SR 31 from SR 80 (Palm Beach Boulevard) to SR 78 (Bayshore Road) Project Development and Environment (PD&E) Study

Bridge Development Report *(BDR)*

Financial Project ID: 441942-1-22-01
Efficient Transportation Decision Making (ETDM) No.: 14359
Lee County, Florida

Prepared for the

Florida Department of Transportation District One

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FIGURES:

TABLES:

ATTACHMENTS:

EXECUTIVE SUMMARY

The purpose of this Bridge Development Report (BDR) is to present alternatives for the replacement of the SR 31 bridge also known as Wilson Pigott Bridge (Bridge No. 120064) over Caloosahatchee River in Lee County, Florida. This report will address the existing conditions, horizontal and vertical clearance requirements, and viable superstructure and substructure alternatives. Optimal superstructure and substructure types will be identified and combined into alternatives. A preferred structural alternative will be selected based on a combination of cost, constructability, and durability. The preferred alternative will be recommended as the alternative to be carried forward to final design.

Issues influencing the selection of the vertical alignment and resulting bridge vertical clearances include: proposed access roads under the bridge, and navigable channel clearance. The criteria used to establish the roadway vertical alignment are to provide adequate navigable vertical clearance above the Mean High Water (MHW) over the Caloosahatchee River, debris clearance, proximity to the “splash zone”, and the 100-year wave crest elevation.

For the proposed bridge, one viable superstructure alternative was identified, Florida-I 84 Beams provides efficient superstructure spans. A cost comparison was performed which established the Florida-I 84 Beam as the least cost alternative and therefore, the recommended superstructure alternative to be carried forward. Based on the project soil conditions, the feasible foundation alternatives included 24” and 30” square prestressed concrete piles. The selected superstructure alternative was then combined with the two foundation alternatives. The combinations were evaluated based on cost and constructability, and the optimal solution was identified.

The recommended alternative for the proposed bridge is a twelve-span structure supported by hammerhead piers and retaining walls at the bridge ends. Spans one and twelve are 166’-6” long, and spans two thru eleven are 165’-0” long for an overall bridge length equal to 1983’-0”. Wrap-around wall configuration will be implemented in both locations, allowing for an access road under the south bridge end.

The bridge typical section will carry 12’-0” sidewalks, bi-directional traffic in 11’-0” lanes, and standard 8’-0” inside and outside shoulders. Crash tested barriers and fencing will be provided along the edges of the deck. The resulting overall bridge width is 128’-8”. The proposed superstructure will consist of fourteen Florida-I 84 Beams spaced at 9’-4”. The prestressed concrete beams support an 8½” cast-in-place composite reinforced concrete deck. To minimize the number of support locations and satisfy hydraulic impedance in the channel, Florida-I 84 Beams were used at their maximum practical span length.

The following table lists the estimated construction cost for the recommended alternative. The cost includes both the bridge and walls.

Location	Total Cost
Bridge Construction	$62,120,038

1.0 INTRODUCTION

1.1 Purpose of the Bridge Development Report

The purpose of this Bridge Development Report (BDR) is to present alternatives for the replacement of the SR 31 bridge also known as Wilson Pigott Bridge (Bridge No. 120064) over Caloosahatchee River in Lee County, Florida.

The report will address the existing conditions, horizontal and vertical clearance requirements, and viable superstructure and substructure alternatives. Optimal superstructure and substructure types will be identified and combined into alternatives. A preferred structural alternative will be selected based on a combination of cost, constructability, and durability and will be recommended as the alternative to be carried forward to final design.

1.2 Project Description

The principal intent of this project is to replace the existing SR 31 bridge also known as Wilson Pigott Bridge (Bridge No. 120064), built in 1960. The current bridge inspection report indicates that the bridge is functionally obsolete, with the bridge featuring design deficiencies and mechanical malfunctions. In addition to the present condition of the bridge, it does not meet the minimum horizontal clearance guidance from the United States Coast Guard (USCG) for a navigable waterway.

The replacement bridge will consist of twelve fixed spans with six travel lanes, two sidewalks, and shoulders. The bridge will also be lengthened to satisfy hydraulic recommendations and accommodate future access road under the south end of the bridge. This bridge replacement project is a multi-disciplined effort involving field survey, geotechnical investigation, hydraulic analysis, roadway design, traffic control design, drainage design, environmental permitting, and public involvement.

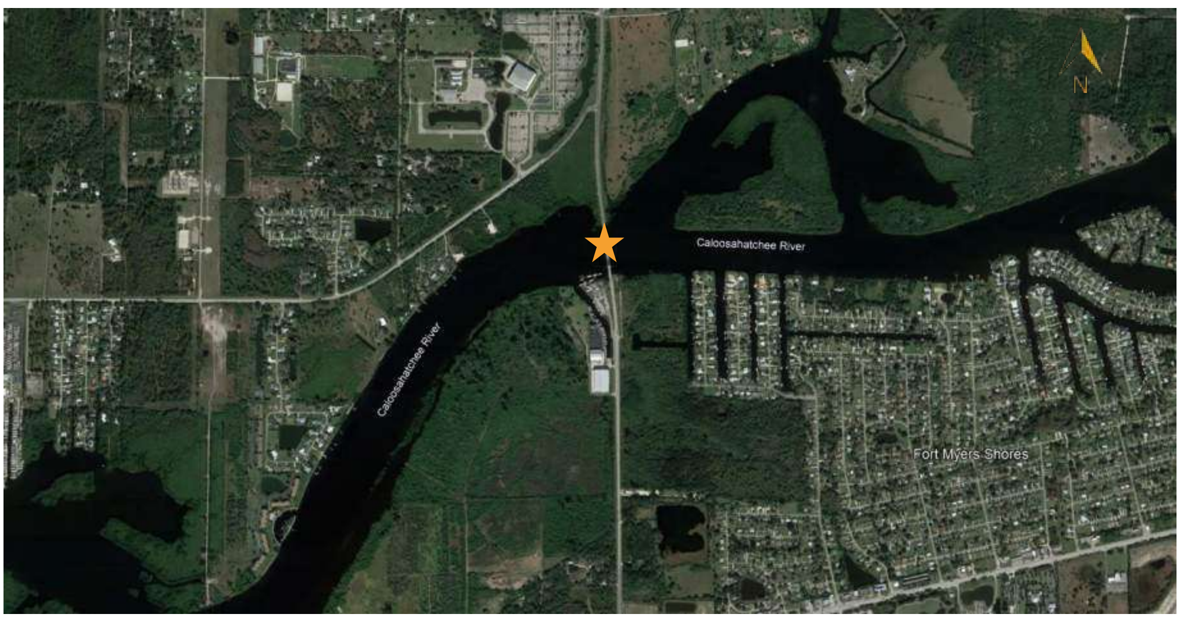


Figure 1.2.1 Vicinity Map

2.0 EXISTING CONDITION

2.1 Roadway

State Road 31 (SR 31) serves as a north-south connection through a predominiantly rural area of Lee County, Florida. The stretch of corridor encompassed in this project is classified by FDOT as Suburban Commercial, and provides access to residential homes, agricultural lands, light industrial facilities, and open space/conservation lands. The existing SR 31 roadway between SR 80 and the Wilson Pigott Bridge consists of two 12'-0" lanes in each direction with paved shoulders ranging from 4' to 6'. North of the Wilson Pigott Bridge to SR 78 consists of two 12'-0" lanes in each direction, with a 7' bike lane in the southbound direction and a 6' bike lane in the northbound direction; a northbound turn lane and a short tapered southbound acceleration lane is provided at the SR 78 intersection. The existing right-of-way (R/W) corridor maintains approximately 100-feet of width throughout the project corridor. Current traffic data estimates a recent AADT of 15,900. The current, and proposed, design speed along SR 31 is 45-mph.

Figure 2.1.1 **Roadway Typical Section**

2.2 Description of Existing Bridge No. 120064 – SR 31 over the Caloosahatchee River

The Wilson Pigott Bridge, existing bridge no. 120064, was constructed approximately 1-mile north of SR 80. The existing structure spans 777'-9" and consists of: one 140'-0" movable span flanked on both ends by adjacent 38'-10½" steel beam spans, three 40-foot concrete beam approach spans to the south, and eight concrete beam approach spans to the north: six 60-foot spans and two 40-foot spans. The superstructure is supported on concrete pile bents and piers founded on steel piles. The typical section conveys two 12'-0" lanes carrying bi-directional traffic, and 3'-6" sidewalks along the edges of the deck. The movable span provides a clear navigational width of 90-feet, measured between the inside face of fenders. When closed, the bascule span provides approximately 23-feet of clearance at the face of its fenders, and 27-feet of clearance at the center of the span above mean high water (M.H.W.) for passage of lower height vessels.

Figure 2.2.1 **Bridge Elevation – Bascule Span Open**

Figure 2.2.2 **Vertical Clearance Post**

The Wilson Pigott Bridge was constructed in 1960 and has exceeded its fifty-year design life. Based on a FDOT bridge inspection report conducted in October 2021, the Wilson Pigott Bridge is functionally obsolete and received a sufficiency rating of 52.0. The bridge sufficiency rating is a method of evaluating highway bridge data by calculating a numeric value which is indicative of bridge sufficiency to remain in service. Criteria incorporated into the sufficiency rating includes structural condition, function obsolescence, and its essentiality to the public. The numeric result of this method is a percentage in which 100 percent would represent an entirely sufficient bridge and zero percent would represent an entirely insufficient or deficient bridge. A sufficiency rating below 50.0 qualifies a bridge for replacement funds.

Figure 2.2.3 Typical Corrosion at Footing

Although some elements of the bridge are currently considered to be in satisfactory condition, the Wilson Pigott Bridge has reached a critical threshold in which deterioration is expected to accelerate. Based on the age of the bridge with respect to its intended design life and structural condition, the bridge was programmed by FDOT for replacement.

2.3 Soil and Geotechnical Data

A geotechnical engineering report was provided by Tierra outlining the soil and environment characteristics, recommended foundations, and other construction considerations. This report will be referenced throughout this Bridge Development Report and can be found in the Appendices.

2.4 Existing Utilities

Utilities located in the vicinity of the bridge are listed below in Table 2.4.1.

DRMP's approach to the bridge design and construction sequencing is to coordinate with Utility Agency Owners to ensure utility service is maintained to the greatest extent possible with no exceptions or interruptions. Negotiations and coordination with the remaining utilities are ongoing and will continue to establish the exact location of all permanent and temporary utility relocations.

Utility Company	Utility Type	Contact Information
AT&T Transmission	6-inch Steel Pipe (East Side of SR31, Crossing under Caloosahatchee River)	Greg Jacobson gtjacobson@att.com (813) 342-0512
Comcast	Subsurface and Bridge Mounted Comcast Facilities (East Side of Bridge)	Mark Cook mark_cook@cable.comcast.com (239) 432-1805
CenturyLink National fka Core Network, Qwest, Time Warner, Level 3	Subsurface Utilities (East and West Side of SR31)	Xan Marie Rypkema NationalRelo@centurylink.com (941) 637-5145
CenturyLink	See Above (Contact for North of Bridge)	Ronald Smith Ronald.o.smith@centurylink.com (941) 637-5145
CenturyLink	See Above (Contact for South of Bridge)	Ezekiel “Zeke” Reid Ezekiel.Reid1@centurylink.com (239) 336-2030
City of Fort Myers	N/A	Nicole Monahan nmonahan@cityftmyers.com (239) 910-2295
Crown Castle	Buried Fiber Optic Facilities (South Side of SR 80)	Danny Haskett fiber.dig@crowncastle.com (786) 610-7073
Florida Gas Transmission	26-inch Subsurface Gas Main (East of Existing Structure)	Joseph Sanchez joseph.e.sanchez@energytransfer.com (407) 838-7171
Florida Government Utility Authority	N/A	Michael Currier mcurrier@govmserv.com (321) 246-4642
Florida Power & Light - Distribution	Overhead Utilities (East and West Side of SR 31, South of Bridge)	Greg Coker greg.coker@fpl.com (941) 723-4430
Lee County Signal Division	N/A	Efrain Cruz ecruz@leegov.com (239) 533-9500
Lee County Electric Co-Op	Overhead Utilities (North of Bridge Past Project Limits)	Tom Bailey tom.bailey@lcec.net (239) 656-2414
Lee County Utilities Division	Buried 6-inch Force Main (West Side of Bridge) Buried 8-inch Sanitary Force Buried 12-inch Water Main (W SR 31, South of Bridge)	Victor Gagnon vgagnon@leegov.com (239) 533-8178
TECO Peoples Gas	8-inch Steel Gas Main (East side of SR 31)	Anthony Baublitz AFBaublitz@tecoenergy.com (941) 313-6761

Table 2.4.1 Utility Contact Matrix

2.5 Existing Right-of-Way

At the bridge location, SR 31 is being realigned, obtaining right-of-way is required. There is no existing right-of-way or Board of Trustees of the Internal Improvement Trust Fund of the State of Florida (TIIFT) Easement along the new proposed bridge.

3.0 DESIGN CRITERIA

3.1 Hydraulics Design Criteria

The Bridge Hydraulics Report prepared by Intera, dated November 2022, establishes key parameters that influence the proposed bridge geometry and structural design. The hydraulic modeling resulted in key water elevations, including the effect of sea level rise, and predicted channel scour. Significant water elevations are as follows:

Water Level Parameter	Frequency (Yrs.)	Elevation (NAVD88)
Mean Low Water (MLW)	N/A	-0.78
Mean High Water (MHW)	N/A	+0.23
Water Surface Elevation	500	+13.4 (+14.8)
Wave Crest Elevation	100	+10.6 (+12.1)
Design Flood	50	+8.1 (+9.6)

Table 3.1.1 Water Elevations (Values in parenthesis include Sea Level Rise)

Predicted Scour values are as follows:

Pier Number	Initial Bed Elevation (ft-NAVD)	Degradation (ft)	100-year Event			500-year Event		
			Contraction Scour (ft)	Local Pier Scour (ft)	Total Scour Elevation (ft-NAVD)	Contraction Scour (ft)	Local Pier Scour (ft)	Total Scour Elevation (ft-NAVD)
2	7.0	0.0	0.0	5.9	1.1	0.0	6.0	1.0
3	5.0	0.0	0.0	5.9	-0.9	0.0	6.0	-1.0
4	2.0	0.0	0.0	5.9	-3.9	0.0	6.0	-4.0
5	-13.0	1.0	0.0	16.1	-30.1	0.0	19.4	-33.4
6	-21.0	1.0	0.0	15.4	-37.4	0.0	18.1	-40.1
7	-23.0	1.0	0.0	15.3	-39.3	0.0	17.9	-41.9
8	-8.0	1.0	0.0	17.3	-26.3	0.0	21.5	-30.5
9	-8.0	1.0	0.0	17.3	-26.3	0.0	21.5	-30.5
10	-2.0	1.0	0.0	24.4	-27.4	0.0	30.2	-33.2
11	-2.0	1.0	0.0	24.4	-27.4	0.0	30.2	-33.2
12	2.0	0.0	0.0	5.9	-3.9	0.0	6.0	-4.0

Table 3.1.2 Scour Values

Per the Hydraulic Engineer recommendations, Long term scour shall match the 100-year scour.

3.2 Roadway Design Criteria

The proposed roadway design criteria will follow Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Florida Greenbook) and FDOT Design Manual (FDM) 2022.

3.2.1 Traffic Data

A traffic analysis was performed in April of 2020 for SR 31 from SR 80 to SR 78, including the Wilson Pigott Bridge. The projected traffic data for this facility is summarized in the following table:

Traffic	Distribution	Design Speed
Current Year (2019) AADT = 15,900 Future AADT (2045) = 56,800	T = 10.6 %	45 mph

Table 3.2.1.1 Traffic Data

3.2.2 Geometric Criteria

3.2.2.1 Horizontal Alignment:

The proposed horizontal geometry was established based on current right-of-way constraints and limitations. The proposed horizontal alignment is as follows:

Bridge Bearing	Bridge Skew
N 02º 13’ 48" W	00°00’00”

Table 3.2.2.1.1 Horizontal Alignment

3.2.2.2 Vertical Alignment:

Challenges influencing the selection of the vertical alignment and resulting bridge under clearance include: debris clearance, seal level rise, minimum navigational criteria, proximity to the “splash zone”, and the 100-year wave crest elevation.

Debris Clearance: FDOT design criteria specified in the Drainage Manual requires that clearance between the Design Flood Stage, which is the elevation of the design flood event associated with the probability of exceedance designed for, and the low member at both bridges be a minimum of 2-feet to allow for the passage of debris. The proposed bridge will be a high-level fixed bridge with the proposed LME at Pier 11 and End Bent 13 being 27.31-ft and 14.09-ft respectively above MHW and exceeding the 2-ft minimum debris clearance over the design flood elevation.

Minimum Navigational Criteria: Based on coordination with United States Coast Guard (USCG), the minimum vertical clearance at the channel shall be 55-feet. Therefore, the new bridge profile has been raised to ensure this criteria is met.

Splash Zone: The splash zone is defined as the vertical distance measured from 4-feet below the Mean Low Water (MLW) elevation (-0.78-feet NAVD) to 12-feet above MHW (0.23-feet NAVD). To avoid the splash zone, the bridge LME will be at 27.54-feet NAVD and 14.32-feet NAVD for Pier 11 and End Bent 13 respectively, therefore the superstructure will be above the splash zone. For substructure elements located within the splash zone, additional material considerations are required to meet or exceed a 75-year design life.

Wave Criteria: For coastal bridges, a minimum vertical clearance of 1 foot above the 100-year design wave crest elevation, including the storm surge elevation and wind setup, is required for the superstructure. However, where this criterion cannot practically be met, the designer is referred to *The*

AASHTO Guide Specification for Bridges Vulnerable to Coastal Storms. This document was developed in response to the significant damage caused by Hurricanes Ivan and Rita to Gulf Coast bridges. The code provides methodology to calculate wave induced forces on bridge structures and guidance on mitigating the effects. The code states that wherever "practical" the vertical clearance of bridges should be raised to provide at least 1-foot of clearance over the 100-year design wave crest elevation. Where this is not possible other force mitigation strategies should be considered.

The FDOT SDG and AASHTO guide specification allows bridges to be designed at the "strength limit state" or the "extreme limit state" depending on the level of importance of the proposed bridges and consequences of bridge damage caused by wave forces. These levels of importance are divided into three categories:

- ***Extremely Critical:*** Bridges typically designed to resist wave forces at the Strength Limit State to the "Service Immediate" performance level. The service immediate performance level shall be taken as the bridges may be assumed to be sufficiently undamaged, stable, and aligned to be usable tor rescue and recovery forces after cursory inspections. Backfill behind abutments may need to be replaced.
- ***Critical:*** Bridges typically designed to resist the wave forces at the Extreme Event Limit State to a "Repairable Damage" performance level. The repairable damage performance level is defined as some repairs could be needed to restore sufficient serviceability to put the bridges back in limited use within the Owner's criteria for outage duration and after an inspection. Where sacrificial spans are employed, the replacement period should satisfy the Owner's criteria for outage duration. Load posting may be considered as needed. These bridges are considered secondary to rescue and recovery and are expected to have major repairs or replacements as needed, primarily due to superstructure dislodgement.
- ***Non-Critical:*** Bridges will not be evaluated for wave forces.

Based on the Bridge Hydraulics Report, to provide adequate Wave Crest Clearance, an LME of 10.6-feet NAVD is required. The new bridge superstructure and LME will be above the required wave crest clearance elevation.

Based on the above, the proposed vertical alignment is as follows:

<table>
<tr><th colspan="2">PVC</th><th colspan="2">PVI</th><th colspan="2">PVT</th><th>VC Length</th><th>G1</th><th>G2</th></tr>
<tr><td>STA.</td><td>100+20.82</td><td>STA.</td><td>104+12.82</td><td>STA.</td><td>108+04.82</td><td rowspan="2">784'-0"</td><td rowspan="2">4.000%</td><td rowspan="2">(-) 4.000%</td></tr>
<tr><td>EL.</td><td>57.51 NAVD</td><td>EL.</td><td>73.19 NAVD</td><td>EL.</td><td>57.51 NAVD</td></tr>
</table>

Table 3.2.2.2.1 Vertical Alignment

3.2.2.3 Roadway Typical Section:

The proposed roadway improvements utilize a realignment of SR 31, allowing construction to take place without closing the Wilson Pigott Bridge. The approach roadway would accommodate bi-directional traffic in six 11'-0" lanes, type F curb and gutters, and two 12-foot shared use paths.

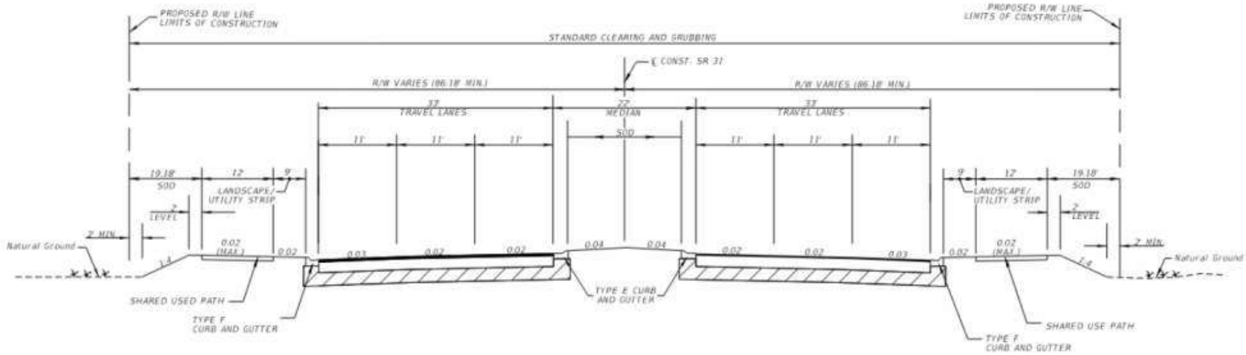


Figure 3.2.2.3.1 Proposed Roadway Typical Section

3.2.2.4 Bridge Typical Section:

The bridge will carry bi-directional traffic in six 11’-0” lanes with 8’-0” outside and inside shoulders. Crash tested barriers will separate the travel lanes from two 12’-0” multi-use paths and pedestrian railings along the edges of the deck. The design and posted speed for this corridor is 45 mph.

3.2.2.5 Bridge Deck Drainage:

The proposed bridge is crowned, with the crown break located at centerline construction, implementing a uniform 2.0% cross-slope. This cross-slope is sufficient to drain stormwater from the roadway surface of the bridge to the gutter lines.

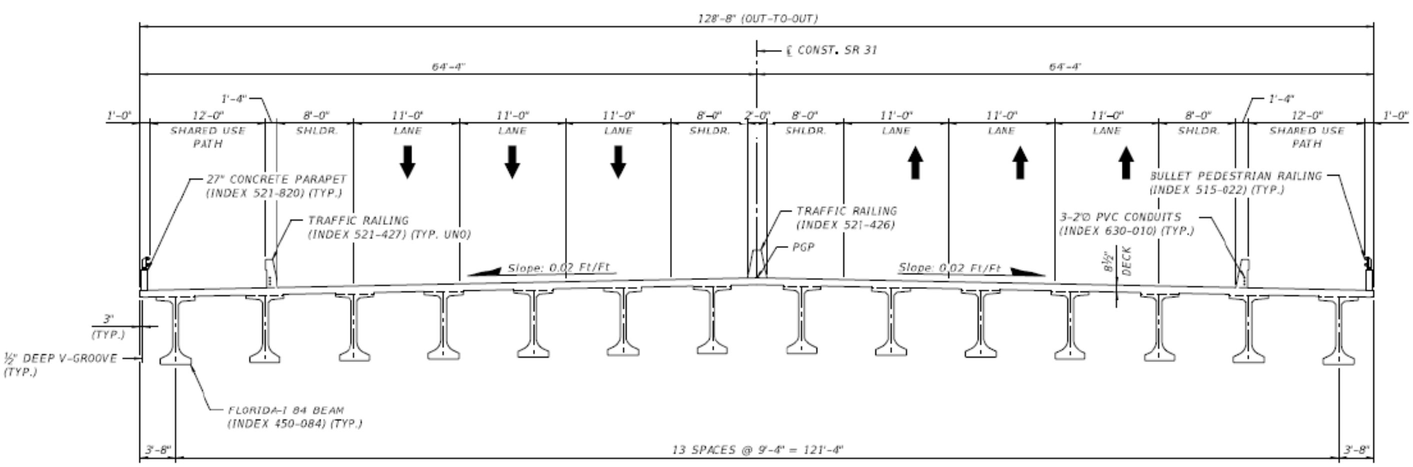


Figure 3.2.2.4.1 Bridge Typical Section

3.2.2.6 Design Exceptions:

No design exceptions are required for the replacement of SR 31 bridge over the Caloosahatchee River.

3.3 Structural Design Criteria

The design of the structural elements for this project will be in accordance with the FDOT Structures Design Guidelines and Detailing Manual. This section includes design data and criteria for the evaluation of bridge superstructures and substructures.

3.3.1 Design Specifications

Structures shall be designed in accordance with FDOT standard practices and procedures. The design is governed by the following design specifications:

1. FDOT Standard Specifications for Road and Bridge Construction (January 2022)
2. AASHTO LRFD Bridge Design Specifications (9th Edition, 2020)
3. FDOT Structures Manual, Topic No. 625-020-018 (January 2022) including current FDOT Structures Design Bulletins.
4. FDOT Design Manual (FDM), Topic No. 625-000-002 (January 2022).
5. FDOT Drainage Manual, Topic No. 625-040-002 (January 2022).
6. FDOT Standard Plans for Road and Bridge Construction (FY 2022-2023).
7. AASHTO Guide Specifications for Bridges Vulnerable to Coastal Storms (1st Edition, 2008)
8. AASHTO Guide Specifications for Vessel Collision Design of Highway Bridges (1991)

3.3.2 Design Loads

The following design loads are used in superstructure and substructure alternative investigations:

1. Dead Loads:

Unit Weight of Structural Concrete (Steel-RC/PC)	150 pcf
Traffic Railing (36” Single-Slope Median – Index 521-426)	430 plf
Traffic Railing (36” Single-Slope – Index 521-427)	645 plf
Concrete Parapet (27” w/ 2 Bullet Railing – Index 521-820)	235 plf
Stay-in-place Metal Forms	20 psf
Compacted Soil	115 psf

Sacrificial Thickness: The bridge riding surface includes one-half inch sacrificial thickness. The upper one-quarter inch of this sacrificial thickness shall be considered a long-term permanent dead load. The entire one-half inch sacrificial thickness shall be omitted from the superstructure section properties used in design for all alternatives.

2. Live Loads

Vehicular: HL-93 loading with Dynamic Load Allowance

3. Wind Loads

Wind Speed: 170 mph.
Design wind loads on bridges in accordance with AASHTO LRFD Bridge Design Specifications Section 3.8 and as modified by FDOT Structures Design Guidelines (SDG) Section 2.4.

4. Thermal Forces

Movements of the bridge structures shall be calculated assuming the following temperature ranges:

Superstructure Material	Mean	High	Low	Range
Concrete Only	70°F	105°F	35°F	70°F

The coefficient of thermal expansion for concrete shall be taken as 6 x 10^{-6} /°F

5. Seismic Design

The connections between the superstructure and substructure shall be designed in accordance with the requirements of FDOT SDG Section 2.3 and AASHTO LRFD Bridge Design Specifications Sections 3.10.9 and 4.7.4.

6. Wave and Current Forces

Design shall be in accordance with the AASHTO Guide Specification for Bridges Vulnerable to Coastal Storms.

7. Vessel Impact

The AASHTO LRFD Bridge Design Specifications require that all bridge components in navigable waters exceeding 2-feet in depth be designed for vessel impact. The equivalent static loads to be applied to the structures resulting from vessel impact are summarized in Table 3.3.2.1.

Pier #	Longitudinal Impact Load (kip)	Transverse Impact Load (kip)
Pier 5	1,720	860
Pier 6	1,730	865
Pier 7	1,550	775
Pier 8	1,270	635
Pier 9	760	380
Pier 10	130	65

Table 3.3.2.1 Vessel Impact Loads

3.3.3 Environment

As detailed in the “Bridge Geotechnical Report”, water samples taken at the bridge sites indicated chloride concentrations of over 10,295 ppm. According to the FDOT SDG, structures located over water bodies containing chloride concentrations exceeding 6,000 ppm are classified as “Marine Structures”.

Superstructure:	Extremely Aggressive
Substructure (Concrete):	Extremely Aggressive
Substructure (Steel):	Extremely Aggressive

3.3.4 Materials

The FDOT SDG provides parameters used to classify environmental conditions as Slightly, Moderately or Extremely (Marine or Non-Marine) aggressive. For each environmental classification, the concrete classification and amount of required concrete cover over the reinforcing steel is specified. The goal is to provide structures to meet or exceed a 75-year design life regardless of the environment in which they are constructed. For structures classified as "Marine Structure" and with substructure and superstructure located within the splash zone, material selection becomes critical to meet the desired design life and resiliency.

- **Substructure Corrosion Protection:** Due to the classification as a "Marine Structure", FDOT Structures Design Guidelines (SDG) recommend highly reactive pozzolans concrete admixture to be included in all piles and pile bent caps. Inclusion of highly reactive pozzolans result in a denser, less permeable concrete which improves the design life and resiliency.

- **Superstructure Corrosion Protection:** For superstructure within the splash zone, FDOT SDG recommend coordinating with the State Materials Office and the Structures Design Office (SDO) for guidance on concrete design mix requirements and cover. The superstructure will be outside of the splash zone therefore no additional concrete mix requirements are needed.

1. Concrete shall be in accordance with FDOT Standard Specifications for Road and Bridge Construction, Section 346. The following concrete properties with Florida Limerock are utilized:

Element	Concrete Class	28-day Strength (psi)	Modulus of Elasticity (ksi)
Superstructure (CIP)	IV	5,500	4,428
Substructure (CIP)	IV	5,500	4,428
Prestressed Piles	VI	8,500	5,112
Prestressed Beams	VI	8,500	5,112

   Due to the classification as a "Marine Structure", highly reactive pozzolans will be included in substructure elements located within the splash zone.

2. Reinforcing Steel

   Carbon steel bars for concrete reinforcement shall conform to the requirements ASTM A615, Grades 60. Concrete cover shall be per FDOT SDG Section 1.4.2.

3. Prestressing Strands

   Prestressing strands shall be ASTM A416, Grade 270, low-relaxation.

3.3.5 Substructure Design Limit States

The following limit states shall be satisfied:

1. Conventional LRFD loadings and wave loads using load factor combination groups specified in AASHTO LRFD Table 3.4.1-1 in combination with the most severe case of scour up to and including that from a 100-year flood event.
2. Stability check during the "super-flood" using the most severe case of scour up to and including that from the 500-year flood event.

$$\gamma p\ (DC) + \gamma p\ (DW) + \gamma p\ (EH) + 0.5\ (L) + \gamma p\ (EL) + 1.0\ (WA) + 1.0\ (FR)$$

Where L=LL+IM+CE+BR+PL+LS

3. Stability check for an Extreme Event Vessel Collision:

Load/Scour Combination 1 = Vessel Collision @ ½ Long-Term Scour

Load/Scour Combination 2 = Minimum Impact Vessel @ ½ 100-Year Scour

3.4 Traffic Control and Constructability

A prudent design begins with constructability in mind since it is a key component used to identify and evaluate bridge alternatives. Several key items including maintenance of traffic, construction phasing, access and operation affect the design decisions.

3.4.1 Maintenance of Traffic and Construction Phasing

The new roadway alignment will allow the new bridge to be built in its entirety. Therefore, no construction phasing is needed.

3.4.2 Construction Access and Operation

Ultimately, the contractor will determine "means and methods" to construct this project most economically. It is the responsibility of the designer to recognize site limitations and likely construction methods so that the contract documents attract multiple competitive bids. However, since the new roadway alignment will allow the new bridge to be built in its entirety off-site. It is likely that the Contractor will use the area within the right-of-way for staging and storage without affecting traffic.

3.5 Precast Feasibility Assessment

In April of 2011, FDOT formalized support of the FHWA "Everyday Counts" initiative. The intent of this initiative is to acknowledge that every roadway project includes both direct costs, which are routinely calculated and compared, and indirect costs. These indirect costs are incurred by the road users and include added fuel costs and man-hour losses resulting from traffic delays and detours. The goal is to minimize total cost (direct + indirect costs).

Accelerated Bridge Construction (ABC) is a way to minimize indirect cost. The acceleration of bridge construction is most often achieved with the use of precast elements which can be fabricated on-site or off-site and which can also be assembled into bridge systems that can placed together. The goal is to assemble as much as possible off-line to minimize disruption and delay on-line. ABC can range from as little as the use of individual precast components to a completely prefabricated bridge.

The reconstruction of SR 31 over the Caloosahatchee River is proposed to be realigned upstream of the existing structure. DRMP's solution to ABC is to provide precast elements including Florida I-Beam's (FIBs) and prestressed concrete piles. Standard prefabricated elements can typically be supplied from multiple precast manufacturers yielding them readily available and cost effective. Other precast and prefabricated elements i.e., traffic railings, are impractical and do not provide added-value due to the structures overall impact on project schedule.

3.6 Aesthetic Design Criteria

Level One Aesthetics are proposed for this bridge site. FDM 121.9.3 describes Level One Aesthetics as follows:

> *"…consists of cosmetic improvements to conventional Department bridge types, such as the use of color pigments in the concrete, texturing the surfaces, modifications to fascia walls, beams and surfaces or more pleasing shapes for columns and caps."*

The proposed bridge will implement a Class 2 surface finish (smooth uncoated) consistent with FDOT preferences.

3.7 ITS and Lighting Requirements

The proposed bridge will incorporate three 2-inch diameter PVC conduits located internally within both of the traffic railings along the edge of travel. The conduit will be used to serve any future ITS and lighting for this corridor. Navigational lighting will follow Standard Plans 510-001.

3.8 Bicycle and Pedestrian Requirements

The proposed SR 31 structure will accommodate bi-directional pedestrian and bicycle traffic within 12'-0" multi-use paths located along the edges of the bridge deck.

3.9 Abutment Protection

This information was not available at the time of this draft BDR and will be updated for the final BDR.

3.10 Historical Significance

Under FPID 428917-1-22-01, a Cultural Resource Assessment Survey (CRAS) was performed for movable and high-level fixed bridge alternatives. The report indicated: *"Neither alternative will have an adverse effect on historic resources listed or eligible for listing in the NRHP"*.

3.11 Bridge Demolition

In response to Section 1805, SAFETEA-LU Legislation, the State is required to notify local, state and federal government agencies of the availability of bridge debris resulting from the demolition of a bridge if the State themselves has no need for the debris. The recipient of the debris shall bear the additional cost of processing, delivery, placement and use of the materials, and shall assume all legal responsibility for the placement of the debris. Beneficial uses of the debris include shore erosion control or stabilization, ecosystem restoration, and marine habitat restoration.

Preconstruction agreement should be established between the State and recipients of the debris, outlining responsibility, cost and compliance with environmental laws and regulations. The agreement should include such language holding the owner of the demolished structures harmless in any liability action. The State should include appropriate contract provisions to clearly identify the responsibilities of the contractor, the State and the recipient. The debris volume associated with the proposed bridge work is 356.7 CY.

3.12 Removal of Existing Structure and Hazardous Materials

A hazardous material report was performed in May 2019 and it is included in the appendix. The report concluded that Asbestos Containing Material and Metals-Based Coatings are present on the structure which will require special handling and disposal by the Contractor.

3.13 Vibration and Settlement Monitoring of Existing Structures

All design elements and construction activities will be thoroughly vetted for their contribution to vibration and settlement of existing structures and utilities. A comprehensive vibration and settlement program will be required in the contract documents in accordance with FDOT Specifications Section 108 and to include additional limits per surrounding facilities and utilities requirements.

4.0 COST ESTIMATION

4.1 Historical Price Information

An appropriate method for preparing estimates of probable construction costs is essential to the economic analysis performed for each alternative. Preliminary quantities were prepared for each alternative and unit prices were applied to determine the estimated probable construction costs of the structure. A complete listing of unit prices, estimated quantities and probable cost estimates are contained in the Probable Construction Costs within the attachments of this document. Probable Costs are used only to compare structural alternatives and should not be considered the Engineers Estimate of construction cost. Since DRMP has no control over market conditions or bidding procedures, DRMP cannot and does not warrant that bids will not vary from such estimates.

4.2 Proposed Unit Prices

The unit costs that follow are based on the most conservative values from FDOT Historic Unit Costs from August 01, 2021 to July 31, 2022 or SDG Volume 1 Chapter 9. Please note that current construction material trends are varying and DRMP will include contingencies.

Item Description	Unit	Unit Cost
Superstructure:		
Approach Slab Concrete (Class II)	CY	$510.00
Superstructure Concrete (Class IV)	CY	$1,200.00
Bridge Deck Grooving	SY	$5.00
Bridge Deck Planning	SY	$6.00
Composite Neoprene Bearing Pads	CF	$1,095.00
Carbon Reinforcing Steel (Superstructure)	LB	$1.45
Carbon Reinforcing Steel (Approach Slab)	LB	$1.45
Prestressed Beams: Florida-I Beam 84”	LF	$557.00
Bridge Deck Expansion Joint – Strip Seal	LF	$778.00
Traffic Railing – Bridge, 36” Median Single-Slope	LF	$120.00
Traffic Railing – Bridge 36” Single-Slope (including conduits)	LF	$110.00
Concrete Parapet – Pedestrian/Bicycle, 27”	LF	$115.00

Table 4.2.1 Superstructure Unit Cost

	Unit	Unit Cost
Substructure:		
Seal Slab Concrete (Class III)	CY	$690.00
Substructure Concrete (Class IV)	CY	$1,654.00
Substructure Concrete, Mass (Class IV)	CY	$750.00
Carbon Reinforcing Steel (Substructure)	LB	$1.55
30-inch Prestressed Concrete Piling (Carbon)	LF	$225.00
30-inch Prestressed Concrete Test Piling	LF	$300.00

Table 4.2.2 Substructure Unit Cost

Item Description	Unit	Unit Cost
Miscellaneous:		
Removal of Existing Structure	SF	$32.00
Bridge Fender System, Removal & Disposal	LF	$75.00
Fender System, Plastic Marine Lumber, Reinforced	MB	$21,075.00
Retaining Wall System, Permanent, Excluding Barrier	SF	$45.00

Table 4.2.3 Miscellaneous Unit Costs

The quantity of steel reinforcing is based on the ratio of pounds of reinforcing per cubic yard of concrete for each of the concrete elements as shown in the table below.

Element Description	Pounds per Cubic Yard
Pile Abutment	135
Single Column, Short	150
Single Column, Tall	210
Deck Slab, Standard	205
Approach Slab	200

Table 4.2.4 Steel Reinforcing Design Aid

The next step in the estimation process is to modify the costs to account for site specific variables. The estimating guide provides the following factors:

Condition	Cost Factor
Construction over Water	+3%

Table 4.2.5 Condition Factors

The bridge cost will also be adjusted by the factor for construction over water.

5.0 SUPERSTRUCTURE ALTERNATIVES

Viable superstructure types depend on the required bridge length, the availability of substructure support locations and vertical geometric constraints related to require under clearance and roadway level tie-ins at the bridge ends. In this chapter, we will identify site specific constraints, evaluate and establish span arrangements, and identify viable superstructure types. In a subsequent section of this report, we will combine the superstructure alternatives with the selected substructure alternatives and identify the optimal structure.

5.1 Bridge Length Determination

The main considerations that influenced the overall bridge length were width of the channel being crossed, conveyance of better hydraulic than the existing condition, minimum vertical clearance for the future access road under the bridge near the south end, minimum vertical clearance for structure along the waterway, and limiting the overall structure footprint for the new fixed bridge. Therefore, the new bridge length will be longer than the existing bridge.

This chapter identifies site specific constraints and establishes a recommended superstructure type. In a subsequent section of this report, the selected superstructure alternative will be combined with the substructure alternative to determine the optimal structure.

5.1.1 Span Arrangement

To minimize hydraulic impedance in the waterway, it is desirable to reduce the number of support locations and in turn, maximize the span lengths. Prestressed Concrete I-Beams allow for longer spans and the ability to clear the channel, maximizing the hydraulic opening. These considerations resulted in a bridge length of 1983-feet with twelve-span bridge composed of precast prestressed concrete beams and cast-in-place decking. The span arrangement for the preferred alternative can be found in the table below:

Alternative	Bridge	Number of Spans	Span Length	Bridge Length
1	Single	12	Span 1 & 12 = 166’-6” Spans 2 thru 11 = 165’-0”	1983’-0”

Table 5.2.1 Viable Span Arrangements

Span five will accommodate the 90-feet of horizontal navigational clearance required by the United States Coast Guards (USCG). It will also provide a minimum of 55-feet of vertical clearance above mean high water required for the fixed structure.

5.2 Superstructure Design Alternatives

5.2.1 Alternative 1 –Florida-I 84 Beams

The FY 2022-2023 FDOT Standard Plans Index 450-210 Instructions include a chart that indicates maximum span length versus beam spacing. For extremely aggressive environments, the recommended span lengths for Florida-I 84 Beams range from 165’-0” to 166’-6” with 9’-4” beam spacings.

Based on these design parameters and with consideration of span lengths, the bridge will consist of fourteen

Florida-I 84 Beams spaced at 9’-4” in all twelve spans. The beams will support an 8.5” cast-in-place composite reinforced concrete deck.

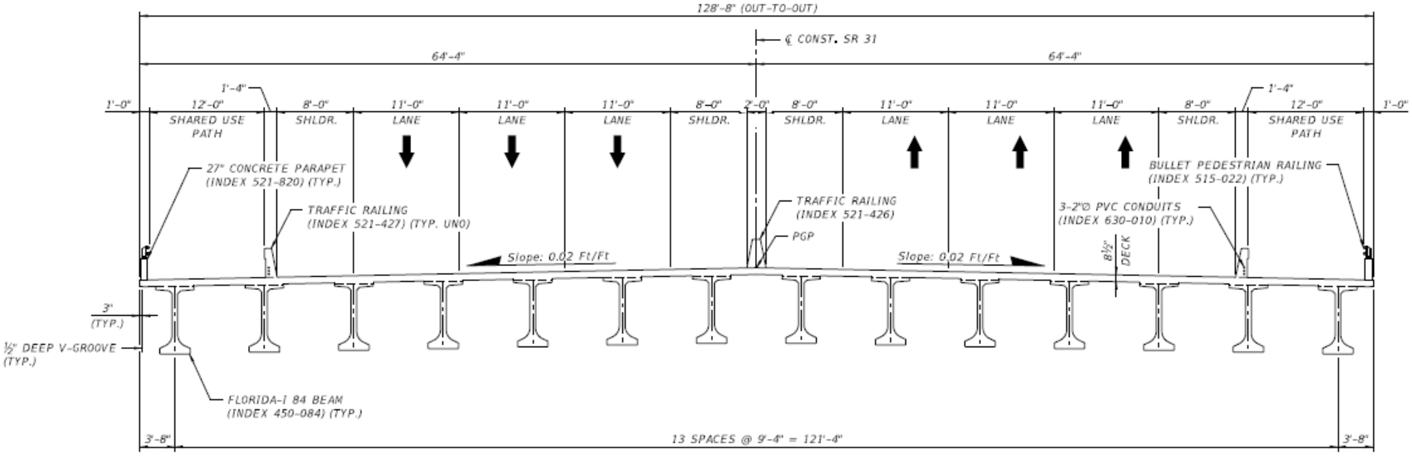


Figure 5.2.1 Florida-I 84 Beam Alternative

6.0 SUBSTRUCTURE ALTERNATIVES

In this section, subsurface conditions will be discussed, and viable substructure alternatives will be identified. Substructure alternatives will be advanced for further consideration based on cost, constructability and durability. In a subsequent section of this report, superstructure alternatives advanced from the previous section will be combined with the substructure alternatives advanced in this section and the optimal structure will be identified.

Tierra conducted a Geotechnical Investigation for the proposed bridge site. Their findings have been documented in the Geotechnical Report. These borings generally encountered sandy soils with silt and shell underlain by alternating layers of sand to silty sand, silty sand, sand to sand with silt, silt, silt to clay, sand, sand to clayey-silty sand, silt to clay, clay, and weathered limestone to the boring termination elevations ranging from -79-feet to -135-feet NAVD.

Evaluations of foundation alternatives for the proposed bridge are based on the subsurface conditions encountered in the borings performed at the bridge. The two general foundation options evaluated are shallow foundations and deep foundations. Shallow foundations are designed to distribute bridge loads to near surface soils whereas deep foundations transfer the loads through upper soils and the scour zone to dense underlying soils. The shallow foundation considered is a spread footing. The deep foundations considered include the following: drilled shafts, driven steel piles, and driven precast concrete piles.

6.1 Shallow Foundation (Spread Footing)

With this method of support, the structure loads are transmitted to the subsoil at a pressure suited for the properties of the soil. The design of shallow foundations is typically governed by the soil bearing capacity and the total and differential settlement criteria. On the land side, the high-level profile would require abutments with large stems and intermediate footings to bear on competent deep soils. Additionally, intermediate piers in the water are subject to scour. In this case significant scour is predicted in the near surface soils on which the foundations would bear. <u>Therefore, spread footings are eliminated from further consideration.</u>

6.2 Drilled Shafts

The construction of drilled shafts generally induces less vibration and provides a quieter installation compared to driven piles. Under favorable subsurface conditions and large design loads, drilled shafts can provide cost effective foundations when one large diameter shaft is used in lieu of several smaller piles. Disadvantages of this method of support are that load capacity of the completed shaft is dependent upon the skill and care exercised by the contractor and the capacity of drilled shafts cannot be verified as easily as driven piles during construction. Additionally, the 1958 geotechnical boring sheets indicate Artesian conditions were present. The new geotechnical boring exploration did not encounter artesian conditions, drilled shafts are known to pose problems when such conditions occur. <u>Therefore, drilled shafts are eliminated from further consideration.</u>

6.3 Steel Piles

Steel piles are easy to handle, drive and splice, and require less “lay-down” area than longer concrete piles. Steel pile types include pipe and H-piles. This is an advantage when construction is proposed in a constrained location (i.e. proposed median work required for pier construction). Lighter steel piles also allow for the use of smaller pile driving equipment. Non-displacement piles require significantly less hammer energy to drive than driving concrete piles. Reduced hammer energy results in lower vibration and smaller radius of area requiring monitoring and reduces the potential of pile rebound. Regardless, vibrations will be present during pile installations. Vibrations and settlements could be mitigated by preforming the soil down to the very dense sand or beyond where nominal bearing resistance can be achieved by relying only on bearing capacity with no contribution from soil side friction. However, table 3.1-1of the Structures Design Guidelines precludes the use of steel piles for water applications where the environmental classification is considered extremely aggressive, unless a concrete core is provided. The construction of the concrete core would require drilling and create similar potentiometric conditions as described in the drilled shaft section would be present. Therefore, Steel Piles are eliminated from further consideration.

6.4 Precast Prestressed Concrete Piles

Precast concrete piles are the most widely used method of deep foundation support for bridge structures in Florida. They are readily available and typically offer a significant cost advantage over other alternatives considered. A disadvantage of these piles is the difficulty associated with unanticipated splicing. The longest single piece of precast pile that can be readily transported and driven is approximately 125-feet. These piles offer the greatest advantage when there is a predictable uniform bearing stratum, and the production pile length is less than 125-feet. The subsurface conditions at the bearing layer are sufficiently dense and uniform, providing the required resistance within 100-feet of the ground surface and result in total pile lengths that fall within the 125-foot limit.

6.5 Foundation Alternative Evaluation, Construction and Recommendation

The two pile types considered are 24-inch and 30-inch PPC Piles. Axial capacity curves were generated for analysis, and the maximum recommended nominal bearing resistance value was set as indicated on Table below. The selected superstructure alternative is paired with each of these two pile types in a subsequent section of this report.

Pile Type	Maximum Recommended Nominal Bearing Resistance
24-inch PPC Piles	450 tons
30-inch PPC Piles	600 tons

Table 6.5.1 Max. Recommended Nominal Bearing Resistance

Both pile bents and piers were considered. Piles bents would consist of driven piles with a cast-in-place concrete cap on which the superstructure is placed. Piers would consist of driven piles with a footing cast at the waterline. A column would extend above the footing to a pier cap on which the superstructure is placed.

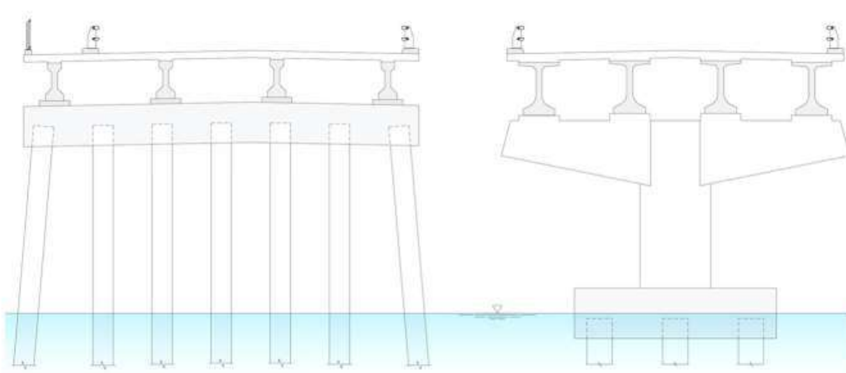


Figure 6.5.1 Pile Bent and Pier Graphical Sample (not project specific)

Pile bents are typically better suited to short span low level bridges while piers permit longer spans since more piles can be configured below a pier footing than a bent cap. Piles configured in bents would extend from the scoured channel bottom to elevated bent caps. This leads to long unbraced lengths which are subject to high bending moments. Strategies used to achieve acceptable demand/capacity ratios in pile design include driving piles with longitudinal or transverse batter and splitting bridges into individual design units consisting of one fixed bent with the remaining bents configured as expansion bents. Piles driven battered resist horizontal forces in both axial load and bending rather than in bending alone. Pier footings can be located at either the waterline or buried in the channel bottom. Footings located at the waterline offer a cost advantage since they do not require expensive cofferdams to construct. In addition, environmental impacts are minimized with waterline footing construction since dewatering is limited.

For this BDR, piles bents will not be advanced for further consideration. Waterline footings will be advanced for further consideration. Piers on land will follow SDG Chapter 3 requirements and provide sufficient depth for any rip-rap or equivalent protection as recommended by the Hydraulics Engineer.

7.0 RETAINING WALLS

Permanent walls will be used in the construction of the bridge. The construction of permanent retaining walls will be required at both begin and end bridge locations to retain the end bent spill slopes. Application of retaining walls in lieu of spill slopes significantly reduces the structure length.

Permanent retaining walls can be constructed in either a wrap-around configuration or a flared configuration. In the wrap-around configuration, the walls run parallel to the roadway beneath the bridge and then turn parallel with the bridge crossing at the bridge copings. In the flared configuration, the walls run parallel to the roadway beneath the bridge and then break at a given angle at the berm lines adjacent to the bridge copings and continue to the toe of the embankment. Considerations when selecting the optimal configuration include right-of-way limits, probability of future expansion, aesthetic guidelines, maintenance access and locations of ponds and other obstructions. Due to tight right-of-way, a wrap-around wall configuration will be implemented at the end bridge locations.

Figure 7.0.1 Wrap-Around MSE Wall

Figure 7.0.2 Flared MSE Wall

7.1 Retaining Wall Types

Several retaining wall types have been considered viable options for the SR 31 over the Caloosahatchee River bridge site. The retaining wall alternatives that have been investigated include Reinforced Concrete Panel Mechanically Stabilized Earth (MSE), Wire Faced Mechanically Stabilized Earth, Conventional Cast-In-Place (CIP) Concrete and Steel Sheet Pile. Additionally, a Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS) was considered. The selection of the preferred temporary retaining wall type will be based on cost and constructability.

7.1.1 Reinforced Concrete Panel Mechanically Stabilized Earth

Reinforced Concrete Panel MSE walls are very adaptable to both cut and fill conditions and will tolerate a greater degree of differential settlement than CIP walls. Because of their adaptability, Reinforced Concrete Panel MSE walls are being used almost exclusively in Florida. Reinforced Concrete Panel MSE walls are generally the most economical of all wall types when the area of retaining wall is greater than 1,000 square feet and the wall height is greater than 10 feet. At this location, the quantity of wall needed exceeds 1,000 square feet and the average wall height exceeds 10 feet. Reinforced Concrete Panel MSE wall panels are considered aesthetically pleasing and require very little maintenance.

7.1.2 Wire Faced Mechanically Stabilized Earth

Wire Faced MSE walls are very similar to the Reinforced Concrete Panel MSE walls but are used primarily for temporary construction in a fill condition. Wire Faced MSE walls offer a cost advantage when compared to steel sheet pile wall. Wire Faced MSE walls can support fill heights in excess of 30-feet.

7.1.3 Conventional Cast-In-Place Concrete

Conventional CIP concrete walls are normally used in either a cut or fill condition. The foundation soil must be capable of withstanding the design bearing pressure and must exhibit very little differential settlement. Very little maintenance is required for CIP walls. Form liners can be used to enhance the appearance of the walls. However, the relative cost of CIP walls is greater than Reinforced Concrete Panel MSE walls when the site and environment are appropriate for each wall type and the quantity required exceeds 1,000 square feet with a wall height greater than 10 feet.

7.1.4 Steel Sheet Pile

Steel sheet pile walls are applicable for use in both temporary and permanent locations. Generally, steel sheet pile walls can be designed as cantilevered walls up to approximately 15 feet in height. Steel sheet pile walls over 15 feet in height are tied back with prestressed soil anchors, soil nails or dead men. Bare steel sheet pile walls are not considered aesthetically pleasing, but can be enhanced using a concrete facing which adds substantially to the cost. Overall, permanent steel sheet pile walls are expensive when compared to other options and when not faced, require periodic maintenance including painting and the application of protective coatings.

7.1.5 Geosynthetic Reinforced Soil (GRS)

Geosynthetic Reinforced Soil walls, like MSE walls, are very adaptable to both cut and fill conditions and will tolerate a greater degree of differential settlement than CIP walls. GRS walls can be constructed as permanent walls with modular block facing or as temporary walls with geosynthetic facing. Permanent GRS walls offer the option to incorporate a bridge abutment as part of a GRS-Integrated Bridge System. GRS walls and abutments may prove cost effective when favorable conditions exist including a rural setting where skilled labor is limited; however, availability of qualified laborers is not a concern. The use of GRS walls for temporary embankment support has not proven to be cost effective.

7.2 Permanent Retaining Wall Evaluation and Recommendation

With consideration of cost, aesthetics, constructability and long-term maintenance, Reinforced Concrete Panel MSE walls will be used at both begin and end bridge locations at the SR 31 over the Caloosahatchee River bridge site. At both locations, the retaining walls will implement a wrap-around configuration using 2:1 slope to tie the existing ground elevations at the top of slope in with the top of wall and reduce their length.

8.0 ALTERNATIVES EVALUATION AND RECOMMENDATIONS

The superstructure and substructure alternatives discussed in the preceding sections of this report were evaluated based on their structural capacity and eliminated or advanced. See Table 8.0.1 below.

Alternative Designation	Number of Spans	Description of Superstructure	Description of Foundation
1	12	Florida-I 84 Beam	24” Square Prestressed Concrete Piles
2	12	Florida-I 84 Beam	30” Square Prestressed Concrete Piles

Table 8.0.1 Description of Bridge Alternatives

8.1 Evaluation Matrix for Bridge Type Selection

A quantitative comparison that includes relevant selection criteria is warranted to select from the remaining alternatives. Using the criteria of cost, constructability and durability, a matrix of comparative rankings is developed to determine the alternative that best satisfies the criteria. Importance Factors of 4, 3 and 3 are respectively assigned to the evaluation criteria. Each alternative is assigned a rating from 1 (Low) to 10 (High) for each criterion in the evaluation matrix. The rating is based on the alternative’s relative merits with respect to each criterion. A weighted score (the sum of the Importance Factor x Ratings) for each alternative is compiled to be used in recommending the preferred alternative. The maximum possible score for each alternative is 100.

8.1.1 Total Cost

A preliminary design for each bridge alternative was developed and detailed comparative construction costs were tabulated. For total cost, a value of 10 is assigned to the least cost option. Rankings for the other alternative is proportionally distributed based on the comparative cost of that alternative. A complete listing of costs is included in the Probable Construction Costs located in the attachments of this document.

8.1.2 Constructability

Constructability ratings were established with respect to the superstructure and substructure construction. Superstructure construction is the same for both alternatives. For substructure construction, Alternatives 2 offers substantially fewer prestressed concrete piles per pier, increasing its constructability rating slightly over Alternative 1.

8.1.3 Durability

Given that the entire superstructure will be outside of the splash zone for both alternatives, superstructure durability is of lesser concern. For Alternatives 1 and 2, the primary difference will be the size and number of piles provided. Since both 24" and 30" prestressed concrete piles are allowed for Extremely Aggressive environment, there is no durability difference between them.

8.1.4 Evaluation Matrix

The following evaluation matrix provides an overall ranking for the alternatives evaluated in this report. A score of 100 is the maximum possible value. The highest overall score is the recommended alternative.

COMPARATIVE EVALUATION OF ALTERNATIVES					
Alternative	EVALUATION CRITERIA			SCORE	RANKING
	Cost	Constructability	Durability	(I.F. x Rating)	
Importance Factor (I.F.)	**4**	**3**	**3**		
1	9.7	8.0	9	89.8	2
2	10.0	8.1	9	91.3	1

Table 8.1.4.1 Comparative Evaluation of Alternatives

8.2 Recommendations

The alternative selected is based on cost, constructability and durability. This superstructure consists of Florida-I 84 Beams with an 8½" cast in place concrete deck. The 1983'-0" bridge will span over the Caloosahatchee River, and it will carry 12'-0" shared use path, bi-directional traffic in 11'-0" lanes, and standard inside and outside shoulders. The substructure will consist of two Hammerhead Piers supported by 30-inch prestressed concrete piles.

Figure 8.2.1 Proposed Superstructure

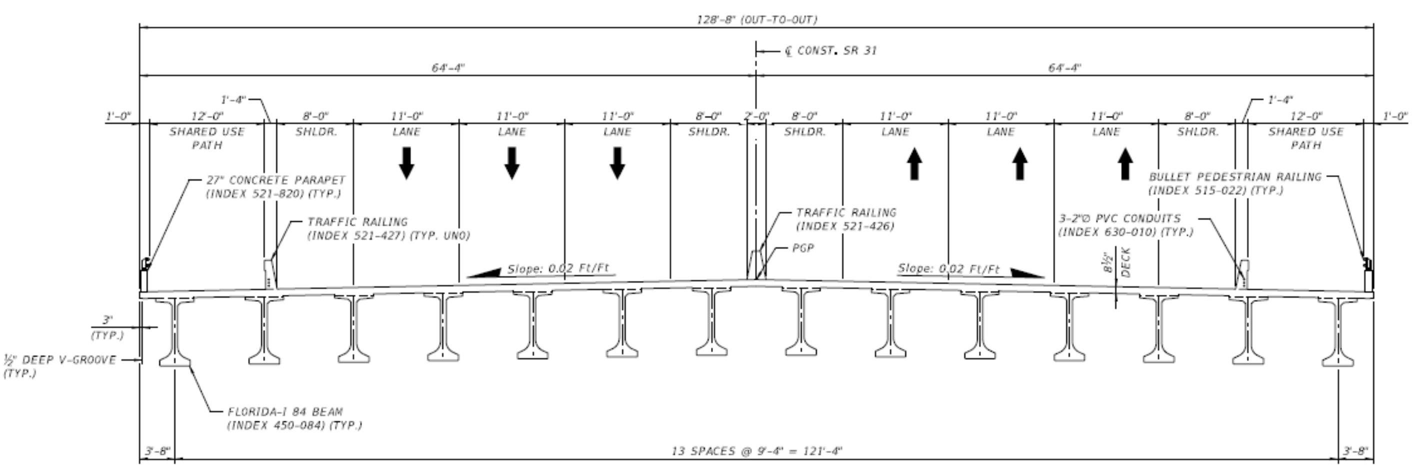


Figure 8.2.2 Proposed Substructure

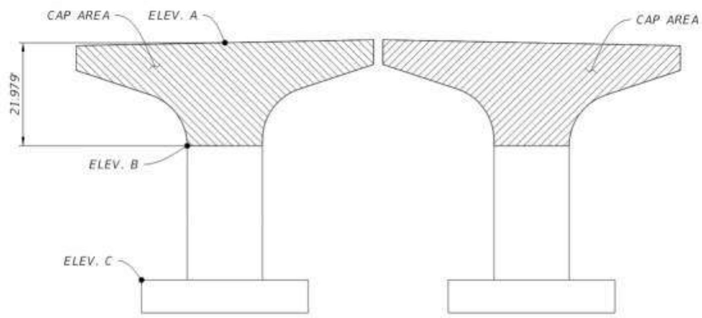
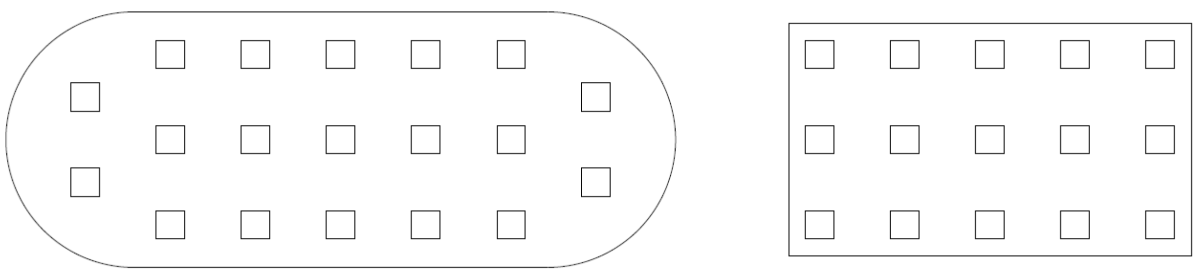


Figure 8.2.2 Proposed Foundation



Water Piers **Land Piers**

8.3 Estimated Probable Construction Cost

The following table lists the estimated construction cost for the recommended alternative.

Location	Total Cost
Bridge Construction	$62,120,038

Table 8.3.1 Estimated Probable Construction Cost