"	–0.45	–1.66	0.75	3.50
"90 Days"	–0.49	–1.79	0.80	3.76
"120 Days"	–0.52	–1.86	0.83	3.92
"240 Days"	–0.57	–2.00	0.89	4.20
"Non-comp DL"	–0.25	0.20	–0.36	–2.23
"Comp DL"	–0.01	0.03	–0.04	–0.23
"LL"	–0.03	0.08	–0.09	–0.52

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.45 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

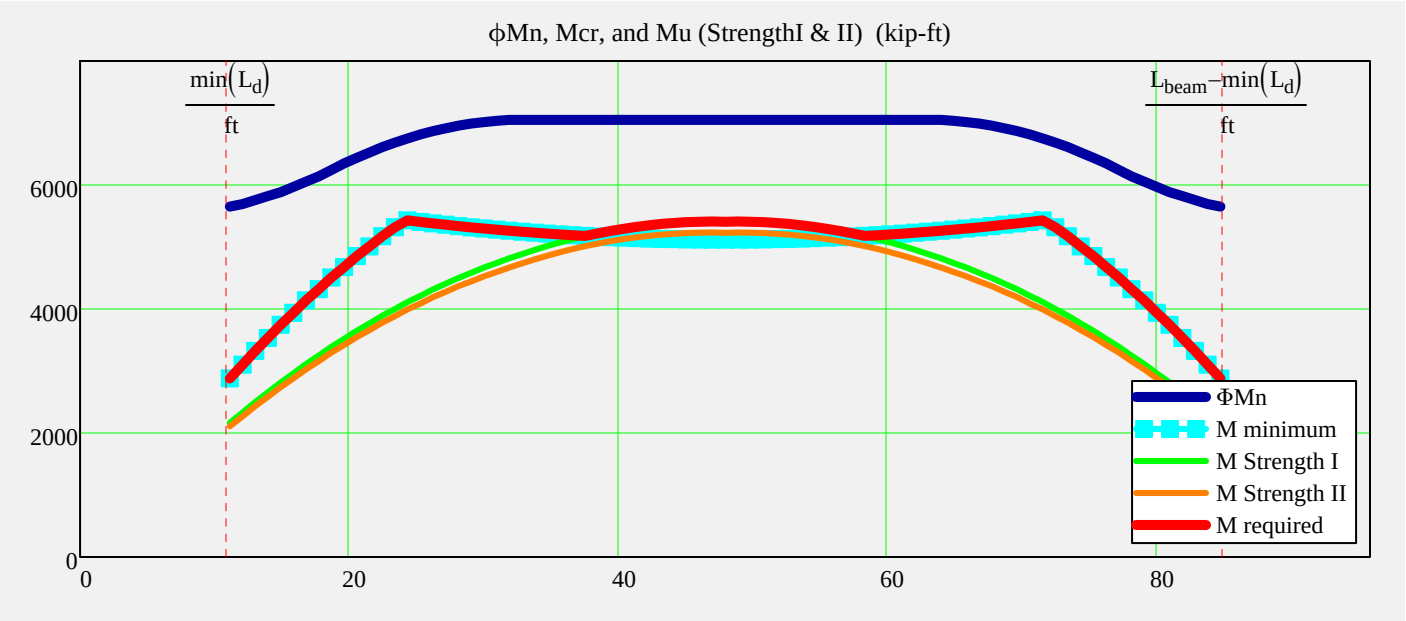
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5410 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5119 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5407 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7052 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 10.9\,\text{ft}$ $\quad L_{beam} - \min(L_d) = 84.9\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.80$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

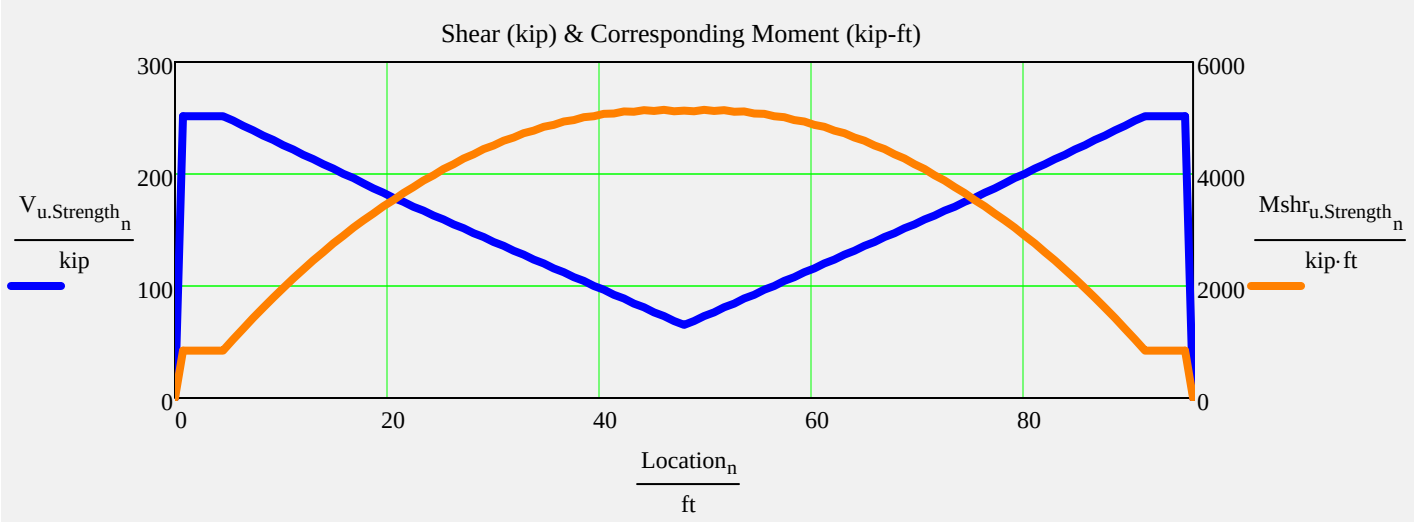
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

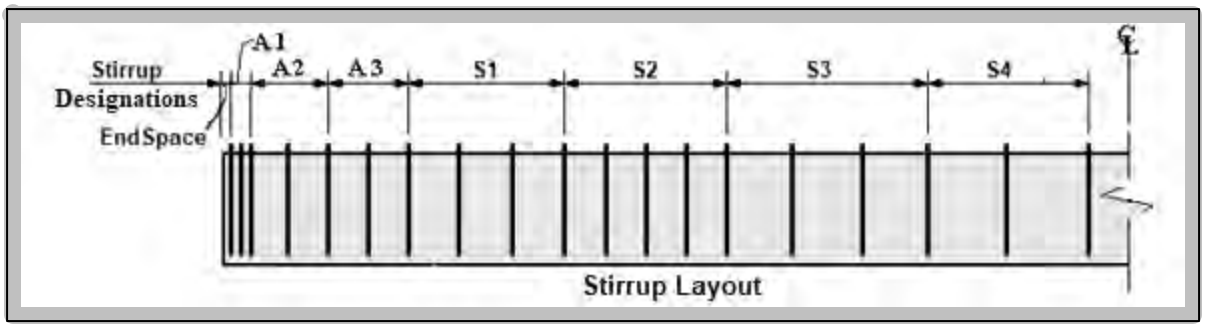
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 269 \\ 261 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 251.6 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5144 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

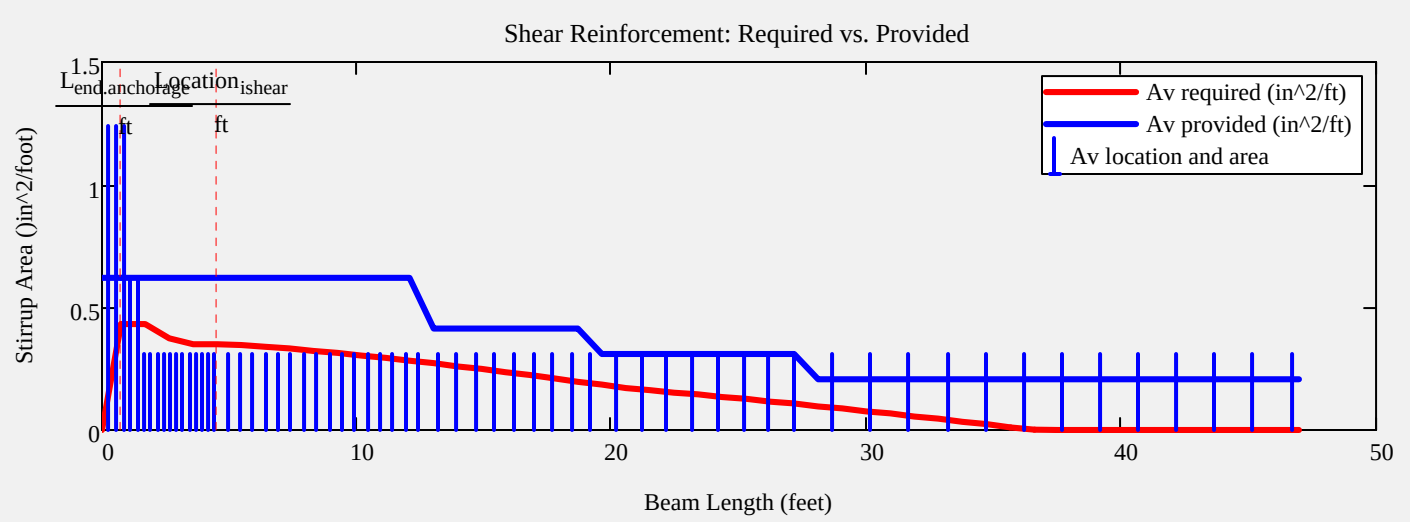
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.52\ ft$

Save Data File

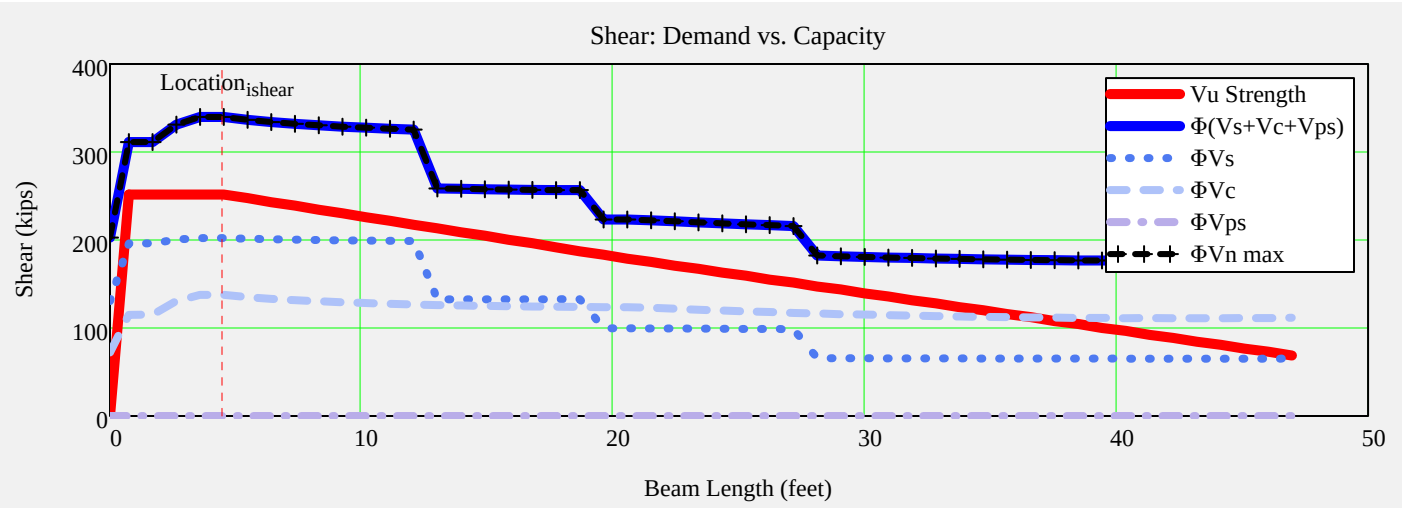
Use current input file

File Name FIB36-96ftSpan_NoSkew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\EB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam"

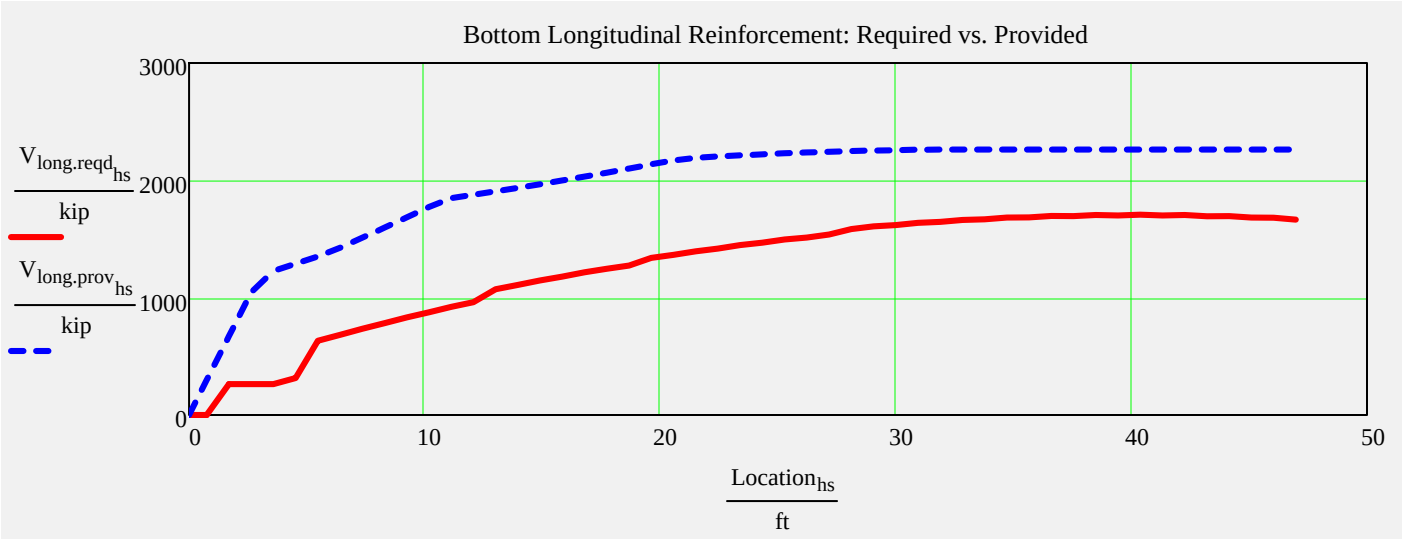
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 13.01 & 213.34 & 258.55 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.83$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

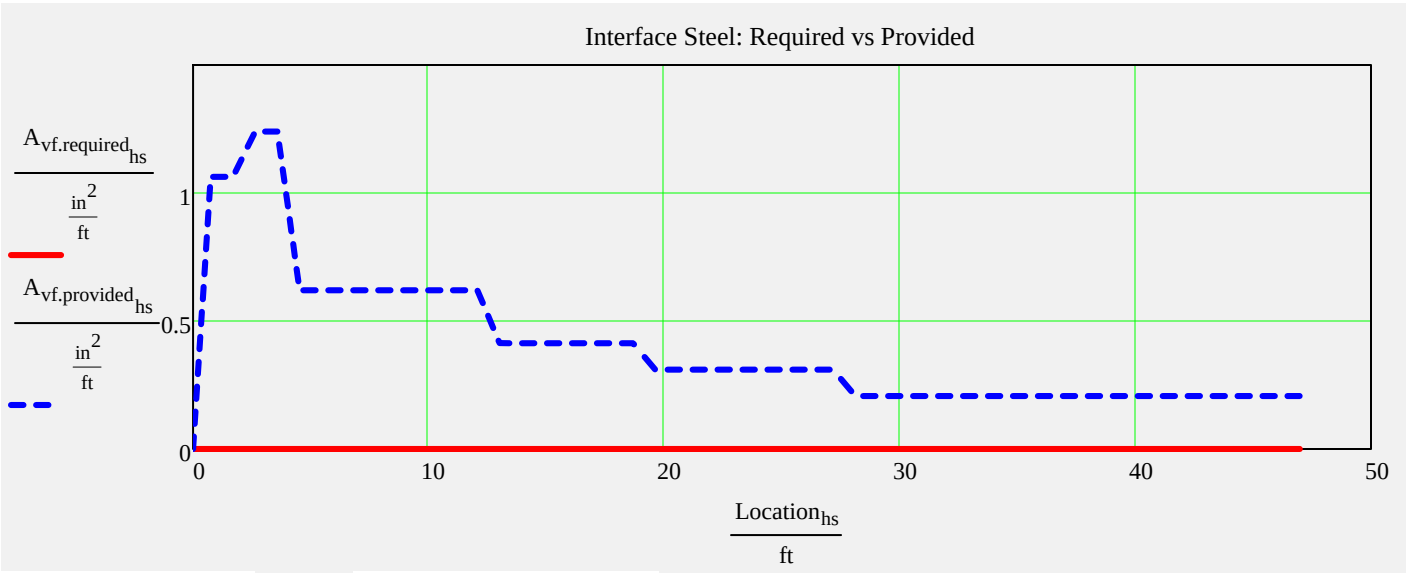


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 40.4 & 1707.0 & 2262.6 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.75$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.86 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

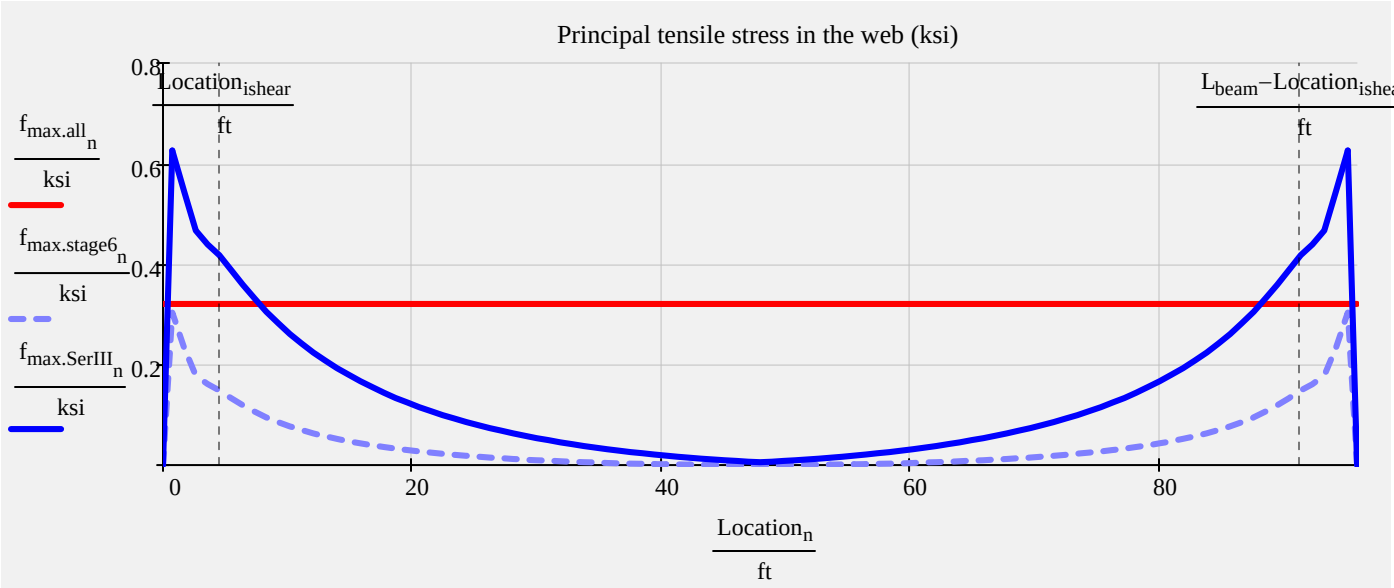
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 54.3 \cdot in$ $\max(DC_f_{max.web}) = 1.3$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

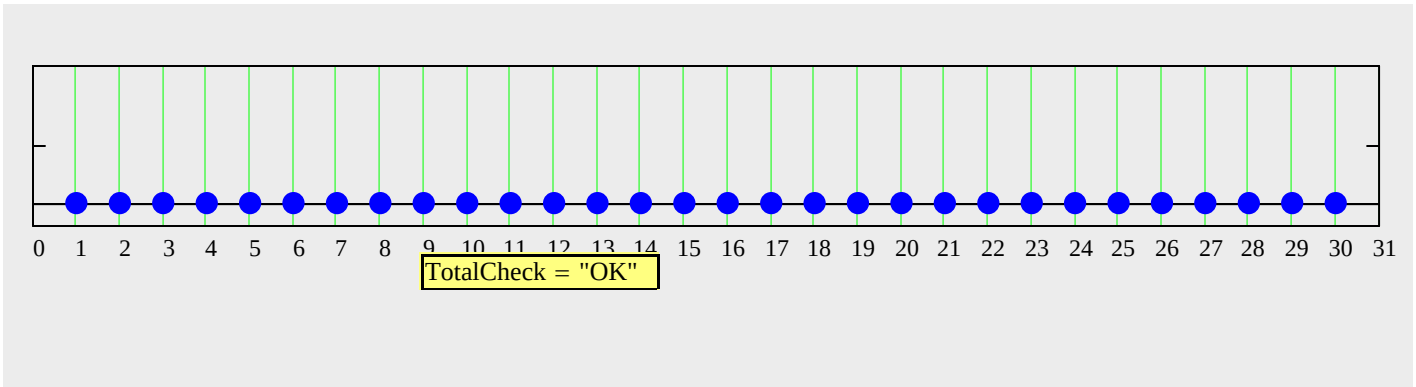
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.59	1.61	"N/A"	48.11	0.76	1.35	"N/A"	18.87	HL-93
"Strength I (Op)"	0.59	2.09	"N/A"	48.11	0.76	1.75	"N/A"	18.87	HL-93
"Service III (Inv)"	0.59	1.44	"N/A"	48.11	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.59	1.57	"N/A"	46.22	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.59	1.73	103.54	48.11	0.76	1.36	81.32	18.87	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)" *is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.74$ $DC_{LongReinf.Permit} = 0.75$ $CheckLongReinf_{loadrating} = "OK"$

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7052	"factored resistance (kip-ft)...."
"γDL"	2727	"factored dead load (kip-ft)...."
"γLL"	2070	"factored live load (kip-ft)....."
"RF"	2.09	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	223.3	"factored resistance (kip)....."
"γDL"	69.4	"factored dead load (kip)....."
"γLL"	87.8	"factored live load (kip)....."
"RF"	1.75	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
EXTERIOR BEAM DESIGN

SPAN LENGTH = 96 FEET (15 DEG. SKEW)
EASTBOUND BRIDGE
(MOSSY GULLY & LONG POINT MARSH)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

Category and Beams

I-Beam	
FSB	
FUB	
FlatSlab	
InvertedT	
DoubleT	

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\EB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-96ftSpan_15Skew_Exterior.dat
FIB36-96ftSpan_15Skew_Interior.dat
FIB36-96ftSpan_NoSkew_Exterior.dat
FIB36-96ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

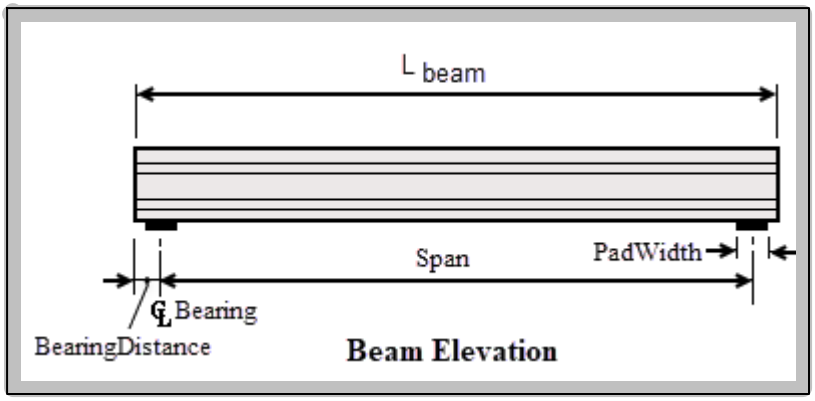
InputDataFile = "FIB36-96ftSpan_15Skew_Exterior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 05 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-96ftSpan_15Skew_Exterior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	95.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	7.1667	ft	*Measured from beam centerline to centerline.*
Overhang	3.625	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.2916	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior / Exterior		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(0.015ksf for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	8		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1.5	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

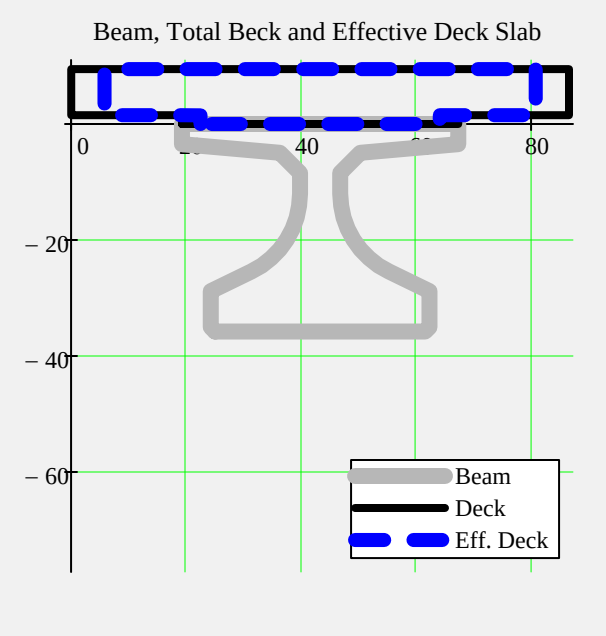
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1.5 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 86·in

$b_e = 86.5 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.80 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.03 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.088 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.11 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 95.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

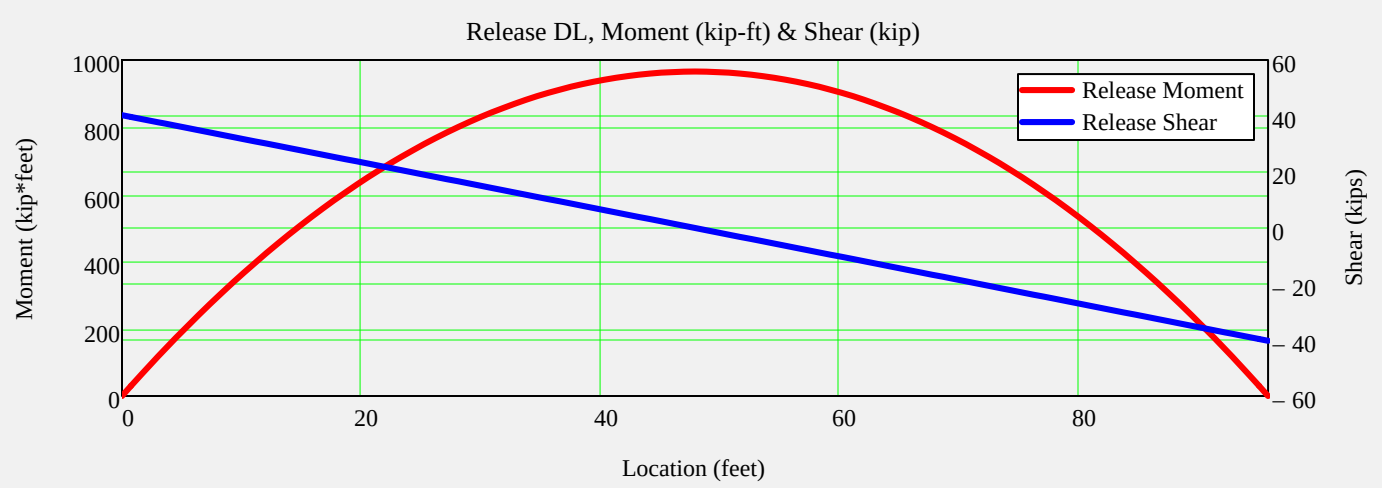
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

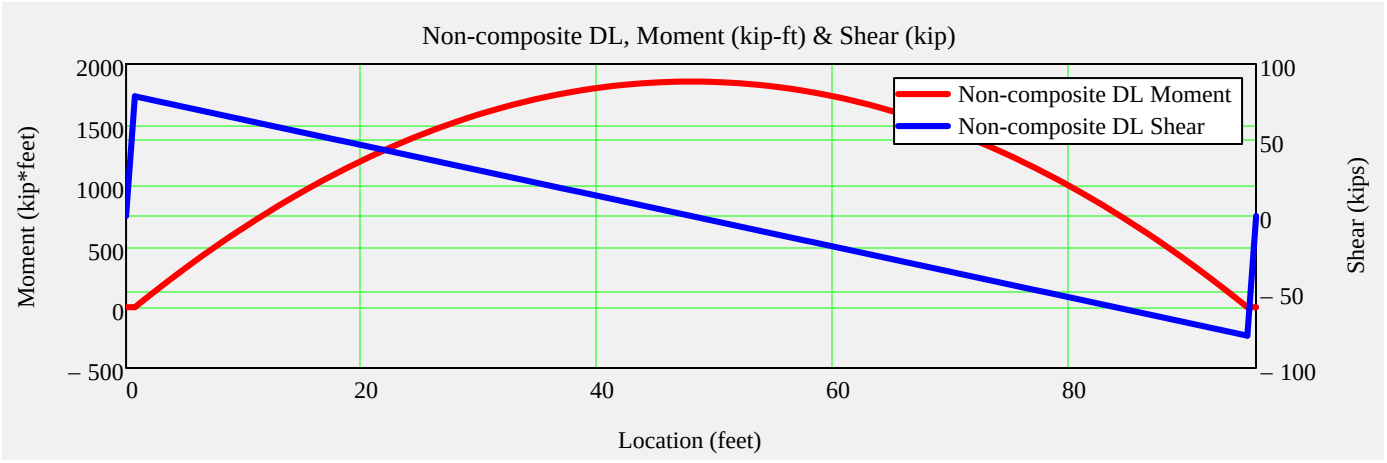
Release Dead Load Moments and Shears

$L_{span} = 94.33\ ft$



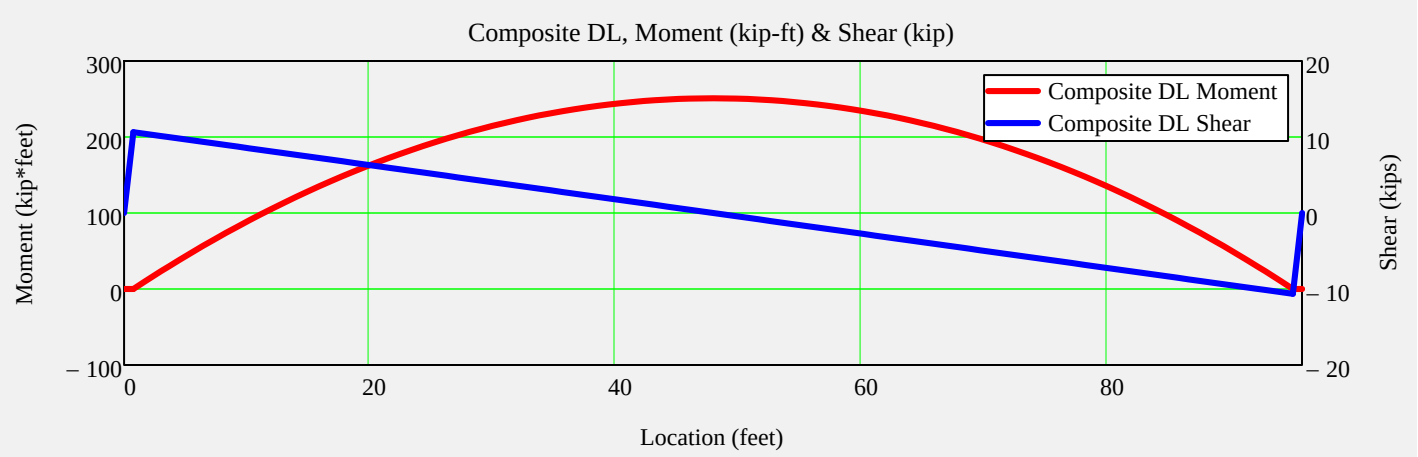
$\max(V_{release}) = 40.3 \cdot kip$ $\max(M_{release}) = 965.5 \cdot kip \cdot ft$ $\min(V_{release}) = -40.3 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 78.7 \cdot kip$ $\max(M_{dl.non.comp}) = 1855.5 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -78.7 \cdot kip$

Composite Dead Load Moments and Shear



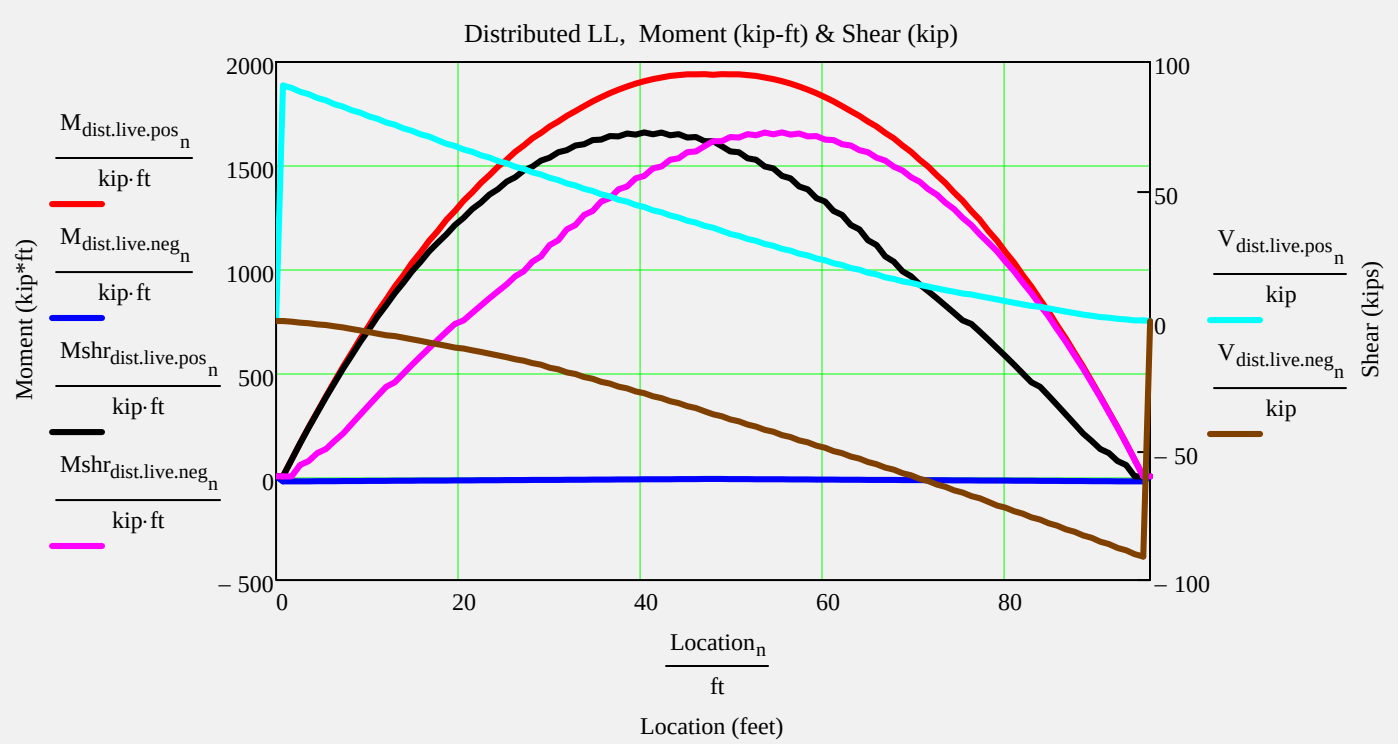
$\max(V_{dl.comp}) = 10.6 \cdot kip$ $\max(M_{dl.comp}) = 250.9 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -10.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 94.33\ ft$ BeamSpacing $= 7.17\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.05$

Final Live Load Distribution Factors: $g_{mom} = 0.75$ $g_{mom.fatigue} = 0.62$ $g_{shear} = 0.78$



$\max(V_{dist.live.pos}) = 90.9 \cdot kip$

$\max(M_{dist.live.pos}) = 1941.5 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -90.9 \cdot kip$

$Reaction_{LL} = 92.3 \cdot kip$

$\min(M_{dist.live.neg}) = -24.0 \cdot kip \cdot ft$

$Reaction_{DL} = 90.8 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1660 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.4 \cdot kip$ $Reaction_{lane} = 30.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 75.4 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-96ftSpan_15Skew_Exterior.dat"

Mild Reinforcement Type:

- Carbon Steel - Grade 60
- Stainless Steel - Grade 60
- Glass Fiber Reinforced Polymer
- Carbon Steel - Grade 80
- Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement					*Partial PS (Dormant) Strand*	
Location	Deck	Bottom of Beam	Beam End: Top	Beam End: Bottom	*Location*	Top of Beam
Area (in^2)	0.62 *1	0	1.58	0	*Diameter(in)*	3/8 inch / 1/2 inch
Distance (in)	4 *2	0 *3			*Distance (in)*	1.5
Length (ft)			16	0	*# Strands*	4
Bar Size		5 *4	5 *4	0 *4	*Force per Strand (kip)*	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

- Carbon Steel - Low Lax
- Carbon Steel - Stress Relieved
- Stainless Steel
- Carbon Fiber Reinforced Polymer

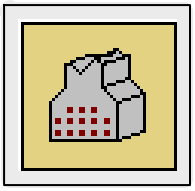
Help on Prestress Reinforcement Typ

Prestress Strand Size

- 0.6 in.
- 0.5 in.
- 0.5 in. Special
- 9/16 in.
- 0.7 in.

Help on Strand Generator | Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout



Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

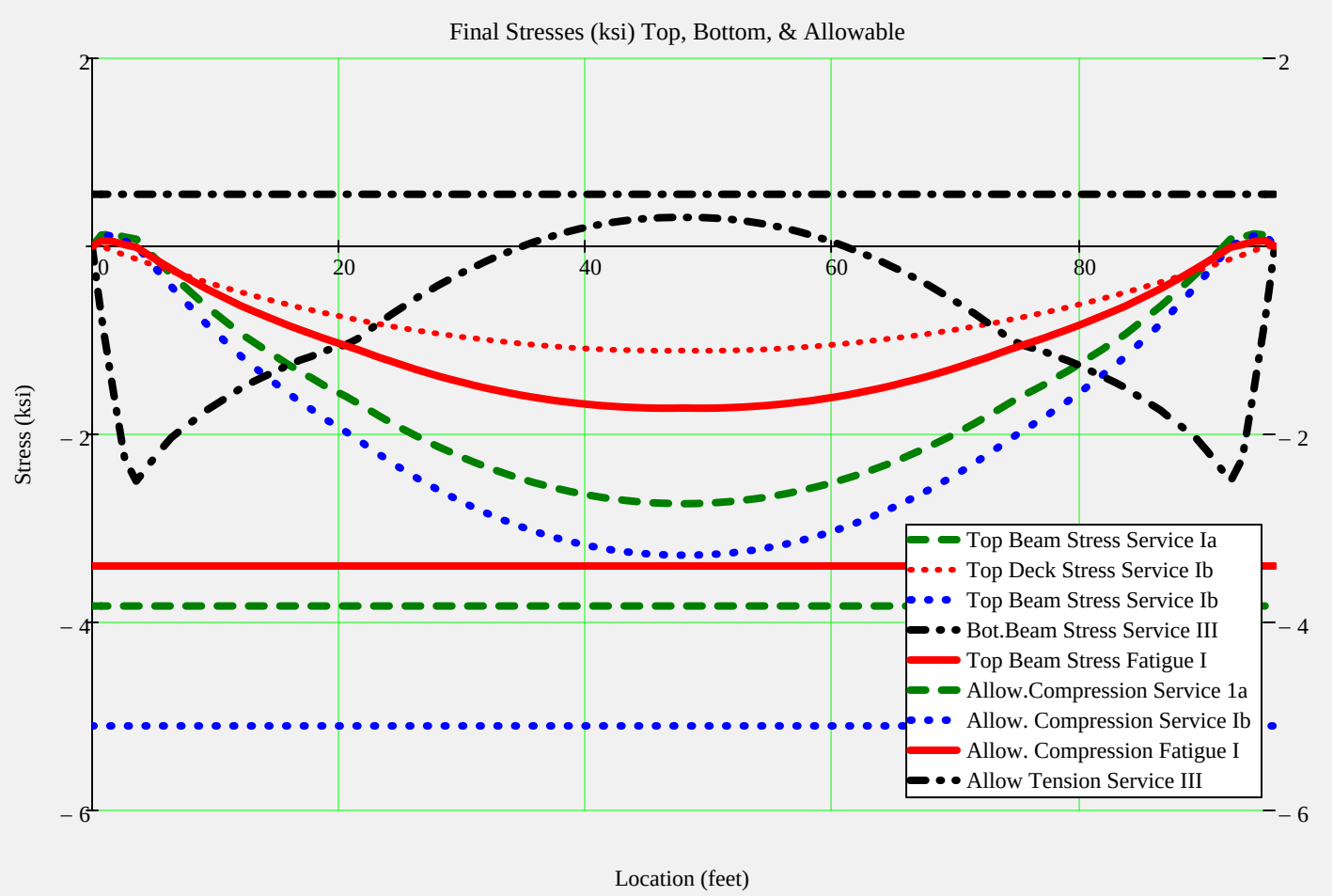
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses

Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.81$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.92$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.72$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.64$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.51$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.58	0.29	0.59
"Compression @ Release"	21.50	–3.51	–3.90
"Tension @ ServiceIII"	46.97	0.31	0.55
"CompressionIa @ ServiceI"	47.92	–2.74	–3.83
"CompressionIb @ ServiceI"	47.92	–3.28	–5.10
"Compression @ FatigueI"	49.80	–1.72	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

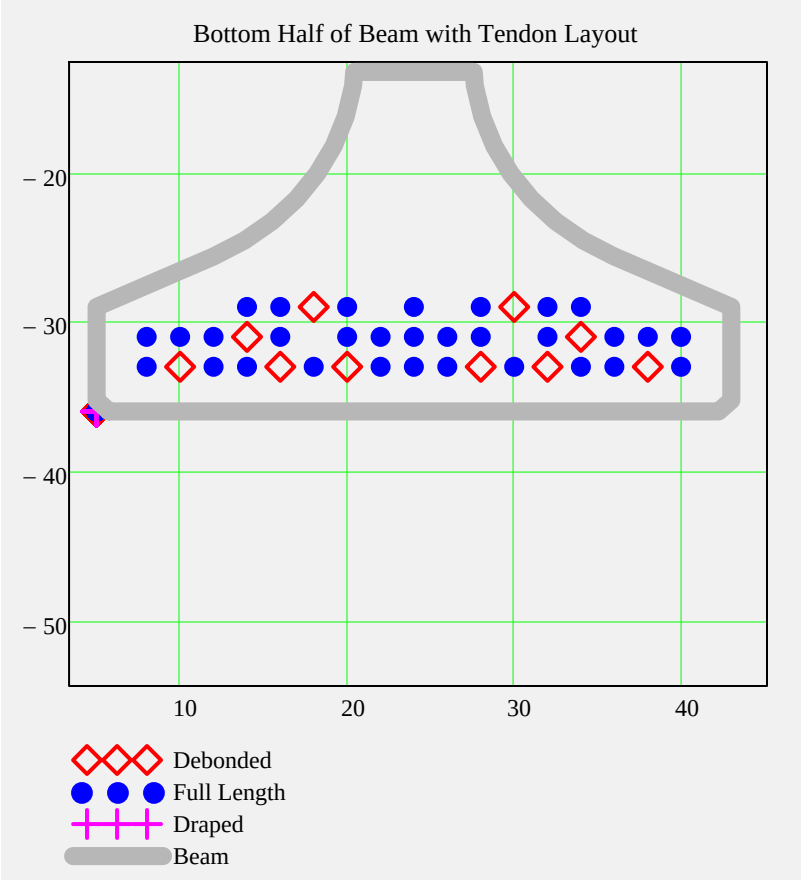
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

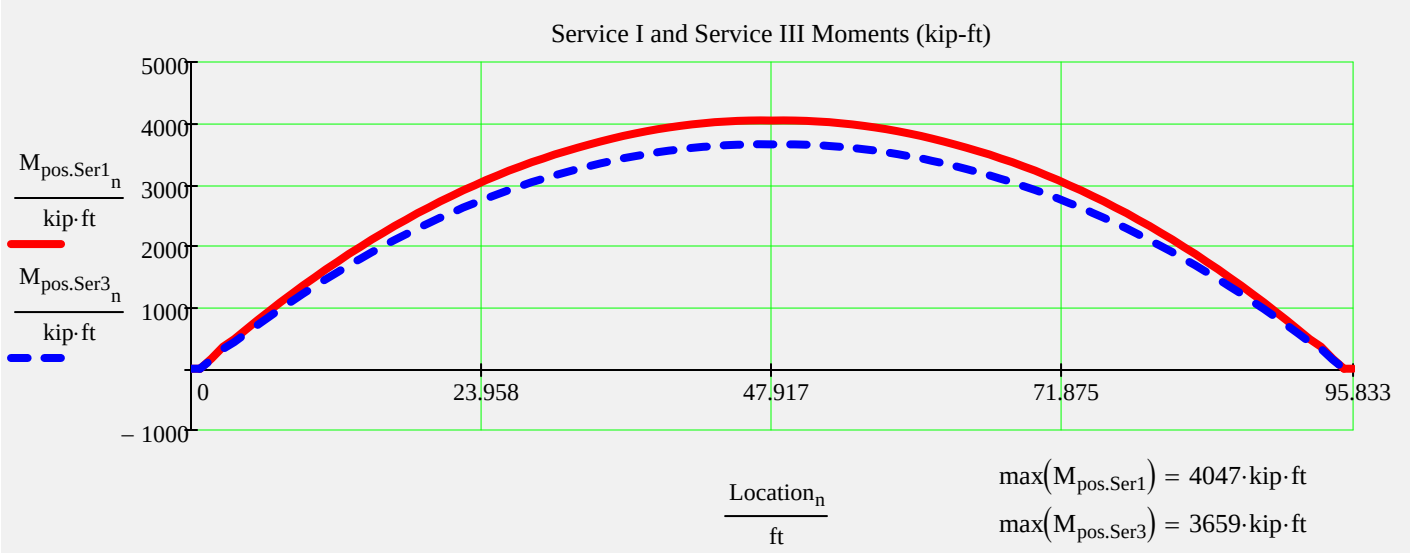
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 4047 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3659 \cdot kip \cdot ft$

Summary of Values at Midspan

$$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.96 & -3.09 \\ \text{"2"} & -1.06 & -2.53 \\ \text{"4"} & -1.01 & -2.57 \\ \text{"6"} & -2.67 & -1.25 \\ \text{"8"} & -3.28 & 0.31 \end{pmatrix}$$

$$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1842 & -1743 \\ \text{"@Final (about composite centroid)"} & -1608 & -1431 \end{pmatrix}$$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1531.7	376824	–8.9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	966
"Non-Composite DL (incl. beam wt.)"	1856
"Composite Dead Load"	251
"Distributed Live Load"	1938

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

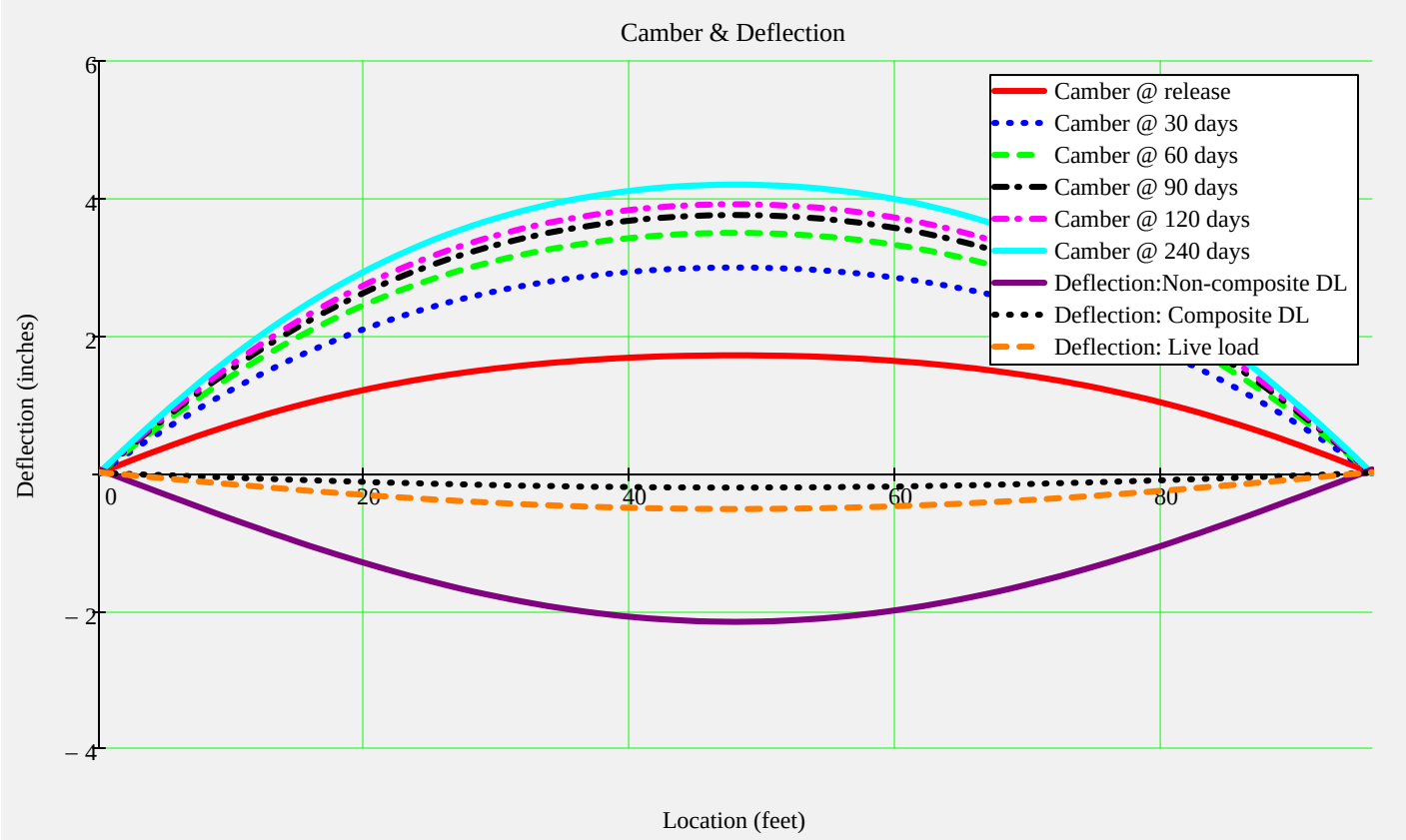
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 94.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.12	–0.80	0.37	1.72
"30 Days"	–0.36	–1.42	0.64	2.99
"60 Days"	–0.45	–1.66	0.75	3.50
"90 Days"	–0.49	–1.79	0.80	3.76
"120 Days"	–0.52	–1.86	0.83	3.92
"240 Days"	–0.57	–2.00	0.89	4.20
"Non-comp DL"	–0.25	0.20	–0.35	–2.16
"Comp DL"	–0.01	0.03	–0.03	–0.21
"LL"	–0.03	0.08	–0.09	–0.52

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.54 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

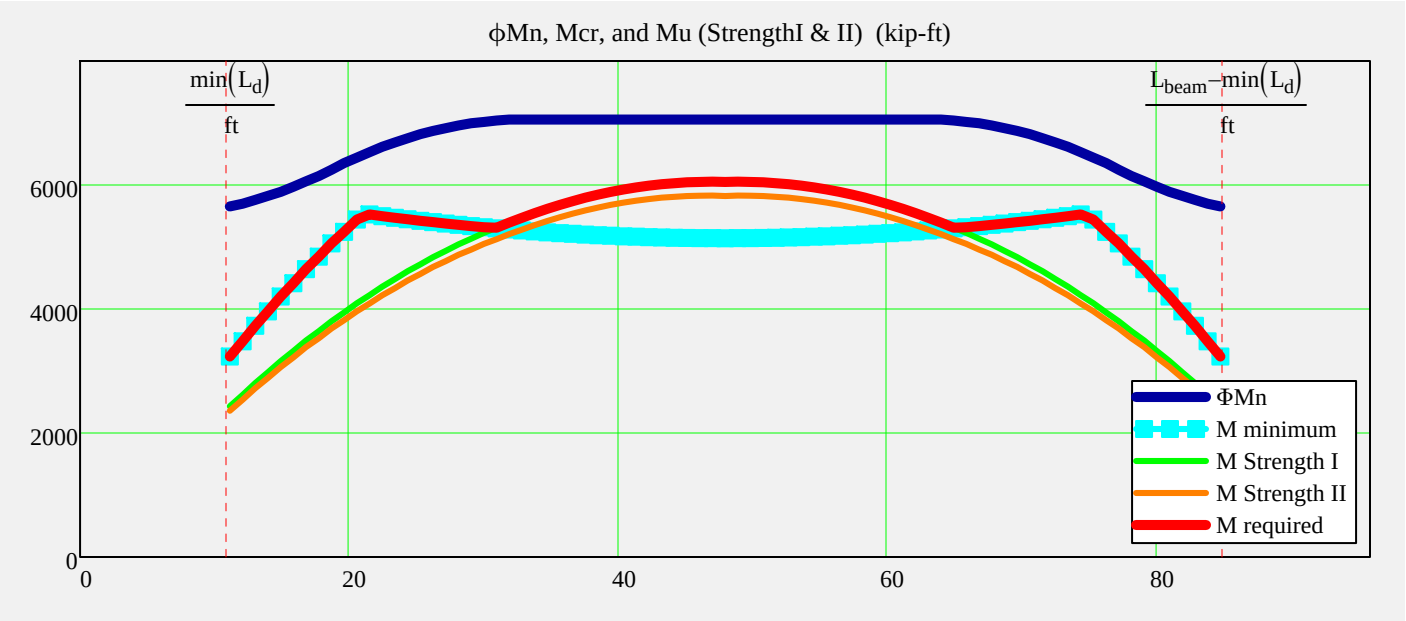
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 6054 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5142 \cdot kip \cdot ft$ $M_{reqd_{51}} = 6049 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7057 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 10.9\ \text{ft}$ $L_{beam} - \min(L_d) = 84.9\ \text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.86$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

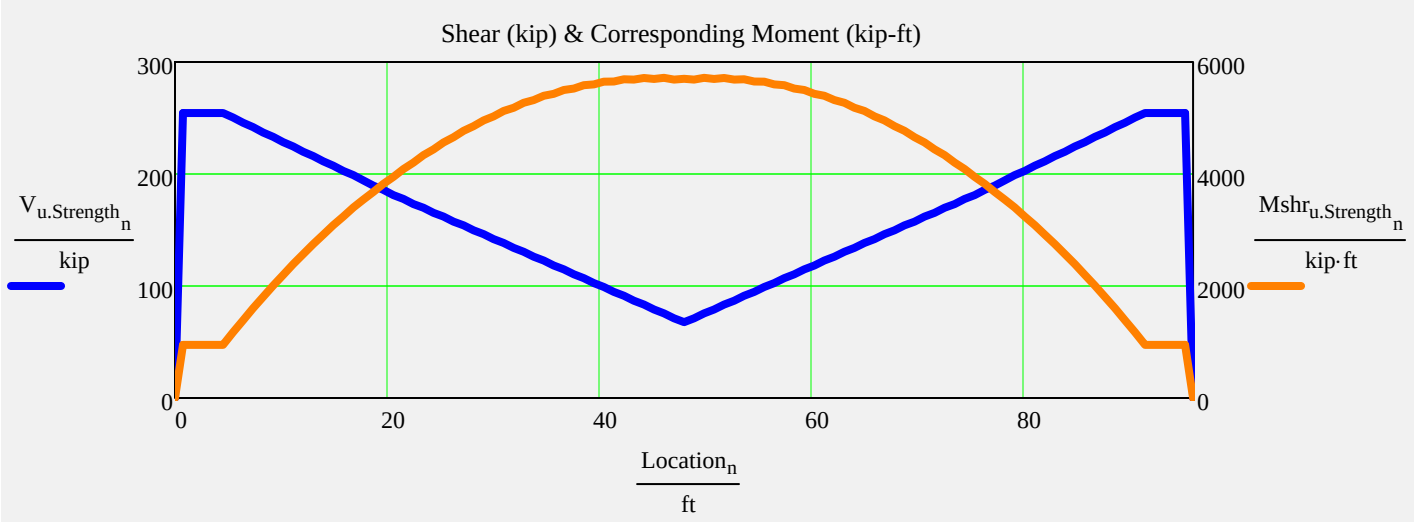
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

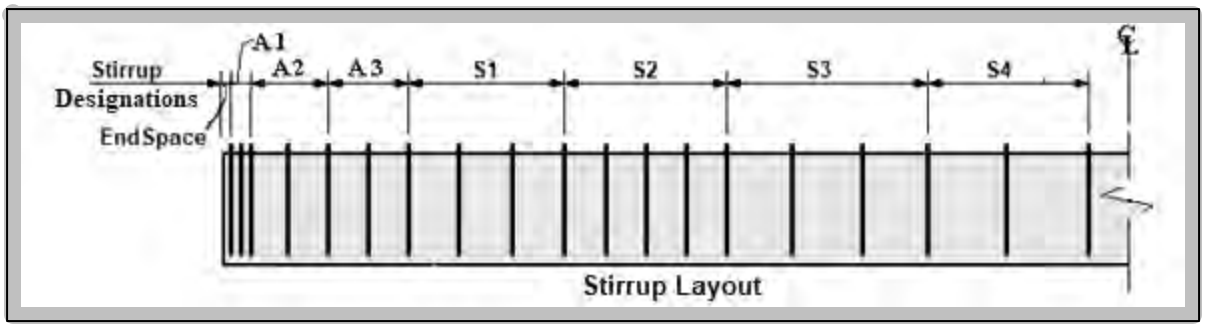
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 272 \\ 264 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 254.4 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5718 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space	3	in	*Distance from end of beam to the centerline of first stirrup or stirrup bundle.*
GFRP Stirrup Bar #	0	*used for GFRP Bars*	Help on Stirrup Design / Help on Stirrup Design Iteration / Table of FDOT Standard Prestressed Beam End Reinforcement / Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

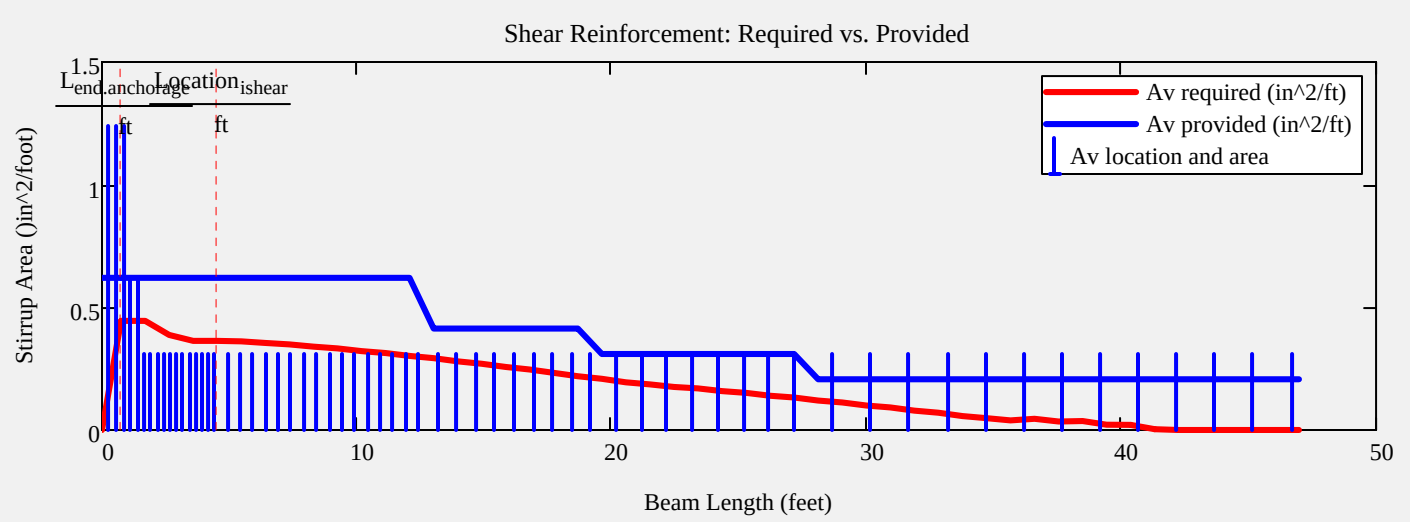
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



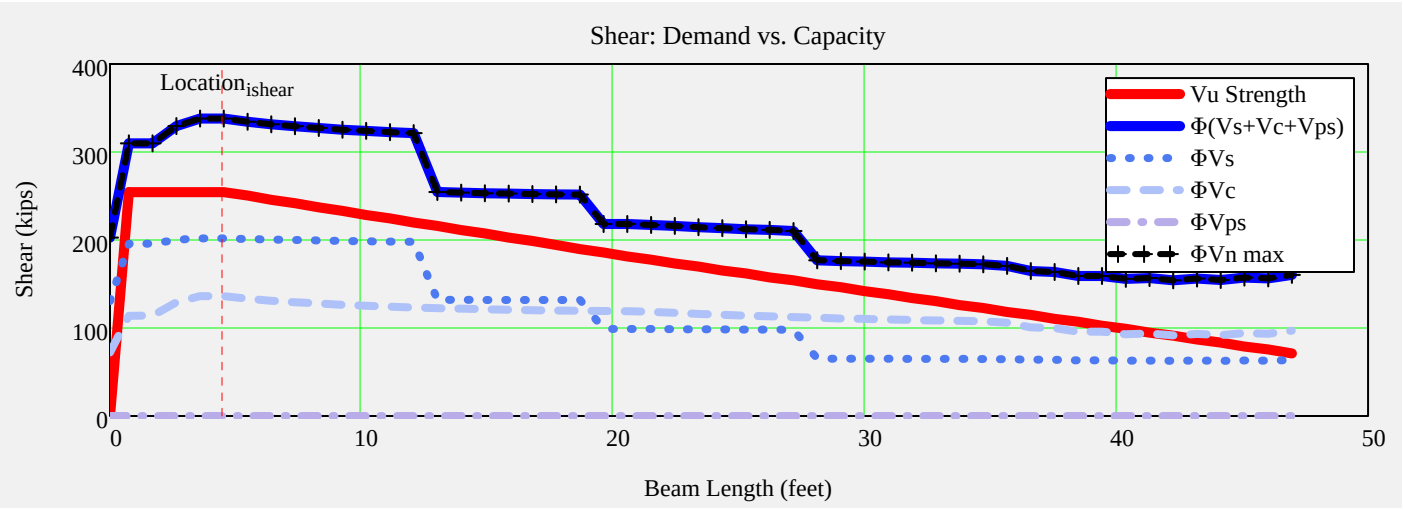
$Location_{ishear} = 4.52\ ft$

Save Data File ☑ Use current input file

File Name FIB36-96ftSpan_15Skew_Exterior.dat Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\EB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam"

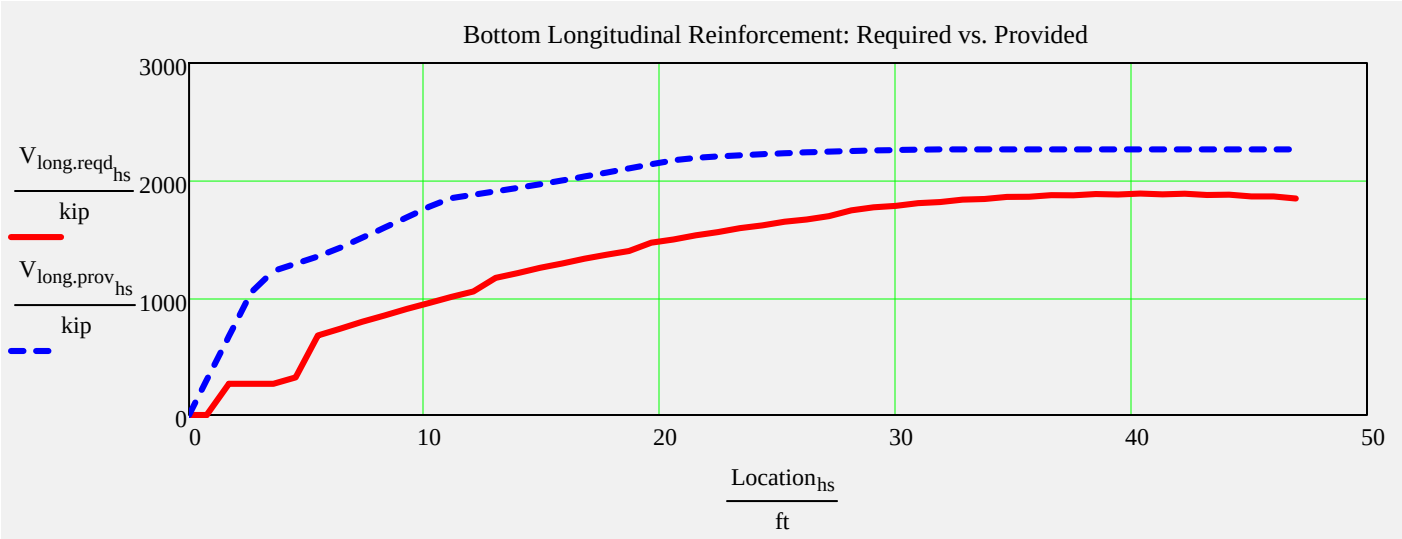
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 19.62 & 185.85 & 218.23 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.85$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

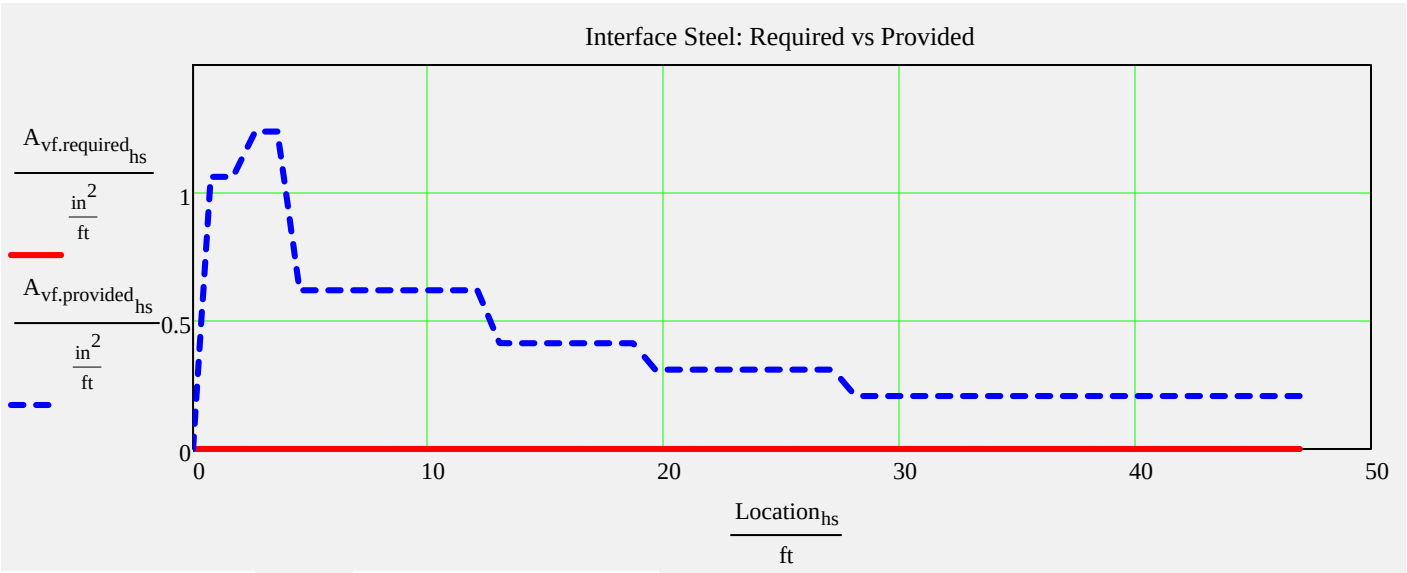


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 40.4 & 1887.6 & 2263.5 \end{pmatrix}$$

$\max\left(D/C_{LongReinf}\right) = 0.83$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.86 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

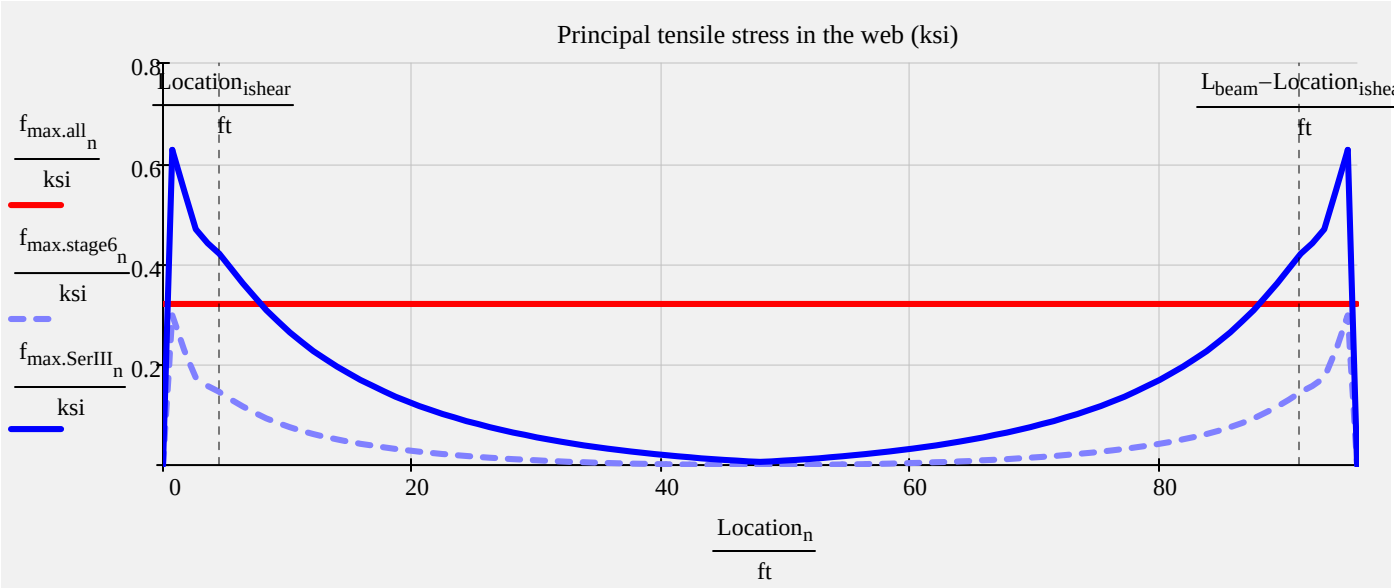
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max\left(A_{vf.min.required}\right) = 0.000 \cdot \frac{in^2}{ft}$ $\max\left(A_{vf.des}\right) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 54.3 \cdot in$ $\max(DC_f_{max.web}) = 1.31$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

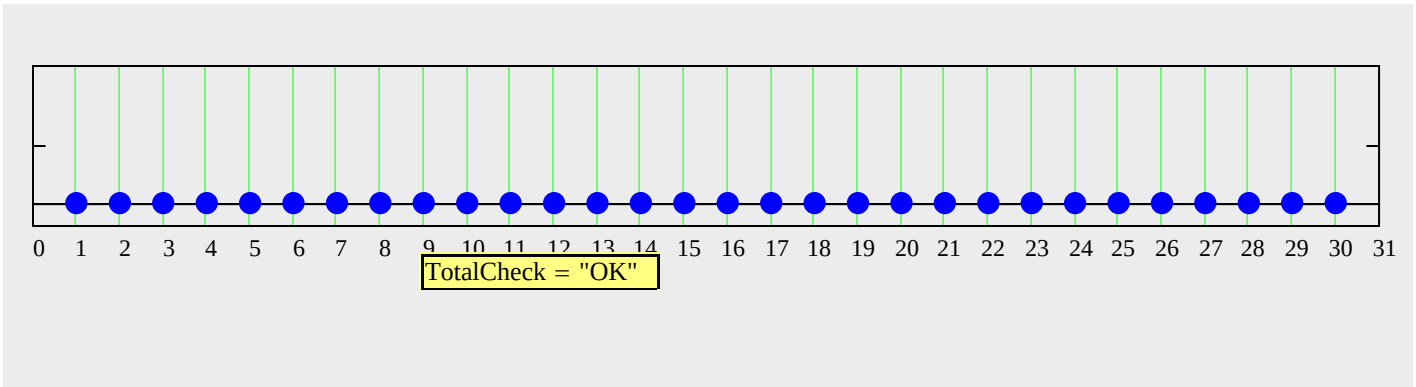
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating} =$

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.75	1.30	"N/A"	46.22	0.78	1.27	"N/A"	18.87	HL-93
"Strength I (Op)"	0.75	1.68	"N/A"	46.22	0.78	1.65	"N/A"	18.87	HL-93
"Service III (Inv)"	0.75	1.18	"N/A"	46.22	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.75	1.29	"N/A"	46.22	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.75	1.39	83.21	46.22	0.78	1.27	76.00	27.36	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)" *is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93} = 0.81$ $DC_{LongReinf.Permit} = 0.83$ $CheckLongReinf_{loadrating} =$ "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment} =$

"φC"	7057	"factored resistance (kip-ft)...."
"γDL"	2656	"factored dead load (kip-ft)...."
"γLL"	2621	"factored live load (kip-ft)....."
"RF"	1.68	"HL93 operating rating factor"

$HL93_{Operating.Shear} =$

"φC"	218.2	"factored resistance (kip)....."
"γDL"	67.6	"factored dead load (kip)....."
"γLL"	91.2	"factored live load (kip)....."
"RF"	1.65	"HL93 operating rating factor"

FLORIDA-I 36 BEAM
INTERIOR BEAM DESIGN

SPAN LENGTH = 96 FEET (15 DEG. SKEW)
EASTBOUND BRIDGE
(MOSSY GULLY & LONG POINT MARSH)

HNTB

FDOT LRFD Prestressed Beam Program v6.2

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Select Beam Data Folder

I-Beam
FSB
FUB
FlatSlab
InvertedT
DoubleT

Category and Beams

I-Beams: *Florida I-Beams (FIBs) and formerly used Florida Bulb Tee and AASHTO Beams*
Slab Beams: *Florida Slab Beams (FSBs)*
U-Beams: *Florida U-Beams (FUBs)*
Flat Slab *Previously used Florida Flat Slab Beams, superceded by FSBs*
Inverted Tee: *Former FDOT Standard Inverted Tee Beams*
Double Tee: *Former FDOT Standard Double Tee Beams from the 1990's*

Data Files Folder

V:\Structures\BDRs\Design\Beam Design\FIB's\EB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam

Change Folder

Open Existing Data File (required). To save New Data Files, enter new data name at the end of Section IX.

FIB36-96ftSpan_15Skew_Exterior.dat
FIB36-96ftSpan_15Skew_Interior.dat
FIB36-96ftSpan_NoSkew_Exterior.dat
FIB36-96ftSpan_NoSkew_Interior.dat

Refresh List

Open File

Reset All Data

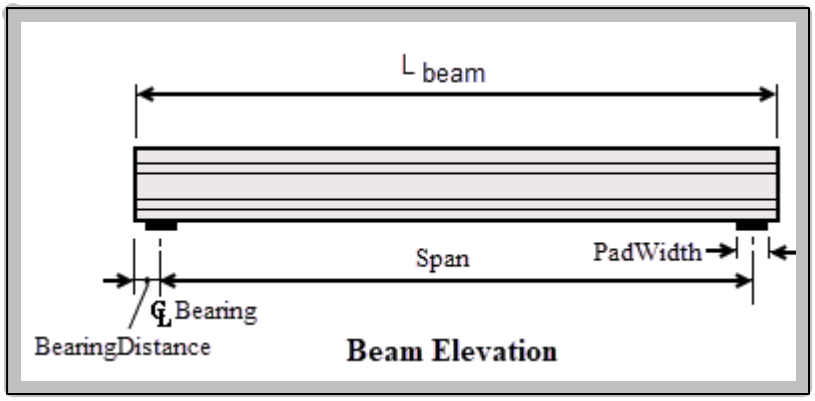
InputDataFile = "FIB36-96ftSpan_15Skew_Interior.dat"

Project Information

Project Information

Project Name	SR 70		
Project No.	75614		
Designed by	GGV	*Date*	03 / 05 / 2025
Checked by	TBD	*Date*	03 / 25 / 2025
Structure Name	SR 70		
Structure No.	EB Bridge		

Plan, Elevation, and Cross Section Data



Note: All dimensions shown in Beam Elevation measured along centerline of beam (requiring adjustment for a skew)

Note: The top of the precast beam is the location of the origin for the coordinate system.

Superstructure Data

InputDataFile = "FIB36-96ftSpan_15Skew_Interior.dat"

Beam Type	FIB36 (FIB36, FIB45, FIB54, FIB63, FIB72, FIB78, FIB84, FIB96, TypeII)		*Beam Types are the designations found in FDOT standards. The user can also create a coordinate file for a custom shape. Top of the beam is at the y=0 ordinate.*
L_{beam}	95.8333	ft	*See Beam Elevation above.*
Bearing Distance	9	in	*See Beam Elevation above.*
Pad Width	10	in	*Width of the bearing pad, see Beam Elevation above.*
Beam Spacing	7.1667	ft	*Measured from beam centerline to centerline.*
Overhang	3.625	ft	*Measured from centerline of exterior beam.*
Deck Thickness	8	in	*Not including sacrificial thickness.*
$t_{sacrificial}$	0	in	*Sacrificial thickness cast with the deck (used for DL only, not section properties).* *(0" for* BridgeLengths ≤ 100 ft, *SDG 4.2.2)*
d_e	2.2916	ft	*Front face of barrier to centerline of exterior beam (3 ft max).* *(LRFD 4.6.2.2.1)*
Beam Position	Interior (Interior, Exterior)		*Use either* "interior" *or* "exterior".
$Weight_{future.ws}$	0.015	kip/ft^2	*Future wearing surface.* *(* 0.015ksf *for* BridgeLengths ≤ 100 ft, *SDG Table 2.1)*
$Weight_{barrier}$	0.43	kip/ft	*Weight of single barrier.* *(0.43 klf for 36" single slope barrier , SDG Table 2-2.1)*
Number of Barriers	2		*Number of barriers in x-section (multiplies single barrier weight).*
Number of Beams	8		*Number of beams in the span cross section.* *(LRFD 4.6.2.2.1)*
Skew	15	deg	*measured from the perpendicular to the longitudinal axis in bridge plan view.*

BMPfile := concat(substr(inpBeamType, 0, strlen(inpBeamType)), ".bmp")

BMPfile = "FIB36.bmp"

Dimensions Specific to Certain Beam Categories

I-Beams, U-Beams and Inverted-T Beams

$h_{buildup}$	1.5	in	*Buildup or haunch is the concrete between the bottom of deck and top of beam.*

Slab-Beams (Florida Slab Beams. Flat Slab Beams)

Slab Beam Width		in	*Width of the slab unit (not including Gap width)*
Slab Beam$_{Thickness}$		in	*Thickness of the slab unit.*
$t_{deck.delta}$		in	*maximum additional deck thickness over support to accommodate camber, used for additional DL only.*
Gap		in	*Gap distance between slab beams.(Beam Spacing - Slab Beam Width)*

Double Tee Beams

Width Double-T		ft	*Width of the Double-T unit.*
Depth$_{flange}$		in	*Depth of the flange of the Double-T unit, See Beam Cross Section above.*

Concrete Material Properties

FDOT Environmental Classification	Slightly / **Moderately** / Extremely		*Environmental Classification determines the Allawable Tension Stress*
f `c of deck or WS	5.5	ksi	*Strength of deck or wearing surface concrete.*
f `c of beam or slab	8.5	ksi	*28 day concrete strength of beam or slab.*
f `ci of beam or slab	6	ksi	*Release concrete strength of beam or slab.*

Help - Conc. Strength

Permit Truck Axle Loads and Spacings

Default value for the permit truck is the FL-120 truck

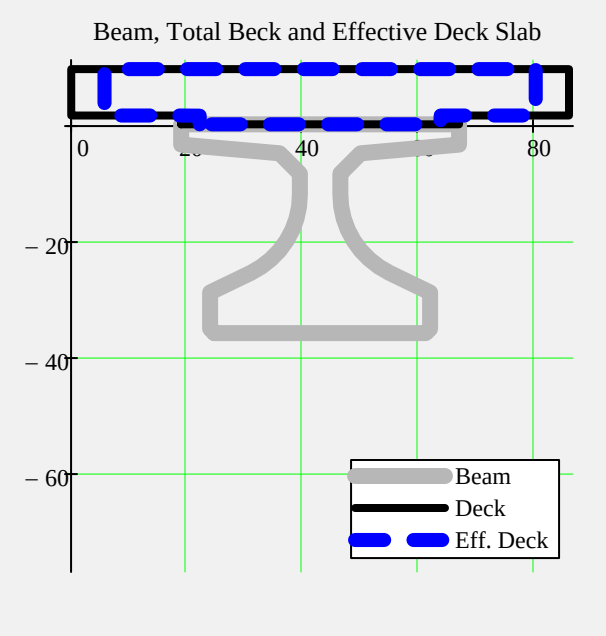
Reset Permit Truck Data

Number of Permit Axles	3		*Number of wheel loads that comprise the permit truck*
Permit Uniform LL	0	kip/ft	*Permit Uniform Live Load coincident with truck load*

Help - Permit Truck

	Axle Number										
	1	2	3	4	5	6	7	8	9	10	11
Load (kips)	13.33	53.33	53.33	0	0	0	0	0	0	0	0
Spacing (ft)	n/a	14	14	0	0	0	0	0	0	0	0

Section View: Beam, Deck and Effective Deck Slab



BeamType = "FIB36"

$t_{deck} = 8 \cdot in$

$h_{buildup} = 1.5 \cdot in$

$h_{beam} = 36 \cdot in$

BeamSpacing = 86·in

$b_e = 86 \cdot in$ *effective slab width*

Additional Dead Load Data:

Uniform Dead Loads

Additional Uniform Noncomposite DL	0	kip/ft
Additional Uniform Composite DL	0.03	kip/ft

$w_{deck} = 0.79 \cdot \frac{kip}{ft}$ $w_{beam} = 0.84 \cdot \frac{kip}{ft}$ $w_{forms} = 0.06 \cdot \frac{kip}{ft}$

$w_{future.ws} = 0.108 \cdot \frac{kip}{ft}$ $w_{barrier} = 0.11 \cdot \frac{kip}{ft}$

Diaphragms (Point) Dead Loads

$L_{beam} = 95.83\ ft$

End Diaphragms or Point Loads over bearing included in bearing reaction calculation only.
Intermediate Diaphragms or Point Loads included in shear, moment, and bearing reaction calculations

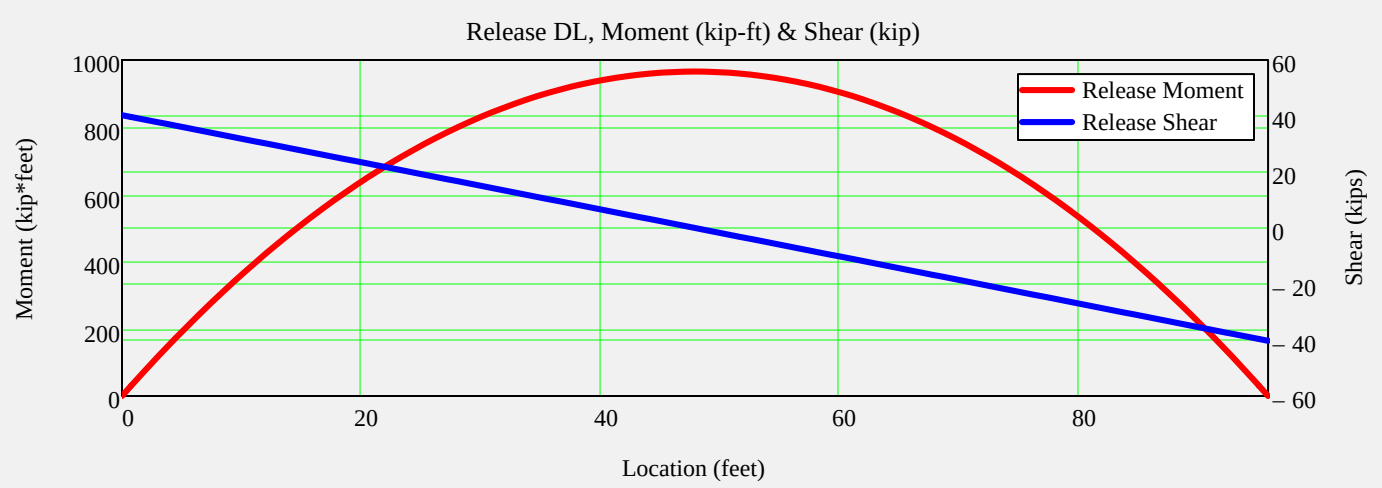
Diaphragm (Point) Dead Loads and Location

	Begin	Int. 1	Int. 2	Int. 3	End
Load (kips)	0	0	0	0	0
Distance (ft)	0	0	0	0	0

Distance measured from CL Bearing at begin bridge

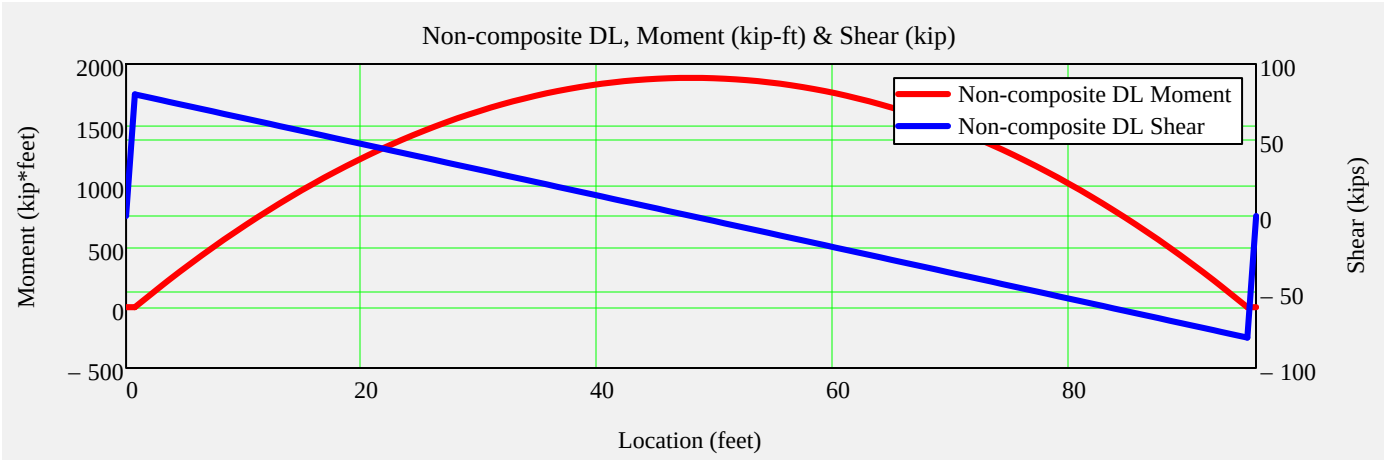
Release Dead Load Moments and Shears

$L_{span} = 94.33\ ft$



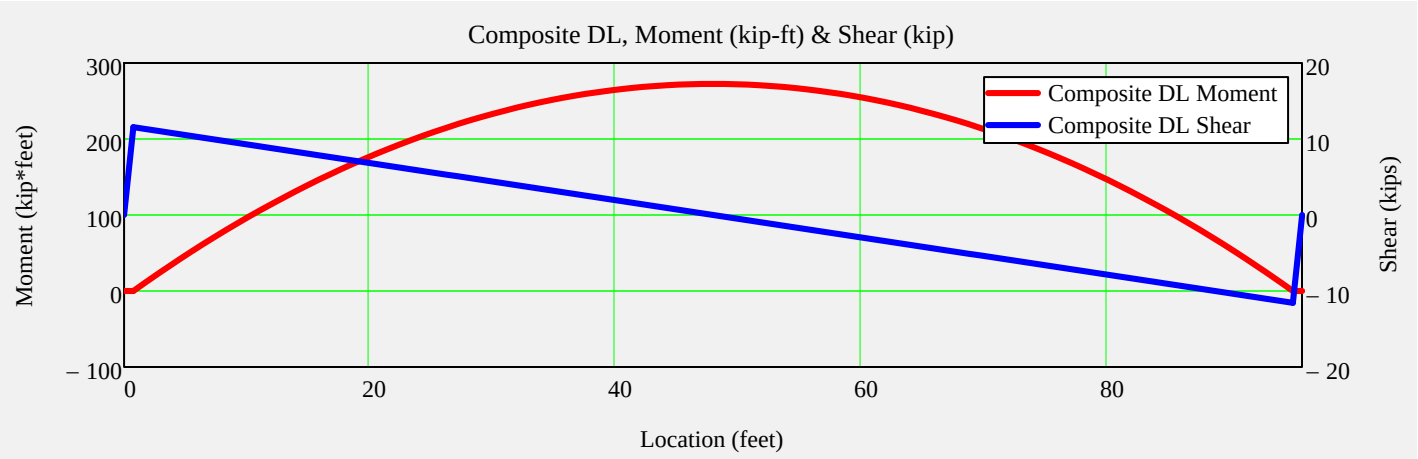
$\max(V_{release}) = 40.3 \cdot kip$ $\max(M_{release}) = 965.5 \cdot kip \cdot ft$ $\min(V_{release}) = -40.3 \cdot kip$

Noncomposite Dead Load Moments and Shears



$\max(V_{dl.non.comp}) = 80.0 \cdot kip$ $\max(M_{dl.non.comp}) = 1886.1 \cdot kip \cdot ft$ $\min(V_{dl.non.comp}) = -80.0 \cdot kip$

Composite Dead Load Moments and Shear



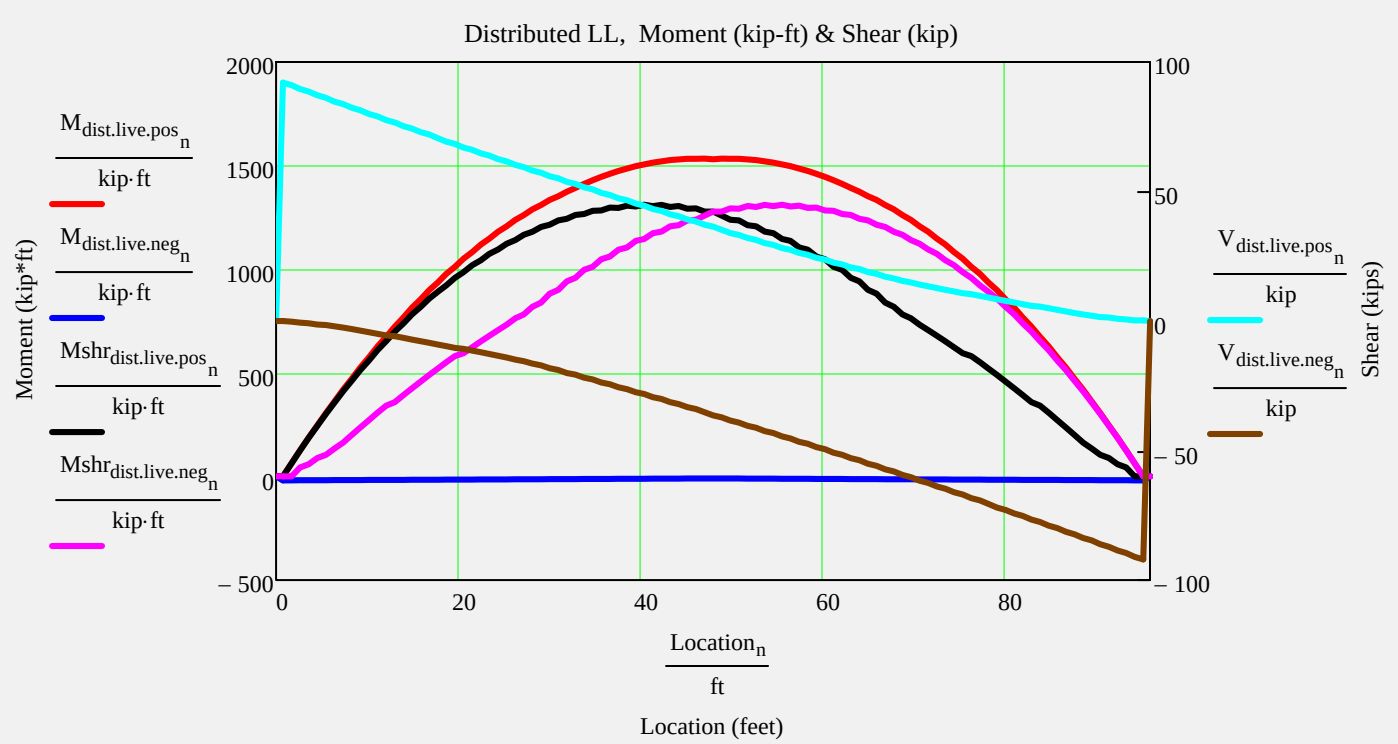
$\max(V_{dl.comp}) = 11.6 \cdot kip$ $\max(M_{dl.comp}) = 272.5 \cdot kip \cdot ft$ $\min(V_{dl.comp}) = -11.6 \cdot kip$

Distributed Live Load Moments and Shears

$L_{span} = 94.33\ ft$ BeamSpacing $= 7.17\ ft$ Skew $= 15 \cdot deg$

Live Load Shear Distribution Correction Factor for Skewed Bridges: CorrectionFactor $= 1.05$

Final Live Load Distribution Factors: $g_{mom} = 0.59$ $g_{mom.fatigue} = 0.35$ $g_{shear} = 0.79$



$\max(V_{dist.live.pos}) = 92.0 \cdot kip$

$\max(M_{dist.live.pos}) = 1533.4 \cdot kip \cdot ft$

$\min(V_{dist.live.neg}) = -92.0 \cdot kip$

$Reaction_{LL} = 93.4 \cdot kip$

$\min(M_{dist.live.neg}) = -18.9 \cdot kip \cdot ft$

$Reaction_{DL} = 93.0 \cdot kip$

$\max(Mshr_{dist.live.pos}) = 1311 \cdot kip \cdot ft$

Beam End Reactions... with IM factor only

Beam End Reactions... without IM factor for use in estimating Pile numbers and lenghts required.

$Reaction_{truck} = 65.4 \cdot kip$ $Reaction_{lane} = 30.7 \cdot kip$

$Reaction_{LL.without.IM} := (Reaction_{truck} + Reaction_{lane}) \cdot g_{shear}$

$Reaction_{LL.without.IM} = 76.3 \cdot kip$

Reinforcement Properties

InputDataFile = "FIB36-96ftSpan_15Skew_Interior.dat"

Mild Reinforcement Type:

Carbon Steel - Grade 60
Stainless Steel - Grade 60
Glass Fiber Reinforced Polymer
Carbon Steel - Grade 80
Stainless Steel - Grade 75

Help on Mild Reinforcement Types

Longitudinal Mild and Partial PS Reinforcement:

Excel Table of Standard FDOT Prestressed Beam Mild and Partial PS Longitudinal Reinforcement

Help on Longitudinal Mild and Partial PS Reinf

Mild Reinforcement

Location	Deck		Bottom of Beam		Beam End: Top	Beam End: Bottom
Area (in^2)	0.62	*1	0		1.58	0
Distance (in)	4	*2	0	*3		
Length (ft)					16	0
Bar Size			5	*4	5 *4	0 *4

Partial PS (Dormant) Strand

Location	Top of Beam
Diameter(in)	3/8 inch 1/2 inch
Distance (in)	1.5
# Strands	4
Force per Strand (kip)	10

**1 - Area of longitudinal deck reinf. per unit width of deck, both layers combined. Typically one #5 Bar top & bottom for 8" decks.*
**2 - Distance measured from top of deck to centroid of deck longitudinal reinforcement, positive value.*
**3 - Distance measured from top of beam, positive value.*
**4 - Size of bars used to create* $A_{s.long}$ *needed to calculate development length.*

Prestressing Tendons:

Humidity 75 % *% relative humidity (75% typical)*

Time: jacking to transfer 1.5 days *Time in days between jacking and transfer.*

Prestress Strand Type

Carbon Steel - Low Lax
Carbon Steel - Stress Relieved
Stainless Steel
Carbon Fiber Reinforced Polymer

Help on Prestress Reinforcement Typ

Prestress Strand Size

0.6 in.
0.5 in.
0.5 in. Special
9/16 in.
0.7 in.

Help on Strand Generator Help on Strand Debonding

Strand Pattern Generator for Entering Prestressing Strand Layout

Double click the icon to open the 'Strand Pattern Generator'. Specify the location and debonding of strands. When finished, press the 'Continue' button. Then press 'Read Strand Data' button below.

Press 'Read Strand Data' Button.to Read in Strand Generator Data

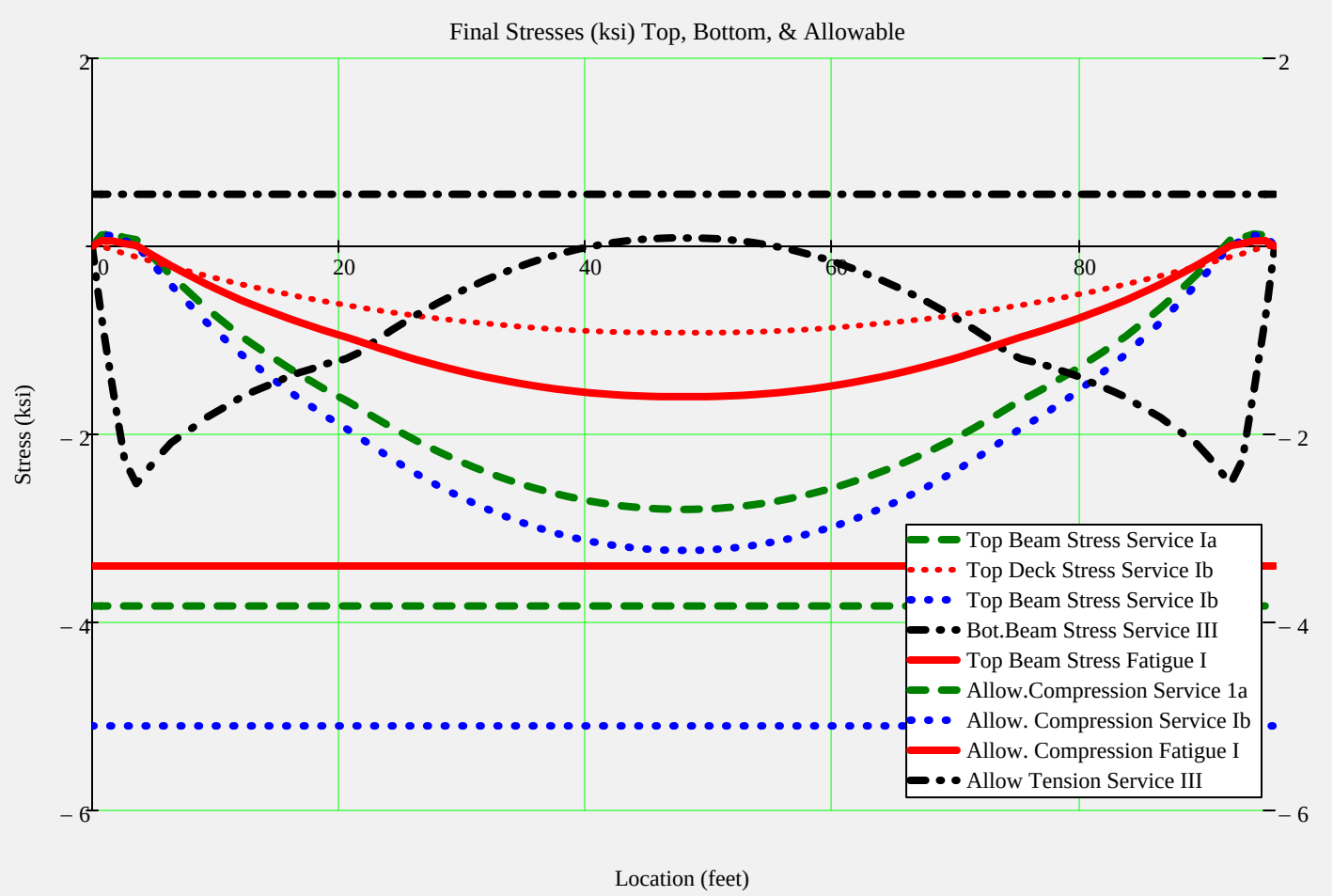
Read Strand Data

Press 'Read Strand Data' button to Read in Strand Generator Data.

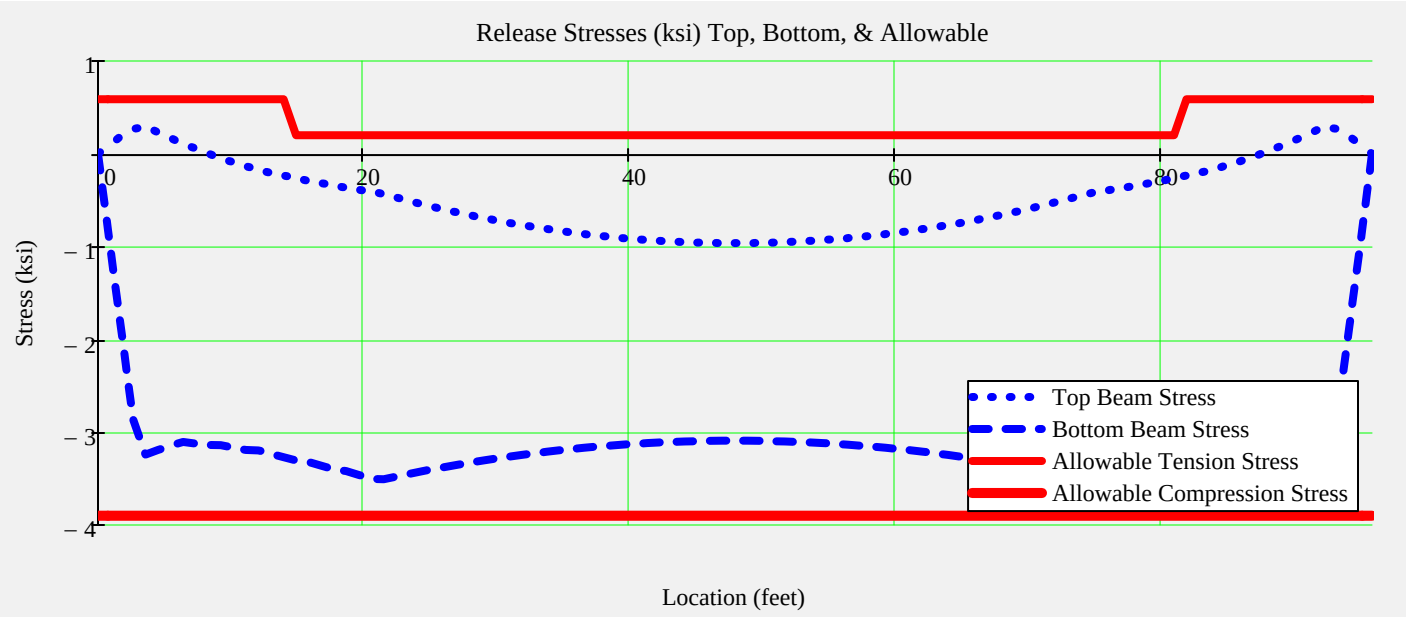
Service I and III Stresses and Limits and Tendon Layout Summary

tension (+), compression (--)

Final Stresses



Release Stresses



Stress Checks at Service Limit States

Release tension	$Check_f_{tension.rel}$ = "OK"	$\max(DC_f_{tension.rel}) = 0.81$
Release compression	$Check_f_{comp.rel}$ = "OK"	$\max(DC_f_{comp.rel}) = 0.90$
*Service III , PS+DL+0.8*LL*	$Check_f_{tension.ServiceIII}$ = "OK"	$\max(DC_f_{tension.ServiceIII}) = 0.85$
Service Ia , PS+DL	$Check_f_{comp.ServiceIa}$ = "OK"	$\max(DC_f_{comp.ServiceIa}) = 0.73$
Service Ib , PS+DL+LL	$Check_f_{comp.ServiceIb}$ = "OK"	$\max(DC_f_{comp.ServiceIb}) = 0.63$
*Fatigue I , (PS + DL)*0.5 +1.5 Fatigue Truck*	$Check_f_{comp.FatigueI}$ = "OK"	$\max(DC_f_{comp.FatigueI}) = 0.47$

StressChecks =

"StressCheck"	"Location(ft)"	"Stress(ksi)"	"AllowableStress(ksi)"
"Tension @ Release"	3.58	0.29	0.59
"Compression @ Release"	21.50	–3.51	–3.90
"Tension @ ServiceIII"	46.97	0.09	0.55
"CompressionIa @ ServiceI"	47.92	–2.80	–3.83
"CompressionIb @ ServiceI"	47.92	–3.23	–5.10
"Compression @ FatigueI"	48.86	–1.60	–3.40

CheckBeamEndTopLongReinf = "OK"

Strand Pattern Checks

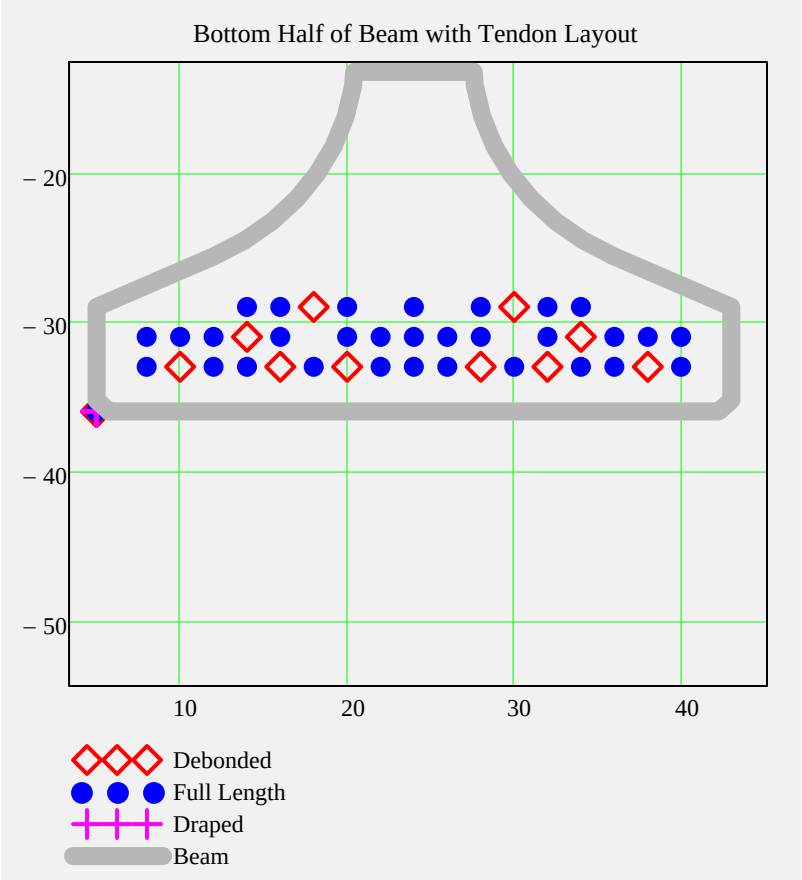
1. *The number of strands debonded per row shall not exceed 45 percent of the strands provided in that row.*
2. *Debonding shall not be terminated for more than six strands in any given section. When a total of ten or fewer strands are debonded, debonding shall not be terminated for more than four strands in any given section*
3. *Longitudinal spacing of debonding termination locations shall be at least 60db apart.*
4. *Alternate bonded and debonded strand locations both horizontally and vertically.*
5. *For simple span precast, pretensioned girders, debonding length from the beam end should be limited to 20 percent of the span length or one half the span length minus the development length, whichever is less.*

$$\text{CheckPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

For single-web flanged sections (I-beams, bulbtees, and inverted-tees):
1. Bond all strands within the horizontal limits of the web
2. Bond the outer-most strands in all rows located within the full-width section of the flange.
3. Position debonded strands furthest from the vertical centerline.
For multi-web sections having bottom flanges (voided slab, box beams and U-beams):
1. Strands shall be bonded within 1.0 times the web width projection.
2. Bond the outer-most strands within the section.
3. Uniformly distribute debonded strands between webs.

$\text{BeamType} = \text{"FIB36"}$ $\quad\quad$ $\text{CheckWebPattern} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Tendon Layout



$\text{BeamType} = \text{"FIB36"}$

$h_{beam} = 36 \cdot \text{in}$

$A_{strand} = 0.217 \cdot \text{in}^2$

#Strands = 41

Prestress Losses Summary

$f_{pj} = 202.5 \cdot \text{ksi}$ $\quad\quad$ $\text{Check_}f_{pt} = \text{"OK"}$

$\Delta f_{pES} = 0 \cdot ksi$

Note: Elastic shortening losses are zero in concrete stress calculations when using transformed section properties per *LRFD 5.9.3.2.3*

$\Delta f_{pT} = -26 \cdot ksi$

$\frac{\Delta f_{pT}}{f_{pj}} = -12.68 \cdot \%$

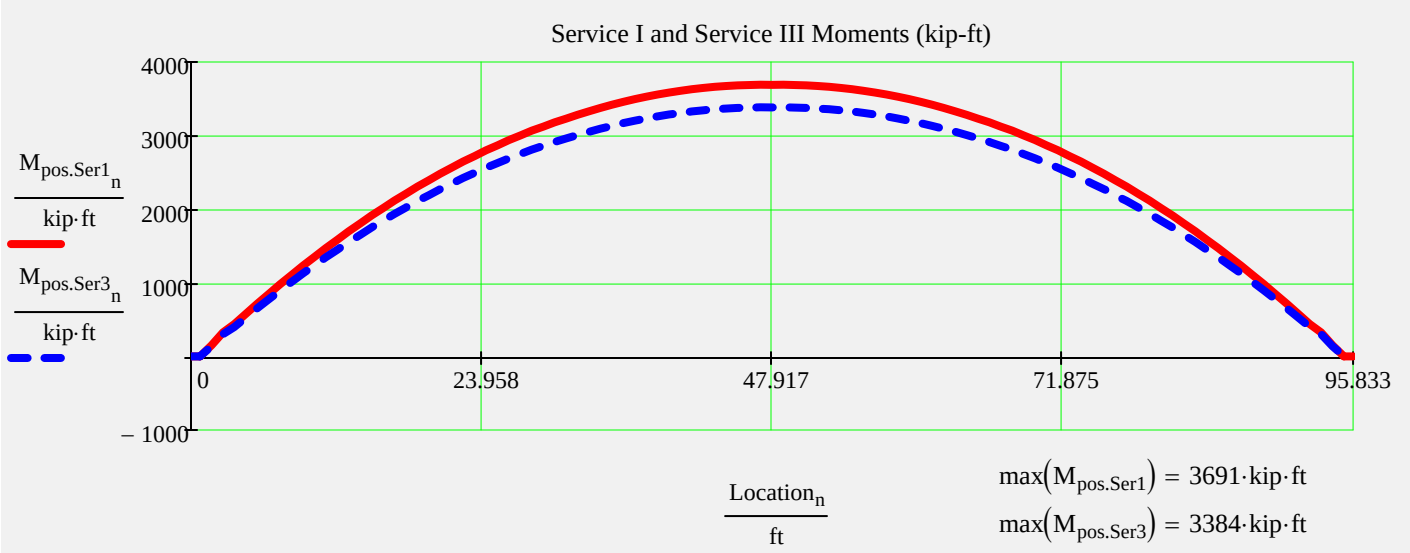
$f_{pe} = 177 \cdot ksi$

$\frac{f_{pe}}{f_{pj}} = 87.32 \cdot \%$

$0.8 \cdot f_{py} = 194 \cdot ksi$

$Check_f_{pe} = \text{"OK"}$

Moments at Service Limit States



$\max(M_{pos.Ser1}) = 3691 \cdot kip \cdot ft$

$\max(M_{pos.Ser3}) = 3384 \cdot kip \cdot ft$

Summary of Values at Midspan

$Stresses = \begin{pmatrix} \text{"Stage"} & \text{"Top of Beam (ksi)"} & \text{"Bottom of Beam (ksi)"} \\ \text{"1"} & -0.96 & -3.09 \\ \text{"2"} & -1.06 & -2.53 \\ \text{"4"} & -1.01 & -2.57 \\ \text{"6"} & -2.72 & -1.21 \\ \text{"8"} & -3.23 & 0.09 \end{pmatrix}$

$PrestressForce = \begin{pmatrix} \text{"Time"} & \text{"Axial (kip)"} & \text{"Moment (kip*ft)"} \\ \text{"@Release"} & -1842 & -1743 \\ \text{"@Final (about composite centroid)"} & -1608 & -1431 \end{pmatrix}$

Properties =

"Section"	"Area (in^2)"	"Inertia (in^4)"	"Top of Beam to Centroid (in)"
"Net Beam"	798.3	126204	–19.4
"Transformed Beam (initial)"	855.2	134266	–20.1
"Transformed Beam (final)"	849	133435	–20.1
"Composite Section"	1528.1	376065	–8.9

ServiceMoments =

"Load Type "	"Moment (kip*ft)"
"Release Dead Load"	966
"Non-Composite DL (incl. beam wt.)"	1886
"Composite Dead Load"	272
"Distributed Live Load"	1531

Stage 1 ---> At release with span length equal to length of the beam. Prestress losses are elastic shortening and overnight relax

Stage 2 ---> At final, starting with Stage 1 and adding the remaining prestress losses applied to the transformed beam

Stage 4 ---> Starting with Stage 2 and changing the support locations from the end of the beam to the bearing locations

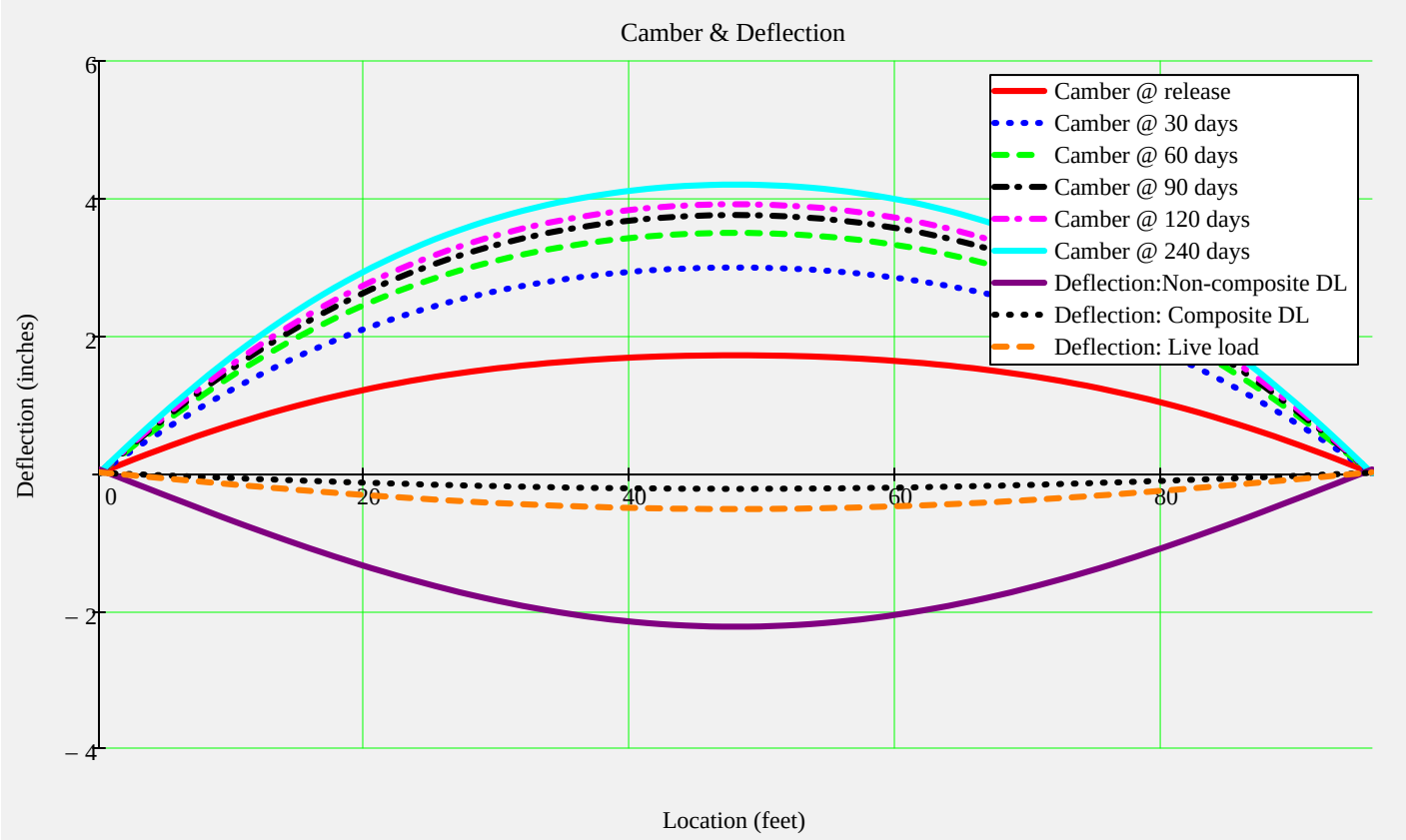
Stage 6 ---> Starting with Stage 4 and adding non-composite dead load (excluding beam wt included in Stage 1)

Stage 8 ---> Starting with Stage 6 and adding composite dead load and distributed live loads applied to the composite section

Camber at Release, Short Term Camber, & Summary of Slope Data

Camber at Different Stages and Deflection due to Dead Load and Live Load

L_{span} = 94.33 ft



Slope&Defl =

"Stage"	"ΔL @ Beam Top (in)"	"ΔL @ Beam Bot. (in)"	"Slope at End (deg)"	"Midspan Defl (in)"
"Release"	–0.12	–0.80	0.37	1.72
"30 Days"	–0.36	–1.42	0.64	2.99
"60 Days"	–0.45	–1.66	0.75	3.50
"90 Days"	–0.49	–1.79	0.80	3.76
"120 Days"	–0.52	–1.86	0.83	3.92
"240 Days"	–0.57	–2.00	0.89	4.20
"Non-comp DL"	–0.25	0.20	–0.36	–2.23
"Comp DL"	–0.01	0.03	–0.04	–0.23
"LL"	–0.03	0.08	–0.09	–0.52

Check net camber at end of construction (120 day) *SDG 4.3.2.D & 4.4.3.A*

$NetCamber := \max(Defl_{120day}) + \min(Defl_{dl.nc}) + \min(Defl_{dl.c}) = 1.45 \cdot in$

$CheckNetCamber := if(NetCamber > 0, "OK", "No Good")$ $CheckNetCamber = "OK"$

Moment Resistance

Moments and Moment Resistance at StrengthI and StrengthII Limit State

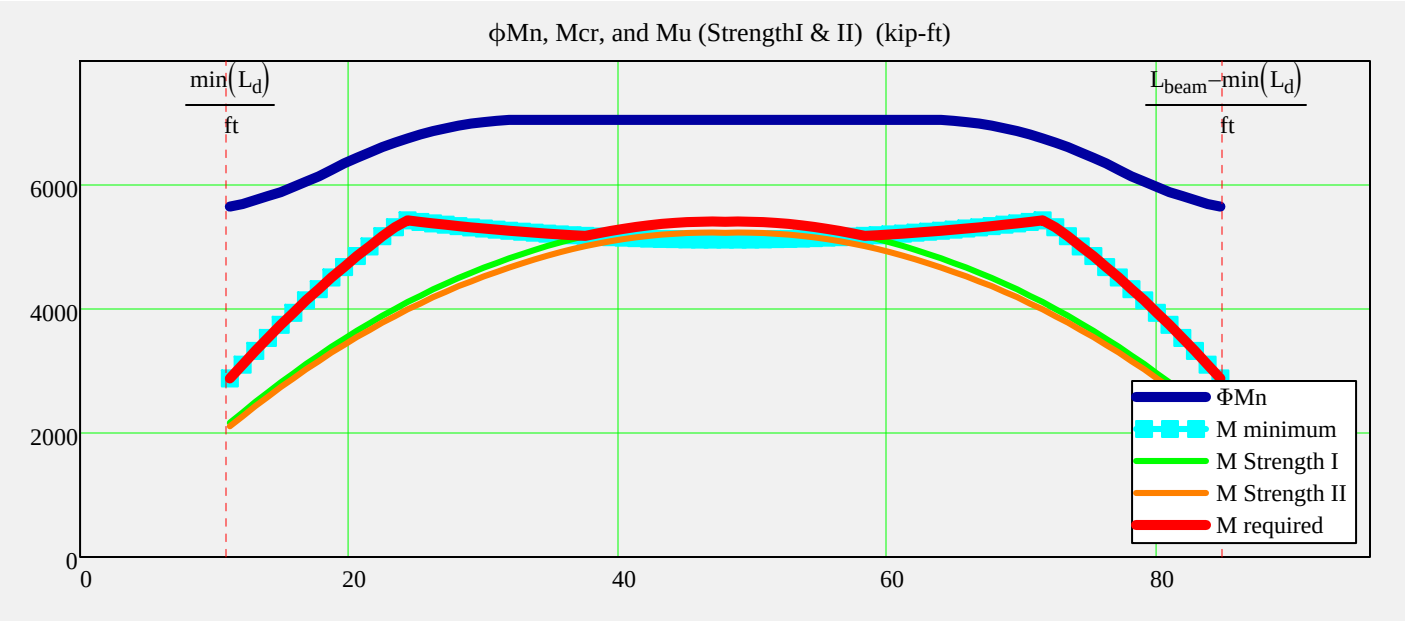
Values at midspan

$LimitStateForMoment_{51} = "Strength\ I"$ $\max(M_{Strength}) = 5410 \cdot kip \cdot ft$

$IsSectionNonCompControlled?_{51} = "Yes"$ $M_{minimum_{51}} = 5119 \cdot kip \cdot ft$ $M_{reqd_{51}} = 5407 \cdot kip \cdot ft$

$StrandType = "Carbon\ Steel\ -\ Low\ Lax"$ $\phi_{mom_{51}} = 1.00$ $\phi_{mom_{51}} \cdot (M_{n_{51}}) = 7052 \cdot kip \cdot ft$

$FailureMode_{51} = "N.A."$ $CheckMinSSLimit = "N.A."$



$\min(L_d) = 10.9\,\text{ft}$ $\quad L_{beam} - \min(L_d) = 84.9\,\text{ft}$

$DC_{moment_{mn}} := \dfrac{M_{reqd_{mn}}}{\phi_{mom_{mn}} \cdot (M_{n_{mn}})}$ *Demand/Capacity Ratio at locations where all strands are fully developed*

$\max(DC_{moment}) = 0.80$

CheckMomentCapacity := if(max(DC_moment) < 1.0, "OK" , "No Good!") = "OK"

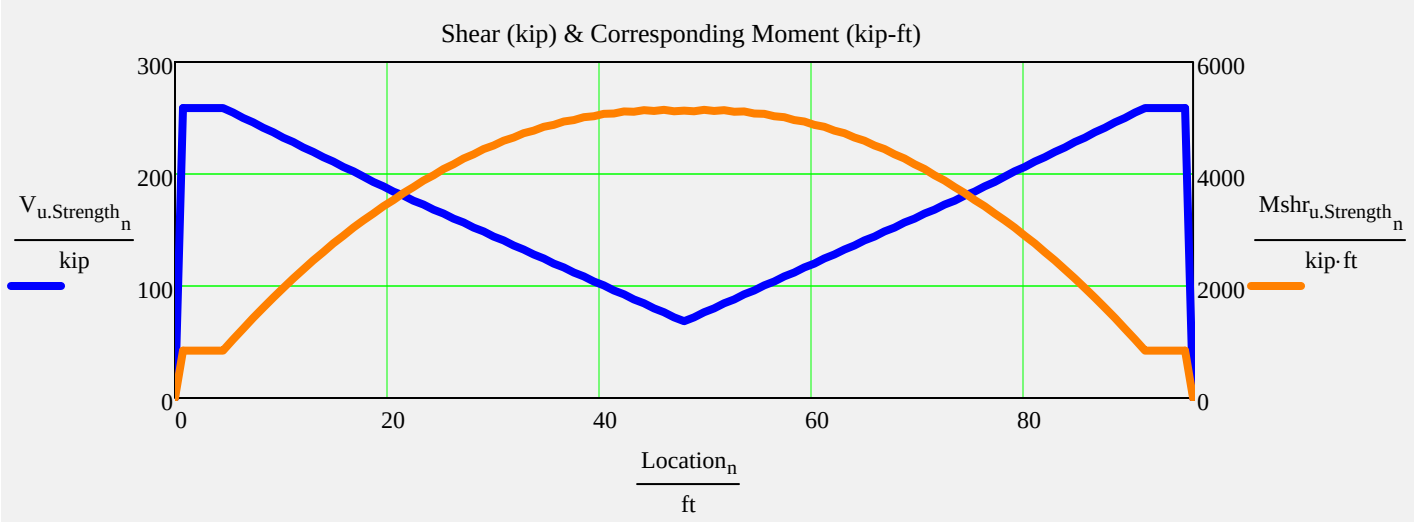
FSB only - Design Check of Transverse Reinforcing Bars E

Shear Loads

Shear and Corresponding Moments:

Calcultions use the greater of Strength I or Strength II Limit State

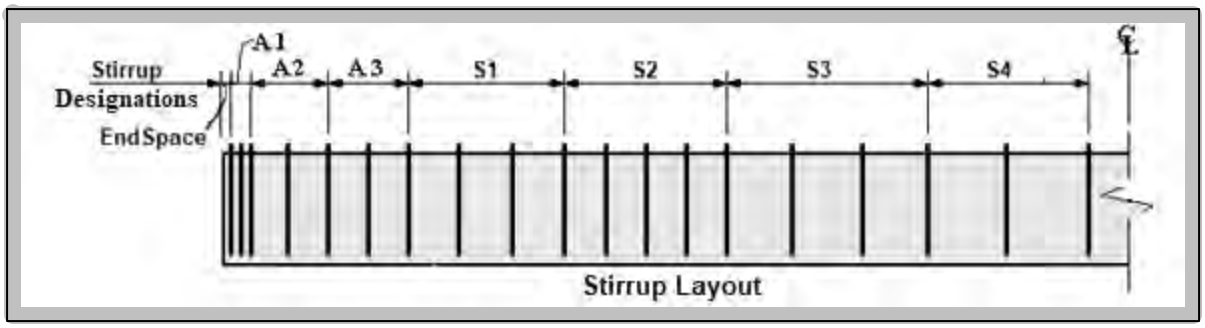
$$\begin{pmatrix} \max(V_{pos.StrengthI}) \\ \max(V_{pos.StrengthII}) \end{pmatrix} = \begin{pmatrix} 277 \\ 269 \end{pmatrix} \cdot kip \quad \begin{pmatrix} \text{"HL93"} \\ \text{"Permit Vehicle"} \end{pmatrix}$$



$\max(V_{u.Strength}) = 258.9 \cdot kip$ ControllingShearLimitState = "Strength I" $\max(Mshr_{u.Strength}) = 5144 \cdot kip \cdot ft$

Shear Resistance

Stirrup Size and Spacings (values are for one half of the beam)



End Stirrup Space: 3 in *Distance from end of beam to the centerline of first stirrup or stirrup bundle.*

GFRP Stirrup Bar #: 0 *used for GFRP Bars*

Help on Stirrup Design | Help on Stirrup Design Iteration | Table of FDOT Standard Prestressed Beam End Reinforcement | Reset Load Data

Stirrup Design - see Stirrup Layout

Designation	A1	A2	A3	S1	S2	S3	S4
Spacing (in)	3.5	3.5	3	6	9	12	18
# of Spaces	2	2	12	16	9	8	Calculated
Area (in^2)	1.24	0.62	0.31	0.31	0.31	0.31	0.31
Interface Factor	0.25	0.5	1	1	1	1	1

Save and Initialize Data

Shear Demand/Capacity and Longitudinal Steel Demand/Capacity

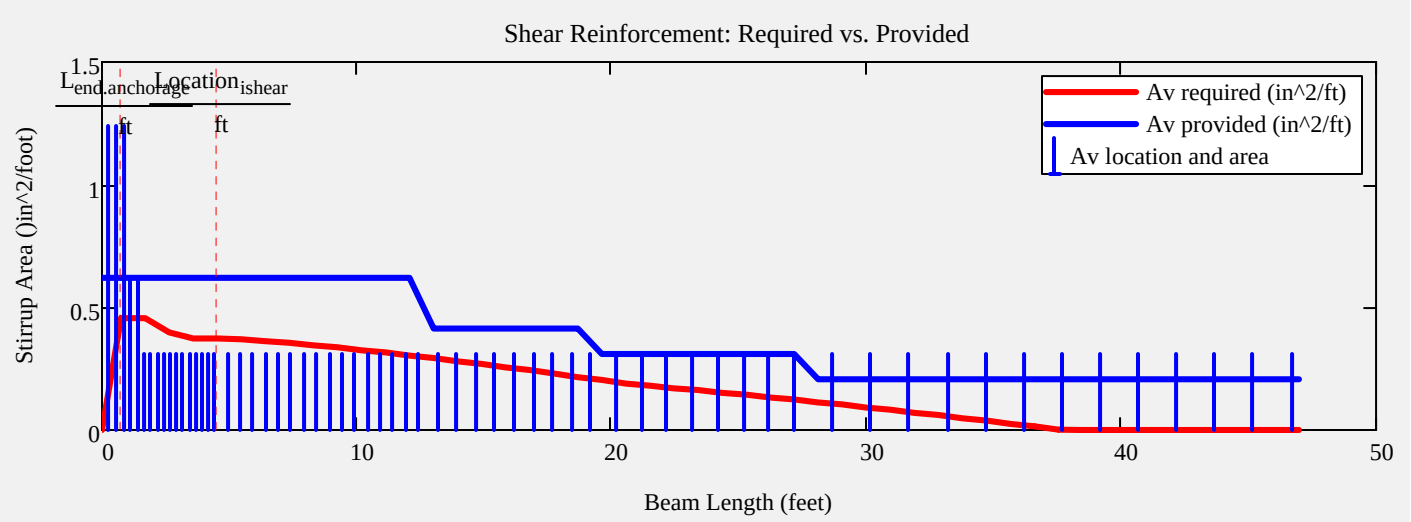
CheckShearCapacity = "OK"

CheckStirArea = "OK"

CheckMaxShearStress = "OK"

CheckMinStirArea = "OK"

CheckMaxStirSpacing = "OK"



$Location_{ishear} = 4.52\ ft$

Save Data File

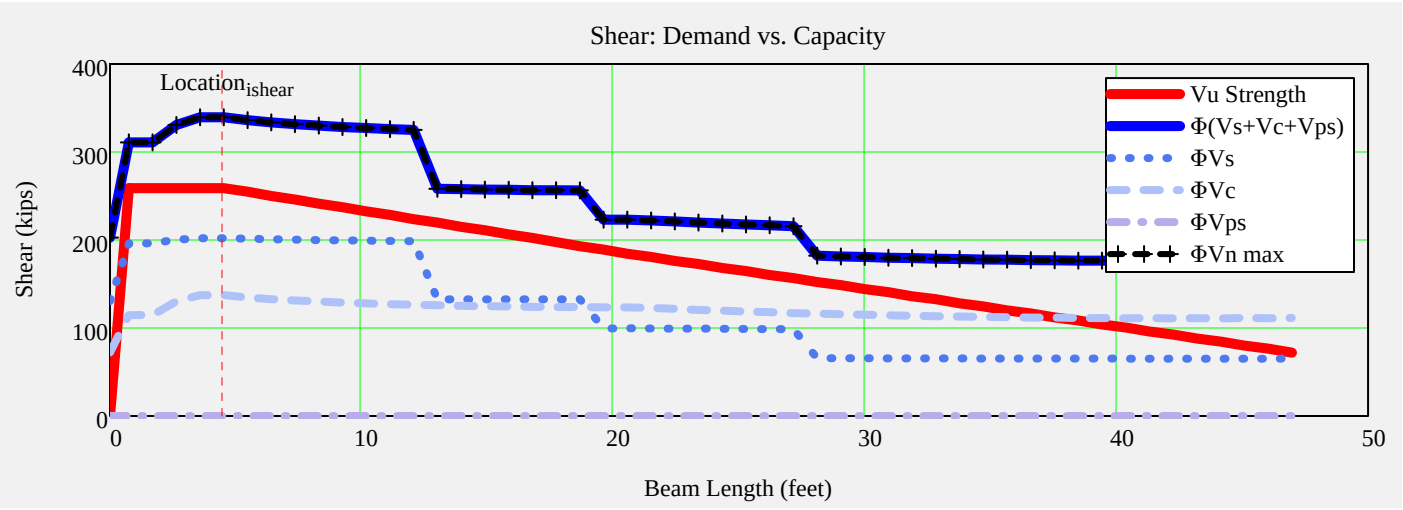
Use current input file

File Name FIB36-96ftSpan_15Skew_Interior.dat

Save Data

DataFileFolder = "V:\Structures\BDRs\Design\Beam Design\FIB's\EB 96' Span\prestressedbeamv6-2\DataFiles-I-Beam"

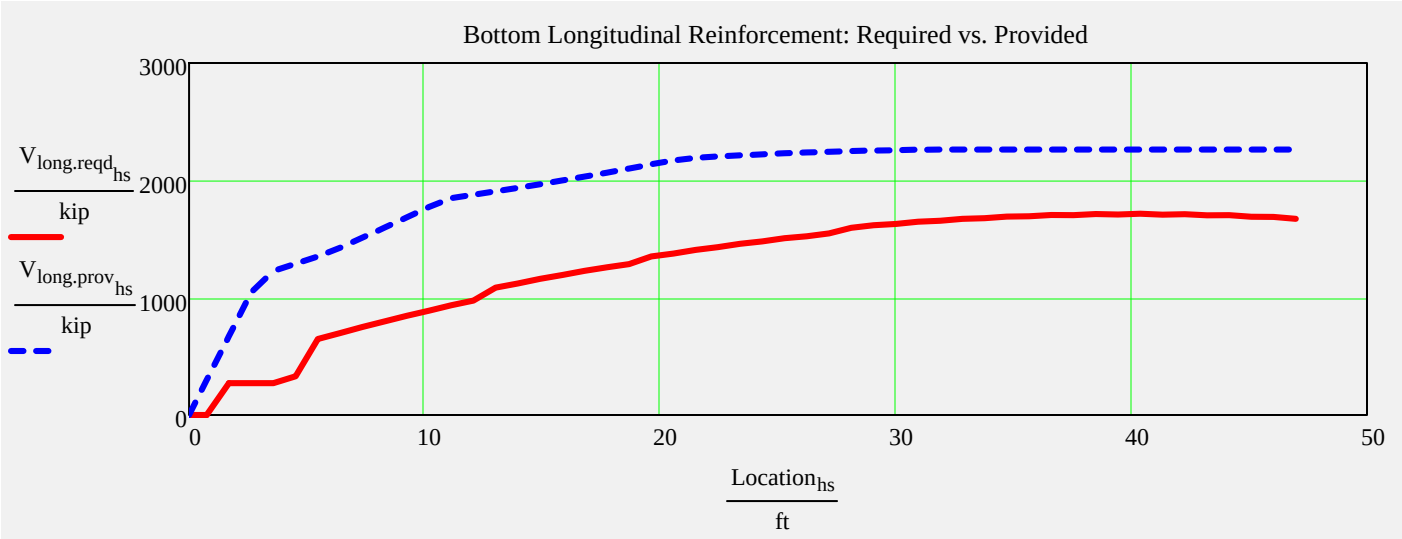
Note: Select an output folder by using the "Change Folder" option on page 1.



$$fCheckD/CShear = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"Vu (kip)"} & \text{"Vr (kip)"} \\ \text{"Shear"} & 13.01 & 219.78 & 258.26 \end{pmatrix} \qquad \max\left(D/C_{shear}\right) = 0.85$$

Botom Longitudinal Reinf. (LRFD 5.7.3.5)

Longitutinal Reinforcement:

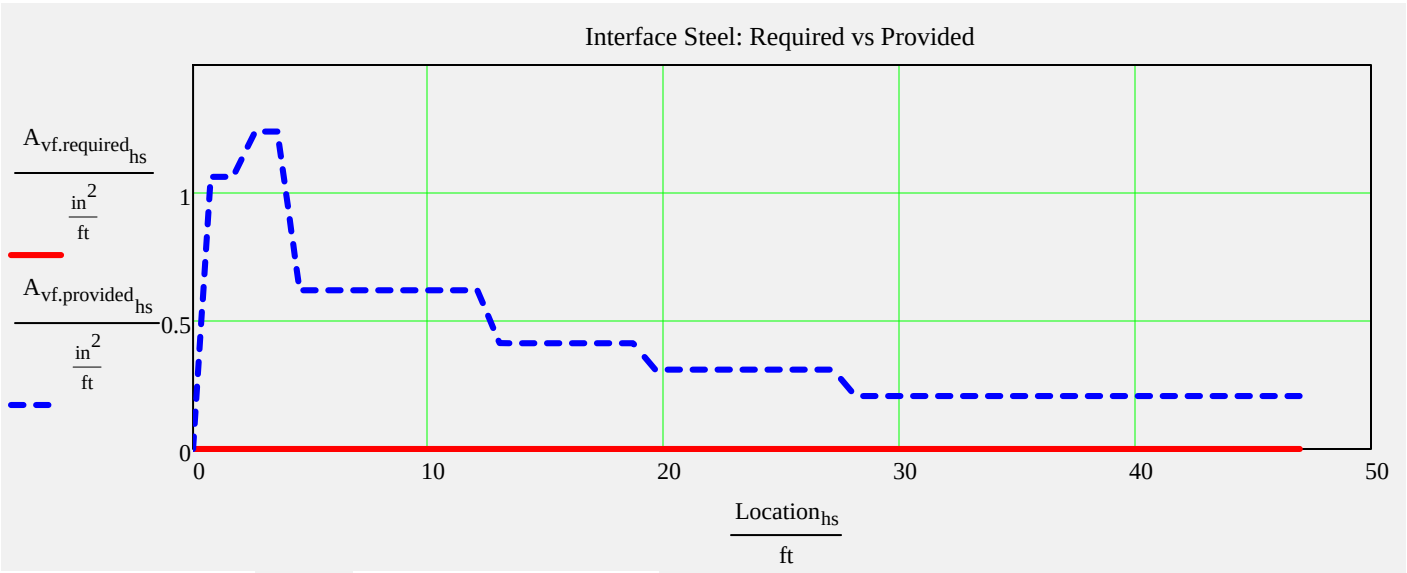


$$CheckD/CLong = \begin{pmatrix} \text{"CheckType"} & \text{"Location(ft)"} & \text{"V long Req'd (kip)"} & \text{"V long Prov (kip)"} \\ \text{"Longitudinal Reinf."} & 40.4 & 1715.0 & 2262.6 \end{pmatrix}$$

$\max(D/C_{LongReinf}) = 0.76$ CheckLongReinf = "OK" *(LRFD 6.7.3.5)*

Interface Shear Reinforcement

Interface Shear:



$TotalA_{vf.required} = 0 \cdot in^2$ $TotalA_{vf.provided} = 18.86 \cdot in^2$ $DC_{InterfaceReinf} = 0$ CheckInterfaceReinf = "OK"

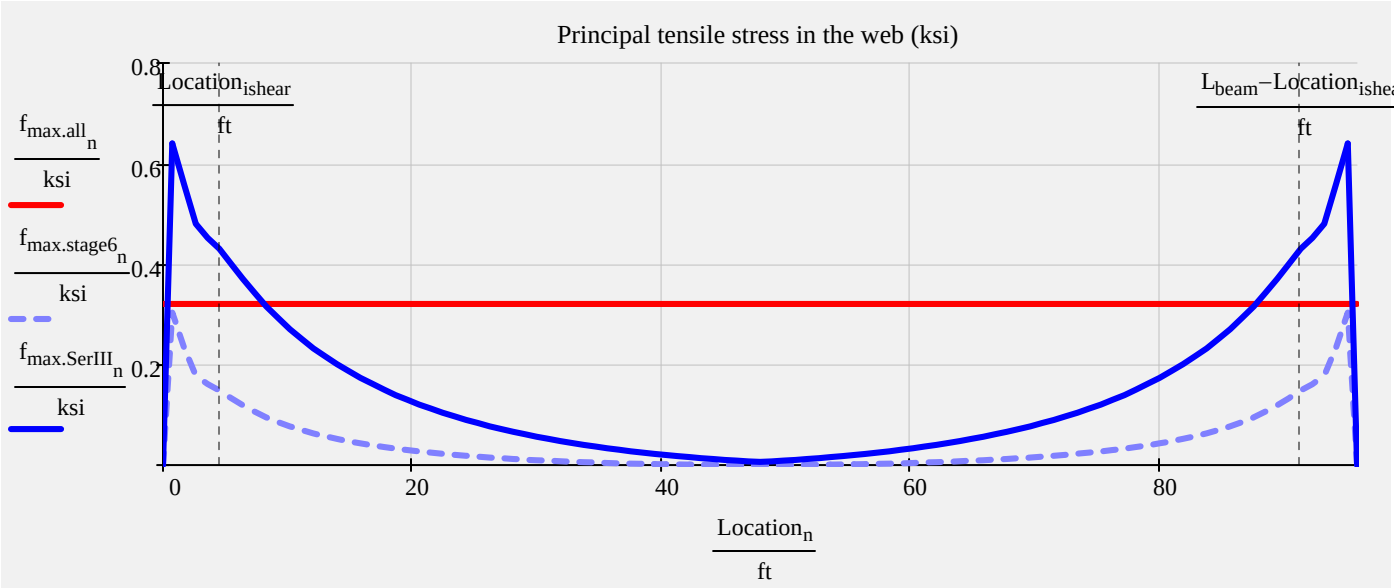
Typically shear reinforcement is extended up into the deck slab.
These calculations are based on shear reinforcement functioning as interface reinforcing.
The interface_factor *can be used to adjust this assumption.*

$\max(A_{vf.min.required}) = 0.000 \cdot \frac{in^2}{ft}$ $\max(A_{vf.des}) = 0.000 \cdot \frac{in^2}{ft}$

If max(Avf.min) or max(Avf.des) is greater than 0 in²/ft, interface reinforcement is required.

CheckInterfaceSpacing = "OK"

Principal Stresses:



Crital Location for Principal Stress: $Location_{ishear} = 54.3 \cdot in$ $\max(DC_f_{max.web}) = 1.34$ Check_$f_{max.web}$ = "No Good!"

Note: The check for pricipal tensile stresses in webs is only required for pretensioned girders with a compressive strength of concrete for use in design greater than 10 ksi per AASHTO BDS Article 5.9.2.3.3. The check is displayed for all concrete strengths for consideration when optimizing the strands design.

Splitting Reinforcement:

FDOT Splitting Rein Demand/Capacity Ratio and Check for FDOT Standard Beam End Reinforcement

$P_{r.standard} = 1450 \cdot kip$ $P_{prestress} = 1362 \cdot kip$ $D/C_{splitting.FDOT} = 0.94$

$CheckD/C_{splitting}$ = "OK"

Confinement Bars:

TotalNoConfineBars = 20

Summary of Design Checks

$check_1 := "OK"$

$check_2 := CheckDeflectionOrSpanToDepth = "OK"$

$check_3 := CheckStrandFit = "OK"$

$check_4 := Check_f_{pt} = "OK"$

$check_5 := Check_f_{pe} = "OK"$

$check_6 := Check_f_{tension.rel} = "OK"$

$check_7 := Check_f_{comp.rel} = "OK"$

$check_8 := Check_f_{tension.ServiceIII} = "OK"$

$check_9 := Check_f_{comp.ServiceIa} = "OK"$

$check_{10} := Check_f_{comp.ServiceIb} = "OK"$

$check_{11} := Check_f_{comp.FatigueI} = "OK"$

$check_{12} := CheckMomentCapacity = "OK"$

$check_{13} := CheckMaxCapacity = "OK"$

$check_{14} := CheckStirArea = "OK"$

$check_{15} := CheckShearCapacity = "OK"$

$check_{16} := CheckMinStirArea = "OK"$

$check_{17} := CheckMaxStirSpacing = "OK"$

$check_{18} := CheckLongReinf = "OK"$

$check_{19} := CheckInterfaceSpacing = "OK"$

$check_{20} := CheckInterfaceReinf = "OK"$

$check_{21} := "OK"$

$check_{22} := CheckD/C_{splitting} = "OK"$

$check_{23} := CheckPattern_0 = "OK"$

$check_{24} := CheckPattern_1 = "OK"$

$check_{25} := CheckPattern_2 = "OK"$

$check_{26} := CheckPattern_3 = "OK"$

$check_{27} := CheckPattern_4 = "OK"$

$check_{28} := CheckWebPattern_0 = "OK"$

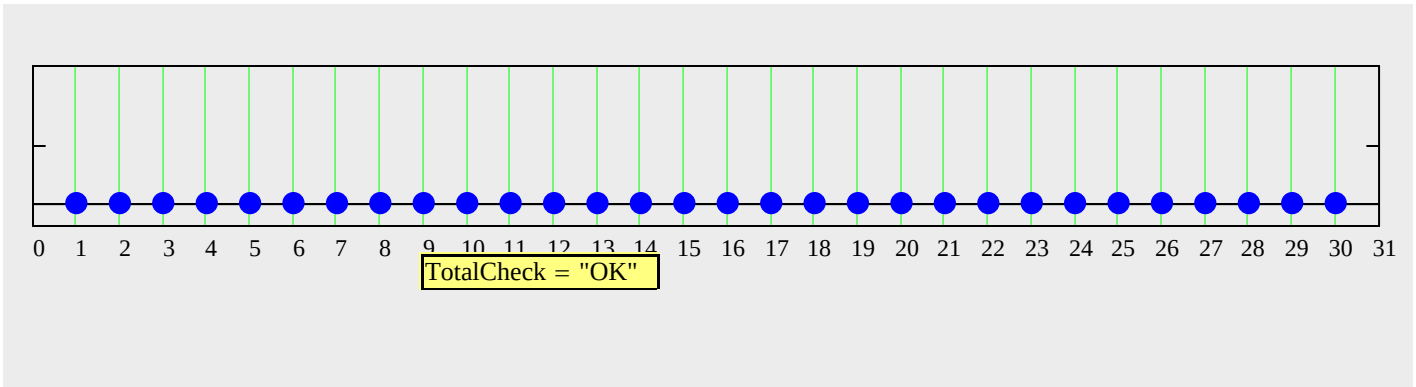
$check_{29} := CheckWebPattern_1 = "OK"$

$check_{30} := CheckBeamEndTopLongReinf = "OK"$

All Beam Checks

$check^T =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	"OK"	...



Load Rating Analysis: Load and Resistance Factor Rating (LRFR)

ref.: Maintenance Office FDOT Bridge Load Rating Manual

Load Rating Computations

$LRFR_{loadrating}$ =

	Moment (Strength) or Stress (Service)				Shear (Strength)				
"Limit State"	"DF"	"Rating"	"Tons"	"Dim(ft)"	"DF"	"Rating"	"Tons"	"Dim(ft)"	
"Strength I (Inv)"	0.59	1.61	"N/A"	48.11	0.79	1.28	"N/A"	18.87	HL-93
"Strength I (Op)"	0.59	2.09	"N/A"	48.11	0.79	1.66	"N/A"	18.87	HL-93
"Service III (Inv)"	0.59	1.44	"N/A"	48.11	"N/A"	"N/A"	"N/A"	"N/A"	HL-93
"Service III (Op)"	0.59	1.57	"N/A"	46.22	"N/A"	"N/A"	"N/A"	"N/A"	HL-93*
"Strength II"	0.59	1.73	103.54	48.11	0.79	1.29	77.29	18.87	Permit**

Notes:
** Not applicable for prestressed beams in good condition.*
*** FDOT Permit Rating truck is the FL120 .*
"Dim(ft)" *is measured from the centerline of bearings*

Longitudinal Reinforcement Check:

$DC_{LongReinf.HL93}$ = 0.74 $DC_{LongReinf.Permit}$ = 0.76 $CheckLongReinf_{loadrating}$ = "OK"

QUICK CHECK: Factored Components of the Rating Factor Equation for the Design Operating Moment and Shear Ratings

$HL93_{Operating.Moment}$ =

"φC"	7052	"factored resistance (kip-ft)...."
"γDL"	2727	"factored dead load (kip-ft)...."
"γLL"	2070	"factored live load (kip-ft)....."
"RF"	2.09	"HL93 operating rating factor"

$HL93_{Operating.Shear}$ =

"φC"	223	"factored resistance (kip)....."
"γDL"	69.4	"factored dead load (kip)....."
"γLL"	92.3	"factored live load (kip)....."
"RF"	1.66	"HL93 operating rating factor"

APPENDIX - E

BRIDGE GEOTECHNICAL REPORTS

April 3, 2025

HNTB Corporation
201 N. Franklin Street, Suite 1200
Tampa, FL 33602

Attn: Mr. John Burton, PE, PMP, PTOE, ENV SP.

RE: Preliminary Bridge Geotechnical Report
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over Whidden Creek Bridges
FPID No. 451942-2-52-01
DeSoto County, Florida
Tierra Project No. 6511-24-001

Mr. Burton:

Tierra, Inc. (Tierra) has performed a preliminary geotechnical study for the proposed bridge structures associated with the project referenced above. This report has been prepared to support the project Bridge Development Report (BDR). This report presents the results of our study including field and laboratory testing, a preliminary foundation design analysis and our opinions regarding appropriate foundation alternatives for the proposed bridge structures.

Tierra, Inc. appreciates the opportunity to be of service to HNTB Corporation (HNTB) on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.

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USDA Soil Survey & USGS Quadrangle Maps
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APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

1.0 PROJECT INFORMATION

1.1 Project Authorization

Authorization to proceed with this project was issued by HNTB in accordance with our Subconsultant Agreement.

1.2 Project Description

This project consists of widening SR 70 from two lanes to four-lane divided section from West of SR 31 (MP 14.973) to the Highlands County Line (MP 31.763). A shared use path is also proposed on the south side of the SR 70 widening.

This report has been prepared to provide geotechnical input for the Bridge Development Report (BDR) associated with the design of the proposed SR 70 over Whidden Creek bridge structures. The subsurface information obtained to date and preliminary engineering recommendations for the proposed foundation alternatives are provided herein.

1.3 General Site Description

The subject bridge site is located in an area surrounded by wetlands, pasturelands and low-density residential areas. Two eastbound/westbound SR 70 travel lanes traverse the existing SR 70 over Whidden Creek bridge (Bridge No. 040024). At the time of this report, Bridge Plans and Pile Driving Logs for the existing Bridge No. 040024 were not available for review. The existing bridge is a six-span structure founded on two (2) end bents and five (5) intermediate bents. The intermediate bents are supported by Pre-stressed, Pre-cast, Square Concrete (PPSC) Piles. A field photo of the existing Bridge No. 040024 is shown below:

Photograph 1: Existing Bridge No. 040024 (Facing Southwest)

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to provide geotechnical (i.e. subsurface soil conditions and related engineering properties) input to the design team to assist with the design and construction of the proposed SR 70 over Whidden Creek bridge structures. The following services were provided in order to achieve the preceding objective:

1. Reviewed soil information from the “Soil Survey of DeSoto County, Florida” published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Reviewed topographic and potentiometric information obtained from the “Arcadia, Florida” Quadrangle map and the “Upper Floridan Aquifer Potentiometric Surface” maps published by the United States Geological Survey (USGS).

2. Conducted a visual reconnaissance of the project site and coordinated utility clearance through Sunshine State One Call.

3. Executed a program of subsurface exploration consisting of subsurface sampling and field testing. Performed two (2) Standard Penetration Test (SPT) borings advanced to depths of approximately 115 to 120 feet below existing grades.

4. Visually classified and stratified the obtained soil samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D-2488. Conducted laboratory testing on selected soil samples to confirm the visual classification and evaluate the corrosive nature of the soil and water.

5. Evaluated foundation criteria and performed engineering analyses to develop preliminary design recommendations for the foundation alternatives associated with the proposed bridge structures.

6. Prepared this formal engineering report, which summarizes the course of study pursued, the field and laboratory data generated, the subsurface conditions encountered and the preliminary geotechnical recommendations for the design and construction of the proposed bridge structure foundation alternatives.

3.0 REVIEW OF PUBLISHED DATA

3.1 Regional Geology

DeSoto County Geology has been paraphrased from the Florida Geological Survey, Open-File Report 80, 2001 and other geologic references.

Based on a review of the Surficial Geology Maps published by FGS, the Hawthorn Group, Peace River Formation is mapped at the surface of the bridge site. Lithologically, these sediments consist of yellowish-grey to light olive green interbedded phosphatic sands, clayey sands, clays and dolomite stringers. The thickness of the Peace River Formation is approximately 50 feet in the northeastern and southwestern corners of the county. The Peace River thickens to more than 160 feet in the southeastern corner of the county. The Peace River dips and thickens in the general south easterly direction.

3.2 USDA Soil Survey

Based on a review of the Soil Survey for DeSoto County published by the USDA NRCS, it appears that there is one (1) primary soil-mapping unit noted at the bridge site. The general soil description as described in the Soil Survey is presented in the following table. The **USDA Soil Survey Map** for the bridge site is illustrated in **Appendix A**.

SUMMARY OF USDA SOIL SURVEY DESOTO COUNTY, FLORIDA							
USDA Map Symbol and Soil Name	**Depth (in)**	**Soil Classification**		**Permeability (in/hr)**	**pH**	**Seasonal High Water Table**	
		USCS	**AASHTO**			**Depth (feet)**	**Months**
(4) Basinger, Frequently Flooded	0-4	SP	A-3	20.0 - 40.0	3.5-7.3	0.0	Jun-Sep
	4-16	SP	A-3	20.0 - 40.0	3.5-7.3		
	16-36	SP-SM, SP	A-2-4, A-3	20.0 - 40.0	3.5-7.3		
	36-80	SP-SM, SP	A-2-4, A-3	20.0 - 40.0	3.5-7.3		

It should be noted that information contained in the USDA Soil Survey Map may not be reflective of actual soil and groundwater conditions, particularly if recent development in the project vicinity has modified soil conditions or surface/subsurface drainage.

3.3 USGS Quadrangle Map

Based on a review of the "Arcadia, Florida" USGS Quadrangle Map, it appears that the natural elevation at the project site ranges from approximately +50 feet to +55 feet National Geodetic Vertical Datum of 1929 (NGVD 29) as illustrated on the **USGS Quadrangle Map** in **Appendix A.**

3.4 Review of Potentiometric Surface Information

Based on a review of the "Upper Floridan Aquifer Potentiometric Surface" maps published by the USGS, the potentiometric surface elevation at the bridge site is reported to range from approximately +40 to +50 feet, NGVD 29. As indicated in **Section 3.3**, the natural ground surface elevation at the bridge site ranges from approximately +50 to +55 feet, NGVD 29. Artesian flow conditions were not encountered during the field exploration.

4.0 SUBSURFACE EXPLORATION

4.1 Boring Location Plan

Prior to commencing our subsurface explorations, a boring location plan for the proposed bridge structures was developed based on design information provided by HNTB. This boring location plan was generated based on our engineering judgment and guidelines provided in the "Soils and Foundations Handbook" published by the FDOT. Tierra submitted this boring location plan to FDOT for approval. Following completion of the borings, the boring locations were surveyed by the project surveyor. The Boring Location Plan for the borings performed is provided on the **Report of Core Borings** sheets in **Appendix A.**

Utility clearances were coordinated by Tierra via Sunshine State One Call and updated as required prior to performing the soil borings in order to reduce the potential for damage to the utilities during drilling.

4.2 Soil Borings

Subsurface conditions were explored at the bridge site with two (2) SPT borings. The results and locations of the SPT borings are presented on the **Report of Core Borings** sheets in **Appendix A**.

The SPT borings were performed with the use of a drill rig using Bentonite Mud drilling procedures. Temporary 3-inch diameter rotary installed casing was utilized to help keep the boreholes stable. The soil sampling was performed in general accordance with the ASTM test designation D-1586. The initial 6 feet of the borings were hand augered to verify utility clearances. SPT resistance N-values were then taken at intervals of 2 feet from the hand auger boring depth of 6 feet to a depth of 17½ feet and on intervals of 2½ feet thereafter to the boring termination depths. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our laboratory for classification and analyses.

Soil stratification was determined based on a review of recovered samples, laboratory test results, and interpretation of field boring logs. Stratification lines represent approximate boundaries between soil layers of different engineering properties; however actual transitions between layers may be gradual. In some cases, small variations in properties that were not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The soil profiles represent the conditions at the particular boring location; variations do occur among the borings. Specific details about subsurface conditions and materials encountered at each test location can be obtained from the soil profiles presented on the **Report of Core Borings** sheets in **Appendix A** of this report.

5.0 LABORATORY TESTING

5.1 General

Representative soil samples collected from the SPT borings were classified and stratified in general accordance with the Unified Soil Classification System (USCS). Our classification was based on visual observations, using the results from the laboratory testing as confirmation. Laboratory testing consisting of fines content (percentage passing No. 200 mesh sieve), Atterberg limits testing, and natural moisture content determination tests were completed on representative soil samples. In addition, Environmental classification tests were performed to evaluate the corrosive nature of the soil and water encountered at the bridge site. The results of the laboratory tests are presented on the **Report of Core Borings** sheets in **Appendix A**. Detailed results of the tests performed are presented on the **Summary of Laboratory Test Results for Soil Classification**, **Summary of Laboratory Test Results for Environmental Classification** and **Grain Size Distribution Report** in **Appendix C.**

5.2 Test Designation

The following list summarizes the laboratory tests performed and respective test methods utilized.

- Fines Content - The fines content tests were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-1140).

- Grain-Size Analyses - The grain-size analyses were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-6913).

- Atterberg Limits - The liquid limit and the plastic limit tests ("Atterberg Limits") were conducted in general accordance with the AASHTO test designations T-089 and T-090, respectively (ASTM test designation D-4318).

- Natural Moisture Content - The moisture content tests were conducted in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).

- Environmental Classification – The environmental classification tests were conducted in general accordance with the FSTM test designations FM 5-550, FM 5-551, FM 5-552, and FM 5-553.

6.0 ENVIRONMENTAL CLASSIFICATION

Environmental classification tests were performed on recovered soil samples obtained from within the borings performed at the bridge site and from water samples obtained from Whidden Creek. Based on the laboratory test results and the 2025 FDOT Structure Design Guidelines (SDG), the environmental classifications of the superstructure and substructure for the bridge are classified as follows:

Superstructure Environmental Classification	Concrete Substructure Classification	Steel Substructure Classification
Slightly Aggressive	Moderately Aggressive (Water - Resistivity = 2,500 Ohm-cm)	Moderately Aggressive (Soil - pH = 6.5) (Water - Resistivity = 2,500 Ohm-cm)

The range of test results is presented on the **Report of Core Borings** sheets in **Appendix A.** A summary of the individual corrosion series test results is provided in **Appendix C**.

7.0 RESULTS OF SUBSURFACE EXPLORATION

7.1 General Subsurface Conditions

Typically, the borings encountered sandy soils underlain by intermittent layers of clayey, silty and sandy soils to the boring termination elevation. Specific information on the soil conditions encountered can be found on the **Report of Core Boring** sheets in **Appendix A.** The soil descriptions and classifications associated with this project are listed in the following table.

Soil Description	USCS Symbol
SAND	SP/SP-SM
SILTY SAND	SM
SILTY CLAYEY TO CLAYEY SAND	SC-SM/SC
SILTY-CLAY TO CLAY	CL-ML/CL
SILT	MH

Additional borings will be performed as the project progresses beyond the BDR stage; the results will be presented in future submittals.

7.2 Groundwater

The groundwater table was encountered at depths ranging from approximately 6 feet to 9 feet below existing grades within the borings performed and is presented on the **Report of Core Borings** sheets in **Appendix A**.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e. swales, drainage ponds, underdrains and impervious areas) and creek water levels.

8.0 EVALUATIONS OF BRIDGE FOUNDATION ALTERNATIVES

Evaluations of foundation alternatives for the proposed bridge structures were based on the results of our field study. Based on our discussions with HNTB the following foundation alternatives were considered:

- Shallow Foundations
- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)
- Steel Piles, including H Sections
- Pre-stressed, Pre-cast, Square Concrete (PPSC) Piles
- Drilled Shafts

The following paragraphs discuss each of these alternatives briefly.

8.1 Shallow Foundations

With shallow foundation systems, the structure loads are supported by the bearing capacity of the foundation soils. The design of shallow foundations is typically governed by the soil bearing capacity and total and differential settlement criteria.

Loose/soft soils were encountered within the influence zone of typical shallow foundation sizes and settlement due to the soft clay/silt as they consolidate will occur over time. Based on the anticipated loading conditions for roadway bridges of this size, a shallow footing would have to be relatively large for bearing capacity and settlement criteria to be achieved or would require

some form of subsurface remediation to increase the bearing capacity and decrease settlement potential.

For these reasons, shallow foundations were not considered further for this report.

8.2 Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)

GRS-IBS consists of a shallow foundation combined with a retaining wall system to provide support for single span bridges or multi-span bridges with simply supported end spans. The reasons discussed in **Section 8.1** that preclude the use of shallow foundations also apply to the GRS-IBS.

For these reasons, GRS-IBS was not considered further for this report.

8.3 Pre-Cast Pre-Stressed Square Concrete (PPSC) Piles

PPSC pile foundations are a feasible foundation alternative. They are a widely used and proven foundation system in Florida. PPSC pile foundations are readily available and generally have a lower cost per ton of capacity than other pile types. Analyses were performed for 18-inch and 24-inch PPSC piles for this Preliminary Bridge Geotechnical Report.

8.4 Steel Piles

Steel pile types include H-sections and pipe piles. Steel piles generally do not develop as much capacity for similar penetration depths as PPSC piles. Steel piles are well suited to soil conditions with high variability and where frequent pile splicing is expected and/or required due to overhead restrictions, subsurface variability, etc. Steel piles may also more easily penetrate dense layers to achieve a desired penetration depth and are less susceptible to damage compared to concrete piles. Steel H-Piles are low displacement piles, and therefore vibrations associated with installations are minimized due to the low-displacement nature of the piles. Open end pipe piles are also low displacement but will eventually become plugged at the pile toe. Based on coordination with the Structural Engineer, pile capacity analyses for 14X89 H-Piles were performed for this Preliminary Bridge Geotechnical Report.

8.5 Drilled Shafts

Drilled, cast-in-place, concrete shafts have the ability to develop high axial and lateral capacities. One drilled shaft could potentially take the place of several driven piles depending on soil/rock conditions.

This type of foundation system is often the chosen alternative for sites where competent limestone is present at a relatively shallow depth and with a sufficient thickness. Drilled shafts will develop large skin friction capacities in limestone compared to dense sand, and therefore drilled shafts are most suited for sites with shallow, competent consistent limestone. Drilled shafts foundations may also be considered as a preferred foundation alternative for sites in order to limit construction induced vibrations compared to the vibrations caused by driven piles.

Limestone was not encountered within the SPT Borings performed at the bridge site. Therefore, drilled shafts were not analyzed further for this Preliminary Bridge Geotechnical Report.

9.0 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

9.1 General

Based on the subsurface conditions encountered in the test borings performed to date, it is Tierra's opinion that driven pile foundations are the most suitable foundation alternative type for the proposed bridge structures. Foundation systems comprised of 18-inch and 24-inch PPSC piles and 14X89 H-Piles were analyzed for this Preliminary Bridge Geotechnical Report. The following sections present the results of the engineering analyses for the proposed deep foundation alternatives.

9.2 Environmental Classification

Based on the laboratory test results and the 2025 SDG, the environmental classification for steel substructure for the proposed bridge structures is Moderately Aggressive (Soil pH = 6.5; Water Resistivity = 2,500 Ohm-cm). Steel piles will need to be designed with proper sacrificial thickness.

9.3 Downdrag (Negative Skin Friction)

Based on a review of preliminary cross sections, the new bridge supporting the eastbound travel lanes will be at/near the elevation of the existing bridge, and the new bridge supporting the westbound travel lanes will have new embankments (anticipated to be less than about 15 feet high) at each end bent approach. Based on the new embankments and soil conditions encountered in the borings, there will be downdrag loads imparted to the end bent piles. Actual loads will be determined following the BDR stage once a foundation alternative has been selected and the roadway geometry has been finalized. For preliminary estimation purposes, downdrag loads up to 20 tons should be anticipated at the end bent locations.

The portion of the end bent concrete piles within the embankment should be provided with a double wrap of polyethylene sheeting according to the FDOT Specifications to minimize development of downdrag loads from the embankment fill.

9.4 Scour

It is our understanding that the scour analysis will be performed by others. Tierra performed sieve analyses on soil samples collected within two feet of the mudline of Whidden Creek near the existing bridge. The results of the sieve analyses along with D_{50} values for use in the scour analysis calculations are provided on the **Grain Size Distribution Report** in **Appendix C**.

9.5 Driven Pile Axial Capacity

Axial pile capacities for the proposed bridge were analyzed based on the subsurface conditions encountered in the borings and the FDOT program FB-Deep. The Load and Resistance Factor Design (LRFD) method was utilized for the analysis.

As indicated in the FDOT Structure Design Guidelines (SDG), the required Nominal Bearing Resistance (Rn) must satisfy the following requirement:

$$Rn > \frac{\text{(Factored Design Load + Downdrag + Net Scour)}}{\phi}$$

Where ϕ = 0.75; dynamic load testing will be performed on all piles.

Other ϕ factors may be used based on the type of foundation testing recommended.

The R_n is taken as the Davisson Capacity. The Davisson axial capacity consists of the ultimate skin friction and mobilized end bearing (i.e., one-third of the ultimate end bearing). Tierra modeled the top 15 feet of the soil boring profile in the capacity analyses as a cavity layer to mimic a "starter hole" as described in FDOT Specification 455-5.1.

Based on the results of borings performed at the bridge sites to date, medium dense to very dense silty to clayey sands were encountered at the bridge site where concrete piles will likely tip. Based on the information provided in the FDOT Publication *"Improving Design Phase Evaluations of High Pile Rebound Soils with an Emphasis on SPT Testing"* and our experience, concrete displacement piles have the potential to experience pile “rebound” during pile driving activities into these types of soils. We therefore recommend limiting the maximum NBR values below what is stated in SDG Table 3.5.13-1. The following table summarizes the approximate maximum recommended R_n for each driven pile foundation alternative:

Driven Pile Foundation Alternative	Approximate Maximum Recommended R_n[(1)]
18-Inch PPSC Piles	275 tons
24-Inch PPSC Piles	425 tons
14X89 Steel H-Pile	175 tons
(1) Anticipate downdrag loads up to 20 tons for preliminary estimation purposes.	

The axial capacity for 18-inch and 24-inch PPSC piles and 14X89 H-Piles were computed using the program FB-Deep. The results of the axial pile analyses are presented in **APPENDIX B**, including the axial capacity curves, FB-Deep output curves (including Davisson Capacity Curves, Ultimate Skin Friction Curves and Mobilized End Bearing Curves) and FB-Deep computer output files.

9.6 Group Action

No reductions of the individual pile capacities will be required if piles are spaced center-to-center at 3 times their width or greater.

9.7 Settlement

Settlement of pile supported bridge bents should be small and tolerable for a typical single row group. However, the tolerance should be confirmed by the structural engineer. Based on soil conditions encountered at the boring locations, and that piles will be tipped in a suitable bearing layer, individual pile head settlements are estimated to be on the order of ½ inch or less.

10.0 CONSTRUCTION CONSIDERATIONS

10.1 General

The overall site preparation and construction should be in accordance with the FDOT Specifications.

10.2 Temporary Side Slopes

Temporary side slopes and excavations should comply with the Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 C.F.R., s. 1926.650, Subpart P, all subsequent revisions or updates of OSHA's referenced standard adopted by the Department of Labor and Employment Security and Florida's Trench Safety Act, Section 553.62, Florida Statutes. Excavated materials should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth.

10.3 Groundwater Control

Depending upon groundwater levels at the time of construction, some form of dewatering may be required based on the anticipated construction activities due to perched groundwater. Due to groundwater levels anticipated during the wet season of the year, seepage may enter the bottom and sides of excavated areas. Such seepage will act to loosen soils and create difficult working conditions. Groundwater levels should be determined immediately prior to construction. Shallow groundwater should be kept below the lowest working area to facilitate proper material placement and compaction in accordance with the FDOT Specifications.

10.4 Dynamic Load Testing & Pile Installation

We recommend that a test pile program be conducted for the proposed bridge construction including test piles. The test piles should be dynamically monitored. The monitoring will provide estimates of pile capacity versus pile penetration, stresses in the pile, and other relevant parameters used to evaluate the pile driving process. analyses should be performed on selected conditions for evaluation of the dynamic test results. The results of these analyses will provide information for developing production pile lengths. In addition, all production piles will be dynamically monitored.

The installation of the piles should be carried out in accordance with the FDOT Specifications.

10.5 Protection of Existing Structures

The FDOT Specifications should be followed for protection of existing structures during foundation construction operations.

11.0 REPORT LIMITATIONS

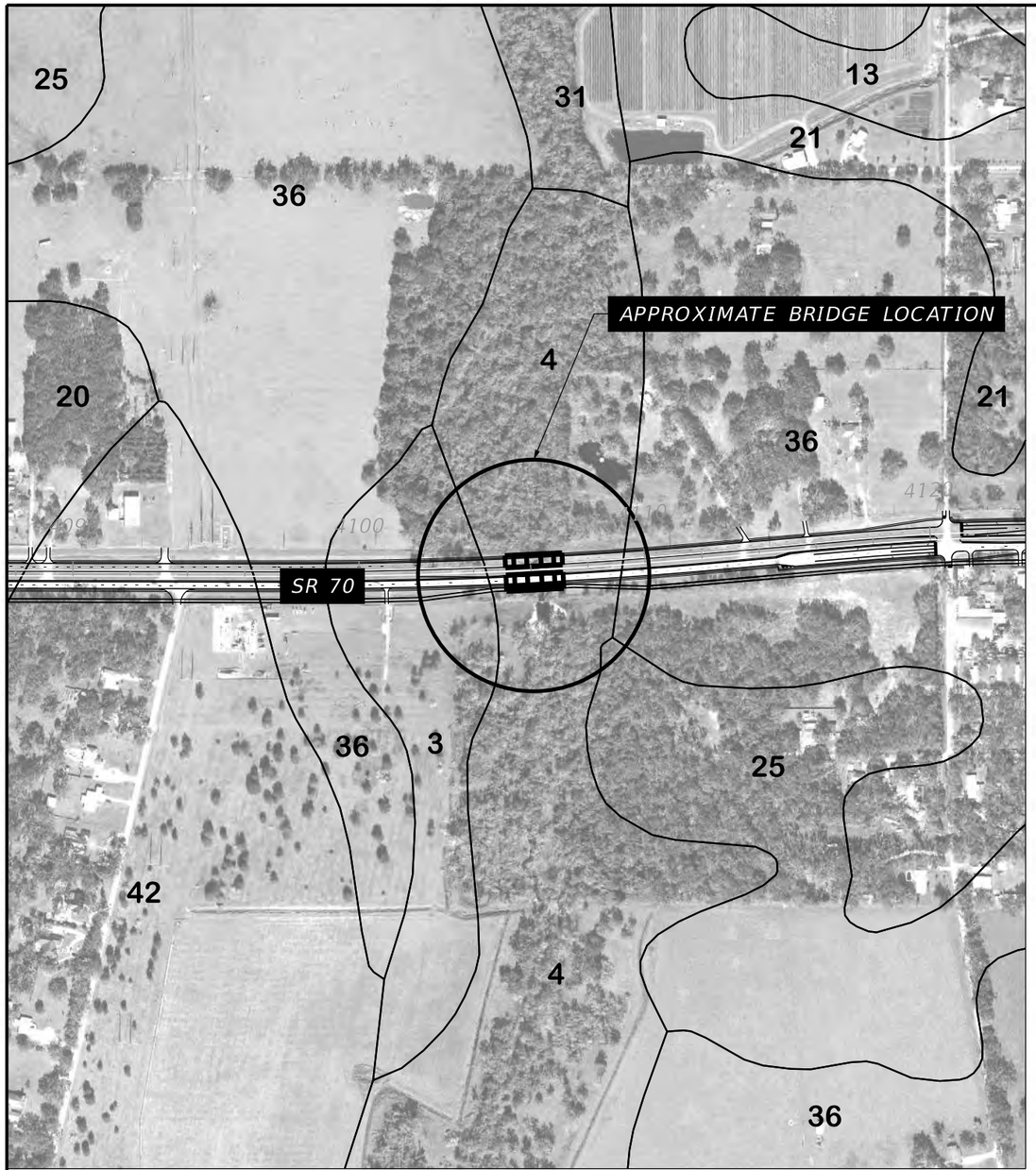
Our services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions, or recommendations made by others based on this data.

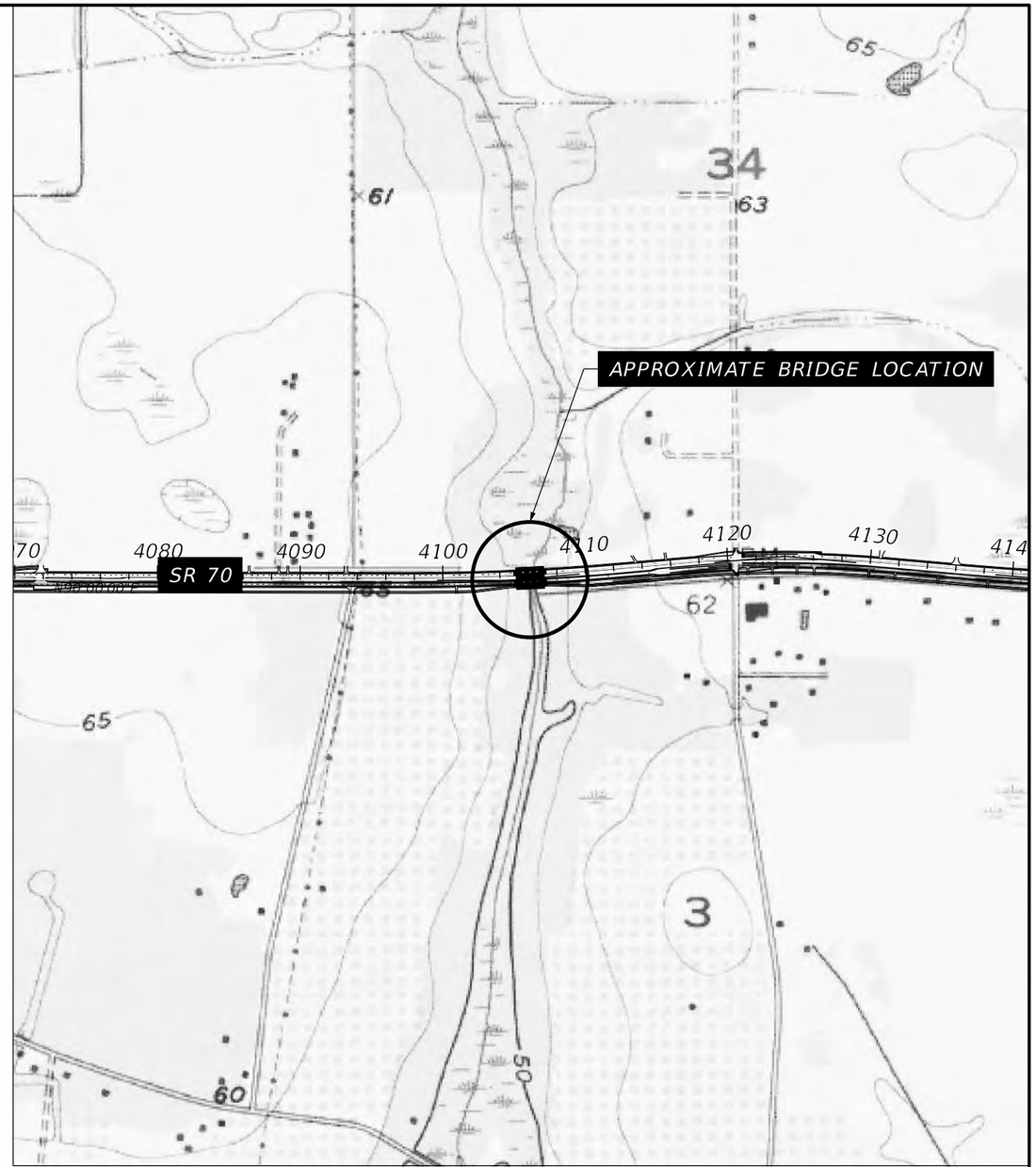
The scope of the investigation was intended to evaluate soil conditions within the influence zone of the deep foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed structure.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of the HNTB design team and the Florida Department of Transportation.

APPENDIX A

USDA Soil Survey & USGS Quadrangle Maps
Report of Core Borings (2 Sheets)





REFERENCE: USDA SOIL SURVEY OF DESOTO COUNTY, FLORIDA

0 100 500
Feet

TOWNSHIP: 37S , 38S
RANGE: 25E
SECTION: 34, 3

REFERENCE: USGS QUADRANGLE MAP OF "ARCADIA, FLORIDA"

0 200 1000
Feet

BRIDGE NO. XXXXXX

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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DESIGNED BY: BJS 04-25
CHECKED BY: DAN 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

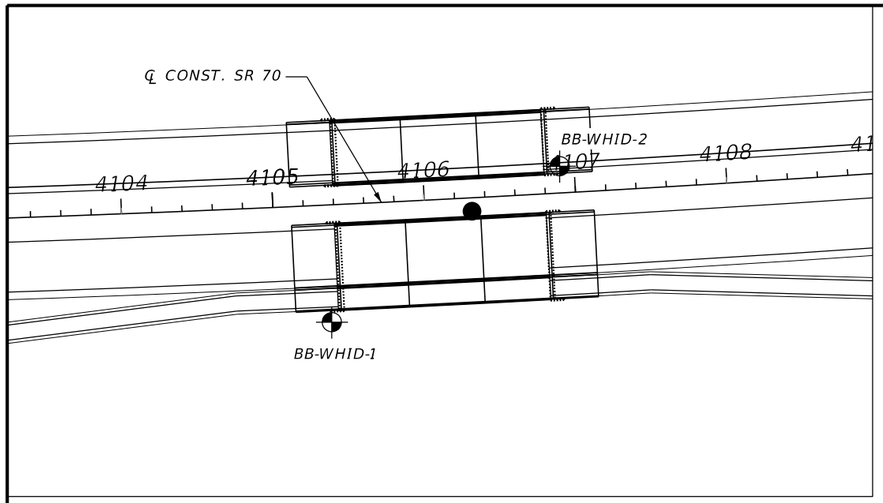
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: USDA SOIL SURVEY & USGS QUADRANGLE MAPS

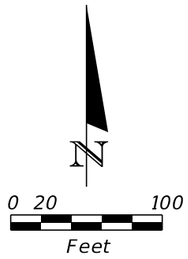
REF. DWG. NO.

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

SHEET NO.



BORING LOCATION PLAN



NOTES:

1. THE BORING LOCATIONS AND ELEVATIONS WERE PROVIDED BY THE PROJECT SURVEYOR.
2. BASED ON A REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION AT THE BRIDGE SITE IS REPORTED TO RANGE FROM APPROXIMATELY +40 FEET TO +50 FEET, NGVD 29. ARTESIAN CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED AT THE TIME OF OUR FIELD ACTIVITIES; HOWEVER, THE CONTRACTOR SHOULD BE PREPARED TO ADDRESS ARTESIAN LEVELS UP TO A HEAD OF +50 FEET, NGVD 29.

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: MODERATELY AGGRESSIVE (WATER - RESISTIVITY = 2,500 OHM-CM)
SUBSTRUCTURE	STEEL: MODERATELY AGGRESSIVE (SOIL - pH = 6.5, WATER - RESISTIVITY = 2,500 OHM-CM)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

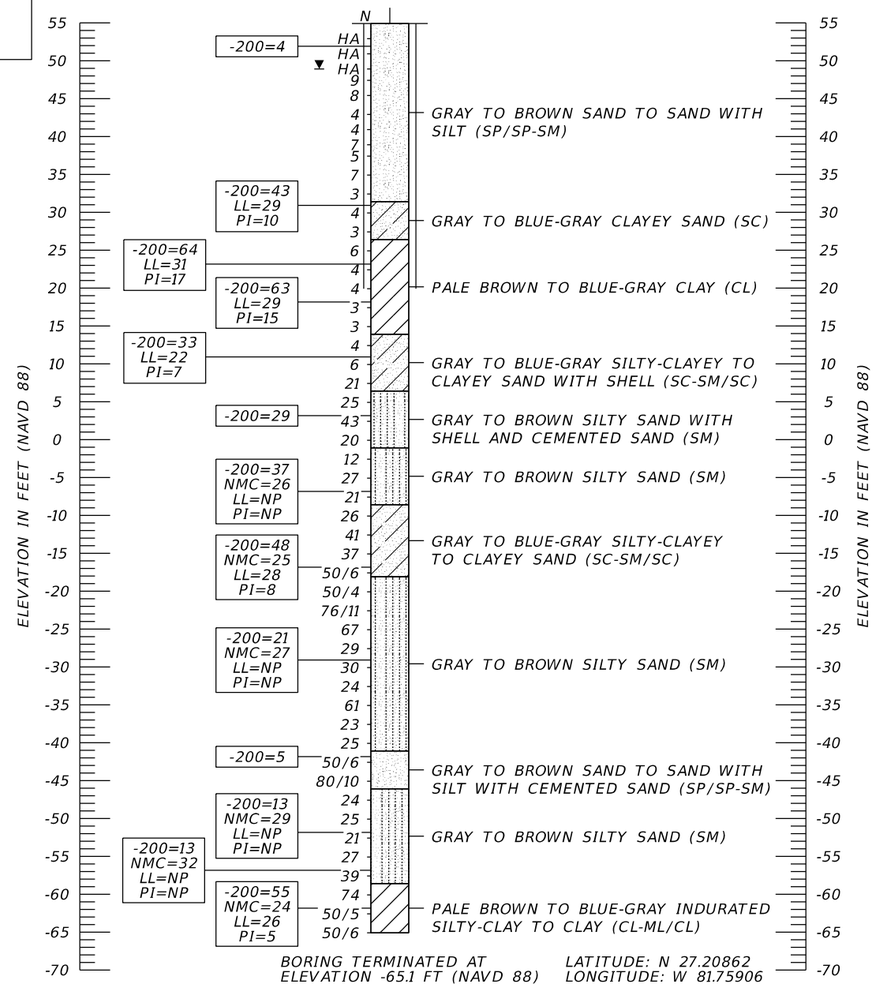
SOIL TEST RESULTS:

RESISTIVITY	5,800 TO 7,100 OHM-CM
CHLORIDES	15 PPM
SULFATES	93 TO 129 PPM
pH	6.5 TO 7.6

WATER TEST RESULTS:

RESISTIVITY	2,500 OHM-CM
CHLORIDES	90 PPM
SULFATES	90 PPM
pH	7.9

BOR #	BB-WHID-1
STA.	4105+37
REF.	℄ CONST. SR 70
OFF.	79' RT.
ELEV.	54.9
DATE	4/9/2024
DRILLER	J. SHAW
HAMMER	AUTOMATIC
RIG	D-25



LEGEND

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	SILTY-CLAY TO CLAY
	SILTY SAND
	SILT
	SILTY-CLAYEY TO CLAYEY SAND
SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCE
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON-PLASTIC
NAVD 88	NORTH AMERICAN VERTICAL DATUM OF 1988
	APPROXIMATE SPT BORING LOCATION
	GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
	CASING
	APPROXIMATE SEDIMENT SAMPLE LOCATION FOR D_{50} DETERMINATION

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

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DESIGNED BY: BMG 06-24
CHECKED BY: DAN 06-24

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942--52-01

SHEET TITLE: REPORT OF CORE BORINGS (1 OF 2)

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

REF. DWG. NO.

SHEET NO.

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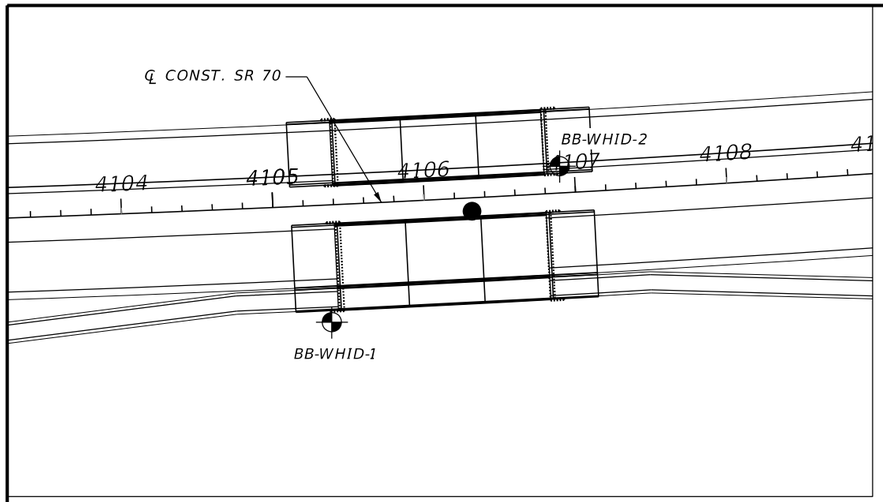

BORING LOCATION PLAN

NOTES:

1. THE BORING LOCATIONS AND ELEVATIONS WERE PROVIDED BY THE PROJECT SURVEYOR.
2. BASED ON A REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION AT THE BRIDGE SITE IS REPORTED TO RANGE FROM APPROXIMATELY +40 FEET TO +50 FEET, NGVD 29. ARTESIAN CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED AT THE TIME OF OUR FIELD ACTIVITIES; HOWEVER, THE CONTRACTOR SHOULD BE PREPARED TO ADDRESS ARTESIAN LEVELS UP TO A HEAD OF +50 FEET, NGVD 29.

ENVIRONMENTAL CLASSIFICATION:

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SUBSTRUCTURE	STEEL: MODERATELY AGGRESSIVE (SOIL - pH = 6.5, WATER - RESISTIVITY = 2,500 OHM-CM)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

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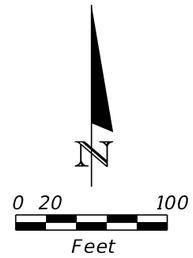
pH	6.5 TO 7.6

WATER TEST RESULTS:

RESISTIVITY	2,500 OHM-CM
CHLORIDES	90 PPM
SULFATES	90 PPM
pH	7.9



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STA.	4106+90
REF.	℄ CONST. SR 70
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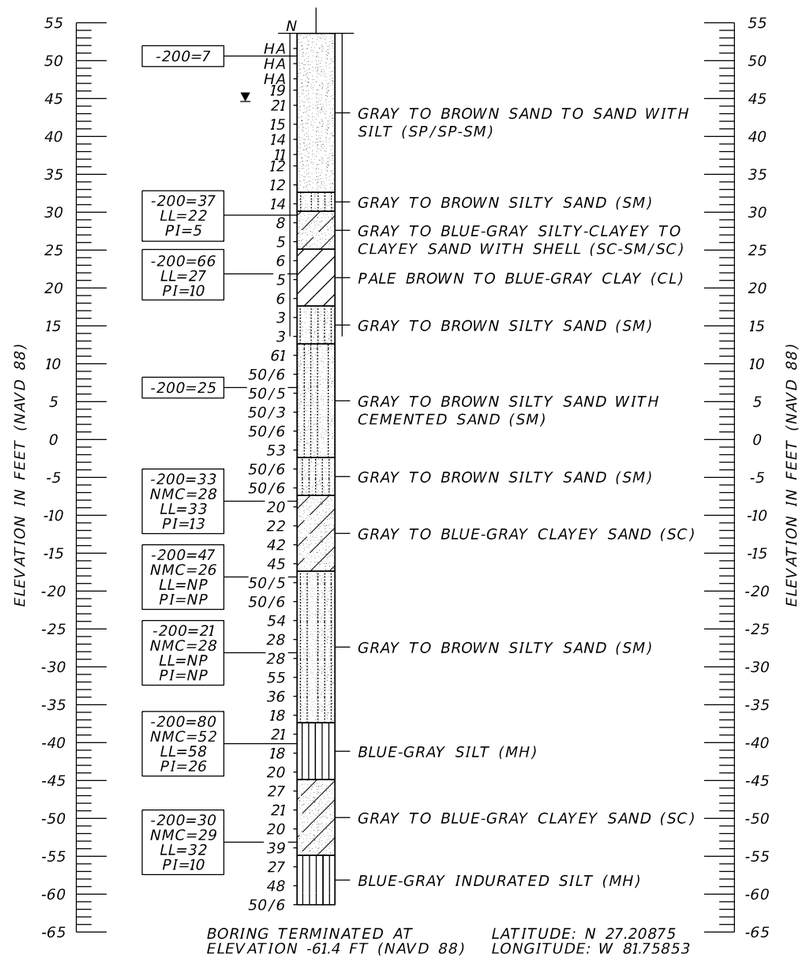
ELEV.	53.6
DATE	4/30/2024
DRILLER	J. SHAW
HAMMER	AUTOMATIC
RIG	D-25



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LONGITUDE: W 81.75853

LEGEND

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	SILTY SAND
	SILTY-CLAYEY TO CLAYEY SAND
	SILTY-CLAY TO CLAY
	SILT
SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCE
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON-PLASTIC
NAVD 88	NORTH AMERICAN VERTICAL DATUM OF 1988
	APPROXIMATE SPT BORING LOCATION
	GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
	CASING
	APPROXIMATE SEDIMENT SAMPLE LOCATION FOR D_{50} DETERMINATION

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
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MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
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SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
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FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

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CHECKED BY:	DAN 06-24

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: REPORT OF CORE BORINGS (2 OF 2)

REF. DWG. NO.:

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

SHEET NO.:

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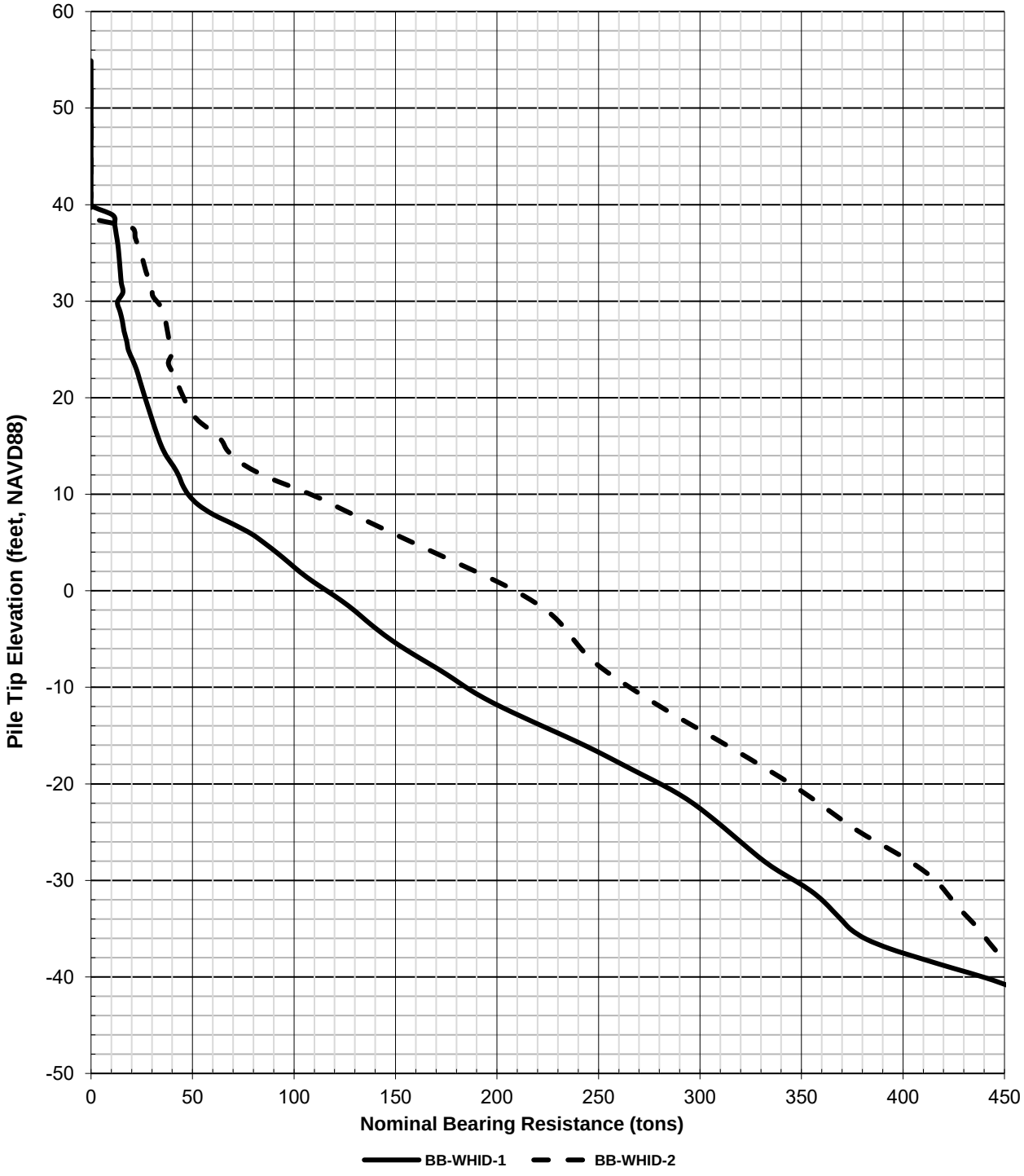
APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

SR 70 over Whidden Creek
18x18 inch Square Concrete Piles



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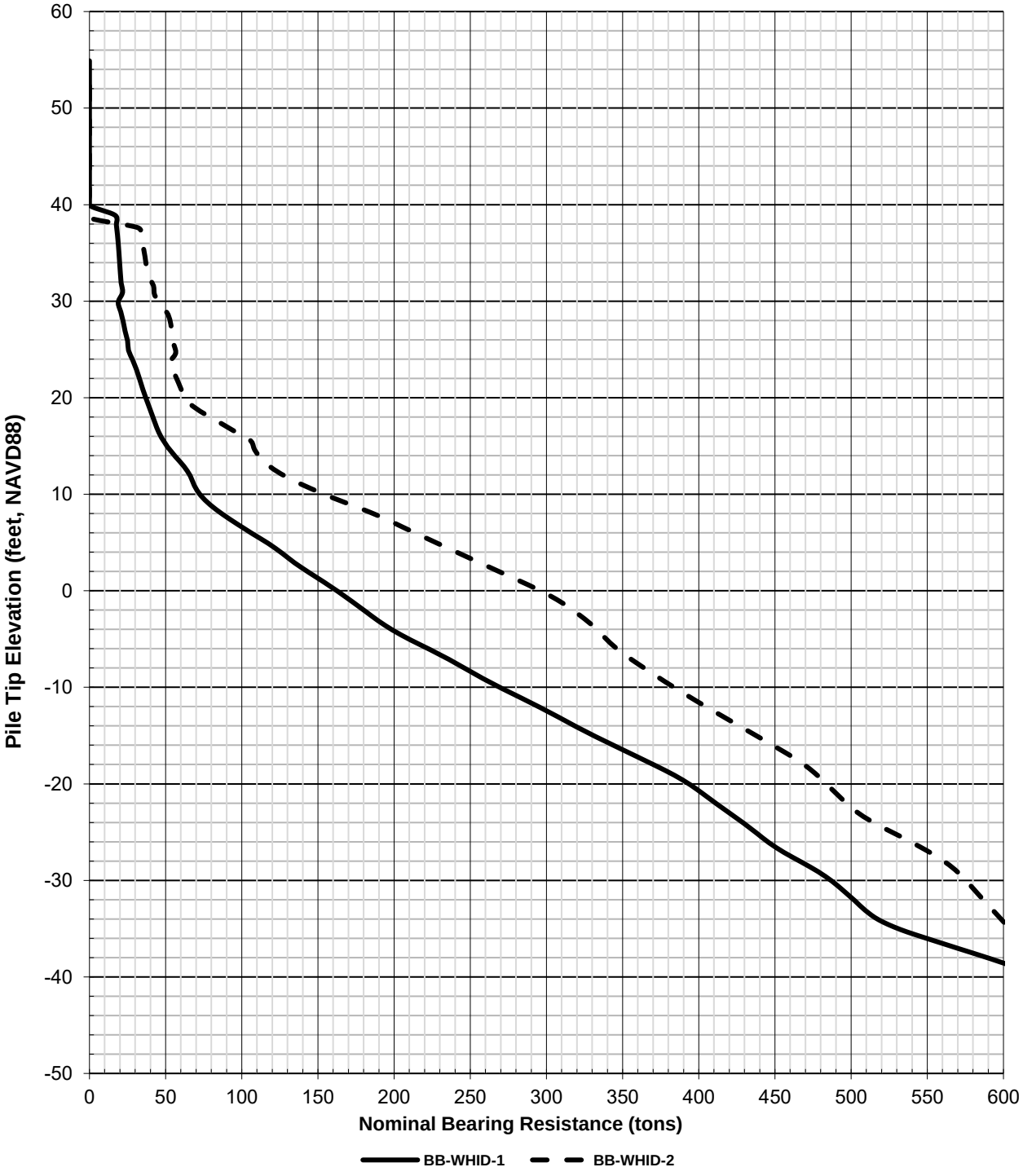
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to Highlands County Line
SR 70 over Whidden Creek
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Whidden Creek
24x24 inch Square Concrete Piles



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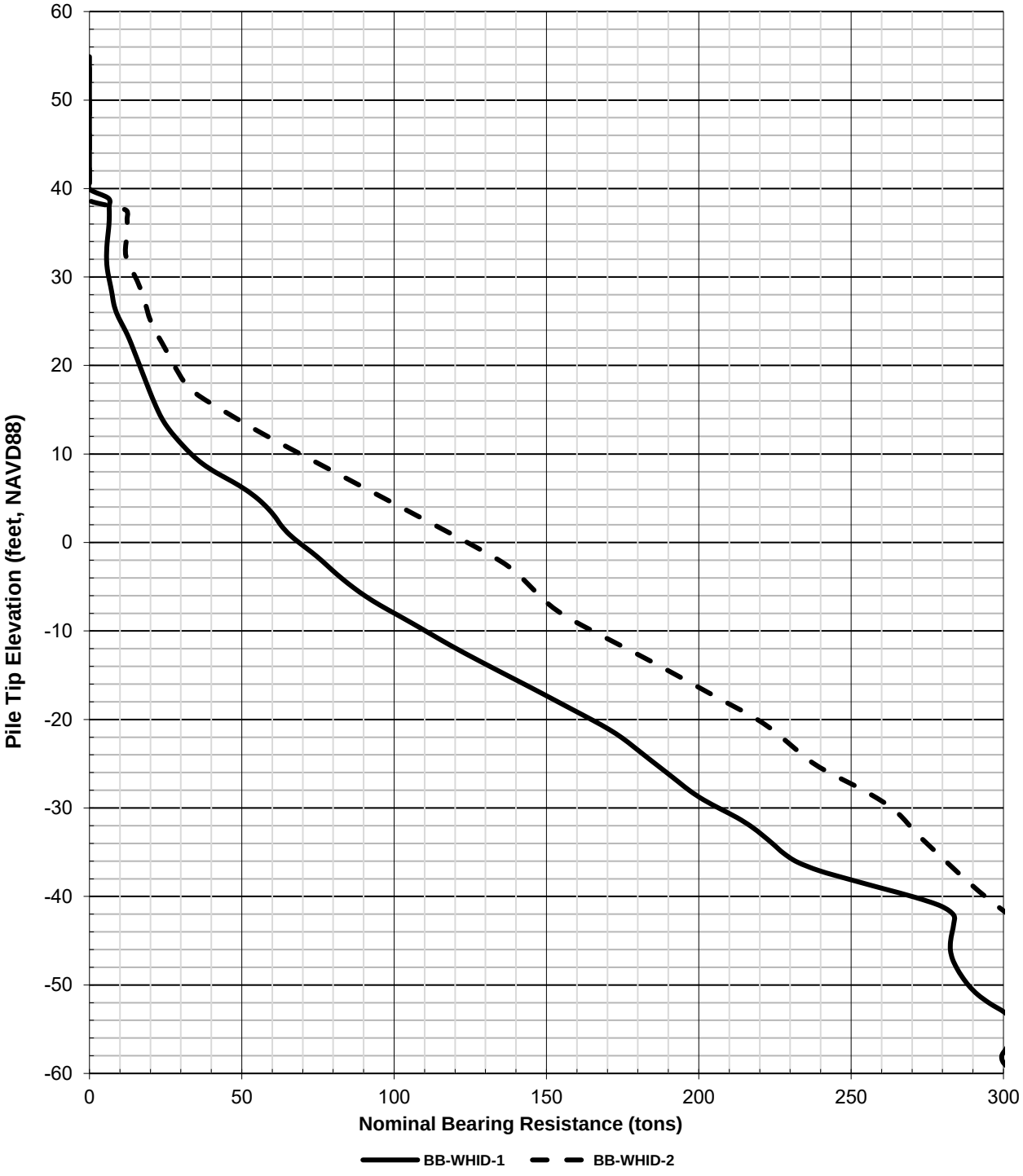
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to Highlands County Line
SR 70 over Whidden Creek
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Whidden Creek
HP 14x89 Steel Piles



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GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	JUN 2024	

SR 70 from West of SR 31 to Highlands County Line
SR 70 over Whidden Creek
DeSoto County, FL
FPID No. 451942-2-52-01

General Information:
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Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc. DN
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 4/9/2024, Boring Number: BB-WHID-1
Station number: Offset:

Ground Elevation: 54.900(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	9.00	5- Cavity layer
6	10.00	8.00	5- Cavity layer
7	12.00	4.00	5- Cavity layer
8	14.00	4.00	5- Cavity layer
9	16.00	7.00	3- Clean sand
10	17.50	5.00	3- Clean sand
11	20.00	7.00	3- Clean sand
12	22.50	3.00	3- Clean sand
13	25.00	4.00	2- Clay and silty sand
14	27.50	3.00	2- Clay and silty sand
15	30.00	6.00	1- Plastic Clay
16	32.50	4.00	1- Plastic Clay
17	35.00	4.00	1- Plastic Clay
18	37.50	3.00	1- Plastic Clay
19	40.00	3.00	1- Plastic Clay

20	42.50	4.00	2- Clay and silty sand
21	45.00	6.00	2- Clay and silty sand
22	47.50	21.00	2- Clay and silty sand
23	50.00	25.00	2- Clay and silty sand
24	52.50	43.00	2- Clay and silty sand
25	55.00	20.00	2- Clay and silty sand
26	57.50	12.00	2- Clay and silty sand
27	60.00	27.00	2- Clay and silty sand
28	62.50	21.00	2- Clay and silty sand
29	65.00	26.00	2- Clay and silty sand
30	67.50	41.00	2- Clay and silty sand
31	70.00	37.00	2- Clay and silty sand
32	72.50	100.00	2- Clay and silty sand
33	75.00	100.00	2- Clay and silty sand
34	77.50	82.00	2- Clay and silty sand
35	80.00	67.00	2- Clay and silty sand
36	82.50	29.00	2- Clay and silty sand
37	85.00	30.00	2- Clay and silty sand
38	87.50	24.00	2- Clay and silty sand
39	90.00	61.00	2- Clay and silty sand
40	92.50	23.00	2- Clay and silty sand
41	95.00	25.00	2- Clay and silty sand
42	97.50	100.00	3- Clean sand
43	100.00	96.00	3- Clean sand
44	102.50	24.00	3- Clean sand
45	105.00	25.00	3- Clean sand
46	107.50	21.00	3- Clean sand
47	110.00	27.00	3- Clean sand
48	112.50	39.00	3- Clean sand
49	115.00	74.00	1- Plastic Clay
50	117.50	100.00	1- Plastic Clay
51	120.00	100.00	1- Plastic Clay

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	54.90	38.90	16.00	4.62	5-Void
2	38.90	29.90	9.00	5.33	3-Clean Sand
3	29.90	24.90	5.00	3.50	2-Clay and Silty Sand
4	24.90	12.40	12.50	4.00	1-Plastic Clay
5	12.40	-42.60	55.00	37.45	2-Clay and Silty Sand
6	-42.60	-60.10	17.50	47.43	3-Clean Sand
7	-60.10	-65.10	5.00	87.00	1-Plastic Clay

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	53.90
18.00	2.00	52.90
18.00	3.00	51.90
18.00	4.00	50.90
18.00	5.00	49.90
18.00	6.00	48.90
18.00	7.00	47.90
18.00	8.00	46.90
18.00	9.00	45.90
18.00	10.00	44.90
18.00	11.00	43.90
18.00	12.00	42.90
18.00	13.00	41.90
18.00	14.00	40.90
18.00	15.00	39.90
18.00	16.00	38.90
18.00	17.00	37.90
18.00	18.00	36.90
18.00	19.00	35.90
18.00	20.00	34.90
18.00	21.00	33.90
18.00	22.00	32.90
18.00	23.00	31.90
18.00	24.00	30.90
18.00	25.00	29.90
18.00	26.00	28.90
18.00	27.00	27.90
18.00	28.00	26.90
18.00	29.00	25.90
18.00	30.00	24.90
18.00	31.00	23.90
18.00	32.00	22.90
18.00	33.00	21.90
18.00	34.00	20.90
18.00	35.00	19.90
18.00	36.00	18.90
18.00	37.00	17.90
18.00	38.00	16.90
18.00	39.00	15.90

18.00	40.00	14.90
18.00	41.00	13.90
18.00	42.00	12.90
18.00	43.00	11.90
18.00	44.00	10.90
18.00	45.00	9.90
18.00	46.00	8.90
18.00	47.00	7.90
18.00	48.00	6.90
18.00	49.00	5.90
18.00	50.00	4.90
18.00	51.00	3.90
18.00	52.00	2.90
18.00	53.00	1.90
18.00	54.00	0.90
18.00	55.00	-0.10
18.00	56.00	-1.10
18.00	57.00	-2.10
18.00	58.00	-3.10
18.00	59.00	-4.10
18.00	60.00	-5.10
18.00	61.00	-6.10
18.00	62.00	-7.10
18.00	63.00	-8.10
18.00	64.00	-9.10
18.00	65.00	-10.10
18.00	66.00	-11.10
18.00	67.00	-12.10
18.00	68.00	-13.10
18.00	69.00	-14.10
18.00	70.00	-15.10
18.00	71.00	-16.10
18.00	72.00	-17.10
18.00	73.00	-18.10
18.00	74.00	-19.10
18.00	75.00	-20.10
18.00	76.00	-21.10
18.00	77.00	-22.10
18.00	78.00	-23.10
18.00	79.00	-24.10
18.00	80.00	-25.10
18.00	81.00	-26.10
18.00	82.00	-27.10
18.00	83.00	-28.10
18.00	84.00	-29.10
18.00	85.00	-30.10
18.00	86.00	-31.10
18.00	87.00	-32.10
18.00	88.00	-33.10
18.00	89.00	-34.10

18.00	90.00	-35.10
18.00	91.00	-36.10
18.00	92.00	-37.10
18.00	93.00	-38.10
18.00	94.00	-39.10
18.00	95.00	-40.10
18.00	96.00	-41.10
18.00	97.00	-42.10
18.00	98.00	-43.10
18.00	99.00	-44.10
18.00	100.00	-45.10
18.00	101.00	-46.10
18.00	102.00	-47.10
18.00	103.00	-48.10
18.00	104.00	-49.10
18.00	105.00	-50.10
18.00	106.00	-51.10
18.00	107.00	-52.10
18.00	108.00	-53.10
18.00	109.00	-54.10
18.00	110.00	-55.10
18.00	111.00	-56.10
18.00	112.00	-57.10
18.00	113.00	-58.10
18.00	114.00	-59.10
18.00	115.00	-60.10
18.00	116.00	-61.10
18.00	117.00	-62.10
18.00	118.00	-63.10
18.00	119.00	-64.10
18.00	120.00	-65.10

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00

2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	0.00	0.00	0.00	0.00
4.00	18.0	0.00	0.00	0.00	0.00	0.00
5.00	18.0	0.00	0.00	0.00	0.00	0.00
6.00	18.0	0.00	0.00	0.00	0.00	0.00
7.00	18.0	0.00	0.00	0.00	0.00	0.00
8.00	18.0	0.00	0.00	0.00	0.00	0.00
9.00	18.0	0.00	0.00	0.00	0.00	0.00
10.00	18.0	0.00	0.00	0.00	0.00	0.00
11.00	18.0	0.00	0.00	0.00	0.00	0.00
12.00	18.0	0.00	0.00	0.00	0.00	0.00
13.00	18.0	0.00	0.00	0.00	0.00	0.00
14.00	18.0	0.00	0.00	0.00	0.00	0.00
15.00	18.0	0.25	0.00	0.25	0.12	0.25
16.00	18.0	0.99	9.80	10.79	5.39	30.38
17.00	18.0	1.87	9.82	11.69	5.84	31.32
18.00	18.0	2.60	9.83	12.44	6.22	32.11
19.00	18.0	3.45	9.75	13.20	6.60	32.71
20.00	18.0	4.38	9.30	13.68	6.84	32.28
21.00	18.0	5.26	8.83	14.09	7.05	31.76
22.00	18.0	5.91	8.57	14.48	7.24	31.61
23.00	18.0	6.41	8.49	14.90	7.45	31.87
24.00	18.0	7.21	8.47	15.68	7.84	32.62
25.00	18.0	8.38	4.66	13.04	6.52	22.35
26.00	18.0	9.61	4.71	14.32	7.16	23.73
27.00	18.0	10.85	4.61	15.46	7.73	24.67
28.00	18.0	11.96	4.28	16.25	8.12	24.82
29.00	18.0	13.50	4.02	17.52	8.76	25.57
30.00	18.0	15.53	2.91	18.45	9.22	24.27
31.00	18.0	17.53	3.00	20.53	10.26	26.52
32.00	18.0	19.50	2.93	22.43	11.22	28.29
33.00	18.0	21.12	2.75	23.87	11.94	29.38
34.00	18.0	22.68	2.62	25.30	12.65	30.55
35.00	18.0	24.24	2.52	26.77	13.38	31.81
36.00	18.0	25.73	2.55	28.28	14.14	33.38
37.00	18.0	27.06	2.75	29.81	14.90	35.30
38.00	18.0	28.27	3.10	31.37	15.68	37.57
39.00	18.0	29.45	3.59	33.03	16.52	40.21
40.00	18.0	30.63	4.21	34.85	17.42	43.27
41.00	18.0	31.85	5.45	37.30	18.65	48.20
42.00	18.0	33.15	7.45	40.59	20.30	55.49
43.00	18.0	34.44	8.80	43.24	21.62	60.84
44.00	18.0	35.50	9.70	45.20	22.60	64.61
45.00	18.0	36.54	11.61	48.14	24.07	71.36
46.00	18.0	38.07	14.81	52.88	26.44	82.49
47.00	18.0	40.63	19.57	60.20	30.10	99.34
48.00	18.0	44.40	25.62	70.02	35.01	121.27
49.00	18.0	49.26	29.73	78.99	39.49	138.45
50.00	18.0	54.76	30.91	85.67	42.83	147.48
51.00	18.0	60.77	31.04	91.81	45.91	153.89

52.00	18.0	67.40	30.15	97.55	48.77	157.84
53.00	18.0	74.48	28.72	103.21	51.60	160.65
54.00	18.0	81.06	28.61	109.67	54.83	166.88
55.00	18.0	86.90	29.98	116.88	58.44	176.84
56.00	18.0	92.06	31.78	123.84	61.92	187.41
57.00	18.0	96.59	33.46	130.05	65.02	196.96
58.00	18.0	100.69	34.92	135.61	67.80	205.44
59.00	18.0	105.60	35.88	141.49	70.74	213.25
60.00	18.0	111.58	36.33	147.91	73.96	220.58
61.00	18.0	117.92	37.20	155.12	77.56	229.51
62.00	18.0	123.93	39.00	162.94	81.47	240.95
63.00	18.0	129.68	41.23	170.92	85.46	253.38
64.00	18.0	135.66	42.71	178.37	89.18	263.78
65.00	18.0	141.95	43.50	185.45	92.73	272.46
66.00	18.0	148.64	44.82	193.46	96.73	283.11
67.00	18.0	155.82	46.88	202.70	101.35	296.46
68.00	18.0	163.43	49.38	212.81	106.41	311.58
69.00	18.0	171.06	52.16	223.21	111.61	327.53
70.00	18.0	178.63	55.19	233.82	116.91	344.19
71.00	18.0	186.22	57.80	244.01	122.01	359.61
72.00	18.0	193.87	59.67	253.54	126.77	372.88
73.00	18.0	201.58	61.12	262.69	131.35	384.93
74.00	18.0	209.30	62.67	271.97	135.98	397.30
75.00	18.0	217.03	64.30	281.33	140.67	409.92
76.00	18.0	224.77	65.05	289.82	144.91	419.91
77.00	18.0	232.52	64.57	297.09	148.55	426.24
78.00	18.0	240.27	63.08	303.35	151.68	429.51
79.00	18.0	248.03	61.23	309.26	154.63	431.73
80.00	18.0	255.80	59.12	314.91	157.46	433.15
81.00	18.0	263.40	57.12	320.52	160.26	434.76
82.00	18.0	270.67	55.50	326.17	163.09	437.18
83.00	18.0	277.65	54.48	332.13	166.07	441.08
84.00	18.0	284.64	54.54	339.18	169.59	448.27
85.00	18.0	291.67	55.63	347.30	173.65	458.56
86.00	18.0	298.57	56.11	354.68	177.34	466.90
87.00	18.0	305.15	55.34	360.49	180.25	471.18
88.00	18.0	311.52	53.65	365.17	182.58	472.46
89.00	18.0	318.39	51.36	369.75	184.87	472.46
90.00	18.0	325.88	48.53	374.40	187.20	471.46
91.00	18.0	333.33	48.67	382.00	191.00	479.34
92.00	18.0	340.11	53.69	393.80	196.90	501.17
93.00	18.0	346.31	62.57	408.88	204.44	534.03
94.00	18.0	352.54	72.11	424.65	212.32	568.87
95.00	18.0	358.89	81.92	440.80	220.40	604.64
96.00	18.0	365.38	88.60	453.98	226.99	631.18
97.00	18.0	372.04	90.20	462.24	231.12	642.64
98.00	18.0	392.34	87.91	480.25	240.13	656.07
99.00	18.0	399.18	85.50	484.68	242.34	655.68
100.00	18.0	406.02	83.24	489.27	244.63	655.75

Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	18.0	412.17	80.96	493.13	246.57	655.05
102.00	18.0	416.95	79.17	496.12	248.06	654.46
103.00	18.0	420.52	78.62	499.13	249.57	656.37
104.00	18.0	423.97	79.47	503.44	251.72	662.39
105.00	18.0	427.47	81.51	508.98	254.49	672.01
106.00	18.0	430.89	84.85	515.74	257.87	685.45
107.00	18.0	433.89	89.50	523.38	261.69	702.38
108.00	18.0	435.39	92.00	527.39	263.69	711.39
109.00	18.0	438.98	91.68	530.66	265.33	714.01
110.00	18.0	444.08	87.09	531.17	265.58	705.34
111.00	18.0	448.24	79.40	527.64	263.82	686.43
112.00	18.0	453.07	70.95	524.02	262.01	665.91
113.00	18.0	458.67	62.65	521.33	260.66	646.64
114.00	18.0	465.58	57.06	522.64	261.32	636.77
115.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
116.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
117.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
118.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
119.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
120.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....& 10\FBDeep\WHID Bridge\18-Inch PPSC\BB-WHID-2_18-inch PPSC.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc. DN
Units: English

Analysis Information:
==========
Analysis Type: SPT

Soil Information:
==========
Boring date: , Boring Number: BB-WHID-2
Station number: Offset:

Ground Elevation: 53.600(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	19.00	5- Cavity layer
6	10.00	21.00	5- Cavity layer
7	12.00	15.00	5- Cavity layer
8	14.00	14.00	5- Cavity layer
9	16.00	11.00	3- Clean sand
10	17.50	12.00	3- Clean sand
11	20.00	12.00	3- Clean sand
12	22.50	14.00	2- Clay and silty sand
13	25.00	8.00	2- Clay and silty sand
14	27.50	5.00	2- Clay and silty sand
15	30.00	6.00	1- Plastic Clay
16	32.50	5.00	1- Plastic Clay
17	35.00	6.00	1- Plastic Clay
18	37.50	3.00	2- Clay and silty sand
19	40.00	3.00	2- Clay and silty sand

20	42.50	61.00	2- Clay and silty sand
21	45.00	100.00	2- Clay and silty sand
22	47.50	100.00	2- Clay and silty sand
23	50.00	100.00	2- Clay and silty sand
24	52.50	100.00	2- Clay and silty sand
25	55.00	53.00	2- Clay and silty sand
26	57.50	100.00	2- Clay and silty sand
27	60.00	100.00	2- Clay and silty sand
28	62.50	20.00	2- Clay and silty sand
29	65.00	22.00	2- Clay and silty sand
30	67.50	42.00	2- Clay and silty sand
31	70.00	45.00	2- Clay and silty sand
32	72.50	100.00	2- Clay and silty sand
33	75.00	100.00	2- Clay and silty sand
34	77.50	54.00	2- Clay and silty sand
35	80.00	28.00	2- Clay and silty sand
36	82.50	28.00	2- Clay and silty sand
37	85.00	55.00	2- Clay and silty sand
38	87.50	36.00	2- Clay and silty sand
39	90.00	18.00	2- Clay and silty sand
40	92.50	21.00	2- Clay and silty sand
41	95.00	18.00	2- Clay and silty sand
42	97.50	20.00	2- Clay and silty sand
43	100.00	27.00	2- Clay and silty sand
44	102.50	21.00	2- Clay and silty sand
45	105.00	20.00	2- Clay and silty sand
46	107.50	39.00	2- Clay and silty sand
47	110.00	27.00	2- Clay and silty sand
48	112.50	48.00	2- Clay and silty sand
49	115.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	53.60	37.60	16.00	10.12	5-Void
2	37.60	31.10	6.50	11.77	3-Clean Sand
3	31.10	23.60	7.50	9.00	2-Clay and Silty Sand
4	23.60	16.10	7.50	5.67	1-Plastic Clay
5	16.10	-61.40	77.50	48.68	2-Clay and Silty Sand

Driven Pile Data:
==========

Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	52.60
18.00	2.00	51.60
18.00	3.00	50.60
18.00	4.00	49.60
18.00	5.00	48.60
18.00	6.00	47.60
18.00	7.00	46.60
18.00	8.00	45.60
18.00	9.00	44.60
18.00	10.00	43.60
18.00	11.00	42.60
18.00	12.00	41.60
18.00	13.00	40.60
18.00	14.00	39.60
18.00	15.00	38.60
18.00	16.00	37.60
18.00	17.00	36.60
18.00	18.00	35.60
18.00	19.00	34.60
18.00	20.00	33.60
18.00	21.00	32.60
18.00	22.00	31.60
18.00	23.00	30.60
18.00	24.00	29.60
18.00	25.00	28.60
18.00	26.00	27.60
18.00	27.00	26.60
18.00	28.00	25.60
18.00	29.00	24.60
18.00	30.00	23.60
18.00	31.00	22.60
18.00	32.00	21.60
18.00	33.00	20.60
18.00	34.00	19.60
18.00	35.00	18.60
18.00	36.00	17.60
18.00	37.00	16.60
18.00	38.00	15.60
18.00	39.00	14.60
18.00	40.00	13.60
18.00	41.00	12.60
18.00	42.00	11.60
18.00	43.00	10.60

18.00	44.00	9.60
18.00	45.00	8.60
18.00	46.00	7.60
18.00	47.00	6.60
18.00	48.00	5.60
18.00	49.00	4.60
18.00	50.00	3.60
18.00	51.00	2.60
18.00	52.00	1.60
18.00	53.00	0.60
18.00	54.00	-0.40
18.00	55.00	-1.40
18.00	56.00	-2.40
18.00	57.00	-3.40
18.00	58.00	-4.40
18.00	59.00	-5.40
18.00	60.00	-6.40
18.00	61.00	-7.40
18.00	62.00	-8.40
18.00	63.00	-9.40
18.00	64.00	-10.40
18.00	65.00	-11.40
18.00	66.00	-12.40
18.00	67.00	-13.40
18.00	68.00	-14.40
18.00	69.00	-15.40
18.00	70.00	-16.40
18.00	71.00	-17.40
18.00	72.00	-18.40
18.00	73.00	-19.40
18.00	74.00	-20.40
18.00	75.00	-21.40
18.00	76.00	-22.40
18.00	77.00	-23.40
18.00	78.00	-24.40
18.00	79.00	-25.40
18.00	80.00	-26.40
18.00	81.00	-27.40
18.00	82.00	-28.40
18.00	83.00	-29.40
18.00	84.00	-30.40
18.00	85.00	-31.40
18.00	86.00	-32.40
18.00	87.00	-33.40
18.00	88.00	-34.40
18.00	89.00	-35.40
18.00	90.00	-36.40
18.00	91.00	-37.40
18.00	92.00	-38.40
18.00	93.00	-39.40

18.00	94.00	-40.40
18.00	95.00	-41.40
18.00	96.00	-42.40
18.00	97.00	-43.40
18.00	98.00	-44.40
18.00	99.00	-45.40
18.00	100.00	-46.40
18.00	101.00	-47.40
18.00	102.00	-48.40
18.00	103.00	-49.40
18.00	104.00	-50.40
18.00	105.00	-51.40
18.00	106.00	-52.40
18.00	107.00	-53.40
18.00	108.00	-54.40
18.00	109.00	-55.40
18.00	110.00	-56.40
18.00	111.00	-57.40
18.00	112.00	-58.40
18.00	113.00	-59.40
18.00	114.00	-60.40
18.00	115.00	-61.40

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	0.00	0.00	0.00	0.00
4.00	18.0	0.00	0.00	0.00	0.00	0.00
5.00	18.0	0.00	0.00	0.00	0.00	0.00
6.00	18.0	0.00	0.00	0.00	0.00	0.00
7.00	18.0	0.00	0.00	0.00	0.00	0.00
8.00	18.0	0.00	0.00	0.00	0.00	0.00
9.00	18.0	0.00	0.00	0.00	0.00	0.00
10.00	18.0	0.00	0.00	0.00	0.00	0.00

11.00	18.0	0.00	0.00	0.00	0.00	0.00
12.00	18.0	0.00	0.00	0.00	0.00	0.00
13.00	18.0	0.00	0.00	0.00	0.00	0.00
14.00	18.0	0.00	0.00	0.00	0.00	0.00
15.00	18.0	0.39	0.00	0.39	0.19	0.39
16.00	18.0	1.55	18.56	20.12	10.06	57.25
17.00	18.0	3.11	18.61	21.72	10.86	58.94
18.00	18.0	4.75	18.65	23.40	11.70	60.71
19.00	18.0	6.48	18.62	25.10	12.55	62.34
20.00	18.0	8.23	18.13	26.36	13.18	62.62
21.00	18.0	10.43	17.38	27.82	13.91	62.58
22.00	18.0	13.64	16.78	30.42	15.21	63.99
23.00	18.0	17.28	12.99	30.27	15.13	56.26
24.00	18.0	20.86	12.99	33.85	16.93	59.83
25.00	18.0	24.13	11.93	36.06	18.03	59.92
26.00	18.0	26.55	10.47	37.02	18.51	57.95
27.00	18.0	28.60	9.30	37.89	18.95	56.48
28.00	18.0	30.36	8.35	38.70	19.35	55.39
29.00	18.0	32.28	7.62	39.90	19.95	55.13
30.00	18.0	34.45	3.60	38.05	19.02	45.24
31.00	18.0	36.60	3.64	40.24	20.12	47.51
32.00	18.0	38.64	3.68	42.32	21.16	49.68
33.00	18.0	40.55	3.78	44.33	22.16	51.88
34.00	18.0	42.62	3.87	46.48	23.24	54.22
35.00	18.0	44.83	4.04	48.87	24.43	56.94
36.00	18.0	46.87	6.04	52.91	26.46	65.00
37.00	18.0	48.41	10.61	59.02	29.51	80.24
38.00	18.0	49.56	14.68	64.24	32.12	93.60
39.00	18.0	50.15	16.75	66.90	33.45	100.41
40.00	18.0	50.65	20.93	71.59	35.79	113.45
41.00	18.0	52.01	26.83	78.84	39.42	132.50
42.00	18.0	55.21	33.57	88.77	44.39	155.91
43.00	18.0	60.42	40.59	101.01	50.50	182.19
44.00	18.0	66.67	45.83	112.50	56.25	204.15
45.00	18.0	73.46	48.69	122.15	61.08	219.53
46.00	18.0	80.51	51.54	132.05	66.02	235.13
47.00	18.0	87.72	54.38	142.10	71.05	250.87
48.00	18.0	95.06	57.22	152.27	76.14	266.70
49.00	18.0	102.48	60.04	162.52	81.26	282.60
50.00	18.0	109.98	62.85	172.83	86.41	298.54
51.00	18.0	117.52	65.67	183.19	91.60	314.53
52.00	18.0	125.11	68.48	193.60	96.80	330.56
53.00	18.0	132.74	70.73	203.47	101.74	344.94
54.00	18.0	140.39	71.86	212.25	106.12	355.97
55.00	18.0	148.06	71.95	220.01	110.01	363.91
56.00	18.0	155.76	70.74	226.50	113.25	367.99
57.00	18.0	163.47	67.93	231.40	115.70	367.25
58.00	18.0	171.20	63.99	235.18	117.59	363.15
59.00	18.0	178.93	60.11	239.04	119.52	359.25
60.00	18.0	186.68	56.37	243.05	121.52	355.79

61.00	18.0	194.01	53.93	247.94	123.97	355.81
62.00	18.0	200.50	53.53	254.03	127.02	361.10
63.00	18.0	206.25	54.78	261.03	130.52	370.60
64.00	18.0	212.01	56.29	268.30	134.15	380.88
65.00	18.0	217.90	57.90	275.81	137.90	391.61
66.00	18.0	224.23	59.35	283.58	141.79	402.29
67.00	18.0	231.30	60.36	291.65	145.83	412.36
68.00	18.0	239.02	60.93	299.95	149.97	421.80
69.00	18.0	246.85	61.34	308.19	154.09	430.87
70.00	18.0	254.69	61.66	316.34	158.17	439.66
71.00	18.0	262.52	61.87	324.40	162.20	448.14
72.00	18.0	270.34	61.98	332.32	166.16	456.28
73.00	18.0	278.14	62.02	340.16	170.08	464.20
74.00	18.0	285.93	61.63	347.57	173.78	470.83
75.00	18.0	293.74	60.74	354.47	177.24	475.94
76.00	18.0	301.54	59.56	361.10	180.55	480.21
77.00	18.0	309.35	58.33	367.67	183.84	484.33
78.00	18.0	317.11	57.23	374.34	187.17	488.81
79.00	18.0	324.53	57.33	381.86	190.93	496.53
80.00	18.0	331.58	58.73	390.31	195.15	507.77
81.00	18.0	338.43	60.15	398.58	199.29	518.88
82.00	18.0	345.27	60.80	406.07	203.04	527.66
83.00	18.0	352.17	60.49	412.66	206.33	533.63
84.00	18.0	359.41	58.52	417.92	208.96	534.95
85.00	18.0	367.03	54.84	421.87	210.93	531.54
86.00	18.0	374.81	50.86	425.66	212.83	527.38
87.00	18.0	382.50	47.44	429.94	214.97	524.82
88.00	18.0	390.01	44.52	434.52	217.26	523.55
89.00	18.0	396.66	41.98	438.64	219.32	522.61
90.00	18.0	402.34	39.93	442.26	221.13	522.12
91.00	18.0	407.65	38.59	446.23	223.12	523.40
92.00	18.0	413.19	37.77	450.95	225.48	526.49
93.00	18.0	418.90	37.32	456.22	228.11	530.87
94.00	18.0	424.43	37.34	461.77	230.89	536.45
95.00	18.0	429.73	37.76	467.50	233.75	543.02
96.00	18.0	435.00	37.62	472.62	236.31	547.87
97.00	18.0	440.42	36.58	476.99	238.50	550.15
98.00	18.0	446.03	35.09	481.12	240.56	551.29
99.00	18.0	452.06	33.64	485.69	242.85	552.97
100.00	18.0	458.54	32.27	490.80	245.40	555.33

Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length	Pile Width	Ultimate Side Friction	Mobilized End Bearing	Estimated Davisson Capacity	Allowable Pile Capacity	Ultimate Pile Capacity

(ft)	(in)	(tons)	(tons)	(tons)	(tons)	(tons)
101.00	18.0	465.06	32.07	497.12	248.56	561.25
102.00	18.0	471.20	33.58	504.78	252.39	571.93
103.00	18.0	476.99	36.03	513.02	256.51	585.09
104.00	18.0	482.67	37.84	520.51	260.26	596.19
105.00	18.0	488.28	39.00	527.28	263.64	605.28
106.00	18.0	494.28	40.60	534.88	267.44	616.07
107.00	18.0	501.17	42.85	544.02	272.01	629.72
108.00	18.0	508.78	45.50	554.28	277.14	645.27
109.00	18.0	516.13	48.41	564.54	282.27	661.36
110.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
111.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
112.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
113.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
114.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
115.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....& 10\FBDeep\WHID Bridge\24-Inch PPSC\BB-WHID-1_24-inch PPSC.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc. DN
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 4/9/2024, Boring Number: BB-WHID-1
Station number: Offset:

Ground Elevation: 54.900(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	9.00	5- Cavity layer
6	10.00	8.00	5- Cavity layer
7	12.00	4.00	5- Cavity layer
8	14.00	4.00	5- Cavity layer
9	16.00	7.00	3- Clean sand
10	17.50	5.00	3- Clean sand
11	20.00	7.00	3- Clean sand
12	22.50	3.00	3- Clean sand
13	25.00	4.00	2- Clay and silty sand
14	27.50	3.00	2- Clay and silty sand
15	30.00	6.00	1- Plastic Clay
16	32.50	4.00	1- Plastic Clay
17	35.00	4.00	1- Plastic Clay
18	37.50	3.00	1- Plastic Clay
19	40.00	3.00	1- Plastic Clay

20	42.50	4.00	2- Clay and silty sand
21	45.00	6.00	2- Clay and silty sand
22	47.50	21.00	2- Clay and silty sand
23	50.00	25.00	2- Clay and silty sand
24	52.50	43.00	2- Clay and silty sand
25	55.00	20.00	2- Clay and silty sand
26	57.50	12.00	2- Clay and silty sand
27	60.00	27.00	2- Clay and silty sand
28	62.50	21.00	2- Clay and silty sand
29	65.00	26.00	2- Clay and silty sand
30	67.50	41.00	2- Clay and silty sand
31	70.00	37.00	2- Clay and silty sand
32	72.50	100.00	2- Clay and silty sand
33	75.00	100.00	2- Clay and silty sand
34	77.50	82.00	2- Clay and silty sand
35	80.00	67.00	2- Clay and silty sand
36	82.50	29.00	2- Clay and silty sand
37	85.00	30.00	2- Clay and silty sand
38	87.50	24.00	2- Clay and silty sand
39	90.00	61.00	2- Clay and silty sand
40	92.50	23.00	2- Clay and silty sand
41	95.00	25.00	2- Clay and silty sand
42	97.50	100.00	3- Clean sand
43	100.00	96.00	3- Clean sand
44	102.50	24.00	3- Clean sand
45	105.00	25.00	3- Clean sand
46	107.50	21.00	3- Clean sand
47	110.00	27.00	3- Clean sand
48	112.50	39.00	3- Clean sand
49	115.00	74.00	1- Plastic Clay
50	117.50	100.00	1- Plastic Clay
51	120.00	100.00	1- Plastic Clay

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	54.90	38.90	16.00	4.62	5-Void
2	38.90	29.90	9.00	5.33	3-Clean Sand
3	29.90	24.90	5.00	3.50	2-Clay and Silty Sand
4	24.90	12.40	12.50	4.00	1-Plastic Clay
5	12.40	-42.60	55.00	37.45	2-Clay and Silty Sand
6	-42.60	-60.10	17.50	47.43	3-Clean Sand
7	-60.10	-65.10	5.00	87.00	1-Plastic Clay

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
24.00	1.00	53.90
24.00	2.00	52.90
24.00	3.00	51.90
24.00	4.00	50.90
24.00	5.00	49.90
24.00	6.00	48.90
24.00	7.00	47.90
24.00	8.00	46.90
24.00	9.00	45.90
24.00	10.00	44.90
24.00	11.00	43.90
24.00	12.00	42.90
24.00	13.00	41.90
24.00	14.00	40.90
24.00	15.00	39.90
24.00	16.00	38.90
24.00	17.00	37.90
24.00	18.00	36.90
24.00	19.00	35.90
24.00	20.00	34.90
24.00	21.00	33.90
24.00	22.00	32.90
24.00	23.00	31.90
24.00	24.00	30.90
24.00	25.00	29.90
24.00	26.00	28.90
24.00	27.00	27.90
24.00	28.00	26.90
24.00	29.00	25.90
24.00	30.00	24.90
24.00	31.00	23.90
24.00	32.00	22.90
24.00	33.00	21.90
24.00	34.00	20.90
24.00	35.00	19.90
24.00	36.00	18.90
24.00	37.00	17.90
24.00	38.00	16.90
24.00	39.00	15.90

24.00	40.00	14.90
24.00	41.00	13.90
24.00	42.00	12.90
24.00	43.00	11.90
24.00	44.00	10.90
24.00	45.00	9.90
24.00	46.00	8.90
24.00	47.00	7.90
24.00	48.00	6.90
24.00	49.00	5.90
24.00	50.00	4.90
24.00	51.00	3.90
24.00	52.00	2.90
24.00	53.00	1.90
24.00	54.00	0.90
24.00	55.00	-0.10
24.00	56.00	-1.10
24.00	57.00	-2.10
24.00	58.00	-3.10
24.00	59.00	-4.10
24.00	60.00	-5.10
24.00	61.00	-6.10
24.00	62.00	-7.10
24.00	63.00	-8.10
24.00	64.00	-9.10
24.00	65.00	-10.10
24.00	66.00	-11.10
24.00	67.00	-12.10
24.00	68.00	-13.10
24.00	69.00	-14.10
24.00	70.00	-15.10
24.00	71.00	-16.10
24.00	72.00	-17.10
24.00	73.00	-18.10
24.00	74.00	-19.10
24.00	75.00	-20.10
24.00	76.00	-21.10
24.00	77.00	-22.10
24.00	78.00	-23.10
24.00	79.00	-24.10
24.00	80.00	-25.10
24.00	81.00	-26.10
24.00	82.00	-27.10
24.00	83.00	-28.10
24.00	84.00	-29.10
24.00	85.00	-30.10
24.00	86.00	-31.10
24.00	87.00	-32.10
24.00	88.00	-33.10
24.00	89.00	-34.10

24.00	90.00	-35.10
24.00	91.00	-36.10
24.00	92.00	-37.10
24.00	93.00	-38.10
24.00	94.00	-39.10
24.00	95.00	-40.10
24.00	96.00	-41.10
24.00	97.00	-42.10
24.00	98.00	-43.10
24.00	99.00	-44.10
24.00	100.00	-45.10
24.00	101.00	-46.10
24.00	102.00	-47.10
24.00	103.00	-48.10
24.00	104.00	-49.10
24.00	105.00	-50.10
24.00	106.00	-51.10
24.00	107.00	-52.10
24.00	108.00	-53.10
24.00	109.00	-54.10
24.00	110.00	-55.10
24.00	111.00	-56.10
24.00	112.00	-57.10
24.00	113.00	-58.10
24.00	114.00	-59.10
24.00	115.00	-60.10
24.00	116.00	-61.10
24.00	117.00	-62.10
24.00	118.00	-63.10
24.00	119.00	-64.10
24.00	120.00	-65.10

Driven Pile Capacity:
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Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	24.0	0.00	0.00	0.00	0.00	0.00

2.00	24.0	0.00	0.00	0.00	0.00	0.00
3.00	24.0	0.00	0.00	0.00	0.00	0.00
4.00	24.0	0.00	0.00	0.00	0.00	0.00
5.00	24.0	0.00	0.00	0.00	0.00	0.00
6.00	24.0	0.00	0.00	0.00	0.00	0.00
7.00	24.0	0.00	0.00	0.00	0.00	0.00
8.00	24.0	0.00	0.00	0.00	0.00	0.00
9.00	24.0	0.00	0.00	0.00	0.00	0.00
10.00	24.0	0.00	0.00	0.00	0.00	0.00
11.00	24.0	0.00	0.00	0.00	0.00	0.00
12.00	24.0	0.00	0.00	0.00	0.00	0.00
13.00	24.0	0.00	0.00	0.00	0.00	0.00
14.00	24.0	0.00	0.00	0.00	0.00	0.00
15.00	24.0	0.33	0.00	0.33	0.16	0.33
16.00	24.0	1.32	15.50	16.82	8.41	47.82
17.00	24.0	2.51	15.14	17.65	8.82	47.92
18.00	24.0	3.51	14.85	18.35	9.18	48.05
19.00	24.0	4.60	14.33	18.93	9.47	47.60
20.00	24.0	5.84	13.57	19.41	9.71	46.56
21.00	24.0	7.01	12.83	19.84	9.92	45.49
22.00	24.0	7.88	12.39	20.27	10.13	45.04
23.00	24.0	8.54	12.23	20.77	10.39	45.23
24.00	24.0	9.61	12.14	21.75	10.87	46.02
25.00	24.0	11.18	7.68	18.86	9.43	34.23
26.00	24.0	12.76	7.78	20.54	10.27	36.11
27.00	24.0	14.38	7.74	22.12	11.06	37.60
28.00	24.0	15.95	7.42	23.37	11.69	38.21
29.00	24.0	18.00	7.01	25.01	12.50	39.03
30.00	24.0	20.71	4.91	25.62	12.81	35.44
31.00	24.0	23.30	5.05	28.36	14.18	38.47
32.00	24.0	25.88	5.01	30.89	15.44	40.90
33.00	24.0	28.16	4.80	32.96	16.48	42.57
34.00	24.0	30.24	4.70	34.94	17.47	44.34
35.00	24.0	32.32	4.85	37.17	18.59	46.87
36.00	24.0	34.30	5.22	39.52	19.76	49.96
37.00	24.0	36.08	5.76	41.84	20.92	53.37
38.00	24.0	37.69	6.48	44.17	22.08	57.13
39.00	24.0	39.27	7.86	47.13	23.56	62.86
40.00	24.0	40.84	10.39	51.24	25.62	72.03
41.00	24.0	42.47	13.93	56.40	28.20	84.25
42.00	24.0	44.19	17.78	61.97	30.99	97.53
43.00	24.0	45.96	20.20	66.16	33.08	106.56
44.00	24.0	47.50	21.31	68.82	34.41	111.45
45.00	24.0	48.88	24.00	72.87	36.44	120.86
46.00	24.0	50.82	28.43	79.26	39.63	136.12
47.00	24.0	54.20	33.40	87.60	43.80	154.40
48.00	24.0	59.16	37.94	97.10	48.55	172.99
49.00	24.0	65.11	41.95	107.05	53.53	190.95
50.00	24.0	71.99	45.46	117.44	58.72	208.35
51.00	24.0	79.92	46.45	126.37	63.19	219.27

52.00	24.0	88.68	45.91	134.58	67.29	226.40
53.00	24.0	98.04	45.97	144.01	72.00	235.94
54.00	24.0	106.76	47.14	153.90	76.95	248.18
55.00	24.0	114.53	48.84	163.37	81.68	261.04
56.00	24.0	121.40	50.84	172.25	86.12	273.94
57.00	24.0	127.46	53.42	180.88	90.44	287.73
58.00	24.0	132.94	56.51	189.45	94.72	302.46
59.00	24.0	139.50	59.74	199.24	99.62	318.73
60.00	24.0	147.44	63.41	210.86	105.43	337.68
61.00	24.0	155.88	67.77	223.66	111.83	359.20
62.00	24.0	163.89	71.99	235.87	117.94	379.85
63.00	24.0	171.54	75.60	247.14	123.57	398.34
64.00	24.0	179.50	78.89	258.39	129.19	416.16
65.00	24.0	187.88	82.64	270.52	135.26	435.80
66.00	24.0	196.78	86.59	283.37	141.69	456.56
67.00	24.0	206.33	89.65	295.98	147.99	475.29
68.00	24.0	216.45	91.58	308.03	154.02	491.19
69.00	24.0	226.60	93.15	319.75	159.87	506.05
70.00	24.0	236.68	95.48	332.16	166.08	523.12
71.00	24.0	246.77	98.42	345.19	172.59	542.02
72.00	24.0	256.95	101.38	358.33	179.17	561.09
73.00	24.0	267.22	104.18	371.40	185.70	579.76
74.00	24.0	277.50	106.36	383.86	191.93	596.59
75.00	24.0	287.80	106.68	394.47	197.24	607.83
76.00	24.0	298.10	105.22	403.32	201.66	613.77
77.00	24.0	308.42	103.50	411.92	205.96	618.92
78.00	24.0	318.74	102.06	420.80	210.40	624.91
79.00	24.0	329.08	100.57	429.65	214.82	630.79
80.00	24.0	339.42	98.52	437.93	218.97	634.97
81.00	24.0	349.54	96.54	446.08	223.04	639.17
82.00	24.0	359.23	96.62	455.84	227.92	649.08
83.00	24.0	368.54	98.75	467.29	233.65	664.80
84.00	24.0	377.85	100.50	478.35	239.17	679.35
85.00	24.0	387.22	100.34	487.56	243.78	688.24
86.00	24.0	396.41	98.76	495.17	247.59	692.69
87.00	24.0	405.18	97.20	502.39	251.19	696.79
88.00	24.0	413.68	95.52	509.20	254.60	700.23
89.00	24.0	422.84	95.41	518.25	259.13	709.08
90.00	24.0	432.81	99.65	532.46	266.23	731.76
91.00	24.0	442.75	108.65	551.40	275.70	768.71
92.00	24.0	451.78	119.41	571.20	285.60	810.03
93.00	24.0	460.05	131.11	591.16	295.58	853.38
94.00	24.0	468.35	141.02	609.38	304.69	891.42
95.00	24.0	476.82	147.16	623.99	311.99	918.31
96.00	24.0	485.48	148.53	634.01	317.01	931.08
97.00	24.0	494.36	146.84	641.20	320.60	934.88
98.00	24.0	523.12	143.27	666.39	333.20	952.93
99.00	24.0	532.24	139.65	671.89	335.95	951.18
100.00	24.0	541.36	135.47	676.83	338.42	947.78

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	24.0	549.57	131.88	681.45	340.72	945.21
102.00	24.0	555.93	131.17	687.10	343.55	949.44
103.00	24.0	560.69	133.37	694.06	347.03	960.79
104.00	24.0	565.29	137.18	702.47	351.23	976.83
105.00	24.0	569.96	142.04	712.01	356.00	996.09
106.00	24.0	573.86	145.90	719.76	359.88	1011.56
107.00	24.0	577.43	146.80	724.23	362.12	1017.84
108.00	24.0	581.81	146.47	728.28	364.14	1021.22
109.00	24.0	587.23	145.16	732.40	366.20	1022.72
110.00	24.0	592.11	141.73	733.84	366.92	1017.30
111.00	24.0	597.65	137.45	735.10	367.55	1009.99
112.00	24.0	604.10	130.92	735.02	367.51	996.87
113.00	24.0	611.57	121.44	733.00	366.50	975.88
114.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
115.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
116.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
117.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
118.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
119.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
120.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....& 10\FBDeep\WHID Bridge\24-Inch PPSC\BB-WHID-2_24-inch PPSC.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc. DN
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: , Boring Number: BB-WHID-2
Station number: Offset:

Ground Elevation: 53.600(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	19.00	5- Cavity layer
6	10.00	21.00	5- Cavity layer
7	12.00	15.00	5- Cavity layer
8	14.00	14.00	5- Cavity layer
9	16.00	11.00	3- Clean sand
10	17.50	12.00	3- Clean sand
11	20.00	12.00	3- Clean sand
12	22.50	14.00	2- Clay and silty sand
13	25.00	8.00	2- Clay and silty sand
14	27.50	5.00	2- Clay and silty sand
15	30.00	6.00	1- Plastic Clay
16	32.50	5.00	1- Plastic Clay
17	35.00	6.00	1- Plastic Clay
18	37.50	3.00	2- Clay and silty sand
19	40.00	3.00	2- Clay and silty sand

20	42.50	61.00	2- Clay and silty sand
21	45.00	100.00	2- Clay and silty sand
22	47.50	100.00	2- Clay and silty sand
23	50.00	100.00	2- Clay and silty sand
24	52.50	100.00	2- Clay and silty sand
25	55.00	53.00	2- Clay and silty sand
26	57.50	100.00	2- Clay and silty sand
27	60.00	100.00	2- Clay and silty sand
28	62.50	20.00	2- Clay and silty sand
29	65.00	22.00	2- Clay and silty sand
30	67.50	42.00	2- Clay and silty sand
31	70.00	45.00	2- Clay and silty sand
32	72.50	100.00	2- Clay and silty sand
33	75.00	100.00	2- Clay and silty sand
34	77.50	54.00	2- Clay and silty sand
35	80.00	28.00	2- Clay and silty sand
36	82.50	28.00	2- Clay and silty sand
37	85.00	55.00	2- Clay and silty sand
38	87.50	36.00	2- Clay and silty sand
39	90.00	18.00	2- Clay and silty sand
40	92.50	21.00	2- Clay and silty sand
41	95.00	18.00	2- Clay and silty sand
42	97.50	20.00	2- Clay and silty sand
43	100.00	27.00	2- Clay and silty sand
44	102.50	21.00	2- Clay and silty sand
45	105.00	20.00	2- Clay and silty sand
46	107.50	39.00	2- Clay and silty sand
47	110.00	27.00	2- Clay and silty sand
48	112.50	48.00	2- Clay and silty sand
49	115.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	53.60	37.60	16.00	10.13	5-Void
2	37.60	31.10	6.50	11.77	3-Clean Sand
3	31.10	23.60	7.50	9.00	2-Clay and Silty Sand
4	23.60	16.10	7.50	5.67	1-Plastic Clay
5	16.10	-61.40	77.50	48.68	2-Clay and Silty Sand

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
24.00	1.00	52.60
24.00	2.00	51.60
24.00	3.00	50.60
24.00	4.00	49.60
24.00	5.00	48.60
24.00	6.00	47.60
24.00	7.00	46.60
24.00	8.00	45.60
24.00	9.00	44.60
24.00	10.00	43.60
24.00	11.00	42.60
24.00	12.00	41.60
24.00	13.00	40.60
24.00	14.00	39.60
24.00	15.00	38.60
24.00	16.00	37.60
24.00	17.00	36.60
24.00	18.00	35.60
24.00	19.00	34.60
24.00	20.00	33.60
24.00	21.00	32.60
24.00	22.00	31.60
24.00	23.00	30.60
24.00	24.00	29.60
24.00	25.00	28.60
24.00	26.00	27.60
24.00	27.00	26.60
24.00	28.00	25.60
24.00	29.00	24.60
24.00	30.00	23.60
24.00	31.00	22.60
24.00	32.00	21.60
24.00	33.00	20.60
24.00	34.00	19.60
24.00	35.00	18.60
24.00	36.00	17.60
24.00	37.00	16.60
24.00	38.00	15.60
24.00	39.00	14.60
24.00	40.00	13.60
24.00	41.00	12.60
24.00	42.00	11.60
24.00	43.00	10.60

24.00	44.00	9.60
24.00	45.00	8.60
24.00	46.00	7.60
24.00	47.00	6.60
24.00	48.00	5.60
24.00	49.00	4.60
24.00	50.00	3.60
24.00	51.00	2.60
24.00	52.00	1.60
24.00	53.00	0.60
24.00	54.00	-0.40
24.00	55.00	-1.40
24.00	56.00	-2.40
24.00	57.00	-3.40
24.00	58.00	-4.40
24.00	59.00	-5.40
24.00	60.00	-6.40
24.00	61.00	-7.40
24.00	62.00	-8.40
24.00	63.00	-9.40
24.00	64.00	-10.40
24.00	65.00	-11.40
24.00	66.00	-12.40
24.00	67.00	-13.40
24.00	68.00	-14.40
24.00	69.00	-15.40
24.00	70.00	-16.40
24.00	71.00	-17.40
24.00	72.00	-18.40
24.00	73.00	-19.40
24.00	74.00	-20.40
24.00	75.00	-21.40
24.00	76.00	-22.40
24.00	77.00	-23.40
24.00	78.00	-24.40
24.00	79.00	-25.40
24.00	80.00	-26.40
24.00	81.00	-27.40
24.00	82.00	-28.40
24.00	83.00	-29.40
24.00	84.00	-30.40
24.00	85.00	-31.40
24.00	86.00	-32.40
24.00	87.00	-33.40
24.00	88.00	-34.40
24.00	89.00	-35.40
24.00	90.00	-36.40
24.00	91.00	-37.40
24.00	92.00	-38.40
24.00	93.00	-39.40

24.00	94.00	-40.40
24.00	95.00	-41.40
24.00	96.00	-42.40
24.00	97.00	-43.40
24.00	98.00	-44.40
24.00	99.00	-45.40
24.00	100.00	-46.40
24.00	101.00	-47.40
24.00	102.00	-48.40
24.00	103.00	-49.40
24.00	104.00	-50.40
24.00	105.00	-51.40
24.00	106.00	-52.40
24.00	107.00	-53.40
24.00	108.00	-54.40
24.00	109.00	-55.40
24.00	110.00	-56.40
24.00	111.00	-57.40
24.00	112.00	-58.40
24.00	113.00	-59.40
24.00	114.00	-60.40
24.00	115.00	-61.40

Driven Pile Capacity:
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Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	24.0	0.00	0.00	0.00	0.00	0.00
2.00	24.0	0.00	0.00	0.00	0.00	0.00
3.00	24.0	0.00	0.00	0.00	0.00	0.00
4.00	24.0	0.00	0.00	0.00	0.00	0.00
5.00	24.0	0.00	0.00	0.00	0.00	0.00
6.00	24.0	0.00	0.00	0.00	0.00	0.00
7.00	24.0	0.00	0.00	0.00	0.00	0.00
8.00	24.0	0.00	0.00	0.00	0.00	0.00
9.00	24.0	0.00	0.00	0.00	0.00	0.00
10.00	24.0	0.00	0.00	0.00	0.00	0.00

11.00	24.0	0.00	0.00	0.00	0.00	0.00
12.00	24.0	0.00	0.00	0.00	0.00	0.00
13.00	24.0	0.00	0.00	0.00	0.00	0.00
14.00	24.0	0.00	0.00	0.00	0.00	0.00
15.00	24.0	0.52	0.00	0.52	0.26	0.52
16.00	24.0	2.07	29.92	31.99	15.99	91.82
17.00	24.0	4.21	29.70	33.91	16.95	93.31
18.00	24.0	6.46	28.90	35.36	17.68	93.17
19.00	24.0	8.72	27.75	36.47	18.23	91.97
20.00	24.0	10.98	26.37	37.35	18.68	90.09
21.00	24.0	13.91	24.98	38.90	19.45	88.86
22.00	24.0	18.18	23.84	42.02	21.01	89.69
23.00	24.0	22.84	20.03	42.87	21.43	82.92
24.00	24.0	27.22	20.28	47.50	23.75	88.05
25.00	24.0	31.82	19.83	51.65	25.82	91.31
26.00	24.0	35.40	18.01	53.41	26.70	89.42
27.00	24.0	38.13	16.18	54.31	27.15	86.66
28.00	24.0	40.48	14.72	55.20	27.60	84.63
29.00	24.0	43.04	13.58	56.63	28.31	83.79
30.00	24.0	45.93	6.64	52.58	26.29	65.86
31.00	24.0	48.84	6.67	55.51	27.76	68.86
32.00	24.0	51.57	6.71	58.27	29.14	71.68
33.00	24.0	54.13	6.77	60.90	30.45	74.45
34.00	24.0	55.74	8.65	64.39	32.19	81.68
35.00	24.0	58.67	13.92	72.60	36.30	100.44
36.00	24.0	61.39	22.19	83.59	41.79	127.97
37.00	24.0	63.49	30.87	94.36	47.18	156.10
38.00	24.0	66.14	39.37	105.52	52.76	184.27
39.00	24.0	67.16	41.27	108.43	54.21	190.98
40.00	24.0	68.00	45.15	113.15	56.58	203.45
41.00	24.0	70.07	50.66	120.73	60.36	222.05
42.00	24.0	74.66	56.94	131.60	65.80	245.48
43.00	24.0	81.69	63.46	145.15	72.58	272.07
44.00	24.0	89.42	70.79	160.22	80.11	301.80
45.00	24.0	97.65	79.10	176.75	88.37	334.94
46.00	24.0	106.68	85.51	192.19	96.09	363.20
47.00	24.0	116.26	89.30	205.55	102.78	384.15
48.00	24.0	126.00	93.10	219.10	109.55	405.30
49.00	24.0	135.87	96.92	232.79	116.40	426.62
50.00	24.0	145.84	100.72	246.56	123.28	448.01
51.00	24.0	155.89	104.51	260.40	130.20	469.42
52.00	24.0	165.99	108.29	274.28	137.14	490.85
53.00	24.0	176.14	112.05	288.19	144.10	512.30
54.00	24.0	186.33	114.73	301.06	150.53	530.53
55.00	24.0	196.55	115.27	311.82	155.91	542.35
56.00	24.0	206.80	113.94	320.74	160.37	548.62
57.00	24.0	217.07	111.73	328.80	164.40	552.26
58.00	24.0	227.36	108.17	335.53	167.77	551.87
59.00	24.0	237.67	104.13	341.80	170.90	550.05
60.00	24.0	247.99	101.41	349.40	174.70	552.22

61.00	24.0	257.76	100.65	358.41	179.20	559.70
62.00	24.0	266.41	101.48	367.89	183.94	570.84
63.00	24.0	274.09	103.58	377.66	188.83	584.82
64.00	24.0	281.77	106.00	387.77	193.88	599.77
65.00	24.0	289.63	108.59	398.22	199.11	615.40
66.00	24.0	298.07	110.94	409.01	204.50	630.88
67.00	24.0	307.50	112.47	419.96	209.98	644.89
68.00	24.0	317.79	113.23	431.02	215.51	657.49
69.00	24.0	328.22	113.79	442.00	221.00	669.57
70.00	24.0	338.66	114.21	452.87	226.44	681.29
71.00	24.0	349.11	114.31	463.41	231.71	692.02
72.00	24.0	359.52	112.91	472.43	236.22	698.25
73.00	24.0	369.92	109.84	479.76	239.88	699.45
74.00	24.0	380.31	105.99	486.30	243.15	698.29
75.00	24.0	390.71	102.14	492.85	246.42	697.13
76.00	24.0	401.11	98.48	499.59	249.80	696.55
77.00	24.0	411.52	96.64	508.15	254.08	701.43
78.00	24.0	421.86	97.38	519.25	259.62	714.01
79.00	24.0	431.76	100.00	531.77	265.88	731.77
80.00	24.0	441.15	102.61	543.76	271.88	748.99
81.00	24.0	450.28	104.60	554.89	277.44	764.09
82.00	24.0	459.42	104.92	564.33	282.17	774.17
83.00	24.0	468.61	103.10	571.72	285.86	777.93
84.00	24.0	478.26	99.37	577.63	288.82	776.38
85.00	24.0	488.42	94.84	583.26	291.63	772.93
86.00	24.0	498.79	90.20	588.99	294.49	769.38
87.00	24.0	509.05	85.81	594.86	297.43	766.48
88.00	24.0	519.05	81.64	600.69	300.35	763.97
89.00	24.0	527.92	78.07	605.99	302.99	762.12
90.00	24.0	535.50	75.40	610.90	305.45	761.70
91.00	24.0	542.58	73.25	615.83	307.92	762.33
92.00	24.0	549.97	71.45	621.42	310.71	764.33
93.00	24.0	557.59	70.09	627.68	313.84	767.86
94.00	24.0	564.97	68.95	633.92	316.96	771.81
95.00	24.0	572.05	68.06	640.11	320.05	776.24
96.00	24.0	579.07	67.47	646.54	323.27	781.48
97.00	24.0	586.29	67.01	653.30	326.65	787.32
98.00	24.0	593.78	66.36	660.14	330.07	792.86
99.00	24.0	601.82	66.03	667.85	333.93	799.92
100.00	24.0	610.46	66.26	676.72	338.36	809.23

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length	Pile Width	Ultimate Side Friction	Mobilized End Bearing	Estimated Davisson Capacity	Allowable Pile Capacity	Ultimate Pile Capacity

(ft)	(in)	(tons)	(tons)	(tons)	(tons)	(tons)
101.00	24.0	619.16	66.93	686.08	343.04	819.94
102.00	24.0	627.34	67.11	694.45	347.22	828.67
103.00	24.0	635.07	67.02	702.09	351.04	836.13
104.00	24.0	642.65	67.77	710.42	355.21	845.96
105.00	24.0	650.12	70.73	720.85	360.42	862.30
106.00	24.0	658.13	75.29	733.42	366.71	883.99
107.00	24.0	667.32	79.51	746.83	373.42	905.85
108.00	24.0	677.46	83.02	760.49	380.24	926.53
109.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
110.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
111.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
112.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
113.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
114.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
115.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....nts 9 & 10\FBDeep\WHID Bridge\H-Pile\BB-WHID-1_14x89 H-Pile.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc. DN
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 4/9/2024, Boring Number: BB-WHID-1
Station number: Offset:

Ground Elevation: 54.900(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	9.00	5- Cavity layer
6	10.00	8.00	5- Cavity layer
7	12.00	4.00	5- Cavity layer
8	14.00	4.00	5- Cavity layer
9	16.00	7.00	3- Clean sand
10	17.50	5.00	3- Clean sand
11	20.00	7.00	3- Clean sand
12	22.50	3.00	3- Clean sand
13	25.00	4.00	2- Clay and silty sand
14	27.50	3.00	2- Clay and silty sand
15	30.00	6.00	1- Plastic Clay
16	32.50	4.00	1- Plastic Clay
17	35.00	4.00	1- Plastic Clay
18	37.50	3.00	1- Plastic Clay
19	40.00	3.00	1- Plastic Clay

20	42.50	4.00	2- Clay and silty sand
21	45.00	6.00	2- Clay and silty sand
22	47.50	21.00	2- Clay and silty sand
23	50.00	25.00	2- Clay and silty sand
24	52.50	43.00	2- Clay and silty sand
25	55.00	20.00	2- Clay and silty sand
26	57.50	12.00	2- Clay and silty sand
27	60.00	27.00	2- Clay and silty sand
28	62.50	21.00	2- Clay and silty sand
29	65.00	26.00	2- Clay and silty sand
30	67.50	41.00	2- Clay and silty sand
31	70.00	37.00	2- Clay and silty sand
32	72.50	100.00	2- Clay and silty sand
33	75.00	100.00	2- Clay and silty sand
34	77.50	82.00	2- Clay and silty sand
35	80.00	67.00	2- Clay and silty sand
36	82.50	29.00	2- Clay and silty sand
37	85.00	30.00	2- Clay and silty sand
38	87.50	24.00	2- Clay and silty sand
39	90.00	61.00	2- Clay and silty sand
40	92.50	23.00	2- Clay and silty sand
41	95.00	25.00	2- Clay and silty sand
42	97.50	100.00	3- Clean sand
43	100.00	96.00	3- Clean sand
44	102.50	24.00	3- Clean sand
45	105.00	25.00	3- Clean sand
46	107.50	21.00	3- Clean sand
47	110.00	27.00	3- Clean sand
48	112.50	39.00	3- Clean sand
49	115.00	74.00	1- Plastic Clay
50	117.50	100.00	1- Plastic Clay
51	120.00	100.00	1- Plastic Clay

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	54.90	38.90	16.00	4.62	5-Void
2	38.90	29.90	9.00	5.33	3-Clean Sand
3	29.90	24.90	5.00	3.50	2-Clay and Silty Sand
4	24.90	12.40	12.50	4.00	1-Plastic Clay
5	12.40	-42.60	55.00	37.45	2-Clay and Silty Sand
6	-42.60	-60.10	17.50	47.43	3-Clean Sand
7	-60.10	-65.10	5.00	87.00	1-Plastic Clay

Driven Pile Data:
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Pile unit weight = 490.00(pcf), Section Type: H-Section

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)	Depth (in)	End Area (in^2)
14.69	1.00	53.90	13.83	101.58
14.69	2.00	52.90	13.83	101.58
14.69	3.00	51.90	13.83	101.58
14.69	4.00	50.90	13.83	101.58
14.69	5.00	49.90	13.83	101.58
14.69	6.00	48.90	13.83	101.58
14.69	7.00	47.90	13.83	101.58
14.69	8.00	46.90	13.83	101.58
14.69	9.00	45.90	13.83	101.58
14.69	10.00	44.90	13.83	101.58
14.69	11.00	43.90	13.83	101.58
14.69	12.00	42.90	13.83	101.58
14.69	13.00	41.90	13.83	101.58
14.69	14.00	40.90	13.83	101.58
14.69	15.00	39.90	13.83	101.58
14.69	16.00	38.90	13.83	101.58
14.69	17.00	37.90	13.83	101.58
14.69	18.00	36.90	13.83	101.58
14.69	19.00	35.90	13.83	101.58
14.69	20.00	34.90	13.83	101.58
14.69	21.00	33.90	13.83	101.58
14.69	22.00	32.90	13.83	101.58
14.69	23.00	31.90	13.83	101.58
14.69	24.00	30.90	13.83	101.58
14.69	25.00	29.90	13.83	101.58
14.69	26.00	28.90	13.83	101.58
14.69	27.00	27.90	13.83	101.58
14.69	28.00	26.90	13.83	101.58
14.69	29.00	25.90	13.83	101.58
14.69	30.00	24.90	13.83	101.58
14.69	31.00	23.90	13.83	101.58
14.69	32.00	22.90	13.83	101.58
14.69	33.00	21.90	13.83	101.58
14.69	34.00	20.90	13.83	101.58
14.69	35.00	19.90	13.83	101.58
14.69	36.00	18.90	13.83	101.58
14.69	37.00	17.90	13.83	101.58
14.69	38.00	16.90	13.83	101.58
14.69	39.00	15.90	13.83	101.58

14.69	40.00	14.90	13.83	101.58
14.69	41.00	13.90	13.83	101.58
14.69	42.00	12.90	13.83	101.58
14.69	43.00	11.90	13.83	101.58
14.69	44.00	10.90	13.83	101.58
14.69	45.00	9.90	13.83	101.58
14.69	46.00	8.90	13.83	101.58
14.69	47.00	7.90	13.83	101.58
14.69	48.00	6.90	13.83	101.58
14.69	49.00	5.90	13.83	101.58
14.69	50.00	4.90	13.83	101.58
14.69	51.00	3.90	13.83	101.58
14.69	52.00	2.90	13.83	101.58
14.69	53.00	1.90	13.83	101.58
14.69	54.00	0.90	13.83	101.58
14.69	55.00	-0.10	13.83	101.58
14.69	56.00	-1.10	13.83	101.58
14.69	57.00	-2.10	13.83	101.58
14.69	58.00	-3.10	13.83	101.58
14.69	59.00	-4.10	13.83	101.58
14.69	60.00	-5.10	13.83	101.58
14.69	61.00	-6.10	13.83	101.58
14.69	62.00	-7.10	13.83	101.58
14.69	63.00	-8.10	13.83	101.58
14.69	64.00	-9.10	13.83	101.58
14.69	65.00	-10.10	13.83	101.58
14.69	66.00	-11.10	13.83	101.58
14.69	67.00	-12.10	13.83	101.58
14.69	68.00	-13.10	13.83	101.58
14.69	69.00	-14.10	13.83	101.58
14.69	70.00	-15.10	13.83	101.58
14.69	71.00	-16.10	13.83	101.58
14.69	72.00	-17.10	13.83	101.58
14.69	73.00	-18.10	13.83	101.58
14.69	74.00	-19.10	13.83	101.58
14.69	75.00	-20.10	13.83	101.58
14.69	76.00	-21.10	13.83	101.58
14.69	77.00	-22.10	13.83	101.58
14.69	78.00	-23.10	13.83	101.58
14.69	79.00	-24.10	13.83	101.58
14.69	80.00	-25.10	13.83	101.58
14.69	81.00	-26.10	13.83	101.58
14.69	82.00	-27.10	13.83	101.58
14.69	83.00	-28.10	13.83	101.58
14.69	84.00	-29.10	13.83	101.58
14.69	85.00	-30.10	13.83	101.58
14.69	86.00	-31.10	13.83	101.58
14.69	87.00	-32.10	13.83	101.58
14.69	88.00	-33.10	13.83	101.58
14.69	89.00	-34.10	13.83	101.58

14.69	90.00	-35.10	13.83	101.58
14.69	91.00	-36.10	13.83	101.58
14.69	92.00	-37.10	13.83	101.58
14.69	93.00	-38.10	13.83	101.58
14.69	94.00	-39.10	13.83	101.58
14.69	95.00	-40.10	13.83	101.58
14.69	96.00	-41.10	13.83	101.58
14.69	97.00	-42.10	13.83	101.58
14.69	98.00	-43.10	13.83	101.58
14.69	99.00	-44.10	13.83	101.58
14.69	100.00	-45.10	13.83	101.58
14.69	101.00	-46.10	13.83	101.58
14.69	102.00	-47.10	13.83	101.58
14.69	103.00	-48.10	13.83	101.58
14.69	104.00	-49.10	13.83	101.58
14.69	105.00	-50.10	13.83	101.58
14.69	106.00	-51.10	13.83	101.58
14.69	107.00	-52.10	13.83	101.58
14.69	108.00	-53.10	13.83	101.58
14.69	109.00	-54.10	13.83	101.58
14.69	110.00	-55.10	13.83	101.58
14.69	111.00	-56.10	13.83	101.58
14.69	112.00	-57.10	13.83	101.58
14.69	113.00	-58.10	13.83	101.58
14.69	114.00	-59.10	13.83	101.58
14.69	115.00	-60.10	13.83	101.58
14.69	116.00	-61.10	13.83	0.00
14.69	117.00	-62.10	13.83	0.00
14.69	118.00	-63.10	13.83	0.00
14.69	119.00	-64.10	13.83	0.00
14.69	120.00	-65.10	13.83	0.00

Driven Pile Capacity:
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Section Type: H
Pile Width: 14.69 (in)
Sect. Depth: 13.83 (in)
End Area: 101.58 (in^2)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)

1.00	14.7	0.00	0.00	0.00	0.00	0.00
2.00	14.7	0.00	0.00	0.00	0.00	0.00
3.00	14.7	0.00	0.00	0.00	0.00	0.00
4.00	14.7	0.00	0.00	0.00	0.00	0.00
5.00	14.7	0.00	0.00	0.00	0.00	0.00
6.00	14.7	0.00	0.00	0.00	0.00	0.00
7.00	14.7	0.00	0.00	0.00	0.00	0.00
8.00	14.7	0.00	0.00	0.00	0.00	0.00
9.00	14.7	0.00	0.00	0.00	0.00	0.00
10.00	14.7	0.00	0.00	0.00	0.00	0.00
11.00	14.7	0.00	0.00	0.00	0.00	0.00
12.00	14.7	0.00	0.00	0.00	0.00	0.00
13.00	14.7	0.00	0.00	0.00	0.00	0.00
14.00	14.7	0.00	0.00	0.00	0.00	0.00
15.00	14.7	0.15	0.00	0.15	0.07	0.15
16.00	14.7	0.58	5.65	6.23	3.11	11.87
17.00	14.7	1.11	5.35	6.45	3.23	11.80
18.00	14.7	1.54	4.97	6.51	3.25	11.47
19.00	14.7	2.03	4.36	6.39	3.19	10.75
20.00	14.7	2.57	3.53	6.11	3.05	9.64
21.00	14.7	3.09	2.72	5.81	2.90	8.52
22.00	14.7	3.47	2.17	5.64	2.82	7.81
23.00	14.7	3.76	1.86	5.62	2.81	7.48
24.00	14.7	4.22	1.64	5.86	2.93	7.50
25.00	14.7	4.89	1.48	6.37	3.19	9.33
26.00	14.7	5.63	1.35	6.98	3.49	9.68
27.00	14.7	6.28	1.23	7.51	3.75	9.97
28.00	14.7	6.90	1.12	8.02	4.01	10.25
29.00	14.7	7.93	1.01	8.94	4.47	10.96
30.00	14.7	9.41	0.92	10.33	5.16	12.17
31.00	14.7	11.01	0.85	11.85	5.93	13.55
32.00	14.7	12.39	0.79	13.18	6.59	14.76
33.00	14.7	13.58	0.75	14.33	7.17	15.83
34.00	14.7	14.75	0.71	15.46	7.73	16.87
35.00	14.7	15.92	0.66	16.58	8.29	17.91
36.00	14.7	17.03	0.67	17.70	8.85	19.05
37.00	14.7	18.03	0.80	18.83	9.41	20.42
38.00	14.7	18.93	1.04	19.97	9.98	22.05
39.00	14.7	19.81	1.36	21.18	10.59	23.91
40.00	14.7	20.70	1.76	22.47	11.23	26.00
41.00	14.7	21.56	2.39	23.95	11.98	28.73
42.00	14.7	22.38	3.48	25.87	12.93	32.83
43.00	14.7	23.19	5.01	28.20	14.10	38.22
44.00	14.7	24.13	6.69	30.82	15.41	44.21
45.00	14.7	25.23	8.45	33.68	16.84	50.58
46.00	14.7	26.86	10.25	37.11	18.56	57.61
47.00	14.7	29.38	12.16	41.54	20.77	65.86
48.00	14.7	32.70	14.11	46.81	23.41	75.04
49.00	14.7	36.26	15.27	51.53	25.76	82.07
50.00	14.7	39.97	15.40	55.37	27.68	86.17

51.00	14.7	43.97	14.46	58.43	29.22	87.36
52.00	14.7	48.39	12.53	60.92	30.46	85.98
53.00	14.7	53.10	9.87	62.97	31.49	82.72
54.00	14.7	57.32	8.31	65.63	32.82	82.25
55.00	14.7	60.93	8.19	69.12	34.56	85.51
56.00	14.7	64.02	8.92	72.93	36.47	90.77
57.00	14.7	66.68	9.72	76.40	38.20	95.85
58.00	14.7	69.06	10.53	79.59	39.79	100.64
59.00	14.7	71.99	10.98	82.97	41.49	104.94
60.00	14.7	75.60	11.06	86.66	43.33	108.78
61.00	14.7	79.45	11.31	90.75	45.38	113.37
62.00	14.7	83.07	12.35	95.43	47.71	120.13
63.00	14.7	86.53	14.09	100.62	50.31	128.80
64.00	14.7	90.12	15.67	105.79	52.90	137.13
65.00	14.7	93.90	16.90	110.81	55.40	144.61
66.00	14.7	97.96	17.84	115.80	57.90	151.48
67.00	14.7	102.36	18.64	121.00	60.50	158.27
68.00	14.7	107.07	19.35	126.42	63.21	165.13
69.00	14.7	111.76	20.21	131.96	65.98	172.38
70.00	14.7	116.37	21.22	137.59	68.79	180.02
71.00	14.7	121.13	22.09	143.22	71.61	187.39
72.00	14.7	126.26	22.52	148.78	74.39	193.82
73.00	14.7	131.70	22.57	154.27	77.14	199.42
74.00	14.7	137.19	22.57	159.76	79.88	204.91
75.00	14.7	142.68	22.57	165.25	82.63	210.40
76.00	14.7	148.17	22.28	170.44	85.22	215.00
77.00	14.7	153.66	21.24	174.90	87.45	217.39
78.00	14.7	159.14	19.54	178.68	89.34	217.75
79.00	14.7	164.63	17.72	182.35	91.18	217.80
80.00	14.7	170.12	15.95	186.07	93.03	217.96
81.00	14.7	175.33	14.47	189.81	94.90	218.75
82.00	14.7	179.99	13.51	193.50	96.75	220.52
83.00	14.7	184.17	13.05	197.22	98.61	223.32
84.00	14.7	188.30	13.37	201.67	100.84	228.41
85.00	14.7	192.47	14.58	207.05	103.52	236.21
86.00	14.7	196.55	16.05	212.60	106.30	244.70
87.00	14.7	200.44	16.80	217.23	108.62	250.83
88.00	14.7	204.25	16.74	220.99	110.49	254.46
89.00	14.7	208.67	15.78	224.45	112.22	256.01
90.00	14.7	213.80	13.97	227.77	113.88	255.71
91.00	14.7	218.91	13.33	232.24	116.12	258.89
92.00	14.7	223.27	16.37	239.64	119.82	272.38
93.00	14.7	226.98	22.77	249.75	124.88	295.29
94.00	14.7	230.66	29.72	260.38	130.19	319.83
95.00	14.7	234.41	36.60	271.01	135.51	344.21
96.00	14.7	238.25	41.32	279.57	139.79	362.22
97.00	14.7	242.17	41.46	283.64	141.82	366.56
98.00	14.7	246.18	37.50	283.68	141.84	321.18
99.00	14.7	250.20	32.92	283.12	141.56	316.04
100.00	14.7	254.21	28.42	282.63	141.32	311.05

Section Type: H
Pile Width: 14.69 (in)
Sect. Depth: 13.83 (in)
End Area: 101.58 (in^2)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	14.7	257.83	24.77	282.60	141.30	307.37
102.00	14.7	260.63	22.68	283.30	141.65	305.98
103.00	14.7	262.73	21.95	284.68	142.34	306.63
104.00	14.7	264.75	21.72	286.47	143.23	308.18
105.00	14.7	266.81	21.86	288.67	144.33	310.53
106.00	14.7	268.82	22.76	291.58	145.79	314.34
107.00	14.7	270.69	24.87	295.57	147.78	320.44
108.00	14.7	272.48	27.87	300.35	150.18	328.22
109.00	14.7	274.42	28.90	303.33	151.66	332.23
110.00	14.7	276.56	27.31	303.87	151.94	331.18
111.00	14.7	279.00	23.74	302.74	151.37	326.48
112.00	14.7	281.84	19.24	301.08	150.54	320.32
113.00	14.7	285.21	14.21	299.41	149.71	313.62
114.00	14.7	289.84	10.96	300.80	150.40	311.75
115.00	14.7	295.86	9.88	305.74	152.87	325.49
116.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
117.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
118.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
119.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
120.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....nts 9 & 10\FBDeep\WHID Bridge\H-Pile\BB-WHID-2_14x89 H-Pile.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc. DN
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: , Boring Number: BB-WHID-2
Station number: Offset:

Ground Elevation: 53.600(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	19.00	5- Cavity layer
6	10.00	21.00	5- Cavity layer
7	12.00	15.00	5- Cavity layer
8	14.00	14.00	5- Cavity layer
9	16.00	11.00	3- Clean sand
10	17.50	12.00	3- Clean sand
11	20.00	12.00	3- Clean sand
12	22.50	14.00	2- Clay and silty sand
13	25.00	8.00	2- Clay and silty sand
14	27.50	5.00	2- Clay and silty sand
15	30.00	6.00	1- Plastic Clay
16	32.50	5.00	1- Plastic Clay
17	35.00	6.00	1- Plastic Clay
18	37.50	3.00	2- Clay and silty sand
19	40.00	3.00	2- Clay and silty sand

20	42.50	61.00	2- Clay and silty sand
21	45.00	100.00	2- Clay and silty sand
22	47.50	100.00	2- Clay and silty sand
23	50.00	100.00	2- Clay and silty sand
24	52.50	100.00	2- Clay and silty sand
25	55.00	53.00	2- Clay and silty sand
26	57.50	100.00	2- Clay and silty sand
27	60.00	100.00	2- Clay and silty sand
28	62.50	20.00	2- Clay and silty sand
29	65.00	22.00	2- Clay and silty sand
30	67.50	42.00	2- Clay and silty sand
31	70.00	45.00	2- Clay and silty sand
32	72.50	100.00	2- Clay and silty sand
33	75.00	100.00	2- Clay and silty sand
34	77.50	54.00	2- Clay and silty sand
35	80.00	28.00	2- Clay and silty sand
36	82.50	28.00	2- Clay and silty sand
37	85.00	55.00	2- Clay and silty sand
38	87.50	36.00	2- Clay and silty sand
39	90.00	18.00	2- Clay and silty sand
40	92.50	21.00	2- Clay and silty sand
41	95.00	18.00	2- Clay and silty sand
42	97.50	20.00	2- Clay and silty sand
43	100.00	27.00	2- Clay and silty sand
44	102.50	21.00	2- Clay and silty sand
45	105.00	20.00	2- Clay and silty sand
46	107.50	39.00	2- Clay and silty sand
47	110.00	27.00	2- Clay and silty sand
48	112.50	48.00	2- Clay and silty sand
49	115.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	53.60	37.60	16.00	10.13	5-Void
2	37.60	31.10	6.50	11.77	3-Clean Sand
3	31.10	23.60	7.50	9.00	2-Clay and Silty Sand
4	23.60	16.10	7.50	5.67	1-Plastic Clay
5	16.10	-61.40	77.50	48.68	2-Clay and Silty Sand

Driven Pile Data:
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Pile unit weight = 490.00(pcf), Section Type: H-Section

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)	Depth (in)	End Area (in^2)
14.69	1.00	52.60	13.83	101.58
14.69	2.00	51.60	13.83	101.58
14.69	3.00	50.60	13.83	101.58
14.69	4.00	49.60	13.83	101.58
14.69	5.00	48.60	13.83	101.58
14.69	6.00	47.60	13.83	101.58
14.69	7.00	46.60	13.83	101.58
14.69	8.00	45.60	13.83	101.58
14.69	9.00	44.60	13.83	101.58
14.69	10.00	43.60	13.83	101.58
14.69	11.00	42.60	13.83	101.58
14.69	12.00	41.60	13.83	101.58
14.69	13.00	40.60	13.83	101.58
14.69	14.00	39.60	13.83	101.58
14.69	15.00	38.60	13.83	101.58
14.69	16.00	37.60	13.83	101.58
14.69	17.00	36.60	13.83	101.58
14.69	18.00	35.60	13.83	101.58
14.69	19.00	34.60	13.83	101.58
14.69	20.00	33.60	13.83	101.58
14.69	21.00	32.60	13.83	101.58
14.69	22.00	31.60	13.83	101.58
14.69	23.00	30.60	13.83	101.58
14.69	24.00	29.60	13.83	101.58
14.69	25.00	28.60	13.83	101.58
14.69	26.00	27.60	13.83	101.58
14.69	27.00	26.60	13.83	101.58
14.69	28.00	25.60	13.83	101.58
14.69	29.00	24.60	13.83	101.58
14.69	30.00	23.60	13.83	101.58
14.69	31.00	22.60	13.83	101.58
14.69	32.00	21.60	13.83	101.58
14.69	33.00	20.60	13.83	101.58
14.69	34.00	19.60	13.83	101.58
14.69	35.00	18.60	13.83	101.58
14.69	36.00	17.60	13.83	101.58
14.69	37.00	16.60	13.83	101.58
14.69	38.00	15.60	13.83	101.58
14.69	39.00	14.60	13.83	101.58
14.69	40.00	13.60	13.83	101.58
14.69	41.00	12.60	13.83	101.58
14.69	42.00	11.60	13.83	101.58
14.69	43.00	10.60	13.83	101.58

14.69	44.00	9.60	13.83	101.58
14.69	45.00	8.60	13.83	101.58
14.69	46.00	7.60	13.83	101.58
14.69	47.00	6.60	13.83	101.58
14.69	48.00	5.60	13.83	101.58
14.69	49.00	4.60	13.83	101.58
14.69	50.00	3.60	13.83	101.58
14.69	51.00	2.60	13.83	101.58
14.69	52.00	1.60	13.83	101.58
14.69	53.00	0.60	13.83	101.58
14.69	54.00	-0.40	13.83	101.58
14.69	55.00	-1.40	13.83	101.58
14.69	56.00	-2.40	13.83	101.58
14.69	57.00	-3.40	13.83	101.58
14.69	58.00	-4.40	13.83	101.58
14.69	59.00	-5.40	13.83	101.58
14.69	60.00	-6.40	13.83	101.58
14.69	61.00	-7.40	13.83	101.58
14.69	62.00	-8.40	13.83	101.58
14.69	63.00	-9.40	13.83	101.58
14.69	64.00	-10.40	13.83	101.58
14.69	65.00	-11.40	13.83	101.58
14.69	66.00	-12.40	13.83	101.58
14.69	67.00	-13.40	13.83	101.58
14.69	68.00	-14.40	13.83	101.58
14.69	69.00	-15.40	13.83	101.58
14.69	70.00	-16.40	13.83	101.58
14.69	71.00	-17.40	13.83	101.58
14.69	72.00	-18.40	13.83	101.58
14.69	73.00	-19.40	13.83	101.58
14.69	74.00	-20.40	13.83	101.58
14.69	75.00	-21.40	13.83	101.58
14.69	76.00	-22.40	13.83	101.58
14.69	77.00	-23.40	13.83	101.58
14.69	78.00	-24.40	13.83	101.58
14.69	79.00	-25.40	13.83	101.58
14.69	80.00	-26.40	13.83	101.58
14.69	81.00	-27.40	13.83	101.58
14.69	82.00	-28.40	13.83	101.58
14.69	83.00	-29.40	13.83	101.58
14.69	84.00	-30.40	13.83	101.58
14.69	85.00	-31.40	13.83	101.58
14.69	86.00	-32.40	13.83	101.58
14.69	87.00	-33.40	13.83	101.58
14.69	88.00	-34.40	13.83	101.58
14.69	89.00	-35.40	13.83	101.58
14.69	90.00	-36.40	13.83	101.58
14.69	91.00	-37.40	13.83	101.58
14.69	92.00	-38.40	13.83	101.58
14.69	93.00	-39.40	13.83	101.58

14.69	94.00	-40.40	13.83	101.58
14.69	95.00	-41.40	13.83	101.58
14.69	96.00	-42.40	13.83	101.58
14.69	97.00	-43.40	13.83	101.58
14.69	98.00	-44.40	13.83	101.58
14.69	99.00	-45.40	13.83	101.58
14.69	100.00	-46.40	13.83	101.58
14.69	101.00	-47.40	13.83	101.58
14.69	102.00	-48.40	13.83	101.58
14.69	103.00	-49.40	13.83	101.58
14.69	104.00	-50.40	13.83	101.58
14.69	105.00	-51.40	13.83	101.58
14.69	106.00	-52.40	13.83	101.58
14.69	107.00	-53.40	13.83	101.58
14.69	108.00	-54.40	13.83	101.58
14.69	109.00	-55.40	13.83	101.58
14.69	110.00	-56.40	13.83	101.58
14.69	111.00	-57.40	13.83	0.00
14.69	112.00	-58.40	13.83	0.00
14.69	113.00	-59.40	13.83	0.00
14.69	114.00	-60.40	13.83	0.00
14.69	115.00	-61.40	13.83	0.00

Driven Pile Capacity:
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Section Type: H
Pile Width: 14.69 (in)
Sect. Depth: 13.83 (in)
End Area: 101.58 (in^2)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	14.7	0.00	0.00	0.00	0.00	0.00
2.00	14.7	0.00	0.00	0.00	0.00	0.00
3.00	14.7	0.00	0.00	0.00	0.00	0.00
4.00	14.7	0.00	0.00	0.00	0.00	0.00
5.00	14.7	0.00	0.00	0.00	0.00	0.00
6.00	14.7	0.00	0.00	0.00	0.00	0.00
7.00	14.7	0.00	0.00	0.00	0.00	0.00
8.00	14.7	0.00	0.00	0.00	0.00	0.00
9.00	14.7	0.00	0.00	0.00	0.00	0.00

10.00	14.7	0.00	0.00	0.00	0.00	0.00
11.00	14.7	0.00	0.00	0.00	0.00	0.00
12.00	14.7	0.00	0.00	0.00	0.00	0.00
13.00	14.7	0.00	0.00	0.00	0.00	0.00
14.00	14.7	0.00	0.00	0.00	0.00	0.00
15.00	14.7	0.23	0.00	0.23	0.11	0.23
16.00	14.7	0.91	10.90	11.81	5.91	22.71
17.00	14.7	1.85	10.50	12.35	6.17	22.84
18.00	14.7	2.84	9.61	12.45	6.23	22.06
19.00	14.7	3.84	8.45	12.29	6.15	20.74
20.00	14.7	4.84	7.07	11.90	5.95	18.97
21.00	14.7	6.14	5.69	11.83	5.91	17.51
22.00	14.7	8.06	4.57	12.64	6.32	17.21
23.00	14.7	10.48	3.71	14.19	7.10	21.61
24.00	14.7	12.63	3.00	15.63	7.82	21.64
25.00	14.7	14.39	2.43	16.82	8.41	21.68
26.00	14.7	15.84	1.97	17.81	8.91	21.75
27.00	14.7	17.06	1.60	18.67	9.33	21.88
28.00	14.7	18.11	1.34	19.45	9.72	22.13
29.00	14.7	19.39	1.18	20.56	10.28	22.91
30.00	14.7	20.95	1.12	22.07	11.04	24.31
31.00	14.7	22.61	1.13	23.74	11.87	26.01
32.00	14.7	24.16	1.18	25.34	12.67	27.69
33.00	14.7	25.63	1.25	26.88	13.44	29.38
34.00	14.7	27.17	1.31	28.48	14.24	31.11
35.00	14.7	28.83	1.35	30.19	15.09	32.89
36.00	14.7	30.31	2.08	32.39	16.19	36.55
37.00	14.7	31.33	4.51	35.84	17.92	44.86
38.00	14.7	31.95	8.52	40.47	20.23	57.51
39.00	14.7	32.51	12.84	45.35	22.68	71.04
40.00	14.7	33.07	17.17	50.24	25.12	84.58
41.00	14.7	34.62	20.63	55.25	27.62	96.50
42.00	14.7	38.14	22.36	60.49	30.25	105.21
43.00	14.7	43.38	22.57	65.95	32.98	111.10
44.00	14.7	48.87	22.57	71.44	35.72	116.59
45.00	14.7	54.35	22.57	76.93	38.46	122.08
46.00	14.7	59.84	22.57	82.42	41.21	127.56
47.00	14.7	65.33	22.57	87.91	43.95	133.05
48.00	14.7	70.82	22.57	93.39	46.70	138.54
49.00	14.7	76.31	22.57	98.88	49.44	144.03
50.00	14.7	81.80	22.57	104.37	52.19	149.52
51.00	14.7	87.29	22.57	109.86	54.93	155.01
52.00	14.7	92.78	22.57	115.35	57.67	160.50
53.00	14.7	98.25	22.57	120.82	60.41	165.97
54.00	14.7	103.62	22.57	126.19	63.10	171.34
55.00	14.7	108.88	22.57	131.45	65.72	176.60
56.00	14.7	114.13	22.14	136.27	68.13	180.55
57.00	14.7	119.50	20.63	140.13	70.07	181.39
58.00	14.7	124.98	18.13	143.10	71.55	179.36
59.00	14.7	130.47	15.49	145.96	72.98	176.94

60.00	14.7	135.95	12.93	148.88	74.44	174.74
61.00	14.7	141.00	11.26	152.27	76.13	174.79
62.00	14.7	145.18	11.44	156.62	78.31	179.49
63.00	14.7	148.60	13.26	161.86	80.93	188.37
64.00	14.7	151.98	15.38	167.36	83.68	198.12
65.00	14.7	155.45	17.54	172.99	86.49	208.07
66.00	14.7	159.22	19.40	178.62	89.31	217.42
67.00	14.7	163.50	20.63	184.13	92.06	225.39
68.00	14.7	168.24	21.30	189.54	94.77	232.13
69.00	14.7	173.09	21.79	194.88	97.44	238.46
70.00	14.7	177.98	22.17	200.15	100.07	244.49
71.00	14.7	183.01	22.43	205.43	102.72	250.29
72.00	14.7	188.27	22.56	210.82	105.41	255.94
73.00	14.7	193.73	22.51	216.24	108.12	261.26
74.00	14.7	199.21	21.82	221.03	110.51	264.66
75.00	14.7	204.70	20.34	225.04	112.52	265.73
76.00	14.7	210.14	18.40	228.54	114.27	265.35
77.00	14.7	215.47	16.46	231.94	115.97	264.86
78.00	14.7	220.66	14.68	235.34	117.67	264.69
79.00	14.7	225.41	14.21	239.62	119.81	268.04
80.00	14.7	229.68	15.29	244.98	122.49	275.57
81.00	14.7	233.72	17.04	250.76	125.38	284.84
82.00	14.7	237.75	18.33	256.08	128.04	292.73
83.00	14.7	241.84	19.02	260.87	130.43	298.91
84.00	14.7	246.37	18.39	264.76	132.38	301.55
85.00	14.7	251.39	16.30	267.69	133.85	300.29
86.00	14.7	256.51	13.69	270.20	135.10	297.58
87.00	14.7	261.34	11.66	273.00	136.50	296.33
88.00	14.7	265.83	10.23	276.06	138.03	296.53
89.00	14.7	269.78	9.39	279.16	139.58	297.93
90.00	14.7	273.14	9.11	282.25	141.12	300.47
91.00	14.7	276.27	9.09	285.36	142.68	303.53
92.00	14.7	279.55	9.02	288.57	144.28	306.61
93.00	14.7	282.92	8.96	291.88	145.94	309.80
94.00	14.7	286.19	9.22	295.41	147.70	313.85
95.00	14.7	289.32	9.86	299.18	149.59	318.90
96.00	14.7	292.44	10.58	303.02	151.51	324.19
97.00	14.7	295.65	11.01	306.65	153.33	328.67
98.00	14.7	298.97	11.12	310.08	155.04	332.32
99.00	14.7	302.53	10.91	313.44	156.72	335.26
100.00	14.7	306.35	10.40	316.75	158.38	337.56

Section Type: H
Pile Width: 14.69 (in)
Sect. Depth: 13.83 (in)
End Area: 101.58 (in^2)

Test	Pile	Ultimate	Mobilized	Estimated	Allowable	Ultimate

Pile Length (ft)	Width (in)	Side Friction (tons)	End Bearing (tons)	Davisson Capacity (tons)	Pile Capacity (tons)	Pile Capacity (tons)
101.00	14.7	310.20	10.14	320.34	160.17	340.62
102.00	14.7	313.82	10.83	324.65	162.33	346.31
103.00	14.7	317.25	12.35	329.60	164.80	354.31
104.00	14.7	320.61	13.69	334.31	167.15	361.70
105.00	14.7	323.93	14.62	338.55	169.28	367.79
106.00	14.7	327.51	15.25	342.76	171.38	373.25
107.00	14.7	331.63	15.95	347.58	173.79	379.47
108.00	14.7	336.20	16.81	353.01	176.50	386.62
109.00	14.7	340.59	18.13	358.72	179.36	394.99
110.00	14.7	344.68	19.93	364.62	182.31	404.49
111.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
112.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
113.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
114.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
115.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

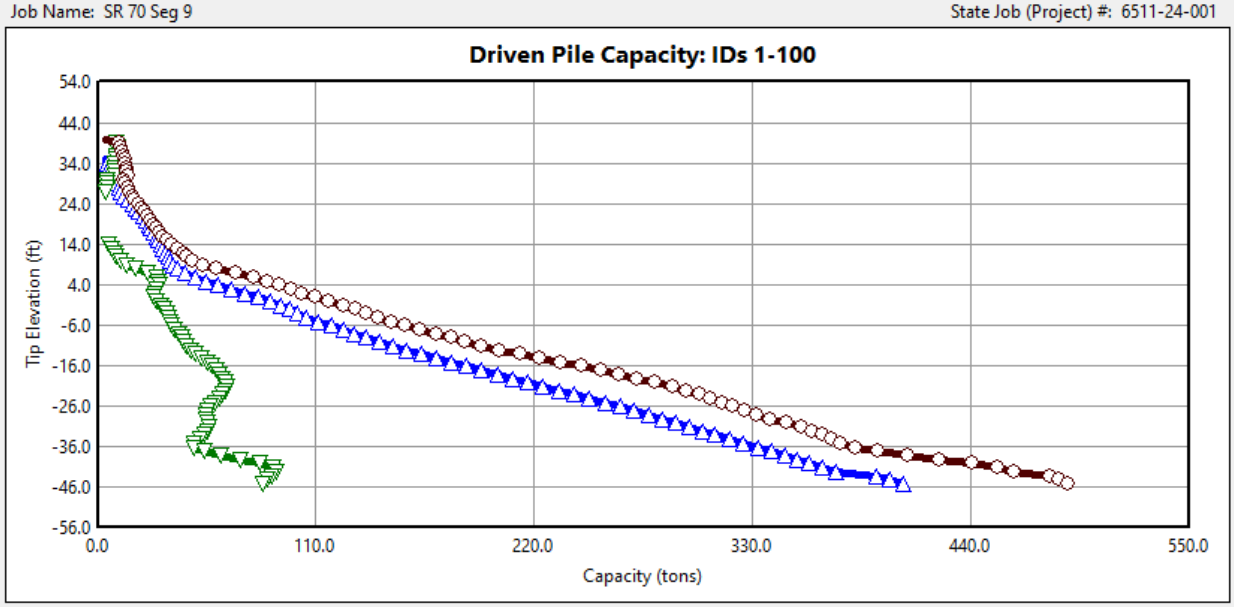
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- ☑ Ultimate Side Friction
- ☑ Mobilized End Bearing
- ☐ Ultimate Pile Capacity
- ☑ Estimated Davisson Capacity
- ☐ Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-WHID-1	
Ground Surface Elevation	54.90	(ft)
Section:	Square	
Width	18.00	(in)

Project Data

File:	BB-WHID-1_18-inch
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. DN

Analysis Data

Analysis Type:	SPT

Plot Options

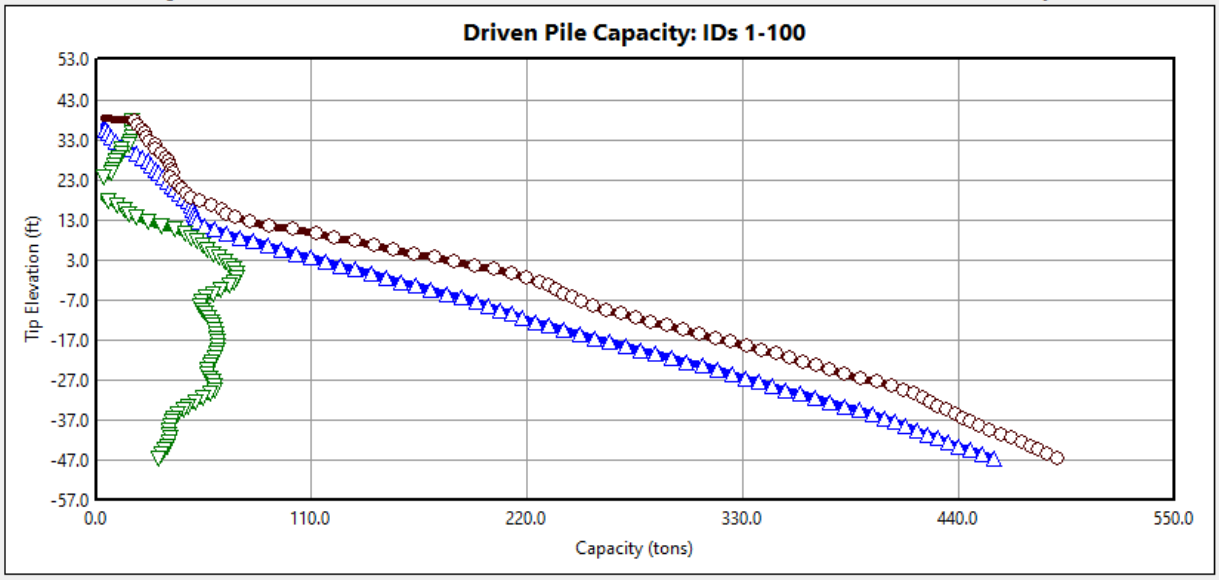
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-WHID-2	
Ground Surface Elevation	53.60	(ft)
Section:	Square	
Width	18.00	(in)

Project Data

File:	BB-WHID-2_18-inch
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. DN

Analysis Data

Analysis Type:	SPT

Plot Options

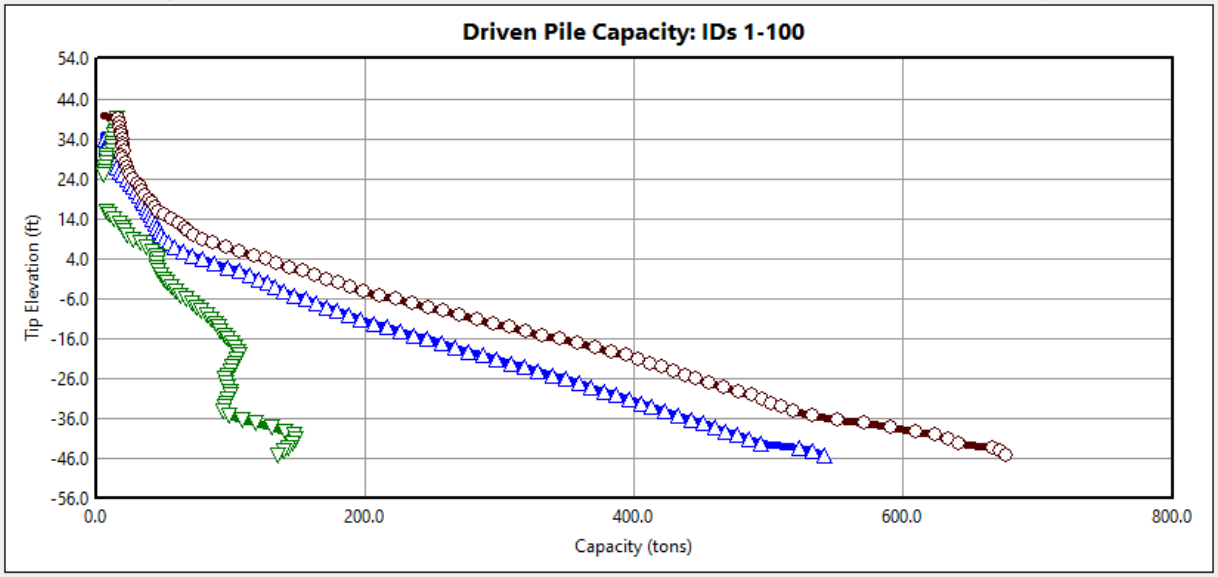
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-WHID-1
Ground Surface Elevation	54.90 (ft)
Section:	Square
Width	24.00 (in)

Project Data

File:	BB-WHID-1_24-inch
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. DN

Analysis Data

Analysis Type:	SPT

Plot Options

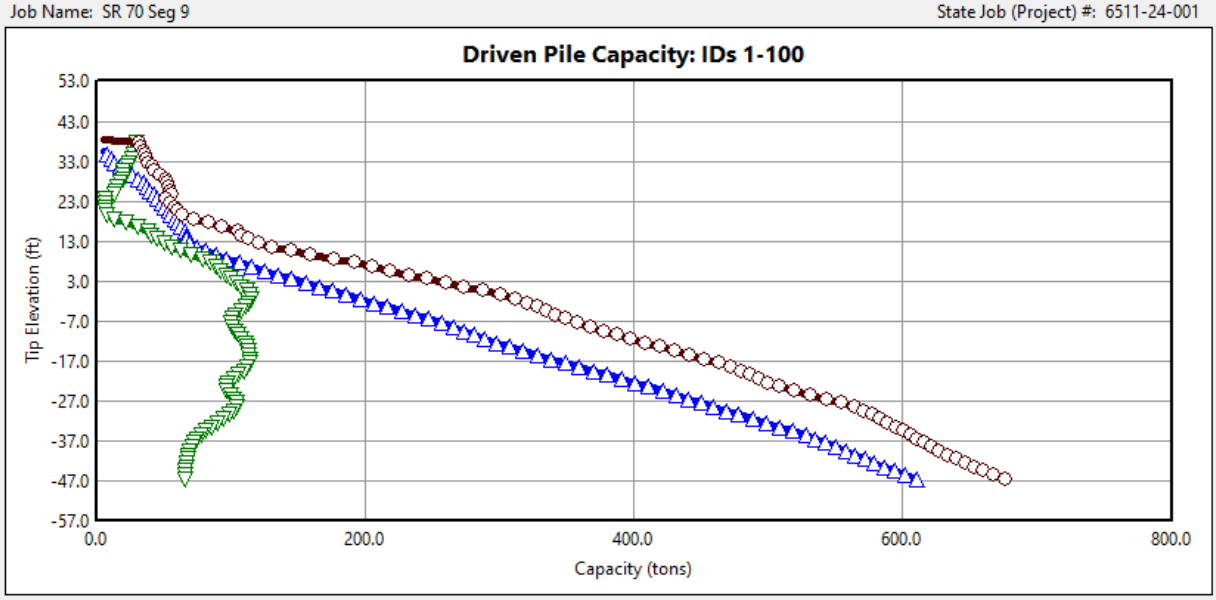
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- ☑ Ultimate Side Friction
- ☑ Mobilized End Bearing
- ☐ Ultimate Pile Capacity
- ☑ Estimated Davisson Capacity
- ☐ Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-WHID-2
Ground Surface Elevation	53.60 (ft)
Section:	Square
Width	24.00 (in)

Project Data

File:	BB-WHID-2_24-inch
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. DN

Analysis Data

Analysis Type:	SPT

Plot Options

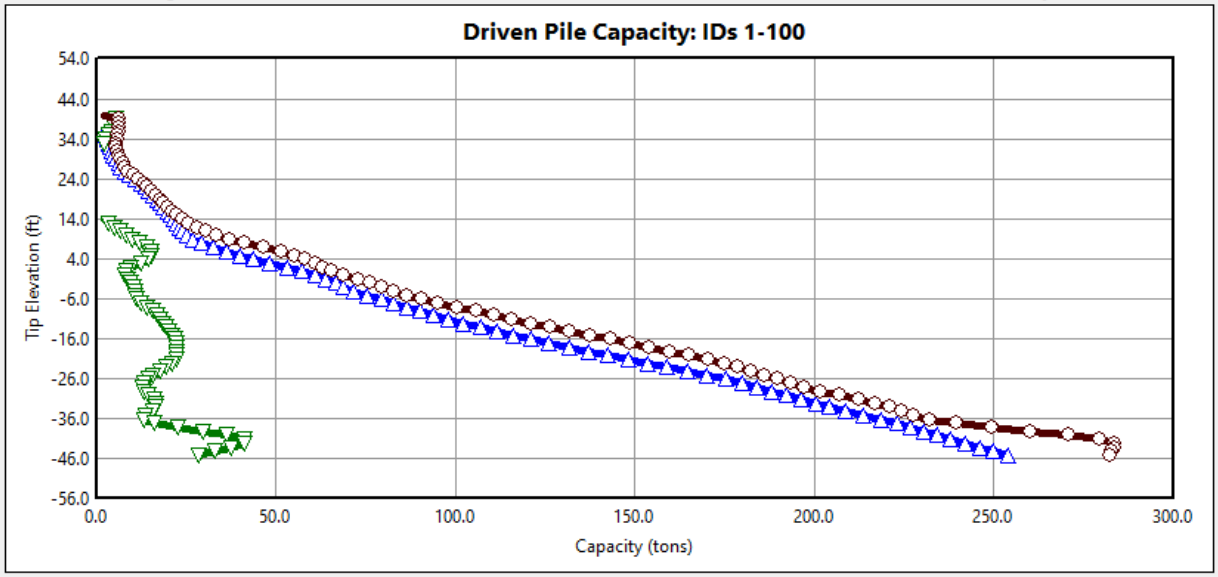
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-WHID-1	
Ground Surface Elevation	54.90	(ft)
Section:	H-Section	
Width	14.69	(in)
Depth	13.83	(in)
End Area	101.58	(in2)

Project Data

File:	BB-WHID-1_14x89
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. DN

Analysis Data

Analysis Type:	SPT

Plot Options

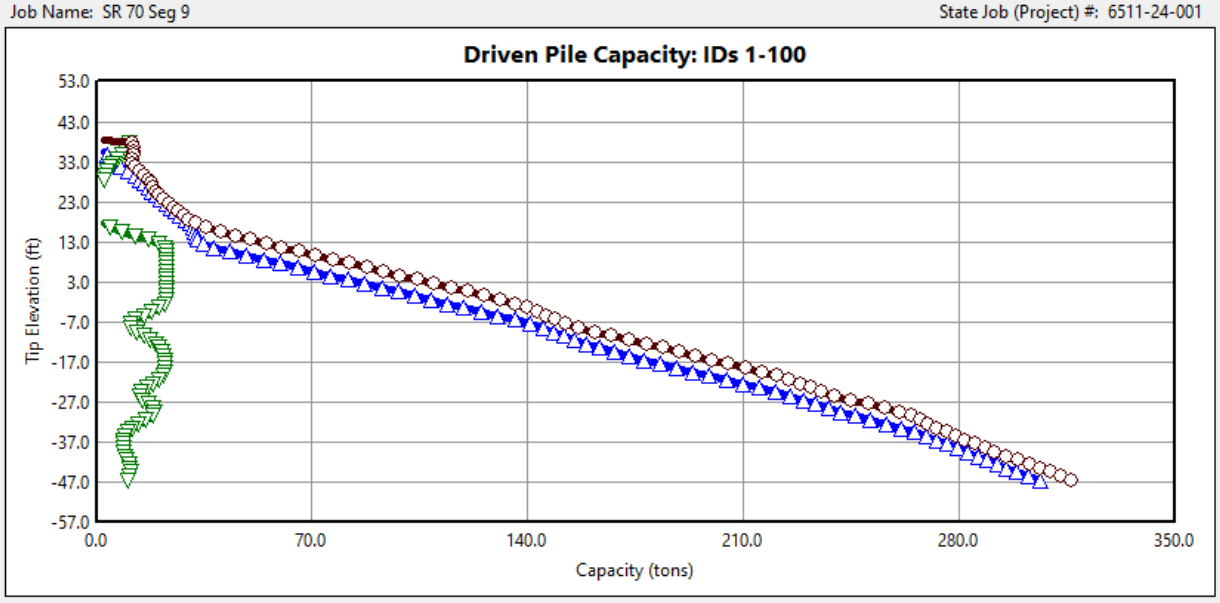
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-WHID-2	
Ground Surface Elevation	53.60	(ft)
Section:	H-Section	
Width	14.69	(in)
Depth	13.83	(in)
End Area	101.58	(in2

Project Data

File:	BB-WHID-2_14x89
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. DN

Analysis Data

Analysis Type:	SPT

Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

Summary of Laboratory Test Results for Soil Classification
SR 70 from West of SR 31 to Highlands County Line
SR 70 over Whidden Creek Bridge
DeSoto County, Florida
FPID No. 451942-2-52-01
Tierra Project No: 6511-24-001

Boring Number	Sample Depth (ft)	USCS Symbol	Sieve Analysis					Atterberg Limits			Organic Content (%)	Natural Moisture Content (%)
			#10	#40	#60	#100	#200	Liquid Limit	Plastic Limit	Plasticity Index		
BB-WHID-1	2.0 - 6.0	SP	---	---	---	---	4	---	---	---	---	---
BB-WHID-1	23.5 - 25.0	SC	---	---	---	---	43	29	19	10	---	---
BB-WHID-1	31.0 - 32.5	CL	---	---	---	---	64	31	14	17	---	---
BB-WHID-1	36.0 - 37.5	CL	---	---	---	---	63	29	14	15	---	---
BB-WHID-1	43.5 - 45.0	SC-SM	---	---	---	---	33	22	15	7	---	---
BB-WHID-1	51.0 - 52.5	SM	---	---	---	---	29	---	---	---	---	---
BB-WHID-1	61.0 - 62.5	SM	---	---	---	---	37	NP	NP	NP	---	26
BB-WHID-1	71.0 - 72.5	SC	---	---	---	---	48	28	20	8	---	25
BB-WHID-1	83.5 - 85.0	SM	---	---	---	---	21	NP	NP	NP	---	27
BB-WHID-1	96.0 - 97.5	SP-SM	---	---	---	---	5	---	---	---	---	---
BB-WHID-1	106.0 - 107.5	SM	---	---	---	---	13	NP	NP	NP	---	29
BB-WHID-1	111.0 - 112.5	SM	---	---	---	---	13	NP	NP	NP	---	32
BB-WHID-1	116.0 - 117.5	CL-ML	---	---	---	---	55	26	21	5	---	24
BB-WHID-2	2.0 - 6.0	SP-SM	---	---	---	---	7	---	---	---	---	---
BB-WHID-2	23.5 - 25.0	SC-SM	---	---	---	---	37	22	17	5	---	---
BB-WHID-2	31.0 - 32.5	CL	---	---	---	---	66	27	17	10	---	---
BB-WHID-2	46.0 - 47.5	SM	---	---	---	---	25	---	---	---	---	---
BB-WHID-2	61.0 - 62.5	SC	---	---	---	---	33	33	20	13	---	28
BB-WHID-2	71.0 - 72.5	SM	---	---	---	---	47	NP	NP	NP	---	26
BB-WHID-2	81.0 - 82.5	SM	---	---	---	---	21	NP	NP	NP	---	28
BB-WHID-2	93.5 - 95.0	MH	---	---	---	---	80	58	32	26	---	52
BB-WHID-2	106.0 - 107.5	SC	---	---	---	---	30	32	22	10	---	29

Summary of Laboratory Test Results for Environmental Classification
SR 70 from West of SR 31 to Highlands County Line
SR 70 over Whidden Creek Bridge
DeSoto County, Florida
FPID No. 451942-2-52-01
Tierra Project No: 6511-24-001

Soil Samples

Boring Number	Depth (feet)	USCS Symbol	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
							Steel	Concrete
BB-WHID-1	2.0 - 6.0	SP	6.5	5,800	15	129	Moderately Aggressive	Slightly Aggressive
BB-WHID-2	2.0 - 6.0	SP-SM	7.6	7,100	15	93	Slightly Aggressive	Slightly Aggressive

Water Samples

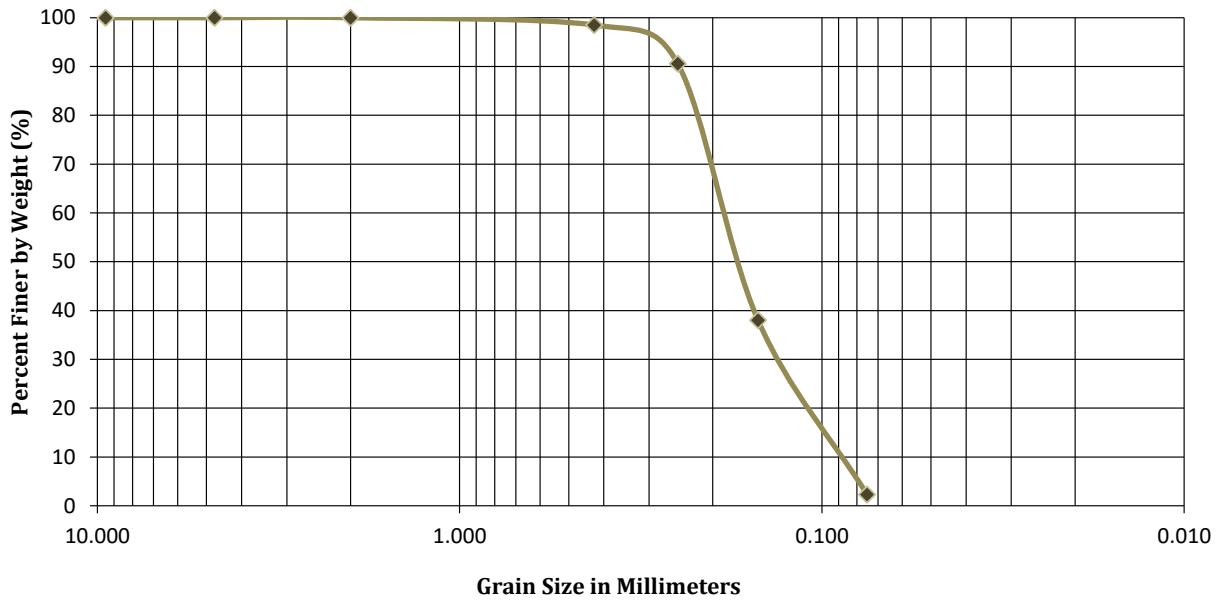
Sample Location	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
					Steel	Concrete
Whidden Creek	7.9	2,500	90	90	Moderately Aggressive	Moderately Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Grain Size Distribution Report
SR 70 from West of SR 31 to Highlands County Line
SR 70 over Whidden Creek Bridge
DeSoto County, Florida
FPID No. 451942-2-52-01
Tierra Project No.: 6511-24-001

Approximate Sample Location		Depth Below Mudline (ft)
Northing	Easting	
1045152	719777	0.0-2.0

Grain Size Distribution Curve



Material Description	Classification	
	USCS	AASHTO
Gray to Brown Sand	SP	A-3

Sieve Number	Diameter (mm)	Percent Finer by Weight (%)
3/4"	19.000	100
3/8"	9.500	100
4	4.750	100
10	2.000	100
40	0.425	98.5
60	0.250	90.6
100	0.150	38
200	0.075	2.3

Coefficients

D_{10}	0.087	D_{30}	0.128
D_{50}	*0.169*	D_{60}	0.186
D_{85}	0.237	D_{90}	0.249
D_{95}	0.336		
C_U	2.133	C_C	1.020

TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

April 3, 2025

HNTB Corporation
201 N. Franklin Street, Suite 1200
Tampa, FL 33602

Attn: Mr. John Burton, PE, PMP, PTOE, ENV SP.

RE: Preliminary Bridge Geotechnical Report
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over Joshua Creek Bridges
FPID No. 451942-2-52-01
DeSoto County, Florida
Tierra Project No. 6511-24-001

Mr. Burton:

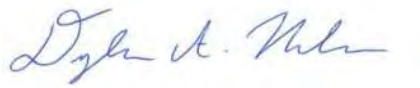
Tierra, Inc. (Tierra) has performed a preliminary geotechnical study for the proposed bridge structures associated with the project referenced above. This report has been prepared to support the project Bridge Development Report (BDR). This report presents the results of our study including field and laboratory testing, a preliminary foundation design analysis and our opinions regarding appropriate foundation alternatives for the proposed bridge structures.

Tierra, Inc. appreciates the opportunity to be of service to HNTB Corporation (HNTB) on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.

Kaitlyn C. Waterman, P.E.
Geotechnical Engineer
Florida License No. 96615



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USDA Soil Survey & USGS Quadrangle Maps
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APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

1.0 PROJECT INFORMATION

1.1 Project Authorization

Authorization to proceed with this project was issued by HNTB in accordance with our Subconsultant Agreement.

1.2 Project Description

This project consists of widening SR 70 from two lanes to four-lane divided section from West of SR 31 (MP 14.973) to the Highlands County Line (MP 31.763). A shared use path is also proposed on the south side of the SR 70 widening.

This report has been prepared to provide geotechnical input for the Bridge Development Report (BDR) associated with the design of the proposed SR 70 over Joshua Creek bridge structures in Segment 9. The subsurface information obtained to date and preliminary engineering recommendations for the proposed foundation alternatives are provided herein.

1.3 General Site Description

The proposed bridge structures are located in an area surrounded by wetlands, pasturelands, wooded areas and low-density residential areas. Two eastbound/westbound SR 70 travel lanes traverse the existing SR 70 over Joshua Creek bridge (Bridge No. 040027). Based on a review of Existing Bridge Plans circa 1958, the existing Bridge No. 040027 is a six-span structure founded on two (2) end bents and five (5) intermediate bents supported by 14-inch Pre-stressed, Pre-cast, Square Concrete (PPSC) Piles. Non-structural pile jackets were installed on select intermediate bents circa 2022. At the time of this report, Pile Driving Logs for the existing Bridge No. 040027 were not available for review. A field photo of the existing Bridge No. 040027 is shown below:

Photograph 1: Existing Bridge No. 040027 (Facing Southeast)

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to provide geotechnical (i.e. subsurface soil conditions and related engineering properties) input to the design team to assist with the design and construction of the proposed SR 70 over Joshua Creek bridge structures. The following services were provided in order to achieve the preceding objective:

1. Reviewed soil information from the “Soil Survey of DeSoto County, Florida” published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Reviewed topographic and potentiometric information obtained from the “Arcadia, Florida” Quadrangle map and the “Upper Floridan Aquifer Potentiometric Surface” maps published by the United States Geological Survey (USGS).

2. Conducted a visual reconnaissance of the project site and coordinated utility clearance through Sunshine State One Call.

3. Executed a program of subsurface exploration consisting of subsurface sampling and field testing. Performed two (2) Standard Penetration Test (SPT) borings advanced to depths of approximately 125 to 130 feet below existing grades.

4. Visually classified and stratified the obtained soil samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D-2488. Conducted laboratory testing on selected soil samples to confirm the visual classification and evaluate the corrosive nature of the soil and water.

5. Evaluated foundation criteria and performed engineering analyses to develop preliminary design recommendations for the foundation alternatives associated with the proposed bridge structures.

6. Prepared this formal engineering report, which summarizes the course of study pursued, the field and laboratory data generated, the subsurface conditions encountered and the preliminary geotechnical recommendations for the design and construction of the proposed bridge structure foundation alternatives.

3.0 REVIEW OF PUBLISHED DATA

3.1 Regional Geology

DeSoto County Geology has been paraphrased from the Florida Geological Survey, Open-File Report 80, 2001 and other geologic references.

Based on a review of the Surficial Geology Maps published by FGS, the Hawthorn Group, Peace River Formation is mapped at the surface of the bridge site. Lithologically, these sediments consist of yellowish-grey to light olive green interbedded phosphatic sands, clayey sands, clays and dolomite stringers. The thickness of the Peace River Formation is approximately 50 feet in the northeastern and southwestern corners of the county. The Peace River thickens to more than 160 feet in the southeastern corner of the county. The Peace River dips and thickens in the general south easterly direction.

3.2 USDA Soil Survey

Based on a review of the Soil Survey for DeSoto County published by the USDA NRCS, it appears that there is one (1) primary soil-mapping unit noted at the bridge site. The general soil description as described in the Soil Survey is presented in the following table. The **USDA Soil Survey Map** for the bridge site is illustrated in **Appendix A**.

SUMMARY OF USDA SOIL SURVEY DESOTO COUNTY, FLORIDA							
USDA Map Symbol and Soil Name	**Depth (in)**	**Soil Classification**		**Permeability (in/hr)**	**pH**	**Seasonal High Water Table**	
		USCS	**AASHTO**			**Depth (feet)**	**Months**
(2) Anclote	0-10	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	5.1-8.4	+2.0-0.0	Jan, Feb, Jun, Jul-Oct, Nov-Dec
	10-14	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	5.1-8.4		
	14-35	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	5.1-8.4		
	35-65	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	5.1-8.4		
	65-80	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	5.1-8.4		

It should be noted that information contained in the USDA Soil Survey Map may not be reflective of actual soil and groundwater conditions, particularly if recent development in the project vicinity has modified soil conditions or surface/subsurface drainage.

3.3 USGS Quadrangle Map

Based on a review of the "Arcadia, Florida" USGS Quadrangle Map, it appears that the natural elevation at the project site ranges from approximately +55 feet to +60 feet National Geodetic Vertical Datum of 1929 (NGVD 29) as illustrated on the **USGS Quadrangle Map** in **Appendix A.**

3.4 Review of Potentiometric Surface Information

Based on a review of the "Upper Floridan Aquifer Potentiometric Surface" maps published by the USGS, the potentiometric surface elevation at the bridge site is reported to range from approximately +40 to +50 feet, NGVD 29. As indicated in **Section 3.3**, the natural ground surface elevation at the bridge site ranges from approximately +55 to +60 feet, NGVD 29. Artesian flow conditions were not encountered during the field exploration.

4.0 SUBSURFACE EXPLORATION

4.1 Boring Location Plan

Prior to commencing our subsurface explorations, a boring location plan for the proposed bridge structures was developed based on design information provided by HNTB. This boring location plan was generated based on our engineering judgment and guidelines provided in the "Soils and Foundations Handbook" published by the FDOT. Tierra submitted this boring location plan to FDOT for approval. Following completion of the borings, the boring locations were surveyed by the project surveyor. The Boring Location Plan for the borings performed is provided on the **Report of Core Borings** sheets in **Appendix A.**

Utility clearances were coordinated by Tierra via Sunshine State One Call and updated as required prior to performing the soil borings in order to reduce the potential for damage to the utilities during drilling.

4.2 Soil Borings

Subsurface conditions were explored at the bridge site with two (2) SPT borings. The results and locations of the SPT borings are presented on the **Report of Core Borings** sheets in **Appendix A**.

The SPT borings were performed with the use of a drill rig using Bentonite Mud drilling procedures. Temporary 3-inch diameter rotary installed casing was utilized to help keep the boreholes stable. The soil sampling was performed in general accordance with the ASTM test designation D-1586. The initial 6 feet of the borings were hand augered to verify utility clearances. SPT resistance N-values were then taken at intervals of 2 feet from the hand auger boring depth of 6 feet to a depth of 17½ feet and on intervals of 2½ feet thereafter to the boring termination depths. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our laboratory for classification and analyses.

Soil stratification was determined based on a review of recovered samples, laboratory test results, and interpretation of field boring logs. Stratification lines represent approximate boundaries between soil layers of different engineering properties; however actual transitions between layers may be gradual. In some cases, small variations in properties that were not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The soil profiles represent the conditions at the particular boring location; variations do occur among the borings. Specific details about subsurface conditions and materials encountered at each test location can be obtained from the soil profiles presented on the **Report of Core Borings** sheets in **Appendix A** of this report.

5.0 LABORATORY TESTING

5.1 General

Representative soil samples collected from the SPT borings were classified and stratified in general accordance with the Unified Soil Classification System (USCS). Our classification was based on visual observations, using the results from the laboratory testing as confirmation. Laboratory testing consisting of fines content (percentage passing No. 200 mesh sieve), Atterberg limits testing, and natural moisture content determination tests were completed on representative soil samples. In addition, Environmental classification tests were performed to evaluate the corrosive nature of the soil and water encountered at the bridge site. The results of the laboratory tests are presented on the **Report of Core Borings** sheets in **Appendix A**. Detailed results of the tests performed are presented on the **Summary of Laboratory Test Results for Soil Classification**, **Summary of Laboratory Test Results for Environmental Classification** and **Grain Size Distribution Report** in **Appendix C.**

5.2 Test Designation

The following list summarizes the laboratory tests performed and respective test methods utilized.

- Fines Content - The fines content tests were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-1140).

- Grain-Size Analyses - The grain-size analyses were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-6913).

- Atterberg Limits - The liquid limit and the plastic limit tests ("Atterberg Limits") were conducted in general accordance with the AASHTO test designations T-089 and T-090, respectively (ASTM test designation D-4318).

- Natural Moisture Content - The moisture content tests were conducted in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).

- Environmental Classification – The environmental classification tests were conducted in general accordance with the FSTM test designations FM 5-550, FM 5-551, FM 5-552, and FM 5-553.

6.0 ENVIRONMENTAL CLASSIFICATION

Environmental classification tests were performed on recovered soil samples obtained from within the borings performed at the bridge site and from water samples obtained from Joshua Creek. Based on the laboratory test results and the 2025 FDOT Structure Design Guidelines (SDG), the environmental classifications of the superstructure and substructure for the bridge are classified as follows:

Superstructure Environmental Classification	Concrete Substructure Classification	Steel Substructure Classification
Slightly Aggressive	Moderately Aggressive (Soil – pH = 5.5) (Water - Resistivity = 2,300 Ohm-cm)	Extremely Aggressive (Soil - pH = 5.5)

The range of test results is presented on the **Report of Core Borings** sheets in **Appendix A.** A summary of the individual corrosion series test results is provided in **Appendix C**.

7.0 RESULTS OF SUBSURFACE EXPLORATION

7.1 General Subsurface Conditions

Typically, the borings encountered sandy soils underlain by intermittent layers of clayey, silty and sandy soils to the boring termination elevation. Specific information on the soil conditions

encountered can be found on the **Report of Core Boring** sheets in **Appendix A.** The soil descriptions and classifications associated with this project are listed in the following table.

Soil Description	USCS Symbol
SAND	SP/SP-SM
SILTY SAND	SM
CLAYEY SAND	SC
CLAY	CL/CH
SILT	MH

Additional borings will be performed as the project progresses beyond the BDR stage; the results will be presented in future submittals.

7.2 Groundwater

The groundwater table was encountered at depths ranging from approximately 15 feet to 16 feet below existing grades within the borings performed and is presented on the **Report of Core Borings** sheets in **Appendix A**.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e. swales, drainage ponds, underdrains and impervious areas) and creek water levels.

8.0 EVALUATIONS OF BRIDGE FOUNDATION ALTERNATIVES

Evaluations of foundation alternatives for the proposed bridge structures were based on the results of our field study at the location of the proposed bridge structures. Based on our discussions with HNTB the following foundation alternatives were considered:

- Shallow Foundations
- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)
- Steel Piles, including H Sections
- Pre-stressed, Pre-cast, Square Concrete (PPSC) Piles
- Drilled Shafts

The following paragraphs discuss each of these alternatives briefly.

8.1 Shallow Foundations

With shallow foundation systems, the structure loads are supported by the bearing capacity of the foundation soils. The design of shallow foundations is typically governed by the soil bearing capacity and total and differential settlement criteria.

Very loose/soft soils were encountered within the influence zone of typical shallow foundation sizes and settlement due to the soft clay/silt as they consolidate will occur over time. Based on

the anticipated loading conditions for roadway bridges of this size, a shallow footing would have to be relatively large for bearing capacity and settlement criteria to be achieved or would require some form of subsurface remediation to increase the bearing capacity and decrease settlement potential.

For these reasons, shallow foundations were not considered further for this report.

8.2 Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)

GRS-IBS consists of a shallow foundation combined with a retaining wall system to provide support for single span bridges or multi-span bridges with simply supported end spans. The reasons discussed in **Section 8.1** that preclude the use of shallow foundations also apply to the GRS-IBS.

For these reasons, GRS-IBS was not considered further for this report.

8.3 Pre-Cast Pre-Stressed Square Concrete (PPSC) Piles

PPSC pile foundations are a feasible foundation alternative. They are a widely used and proven foundation system in Florida. PPSC pile foundations are readily available and generally have a lower cost per ton of capacity than other pile types. Analyses were performed for 18-inch and 24-inch PPSC piles for this Preliminary Bridge Geotechnical Report.

8.4 Steel Piles

Steel pile types include H-sections and pipe piles. Steel piles generally do not develop as much capacity for similar penetration depths as PPSC piles. Steel piles are well suited to soil conditions with high variability and where frequent pile splicing is expected and/or required due to overhead restrictions, subsurface variability, etc. Steel piles may also more easily penetrate dense layers to achieve a desired penetration depth and are less susceptible to damage compared to concrete piles. Steel H-Piles are low displacement piles, and therefore vibrations associated with installations are minimized due to the low-displacement nature of the piles. Open end pipe piles are also low displacement but will eventually become plugged at the pile toe. Closed-end pipe piles are displacement piles and would generate more end bearing capacity compared to open-end pipe piles.

A pH test value of 5.5 performed on a soil sample obtained from the bridge site results in an Extremely Aggressive Environmental Classification for steel. The SR 70 bridges over Joshua Creek are water-based bridges. Therefore, the use of steel H-piles is precluded per SDG Table 3.1-1. Only internally redundant steel pipe piles (i.e., closed-end pipe piles filled with concrete refer to SDG 3.1.G.2) would be permitted. Based on coordination with the Structural Engineer, steel piles were not evaluated further for the SR 70 over Joshua Creek bridges.

8.5 Drilled Shafts

Drilled, cast-in-place, concrete shafts have the ability to develop high axial and lateral capacities. One drilled shaft could potentially take the place of several driven piles depending on soil/rock conditions.

This type of foundation system is often the chosen alternative for sites where competent limestone are present at a relatively shallow depth and with a sufficient thickness. Drilled shafts will develop large skin friction capacities in limestone compared to dense sand, and therefore drilled shafts are most suited for sites with shallow, competent consistent limestone. Drilled shafts foundations may also be considered as a preferred foundation alternative for sites in order to limit construction induced vibrations compared to the vibrations caused by driven piles.

Limestone was not encountered within the SPT Borings performed at the bridge site. Therefore, drilled shafts were not analyzed further for this Preliminary Bridge Geotechnical Report.

9.0 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

9.1 General

Based on the subsurface conditions encountered in the test borings performed to date, it is Tierra's opinion that driven pile foundations are the most suitable foundation alternative type for the proposed bridge structures. Foundation systems comprised of 18-inch and 24-inch PPSC piles were analyzed for this Preliminary Bridge Geotechnical Report. The following sections present the results of the engineering analyses for the proposed deep foundation alternatives.

9.2 Downdrag (Negative Skin Friction)

Based on a review of preliminary cross sections, the new bridge supporting the eastbound travel lanes will be at/near the elevation of the existing bridge, and the new bridge supporting the westbound travel lanes will have new embankments (anticipated to be less than about 15 feet high) at each end bent approach. Based on the new embankments and soil conditions encountered in the borings, there will be downdrag loads imparted to the end bent piles. Actual loads will be determined following the BDR stage once a foundation alternative has been selected and the roadway geometry has been finalized. For preliminary estimation purposes, downdrag loads up to 20 tons should be anticipated at the end bent locations.

The portion of the end bent concrete piles within the embankment should be provided with a double wrap of polyethylene sheeting according to the FDOT Specifications to minimize development of downdrag loads from the embankment fill.

9.3 Scour

It is our understanding that the scour analysis will be performed by others. Tierra performed sieve analyses on soil samples collected within two feet of the mudline of Joshua Creek near the existing bridge. The results of the sieve analyses along with D_{50} values for use in the scour analysis calculations are provided on the **Grain Size Distribution Report** in **Appendix C**.

9.4 Driven Pile Axial Capacity

Axial pile capacities for the proposed bridge were analyzed based on the subsurface conditions encountered in the borings and the FDOT program FB-Deep. The Load and Resistance Factor Design (LRFD) method was utilized for the analysis.

As indicated in the FDOT Structure Design Guidelines (SDG), the required Nominal Bearing Resistance (Rn) must satisfy the following requirement:

$$Rn > \frac{\text{(Factored Design Load + Downdrag + Net Scour)}}{\phi}$$

Where ϕ = 0.75; dynamic load testing will be performed on all piles.

Other ϕ factors may be used based on the type of foundation testing recommended.

The R_n is taken as the Davisson Capacity. The Davisson axial capacity consists of the ultimate skin friction and mobilized end bearing (i.e., one-third of the ultimate end bearing).

Based on the results of borings performed at the bridge sites to date, medium dense to very dense silty to clayey sands were encountered at the bridge site where concrete piles will likely tip. Based on the information provided in the FDOT Publication *"Improving Design Phase Evaluations of High Pile Rebound Soils with an Emphasis on SPT Testing"* and our experience, concrete displacement piles have the potential to experience pile "rebound" during pile driving activities into these types of soils. We therefore recommend limiting the maximum NBR values below what is stated in SDG Table 3.5.13-1. The following table summarizes the approximate maximum recommended R_n for each driven pile foundation alternative:

Driven Pile Foundation Alternative	Approximate Maximum Recommended R_n(1)
18-Inch PPSC Piles	275 tons
24-Inch PPSC Piles	425 tons
(1) Anticipate downdrag loads up to 20 tons for preliminary estimation purposes.	

The axial capacity for 18-inch and 24-inch PPSC piles were computed using the program FB-Deep. The results of the axial pile analyses are presented in **Appendix B**, including the axial capacity curves, FB-Deep computer output files, and FB-Deep output curves (including Davisson Capacity Curves, Ultimate Skin Friction Curves and Mobilized End Bearing Curves).

9.5 Group Action

No reductions of the individual pile capacities will be required if piles are spaced center-to-center at 3 times their width or greater.

9.6 Settlement

Settlement of pile supported bridge bents should be small and tolerable for a typical single row group. However, the tolerance should be confirmed by the structural engineer. Based on soil conditions encountered at the boring locations, and that piles will be tipped in a suitable bearing layer, individual pile head settlements are estimated to be on the order of ½ inch or less.

10.0 CONSTRUCTION CONSIDERATIONS

10.1 General

The overall site preparation and construction should be in accordance with the FDOT Specifications.

10.2 Temporary Side Slopes

Temporary side slopes and excavations should comply with the Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 C.F.R., s. 1926.650, Subpart P, all subsequent revisions or updates of OSHA's referenced standard adopted by the Department of Labor and Employment Security and Florida's Trench Safety Act, Section 553.62, Florida Statutes. Excavated materials should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth.

10.3 Groundwater Control

Depending upon groundwater levels at the time of construction, some form of dewatering may be required based on the anticipated construction activities due to perched groundwater. Due to groundwater levels anticipated during the wet season of the year, seepage may enter the bottom and sides of excavated areas. Such seepage will act to loosen soils and create difficult working conditions. Groundwater levels should be determined immediately prior to construction. Shallow groundwater should be kept below the lowest working area to facilitate proper material placement and compaction in accordance with the FDOT Specifications.

10.4 Dynamic Load Testing & Pile Installation

We recommend that a test pile program be conducted for the proposed bridge construction including test piles. The test piles should be dynamically monitored. The monitoring will provide estimates of pile capacity versus pile penetration, stresses in the pile, and other relevant parameters used to evaluate the pile driving process. analyses should be performed on selected conditions for evaluation of the dynamic test results. The results of these analyses will provide information for developing production pile lengths. In addition, all production piles will be dynamically monitored.

The installation of the piles should be carried out in accordance with the FDOT Specifications.

10.5 Protection of Existing Structures

The FDOT Specifications should be followed for protection of existing structures during foundation construction operations.

11.0 REPORT LIMITATIONS

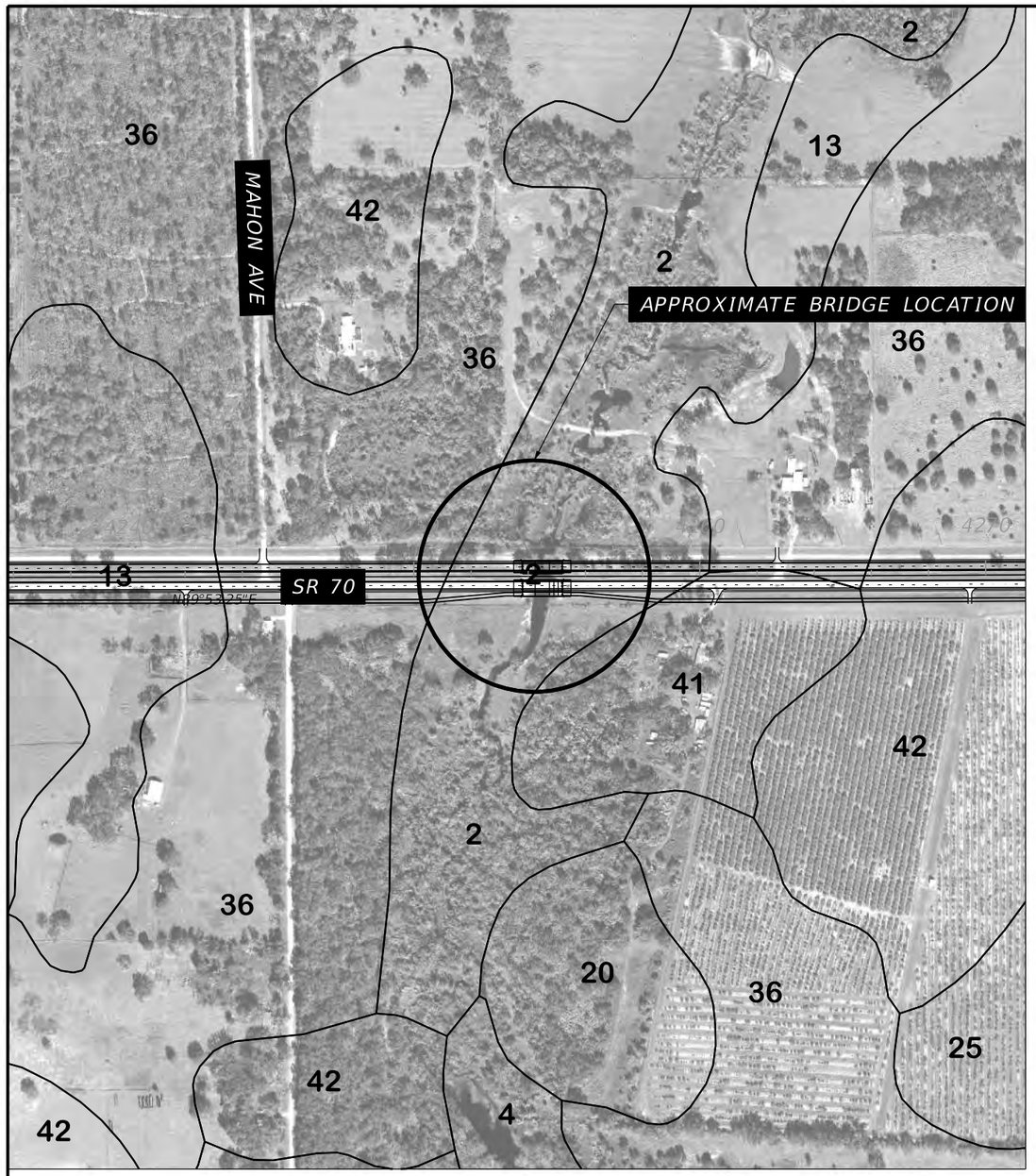
Our services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions, or recommendations made by others based on this data.

The scope of the investigation was intended to evaluate soil conditions within the influence zone of the deep foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed structure.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of the HNTB design team and the Florida Department of Transportation.

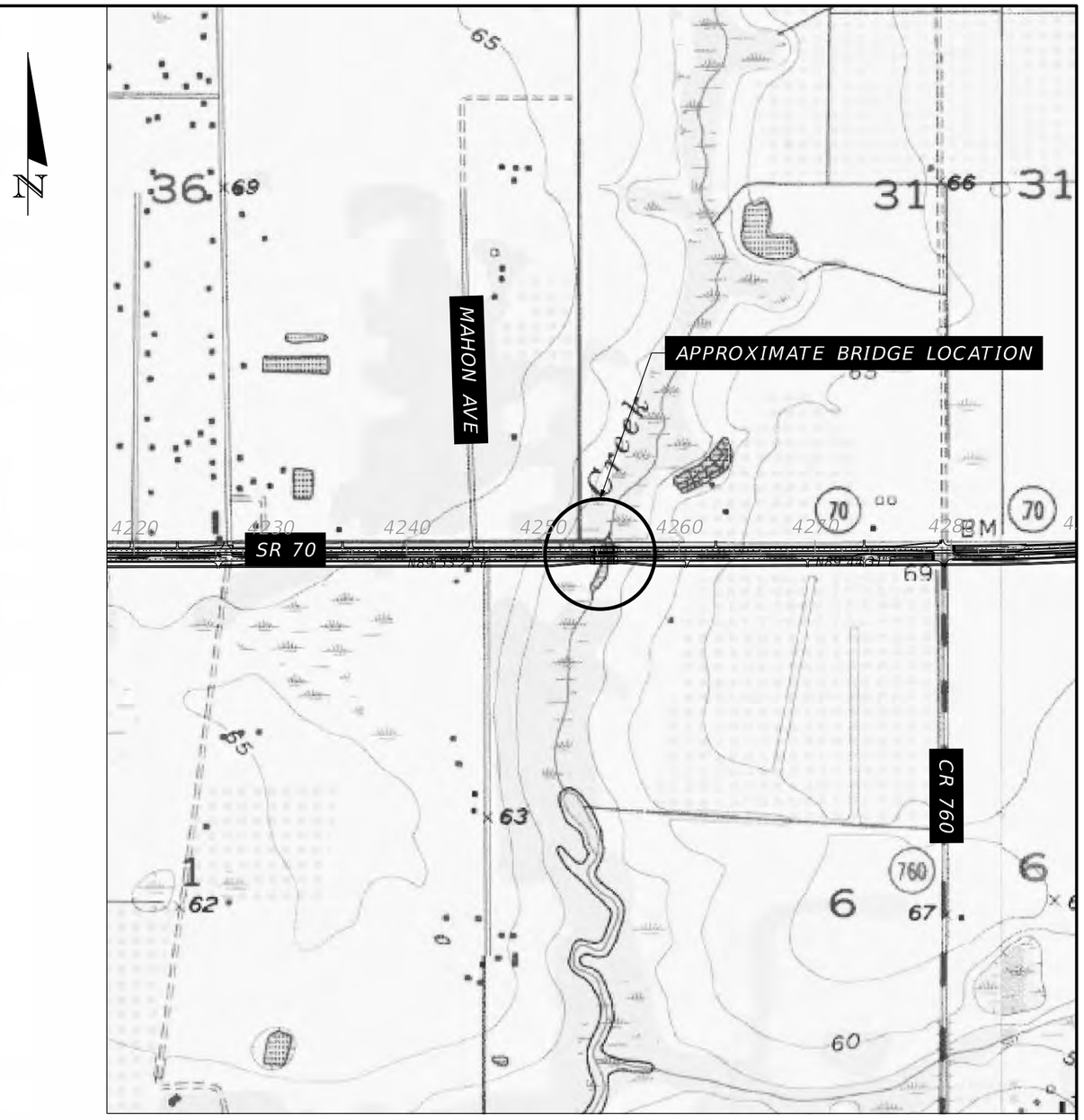
APPENDIX A

USDA Soil Survey & USGS Quadrangle Maps
Report of Core Borings (2 Sheets)



REFERENCE: USDA SOIL SURVEY OF DESOTO COUNTY, FLORIDA

0 100 500
Feet



REFERENCE: USGS QUADRANGLE MAP OF "ARCADIA, FLORIDA"

0 200 1000
Feet

TOWNSHIP: 37S , 38S
RANGE: 26E
SECTION: 6, 31

BRIDGE NO. XXXXXX

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

DYLAN A. NELSON, P.E.
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7351 TEMPLE TERRACE HIGHWAY
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DESIGNED BY: BJS 04-25
CHECKED BY: DAN 04-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: USDA SOIL SURVEY & USGS QUADRANGLE MAPS

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

REF. DWG. NO.

SHEET NO.

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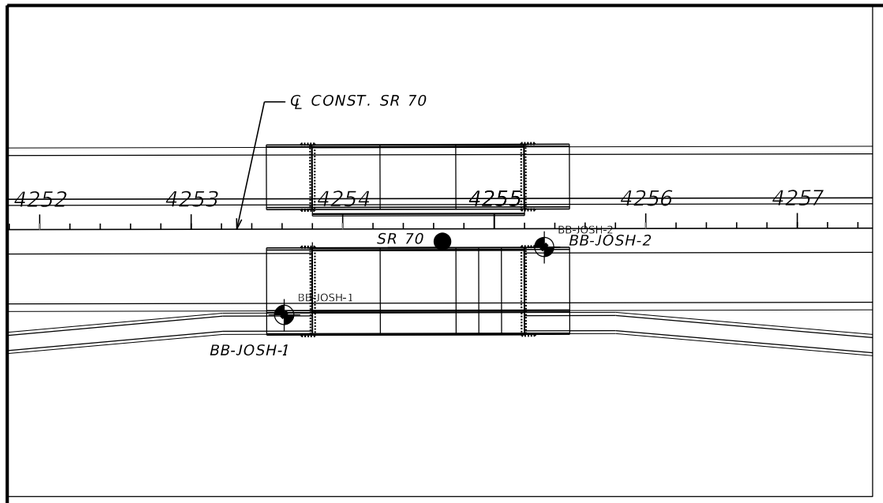
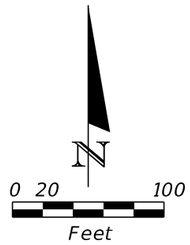


BORING LOCATION PLAN



NOTES:
1. THE BORING LOCATIONS AND ELEVATIONS WERE PROVIDED BY THE PROJECT SURVEYOR.
2. BASED ON A REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION AT THE BRIDGE SITE IS REPORTED TO RANGE FROM APPROXIMATELY +40 FEET TO +50 FEET, NGVD 29. ARTESIAN CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED AT THE TIME OF OUR FIELD ACTIVITIES; HOWEVER, THE CONTRACTOR SHOULD BE PREPARED TO ADDRESS ARTESIAN LEVELS UP TO A HEAD OF +50 FEET, NGVD 29.

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: MODERATELY AGGRESSIVE (SOIL - pH = 5.5, WATER - RESISTIVITY = 2,300 OHM-CM)
SUBSTRUCTURE	STEEL: EXTREMELY AGGRESSIVE (SOIL - pH = 5.5)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

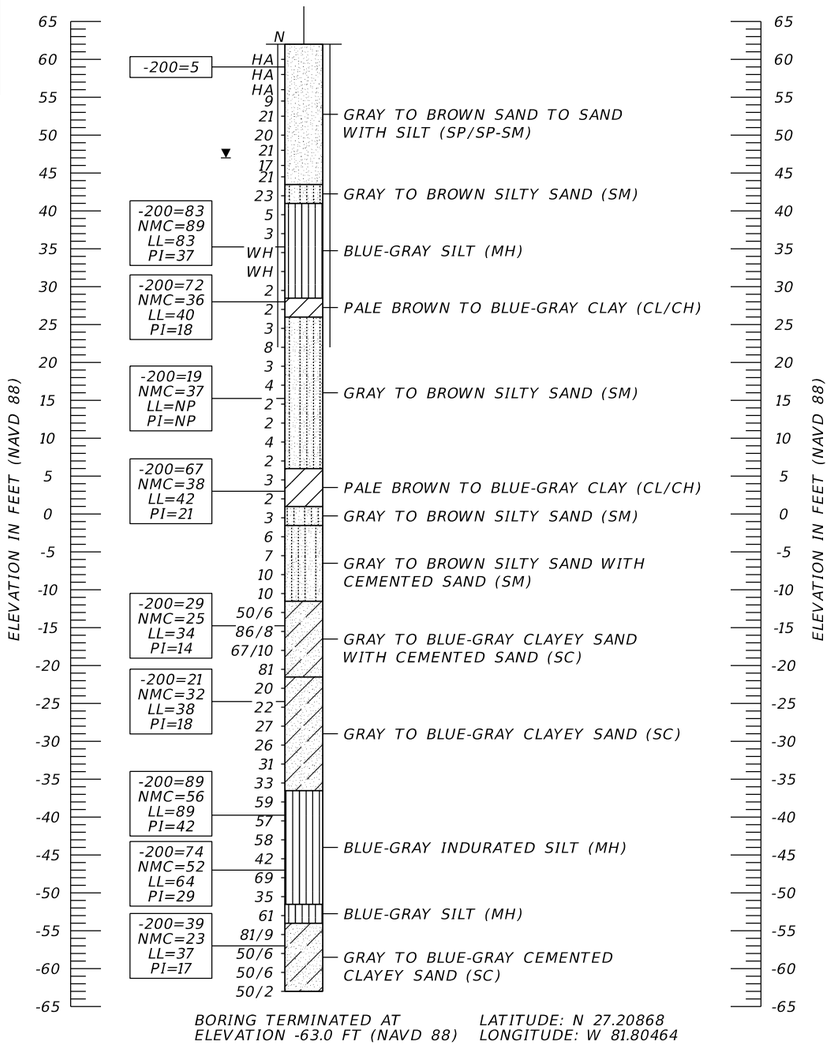
SOIL TEST RESULTS:

RESISTIVITY	20,000 TO 26,000 OHM-CM
CHLORIDES	15 PPM
SULFATES	24 TO 71 PPM
pH	5.5 TO 6.8

WATER TEST RESULTS:

RESISTIVITY	2,300 OHM-CM
CHLORIDES	90 PPM
SULFATES	80 PPM
pH	7.9

BOR #	BB-JOSH-1
STA.	4253+61
REF.	℄ CONST. SR 70
OFF.	57' RT.
ELEV.	62.0
DATE	4/12/2024
DRILLER	J. SHAW
HAMMER	AUTOMATIC
RIG	D-25



BORING TERMINATED AT ELEVATION -63.0 FT (NAVD 88)

LATITUDE: N 27.20868
LONGITUDE: W 81.80464

LEGEND

	SAND
	CLAY
	SILTY SAND
	SILT
	CLAYEY SAND
SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCE
WH	SPLIT-SPOON SAMPLER ADVANCED UNDER WEIGHT OF ROD AND HAMMER
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON-PLASTIC
NAVD 88	NORTH AMERICAN VERTICAL DATUM OF 1988
▼	GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
⊕	APPROXIMATE SPT BORING LOCATION
●	APPROXIMATE SEDIMENT SAMPLE LOCATION FOR D_{50} DETERMINATION
| |	CASING

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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CHECKED BY: DAN 06-24
DESIGNED BY: BMG 06-24
CHECKED BY: DAN 06-24

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: REPORT OF CORE BORINGS (1 OF 2)

REF. DWG. NO.

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

SHEET NO.

J:\6511\2024 Files\6511-24-001 SR 70 Segments 9 & 10\ORD\6511-24-001\Geotechnical\B2Boring01.dgn : RCB_B2_01 [SHEET]
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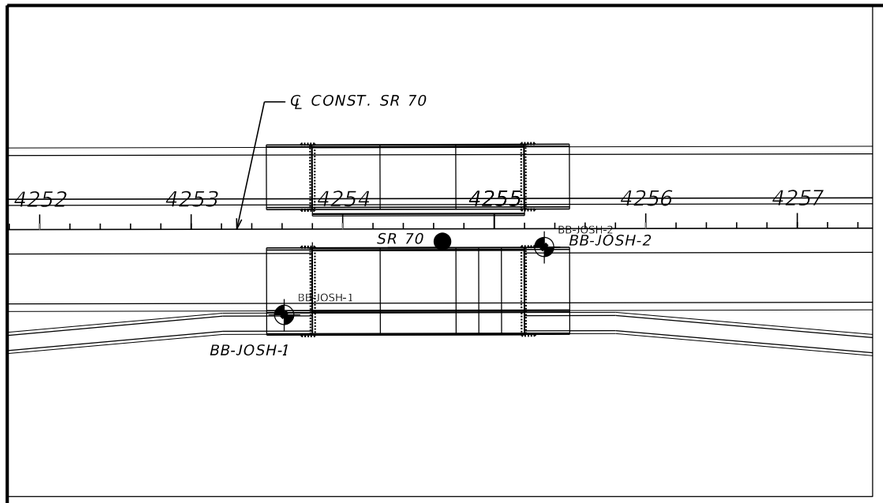
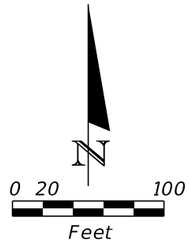
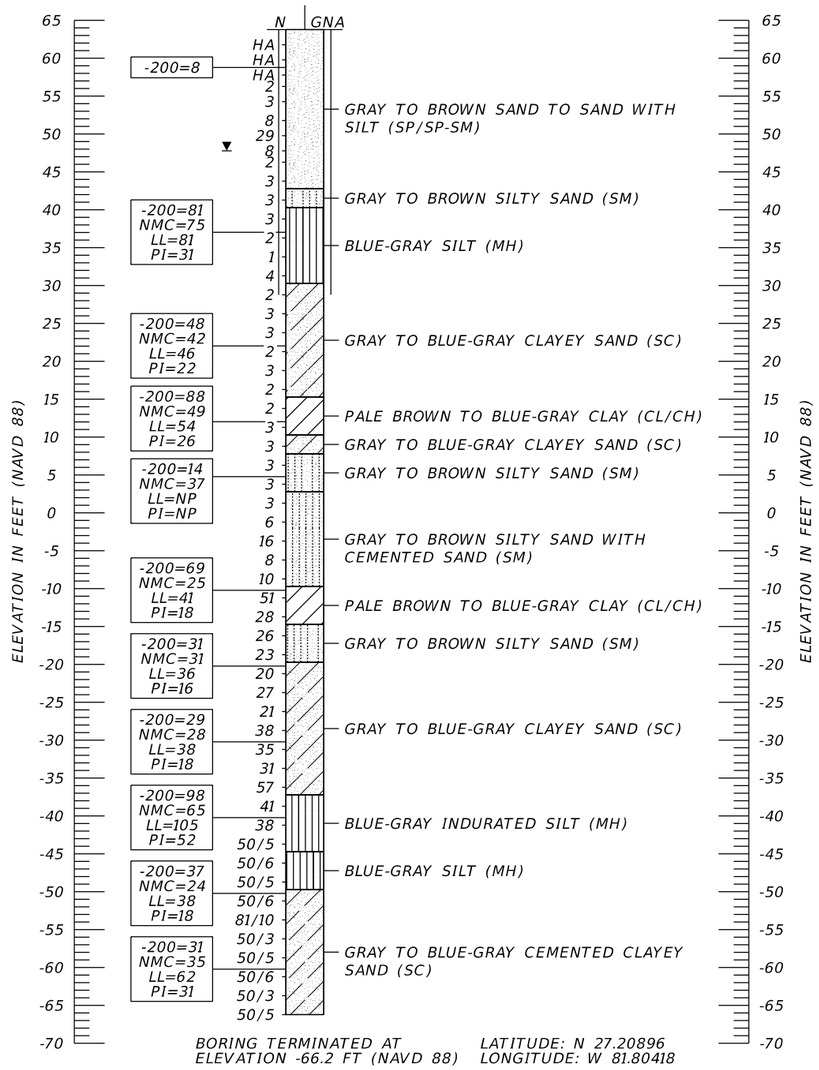


BORING LOCATION PLAN



BOR # BB-JOSH-2
STA. 4255+33
REF. ℄ CONST. SR 70
OFF. 12' RT.
ELEV. 63.8
DATE 4/22/2024
DRILLER J. SHAW
HAMMER AUTOMATIC
RIG D-25



BORING TERMINATED AT ELEVATION -66.2 FT (NAVD 88)
LATITUDE: N 27.20896
LONGITUDE: W 81.80418

LEGEND

	SAND
	CLAY
	SILTY SAND
	SILT
	CLAYEY SAND
SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCE
WH	SPLIT-SPOON SAMPLER ADVANCED UNDER WEIGHT OF ROD AND HAMMER
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON-PLASTIC
NAVD 88	NORTH AMERICAN VERTICAL DATUM OF 1988
	GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
	APPROXIMATE SPT BORING LOCATION
	APPROXIMATE SEDIMENT SAMPLE LOCATION FOR D_{50} DETERMINATION
	CASING

NOTES:
1. THE BORING LOCATIONS AND ELEVATIONS WERE PROVIDED BY THE PROJECT SURVEYOR.
2. BASED ON A REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION AT THE BRIDGE SITE IS REPORTED TO RANGE FROM APPROXIMATELY +40 FEET TO +50 FEET, NGVD 29. ARTESIAN CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED AT THE TIME OF OUR FIELD ACTIVITIES; HOWEVER, THE CONTRACTOR SHOULD BE PREPARED TO ADDRESS ARTESIAN LEVELS UP TO A HEAD OF +50 FEET, NGVD 29.

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: MODERATELY AGGRESSIVE (SOIL - pH = 5.5, WATER - RESISTIVITY = 2,300 OHM-CM)
SUBSTRUCTURE	STEEL: EXTREMELY AGGRESSIVE (SOIL - pH = 5.5)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

SOIL TEST RESULTS:

RESISTIVITY	20,000 TO 26,000 OHM-CM
CHLORIDES	15 PPM
SULFATES	24 TO 71 PPM
pH	5.5 TO 6.8

WATER TEST RESULTS:

RESISTIVITY	2,300 OHM-CM
CHLORIDES	90 PPM
SULFATES	80 PPM
pH	7.9

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

DYLAN A. NELSON, P.E.
License Number: 96772
TIERRA, INC.
7351 TEMPLE TERRACE HIGHWAY
TAMPA, FLORIDA 33637

DRAWN BY: BMG 06-24
CHECKED BY: DAN 06-24
DESIGNED BY: BMG 06-24
CHECKED BY: DAN 06-24

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: REPORT OF CORE BORINGS (2 OF 2)

REF. DWG. NO.

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

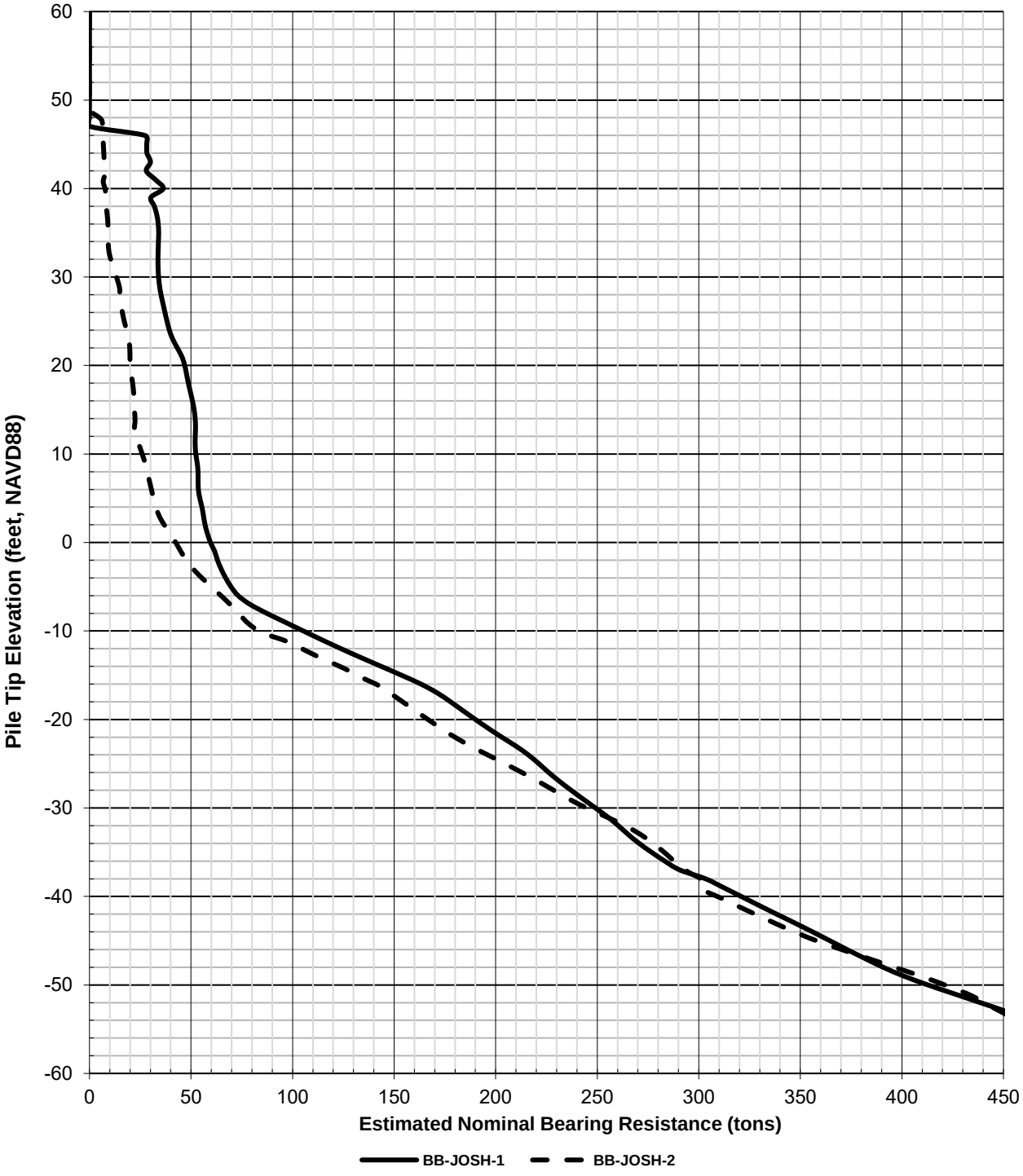
SHEET NO.

J:\6511\2024 Files\6511-24-001 SR 70 Segments 9 & 10\ORD\6511-24-001\Geotechnical\B2Boring01.dgn : RCB_B2_02 [SHEET]
jcoker 4/3/2025 4:08:54 PM

APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

SR 70 over Joshua Creek
18x18 inch Square Concrete Piles

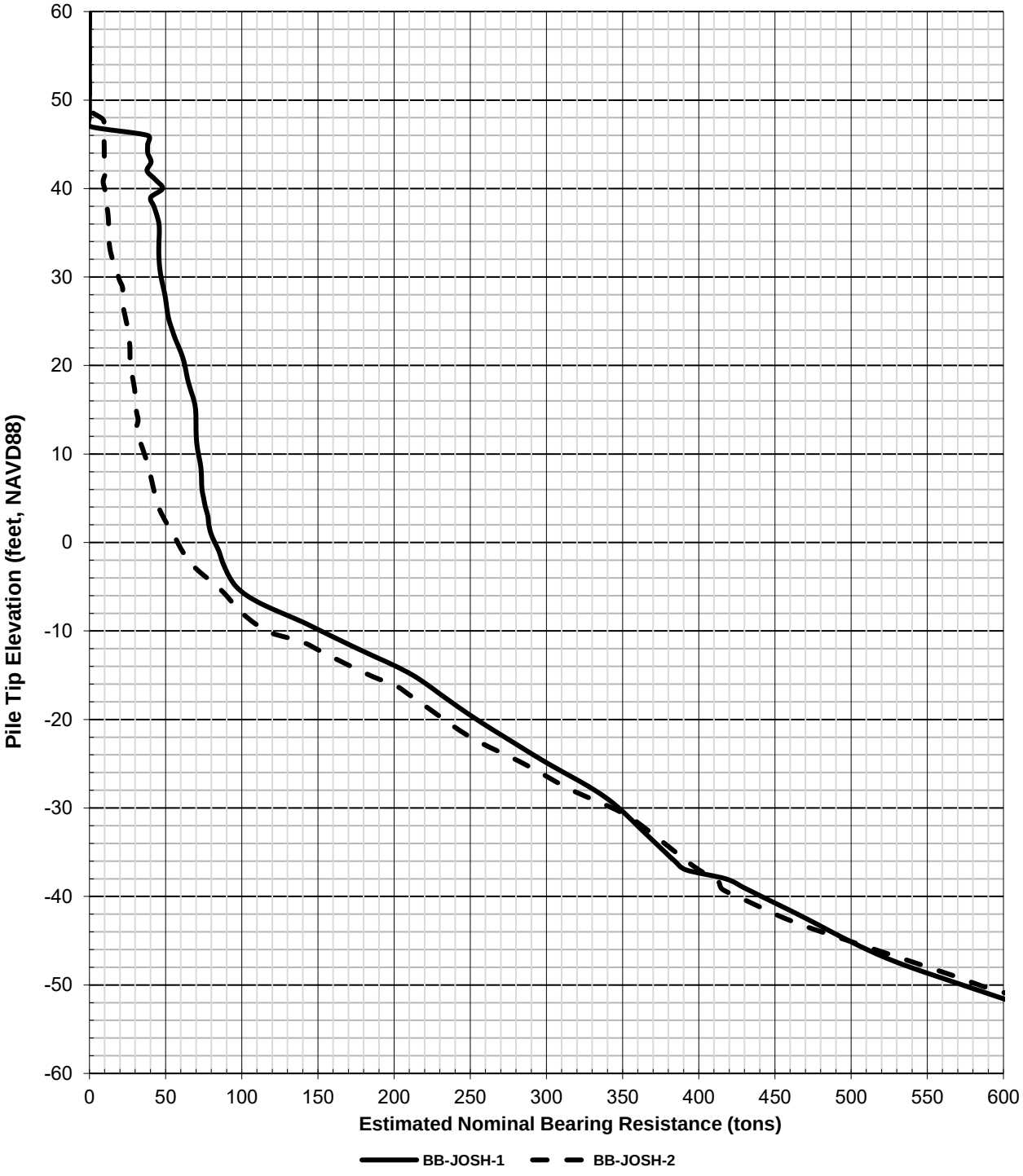


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to Highlands County Line
SR 70 over Joshua Creek
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Joshua Creek
24x24 inch Square Concrete Piles

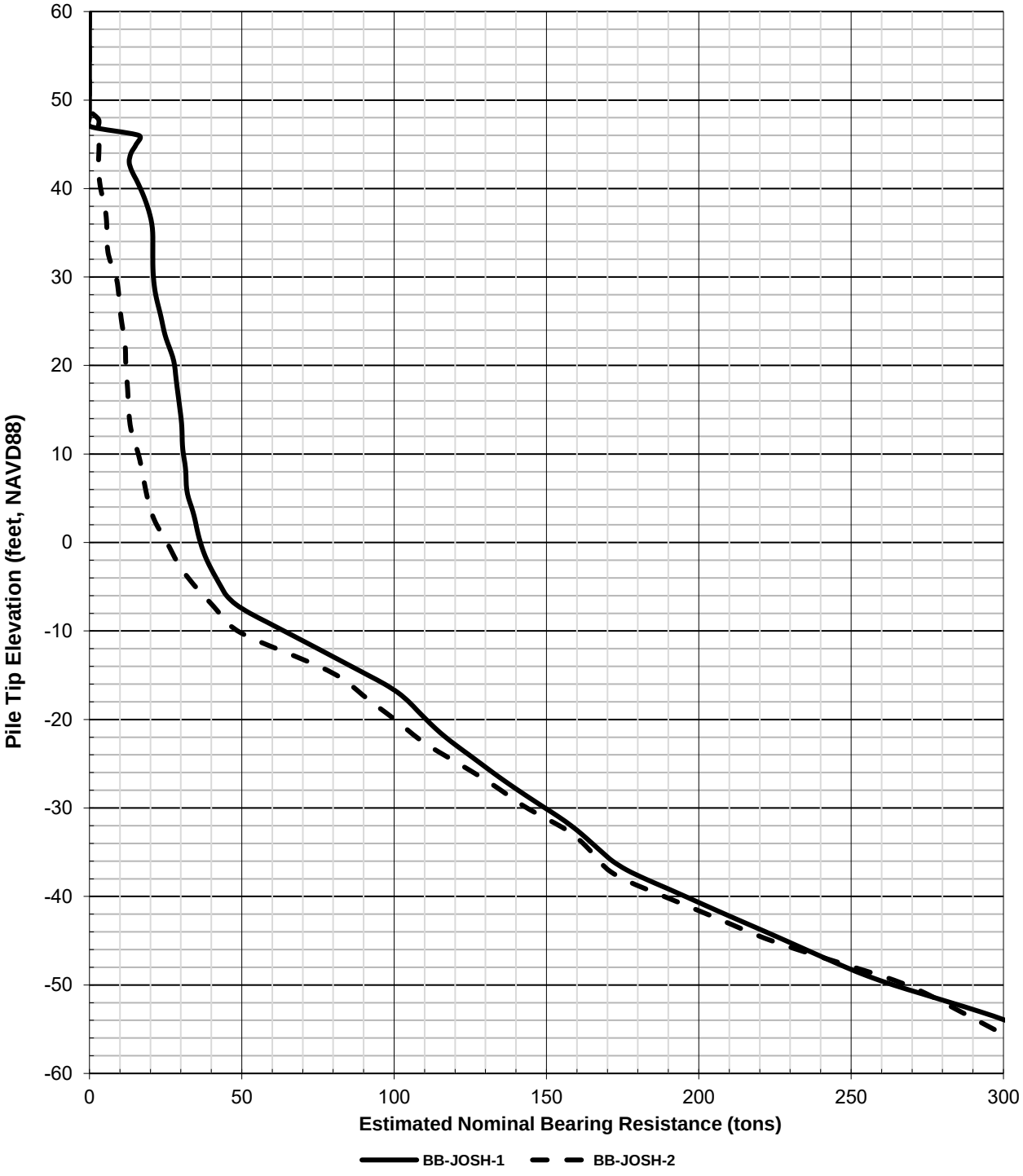


TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to Highlands County Line
SR 70 over Joshua Creek
DeSoto County, FL
FPID No. 451942-2-52-01

SR 70 over Joshua Creek
HP 14x89 Steel Piles



TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to Highlands County Line
SR 70 over Joshua Creek
DeSoto County, FL
FPID No. 451942-2-52-01

General Information:
==========
Input file: .....0 Segments 9 & 10\FBDeep\JOSH Bridge\BB-JOSH-1_18-inch PPSC.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc. SS
Units: English

Analysis Information:
==========
Analysis Type: SPT

Soil Information:
==========
Boring date: 4/19/2024, Boring Number: BB-JOSH-1
Station number: Offset:

Ground Elevation: 62.000(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	9.00	5- Cavity layer
6	10.00	21.00	5- Cavity layer
7	12.00	20.00	5- Cavity layer
8	14.00	21.00	5- Cavity layer
9	16.00	17.00	3- Clean sand
10	17.50	21.00	3- Clean sand
11	20.00	23.00	2- Clay and silty sand
12	22.50	5.00	1- Plastic Clay
13	25.00	3.00	1- Plastic Clay
14	27.50	0.50	1- Plastic Clay
15	30.00	0.50	1- Plastic Clay
16	32.50	2.00	1- Plastic Clay
17	35.00	2.00	1- Plastic Clay
18	37.50	3.00	2- Clay and silty sand
19	40.00	8.00	2- Clay and silty sand

20	42.50	3.00	2- Clay and silty sand
21	45.00	4.00	2- Clay and silty sand
22	47.50	2.00	2- Clay and silty sand
23	50.00	2.00	2- Clay and silty sand
24	52.50	4.00	2- Clay and silty sand
25	55.00	2.00	2- Clay and silty sand
26	57.50	3.00	1- Plastic Clay
27	60.00	2.00	1- Plastic Clay
28	62.50	3.00	2- Clay and silty sand
29	65.00	6.00	2- Clay and silty sand
30	67.50	7.00	2- Clay and silty sand
31	70.00	10.00	2- Clay and silty sand
32	72.50	10.00	2- Clay and silty sand
33	75.00	100.00	2- Clay and silty sand
34	77.50	100.00	2- Clay and silty sand
35	80.00	80.00	2- Clay and silty sand
36	82.50	81.00	2- Clay and silty sand
37	85.00	20.00	2- Clay and silty sand
38	87.50	22.00	2- Clay and silty sand
39	90.00	27.00	2- Clay and silty sand
40	92.50	26.00	2- Clay and silty sand
41	95.00	31.00	2- Clay and silty sand
42	97.50	33.00	2- Clay and silty sand
43	100.00	59.00	1- Plastic Clay
44	102.50	57.00	1- Plastic Clay
45	105.00	58.00	1- Plastic Clay
46	107.50	42.00	1- Plastic Clay
47	110.00	69.00	1- Plastic Clay
48	112.50	35.00	1- Plastic Clay
49	115.00	61.00	1- Plastic Clay
50	117.50	100.00	2- Clay and silty sand
51	120.00	100.00	2- Clay and silty sand
52	122.50	100.00	2- Clay and silty sand
53	125.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	62.00	46.00	16.00	10.38	5-Void
2	46.00	42.00	4.00	19.50	3-Clean Sand
3	42.00	39.50	2.50	23.00	2-Clay and Silty Sand
4	39.50	24.50	15.00	2.17	1-Plastic Clay
5	24.50	4.50	20.00	3.50	2-Clay and Silty Sand

6	4.50	-0.50	5.00	2.50	1-Plastic Clay
7	-0.50	-38.00	37.50	37.07	2-Clay and Silty Sand
8	-38.00	-55.50	17.50	54.43	1-Plastic Clay
9	-55.50	-63.00	7.50	100.00	2-Clay and Silty Sand

Driven Pile Data:
==========
Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	61.00
18.00	2.00	60.00
18.00	3.00	59.00
18.00	4.00	58.00
18.00	5.00	57.00
18.00	6.00	56.00
18.00	7.00	55.00
18.00	8.00	54.00
18.00	9.00	53.00
18.00	10.00	52.00
18.00	11.00	51.00
18.00	12.00	50.00
18.00	13.00	49.00
18.00	14.00	48.00
18.00	15.00	47.00
18.00	16.00	46.00
18.00	17.00	45.00
18.00	18.00	44.00
18.00	19.00	43.00
18.00	20.00	42.00
18.00	21.00	41.00
18.00	22.00	40.00
18.00	23.00	39.00
18.00	24.00	38.00
18.00	25.00	37.00
18.00	26.00	36.00
18.00	27.00	35.00
18.00	28.00	34.00
18.00	29.00	33.00
18.00	30.00	32.00
18.00	31.00	31.00
18.00	32.00	30.00
18.00	33.00	29.00
18.00	34.00	28.00
18.00	35.00	27.00

18.00	36.00	26.00
18.00	37.00	25.00
18.00	38.00	24.00
18.00	39.00	23.00
18.00	40.00	22.00
18.00	41.00	21.00
18.00	42.00	20.00
18.00	43.00	19.00
18.00	44.00	18.00
18.00	45.00	17.00
18.00	46.00	16.00
18.00	47.00	15.00
18.00	48.00	14.00
18.00	49.00	13.00
18.00	50.00	12.00
18.00	51.00	11.00
18.00	52.00	10.00
18.00	53.00	9.00
18.00	54.00	8.00
18.00	55.00	7.00
18.00	56.00	6.00
18.00	57.00	5.00
18.00	58.00	4.00
18.00	59.00	3.00
18.00	60.00	2.00
18.00	61.00	1.00
18.00	62.00	0.00
18.00	63.00	-1.00
18.00	64.00	-2.00
18.00	65.00	-3.00
18.00	66.00	-4.00
18.00	67.00	-5.00
18.00	68.00	-6.00
18.00	69.00	-7.00
18.00	70.00	-8.00
18.00	71.00	-9.00
18.00	72.00	-10.00
18.00	73.00	-11.00
18.00	74.00	-12.00
18.00	75.00	-13.00
18.00	76.00	-14.00
18.00	77.00	-15.00
18.00	78.00	-16.00
18.00	79.00	-17.00
18.00	80.00	-18.00
18.00	81.00	-19.00
18.00	82.00	-20.00
18.00	83.00	-21.00
18.00	84.00	-22.00
18.00	85.00	-23.00

18.00	86.00	-24.00
18.00	87.00	-25.00
18.00	88.00	-26.00
18.00	89.00	-27.00
18.00	90.00	-28.00
18.00	91.00	-29.00
18.00	92.00	-30.00
18.00	93.00	-31.00
18.00	94.00	-32.00
18.00	95.00	-33.00
18.00	96.00	-34.00
18.00	97.00	-35.00
18.00	98.00	-36.00
18.00	99.00	-37.00
18.00	100.00	-38.00
18.00	101.00	-39.00
18.00	102.00	-40.00
18.00	103.00	-41.00
18.00	104.00	-42.00
18.00	105.00	-43.00
18.00	106.00	-44.00
18.00	107.00	-45.00
18.00	108.00	-46.00
18.00	109.00	-47.00
18.00	110.00	-48.00
18.00	111.00	-49.00
18.00	112.00	-50.00
18.00	113.00	-51.00
18.00	114.00	-52.00
18.00	115.00	-53.00
18.00	116.00	-54.00
18.00	117.00	-55.00
18.00	118.00	-56.00
18.00	119.00	-57.00
18.00	120.00	-58.00
18.00	121.00	-59.00
18.00	122.00	-60.00
18.00	123.00	-61.00
18.00	124.00	-62.00
18.00	125.00	-63.00

Driven Pile Capacity:
==========

Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	0.00	0.00	0.00	0.00
4.00	18.0	0.00	0.00	0.00	0.00	0.00
5.00	18.0	0.00	0.00	0.00	0.00	0.00
6.00	18.0	0.00	0.00	0.00	0.00	0.00
7.00	18.0	0.00	0.00	0.00	0.00	0.00
8.00	18.0	0.00	0.00	0.00	0.00	0.00
9.00	18.0	0.00	0.00	0.00	0.00	0.00
10.00	18.0	0.00	0.00	0.00	0.00	0.00
11.00	18.0	0.00	0.00	0.00	0.00	0.00
12.00	18.0	0.00	0.00	0.00	0.00	0.00
13.00	18.0	0.00	0.00	0.00	0.00	0.00
14.00	18.0	0.00	0.00	0.00	0.00	0.00
15.00	18.0	0.60	0.00	0.60	0.30	0.60
16.00	18.0	2.40	24.85	27.26	13.63	76.96
17.00	18.0	4.99	23.12	28.12	14.06	74.37
18.00	18.0	8.07	20.24	28.31	14.16	68.79
19.00	18.0	12.29	17.74	30.03	15.02	65.52
20.00	18.0	17.75	10.25	28.00	14.00	48.50
21.00	18.0	21.16	11.31	32.47	16.23	55.09
22.00	18.0	25.48	10.86	36.34	18.17	58.06
23.00	18.0	28.48	1.80	30.28	15.14	33.87
24.00	18.0	30.14	1.79	31.94	15.97	35.52
25.00	18.0	31.65	1.53	33.19	16.59	36.26
26.00	18.0	32.60	1.24	33.84	16.92	36.31
27.00	18.0	33.07	0.99	34.07	17.03	36.05
28.00	18.0	33.13	0.81	33.95	16.97	35.57
29.00	18.0	33.13	0.69	33.82	16.91	35.20
30.00	18.0	33.13	0.60	33.73	16.87	34.94
31.00	18.0	33.13	0.66	33.79	16.90	35.11
32.00	18.0	33.13	0.90	34.03	17.02	35.84
33.00	18.0	33.13	1.36	34.49	17.24	37.20
34.00	18.0	33.13	2.10	35.23	17.62	39.43
35.00	18.0	33.13	3.06	36.19	18.10	42.32
36.00	18.0	33.34	3.82	37.16	18.58	44.80
37.00	18.0	33.96	4.22	38.18	19.09	46.63
38.00	18.0	35.01	4.31	39.32	19.66	47.94
39.00	18.0	36.63	4.33	40.96	20.48	49.63
40.00	18.0	38.88	4.35	43.23	21.61	51.92
41.00	18.0	41.26	4.25	45.50	22.75	54.00
42.00	18.0	42.92	4.02	46.93	23.47	54.97

43.00	18.0	44.05	3.76	47.81	23.90	55.33
44.00	18.0	45.21	3.49	48.70	24.35	55.69
45.00	18.0	46.51	3.20	49.71	24.85	56.10
46.00	18.0	47.60	3.11	50.71	25.36	56.93
47.00	18.0	48.15	3.38	51.53	25.76	58.29
48.00	18.0	48.22	3.82	52.04	26.02	59.68
49.00	18.0	48.22	3.99	52.21	26.11	60.20
50.00	18.0	48.22	3.87	52.08	26.04	59.82
51.00	18.0	48.49	3.55	52.04	26.02	59.14
52.00	18.0	49.31	3.06	52.36	26.18	58.47
53.00	18.0	50.54	2.50	53.03	26.52	58.03
54.00	18.0	51.35	2.09	53.44	26.72	57.62
55.00	18.0	51.63	1.85	53.47	26.74	57.17
56.00	18.0	51.86	1.74	53.61	26.80	57.09
57.00	18.0	52.57	1.74	54.32	27.16	57.80
58.00	18.0	53.60	1.78	55.38	27.69	58.94
59.00	18.0	54.14	2.00	56.14	28.07	60.15
60.00	18.0	54.26	2.65	56.91	28.45	62.20
61.00	18.0	54.47	3.62	58.09	29.05	65.34
62.00	18.0	55.07	4.51	59.58	29.79	68.60
63.00	18.0	56.41	5.22	61.64	30.82	72.08
64.00	18.0	57.57	5.47	63.03	31.52	73.97
65.00	18.0	58.90	5.95	64.84	32.42	76.74
66.00	18.0	60.36	6.70	67.05	33.53	80.45
67.00	18.0	61.92	7.76	69.68	34.84	85.20
68.00	18.0	63.53	9.66	73.18	36.59	92.50
69.00	18.0	65.59	13.50	79.09	39.55	106.09
70.00	18.0	68.37	18.92	87.29	43.64	125.13
71.00	18.0	71.34	24.93	96.27	48.13	146.13
72.00	18.0	74.35	30.98	105.32	52.66	167.27
73.00	18.0	77.59	36.84	114.43	57.22	188.12
74.00	18.0	82.26	41.57	123.83	61.91	206.97
75.00	18.0	88.62	45.00	133.61	66.81	223.60
76.00	18.0	95.88	47.73	143.62	71.81	239.08
77.00	18.0	103.23	50.40	153.63	76.81	254.43
78.00	18.0	110.64	52.56	163.20	81.60	268.33
79.00	18.0	118.10	53.14	171.24	85.62	277.53
80.00	18.0	125.61	52.14	177.75	88.87	282.02
81.00	18.0	133.16	50.69	183.85	91.92	285.23
82.00	18.0	140.74	49.28	190.02	95.01	288.58
83.00	18.0	148.24	48.11	196.35	98.17	292.57
84.00	18.0	155.01	48.01	203.02	101.51	299.04
85.00	18.0	160.93	48.97	209.90	104.95	307.84
86.00	18.0	166.50	49.56	216.05	108.03	315.17
87.00	18.0	172.21	49.07	221.28	110.64	319.42
88.00	18.0	178.08	48.07	226.15	113.08	322.29
89.00	18.0	184.24	47.20	231.44	115.72	325.83
90.00	18.0	190.71	46.44	237.15	118.57	330.03
91.00	18.0	197.30	45.78	243.08	121.54	334.65
92.00	18.0	203.85	45.27	249.11	124.56	339.65

93.00	18.0	210.38	44.66	255.04	127.52	344.35
94.00	18.0	217.12	43.26	260.38	130.19	346.91
95.00	18.0	224.11	41.15	265.26	132.63	347.56
96.00	18.0	231.27	39.35	270.61	135.31	349.31
97.00	18.0	238.50	38.19	276.69	138.35	353.07
98.00	18.0	245.88	37.35	283.23	141.62	357.93
99.00	18.0	253.81	36.78	290.59	145.29	364.15
100.00	18.0	271.83	31.49	303.32	151.66	366.30

Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	18.0	280.82	31.38	312.19	156.10	374.95
102.00	18.0	289.80	31.10	320.90	160.45	383.10
103.00	18.0	298.79	30.75	329.54	164.77	391.05
104.00	18.0	307.77	30.55	338.33	169.16	399.44
105.00	18.0	316.76	30.50	347.26	173.63	408.26
106.00	18.0	325.75	30.26	356.01	178.01	416.54
107.00	18.0	334.77	29.75	364.52	182.26	424.02
108.00	18.0	343.80	29.17	372.97	186.49	431.32
109.00	18.0	352.81	28.91	381.72	190.86	439.54
110.00	18.0	361.81	28.95	390.76	195.38	448.67
111.00	18.0	370.73	30.24	400.97	200.49	461.46
112.00	18.0	379.52	33.27	412.79	206.39	479.33
113.00	18.0	388.21	37.50	425.71	212.85	500.71
114.00	18.0	396.99	41.64	438.63	219.32	521.91
115.00	18.0	405.91	45.59	451.50	225.75	542.68
116.00	18.0	414.67	49.01	463.68	231.84	561.71
117.00	18.0	422.98	51.57	474.55	237.27	577.68
118.00	18.0	430.83	52.60	483.43	241.71	588.63
119.00	18.0	438.25	53.19	491.44	245.72	597.83
120.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
121.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
122.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
123.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
124.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
125.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....0 Segments 9 & 10\FBDeep\JOSH Bridge\BB-JOSH-2_18-inch PPSC.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc. SS
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 4/25/2024, Boring Number: BB-JOSH-2
Station number: Offset:

Ground Elevation: 63.800(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	2.00	5- Cavity layer
6	10.00	3.00	5- Cavity layer
7	12.00	8.00	5- Cavity layer
8	14.00	29.00	5- Cavity layer
9	16.00	8.00	3- Clean sand
10	17.50	2.00	3- Clean sand
11	20.00	3.00	3- Clean sand
12	22.50	3.00	2- Clay and silty sand
13	25.00	3.00	1- Plastic Clay
14	27.50	2.00	1- Plastic Clay
15	30.00	1.00	1- Plastic Clay
16	32.50	4.00	1- Plastic Clay
17	35.00	2.00	2- Clay and silty sand
18	37.50	3.00	2- Clay and silty sand
19	40.00	3.00	2- Clay and silty sand

20	42.50	2.00	2- Clay and silty sand
21	45.00	3.00	2- Clay and silty sand
22	47.50	2.00	2- Clay and silty sand
23	50.00	2.00	1- Plastic Clay
24	52.50	3.00	1- Plastic Clay
25	55.00	3.00	2- Clay and silty sand
26	57.50	3.00	2- Clay and silty sand
27	60.00	3.00	2- Clay and silty sand
28	62.50	3.00	2- Clay and silty sand
29	65.00	6.00	2- Clay and silty sand
30	67.50	16.00	2- Clay and silty sand
31	70.00	8.00	2- Clay and silty sand
32	72.50	10.00	2- Clay and silty sand
33	75.00	51.00	1- Plastic Clay
34	77.50	28.00	1- Plastic Clay
35	80.00	26.00	2- Clay and silty sand
36	82.50	23.00	2- Clay and silty sand
37	85.00	20.00	2- Clay and silty sand
38	87.50	27.00	2- Clay and silty sand
39	90.00	21.00	2- Clay and silty sand
40	92.50	38.00	2- Clay and silty sand
41	95.00	35.00	2- Clay and silty sand
42	97.50	31.00	2- Clay and silty sand
43	100.00	57.00	2- Clay and silty sand
44	102.50	41.00	1- Plastic Clay
45	105.00	38.00	1- Plastic Clay
46	107.50	100.00	1- Plastic Clay
47	110.00	100.00	1- Plastic Clay
48	112.50	100.00	1- Plastic Clay
49	115.00	100.00	2- Clay and silty sand
50	117.50	97.00	2- Clay and silty sand
51	120.00	100.00	2- Clay and silty sand
52	122.50	100.00	2- Clay and silty sand
53	125.00	100.00	2- Clay and silty sand
54	127.50	100.00	2- Clay and silty sand
55	130.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	63.80	47.80	16.00	6.75	5-Void
2	47.80	41.30	6.50	3.77	3-Clean Sand
3	41.30	38.80	2.50	3.00	2-Clay and Silty Sand

4	38.80	28.80	10.00	2.50	1-Plastic Clay
5	28.80	13.80	15.00	2.50	2-Clay and Silty Sand
6	13.80	8.80	5.00	2.50	1-Plastic Clay
7	8.80	-11.20	20.00	6.50	2-Clay and Silty Sand
8	-11.20	-16.20	5.00	39.50	1-Plastic Clay
9	-16.20	-38.70	22.50	30.89	2-Clay and Silty Sand
10	-38.70	-51.20	12.50	75.80	1-Plastic Clay
11	-51.20	-66.20	15.00	99.50	2-Clay and Silty Sand

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	62.80
18.00	2.00	61.80
18.00	3.00	60.80
18.00	4.00	59.80
18.00	5.00	58.80
18.00	6.00	57.80
18.00	7.00	56.80
18.00	8.00	55.80
18.00	9.00	54.80
18.00	10.00	53.80
18.00	11.00	52.80
18.00	12.00	51.80
18.00	13.00	50.80
18.00	14.00	49.80
18.00	15.00	48.80
18.00	16.00	47.80
18.00	17.00	46.80
18.00	18.00	45.80
18.00	19.00	44.80
18.00	20.00	43.80
18.00	21.00	42.80
18.00	22.00	41.80
18.00	23.00	40.80
18.00	24.00	39.80
18.00	25.00	38.80
18.00	26.00	37.80
18.00	27.00	36.80
18.00	28.00	35.80
18.00	29.00	34.80
18.00	30.00	33.80
18.00	31.00	32.80

18.00	32.00	31.80
18.00	33.00	30.80
18.00	34.00	29.80
18.00	35.00	28.80
18.00	36.00	27.80
18.00	37.00	26.80
18.00	38.00	25.80
18.00	39.00	24.80
18.00	40.00	23.80
18.00	41.00	22.80
18.00	42.00	21.80
18.00	43.00	20.80
18.00	44.00	19.80
18.00	45.00	18.80
18.00	46.00	17.80
18.00	47.00	16.80
18.00	48.00	15.80
18.00	49.00	14.80
18.00	50.00	13.80
18.00	51.00	12.80
18.00	52.00	11.80
18.00	53.00	10.80
18.00	54.00	9.80
18.00	55.00	8.80
18.00	56.00	7.80
18.00	57.00	6.80
18.00	58.00	5.80
18.00	59.00	4.80
18.00	60.00	3.80
18.00	61.00	2.80
18.00	62.00	1.80
18.00	63.00	0.80
18.00	64.00	-0.20
18.00	65.00	-1.20
18.00	66.00	-2.20
18.00	67.00	-3.20
18.00	68.00	-4.20
18.00	69.00	-5.20
18.00	70.00	-6.20
18.00	71.00	-7.20
18.00	72.00	-8.20
18.00	73.00	-9.20
18.00	74.00	-10.20
18.00	75.00	-11.20
18.00	76.00	-12.20
18.00	77.00	-13.20
18.00	78.00	-14.20
18.00	79.00	-15.20
18.00	80.00	-16.20
18.00	81.00	-17.20

18.00	82.00	-18.20
18.00	83.00	-19.20
18.00	84.00	-20.20
18.00	85.00	-21.20
18.00	86.00	-22.20
18.00	87.00	-23.20
18.00	88.00	-24.20
18.00	89.00	-25.20
18.00	90.00	-26.20
18.00	91.00	-27.20
18.00	92.00	-28.20
18.00	93.00	-29.20
18.00	94.00	-30.20
18.00	95.00	-31.20
18.00	96.00	-32.20
18.00	97.00	-33.20
18.00	98.00	-34.20
18.00	99.00	-35.20
18.00	100.00	-36.20
18.00	101.00	-37.20
18.00	102.00	-38.20
18.00	103.00	-39.20
18.00	104.00	-40.20
18.00	105.00	-41.20
18.00	106.00	-42.20
18.00	107.00	-43.20
18.00	108.00	-44.20
18.00	109.00	-45.20
18.00	110.00	-46.20
18.00	111.00	-47.20
18.00	112.00	-48.20
18.00	113.00	-49.20
18.00	114.00	-50.20
18.00	115.00	-51.20
18.00	116.00	-52.20
18.00	117.00	-53.20
18.00	118.00	-54.20
18.00	119.00	-55.20
18.00	120.00	-56.20
18.00	121.00	-57.20
18.00	122.00	-58.20
18.00	123.00	-59.20
18.00	124.00	-60.20
18.00	125.00	-61.20
18.00	126.00	-62.20
18.00	127.00	-63.20
18.00	128.00	-64.20
18.00	129.00	-65.20
18.00	130.00	-66.20

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	0.00	0.00	0.00	0.00
4.00	18.0	0.00	0.00	0.00	0.00	0.00
5.00	18.0	0.00	0.00	0.00	0.00	0.00
6.00	18.0	0.00	0.00	0.00	0.00	0.00
7.00	18.0	0.00	0.00	0.00	0.00	0.00
8.00	18.0	0.00	0.00	0.00	0.00	0.00
9.00	18.0	0.00	0.00	0.00	0.00	0.00
10.00	18.0	0.00	0.00	0.00	0.00	0.00
11.00	18.0	0.00	0.00	0.00	0.00	0.00
12.00	18.0	0.00	0.00	0.00	0.00	0.00
13.00	18.0	0.00	0.00	0.00	0.00	0.00
14.00	18.0	0.00	0.00	0.00	0.00	0.00
15.00	18.0	0.28	0.00	0.28	0.14	0.28
16.00	18.0	1.13	4.69	5.82	2.91	15.19
17.00	18.0	1.88	4.39	6.27	3.14	15.05
18.00	18.0	2.00	4.66	6.66	3.33	15.98
19.00	18.0	2.15	4.72	6.87	3.43	16.30
20.00	18.0	2.51	4.60	7.11	3.56	16.32
21.00	18.0	3.06	4.30	7.36	3.68	15.96
22.00	18.0	3.85	4.02	7.87	3.94	15.92
23.00	18.0	4.70	2.07	6.77	3.38	10.91
24.00	18.0	5.75	2.08	7.83	3.91	11.98
25.00	18.0	7.11	0.47	7.58	3.79	8.52
26.00	18.0	7.66	0.63	8.29	4.14	9.54
27.00	18.0	8.11	0.72	8.83	4.41	10.27
28.00	18.0	8.25	0.87	9.12	4.56	10.87
29.00	18.0	8.33	0.90	9.23	4.61	11.02
30.00	18.0	8.38	0.87	9.25	4.63	10.99
31.00	18.0	8.69	0.95	9.64	4.82	11.54
32.00	18.0	9.57	1.18	10.74	5.37	13.09
33.00	18.0	10.88	1.48	12.36	6.18	15.32

34.00	18.0	11.79	1.79	13.58	6.79	17.17
35.00	18.0	12.49	2.31	14.80	7.40	19.43
36.00	18.0	12.69	2.33	15.02	7.51	19.68
37.00	18.0	13.32	2.30	15.62	7.81	20.22
38.00	18.0	14.30	2.06	16.36	8.18	20.49
39.00	18.0	15.34	2.00	17.34	8.67	21.35
40.00	18.0	16.37	2.13	18.50	9.25	22.77
41.00	18.0	17.20	2.24	19.44	9.72	23.91
42.00	18.0	17.61	2.27	19.88	9.94	24.42
43.00	18.0	17.72	2.23	19.95	9.97	24.41
44.00	18.0	18.13	2.07	20.20	10.10	24.34
45.00	18.0	18.96	1.78	20.74	10.37	24.31
46.00	18.0	19.79	1.58	21.37	10.68	24.53
47.00	18.0	20.20	1.60	21.80	10.90	24.99
48.00	18.0	20.25	1.76	22.01	11.00	25.52
49.00	18.0	20.25	1.95	22.20	11.10	26.10
50.00	18.0	20.25	2.21	22.46	11.23	26.87
51.00	18.0	20.49	1.69	22.17	11.09	25.55
52.00	18.0	21.20	2.19	23.39	11.70	27.78
53.00	18.0	22.15	2.63	24.78	12.39	30.04
54.00	18.0	23.25	3.00	26.24	13.12	32.24
55.00	18.0	24.51	3.12	27.63	13.81	33.88
56.00	18.0	25.51	3.14	28.65	14.33	34.94
57.00	18.0	26.50	3.17	29.67	14.84	36.02
58.00	18.0	27.45	3.24	30.69	15.34	37.17
59.00	18.0	28.23	3.50	31.72	15.86	38.72
60.00	18.0	28.88	4.07	32.95	16.47	41.08
61.00	18.0	29.45	5.29	34.74	17.37	45.31
62.00	18.0	30.48	6.89	37.37	18.69	51.16
63.00	18.0	31.56	8.75	40.30	20.15	57.80
64.00	18.0	32.92	10.06	42.99	21.49	63.12
65.00	18.0	34.64	10.82	45.46	22.73	67.09
66.00	18.0	37.02	11.27	48.30	24.15	70.84
67.00	18.0	40.39	11.48	51.88	25.94	74.85
68.00	18.0	44.56	11.69	56.24	28.12	79.62
69.00	18.0	48.22	12.69	60.91	30.45	86.29
70.00	18.0	51.14	14.54	65.68	32.84	94.77
71.00	18.0	53.79	16.31	70.10	35.05	102.72
72.00	18.0	56.67	17.50	74.17	37.08	109.18
73.00	18.0	60.00	18.46	78.46	39.23	115.37
74.00	18.0	65.28	19.83	85.10	42.55	124.76
75.00	18.0	75.92	21.58	97.50	48.75	140.67
76.00	18.0	84.12	22.17	106.29	53.15	150.62
77.00	18.0	91.36	23.94	115.30	57.65	163.19
78.00	18.0	98.37	26.78	125.15	62.58	178.71
79.00	18.0	105.77	27.67	133.43	66.72	188.77
80.00	18.0	114.92	27.77	142.70	71.35	198.24
81.00	18.0	121.33	27.82	149.15	74.58	204.80
82.00	18.0	127.19	28.21	155.40	77.70	211.82
83.00	18.0	132.51	29.11	161.62	80.81	219.84

84.00	18.0	137.64	30.29	167.93	83.97	228.51
85.00	18.0	142.75	31.59	174.34	87.17	237.53
86.00	18.0	147.96	33.45	181.41	90.71	248.32
87.00	18.0	154.18	35.01	189.19	94.60	259.22
88.00	18.0	160.74	37.02	197.76	98.88	271.80
89.00	18.0	167.05	39.25	206.29	103.15	284.79
90.00	18.0	172.98	41.65	214.63	107.31	297.93
91.00	18.0	179.11	43.39	222.50	111.25	309.29
92.00	18.0	186.02	44.03	230.05	115.02	318.11
93.00	18.0	193.61	44.18	237.79	118.89	326.15
94.00	18.0	201.24	45.37	246.61	123.31	337.36
95.00	18.0	208.80	47.64	256.44	128.22	351.71
96.00	18.0	216.26	49.12	265.39	132.69	363.63
97.00	18.0	223.59	49.08	272.67	136.34	370.83
98.00	18.0	230.82	47.77	278.60	139.30	374.14
99.00	18.0	238.26	45.70	283.96	141.98	375.35
100.00	18.0	245.96	42.87	288.83	144.41	374.56

Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	18.0	254.01	40.52	294.53	147.27	375.57
102.00	18.0	262.52	39.55	302.07	151.03	381.17
103.00	18.0	274.96	27.05	302.02	151.01	356.12
104.00	18.0	283.82	27.26	311.09	155.54	365.61
105.00	18.0	292.50	27.69	320.20	160.10	375.58
106.00	18.0	301.27	28.37	329.64	164.82	386.38
107.00	18.0	310.21	28.96	339.17	169.58	397.09
108.00	18.0	319.19	29.85	349.04	174.52	408.74
109.00	18.0	328.17	32.10	360.27	180.14	424.47
110.00	18.0	337.16	35.76	372.92	186.46	444.43
111.00	18.0	346.14	39.79	385.94	192.97	465.53
112.00	18.0	355.13	43.79	398.92	199.46	486.51
113.00	18.0	364.06	47.67	411.73	205.86	507.07
114.00	18.0	372.59	50.77	423.37	211.68	524.92
115.00	18.0	381.12	53.01	434.13	217.06	540.14
116.00	18.0	388.72	53.33	442.05	221.02	548.71
117.00	18.0	395.94	54.30	450.24	225.12	558.83
118.00	18.0	402.94	55.90	458.84	229.42	570.65
119.00	18.0	409.91	58.07	467.98	233.99	584.11
120.00	18.0	416.97	60.75	477.72	238.86	599.22
121.00	18.0	424.20	63.98	488.19	244.09	616.16

122.00	18.0	432.06	65.67	497.73	248.86	629.07
123.00	18.0	439.91	67.36	507.27	253.64	641.99
124.00	18.0	447.77	69.05	516.81	258.41	654.91
125.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
126.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
127.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
128.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
129.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
130.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

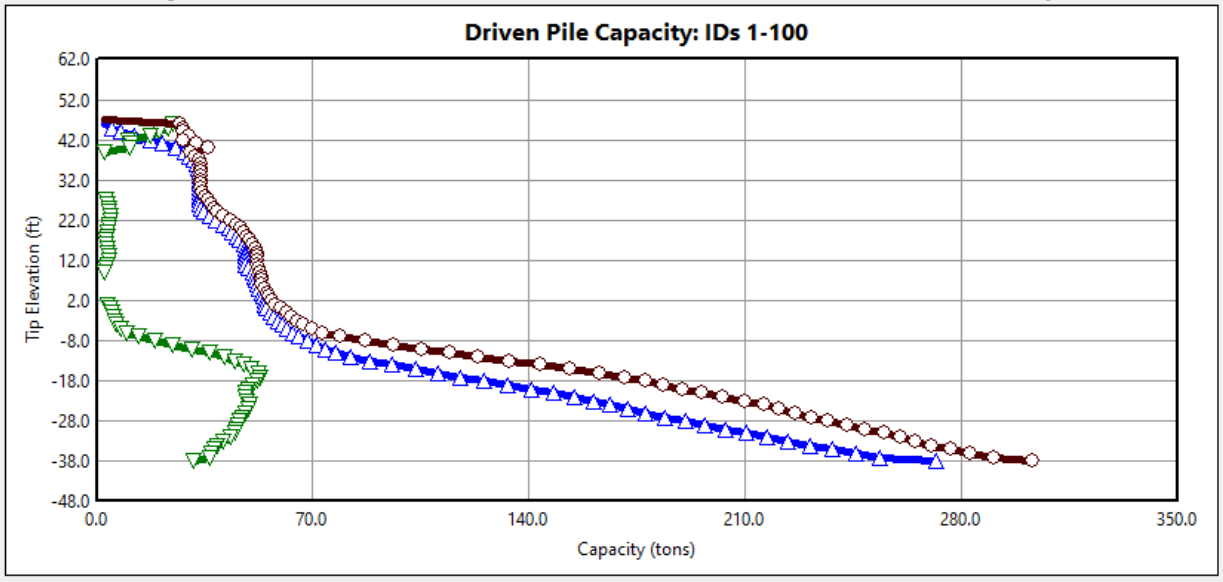
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-JOSH-1	
Ground Surface Elevation	62.00	(ft)
Section:	Square	
Width	18.00	(in)

Project Data

File:	BB-JOSH-1_18-inch
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. SS

Analysis Data

Analysis Type:	SPT

Plot Options

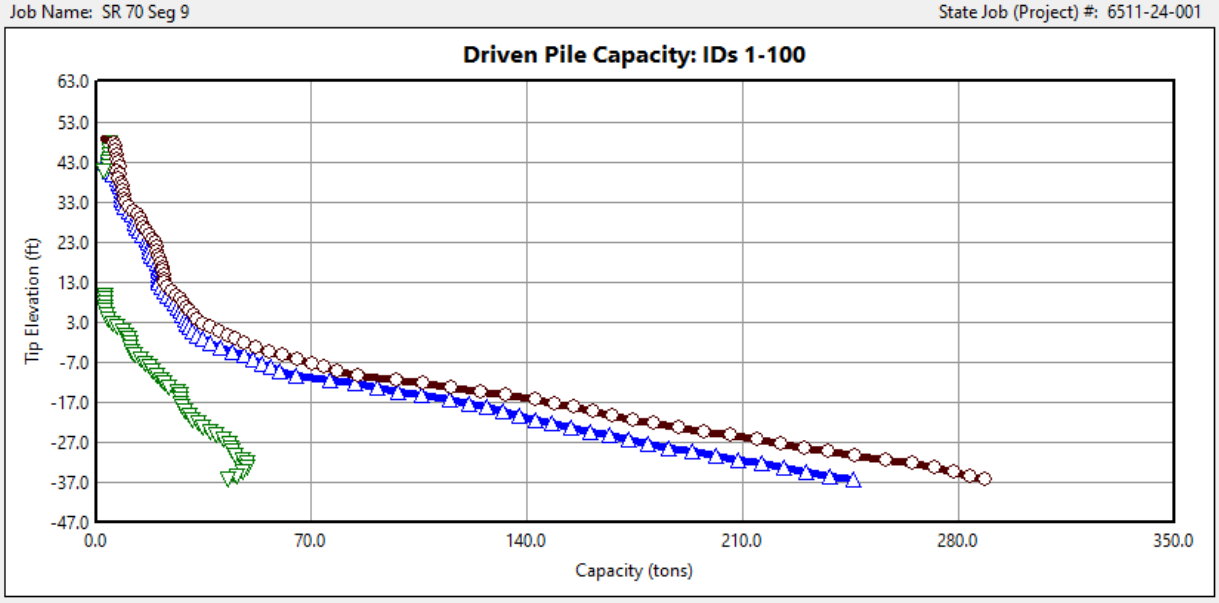
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-JOSH-2	
Ground Surface Elevation	63.80	(ft)
Section:	Square	
Width	18.00	(in)

Project Data

File:	BB-JOSH-2_18-inch
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. SS

Analysis Data

Analysis Type:	SPT

Plot Options

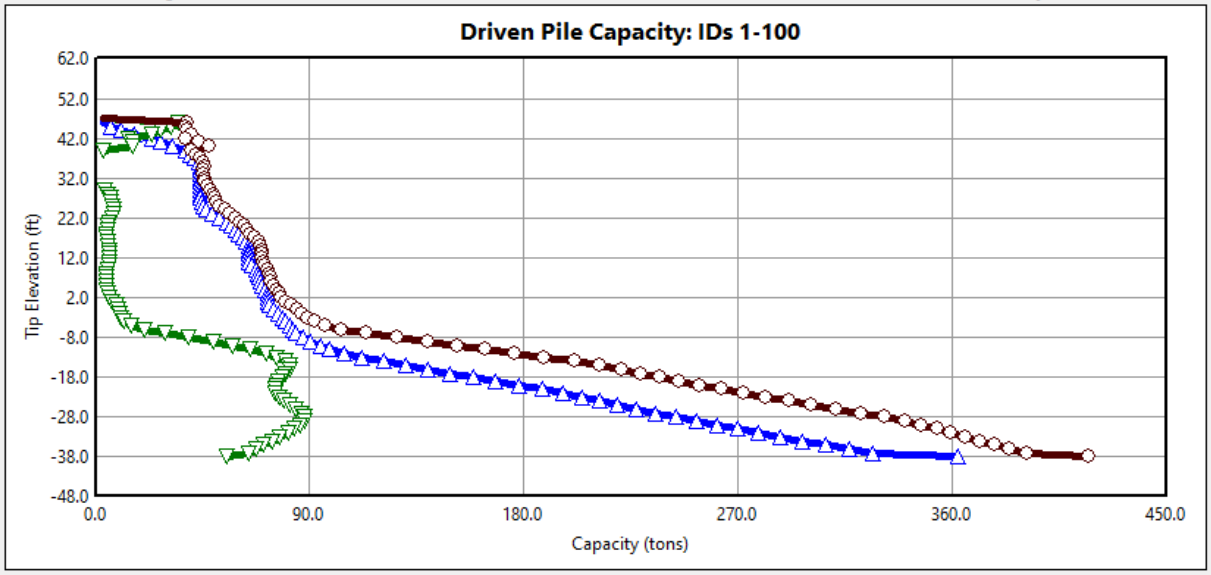
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-JOSH-1	
Ground Surface Elevation	62.00	(ft)
Section:	Square	
Width	24.00	(in)

Project Data

File:	BB-JOSH-1_24-inch
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. SS

Analysis Data

Analysis Type:	SPT

Plot Options

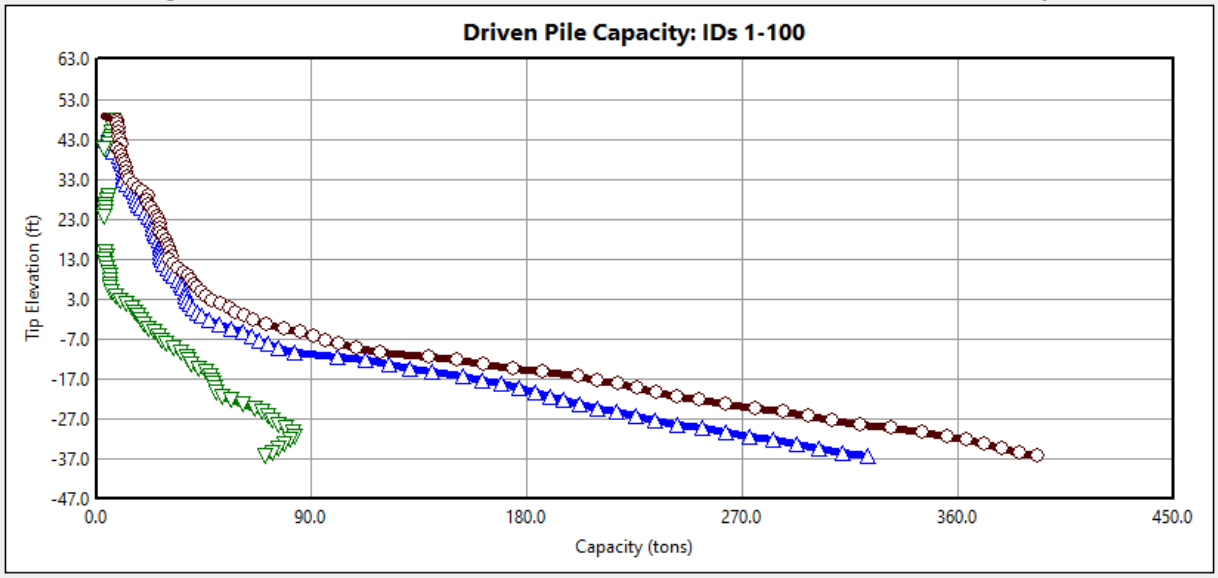
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-JOSH-2	
Ground Surface Elevation	63.80	(ft)
Section:	Square	
Width	24.00	(in)

Project Data

File:	BB-JOSH-2_24-inch
Date:	Sep 30, 2024
Engineer:	Tierra, Inc. SS

Analysis Data

Analysis Type:	SPT

Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

Summary of Laboratory Test Results for Soil Classification
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over Joshua Creek Bridges
DeSoto County, Florida
FPID No. 451690-2-52-01
Tierra Project No: 6511-24-001

Boring Number	Sample Depth (ft)	USCS Symbol	Sieve Analysis					Atterberg Limits			Organic Content (%)	Natural Moisture Content (%)
			#10	#40	#60	#100	#200	Liquid Limit	Plastic Limit	Plasticity Index		
BB-JOSH-1	2.0 - 6.0	SP-SM	---	---	---	---	5	---	---	---	---	---
BB-JOSH-1	26.0 - 27.5	MH	---	---	---	---	83	83	46	37	---	89
BB-JOSH-1	33.5 - 35.0	CL	---	---	---	---	72	40	22	18	---	36
BB-JOSH-1	46.0 - 47.5	SM	---	---	---	---	19	NP	NP	NP	---	37
BB-JOSH-1	58.5 - 60.0	CL	---	---	---	---	67	42	21	21	---	38
BB-JOSH-1	76.0 - 77.5	SC	---	---	---	---	29	34	20	14	---	25
BB-JOSH-1	86.0 - 87.5	SC	---	---	---	---	21	38	20	18	---	32
BB-JOSH-1	101.0 - 102.5	MH	---	---	---	---	89	89	47	42	---	56
BB-JOSH-1	108.5 - 110.0	MH	---	---	---	---	74	64	35	29	---	52
BB-JOSH-1	118.5 - 120.0	SC	---	---	---	---	39	37	20	17	---	23
BB-JOSH-2	4.0 - 8.0	SP-SM	---	---	---	---	8	---	---	---	---	---
BB-JOSH-2	26.0 - 27.5	MH	---	---	---	---	81	81	50	31	---	74
BB-JOSH-2	41.0 - 42.5	SC	---	---	---	---	48	46	24	22	---	42
BB-JOSH-2	51.0 - 52.5	CH	---	---	---	---	88	54	28	26	---	49
BB-JOSH-2	58.5 - 60.0	SM	---	---	---	---	14	NP	NP	NP	---	37
BB-JOSH-2	73.5 - 75.0	CL	---	---	---	---	69	41	23	18	---	25
BB-JOSH-2	83.5 - 85.0	SC	---	---	---	---	31	36	20	16	---	31
BB-JOSH-2	93.5 - 95.0	SC	---	---	---	---	29	38	20	18	---	28
BB-JOSH-2	103.5 - 105.0	MH	---	---	---	---	98	105	53	52	---	65
BB-JOSH-2	113.5 - 115.0	SC	---	---	---	---	37	38	20	18	---	24
BB-JOSH-2	123.5 - 125.0	SC	---	---	---	---	31	62	31	31	---	35

Summary of Laboratory Test Results for Environmental Classification
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over Joshua Creek Bridges
DeSoto County, Florida
FPID No. 451690-2-52-01
Tierra Project No: 6511-24-001

Soil Samples

Boring Number	Depth (feet)	USCS Symbol	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
							Steel	Concrete
BB-JOSH-1	2.0 - 6.0	SP-SM	6.8	26,000	15	24	Moderately Aggressive	Slightly Aggressive
BB-JOSH-2	4.0 - 8.0	SP-SM	5.5	20,000	15	71	Extremely Aggressive	Moderately Aggressive

Water Samples

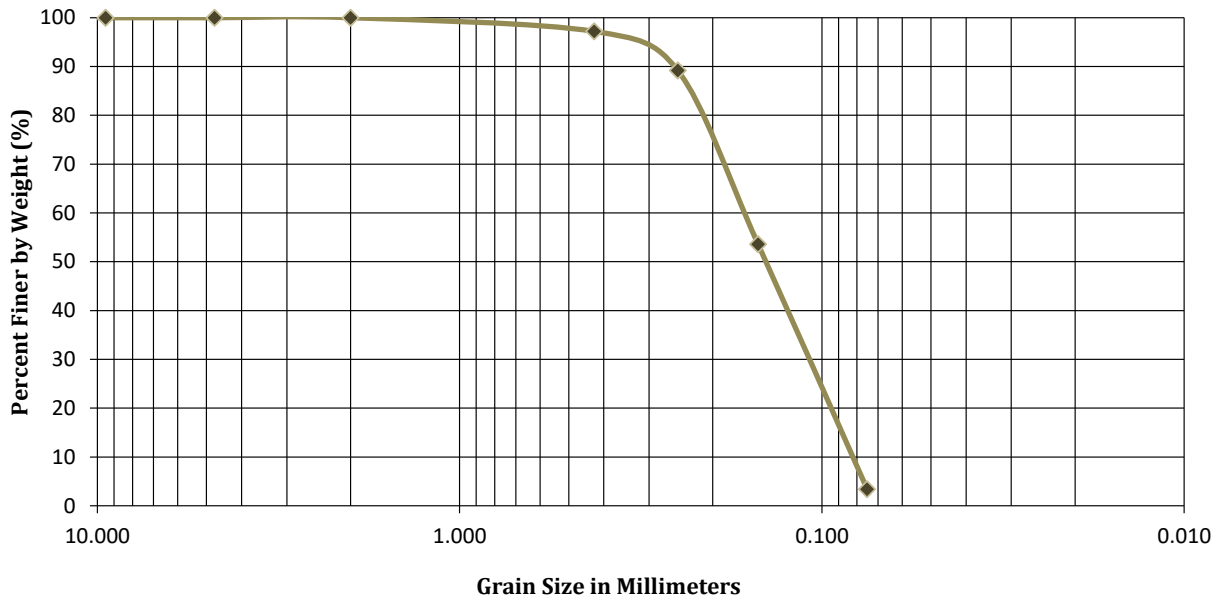
Sample Location	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
					Steel	Concrete
Joshua Creek	7.9	2,300	90	80	Moderately Aggressive	Moderately Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Grain Size Distribution Report
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over Joshua Creek Bridges
DeSoto County, Florida
FPID No. 451690-2-52-01
Tierra Project No.: 6511-24-001

Approximate Sample Location		Depth Below Mudline (ft)
Northing	Easting	
1045132	734580	0.0-2.0

Grain Size Distribution Curve



Material Description	Classification	
	USCS	AASHTO
Gray to Brown Sand	SP	A-3

Sieve Number	Diameter (mm)	Percent Finer by Weight (%)
3/4"	19.000	100
3/8"	9.500	100
4	4.750	100
10	2.000	100
40	0.425	97.2
60	0.250	89.2
100	0.150	53.6
200	0.075	3.4

Coefficients

D_{10}	0.082	D_{30}	0.108
D_{50}	*0.143*	D_{60}	0.164
D_{85}	0.235	D_{90}	0.264
D_{95}	0.367		
C_U	2.001	C_C	0.868

TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

April 3, 2025

HNTB Corporation
201 N. Franklin Street, Suite 1200
Tampa, FL 33602

Attn: Mr. John Burton, PE, PMP, PTOE, ENV SP.

RE: Preliminary Bridge Geotechnical Report
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over Tiger Bay Slough Bridges
FPID No. 451942-2-52-01
DeSoto County, Florida
Tierra Project No. 6511-24-001

Mr. Burton:

Tierra, Inc. (Tierra) has performed a preliminary geotechnical study for the proposed bridge structures associated with the project referenced above. This report has been prepared to support the project Bridge Development Report (BDR). This report presents the results of our study including field and laboratory testing, a preliminary foundation design analysis and our opinions regarding appropriate foundation alternatives for the proposed bridge structures.

Tierra, Inc. appreciates the opportunity to be of service to HNTB Corporation (HNTB) on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.

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APPENDIX A

USDA Soil Survey & USGS Quadrangle Maps
Report of Core Boring Sheet (1 Sheet)

APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

1.0 PROJECT INFORMATION

1.1 Project Authorization

Authorization to proceed with this project was issued by HNTB in accordance with our Subconsultant Agreement.

1.2 Project Description

This project consists of widening SR 70 from two lanes to four-lane divided section from West of SR 31 (MP 14.973) to the Highlands County Line (MP 31.763). A shared use path is also proposed on the south side of the SR 70 widening.

This report has been prepared to provide geotechnical input for the Bridge Development Report (BDR) associated with the design of the proposed SR 70 over Tiger Bay Slough bridge structures. The subsurface information obtained to date and preliminary engineering recommendations for the proposed foundation alternatives are provided herein.

1.3 General Site Description

A concrete bridge culvert (Bridge No. 040031) supporting the existing SR 70 roadway is currently located at the subject bridge site. The concrete bridge culvert was built circa 1959 and reconstructed circa 1979. The subject bridge site is located in an area surrounded by pasturelands.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to provide geotechnical (i.e. subsurface soil conditions and related engineering properties) input to the design team to assist with the design and construction of the proposed SR 70 over Tiger Bay Slough bridge structures. The following services were provided in order to achieve the preceding objective:

1. Reviewed soil information from the "Soil Survey of DeSoto County, Florida" published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Reviewed topographic and potentiometric information obtained from the "Long Island Marsh NW, Florida" Quadrangle map and the "Upper Floridan Aquifer Potentiometric Surface" maps published by the United States Geological Survey (USGS).

2. Conducted a visual reconnaissance of the project site and coordinated utility clearance through Sunshine State One Call.

3. Executed a program of subsurface exploration consisting of subsurface sampling and field testing. Performed one (1) Standard Penetration Test (SPT) boring advanced to a depth of approximately 125 feet below existing grades.

4. Visually classified and stratified the obtained soil samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D-2488. Conducted laboratory testing on selected soil samples to confirm the visual classification and evaluate the corrosive nature of the soil and water.

5. Evaluated foundation criteria and performed engineering analyses to develop preliminary design recommendations for the foundation alternatives associated with the proposed bridge structures.

6. Prepared this formal engineering report, which summarizes the course of study pursued, the field and laboratory data generated, the subsurface conditions encountered and the preliminary geotechnical recommendations for the design and construction of the proposed bridge structure foundation alternatives.

3.0 REVIEW OF PUBLISHED DATA

3.1 Regional Geology

DeSoto County Geology has been paraphrased from the Florida Geological Survey, Open-File Report 80, 2001 and other geologic references.

Based on a review of the Surficial Geology Maps published by FGS, the Hawthorn Group, Peace River Formation (Thp) and Reworked Cypresshead sediments (TQuc) are mapped at the surface in the vicinity of the bridge site.

Lithologically, the Hawthorn Group, Peace River Formation (Thp) sediments consist of yellowish-grey to light olive green interbedded phosphatic sands, clayey sands, clays and dolomite stringers. The thickness of the Peace River Formation is approximately 50 feet in the northeastern and southwestern corners of the county. The Peace River thickens to more than 160 feet in the southeastern corner of the county. The Peace River dips and thickens in the general south easterly direction.

The Reworked Cypresshead sediments (TQuc) is the result of post depositional reworking of the Cypresshead siliciclastics, formed during the Pliocene and Pleistocene epochs. The sediments are fine to coarse quartz sands with scattered quartz gravel and varying percentages of clay matrix.

3.2 USDA Soil Survey

Based on a review of the Soil Survey for DeSoto County published by the USDA NRCS, it appears that there are two (2) primary soil-mapping unit noted at the bridge site. The general soil description as described in the Soil Survey are presented in the following table. The **USDA Soil Survey Map** for the bridge site is illustrated in **Appendix A**.

Summary of USDA Soil Survey
DeSoto, Florida

USDA Map Symbol and Soil Name	Depth (in)	Soil Classification		Permeability (in/hr)	pH	Seasonal High Water Table	
		USCS	AASHTO			Depth (feet)	Months
(14) Farmton	0-4	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	3.5-5.5	0.5-1.5	Jun-Nov
	4-34	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	3.5-5.5		
	34-48	SP-SM, SM	A-2-4	0.6 - 2.0	3.5-5.5		
	48-80	CL, SC, SM	A-4, A-6	0.1 - 0.2	3.5-5.5		
(20) Immokalee	0-6	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	3.5-6.0	0.5-1.5	Jun-Nov
	6-35	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	3.5-6.0		
	35-54	SP-SM, SM	A-2-4, A-3	0.6 - 2.0	3.5-6.0		
	54-80	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	3.5-6.0		

It should be noted that information contained in the USDA Soil Survey Map may not be reflective of actual soil and groundwater conditions, particularly if recent development in the project vicinity has modified soil conditions or surface/subsurface drainage.

3.3 USGS Quadrangle Map

Based on a review of the “Long Island Marsh NW, Florida” USGS Quadrangle Map, it appears that the natural elevation at the project site ranges from approximately +70 feet to +75 feet

National Geodetic Vertical Datum of 1929 (NGVD 29) as illustrated on the **USGS Quadrangle Map** in **Appendix A.**

3.4 Review of Potentiometric Surface Information

Based on a review of the "Upper Floridan Aquifer Potentiometric Surface" maps published by the USGS, the potentiometric surface elevation at the bridge site is reported to range from approximately +50 to +60 feet, NGVD 29. As indicated in **Section 3.3**, the natural ground surface elevation at the bridge site ranges from approximately +70 to +75 feet, NGVD 29. Artesian flow conditions were not encountered during the field exploration.

4.0 SUBSURFACE EXPLORATION

4.1 Boring Location Plan

Prior to commencing our subsurface explorations, a boring location plan for the proposed bridge structures was developed based on design information provided by HNTB. This boring location plan was generated based on our engineering judgment and guidelines provided in the "Soils and Foundations Handbook" published by the FDOT. Tierra submitted this boring location plan to FDOT for approval. Following completion of the boring, the boring locations were surveyed by the project surveyor. The Boring Location Plan for the boring performed is provided on the **Report of Core Boring** sheet in **Appendix A.**

Utility clearances were coordinated by Tierra via Sunshine State One Call and updated as required prior to performing the soil boring in order to reduce the potential for damage to the utilities during drilling.

4.2 Soil Boring

Subsurface conditions were explored at the bridge site one (1) SPT boring. The results and location of the SPT boring are presented on the **Report of Core Boring** sheet in **Appendix A**.

The SPT boring was performed with the use of a drill rig using Bentonite Mud drilling procedures. Temporary 3-inch diameter rotary installed casing was utilized to help keep the borehole stable. The soil sampling was performed in general accordance with the ASTM test designation D-1586. The initial 6 feet of the boring was hand augered to verify utility clearances. SPT resistance N-values were then taken at intervals of 2 feet from the hand auger boring depth of 6 feet to a depth of 17½ feet and on intervals of 2½ feet thereafter to the boring termination depths. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our laboratory for classification and analyses.

Soil stratification was determined based on a review of recovered samples, laboratory test results, and interpretation of field boring logs. Stratification lines represent approximate boundaries between soil layers of different engineering properties; however actual transitions between layers may be gradual. In some cases, small variations in properties that were not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The soil profiles represent the conditions at the particular boring location; variations do

occur among the boring. Specific details about subsurface conditions and materials encountered at each test location can be obtained from the soil profiles presented on the **Report of Core Boring** sheet in **Appendix A** of this report.

5.0 LABORATORY TESTING

5.1 General

Representative soil samples collected from the SPT boring were classified and stratified in general accordance with the Unified Soil Classification System (USCS). Our classification was based on visual observations, using the results from the laboratory testing as confirmation. Laboratory testing consisting of fines content (percentage passing No. 200 mesh sieve), Atterberg limits testing, and natural moisture content determination tests were completed on representative soil samples. In addition, Environmental classification tests were performed to evaluate the corrosive nature of the soil and water encountered at the bridge site. The results of the laboratory tests are presented on the **Report of Core Boring** sheet in **Appendix A**. Detailed results of the tests performed are presented on the **Summary of Laboratory Test Results for Soil Classification**, **Summary of Laboratory Test Results for Environmental Classification** and **Grain Size Distribution Report** in **Appendix C.**

5.2 Test Designation

The following list summarizes the laboratory tests performed and respective test methods utilized.

- Fines Content - The fines content tests were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-1140).

- Grain-Size Analyses - The grain-size analyses were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-6913).

- Atterberg Limits - The liquid limit and the plastic limit tests ("Atterberg Limits") were conducted in general accordance with the AASHTO test designations T-089 and T-090, respectively (ASTM test designation D-4318).

- Natural Moisture Content - The moisture content tests were conducted in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).

- Environmental Classification – The environmental classification tests were conducted in general accordance with the FSTM test designations FM 5-550, FM 5-551, FM 5-552, and FM 5-553.

6.0 ENVIRONMENTAL CLASSIFICATION

Environmental classification tests were performed on recovered soil samples obtained from within the boring performed at the bridge site and from water samples obtained from Tiger Bay Slough. Based on the laboratory test results and the 2025 FDOT Structure Design Guidelines (SDG), the environmental classifications of the superstructure and substructure for the bridge are classified as follows:

Superstructure Environmental Classification	Concrete Substructure Classification	Steel Substructure Classification
Slightly Aggressive	Slightly Aggressive	Moderately Aggressive (Soil - pH = 6.9) (Water - Resistivity = 3,400 Ohm-cm)

The range of test results is presented on the **Report of Core Boring** sheet in **Appendix A.** A summary of the individual environmental classification test results is provided in **Appendix C**.

7.0 RESULTS OF SUBSURFACE EXPLORATION

7.1 General Subsurface Conditions

Generally, the boring encountered sandy soils underlain by intermittent layers of clayey, silty and sandy soils to the boring termination elevation. Specific information on the soil conditions encountered can be found on the **Report of Core Boring** sheet in **Appendix A.** The soil descriptions and classifications associated with this project are listed in the following table.

Soil Description	USCS Symbol
SAND	SP/SP-SM
SILTY SAND	SM
CLAYEY SAND	SC
CLAYEY SILT	MH

Additional borings will be performed as the project progresses beyond the BDR stage; the results will be presented in future submittals.

7.2 Groundwater

The groundwater table was encountered at a depth of approximately 8 feet below existing grades within the boring performed and is presented on the **Report of Core Boring** sheet in **Appendix A**.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e. swales, drainage ponds, underdrains and impervious areas) and creek water levels.

8.0 EVALUATIONS OF BRIDGE FOUNDATION ALTERNATIVES

Evaluations of foundation alternatives for the proposed bridge structures were based on the results of our field study. Based on our discussions with HNTB the following foundation alternatives were considered:

- Shallow Foundations
- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)
- Steel Piles, including H Sections
- Pre-stressed, Pre-cast, Square Concrete (PPSC) Piles
- Drilled Shafts

The following paragraphs discuss each of these alternatives briefly.

8.1 Shallow Foundations

With shallow foundation systems, the structure loads are supported by the bearing capacity of the foundation soils. The design of shallow foundations is typically governed by the soil bearing capacity and total and differential settlement criteria.

Loose soils were encountered within the influence zone of typical shallow foundation sizes. Based on the anticipated loading conditions for roadway bridges of this size, a shallow footing would have to be relatively large for bearing capacity and settlement criteria to be achieved or would require some form of subsurface remediation to increase the bearing capacity and decrease settlement potential.

For these reasons, shallow foundations were not considered further for this report.

8.2 Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)

GRS-IBS consists of a shallow foundation combined with a retaining wall system to provide support for single span bridges or multi-span bridges with simply supported end spans. The reasons discussed in **Section 8.1** that preclude the use of shallow foundations also apply to the GRS-IBS.

For these reasons, GRS-IBS was not considered further for this report.

8.3 Pre-Cast Pre-Stressed Square Concrete (PPSC) Piles

PPSC pile foundations are a feasible foundation alternative. They are a widely used and proven foundation system in Florida. PPSC pile foundations are readily available and generally have a lower cost per ton of capacity than other pile types. Analyses were performed for 18-inch and 24-inch PPSC piles for this Preliminary Bridge Geotechnical Report.

8.4 Steel Piles

Steel pile types include H-sections and pipe piles. Steel piles generally do not develop as much capacity for similar penetration depths as PPSC piles. Steel piles are well suited to soil conditions with high variability and where frequent pile splicing is expected and/or required due to overhead restrictions, subsurface variability, etc. Steel piles may also more easily penetrate dense layers to achieve a desired penetration depth and are less susceptible to damage compared to concrete piles. Steel H-Piles are low displacement piles, and therefore vibrations associated with installations are minimized due to the low-displacement nature of the piles. Open end pipe piles are also low displacement but will eventually become plugged at the pile toe. Based on coordination with the Structural Engineer, pile capacity analyses for 14X89 H-Piles were performed for this Preliminary Bridge Geotechnical Report.

8.5 Drilled Shafts

Drilled, cast-in-place, concrete shafts have the ability to develop high axial and lateral capacities. One drilled shaft could potentially take the place of several driven piles depending on soil/rock conditions.

This type of foundation system is often the chosen alternative for sites where competent limestone is present at a relatively shallow depth and with a sufficient thickness. Drilled shafts will develop large skin friction capacities in limestone compared to dense sand, and therefore drilled shafts are most suited for sites with shallow, competent consistent limestone. Drilled shafts foundations may also be considered as a preferred foundation alternative for sites in order to limit construction induced vibrations compared to the vibrations caused by driven piles.

Limestone was not encountered within the SPT Boring performed at the bridge site. Therefore, drilled shafts were not analyzed further for this Preliminary Bridge Geotechnical Report.

9.0 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

9.1 General

Based on the subsurface conditions encountered in the test boring performed to date, it is Tierra's opinion that driven pile foundations are the most suitable foundation alternative type for the proposed bridge structures. Foundation systems comprised of 18-inch and 24-inch PPSC piles and 14X89 H-Piles were analyzed for this Preliminary Bridge Geotechnical Report. The following sections present the results of the engineering analyses for the proposed deep foundation alternatives.

9.2 Environmental Classification

Based on the laboratory test results and the 2025 SDG, the environmental classification for steel substructure for the proposed bridge structures is Moderately Aggressive (Soil pH = 6.9; Water Resistivity = 3,400 Ohm-cm). Steel piles will need to be designed with proper sacrificial thickness.

9.3 Downdrag (Negative Skin Friction)

Based on a review of preliminary cross sections, the new bridge supporting the eastbound travel lanes will be at/near the elevation of the existing bridge, and the new bridge supporting the westbound travel lanes will have new embankments (anticipated to be less than about 10 feet high) at each end bent approach. Based on the new embankments and soil conditions encountered in the boring, there will be downdrag loads imparted to the end bent piles. Actual loads will be determined following the BDR stage once a foundation alternative has been selected and the roadway geometry has been finalized. For preliminary estimation purposes, downdrag loads up to 20 tons should be anticipated at the end bent locations.

The portion of the end bent concrete piles within the embankment should be provided with a double wrap of polyethylene sheeting according to the FDOT Specifications to minimize development of downdrag loads from the embankment fill.

9.4 Scour

It is our understanding that the scour analysis will be performed by others. Tierra performed sieve analyses on soil samples collected within two feet of the mudline of Tiger Bay Slough near the existing bridge. The results of the sieve analyses along with D_{50} values for use in the scour analysis calculations are provided on the **Grain Size Distribution Report** in **Appendix C**.

9.5 Driven Pile Axial Capacity

Axial pile capacities for the proposed bridge were analyzed based on the subsurface conditions encountered in the boring and the FDOT program FB-Deep. The Load and Resistance Factor Design (LRFD) method was utilized for the analysis.

As indicated in the FDOT Structure Design Guidelines (SDG), the required Nominal Bearing Resistance (Rn) must satisfy the following requirement:

$$\mathbf{Rn} > \frac{\mathbf{(Factored\ Design\ Load + Downdrag + Net\ Scour)}}{\phi}$$

Where ϕ = 0.75; dynamic load testing will be performed on all piles.

Other ϕ factors may be used based on the type of foundation testing recommended.

The R_n is taken as the Davisson Capacity. The Davisson axial capacity consists of the ultimate skin friction and mobilized end bearing (i.e., one-third of the ultimate end bearing). Tierra modeled the top 15 feet of the soil boring profile in the capacity analyses as a cavity layer to mimic a "starter hole" as described in FDOT Specification 455-5.1.

Based on the results of boring performed at the bridge sites to date, medium dense to very dense silty to clayey sands were encountered at the bridge site where concrete piles will likely tip. Based on the information provided in the FDOT Publication *"Improving Design Phase*

Evaluations of High Pile Rebound Soils with an Emphasis on SPT Testing" and our experience, concrete displacement piles have the potential to experience pile "rebound" during pile driving activities into these types of soils. We therefore recommend limiting the maximum NBR values below what is stated in SDG Table 3.5.13-1. The following table summarizes the approximate maximum recommended R_n for each driven pile foundation alternative:

Driven Pile Foundation Alternative	Approximate Maximum Recommended R_n(1)
18-Inch PPSC Piles	275 tons
24-Inch PPSC Piles	425 tons
14X89 Steel H-Pile	175 tons
(1) Anticipate downdrag loads up to 20 tons for preliminary estimation purposes.	

The axial capacity for 18-inch and 24-inch PPSC piles and 14X89 H-Piles were computed using the program FB-Deep. The results of the axial pile analyses are presented in **APPENDIX B**, including the axial capacity curves, FB-Deep output curves (including Davisson Capacity Curves, Ultimate Skin Friction Curves and Mobilized End Bearing Curves) and FB-Deep computer output files.

9.6 Group Action

No reductions of the individual pile capacities will be required if piles are spaced center-to-center at 3 times their width or greater.

9.7 Settlement

Settlement of pile supported bridge bents should be small and tolerable for a typical single row group. However, the tolerance should be confirmed by the structural engineer. Based on soil conditions encountered at the boring locations, and that piles will be tipped in a suitable bearing layer, individual pile head settlements are estimated to be on the order of ½ inch or less.

10.0 CONSTRUCTION CONSIDERATIONS

10.1 General

The overall site preparation and construction should be in accordance with the FDOT Specifications.

10.2 Temporary Side Slopes

Temporary side slopes and excavations should comply with the Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 C.F.R., s. 1926.650, Subpart P, all subsequent revisions or updates of OSHA's referenced standard adopted by the Department of Labor and Employment Security and Florida's Trench Safety Act, Section 553.62, Florida Statutes. Excavated materials should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth.

10.3 Groundwater Control

Depending upon groundwater levels at the time of construction, some form of dewatering may be required based on the anticipated construction activities due to perched groundwater. Due to groundwater levels anticipated during the wet season of the year, seepage may enter the bottom and sides of excavated areas. Such seepage will act to loosen soils and create difficult working conditions. Groundwater levels should be determined immediately prior to construction. Shallow groundwater should be kept below the lowest working area to facilitate proper material placement and compaction in accordance with the FDOT Specifications.

10.4 Dynamic Load Testing & Pile Installation

We recommend that a test pile program be conducted for the proposed bridge construction including test piles. The test piles should be dynamically monitored. The monitoring will provide estimates of pile capacity versus pile penetration, stresses in the pile, and other relevant parameters used to evaluate the pile driving process. analyses should be performed on selected conditions for evaluation of the dynamic test results. The results of these analyses will provide information for developing production pile lengths. In addition, all production piles will be dynamically monitored.

The installation of the piles should be carried out in accordance with the FDOT Specifications.

10.5 Protection of Existing Structures

The FDOT Specifications should be followed for protection of existing structures during foundation construction operations.

11.0 REPORT LIMITATIONS

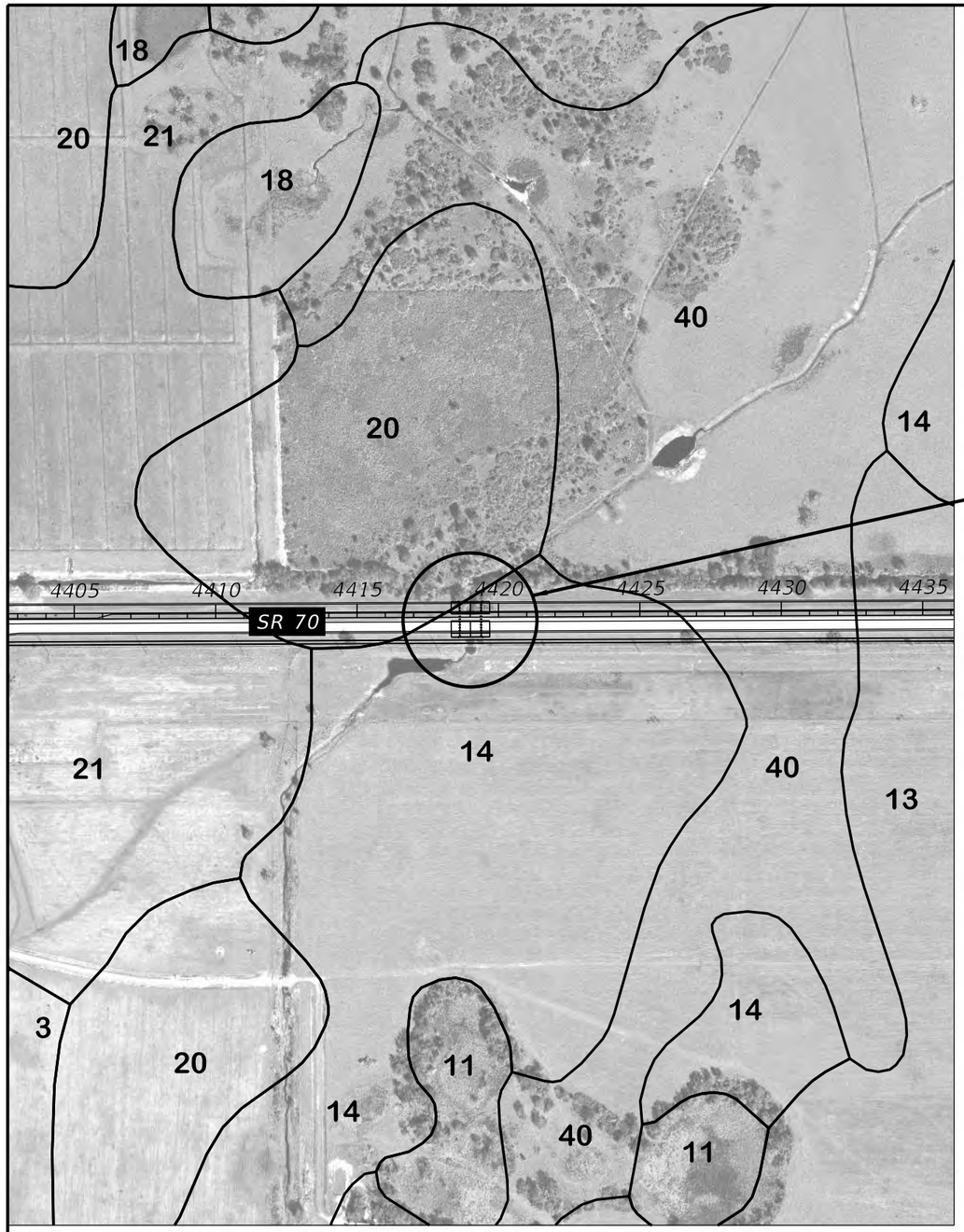
Our services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions, or recommendations made by others based on this data.

The scope of the investigation was intended to evaluate soil conditions within the influence zone of the deep foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil boring performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed structure.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of the HNTB design team and the Florida Department of Transportation.

APPENDIX A

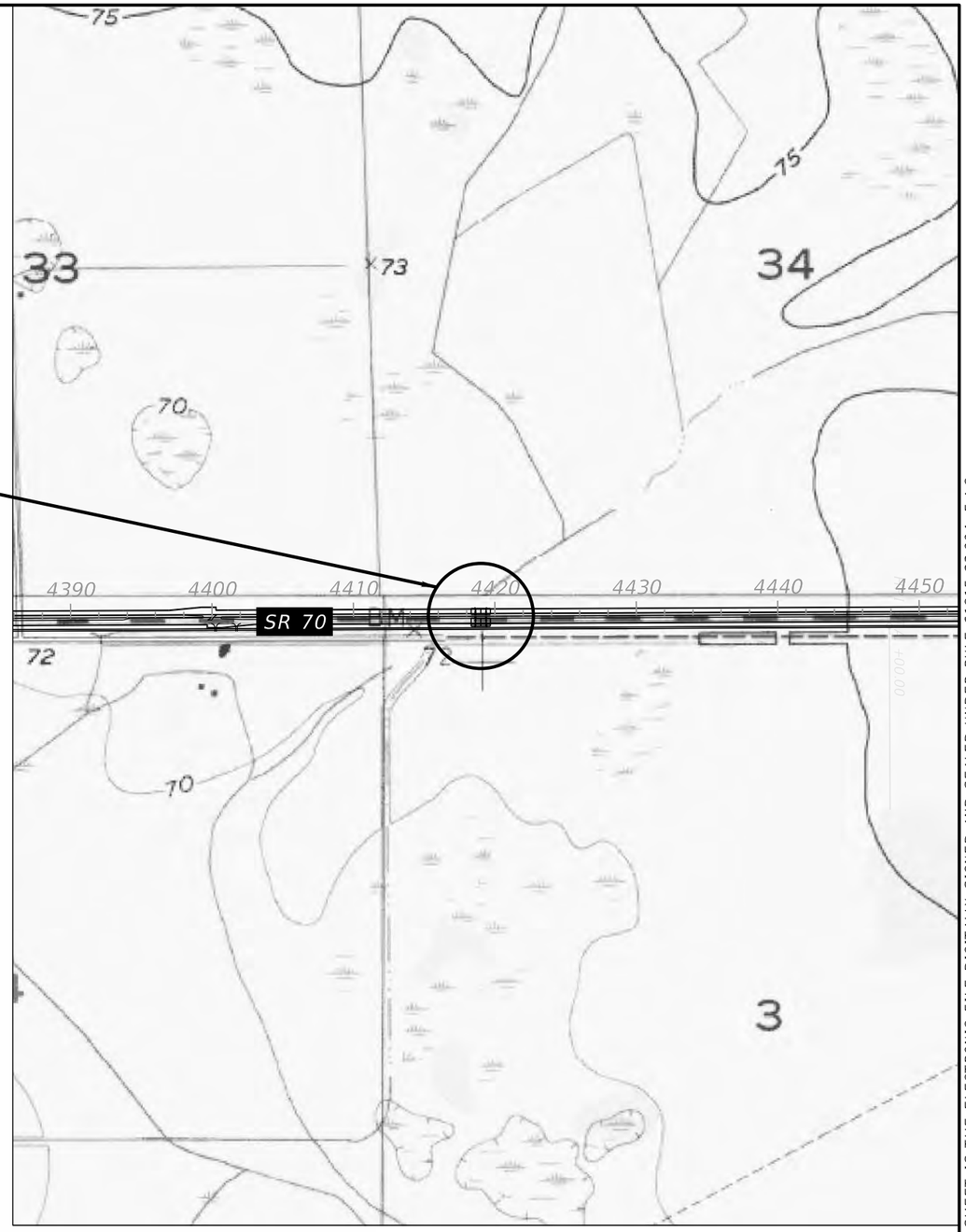
USDA Soil Survey & USGS Quadrangle Maps
Report of Core Boring (1 Sheet)



REFERENCE: USDA SOIL SURVEY OF DESOTO COUNTY, FLORIDA

0 100 500
Feet

APPROXIMATE BRIDGE LOCATION



REFERENCE: USGS QUADRANGLE MAP OF "LONG ISLAND MARSH NW, FLORIDA"

0 200 1000
Feet

TOWNSHIP: 37S
RANGE: 26E
SECTION: 34

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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TIERRA, INC.
7351 TEMPLE TERRACE HIGHWAY
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DESIGNED BY: BJS 02-25
CHECKED BY: DAN 02-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: USDA SOIL SURVEY AND USGS QUADRANGLE MAPS

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

REF. DWG. NO.

SHEET NO.

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

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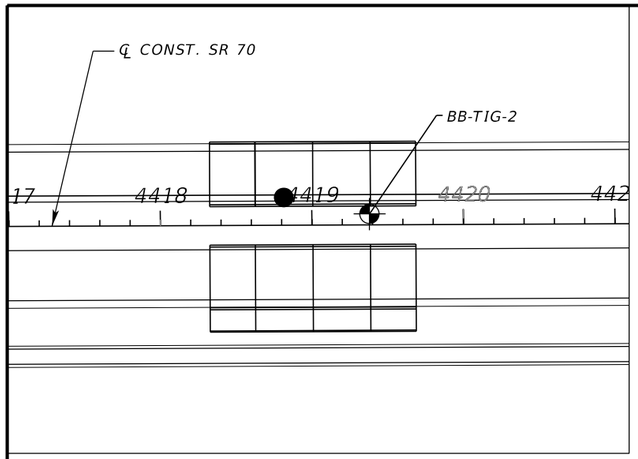
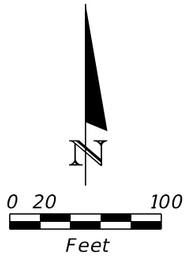




BORING LOCATION PLAN

NOTES:

1. THE BORING LOCATIONS AND ELEVATIONS WERE PROVIDED BY THE PROJECT SURVEYOR.
2. BASED ON A REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION AT THE BRIDGE SITE IS REPORTED TO RANGE FROM APPROXIMATELY +50 FEET TO +60 FEET, NGVD 29. ARTESIAN CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED.

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: SLIGHTLY AGGRESSIVE
SUBSTRUCTURE	STEEL: MODERATELY AGGRESSIVE (SOIL - pH = 6.9, WATER - RESISTIVITY = 3,400 OHM-CM)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

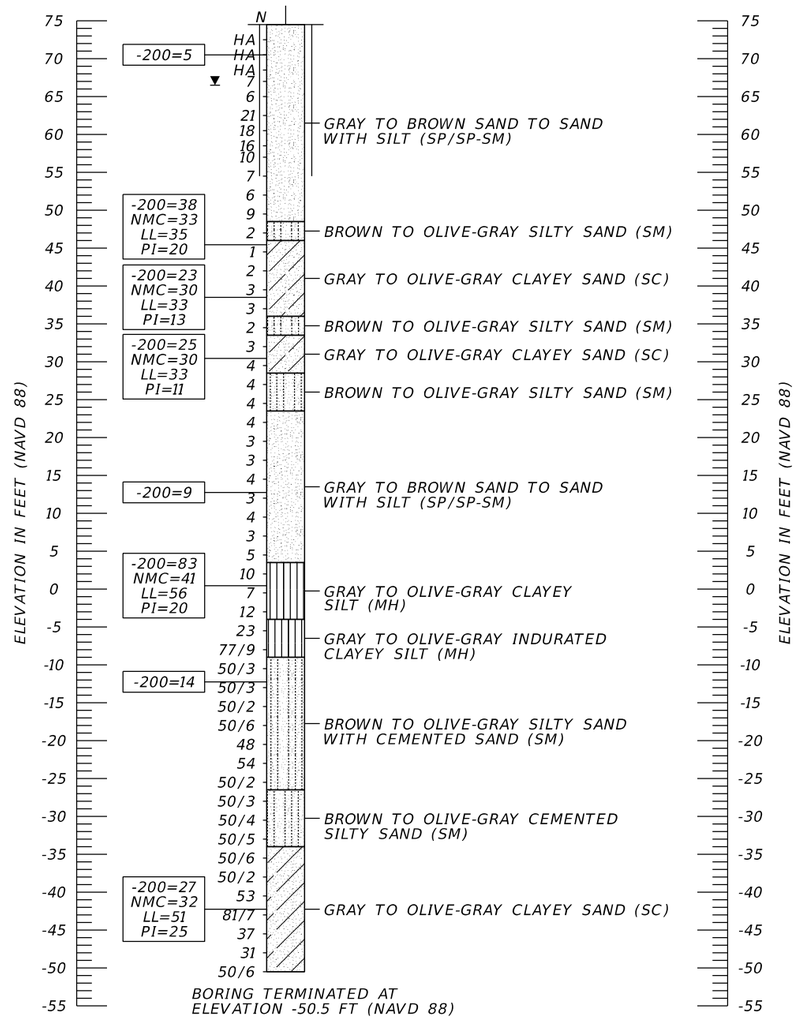
SOIL TEST RESULTS:

RESISTIVITY	16,000 TO 17,000 OHM-CM
CHLORIDES	15 PPM
SULFATES	12 TO 21 PPM
pH	7.4 TO 7.6

WATER TEST RESULTS:

RESISTIVITY	3,400 TO 4,100 OHM-CM
CHLORIDES	15 TO 45 PPM
SULFATES	43 TO 55 PPM
pH	6.9 TO 8.1

BOR # BB-TIG-2
STA. 4419+38
REF. ℄ CONST. SR 70
OFF. 7' LT.
ELEV. 74.5
DATE 2/12/2025
DRILLER J. SHAW
HAMMER AUTOMATIC
RIG D-25



BORING TERMINATED AT ELEVATION -50.5 FT (NAVD 88)

LATITUDE: N 27.20953
LONGITUDE: W 81.70809

LEGEND

SAND — CLAYEY SAND
SILTY SAND — CLAYEY SILT

SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCE
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON-PLASTIC
NAVD 88	NORTH AMERICAN VERTICAL DATUM OF 1988
	APPROXIMATE SPT BORING LOCATION
	GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
	CASING
	APPROXIMATE SEDIMENT SAMPLE LOCATION FOR D_{50} DETERMINATION

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

DYLAN A. NELSON, P.E.
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CHECKED BY: DAN 02-25
DESIGNED BY: BJS 02-25
CHECKED BY: DAN 02-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: REPORT OF CORE BORINGS (1)
REF. DWG. NO.
PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE
SHEET NO.

J:\6511\2024 Files\6511-24-001 SR 70 Segments 9 & 10\ORD\6511-24-001\Geotechnical\B3BoringTig01.dgn : RCB_B1_01 [SHEET]
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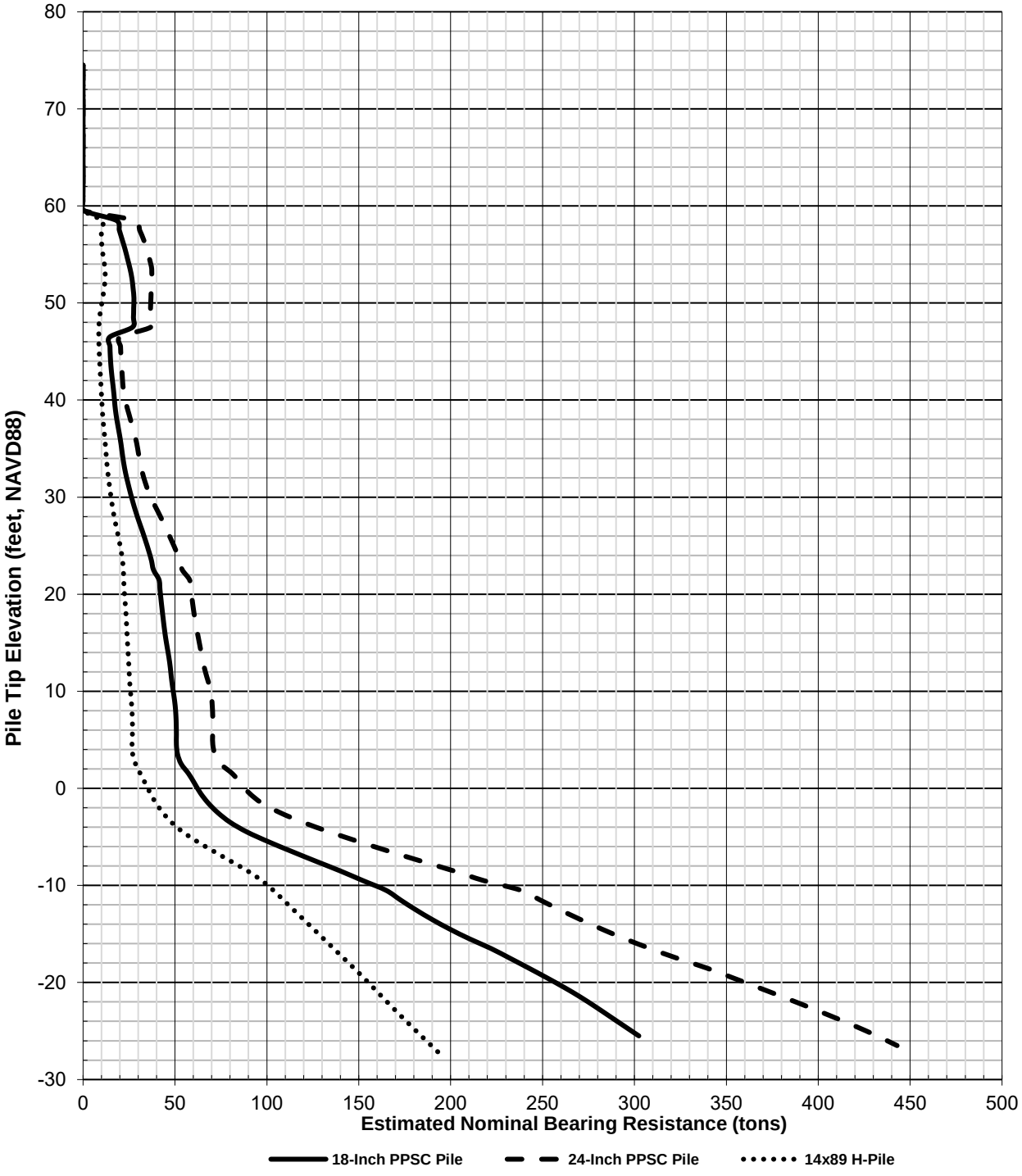
APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

SR 70 over Tiger Bay Slough
SPT Boring BB-TIG-2



TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Tiger Bay Slough
DeSoto County, FL
FPID No. 451942-2-52-01

General Information:
====================
Input file: .....ments 9 & 10\FBDeep\B3_TIG\BB-TIG-2_14x49 H-Pile_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
=====================
Analysis Type: SPT

Soil Information:
=================
Boring date: 2/12/2025, Boring Number: BB-TIG-2
Station number: 4419+38 Offset: 7' LT.

Ground Elevation: 74.500(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	7.00	5- Cavity layer
6	10.00	6.00	5- Cavity layer
7	12.00	21.00	5- Cavity layer
8	14.00	18.00	5- Cavity layer
9	16.00	16.00	3- Clean sand
10	17.50	10.00	3- Clean sand
11	20.00	7.00	3- Clean sand
12	22.50	6.00	3- Clean sand
13	25.00	9.00	3- Clean sand
14	27.50	2.00	2- Clay and silty sand
15	30.00	1.00	2- Clay and silty sand
16	32.50	2.00	2- Clay and silty sand
17	35.00	3.00	2- Clay and silty sand
18	37.50	3.00	2- Clay and silty sand
19	40.00	2.00	2- Clay and silty sand

20	42.50	3.00	2- Clay and silty sand
21	45.00	4.00	2- Clay and silty sand
22	47.50	4.00	2- Clay and silty sand
23	50.00	4.00	2- Clay and silty sand
24	52.50	4.00	3- Clean sand
25	55.00	3.00	3- Clean sand
26	57.50	3.00	3- Clean sand
27	60.00	4.00	3- Clean sand
28	62.50	3.00	3- Clean sand
29	65.00	4.00	3- Clean sand
30	67.50	3.00	3- Clean sand
31	70.00	5.00	3- Clean sand
32	72.50	10.00	1- Plastic Clay
33	75.00	7.00	1- Plastic Clay
34	77.50	12.00	1- Plastic Clay
35	80.00	23.00	1- Plastic Clay
36	82.50	100.00	1- Plastic Clay
37	85.00	100.00	2- Clay and silty sand
38	87.50	100.00	2- Clay and silty sand
39	90.00	100.00	2- Clay and silty sand
40	92.50	100.00	2- Clay and silty sand
41	95.00	48.00	2- Clay and silty sand
42	97.50	54.00	2- Clay and silty sand
43	100.00	100.00	2- Clay and silty sand
44	102.50	100.00	2- Clay and silty sand
45	105.00	100.00	2- Clay and silty sand
46	107.50	100.00	2- Clay and silty sand
47	110.00	100.00	2- Clay and silty sand
48	112.50	100.00	2- Clay and silty sand
49	115.00	53.00	2- Clay and silty sand
50	117.50	100.00	2- Clay and silty sand
51	120.00	37.00	2- Clay and silty sand
52	122.50	31.00	2- Clay and silty sand
53	125.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	74.50	58.50	16.00	8.00	5-Void
2	58.50	47.00	11.50	9.04	3-Clean Sand
3	47.00	22.00	25.00	2.80	2-Clay and Silty Sand
4	22.00	2.00	20.00	3.62	3-Clean Sand
5	2.00	-10.50	12.50	30.40	1-Plastic Clay

6	-10.50	-50.50	40.00	82.69	2-Clay and Silty Sand

Driven Pile Data:
==========
Pile unit weight = 490.00(pcf), Section Type: H-Section

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)	Depth (in)	End Area (in^2)
14.69	1.00	73.50	13.83	101.58
14.69	2.00	72.50	13.83	101.58
14.69	3.00	71.50	13.83	101.58
14.69	4.00	70.50	13.83	101.58
14.69	5.00	69.50	13.83	101.58
14.69	6.00	68.50	13.83	101.58
14.69	7.00	67.50	13.83	101.58
14.69	8.00	66.50	13.83	101.58
14.69	9.00	65.50	13.83	101.58
14.69	10.00	64.50	13.83	101.58
14.69	11.00	63.50	13.83	101.58
14.69	12.00	62.50	13.83	101.58
14.69	13.00	61.50	13.83	101.58
14.69	14.00	60.50	13.83	101.58
14.69	15.00	59.50	13.83	101.58
14.69	16.00	58.50	13.83	101.58
14.69	17.00	57.50	13.83	101.58
14.69	18.00	56.50	13.83	101.58
14.69	19.00	55.50	13.83	101.58
14.69	20.00	54.50	13.83	101.58
14.69	21.00	53.50	13.83	101.58
14.69	22.00	52.50	13.83	101.58
14.69	23.00	51.50	13.83	101.58
14.69	24.00	50.50	13.83	101.58
14.69	25.00	49.50	13.83	101.58
14.69	26.00	48.50	13.83	101.58
14.69	27.00	47.50	13.83	101.58
14.69	28.00	46.50	13.83	101.58
14.69	29.00	45.50	13.83	101.58
14.69	30.00	44.50	13.83	101.58
14.69	31.00	43.50	13.83	101.58
14.69	32.00	42.50	13.83	101.58
14.69	33.00	41.50	13.83	101.58
14.69	34.00	40.50	13.83	101.58
14.69	35.00	39.50	13.83	101.58
14.69	36.00	38.50	13.83	101.58
14.69	37.00	37.50	13.83	101.58
14.69	38.00	36.50	13.83	101.58

14.69	39.00	35.50	13.83	101.58
14.69	40.00	34.50	13.83	101.58
14.69	41.00	33.50	13.83	101.58
14.69	42.00	32.50	13.83	101.58
14.69	43.00	31.50	13.83	101.58
14.69	44.00	30.50	13.83	101.58
14.69	45.00	29.50	13.83	101.58
14.69	46.00	28.50	13.83	101.58
14.69	47.00	27.50	13.83	101.58
14.69	48.00	26.50	13.83	101.58
14.69	49.00	25.50	13.83	101.58
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14.69	60.00	14.50	13.83	101.58
14.69	61.00	13.50	13.83	101.58
14.69	62.00	12.50	13.83	101.58
14.69	63.00	11.50	13.83	101.58
14.69	64.00	10.50	13.83	101.58
14.69	65.00	9.50	13.83	101.58
14.69	66.00	8.50	13.83	101.58
14.69	67.00	7.50	13.83	101.58
14.69	68.00	6.50	13.83	101.58
14.69	69.00	5.50	13.83	101.58
14.69	70.00	4.50	13.83	101.58
14.69	71.00	3.50	13.83	101.58
14.69	72.00	2.50	13.83	101.58
14.69	73.00	1.50	13.83	101.58
14.69	74.00	0.50	13.83	101.58
14.69	75.00	-0.50	13.83	101.58
14.69	76.00	-1.50	13.83	101.58
14.69	77.00	-2.50	13.83	101.58
14.69	78.00	-3.50	13.83	101.58
14.69	79.00	-4.50	13.83	101.58
14.69	80.00	-5.50	13.83	101.58
14.69	81.00	-6.50	13.83	101.58
14.69	82.00	-7.50	13.83	101.58
14.69	83.00	-8.50	13.83	101.58
14.69	84.00	-9.50	13.83	101.58
14.69	85.00	-10.50	13.83	101.58
14.69	86.00	-11.50	13.83	101.58
14.69	87.00	-12.50	13.83	101.58
14.69	88.00	-13.50	13.83	101.58

14.69	89.00	-14.50	13.83	101.58
14.69	90.00	-15.50	13.83	101.58
14.69	91.00	-16.50	13.83	101.58
14.69	92.00	-17.50	13.83	101.58
14.69	93.00	-18.50	13.83	101.58
14.69	94.00	-19.50	13.83	101.58
14.69	95.00	-20.50	13.83	101.58
14.69	96.00	-21.50	13.83	101.58
14.69	97.00	-22.50	13.83	101.58
14.69	98.00	-23.50	13.83	101.58
14.69	99.00	-24.50	13.83	101.58
14.69	100.00	-25.50	13.83	101.58
14.69	101.00	-26.50	13.83	101.58
14.69	102.00	-27.50	13.83	101.58
14.69	103.00	-28.50	13.83	101.58
14.69	104.00	-29.50	13.83	101.58
14.69	105.00	-30.50	13.83	101.58
14.69	106.00	-31.50	13.83	101.58
14.69	107.00	-32.50	13.83	101.58
14.69	108.00	-33.50	13.83	101.58
14.69	109.00	-34.50	13.83	101.58
14.69	110.00	-35.50	13.83	101.58
14.69	111.00	-36.50	13.83	101.58
14.69	112.00	-37.50	13.83	101.58
14.69	113.00	-38.50	13.83	101.58
14.69	114.00	-39.50	13.83	101.58
14.69	115.00	-40.50	13.83	101.58
14.69	116.00	-41.50	13.83	101.58
14.69	117.00	-42.50	13.83	101.58
14.69	118.00	-43.50	13.83	101.58
14.69	119.00	-44.50	13.83	101.58
14.69	120.00	-45.50	13.83	101.58
14.69	121.00	-46.50	13.83	0.00
14.69	122.00	-47.50	13.83	0.00
14.69	123.00	-48.50	13.83	0.00
14.69	124.00	-49.50	13.83	0.00
14.69	125.00	-50.50	13.83	0.00

Driven Pile Capacity:
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Section Type: H
Pile Width: 14.69 (in)
Sect. Depth: 13.83 (in)
End Area: 101.58 (in^2)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	14.7	0.00	0.00	0.00	0.00	0.00
2.00	14.7	0.00	0.00	0.00	0.00	0.00
3.00	14.7	0.00	0.00	0.00	0.00	0.00
4.00	14.7	0.00	0.00	0.00	0.00	0.00
5.00	14.7	0.00	0.00	0.00	0.00	0.00
6.00	14.7	0.00	0.00	0.00	0.00	0.00
7.00	14.7	0.00	0.00	0.00	0.00	0.00
8.00	14.7	0.00	0.00	0.00	0.00	0.00
9.00	14.7	0.00	0.00	0.00	0.00	0.00
10.00	14.7	0.00	0.00	0.00	0.00	0.00
11.00	14.7	0.00	0.00	0.00	0.00	0.00
12.00	14.7	0.00	0.00	0.00	0.00	0.00
13.00	14.7	0.00	0.00	0.00	0.00	0.00
14.00	14.7	0.00	0.00	0.00	0.00	0.00
15.00	14.7	0.33	0.00	0.33	0.17	0.33
16.00	14.7	1.33	8.93	10.26	5.13	19.19
17.00	14.7	2.49	7.49	9.98	4.99	17.47
18.00	14.7	3.35	6.69	10.04	5.02	16.74
19.00	14.7	4.08	6.36	10.44	5.22	16.81
20.00	14.7	4.71	6.49	11.20	5.60	17.70
21.00	14.7	5.28	6.64	11.91	5.96	18.55
22.00	14.7	5.81	6.17	11.98	5.99	18.15
23.00	14.7	6.32	5.12	11.44	5.72	16.55
24.00	14.7	6.92	3.74	10.66	5.33	14.41
25.00	14.7	7.62	2.14	9.76	4.88	11.90
26.00	14.7	8.21	0.77	8.99	4.49	9.76
27.00	14.7	8.51	0.09	8.60	4.30	8.68
28.00	14.7	8.55	0.01	8.56	4.28	8.58
29.00	14.7	8.55	0.11	8.66	4.33	8.89
30.00	14.7	8.55	0.33	8.88	4.44	9.54
31.00	14.7	8.55	0.61	9.16	4.58	10.39
32.00	14.7	8.55	0.90	9.45	4.72	11.25
33.00	14.7	8.58	1.16	9.74	4.87	12.06
34.00	14.7	8.80	1.23	10.03	5.02	12.50
35.00	14.7	9.25	1.07	10.32	5.16	12.47
36.00	14.7	9.81	0.83	10.64	5.32	12.31
37.00	14.7	10.37	0.71	11.08	5.54	12.49
38.00	14.7	10.91	0.70	11.61	5.80	13.01
39.00	14.7	11.24	0.85	12.09	6.05	13.80
40.00	14.7	11.36	1.15	12.51	6.25	14.81
41.00	14.7	11.47	1.48	12.94	6.47	15.89
42.00	14.7	11.80	1.69	13.49	6.74	16.86
43.00	14.7	12.35	1.79	14.14	7.07	17.72
44.00	14.7	13.00	1.85	14.84	7.42	18.54

45.00	14.7	13.73	1.87	15.60	7.80	19.33
46.00	14.7	14.51	1.93	16.43	8.22	20.29
47.00	14.7	15.28	2.14	17.42	8.71	21.70
48.00	14.7	16.06	2.49	18.55	9.27	23.52
49.00	14.7	16.84	2.80	19.64	9.82	25.24
50.00	14.7	17.62	3.04	20.65	10.33	26.73
51.00	14.7	18.30	3.15	21.46	10.73	27.76
52.00	14.7	18.81	3.11	21.93	10.96	28.15
53.00	14.7	19.16	2.96	22.12	11.06	25.08
54.00	14.7	19.46	2.91	22.37	11.19	25.29
55.00	14.7	19.73	3.02	22.75	11.37	25.76
56.00	14.7	19.98	3.18	23.16	11.58	26.33
57.00	14.7	20.23	3.26	23.49	11.74	26.75
58.00	14.7	20.48	3.27	23.75	11.88	27.02
59.00	14.7	20.76	3.26	24.03	12.01	27.29
60.00	14.7	21.08	3.26	24.33	12.17	27.59
61.00	14.7	21.39	3.26	24.66	12.33	27.92
62.00	14.7	21.68	3.27	24.95	12.47	28.22
63.00	14.7	21.93	3.28	25.21	12.61	28.49
64.00	14.7	22.22	3.34	25.55	12.78	28.89
65.00	14.7	22.53	3.48	26.01	13.00	29.48
66.00	14.7	22.85	3.62	26.46	13.23	30.08
67.00	14.7	23.13	3.62	26.75	13.38	30.37
68.00	14.7	23.39	3.47	26.86	13.43	30.34
69.00	14.7	23.71	3.12	26.83	13.41	29.95
70.00	14.7	24.09	2.57	26.65	13.33	29.22
71.00	14.7	24.96	2.05	27.01	13.50	29.06
72.00	14.7	26.75	1.82	28.58	14.29	30.40
73.00	14.7	29.31	1.89	31.20	15.60	34.97
74.00	14.7	31.73	2.18	33.91	16.96	38.28
75.00	14.7	33.85	2.72	36.56	18.28	41.99
76.00	14.7	36.06	3.51	39.57	19.78	46.59
77.00	14.7	38.75	4.64	43.39	21.70	52.68
78.00	14.7	41.96	6.15	48.11	24.06	60.42
79.00	14.7	45.95	8.42	54.36	27.18	71.19
80.00	14.7	50.75	11.53	62.28	31.14	85.34
81.00	14.7	56.26	14.97	71.22	35.61	101.16
82.00	14.7	62.37	17.98	80.35	40.18	116.32
83.00	14.7	68.96	20.50	89.45	44.73	130.45
84.00	14.7	75.18	22.06	97.24	48.62	141.35
85.00	14.7	80.92	22.57	103.49	51.75	148.64
86.00	14.7	86.41	22.57	108.98	54.49	154.13
87.00	14.7	91.90	22.57	114.47	57.24	159.62
88.00	14.7	97.39	22.57	119.96	59.98	165.10
89.00	14.7	102.87	22.56	125.43	62.72	170.55
90.00	14.7	108.36	22.53	130.89	65.45	175.96
91.00	14.7	113.85	22.50	136.35	68.18	181.35
92.00	14.7	119.34	22.48	141.82	70.91	186.79
93.00	14.7	124.81	22.48	147.29	73.64	192.26
94.00	14.7	130.11	22.50	152.61	76.30	197.60

95.00	14.7	135.22	22.53	157.75	78.87	202.80
96.00	14.7	140.29	22.56	162.84	81.42	207.96
97.00	14.7	145.43	22.57	168.01	84.00	213.15
98.00	14.7	150.67	22.57	173.24	86.62	218.39
99.00	14.7	156.00	22.57	178.58	89.29	223.72
100.00	14.7	161.44	22.57	184.01	92.01	229.16

Section Type: H
Pile Width: 14.69 (in)
Sect. Depth: 13.83 (in)
End Area: 101.58 (in^2)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	14.7	166.93	22.57	189.50	94.75	234.65
102.00	14.7	172.42	22.57	194.99	97.50	240.14
103.00	14.7	177.91	22.57	200.48	100.24	245.63
104.00	14.7	183.40	22.57	205.97	102.98	251.12
105.00	14.7	188.88	22.57	211.46	105.73	256.61
106.00	14.7	194.37	22.57	216.95	108.47	262.09
107.00	14.7	199.86	22.57	222.44	111.22	267.58
108.00	14.7	205.35	22.57	227.92	113.96	273.07
109.00	14.7	210.84	22.57	233.41	116.71	278.56
110.00	14.7	216.33	22.57	238.90	119.45	284.05
111.00	14.7	221.82	22.57	244.39	122.20	289.54
112.00	14.7	227.31	22.57	249.88	124.94	295.03
113.00	14.7	232.78	22.54	255.32	127.66	300.40
114.00	14.7	238.15	22.15	260.30	130.15	304.60
115.00	14.7	243.41	21.33	264.73	132.37	307.39
116.00	14.7	248.66	20.15	268.81	134.41	309.12
117.00	14.7	254.03	18.75	272.78	136.39	310.28
118.00	14.7	259.46	17.24	276.70	138.35	311.18
119.00	14.7	264.59	16.61	281.20	140.60	314.42
120.00	14.7	269.35	17.08	286.43	143.21	320.59
121.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
122.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
123.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
124.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
125.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA,

AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....0 Segments 9 & 10\FBDeep\B3_TIG\BB-TIG-2_18-Inch_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 2/12/2025, Boring Number: BB-TIG-2
Station number: 4419+38 Offset: 7' LT.

Ground Elevation: 74.500(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	7.00	5- Cavity layer
6	10.00	6.00	5- Cavity layer
7	12.00	21.00	5- Cavity layer
8	14.00	18.00	5- Cavity layer
9	16.00	16.00	3- Clean sand
10	17.50	10.00	3- Clean sand
11	20.00	7.00	3- Clean sand
12	22.50	6.00	3- Clean sand
13	25.00	9.00	3- Clean sand
14	27.50	2.00	2- Clay and silty sand
15	30.00	1.00	2- Clay and silty sand
16	32.50	2.00	2- Clay and silty sand
17	35.00	3.00	2- Clay and silty sand
18	37.50	3.00	2- Clay and silty sand
19	40.00	2.00	2- Clay and silty sand

20	42.50	3.00	2- Clay and silty sand
21	45.00	4.00	2- Clay and silty sand
22	47.50	4.00	2- Clay and silty sand
23	50.00	4.00	2- Clay and silty sand
24	52.50	4.00	3- Clean sand
25	55.00	3.00	3- Clean sand
26	57.50	3.00	3- Clean sand
27	60.00	4.00	3- Clean sand
28	62.50	3.00	3- Clean sand
29	65.00	4.00	3- Clean sand
30	67.50	3.00	3- Clean sand
31	70.00	5.00	3- Clean sand
32	72.50	10.00	1- Plastic Clay
33	75.00	7.00	1- Plastic Clay
34	77.50	12.00	1- Plastic Clay
35	80.00	23.00	1- Plastic Clay
36	82.50	100.00	1- Plastic Clay
37	85.00	100.00	2- Clay and silty sand
38	87.50	100.00	2- Clay and silty sand
39	90.00	100.00	2- Clay and silty sand
40	92.50	100.00	2- Clay and silty sand
41	95.00	48.00	2- Clay and silty sand
42	97.50	54.00	2- Clay and silty sand
43	100.00	100.00	2- Clay and silty sand
44	102.50	100.00	2- Clay and silty sand
45	105.00	100.00	2- Clay and silty sand
46	107.50	100.00	2- Clay and silty sand
47	110.00	100.00	2- Clay and silty sand
48	112.50	100.00	2- Clay and silty sand
49	115.00	53.00	2- Clay and silty sand
50	117.50	100.00	2- Clay and silty sand
51	120.00	37.00	2- Clay and silty sand
52	122.50	31.00	2- Clay and silty sand
53	125.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	74.50	58.50	16.00	8.00	5-Void
2	58.50	47.00	11.50	9.04	3-Clean Sand
3	47.00	22.00	25.00	2.80	2-Clay and Silty Sand
4	22.00	2.00	20.00	3.62	3-Clean Sand
5	2.00	-10.50	12.50	30.40	1-Plastic Clay

6	-10.50	-50.50	40.00	82.69	2-Clay and Silty Sand

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	73.50
18.00	2.00	72.50
18.00	3.00	71.50
18.00	4.00	70.50
18.00	5.00	69.50
18.00	6.00	68.50
18.00	7.00	67.50
18.00	8.00	66.50
18.00	9.00	65.50
18.00	10.00	64.50
18.00	11.00	63.50
18.00	12.00	62.50
18.00	13.00	61.50
18.00	14.00	60.50
18.00	15.00	59.50
18.00	16.00	58.50
18.00	17.00	57.50
18.00	18.00	56.50
18.00	19.00	55.50
18.00	20.00	54.50
18.00	21.00	53.50
18.00	22.00	52.50
18.00	23.00	51.50
18.00	24.00	50.50
18.00	25.00	49.50
18.00	26.00	48.50
18.00	27.00	47.50
18.00	28.00	46.50
18.00	29.00	45.50
18.00	30.00	44.50
18.00	31.00	43.50
18.00	32.00	42.50
18.00	33.00	41.50
18.00	34.00	40.50
18.00	35.00	39.50
18.00	36.00	38.50
18.00	37.00	37.50
18.00	38.00	36.50

18.00	39.00	35.50
18.00	40.00	34.50
18.00	41.00	33.50
18.00	42.00	32.50
18.00	43.00	31.50
18.00	44.00	30.50
18.00	45.00	29.50
18.00	46.00	28.50
18.00	47.00	27.50
18.00	48.00	26.50
18.00	49.00	25.50
18.00	50.00	24.50
18.00	51.00	23.50
18.00	52.00	22.50
18.00	53.00	21.50
18.00	54.00	20.50
18.00	55.00	19.50
18.00	56.00	18.50
18.00	57.00	17.50
18.00	58.00	16.50
18.00	59.00	15.50
18.00	60.00	14.50
18.00	61.00	13.50
18.00	62.00	12.50
18.00	63.00	11.50
18.00	64.00	10.50
18.00	65.00	9.50
18.00	66.00	8.50
18.00	67.00	7.50
18.00	68.00	6.50
18.00	69.00	5.50
18.00	70.00	4.50
18.00	71.00	3.50
18.00	72.00	2.50
18.00	73.00	1.50
18.00	74.00	0.50
18.00	75.00	-0.50
18.00	76.00	-1.50
18.00	77.00	-2.50
18.00	78.00	-3.50
18.00	79.00	-4.50
18.00	80.00	-5.50
18.00	81.00	-6.50
18.00	82.00	-7.50
18.00	83.00	-8.50
18.00	84.00	-9.50
18.00	85.00	-10.50
18.00	86.00	-11.50
18.00	87.00	-12.50
18.00	88.00	-13.50

18.00	89.00	-14.50
18.00	90.00	-15.50
18.00	91.00	-16.50
18.00	92.00	-17.50
18.00	93.00	-18.50
18.00	94.00	-19.50
18.00	95.00	-20.50
18.00	96.00	-21.50
18.00	97.00	-22.50
18.00	98.00	-23.50
18.00	99.00	-24.50
18.00	100.00	-25.50
18.00	101.00	-26.50
18.00	102.00	-27.50
18.00	103.00	-28.50
18.00	104.00	-29.50
18.00	105.00	-30.50
18.00	106.00	-31.50
18.00	107.00	-32.50
18.00	108.00	-33.50
18.00	109.00	-34.50
18.00	110.00	-35.50
18.00	111.00	-36.50
18.00	112.00	-37.50
18.00	113.00	-38.50
18.00	114.00	-39.50
18.00	115.00	-40.50
18.00	116.00	-41.50
18.00	117.00	-42.50
18.00	118.00	-43.50
18.00	119.00	-44.50
18.00	120.00	-45.50
18.00	121.00	-46.50
18.00	122.00	-47.50
18.00	123.00	-48.50
18.00	124.00	-49.50
18.00	125.00	-50.50

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	0.00	0.00	0.00	0.00
4.00	18.0	0.00	0.00	0.00	0.00	0.00
5.00	18.0	0.00	0.00	0.00	0.00	0.00
6.00	18.0	0.00	0.00	0.00	0.00	0.00
7.00	18.0	0.00	0.00	0.00	0.00	0.00
8.00	18.0	0.00	0.00	0.00	0.00	0.00
9.00	18.0	0.00	0.00	0.00	0.00	0.00
10.00	18.0	0.00	0.00	0.00	0.00	0.00
11.00	18.0	0.00	0.00	0.00	0.00	0.00
12.00	18.0	0.00	0.00	0.00	0.00	0.00
13.00	18.0	0.00	0.00	0.00	0.00	0.00
14.00	18.0	0.00	0.00	0.00	0.00	0.00
15.00	18.0	0.57	0.00	0.57	0.28	0.57
16.00	18.0	2.26	15.93	18.19	9.09	50.04
17.00	18.0	4.24	15.48	19.72	9.86	50.68
18.00	18.0	5.70	15.63	21.33	10.67	52.59
19.00	18.0	6.85	16.07	22.91	11.46	55.05
20.00	18.0	7.60	16.65	24.26	12.13	57.56
21.00	18.0	8.36	17.22	25.59	12.79	60.04
22.00	18.0	9.30	17.31	26.61	13.31	61.24
23.00	18.0	10.42	16.80	27.22	13.61	60.83
24.00	18.0	11.78	15.90	27.69	13.84	59.50
25.00	18.0	12.97	14.57	27.54	13.77	56.67
26.00	18.0	13.99	13.42	27.41	13.70	54.24
27.00	18.0	14.50	12.35	26.84	13.42	51.54
28.00	18.0	14.56	0.01	14.57	7.29	14.60
29.00	18.0	14.56	0.07	14.63	7.32	14.78
30.00	18.0	14.56	0.27	14.83	7.42	15.38
31.00	18.0	14.56	0.62	15.18	7.59	16.43
32.00	18.0	14.56	1.12	15.68	7.84	17.92
33.00	18.0	14.58	1.71	16.29	8.15	19.71
34.00	18.0	14.81	2.04	16.85	8.43	20.94
35.00	18.0	15.34	1.97	17.31	8.66	21.25
36.00	18.0	16.07	1.89	17.96	8.98	21.75
37.00	18.0	16.87	1.94	18.81	9.40	22.68
38.00	18.0	17.67	2.10	19.77	9.89	23.97
39.00	18.0	18.24	2.38	20.62	10.31	25.38
40.00	18.0	18.50	2.84	21.34	10.67	27.03
41.00	18.0	18.75	3.36	22.12	11.06	28.84
42.00	18.0	19.33	3.79	23.11	11.56	30.68
43.00	18.0	20.22	4.12	24.34	12.17	32.58
44.00	18.0	21.25	4.42	25.67	12.83	34.50
45.00	18.0	22.41	4.68	27.09	13.55	36.45

46.00	18.0	23.65	5.02	28.67	14.33	38.71
47.00	18.0	24.89	5.52	30.41	15.20	41.45
48.00	18.0	26.15	6.11	32.26	16.13	44.47
49.00	18.0	27.41	6.60	34.01	17.00	47.20
50.00	18.0	28.69	6.98	35.67	17.84	49.64
51.00	18.0	29.83	7.34	37.17	18.59	51.85
52.00	18.0	30.70	7.64	38.34	19.17	53.62
53.00	18.0	33.53	7.76	41.30	20.65	56.82
54.00	18.0	34.01	7.83	41.84	20.92	57.49
55.00	18.0	34.40	7.99	42.38	21.19	58.36
56.00	18.0	34.74	8.22	42.96	21.48	59.40
57.00	18.0	35.11	8.46	43.57	21.78	60.49
58.00	18.0	35.48	8.71	44.20	22.10	61.62
59.00	18.0	35.90	9.03	44.93	22.47	63.00
60.00	18.0	36.37	9.43	45.80	22.90	64.66
61.00	18.0	36.86	9.84	46.70	23.35	66.37
62.00	18.0	37.32	10.11	47.43	23.71	67.64
63.00	18.0	37.76	10.23	48.00	24.00	68.46
64.00	18.0	38.25	10.43	48.67	24.34	69.52
65.00	18.0	38.78	10.69	49.46	24.73	70.84
66.00	18.0	39.31	10.81	50.12	25.06	71.75
67.00	18.0	39.79	10.73	50.52	25.26	71.99
68.00	18.0	40.24	10.47	50.71	25.35	71.64
69.00	18.0	40.77	10.02	50.79	25.39	70.82
70.00	18.0	41.41	9.36	50.78	25.39	69.51
71.00	18.0	42.66	8.76	51.42	25.71	68.95
72.00	18.0	45.02	8.41	53.43	26.72	70.26
73.00	18.0	49.09	8.36	57.45	28.72	74.16
74.00	18.0	52.15	8.55	60.71	30.35	77.81
75.00	18.0	54.62	9.28	63.90	31.95	82.47
76.00	18.0	57.35	10.67	68.02	34.01	89.35
77.00	18.0	60.92	12.37	73.29	36.65	98.04
78.00	18.0	65.16	14.89	80.05	40.03	109.83
79.00	18.0	70.42	18.82	89.24	44.62	126.89
80.00	18.0	76.74	24.13	100.87	50.44	149.14
81.00	18.0	84.01	29.54	113.55	56.77	172.63
82.00	18.0	92.09	34.49	126.58	63.29	195.56
83.00	18.0	100.82	39.05	139.87	69.93	217.96
84.00	18.0	109.28	42.94	152.22	76.11	238.10
85.00	18.0	118.73	46.09	164.82	82.41	256.99
86.00	18.0	126.18	46.55	172.72	86.36	265.82
87.00	18.0	133.03	47.94	180.97	90.48	276.85
88.00	18.0	139.59	50.25	189.84	94.92	290.35
89.00	18.0	146.10	53.44	199.54	99.77	306.43
90.00	18.0	152.77	57.46	210.23	105.11	325.16
91.00	18.0	159.74	62.26	221.99	111.00	346.50
92.00	18.0	167.59	64.67	232.27	116.13	361.61
93.00	18.0	175.45	66.91	242.36	121.18	376.19
94.00	18.0	183.31	68.89	252.19	126.10	389.97
95.00	18.0	191.17	70.55	261.72	130.86	402.82

96.00	18.0	199.03	71.59	270.62	135.31	413.80
97.00	18.0	206.89	71.94	278.83	139.41	422.71
98.00	18.0	214.75	71.94	286.69	143.34	430.57
99.00	18.0	222.60	71.94	294.54	147.27	438.42
100.00	18.0	230.46	71.94	302.40	151.20	446.28

Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	18.0	238.31	71.94	310.25	155.13	454.13
102.00	18.0	246.17	71.94	318.11	159.05	461.99
103.00	18.0	254.02	71.94	325.96	162.98	469.84
104.00	18.0	261.88	71.94	333.82	166.91	477.70
105.00	18.0	269.73	71.94	341.67	170.84	485.55
106.00	18.0	277.58	71.95	349.54	174.77	493.44
107.00	18.0	285.44	71.97	357.41	178.70	501.35
108.00	18.0	293.29	71.99	365.28	182.64	509.26
109.00	18.0	301.15	72.00	373.15	186.57	517.14
110.00	18.0	309.00	72.00	381.00	190.50	525.00
111.00	18.0	316.86	72.00	388.86	194.43	532.86
112.00	18.0	324.71	72.00	396.71	198.36	540.71
113.00	18.0	332.57	71.82	404.39	202.19	548.02
114.00	18.0	340.42	71.01	411.43	205.72	553.46
115.00	18.0	348.28	69.57	417.84	208.92	556.98
116.00	18.0	356.13	67.70	423.83	211.92	559.23
117.00	18.0	363.99	65.49	429.48	214.74	560.46
118.00	18.0	371.83	63.36	435.19	217.60	561.91
119.00	18.0	379.63	62.49	442.12	221.06	567.10
120.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
121.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
122.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
123.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
124.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
125.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....0 Segments 9 & 10\FBDeep\B3_TIG\BB-TIG-2_24-Inch_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 2/12/2025, Boring Number: BB-TIG-2
Station number: 4419+38 Offset: 7' LT.

Ground Elevation: 74.500(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	7.00	5- Cavity layer
6	10.00	6.00	5- Cavity layer
7	12.00	21.00	5- Cavity layer
8	14.00	18.00	5- Cavity layer
9	16.00	16.00	3- Clean sand
10	17.50	10.00	3- Clean sand
11	20.00	7.00	3- Clean sand
12	22.50	6.00	3- Clean sand
13	25.00	9.00	3- Clean sand
14	27.50	2.00	2- Clay and silty sand
15	30.00	1.00	2- Clay and silty sand
16	32.50	2.00	2- Clay and silty sand
17	35.00	3.00	2- Clay and silty sand
18	37.50	3.00	2- Clay and silty sand
19	40.00	2.00	2- Clay and silty sand

20	42.50	3.00	2- Clay and silty sand
21	45.00	4.00	2- Clay and silty sand
22	47.50	4.00	2- Clay and silty sand
23	50.00	4.00	2- Clay and silty sand
24	52.50	4.00	3- Clean sand
25	55.00	3.00	3- Clean sand
26	57.50	3.00	3- Clean sand
27	60.00	4.00	3- Clean sand
28	62.50	3.00	3- Clean sand
29	65.00	4.00	3- Clean sand
30	67.50	3.00	3- Clean sand
31	70.00	5.00	3- Clean sand
32	72.50	10.00	1- Plastic Clay
33	75.00	7.00	1- Plastic Clay
34	77.50	12.00	1- Plastic Clay
35	80.00	23.00	1- Plastic Clay
36	82.50	100.00	1- Plastic Clay
37	85.00	100.00	2- Clay and silty sand
38	87.50	100.00	2- Clay and silty sand
39	90.00	100.00	2- Clay and silty sand
40	92.50	100.00	2- Clay and silty sand
41	95.00	48.00	2- Clay and silty sand
42	97.50	54.00	2- Clay and silty sand
43	100.00	100.00	2- Clay and silty sand
44	102.50	100.00	2- Clay and silty sand
45	105.00	100.00	2- Clay and silty sand
46	107.50	100.00	2- Clay and silty sand
47	110.00	100.00	2- Clay and silty sand
48	112.50	100.00	2- Clay and silty sand
49	115.00	53.00	2- Clay and silty sand
50	117.50	100.00	2- Clay and silty sand
51	120.00	37.00	2- Clay and silty sand
52	122.50	31.00	2- Clay and silty sand
53	125.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	74.50	58.50	16.00	8.00	5-Void
2	58.50	47.00	11.50	9.04	3-Clean Sand
3	47.00	22.00	25.00	2.80	2-Clay and Silty Sand
4	22.00	2.00	20.00	3.62	3-Clean Sand
5	2.00	-10.50	12.50	30.40	1-Plastic Clay

6	-10.50	-50.50	40.00	82.69	2-Clay and Silty Sand

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
24.00	1.00	73.50
24.00	2.00	72.50
24.00	3.00	71.50
24.00	4.00	70.50
24.00	5.00	69.50
24.00	6.00	68.50
24.00	7.00	67.50
24.00	8.00	66.50
24.00	9.00	65.50
24.00	10.00	64.50
24.00	11.00	63.50
24.00	12.00	62.50
24.00	13.00	61.50
24.00	14.00	60.50
24.00	15.00	59.50
24.00	16.00	58.50
24.00	17.00	57.50
24.00	18.00	56.50
24.00	19.00	55.50
24.00	20.00	54.50
24.00	21.00	53.50
24.00	22.00	52.50
24.00	23.00	51.50
24.00	24.00	50.50
24.00	25.00	49.50
24.00	26.00	48.50
24.00	27.00	47.50
24.00	28.00	46.50
24.00	29.00	45.50
24.00	30.00	44.50
24.00	31.00	43.50
24.00	32.00	42.50
24.00	33.00	41.50
24.00	34.00	40.50
24.00	35.00	39.50
24.00	36.00	38.50
24.00	37.00	37.50
24.00	38.00	36.50

24.00	39.00	35.50
24.00	40.00	34.50
24.00	41.00	33.50
24.00	42.00	32.50
24.00	43.00	31.50
24.00	44.00	30.50
24.00	45.00	29.50
24.00	46.00	28.50
24.00	47.00	27.50
24.00	48.00	26.50
24.00	49.00	25.50
24.00	50.00	24.50
24.00	51.00	23.50
24.00	52.00	22.50
24.00	53.00	21.50
24.00	54.00	20.50
24.00	55.00	19.50
24.00	56.00	18.50
24.00	57.00	17.50
24.00	58.00	16.50
24.00	59.00	15.50
24.00	60.00	14.50
24.00	61.00	13.50
24.00	62.00	12.50
24.00	63.00	11.50
24.00	64.00	10.50
24.00	65.00	9.50
24.00	66.00	8.50
24.00	67.00	7.50
24.00	68.00	6.50
24.00	69.00	5.50
24.00	70.00	4.50
24.00	71.00	3.50
24.00	72.00	2.50
24.00	73.00	1.50
24.00	74.00	0.50
24.00	75.00	-0.50
24.00	76.00	-1.50
24.00	77.00	-2.50
24.00	78.00	-3.50
24.00	79.00	-4.50
24.00	80.00	-5.50
24.00	81.00	-6.50
24.00	82.00	-7.50
24.00	83.00	-8.50
24.00	84.00	-9.50
24.00	85.00	-10.50
24.00	86.00	-11.50
24.00	87.00	-12.50
24.00	88.00	-13.50

24.00	89.00	-14.50
24.00	90.00	-15.50
24.00	91.00	-16.50
24.00	92.00	-17.50
24.00	93.00	-18.50
24.00	94.00	-19.50
24.00	95.00	-20.50
24.00	96.00	-21.50
24.00	97.00	-22.50
24.00	98.00	-23.50
24.00	99.00	-24.50
24.00	100.00	-25.50
24.00	101.00	-26.50
24.00	102.00	-27.50
24.00	103.00	-28.50
24.00	104.00	-29.50
24.00	105.00	-30.50
24.00	106.00	-31.50
24.00	107.00	-32.50
24.00	108.00	-33.50
24.00	109.00	-34.50
24.00	110.00	-35.50
24.00	111.00	-36.50
24.00	112.00	-37.50
24.00	113.00	-38.50
24.00	114.00	-39.50
24.00	115.00	-40.50
24.00	116.00	-41.50
24.00	117.00	-42.50
24.00	118.00	-43.50
24.00	119.00	-44.50
24.00	120.00	-45.50
24.00	121.00	-46.50
24.00	122.00	-47.50
24.00	123.00	-48.50
24.00	124.00	-49.50
24.00	125.00	-50.50

Driven Pile Capacity:
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Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	24.0	0.00	0.00	0.00	0.00	0.00
2.00	24.0	0.00	0.00	0.00	0.00	0.00
3.00	24.0	0.00	0.00	0.00	0.00	0.00
4.00	24.0	0.00	0.00	0.00	0.00	0.00
5.00	24.0	0.00	0.00	0.00	0.00	0.00
6.00	24.0	0.00	0.00	0.00	0.00	0.00
7.00	24.0	0.00	0.00	0.00	0.00	0.00
8.00	24.0	0.00	0.00	0.00	0.00	0.00
9.00	24.0	0.00	0.00	0.00	0.00	0.00
10.00	24.0	0.00	0.00	0.00	0.00	0.00
11.00	24.0	0.00	0.00	0.00	0.00	0.00
12.00	24.0	0.00	0.00	0.00	0.00	0.00
13.00	24.0	0.00	0.00	0.00	0.00	0.00
14.00	24.0	0.00	0.00	0.00	0.00	0.00
15.00	24.0	0.75	0.00	0.75	0.38	0.75
16.00	24.0	3.02	25.38	28.39	14.20	79.14
17.00	24.0	5.65	25.12	30.78	15.39	81.02
18.00	24.0	7.49	25.50	32.99	16.49	83.98
19.00	24.0	8.95	25.77	34.71	17.36	86.25
20.00	24.0	10.38	25.81	36.20	18.10	87.82
21.00	24.0	11.97	25.39	37.36	18.68	88.14
22.00	24.0	13.18	24.05	37.24	18.62	85.35
23.00	24.0	14.35	22.74	37.09	18.54	82.56
24.00	24.0	15.71	21.21	36.92	18.46	79.33
25.00	24.0	17.29	19.42	36.71	18.36	75.56
26.00	24.0	18.65	17.92	36.57	18.28	72.41
27.00	24.0	19.33	17.38	36.71	18.35	71.47
28.00	24.0	19.41	0.71	20.12	10.06	21.54
29.00	24.0	19.41	0.98	20.39	10.19	22.34
30.00	24.0	19.41	1.20	20.61	10.31	23.01
31.00	24.0	19.41	1.55	20.97	10.48	24.07
32.00	24.0	19.41	1.93	21.34	10.67	25.20
33.00	24.0	19.45	2.24	21.69	10.84	26.16
34.00	24.0	19.78	2.58	22.36	11.18	27.52
35.00	24.0	20.48	3.09	23.57	11.79	29.76
36.00	24.0	21.45	3.61	25.06	12.53	32.28
37.00	24.0	22.51	3.99	26.50	13.25	34.49
38.00	24.0	23.59	4.40	27.99	14.00	36.80
39.00	24.0	24.35	4.89	29.23	14.62	39.01
40.00	24.0	24.69	5.46	30.15	15.08	41.07
41.00	24.0	25.03	6.04	31.07	15.54	43.16
42.00	24.0	25.80	6.52	32.31	16.16	45.35
43.00	24.0	26.98	6.87	33.85	16.93	47.60
44.00	24.0	28.37	7.36	35.73	17.87	50.46
45.00	24.0	29.92	8.17	38.09	19.04	54.42

46.00	24.0	31.56	9.20	40.76	20.38	59.16
47.00	24.0	33.22	10.13	43.36	21.68	63.63
48.00	24.0	34.90	10.92	45.82	22.91	67.66
49.00	24.0	36.59	11.61	48.21	24.10	71.44
50.00	24.0	38.30	12.22	50.52	25.26	74.97
51.00	24.0	39.82	12.67	52.49	26.24	77.82
52.00	24.0	40.98	13.02	54.00	27.00	80.05
53.00	24.0	44.71	13.20	57.91	28.96	84.32
54.00	24.0	45.35	13.27	58.62	29.31	85.17
55.00	24.0	45.88	13.42	59.31	29.65	86.15
56.00	24.0	46.36	13.65	60.02	30.01	87.32
57.00	24.0	46.81	14.01	60.82	30.41	88.84
58.00	24.0	47.25	14.48	61.73	30.87	90.70
59.00	24.0	47.76	14.97	62.74	31.37	92.69
60.00	24.0	48.38	15.37	63.75	31.88	94.49
61.00	24.0	49.03	15.71	64.74	32.37	96.16
62.00	24.0	49.58	16.31	65.88	32.94	98.50
63.00	24.0	50.02	17.29	67.31	33.66	101.89
64.00	24.0	50.55	18.28	68.83	34.42	105.39
65.00	24.0	51.24	18.61	69.85	34.93	107.07
66.00	24.0	51.94	18.34	70.29	35.14	106.97
67.00	24.0	52.59	17.95	70.54	35.27	106.43
68.00	24.0	53.19	17.38	70.56	35.28	105.32
69.00	24.0	53.89	16.60	70.49	35.24	103.68
70.00	24.0	54.74	15.85	70.59	35.29	102.29
71.00	24.0	56.36	15.39	71.75	35.88	102.54
72.00	24.0	59.41	15.55	74.96	37.48	106.05
73.00	24.0	65.40	15.91	81.31	40.66	113.12
74.00	24.0	69.20	16.54	85.75	42.87	118.83
75.00	24.0	72.07	18.41	90.48	45.24	127.29
76.00	24.0	74.95	22.18	97.13	48.57	141.50
77.00	24.0	79.09	28.05	107.15	53.57	163.25
78.00	24.0	84.62	35.03	119.65	59.83	189.72
79.00	24.0	91.43	42.90	134.33	67.16	220.13
80.00	24.0	99.62	50.51	150.14	75.07	251.16
81.00	24.0	109.05	57.72	166.78	83.39	282.22
82.00	24.0	119.56	64.46	184.02	92.01	312.94
83.00	24.0	130.95	70.71	201.66	100.83	343.07
84.00	24.0	142.04	75.92	217.96	108.98	369.80
85.00	24.0	158.30	79.87	238.18	119.09	397.92
86.00	24.0	168.40	80.28	248.67	124.34	409.22
87.00	24.0	177.88	81.49	259.37	129.68	422.34
88.00	24.0	186.92	83.57	270.49	135.24	437.63
89.00	24.0	195.67	86.58	282.26	141.13	455.43
90.00	24.0	204.33	90.55	294.87	147.44	475.97
91.00	24.0	213.03	95.47	308.50	154.25	499.44
92.00	24.0	221.93	101.32	323.25	161.63	525.89
93.00	24.0	231.17	108.02	339.19	169.60	555.24
94.00	24.0	241.65	111.60	353.24	176.62	576.44
95.00	24.0	252.13	115.04	367.17	183.58	597.24

96.00	24.0	262.62	118.32	380.93	190.47	617.57
97.00	24.0	273.10	121.32	394.41	197.21	637.05
98.00	24.0	283.57	123.94	407.51	203.75	655.38
99.00	24.0	294.04	126.12	420.16	210.08	672.40
100.00	24.0	304.52	127.47	431.99	215.99	686.93

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	24.0	314.99	127.92	442.91	221.45	698.75
102.00	24.0	325.46	127.92	453.38	226.69	709.22
103.00	24.0	335.94	127.92	463.86	231.93	719.70
104.00	24.0	346.41	127.92	474.33	237.16	730.17
105.00	24.0	356.88	127.92	484.80	242.40	740.64
106.00	24.0	367.35	127.92	495.27	247.64	751.11
107.00	24.0	377.83	127.92	505.75	252.87	761.59
108.00	24.0	388.30	127.92	516.22	258.11	772.06
109.00	24.0	398.77	127.92	526.69	263.35	782.54
110.00	24.0	409.25	127.93	537.18	268.59	793.05
111.00	24.0	419.72	127.85	547.57	273.79	803.28
112.00	24.0	430.19	127.02	557.21	278.60	811.24
113.00	24.0	440.66	125.31	565.97	282.99	816.59
114.00	24.0	451.14	122.93	574.07	287.03	819.93
115.00	24.0	461.61	120.10	581.71	290.85	821.91
116.00	24.0	472.08	117.04	589.12	294.56	823.19
117.00	24.0	482.56	115.06	597.62	298.81	827.75
118.00	24.0	493.02	114.47	607.49	303.74	836.42
119.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
120.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
121.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
122.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
123.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
124.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
125.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

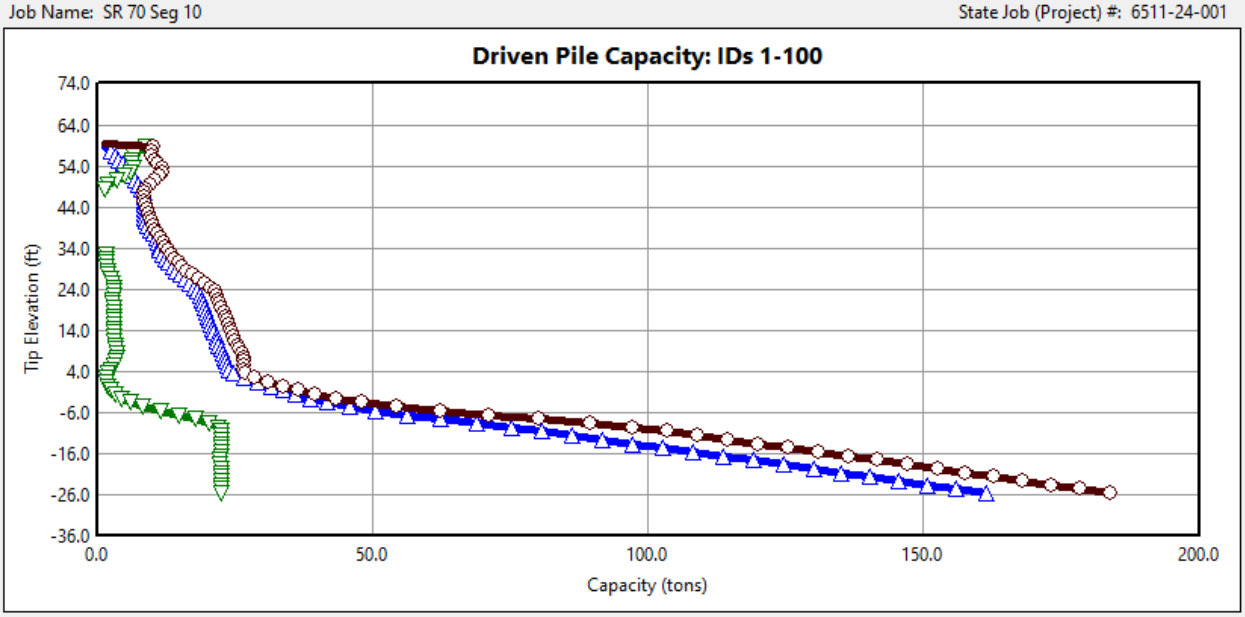
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

Plot Window

Job Name: SR 70 Seg 10

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-TIG-2	
Ground Surface Elevation	74.50	(ft)
Section:	H-Section	
Width	14.69	(in)
Depth	13.83	(in)
End Area	101.58	(in2

Project Data

File:	BB-TIG-2_14x49
Date:	Mar 20, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

Plot Options

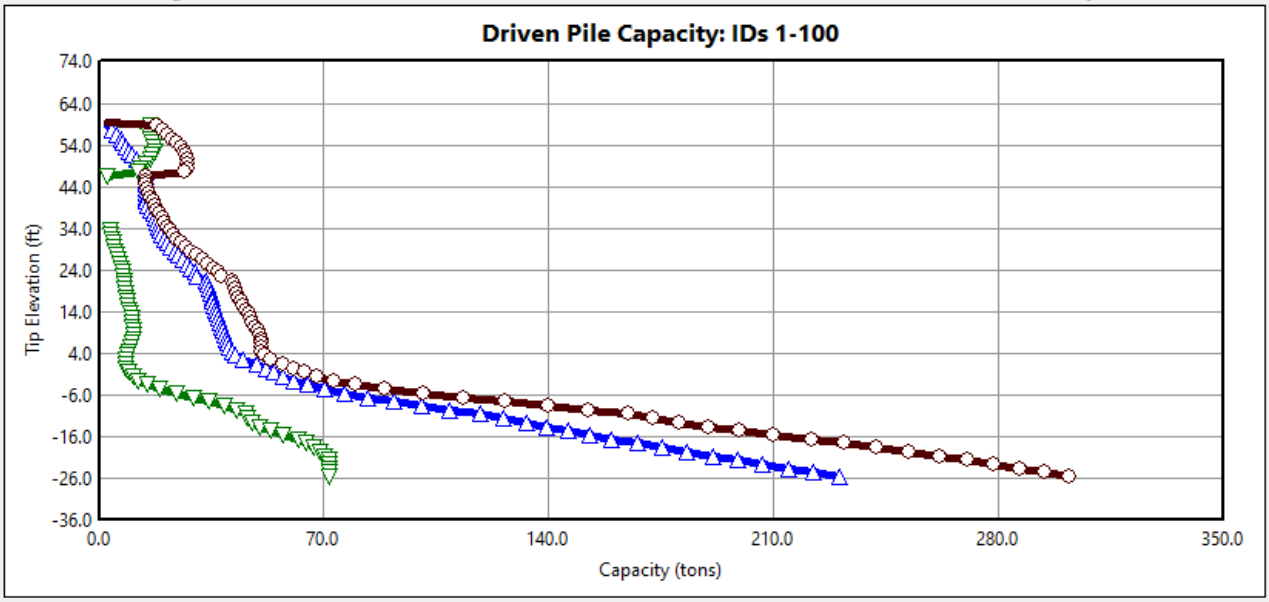
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 10

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-TIG-2	
Ground Surface Elevation	74.50	(ft)
Section:	Square	
Width	18.00	(in)

Project Data

File:	BB-TIG-2_18-Inch
Date:	Mar 20, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

Plot Options

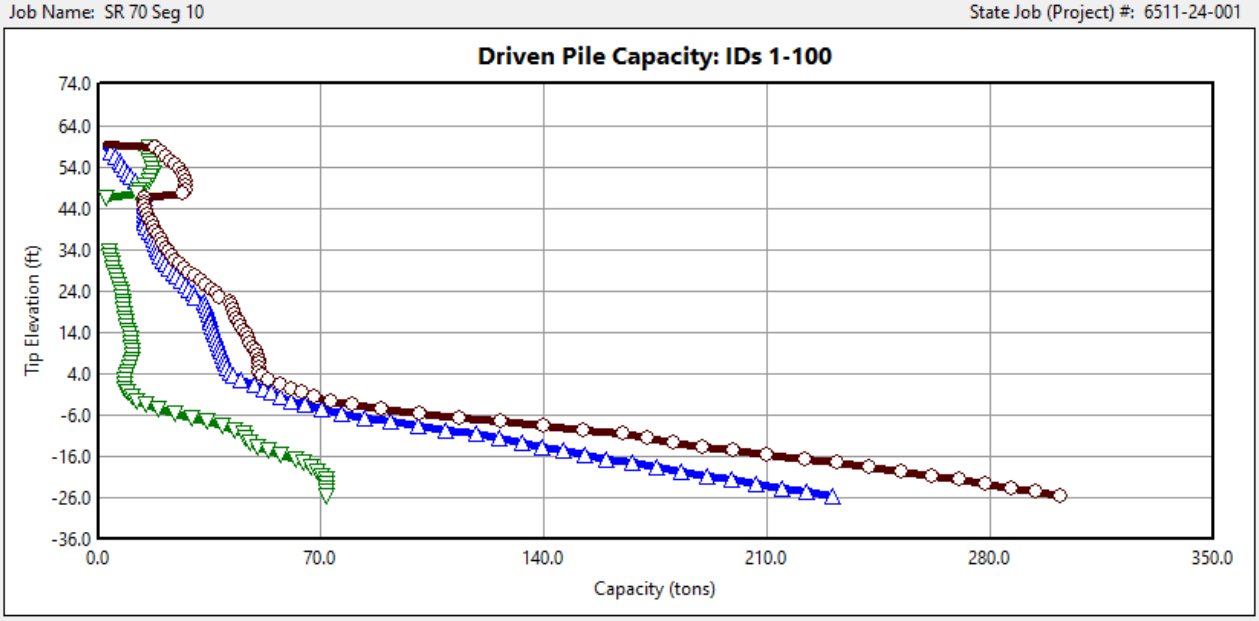
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 10

State Job (Project) #: 6511-24-001



Curves

- ☑ Ultimate Side Friction
- ☑ Mobilized End Bearing
- ☐ Ultimate Pile Capacity
- ☑ Estimated Davisson Capacity
- ☐ Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-TIG-2	
Ground Surface Elevation	74.50	(ft)
Section:	Square	
Width	18.00	(in)

Project Data

File:	BB-TIG-2_18-Inch
Date:	Mar 20, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

Summary of Laboratory Test Results for Soil Classification
SR 70 from West of SR 31 to Highlands County Line
SR 70 over Tiger Bay Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Boring Number	Sample Depth (ft)	USCS Symbol	Sieve Analysis					Atterberg Limits			Organic Content (%)	Natural Moisture Content
			#10	#40	#60	#100	#200	Liquid Limit	Plastic Limit	Plasticity Index		
BB-TIG-2	2.0 - 6.0	SP-SM	---	---	---	---	5	---	---	---	---	---
BB-TIG-2	28.5 - 30.0	SC	---	---	---	---	38	35	15	20	---	33
BB-TIG-2	36.0 - 37.5	SC	---	---	---	---	23	33	20	13	---	30
BB-TIG-2	43.5 - 45.0	SC	---	---	---	---	25	33	22	11	---	30
BB-TIG-2	61.0 - 62.5	SP-SM	---	---	---	---	9	---	---	---	---	---
BB-TIG-2	73.5 - 75.0	MH	---	---	---	---	83	56	36	20	---	41
BB-TIG-2	86.0 - 87.5	SM	---	---	---	---	14	---	---	---	---	---
BB-TIG-2	116.0 - 117.5	SC	---	---	---	---	27	51	26	25	---	32

Summary of Laboratory Test Results for Environmental Classification
SR 70 from West of SR 31 to Highlands County Line
SR 70 over Tiger Bay Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Soil Samples

Boring Number	Depth (feet)	USCS Symbol	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
							Steel	Concrete
BBC-TIG-1	2.0 - 6.0	SP-SM	7.4	17,000	15	12	Slightly Aggressive	Slightly Aggressive
BB-TIG-2	2.0 - 6.0	SP-SM	7.6	16,000	15	21	Slightly Aggressive	Slightly Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Water Samples

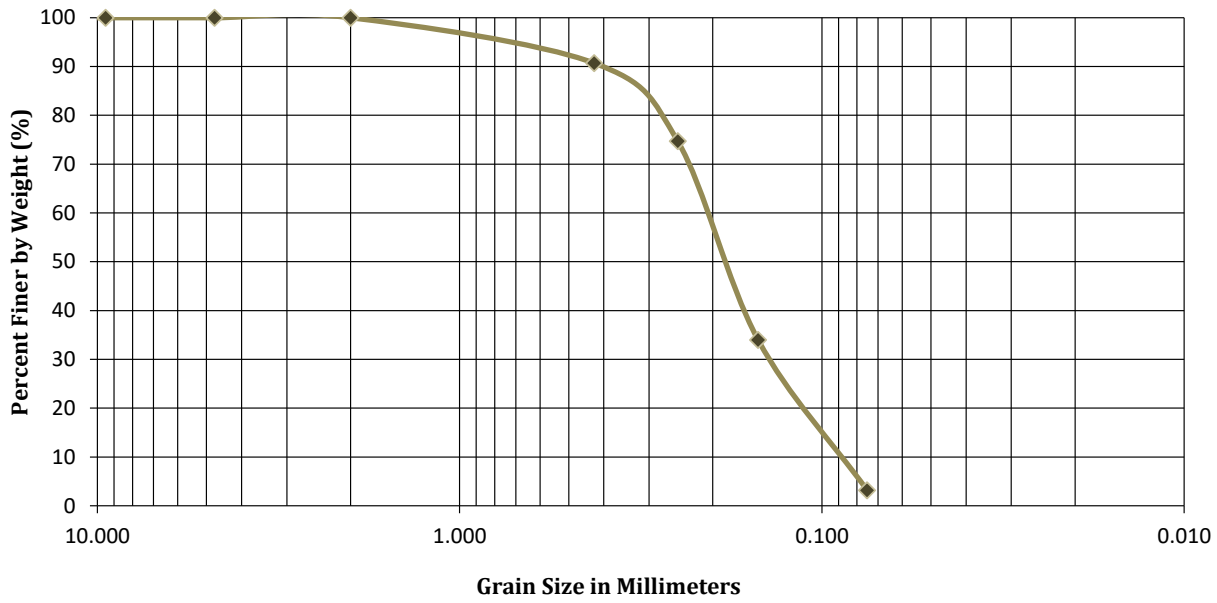
Sample Location	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
					Steel	Concrete
TIGER BAY SLOUGH	8.1	3,400	45	55	Moderately Aggressive	Slightly Aggressive
	6.9	4,100	15	43	Moderately Aggressive	Slightly Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Grain Size Distribution Report
SR 70 from West of SR 31 to Highlands County Line
SR 70 over Tiger Bay Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No.: 6511-24-001

Approximate Sample Location		Depth Below Mudline (ft)
Latitude	Longitude	
N 27.20956	W 81.70826	0.0-2.0

Grain Size Distribution Curve



Material Description	Classification	
	USCS	AASHTO
Gray to Brown Sand	SP	A-3

Sieve Number	Diameter (mm)	Percent Finer by Weight (%)
3/4"	19.000	100
3/8"	9.500	100
4	4.750	100
10	2.000	100
40	0.425	90.7
60	0.250	74.7
100	0.150	34
200	0.075	3.2

Coefficients

D_{10}	0.087	D_{30}	0.137
D_{50}	*0.183*	D_{60}	0.208
D_{85}	0.352	D_{90}	0.415
D_{95}	0.870		
C_U	2.378	C_C	1.034

TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

April 3, 2025

HNTB Corporation
201 N. Franklin Street, Suite 1200
Tampa, FL 33602

Attn: Mr. John Burton, PE, PMP, PTOE, ENV SP.

RE: Preliminary Bridge Geotechnical Report
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over Mossy Gully Bridges
FPID No. 451942-2-52-01
DeSoto County, Florida
Tierra Project No. 6511-24-001

Mr. Burton:

Tierra, Inc. (Tierra) has performed a preliminary geotechnical study for the proposed bridge structures associated with the project referenced above. This report has been prepared to support the project Bridge Development Report (BDR). This report presents the results of our study including field and laboratory testing, a preliminary foundation design analysis and our opinions regarding appropriate foundation alternatives for the proposed bridge structures.

Tierra, Inc. appreciates the opportunity to be of service to HNTB Corporation (HNTB) on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.

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USDA Soil Survey & USGS Quadrangle Maps
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APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

1.0 PROJECT INFORMATION

1.1 Project Authorization

Authorization to proceed with this project was issued by HNTB in accordance with our Subconsultant Agreement.

1.2 Project Description

This project consists of widening SR 70 from two lanes to four-lane divided section from West of SR 31 (MP 14.973) to the Highlands County Line (MP 31.763). A shared use path is also proposed on the south side of the SR 70 widening.

This report has been prepared to provide geotechnical input for the Bridge Development Report (BDR) associated with the design of the proposed SR 70 over Mossy Gully bridge structures. The subsurface information obtained to date and preliminary engineering recommendations for the proposed foundation alternatives are provided herein.

1.3 General Site Description

A concrete bridge culvert (Bridge No. 040032) supporting the existing SR 70 roadway is currently located at the subject bridge site. The concrete bridge culvert was built circa 1959. The subject bridge site is located in an area surrounded by pasturelands.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to provide geotechnical (i.e. subsurface soil conditions and related engineering properties) input to the design team to assist with the design and construction of the proposed SR 70 over Mossy Gully bridge structures. The following services were provided in order to achieve the preceding objective:

1. Reviewed soil information from the "Soil Survey of DeSoto County, Florida" published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Reviewed topographic and potentiometric information obtained from the "Long Island Marsh NW, Florida" Quadrangle map and the "Upper Floridan Aquifer Potentiometric Surface" maps published by the United States Geological Survey (USGS).

2. Conducted a visual reconnaissance of the project site and coordinated utility clearance through Sunshine State One Call.

3. Executed a program of subsurface exploration consisting of subsurface sampling and field testing. Performed one (1) Standard Penetration Test (SPT) boring advanced to a depth of approximately 150 feet below existing grades.

4. Visually classified and stratified the obtained soil samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D-2488. Conducted laboratory testing on selected soil samples to confirm the visual classification and evaluate the corrosive nature of the soil and water.

5. Evaluated foundation criteria and performed engineering analyses to develop preliminary design recommendations for the foundation alternatives associated with the proposed bridge structures.

6. Prepared this formal engineering report, which summarizes the course of study pursued, the field and laboratory data generated, the subsurface conditions encountered and the preliminary geotechnical recommendations for the design and construction of the proposed bridge structure foundation alternatives.

3.0 REVIEW OF PUBLISHED DATA

3.1 Regional Geology

DeSoto County Geology has been paraphrased from the Florida Geological Survey, Open-File Report 80, 2001 and other geologic references.

Based on a review of the Surficial Geology Maps published by FGS, the Hawthorn Group, Peace River Formation (Thp) and Reworked Cypresshead sediments (TQuc) are mapped at the surface in the vicinity of the bridge site.

Lithologically, the Hawthorn Group, Peace River Formation (Thp) sediments consist of yellowish-grey to light olive green interbedded phosphatic sands, clayey sands, clays and dolomite stringers. The thickness of the Peace River Formation is approximately 50 feet in the northeastern and southwestern corners of the county. The Peace River thickens to more than 160 feet in the southeastern corner of the county. The Peace River dips and thickens in the general south easterly direction.

The Reworked Cypresshead sediments (TQuc) is the result of post depositional reworking of the Cypresshead siliciclastics, formed during the Pliocene and Pleistocene epochs. The sediments are fine to coarse quartz sands with scattered quartz gravel and varying percentages of clay matrix.

3.2 USDA Soil Survey

Based on a review of the Soil Survey for DeSoto County published by the USDA NRCS, it appears that there is one (1) primary soil-mapping unit noted at the bridge site. The general soil description as described in the Soil Survey is presented in the following table. The **USDA Soil Survey Map** for the bridge site is illustrated in **Appendix A**.

Summary of USDA Soil Survey
DeSoto, Florida

USDA Map Symbol and Soil Name	Depth (in)	Soil Classification		Permeability (in/hr)	pH	Seasonal High Water Table	
		USCS	AASHTO			Depth (feet)	Months
(21) Malabar	0-5	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	5.1-7.0	0.3-1.5	Jul-Oct
	5-17	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	5.1-8.0		
	17-42	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	5.1-8.0		
	42-59	SC-SM, CL, SC	A-2-4, A-4, A-6	2.0 - 6.0	3.8-8.0		
	59-80	SM	A-2-4, A-4	6.0 - 20.0	5.1-8.0		

It should be noted that information contained in the USDA Soil Survey Map may not be reflective of actual soil and groundwater conditions, particularly if recent development in the project vicinity has modified soil conditions or surface/subsurface drainage.

3.3 USGS Quadrangle Map

Based on a review of the “Long Island Marsh NW, Florida” USGS Quadrangle Map, it appears that the natural elevation at the project site ranges from approximately +70 feet to +75 feet National Geodetic Vertical Datum of 1929 (NGVD 29) as illustrated on the **USGS Quadrangle Map** in **Appendix A.**

3.4 Review of Potentiometric Surface Information

Based on a review of the "Upper Floridan Aquifer Potentiometric Surface" maps published by the USGS, the potentiometric surface elevation at the bridge site is reported to range from approximately +50 to +60 feet, NGVD 29. As indicated in **Section 3.3**, the natural ground surface elevation at the bridge site ranges from approximately +70 to +75 feet, NGVD 29. Artesian flow conditions were not encountered during the field exploration.

4.0 SUBSURFACE EXPLORATION

4.1 Boring Location Plan

Prior to commencing our subsurface explorations, a boring location plan for the proposed bridge structures was developed based on design information provided by HNTB. This boring location plan was generated based on our engineering judgment and guidelines provided in the "Soils and Foundations Handbook" published by the FDOT. Tierra submitted this boring location plan to FDOT for approval. Following completion of the boring, the boring locations were surveyed by the project surveyor. The Boring Location Plan for the boring performed is provided on the **Report of Core Boring** sheet in **Appendix A.**

Utility clearances were coordinated by Tierra via Sunshine State One Call and updated as required prior to performing the soil boring in order to reduce the potential for damage to the utilities during drilling.

4.2 Soil Boring

Subsurface conditions were explored at the bridge site one (1) SPT boring. The results and location of the SPT boring are presented on the **Report of Core Boring** sheet in **Appendix A**.

The SPT boring was performed with the use of a drill rig using Bentonite Mud drilling procedures. Temporary 3-inch diameter rotary installed casing was utilized to help keep the boreholes stable. The soil sampling was performed in general accordance with the ASTM test designation D-1586. The initial 6 feet of the boring was hand augered to verify utility clearances. SPT resistance N-values were then taken at intervals of 2 feet from the hand auger boring depth of 6 feet to a depth of 17½ feet and on intervals of 2½ feet thereafter to the boring termination depths. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our laboratory for classification and analyses.

Soil stratification was determined based on a review of recovered samples, laboratory test results, and interpretation of field boring logs. Stratification lines represent approximate boundaries between soil layers of different engineering properties; however actual transitions between layers may be gradual. In some cases, small variations in properties that were not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The soil profiles represent the conditions at the particular boring location; variations do occur among the boring. Specific details about subsurface conditions and materials encountered at each test location can be obtained from the soil profiles presented on the **Report of Core Boring** sheet in **Appendix A** of this report.

5.0 LABORATORY TESTING

5.1 General

Representative soil samples collected from the SPT boring were classified and stratified in general accordance with the Unified Soil Classification System (USCS). Our classification was based on visual observations, using the results from the laboratory testing as confirmation. Laboratory testing consisting of fines content (percentage passing No. 200 mesh sieve), Atterberg limits testing, and natural moisture content determination tests were completed on representative soil samples. In addition, Environmental Classification tests were performed to evaluate the corrosive nature of the soil and water encountered at the bridge site. The results of the laboratory tests are presented on the **Report of Core Boring** sheet in **Appendix A**. Detailed results of the tests performed are presented on the **Summary of Laboratory Test Results for Soil Classification**, **Summary of Laboratory Test Results for Environmental Classification** and **Grain Size Distribution Report** in **Appendix C.**

5.2 Test Designation

The following list summarizes the laboratory tests performed and respective test methods utilized.

- Fines Content - The fines content tests were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-1140).

- Grain-Size Analyses - The grain-size analyses were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-6913).

- Atterberg Limits - The liquid limit and the plastic limit tests ("Atterberg Limits") were conducted in general accordance with the AASHTO test designations T-089 and T-090, respectively (ASTM test designation D-4318).

- Natural Moisture Content - The moisture content tests were conducted in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).

- Environmental Classification – The environmental classification tests were conducted in general accordance with the FSTM test designations FM 5-550, FM 5-551, FM 5-552, and FM 5-553.

6.0 ENVIRONMENTAL CLASSIFICATION

Environmental classification tests were performed on recovered soil samples obtained from within the boring performed at the bridge site and from water samples obtained from Mossy Gully. Based on the laboratory test results and the 2025 FDOT Structure Design Guidelines (SDG), the environmental classifications of the superstructure and substructure for the bridge are classified as follows:

Superstructure Environmental Classification	Concrete Substructure Classification	Steel Substructure Classification
Slightly Aggressive	Moderately Aggressive (Soil – pH = 5.7) (Water - Resistivity = 1,200 Ohm-cm)	Extremely Aggressive (Soil - pH = 5.7)

The range of test results is presented on the **Report of Core Boring** sheet in **Appendix A.** A summary of the individual environmental classification test results is provided in **Appendix C**.

7.0 RESULTS OF SUBSURFACE EXPLORATION

7.1 General Subsurface Conditions

Generally, the boring encountered sandy soils underlain by clayey soils underlain by intermittent layers of clayey, silty and sandy soils to the boring termination elevation. Specific information on the soil conditions encountered can be found on the **Report of Core Boring** sheet in **Appendix A.** The soil descriptions and classifications associated with this project are listed in the following table.

Soil Description	USCS Symbol
SAND	SP/SP-SM
SILTY SAND	SM
CLAYEY SAND	SC
CLAY	CL

Additional borings will be performed as the project progresses beyond the BDR stage; the results will be presented in future submittals.

7.2 Groundwater

The groundwater table was encountered at a depth of approximately 6 feet below existing grades within the boring performed and is presented on the **Report of Core Boring** sheet in **Appendix A**.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e. swales, drainage ponds, underdrains and impervious areas) and creek water levels.

8.0 EVALUATIONS OF BRIDGE FOUNDATION ALTERNATIVES

Evaluations of foundation alternatives for the proposed bridge structures were based on the results of our field study. Based on our discussions with HNTB the following foundation alternatives were considered:

- Shallow Foundations
- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)
- Steel Piles, including H Sections
- Pre-stressed, Pre-cast, Square Concrete (PPSC) Piles
- Drilled Shafts

The following paragraphs discuss each of these alternatives briefly.

8.1 Shallow Foundations

With shallow foundation systems, the structure loads are supported by the bearing capacity of the foundation soils. The design of shallow foundations is typically governed by the soil bearing capacity and total and differential settlement criteria.

Loose soils were encountered within the influence zone of typical shallow foundation sizes. Based on the anticipated loading conditions for roadway bridges of this size, a shallow footing would have to be relatively large for bearing capacity and settlement criteria to be achieved or would require some form of subsurface remediation to increase the bearing capacity and decrease settlement potential.

For these reasons, shallow foundations were not considered further for this report.

8.2 Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)

GRS-IBS consists of a shallow foundation combined with a retaining wall system to provide support for single span bridges or multi-span bridges with simply supported end spans. The reasons discussed in **Section 8.1** that preclude the use of shallow foundations also apply to the GRS-IBS.

For these reasons, GRS-IBS was not considered further for this report.

8.3 Pre-Cast Pre-Stressed Square Concrete (PPSC) Piles

PPSC pile foundations are a feasible foundation alternative. They are a widely used and proven foundation system in Florida. PPSC pile foundations are readily available and generally have a lower cost per ton of capacity than other pile types. Analyses were performed for 18-inch and 24-inch PPSC piles for this Preliminary Bridge Geotechnical Report.

8.4 Steel Piles

Steel pile types include H-sections and pipe piles. Steel piles generally do not develop as much capacity for similar penetration depths as PPSC piles. Steel piles are well suited to soil conditions with high variability and where frequent pile splicing is expected and/or required due to overhead restrictions, subsurface variability, etc. Steel piles may also more easily penetrate dense layers to achieve a desired penetration depth and are less susceptible to damage compared to concrete piles. Steel H-Piles are low displacement piles, and therefore vibrations associated with installations are minimized due to the low-displacement nature of the piles. Open end pipe piles are also low displacement but will eventually become plugged at the pile toe. Closed-end pipe piles are displacement piles and would generate more end bearing capacity compared to open-end pipe piles.

A pH test value of 5.7 performed on a soil sample obtained from the bridge site results in an Extremely Aggressive Environmental Classification for steel. The SR 70 bridges over Mossy Gully are water-based bridges. Therefore, the use of steel H-piles is precluded per SDG Table 3.1-1. Only internally redundant steel pipe piles (i.e., closed-end pipe piles filled with concrete refer to SDG 3.1.G.2) would be permitted. Based on coordination with the Structural Engineer, steel piles were not evaluated further for the SR 70 over Mossy Gully bridges.

8.5 Drilled Shafts

Drilled, cast-in-place, concrete shafts have the ability to develop high axial and lateral capacities. One drilled shaft could potentially take the place of several driven piles depending on soil/rock conditions.

This type of foundation system is often the chosen alternative for sites where competent limestone is present at a relatively shallow depth and with a sufficient thickness. Drilled shafts will develop large skin friction capacities in limestone compared to dense sand, and therefore drilled shafts are most suited for sites with shallow, competent consistent limestone. Drilled shafts foundations may also be considered as a preferred foundation alternative for sites in order to limit construction induced vibrations compared to the vibrations caused by driven piles.

Limestone was not encountered within the SPT Boring performed at the bridge site. Therefore, drilled shafts were not analyzed further for this Preliminary Bridge Geotechnical Report.

9.0 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

9.1 General

Based on the subsurface conditions encountered in the test boring performed to date, it is Tierra's opinion that driven pile foundations are the most suitable foundation alternative type for the proposed bridge structures. Foundation systems comprised of 18-inch and 24-inch PPSC piles were analyzed for this Preliminary Bridge Geotechnical Report. The following sections present the results of the engineering analyses for the proposed deep foundation alternatives.

9.2 Downdrag (Negative Skin Friction)

Based on a review of preliminary cross sections, the new bridge supporting the eastbound travel lanes will be at/near the elevation of the existing bridge, and the new bridge supporting the westbound travel lanes will have new embankments (anticipated to be less than about 10 feet high) at each end bent approach. Based on the new embankments and soil conditions encountered in the boring, there will be downdrag loads imparted to the end bent piles. Actual loads will be determined following the BDR stage once a foundation alternative has been selected and the roadway geometry has been finalized. For preliminary estimation purposes, downdrag loads up to 20 tons should be anticipated at the end bent locations.

The portion of the end bent concrete piles within the embankment should be provided with a double wrap of polyethylene sheeting according to the FDOT Specifications to minimize development of downdrag loads from the embankment fill.

9.3 Scour

It is our understanding that the scour analysis will be performed by others. Tierra performed sieve analyses on soil samples collected within two feet of the mudline of Tiger Bay near the existing bridge. The results of the sieve analyses along with D_{50} values for use in the scour analysis calculations are provided on the **Grain Size Distribution Report** in **Appendix C**.

9.4 Driven Pile Axial Capacity

Axial pile capacities for the proposed bridge were analyzed based on the subsurface conditions encountered in the boring and the FDOT program FB-Deep. The Load and Resistance Factor Design (LRFD) method was utilized for the analysis.

As indicated in the FDOT Structure Design Guidelines (SDG), the required Nominal Bearing Resistance (Rn) must satisfy the following requirement:

$$\mathbf{Rn} > \frac{\mathbf{(Factored\ Design\ Load + Downdrag + Net\ Scour)}}{\phi}$$

Where ϕ = 0.75; dynamic load testing will be performed on all piles.

Other ϕ factors may be used based on the type of foundation testing recommended.

The R_n is taken as the Davisson Capacity. The Davisson axial capacity consists of the ultimate skin friction and mobilized end bearing (i.e., one-third of the ultimate end bearing). Tierra modeled the top 15 feet of the soil boring profile in the capacity analyses as a cavity layer to mimic a "starter hole" as described in FDOT Specification 455-5.1.

Driven Pile Foundation Alternative	Approximate Maximum Recommended R_n(1)
18-Inch PPSC Piles	275 tons
24-Inch PPSC Piles	425 tons
(1) Anticipate downdrag loads up to 20 tons for preliminary estimation purposes.	

The axial capacity for 18-inch and 24-inch PPSC piles were computed using the program FB-Deep. The results of the axial pile analyses are presented in **APPENDIX B**, including the axial capacity curves, FB-Deep output curves (including Davisson Capacity Curves, Ultimate Skin Friction Curves and Mobilized End Bearing Curves) and FB-Deep computer output files.

9.5 Group Action

No reductions of the individual pile capacities will be required if piles are spaced center-to-center at 3 times their width or greater.

9.6 Settlement

Settlement of pile supported bridge bents should be small and tolerable for a typical single row group. However, the tolerance should be confirmed by the structural engineer. Based on soil conditions encountered at the boring locations, and that piles will be tipped in a suitable bearing layer, individual pile head settlements are estimated to be on the order of ½ inch or less.

10.0 CONSTRUCTION CONSIDERATIONS

10.1 General

The overall site preparation and construction should be in accordance with the FDOT Specifications.

10.2 Temporary Side Slopes

Temporary side slopes and excavations should comply with the Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 C.F.R., s. 1926.650, Subpart P, all subsequent revisions or updates of OSHA's referenced standard adopted by the Department of Labor and Employment Security and Florida's Trench Safety Act, Section 553.62, Florida Statutes. Excavated materials should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth.

10.3 Groundwater Control

Depending upon groundwater levels at the time of construction, some form of dewatering may be required based on the anticipated construction activities due to perched groundwater. Due to groundwater levels anticipated during the wet season of the year, seepage may enter the bottom and sides of excavated areas. Such seepage will act to loosen soils and create difficult working conditions. Groundwater levels should be determined immediately prior to construction.

Shallow groundwater should be kept below the lowest working area to facilitate proper material placement and compaction in accordance with the FDOT Specifications.

10.4 Dynamic Load Testing & Pile Installation

We recommend that a test pile program be conducted for the proposed bridge construction including test piles. The test piles should be dynamically monitored. The monitoring will provide estimates of pile capacity versus pile penetration, stresses in the pile, and other relevant parameters used to evaluate the pile driving process. analyses should be performed on selected conditions for evaluation of the dynamic test results. The results of these analyses will provide information for developing production pile lengths. In addition, all production piles will be dynamically monitored.

The installation of the piles should be carried out in accordance with the FDOT Specifications.

10.5 Protection of Existing Structures

The FDOT Specifications should be followed for protection of existing structures during foundation construction operations.

11.0 REPORT LIMITATIONS

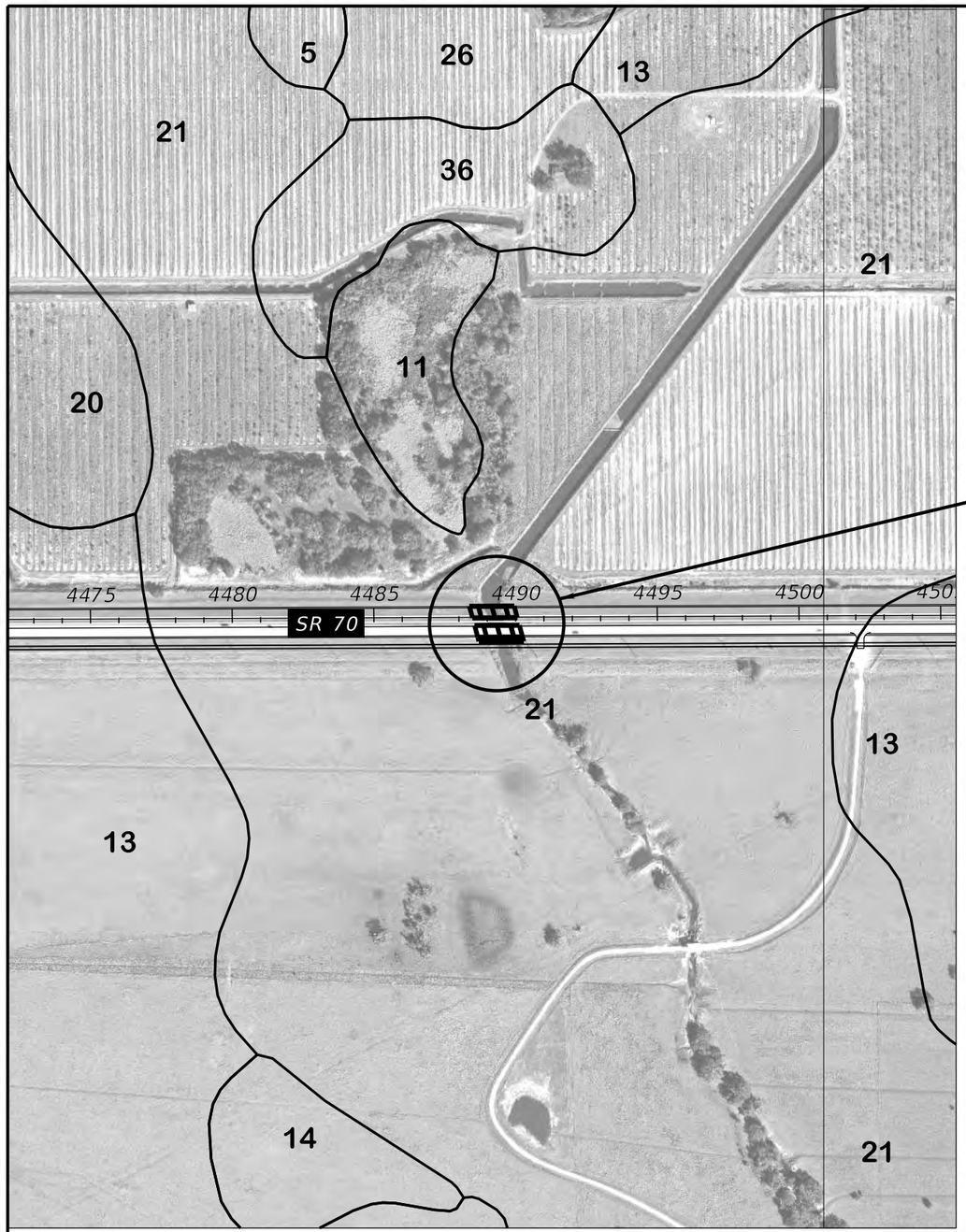
Our services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions, or recommendations made by others based on this data.

The scope of the investigation was intended to evaluate soil conditions within the influence zone of the deep foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil boring performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed structure.

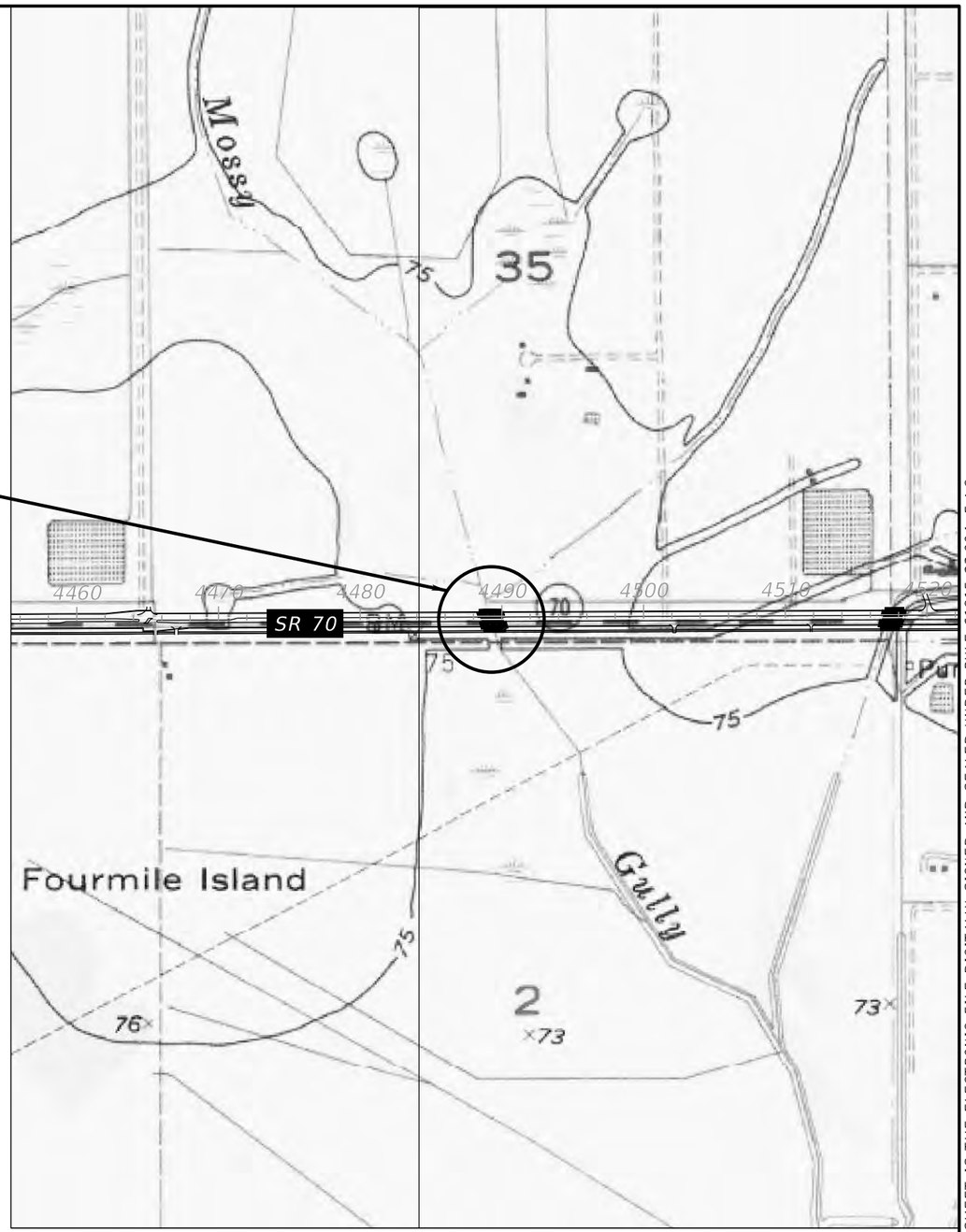
The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of the HNTB design team and the Florida Department of Transportation.

APPENDIX A

USDA Soil Survey & USGS Quadrangle Maps
Report of Core Boring (1 Sheet)



APPROXIMATE BRIDGE LOCATION



REFERENCE: USDA SOIL SURVEY OF DESOTO COUNTY, FLORIDA

0 100 500
Feet

TOWNSHIP: 37S
RANGE: 26E
SECTION: 35

REFERENCE: USGS QUADRANGLE MAP OF "LONG ISLAND MARSH NW, FLORIDA"

0 200 1000
Feet

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REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

DYLAN A. NELSON, P.E.
License Number: 96772
TIERRA, INC.
7351 TEMPLE TERRACE HIGHWAY
TAMPA, FLORIDA 33637

DRAWN BY:	BJS 02-25
CHECKED BY:	DAN 02-25
DESIGNED BY:	BJS 02-25
CHECKED BY:	DAN 02-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: USDA SOIL SURVEY & USGS QUADRANGLE MAPS

REF. DWG. NO.

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

SHEET NO.

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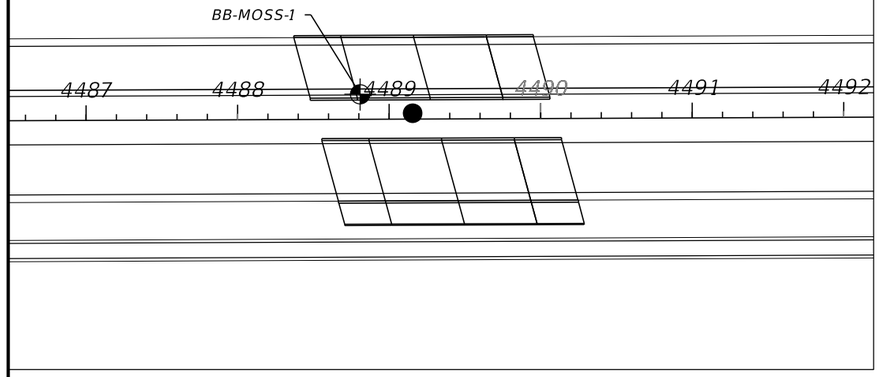
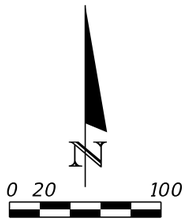
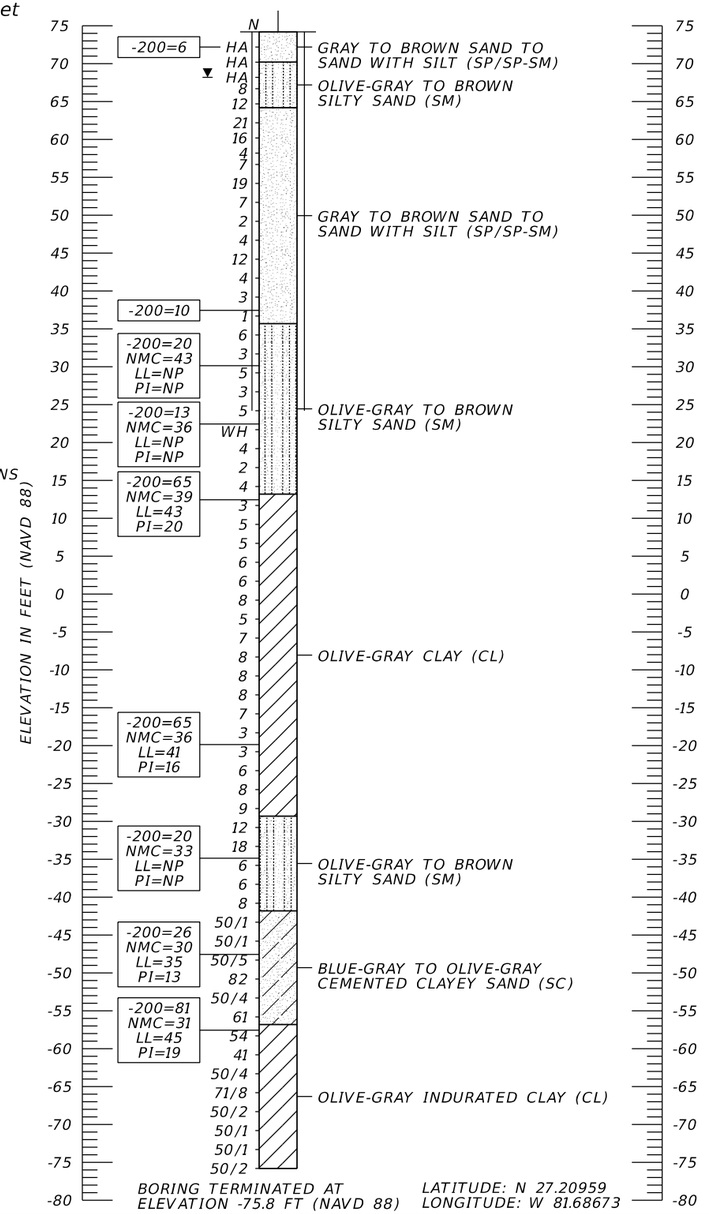


BORING LOCATION PLAN



BOR # BB-MOSS-1
STA. 4488+81
REF. ℄ CONST. SR 70
OFF. 16' LT.
ELEV. 74.2
DATE 1/27/2025
DRILLER J. BOOTH
HAMMER AUTOMATIC
RIG D-25



BORING TERMINATED AT ELEVATION -75.8 FT (NAVD 88)

LATITUDE: N 27.20959
LONGITUDE: W 81.68673

LEGEND

	SAND
	CLAYEY SAND
	SILTY SAND
	CLAY
SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCE
WH	SPLIT-SPOON SAMPLER ADVANCED UNDER WEIGHT OF ROD AND HAMMER
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON-PLASTIC
NAVD 88	NORTH AMERICAN VERTICAL DATUM OF 1988
▼	GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
⊕	APPROXIMATE SPT BORING LOCATION
●	APPROXIMATE SEDIMENT SAMPLE LOCATION FOR D_{50} DETERMINATION
| |	CASING

NOTES:
1. THE BORING LOCATIONS AND ELEVATIONS WERE PROVIDED BY THE PROJECT SURVEYOR.
2. BASED ON A REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION AT THE BRIDGE SITE IS REPORTED TO RANGE FROM APPROXIMATELY +50 TO +60 FEET, NGVD 29. ARTESIAN CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED.

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: MODERATELY AGGRESSIVE (SOIL - pH = 5.7, WATER - RESISTIVITY = 1,200 OHM-CM)
SUBSTRUCTURE	STEEL: EXTREMELY AGGRESSIVE (SOIL - pH = 5.7)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

SOIL TEST RESULTS:

RESISTIVITY	17,000 TO 22,000 OHM-CM
CHLORIDES	15 PPM
SULFATES	<5 TO 9 PPM
pH	5.7 TO 6.4

WATER TEST RESULTS:

RESISTIVITY	1,200 TO 1,500 OHM-CM
CHLORIDES	45 TO 95 PPM
SULFATES	180 TO 240 PPM
pH	7.3 TO 7.7

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

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REVISIONS

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CHECKED BY: DAN 02-25
DESIGNED BY: BJS 02-25
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: REPORT OF CORE BORINGS

REF. DWG. NO.

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

SHEET NO.

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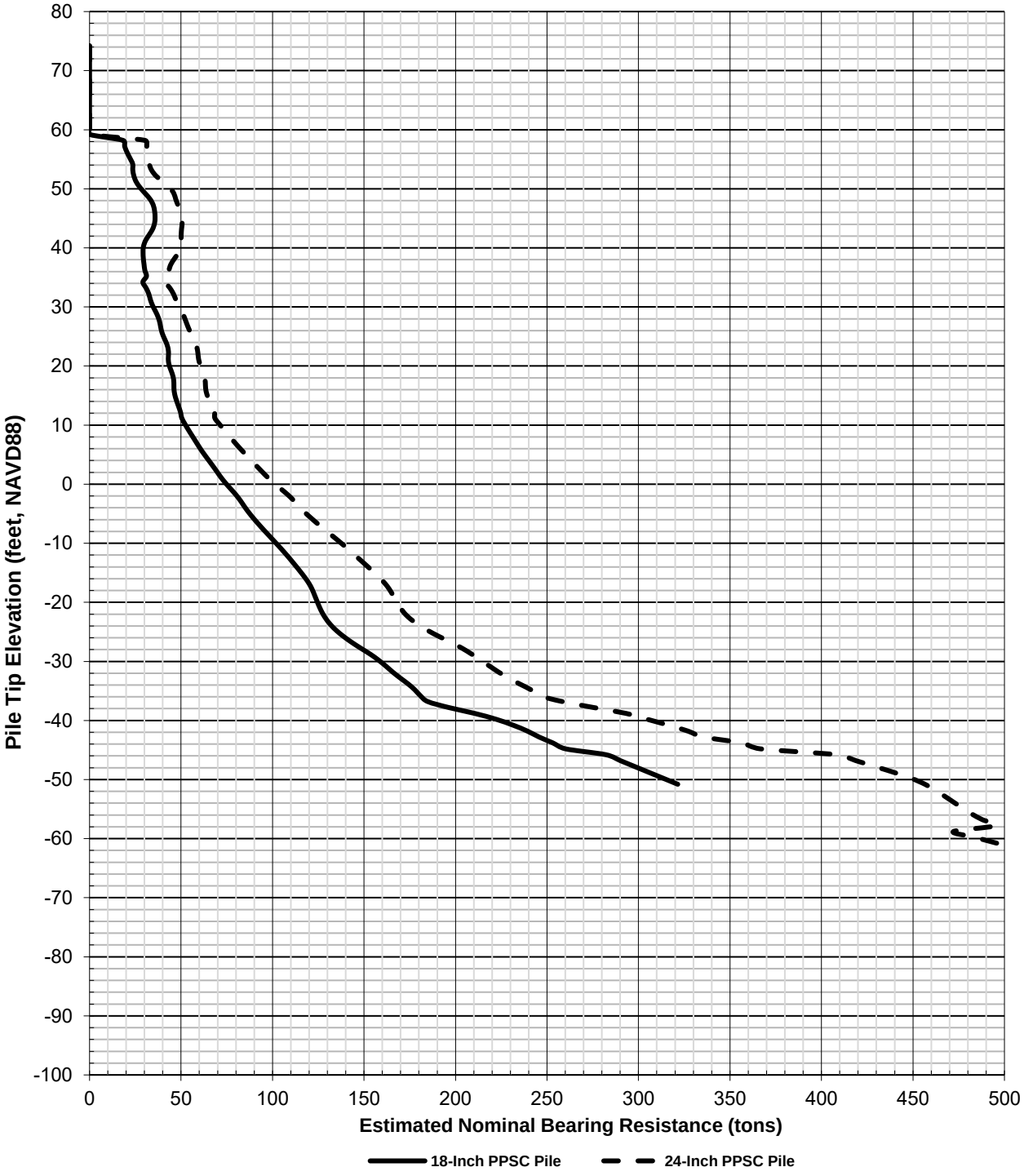
APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

SR 70 over Mossy Gully
SPT Boring BB-MOSS-1



TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Mossy Gully
DeSoto County, FL
FPID No. 451942-2-52-01

General Information:
==========
Input file: .....-001 SR 70 Segments 9 & 10\FBDeep\B4_MOSS\BB-MOSS-1_18-Inch.in
Project number: 6511-24-001
Job name: SR 70 Seg 10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
==========
Analysis Type: SPT

Soil Information:
==========
Boring date: 1/27/2025, Boring Number: BB-MOSS-1
Station number: 4488+81 Offset: 16' LT.

Ground Elevation: 74.200(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	8.00	5- Cavity layer
6	10.00	12.00	5- Cavity layer
7	12.00	21.00	5- Cavity layer
8	14.00	16.00	5- Cavity layer
9	16.00	4.00	3- Clean sand
10	17.50	7.00	3- Clean sand
11	20.00	19.00	3- Clean sand
12	22.50	7.00	3- Clean sand
13	25.00	2.00	3- Clean sand
14	27.50	4.00	3- Clean sand
15	30.00	12.00	3- Clean sand
16	32.50	4.00	3- Clean sand
17	35.00	3.00	3- Clean sand
18	37.50	1.00	3- Clean sand
19	40.00	6.00	2- Clay and silty sand

20	42.50	3.00	2- Clay and silty sand
21	45.00	5.00	2- Clay and silty sand
22	47.50	3.00	2- Clay and silty sand
23	50.00	5.00	2- Clay and silty sand
24	52.50	0.50	2- Clay and silty sand
25	55.00	4.00	2- Clay and silty sand
26	57.50	2.00	2- Clay and silty sand
27	60.00	4.00	2- Clay and silty sand
28	62.50	3.00	1- Plastic Clay
29	65.00	5.00	1- Plastic Clay
30	67.50	5.00	1- Plastic Clay
31	70.00	6.00	1- Plastic Clay
32	72.50	6.00	1- Plastic Clay
33	75.00	8.00	1- Plastic Clay
34	77.50	5.00	1- Plastic Clay
35	80.00	7.00	1- Plastic Clay
36	82.50	8.00	1- Plastic Clay
37	85.00	8.00	1- Plastic Clay
38	87.50	8.00	1- Plastic Clay
39	90.00	7.00	1- Plastic Clay
40	92.50	3.00	1- Plastic Clay
41	95.00	3.00	1- Plastic Clay
42	97.50	6.00	1- Plastic Clay
43	100.00	8.00	1- Plastic Clay
44	102.50	9.00	1- Plastic Clay
45	105.00	12.00	2- Clay and silty sand
46	107.50	18.00	2- Clay and silty sand
47	110.00	6.00	2- Clay and silty sand
48	112.50	6.00	2- Clay and silty sand
49	115.00	8.00	2- Clay and silty sand
50	117.50	100.00	3- Clean sand
51	120.00	100.00	2- Clay and silty sand
52	122.50	100.00	2- Clay and silty sand
53	125.00	82.00	2- Clay and silty sand
54	127.50	100.00	2- Clay and silty sand
55	130.00	61.00	2- Clay and silty sand
56	132.50	54.00	1- Plastic Clay
57	135.00	41.00	1- Plastic Clay
58	137.50	100.00	1- Plastic Clay
59	140.00	100.00	1- Plastic Clay
60	142.50	100.00	1- Plastic Clay
61	145.00	100.00	1- Plastic Clay
62	147.50	100.00	1- Plastic Clay
63	150.00	100.00	1- Plastic Clay

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	74.20	58.20	16.00	8.62	5-Void
2	58.20	34.20	24.00	6.40	3-Clean Sand
3	34.20	11.70	22.50	3.61	2-Clay and Silty Sand
4	11.70	-30.80	42.50	6.18	1-Plastic Clay
5	-30.80	-43.30	12.50	10.00	2-Clay and Silty Sand
6	-43.30	-45.80	2.50	100.00	3-Clean Sand
7	-45.80	-58.30	12.50	88.60	2-Clay and Silty Sand
8	-58.30	-75.80	17.50	85.00	1-Plastic Clay

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	73.20
18.00	2.00	72.20
18.00	3.00	71.20
18.00	4.00	70.20
18.00	5.00	69.20
18.00	6.00	68.20
18.00	7.00	67.20
18.00	8.00	66.20
18.00	9.00	65.20
18.00	10.00	64.20
18.00	11.00	63.20
18.00	12.00	62.20
18.00	13.00	61.20
18.00	14.00	60.20
18.00	15.00	59.20
18.00	16.00	58.20
18.00	17.00	57.20
18.00	18.00	56.20
18.00	19.00	55.20
18.00	20.00	54.20
18.00	21.00	53.20
18.00	22.00	52.20
18.00	23.00	51.20
18.00	24.00	50.20
18.00	25.00	49.20
18.00	26.00	48.20

18.00	27.00	47.20
18.00	28.00	46.20
18.00	29.00	45.20
18.00	30.00	44.20
18.00	31.00	43.20
18.00	32.00	42.20
18.00	33.00	41.20
18.00	34.00	40.20
18.00	35.00	39.20
18.00	36.00	38.20
18.00	37.00	37.20
18.00	38.00	36.20
18.00	39.00	35.20
18.00	40.00	34.20
18.00	41.00	33.20
18.00	42.00	32.20
18.00	43.00	31.20
18.00	44.00	30.20
18.00	45.00	29.20
18.00	46.00	28.20
18.00	47.00	27.20
18.00	48.00	26.20
18.00	49.00	25.20
18.00	50.00	24.20
18.00	51.00	23.20
18.00	52.00	22.20
18.00	53.00	21.20
18.00	54.00	20.20
18.00	55.00	19.20
18.00	56.00	18.20
18.00	57.00	17.20
18.00	58.00	16.20
18.00	59.00	15.20
18.00	60.00	14.20
18.00	61.00	13.20
18.00	62.00	12.20
18.00	63.00	11.20
18.00	64.00	10.20
18.00	65.00	9.20
18.00	66.00	8.20
18.00	67.00	7.20
18.00	68.00	6.20
18.00	69.00	5.20
18.00	70.00	4.20
18.00	71.00	3.20
18.00	72.00	2.20
18.00	73.00	1.20
18.00	74.00	0.20
18.00	75.00	-0.80
18.00	76.00	-1.80

18.00	77.00	-2.80
18.00	78.00	-3.80
18.00	79.00	-4.80
18.00	80.00	-5.80
18.00	81.00	-6.80
18.00	82.00	-7.80
18.00	83.00	-8.80
18.00	84.00	-9.80
18.00	85.00	-10.80
18.00	86.00	-11.80
18.00	87.00	-12.80
18.00	88.00	-13.80
18.00	89.00	-14.80
18.00	90.00	-15.80
18.00	91.00	-16.80
18.00	92.00	-17.80
18.00	93.00	-18.80
18.00	94.00	-19.80
18.00	95.00	-20.80
18.00	96.00	-21.80
18.00	97.00	-22.80
18.00	98.00	-23.80
18.00	99.00	-24.80
18.00	100.00	-25.80
18.00	101.00	-26.80
18.00	102.00	-27.80
18.00	103.00	-28.80
18.00	104.00	-29.80
18.00	105.00	-30.80
18.00	106.00	-31.80
18.00	107.00	-32.80
18.00	108.00	-33.80
18.00	109.00	-34.80
18.00	110.00	-35.80
18.00	111.00	-36.80
18.00	112.00	-37.80
18.00	113.00	-38.80
18.00	114.00	-39.80
18.00	115.00	-40.80
18.00	116.00	-41.80
18.00	117.00	-42.80
18.00	118.00	-43.80
18.00	119.00	-44.80
18.00	120.00	-45.80
18.00	121.00	-46.80
18.00	122.00	-47.80
18.00	123.00	-48.80
18.00	124.00	-49.80
18.00	125.00	-50.80
18.00	126.00	-51.80

18.00	127.00	-52.80
18.00	128.00	-53.80
18.00	129.00	-54.80
18.00	130.00	-55.80
18.00	131.00	-56.80
18.00	132.00	-57.80
18.00	133.00	-58.80
18.00	134.00	-59.80
18.00	135.00	-60.80
18.00	136.00	-61.80
18.00	137.00	-62.80
18.00	138.00	-63.80
18.00	139.00	-64.80
18.00	140.00	-65.80
18.00	141.00	-66.80
18.00	142.00	-67.80
18.00	143.00	-68.80
18.00	144.00	-69.80
18.00	145.00	-70.80
18.00	146.00	-71.80
18.00	147.00	-72.80
18.00	148.00	-73.80
18.00	149.00	-74.80
18.00	150.00	-75.80

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	0.00	0.00	0.00	0.00
4.00	18.0	0.00	0.00	0.00	0.00	0.00
5.00	18.0	0.00	0.00	0.00	0.00	0.00
6.00	18.0	0.00	0.00	0.00	0.00	0.00
7.00	18.0	0.00	0.00	0.00	0.00	0.00
8.00	18.0	0.00	0.00	0.00	0.00	0.00

9.00	18.0	0.00	0.00	0.00	0.00	0.00
10.00	18.0	0.00	0.00	0.00	0.00	0.00
11.00	18.0	0.00	0.00	0.00	0.00	0.00
12.00	18.0	0.00	0.00	0.00	0.00	0.00
13.00	18.0	0.00	0.00	0.00	0.00	0.00
14.00	18.0	0.00	0.00	0.00	0.00	0.00
15.00	18.0	0.14	0.00	0.14	0.07	0.14
16.00	18.0	0.57	17.71	18.28	9.14	53.71
17.00	18.0	1.20	17.96	19.16	9.58	55.08
18.00	18.0	2.10	18.35	20.44	10.22	57.13
19.00	18.0	3.70	18.36	22.06	11.03	58.79
20.00	18.0	6.33	17.25	23.58	11.79	58.09
21.00	18.0	8.67	14.95	23.62	11.81	53.52
22.00	18.0	10.34	13.86	24.20	12.10	51.92
23.00	18.0	11.37	14.08	25.44	12.72	53.60
24.00	18.0	11.96	15.68	27.64	13.82	58.99
25.00	18.0	11.89	18.57	30.46	15.23	67.60
26.00	18.0	12.03	21.17	33.19	16.60	75.52
27.00	18.0	12.38	22.47	34.85	17.43	79.80
28.00	18.0	12.98	22.56	35.55	17.77	80.67
29.00	18.0	14.00	21.79	35.79	17.89	79.36
30.00	18.0	15.47	20.09	35.55	17.78	75.73
31.00	18.0	16.93	17.56	34.49	17.25	69.61
32.00	18.0	17.95	14.61	32.56	16.28	61.78
33.00	18.0	18.57	11.96	30.54	15.27	54.46
34.00	18.0	19.09	10.35	29.44	14.72	50.14
35.00	18.0	19.55	9.69	29.24	14.62	48.62
36.00	18.0	19.89	9.51	29.40	14.70	48.43
37.00	18.0	20.07	9.70	29.77	14.88	49.17
38.00	18.0	20.20	10.01	30.21	15.11	50.24
39.00	18.0	21.00	10.09	31.09	15.55	51.28
40.00	18.0	22.78	6.37	29.15	14.58	41.89
41.00	18.0	24.43	6.49	30.91	15.46	43.88
42.00	18.0	25.94	6.42	32.37	16.18	45.21
43.00	18.0	27.12	6.15	33.27	16.63	45.56
44.00	18.0	28.42	6.08	34.50	17.25	46.67
45.00	18.0	29.97	6.16	36.14	18.07	48.47
46.00	18.0	31.53	6.05	37.58	18.79	49.68
47.00	18.0	32.82	5.67	38.50	19.25	49.84
48.00	18.0	33.92	5.19	39.12	19.56	49.51
49.00	18.0	35.22	4.91	40.13	20.07	49.96
50.00	18.0	36.77	4.80	41.57	20.79	51.17
51.00	18.0	38.12	4.62	42.74	21.37	51.98
52.00	18.0	38.80	4.37	43.17	21.59	51.92
53.00	18.0	38.95	4.08	43.02	21.51	51.17
54.00	18.0	39.49	3.97	43.46	21.73	51.41
55.00	18.0	40.59	4.01	44.60	22.30	52.62
56.00	18.0	41.68	3.97	45.65	22.83	53.60
57.00	18.0	42.22	3.86	46.08	23.04	53.81
58.00	18.0	42.36	3.75	46.11	23.05	53.61

59.00	18.0	42.90	3.63	46.54	23.27	53.81
60.00	18.0	44.00	3.48	47.47	23.74	54.43
61.00	18.0	45.32	3.28	48.60	24.30	55.15
62.00	18.0	46.58	3.11	49.69	24.84	55.91
63.00	18.0	47.81	2.58	50.39	25.19	55.54
64.00	18.0	49.29	2.81	52.10	26.05	57.73
65.00	18.0	51.01	3.01	54.02	27.01	60.04
66.00	18.0	52.87	3.18	56.05	28.02	62.40
67.00	18.0	54.79	3.29	58.08	29.04	64.66
68.00	18.0	56.73	3.40	60.13	30.07	66.93
69.00	18.0	58.80	3.54	62.34	31.17	69.42
70.00	18.0	61.01	3.71	64.72	32.36	72.14
71.00	18.0	63.29	3.82	67.11	33.56	74.76
72.00	18.0	65.57	3.85	69.43	34.71	77.13
73.00	18.0	67.89	3.83	71.72	35.86	79.39
74.00	18.0	70.45	3.83	74.28	37.14	81.93
75.00	18.0	73.28	3.87	77.15	38.57	84.88
76.00	18.0	76.04	3.96	80.00	40.00	87.92
77.00	18.0	78.38	4.10	82.48	41.24	90.67
78.00	18.0	80.40	4.27	84.67	42.34	93.22
79.00	18.0	82.61	4.43	87.04	43.52	95.90
80.00	18.0	85.10	4.56	89.66	44.83	98.78
81.00	18.0	87.80	4.66	92.46	46.23	101.77
82.00	18.0	90.64	4.73	95.37	47.68	104.83
83.00	18.0	93.59	4.78	98.37	49.19	107.93
84.00	18.0	96.56	4.80	101.36	50.68	110.97
85.00	18.0	99.53	4.80	104.33	52.16	113.92
86.00	18.0	102.50	4.69	107.20	53.60	116.58
87.00	18.0	105.47	4.47	109.94	54.97	118.88
88.00	18.0	108.43	4.18	112.61	56.30	120.97
89.00	18.0	111.27	3.93	115.20	57.60	123.06
90.00	18.0	113.97	3.73	117.69	58.85	125.15
91.00	18.0	116.31	3.60	119.91	59.95	127.10
92.00	18.0	118.08	3.57	121.65	60.82	128.79
93.00	18.0	119.34	3.65	122.99	61.49	130.28
94.00	18.0	120.52	3.77	124.30	62.15	131.84
95.00	18.0	121.71	3.93	125.65	62.82	133.52
96.00	18.0	123.12	4.11	127.22	63.61	135.44
97.00	18.0	124.96	4.26	129.22	64.61	137.75
98.00	18.0	127.23	4.52	131.75	65.88	140.80
99.00	18.0	129.79	5.20	134.99	67.49	145.38
100.00	18.0	132.62	6.30	138.92	69.46	151.52

Section Type: Square
Pile Width: 18.00 (in)

Test	Pile	Ultimate	Mobilized	Estimated	Allowable	Ultimate

Pile Length (ft)	Width (in)	Side Friction (tons)	End Bearing (tons)	Davisson Capacity (tons)	Pile Capacity (tons)	Pile Capacity (tons)
101.00	18.0	135.66	7.76	143.42	71.71	158.95
102.00	18.0	138.83	9.56	148.39	74.20	167.52
103.00	18.0	142.14	11.40	153.54	76.77	176.34
104.00	18.0	145.60	12.41	158.00	79.00	182.81
105.00	18.0	149.41	12.53	161.94	80.97	187.01
106.00	18.0	153.40	12.25	165.65	82.82	190.14
107.00	18.0	157.95	11.77	169.73	84.86	193.28
108.00	18.0	162.85	11.20	174.05	87.02	196.44
109.00	18.0	166.72	11.01	177.73	88.86	199.74
110.00	18.0	169.35	11.43	180.78	90.39	203.65
111.00	18.0	169.14	15.68	184.82	92.41	216.18
112.00	18.0	171.28	24.93	196.22	98.11	246.09
113.00	18.0	173.42	37.01	210.43	105.21	284.45
114.00	18.0	175.72	46.52	222.24	111.12	315.29
115.00	18.0	178.24	53.28	231.52	115.76	338.07
116.00	18.0	181.67	57.64	239.30	119.65	354.58
117.00	18.0	186.71	58.97	245.68	122.84	363.61
118.00	18.0	195.36	57.84	253.20	126.60	368.87
119.00	18.0	202.60	57.56	260.16	130.08	375.27
120.00	18.0	210.26	72.00	282.26	141.13	426.26
121.00	18.0	218.11	72.00	290.11	145.06	434.11
122.00	18.0	225.96	72.00	297.96	148.98	441.96
123.00	18.0	233.82	72.00	305.82	152.91	449.82
124.00	18.0	241.67	72.00	313.67	156.84	457.67
125.00	18.0	249.53	71.95	321.48	160.74	465.38
126.00	18.0	257.38	70.79	328.18	164.09	469.77
127.00	18.0	265.24	68.09	333.33	166.67	469.52
128.00	18.0	273.09	64.23	337.33	168.66	465.80
129.00	18.0	280.95	60.15	341.10	170.55	461.39
130.00	18.0	288.80	55.89	344.69	172.35	456.47
131.00	18.0	296.88	52.12	349.00	174.50	453.23
132.00	18.0	305.42	49.45	354.87	177.43	453.78
133.00	18.0	314.22	29.36	343.58	171.79	402.31
134.00	18.0	323.13	29.52	352.65	176.33	411.70
135.00	18.0	332.12	29.64	361.76	180.88	421.03
136.00	18.0	341.09	29.89	370.98	185.49	430.75
137.00	18.0	350.09	30.17	380.25	190.13	440.59
138.00	18.0	359.07	30.41	389.48	194.74	450.29
139.00	18.0	368.06	30.58	398.63	199.32	459.78
140.00	18.0	377.04	30.70	407.74	203.87	469.14
141.00	18.0	386.03	30.79	416.82	208.41	478.41
142.00	18.0	395.01	30.87	425.88	212.94	487.62
143.00	18.0	404.00	30.93	434.93	217.46	496.78
144.00	18.0	412.98	30.98	443.96	221.98	505.92
145.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
146.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

147.00 18.0 Soil Elevations Must Extend At or Below Contribution Zone
148.00 18.0 Soil Elevations Must Extend At or Below Contribution Zone
149.00 18.0 Soil Elevations Must Extend At or Below Contribution Zone
150.00 18.0 Soil Elevations Must Extend At or Below Contribution Zone

NOTES
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1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....-001 SR 70 Segments 9 & 10\FBDeep\B4_MOSS\BB-MOSS-1_24-Inch.in
Project number: 6511-24-001
Job name: SR 70 Seg 10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 1/27/2025, Boring Number: BB-MOSS-1
Station number: 4488+81 Offset: 16' LT.

Ground Elevation: 74.200(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	8.00	5- Cavity layer
6	10.00	12.00	5- Cavity layer
7	12.00	21.00	5- Cavity layer
8	14.00	16.00	5- Cavity layer
9	16.00	4.00	3- Clean sand
10	17.50	7.00	3- Clean sand
11	20.00	19.00	3- Clean sand
12	22.50	7.00	3- Clean sand
13	25.00	2.00	3- Clean sand
14	27.50	4.00	3- Clean sand
15	30.00	12.00	3- Clean sand
16	32.50	4.00	3- Clean sand
17	35.00	3.00	3- Clean sand
18	37.50	1.00	3- Clean sand
19	40.00	6.00	2- Clay and silty sand

20	42.50	3.00	2- Clay and silty sand
21	45.00	5.00	2- Clay and silty sand
22	47.50	3.00	2- Clay and silty sand
23	50.00	5.00	2- Clay and silty sand
24	52.50	0.50	2- Clay and silty sand
25	55.00	4.00	2- Clay and silty sand
26	57.50	2.00	2- Clay and silty sand
27	60.00	4.00	2- Clay and silty sand
28	62.50	3.00	1- Plastic Clay
29	65.00	5.00	1- Plastic Clay
30	67.50	5.00	1- Plastic Clay
31	70.00	6.00	1- Plastic Clay
32	72.50	6.00	1- Plastic Clay
33	75.00	8.00	1- Plastic Clay
34	77.50	5.00	1- Plastic Clay
35	80.00	7.00	1- Plastic Clay
36	82.50	8.00	1- Plastic Clay
37	85.00	8.00	1- Plastic Clay
38	87.50	8.00	1- Plastic Clay
39	90.00	7.00	1- Plastic Clay
40	92.50	3.00	1- Plastic Clay
41	95.00	3.00	1- Plastic Clay
42	97.50	6.00	1- Plastic Clay
43	100.00	8.00	1- Plastic Clay
44	102.50	9.00	1- Plastic Clay
45	105.00	12.00	2- Clay and silty sand
46	107.50	18.00	2- Clay and silty sand
47	110.00	6.00	2- Clay and silty sand
48	112.50	6.00	2- Clay and silty sand
49	115.00	8.00	2- Clay and silty sand
50	117.50	100.00	3- Clean sand
51	120.00	100.00	2- Clay and silty sand
52	122.50	100.00	2- Clay and silty sand
53	125.00	82.00	2- Clay and silty sand
54	127.50	100.00	2- Clay and silty sand
55	130.00	61.00	2- Clay and silty sand
56	132.50	54.00	1- Plastic Clay
57	135.00	41.00	1- Plastic Clay
58	137.50	100.00	1- Plastic Clay
59	140.00	100.00	1- Plastic Clay
60	142.50	100.00	1- Plastic Clay
61	145.00	100.00	1- Plastic Clay
62	147.50	100.00	1- Plastic Clay
63	150.00	100.00	1- Plastic Clay

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	74.20	58.20	16.00	8.62	5-Void
2	58.20	34.20	24.00	6.40	3-Clean Sand
3	34.20	11.70	22.50	3.61	2-Clay and Silty Sand
4	11.70	-30.80	42.50	6.18	1-Plastic Clay
5	-30.80	-43.30	12.50	10.00	2-Clay and Silty Sand
6	-43.30	-45.80	2.50	100.00	3-Clean Sand
7	-45.80	-58.30	12.50	88.60	2-Clay and Silty Sand
8	-58.30	-75.80	17.50	85.00	1-Plastic Clay

Driven Pile Data:
==========
Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
24.00	1.00	73.20
24.00	2.00	72.20
24.00	3.00	71.20
24.00	4.00	70.20
24.00	5.00	69.20
24.00	6.00	68.20
24.00	7.00	67.20
24.00	8.00	66.20
24.00	9.00	65.20
24.00	10.00	64.20
24.00	11.00	63.20
24.00	12.00	62.20
24.00	13.00	61.20
24.00	14.00	60.20
24.00	15.00	59.20
24.00	16.00	58.20
24.00	17.00	57.20
24.00	18.00	56.20
24.00	19.00	55.20
24.00	20.00	54.20
24.00	21.00	53.20
24.00	22.00	52.20
24.00	23.00	51.20
24.00	24.00	50.20
24.00	25.00	49.20
24.00	26.00	48.20

24.00	27.00	47.20
24.00	28.00	46.20
24.00	29.00	45.20
24.00	30.00	44.20
24.00	31.00	43.20
24.00	32.00	42.20
24.00	33.00	41.20
24.00	34.00	40.20
24.00	35.00	39.20
24.00	36.00	38.20
24.00	37.00	37.20
24.00	38.00	36.20
24.00	39.00	35.20
24.00	40.00	34.20
24.00	41.00	33.20
24.00	42.00	32.20
24.00	43.00	31.20
24.00	44.00	30.20
24.00	45.00	29.20
24.00	46.00	28.20
24.00	47.00	27.20
24.00	48.00	26.20
24.00	49.00	25.20
24.00	50.00	24.20
24.00	51.00	23.20
24.00	52.00	22.20
24.00	53.00	21.20
24.00	54.00	20.20
24.00	55.00	19.20
24.00	56.00	18.20
24.00	57.00	17.20
24.00	58.00	16.20
24.00	59.00	15.20
24.00	60.00	14.20
24.00	61.00	13.20
24.00	62.00	12.20
24.00	63.00	11.20
24.00	64.00	10.20
24.00	65.00	9.20
24.00	66.00	8.20
24.00	67.00	7.20
24.00	68.00	6.20
24.00	69.00	5.20
24.00	70.00	4.20
24.00	71.00	3.20
24.00	72.00	2.20
24.00	73.00	1.20
24.00	74.00	0.20
24.00	75.00	-0.80
24.00	76.00	-1.80

24.00	77.00	-2.80
24.00	78.00	-3.80
24.00	79.00	-4.80
24.00	80.00	-5.80
24.00	81.00	-6.80
24.00	82.00	-7.80
24.00	83.00	-8.80
24.00	84.00	-9.80
24.00	85.00	-10.80
24.00	86.00	-11.80
24.00	87.00	-12.80
24.00	88.00	-13.80
24.00	89.00	-14.80
24.00	90.00	-15.80
24.00	91.00	-16.80
24.00	92.00	-17.80
24.00	93.00	-18.80
24.00	94.00	-19.80
24.00	95.00	-20.80
24.00	96.00	-21.80
24.00	97.00	-22.80
24.00	98.00	-23.80
24.00	99.00	-24.80
24.00	100.00	-25.80
24.00	101.00	-26.80
24.00	102.00	-27.80
24.00	103.00	-28.80
24.00	104.00	-29.80
24.00	105.00	-30.80
24.00	106.00	-31.80
24.00	107.00	-32.80
24.00	108.00	-33.80
24.00	109.00	-34.80
24.00	110.00	-35.80
24.00	111.00	-36.80
24.00	112.00	-37.80
24.00	113.00	-38.80
24.00	114.00	-39.80
24.00	115.00	-40.80
24.00	116.00	-41.80
24.00	117.00	-42.80
24.00	118.00	-43.80
24.00	119.00	-44.80
24.00	120.00	-45.80
24.00	121.00	-46.80
24.00	122.00	-47.80
24.00	123.00	-48.80
24.00	124.00	-49.80
24.00	125.00	-50.80
24.00	126.00	-51.80

24.00	127.00	-52.80
24.00	128.00	-53.80
24.00	129.00	-54.80
24.00	130.00	-55.80
24.00	131.00	-56.80
24.00	132.00	-57.80
24.00	133.00	-58.80
24.00	134.00	-59.80
24.00	135.00	-60.80
24.00	136.00	-61.80
24.00	137.00	-62.80
24.00	138.00	-63.80
24.00	139.00	-64.80
24.00	140.00	-65.80
24.00	141.00	-66.80
24.00	142.00	-67.80
24.00	143.00	-68.80
24.00	144.00	-69.80
24.00	145.00	-70.80
24.00	146.00	-71.80
24.00	147.00	-72.80
24.00	148.00	-73.80
24.00	149.00	-74.80
24.00	150.00	-75.80

Driven Pile Capacity:
==========

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	24.0	0.00	0.00	0.00	0.00	0.00
2.00	24.0	0.00	0.00	0.00	0.00	0.00
3.00	24.0	0.00	0.00	0.00	0.00	0.00
4.00	24.0	0.00	0.00	0.00	0.00	0.00
5.00	24.0	0.00	0.00	0.00	0.00	0.00
6.00	24.0	0.00	0.00	0.00	0.00	0.00
7.00	24.0	0.00	0.00	0.00	0.00	0.00
8.00	24.0	0.00	0.00	0.00	0.00	0.00

9.00	24.0	0.00	0.00	0.00	0.00	0.00
10.00	24.0	0.00	0.00	0.00	0.00	0.00
11.00	24.0	0.00	0.00	0.00	0.00	0.00
12.00	24.0	0.00	0.00	0.00	0.00	0.00
13.00	24.0	0.00	0.00	0.00	0.00	0.00
14.00	24.0	0.00	0.00	0.00	0.00	0.00
15.00	24.0	0.19	0.00	0.19	0.09	0.19
16.00	24.0	0.75	29.53	30.29	15.14	89.35
17.00	24.0	1.68	29.58	31.26	15.63	90.41
18.00	24.0	3.08	29.02	32.11	16.05	90.15
19.00	24.0	5.31	26.82	32.12	16.06	85.76
20.00	24.0	8.43	24.20	32.63	16.32	81.02
21.00	24.0	11.56	22.26	33.82	16.91	78.33
22.00	24.0	13.79	22.47	36.25	18.13	81.19
23.00	24.0	15.15	24.86	40.01	20.01	89.72
24.00	24.0	15.95	27.89	43.84	21.92	99.63
25.00	24.0	15.96	30.12	46.08	23.04	106.32
26.00	24.0	15.71	31.41	47.13	23.56	109.96
27.00	24.0	15.98	32.38	48.37	24.18	113.13
28.00	24.0	16.73	32.96	49.69	24.84	115.60
29.00	24.0	18.09	32.33	50.42	25.21	115.09
30.00	24.0	20.02	30.58	50.60	25.30	111.75
31.00	24.0	21.96	28.31	50.28	25.14	106.91
32.00	24.0	23.32	26.74	50.06	25.03	103.55
33.00	24.0	24.17	25.90	50.06	25.03	101.86
34.00	24.0	24.87	24.94	49.81	24.90	99.68
35.00	24.0	25.50	23.10	48.60	24.30	94.80
36.00	24.0	25.98	20.46	46.44	23.22	87.36
37.00	24.0	26.24	18.18	44.42	22.21	80.77
38.00	24.0	26.43	17.03	43.46	21.73	77.53
39.00	24.0	27.50	16.45	43.95	21.97	76.84
40.00	24.0	30.38	11.20	41.58	20.79	63.99
41.00	24.0	32.58	11.35	43.92	21.96	66.61
42.00	24.0	34.59	11.27	45.86	22.93	68.40
43.00	24.0	36.16	11.03	47.20	23.60	69.26
44.00	24.0	37.89	10.91	48.80	24.40	70.62
45.00	24.0	39.96	10.53	50.50	25.25	71.57
46.00	24.0	42.04	9.83	51.87	25.93	71.52
47.00	24.0	43.77	9.32	53.08	26.54	71.71
48.00	24.0	45.23	9.14	54.38	27.19	72.66
49.00	24.0	46.96	8.99	55.94	27.97	73.92
50.00	24.0	49.03	8.49	57.52	28.76	74.50
51.00	24.0	50.83	7.79	58.62	29.31	74.21
52.00	24.0	51.73	7.48	59.21	29.61	74.18
53.00	24.0	51.93	7.65	59.58	29.79	74.88
54.00	24.0	52.66	7.81	60.46	30.23	76.08
55.00	24.0	54.11	7.62	61.74	30.87	76.99
56.00	24.0	55.57	7.28	62.85	31.42	77.40
57.00	24.0	56.30	6.97	63.27	31.64	77.22
58.00	24.0	56.48	6.96	63.44	31.72	77.37

59.00	24.0	57.21	6.94	64.14	32.07	78.02
60.00	24.0	58.66	6.70	65.36	32.68	78.76
61.00	24.0	60.43	6.37	66.80	33.40	79.53
62.00	24.0	62.11	6.18	68.29	34.14	80.65
63.00	24.0	63.75	4.72	68.46	34.23	77.90
64.00	24.0	65.72	5.13	70.85	35.43	81.11
65.00	24.0	68.09	5.48	73.57	36.79	84.52
66.00	24.0	70.49	5.70	76.20	38.10	87.60
67.00	24.0	72.96	5.97	78.94	39.47	90.88
68.00	24.0	75.55	6.25	81.80	40.90	94.29
69.00	24.0	78.30	6.49	84.79	42.40	97.77
70.00	24.0	81.25	6.61	87.85	43.93	101.07
71.00	24.0	84.29	6.63	90.91	45.46	104.16
72.00	24.0	87.33	6.67	94.00	47.00	107.34
73.00	24.0	90.41	6.77	97.18	48.59	110.72
74.00	24.0	93.82	6.88	100.71	50.35	114.47
75.00	24.0	97.59	6.99	104.58	52.29	118.56
76.00	24.0	101.27	7.12	108.39	54.19	122.62
77.00	24.0	104.40	7.29	111.68	55.84	126.26
78.00	24.0	107.08	7.50	114.58	57.29	129.58
79.00	24.0	110.03	7.73	117.76	58.88	133.22
80.00	24.0	113.35	7.95	121.30	60.65	137.19
81.00	24.0	116.95	8.10	125.05	62.53	141.26
82.00	24.0	120.73	8.20	128.93	64.46	145.32
83.00	24.0	124.66	8.24	132.91	66.45	149.39
84.00	24.0	128.62	8.20	136.82	68.41	153.22
85.00	24.0	132.58	8.01	140.60	70.30	156.62
86.00	24.0	136.54	7.70	144.24	72.12	159.63
87.00	24.0	140.50	7.35	147.86	73.93	162.57
88.00	24.0	144.44	7.02	151.46	75.73	165.49
89.00	24.0	148.22	6.74	154.96	77.48	168.44
90.00	24.0	151.83	6.56	158.38	79.19	171.49
91.00	24.0	154.95	6.48	161.44	80.72	174.40
92.00	24.0	157.31	6.57	163.87	81.94	177.00
93.00	24.0	158.99	6.82	165.81	82.90	179.45
94.00	24.0	160.57	7.17	167.74	83.87	182.08
95.00	24.0	162.16	7.53	169.69	84.84	184.75
96.00	24.0	164.03	7.94	171.97	85.99	187.86
97.00	24.0	166.50	8.81	175.31	87.65	192.93
98.00	24.0	169.52	10.22	179.74	89.87	200.18
99.00	24.0	172.93	12.11	185.04	92.52	209.26
100.00	24.0	176.71	14.42	191.12	95.56	219.96

Section Type: Square
Pile Width: 24.00 (in)

Test	Pile	Ultimate	Mobilized	Estimated	Allowable	Ultimate

Pile Length (ft)	Width (in)	Side Friction (tons)	End Bearing (tons)	Davisson Capacity (tons)	Pile Capacity (tons)	Pile Capacity (tons)
101.00	24.0	180.76	16.98	197.73	98.87	231.69
102.00	24.0	184.98	18.78	203.76	101.88	241.33
103.00	24.0	189.39	19.62	209.01	104.50	248.25
104.00	24.0	194.00	19.71	213.71	106.85	253.12
105.00	24.0	199.21	19.46	218.67	109.34	257.59
106.00	24.0	204.53	18.95	223.48	111.74	261.38
107.00	24.0	210.61	18.35	228.96	114.48	265.66
108.00	24.0	217.13	17.80	234.94	117.47	270.55
109.00	24.0	220.91	20.31	241.22	120.61	281.83
110.00	24.0	218.73	27.13	245.86	122.93	300.11
111.00	24.0	217.60	40.84	258.44	129.22	340.13
112.00	24.0	218.82	56.54	275.36	137.68	388.43
113.00	24.0	221.20	71.98	293.18	146.59	437.14
114.00	24.0	224.62	80.19	304.80	152.40	465.18
115.00	24.0	228.18	88.28	316.45	158.23	493.00
116.00	24.0	232.64	94.41	327.05	163.52	515.86
117.00	24.0	238.84	96.74	335.58	167.79	529.06
118.00	24.0	260.48	96.02	356.49	178.25	548.52
119.00	24.0	270.13	96.49	366.62	183.31	559.60
120.00	24.0	280.34	128.00	408.34	204.17	664.34
121.00	24.0	290.81	128.00	418.81	209.41	674.81
122.00	24.0	301.29	128.00	429.29	214.64	685.29
123.00	24.0	311.76	128.00	439.76	219.88	695.76
124.00	24.0	322.23	126.97	449.20	224.60	703.15
125.00	24.0	332.70	123.89	456.59	228.30	704.36
126.00	24.0	343.18	118.97	462.15	231.07	700.09
127.00	24.0	353.65	113.58	467.23	233.62	694.40
128.00	24.0	364.12	107.95	472.07	236.04	687.98
129.00	24.0	374.60	102.32	476.92	238.46	681.55
130.00	24.0	385.07	96.93	482.00	241.00	675.87
131.00	24.0	395.84	92.13	487.98	243.99	672.24
132.00	24.0	407.22	88.33	495.55	247.78	672.21
133.00	24.0	419.01	53.09	472.10	236.05	578.27
134.00	24.0	430.98	53.14	484.12	242.06	590.40
135.00	24.0	443.06	53.04	496.11	248.05	602.19
136.00	24.0	455.01	53.19	508.19	254.10	614.57
137.00	24.0	466.91	53.64	520.55	260.28	627.84
138.00	24.0	478.89	54.06	532.95	266.47	641.06
139.00	24.0	490.87	54.36	545.23	272.61	653.94
140.00	24.0	502.85	54.58	557.43	278.71	666.58
141.00	24.0	514.83	54.74	569.57	284.79	679.06
142.00	24.0	526.81	54.88	581.69	290.84	691.44
143.00	24.0	538.79	54.98	593.77	296.89	703.74
144.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
145.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
146.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				

147.00 24.0 Soil Elevations Must Extend At or Below Contribution Zone
148.00 24.0 Soil Elevations Must Extend At or Below Contribution Zone
149.00 24.0 Soil Elevations Must Extend At or Below Contribution Zone
150.00 24.0 Soil Elevations Must Extend At or Below Contribution Zone

NOTES
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1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

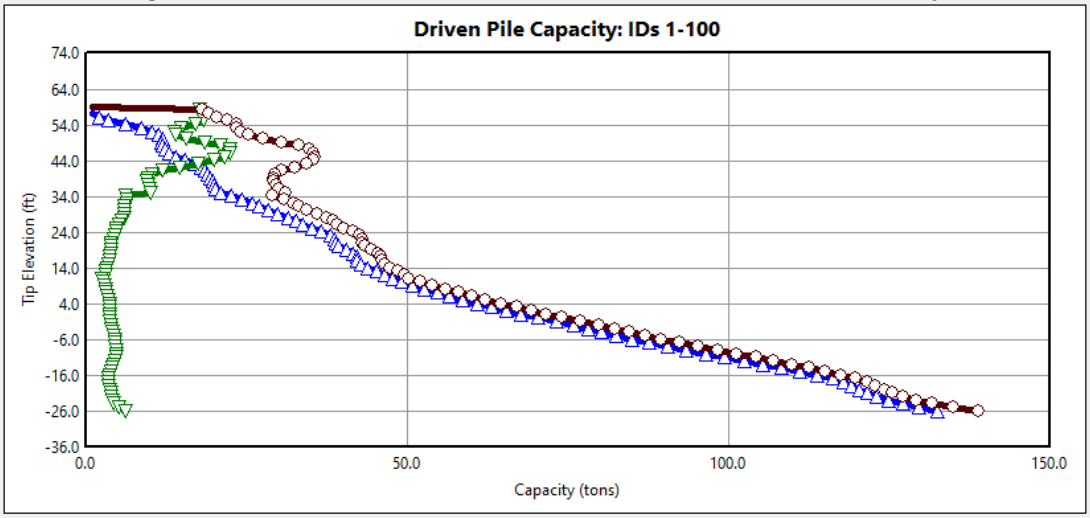
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

Plot Window

Job Name: SR 70 Seg 10

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-MOSS-1	
Ground Surface Elevation	74.20	(ft)
Section:	Square	
Width	18.00	(in)

Project Data

File:	BB-MOSS-1_18-Inch
Date:	Mar 21, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

Plot Options

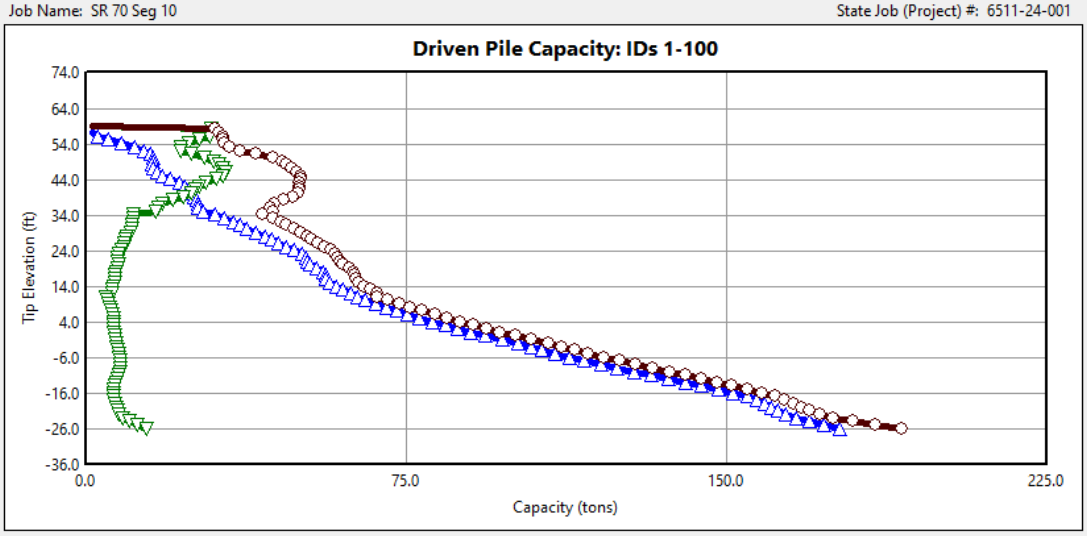
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 10

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-MOSS-1	
Ground Surface Elevation	74.20	(ft)
Section:	Square	
Width	24.00	(in)

Project Data

File:	BB-MOSS-1_24-Inch
Date:	Mar 21, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

Summary of Laboratory Test Results for Soil Classification
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Mossy Gully Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Boring Number	Sample Depth (ft)	USCS Symbol	Sieve Analysis					Atterberg Limits			Organic Content (%)	Natural Moisture Content
			#10	#40	#60	#100	#200	Liquid Limit	Plastic Limit	Plasticity Index		
BB-MOSS-1	0.0 - 4.0	SP-SM	---	---	---	---	6	---	---	---	---	---
BB-MOSS-1	36.0 - 37.5	SP-SM	---	---	---	---	10	---	---	---	---	---
BB-MOSS-1	43.5 - 45.0	SM	---	---	---	---	20	NP	NP	NP	---	43
BB-MOSS-1	51.0 - 52.5	SM	---	---	---	---	13	NP	NP	NP	---	36
BB-MOSS-1	61.0 - 62.5	CL	---	---	---	---	65	43	23	20	---	39
BB-MOSS-1	93.5 - 95.0	CL	---	---	---	---	65	41	25	16	---	36
BB-MOSS-1	108.5 - 110.0	SM	---	---	---	---	20	NP	NP	NP	---	33
BB-MOSS-1	121.0 - 122.5	SC	---	---	---	---	26	35	22	13	---	30
BB-MOSS-1	131.0 - 132.5	CL	---	---	---	---	81	45	26	19	---	31

Summary of Laboratory Test Results for Environmental Classification
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Mossy Gully Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Soil Samples

Boring Number	Depth (feet)	USCS Symbol	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
							Steel	Concrete
BBC-MOSS-1	2.0 - 6.0	SP	5.7	22,000	15	<5	Extremely Aggressive	Moderately Aggressive
BB-MOSS-1	0.0 - 4.0	SP-SM	6.4	17,000	15	9	Moderately Aggressive	Slightly Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Water Samples

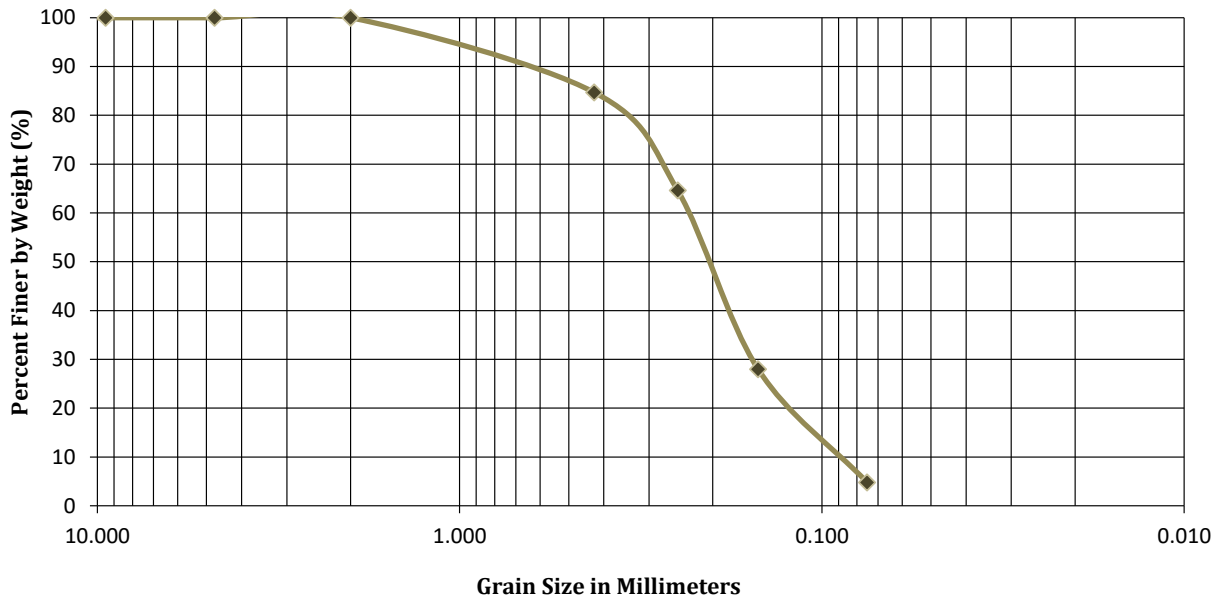
Sample Location	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
					Steel	Concrete
MOSSY GULLY	7.7	1,200	95	180	Moderately Aggressive	Moderately Aggressive
	7.3	1,500	45	240	Moderately Aggressive	Moderately Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Grain Size Distribution Report
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Mossy Gully Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No.: 6511-24-001

Approximate Sample Location		Depth Below Mudline (ft)
Latitude	Longitude	
N 27.20956	W 81.68662	0.0-2.0

Grain Size Distribution Curve



Material Description	Classification	
	USCS	AASHTO
Gray to Brown Sand	SP	A-3

Sieve Number	Diameter (mm)	Percent Finer by Weight (%)
3/4"	19.000	100
3/8"	9.500	100
4	4.750	100
10	2.000	100
40	0.425	84.7
60	0.250	64.6
100	0.150	28
200	0.075	4.8

Coefficients

D_{10}	0.088	D_{30}	0.154
D_{50}	*0.204*	D_{60}	0.234
D_{85}	0.438	D_{90}	0.727
D_{95}	1.206		
C_U	2.676	C_C	1.158

TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

April 3, 2025

HNTB Corporation
201 N. Franklin Street, Suite 1200
Tampa, FL 33602

Attn: Mr. John Burton, PE, PMP, PTOE, ENV SP.

RE: Preliminary Bridge Geotechnical Report
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over D.C.I. Canal Bridges
FPID No. 451942-2-52-01
DeSoto County, Florida
Tierra Project No. 6511-24-001

Mr. Burton:

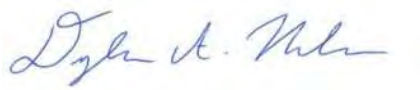
Tierra, Inc. (Tierra) has performed a preliminary geotechnical study for the proposed bridge structures associated with the project referenced above. This report has been prepared to support the project Bridge Development Report (BDR). This report presents the results of our study including field and laboratory testing, a preliminary foundation design analysis and our opinions regarding appropriate foundation alternatives for the proposed bridge structures.

Tierra, Inc. appreciates the opportunity to be of service to HNTB Corporation (HNTB) on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.

Kaitlyn C. Waterman, P.E.
Geotechnical Engineer
Florida License No. 96615



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APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

1.0 PROJECT INFORMATION

1.1 Project Authorization

Authorization to proceed with this project was issued by HNTB in accordance with our Subconsultant Agreement.

1.2 Project Description

This project consists of widening SR 70 from two lanes to four-lane divided section from West of SR 31 (MP 14.973) to the Highlands County Line (MP 31.763). A shared use path is also proposed on the south side of the SR 70 widening.

This report has been prepared to provide geotechnical input for the Bridge Development Report (BDR) associated with the design of the proposed SR 70 over D.C.I. Canal bridge structures. The subsurface information obtained to date and preliminary engineering recommendations for the proposed foundation alternatives are provided herein.

1.3 General Site Description

A concrete bridge culvert (Bridge No. 040033) supporting the existing SR 70 roadway is currently located at the subject bridge site. The concrete bridge culvert was built circa 1959. Farmlands/pasturelands are located west of the subject bridge site. An agricultural company is located northeast of the bridge site and the DeSoto Correctional Institution is located southeast of the bridge site.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to provide geotechnical (i.e. subsurface soil conditions and related engineering properties) input to the design team to assist with the design and construction of the proposed SR 70 over D.C.I. Canal bridge structures. The following services were provided in order to achieve the preceding objective:

1. Reviewed soil information from the "Soil Survey of DeSoto County, Florida" published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Reviewed topographic and potentiometric information obtained from the "Long Island Marsh NW, Florida" Quadrangle map and the "Upper Floridan Aquifer Potentiometric Surface" maps published by the United States Geological Survey (USGS).

2. Conducted a visual reconnaissance of the project site and coordinated utility clearance through Sunshine State One Call.

3. Executed a program of subsurface exploration consisting of subsurface sampling and field testing. Performed one (1) Standard Penetration Test (SPT) boring advanced to a depth of approximately 160 feet below existing grades.

4. Visually classified and stratified the obtained soil samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D-2488. Conducted laboratory testing on selected soil samples to confirm the visual classification and evaluate the corrosive nature of the soil and water.

5. Evaluated foundation criteria and performed engineering analyses to develop preliminary design recommendations for the foundation alternatives associated with the proposed bridge structures.

6. Prepared this formal engineering report, which summarizes the course of study pursued, the field and laboratory data generated, the subsurface conditions encountered and the preliminary geotechnical recommendations for the design and construction of the proposed bridge structure foundation alternatives.

3.0 REVIEW OF PUBLISHED DATA

3.1 Regional Geology

DeSoto County Geology has been paraphrased from the Florida Geological Survey, Open-File Report 80, 2001 and other geologic references.

Based on a review of the Surficial Geology Maps published by FGS, the Hawthorn Group, Peace River Formation (Thp) and Reworked Cypresshead sediments (TQuc) are mapped at the surface in the vicinity of the bridge site.

Lithologically, the Hawthorn Group, Peace River Formation (Thp) sediments consist of yellowish-grey to light olive green interbedded phosphatic sands, clayey sands, clays and dolomite stringers. The thickness of the Peace River Formation is approximately 50 feet in the northeastern and southwestern corners of the county. The Peace River thickens to more than 160 feet in the southeastern corner of the county. The Peace River dips and thickens in the general south easterly direction.

The Reworked Cypresshead sediments (TQuc) is the result of post depositional reworking of the Cypresshead siliciclastics, formed during the Pliocene and Pleistocene epochs. The sediments are fine to coarse quartz sands with scattered quartz gravel and varying percentages of clay matrix.

3.2 USDA Soil Survey

Based on a review of the Soil Survey for DeSoto County published by the USDA NRCS, it appears that there is one (1) primary soil-mapping unit noted at the bridge site. The general soil description as described in the Soil Survey is presented in the following table. The **USDA Soil Survey Map** for the bridge site is illustrated in **Appendix A**.

Summary of USDA Soil Survey
DeSoto, Florida

USDA Map Symbol and Soil Name	Depth (in)	Soil Classification		Permeability (in/hr)	pH	Seasonal High Water Table	
		USCS	AASHTO			Depth (feet)	Months
(14) Farmton	0-4	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	3.5-5.5	0.5-1.5	Jun-Nov
	4-34	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	3.5-5.5		
	34-48	SP-SM, SM	A-2-4	0.6 - 2.0	3.5-5.5		
	48-80	CL, SC, SM	A-4, A-6	0.1 - 0.2	3.5-5.5		

It should be noted that information contained in the USDA Soil Survey Map may not be reflective of actual soil and groundwater conditions, particularly if recent development in the project vicinity has modified soil conditions or surface/subsurface drainage.

3.3 USGS Quadrangle Map

Based on a review of the "Long Island Marsh NW, Florida" USGS Quadrangle Map, it appears that the natural elevation at the project site ranges from approximately +70 feet to +75 feet National Geodetic Vertical Datum of 1929 (NGVD 29) as illustrated on the **USGS Quadrangle Map** in **Appendix A.**

3.4 Review of Potentiometric Surface Information

Based on a review of the "Upper Floridan Aquifer Potentiometric Surface" maps published by the USGS, the potentiometric surface elevation at the bridge site is reported to range from

approximately +50 to +60 feet, NGVD 29. As indicated in **Section 3.3**, the natural ground surface elevation at the bridge site ranges from approximately +70 to +75 feet, NGVD 29. Artesian flow conditions were not encountered during the field exploration.

4.0 SUBSURFACE EXPLORATION

4.1 Boring Location Plan

Prior to commencing our subsurface explorations, a boring location plan for the proposed bridge structures was developed based on design information provided by HNTB. This boring location plan was generated based on our engineering judgment and guidelines provided in the "Soils and Foundations Handbook" published by the FDOT. Tierra submitted this boring location plan to FDOT for approval. Following completion of the boring, the boring locations were surveyed by the project surveyor. The Boring Location Plan for the boring performed is provided on the **Report of Core Boring** sheet in **Appendix A.**

Utility clearances were coordinated by Tierra via Sunshine State One Call and updated as required prior to performing the soil boring in order to reduce the potential for damage to the utilities during drilling.

4.2 Soil Boring

Subsurface conditions were explored at the bridge site one (1) SPT boring. The results and location of the SPT boring are presented on the **Report of Core Boring** sheet in **Appendix A**.

The SPT boring was performed with the use of a drill rig using Bentonite Mud drilling procedures. Temporary 3-inch diameter rotary installed casing was utilized to help keep the borehole stable. The soil sampling was performed in general accordance with the ASTM test designation D-1586. The initial 6 feet of the boring was hand augered to verify utility clearances. SPT resistance N-values were then taken at intervals of 2 feet from the hand auger boring depth of 6 feet to a depth of 17½ feet and on intervals of 2½ feet thereafter to the boring termination depths. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our laboratory for classification and analyses.

Soil stratification was determined based on a review of recovered samples, laboratory test results, and interpretation of field boring logs. Stratification lines represent approximate boundaries between soil layers of different engineering properties; however actual transitions between layers may be gradual. In some cases, small variations in properties that were not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The soil profiles represent the conditions at the particular boring location; variations do occur among the boring. Specific details about subsurface conditions and materials encountered at each test location can be obtained from the soil profiles presented on the **Report of Core Boring** sheet in **Appendix A** of this report.

5.0 LABORATORY TESTING

5.1 General

Representative soil samples collected from the SPT boring were classified and stratified in general accordance with the Unified Soil Classification System (USCS). Our classification was based on visual observations, using the results from the laboratory testing as confirmation. Laboratory testing consisting of fines content (percentage passing No. 200 mesh sieve), Atterberg limits testing, and natural moisture content determination tests were completed on representative soil samples. In addition, Environmental Classification tests were performed to evaluate the corrosive nature of the soil and water encountered at the bridge site. The results of the laboratory tests are presented on the **Report of Core Boring** sheet in **Appendix A**. Detailed results of the tests performed are presented on the **Summary of Laboratory Test Results for Soil Classification**, **Summary of Laboratory Test Results for Environmental Classification** and **Grain Size Distribution Report** in **Appendix C.**

5.2 Test Designation

The following list summarizes the laboratory tests performed and respective test methods utilized.

- Fines Content - The fines content tests were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-1140).

- Grain-Size Analyses - The grain-size analyses were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-6913).

- Atterberg Limits - The liquid limit and the plastic limit tests ("Atterberg Limits") were conducted in general accordance with the AASHTO test designations T-089 and T-090, respectively (ASTM test designation D-4318).

- Natural Moisture Content - The moisture content tests were conducted in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).

- Environmental Classification – The environmental classification tests were conducted in general accordance with the FSTM test designations FM 5-550, FM 5-551, FM 5-552, and FM 5-553.

6.0 ENVIRONMENTAL CLASSIFICATION

Environmental classification tests were performed on recovered soil samples obtained from within the boring performed at the bridge site and from water samples obtained from D.C.I. Canal. Based on the laboratory test results and the 2025 FDOT Structure Design Guidelines (SDG), the environmental classifications of the superstructure and substructure for the bridge are classified as follows:

Superstructure Environmental Classification	Concrete Substructure Classification	Steel Substructure Classification
Slightly Aggressive	Moderately Aggressive (Soil – pH = 5.1) (Water - Resistivity = 1,400 Ohm-cm)	Extremely Aggressive (Soil - pH = 5.1)

The range of test results is presented on the **Report of Core Boring** sheet in **Appendix A.** A summary of the individual environmental classification test results is provided in **Appendix C**.

7.0 RESULTS OF SUBSURFACE EXPLORATION

7.1 General Subsurface Conditions

Generally, the boring encountered sandy soils underlain by clayey soils underlain by intermittent layers of clayey, silty and sandy soils to the boring termination elevation. Specific information on the soil conditions encountered can be found on the **Report of Core Boring** sheet in **Appendix A.** The soil descriptions and classifications associated with this project are listed in the following table.

Soil Description	USCS Symbol
SAND	SP/SP-SM
SILTY SAND	SM
CLAYEY SAND	SC
CLAY	CL

Additional borings will be performed as the project progresses beyond the BDR stage; the results will be presented in future submittals.

7.2 Groundwater

The groundwater table was encountered at a depth of approximately 8 feet below existing grades within the boring performed and is presented on the **Report of Core Boring** sheet in **Appendix A**.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e. swales, drainage ponds, underdrains and impervious areas) and creek water levels.

8.0 EVALUATIONS OF BRIDGE FOUNDATION ALTERNATIVES

Evaluations of foundation alternatives for the proposed bridge structures were based on the results of our field study. Based on our discussions with HNTB the following foundation alternatives were considered:

- Shallow Foundations
- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)
- Steel Piles, including H Sections
- Pre-stressed, Pre-cast, Square Concrete (PPSC) Piles
- Drilled Shafts

The following paragraphs discuss each of these alternatives briefly.

8.1 Shallow Foundations

With shallow foundation systems, the structure loads are supported by the bearing capacity of the foundation soils. The design of shallow foundations is typically governed by the soil bearing capacity and total and differential settlement criteria.

Loose soils were encountered within the influence zone of typical shallow foundation sizes. Based on the anticipated loading conditions for roadway bridges of this size, a shallow footing would have to be relatively large for bearing capacity and settlement criteria to be achieved or would require some form of subsurface remediation to increase the bearing capacity and decrease settlement potential.

For these reasons, shallow foundations were not considered further for this report.

8.2 Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)

GRS-IBS consists of a shallow foundation combined with a retaining wall system to provide support for single span bridges or multi-span bridges with simply supported end spans. The reasons discussed in **Section 8.1** that preclude the use of shallow foundations also apply to the GRS-IBS.

For these reasons, GRS-IBS was not considered further for this report.

8.3 Pre-Cast Pre-Stressed Square Concrete (PPSC) Piles

PPSC pile foundations are a feasible foundation alternative. They are a widely used and proven foundation system in Florida. PPSC pile foundations are readily available and generally have a lower cost per ton of capacity than other pile types. Analyses were performed for 18-inch and 24-inch PPSC piles for this Preliminary Bridge Geotechnical Report.

8.4 Steel Piles

Steel pile types include H-sections and pipe piles. Steel piles generally do not develop as much capacity for similar penetration depths as PPSC piles. Steel piles are well suited to soil conditions with high variability and where frequent pile splicing is expected and/or required due to overhead restrictions, subsurface variability, etc. Steel piles may also more easily penetrate dense layers to achieve a desired penetration depth and are less susceptible to damage compared to concrete piles. Steel H-Piles are low displacement piles, and therefore vibrations associated with installations are minimized due to the low-displacement nature of the piles. Open end pipe piles are also low displacement but will eventually become plugged at the pile toe. Closed-end pipe piles are displacement piles and would generate more end bearing capacity compared to open-end pipe piles.

A pH test value of 5.1 performed on a soil sample obtained from the bridge site results in an Extremely Aggressive Environmental Classification for steel. The SR 70 bridges over D.C.I. Canal are water-based bridges. Therefore, the use of steel H-piles is precluded per SDG Table 3.1-1. Only internally redundant steel pipe piles (i.e., closed-end pipe piles filled with concrete refer to SDG 3.1.G.2) would be permitted. Based on coordination with the Structural Engineer, steel piles were not evaluated further for the SR 70 over D.C.I. Canal bridges.

8.5 Drilled Shafts

Drilled, cast-in-place, concrete shafts have the ability to develop high axial and lateral capacities. One drilled shaft could potentially take the place of several driven piles depending on soil/rock conditions.

This type of foundation system is often the chosen alternative for sites where competent limestone is present at a relatively shallow depth and with a sufficient thickness. Drilled shafts will develop large skin friction capacities in limestone compared to dense sand, and therefore drilled shafts are most suited for sites with shallow, competent consistent limestone. Drilled shafts foundations may also be considered as a preferred foundation alternative for sites in order to limit construction induced vibrations compared to the vibrations caused by driven piles.

Limestone was not encountered within the SPT Boring performed at the bridge site. Therefore, drilled shafts were not analyzed further for this Preliminary Bridge Geotechnical Report.

9.0 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

9.1 General

Based on the subsurface conditions encountered in the test boring performed to date, it is Tierra's opinion that driven pile foundations are the most suitable foundation alternative type for the proposed bridge structures. Foundation systems comprised of 18-inch and 24-inch PPSC piles were analyzed for this Preliminary Bridge Geotechnical Report. The following sections present the results of the engineering analyses for the proposed deep foundation alternatives.

9.2 Downdrag (Negative Skin Friction)

Based on a review of preliminary cross sections, the new bridge supporting the eastbound travel lanes will be at/near the elevation of the existing bridge, and the new bridge supporting the westbound travel lanes will have new embankments (anticipated to be less than about 10 feet high) at each end bent approach. Based on the new embankments and soil conditions encountered in the boring, there will be downdrag loads imparted to the end bent piles. Actual loads will be determined following the BDR stage once a foundation alternative has been selected and the roadway geometry has been finalized. For preliminary estimation purposes, downdrag loads up to 20 tons should be anticipated at the end bent locations.

The portion of the end bent concrete piles within the embankment should be provided with a double wrap of polyethylene sheeting according to the FDOT Specifications to minimize development of downdrag loads from the embankment fill.

9.3 Scour

It is our understanding that the scour analysis will be performed by others. Tierra performed sieve analyses on soil samples collected within two feet of the mudline of Tiger Bay near the existing bridge. The results of the sieve analyses along with D_{50} values for use in the scour analysis calculations are provided on the **Grain Size Distribution Report** in **Appendix C**.

9.4 Driven Pile Axial Capacity

Axial pile capacities for the proposed bridge were analyzed based on the subsurface conditions encountered in the boring and the FDOT program FB-Deep. The Load and Resistance Factor Design (LRFD) method was utilized for the analysis.

As indicated in the FDOT Structure Design Guidelines (SDG), the required Nominal Bearing Resistance (Rn) must satisfy the following requirement:

$$\mathbf{Rn} > \frac{\mathbf{(Factored\ Design\ Load + Downdrag + Net\ Scour)}}{\phi}$$

Where ϕ = 0.75; dynamic load testing will be performed on all piles.

Other ϕ factors may be used based on the type of foundation testing recommended.

The R_n is taken as the Davisson Capacity. The Davisson axial capacity consists of the ultimate skin friction and mobilized end bearing (i.e., one-third of the ultimate end bearing). Tierra modeled the top 15 feet of the soil boring profile in the capacity analyses as a cavity layer to mimic a "starter hole" as described in FDOT Specification 455-5.1.

Driven Pile Foundation Alternative	Approximate Maximum Recommended R_n(1)
18-Inch PPSC Piles	275 tons
24-Inch PPSC Piles	425 tons
(1) Anticipate downdrag loads up to 20 tons for preliminary estimation purposes.	

The axial capacity for 18-inch and 24-inch PPSC piles were computed using the program FB-Deep. The results of the axial pile analyses are presented in **APPENDIX B**, including the axial capacity curves, FB-Deep output curves (including Davisson Capacity Curves, Ultimate Skin Friction Curves and Mobilized End Bearing Curves) and FB-Deep computer output files.

9.5 Group Action

No reductions of the individual pile capacities will be required if piles are spaced center-to-center at 3 times their width or greater.

9.6 Settlement

Settlement of pile supported bridge bents should be small and tolerable for a typical single row group. However, the tolerance should be confirmed by the structural engineer. Based on soil conditions encountered at the boring locations, and that piles will be tipped in a suitable bearing layer, individual pile head settlements are estimated to be on the order of ½ inch or less.

10.0 CONSTRUCTION CONSIDERATIONS

10.1 General

The overall site preparation and construction should be in accordance with the FDOT Specifications.

10.2 Temporary Side Slopes

Temporary side slopes and excavations should comply with the Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 C.F.R., s. 1926.650, Subpart P, all subsequent revisions or updates of OSHA's referenced standard adopted by the Department of Labor and Employment Security and Florida's Trench Safety Act, Section 553.62, Florida Statutes. Excavated materials should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth.

10.3 Groundwater Control

Depending upon groundwater levels at the time of construction, some form of dewatering may be required based on the anticipated construction activities due to perched groundwater. Due to groundwater levels anticipated during the wet season of the year, seepage may enter the bottom and sides of excavated areas. Such seepage will act to loosen soils and create difficult working conditions. Groundwater levels should be determined immediately prior to construction.

Shallow groundwater should be kept below the lowest working area to facilitate proper material placement and compaction in accordance with the FDOT Specifications.

10.4 Dynamic Load Testing & Pile Installation

We recommend that a test pile program be conducted for the proposed bridge construction including test piles. The monitoring will provide estimates of pile capacity versus pile penetration, stresses in the pile, and other relevant parameters used to evaluate the pile driving process. analyses should be performed on selected conditions for evaluation of the dynamic test results. The results of these analyses will provide information for developing production pile lengths. In addition, all production piles will be dynamically monitored.

The installation of the piles should be carried out in accordance with the FDOT Specifications.

10.5 Protection of Existing Structures

The FDOT Specifications should be followed for protection of existing structures during foundation construction operations.

11.0 REPORT LIMITATIONS

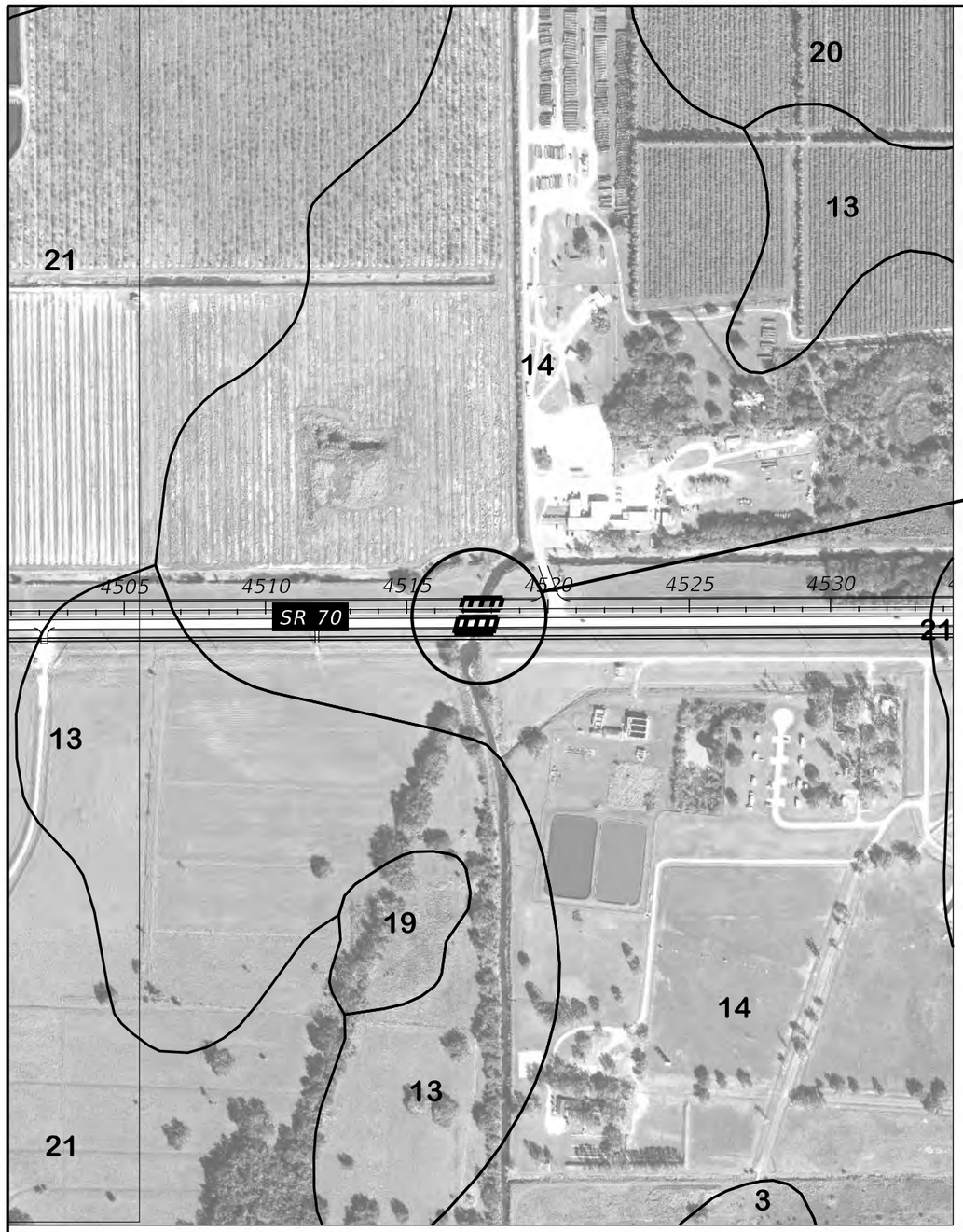
Our services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions, or recommendations made by others based on this data.

The scope of the investigation was intended to evaluate soil conditions within the influence zone of the deep foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil boring performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed structure.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of the HNTB design team and the Florida Department of Transportation.

APPENDIX A

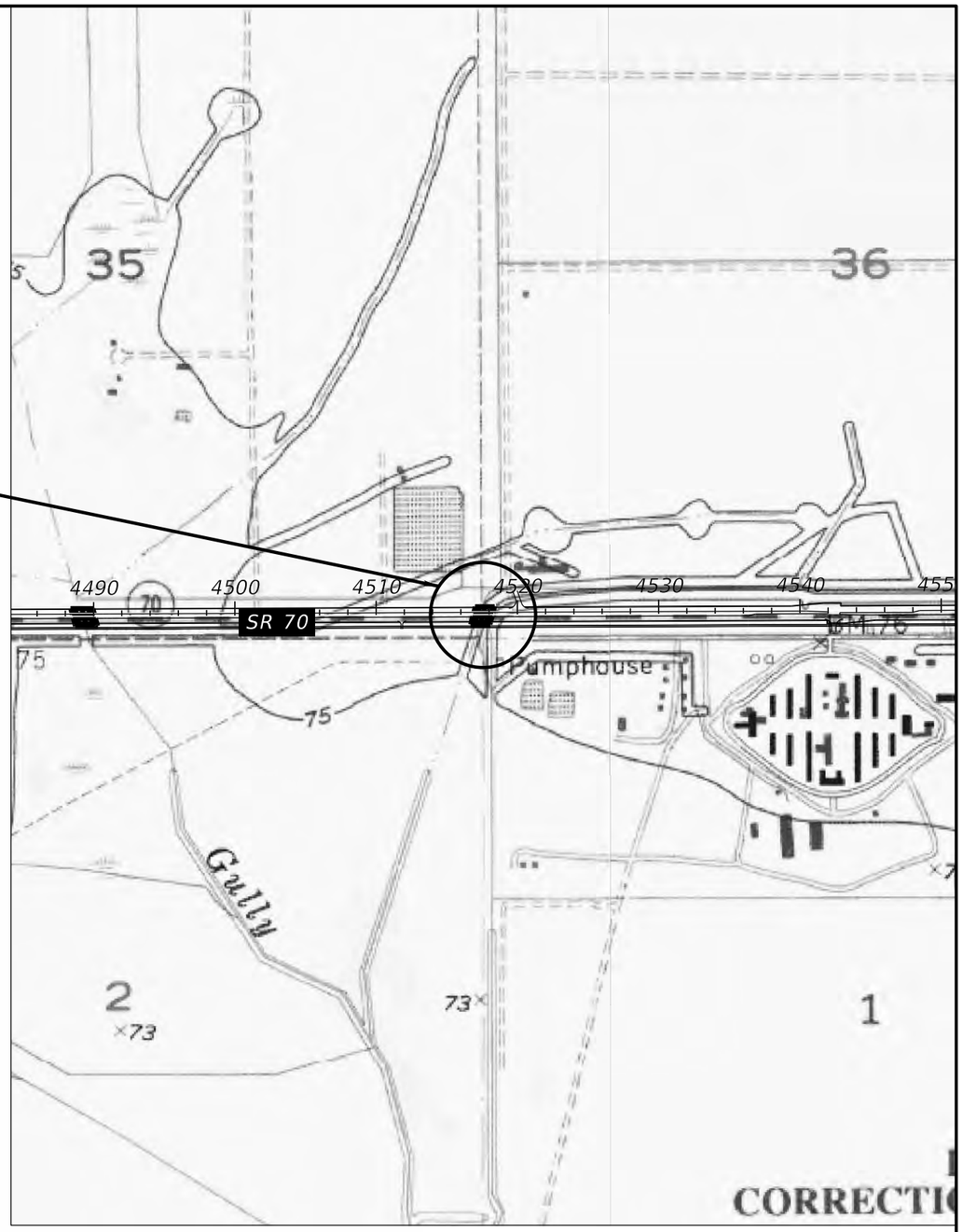
USDA Soil Survey & USGS Quadrangle Maps
Report of Core Boring (1 Sheet)



REFERENCE: USDA SOIL SURVEY OF DESOTO COUNTY, FLORIDA

N

APPROXIMATE BRIDGE LOCATION



REFERENCE: USGS QUADRANGLE MAP OF "LONG ISLAND MARSH NW, FLORIDA"

0 100 500
Feet

TOWNSHIP: 37S
RANGE: 26E
SECTION: 35, 36

0 200 1000
Feet

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

DYLAN A. NELSON, P.E.
License Number: 96772
TIERRA, INC.
7351 TEMPLE TERRACE HIGHWAY
TAMPA, FLORIDA 33637

DRAWN BY: BJS 02-25
CHECKED BY: DAN 02-25
DESIGNED BY: BJS 02-25
CHECKED BY: DAN 02-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

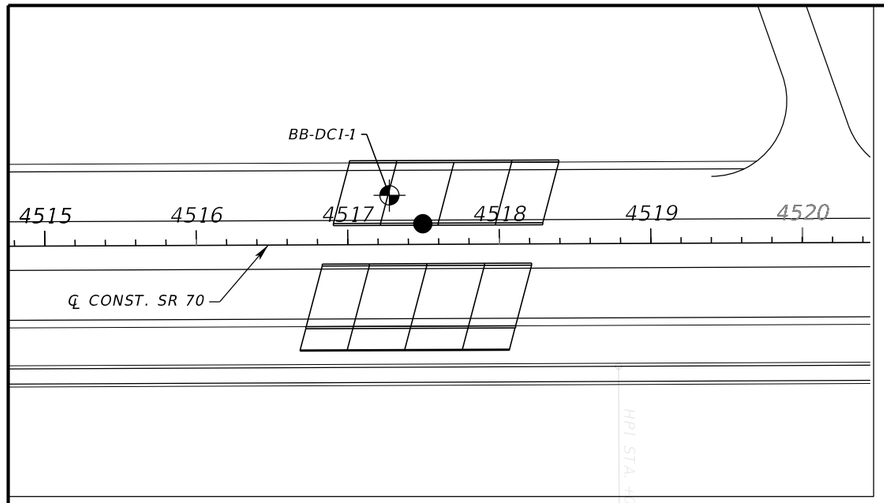
SHEET TITLE: USDA SOIL SURVEY & USGS QUADRANGLE MAPS

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

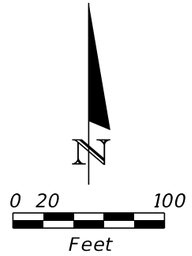
REF. DWG. NO.

SHEET NO.

J:\6511\2024 Files\6511-24-001 SR 70 Segments 9 & 10\ORD\6511-24-001\Geotechnical\USDA_USGS_05DCI.dgn : USDA_USGS_BRIDGE05 SHEET
bsawaska 2/17/2025 2:38:18 PM



BORING LOCATION PLAN



NOTES:

1. THE BORING LOCATIONS AND ELEVATIONS WERE PROVIDED BY THE PROJECT SURVEYOR.
2. BASED ON A REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION AT THE BRIDGE SITE IS REPORTED TO RANGE FROM APPROXIMATELY +50 FEET TO +60 FEET, NGVD 29. ARTESIAN CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED.

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: MODERATELY AGGRESSIVE (SOIL - pH = 5.1, WATER - RESISTIVITY = 1,400 OHM-CM)
SUBSTRUCTURE	STEEL: EXTREMELY AGGRESSIVE (SOIL - pH = 5.1)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

SOIL TEST RESULTS:

RESISTIVITY	16,000 TO 28,000 OHM-CM
CHLORIDES	15 TO 30 PPM
SULFATES	<5 TO 63 PPM
pH	5.1 TO 6.2

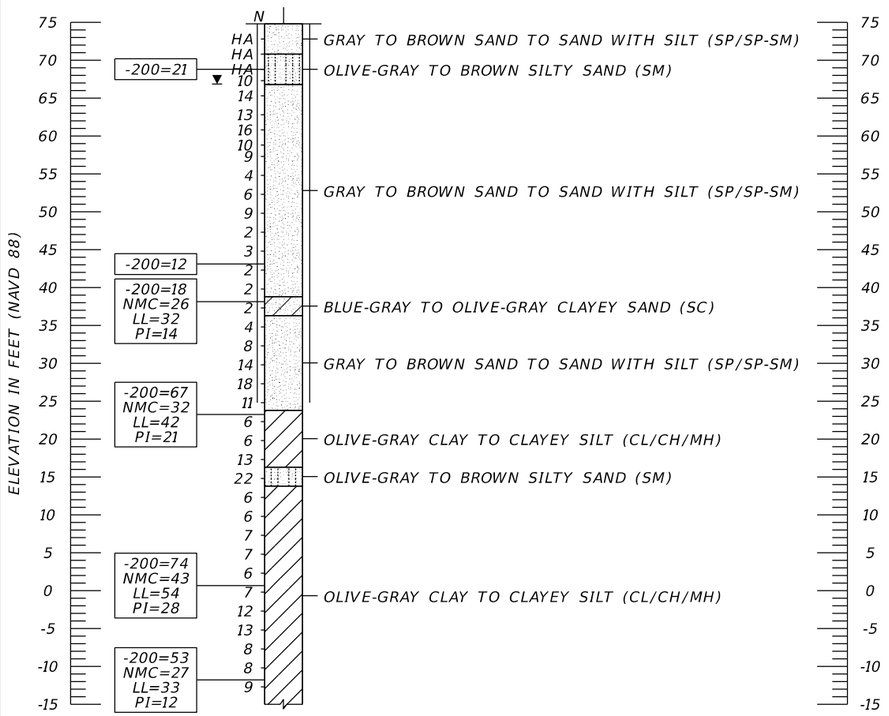
WATER TEST RESULTS:

RESISTIVITY	1,400 TO 1,700 OHM-CM
CHLORIDES	45 TO 90 PPM
SULFATES	180 PPM
pH	7.4 TO 7.8

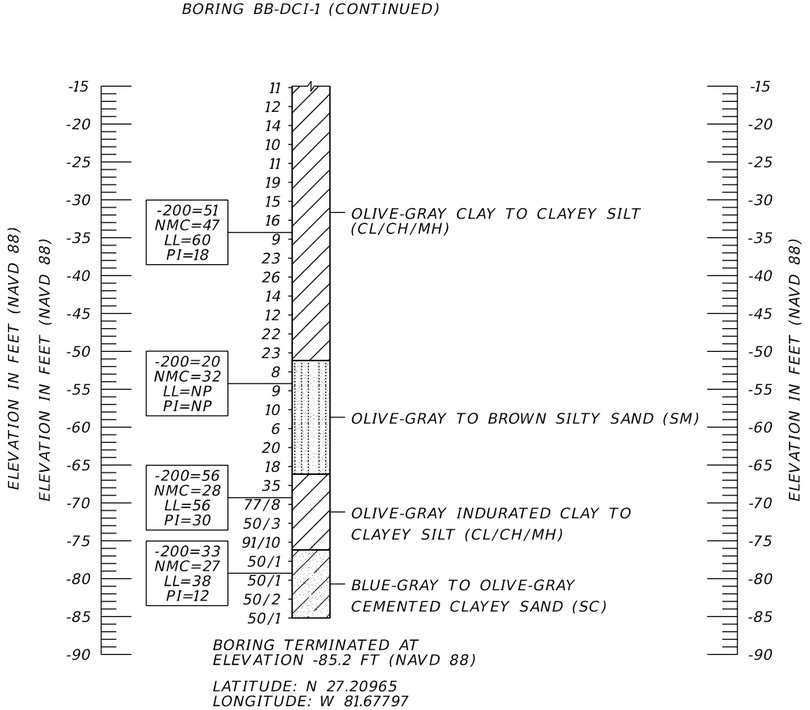
LEGEND

	SAND
	CLAYEY SAND
	SILTY SAND
	CLAY TO CLAYEY SILT
SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCE
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON-PLASTIC
NAVD 88	NORTH AMERICAN VERTICAL DATUM OF 1988
	APPROXIMATE SPT BORING LOCATION
	GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
	CASING
	APPROXIMATE SEDIMENT SAMPLE LOCATION FOR D_{50} DETERMINATION

BOR # BB-DCI-1
STA. 4517+28
REF. ℄ CONST. SR 70
OFF. 32' LT.
ELEV. 74.8
DATE 1/20/2025
DRILLER J. BOOTH
HAMMER AUTOMATIC
RIG D-25



BORING BB-DCI-1 (CONTINUED)



BORING TERMINATED AT ELEVATION -85.2 FT (NAVD 88)

LATITUDE: N 27.20965
LONGITUDE: W 81.67797

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

BRIDGE NOS. XXXXXX & XXXXXX

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

DYLAN A. NELSON, P.E.
License Number: 96772
TIERRA, INC.
7351 TEMPLE TERRACE HIGHWAY
TAMPA, FLORIDA 33637

DRAWN BY: BJS 02-25
CHECKED BY: DAN 02-25
DESIGNED BY: BJS 02-25
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: REPORT OF CORE BORINGS (1)

REF. DWG. NO.

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

SHEET NO.

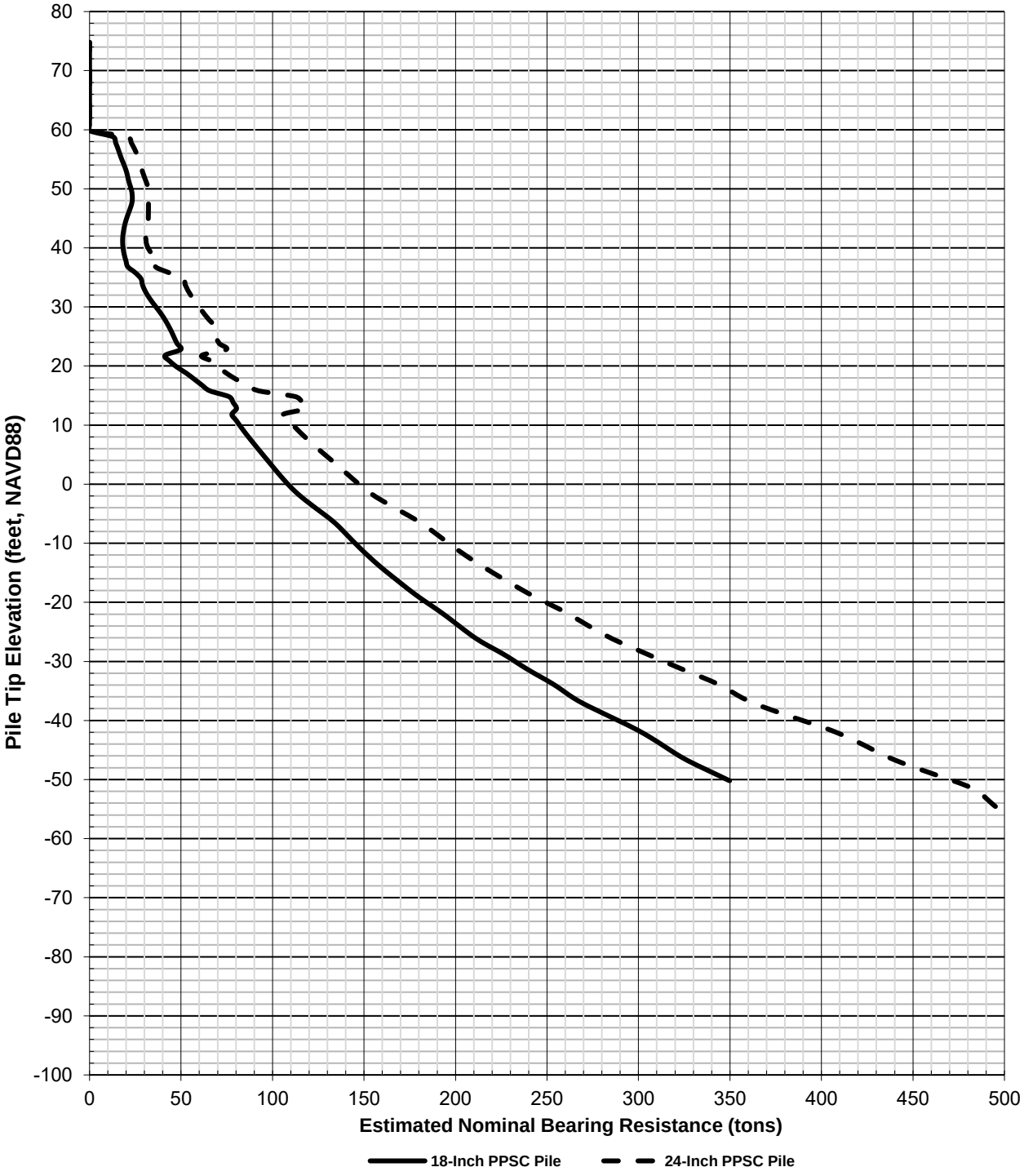
THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

J:\6511\2024 Files\6511-24-001 SR 70 Segments 9 & 10\ORD\6511-24-001\Geotechnical\B5BoringDCI01.dgn : RCB_DCI01 [SHEET]
bsawaska 2/21/2025 8:59:52 AM

APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

SR 70 over D.C.I. Canal
SPT Boring BB-DCI-1



TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	FEB 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over D.C.I. Canal
DeSoto County, FL
FPID No. 451942-2-52-01

General Information:
==========
Input file: .....R 70 Segments 9 & 10\FBDeep\DCI\BB-DCI-1_18-Inch_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
==========
Analysis Type: SPT

Soil Information:
==========
Boring date: 1/20/2025, Boring Number: BB-DCI-1
Station number: 4517+28 Offset: 32' LT.

Ground Elevation: 74.800(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	10.00	5- Cavity layer
6	10.00	14.00	5- Cavity layer
7	12.00	13.00	5- Cavity layer
8	14.00	16.00	5- Cavity layer
9	16.00	10.00	3- Clean sand
10	17.50	9.00	3- Clean sand
11	20.00	4.00	3- Clean sand
12	22.50	6.00	3- Clean sand
13	25.00	9.00	3- Clean sand
14	27.50	2.00	3- Clean sand
15	30.00	3.00	3- Clean sand
16	32.50	2.00	3- Clean sand
17	35.00	2.00	3- Clean sand
18	37.50	2.00	2- Clay and silty sand
19	40.00	4.00	3- Clean sand

20	42.50	8.00	3- Clean sand
21	45.00	14.00	3- Clean sand
22	47.50	18.00	3- Clean sand
23	50.00	11.00	3- Clean sand
24	52.50	6.00	1- Plastic Clay
25	55.00	6.00	1- Plastic Clay
26	57.50	13.00	1- Plastic Clay
27	60.00	22.00	2- Clay and silty sand
28	62.50	6.00	1- Plastic Clay
29	65.00	6.00	1- Plastic Clay
30	67.50	7.00	1- Plastic Clay
31	70.00	7.00	1- Plastic Clay
32	72.50	6.00	1- Plastic Clay
33	75.00	7.00	1- Plastic Clay
34	77.50	12.00	1- Plastic Clay
35	80.00	13.00	1- Plastic Clay
36	82.50	8.00	1- Plastic Clay
37	85.00	8.00	1- Plastic Clay
38	87.50	9.00	1- Plastic Clay
39	90.00	11.00	1- Plastic Clay
40	92.50	12.00	1- Plastic Clay
41	95.00	14.00	1- Plastic Clay
42	97.50	10.00	1- Plastic Clay
43	100.00	11.00	1- Plastic Clay
44	102.50	19.00	1- Plastic Clay
45	105.00	15.00	1- Plastic Clay
46	107.50	16.00	1- Plastic Clay
47	110.00	9.00	1- Plastic Clay
48	112.50	23.00	1- Plastic Clay
49	115.00	26.00	1- Plastic Clay
50	117.50	14.00	1- Plastic Clay
51	120.00	12.00	1- Plastic Clay
52	122.50	22.00	1- Plastic Clay
53	125.00	23.00	1- Plastic Clay
54	127.50	8.00	2- Clay and silty sand
55	130.00	9.00	2- Clay and silty sand
56	132.50	10.00	2- Clay and silty sand
57	135.00	6.00	2- Clay and silty sand
58	137.50	20.00	2- Clay and silty sand
59	140.00	18.00	2- Clay and silty sand
60	142.50	35.00	1- Plastic Clay
61	145.00	100.00	1- Plastic Clay
62	147.50	50.00	1- Plastic Clay
63	150.00	100.00	1- Plastic Clay
64	152.50	100.00	2- Clay and silty sand
65	155.00	100.00	2- Clay and silty sand
66	157.50	100.00	2- Clay and silty sand
67	160.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	74.80	58.80	16.00	8.12	5-Void
2	58.80	37.30	21.50	5.00	3-Clean Sand
3	37.30	34.80	2.50	2.00	2-Clay and Silty Sand
4	34.80	22.30	12.50	11.00	3-Clean Sand
5	22.30	14.80	7.50	8.33	1-Plastic Clay
6	14.80	12.30	2.50	22.00	2-Clay and Silty Sand
7	12.30	-52.70	65.00	12.54	1-Plastic Clay
8	-52.70	-67.70	15.00	11.83	2-Clay and Silty Sand
9	-67.70	-77.70	10.00	71.25	1-Plastic Clay
10	-77.70	-85.20	7.50	100.00	2-Clay and Silty Sand

Driven Pile Data:

Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	73.80
18.00	2.00	72.80
18.00	3.00	71.80
18.00	4.00	70.80
18.00	5.00	69.80
18.00	6.00	68.80
18.00	7.00	67.80
18.00	8.00	66.80
18.00	9.00	65.80
18.00	10.00	64.80
18.00	11.00	63.80
18.00	12.00	62.80
18.00	13.00	61.80
18.00	14.00	60.80
18.00	15.00	59.80
18.00	16.00	58.80
18.00	17.00	57.80
18.00	18.00	56.80
18.00	19.00	55.80
18.00	20.00	54.80

18.00	21.00	53.80
18.00	22.00	52.80
18.00	23.00	51.80
18.00	24.00	50.80
18.00	25.00	49.80
18.00	26.00	48.80
18.00	27.00	47.80
18.00	28.00	46.80
18.00	29.00	45.80
18.00	30.00	44.80
18.00	31.00	43.80
18.00	32.00	42.80
18.00	33.00	41.80
18.00	34.00	40.80
18.00	35.00	39.80
18.00	36.00	38.80
18.00	37.00	37.80
18.00	38.00	36.80
18.00	39.00	35.80
18.00	40.00	34.80
18.00	41.00	33.80
18.00	42.00	32.80
18.00	43.00	31.80
18.00	44.00	30.80
18.00	45.00	29.80
18.00	46.00	28.80
18.00	47.00	27.80
18.00	48.00	26.80
18.00	49.00	25.80
18.00	50.00	24.80
18.00	51.00	23.80
18.00	52.00	22.80
18.00	53.00	21.80
18.00	54.00	20.80
18.00	55.00	19.80
18.00	56.00	18.80
18.00	57.00	17.80
18.00	58.00	16.80
18.00	59.00	15.80
18.00	60.00	14.80
18.00	61.00	13.80
18.00	62.00	12.80
18.00	63.00	11.80
18.00	64.00	10.80
18.00	65.00	9.80
18.00	66.00	8.80
18.00	67.00	7.80
18.00	68.00	6.80
18.00	69.00	5.80
18.00	70.00	4.80

18.00	71.00	3.80
18.00	72.00	2.80
18.00	73.00	1.80
18.00	74.00	0.80
18.00	75.00	-0.20
18.00	76.00	-1.20
18.00	77.00	-2.20
18.00	78.00	-3.20
18.00	79.00	-4.20
18.00	80.00	-5.20
18.00	81.00	-6.20
18.00	82.00	-7.20
18.00	83.00	-8.20
18.00	84.00	-9.20
18.00	85.00	-10.20
18.00	86.00	-11.20
18.00	87.00	-12.20
18.00	88.00	-13.20
18.00	89.00	-14.20
18.00	90.00	-15.20
18.00	91.00	-16.20
18.00	92.00	-17.20
18.00	93.00	-18.20
18.00	94.00	-19.20
18.00	95.00	-20.20
18.00	96.00	-21.20
18.00	97.00	-22.20
18.00	98.00	-23.20
18.00	99.00	-24.20
18.00	100.00	-25.20
18.00	101.00	-26.20
18.00	102.00	-27.20
18.00	103.00	-28.20
18.00	104.00	-29.20
18.00	105.00	-30.20
18.00	106.00	-31.20
18.00	107.00	-32.20
18.00	108.00	-33.20
18.00	109.00	-34.20
18.00	110.00	-35.20
18.00	111.00	-36.20
18.00	112.00	-37.20
18.00	113.00	-38.20
18.00	114.00	-39.20
18.00	115.00	-40.20
18.00	116.00	-41.20
18.00	117.00	-42.20
18.00	118.00	-43.20
18.00	119.00	-44.20
18.00	120.00	-45.20

18.00	121.00	-46.20
18.00	122.00	-47.20
18.00	123.00	-48.20
18.00	124.00	-49.20
18.00	125.00	-50.20
18.00	126.00	-51.20
18.00	127.00	-52.20
18.00	128.00	-53.20
18.00	129.00	-54.20
18.00	130.00	-55.20
18.00	131.00	-56.20
18.00	132.00	-57.20
18.00	133.00	-58.20
18.00	134.00	-59.20
18.00	135.00	-60.20
18.00	136.00	-61.20
18.00	137.00	-62.20
18.00	138.00	-63.20
18.00	139.00	-64.20
18.00	140.00	-65.20
18.00	141.00	-66.20
18.00	142.00	-67.20
18.00	143.00	-68.20
18.00	144.00	-69.20
18.00	145.00	-70.20
18.00	146.00	-71.20
18.00	147.00	-72.20
18.00	148.00	-73.20
18.00	149.00	-74.20
18.00	150.00	-75.20
18.00	151.00	-76.20
18.00	152.00	-77.20
18.00	153.00	-78.20
18.00	154.00	-79.20
18.00	155.00	-80.20
18.00	156.00	-81.20
18.00	157.00	-82.20
18.00	158.00	-83.20
18.00	159.00	-84.20
18.00	160.00	-85.20

Driven Pile Capacity:
==========

Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	0.00	0.00	0.00	0.00
4.00	18.0	0.00	0.00	0.00	0.00	0.00
5.00	18.0	0.00	0.00	0.00	0.00	0.00
6.00	18.0	0.00	0.00	0.00	0.00	0.00
7.00	18.0	0.00	0.00	0.00	0.00	0.00
8.00	18.0	0.00	0.00	0.00	0.00	0.00
9.00	18.0	0.00	0.00	0.00	0.00	0.00
10.00	18.0	0.00	0.00	0.00	0.00	0.00
11.00	18.0	0.00	0.00	0.00	0.00	0.00
12.00	18.0	0.00	0.00	0.00	0.00	0.00
13.00	18.0	0.00	0.00	0.00	0.00	0.00
14.00	18.0	0.00	0.00	0.00	0.00	0.00
15.00	18.0	0.35	0.00	0.35	0.18	0.35
16.00	18.0	1.41	11.48	12.89	6.45	35.85
17.00	18.0	2.78	11.47	14.25	7.12	37.18
18.00	18.0	3.96	11.56	15.52	7.76	38.64
19.00	18.0	4.70	11.94	16.63	8.32	40.51
20.00	18.0	5.03	12.81	17.84	8.92	43.47
21.00	18.0	5.41	13.75	19.16	9.58	46.66
22.00	18.0	6.10	14.16	20.26	10.13	48.59
23.00	18.0	7.07	13.96	21.03	10.52	48.95
24.00	18.0	8.21	13.67	21.89	10.94	49.23
25.00	18.0	9.53	13.35	22.88	11.44	49.58
26.00	18.0	10.55	12.80	23.34	11.67	48.94
27.00	18.0	11.08	12.17	23.25	11.62	47.59
28.00	18.0	11.21	11.15	22.36	11.18	44.67
29.00	18.0	11.41	9.76	21.18	10.59	40.71
30.00	18.0	11.77	8.29	20.06	10.03	36.63
31.00	18.0	12.13	7.04	19.17	9.58	33.24
32.00	18.0	12.32	6.22	18.55	9.27	31.00
33.00	18.0	12.37	5.78	18.15	9.08	29.72
34.00	18.0	12.39	5.70	18.10	9.05	29.51
35.00	18.0	12.42	5.97	18.39	9.19	30.34
36.00	18.0	12.43	6.56	18.99	9.49	32.10
37.00	18.0	12.45	7.44	19.89	9.95	34.77
38.00	18.0	12.82	8.10	20.92	10.46	37.12
39.00	18.0	13.05	11.95	25.00	12.50	48.91
40.00	18.0	13.50	14.58	28.08	14.04	57.25
41.00	18.0	14.06	14.83	28.89	14.44	58.56
42.00	18.0	14.62	15.60	30.21	15.11	61.40

43.00	18.0	15.24	16.83	32.07	16.03	65.73
44.00	18.0	16.05	18.26	34.32	17.16	70.84
45.00	18.0	17.14	19.64	36.78	18.39	76.07
46.00	18.0	18.56	20.63	39.19	19.59	80.44
47.00	18.0	20.41	20.90	41.30	20.65	83.10
48.00	18.0	22.74	20.39	43.13	21.57	83.92
49.00	18.0	25.06	19.75	44.81	22.40	84.31
50.00	18.0	27.16	19.12	46.28	23.14	84.53
51.00	18.0	29.20	18.65	47.84	23.92	85.13
52.00	18.0	31.33	18.53	49.85	24.93	86.91
53.00	18.0	36.23	5.03	41.26	20.63	51.33
54.00	18.0	37.99	5.94	43.93	21.97	55.82
55.00	18.0	39.40	8.44	47.84	23.92	64.72
56.00	18.0	41.79	11.04	52.83	26.41	74.91
57.00	18.0	45.22	11.88	57.10	28.55	80.86
58.00	18.0	49.47	11.82	61.29	30.64	84.92
59.00	18.0	54.33	11.43	65.75	32.88	88.60
60.00	18.0	62.37	13.91	76.29	38.14	104.11
61.00	18.0	67.56	10.97	78.53	39.27	100.48
62.00	18.0	71.29	9.03	80.32	40.16	98.37
63.00	18.0	73.76	4.03	77.79	38.89	85.85
64.00	18.0	76.04	4.09	80.14	40.07	88.32
65.00	18.0	78.28	4.14	82.42	41.21	90.71
66.00	18.0	80.61	4.20	84.81	42.41	93.22
67.00	18.0	83.10	4.22	87.33	43.66	95.77
68.00	18.0	85.72	4.22	89.94	44.97	98.37
69.00	18.0	88.35	4.22	92.57	46.29	101.02
70.00	18.0	90.99	4.24	95.23	47.61	103.71
71.00	18.0	93.55	4.36	97.91	48.95	106.63
72.00	18.0	95.97	4.61	100.58	50.29	109.80
73.00	18.0	98.29	4.97	103.26	51.63	113.19
74.00	18.0	100.72	5.34	106.06	53.03	116.74
75.00	18.0	103.28	5.73	109.01	54.51	120.47
76.00	18.0	106.24	6.00	112.24	56.12	124.24
77.00	18.0	109.83	6.08	115.91	57.96	128.07
78.00	18.0	114.00	6.00	120.00	60.00	132.00
79.00	18.0	118.36	5.88	124.24	62.12	136.01
80.00	18.0	122.83	5.75	128.57	64.29	140.06
81.00	18.0	127.05	5.65	132.70	66.35	144.00
82.00	18.0	130.64	5.65	136.29	68.15	147.60
83.00	18.0	133.69	5.75	139.44	69.72	150.95
84.00	18.0	136.67	5.92	142.59	71.29	154.42
85.00	18.0	139.64	6.14	145.78	72.89	158.07
86.00	18.0	142.68	6.38	149.06	74.53	161.83
87.00	18.0	145.85	6.63	152.48	76.24	165.73
88.00	18.0	149.17	6.85	156.02	78.01	169.72
89.00	18.0	152.73	7.04	159.77	79.88	173.85
90.00	18.0	156.53	7.20	163.74	81.87	178.15
91.00	18.0	160.53	7.27	167.80	83.90	182.34
92.00	18.0	164.65	7.21	171.86	85.93	186.29

93.00	18.0	168.90	7.10	176.00	88.00	190.19
94.00	18.0	173.37	7.03	180.40	90.20	194.46
95.00	18.0	178.07	7.01	185.08	92.54	199.11
96.00	18.0	182.64	7.17	189.81	94.91	204.15
97.00	18.0	186.75	7.58	194.32	97.16	209.47
98.00	18.0	190.45	8.14	198.58	99.29	214.86
99.00	18.0	194.19	8.60	202.79	101.40	219.99
100.00	18.0	198.07	8.93	207.00	103.50	224.87

Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	18.0	202.44	9.18	211.61	105.81	229.97
102.00	18.0	207.67	9.31	216.98	108.49	235.61
103.00	18.0	213.61	9.31	222.92	111.46	241.53
104.00	18.0	219.30	9.16	228.47	114.23	246.79
105.00	18.0	224.59	8.90	233.50	116.75	251.30
106.00	18.0	229.74	8.84	238.58	119.29	256.27
107.00	18.0	234.99	9.10	244.08	122.04	262.28
108.00	18.0	240.23	9.63	249.86	124.93	269.12
109.00	18.0	244.76	10.37	255.14	127.57	275.89
110.00	18.0	248.48	11.32	259.79	129.90	282.42
111.00	18.0	252.51	12.01	264.52	132.26	288.54
112.00	18.0	258.01	12.20	270.21	135.11	294.61
113.00	18.0	264.81	11.94	276.75	138.38	300.63
114.00	18.0	271.99	11.47	283.46	141.73	306.41
115.00	18.0	279.39	10.85	290.24	145.12	311.95
116.00	18.0	286.35	10.49	296.84	148.42	317.82
117.00	18.0	292.25	10.58	302.83	151.42	324.00
118.00	18.0	297.17	11.03	308.20	154.10	330.25
119.00	18.0	301.75	11.54	313.29	156.65	336.37
120.00	18.0	306.11	12.10	318.21	159.10	342.41
121.00	18.0	310.85	12.59	323.44	161.72	348.63
122.00	18.0	316.60	12.90	329.50	164.75	355.31
123.00	18.0	323.24	12.98	336.23	168.11	362.20
124.00	18.0	330.08	12.94	343.02	171.51	368.89
125.00	18.0	337.00	12.79	349.79	174.90	375.38
126.00	18.0	343.09	12.69	355.77	177.89	381.14
127.00	18.0	347.43	12.67	360.10	180.05	385.43
128.00	18.0	350.39	12.71	363.10	181.55	388.51
129.00	18.0	353.11	12.68	365.80	182.90	391.16
130.00	18.0	355.94	12.53	368.47	184.23	393.52

131.00	18.0	358.79	12.81	371.60	185.80	397.21
132.00	18.0	361.19	13.69	374.88	187.44	402.26
133.00	18.0	363.42	15.40	378.81	189.41	409.60
134.00	18.0	365.79	17.17	382.97	191.48	417.31
135.00	18.0	368.08	18.63	386.71	193.35	423.96
136.00	18.0	370.79	19.75	390.54	195.27	430.05
137.00	18.0	374.81	20.27	395.09	197.54	435.63
138.00	18.0	379.99	20.41	400.40	200.20	441.22
139.00	18.0	385.23	20.92	406.15	203.07	447.98
140.00	18.0	390.33	21.85	412.19	206.09	455.89
141.00	18.0	396.05	22.94	418.99	209.49	464.87
142.00	18.0	403.12	24.09	427.21	213.61	475.39
143.00	18.0	414.18	24.78	438.96	219.48	488.53
144.00	18.0	422.47	25.47	447.94	223.97	498.89
145.00	18.0	430.83	26.71	457.54	228.77	510.95
146.00	18.0	439.44	29.06	468.50	234.25	526.62
147.00	18.0	448.42	32.65	481.07	240.54	546.37
148.00	18.0	457.41	37.23	494.63	247.32	569.08
149.00	18.0	466.39	41.50	507.89	253.95	590.90
150.00	18.0	475.37	45.48	520.85	260.43	611.82
151.00	18.0	484.14	49.03	533.16	266.58	631.22
152.00	18.0	492.45	51.75	544.21	272.10	647.71
153.00	18.0	501.82	52.89	554.71	277.36	660.50
154.00	18.0	509.19	53.55	562.74	281.37	669.84
155.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
156.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
157.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
158.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
159.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
160.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....R 70 Segments 9 & 10\FBDeep\DCI\BB-DCI-1_24-Inch_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 1/20/2025, Boring Number: BB-DCI-1
Station number: 4517+28 Offset: 32' LT.

Ground Elevation: 74.800(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	10.00	5- Cavity layer
6	10.00	14.00	5- Cavity layer
7	12.00	13.00	5- Cavity layer
8	14.00	16.00	5- Cavity layer
9	16.00	10.00	3- Clean sand
10	17.50	9.00	3- Clean sand
11	20.00	4.00	3- Clean sand
12	22.50	6.00	3- Clean sand
13	25.00	9.00	3- Clean sand
14	27.50	2.00	3- Clean sand
15	30.00	3.00	3- Clean sand
16	32.50	2.00	3- Clean sand
17	35.00	2.00	3- Clean sand
18	37.50	2.00	2- Clay and silty sand
19	40.00	4.00	3- Clean sand

20	42.50	8.00	3- Clean sand
21	45.00	14.00	3- Clean sand
22	47.50	18.00	3- Clean sand
23	50.00	11.00	3- Clean sand
24	52.50	6.00	1- Plastic Clay
25	55.00	6.00	1- Plastic Clay
26	57.50	13.00	1- Plastic Clay
27	60.00	22.00	2- Clay and silty sand
28	62.50	6.00	1- Plastic Clay
29	65.00	6.00	1- Plastic Clay
30	67.50	7.00	1- Plastic Clay
31	70.00	7.00	1- Plastic Clay
32	72.50	6.00	1- Plastic Clay
33	75.00	7.00	1- Plastic Clay
34	77.50	12.00	1- Plastic Clay
35	80.00	13.00	1- Plastic Clay
36	82.50	8.00	1- Plastic Clay
37	85.00	8.00	1- Plastic Clay
38	87.50	9.00	1- Plastic Clay
39	90.00	11.00	1- Plastic Clay
40	92.50	12.00	1- Plastic Clay
41	95.00	14.00	1- Plastic Clay
42	97.50	10.00	1- Plastic Clay
43	100.00	11.00	1- Plastic Clay
44	102.50	19.00	1- Plastic Clay
45	105.00	15.00	1- Plastic Clay
46	107.50	16.00	1- Plastic Clay
47	110.00	9.00	1- Plastic Clay
48	112.50	23.00	1- Plastic Clay
49	115.00	26.00	1- Plastic Clay
50	117.50	14.00	1- Plastic Clay
51	120.00	12.00	1- Plastic Clay
52	122.50	22.00	1- Plastic Clay
53	125.00	23.00	1- Plastic Clay
54	127.50	8.00	2- Clay and silty sand
55	130.00	9.00	2- Clay and silty sand
56	132.50	10.00	2- Clay and silty sand
57	135.00	6.00	2- Clay and silty sand
58	137.50	20.00	2- Clay and silty sand
59	140.00	18.00	2- Clay and silty sand
60	142.50	35.00	1- Plastic Clay
61	145.00	100.00	1- Plastic Clay
62	147.50	50.00	1- Plastic Clay
63	150.00	100.00	1- Plastic Clay
64	152.50	100.00	2- Clay and silty sand
65	155.00	100.00	2- Clay and silty sand
66	157.50	100.00	2- Clay and silty sand
67	160.00	100.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	74.80	58.80	16.00	8.12	5-Void
2	58.80	37.30	21.50	5.00	3-Clean Sand
3	37.30	34.80	2.50	2.00	2-Clay and Silty Sand
4	34.80	22.30	12.50	11.00	3-Clean Sand
5	22.30	14.80	7.50	8.33	1-Plastic Clay
6	14.80	12.30	2.50	22.00	2-Clay and Silty Sand
7	12.30	-52.70	65.00	12.54	1-Plastic Clay
8	-52.70	-67.70	15.00	11.83	2-Clay and Silty Sand
9	-67.70	-77.70	10.00	71.25	1-Plastic Clay
10	-77.70	-85.20	7.50	100.00	2-Clay and Silty Sand

Driven Pile Data:

Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
24.00	1.00	73.80
24.00	2.00	72.80
24.00	3.00	71.80
24.00	4.00	70.80
24.00	5.00	69.80
24.00	6.00	68.80
24.00	7.00	67.80
24.00	8.00	66.80
24.00	9.00	65.80
24.00	10.00	64.80
24.00	11.00	63.80
24.00	12.00	62.80
24.00	13.00	61.80
24.00	14.00	60.80
24.00	15.00	59.80
24.00	16.00	58.80
24.00	17.00	57.80
24.00	18.00	56.80
24.00	19.00	55.80
24.00	20.00	54.80

24.00	21.00	53.80
24.00	22.00	52.80
24.00	23.00	51.80
24.00	24.00	50.80
24.00	25.00	49.80
24.00	26.00	48.80
24.00	27.00	47.80
24.00	28.00	46.80
24.00	29.00	45.80
24.00	30.00	44.80
24.00	31.00	43.80
24.00	32.00	42.80
24.00	33.00	41.80
24.00	34.00	40.80
24.00	35.00	39.80
24.00	36.00	38.80
24.00	37.00	37.80
24.00	38.00	36.80
24.00	39.00	35.80
24.00	40.00	34.80
24.00	41.00	33.80
24.00	42.00	32.80
24.00	43.00	31.80
24.00	44.00	30.80
24.00	45.00	29.80
24.00	46.00	28.80
24.00	47.00	27.80
24.00	48.00	26.80
24.00	49.00	25.80
24.00	50.00	24.80
24.00	51.00	23.80
24.00	52.00	22.80
24.00	53.00	21.80
24.00	54.00	20.80
24.00	55.00	19.80
24.00	56.00	18.80
24.00	57.00	17.80
24.00	58.00	16.80
24.00	59.00	15.80
24.00	60.00	14.80
24.00	61.00	13.80
24.00	62.00	12.80
24.00	63.00	11.80
24.00	64.00	10.80
24.00	65.00	9.80
24.00	66.00	8.80
24.00	67.00	7.80
24.00	68.00	6.80
24.00	69.00	5.80
24.00	70.00	4.80

24.00	71.00	3.80
24.00	72.00	2.80
24.00	73.00	1.80
24.00	74.00	0.80
24.00	75.00	-0.20
24.00	76.00	-1.20
24.00	77.00	-2.20
24.00	78.00	-3.20
24.00	79.00	-4.20
24.00	80.00	-5.20
24.00	81.00	-6.20
24.00	82.00	-7.20
24.00	83.00	-8.20
24.00	84.00	-9.20
24.00	85.00	-10.20
24.00	86.00	-11.20
24.00	87.00	-12.20
24.00	88.00	-13.20
24.00	89.00	-14.20
24.00	90.00	-15.20
24.00	91.00	-16.20
24.00	92.00	-17.20
24.00	93.00	-18.20
24.00	94.00	-19.20
24.00	95.00	-20.20
24.00	96.00	-21.20
24.00	97.00	-22.20
24.00	98.00	-23.20
24.00	99.00	-24.20
24.00	100.00	-25.20
24.00	101.00	-26.20
24.00	102.00	-27.20
24.00	103.00	-28.20
24.00	104.00	-29.20
24.00	105.00	-30.20
24.00	106.00	-31.20
24.00	107.00	-32.20
24.00	108.00	-33.20
24.00	109.00	-34.20
24.00	110.00	-35.20
24.00	111.00	-36.20
24.00	112.00	-37.20
24.00	113.00	-38.20
24.00	114.00	-39.20
24.00	115.00	-40.20
24.00	116.00	-41.20
24.00	117.00	-42.20
24.00	118.00	-43.20
24.00	119.00	-44.20
24.00	120.00	-45.20

24.00	121.00	-46.20
24.00	122.00	-47.20
24.00	123.00	-48.20
24.00	124.00	-49.20
24.00	125.00	-50.20
24.00	126.00	-51.20
24.00	127.00	-52.20
24.00	128.00	-53.20
24.00	129.00	-54.20
24.00	130.00	-55.20
24.00	131.00	-56.20
24.00	132.00	-57.20
24.00	133.00	-58.20
24.00	134.00	-59.20
24.00	135.00	-60.20
24.00	136.00	-61.20
24.00	137.00	-62.20
24.00	138.00	-63.20
24.00	139.00	-64.20
24.00	140.00	-65.20
24.00	141.00	-66.20
24.00	142.00	-67.20
24.00	143.00	-68.20
24.00	144.00	-69.20
24.00	145.00	-70.20
24.00	146.00	-71.20
24.00	147.00	-72.20
24.00	148.00	-73.20
24.00	149.00	-74.20
24.00	150.00	-75.20
24.00	151.00	-76.20
24.00	152.00	-77.20
24.00	153.00	-78.20
24.00	154.00	-79.20
24.00	155.00	-80.20
24.00	156.00	-81.20
24.00	157.00	-82.20
24.00	158.00	-83.20
24.00	159.00	-84.20
24.00	160.00	-85.20

Driven Pile Capacity:
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Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	24.0	0.00	0.00	0.00	0.00	0.00
2.00	24.0	0.00	0.00	0.00	0.00	0.00
3.00	24.0	0.00	0.00	0.00	0.00	0.00
4.00	24.0	0.00	0.00	0.00	0.00	0.00
5.00	24.0	0.00	0.00	0.00	0.00	0.00
6.00	24.0	0.00	0.00	0.00	0.00	0.00
7.00	24.0	0.00	0.00	0.00	0.00	0.00
8.00	24.0	0.00	0.00	0.00	0.00	0.00
9.00	24.0	0.00	0.00	0.00	0.00	0.00
10.00	24.0	0.00	0.00	0.00	0.00	0.00
11.00	24.0	0.00	0.00	0.00	0.00	0.00
12.00	24.0	0.00	0.00	0.00	0.00	0.00
13.00	24.0	0.00	0.00	0.00	0.00	0.00
14.00	24.0	0.00	0.00	0.00	0.00	0.00
15.00	24.0	0.47	0.00	0.47	0.24	0.47
16.00	24.0	1.88	19.09	20.98	10.49	59.17
17.00	24.0	3.65	19.15	22.80	11.40	61.10
18.00	24.0	5.07	19.42	24.49	12.25	63.34
19.00	24.0	6.09	19.89	25.98	12.99	65.77
20.00	24.0	6.89	20.26	27.15	13.58	67.67
21.00	24.0	7.80	20.25	28.05	14.03	68.56
22.00	24.0	8.87	20.16	29.03	14.52	69.35
23.00	24.0	10.06	20.12	30.18	15.09	70.41
24.00	24.0	11.57	19.85	31.41	15.71	71.11
25.00	24.0	13.52	18.89	32.42	16.21	70.20
26.00	24.0	14.88	17.42	32.30	16.15	67.13
27.00	24.0	15.56	16.65	32.21	16.11	65.52
28.00	24.0	15.67	16.53	32.20	16.10	65.25
29.00	24.0	15.90	16.27	32.17	16.08	64.71
30.00	24.0	16.35	15.76	32.11	16.06	63.63
31.00	24.0	16.80	14.91	31.71	15.86	61.54
32.00	24.0	17.03	14.02	31.05	15.53	59.09
33.00	24.0	17.06	13.60	30.66	15.33	57.86
34.00	24.0	17.06	13.95	31.01	15.51	58.92
35.00	24.0	17.06	15.22	32.27	16.14	62.70
36.00	24.0	17.06	17.45	34.51	17.25	69.41
37.00	24.0	17.06	20.65	37.71	18.85	79.01
38.00	24.0	17.10	18.93	36.03	18.01	73.89
39.00	24.0	17.40	26.04	43.43	21.72	95.51
40.00	24.0	18.00	33.17	51.17	25.58	117.50
41.00	24.0	18.81	33.40	52.21	26.10	119.00
42.00	24.0	19.75	33.99	53.73	26.87	121.71

43.00	24.0	20.88	34.79	55.67	27.84	125.26
44.00	24.0	22.37	35.58	57.95	28.98	129.11
45.00	24.0	24.42	35.92	60.34	30.17	132.18
46.00	24.0	27.22	35.51	62.74	31.37	133.76
47.00	24.0	30.78	34.59	65.37	32.68	134.54
48.00	24.0	35.08	33.27	68.36	34.18	134.91
49.00	24.0	38.04	30.76	68.81	34.40	130.34
50.00	24.0	40.38	28.97	69.35	34.68	127.30
51.00	24.0	42.65	28.24	70.89	35.45	127.38
52.00	24.0	45.31	29.45	74.76	37.38	133.66
53.00	24.0	48.31	12.97	61.27	30.64	87.21
54.00	24.0	51.29	15.73	67.03	33.51	98.49
55.00	24.0	53.88	16.71	70.59	35.30	104.02
56.00	24.0	57.32	17.41	74.73	37.36	109.54
57.00	24.0	62.04	17.80	79.84	39.92	115.44
58.00	24.0	67.93	17.86	85.79	42.89	121.51
59.00	24.0	74.60	17.79	92.39	46.20	127.97
60.00	24.0	83.16	29.64	112.81	56.40	172.10
61.00	24.0	90.08	26.18	116.25	58.13	168.60
62.00	24.0	95.06	23.21	118.26	59.13	164.67
63.00	24.0	98.34	7.25	105.60	52.80	120.11
64.00	24.0	101.39	7.32	108.71	54.36	123.35
65.00	24.0	104.44	7.35	111.79	55.90	126.50
66.00	24.0	107.58	7.38	114.96	57.48	129.71
67.00	24.0	110.90	7.43	118.34	59.17	133.20
68.00	24.0	114.39	7.50	121.89	60.95	136.89
69.00	24.0	117.91	7.64	125.55	62.77	140.84
70.00	24.0	121.42	7.94	129.35	64.68	145.23
71.00	24.0	124.84	8.37	133.21	66.60	149.95
72.00	24.0	128.07	8.86	136.93	68.46	154.64
73.00	24.0	131.16	9.39	140.55	70.28	159.33
74.00	24.0	134.40	9.85	144.24	72.12	163.94
75.00	24.0	137.82	10.13	147.94	73.97	168.20
76.00	24.0	141.76	10.21	151.97	75.98	172.39
77.00	24.0	146.55	10.18	156.73	78.37	177.10
78.00	24.0	152.12	10.05	162.17	81.08	182.27
79.00	24.0	157.93	9.92	167.84	83.92	187.67
80.00	24.0	163.89	9.81	173.70	86.85	193.33
81.00	24.0	169.52	9.79	179.31	89.65	198.88
82.00	24.0	174.31	9.91	184.22	92.11	204.04
83.00	24.0	178.38	10.16	188.55	94.27	208.87
84.00	24.0	182.35	10.46	192.81	96.41	213.74
85.00	24.0	186.31	10.80	197.11	98.56	218.71
86.00	24.0	190.36	11.16	201.53	100.76	223.85
87.00	24.0	194.59	11.57	206.17	103.08	229.31
88.00	24.0	199.02	12.04	211.06	105.53	235.15
89.00	24.0	203.76	12.46	216.22	108.11	241.14
90.00	24.0	208.84	12.69	221.54	110.77	246.92
91.00	24.0	214.17	12.77	226.95	113.47	252.49
92.00	24.0	219.66	12.81	232.47	116.23	258.08

93.00	24.0	225.33	12.78	238.11	119.05	263.66
94.00	24.0	231.29	12.80	244.09	122.04	269.68
95.00	24.0	237.56	13.02	250.58	125.29	276.62
96.00	24.0	243.67	13.47	257.13	128.57	284.06
97.00	24.0	249.13	13.93	263.06	131.53	290.93
98.00	24.0	254.07	14.40	268.47	134.23	297.26
99.00	24.0	259.07	14.87	273.94	136.97	303.69
100.00	24.0	264.23	15.37	279.60	139.80	310.35

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	24.0	270.06	15.79	285.84	142.92	317.41
102.00	24.0	277.04	15.85	292.88	146.44	324.57
103.00	24.0	284.96	15.54	300.50	150.25	331.57
104.00	24.0	292.55	15.38	307.93	153.97	338.69
105.00	24.0	299.61	15.73	315.34	157.67	346.79
106.00	24.0	306.47	16.49	322.96	161.48	355.95
107.00	24.0	313.47	17.36	330.83	165.42	365.56
108.00	24.0	320.46	18.32	338.78	169.39	375.41
109.00	24.0	326.51	19.22	345.73	172.86	384.17
110.00	24.0	331.46	19.83	351.29	175.64	390.94
111.00	24.0	336.84	19.98	356.83	178.41	396.79
112.00	24.0	344.17	19.79	363.96	181.98	403.54
113.00	24.0	353.24	19.35	372.59	186.30	411.30
114.00	24.0	362.82	19.01	381.83	190.91	419.85
115.00	24.0	372.68	18.94	391.62	195.81	429.51
116.00	24.0	381.98	19.24	401.21	200.61	439.68
117.00	24.0	389.83	19.76	409.59	204.80	449.11
118.00	24.0	396.40	20.40	416.79	208.40	457.59
119.00	24.0	402.51	20.94	423.45	211.73	465.33
120.00	24.0	408.32	21.40	429.72	214.86	472.53
121.00	24.0	414.64	21.72	436.36	218.18	479.80
122.00	24.0	422.31	21.92	444.23	222.12	488.07
123.00	24.0	431.17	22.02	453.18	226.59	497.22
124.00	24.0	440.28	22.15	462.44	231.22	506.74
125.00	24.0	449.51	22.43	471.94	235.97	516.79
126.00	24.0	457.63	22.87	480.50	240.25	526.23
127.00	24.0	463.42	23.09	486.51	243.25	532.69
128.00	24.0	467.20	22.88	490.07	245.04	535.83
129.00	24.0	470.82	22.84	493.65	246.83	539.33
130.00	24.0	474.36	23.26	497.62	248.81	544.15

131.00	24.0	477.54	24.11	501.65	250.82	549.87
132.00	24.0	480.69	25.40	506.09	253.05	556.90
133.00	24.0	483.85	27.13	510.99	255.49	565.26
134.00	24.0	486.57	29.41	515.98	257.99	574.79
135.00	24.0	488.90	32.16	521.07	260.53	585.39
136.00	24.0	492.24	34.36	526.61	263.30	595.33
137.00	24.0	497.50	35.66	533.16	266.58	604.48
138.00	24.0	504.22	36.75	540.97	270.49	614.47
139.00	24.0	511.06	37.93	548.99	274.49	624.84
140.00	24.0	517.75	39.16	556.91	278.46	635.24
141.00	24.0	525.23	40.48	565.71	282.86	646.68
142.00	24.0	534.48	41.94	576.42	288.21	660.30
143.00	24.0	552.27	42.84	595.11	297.55	680.79
144.00	24.0	563.07	43.97	607.04	303.52	694.98
145.00	24.0	572.94	47.46	620.40	310.20	715.31
146.00	24.0	582.38	54.51	636.89	318.45	745.92
147.00	24.0	593.32	62.32	655.65	327.82	780.30
148.00	24.0	605.29	68.42	673.72	336.86	810.56
149.00	24.0	617.26	74.51	691.77	345.89	840.80
150.00	24.0	629.24	80.71	709.95	354.97	871.36
151.00	24.0	640.93	86.46	727.39	363.70	900.32
152.00	24.0	652.05	90.89	742.95	371.47	924.73
153.00	24.0	669.11	92.58	761.69	380.84	946.85
154.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
155.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
156.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
157.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
158.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
159.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
160.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

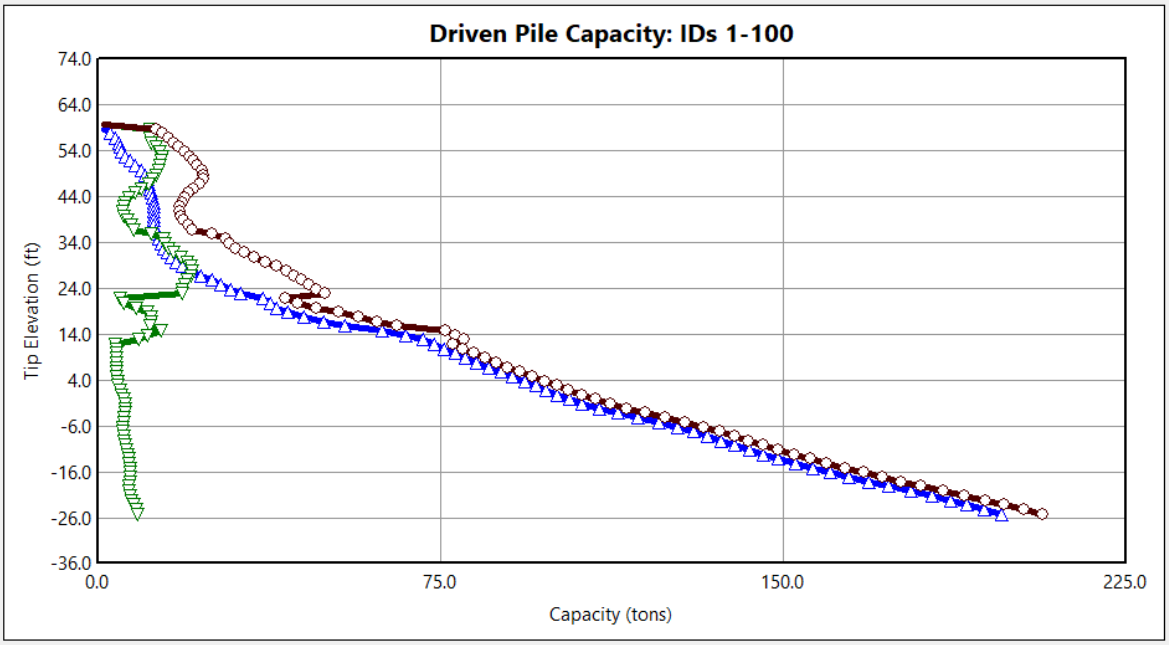
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

Plot Window

Job Name: SR 70 Seg 10

State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-DCI-1
Ground Surface Elevation	74.80 (ft)
Section:	Square
Width	18.00 (in)

Project Data

File:	BB-DCI-1_18-Inch
Date:	Mar 23, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

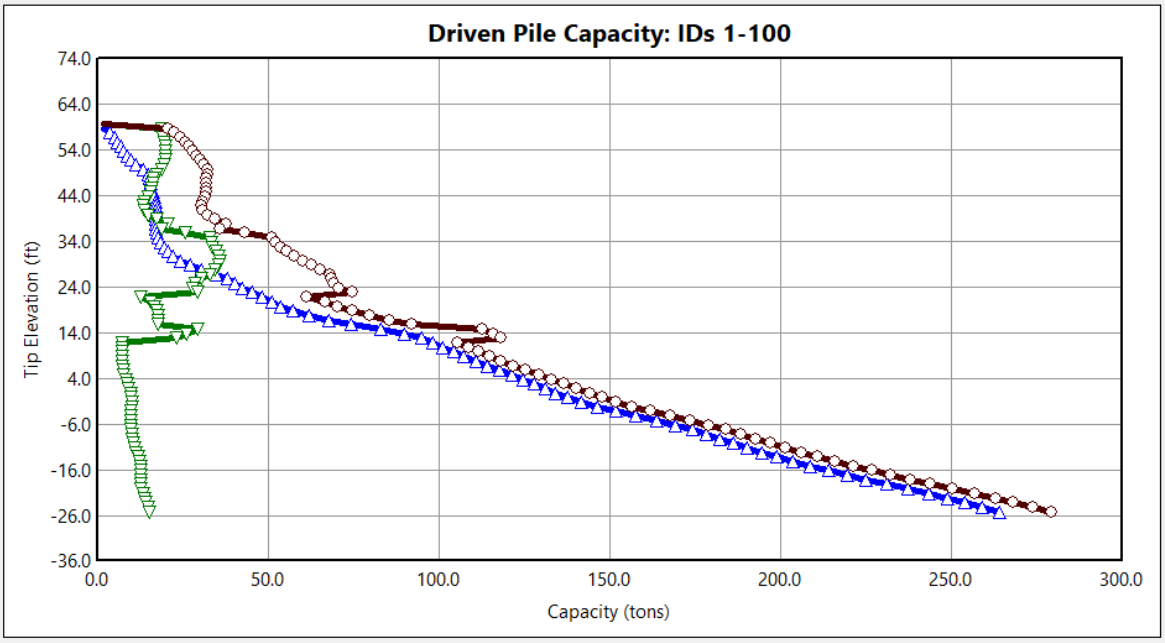
Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 10 State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-DCI-1
Ground Surface Elevation	74.80 (ft)
Section:	Square
Width	24.00 (in)

Project Data

File:	BB-DCI-1_24-Inch
Date:	Mar 23, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

Summary of Laboratory Test Results for Soil Classification
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over D.C.I. Canal Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Boring Number	Sample Depth (ft)	USCS Symbol	Sieve Analysis					Atterberg Limits			Organic Content (%)	Natural Moisture Content
			#10	#40	#60	#100	#200	Liquid Limit	Plastic Limit	Plasticity Index		
BB-DCI-1	4.0 - 8.0	SM	---	---	---	---	21	---	---	---	---	---
BB-DCI-1	31.0 - 32.5	SP-SM	---	---	---	---	12	---	---	---	---	---
BB-DCI-1	36.0 - 37.5	SC	---	---	---	---	18	32	18	14	---	26
BB-DCI-1	51.0 - 52.5	CL	---	---	---	---	67	42	21	21	---	32
BB-DCI-1	73.5 - 75.0	CH	---	---	---	---	74	54	26	28	---	43
BB-DCI-1	86.0 - 87.5	CL	---	---	---	---	53	33	21	12	---	27
BB-DCI-1	108.5 - 110.0	MH	---	---	---	---	51	60	42	18	---	47
BB-DCI-1	128.5 - 130.0	SM	---	---	---	---	20	NP	NP	NP	---	32
BB-DCI-1	143.5 - 145.0	CH	---	---	---	---	56	56	26	30	---	28
BB-DCI-1	153.5 - 155.0	SC	---	---	---	---	33	38	26	12	---	27

Summary of Laboratory Test Results for Environmental Classification
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over D.C.I. Canal Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Soil Samples

Boring Number	Depth (feet)	USCS Symbol	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
							Steel	Concrete
BBC-DCI-1	2.0 - 6.0	SP-SM	6.2	28,000	15	<5	Moderately Aggressive	Slightly Aggressive
BB-DCI-1	4.0 - 8.0	SM	5.1	16,000	30	63	Extremely Aggressive	Moderately Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Water Samples

Sample Location	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
					Steel	Concrete
D.C.I. CANAL	7.8	1,700	90	180	Moderately Aggressive	Moderately Aggressive
	7.4	1,400	45	180	Moderately Aggressive	Moderately Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Grain Size Distribution Report
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over D.C.I. Canal Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No.: 6511-24-001

Approximate Sample Location		Depth Below Mudline (ft)
Latitude	Longitude	
N 27.20960	W 81.67790	0.0-2.0

Grain Size Distribution Curve

Material Description	Classification	
	USCS	AASHTO
Gray to Brown Sand	SP	A-3

Sieve Number	Diameter (mm)	Percent Finer by Weight (%)
3/4"	19.000	90
3/8"	9.500	82
4	4.750	70.9
10	2.000	61.4
40	0.425	32.8
60	0.250	20.9
100	0.150	9.2
200	0.075	1.8

Coefficients

D_{10}	0.155	D_{30}	0.375
D_{50}	*1.079*	D_{60}	1.854
D_{85}	12.320	D_{90}	19.000
D_{95}	---		
C_U	11.936	C_C	0.489

TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

March 20, 2025

HNTB Corporation
201 N. Franklin Street, Suite 1200
Tampa, FL 33602

Attn: Mr. John Burton, PE, PMP, PTOE, ENV SP.

RE: Preliminary Bridge Geotechnical Report
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over Long Point Marsh Bridges
FPID No. 451942-2-52-01
DeSoto County, Florida
Tierra Project No. 6511-24-001

Mr. Burton:

Tierra, Inc. (Tierra) has performed a preliminary geotechnical study for the proposed bridge structures associated with the project referenced above. This report has been prepared to support the project Bridge Development Report (BDR). This report presents the results of our study including field and laboratory testing, a preliminary foundation design analysis and our opinions regarding appropriate foundation alternatives for the proposed bridge structures.

Tierra, Inc. appreciates the opportunity to be of service to HNTB Corporation (HNTB) on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.

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APPENDIX A

USDA Soil Survey & USGS Quadrangle Maps
Report of Core Boring Sheet (1 Sheet)

APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

1.0 PROJECT INFORMATION

1.1 Project Authorization

Authorization to proceed with this project was issued by HNTB in accordance with our Subconsultant Agreement.

1.2 Project Description

This project consists of widening SR 70 from two lanes to four-lane divided section from West of SR 31 (MP 14.973) to the Highlands County Line (MP 31.763). A shared use path is also proposed on the south side of the SR 70 widening.

This report has been prepared to provide geotechnical input for the Bridge Development Report (BDR) associated with the design of the proposed SR 70 over Long Point Marsh bridge structures. The subsurface information obtained to date and preliminary engineering recommendations for the proposed foundation alternatives are provided herein.

1.3 General Site Description

A concrete bridge culvert (Bridge No. 040037) supporting the existing SR 70 roadway is currently located at the subject bridge site. The concrete bridge culvert was built circa 1959. The subject bridge site is located in an area with pasturelands to the south and landfill property to the north.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to provide geotechnical (i.e. subsurface soil conditions and related engineering properties) input to the design team to assist with the design and construction of the proposed SR 70 over Long Point Marsh bridge structures. The following services were provided in order to achieve the preceding objective:

1. Reviewed soil information from the "Soil Survey of DeSoto County, Florida" published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Reviewed topographic and potentiometric information obtained from the "Long Island Marsh NW, Florida" Quadrangle map and the "Upper Floridan Aquifer Potentiometric Surface" maps published by the United States Geological Survey (USGS).

2. Conducted a visual reconnaissance of the project site and coordinated utility clearance through Sunshine State One Call.

3. Executed a program of subsurface exploration consisting of subsurface sampling and field testing. Performed one (1) Standard Penetration Test (SPT) boring advanced to a depth of approximately 125 feet below existing grades.

4. Visually classified and stratified the obtained soil samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D-2488. Conducted laboratory testing on selected soil samples to confirm the visual classification and evaluate the corrosive nature of the soil and water.

5. Evaluated foundation criteria and performed engineering analyses to develop preliminary design recommendations for the foundation alternatives associated with the proposed bridge structures.

6. Prepared this formal engineering report, which summarizes the course of study pursued, the field and laboratory data generated, the subsurface conditions encountered and the preliminary geotechnical recommendations for the design and construction of the proposed bridge structure foundation alternatives.

3.0 REVIEW OF PUBLISHED DATA

3.1 Regional Geology

DeSoto County Geology has been paraphrased from the Florida Geological Survey, Open-File Report 80, 2001 and other geologic references.

Based on a review of the Surficial Geology Maps published by FGS, Reworked Cypresshead sediments (TQuc) is mapped at the surface in the vicinity of the bridge site.

The Reworked Cypresshead sediments (TQuc) is the result of post depositional reworking of the Cypresshead siliciclastics, formed during the Pliocene and Pleistocene epochs. The

sediments are fine to coarse quartz sands with scattered quartz gravel and varying percentages of clay matrix.

3.2 USDA Soil Survey

Based on a review of the Soil Survey for DeSoto County published by the USDA NRCS, it appears that there are two (2) primary soil-mapping unit noted at the bridge site. The general soil description as described in the Soil Survey are presented in the following table. The **USDA Soil Survey Map** for the bridge site is illustrated in **Appendix A**.

Summary of USDA Soil Survey
DeSoto, Florida

USDA Map Symbol and Soil Name	Depth (in)	Soil Classification		Permeability (in/hr)	pH	Seasonal High Water Table	
		USCS	AASHTO			Depth (feet)	Months
(24) Myakka	6-20	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	3.5-6.5	0.5-1.5	Jun-Nov
	20-36	SP-SM, SM	A-2-4, A-3	0.6 - 6.0	3.5-6.5		
	36-80	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	3.5-6.5		
(40) Valkaria	0-5	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	4.5-7.3	0.3-1.5	Jul-Oct
	5-16	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	4.5-7.3		
	16-51	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	4.5-7.8		
	51-80	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	4.5-7.8		

It should be noted that information contained in the USDA Soil Survey Map may not be reflective of actual soil and groundwater conditions, particularly if recent development in the project vicinity has modified soil conditions or surface/subsurface drainage.

3.3 USGS Quadrangle Map

Based on a review of the "Long Island Marsh NW, Florida" USGS Quadrangle Map, it appears that the natural elevation at the project site ranges from approximately +80 feet to +85 feet National Geodetic Vertical Datum of 1929 (NGVD 29) as illustrated on the **USGS Quadrangle Map** in **Appendix A.**

3.4 Review of Potentiometric Surface Information

Based on a review of the "Upper Floridan Aquifer Potentiometric Surface" maps published by the USGS, the potentiometric surface elevation at the bridge site is reported to range from approximately +50 to +60 feet, NGVD 29. As indicated in **Section 3.3**, the natural ground surface elevation at the bridge site ranges from approximately +80 to +85 feet, NGVD 29. Artesian flow conditions were not encountered during the field exploration.

4.0 SUBSURFACE EXPLORATION

4.1 Boring Location Plan

Prior to commencing our subsurface explorations, a boring location plan for the proposed bridge structures was developed based on design information provided by HNTB. This boring location plan was generated based on our engineering judgment and guidelines provided in the "Soils and Foundations Handbook" published by the FDOT. Tierra submitted this boring location plan to FDOT for approval. Following completion of the boring, the boring locations were surveyed by the project surveyor. The Boring Location Plan for the boring performed is provided on the **Report of Core Boring** sheet in **Appendix A.**

Utility clearances were coordinated by Tierra via Sunshine State One Call and updated as required prior to performing the soil boring in order to reduce the potential for damage to the utilities during drilling.

4.2 Soil Boring

Subsurface conditions were explored at the bridge site one (1) SPT boring. The results and location of the SPT boring are presented on the **Report of Core Boring** sheet in **Appendix A**.

The SPT boring was performed with the use of a drill rig using Bentonite Mud drilling procedures. Temporary 3-inch diameter rotary installed casing was utilized to help keep the boreholes stable. The soil sampling was performed in general accordance with the ASTM test designation D-1586. The initial 6 feet of the boring was hand augered to verify utility clearances. SPT resistance N-values were then taken at intervals of 2 feet from the hand auger boring depth of 6 feet to a depth of 17½ feet and on intervals of 2½ feet thereafter to the boring termination depths. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our laboratory for classification and analyses.

Soil stratification was determined based on a review of recovered samples, laboratory test results, and interpretation of field boring logs. Stratification lines represent approximate boundaries between soil layers of different engineering properties; however actual transitions between layers may be gradual. In some cases, small variations in properties that were not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The soil profiles represent the conditions at the particular boring location; variations do occur among the boring. Specific details about subsurface conditions and materials encountered at each test location can be obtained from the soil profiles presented on the **Report of Core Boring** sheet in **Appendix A** of this report.

5.0 LABORATORY TESTING

5.1 General

Representative soil samples collected from the SPT boring were classified and stratified in general accordance with the Unified Soil Classification System (USCS). Our classification was based on visual observations, using the results from the laboratory testing as confirmation.

Laboratory testing consisting of fines content (percentage passing No. 200 mesh sieve), Atterberg limits testing, and natural moisture content determination tests were completed on representative soil samples. In addition, Environmental classification tests were performed to evaluate the corrosive nature of the soil and water encountered at the bridge site. The results of the laboratory tests are presented on the **Report of Core Boring** sheet in **Appendix A**. Detailed results of the tests performed are presented on the **Summary of Laboratory Test Results for Soil Classification**, **Summary of Laboratory Test Results for Environmental Classification** and **Grain Size Distribution Report** in **Appendix C.**

5.2 Test Designation

The following list summarizes the laboratory tests performed and respective test methods utilized.

- Fines Content - The fines content tests were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-1140).

- Grain-Size Analyses - The grain-size analyses were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-6913).

- Atterberg Limits - The liquid limit and the plastic limit tests ("Atterberg Limits") were conducted in general accordance with the AASHTO test designations T-089 and T-090, respectively (ASTM test designation D-4318).

- Natural Moisture Content - The moisture content tests were conducted in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).

- Environmental Classification – The environmental classification tests were conducted in general accordance with the FSTM test designations FM 5-550, FM 5-551, FM 5-552, and FM 5-553.

6.0 ENVIRONMENTAL CLASSIFICATION

Environmental classification tests were performed on recovered soil samples obtained from within the boring performed at the bridge site and from water samples obtained from Long Point Marsh. Based on the laboratory test results and the 2025 FDOT Structure Design Guidelines (SDG), the environmental classifications of the superstructure and substructure for the bridge are classified as follows:

Superstructure Environmental Classification	Concrete Substructure Classification	Steel Substructure Classification
Slightly Aggressive	Moderately Aggressive (Water - Resistivity = 2,000 Ohm-cm)	Moderately Aggressive (Water - Resistivity = 2,000 Ohm-cm)

The range of test results is presented on the **Report of Core Boring** sheet in **Appendix A.** A summary of the individual environmental classification test results is provided in **Appendix C**.

7.0 RESULTS OF SUBSURFACE EXPLORATION

7.1 General Subsurface Conditions

Generally, the boring encountered sandy soils to the boring termination elevation. Specific information on the soil conditions encountered can be found on the **Report of Core Boring** sheet in **Appendix A.** The soil descriptions and classifications associated with this project are listed in the following table.

Soil Description	USCS Symbol
SAND	SP/SP-SM
SILTY SAND	SM

Additional borings will be performed as the project progresses beyond the BDR stage; the results will be presented in future submittals.

7.2 Groundwater

The groundwater table was encountered at a depth of approximately 8 feet below existing grades within the boring performed and is presented on the **Report of Core Boring** sheet in **Appendix A**.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e. swales, drainage ponds, underdrains and impervious areas) and creek water levels.

8.0 EVALUATIONS OF BRIDGE FOUNDATION ALTERNATIVES

Evaluations of foundation alternatives for the proposed bridge structures were based on the results of our field study. Based on our discussions with HNTB the following foundation alternatives were considered:

- Shallow Foundations
- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)
- Steel Piles, including H Sections
- Pre-stressed, Pre-cast, Square Concrete (PPSC) Piles
- Drilled Shafts

The following paragraphs discuss each of these alternatives briefly.

8.1 Shallow Foundations

With shallow foundation systems, the structure loads are supported by the bearing capacity of the foundation soils. The design of shallow foundations is typically governed by the soil bearing capacity and total and differential settlement criteria.

Loose to very loose soils were encountered within the influence zone of typical shallow foundation sizes. Based on the anticipated loading conditions for roadway bridges of this size, a shallow footing would have to be relatively large for bearing capacity and settlement criteria to be achieved or would require some form of subsurface remediation to increase the bearing capacity and decrease settlement potential.

For these reasons, shallow foundations were not considered further for this report.

8.2 Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)

GRS-IBS consists of a shallow foundation combined with a retaining wall system to provide support for single span bridges or multi-span bridges with simply supported end spans. The reasons discussed in **Section 8.1** that preclude the use of shallow foundations also apply to the GRS-IBS.

For these reasons, GRS-IBS was not considered further for this report.

8.3 Pre-Cast Pre-Stressed Square Concrete (PPSC) Piles

PPSC pile foundations are a feasible foundation alternative. They are a widely used and proven foundation system in Florida. PPSC pile foundations are readily available and generally have a lower cost per ton of capacity than other pile types. Analyses were performed for 18-inch and 24-inch PPSC piles for this Preliminary Bridge Geotechnical Report.

8.4 Steel Piles

Steel pile types include H-sections and pipe piles. Steel piles generally do not develop as much capacity for similar penetration depths as PPSC piles. Steel piles are well suited to soil conditions with high variability and where frequent pile splicing is expected and/or required due to overhead restrictions, subsurface variability, etc. Steel piles may also more easily penetrate dense layers to achieve a desired penetration depth and are less susceptible to damage compared to concrete piles. Steel H-Piles are low displacement piles, and therefore vibrations associated with installations are minimized due to the low-displacement nature of the piles. Open end pipe piles are also low displacement but will eventually become plugged at the pile toe. Based on coordination with the Structural Engineer, pile capacity analyses for 14X89 H-Piles were performed for this Preliminary Bridge Geotechnical Report.

8.5 Drilled Shafts

Drilled, cast-in-place, concrete shafts have the ability to develop high axial and lateral capacities. One drilled shaft could potentially take the place of several driven piles depending on soil/rock conditions.

This type of foundation system is often the chosen alternative for sites where competent limestone is present at a relatively shallow depth and with a sufficient thickness. Drilled shafts will develop large skin friction capacities in limestone compared to dense sand, and therefore drilled shafts are most suited for sites with shallow, competent consistent limestone. Drilled shafts foundations may also be considered as a preferred foundation alternative for sites in order to limit construction induced vibrations compared to the vibrations caused by driven piles.

Limestone was not encountered within the SPT Boring performed at the bridge site. Therefore, drilled shafts were not analyzed further for this Preliminary Bridge Geotechnical Report.

9.0 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

9.1 General

Based on the subsurface conditions encountered in the test boring performed to date, it is Tierra's opinion that driven pile foundations are the most suitable foundation alternative type for the proposed bridge structures. Foundation systems comprised of 18-inch and 24-inch PPSC piles and 14X89 H-Piles were analyzed for this Preliminary Bridge Geotechnical Report. The following sections present the results of the engineering analyses for the proposed deep foundation alternatives.

9.2 Environmental Classification

Based on the laboratory test results and the 2025 SDG, the environmental classification for steel substructure for the proposed bridge structures is Moderately Aggressive (Water - Resistivity = 2,000 Ohm-cm). Steel piles will need to be designed with proper sacrificial thickness.

9.3 Downdrag (Negative Skin Friction)

Based on a review of preliminary cross sections, the new bridge supporting the eastbound travel lanes will be at/near the elevation of the existing bridge, and the new bridge supporting the westbound travel lanes will have new embankments (anticipated to be less than about 10 feet high) at each end bent approach. Based on the new embankments and soil conditions encountered in the boring, there will be downdrag loads imparted to the end bent piles. Actual loads will be determined following the BDR stage once a foundation alternative has been selected and the roadway geometry has been finalized. For preliminary estimation purposes, downdrag loads up to 20 tons should be anticipated at the end bent locations.

The portion of the end bent concrete piles within the embankment should be provided with a double wrap of polyethylene sheeting according to the FDOT Specifications to minimize development of downdrag loads from the embankment fill.

9.4 Scour

It is our understanding that the scour analysis will be performed by others. Tierra performed sieve analyses on soil samples collected within two feet of the mudline of Long Point Marsh near the existing bridge. The results of the sieve analyses along with D_{50} values for use in the scour analysis calculations are provided on the **Grain Size Distribution Report** in **Appendix C**.

9.5 Driven Pile Axial Capacity

Axial pile capacities for the proposed bridge were analyzed based on the subsurface conditions encountered in the boring and the FDOT program FB-Deep. The Load and Resistance Factor Design (LRFD) method was utilized for the analysis.

As indicated in the FDOT Structure Design Guidelines (SDG), the required Nominal Bearing Resistance (Rn) must satisfy the following requirement:

$$\mathbf{Rn} > \frac{\mathbf{(Factored\ Design\ Load + Downdrag + Net\ Scour)}}{\phi}$$

Where ϕ = 0.75; dynamic load testing will be performed on all piles.

Other ϕ factors may be used based on the type of foundation testing recommended.

The R_n is taken as the Davisson Capacity. The Davisson axial capacity consists of the ultimate skin friction and mobilized end bearing (i.e., one-third of the ultimate end bearing). Tierra modeled the top 15 feet of the soil boring profile in the capacity analyses as a cavity layer to mimic a "starter hole" as described in FDOT Specification 455-5.1.

The following table summarizes the approximate maximum recommended R_n for each driven pile foundation alternative:

Driven Pile Foundation Alternative	Approximate Maximum Recommended R_n(1)
18-Inch PPSC Piles	275 tons
24-Inch PPSC Piles	425 tons
14X89 Steel H-Pile	175 tons
(1) Anticipate downdrag loads up to 20 tons for preliminary estimation purposes.	

The axial capacity for 18-inch and 24-inch PPSC piles and 14X89 H-Piles were computed using the program FB-Deep. The results of the axial pile analyses are presented in **APPENDIX B**, including the axial capacity curves, FB-Deep output curves (including Davisson Capacity Curves, Ultimate Skin Friction Curves and Mobilized End Bearing Curves) and FB-Deep computer output files.

9.6 Group Action

No reductions of the individual pile capacities will be required if piles are spaced center-to-center at 3 times their width or greater.

9.7 Settlement

Settlement of pile supported bridge bents should be small and tolerable for a typical single row group. However, the tolerance should be confirmed by the structural engineer. Based on soil conditions encountered at the boring locations, and that piles will be tipped in a suitable bearing layer, individual pile head settlements are estimated to be on the order of ½ inch or less.

10.0 CONSTRUCTION CONSIDERATIONS

10.1 General

The overall site preparation and construction should be in accordance with the FDOT Specifications.

10.2 Temporary Side Slopes

Temporary side slopes and excavations should comply with the Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 C.F.R., s. 1926.650, Subpart P, all subsequent revisions or updates of OSHA's referenced standard adopted by the Department of Labor and Employment Security and Florida's Trench Safety Act, Section 553.62, Florida Statutes. Excavated materials should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth.

10.3 Groundwater Control

Depending upon groundwater levels at the time of construction, some form of dewatering may be required based on the anticipated construction activities due to perched groundwater. Due to groundwater levels anticipated during the wet season of the year, seepage may enter the

bottom and sides of excavated areas. Such seepage will act to loosen soils and create difficult working conditions. Groundwater levels should be determined immediately prior to construction. Shallow groundwater should be kept below the lowest working area to facilitate proper material placement and compaction in accordance with the FDOT Specifications.

10.4 Dynamic Load Testing & Pile Installation

We recommend that a test pile program be conducted for the proposed bridge construction including test piles. The monitoring will provide estimates of pile capacity versus pile penetration, stresses in the pile, and other relevant parameters used to evaluate the pile driving process. analyses should be performed on selected conditions for evaluation of the dynamic test results. The results of these analyses will provide information for developing production pile lengths. In addition, all production piles will be dynamically monitored.

The installation of the piles should be carried out in accordance with the FDOT Specifications.

10.5 Protection of Existing Structures

The FDOT Specifications should be followed for protection of existing structures during foundation construction operations.

11.0 REPORT LIMITATIONS

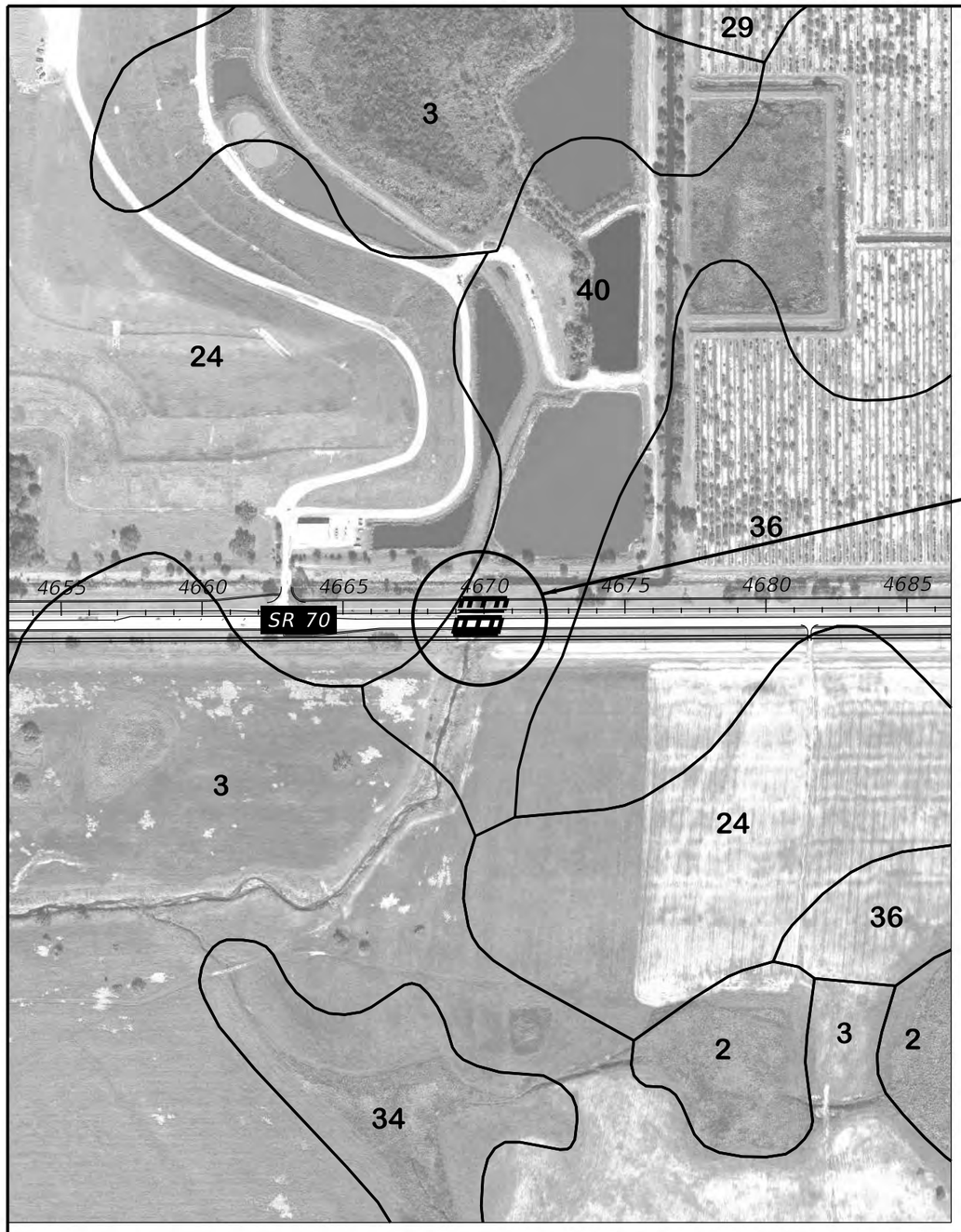
Our services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions, or recommendations made by others based on this data.

The scope of the investigation was intended to evaluate soil conditions within the influence zone of the deep foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil boring performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed structure.

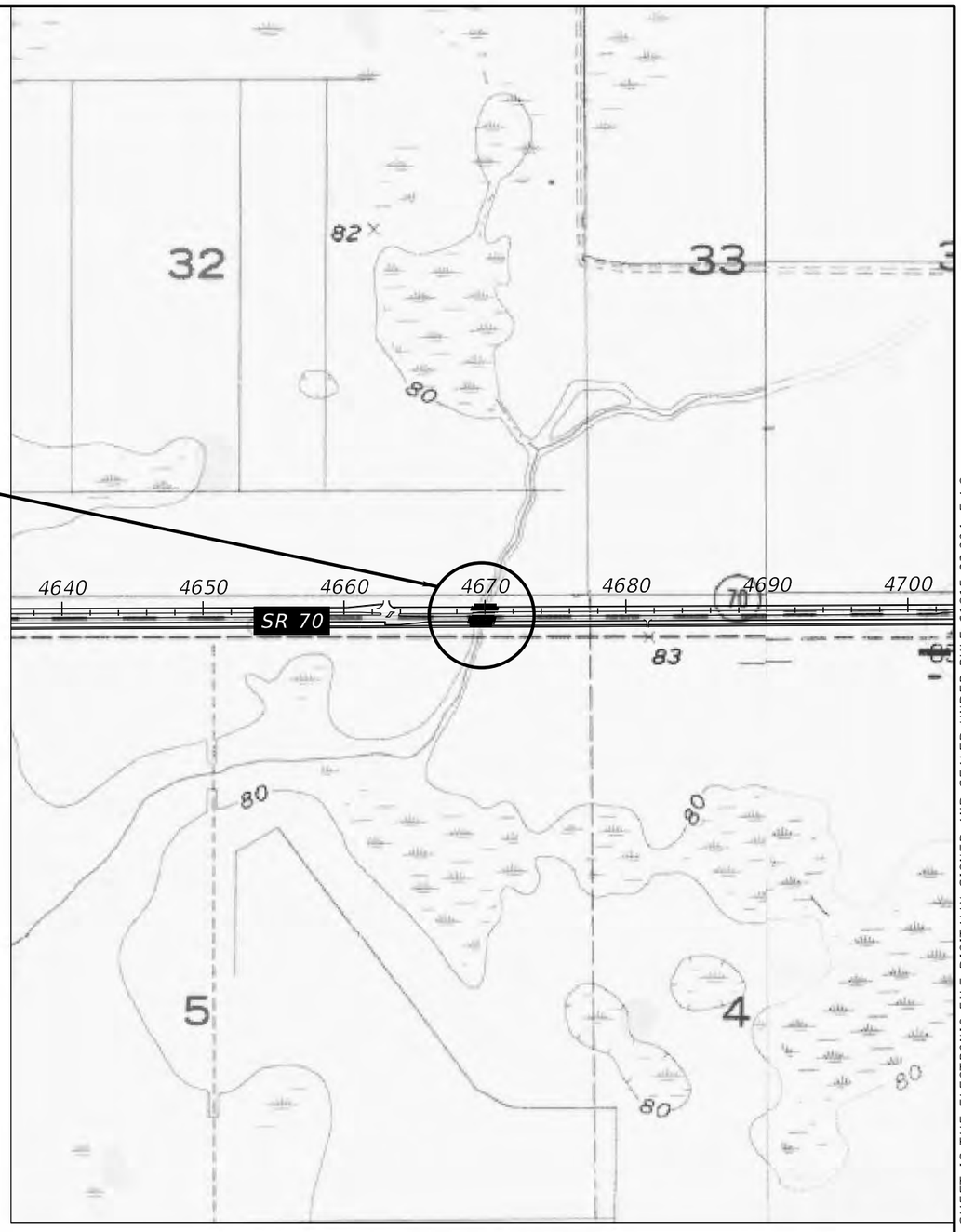
The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of the HNTB design team and the Florida Department of Transportation.

APPENDIX A

USDA Soil Survey & USGS Quadrangle Maps
Report of Core Boring (1 Sheet)



APPROXIMATE BRIDGE LOCATION



REFERENCE: USDA SOIL SURVEY OF DESOTO COUNTY, FLORIDA

0 100 500
Feet

TOWNSHIP: 37S
RANGE: 27E
SECTION: 32

REFERENCE: USGS QUADRANGLE MAP OF "LONG ISLAND MARSH NW, FLORIDA"

0 200 1000
Feet

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CHECKED BY:	DAN 02-25
DESIGNED BY:	BJS 02-25
CHECKED BY:	DAN 02-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

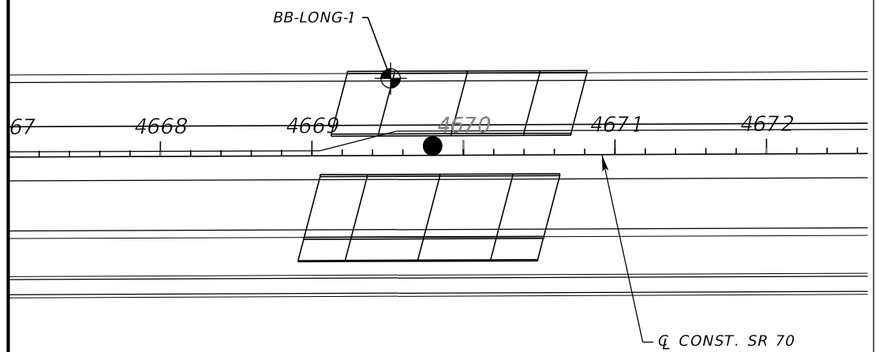
SHEET TITLE:

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

REF. DWG. NO.

SHEET NO.

J:\6511\2024 Files\6511-24-001 SR 70 Segments 9 & 10\ORD\6511-24-001\Geotechnical\USDA_USGS_06Long.dgn : USDA_USGS_BRIDGE06 [SHEET]
bsawaska 2/17/2025 3:13:28 PM



BORING LOCATION PLAN

NOTES:
1. THE BORING LOCATIONS AND ELEVATIONS WERE PROVIDED BY THE PROJECT SURVEYOR.
2. BASED ON A REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION AT THE BRIDGE SITE IS REPORTED TO RANGE FROM APPROXIMATELY +50 FEET TO +60 FEET, NGVD 29. ARTESIAN CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED.

ENVIRONMENTAL CLASSIFICATION:
SUBSTRUCTURE CONCRETE: MODERATELY AGGRESSIVE (WATER - RESISTIVITY = 2,000 OHM-CM)

SUBSTRUCTURE STEEL: MODERATELY AGGRESSIVE (WATER - RESISTIVITY = 2,000 OHM-CM)

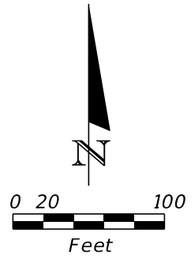
SUPERSTRUCTURE SLIGHTLY AGGRESSIVE

SOIL TEST RESULTS:

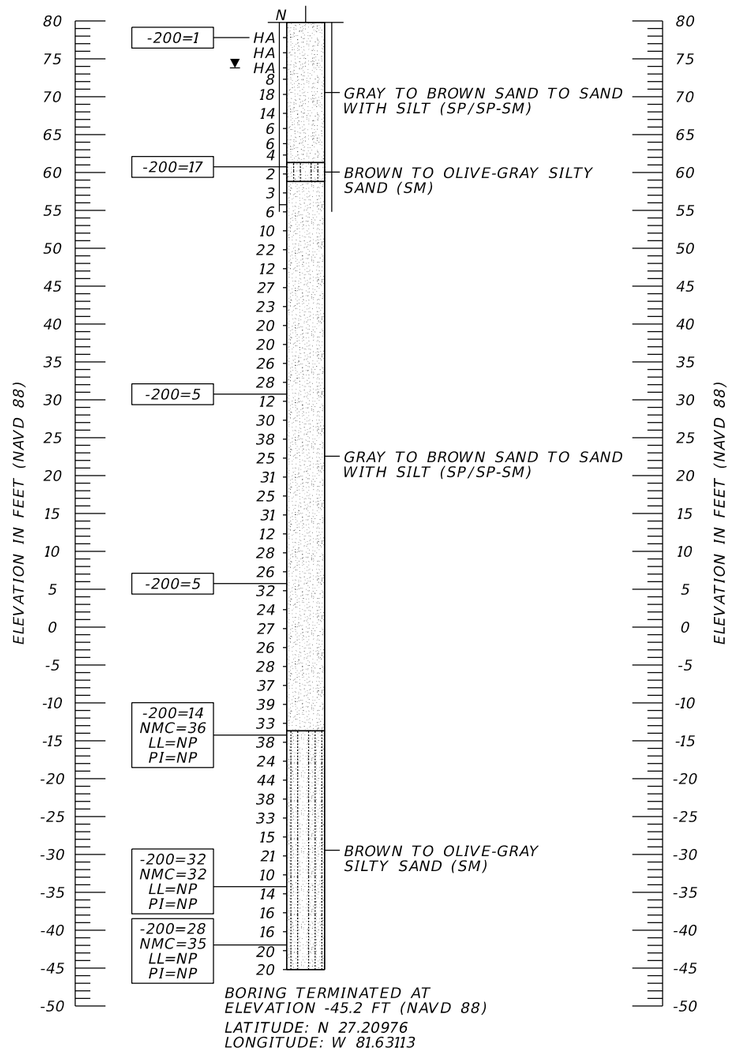
RESISTIVITY	9,600 TO 19,000 OHM-CM
CHLORIDES	15 PPM
SULFATES	<5 TO 36 PPM
pH	7.2 TO 8.0

WATER TEST RESULTS:

RESISTIVITY	2,000 TO 2,200 OHM-CM
CHLORIDES	0 TO 95 PPM
SULFATES	150 TO 180 PPM
pH	7.9 TO 9.0



BOR # BB-LONG-1
STA. 4669+52
REF. ℄ CONST. SR 70
OFF. 51' LT.
ELEV. 79.8
DATE 2/6/2025
DRILLER J. SHAW
HAMMER AUTOMATIC
RIG D-25



BORING TERMINATED AT ELEVATION -45.2 FT (NAVD 88)
LATITUDE: N 27.20976
LONGITUDE: W 81.63113

LEGEND

- SAND
- SILTY SAND

SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCE
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON-PLASTIC
NAVD 88	NORTH AMERICAN VERTICAL DATUM OF 1988

- APPROXIMATE SEDIMENT SAMPLE LOCATION FOR D50 DETERMINATION
- APPROXIMATE SPT BORING LOCATION
- GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
- CASING

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

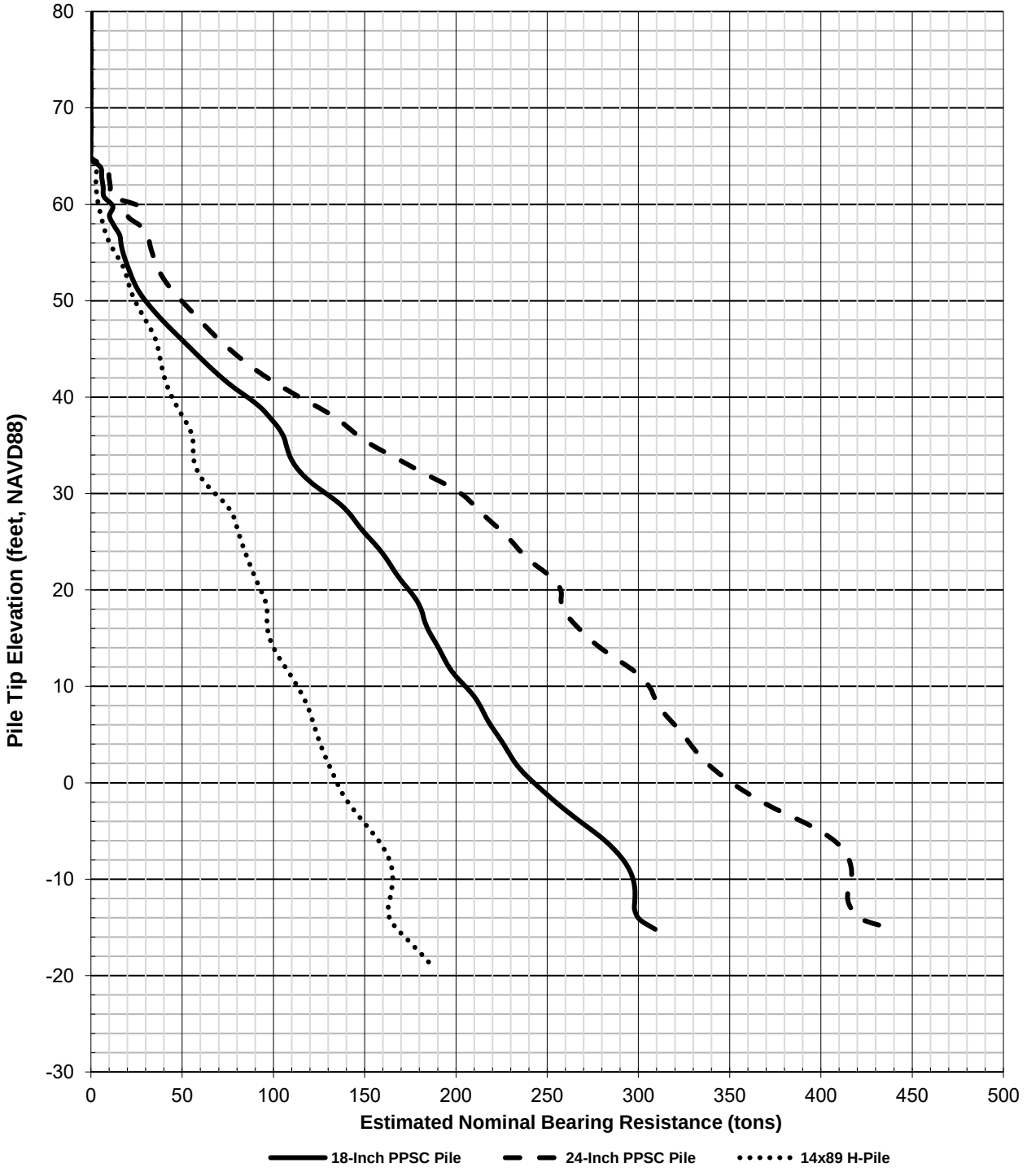
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: REPORT OF CORE BORINGS (1)
REF. DWG. NO.
PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE
SHEET NO.

APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

SR 70 over Long Point Marsh
SPT Boring BB-LONG-1



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DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	MAR 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Long Point Marsh
DeSoto County, FL
FPID No. 451942-2-52-01

General Information:
==========
Input file: .....nts 9 & 10\FBDeep\B6_LONG\BB-LONG-1_14x89 H-Pile_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc.
Units: English

Analysis Information:
==========
Analysis Type: SPT

Soil Information:
==========
Boring date: 2/6/2025, Boring Number: BB-LONG-1
Station number: 4669+52 Offset: 51' LT.

Ground Elevation: 79.800(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	8.00	5- Cavity layer
6	10.00	18.00	5- Cavity layer
7	12.00	14.00	5- Cavity layer
8	14.00	6.00	5- Cavity layer
9	16.00	6.00	3- Clean sand
10	17.50	4.00	3- Clean sand
11	20.00	2.00	2- Clay and silty sand
12	22.50	3.00	3- Clean sand
13	25.00	6.00	3- Clean sand
14	27.50	10.00	3- Clean sand
15	30.00	22.00	3- Clean sand
16	32.50	12.00	3- Clean sand
17	35.00	27.00	3- Clean sand
18	37.50	23.00	3- Clean sand
19	40.00	20.00	3- Clean sand

20	42.50	20.00	3- Clean sand
21	45.00	26.00	3- Clean sand
22	47.50	28.00	3- Clean sand
23	50.00	12.00	3- Clean sand
24	52.50	30.00	3- Clean sand
25	55.00	38.00	3- Clean sand
26	57.50	25.00	3- Clean sand
27	60.00	31.00	3- Clean sand
28	62.50	25.00	3- Clean sand
29	65.00	31.00	3- Clean sand
30	67.50	12.00	3- Clean sand
31	70.00	28.00	3- Clean sand
32	72.50	26.00	3- Clean sand
33	75.00	32.00	3- Clean sand
34	77.50	24.00	3- Clean sand
35	80.00	27.00	3- Clean sand
36	82.50	26.00	3- Clean sand
37	85.00	28.00	3- Clean sand
38	87.50	37.00	3- Clean sand
39	90.00	39.00	3- Clean sand
40	92.50	33.00	3- Clean sand
41	95.00	38.00	2- Clay and silty sand
42	97.50	24.00	2- Clay and silty sand
43	100.00	44.00	2- Clay and silty sand
44	102.50	38.00	2- Clay and silty sand
45	105.00	33.00	2- Clay and silty sand
46	107.50	15.00	2- Clay and silty sand
47	110.00	21.00	2- Clay and silty sand
48	112.50	10.00	2- Clay and silty sand
49	115.00	14.00	2- Clay and silty sand
50	117.50	16.00	2- Clay and silty sand
51	120.00	16.00	2- Clay and silty sand
52	122.50	20.00	2- Clay and silty sand
53	125.00	20.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	79.80	63.80	16.00	7.25	5-Void
2	63.80	59.80	4.00	4.75	3-Clean Sand
3	59.80	57.30	2.50	2.00	2-Clay and Silty Sand
4	57.30	-15.20	72.50	24.17	3-Clean Sand
5	-15.20	-45.20	30.00	24.08	2-Clay and Silty Sand

Driven Pile Data:
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Pile unit weight = 490.00(pcf), Section Type: H-Section

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)	Depth (in)	End Area (in^2)
14.69	1.00	78.80	13.83	101.58
14.69	2.00	77.80	13.83	101.58
14.69	3.00	76.80	13.83	101.58
14.69	4.00	75.80	13.83	101.58
14.69	5.00	74.80	13.83	101.58
14.69	6.00	73.80	13.83	101.58
14.69	7.00	72.80	13.83	101.58
14.69	8.00	71.80	13.83	101.58
14.69	9.00	70.80	13.83	101.58
14.69	10.00	69.80	13.83	101.58
14.69	11.00	68.80	13.83	101.58
14.69	12.00	67.80	13.83	101.58
14.69	13.00	66.80	13.83	101.58
14.69	14.00	65.80	13.83	101.58
14.69	15.00	64.80	13.83	101.58
14.69	16.00	63.80	13.83	101.58
14.69	17.00	62.80	13.83	101.58
14.69	18.00	61.80	13.83	101.58
14.69	19.00	60.80	13.83	101.58
14.69	20.00	59.80	13.83	101.58
14.69	21.00	58.80	13.83	101.58
14.69	22.00	57.80	13.83	101.58
14.69	23.00	56.80	13.83	101.58
14.69	24.00	55.80	13.83	101.58
14.69	25.00	54.80	13.83	101.58
14.69	26.00	53.80	13.83	101.58
14.69	27.00	52.80	13.83	101.58
14.69	28.00	51.80	13.83	101.58
14.69	29.00	50.80	13.83	101.58
14.69	30.00	49.80	13.83	101.58
14.69	31.00	48.80	13.83	101.58
14.69	32.00	47.80	13.83	101.58
14.69	33.00	46.80	13.83	101.58
14.69	34.00	45.80	13.83	101.58
14.69	35.00	44.80	13.83	101.58
14.69	36.00	43.80	13.83	101.58
14.69	37.00	42.80	13.83	101.58
14.69	38.00	41.80	13.83	101.58
14.69	39.00	40.80	13.83	101.58

14.69	40.00	39.80	13.83	101.58
14.69	41.00	38.80	13.83	101.58
14.69	42.00	37.80	13.83	101.58
14.69	43.00	36.80	13.83	101.58
14.69	44.00	35.80	13.83	101.58
14.69	45.00	34.80	13.83	101.58
14.69	46.00	33.80	13.83	101.58
14.69	47.00	32.80	13.83	101.58
14.69	48.00	31.80	13.83	101.58
14.69	49.00	30.80	13.83	101.58
14.69	50.00	29.80	13.83	101.58
14.69	51.00	28.80	13.83	101.58
14.69	52.00	27.80	13.83	101.58
14.69	53.00	26.80	13.83	101.58
14.69	54.00	25.80	13.83	101.58
14.69	55.00	24.80	13.83	101.58
14.69	56.00	23.80	13.83	101.58
14.69	57.00	22.80	13.83	101.58
14.69	58.00	21.80	13.83	101.58
14.69	59.00	20.80	13.83	101.58
14.69	60.00	19.80	13.83	101.58
14.69	61.00	18.80	13.83	101.58
14.69	62.00	17.80	13.83	101.58
14.69	63.00	16.80	13.83	101.58
14.69	64.00	15.80	13.83	101.58
14.69	65.00	14.80	13.83	101.58
14.69	66.00	13.80	13.83	101.58
14.69	67.00	12.80	13.83	101.58
14.69	68.00	11.80	13.83	101.58
14.69	69.00	10.80	13.83	101.58
14.69	70.00	9.80	13.83	101.58
14.69	71.00	8.80	13.83	101.58
14.69	72.00	7.80	13.83	101.58
14.69	73.00	6.80	13.83	101.58
14.69	74.00	5.80	13.83	101.58
14.69	75.00	4.80	13.83	101.58
14.69	76.00	3.80	13.83	101.58
14.69	77.00	2.80	13.83	101.58
14.69	78.00	1.80	13.83	101.58
14.69	79.00	0.80	13.83	101.58
14.69	80.00	-0.20	13.83	101.58
14.69	81.00	-1.20	13.83	101.58
14.69	82.00	-2.20	13.83	101.58
14.69	83.00	-3.20	13.83	101.58
14.69	84.00	-4.20	13.83	101.58
14.69	85.00	-5.20	13.83	101.58
14.69	86.00	-6.20	13.83	101.58
14.69	87.00	-7.20	13.83	101.58
14.69	88.00	-8.20	13.83	101.58
14.69	89.00	-9.20	13.83	101.58

14.69	90.00	-10.20	13.83	101.58
14.69	91.00	-11.20	13.83	101.58
14.69	92.00	-12.20	13.83	101.58
14.69	93.00	-13.20	13.83	101.58
14.69	94.00	-14.20	13.83	101.58
14.69	95.00	-15.20	13.83	101.58
14.69	96.00	-16.20	13.83	101.58
14.69	97.00	-17.20	13.83	101.58
14.69	98.00	-18.20	13.83	101.58
14.69	99.00	-19.20	13.83	101.58
14.69	100.00	-20.20	13.83	101.58
14.69	101.00	-21.20	13.83	101.58
14.69	102.00	-22.20	13.83	101.58
14.69	103.00	-23.20	13.83	101.58
14.69	104.00	-24.20	13.83	101.58
14.69	105.00	-25.20	13.83	101.58
14.69	106.00	-26.20	13.83	101.58
14.69	107.00	-27.20	13.83	101.58
14.69	108.00	-28.20	13.83	101.58
14.69	109.00	-29.20	13.83	101.58
14.69	110.00	-30.20	13.83	101.58
14.69	111.00	-31.20	13.83	101.58
14.69	112.00	-32.20	13.83	101.58
14.69	113.00	-33.20	13.83	101.58
14.69	114.00	-34.20	13.83	101.58
14.69	115.00	-35.20	13.83	101.58
14.69	116.00	-36.20	13.83	101.58
14.69	117.00	-37.20	13.83	101.58
14.69	118.00	-38.20	13.83	101.58
14.69	119.00	-39.20	13.83	101.58
14.69	120.00	-40.20	13.83	101.58
14.69	121.00	-41.20	13.83	0.00
14.69	122.00	-42.20	13.83	0.00
14.69	123.00	-43.20	13.83	0.00
14.69	124.00	-44.20	13.83	0.00
14.69	125.00	-45.20	13.83	0.00

Driven Pile Capacity:
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Section Type: H
Pile Width: 14.69 (in)
Sect. Depth: 13.83 (in)
End Area: 101.58 (in^2)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	14.7	0.00	0.00	0.00	0.00	0.00
2.00	14.7	0.00	0.00	0.00	0.00	0.00
3.00	14.7	0.00	0.00	0.00	0.00	0.00
4.00	14.7	0.00	0.00	0.00	0.00	0.00
5.00	14.7	0.00	0.00	0.00	0.00	0.00
6.00	14.7	0.00	0.00	0.00	0.00	0.00
7.00	14.7	0.00	0.00	0.00	0.00	0.00
8.00	14.7	0.00	0.00	0.00	0.00	0.00
9.00	14.7	0.00	0.00	0.00	0.00	0.00
10.00	14.7	0.00	0.00	0.00	0.00	0.00
11.00	14.7	0.00	0.00	0.00	0.00	0.00
12.00	14.7	0.00	0.00	0.00	0.00	0.00
13.00	14.7	0.00	0.00	0.00	0.00	0.00
14.00	14.7	0.00	0.00	0.00	0.00	0.00
15.00	14.7	0.12	0.00	0.12	0.06	0.12
16.00	14.7	0.50	2.47	2.97	1.49	5.45
17.00	14.7	0.94	1.78	2.72	1.36	4.49
18.00	14.7	1.27	1.57	2.84	1.42	4.41
19.00	14.7	1.47	1.89	3.36	1.68	5.25
20.00	14.7	1.54	2.74	4.28	2.14	9.76
21.00	14.7	1.59	3.89	5.48	2.74	13.26
22.00	14.7	1.74	5.12	6.85	3.43	17.09
23.00	14.7	1.98	6.47	8.45	4.23	14.92
24.00	14.7	2.33	8.39	10.73	5.36	19.12
25.00	14.7	2.78	11.00	13.79	6.89	24.79
26.00	14.7	3.35	13.59	16.94	8.47	30.52
27.00	14.7	4.04	15.12	19.16	9.58	34.28
28.00	14.7	4.91	15.65	20.56	10.28	36.21
29.00	14.7	6.13	16.14	22.28	11.14	38.42
30.00	14.7	7.76	16.86	24.62	12.31	41.49
31.00	14.7	9.42	18.07	27.49	13.74	45.56
32.00	14.7	10.75	19.74	30.49	15.24	50.22
33.00	14.7	11.85	21.63	33.48	16.74	55.12
34.00	14.7	13.34	22.38	35.73	17.86	58.11
35.00	14.7	15.34	21.76	37.09	18.55	58.85
36.00	14.7	17.51	20.58	38.09	19.04	58.66
37.00	14.7	19.55	19.70	39.25	19.63	58.95
38.00	14.7	21.47	19.15	40.62	20.31	59.78
39.00	14.7	23.28	19.22	42.50	21.25	61.72
40.00	14.7	24.99	19.97	44.96	22.48	64.94
41.00	14.7	26.65	21.18	47.82	23.91	69.00
42.00	14.7	28.31	22.53	50.84	25.42	73.37
43.00	14.7	29.99	23.88	53.87	26.93	77.75
44.00	14.7	31.85	23.85	55.70	27.85	79.55
45.00	14.7	33.91	22.15	56.06	28.03	78.20

46.00	14.7	36.10	19.96	56.06	28.03	76.02
47.00	14.7	38.36	18.98	57.34	28.67	76.32
48.00	14.7	40.61	19.33	59.94	29.97	79.27
49.00	14.7	42.40	21.48	63.88	31.94	85.36
50.00	14.7	43.67	25.46	69.12	34.56	94.58
51.00	14.7	44.96	29.32	74.28	37.14	103.60
52.00	14.7	46.85	30.83	77.69	38.84	108.52
53.00	14.7	49.30	30.19	79.50	39.75	109.69
54.00	14.7	52.06	29.04	81.10	40.55	110.14
55.00	14.7	55.08	27.74	82.82	41.41	110.55
56.00	14.7	58.02	26.71	84.73	42.37	111.44
57.00	14.7	60.53	26.22	86.75	43.38	112.98
58.00	14.7	62.68	26.16	88.84	44.42	115.01
59.00	14.7	64.96	26.12	91.07	45.54	117.19
60.00	14.7	67.43	26.07	93.50	46.75	119.57
61.00	14.7	69.90	25.71	95.62	47.81	121.33
62.00	14.7	72.18	24.38	96.55	48.28	120.93
63.00	14.7	74.30	22.14	96.45	48.22	118.59
64.00	14.7	76.58	20.30	96.88	48.44	117.18
65.00	14.7	79.05	19.22	98.28	49.14	117.50
66.00	14.7	81.31	19.31	100.62	50.31	119.93
67.00	14.7	82.94	20.70	103.63	51.82	124.33
68.00	14.7	84.08	23.09	107.17	53.59	130.27
69.00	14.7	85.61	24.95	110.56	55.28	135.51
70.00	14.7	87.66	26.05	113.71	56.86	139.76
71.00	14.7	89.96	26.64	116.60	58.30	143.24
72.00	14.7	92.18	26.78	118.96	59.48	145.74
73.00	14.7	94.37	26.45	120.82	60.41	147.27
74.00	14.7	96.73	25.82	122.55	61.27	148.36
75.00	14.7	99.29	24.96	124.24	62.12	149.20
76.00	14.7	101.81	24.28	126.09	63.04	150.36
77.00	14.7	104.07	24.13	128.20	64.10	152.33
78.00	14.7	106.11	24.43	130.54	65.27	154.97
79.00	14.7	108.20	24.72	132.92	66.46	157.64
80.00	14.7	110.39	24.94	135.33	67.66	160.26
81.00	14.7	112.61	25.44	138.05	69.03	163.49
82.00	14.7	114.81	26.70	141.51	70.75	168.21
83.00	14.7	116.98	28.66	145.63	72.82	174.29
84.00	14.7	119.20	30.74	149.94	74.97	180.67
85.00	14.7	121.49	32.82	154.31	77.15	187.13
86.00	14.7	123.97	34.39	158.35	79.18	192.74
87.00	14.7	126.74	34.81	161.55	80.78	196.37
88.00	14.7	129.78	34.12	163.90	81.95	198.02
89.00	14.7	132.92	32.25	165.17	82.58	197.41
90.00	14.7	136.12	29.15	165.28	82.64	194.43
91.00	14.7	139.26	25.36	164.63	82.31	189.99
92.00	14.7	142.20	21.49	163.70	81.85	185.19
93.00	14.7	145.06	17.73	162.79	81.39	180.51
94.00	14.7	148.55	15.47	164.03	82.01	179.50
95.00	14.7	152.80	15.05	167.86	83.93	197.96

96.00	14.7	157.25	15.80	173.04	86.52	204.63
97.00	14.7	161.32	16.85	178.17	89.08	211.86
98.00	14.7	165.12	18.05	183.17	91.59	219.26
99.00	14.7	169.30	18.45	187.74	93.87	224.64
100.00	14.7	173.94	17.90	191.83	95.92	227.62

Section Type: H
Pile Width: 14.69 (in)
Sect. Depth: 13.83 (in)
End Area: 101.58 (in^2)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	14.7	178.76	16.69	195.45	97.73	228.82
102.00	14.7	183.49	15.02	198.52	99.26	228.56
103.00	14.7	188.12	12.97	201.09	100.54	227.03
104.00	14.7	192.64	11.17	203.82	101.91	226.17
105.00	14.7	197.06	9.80	206.86	103.43	226.45
106.00	14.7	201.09	8.83	209.92	104.96	227.57
107.00	14.7	204.44	8.13	212.57	106.29	228.83
108.00	14.7	207.25	7.63	214.87	107.44	230.12
109.00	14.7	210.22	7.06	217.27	108.64	231.39
110.00	14.7	213.48	6.41	219.89	109.95	232.72
111.00	14.7	216.59	5.99	222.57	111.29	234.54
112.00	14.7	219.10	6.05	225.15	112.58	237.26
113.00	14.7	221.12	6.54	227.66	113.83	240.74
114.00	14.7	223.29	6.96	230.25	115.13	244.17
115.00	14.7	225.71	7.23	232.93	116.47	247.39
116.00	14.7	228.30	7.44	235.74	117.87	250.62
117.00	14.7	231.01	7.73	238.74	119.37	254.20
118.00	14.7	233.81	8.09	241.91	120.95	258.09
119.00	14.7	236.63	8.47	245.10	122.55	262.05
120.00	14.7	239.45	8.85	248.30	124.15	266.01
121.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
122.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
123.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
124.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
125.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....nts 9 & 10\FBDeep\B6_LONG\BB-LONG-1_18-inch PPSC_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc.
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 2/6/2025, Boring Number: BB-LONG-1
Station number: 4669+52 Offset: 51' LT.

Ground Elevation: 79.800(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	8.00	5- Cavity layer
6	10.00	18.00	5- Cavity layer
7	12.00	14.00	5- Cavity layer
8	14.00	6.00	5- Cavity layer
9	16.00	6.00	3- Clean sand
10	17.50	4.00	3- Clean sand
11	20.00	2.00	2- Clay and silty sand
12	22.50	3.00	3- Clean sand
13	25.00	6.00	3- Clean sand
14	27.50	10.00	3- Clean sand
15	30.00	22.00	3- Clean sand
16	32.50	12.00	3- Clean sand
17	35.00	27.00	3- Clean sand
18	37.50	23.00	3- Clean sand
19	40.00	20.00	3- Clean sand

20	42.50	20.00	3- Clean sand
21	45.00	26.00	3- Clean sand
22	47.50	28.00	3- Clean sand
23	50.00	12.00	3- Clean sand
24	52.50	30.00	3- Clean sand
25	55.00	38.00	3- Clean sand
26	57.50	25.00	3- Clean sand
27	60.00	31.00	3- Clean sand
28	62.50	25.00	3- Clean sand
29	65.00	31.00	3- Clean sand
30	67.50	12.00	3- Clean sand
31	70.00	28.00	3- Clean sand
32	72.50	26.00	3- Clean sand
33	75.00	32.00	3- Clean sand
34	77.50	24.00	3- Clean sand
35	80.00	27.00	3- Clean sand
36	82.50	26.00	3- Clean sand
37	85.00	28.00	3- Clean sand
38	87.50	37.00	3- Clean sand
39	90.00	39.00	3- Clean sand
40	92.50	33.00	3- Clean sand
41	95.00	38.00	2- Clay and silty sand
42	97.50	24.00	2- Clay and silty sand
43	100.00	44.00	2- Clay and silty sand
44	102.50	38.00	2- Clay and silty sand
45	105.00	33.00	2- Clay and silty sand
46	107.50	15.00	2- Clay and silty sand
47	110.00	21.00	2- Clay and silty sand
48	112.50	10.00	2- Clay and silty sand
49	115.00	14.00	2- Clay and silty sand
50	117.50	16.00	2- Clay and silty sand
51	120.00	16.00	2- Clay and silty sand
52	122.50	20.00	2- Clay and silty sand
53	125.00	20.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	79.80	63.80	16.00	7.25	5-Void
2	63.80	59.80	4.00	4.75	3-Clean Sand
3	59.80	57.30	2.50	2.00	2-Clay and Silty Sand
4	57.30	-15.20	72.50	24.17	3-Clean Sand
5	-15.20	-45.20	30.00	24.08	2-Clay and Silty Sand

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	78.80
18.00	2.00	77.80
18.00	3.00	76.80
18.00	4.00	75.80
18.00	5.00	74.80
18.00	6.00	73.80
18.00	7.00	72.80
18.00	8.00	71.80
18.00	9.00	70.80
18.00	10.00	69.80
18.00	11.00	68.80
18.00	12.00	67.80
18.00	13.00	66.80
18.00	14.00	65.80
18.00	15.00	64.80
18.00	16.00	63.80
18.00	17.00	62.80
18.00	18.00	61.80
18.00	19.00	60.80
18.00	20.00	59.80
18.00	21.00	58.80
18.00	22.00	57.80
18.00	23.00	56.80
18.00	24.00	55.80
18.00	25.00	54.80
18.00	26.00	53.80
18.00	27.00	52.80
18.00	28.00	51.80
18.00	29.00	50.80
18.00	30.00	49.80
18.00	31.00	48.80
18.00	32.00	47.80
18.00	33.00	46.80
18.00	34.00	45.80
18.00	35.00	44.80
18.00	36.00	43.80
18.00	37.00	42.80
18.00	38.00	41.80
18.00	39.00	40.80

18.00	40.00	39.80
18.00	41.00	38.80
18.00	42.00	37.80
18.00	43.00	36.80
18.00	44.00	35.80
18.00	45.00	34.80
18.00	46.00	33.80
18.00	47.00	32.80
18.00	48.00	31.80
18.00	49.00	30.80
18.00	50.00	29.80
18.00	51.00	28.80
18.00	52.00	27.80
18.00	53.00	26.80
18.00	54.00	25.80
18.00	55.00	24.80
18.00	56.00	23.80
18.00	57.00	22.80
18.00	58.00	21.80
18.00	59.00	20.80
18.00	60.00	19.80
18.00	61.00	18.80
18.00	62.00	17.80
18.00	63.00	16.80
18.00	64.00	15.80
18.00	65.00	14.80
18.00	66.00	13.80
18.00	67.00	12.80
18.00	68.00	11.80
18.00	69.00	10.80
18.00	70.00	9.80
18.00	71.00	8.80
18.00	72.00	7.80
18.00	73.00	6.80
18.00	74.00	5.80
18.00	75.00	4.80
18.00	76.00	3.80
18.00	77.00	2.80
18.00	78.00	1.80
18.00	79.00	0.80
18.00	80.00	-0.20
18.00	81.00	-1.20
18.00	82.00	-2.20
18.00	83.00	-3.20
18.00	84.00	-4.20
18.00	85.00	-5.20
18.00	86.00	-6.20
18.00	87.00	-7.20
18.00	88.00	-8.20
18.00	89.00	-9.20

18.00	90.00	-10.20
18.00	91.00	-11.20
18.00	92.00	-12.20
18.00	93.00	-13.20
18.00	94.00	-14.20
18.00	95.00	-15.20
18.00	96.00	-16.20
18.00	97.00	-17.20
18.00	98.00	-18.20
18.00	99.00	-19.20
18.00	100.00	-20.20
18.00	101.00	-21.20
18.00	102.00	-22.20
18.00	103.00	-23.20
18.00	104.00	-24.20
18.00	105.00	-25.20
18.00	106.00	-26.20
18.00	107.00	-27.20
18.00	108.00	-28.20
18.00	109.00	-29.20
18.00	110.00	-30.20
18.00	111.00	-31.20
18.00	112.00	-32.20
18.00	113.00	-33.20
18.00	114.00	-34.20
18.00	115.00	-35.20
18.00	116.00	-36.20
18.00	117.00	-37.20
18.00	118.00	-38.20
18.00	119.00	-39.20
18.00	120.00	-40.20
18.00	121.00	-41.20
18.00	122.00	-42.20
18.00	123.00	-43.20
18.00	124.00	-44.20
18.00	125.00	-45.20

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test	Pile	Ultimate	Mobilized	Estimated	Allowable	Ultimate

Pile Length (ft)	Width (in)	Side Friction (tons)	End Bearing (tons)	Davisson Capacity (tons)	Pile Capacity (tons)	Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	0.00	0.00	0.00	0.00
4.00	18.0	0.00	0.00	0.00	0.00	0.00
5.00	18.0	0.00	0.00	0.00	0.00	0.00
6.00	18.0	0.00	0.00	0.00	0.00	0.00
7.00	18.0	0.00	0.00	0.00	0.00	0.00
8.00	18.0	0.00	0.00	0.00	0.00	0.00
9.00	18.0	0.00	0.00	0.00	0.00	0.00
10.00	18.0	0.00	0.00	0.00	0.00	0.00
11.00	18.0	0.00	0.00	0.00	0.00	0.00
12.00	18.0	0.00	0.00	0.00	0.00	0.00
13.00	18.0	0.00	0.00	0.00	0.00	0.00
14.00	18.0	0.00	0.00	0.00	0.00	0.00
15.00	18.0	0.21	0.00	0.21	0.11	0.21
16.00	18.0	0.85	4.55	5.40	2.70	14.51
17.00	18.0	1.60	4.30	5.90	2.95	14.49
18.00	18.0	2.15	4.56	6.71	3.36	15.84
19.00	18.0	2.27	4.87	7.13	3.57	16.86
20.00	18.0	2.62	9.38	12.00	6.00	30.76
21.00	18.0	2.70	7.45	10.15	5.08	25.06
22.00	18.0	2.93	9.70	12.63	6.31	32.02
23.00	18.0	3.35	12.41	15.76	7.88	40.58
24.00	18.0	3.73	12.81	16.55	8.27	42.17
25.00	18.0	4.06	13.80	17.86	8.93	45.46
26.00	18.0	4.45	15.21	19.66	9.83	50.08
27.00	18.0	4.97	16.70	21.68	10.84	55.08
28.00	18.0	5.68	18.19	23.86	11.93	60.24
29.00	18.0	6.65	20.15	26.79	13.40	67.09
30.00	18.0	7.88	22.82	30.70	15.35	76.34
31.00	18.0	9.14	26.02	35.17	17.58	87.21
32.00	18.0	10.18	29.85	40.03	20.02	99.73
33.00	18.0	11.11	34.17	45.28	22.64	113.62
34.00	18.0	12.52	38.16	50.69	25.34	127.02
35.00	18.0	14.54	41.49	56.03	28.02	139.02
36.00	18.0	16.88	44.55	61.43	30.72	150.54
37.00	18.0	19.24	47.80	67.05	33.52	162.66
38.00	18.0	21.61	51.40	73.01	36.51	175.82
39.00	18.0	23.97	55.76	79.72	39.86	191.24
40.00	18.0	26.32	60.93	87.25	43.62	209.10
41.00	18.0	28.83	64.83	93.65	46.83	223.31
42.00	18.0	31.45	66.98	98.43	49.21	232.38
43.00	18.0	34.12	68.68	102.80	51.40	240.16
44.00	18.0	37.01	68.79	105.80	52.90	243.38
45.00	18.0	40.15	67.17	107.32	53.66	241.66
46.00	18.0	43.48	65.66	109.14	54.57	240.46

47.00	18.0	46.92	65.32	112.24	56.12	242.88
48.00	18.0	50.39	66.45	116.83	58.42	249.72
49.00	18.0	53.31	69.59	122.90	61.45	262.08
50.00	18.0	55.58	74.78	130.36	65.18	279.91
51.00	18.0	57.88	79.25	137.13	68.57	295.63
52.00	18.0	60.95	81.25	142.20	71.10	304.70
53.00	18.0	64.74	81.39	146.14	73.07	308.92
54.00	18.0	68.97	81.55	150.52	75.26	313.63
55.00	18.0	73.57	81.81	155.38	77.69	318.99
56.00	18.0	78.09	81.66	159.76	79.88	323.08
57.00	18.0	82.07	81.37	163.44	81.72	326.17
58.00	18.0	85.58	81.26	166.83	83.42	329.35
59.00	18.0	89.26	81.45	170.71	85.36	333.61
60.00	18.0	93.23	81.87	175.10	87.55	338.83
61.00	18.0	97.21	81.61	178.82	89.41	342.03
62.00	18.0	100.92	80.37	181.30	90.65	342.04
63.00	18.0	104.44	78.34	182.77	91.39	339.44
64.00	18.0	108.17	76.81	184.97	92.49	338.59
65.00	18.0	112.18	75.82	188.00	94.00	339.64
66.00	18.0	115.90	75.13	191.03	95.52	341.29
67.00	18.0	118.73	75.03	193.76	96.88	343.82
68.00	18.0	120.86	76.02	196.87	98.44	348.91
69.00	18.0	123.53	77.56	201.09	100.55	356.21
70.00	18.0	126.97	79.24	206.21	103.10	364.68
71.00	18.0	130.75	79.83	210.58	105.29	370.23
72.00	18.0	134.44	79.34	213.78	106.89	372.47
73.00	18.0	138.08	78.37	216.44	108.22	373.17
74.00	18.0	141.97	77.67	219.63	109.82	374.97
75.00	18.0	146.15	77.14	223.29	111.64	377.56
76.00	18.0	150.30	76.46	226.75	113.38	379.67
77.00	18.0	154.05	75.88	229.93	114.97	381.70
78.00	18.0	157.49	76.03	233.52	116.76	385.58
79.00	18.0	161.00	77.24	238.24	119.12	392.71
80.00	18.0	164.67	79.23	243.89	121.95	402.35
81.00	18.0	168.39	81.37	249.76	124.88	412.50
82.00	18.0	172.06	83.81	255.87	127.93	423.49
83.00	18.0	175.70	86.74	262.43	131.22	435.91
84.00	18.0	179.42	89.91	269.33	134.67	449.16
85.00	18.0	183.25	93.21	276.45	138.23	462.87
86.00	18.0	187.35	95.48	282.83	141.41	473.78
87.00	18.0	191.91	96.20	288.11	144.05	480.50
88.00	18.0	196.88	95.51	292.39	146.20	483.42
89.00	18.0	202.00	93.48	295.49	147.74	482.45
90.00	18.0	207.24	90.09	297.33	148.66	477.51
91.00	18.0	212.37	85.73	298.10	149.05	469.56
92.00	18.0	217.21	80.81	298.02	149.01	459.64
93.00	18.0	221.93	76.03	297.96	148.98	450.03
94.00	18.0	227.58	73.21	300.79	150.39	447.21
95.00	18.0	260.05	49.15	309.20	154.60	407.51
96.00	18.0	267.16	49.59	316.75	158.37	415.92

97.00	18.0	273.90	49.81	323.71	161.85	423.32
98.00	18.0	280.17	50.14	330.31	165.15	430.59
99.00	18.0	286.69	51.03	337.72	168.86	439.78
100.00	18.0	293.99	51.88	345.87	172.93	449.62

Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	18.0	302.16	51.54	353.70	176.85	456.79
102.00	18.0	309.97	49.37	359.34	179.67	458.07
103.00	18.0	317.71	46.50	364.21	182.11	457.21
104.00	18.0	325.32	43.99	369.31	184.66	457.30
105.00	18.0	332.79	41.92	374.71	187.36	458.56
106.00	18.0	339.61	39.86	379.47	189.73	459.19
107.00	18.0	345.26	37.82	383.08	191.54	458.71
108.00	18.0	349.95	35.84	385.79	192.90	457.48
109.00	18.0	354.93	34.32	389.25	194.63	457.89
110.00	18.0	360.41	33.07	393.49	196.74	459.63
111.00	18.0	365.64	31.66	397.30	198.65	460.62
112.00	18.0	369.85	30.21	400.06	200.03	460.49
113.00	18.0	373.22	28.97	402.19	201.09	460.13
114.00	18.0	376.83	27.81	404.63	202.32	460.25
115.00	18.0	380.84	26.67	407.51	203.76	460.85
116.00	18.0	385.16	25.73	410.89	205.44	462.34
117.00	18.0	389.67	25.07	414.74	207.37	464.88
118.00	18.0	394.33	24.81	419.14	209.57	468.76
119.00	18.0	399.02	24.99	424.01	212.01	474.00
120.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
121.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
122.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
123.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
124.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
125.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....nts 9 & 10\FBDeep\B6_LONG\BB-LONG-1_24-inch PPSC_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 9
Engineer: Tierra, Inc.
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 2/6/2025, Boring Number: BB-LONG-1
Station number: 4669+52 Offset: 51' LT.

Ground Elevation: 79.800(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	8.00	5- Cavity layer
6	10.00	18.00	5- Cavity layer
7	12.00	14.00	5- Cavity layer
8	14.00	6.00	5- Cavity layer
9	16.00	6.00	3- Clean sand
10	17.50	4.00	3- Clean sand
11	20.00	2.00	2- Clay and silty sand
12	22.50	3.00	3- Clean sand
13	25.00	6.00	3- Clean sand
14	27.50	10.00	3- Clean sand
15	30.00	22.00	3- Clean sand
16	32.50	12.00	3- Clean sand
17	35.00	27.00	3- Clean sand
18	37.50	23.00	3- Clean sand
19	40.00	20.00	3- Clean sand

20	42.50	20.00	3- Clean sand
21	45.00	26.00	3- Clean sand
22	47.50	28.00	3- Clean sand
23	50.00	12.00	3- Clean sand
24	52.50	30.00	3- Clean sand
25	55.00	38.00	3- Clean sand
26	57.50	25.00	3- Clean sand
27	60.00	31.00	3- Clean sand
28	62.50	25.00	3- Clean sand
29	65.00	31.00	3- Clean sand
30	67.50	12.00	3- Clean sand
31	70.00	28.00	3- Clean sand
32	72.50	26.00	3- Clean sand
33	75.00	32.00	3- Clean sand
34	77.50	24.00	3- Clean sand
35	80.00	27.00	3- Clean sand
36	82.50	26.00	3- Clean sand
37	85.00	28.00	3- Clean sand
38	87.50	37.00	3- Clean sand
39	90.00	39.00	3- Clean sand
40	92.50	33.00	3- Clean sand
41	95.00	38.00	2- Clay and silty sand
42	97.50	24.00	2- Clay and silty sand
43	100.00	44.00	2- Clay and silty sand
44	102.50	38.00	2- Clay and silty sand
45	105.00	33.00	2- Clay and silty sand
46	107.50	15.00	2- Clay and silty sand
47	110.00	21.00	2- Clay and silty sand
48	112.50	10.00	2- Clay and silty sand
49	115.00	14.00	2- Clay and silty sand
50	117.50	16.00	2- Clay and silty sand
51	120.00	16.00	2- Clay and silty sand
52	122.50	20.00	2- Clay and silty sand
53	125.00	20.00	2- Clay and silty sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	79.80	63.80	16.00	7.25	5-Void
2	63.80	59.80	4.00	4.75	3-Clean Sand
3	59.80	57.30	2.50	2.00	2-Clay and Silty Sand
4	57.30	-15.20	72.50	24.17	3-Clean Sand
5	-15.20	-45.20	30.00	24.08	2-Clay and Silty Sand

Driven Pile Data:
==========
Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
24.00	1.00	78.80
24.00	2.00	77.80
24.00	3.00	76.80
24.00	4.00	75.80
24.00	5.00	74.80
24.00	6.00	73.80
24.00	7.00	72.80
24.00	8.00	71.80
24.00	9.00	70.80
24.00	10.00	69.80
24.00	11.00	68.80
24.00	12.00	67.80
24.00	13.00	66.80
24.00	14.00	65.80
24.00	15.00	64.80
24.00	16.00	63.80
24.00	17.00	62.80
24.00	18.00	61.80
24.00	19.00	60.80
24.00	20.00	59.80
24.00	21.00	58.80
24.00	22.00	57.80
24.00	23.00	56.80
24.00	24.00	55.80
24.00	25.00	54.80
24.00	26.00	53.80
24.00	27.00	52.80
24.00	28.00	51.80
24.00	29.00	50.80
24.00	30.00	49.80
24.00	31.00	48.80
24.00	32.00	47.80
24.00	33.00	46.80
24.00	34.00	45.80
24.00	35.00	44.80
24.00	36.00	43.80
24.00	37.00	42.80
24.00	38.00	41.80
24.00	39.00	40.80

24.00	40.00	39.80
24.00	41.00	38.80
24.00	42.00	37.80
24.00	43.00	36.80
24.00	44.00	35.80
24.00	45.00	34.80
24.00	46.00	33.80
24.00	47.00	32.80
24.00	48.00	31.80
24.00	49.00	30.80
24.00	50.00	29.80
24.00	51.00	28.80
24.00	52.00	27.80
24.00	53.00	26.80
24.00	54.00	25.80
24.00	55.00	24.80
24.00	56.00	23.80
24.00	57.00	22.80
24.00	58.00	21.80
24.00	59.00	20.80
24.00	60.00	19.80
24.00	61.00	18.80
24.00	62.00	17.80
24.00	63.00	16.80
24.00	64.00	15.80
24.00	65.00	14.80
24.00	66.00	13.80
24.00	67.00	12.80
24.00	68.00	11.80
24.00	69.00	10.80
24.00	70.00	9.80
24.00	71.00	8.80
24.00	72.00	7.80
24.00	73.00	6.80
24.00	74.00	5.80
24.00	75.00	4.80
24.00	76.00	3.80
24.00	77.00	2.80
24.00	78.00	1.80
24.00	79.00	0.80
24.00	80.00	-0.20
24.00	81.00	-1.20
24.00	82.00	-2.20
24.00	83.00	-3.20
24.00	84.00	-4.20
24.00	85.00	-5.20
24.00	86.00	-6.20
24.00	87.00	-7.20
24.00	88.00	-8.20
24.00	89.00	-9.20

24.00	90.00	-10.20
24.00	91.00	-11.20
24.00	92.00	-12.20
24.00	93.00	-13.20
24.00	94.00	-14.20
24.00	95.00	-15.20
24.00	96.00	-16.20
24.00	97.00	-17.20
24.00	98.00	-18.20
24.00	99.00	-19.20
24.00	100.00	-20.20
24.00	101.00	-21.20
24.00	102.00	-22.20
24.00	103.00	-23.20
24.00	104.00	-24.20
24.00	105.00	-25.20
24.00	106.00	-26.20
24.00	107.00	-27.20
24.00	108.00	-28.20
24.00	109.00	-29.20
24.00	110.00	-30.20
24.00	111.00	-31.20
24.00	112.00	-32.20
24.00	113.00	-33.20
24.00	114.00	-34.20
24.00	115.00	-35.20
24.00	116.00	-36.20
24.00	117.00	-37.20
24.00	118.00	-38.20
24.00	119.00	-39.20
24.00	120.00	-40.20
24.00	121.00	-41.20
24.00	122.00	-42.20
24.00	123.00	-43.20
24.00	124.00	-44.20
24.00	125.00	-45.20

Driven Pile Capacity:
==========

Section Type: Square
Pile Width: 24.00 (in)

Test	Pile	Ultimate	Mobilized	Estimated	Allowable	Ultimate

Pile Length (ft)	Width (in)	Side Friction (tons)	End Bearing (tons)	Davisson Capacity (tons)	Pile Capacity (tons)	Pile Capacity (tons)
1.00	24.0	0.00	0.00	0.00	0.00	0.00
2.00	24.0	0.00	0.00	0.00	0.00	0.00
3.00	24.0	0.00	0.00	0.00	0.00	0.00
4.00	24.0	0.00	0.00	0.00	0.00	0.00
5.00	24.0	0.00	0.00	0.00	0.00	0.00
6.00	24.0	0.00	0.00	0.00	0.00	0.00
7.00	24.0	0.00	0.00	0.00	0.00	0.00
8.00	24.0	0.00	0.00	0.00	0.00	0.00
9.00	24.0	0.00	0.00	0.00	0.00	0.00
10.00	24.0	0.00	0.00	0.00	0.00	0.00
11.00	24.0	0.00	0.00	0.00	0.00	0.00
12.00	24.0	0.00	0.00	0.00	0.00	0.00
13.00	24.0	0.00	0.00	0.00	0.00	0.00
14.00	24.0	0.00	0.00	0.00	0.00	0.00
15.00	24.0	0.28	0.00	0.28	0.14	0.28
16.00	24.0	1.13	7.76	8.89	4.44	24.40
17.00	24.0	2.08	7.79	9.88	4.94	25.47
18.00	24.0	2.60	8.03	10.63	5.32	26.70
19.00	24.0	2.71	8.68	11.40	5.70	28.76
20.00	24.0	3.49	22.83	26.31	13.16	71.96
21.00	24.0	3.60	16.70	20.30	10.15	53.71
22.00	24.0	3.93	22.92	26.85	13.43	72.69
23.00	24.0	4.47	26.75	31.22	15.61	84.71
24.00	24.0	5.00	27.31	32.31	16.16	86.94
25.00	24.0	5.59	28.25	33.84	16.92	90.34
26.00	24.0	6.30	29.40	35.70	17.85	94.50
27.00	24.0	7.05	31.12	38.17	19.09	100.42
28.00	24.0	7.85	33.68	41.54	20.77	108.90
29.00	24.0	9.02	36.79	45.81	22.90	119.38
30.00	24.0	10.66	39.94	50.61	25.30	130.50
31.00	24.0	12.39	43.21	55.59	27.80	142.00
32.00	24.0	13.78	46.77	60.55	30.27	154.09
33.00	24.0	14.97	50.67	65.64	32.82	166.99
34.00	24.0	16.71	54.43	71.14	35.57	180.01
35.00	24.0	19.14	57.92	77.06	38.53	192.90
36.00	24.0	21.89	61.53	83.42	41.71	206.47
37.00	24.0	24.49	66.00	90.50	45.25	222.51
38.00	24.0	26.96	71.41	98.38	49.19	241.20
39.00	24.0	29.37	77.63	107.00	53.50	262.26
40.00	24.0	31.75	84.52	116.27	58.13	285.30
41.00	24.0	34.20	91.75	125.95	62.98	309.45
42.00	24.0	36.96	97.53	134.49	67.24	329.55
43.00	24.0	40.06	101.20	141.26	70.63	343.66
44.00	24.0	43.56	104.31	147.87	73.94	356.49
45.00	24.0	47.35	108.76	156.11	78.06	373.64
46.00	24.0	51.36	114.66	166.02	83.01	395.34

47.00	24.0	55.67	119.99	175.66	87.83	415.63
48.00	24.0	60.15	125.34	185.49	92.74	436.16
49.00	24.0	64.00	131.93	195.93	97.97	459.80
50.00	24.0	67.07	137.14	204.21	102.11	478.49
51.00	24.0	70.18	139.66	209.84	104.92	489.17
52.00	24.0	74.20	140.84	215.04	107.52	496.72
53.00	24.0	79.13	141.76	220.89	110.44	504.41
54.00	24.0	84.58	142.16	226.74	113.37	511.05
55.00	24.0	90.51	141.17	231.68	115.84	514.02
56.00	24.0	96.37	139.91	236.28	118.14	516.10
57.00	24.0	101.55	140.54	242.09	121.05	523.17
58.00	24.0	106.17	142.98	249.15	124.58	535.11
59.00	24.0	111.01	144.08	255.09	127.55	543.25
60.00	24.0	116.21	141.45	257.66	128.83	540.55
61.00	24.0	121.43	136.21	257.64	128.82	530.05
62.00	24.0	126.32	132.97	259.30	129.65	525.24
63.00	24.0	130.97	132.40	263.38	131.69	528.19
64.00	24.0	135.89	132.53	268.42	134.21	533.48
65.00	24.0	141.17	132.75	273.92	136.96	539.43
66.00	24.0	146.08	134.43	280.52	140.26	549.38
67.00	24.0	149.87	138.42	288.29	144.15	565.13
68.00	24.0	152.78	143.37	296.15	148.07	582.88
69.00	24.0	156.37	146.07	302.44	151.22	594.58
70.00	24.0	160.93	145.59	306.52	153.26	597.69
71.00	24.0	165.93	142.98	308.90	154.45	594.86
72.00	24.0	170.80	140.95	311.75	155.88	593.66
73.00	24.0	175.63	140.32	315.95	157.97	596.60
74.00	24.0	180.76	140.12	320.89	160.44	601.13
75.00	24.0	186.28	139.02	325.30	162.65	603.35
76.00	24.0	191.75	137.52	329.26	164.63	604.30
77.00	24.0	196.72	136.93	333.66	166.83	607.53
78.00	24.0	201.29	137.62	338.91	169.45	614.14
79.00	24.0	205.96	139.29	345.25	172.62	623.83
80.00	24.0	210.82	141.77	352.59	176.30	636.13
81.00	24.0	215.75	144.99	360.75	180.37	650.74
82.00	24.0	220.62	149.17	369.79	184.90	668.13
83.00	24.0	225.46	154.96	380.41	190.21	690.33
84.00	24.0	230.40	161.27	391.67	195.83	714.22
85.00	24.0	235.47	165.74	401.21	200.61	732.70
86.00	24.0	240.90	167.63	408.53	204.26	743.78
87.00	24.0	246.92	166.32	413.24	206.62	745.87
88.00	24.0	253.47	162.33	415.80	207.90	740.47
89.00	24.0	260.22	156.59	416.80	208.40	729.98
90.00	24.0	267.11	149.28	416.39	208.19	714.94
91.00	24.0	273.88	141.01	414.89	207.44	696.90
92.00	24.0	280.27	134.50	414.77	207.39	683.78
93.00	24.0	286.50	130.63	417.13	208.57	678.40
94.00	24.0	293.95	128.84	422.78	211.39	680.46
95.00	24.0	346.73	92.85	439.58	219.79	625.28
96.00	24.0	356.60	92.94	449.54	224.77	635.41

97.00	24.0	365.81	91.03	456.84	228.42	638.89
98.00	24.0	374.36	89.64	464.00	232.00	643.28
99.00	24.0	383.58	89.76	473.34	236.67	652.85
100.00	24.0	393.70	88.87	482.57	241.28	660.32

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
101.00	24.0	404.21	86.12	490.33	245.17	662.57
102.00	24.0	414.64	82.94	497.58	248.79	663.46
103.00	24.0	424.97	79.98	504.95	252.48	664.91
104.00	24.0	435.13	76.81	511.93	255.97	665.55
105.00	24.0	445.09	72.90	517.99	259.00	663.80
106.00	24.0	454.17	68.66	522.83	261.42	660.15
107.00	24.0	461.68	65.26	526.94	263.47	657.47
108.00	24.0	467.89	62.91	530.80	265.40	656.62
109.00	24.0	474.51	60.92	535.43	267.72	657.28
110.00	24.0	481.80	59.04	540.84	270.42	658.91
111.00	24.0	488.75	57.51	546.26	273.13	661.29
112.00	24.0	494.34	56.10	550.44	275.22	662.63
113.00	24.0	498.80	55.53	554.33	277.17	665.39
114.00	24.0	503.58	55.35	558.93	279.47	669.62
115.00	24.0	508.92	54.77	563.70	281.85	673.25
116.00	24.0	514.66	53.68	568.34	284.17	675.70
117.00	24.0	520.65	52.30	572.96	286.48	677.57
118.00	24.0	526.87	51.05	577.92	288.96	680.03
119.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
120.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
121.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
122.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
123.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
124.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				
125.00	24.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

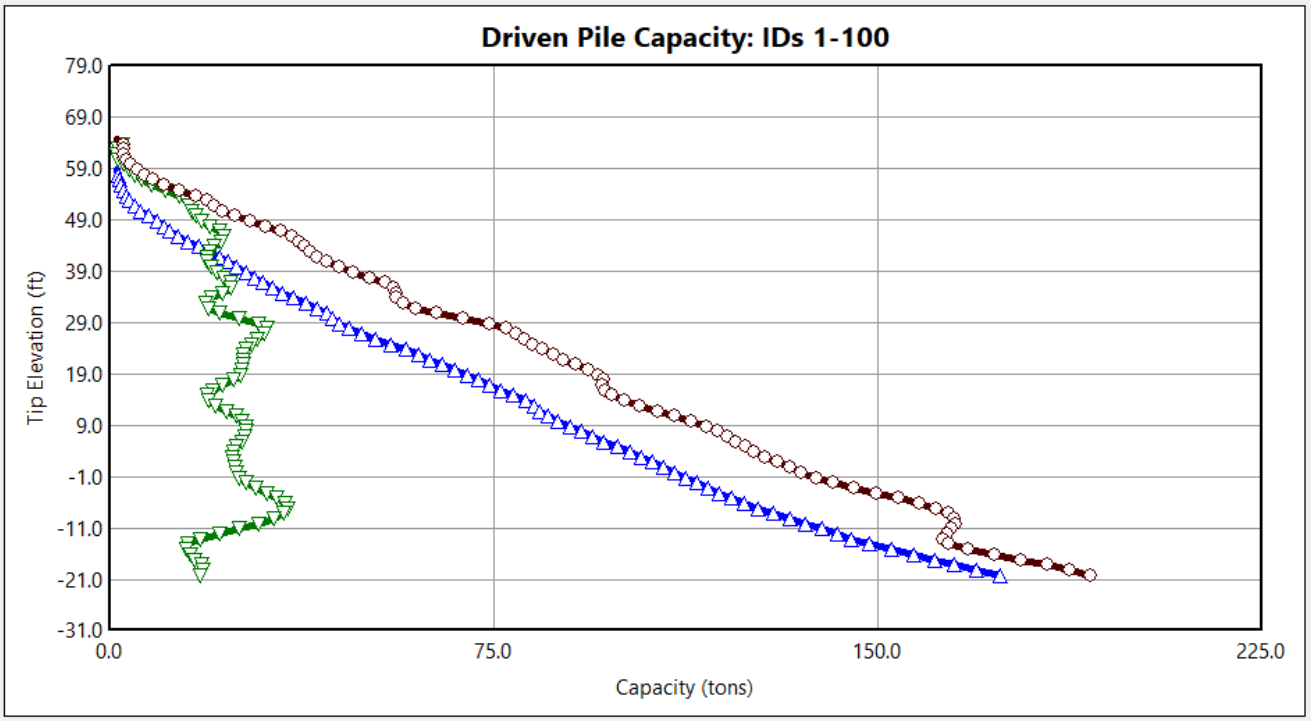
2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

Plot Window

Job Name: SR 70 Seg 9 State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-LONG-1	
Ground Surface Elevation	79.80	(ft)
Section:	H-Section	
Width	14.69	(in)
Depth	13.83	(in)
End Area	101.58	(in2

Project Data

File:	BB-LONG-1_14x89
Date:	Mar 23, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

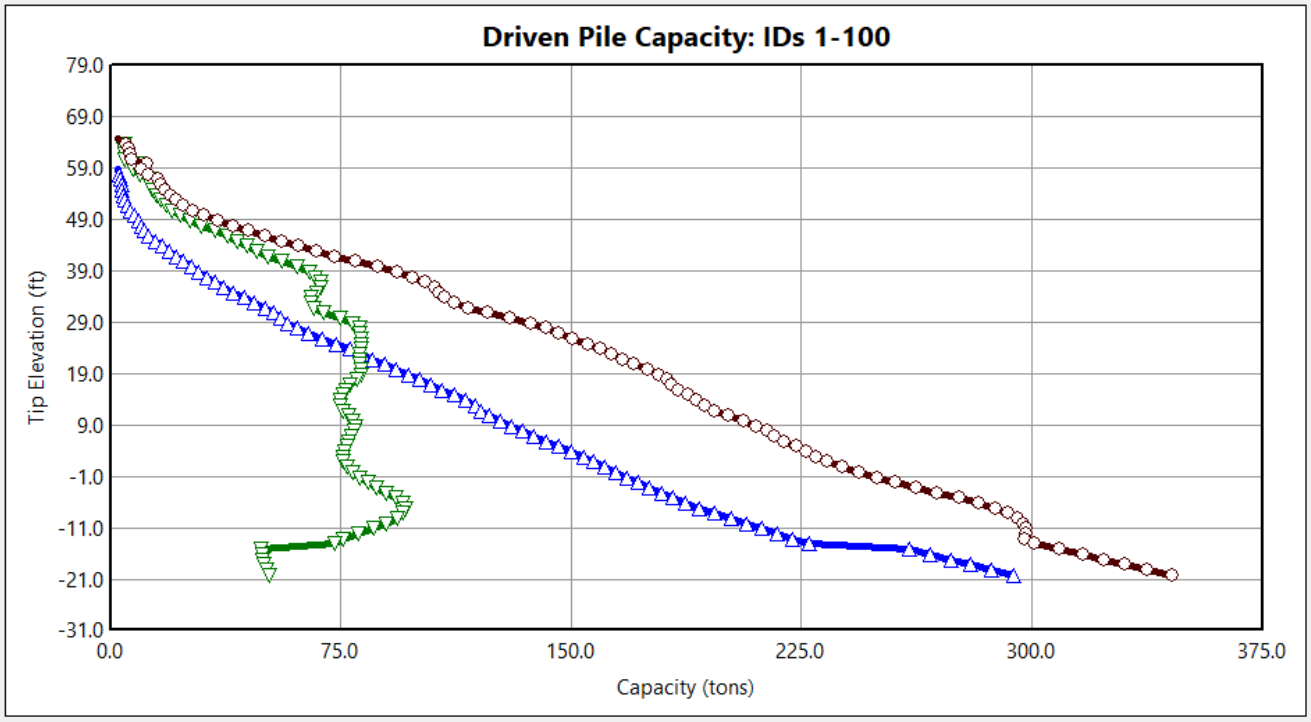
Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9 State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-LONG-1
Ground Surface Elevation	79.80 (ft)
Section:	Square
Width	18.00 (in)

Project Data

File:	BB-LONG-1_18-inch
Date:	Mar 23, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

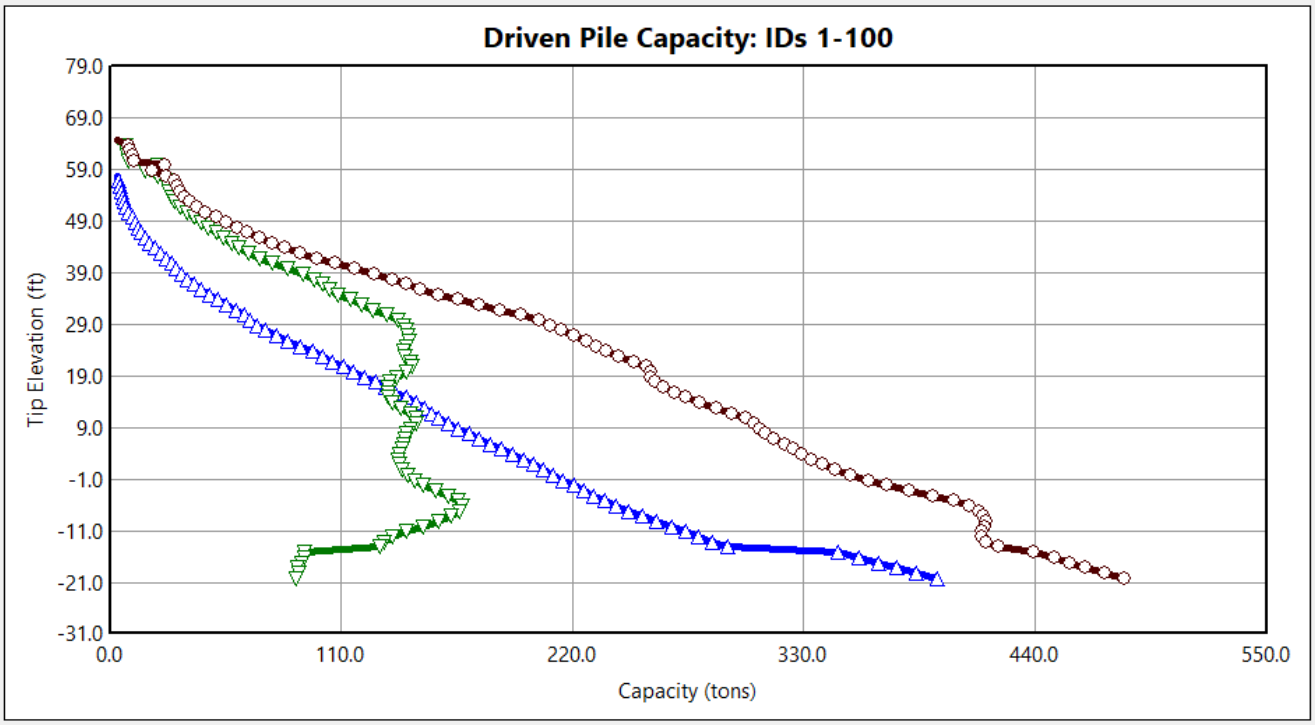
Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9 State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-LONG-1	
Ground Surface Elevation	79.80	(ft)
Section:	Square	
Width	24.00	(in)

Project Data

File:	BB-LONG-1_24-inch
Date:	Mar 23, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

Summary of Laboratory Test Results for Soil Classification
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Long Point Marsh Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Boring Number	Sample Depth (ft)	USCS Symbol	Sieve Analysis					Atterberg Limits			Organic Content (%)	Natural Moisture Content
			#10	#40	#60	#100	#200	Liquid Limit	Plastic Limit	Plasticity Index		
BB-LONG-1	0.0 - 4.0	SP	---	---	---	---	1	---	---	---	---	---
BB-LONG-1	18.5 - 20.0	SM	---	---	---	---	17	---	---	---	---	---
BB-LONG-1	48.5 - 50.0	SP-SM	---	---	---	---	5	---	---	---	---	---
BB-LONG-1	73.5 - 75.0	SP	---	---	---	---	5	---	---	---	---	---
BB-LONG-1	93.5 - 95.0	SM	---	---	---	---	14	NP	NP	NP	---	36
BB-LONG-1	113.5 - 115.0	SM	---	---	---	---	32	NP	NP	NP	---	32
BB-LONG-1	121.0 - 122.5	SM	---	---	---	---	28	NP	NP	NP	---	35

Summary of Laboratory Test Results for Environmental Classification
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Long Point Marsh Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Soil Samples

Boring Number	Depth (feet)	USCS Symbol	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
							Steel	Concrete
BBC-LONG-1	2.0 - 6.0	SP	8.0	9,600	15	36	Slightly Aggressive	Slightly Aggressive
BB-LONG-1	0.0 - 4.0	SP	7.2	19,000	15	<5	Slightly Aggressive	Slightly Aggressive

(1) As per 2025 FDOT Structures Design Guidelines

Water Samples

Sample Location	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
					Steel	Concrete
LONG POINT MARSH	7.9	2,000	95	180	Moderately Aggressive	Moderately Aggressive
	9.0	2,200	30	150	Moderately Aggressive	Moderately Aggressive

(1) As per 2025 FDOT Structures Design Guidelines

Grain Size Distribution Report
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Parker Creek Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No.: 6511-24-001

Approximate Sample Location		Depth Below Mudline (ft)
Latitude	Longitude	
N 27.20964	W 81.63104	0.0-2.0

Grain Size Distribution Curve

Material Description	Classification	
	USCS	AASHTO
Gray to Brown Sand	SP	A-3

Sieve Number	Diameter (mm)	Percent Finer by Weight (%)
3/4"	19.000	100
3/8"	9.500	98.3
4	4.750	98.3
10	2.000	98.3
40	0.425	88.9
60	0.250	73.5
100	0.150	22.3
200	0.075	1.8

Coefficients

D_{10}	0.099	D_{30}	0.162
D_{50}	*0.198*	D_{60}	0.218
D_{85}	0.372	D_{90}	0.509
D_{95}	1.161		
C_U	2.208	C_C	1.213

TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

April 4, 2025

HNTB Corporation
201 N. Franklin Street, Suite 1200
Tampa, FL 33602

Attn: Mr. John Burton, PE, PMP, PTOE, ENV SP.

RE: Preliminary Bridge Geotechnical Report
SR 70 from West of SR 31 to the Highlands County Line
SR 70 over Parker Creek Bridges
FPID No. 451942-2-52-01
DeSoto County, Florida
Tierra Project No. 6511-24-001

Mr. Burton:

Tierra, Inc. (Tierra) has performed a preliminary geotechnical study for the proposed bridge structures associated with the project referenced above. This report has been prepared to support the project Bridge Development Report (BDR). This report presents the results of our study including field and laboratory testing, a preliminary foundation design analysis and our opinions regarding appropriate foundation alternatives for the proposed bridge structures.

Tierra, Inc. appreciates the opportunity to be of service to HNTB Corporation (HNTB) on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.

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1.0 PROJECT INFORMATION

1.1 Project Authorization

Authorization to proceed with this project was issued by HNTB in accordance with our Subconsultant Agreement.

1.2 Project Description

This project consists of widening SR 70 from two lanes to four-lane divided section from West of SR 31 (MP 14.973) to the Highlands County Line (MP 31.763). A shared use path is also proposed on the south side of the SR 70 widening.

This report has been prepared to provide geotechnical input for the Bridge Development Report (BDR) associated with the design of the proposed SR 70 over Parker Creek bridge structures. The subsurface information obtained to date and preliminary engineering recommendations for the proposed foundation alternatives are provided herein.

1.3 General Site Description

A concrete bridge culvert (Bridge No. 040940) supporting the existing SR 70 roadway is currently located at the subject bridge site. The concrete bridge culvert was built circa 1959. The subject bridge site is located in an area surrounded by pasturelands and farmlands.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to provide geotechnical (i.e. subsurface soil conditions and related engineering properties) input to the design team to assist with the design and construction of the proposed SR 70 over Parker Creek bridge structures. The following services were provided in order to achieve the preceding objective:

1. Reviewed soil information from the "Soil Survey of DeSoto County, Florida" published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Reviewed topographic and potentiometric information obtained from the "Long Island Marsh NW, Florida" Quadrangle map and the "Upper Floridan Aquifer Potentiometric Surface" maps published by the United States Geological Survey (USGS).

2. Conducted a visual reconnaissance of the project site and coordinated utility clearance through Sunshine State One Call.

3. Executed a program of subsurface exploration consisting of subsurface sampling and field testing. Performed one (1) Standard Penetration Test (SPT) boring advanced to a depth of approximately 100 feet below existing grades.

4. Visually classified and stratified the obtained soil samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D-2488. Conducted laboratory testing on selected soil samples to confirm the visual classification and evaluate the corrosive nature of the soil and water.

5. Evaluated foundation criteria and performed engineering analyses to develop preliminary design recommendations for the foundation alternatives associated with the proposed bridge structures.

6. Prepared this formal engineering report, which summarizes the course of study pursued, the field and laboratory data generated, the subsurface conditions encountered and the preliminary geotechnical recommendations for the design and construction of the proposed bridge structures.

3.0 REVIEW OF PUBLISHED DATA

3.1 Regional Geology

DeSoto County Geology has been paraphrased from the Florida Geological Survey, Open-File Report 80, 2001 and other geologic references.

Based on a review of the Surficial Geology Maps published by FGS, Reworked Cypresshead sediments (TQuc) is mapped at the surface in the vicinity of the bridge site.

The Reworked Cypresshead sediments (TQuc) is the result of post depositional reworking of the Cypresshead siliciclastics, formed during the Pliocene and Pleistocene epochs. The

sediments are fine to coarse quartz sands with scattered quartz gravel and varying percentages of clay matrix.

3.2 USDA Soil Survey

Based on a review of the Soil Survey for DeSoto County published by the USDA NRCS, it appears that there is one (1) primary soil-mapping unit noted at the bridge site. The general soil description as described in the Soil Survey is presented in the following table. The **USDA Soil Survey Map** for the bridge site is illustrated in **Appendix A**.

Summary of USDA Soil Survey
DeSoto, Florida

USDA Map Symbol and Soil Name	Depth (in)	Soil Classification		Permeability (in/hr)	pH	Seasonal High Water Table	
		USCS	AASHTO			Depth (feet)	Months
(40) Valkaria	0-5	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	4.5-7.3	0.3-1.5	Jul-Oct
	5-16	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	4.5-7.3		
	16-51	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	4.5-7.8		
	51-80	SP-SM, SM	A-2-4, A-3	6.0 - 20.0	4.5-7.8		

It should be noted that information contained in the USDA Soil Survey Map may not be reflective of actual soil and groundwater conditions, particularly if recent development in the project vicinity has modified soil conditions or surface/subsurface drainage.

3.3 USGS Quadrangle Map

Based on a review of the “Long Island Marsh NW, Florida” USGS Quadrangle Map, it appears that the natural elevation at the project site ranges from approximately +80 feet to +85 feet National Geodetic Vertical Datum of 1929 (NGVD 29) as illustrated on the **USGS Quadrangle Map** in **Appendix A.**

3.4 Review of Potentiometric Surface Information

Based on a review of the “Upper Floridan Aquifer Potentiometric Surface” maps published by the USGS, the potentiometric surface elevation at the bridge site is reported to range from approximately +50 to +60 feet, NGVD 29. As indicated in **Section 3.3**, the natural ground surface elevation at the bridge site ranges from approximately +80 to +85 feet, NGVD 29. Artesian flow conditions were not encountered during the field exploration.

4.0 SUBSURFACE EXPLORATION

4.1 Boring Location Plan

Prior to commencing our subsurface explorations, a boring location plan for the proposed bridge structures was developed based on design information provided by HNTB. This boring location plan was generated based on our engineering judgment and guidelines provided in the "Soils and Foundations Handbook" published by the FDOT. Tierra submitted this boring location plan to FDOT for approval. Following completion of the boring, the boring locations were surveyed by the project surveyor. The Boring Location Plan for the boring performed is provided on the **Report of Core Boring** sheet in **Appendix A.**

Utility clearances were coordinated by Tierra via Sunshine State One Call and updated as required prior to performing the soil boring in order to reduce the potential for damage to the utilities during drilling.

4.2 Soil Boring

Subsurface conditions were explored at the bridge site one (1) SPT boring. The results and location of the SPT boring are presented on the **Report of Core Boring** sheet in **Appendix A**.

The SPT boring was performed with the use of a drill rig using Bentonite Mud drilling procedures. Temporary 3-inch diameter rotary installed casing was utilized to help keep the borehole stable. The soil sampling was performed in general accordance with the ASTM test designation D-1586. The initial 6 feet of the boring was hand augered to verify utility clearances. SPT resistance N-values were then taken at intervals of 2 feet from the hand auger boring depth of 6 feet to a depth of 17½ feet and on intervals of 2½ feet thereafter to the boring termination depths. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our laboratory for classification and analyses.

Soil stratification was determined based on a review of recovered samples, laboratory test results, and interpretation of field boring logs. Stratification lines represent approximate boundaries between soil layers of different engineering properties; however actual transitions between layers may be gradual. In some cases, small variations in properties that were not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The soil profiles represent the conditions at the particular boring location; variations do occur among the boring. Specific details about subsurface conditions and materials encountered at each test location can be obtained from the soil profiles presented on the **Report of Core Boring** sheet in **Appendix A** of this report.

5.0 LABORATORY TESTING

5.1 General

Representative soil samples collected from the SPT boring were classified and stratified in general accordance with the Unified Soil Classification System (USCS). Our classification was based on visual observations, using the results from the laboratory testing as confirmation.

Laboratory testing consisting of fines content (percentage passing No. 200 mesh sieve), Atterberg limits testing, and natural moisture content determination tests were completed on representative soil samples. In addition, Environmental classification tests were performed to evaluate the corrosive nature of the soil and water encountered at the bridge site. The results of the laboratory tests are presented on the **Report of Core Boring** sheet in **Appendix A**. Detailed results of the tests performed are presented on the **Summary of Laboratory Test Results for Soil Classification**, **Summary of Laboratory Test Results for Environmental Classification** and **Grain Size Distribution Report** in **Appendix C.**

5.2 Test Designation

The following list summarizes the laboratory tests performed and respective test methods utilized.

- Fines Content - The fines content tests were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-1140).

- Grain-Size Analyses - The grain-size analyses were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-6913).

- Atterberg Limits - The liquid limit and the plastic limit tests ("Atterberg Limits") were conducted in general accordance with the AASHTO test designations T-089 and T-090, respectively (ASTM test designation D-4318).

- Natural Moisture Content - The moisture content tests were conducted in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).

- Environmental Classification – The environmental classification tests were conducted in general accordance with the FSTM test designations FM 5-550, FM 5-551, FM 5-552, and FM 5-553.

6.0 ENVIRONMENTAL CLASSIFICATION

Environmental classification tests were performed on recovered soil samples obtained from within the boring performed at the bridge site and from water samples obtained from Parker Creek. Based on the laboratory test results and the 2025 FDOT Structure Design Guidelines (SDG), the environmental classifications of the superstructure and substructure for the bridge are classified as follows:

Superstructure Environmental Classification	Concrete Substructure Classification	Steel Substructure Classification
Slightly Aggressive	Moderately Aggressive (Water - Resistivity = 2,000 Ohm-cm)	Moderately Aggressive (Soil – pH = 6.1) (Water - Resistivity = 2,000 Ohm-cm)

The range of test results is presented on the **Report of Core Boring** sheet in **Appendix A.** A summary of the individual environmental classification test results is provided in **Appendix C**.

7.0 RESULTS OF SUBSURFACE EXPLORATION

7.1 General Subsurface Conditions

Generally, the boring encountered sandy soils to the boring termination elevation. Specific information on the soil conditions encountered can be found on the **Report of Core Boring** sheet in **Appendix A.** The soil descriptions and classifications associated with this project are listed in the following table.

Soil Description	USCS Symbol
SAND	SP/SP-SM
SILTY SAND	SM
CLAYEY SAND	SC

Additional borings will be performed as the project progresses beyond the BDR stage; the results will be presented in future submittals.

7.2 Groundwater

The groundwater table was encountered at a depth of approximately 6 feet below existing grades within the boring performed and is presented on the **Report of Core Boring** sheet in **Appendix A**.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e. swales, drainage ponds, underdrains and impervious areas) and creek water levels.

8.0 EVALUATIONS OF BRIDGE FOUNDATION ALTERNATIVES

Evaluations of foundation alternatives for the proposed bridge structures were based on the results of our field study. Based on our discussions with HNTB the following foundation alternatives were considered:

- Shallow Foundations
- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)
- Steel Piles, including H Sections
- Pre-stressed, Pre-cast, Square Concrete (PPSC) Piles
- Drilled Shafts

The following paragraphs discuss each of these alternatives briefly.

8.1 Shallow Foundations

With shallow foundation systems, the structure loads are supported by the bearing capacity of the foundation soils. The design of shallow foundations is typically governed by the soil bearing capacity and total and differential settlement criteria.

Based on the anticipated loading conditions for roadway bridges of this size, a shallow footing would have to be relatively large for bearing capacity and settlement criteria to be achieved or would require some form of subsurface remediation to increase the bearing capacity and decrease settlement potential.

For these reasons, shallow foundations were not considered further for this report.

8.2 Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)

GRS-IBS consists of a shallow foundation combined with a retaining wall system to provide support for single span bridges or multi-span bridges with simply supported end spans. The reasons discussed in **Section 8.1** that preclude the use of shallow foundations also apply to the GRS-IBS.

For these reasons, GRS-IBS was not considered further for this report.

8.3 Pre-Cast Pre-Stressed Square Concrete (PPSC) Piles

PPSC pile foundations are a feasible foundation alternative. They are a widely used and proven foundation system in Florida. PPSC pile foundations are readily available and generally have a lower cost per ton of capacity than other pile types. Analyses were performed for 18-inch and 24-inch PPSC piles for this Preliminary Bridge Geotechnical Report.

8.4 Steel Piles

Steel pile types include H-sections and pipe piles. Steel piles generally do not develop as much capacity for similar penetration depths as PPSC piles. Steel piles are well suited to soil conditions with high variability and where frequent pile splicing is expected and/or required due to overhead restrictions, subsurface variability, etc. Steel piles may also more easily penetrate dense layers to achieve a desired penetration depth and are less susceptible to damage compared to concrete piles. Steel H-Piles are low displacement piles, and therefore vibrations associated with installations are minimized due to the low-displacement nature of the piles. Open end pipe piles are also low displacement but will eventually become plugged at the pile toe. Based on coordination with the Structural Engineer, pile capacity analyses for 14X89 H-Piles were performed for this Preliminary Bridge Geotechnical Report.

8.5 Drilled Shafts

Drilled, cast-in-place, concrete shafts have the ability to develop high axial and lateral capacities. One drilled shaft could potentially take the place of several driven piles depending on soil/rock conditions.

This type of foundation system is often the chosen alternative for sites where competent limestone is present at a relatively shallow depth and with a sufficient thickness. Drilled shafts will develop large skin friction capacities in limestone compared to dense sand, and therefore drilled shafts are most suited for sites with shallow, competent consistent limestone. Drilled shafts foundations may also be considered as a preferred foundation alternative for sites in order to limit construction induced vibrations compared to the vibrations caused by driven piles.

Limestone was not encountered within the SPT Boring performed at the bridge site. Therefore, drilled shafts were not analyzed further for this Preliminary Bridge Geotechnical Report.

9.0 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

9.1 General

Based on the subsurface conditions encountered in the test boring performed to date, it is Tierra's opinion that driven pile foundations are the most suitable foundation alternative type for the proposed bridge structures. Foundation systems comprised of 18-inch and 24-inch PPSC piles and 14X89 H-Piles were analyzed for this Preliminary Bridge Geotechnical Report. The following sections present the results of the engineering analyses for the proposed deep foundation alternatives.

9.2 Environmental Classification

Based on the laboratory test results and the 2025 SDG, the environmental classification for steel substructure for the proposed bridge structures is Moderately Aggressive (Soil – pH = 6.1, Water - Resistivity = 2,000 Ohm-cm). Steel piles will need to be designed with proper sacrificial thickness.

9.3 Downdrag (Negative Skin Friction)

Based on a review of preliminary cross sections, the new bridge supporting the eastbound travel lanes will be at/near the elevation of the existing bridge, and the new bridge supporting the westbound travel lanes will have new embankments (anticipated to be less than about 10 feet high) at each end bent approach. Based on the new embankments and soil conditions encountered in the boring, there will be downdrag loads imparted to the end bent piles. Actual loads will be determined following the BDR stage once a foundation alternative has been selected and the roadway geometry has been finalized. For preliminary estimation purposes, downdrag loads up to 20 tons should be anticipated at the end bent locations.

The portion of the end bent concrete piles within the embankment should be provided with a double wrap of polyethylene sheeting according to the FDOT Specifications to minimize development of downdrag loads from the embankment fill.

9.4 Scour

It is our understanding that the scour analysis will be performed by others. Tierra performed sieve analyses on soil samples collected within two feet of the mudline of Parker Creek near the existing bridge. The results of the sieve analyses along with D_{50} values for use in the scour analysis calculations are provided on the **Grain Size Distribution Report** in **Appendix C**.

9.5 Driven Pile Axial Capacity

Axial pile capacities for the proposed bridge were analyzed based on the subsurface conditions encountered in the boring and the FDOT program FB-Deep. The Load and Resistance Factor Design (LRFD) method was utilized for the analysis.

As indicated in the FDOT Structure Design Guidelines (SDG), the required Nominal Bearing Resistance (Rn) must satisfy the following requirement:

$$\mathbf{Rn} > \frac{\mathbf{(Factored\ Design\ Load + Downdrag + Net\ Scour)}}{\phi}$$

Where ϕ = 0.75; dynamic load testing will be performed on all piles.

Other ϕ factors may be used based on the type of foundation testing recommended.

The R_n is taken as the Davisson Capacity. The Davisson axial capacity consists of the ultimate skin friction and mobilized end bearing (i.e., one-third of the ultimate end bearing). Tierra modeled the top 15 feet of the soil boring profile in the capacity analyses as a cavity layer to mimic a "starter hole" as described in FDOT Specification 455-5.1.

The following table summarizes the approximate maximum recommended R_n for each driven pile foundation alternative:

Driven Pile Foundation Alternative	Approximate Maximum Recommended R_n(1)
18-Inch PPSC Piles	275 tons
24-Inch PPSC Piles	425 tons
14X89 Steel H-Pile	175 tons
(1) Anticipate downdrag loads up to 20 tons for preliminary estimation purposes.	

The axial capacity for 18-inch and 24-inch PPSC piles and 14X89 H-Piles were computed using the program FB-Deep. The results of the axial pile analyses are presented in **APPENDIX B**, including the axial capacity curves, FB-Deep output curves (including Davisson Capacity Curves, Ultimate Skin Friction Curves and Mobilized End Bearing Curves) and FB-Deep computer output files.

9.6 Group Action

No reductions of the individual pile capacities will be required if piles are spaced center-to-center at 3 times their width or greater.

9.7 Settlement

Settlement of pile supported bridge bents should be small and tolerable for a typical single row group. However, the tolerance should be confirmed by the structural engineer. Based on soil conditions encountered at the boring locations, and that piles will be tipped in a suitable bearing layer, individual pile head settlements are estimated to be on the order of ½ inch or less.

10.0 CONSTRUCTION CONSIDERATIONS

10.1 General

The overall site preparation and construction should be in accordance with the FDOT Specifications.

10.2 Temporary Side Slopes

Temporary side slopes and excavations should comply with the Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 C.F.R., s. 1926.650, Subpart P, all subsequent revisions or updates of OSHA's referenced standard adopted by the Department of Labor and Employment Security and Florida's Trench Safety Act, Section 553.62, Florida Statutes. Excavated materials should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth.

10.3 Groundwater Control

Depending upon groundwater levels at the time of construction, some form of dewatering may be required based on the anticipated construction activities due to perched groundwater. Due to groundwater levels anticipated during the wet season of the year, seepage may enter the

bottom and sides of excavated areas. Such seepage will act to loosen soils and create difficult working conditions. Groundwater levels should be determined immediately prior to construction. Shallow groundwater should be kept below the lowest working area to facilitate proper material placement and compaction in accordance with the FDOT Specifications.

10.4 Dynamic Load Testing & Pile Installation

We recommend that a test pile program be conducted for the proposed bridge construction including test piles. The monitoring will provide estimates of pile capacity versus pile penetration, stresses in the pile, and other relevant parameters used to evaluate the pile driving process. analyses should be performed on selected conditions for evaluation of the dynamic test results. The results of these analyses will provide information for developing production pile lengths. In addition, all production piles will be dynamically monitored.

The installation of the piles should be carried out in accordance with the FDOT Specifications.

10.5 Protection of Existing Structures

The FDOT Specifications should be followed for protection of existing structures during foundation construction operations.

11.0 REPORT LIMITATIONS

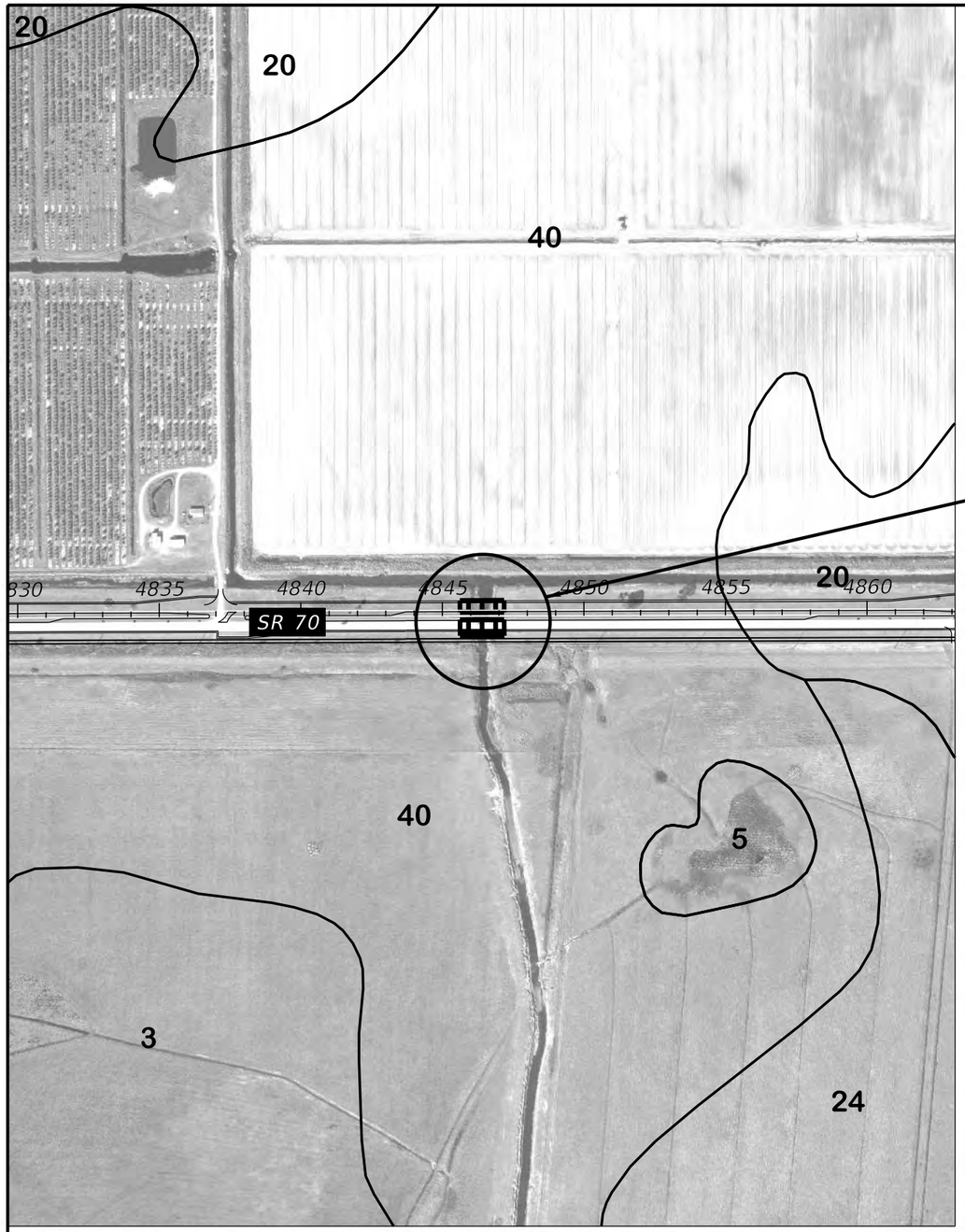
Our services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions, or recommendations made by others based on this data.

The scope of the investigation was intended to evaluate soil conditions within the influence zone of the deep foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil boring performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed structure.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of the HNTB design team and the Florida Department of Transportation.

APPENDIX A

USDA Soil Survey & USGS Quadrangle Maps
Report of Core Boring (1 Sheet)

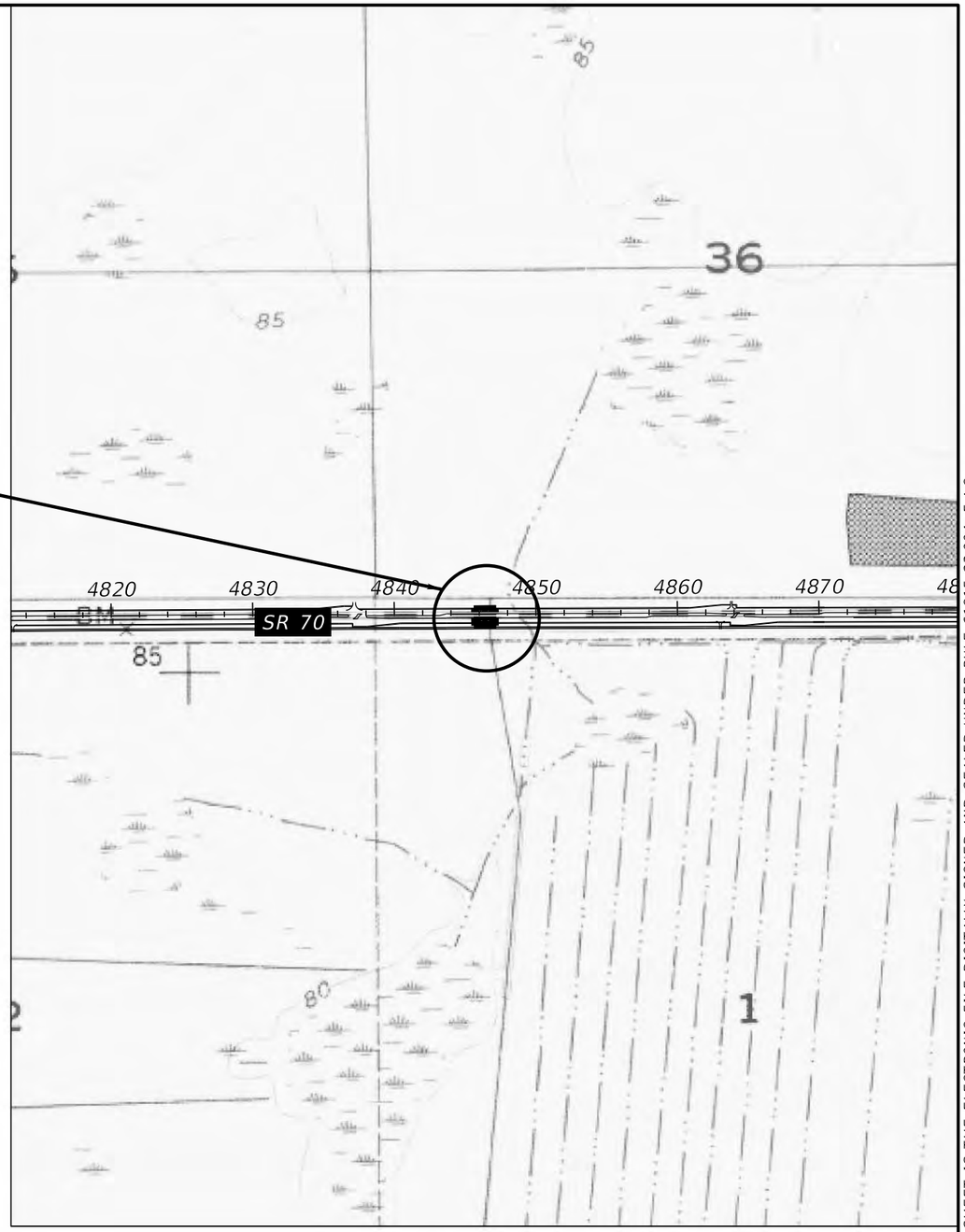


REFERENCE: USDA SOIL SURVEY OF DESOTO COUNTY, FLORIDA

0 100 500
Feet

APPROXIMATE BRIDGE LOCATION

N



REFERENCE: USGS QUADRANGLE MAP OF "LONG ISLAND MARSH NE, FLORIDA"

0 200 1000
Feet

TOWNSHIP: 37S
RANGE: 27E
SECTION: 36

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS					
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CHECKED BY: DAN 02-25
DESIGNED BY: BJS 02-25
CHECKED BY: DAN 02-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: USDA SOIL SURVEY & USGS QUADRANGLE MAPS

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

REF. DWG. NO.

SHEET NO. USDA_USGS_BRIDGE06

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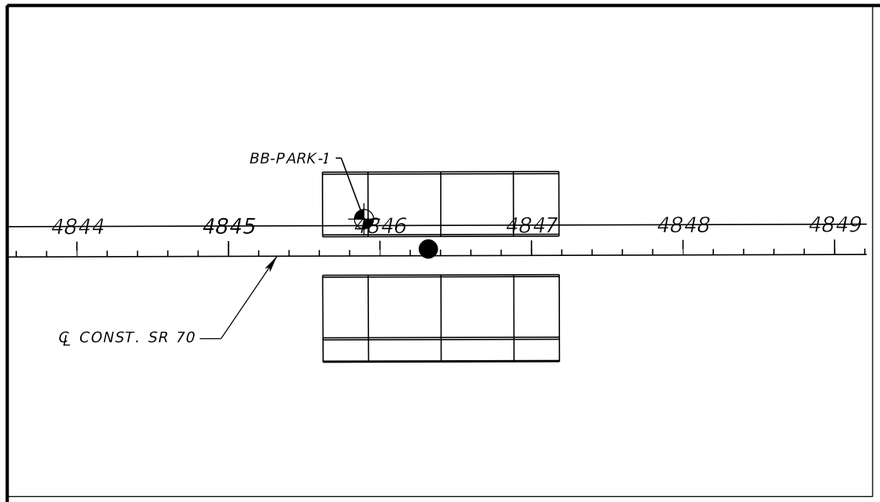
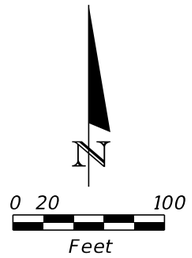




BORING LOCATION PLAN

NOTES:

1. THE BORING LOCATIONS AND ELEVATIONS WERE PROVIDED BY THE PROJECT SURVEYOR.
2. BASED ON A REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION AT THE BRIDGE SITE IS REPORTED TO RANGE FROM APPROXIMATELY +50 FEET TO +60 FEET, NGVD 29. ARTESIAN CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED.

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: MODERATELY AGGRESSIVE (WATER - RESISTIVITY = 2,000 OHM-CM)
SUBSTRUCTURE	STEEL: MODERATELY AGGRESSIVE (SOIL - pH = 6.1, WATER - RESISTIVITY = 2,000 OHM-CM)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

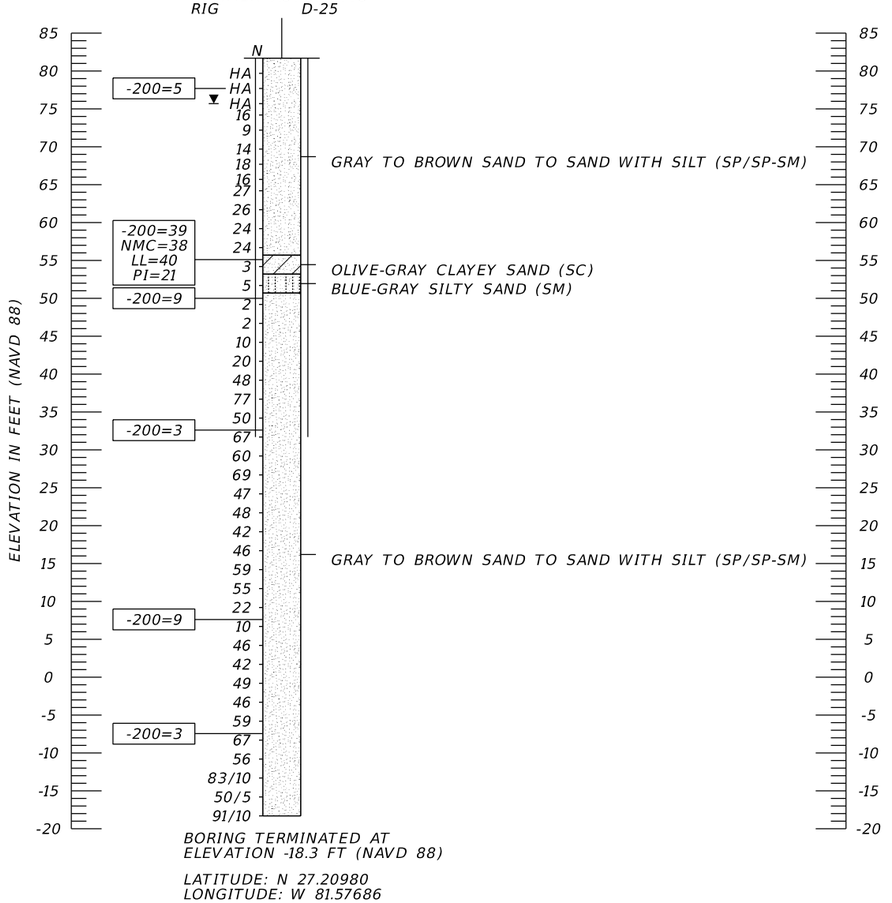
SOIL TEST RESULTS:

RESISTIVITY	23,000 TO 25,000 OHM-CM
CHLORIDES	15 PPM
SULFATES	<5 TO 12 PPM
pH	6.1 TO 7.4

WATER TEST RESULTS:

RESISTIVITY	2,000 TO 2,400 OHM-CM
CHLORIDES	25 TO 90 PPM
SULFATES	120 PPM
pH	7.2 TO 7.8

BOR #	BB-PARK-1
STA.	4845+90
REF.	℄ CONST. SR 70
OFF.	24' LT.
ELEV.	81.7
DATE	1/14/2025
DRILLER	J. BOOTH
HAMMER	AUTOMATIC
RIG	D-25



BORING TERMINATED AT ELEVATION -18.3 FT (NAVD 88)

LATITUDE: N 27.20980
LONGITUDE: W 81.57686

LEGEND

	SAND
	CLAYEY SAND
	SILTY SAND
SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCE
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NAVD 88	NORTH AMERICAN VERTICAL DATUM OF 1988
	APPROXIMATE SPT BORING LOCATION
	GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
	CASING
	APPROXIMATE SEDIMENT SAMPLE LOCATION FOR D_{50} DETERMINATION

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

BRIDGE NOS. XXXXXX & XXXXXX

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

DYLAN A. NELSON, P.E.
License Number: 96772
TIERRA, INC.
7351 TEMPLE TERRACE HIGHWAY
TAMPA, FLORIDA 33637

DRAWN BY:	BJS 02-25
CHECKED BY:	DAN 02-25
DESIGNED BY:	BJS 02-25
CHECKED BY:	DAN 02-25

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	DESOTO	451942-2-52-01

SHEET TITLE: REPORT OF CORE BORINGS (1)

REF. DWG. NO.:

PROJECT NAME: SR 70 FROM WEST OF SR 31 TO HIGHLANDS COUNTY LINE

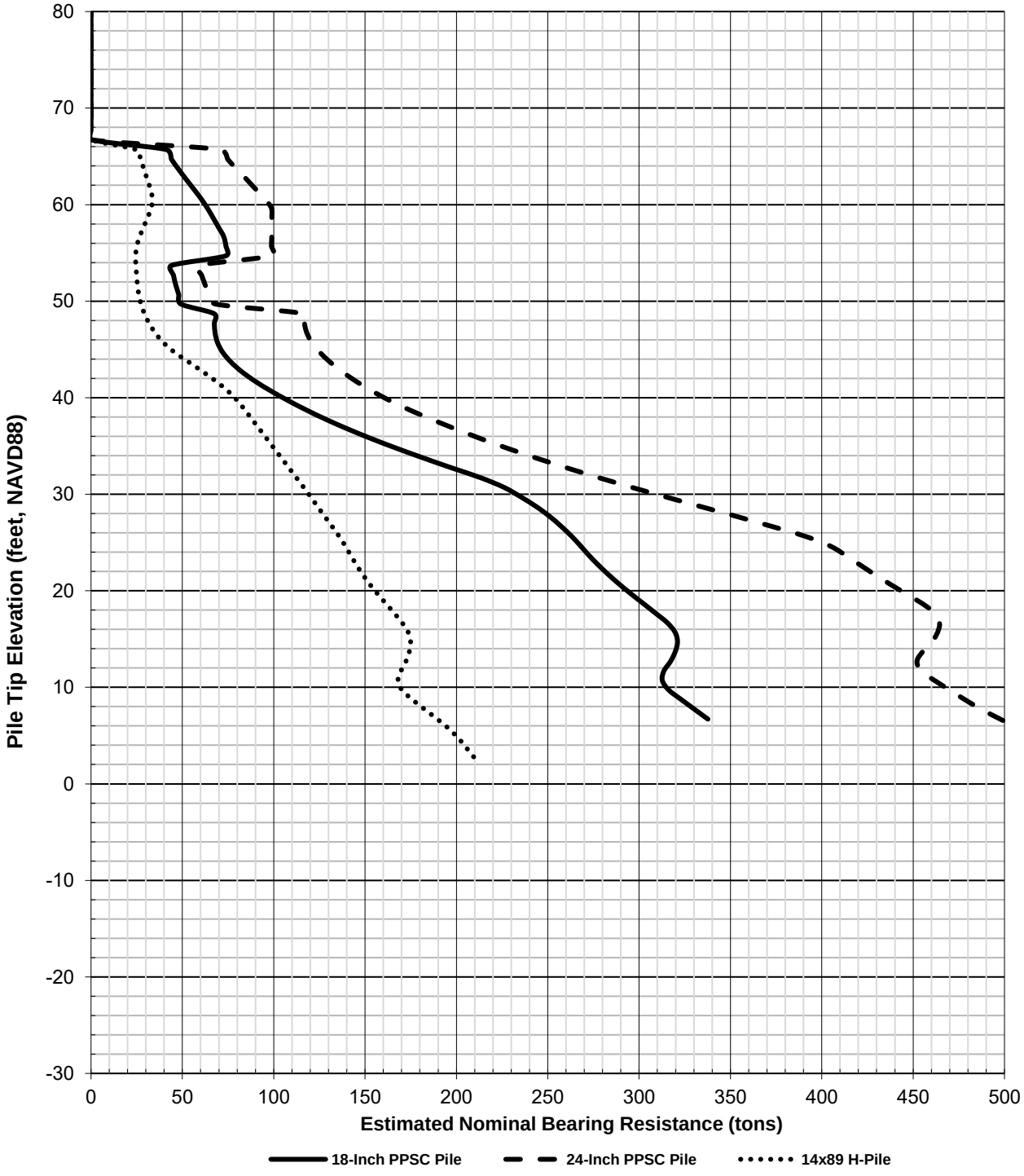
SHEET NO.:

J:\6511\2024 Files\6511-24-001 SR 70 Segments 9 & 10\ORD\6511-24-001\Geotechnical\B7BoringPark01.dgn : RCB_PARK01 [SHEET]
bsawaska 2/21/2025 9:42:01 AM

APPENDIX B

Driven Pile Axial Capacity Curves
FB-Deep Output Curves
FB-Deep Output Files

SR 70 over Parker Creek
SPT Boring BB-PARK-1



TIERRA
GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

DRAWN BY:	SCALE:	PROJECT NO.
DAN	Noted	6511-24-001
CHECKED BY:	DATE:	
MEN	FEB 2025	

SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Parker Creek
DeSoto County, FL
FPID No. 451942-2-52-01

General Information:
==========
Input file: .....gments 9 & 10\FBDeep\PARK\BB-PARK-1_14x89 H-Pile_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 9-10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
==========
Analysis Type: SPT

Soil Information:
==========
Boring date: 1/14/2025, Boring Number: BB-PARK-1
Station number: 4845+90 Offset: 24' LT.

Ground Elevation: 81.700(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	16.00	5- Cavity layer
6	10.00	9.00	5- Cavity layer
7	12.00	14.00	5- Cavity layer
8	14.00	18.00	5- Cavity layer
9	16.00	16.00	3- Clean sand
10	17.50	27.00	3- Clean sand
11	20.00	26.00	3- Clean sand
12	22.50	24.00	3- Clean sand
13	25.00	24.00	3- Clean sand
14	27.50	3.00	2- Clay and silty sand
15	30.00	5.00	2- Clay and silty sand
16	32.50	2.00	3- Clean sand
17	35.00	2.00	3- Clean sand
18	37.50	10.00	3- Clean sand
19	40.00	20.00	3- Clean sand

20	42.50	48.00	3- Clean sand
21	45.00	77.00	3- Clean sand
22	47.50	50.00	3- Clean sand
23	50.00	67.00	3- Clean sand
24	52.50	60.00	3- Clean sand
25	55.00	69.00	3- Clean sand
26	57.50	47.00	3- Clean sand
27	60.00	48.00	3- Clean sand
28	62.50	42.00	3- Clean sand
29	65.00	46.00	3- Clean sand
30	67.50	59.00	3- Clean sand
31	70.00	55.00	3- Clean sand
32	72.50	22.00	3- Clean sand
33	75.00	10.00	3- Clean sand
34	77.50	46.00	3- Clean sand
35	80.00	42.00	3- Clean sand
36	82.50	49.00	3- Clean sand
37	85.00	46.00	3- Clean sand
38	87.50	59.00	3- Clean sand
39	90.00	67.00	3- Clean sand
40	92.50	56.00	3- Clean sand
41	95.00	99.00	3- Clean sand
42	97.50	100.00	3- Clean sand
43	100.00	100.00	3- Clean sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	81.70	65.70	16.00	8.62	5-Void
2	65.70	54.20	11.50	24.04	3-Clean Sand
3	54.20	49.20	5.00	4.00	2-Clay and Silty Sand
4	49.20	-18.30	67.50	48.07	3-Clean Sand

Driven Pile Data:

Pile unit weight = 490.00(pcf), Section Type: H-Section

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)	Depth (in)	End Area (in^2)

14.69	1.00	80.70	13.83	101.58
14.69	2.00	79.70	13.83	101.58
14.69	3.00	78.70	13.83	101.58
14.69	4.00	77.70	13.83	101.58
14.69	5.00	76.70	13.83	101.58
14.69	6.00	75.70	13.83	101.58
14.69	7.00	74.70	13.83	101.58
14.69	8.00	73.70	13.83	101.58
14.69	9.00	72.70	13.83	101.58
14.69	10.00	71.70	13.83	101.58
14.69	11.00	70.70	13.83	101.58
14.69	12.00	69.70	13.83	101.58
14.69	13.00	68.70	13.83	101.58
14.69	14.00	67.70	13.83	101.58
14.69	15.00	66.70	13.83	101.58
14.69	16.00	65.70	13.83	101.58
14.69	17.00	64.70	13.83	101.58
14.69	18.00	63.70	13.83	101.58
14.69	19.00	62.70	13.83	101.58
14.69	20.00	61.70	13.83	101.58
14.69	21.00	60.70	13.83	101.58
14.69	22.00	59.70	13.83	101.58
14.69	23.00	58.70	13.83	101.58
14.69	24.00	57.70	13.83	101.58
14.69	25.00	56.70	13.83	101.58
14.69	26.00	55.70	13.83	101.58
14.69	27.00	54.70	13.83	101.58
14.69	28.00	53.70	13.83	101.58
14.69	29.00	52.70	13.83	101.58
14.69	30.00	51.70	13.83	101.58
14.69	31.00	50.70	13.83	101.58
14.69	32.00	49.70	13.83	101.58
14.69	33.00	48.70	13.83	101.58
14.69	34.00	47.70	13.83	101.58
14.69	35.00	46.70	13.83	101.58
14.69	36.00	45.70	13.83	101.58
14.69	37.00	44.70	13.83	101.58
14.69	38.00	43.70	13.83	101.58
14.69	39.00	42.70	13.83	101.58
14.69	40.00	41.70	13.83	101.58
14.69	41.00	40.70	13.83	101.58
14.69	42.00	39.70	13.83	101.58
14.69	43.00	38.70	13.83	101.58
14.69	44.00	37.70	13.83	101.58
14.69	45.00	36.70	13.83	101.58
14.69	46.00	35.70	13.83	101.58
14.69	47.00	34.70	13.83	101.58
14.69	48.00	33.70	13.83	101.58
14.69	49.00	32.70	13.83	101.58
14.69	50.00	31.70	13.83	101.58

14.69	51.00	30.70	13.83	101.58
14.69	52.00	29.70	13.83	101.58
14.69	53.00	28.70	13.83	101.58
14.69	54.00	27.70	13.83	101.58
14.69	55.00	26.70	13.83	101.58
14.69	56.00	25.70	13.83	101.58
14.69	57.00	24.70	13.83	101.58
14.69	58.00	23.70	13.83	101.58
14.69	59.00	22.70	13.83	101.58
14.69	60.00	21.70	13.83	101.58
14.69	61.00	20.70	13.83	101.58
14.69	62.00	19.70	13.83	101.58
14.69	63.00	18.70	13.83	101.58
14.69	64.00	17.70	13.83	101.58
14.69	65.00	16.70	13.83	101.58
14.69	66.00	15.70	13.83	101.58
14.69	67.00	14.70	13.83	101.58
14.69	68.00	13.70	13.83	101.58
14.69	69.00	12.70	13.83	101.58
14.69	70.00	11.70	13.83	101.58
14.69	71.00	10.70	13.83	101.58
14.69	72.00	9.70	13.83	101.58
14.69	73.00	8.70	13.83	101.58
14.69	74.00	7.70	13.83	101.58
14.69	75.00	6.70	13.83	101.58
14.69	76.00	5.70	13.83	101.58
14.69	77.00	4.70	13.83	101.58
14.69	78.00	3.70	13.83	101.58
14.69	79.00	2.70	13.83	101.58
14.69	80.00	1.70	13.83	101.58
14.69	81.00	0.70	13.83	101.58
14.69	82.00	-0.30	13.83	101.58
14.69	83.00	-1.30	13.83	101.58
14.69	84.00	-2.30	13.83	101.58
14.69	85.00	-3.30	13.83	101.58
14.69	86.00	-4.30	13.83	101.58
14.69	87.00	-5.30	13.83	101.58
14.69	88.00	-6.30	13.83	101.58
14.69	89.00	-7.30	13.83	101.58
14.69	90.00	-8.30	13.83	101.58
14.69	91.00	-9.30	13.83	101.58
14.69	92.00	-10.30	13.83	101.58
14.69	93.00	-11.30	13.83	101.58
14.69	94.00	-12.30	13.83	101.58
14.69	95.00	-13.30	13.83	101.58
14.69	96.00	-14.30	13.83	0.00
14.69	97.00	-15.30	13.83	0.00
14.69	98.00	-16.30	13.83	0.00
14.69	99.00	-17.30	13.83	0.00
14.69	100.00	-18.30	13.83	0.00

Driven Pile Capacity:
==========

Section Type: H
Pile Width: 14.69 (in)
Sect. Depth: 13.83 (in)
End Area: 101.58 (in^2)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	14.7	0.00	0.00	0.00	0.00	0.00
2.00	14.7	0.00	0.00	0.00	0.00	0.00
3.00	14.7	0.00	0.00	0.00	0.00	0.00
4.00	14.7	0.00	0.00	0.00	0.00	0.00
5.00	14.7	0.00	0.00	0.00	0.00	0.00
6.00	14.7	0.00	0.00	0.00	0.00	0.00
7.00	14.7	0.00	0.00	0.00	0.00	0.00
8.00	14.7	0.00	0.00	0.00	0.00	0.00
9.00	14.7	0.00	0.00	0.00	0.00	0.00
10.00	14.7	0.00	0.00	0.00	0.00	0.00
11.00	14.7	0.00	0.00	0.00	0.00	0.00
12.00	14.7	0.00	0.00	0.00	0.00	0.00
13.00	14.7	0.00	0.00	0.00	0.00	0.00
14.00	14.7	0.00	0.00	0.00	0.00	0.00
15.00	14.7	0.33	0.00	0.33	0.17	0.33
16.00	14.7	1.33	23.15	24.48	12.24	47.63
17.00	14.7	2.96	24.14	27.10	13.55	51.25
18.00	14.7	5.12	23.78	28.91	14.45	52.69
19.00	14.7	7.33	23.29	30.62	15.31	53.91
20.00	14.7	9.51	22.87	32.37	16.19	55.24
21.00	14.7	11.63	21.88	33.51	16.75	55.38
22.00	14.7	13.69	19.33	33.02	16.51	52.34
23.00	14.7	15.69	15.34	31.03	15.51	46.37
24.00	14.7	17.68	11.12	28.80	14.40	39.92
25.00	14.7	19.67	6.98	26.65	13.33	33.63
26.00	14.7	21.38	3.66	25.04	12.52	28.70
27.00	14.7	22.51	1.87	24.39	12.19	26.26
28.00	14.7	23.17	1.40	24.56	12.28	27.36
29.00	14.7	23.90	1.03	24.93	12.47	27.00
30.00	14.7	24.80	0.60	25.40	12.70	26.59
31.00	14.7	25.59	0.52	26.11	13.05	27.15

32.00	14.7	25.98	1.39	27.38	13.69	30.17
33.00	14.7	26.03	3.20	29.23	14.61	32.43
34.00	14.7	26.03	5.79	31.82	15.91	37.60
35.00	14.7	26.03	9.14	35.17	17.58	44.31
36.00	14.7	26.20	13.42	39.62	19.81	53.04
37.00	14.7	26.70	19.07	45.77	22.88	64.84
38.00	14.7	27.53	25.92	53.45	26.73	79.37
39.00	14.7	28.69	32.43	61.12	30.56	93.55
40.00	14.7	30.18	38.20	68.38	34.19	106.59
41.00	14.7	32.31	42.54	74.85	37.43	117.39
42.00	14.7	35.36	44.75	80.11	40.06	124.87
43.00	14.7	39.23	45.09	84.32	42.16	129.41
44.00	14.7	43.23	45.13	88.36	44.18	133.50
45.00	14.7	47.24	45.15	92.39	46.19	137.54
46.00	14.7	51.26	45.15	96.41	48.20	141.55
47.00	14.7	55.27	45.15	100.42	50.21	145.57
48.00	14.7	59.29	45.15	104.44	52.22	149.59
49.00	14.7	63.31	45.15	108.46	54.23	153.60
50.00	14.7	67.33	45.15	112.47	56.24	157.62
51.00	14.7	71.34	45.10	116.45	58.22	161.55
52.00	14.7	75.36	44.96	120.32	60.16	165.27
53.00	14.7	79.38	44.72	124.09	62.05	168.81
54.00	14.7	83.39	44.52	127.91	63.96	172.44
55.00	14.7	87.41	44.40	131.81	65.91	176.21
56.00	14.7	91.40	44.20	135.60	67.80	179.80
57.00	14.7	95.35	43.64	138.99	69.50	182.64
58.00	14.7	99.26	42.78	142.04	71.02	184.81
59.00	14.7	103.20	42.02	145.22	72.61	187.24
60.00	14.7	107.17	41.49	148.66	74.33	190.15
61.00	14.7	111.05	41.41	152.46	76.23	193.87
62.00	14.7	114.74	41.97	156.71	78.35	198.68
63.00	14.7	118.27	43.06	161.32	80.66	204.38
64.00	14.7	121.88	43.97	165.86	82.93	209.83
65.00	14.7	125.64	44.58	170.22	85.11	214.79
66.00	14.7	129.50	44.13	173.63	86.81	217.76
67.00	14.7	133.43	41.51	174.94	87.47	216.45
68.00	14.7	137.44	36.80	174.24	87.12	211.03
69.00	14.7	141.46	30.95	172.40	86.20	203.35
70.00	14.7	145.47	24.19	169.66	84.83	193.84
71.00	14.7	149.05	18.98	168.04	84.02	187.02
72.00	14.7	151.76	18.52	170.27	85.14	188.79
73.00	14.7	153.64	22.43	176.07	88.04	198.50
74.00	14.7	155.07	27.65	182.71	91.36	210.36
75.00	14.7	156.10	33.47	189.57	94.78	223.04
76.00	14.7	157.53	38.39	195.92	97.96	234.31
77.00	14.7	160.15	41.05	201.20	100.60	242.26
78.00	14.7	163.80	41.79	205.59	102.79	247.38
79.00	14.7	167.49	42.38	209.87	104.94	252.26
80.00	14.7	171.04	43.10	214.14	107.07	257.25
81.00	14.7	174.63	43.70	218.33	109.17	262.03

82.00	14.7	178.44	43.98	222.42	111.21	266.40
83.00	14.7	182.42	44.03	226.45	113.23	270.48
84.00	14.7	186.36	44.21	230.57	115.29	274.79
85.00	14.7	190.22	44.58	234.79	117.40	279.37
86.00	14.7	194.07	44.94	239.02	119.51	283.96
87.00	14.7	198.01	45.12	243.14	121.57	288.26
88.00	14.7	202.02	45.15	247.17	123.58	292.31
89.00	14.7	206.03	45.15	251.18	125.59	296.33
90.00	14.7	210.05	45.15	255.20	127.60	300.35
91.00	14.7	214.07	45.15	259.22	129.61	304.36
92.00	14.7	218.09	45.15	263.23	131.62	308.38
93.00	14.7	222.10	45.15	267.25	133.62	312.40
94.00	14.7	226.12	45.15	271.27	135.63	316.41
95.00	14.7	230.14	45.15	275.28	137.64	320.43
96.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					
97.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					
98.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					
99.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					
100.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
==========
Input file: .....gments 9 & 10\FBDeep\PARK\BB-PARK-1_18-inch PPSC_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 9-10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
==========
Analysis Type: SPT

Soil Information:
==========
Boring date: 1/14/2025, Boring Number: BB-PARK-1
Station number: 4845+90 Offset: 24' LT.

Ground Elevation: 81.700(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	16.00	5- Cavity layer
6	10.00	9.00	5- Cavity layer
7	12.00	14.00	5- Cavity layer
8	14.00	18.00	5- Cavity layer
9	16.00	16.00	3- Clean sand
10	17.50	27.00	3- Clean sand
11	20.00	26.00	3- Clean sand
12	22.50	24.00	3- Clean sand
13	25.00	24.00	3- Clean sand
14	27.50	3.00	2- Clay and silty sand
15	30.00	5.00	2- Clay and silty sand
16	32.50	2.00	3- Clean sand
17	35.00	2.00	3- Clean sand
18	37.50	10.00	3- Clean sand
19	40.00	20.00	3- Clean sand

20	42.50	48.00	3- Clean sand
21	45.00	77.00	3- Clean sand
22	47.50	50.00	3- Clean sand
23	50.00	67.00	3- Clean sand
24	52.50	60.00	3- Clean sand
25	55.00	69.00	3- Clean sand
26	57.50	47.00	3- Clean sand
27	60.00	48.00	3- Clean sand
28	62.50	42.00	3- Clean sand
29	65.00	46.00	3- Clean sand
30	67.50	59.00	3- Clean sand
31	70.00	55.00	3- Clean sand
32	72.50	22.00	3- Clean sand
33	75.00	10.00	3- Clean sand
34	77.50	46.00	3- Clean sand
35	80.00	42.00	3- Clean sand
36	82.50	49.00	3- Clean sand
37	85.00	46.00	3- Clean sand
38	87.50	59.00	3- Clean sand
39	90.00	67.00	3- Clean sand
40	92.50	56.00	3- Clean sand
41	95.00	99.00	3- Clean sand
42	97.50	100.00	3- Clean sand
43	100.00	100.00	3- Clean sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	81.70	65.70	16.00	8.62	5-Void
2	65.70	54.20	11.50	24.04	3-Clean Sand
3	54.20	49.20	5.00	4.00	2-Clay and Silty Sand
4	49.20	-18.30	67.50	48.07	3-Clean Sand

Driven Pile Data:

Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)

18.00	1.00	80.70
18.00	2.00	79.70
18.00	3.00	78.70
18.00	4.00	77.70
18.00	5.00	76.70
18.00	6.00	75.70
18.00	7.00	74.70
18.00	8.00	73.70
18.00	9.00	72.70
18.00	10.00	71.70
18.00	11.00	70.70
18.00	12.00	69.70
18.00	13.00	68.70
18.00	14.00	67.70
18.00	15.00	66.70
18.00	16.00	65.70
18.00	17.00	64.70
18.00	18.00	63.70
18.00	19.00	62.70
18.00	20.00	61.70
18.00	21.00	60.70
18.00	22.00	59.70
18.00	23.00	58.70
18.00	24.00	57.70
18.00	25.00	56.70
18.00	26.00	55.70
18.00	27.00	54.70
18.00	28.00	53.70
18.00	29.00	52.70
18.00	30.00	51.70
18.00	31.00	50.70
18.00	32.00	49.70
18.00	33.00	48.70
18.00	34.00	47.70
18.00	35.00	46.70
18.00	36.00	45.70
18.00	37.00	44.70
18.00	38.00	43.70
18.00	39.00	42.70
18.00	40.00	41.70
18.00	41.00	40.70
18.00	42.00	39.70
18.00	43.00	38.70
18.00	44.00	37.70
18.00	45.00	36.70
18.00	46.00	35.70
18.00	47.00	34.70
18.00	48.00	33.70
18.00	49.00	32.70
18.00	50.00	31.70

18.00	51.00	30.70
18.00	52.00	29.70
18.00	53.00	28.70
18.00	54.00	27.70
18.00	55.00	26.70
18.00	56.00	25.70
18.00	57.00	24.70
18.00	58.00	23.70
18.00	59.00	22.70
18.00	60.00	21.70
18.00	61.00	20.70
18.00	62.00	19.70
18.00	63.00	18.70
18.00	64.00	17.70
18.00	65.00	16.70
18.00	66.00	15.70
18.00	67.00	14.70
18.00	68.00	13.70
18.00	69.00	12.70
18.00	70.00	11.70
18.00	71.00	10.70
18.00	72.00	9.70
18.00	73.00	8.70
18.00	74.00	7.70
18.00	75.00	6.70
18.00	76.00	5.70
18.00	77.00	4.70
18.00	78.00	3.70
18.00	79.00	2.70
18.00	80.00	1.70
18.00	81.00	0.70
18.00	82.00	-0.30
18.00	83.00	-1.30
18.00	84.00	-2.30
18.00	85.00	-3.30
18.00	86.00	-4.30
18.00	87.00	-5.30
18.00	88.00	-6.30
18.00	89.00	-7.30
18.00	90.00	-8.30
18.00	91.00	-9.30
18.00	92.00	-10.30
18.00	93.00	-11.30
18.00	94.00	-12.30
18.00	95.00	-13.30
18.00	96.00	-14.30
18.00	97.00	-15.30
18.00	98.00	-16.30
18.00	99.00	-17.30
18.00	100.00	-18.30

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	0.00	0.00	0.00	0.00
4.00	18.0	0.00	0.00	0.00	0.00	0.00
5.00	18.0	0.00	0.00	0.00	0.00	0.00
6.00	18.0	0.00	0.00	0.00	0.00	0.00
7.00	18.0	0.00	0.00	0.00	0.00	0.00
8.00	18.0	0.00	0.00	0.00	0.00	0.00
9.00	18.0	0.00	0.00	0.00	0.00	0.00
10.00	18.0	0.00	0.00	0.00	0.00	0.00
11.00	18.0	0.00	0.00	0.00	0.00	0.00
12.00	18.0	0.00	0.00	0.00	0.00	0.00
13.00	18.0	0.00	0.00	0.00	0.00	0.00
14.00	18.0	0.00	0.00	0.00	0.00	0.00
15.00	18.0	0.57	0.00	0.57	0.28	0.57
16.00	18.0	2.26	38.94	41.20	20.60	119.07
17.00	18.0	4.80	39.22	44.02	22.01	122.46
18.00	18.0	7.87	39.90	47.77	23.88	127.56
19.00	18.0	10.77	40.95	51.72	25.86	133.61
20.00	18.0	13.46	42.37	55.84	27.92	140.58
21.00	18.0	16.35	43.53	59.88	29.94	146.95
22.00	18.0	19.76	43.73	63.49	31.75	150.96
23.00	18.0	23.79	42.82	66.61	33.31	152.25
24.00	18.0	28.19	41.44	69.63	34.82	152.52
25.00	18.0	32.94	39.65	72.59	36.30	151.90
26.00	18.0	36.42	37.39	73.82	36.91	148.61
27.00	18.0	38.40	35.44	73.84	36.92	144.71
28.00	18.0	39.59	4.46	44.04	22.02	52.96
29.00	18.0	40.88	4.22	45.10	22.55	53.53
30.00	18.0	42.44	3.90	46.33	23.17	54.13
31.00	18.0	43.79	4.18	47.97	23.98	56.33
32.00	18.0	43.88	5.31	49.20	24.60	59.83

33.00	18.0	44.54	22.84	67.38	33.69	113.07
34.00	18.0	44.54	22.95	67.49	33.74	113.38
35.00	18.0	44.54	23.36	67.90	33.95	114.62
36.00	18.0	44.76	24.49	69.25	34.63	118.24
37.00	18.0	45.27	26.79	72.06	36.03	125.64
38.00	18.0	45.95	30.57	76.53	38.26	137.67
39.00	18.0	46.81	35.63	82.45	41.22	153.72
40.00	18.0	47.87	41.98	89.85	44.93	173.81
41.00	18.0	49.45	48.97	98.42	49.21	196.36
42.00	18.0	51.85	56.03	107.89	53.94	219.95
43.00	18.0	55.06	63.05	118.11	59.06	244.21
44.00	18.0	58.56	70.66	129.21	64.61	270.52
45.00	18.0	62.28	78.98	141.25	70.63	299.21
46.00	18.0	66.24	87.97	154.21	77.11	330.15
47.00	18.0	70.47	97.63	168.10	84.05	363.35
48.00	18.0	74.99	107.74	182.73	91.37	398.21
49.00	18.0	79.83	118.03	197.87	98.93	433.94
50.00	18.0	85.00	128.43	213.43	106.71	470.28
51.00	18.0	90.58	135.59	226.17	113.08	497.35
52.00	18.0	96.40	139.08	235.48	117.74	513.64
53.00	18.0	102.32	141.55	243.87	121.93	526.97
54.00	18.0	108.32	142.74	251.06	125.53	536.53
55.00	18.0	114.40	142.79	257.19	128.60	542.78
56.00	18.0	120.52	142.25	262.76	131.38	547.25
57.00	18.0	126.63	141.09	267.72	133.86	549.90
58.00	18.0	132.75	139.63	272.38	136.19	551.64
59.00	18.0	138.95	138.54	277.49	138.74	554.57
60.00	18.0	145.21	137.84	283.05	141.53	558.74
61.00	18.0	151.41	137.62	289.03	144.52	564.27
62.00	18.0	157.39	138.05	295.44	147.72	571.55
63.00	18.0	163.18	138.98	302.16	151.08	580.13
64.00	18.0	169.10	139.75	308.85	154.42	588.34
65.00	18.0	175.21	140.16	315.37	157.69	595.70
66.00	18.0	181.48	138.22	319.70	159.85	596.15
67.00	18.0	187.87	133.14	321.01	160.51	587.29
68.00	18.0	194.38	125.42	319.80	159.90	570.65
69.00	18.0	200.91	116.35	317.26	158.63	549.95
70.00	18.0	207.46	106.14	313.60	156.80	525.87
71.00	18.0	213.43	99.28	312.71	156.35	511.27
72.00	18.0	218.19	98.14	316.33	158.16	512.60
73.00	18.0	221.80	101.50	323.30	161.65	526.29
74.00	18.0	224.76	105.72	330.48	165.24	541.92
75.00	18.0	227.14	110.53	337.67	168.83	558.72
76.00	18.0	230.05	114.83	344.87	172.44	574.52
77.00	18.0	234.63	117.35	351.98	175.99	586.69
78.00	18.0	240.67	118.19	358.86	179.43	595.24
79.00	18.0	246.77	118.61	365.37	182.69	602.59
80.00	18.0	252.68	118.92	371.60	185.80	609.44
81.00	18.0	258.66	119.26	377.92	188.96	616.44
82.00	18.0	264.94	119.47	384.41	192.21	623.34

83.00	18.0	271.50	120.18	391.68	195.84	632.04
84.00	18.0	277.99	122.30	400.29	200.15	644.89
85.00	18.0	284.38	125.78	410.17	205.08	661.74
86.00	18.0	290.78	129.96	420.74	210.37	680.65
87.00	18.0	297.30	134.57	431.87	215.93	701.01
88.00	18.0	303.93	138.46	442.38	221.19	719.30
89.00	18.0	310.58	140.54	451.12	225.56	732.19
90.00	18.0	317.23	141.08	458.32	229.16	740.48
91.00	18.0	323.90	141.58	465.47	232.74	748.63
92.00	18.0	330.56	142.27	472.83	236.42	757.37
93.00	18.0	337.24	142.90	480.14	240.07	765.95
94.00	18.0	343.92	143.22	487.14	243.57	773.58
95.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
96.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
97.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
98.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
99.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
100.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES
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1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....gments 9 & 10\FBDeep\PARK\BB-PARK-1_24-inch PPSC_FROM FIELD.in
Project number: 6511-24-001
Job name: SR 70 Seg 9-10
Engineer: Tierra, Inc.
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 1/14/2025, Boring Number: BB-PARK-1
Station number: 4845+90 Offset: 24' LT.

Ground Elevation: 81.700(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	4.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	16.00	5- Cavity layer
6	10.00	9.00	5- Cavity layer
7	12.00	14.00	5- Cavity layer
8	14.00	18.00	5- Cavity layer
9	16.00	16.00	3- Clean sand
10	17.50	27.00	3- Clean sand
11	20.00	26.00	3- Clean sand
12	22.50	24.00	3- Clean sand
13	25.00	24.00	3- Clean sand
14	27.50	3.00	2- Clay and silty sand
15	30.00	5.00	2- Clay and silty sand
16	32.50	2.00	3- Clean sand
17	35.00	2.00	3- Clean sand
18	37.50	10.00	3- Clean sand
19	40.00	20.00	3- Clean sand

20	42.50	48.00	3- Clean sand
21	45.00	77.00	3- Clean sand
22	47.50	50.00	3- Clean sand
23	50.00	67.00	3- Clean sand
24	52.50	60.00	3- Clean sand
25	55.00	69.00	3- Clean sand
26	57.50	47.00	3- Clean sand
27	60.00	48.00	3- Clean sand
28	62.50	42.00	3- Clean sand
29	65.00	46.00	3- Clean sand
30	67.50	59.00	3- Clean sand
31	70.00	55.00	3- Clean sand
32	72.50	22.00	3- Clean sand
33	75.00	10.00	3- Clean sand
34	77.50	46.00	3- Clean sand
35	80.00	42.00	3- Clean sand
36	82.50	49.00	3- Clean sand
37	85.00	46.00	3- Clean sand
38	87.50	59.00	3- Clean sand
39	90.00	67.00	3- Clean sand
40	92.50	56.00	3- Clean sand
41	95.00	99.00	3- Clean sand
42	97.50	100.00	3- Clean sand
43	100.00	100.00	3- Clean sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	81.70	65.70	16.00	8.62	5-Void
2	65.70	54.20	11.50	24.04	3-Clean Sand
3	54.20	49.20	5.00	4.00	2-Clay and Silty Sand
4	49.20	-18.30	67.50	48.07	3-Clean Sand

Driven Pile Data:

Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)

24.00	1.00	80.70
24.00	2.00	79.70
24.00	3.00	78.70
24.00	4.00	77.70
24.00	5.00	76.70
24.00	6.00	75.70
24.00	7.00	74.70
24.00	8.00	73.70
24.00	9.00	72.70
24.00	10.00	71.70
24.00	11.00	70.70
24.00	12.00	69.70
24.00	13.00	68.70
24.00	14.00	67.70
24.00	15.00	66.70
24.00	16.00	65.70
24.00	17.00	64.70
24.00	18.00	63.70
24.00	19.00	62.70
24.00	20.00	61.70
24.00	21.00	60.70
24.00	22.00	59.70
24.00	23.00	58.70
24.00	24.00	57.70
24.00	25.00	56.70
24.00	26.00	55.70
24.00	27.00	54.70
24.00	28.00	53.70
24.00	29.00	52.70
24.00	30.00	51.70
24.00	31.00	50.70
24.00	32.00	49.70
24.00	33.00	48.70
24.00	34.00	47.70
24.00	35.00	46.70
24.00	36.00	45.70
24.00	37.00	44.70
24.00	38.00	43.70
24.00	39.00	42.70
24.00	40.00	41.70
24.00	41.00	40.70
24.00	42.00	39.70
24.00	43.00	38.70
24.00	44.00	37.70
24.00	45.00	36.70
24.00	46.00	35.70
24.00	47.00	34.70
24.00	48.00	33.70
24.00	49.00	32.70
24.00	50.00	31.70

24.00	51.00	30.70
24.00	52.00	29.70
24.00	53.00	28.70
24.00	54.00	27.70
24.00	55.00	26.70
24.00	56.00	25.70
24.00	57.00	24.70
24.00	58.00	23.70
24.00	59.00	22.70
24.00	60.00	21.70
24.00	61.00	20.70
24.00	62.00	19.70
24.00	63.00	18.70
24.00	64.00	17.70
24.00	65.00	16.70
24.00	66.00	15.70
24.00	67.00	14.70
24.00	68.00	13.70
24.00	69.00	12.70
24.00	70.00	11.70
24.00	71.00	10.70
24.00	72.00	9.70
24.00	73.00	8.70
24.00	74.00	7.70
24.00	75.00	6.70
24.00	76.00	5.70
24.00	77.00	4.70
24.00	78.00	3.70
24.00	79.00	2.70
24.00	80.00	1.70
24.00	81.00	0.70
24.00	82.00	-0.30
24.00	83.00	-1.30
24.00	84.00	-2.30
24.00	85.00	-3.30
24.00	86.00	-4.30
24.00	87.00	-5.30
24.00	88.00	-6.30
24.00	89.00	-7.30
24.00	90.00	-8.30
24.00	91.00	-9.30
24.00	92.00	-10.30
24.00	93.00	-11.30
24.00	94.00	-12.30
24.00	95.00	-13.30
24.00	96.00	-14.30
24.00	97.00	-15.30
24.00	98.00	-16.30
24.00	99.00	-17.30
24.00	100.00	-18.30

Driven Pile Capacity:
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Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	24.0	0.00	0.00	0.00	0.00	0.00
2.00	24.0	0.00	0.00	0.00	0.00	0.00
3.00	24.0	0.00	0.00	0.00	0.00	0.00
4.00	24.0	0.00	0.00	0.00	0.00	0.00
5.00	24.0	0.00	0.00	0.00	0.00	0.00
6.00	24.0	0.00	0.00	0.00	0.00	0.00
7.00	24.0	0.00	0.00	0.00	0.00	0.00
8.00	24.0	0.00	0.00	0.00	0.00	0.00
9.00	24.0	0.00	0.00	0.00	0.00	0.00
10.00	24.0	0.00	0.00	0.00	0.00	0.00
11.00	24.0	0.00	0.00	0.00	0.00	0.00
12.00	24.0	0.00	0.00	0.00	0.00	0.00
13.00	24.0	0.00	0.00	0.00	0.00	0.00
14.00	24.0	0.00	0.00	0.00	0.00	0.00
15.00	24.0	0.75	0.00	0.75	0.38	0.75
16.00	24.0	3.02	68.02	71.04	35.52	207.08
17.00	24.0	6.48	68.29	74.78	37.39	211.36
18.00	24.0	10.73	68.96	79.69	39.85	217.61
19.00	24.0	15.02	69.71	84.74	42.37	224.16
20.00	24.0	19.74	69.92	89.66	44.83	229.50
21.00	24.0	25.26	69.16	94.42	47.21	232.75
22.00	24.0	31.08	67.58	98.66	49.33	233.81
23.00	24.0	35.62	63.32	98.95	49.47	225.59
24.00	24.0	40.15	58.98	99.12	49.56	217.08
25.00	24.0	44.67	54.25	98.92	49.46	207.43
26.00	24.0	48.56	50.16	98.72	49.36	199.03
27.00	24.0	51.20	47.92	99.13	49.56	194.97
28.00	24.0	52.70	6.19	58.89	29.45	71.28
29.00	24.0	54.09	6.41	60.50	30.25	73.31
30.00	24.0	55.23	7.19	62.42	31.21	76.80
31.00	24.0	55.86	8.93	64.79	32.40	82.65
32.00	24.0	55.98	12.16	68.14	34.07	92.46

33.00	24.0	59.39	57.02	116.41	58.21	230.45
34.00	24.0	59.39	57.43	116.82	58.41	231.69
35.00	24.0	59.39	58.72	118.11	59.06	235.56
36.00	24.0	59.65	61.29	120.94	60.47	243.53
37.00	24.0	60.32	64.90	125.22	62.61	255.03
38.00	24.0	61.32	69.42	130.74	65.37	269.58
39.00	24.0	62.63	74.75	137.38	68.69	286.88
40.00	24.0	64.27	80.76	145.03	72.51	306.55
41.00	24.0	66.62	87.07	153.70	76.85	327.85
42.00	24.0	70.07	93.48	163.56	81.78	350.52
43.00	24.0	74.51	100.23	174.74	87.37	375.19
44.00	24.0	79.10	107.99	187.09	93.55	403.07
45.00	24.0	83.79	116.44	200.23	100.11	433.10
46.00	24.0	88.62	125.48	214.10	107.05	465.06
47.00	24.0	93.61	135.19	228.80	114.40	499.18
48.00	24.0	98.77	145.64	244.42	122.21	535.70
49.00	24.0	104.14	156.78	260.92	130.46	574.47
50.00	24.0	109.75	168.43	278.18	139.09	615.03
51.00	24.0	115.62	180.59	296.21	148.10	657.39
52.00	24.0	121.76	193.20	314.96	157.48	701.36
53.00	24.0	128.20	205.98	334.19	167.09	746.16
54.00	24.0	135.00	218.40	353.40	176.70	790.20
55.00	24.0	142.19	229.83	372.02	186.01	831.67
56.00	24.0	149.73	240.31	390.04	195.02	870.65
57.00	24.0	157.59	246.34	403.93	201.97	896.62
58.00	24.0	165.58	247.32	412.90	206.45	907.55
59.00	24.0	173.68	247.10	420.78	210.39	914.99
60.00	24.0	181.88	246.91	428.79	214.39	922.60
61.00	24.0	190.02	247.21	437.23	218.61	931.65
62.00	24.0	197.89	248.06	445.95	222.97	942.06
63.00	24.0	205.54	249.31	454.85	227.43	953.47
64.00	24.0	213.36	248.33	461.70	230.85	958.36
65.00	24.0	221.42	243.03	464.45	232.23	950.51
66.00	24.0	229.69	233.73	463.42	231.71	930.89
67.00	24.0	238.11	222.15	460.27	230.13	904.57
68.00	24.0	246.69	208.58	455.26	227.63	872.42
69.00	24.0	255.30	196.79	452.09	226.05	845.68
70.00	24.0	263.94	190.45	454.39	227.20	835.29
71.00	24.0	271.86	189.91	461.77	230.88	841.59
72.00	24.0	278.25	191.82	470.07	235.03	853.70
73.00	24.0	283.21	195.30	478.50	239.25	869.10
74.00	24.0	287.32	200.21	487.52	243.76	887.94
75.00	24.0	290.68	207.05	497.73	248.87	911.84
76.00	24.0	294.70	213.61	508.32	254.16	935.55
77.00	24.0	300.85	217.08	517.93	258.97	952.10
78.00	24.0	308.85	217.95	526.80	263.40	962.71
79.00	24.0	316.92	219.05	535.97	267.99	974.08
80.00	24.0	324.76	220.67	545.43	272.72	986.78
81.00	24.0	332.69	222.24	554.93	277.46	999.41
82.00	24.0	341.01	223.10	564.11	282.05	1010.31

83.00	24.0	349.67	223.35	573.02	286.51	1019.73
84.00	24.0	358.27	223.57	581.85	290.92	1028.99
85.00	24.0	366.74	223.98	590.71	295.36	1038.67
86.00	24.0	375.21	224.38	599.60	299.80	1048.37
87.00	24.0	383.84	225.46	609.30	304.65	1060.23
88.00	24.0	392.62	228.10	620.72	310.36	1076.93
89.00	24.0	401.43	232.35	633.77	316.89	1098.47
90.00	24.0	410.25	237.50	647.75	323.87	1122.76
91.00	24.0	419.07	243.45	662.53	331.26	1149.43
92.00	24.0	427.91	248.61	676.52	338.26	1173.74
93.00	24.0	436.76	251.39	688.14	344.07	1190.91
94.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
95.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
96.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
97.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
98.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
99.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					
100.00	24.0 Soil Elevations Must Extend At or Below Contribution Zone					

NOTES
---

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

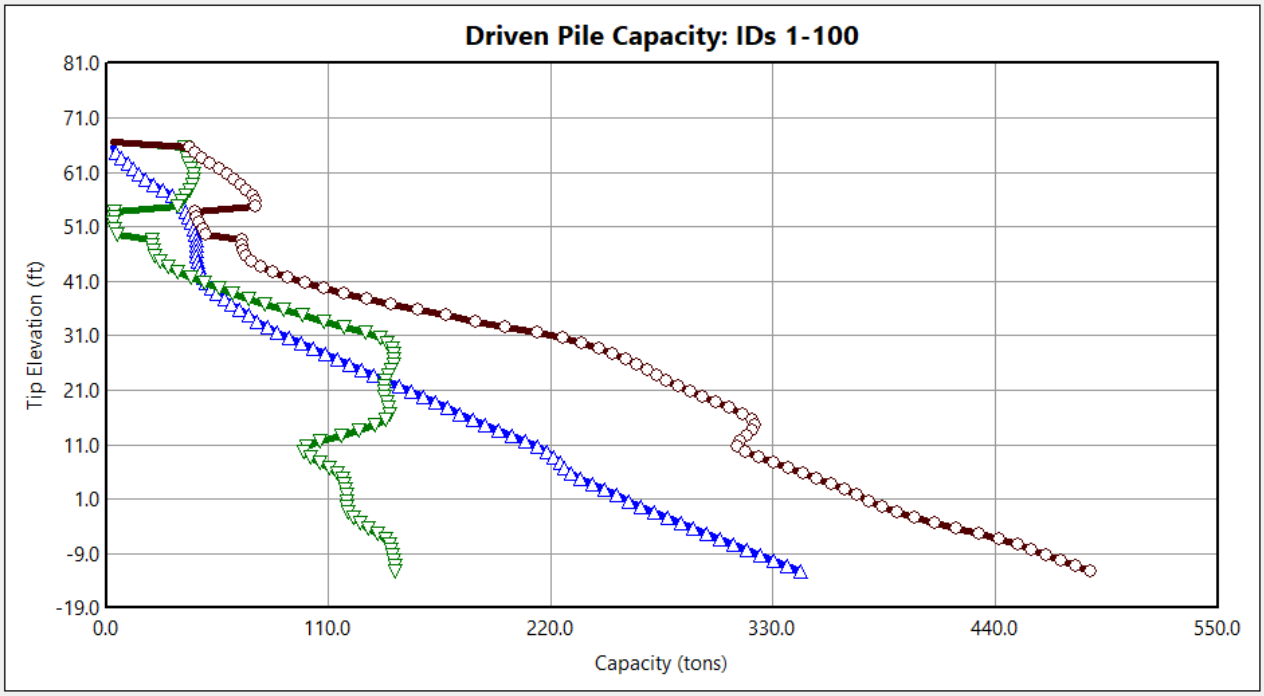
2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

Plot Window

Job Name: SR 70 Seg 9-10 State Job (Project) #: 6511-24-001



Curves

- ☑ Ultimate Side Friction
- ☑ Mobilized End Bearing
- ☐ Ultimate Pile Capacity
- ☑ Estimated Davisson Capacity
- ☐ Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-PARK-1	
Ground Surface Elevation	81.70	(ft)
Section:	Square	
Width	18.00	(in)

Project Data

File:	BB-PARK-1_18-inch
Date:	Mar 23, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

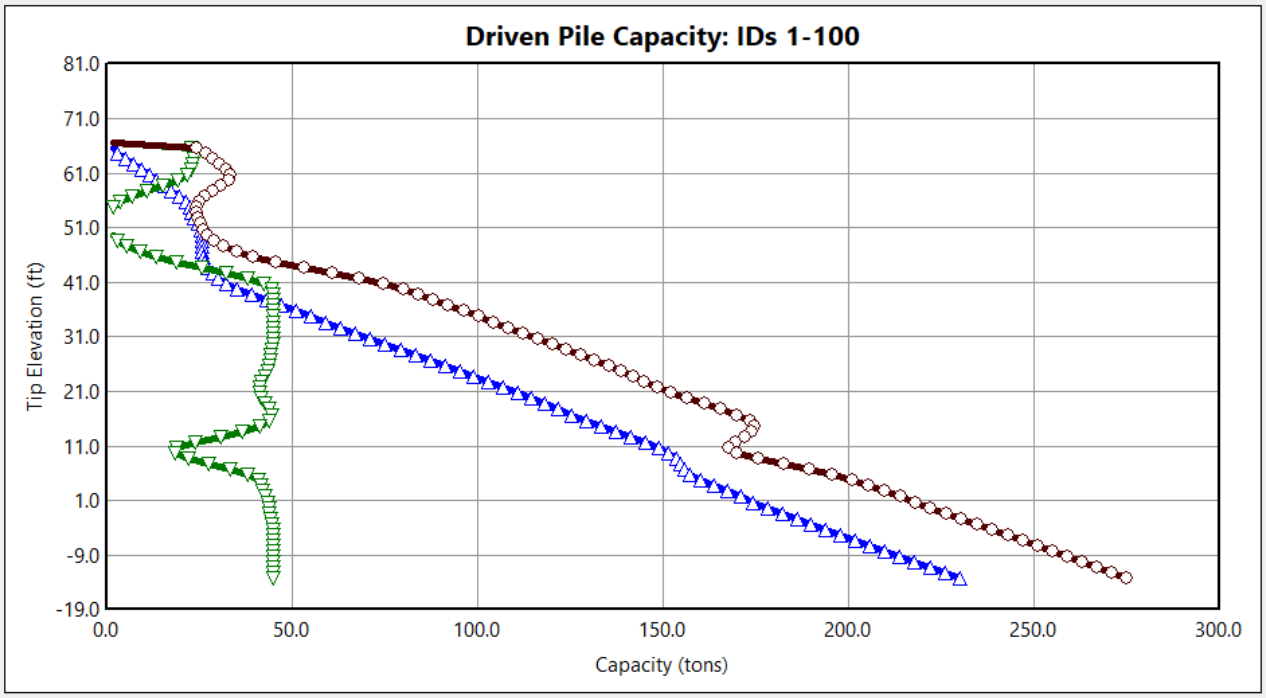
Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9-10 State Job (Project) #: 6511-24-001



Curves

- [x] Ultimate Side Friction
- [x] Mobilized End Bearing
- [ ] Ultimate Pile Capacity
- [x] Estimated Davisson Capacity
- [ ] Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-PARK-1	
Ground Surface Elevation	81.70	(ft)
Section:	H-Section	
Width	14.69	(in)
Depth	13.83	(in)
End Area	101.58	(in2

Project Data

File:	BB-PARK-1_14x89
Date:	Mar 23, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

Plot Options

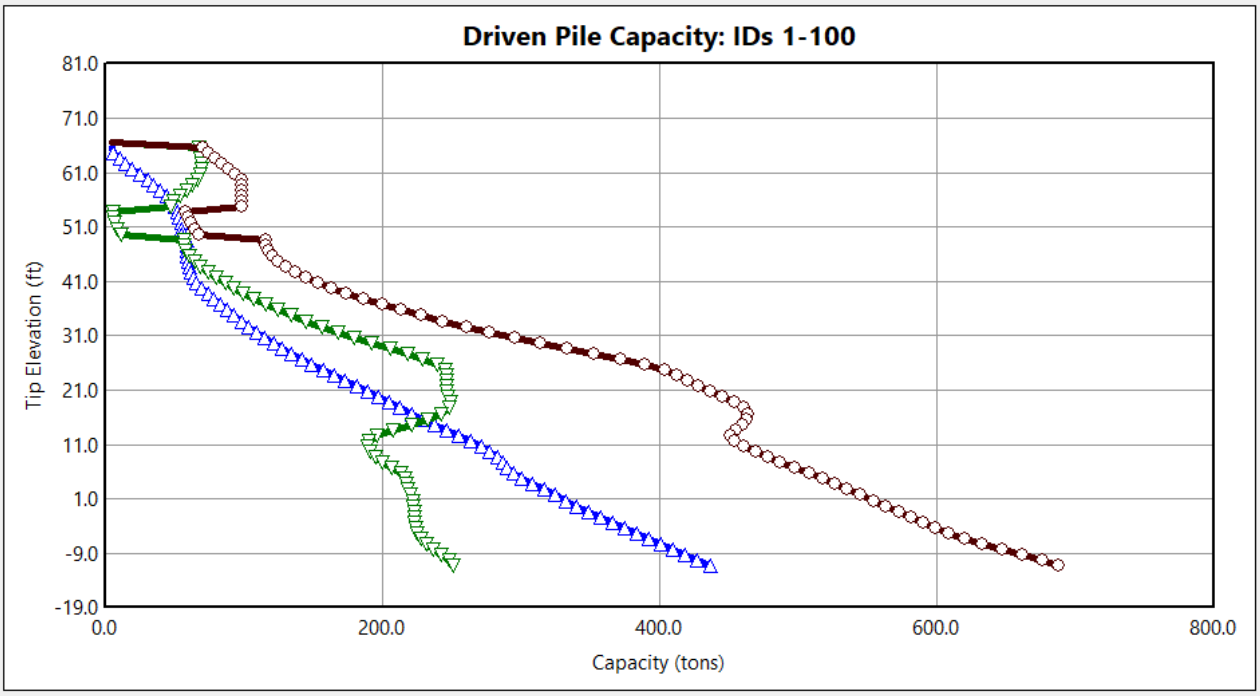
Customize | Update Plot | Print Plot | Print Window | Save To File

Close

Plot Window

Job Name: SR 70 Seg 9-10

State Job (Project) #: 6511-24-001



Curves

- ☑ Ultimate Side Friction
- ☑ Mobilized End Bearing
- ☐ Ultimate Pile Capacity
- ☑ Estimated Davisson Capacity
- ☐ Allowable Pile Capacity

*The 'Save to File' button saves the currently selected Curves to a text file.

Driven Pile Data

Boring Number:	BB-PARK-1	
Ground Surface Elevation	81.70	(ft)
Section:	Square	
Width	24.00	(in)

Project Data

File:	BB-PARK-1_24-inch
Date:	Mar 23, 2025
Engineer:	Tierra, Inc.

Analysis Data

Analysis Type:	SPT

Plot Options

Customize | Update Plot | Print Plot | Print Window | Save To File

Close

APPENDIX C

Summary of Laboratory Test Results for Soil Classification
Summary of Laboratory Test Results for Environmental Classification
Grain Size Distribution Report

Summary of Laboratory Test Results for Soil Classification
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Parker Creek Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Boring Number	Sample Depth (ft)	USCS Symbol	Sieve Analysis					Atterberg Limits			Organic Content (%)	Natural Moisture Content
			#10	#40	#60	#100	#200	Liquid Limit	Plastic Limit	Plasticity Index		
BB-PARK-1	2.0 - 6.0	SP	---	---	---	---	5	---	---	---	---	---
BB-PARK-1	26.0 - 27.5	SC	---	---	---	---	39	40	19	21	---	38
BB-PARK-1	31.0 - 32.5	SP-SM	---	---	---	---	9	---	---	---	---	---
BB-PARK-1	48.5 - 50.0	SP	---	---	---	---	3	---	---	---	---	---
BB-PARK-1	73.5 - 75.0	SP-SM	---	---	---	---	9	---	---	---	---	---
BB-PARK-1	88.5 - 90.0	SP	---	---	---	---	3	---	---	---	---	---

Summary of Laboratory Test Results for Environmental Classification
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Parker Creek Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No: 6511-24-001

Soil Samples

Boring Number	Depth (feet)	USCS Symbol	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
							Steel	Concrete
BBC-PARK-1	2.0 - 6.0	SP-SM	7.4	25,000	15	<5	Slightly Aggressive	Slightly Aggressive
BB-PARK-1	2.0 - 6.0	SP	6.1	23,000	15	12	Moderately Aggressive	Slightly Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Water Samples

Sample Location	pH (FM 5-550)	Resistivity (ohm-cm) (FM 5-551)	Chlorides (ppm) (FM 5-552)	Sulfates (ppm) (FM 5-553)	Environmental Classification[1]	
					Steel	Concrete
PARKER CREEK	7.2	2,000	25	120	Moderately Aggressive	Moderately Aggressive
	7.8	2,400	90	120	Moderately Aggressive	Moderately Aggressive

[1] As per 2025 FDOT Structures Design Guidelines

Grain Size Distribution Report
SR 70 from West of SR 31 to to Highlands County Line
SR 70 over Parker Creek Bridges
DeSoto County, Florida
Financial Project No. 451942-2-52-01
Tierra Project No.: 6511-24-001

Approximate Sample Location		Depth Below Mudline (ft)
Latitude	Longitude	
N 27.20975	W 81.57673	0.0-2.0

Grain Size Distribution Curve

Material Description	Classification	
	USCS	AASHTO
Gray to Brown Sand	SP	A-3

Sieve Number	Diameter (mm)	Percent Finer by Weight (%)
3/4"	19.000	100
3/8"	9.500	100
4	4.750	100
10	2.000	100
40	0.425	99.9
60	0.250	96.4
100	0.150	43.3
200	0.075	1.0

Coefficients

D_{10}	0.087	D_{30}	0.121
D_{50}	*0.160*	D_{60}	0.176
D_{85}	0.224	D_{90}	0.235
D_{95}	0.247		
C_U	2.027	C_C	0.950

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GEOTECHNICAL • MATERIALS
ENVIRONMENTAL • ENGINEERING

APPENDIX - F

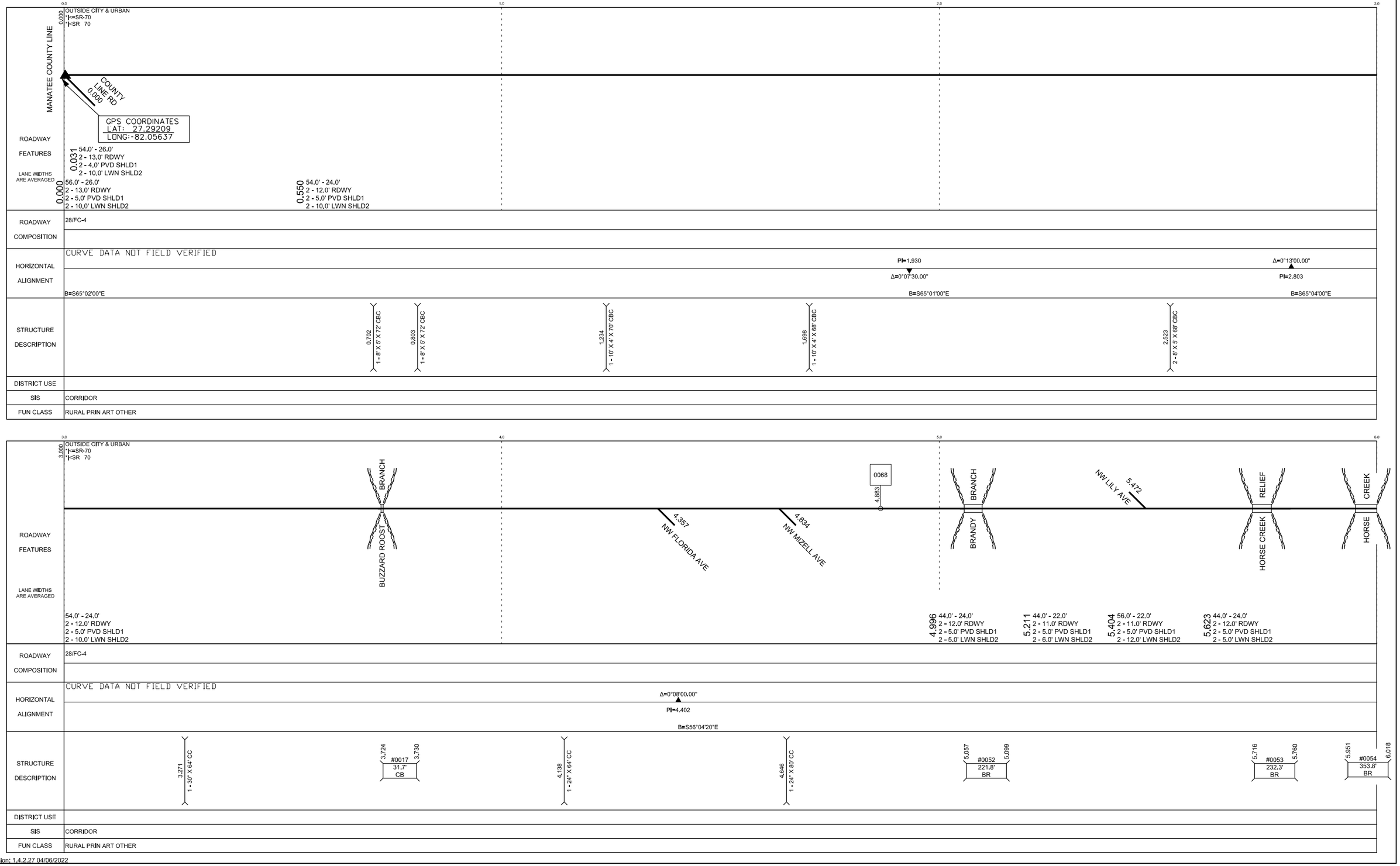
STRAIGHT-LINE DIAGRAM

	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	02/14/2022	04/06/2022	00.000	00.031		6/1/23-444777
BY	FTE	FTE				

FLORIDA DEPARTMENT OF TRANSPORTATION FDOT

STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

SECTION STATUS	INT. or US ROUTE NO.	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET NO.
02		SR 70	DESOTO	01	04040000	1 OF 8

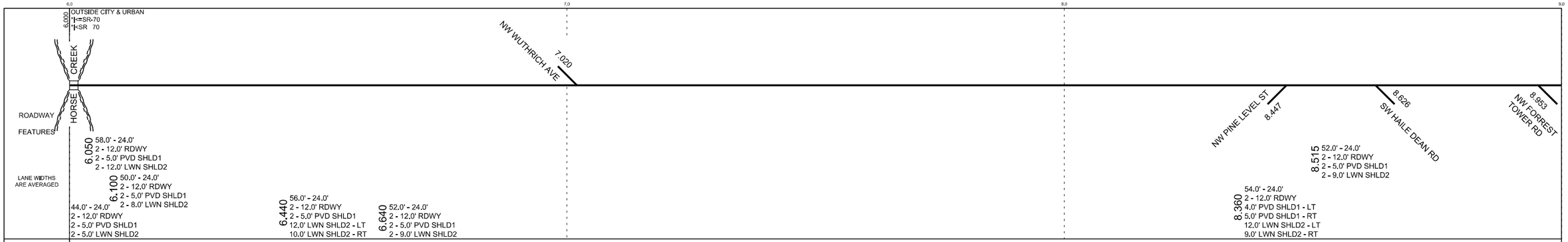


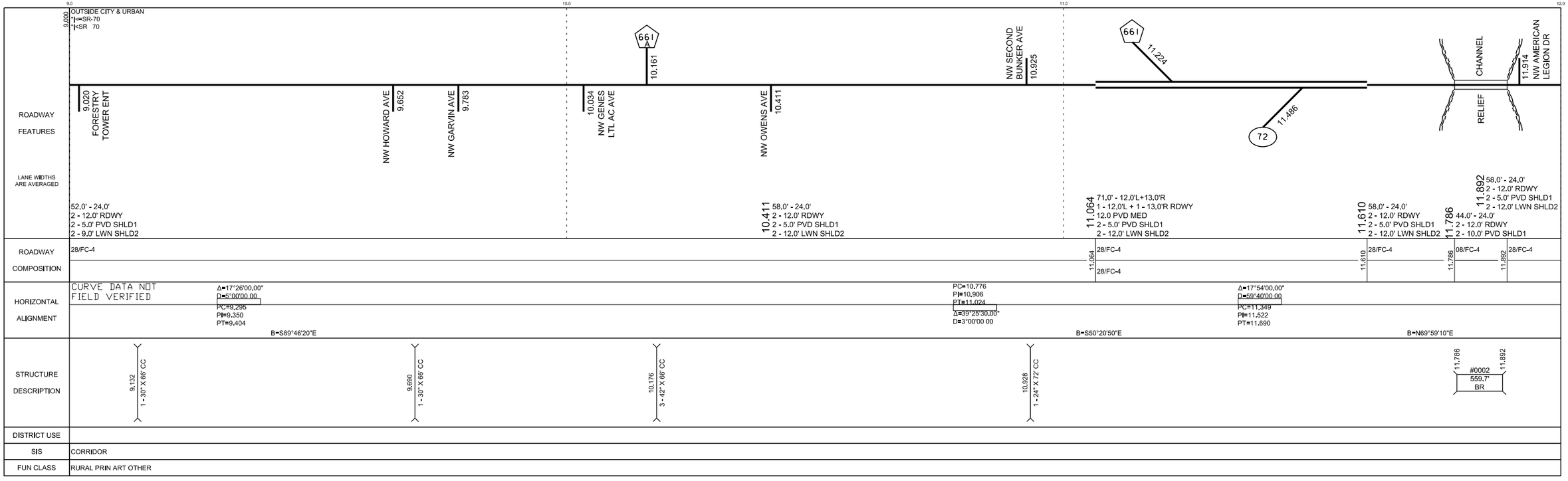
	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	02/14/2022	04/06/2022				
BY	FTE	FTE				

FLORIDA DEPARTMENT OF TRANSPORTATION

STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

SECTION STATUS	INT. or US ROUTE NO.	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET NO:
02		SR 70	DESOTO	01	04040000	2 OF 8



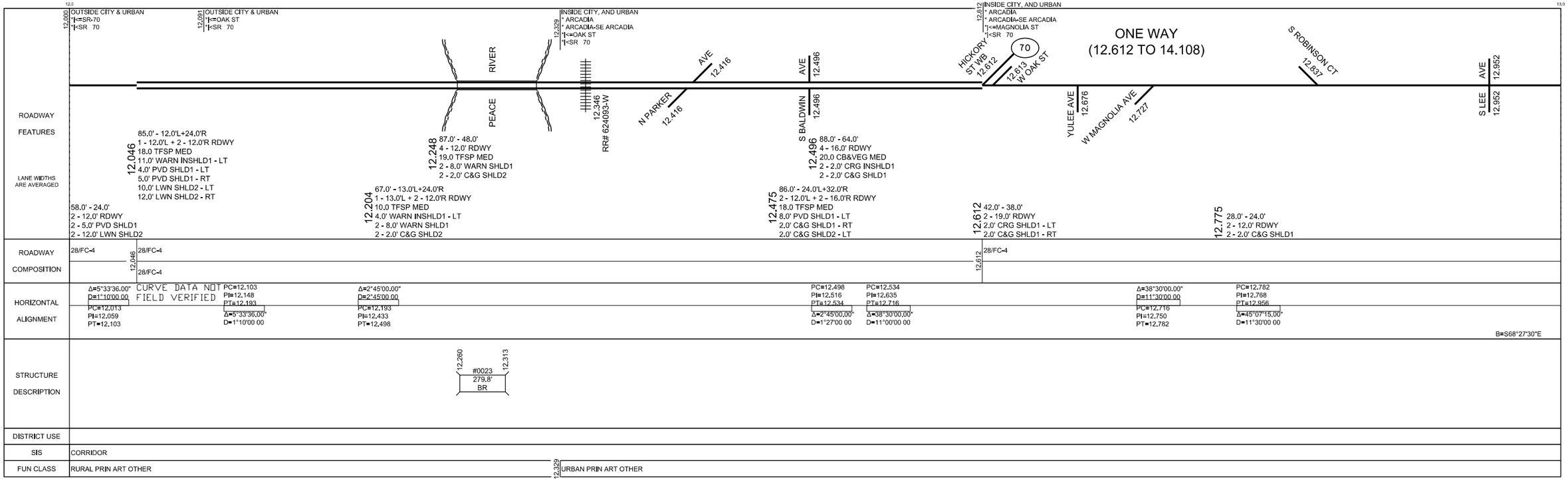


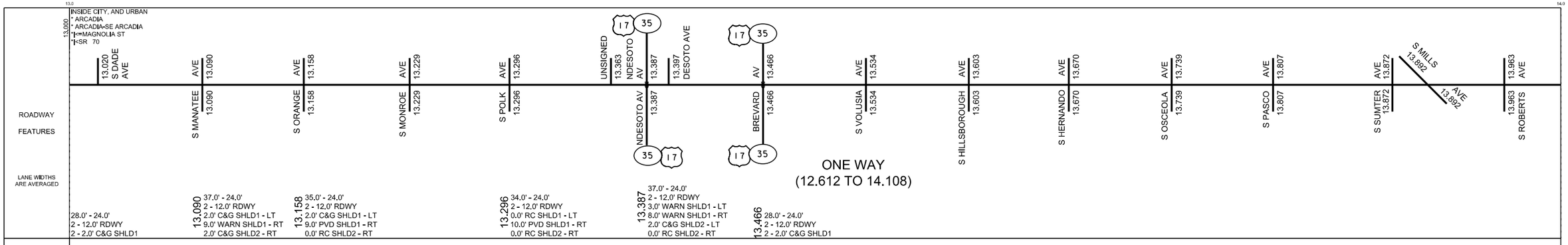
	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	02/14/2022	04/06/2022				
BY	FTE	FTE				

FLORIDA DEPARTMENT OF TRANSPORTATION

STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

SECTION STATUS	INT. or US ROUTE NO.	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET NO:
02		SR 70	DESOTO	01	04040000	3 OF 8



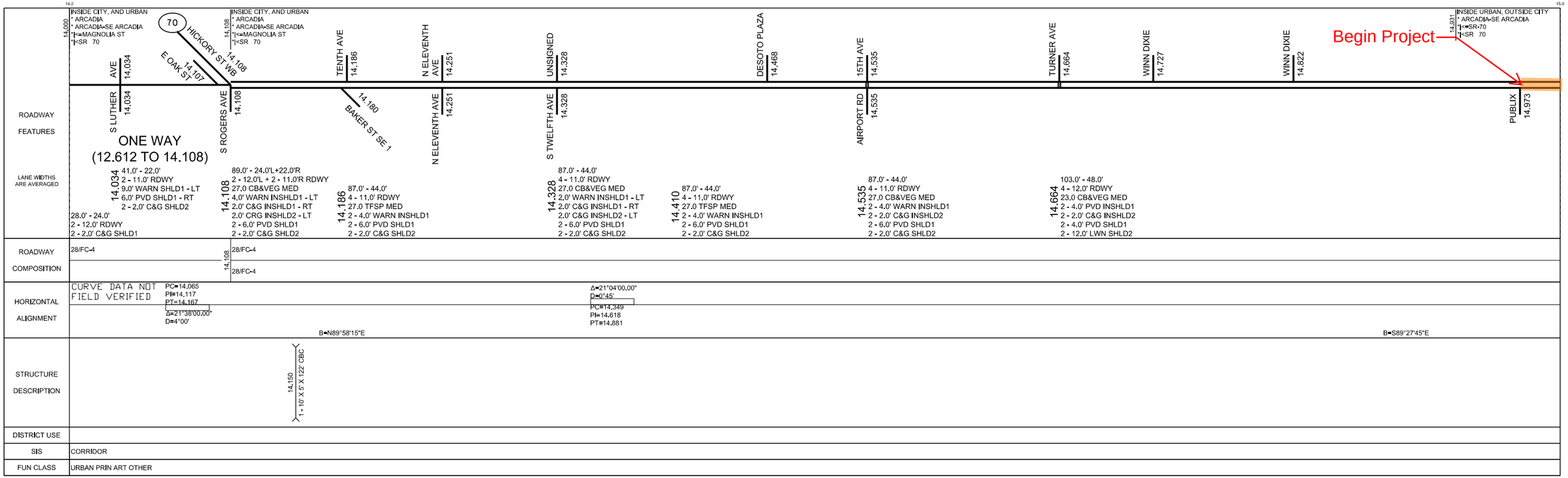


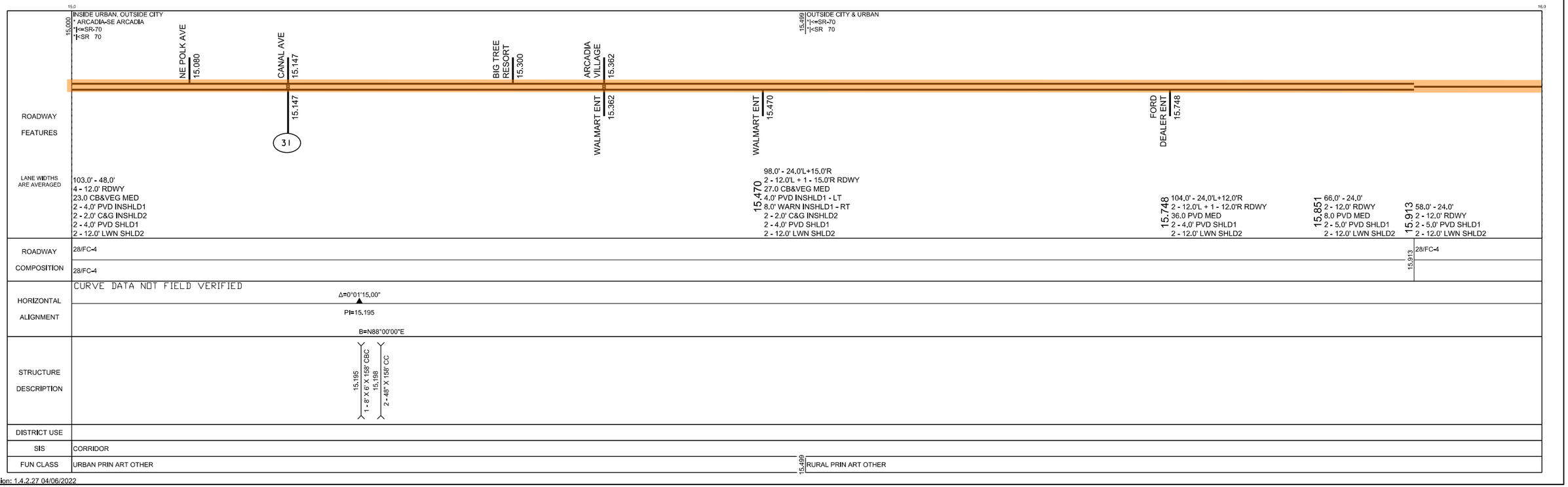
	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	02/14/2022	04/06/2022				
BY	FTE	FTE				

FLORIDA DEPARTMENT OF TRANSPORTATION

STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

SECTION STATUS	INT. or US ROUTE NO.	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET NO.
02		SR 70	DESOTO	01	04040000	4 OF 8



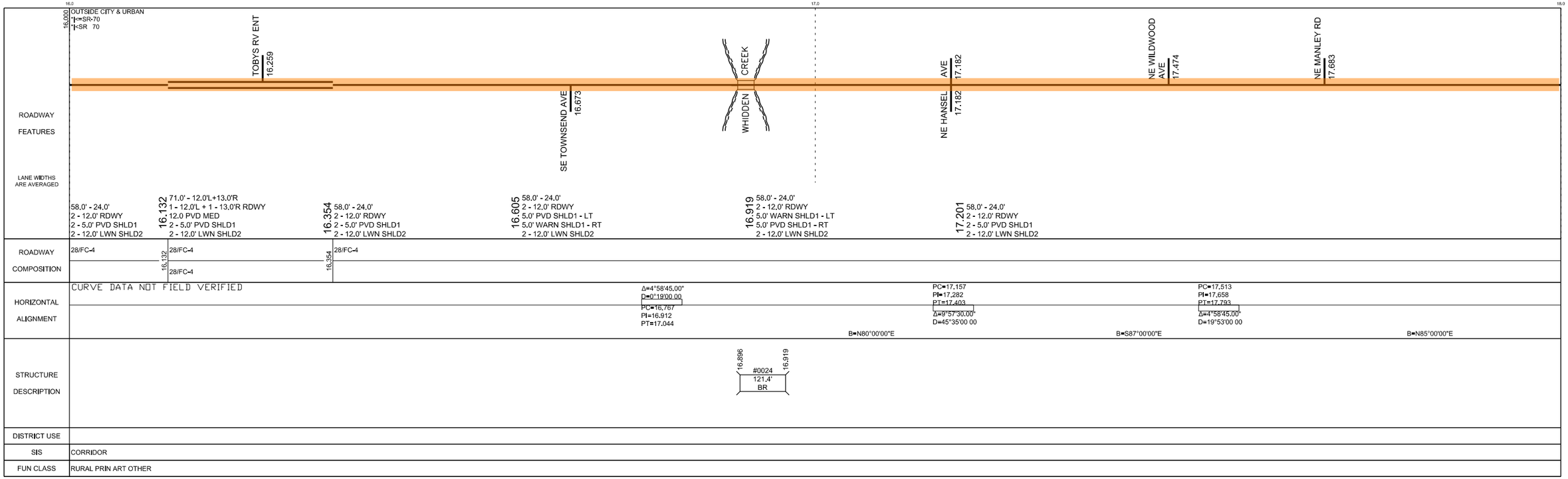


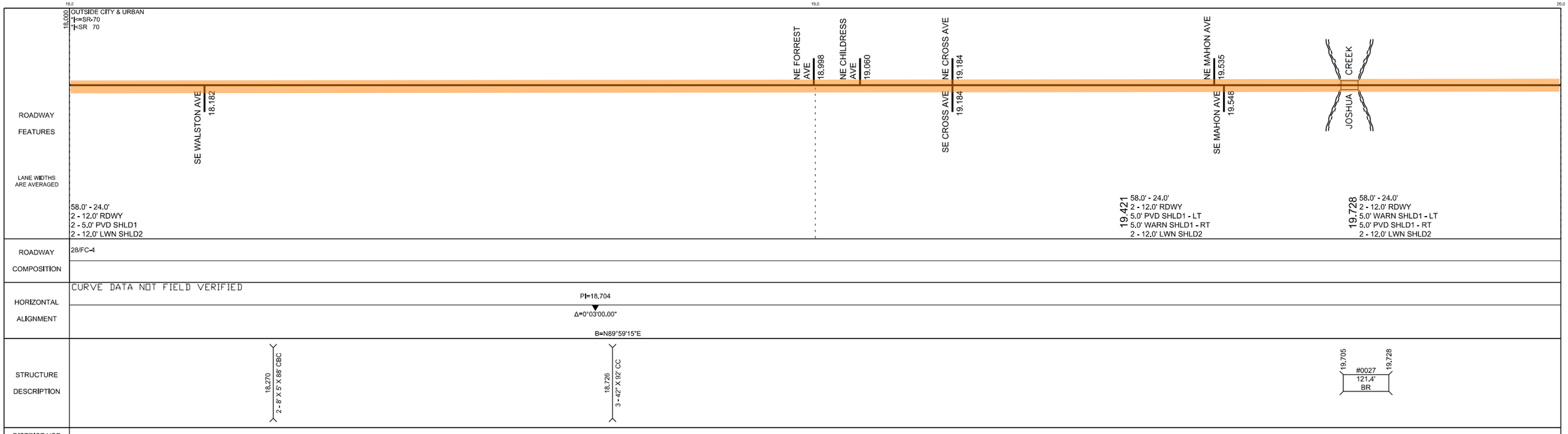
	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	02/14/2022	04/06/2022				
BY	FTE	FTE				

FLORIDA DEPARTMENT OF TRANSPORTATION

STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

SECTION STATUS	INT. or US ROUTE NO.	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET NO:
02		SR 70	DESOTO	01	04040000	5 OF 8



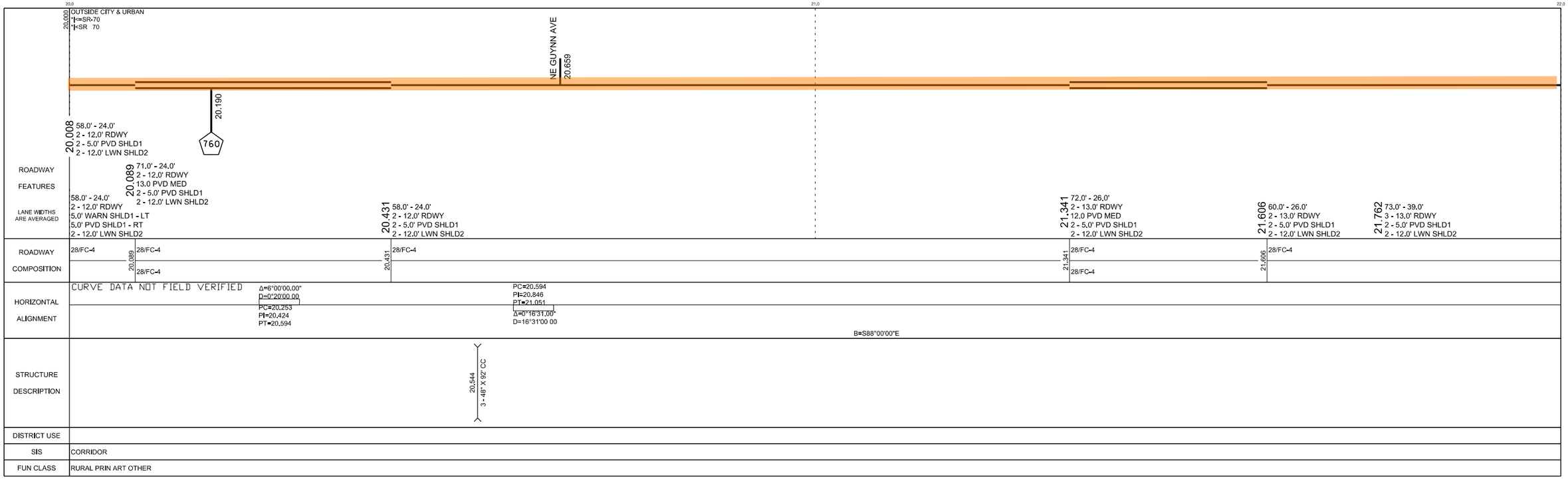


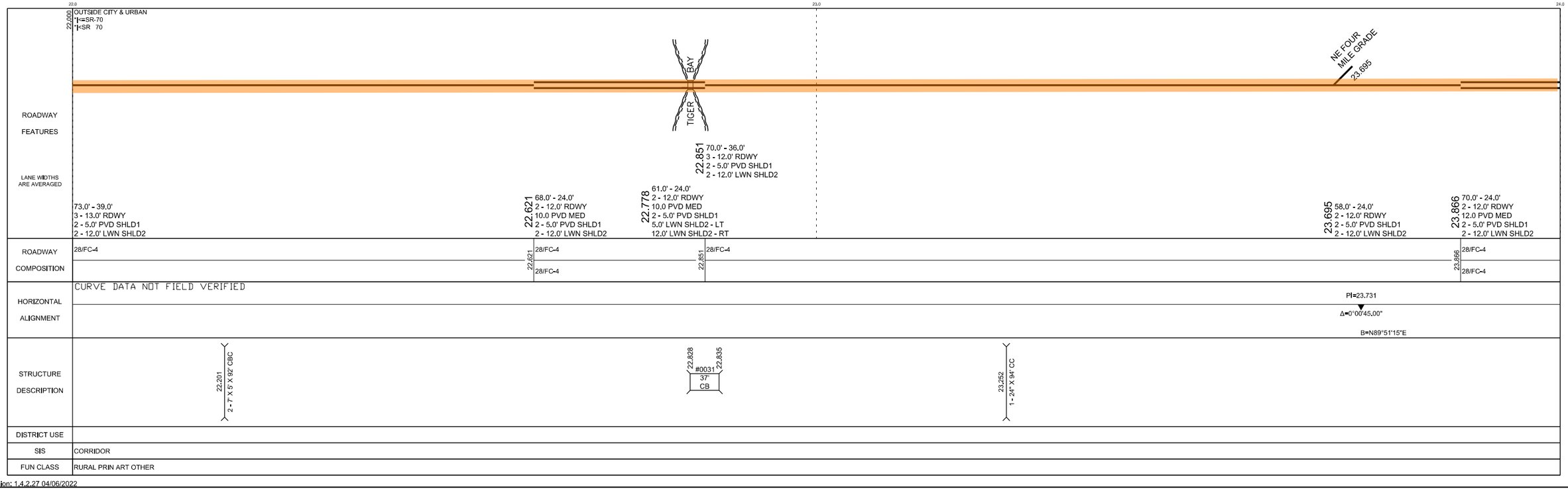
	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	02/14/2022	04/06/2022				
BY	FTE	FTE				

FLORIDA DEPARTMENT OF TRANSPORTATION

STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

SECTION STATUS	INT. or US ROUTE NO.	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET NO:
02		SR 70	DESOTO	01	04040000	6 OF 8



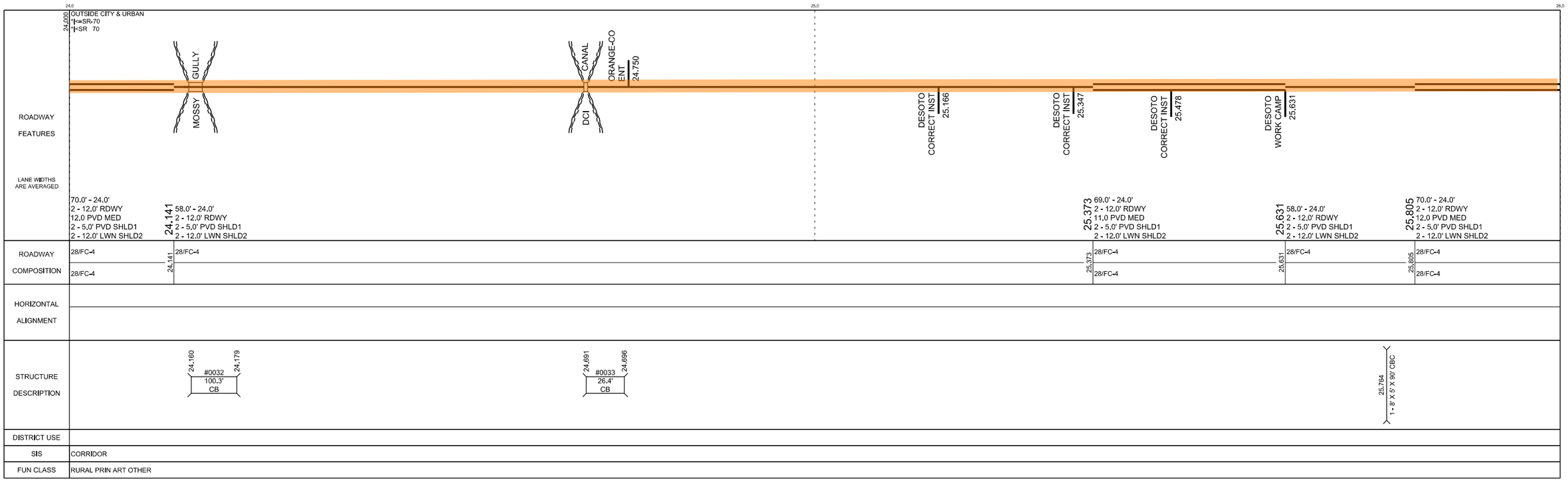


	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	02/14/2022	04/06/2022				
BY	FTE	FTE				

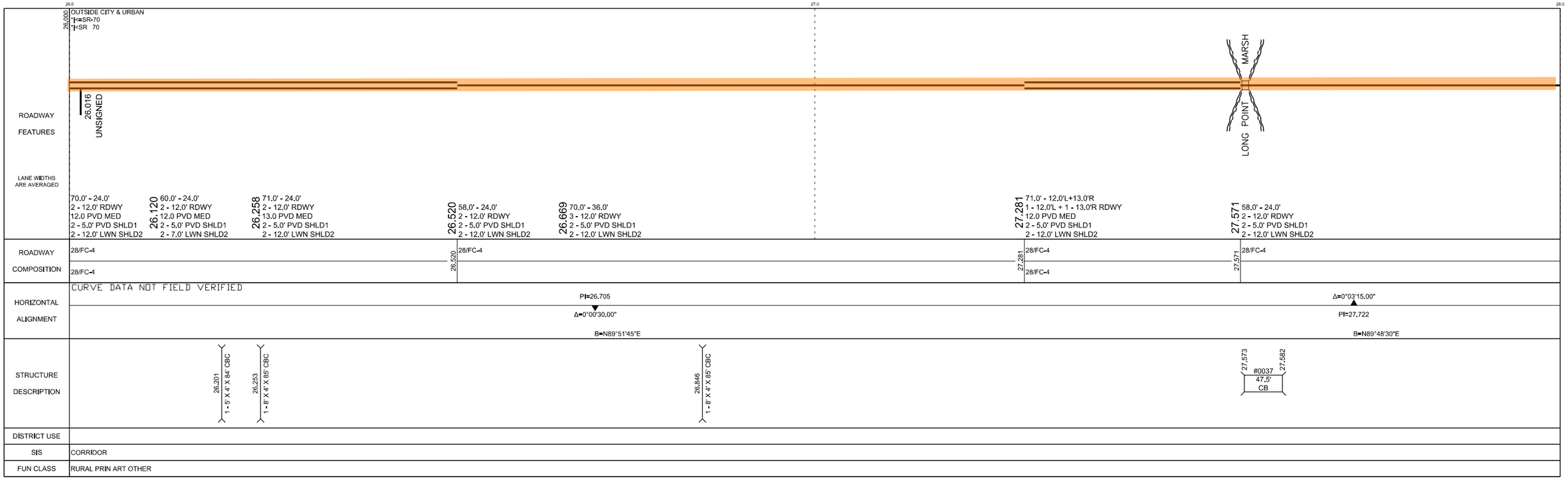
FLORIDA DEPARTMENT OF TRANSPORTATION

STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

SECTION STATUS	INT. or US ROUTE NO.	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET NO:
02		SR 70	DESOTO	01	04040000	7 OF 8



DISTRICT USE	
SIS	CORRIDOR
FUN CLASS	RURAL PRIN ART OTHER



DISTRICT USE	
SIS	CORRIDOR
FUN CLASS	RURAL PRIN ART OTHER

	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	02/14/2022	04/06/2022				
BY	FTE	FTE				

FLORIDA DEPARTMENT OF TRANSPORTATION

STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

SECTION STATUS	INT. or US ROUTE NO.	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET NO:
02		SR 70	DESOTO	01	04040000	8 OF 8

28.0 29.0 30.0

28.000 OUTSIDE CITY & URBAN
*|<=SR-70
*|<SR 70

ROADWAY FEATURES

LANE WIDTHS ARE AVERAGED

58.0' - 24.0'
2 - 12.0' RDWY
2 - 5.0' PVD SHLD1
2 - 12.0' LWN SHLD2

28.473 66.0' - 24.0'
2 - 12.0' RDWY
8.0 PVD MED
2 - 5.0' PVD SHLD1
2 - 12.0' LWN SHLD2

28.594 70.0' - 36.0'
3 - 12.0' RDWY
2 - 5.0' PVD SHLD1
2 - 12.0' LWN SHLD2

29.467 58.0' - 24.0'
2 - 12.0' RDWY
2 - 5.0' PVD SHLD1
2 - 12.0' LWN SHLD2

29.632 71.0' - 24.0'
2 - 12.0' RDWY
13.0 PVD MED
2 - 5.0' PVD SHLD1
2 - 12.0' LWN SHLD2

29.975 58.0' - 24.0'
2 - 12.0' RDWY
2 - 5.0' PVD SHLD1
2 - 12.0' LWN SHLD2

29.897 51.0' - 24.0'
2 - 12.0' RDWY
2 - 5.0' PVD SHLD1
5.0' LWN SHLD2 - LT
12.0' LWN SHLD2 - RT

ROADWAY COMPOSITION

28/FC-4

28.473 28/FC-4 / 28/FC-4

28.594 28/FC-4

29.632 28/FC-4 / 28/FC-4

29.897 28/FC-4

HORIZONTAL ALIGNMENT

CURVE DATA NOT FIELD VERIFIED

Δ=0°03'00.00"
PI=28.759
B=N89°45'30"E

Δ=0°00'30.00"
PI=29.756
B=N89°45'00"E

STRUCTURE DESCRIPTION

28.638 1 - 8' X 4' X 88' CBC

29.953 1 - 8' X 4' X 86' CBC

DISTRICT USE

SIS CORRIDOR

FUN CLASS RURAL PRIN ART OTHER

30.0 31.0

30.000 OUTSIDE CITY & URBAN
*|<=SR-70
*|<SR 70

ROADWAY FEATURES

PARKER CREEK

End Project

SE HGHLNDS CO LN RD 31.763

HIGHLANDS CO LINE

GPS COORDINATES
LAT: 27.20968
LONG:-81.56293

LANE WIDTHS ARE AVERAGED

58.0' - 24.0'
2 - 12.0' RDWY
2 - 5.0' PVD SHLD1
2 - 12.0' LWN SHLD2

END MP: 031.770
NET ROADWAY ID LENGTH: 31.770

ROADWAY COMPOSITION

28/FC-4

HORIZONTAL ALIGNMENT

CURVE DATA NOT FIELD VERIFIED

PI=30.772
Δ=0°10'45.00"
B=N89°55'45"3

STRUCTURE DESCRIPTION

30.916 #0940 47.5' CB 30.925

DISTRICT USE

SIS CORRIDOR CORRIDOR 31.770

FUN CLASS RURAL PRIN ART OTHER

Version: 1.4.2.27 04/06/2022