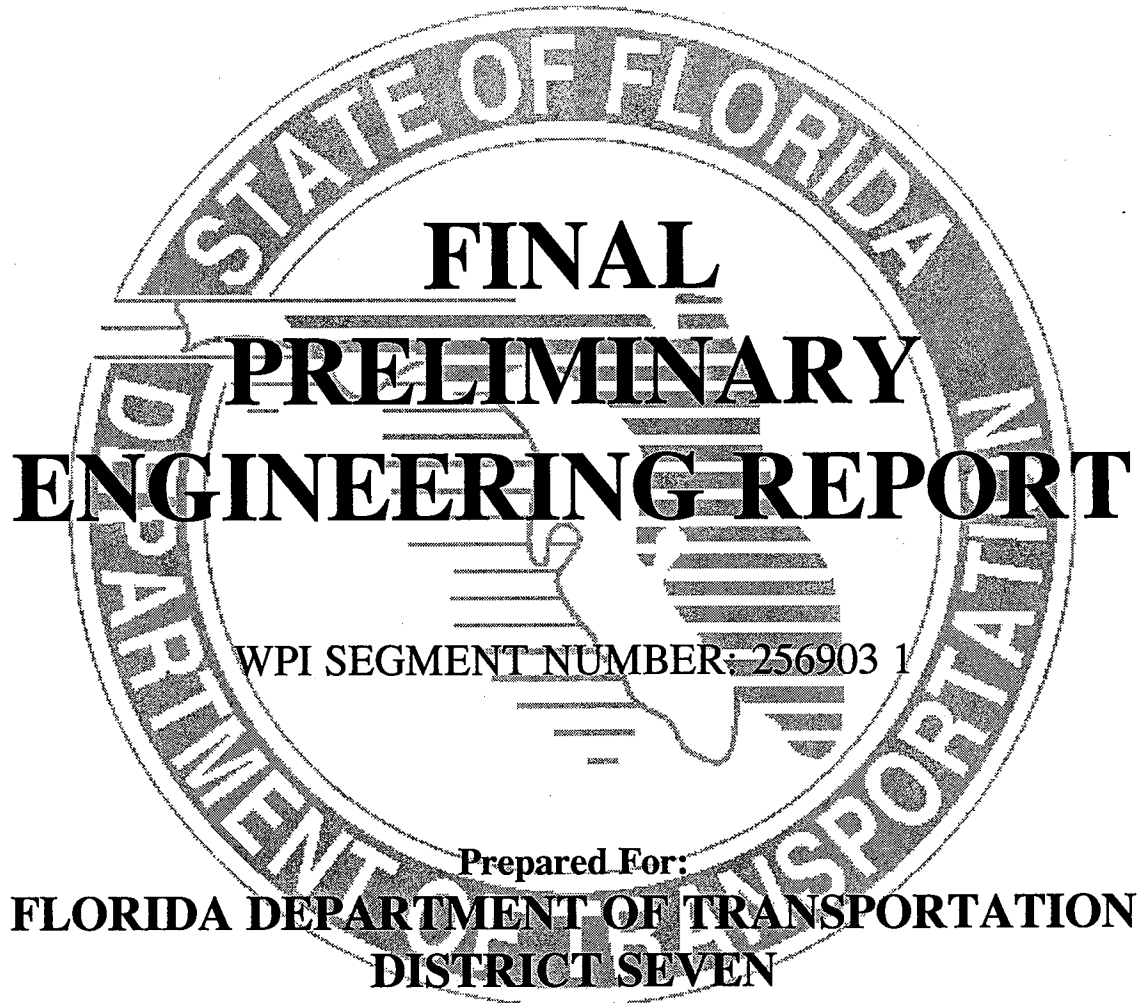
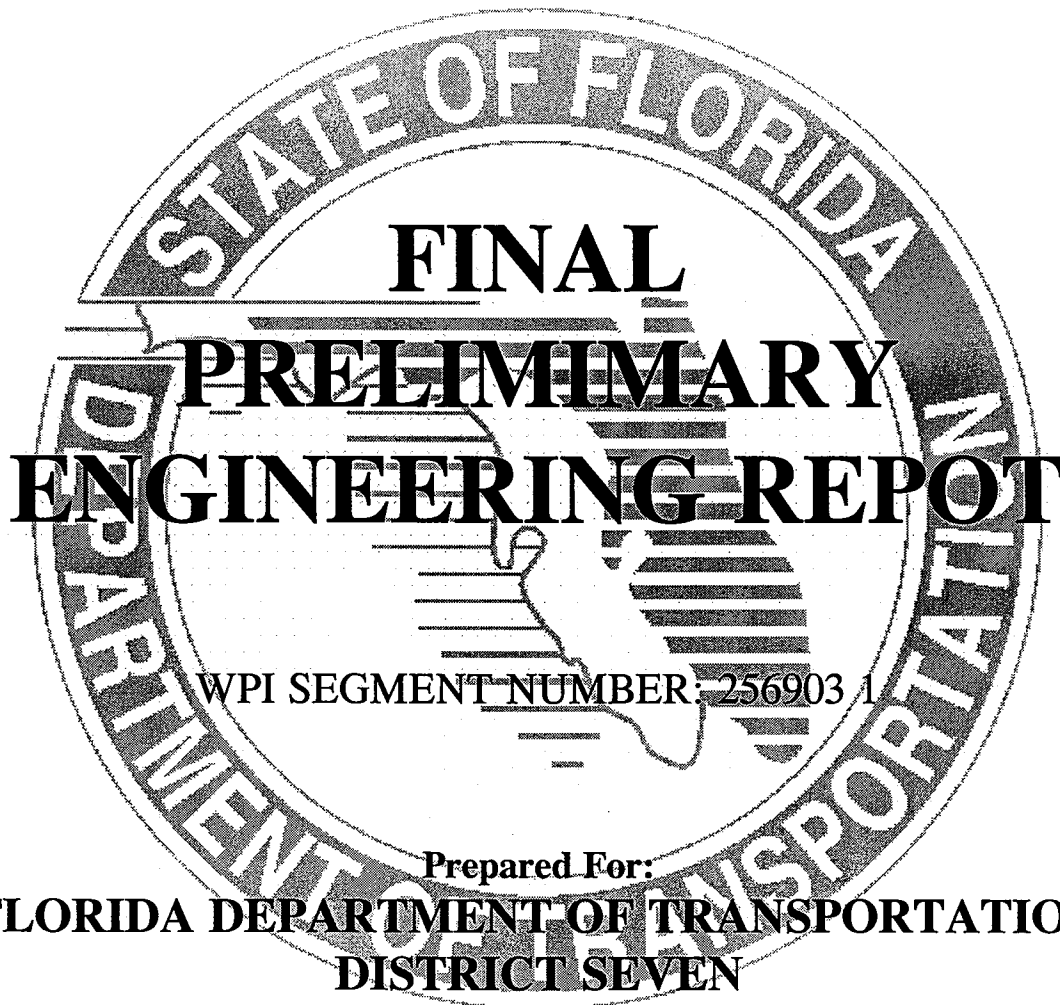


**SR 682 (Pinellas Bayway)
From the West Toll Booth to West of SR 679
PINELLAS COUNTY, FLORIDA**



December 1999

**SR 682 (Pinellas Bayway)
From the West Toll Booth to West of SR 679
PINELLAS COUNTY, FLORIDA**



**Prepared For:
FLORIDA DEPARTMENT OF TRANSPORTATION
DISTRICT SEVEN**

**Prepared by:
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December 1999

Roy Chapman
1-24-00

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1.0 SUMMARY

This study was prepared by the Florida Department of Transportation (FDOT) to reevaluate the findings of a previously prepared Environmental Assessment/Finding of No Significant Impact (EA/FONSI) which was approved by the United States Coast Guard (USCG) in 1983 for SR 682 (Pinellas Bayway) from the West Toll Booth to 41st Street South, a distance of 4.7 kilometers (km) [2.9 miles (mi)] in Pinellas County, Florida. The improvements recommended in the EA/FONSI were to multilane SR 682 within the project limits. The recommended improvements have been completed between SR 679 and 41st Street South. This reevaluation considers improvements to SR 682 from the West Toll Booth to west of SR 679 including an existing drawbridge (Structure "C") which spans the Gulf Coast Intracoastal Waterway (GCIW). The EA/FONSI recommended that a four lane divided roadway be constructed. Additionally, it was recommended that when the design plans for the second stage are to begin, the bridge type (high level fixed span or low level drawbridge) at the GCIW should be analyzed to determine which type of structure best serves the transportation needs of the area.

Six Build Alternatives were developed and analyzed in the last reevaluation which was started in 1992. The Build Alternatives included two low level drawbridges, two mid level drawbridges, and two high level fixed bridges. The low, mid, and high level configurations considered alternatives north and south of the existing structure. Following analysis and evaluation of social, economic, and environmental concerns, the high level fixed bridge alternative on the south alignment was recommended in the reevaluation which was approved by the USCG in 1994. After USCG approval of the reevaluation, the FDOT committed to conducting additional public involvement prior to designing the project. This additional public involvement phase began in 1997. Alternatives presented during this public involvement phase were the low level drawbridge and the high level fixed bridge alternatives located to the south side of the existing bridge.

1.1 RECOMMENDATIONS

Based on the public involvement efforts started in 1997, Alternative 5 has been confirmed as the Recommended Alternative. The recommended improvements for Alternative 5 include the construction of a four-lane high-level fixed bridge with 19.8 meter (m) [65 feet (ft)] of vertical clearance. Widening the bridge approaches to a four lane divided roadway from the West Toll Booth

to west of SR 679 is also to be undertaken. Typical sections showing the recommended bridge and roadway geometry are provided in Figure 1-1.

1.2 COMMITMENTS

In addition to the Department's *Standard Specifications for Road and Bridge Construction* to minimize impacts to the human and natural environment, FDOT is committed to the following measures for this project.

1.2.1 Maintenance of Traffic Flow

FDOT is committed to maintaining traffic flow during the construction of the new bridge. A maintenance of traffic (MOT) plan for the segment between the West Toll Booth and west of SR 679 will be prepared during the project's design. The traffic plan will be based on the latest edition of FDOT's *Roadway and Traffic Design Standards* and *Manual of Uniform Traffic Control Devices*.

1.2.2 Utilities Relocation

FDOT is committed to providing public utilities an opportunity to relocate or renovate their facilities during the construction of the segment between the West Toll Booth and west of SR 679.

1.2.3 Water Quality

FDOT is committed to using Best Management Practices (BMP) during the construction phase between the West Toll Booth and west of SR 679 for erosion control and water quality considerations. If practicable, hay bales, temporary slope drains, and silt curtains will be used during construction to avoid siltation of area wetlands. All cleared areas will be revegetated as quickly as possible in an effort to minimize water quality considerations.

1.2.4 Endangered and Threatened Species

Precautions to protect manatees and sea turtles will be adhered to during the construction of this project. The latest protection measures developed by FDOT through coordination with the United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) for manatees and sea turtles will be followed by the contractor chosen to work on the project. These

protection measures will be incorporated as conditions to the Environmental Resource Permit and be included in the project's design plans documentation.

1.2.5 Wetlands

FDOT is committed to minimizing impacts to seagrasses in the study area by using all reasonable measures, including BMPs, to reduce any impacts to these wetlands. Impacts to seagrasses located at the western end of the bridge structure will be minimized by one of the following alternate construction methods:

1. The new bridge will be built from east to west up to the edge of the seagrass bed. Then, construction equipment will reach from both the completed portion of the bridge and the existing touchdown point in the City of St. Pete Beach; or
2. The contractor will use shallow-draft barges which can navigate over the seagrass bed without a dredged channel.

In addition, FDOT is committed to consider all reasonable levels of wetland compensation to ameliorate the impacts of the proposed project and to obtain the necessary regulatory permits during the design phase of the project. This commitment will be complied with during the design and construction of the new bridge.

1.2.6 Construction Noise

There is the potential for noise impacts to occur during construction of the project. To minimize this potential, the requirements contained in the FDOT's *Standard Specifications for Road and Bridge Construction* will be adhered to during construction of the project.

1.2.7 Construction Staging on City Property

FDOT does not anticipate the staging of any equipment on any City of St. Pete Beach or City of St. Petersburg maintained property for this project. The construction documents will specify that the contractor use project right of way owned by FDOT unless other arrangements have been made. If

the need arises to use City owned property, FDOT will be in contact with the City prior to construction activities.

1.2.8 Construction Staging on Private Property

FDOT does not anticipate staging any construction equipment on private property for this project. Private property can be utilized only when the contractor makes prior arrangements with the property owner in question.

1.2.9 Minimization of Construction Impacts

FDOT's mission is to minimize potential adverse impacts to the traveling public and adjacent property owners during any construction activity. The FDOT will contact local governments during MOT plan development to incorporate construction enhancements to minimize traffic interference and construction impacts.

1.2.10 Minimization of Visual and Aesthetic Concerns

FDOT will provide landscaping and architectural design features to minimize visual concerns and enhance views through the structure.

2.0 INTRODUCTION

The FDOT is conducting a Project Development and Environment (PD&E) Study to evaluate alternatives for improvements to SR 682 from the West Toll Booth to SR 679 including an existing drawbridge (Structure “C”) which spans the GCIW.

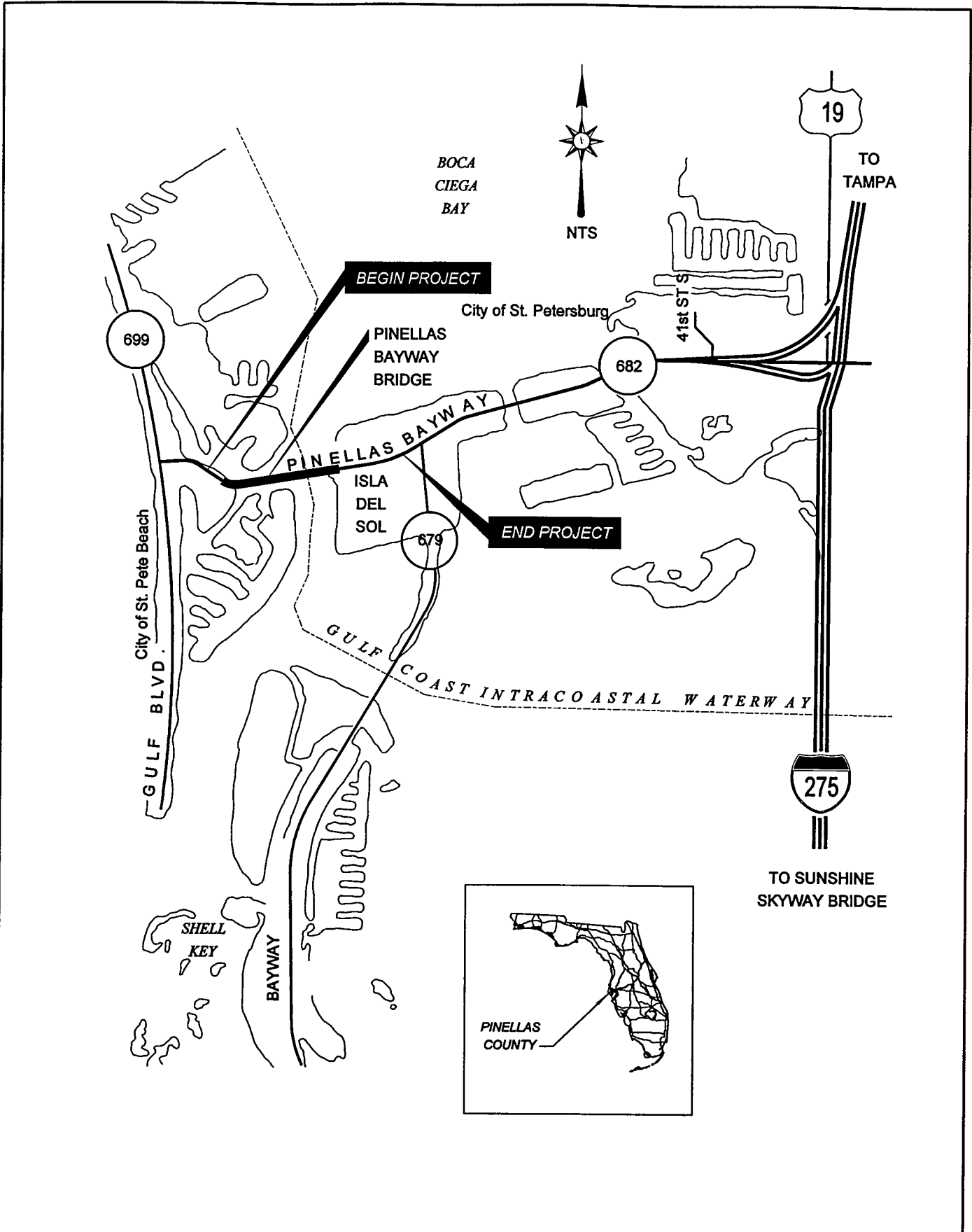
2.1 PURPOSE


The purpose of this report is to document the engineering decisions and the design criteria used in the development of proposed improvements to SR 682 (Pinellas Bayway) from the West Toll Booth to west of SR 679. This report contains information regarding the identification and evaluation of potential corridors, the development of typical sections, and the evaluation of alignment alternatives developed to provide improvements adequate to the 2020 design year. Also included is the economic evaluation of the alternatives considered and the selection of a Recommended Alternative.

2.2 PROJECT DESCRIPTION

SR 682 extends from SR 699 (Gulf Boulevard) to Interstate 275 (I-275) in southern Pinellas County, Florida. Figure 2-1 is a project location map for the study. SR 682 connects the City of St. Pete Beach located west of the GCIW with the City of St. Petersburg located east of the GCIW. SR 682 is classified as a minor arterial under the jurisdiction of FDOT. The roadway is operated as a toll facility between the West Toll Booth which is located approximately 0.40 km (0.25 mi) east of SR 699 and the East Toll Booth located approximately 0.80 km (0.50 mi) west of 41st Street South.

The Pinellas Bayway Bridge crosses over the GCIW. This portion of the GCIW connects boat traffic from the mouth of Tampa Bay just west of the Sunshine Skyway Bridge on I-275 to Tarpon Springs along the Pinellas County coast. Boat exits to the Gulf of Mexico are provided at Pass-A-Grille, John’s Pass, Clearwater Pass, and south of Anclote Key located opposite Tarpon Springs. The Pass-A-Grille inlet is located approximately 3.2 km (2 mi) south of SR 682 and John’s Pass is located approximately 11.3 km (7 mi) north of SR 682.



<p>WPI SEG. NO. 256903 1</p>	<p>SR 682 (PINELLAS BAYWAY) WEST TOLL BOOTH TO WEST OF SR 679</p>	 <p>FLORIDA DEPARTMENT OF TRANSPORTATION DISTRICT VII</p>	<p>PROJECT LOCATION MAP FIGURE 2-1</p>
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SR 682 within the project limits is a two lane roadway from the West Toll Booth to SR 679, a four lane divided roadway from SR 679 to the East Toll Booth, and a six lane divided roadway from the East Toll Booth to 41st Street South. A two lane drawbridge (Structure "C") carries SR 682 over the GCIW.

2.3 BACKGROUND

On November 30, 1983, the USCG signed a FONSI based upon an EA prepared by the FDOT (Work Program Item Number: 1116843). The EA/FONSI recommended upgrading the existing two lane facility to a four lane divided highway with improvements to three bridge structures located within the study limits. The initial construction of SR 682 provided two travel lanes (one in each direction) within 61 m (200 ft) of right of way. The facility was offset to the north to provide for future expansion to four lanes separated by a 5.5 m (18 ft) to 12.2 m (40 ft) wide median.

The EA/FONSI recommended adding two travel lanes to the south and resurfacing the existing two lanes. The travel lanes would be separated by a 5.5 m (18 ft) to 12.2 m (40 ft) wide median. A 1.8 m (6 ft) wide paved shoulder adjacent to the outside of the proposed roadway would be provided. The paved shoulder would also be available for use by bicyclists. Figure 2-2 shows the roadway typical section approved under the EA/FONSI.

The EA/FONSI recommended the construction of new two lane structures south of the existing bridges and widening all three existing bridge structures within the project limits. The navigational clearances (vertical and horizontal) for the proposed bridge structures would match the existing clearances. It was recommended that when the design plans for the new bridge are to be prepared, that a determination be made to select a high level fixed bridge or a low level drawbridge. Figure 2-3 shows the bridge typical section approved in the EA/FONSI.

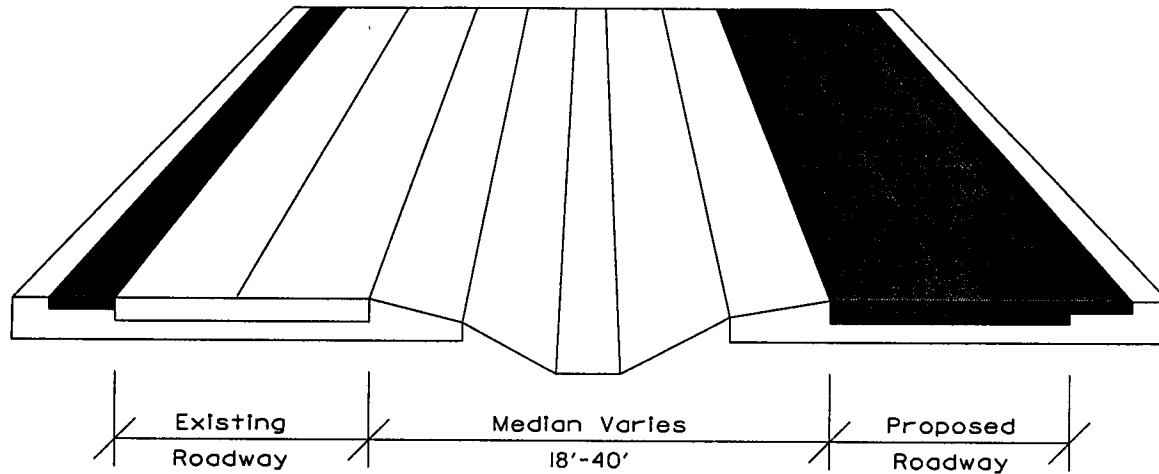
Portions of the improvements recommended in the November 30, 1983 EA/FONSI have been constructed. SR 682 from west of SR 679 to the East Toll Booth has been widened to four lanes. Both bridge structures within these limits have been widened and a new bridge structure has been constructed to the south. The roadway has been widened to six lanes from the East Toll Booth to 41st Street South.

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2-4

PROPOSED ROADWAY IMPROVEMENTS

The proposed roadway improvements will consist of adding two new lanes (located to the south) and resurfacing the existing two lanes separated by a 18'-40' median. A 6' paved shoulder will be provided for use as a refuge lane for disabled vehicles adjacent to the outside of the proposed roadway. This paved shoulder could also provide an area for biking enthusiasts; separate from the vehicular traffic.



DESIGN SPEED: 45 MPH

NTS

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679

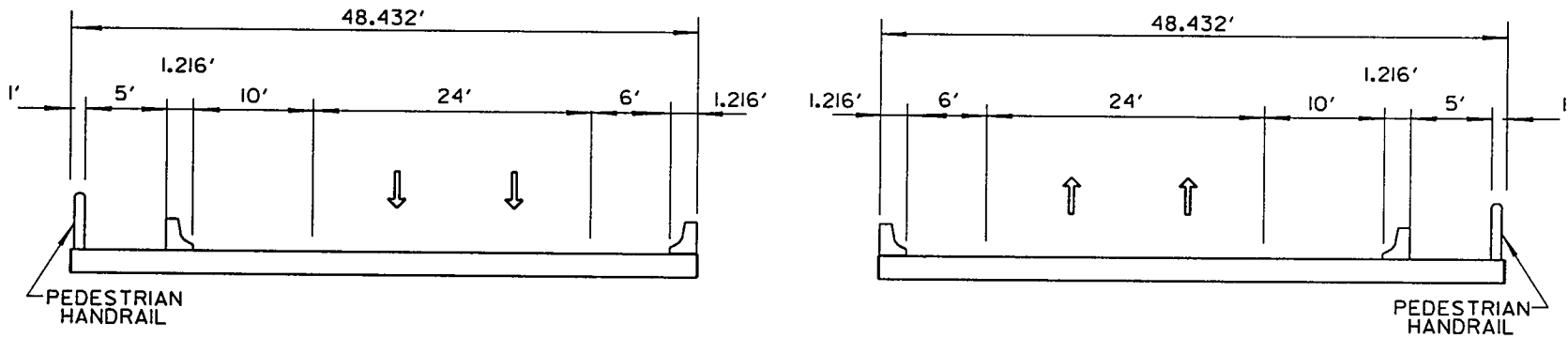


FLORIDA DEPARTMENT OF
TRANSPORTATION
DISTRICT VII

1983 EAFONSI RECOMMENDED
ROADWAY TYPICAL SECTION

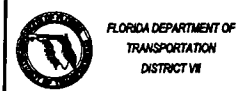
FIGURE 2-2

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LOW LEVEL OR HIGH LEVEL BRIDGE
NTS

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679



1983 EA/FONSI RECOMMENDED
BRIDGE TYPICAL SECTION

FIGURE 2-3

2-5

3.0 NEED FOR IMPROVEMENT

The following section identifies the need for the proposed improvement. The deficiencies and improvements for the proposed project are discussed with respect to local and regional planning efforts.

3.1 DEFICIENCIES OF THE EXISTING FACILITIES

3.1.1 Capacity

A traffic study was completed to determine the Level of Service (LOS) to be provided at the signalized intersection of SR 682 with SR 679 and along the highway links under review. The level of service review standard for state roads in this portion of Pinellas County is LOS D.

The highway link on SR 682 from the West Toll Booth to SR 679 currently operates at LOS F in the peak direction in the AM and PM peak hours. Improvement of this roadway segment to a four lane divided facility would provide a highway link operation of LOS B for the high-level fixed bridge alternative and LOS C for the low-level drawbridge through the 2020 design year. SR 682 from SR 679 to the East Toll Booth was found to operate at an acceptable LOS through the 2020 design year. In order to achieve LOS D or better operation on SR 682 through the 2020 design year, it will be necessary to widen SR 682 from the West Toll Booth to west of SR 679 to a four lane divided facility.

The *Technical Memorandum: Project Traffic Report* (dated October, 1992) and Traffic Report Supplement (dated October 11, 1999) prepared for this study provide additional detailed information regarding the methodology used in developing the traffic projections. Additional information regarding the traffic analysis and results is contained in Section 6.0 of this report.

3.1.2 Evacuation Routes and Emergency Services

According to the 1992 Tampa Bay Region Hurricane Evacuation Study prepared by the Tampa Bay Regional Planning Council (TBRPC) for the Florida Department of Community Affairs, Division of Emergency Management, SR 682 is a designated evacuation route for Pinellas County. SR 682 is one of six evacuation corridors identified within Pinellas County. Pinellas County has been divided

into 136 evacuation zones. The evacuation zones were delineated based on common levels of overland storm surge, clusters of traffic analysis zones that have a common roadway access to non-vulnerable areas, and familiar physical features (roadways) as boundaries for an understandable public information program. Residents within the project study area are located within Zone 1 (Evacuation Level A).

The 1992 Tampa Bay Region Hurricane Evacuation Study utilized five categories to classify hurricanes [Category 1 (least) to Category 5 (worst)] and one tropical storm. Zones were analyzed to identify a plan of action regarding the order in which they should be evacuated based upon the category of the hurricane or tropical storm. Residents located within Zone 1 (Evacuation Level A) are the first to be evacuated for all categories and tropical storms.

The existing drawbridge could restrict the flow of evacuees for a number of reasons. Only one lane would be available for evacuees. The remaining lane would be used for emergency vehicles. In addition, the existing bridge does not have adequate shoulders to accommodate disabled vehicles. Therefore, additional capacity is needed to increase traffic flow during an evacuation.

3.2 SAFETY

Accident data was obtained from FDOT District 7 and was summarized for a five year period from 1993 to 1997. Accidents were grouped according to roadway segments and for major at-grade intersections along the project. By far, the greatest number of accidents occurring within the project study area was at the intersection of SR 682 and SR 679 with an average of 10.4 accidents and 17.6 injuries per year. Sixty-nine percent of these accidents involved collisions with drivers turning left on to SR 679.

The existing drawbridge over the GCIW was the location of 6.6 accidents and 6.8 injuries per year, of which 85% were rear end collisions. The opening of the drawbridge and intermittent traffic stops is the most likely cause of these accidents. Most of the remaining accidents were vehicles hitting fixed objects such as the bridge structure, signs, and utility poles.

3.3 CONSISTENCY WITH TRANSPORTATION PLAN

The Comprehensive Plans for Pinellas County, the City of St. Petersburg, and the City of St. Pete Beach all indicate SR 682 within the project limits as a four lane divided roadway for the design year 2020. Therefore, the proposed improvements are consistent with area Comprehensive Plans.

3.4 SYSTEM LINKAGE

SR 682 west of the West Toll Booth is a four lane divided highway. From west of SR 679 to the East Toll Booth, the roadway is a four lane divided highway and expands to six lanes east of the toll booth. Widening the roadway and bridge to provide a four lane divided facility will eliminate the bottleneck caused by the existing two lane segment.

4.0 EXISTING CONDITIONS

The following sections describe the existing conditions within the project study area.

4.1 EXISTING ROADWAY CHARACTERISTICS

4.1.1 Functional Classification

SR 682 is classified by FDOT as a minor arterial.

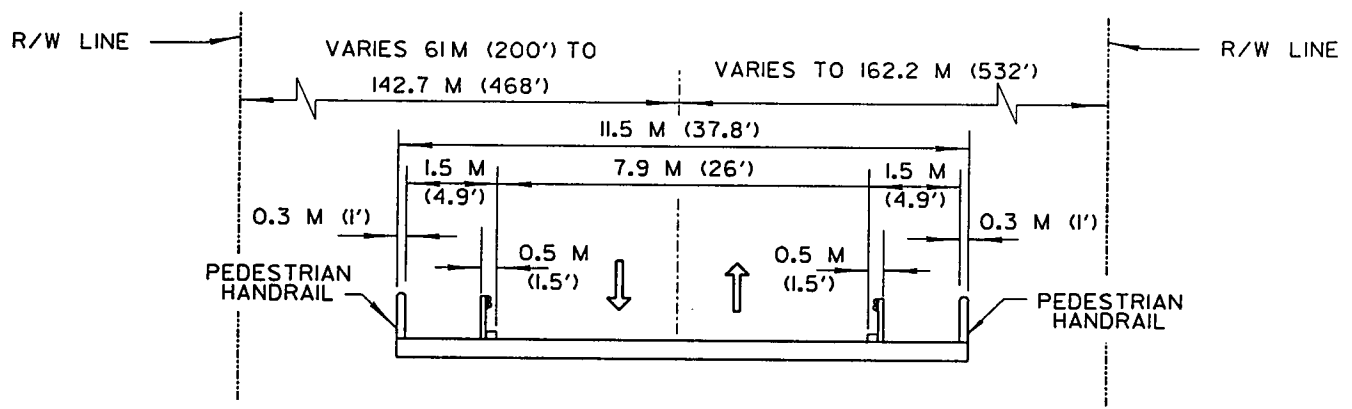
4.1.2 Typical Sections

The typical section of SR 682 varies along the project alignment. The study begins at the toll booth just west of the drawbridge. The roadway at the toll booth is three lanes wide in the eastbound direction and one lane wide in the westbound direction. Pavement on the westbound side is 9.8 m (32 ft) wide with the outside 3.6 m (12 ft) striped for parking of authorized vehicles only. A 1.8 m (6 ft) wide grassed median with curb separates the travel lanes. As the roadway approaches the bridge, the eastbound travel lanes merge to one lane. The median ends at the beginning of a superelevated curve, which continues on to the first 15.2 m (50 ft) of the drawbridge.

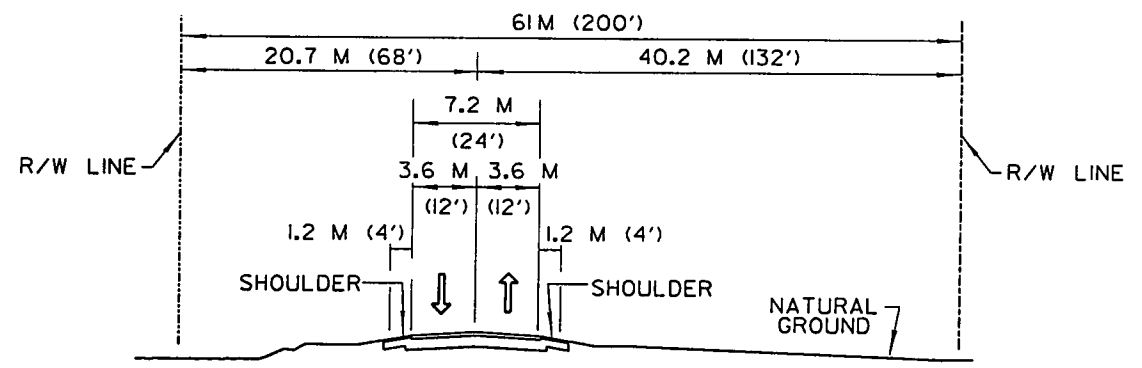
The drawbridge has two travel lanes over 7.9 m (26 ft) of pavement. Figure 4-1 shows the existing bridge typical section. A 0.15 m (0.5 ft) high by 0.3 m (1 ft) wide concrete curb lies along the edge of pavement and there is a guardrail immediately outside, protecting a 1.2 m (4 ft) wide sidewalk with a 0.9 m (3 ft) high concrete railing to the edge of the bridge. Roadway runoff drains to either side of the bridge through slots in the curb, with the exception of the curve on the west end where roadway runoff is drained to the north side only and is directly discharged to the GCIW below via scuppers.

The typical section continues to be two lanes east of the bridge to a point west of the intersection of SR 682 and SR 679. An at grade unsignalized intersection is provided at Bahia Del Mar Boulevard, just east of the drawbridge on Isla Del Sol. A path for golf carts to pass under the east end of the bridge is also provided. At a point approximately 396 m (1,300 ft) west of the intersection, the typical section expands to four lanes. Within this area, the median varies from none to 9.1 m (30 ft)

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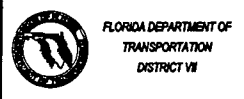
EXISTING BRIDGE



EXISTING 2-LANE ROADWAY

FROM THE EAST END OF THE BRIDGE TO WEST OF SR 679

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679

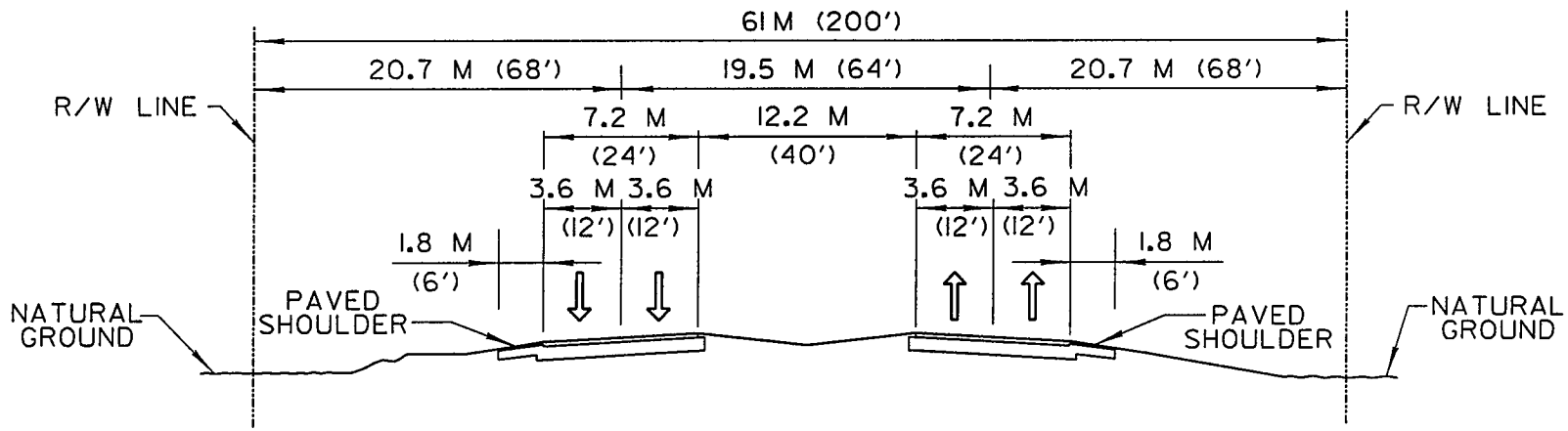


EXISTING BRIDGE & 2-LANE
ROADWAY TYPICAL SECTIONS

FIGURE 4-1

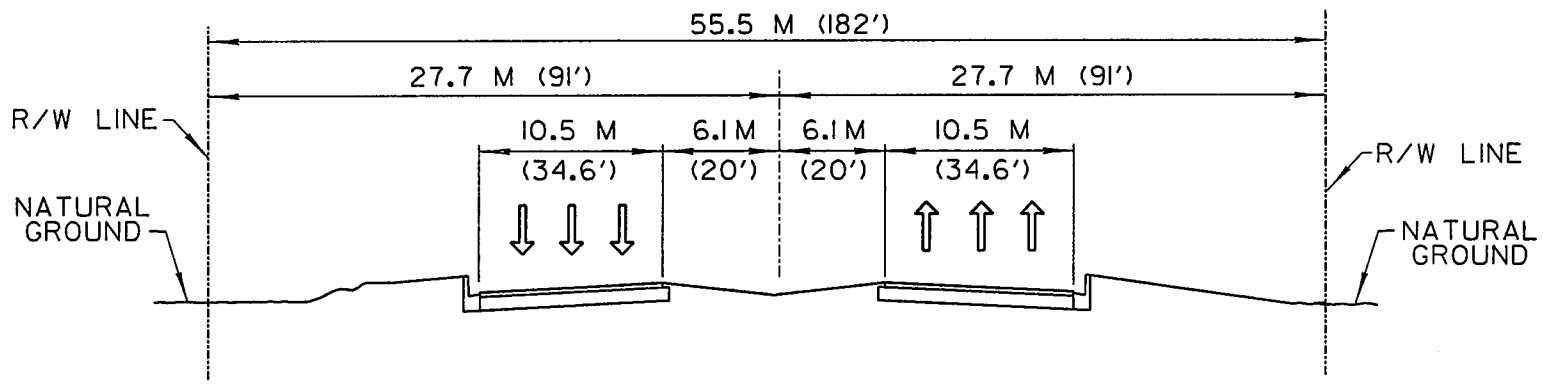
4-2

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EXISTING 4-LANE ROADWAY
FROM WEST OF SR 679 TO THE EAST TOLL BOOTH

4-4



EXISTING 6-LANE ROADWAY
FROM THE EAST TOLL BOOTH
TO 41st STREET SOUTH

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679



FLORIDA DEPARTMENT OF
TRANSPORTATION
DISTRICT VII

EXISTING 4-LANE & 6-LANE
ROADWAY TYPICAL SECTIONS

FIGURE 4-2

an expanded right of way envelope at the intersection of SR 682 and SR 679. The right of way envelope from the East Toll Booth to 41st Street South is 55.5 m (182 ft).

4.1.5 Horizontal Alignment

SR 682 within the limits of the study area generally runs in a east-northeast direction. Five horizontal curves are located within the study area. At the West Toll Booth, the alignment lies in a east-southeast direction. Between the West Toll Booth and the west end of the bridge, a 3 degree curve changes the alignment to the east-northeast. The second alignment change occurs just west of SR 679 with a 1 degree 15 minute curve. The third alignment change occurs at SR 682 and SR 679 with a 1 degree 30 minute curve to the east-northeast. The two remaining alignment changes occur just west of the East Toll Booth with a 1 degree 15 minute curve and a 2 degree curve. From the East Toll Booth to 41st Street South, the alignment continues in a east-northeast direction.

4.1.6 Vertical Alignment

The existing vertical alignment for SR 682 is relatively flat, with the exception of the vertical curves on each of the three bridges. At the drawbridge location, a 122 m (400 ft) long sag vertical curve is used to change the vertical alignment from 0.00% grade to +3.00% grade. A 274.4 m (900 ft) long crest vertical curve is used to change the vertical alignment from +3.00% to -3.00% grade. The second sag vertical curve at the east end of the drawbridge changes the vertical alignment from -3.00% to 0.00%.

The second bridge structure located to the east of SR 679 requires a 98.6 m (323 ft) long sag vertical curve to change the vertical alignment from 0.00% to +2.40%. A 335.4 m (1,100 ft) long crest vertical curve is used to change the vertical alignment from +2.40% to -2.40% grade. A 111.5 m (366 ft) long sag vertical curve is used to change the vertical alignment from -2.40% to 0.00%.

The third bridge structure located to the west of the West Toll Booth has a 122 m (400 ft) long sag vertical curves on both bridge approaches to change the vertical alignment from 0.00% to +3.00% on the west and -3.00% to -0.20% on the east. The crest vertical curve is 396.3 m (1,300 ft) long with +3.00% and -3.00% grade.

4.1.7 Drainage

Stormwater drainage within the study limits is conveyed by a combination of open swales and curb and gutter sections. From the West Toll Booth to the beginning of the west end of the bridge, stormwater drains off the westbound lane to the grassed area on the north side. On the eastbound side, stormwater drains to the median curb and into a curb inlet which carries the stormwater runoff under the roadway to an outfall. Stormwater runoff from the bridge is collected along the curb and gutter and allowed to discharge into the GCIW. Stormwater runoff from the roadway from the east end of the bridge to the East Toll Booth is conveyed to open grassed swales along both sides of the roadway. Starting at the East Toll Booth and continuing east to 41st Street South, stormwater runoff is collected by a curb and gutter section and conveyed to outfall points along the roadway.

4.1.8 Accident Data

Accident data was obtained from the FDOT, District 7 and is summarized for a five year period from 1993 to 1997. Accidents were grouped according to roadway segments and for major at-grade intersections along the project. Two roadway segments, one bridge segment and one intersection were identified for accident tabulation. Table 4-1 provides a summary by accident type and Table 4-2 provides a summary of accident data by number of accidents, monetary damages, and injury. By far, the greatest number of accidents occur at the intersection of SR 682 and SR 679 with an average of 10.4 accidents and 17.6 injuries per year. Sixty-nine percent of these accidents involved collisions with drivers turning left on to SR 679.

The drawbridge itself is the location of 6.6 accidents and 6.8 injuries per year of which 85% are rear end collisions. The opening of the drawbridge and intermittent stopping of traffic is the most likely cause of these accidents. Most of the remaining accidents are vehicles hitting fixed objects such as the bridge structure, signs, and utility poles.

Table 4-1 Summary by Accident Types for SR 682 from 1993 to 1997

DESCRIPTION	MILEPOST	NUMBER OF ACCIDENTS	ACCIDENT TYPES			
			REAR END	LEFT TURN	FIXED OBJECT	OTHER
From Toll Booth to West End of Bridge	0.311 0.428	4	2	0	1	1
From West End of Bridge to East End of Bridge	0.429 0.905	35	29	0	2	4
From East End of Bridge to 152.4 m (500 ft) West of SR 679	0.906 1.326	6	3	0	1	2
From 152.4 m (500 ft) West of SR 679 to 152.4 m (500 ft) East of SR 679	1.327 1.517	14	8	2	3	1

Notes:

(1) Fixed objects include bridge structure, utility/light poles, signs/sign posts, and trees or shrubbery.

Table 4-2 Summary of Accident Data by Type, Monetary Damages, and Injuries for SR 682 from 1993 to 1997

Description	Milepost	Five Year Totals			Annual Average		
		Accidents	No. of vehicles	No. of Injuries	Accidents	No. of vehicles	No. of Injuries
From Toll Booth to West End of Bridge	0.311 0.428	4	10	0	0.8	2.0	0.0
From West End of Bridge to East End of Bridge	0.429 0.905	35	90	49	7.0	18.0	9.8
From East End of Bridge to 152.4 m (500 ft) West of SR 679	0.906 1.326	6	12	15	1.2	2.4	3.0
From 152.4 m (500 ft) West of SR 679 to 152.4 m (500 ft) East of SR 679	1.327 1.517	14	33	27	2.8	6.6	5.4
Totals		59	145	91	11.8	29.0	18.2

4-8

4.1.9 Traffic Signal Locations and Intersection Design

There are two signalized intersections located within the study limits. These are located at SR 682 and SR 679 and SR 682 and Leeland Street South. Figure 4-3 illustrates the existing lane configuration for these intersections.

4.1.10 Lighting

Street lighting is provided for the entire study limits along the roadway section. Lighting is provided on the south side of the drawbridge.

4.1.11 Utilities

Utility companies were contacted to determine existing utility systems within the SR 682 corridor. The results of this coordination are described as follows:

Electric:

Electric service is provided by the Florida Power Company. Overhead electrical lines are located on the north side of the roadway from the West Toll Booth to 41st Street South. The lines are buried within the limits of the drawbridge. High voltage lines are located on the south side of SR 682 from SR 679 to 41st Street South. A large substation is located just south of SR 682 on SR 679.

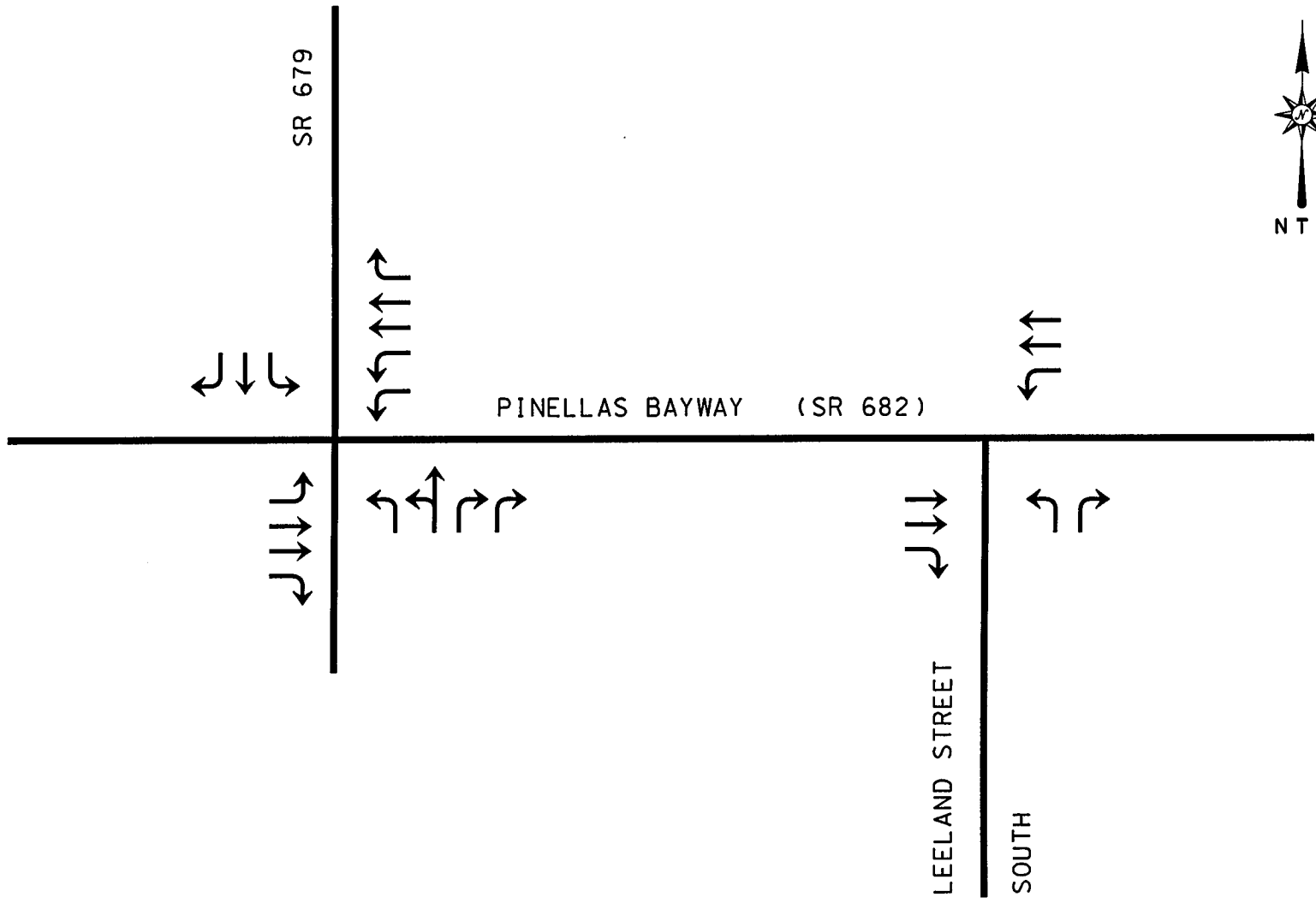
Telephone:

General Telephone and Electric (GTE) Company maintains buried conduits and several switching boxes along the north side of SR 682 within the project limits. GTE maintains a submerged telephone cable on the north side of the bridge.

Intermedia Communications of Florida, Inc. does not have facilities in the project area and does not anticipate any in the future.

11048774.002PER9898AFHIGSFIG4-3.DGN

6-11-7



WPI SEG NO.
256903 01

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679



FLORIDA DEPARTMENT OF
TRANSPORTATION
DISTRICT VII

EXISTING LANE CONFIGURATION
(SIGNALIZED INTERSECTION)

FIGURE 4-3

Cable Television:

Cable television is provided by Paragon Cable. Underground cables are located within the residential areas located within the western limits of the project. No cables are located within the existing right of way of the project.

Gas:

Peoples Gas Systems, Inc. indicated by letter that the company does have facilities in this area and there is a potential for conflict. However, specific locations of these facilities was not provided. Peoples Gas requested that the Engineering Department be contacted prior to construction at (813) 894-2560.

Sewer and Water:

Pinellas County Water Systems Department provides water services within the corridor. A 51 millimeter (mm) [2 inches (in)] and 102 mm (4 in) water main is located on the south side of SR 682 from Casablanca to the west end of the bridge. Information regarding the locations of any sewer system was not provided.

Utility responses are contained in the project files.

4.1.12 Structural and Operational Conditions

SR 682 roadway is in good structural condition along the project alignment. Operational problems occur in and around the drawbridge because of bridge openings and the lack of sufficient capacity on the bridge to handle the traffic demand.

4.2 EXISTING BRIDGES

SR 682 crosses the GCIW. The existing drawbridge (Bridge No. 150050) contains two lanes and was built in 1962. The bridge is 11.5 m (37.8 ft) wide (outside to outside) and has two 4 m (13 ft) wide travel lanes. The structure is 778 m (2,552 ft) long. FDOT is responsible for maintenance of the existing drawbridge.

4.2.1 Type of Structure

The bridge is a prestressed concrete structure and has a concrete wearing surface with a design load of H20-44. The moveable span portion is constructed of steel grate.

4.2.2 Condition (Structural Rating) and Year of Construction

The bridge currently has a sufficiency (structural) rating of 58.2. The bridge was constructed in 1962 and the estimated remaining life is 13 years as of 1999.

4.2.3 Horizontal and Vertical Alignment

The bridge was constructed along a tangent section of SR 682 and runs in an east-northeast direction. Two sag vertical curves and one crest vertical curve are used to change the vertical grade of the bridge. Each sag vertical curve is 122 m (400 ft) long. The crest vertical curve is 274.4 m (900 ft) long. The vertical alignment for the west approach to the bridge is changed from 0.00% to +3.00%. The change in grade for the crest vertical curve is +3.00% to -3.00%. The change in grade for the sag vertical curve located at the east end of the bridge is -3.00% to 0.00%.

4.2.4 Span Arrangement - Number and Length of Spans

This is a 46 span concrete and steel structure. The maximum span length is 14.4 m (48 ft) for an overall bridge length of 778 m (2,552 ft). Horizontal clearance (navigational) at the main span is 27.4 m (90 ft). The bridge has a concrete superstructure and substructure with the exception of the steel drawbridge portion over the channel.

4.2.5 Channel Data

The GCIW is approximately 30 m (100 ft) wide at the Pinellas Bayway bridge crossing. The configuration of the channel is trapezoidal with a 15.2 m (50 ft) wide bottom and 2:1 side slopes. The channel is restricted to a width of 27.4 m (90 ft) due to the existing bridge structure. The depth of the waterway at Mean High Tide is 5.5 m (17.9 ft) and 5.0 m (16.3 ft) at Mean Low Tide. Navigation is not limited by the vertical clearance since the existing bridge is a drawbridge structure. In the closed position, the drawbridge portion has a 6.6 m (21.5 ft) vertical clearance at the fenders.

4.2.6 Bridge Openings

The drawbridge opens for boat traffic on the hour and every 20 minutes thereafter as required to allow boats to pass through.

The average number of openings for the existing drawbridge have been obtained for the last three years and are summarized in Table 4-3.

Table 4-3. Pinellas Bayway Drawbridge Openings

Year	Average Openings Per Month	Average Boats Per Month	Average Openings Per Day	Average Boats Per Day
1996	562	999	18	33
1997	559	941	18	31
1998	554	957	18	31

This GCIW crossing is a busy location with an average of 6,814 openings per year for the years from 1996 through 1998. There were an average of 1.7 vessels passing under the bridge for each opening and an average of 18 openings per day.

4.3 EXISTING ENVIRONMENTAL CHARACTERISTICS

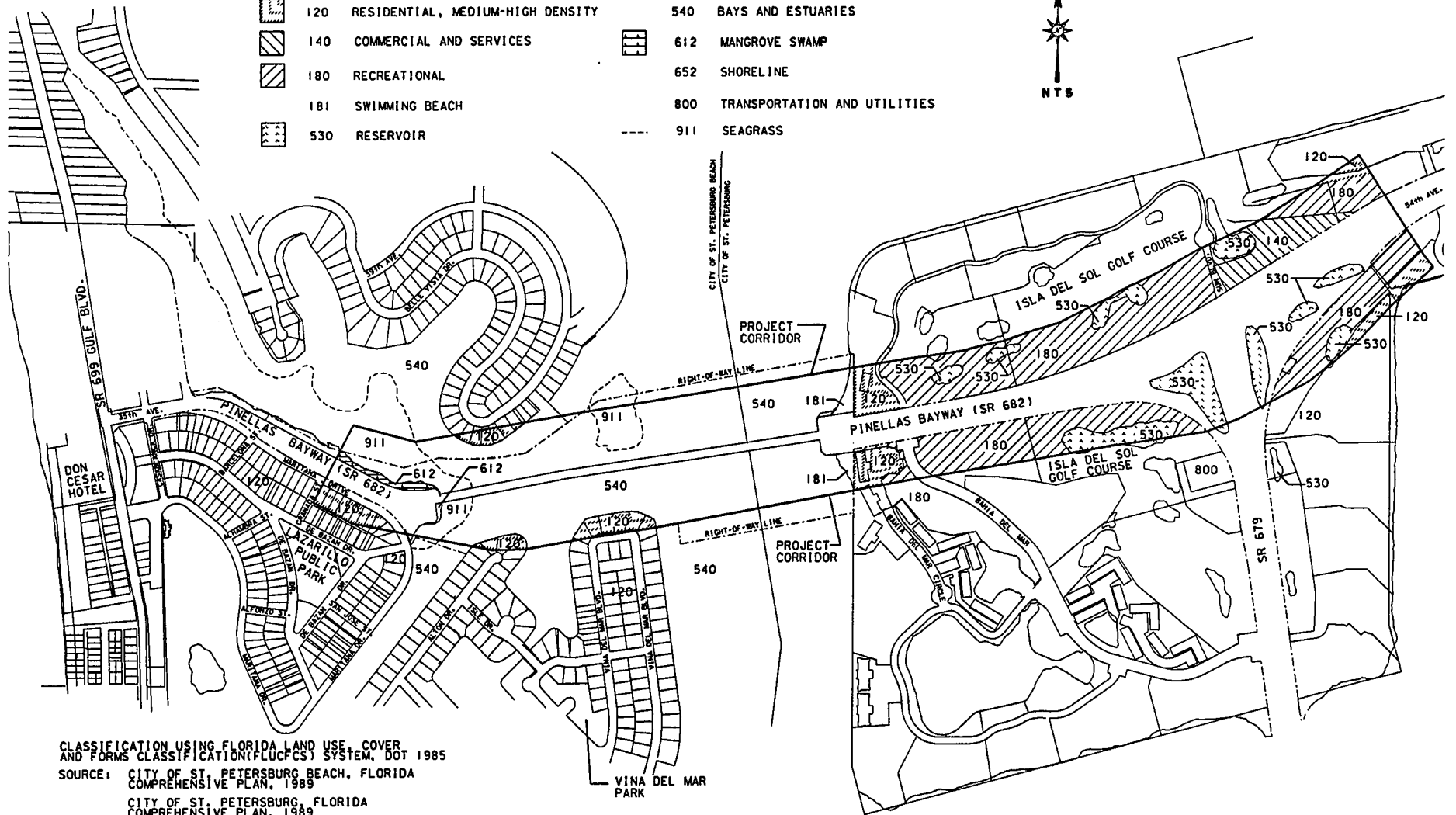
4.3.1 Land Use Data

The existing land uses for the study area are depicted in Figure 4-4. This land use evaluation addresses only the portion of SR 682 west of the SR 679 intersection because improvements to SR 682 east of SR 679 were already completed under conditions described in the 1983 EA/FONSI. The project traverses property within the Cities of St. Petersburg and St. Pete Beach. The study area encompasses residential, recreational, commercial, and utilities land uses.

The west end of the project alignment lies within the City of St. Pete Beach. This portion of the project area, from the east end of the existing Pinellas Bayway Bridge to the intersection of SR 682 and Gulf Boulevard, consists of low density (single family) residential development and Boca Ciega

LAND USE /COVER TYPE CODES

	120 RESIDENTIAL, MEDIUM-HIGH DENSITY		540 BAYS AND ESTUARIES
	140 COMMERCIAL AND SERVICES		612 MANGROVE SWAMP
	180 RECREATIONAL		652 SHORELINE
	181 SWIMMING BEACH		800 TRANSPORTATION AND UTILITIES
	530 RESERVOIR		911 SEAGRASS



CLASSIFICATION USING FLORIDA LAND USE, COVER AND FORMS CLASSIFICATION (FLUCFCS) SYSTEM, DOT 1985
 SOURCE: CITY OF ST. PETERSBURG BEACH, FLORIDA COMPREHENSIVE PLAN, 1989
 CITY OF ST. PETERSBURG, FLORIDA COMPREHENSIVE PLAN, 1989

WPI SEG NO.
256903 01

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679



FLORIDA DEPARTMENT OF
TRANSPORTATION
DISTRICT VII

EXISTING LAND USE/COVER TYPE MAP

FIGURE 4-4

Bay. Residential land use is the predominant land application in St. Petersburg Beach, accounting for approximately 62.4% (City of St. Pete Beach Comprehensive Plan). As there is little available space in the project area for future development, new development in the area can take place only on the vacant lots in the Mangrove Pointe development, located approximately 335.4 m (1,100 ft) north of the west end of the existing Pinellas Bayway Bridge.

The remainder of the project is within St. Petersburg and crosses two man-made islands called Isla Del Sol and Point Brittany. Isla Del Sol occupies the east portion of the project area from the east end of the existing Pinellas Bayway Bridge to the intersection of SR 682 and SR 679. Isla Del Sol includes medium density residential developments (low and high-rise condominiums), the Isla Del Sol Golf Course, and a small retail shopping center at the northeast corner of the intersection of SR 682 and SR 679. Point Brittany Island is mainly medium density residential development (high rise condominiums).

No new development is planned in or adjacent to the project limits, according to the future land use element of the Pinellas County Comprehensive Plan and the land use map.

The City of St. Petersburg Comprehensive Plan future land use element shows no future development for the project area due to the lack of undeveloped land. The City of St. Pete Beach can be classified as a built-out community, according to the Future Land Use element of the St. Pete Beach Comprehensive Plan. Of the 527.5 hectares (ha) [1,303 acres (ac)] making up the community, only 13.5 ha (33.4 ac) or 2.5% is vacant or undeveloped. In the project vicinity, the only available area suitable for development consists of the single family residential lots located in Mangrove Pointe, described above. Because the study area has essentially reached build out, future land use is expected to continue in the same pattern as existing land uses. Therefore, future land use maps are not included in this document.

4.3.2 Cultural Features and Community Services

The cultural features and community service facilities within or adjacent to the project area were identified. The locations of the community facilities were determined by field surveys, from the St.

Petersburg Comprehensive Plan, Pinellas County Comprehensive Plan, and through coordination with the City of St. Pete Beach and are described below.

4.3.2.1 Medical Facilities

No medical facilities occur within the project corridor. The closest hospital is the Humana Hospital Sun Bay located in St. Petersburg on 6th Street South, 2.4 km (1.5 mi) north of SR 682. Blind Pass Nursing Home lies approximately 4.0 km (2.5 mi) north of the west project terminus. Based on the St. Petersburg Comprehensive Plan and conversations with the City of St. Pete Beach planning department, no new medical facilities are scheduled to be built in or adjacent to the project area.

4.3.2.2 Fire and Police Protection

No fire or police stations are located within the project corridor. Fire protection for the study area is provided by the Cities of St. Pete Beach and St. Petersburg. The nearest station, Fire Station No. 22, is located on 20th Avenue in St. Pete Beach, which is less than 1.6 km (1 mi) southwest of the west project terminus. Isla Del Sol is served by a City of St. Petersburg Fire Station located on Tierra Verde which is south of the project on SR 679.

Police protection is provided by St. Petersburg and St. Pete Beach. The nearest police station to the project area lies over 3.2 km (2 mi) to the north, on 77th Avenue in the City of St. Pete Beach. Based on the St. Petersburg Comprehensive plan and conversations with the City of St. Pete Beach planning department, no fire or police stations are planned for construction in the project limits.

4.3.2.3 Educational Facilities

Eckerd College is located on the south side of Pinellas Bayway at the east project limit. Two other elementary schools, Gulf Beaches and St. John's, lie over 4.8 km (3 mi) north of the project area. Based on the St. Petersburg Comprehensive Plan and conversations with the Pinellas County School Board and the City of St. Pete Beach planning department personnel, no new schools are scheduled for the project area or adjacent lands.

4.3.2.4 Religious Institutions and Cemeteries

No churches or cemeteries are located within the study area. The closest church, Pass-A-Grille Community Church, lies more than 0.8 km (0.5 mi) south of the project area. Other churches lie 3.2 km (2 mi) to 4.8 km (3 mi) north of the project area. Based on the St. Petersburg comprehensive plan and conversations with the City of St. Pete Beach planning department personnel, no new churches or cemeteries are scheduled in or adjacent to the project area.

4.3.2.5 Public and Civic Buildings

A post office is located adjacent to the shopping center at the intersection of SR 682 and SR 679. In addition, the Binger Center for the Performing Arts lies on the west side of the Eckerd College campus.

4.3.2.6 Recreational Facilities

The recreational facilities within the project area consist of a private golf course and community parks. Isla Del Sol Golf Course is a private facility that serves the Isla Del Sol developments. Lazarillo Public Park is a small neighborhood park located in the Don Cesar Place subdivision. This park contains tennis and basketball courts, and playgrounds. Another neighborhood public park, Vina Del Mar Park, serves the Vina Del Mar subdivision. Only the Isla Del Sol Golf Course is within the project study area. There is a public beach access located less than 1.6 km (1 mi) north of the project area on SR 699 (Gulf Boulevard). Based on the St. Petersburg Comprehensive Plan and conversations with the City of St. Pete Beach planning department, no new recreational areas or parks are currently proposed within the study area.

4.3.2.7 Archaeological and Historical Resources

No historical or archaeological sites are known to occur within or adjacent to the existing right of way. The closest National Register site, the Don Cesar Hotel, is located at the intersection of SR 682 and SR 699, approximately 0.4 km (0.25 mi) west of the western project limit (See Figure 4-4). The closest known archaeological site is located at Maximo Park, approximately 0.8 km (0.5 mi) south of the SR 682 and US 19 intersection.

4.3.2.8 Social Service Agencies

There are no social service agencies in the project corridor. The closest Social Service Agency to the project site is the Neighborhood Senior Services Dining Hall in the Warren Webster Community Center located on 16th Avenue in St. Pete Beach, which is less than 1.6 km (1 mi) from the project area. Conversations with St. Pete Beach planning department personnel indicate that no new social services agencies are planned for the project area.

4.3.3 Natural and Biological Features

The project area was surveyed for natural and biological communities. The primary issues will involve wetlands (mangrove communities and seagrass beds), and federally protected species. The mangroves consist of a littoral fringe on the north side of the west causeway on Long Key. The mangrove tree fringe is dominated by red and black mangrove (*Rhizophora mangle* and *Avicennia germinans*, respectively). Sea grape (*Coccoloba uvifera*) and saltwort (*Batis maritima*) are also dominant species in this shore vegetation.

Seagrass beds are located north and to a lesser extent, south, of the existing Bayway Bridge, adjacent to the Long Key causeway. The seagrass beds are dominated by manatee-grass (*Syringodium filiforme*), and contain turtle-grass (*Thalassia testudinum*) and shoal-grass (*Halodule wrightii*). The west end of the existing bridge traverses the southeast tip of a 4.9 ha (12 ac) seagrass bed. These wetland areas will be considered jurisdictional wetlands by the Southwest Florida Water Management District (SWFWMD) and the United States Army Corps of Engineers (USACOE).

Other wetlands in the project corridor consist of manmade ponds (water hazards) at the Isla del Sol golf course. Because these are artificial ponds were constructed in upland fill soil, they will not be considered jurisdictional by the agencies requiring permits for this project.

The presence of federal and state listed endangered and threatened species within the study area has been evaluated. Listed wildlife potentially found in the study area include the West Indian manatee, five species of sea turtles, and wading and shore birds. The manatee (*Trichechus manatus latirostris*) is federally and state listed as endangered, and has been observed in Boca Ciega Bay.

The Florida Department of Environmental Protection (FDEP) recorded many sightings of manatees in Boca Ciega Bay during recent aerial surveys.

The waters in the project vicinity are suitable habitat for five federally listed species of sea turtles including the green turtle (*Chelonia mydas mydas*), leatherback turtle (*Dermochelys coriacea*), Atlantic ridley turtle (*Lepidochelys kempi*), Atlantic hawksbill turtle (*Eretmochelys imbricata imbricata*), and Atlantic loggerhead turtle (*Caretta caretta*). The loggerhead turtle is designated as threatened, and the other four turtle species are endangered, according to the USFWS and the Florida Fish and Wildlife Conservation Commission (FWC) [formerly the Florida Game and Fresh Water Fish Commission]. These species, especially the loggerhead turtle, may frequently inhabit the Gulf of Mexico and occasionally enter the lower reaches of Boca Ciega Bay for shelter and foraging.

During the field surveys for listed species, 35 bird species of which three are designated Species of Special Concern by the FWC: little blue heron (*Egretta caerulea*), brown pelican (*Pelecanus occidentalis*), and snowy egret (*Egretta thula*) were observed. No rookeries or nests were observed, and no threatened or endangered species were observed.

A literature review for listed plant species was also conducted. Of listed species known to occur in Pinellas County, no listed plant species are anticipated to occur within the project area due to the replacement of native habitats by development. Furthermore, no listed plants were observed during field reviews.

5.0 DESIGN CRITERIA

Engineering design criteria includes such items as lane and median widths, bridge and roadway shoulders widths, horizontal curvature, superelevation, horizontal clearances, grades, and vertical clearances. Operational criteria consist of design speeds and levels of service.

Design criteria for this study is based upon current design standard established by FDOT, American Association of State Highway and Transportation Officials (AASHTO), and Federal Highway Administration (FHWA). The following documents were among the principal references used in establishing the design criteria for this study:

- **Roadway and Traffic Design Standards for Design, Construction, and Maintenance for Streets and Highways, State of Florida, FDOT, January 1998;**
- **Roadway Plans Preparation Manual, Design Criteria and Process, Roadway Design Office, FDOT, January 2000;**
- **A Policy on Geometric Design of Highways and Streets, AASHTO 1994, and**
- **Manual of Uniform Traffic Control Devices for Streets and Highways, FHWA, 1988.**

Table 5-1 presents the roadway design criteria which were used to develop alternatives for the proposed improvements.

Table 5-1. Roadway Design Criteria

ROADWAY TYPE	DESIGN ELEMENTS	DESIGN STANDARDS (METRIC)	DESIGN STANDARDS (ENGLISH)
Rural	Design Speed ⁽¹⁾	80 kph	50 mph
	Minimum Level of Service	D	D
	Lane Width	3.6 m	12 ft
	Roadway Inside Shoulder Width	2.4 m	8 ft
	Roadway Outside Shoulder Width	3.6 m 1.5 m Paved	12 ft 5 ft Paved
	Bridge Shoulder Width	3 m Outside 1.8 m Inside	10 ft Outside 6 ft Inside
	Minimum Median Width	6.6 m	22 ft
	Horizontal Curvature (Minimum Radius)	210 m	689 ft
	Superelevation Rate	0.10	0.10
	Maximum Grades	6.0 %	6.0 %
	Stopping Sight Distance 4% Grades	111 m to 132 m	364 ft to 433 ft
	Stopping Sight Distance Grades <2%	120 m	394 ft

Notes:

(1) kph = kilometers per hour; mph = miles per hour

6.0 TRAFFIC

The following sections identify existing and projected traffic volumes within the project limits. Much of this information was summarized from the *Technical Memorandum: Project Traffic Report*, dated October 1992, and the Traffic Report Supplement dated October 11, 1999 and should be consulted if more information is desired.

6.1 EXISTING CONDITIONS

Existing link operating conditions were determined based upon the FDOT's *Level of Service Standards and Guidelines Manual* (LOS Manual). Figure 6-1 shows the existing and projected traffic volumes for the project study area. The existing operation of the highway links within the project limits are summarized in Table 6-1. The maximum service volumes for the various levels of service have been determined using the FDOT LOS Manual. As indicated in Table 6-1, SR 682 currently operates at LOS F from the West Toll Booth to SR 679 in the peak direction in the AM and PM peak hours. SR 682 from SR 679 to the East Toll Booth operates at acceptable levels of service.

6.2 MULTIMODAL TRANSPORTATION SYSTEM CONSIDERATIONS

6.2.1 Bus Service

There is currently no mass transit service operating along SR 682 from U.S. 19 west to Gulf Boulevard. Pinellas Transit Authority (PSTA) currently provides service to portions of Pinellas County and St. Petersburg adjacent to the project area. However, PSTA has no plans to provide service to SR 682, at least until the year 2000.

6.2.2 Railroad Crossings

There are no existing railroad crossings within the project limits.

6.2.3 Airports

The closest airport to the project is Albert Whitted Municipal Airport south of downtown St. Petersburg over 8.0 km (5 mi) away.



A = 21,000
B = 22,600
C = 25,800

SR 999

A = 17,000
B = 18,900
C = 22,600

PINELLAS BAYWAY (SR 682)

A = 24,500
B = 27,100
C = 32,000

A = 10,000
B = 10,800
C = 12,300

GULF BOULEVARD

BAYWAY (SR 679)

A = 12,700
B = 18,750
C = 30,000

LEGEND

- A = 1997 COUNT
- B = 2005
- C = 2020
- K₃₀ = 9.6%
- D = 56.6%
- T = 3% PEAK HOUR
6% DAILY

NOTE:
K₃₀, D, T FACTORS FROM
TECHNICAL MEMORANDUM PROJECT
TRAFFIC REPORT, OCTOBER 1992.

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256903 01

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679



EXISTING AND PROJECTED DAILY
TRAFFIC VOLUMES

FIGURE 6-1

11/14/2017 10:52:00 AM

6-2

Table 6-1 Existing Intersection Operation

Intersection	Control Type	Existing Level of Service	
		AM Peak Hour	PM Peak Hour
SR 682 at SR 679	Signalized	B	B
SR 682 at Leeland Street South	Signalized	B	B
SR 682 at 41st Street South	Unsignalized	F	E

6.3 TRAFFIC ANALYSIS ASSUMPTIONS

Future traffic along SR 682 has been estimated using the Florida Standard Urban Transportation Model Structure (FSUTMS) computer program. This program has been used to establish year 2020 traffic volumes. To determine the traffic on SR 682 and the adjacent roadways in the first year the project is open to traffic (2005), the 2020 traffic volume was prorated with the 1997 traffic count.

6.4 EXISTING TRAFFIC VOLUMES

Existing daily traffic volumes on SR 682 within the project study limits vary between 17,000 vehicles per day (vpd) on the west end to 24,500 vpd on the east end. The existing traffic volumes are indicated in Figure 6-1.

6.5 TRAFFIC VOLUME PROJECTIONS

Future traffic along SR 682 has been estimated using the FSUTMS computer program. The daily traffic on the segment of SR 682 between the West Toll Booth and SR 679 is projected to increase to 18,900 vehicles by 2005 and 22,600 vehicles by 2020. These volumes have been reduced to the 30th highest hour for design purposes using a design hour factor (K-Factor) of 9.6% and a direction factor (D-Factor) of 56.6%. Trucks have been assumed to be 3% of the peak hour traffic stream and 6% of the daily total.

6.6 LEVEL OF SERVICE

The highway link on SR 682 from the West Toll Booth to SR 679 will operate at LOS F in the AM and PM peak hours in the 2020 design year. In order to determine the effect of a drawbridge on the operation of the Pinellas Bayway, the Federal Highway Administration's CORSIM software was used. The NETSIM portion of the CORSIM package was used for this arterial road. The USCG has indicated that if a four-lane drawbridge is constructed, then current opening restrictions may be removed and the new bridge would open on demand. Therefore, drawbridge analysis was completed for the 2020 design year considering 3, 4, 5, and 6 openings per hour. The review of openings was stopped at 6 per hour because this is a practical maximum for this location.

Levels of Service were determined at the bridge itself using intersection delay criteria based upon the 1994 Highway Capacity Manual (HCM) for signalized intersections. The HCM average running speed was used to determine the Level of Service along the highway link on SR 682 from Gulf Boulevard to SR 679.

As summarized in Table 6-2, the Pinellas Bayway bridge, using signalized intersection analysis criteria and 2020 design traffic volumes, would operate at LOS A with a high-level fixed bridge, would operate at LOS D with a drawbridge and 3 or 4 openings per hour, and would operate at LOS E with a drawbridge and 5 or 6 openings per hour.

The highway link from Gulf Boulevard to SR 679 for the 2020 design year would operate at LOS B with a high-level fixed bridge and LOS C with a drawbridge (see Table 6-3).

Table 6-2. Bridge Analysis as a Signalized Intersection

Option	Number of Openings	2020 Level of Service	
		Eastbound	Westbound
High Level Fixed Bridge	0	A	A
Drawbridge	3	C	D
Drawbridge	4	C	D
Drawbridge	5	D	E
Drawbridge	6	E	E

Table 6-3. SR 682 (Gulf Blvd. To SR 679) Link Analysis for 4-lane Options

Option	Number of Openings	2020 Level of Service	
		Eastbound	Westbound
High Level Fixed Bridge	0	B	B
Drawbridge	3	C	C
Drawbridge	4	C	C
Drawbridge	5	C	C
Drawbridge	6	C	C

7.0 CORRIDOR ANALYSIS

The purpose of this reevaluation is to assess the EA/FONSI which was approved by the USCG on November 30, 1983 and to determine whether the findings of the 1994 Reevaluation remain valid. The 1983 study recommended making improvements within the existing right of way. The study determined that the only corridor considered feasible for the proposed improvement is the corridor which encompasses the existing right of way. The existing facility was constructed with four lane expansion planned for in the future. Any other corridor would be significantly more costly and environmentally damaging.

This Reevaluation concurs with earlier findings that no other feasible corridor exists for the widening or replacement of the Pinellas Bayway structure.

8.0 ALTERNATIVES ALIGNMENT ANALYSIS

The EA/FONSI which was approved by the USCG in November 1983 recommended that the existing drawbridge be widened and a new two lane structure be constructed to the south. The study also recommended that the bridge type (fixed span or drawbridge) should be analyzed at the time of design to determine which type of structure best serves the transportation needs of the area. Therefore, the EA/FONSI did not specifically address what type of structure should be constructed. The FDOT began reevaluation of the recommendations of the previous study to determine the design alternative. Alternatives which were reviewed included a low level drawbridge, a mid level drawbridge, and a high level fixed span bridge. The following section discusses in detail the alternative design analysis performed during this reevaluation.

8.1 NO BUILD ALTERNATIVE

The No Build Alternative would allow the existing facility to remain without substantial improvements. This alternative would save the cost of construction improvements. This alternative would eliminate any short term disruption to the community that would be experienced during construction and would not have any impacts to the environment.

The No Build Alternative would have no provisions to accommodate the anticipated growth in traffic volumes. Based upon the information contained in Section 6, the existing two lane roadway between the West Toll Booth and SR 679 will operate at LOS F in to the 2020 design year.

8.2 TRANSPORTATION SYSTEM MANAGEMENT (TSM) ALTERNATIVE

Transportation System Management (TSM) alternatives have been reviewed for the project area. These alternatives such as mass transit, fringe parking, and ride-sharing would have little or no impact on reducing the traffic volumes along SR 682 from west of the toll booth to the intersection of SR 679. The primary transportation mode within the study area is the automobile. No other means of land transit are presently available to replace, or supplement, the existing highway proposed for improvement.

8.3 STUDY ALTERNATIVES

8.3.1 Bridge Considerations

8.3.1.1 Minimum Vertical Clearance Requirements

The USCG was contacted to determine the requirements for minimum vertical clearance for both a fixed span bridge and a drawbridge. The minimum vertical clearance for a high level fixed span bridge is 19.8 m (65 ft) and for a drawbridge (closed position) is 6.4 m (21 ft). A 7.6 m (25 ft) vertical clearance for the drawbridge option was selected to provide slightly higher clearance for boats. A minimum vertical clearance of 13.7 m (45 ft) was selected for the mid level drawbridge alternatives. This height was selected since it was halfway between the low level and high level clearances and was projected to reduce the number of bridge openings by 50% over the low level alternative.

8.3.1.2 Horizontal Clearance Requirements

The existing drawbridge has a horizontal clearance for the navigable waterway of 27.4 m (90 ft). The USCG is requiring wider navigable clearances than were allowed at the time the existing bridge was constructed. At this time, a 30.5 m (100 ft) wide navigable clearance is required for structures on the GCIW in Pinellas County. Therefore all alternatives developed include 30.5 m (100 ft) wide navigable clearances.

8.3.1.3 Boat Survey

Information regarding the height and type of vessel using the existing drawbridge was not available. In order to obtain information regarding the height of vessels currently using the GCIW through the existing drawbridge, a mail out boat survey was conducted. This survey was targeted to Pinellas County boaters who have sailboats of 12.2 m (40 ft) or greater in length. Forms were mailed out to all boaters in the county who had a Florida registered sailboat 12.2 m (40 ft) or greater in length. Additionally, survey forms were sent to local marinas and boat clubs to be reviewed by interested boaters. Thirty responses to the survey were received and are summarized in Table 4-3 in Section 4.2.6, Bridge Openings. The results of the survey were based upon the overall height of the boat from the waterline and were grouped into boats less than 16.8 m (55 ft), 16.8 m to 18.2 m (55 to 60 ft), 18.2 m to 19.8 m (60 to 65 ft) and greater than 19.8 m (65 ft). Only five responses were received

from boat owners which indicated a vessel height greater than 19.8 m (65 ft). In addition, information concerning boat frequency traveling through the drawbridge in all of calendar year 1991 and the month of July 1992 was collected. The survey determined that the 5 vessels with a height of 19.8 m (65 ft) or greater passed through the drawbridge an average of 12 times during 1991 and 4 times during the month of July 1992.

8.3.1.4 Vertical Height Restriction on the GCIW

Information regarding the type of bridge structures located north and south of the SR 682 drawbridge was obtained. This information was used to determine if there are bridge height restrictions north and south of the drawbridge along the GCIW. Vessels traveling on the GCIW within the study area can access the Gulf of Mexico at two points. They are North Channel (Pass-A-Grille) to the south and John's Pass to the north. Vessels traveling the GCIW to Tampa Bay use the main channel and pass through the SR 679 bridge at Tierra Verde. The SR 679 bridge is located to the south of SR 682.

There are three bridge structures located to the north of SR 682. They are St. Pete Beach Causeway, Treasure Island Causeway and John's Pass. All three structures are drawbridges which provide unrestricted vertical clearance. The Tierra Verde bridge structure is also a drawbridge which provides unrestricted vertical clearance. The North Channel (Pass-A-Grille) does not have a bridge structure. This information indicates that vessels with a height requirement greater than 19.8 m (65 ft) can access the Gulf of Mexico through other locations along the GCIW.

Based upon the information obtained from the boat height survey and the unrestricted vertical clearance of the bridge structure located north and south, it was decided to evaluate the feasibility of a 19.8 m (65 ft) vertical clearance fixed bridge as one of the alternatives.

8.3.1.5 Bridge Opening Restrictions

The USCG has a requirement that all new drawbridges shall open promptly and fully for the passage of vessels when a request to open is given by a vessel (on-demand). The USCG will therefore require any new drawbridges placed over the navigable waterway to open on demand for boat traffic. This

would increase the number of openings which currently occur since the bridge is currently restricted to openings on the hour and every 20 minutes thereafter.

8.3.2 Existing Corridor Alternatives

Six alternatives were developed to evaluate the feasibility of adding two lanes of capacity to SR 682 from the West Toll Booth to SR 679. Alternatives 1 and 2 considered a low level, 7.6 m (25 ft) vertical clearance drawbridge. Alternatives 3 and 4 evaluated a mid level, 13.7 m (45 ft) vertical clearance drawbridge. Alternatives 5 and 6 considered a 19.8 m (65 ft) high level fixed span bridge.

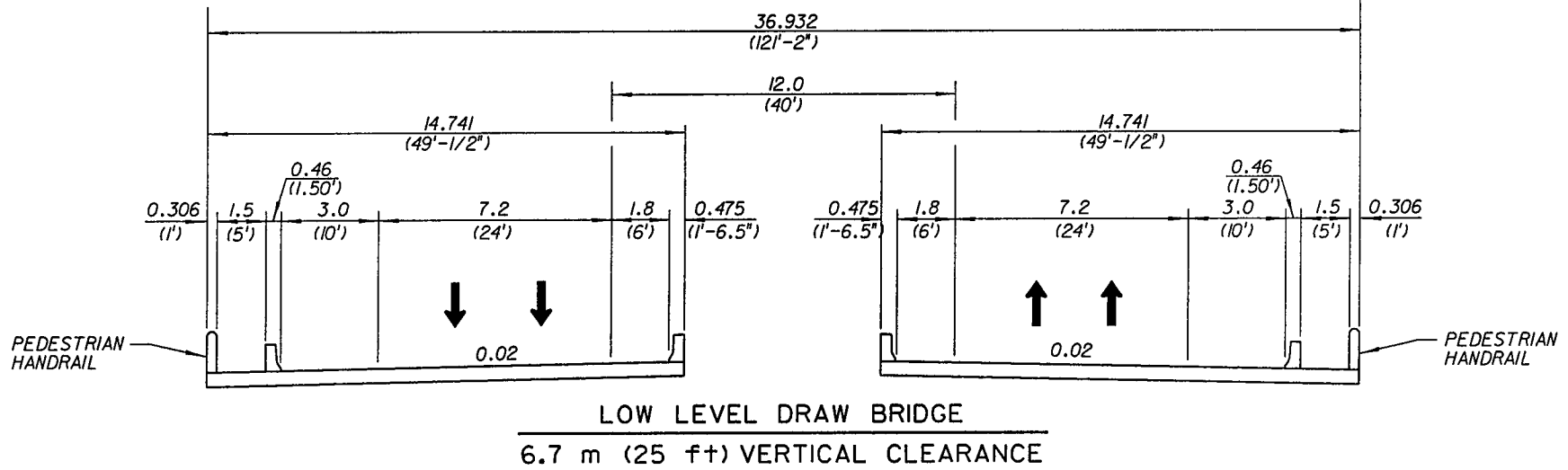
8.3.2.1 Alternatives 1 and 2

Alternatives 1 and 2 consider the feasibility of providing twin-two lane low level [7.6 m (25 ft) vertical clearance, closed position] drawbridge structures. The path of golf carts under the east end of the bridge would be maintained with this alternative. The at grade intersection with Bahia Del Mar Boulevard would also be maintained. Figure 8-1 shows the typical sections for Alternatives 1 and 2.

Alternative 1 considers the feasibility of constructing the additional two lane bridge structure to the south of the existing bridge. For this alternative, there are no business or residential relocations. No additional right of way is required. The total construction cost including preliminary engineering cost is estimated to be \$26,962,000. The present worth value of the additional cost to operate and maintain the drawbridge was estimated to be \$7,870,000. The total estimated cost for Alternative 1 is \$34,832,000.

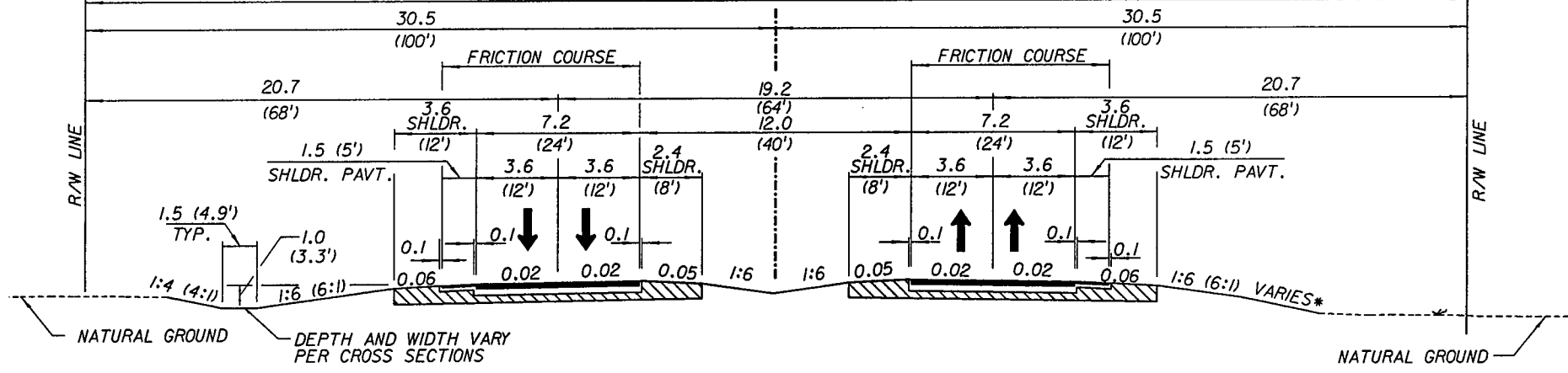
Alternative 2 considers the feasibility of constructing the additional two lane bridge structure to the north of the existing bridge. For this alternative, there are no business or residential relocations. The right of way cost is estimated to be \$1,991,000. The total construction cost including preliminary engineering cost is estimated to be \$28,953,000 (which includes right of way cost). The additional

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CONSTRUCTION

STANDARD CLEARING AND GRUBBING



8-5

WPI SEG NO. 256903 01

SR 682 (PINELLAS BAYWAY) WEST TOLL BOOTH TO WEST OF SR 679



ALTERNATIVES 1 & 2

FIGURE 8-1

operating cost for the drawbridge was estimated to be \$7,870,000. The total estimated cost for Alternative 2 is \$36,823,000.

8.3.2.2 Alternatives 3 and 4

Alternatives 3 and 4 consider the feasibility of constructing twin 13.7 m (45 ft) vertical clearance drawbridges. The bridges would be stage constructed. Initially, a two lane bridge would be constructed and traffic would be rerouted to the new structure. The existing low level drawbridge would be removed and replaced with a new mid level drawbridge structure. The golf cart path under the east end of the bridge would be maintained with this alternative. The intersection of SR 682 with Bahia Del Mar Boulevard would be permanently closed for this alternative with cul-de-sacs constructed for Bahia Del Mar Boulevard north and south of SR 682. Figure 8-2 shows the typical sections for Alternatives 3 and 4.

Alternative 3 considers the feasibility of constructing the new bridge structure to the south of the existing bridge. There are no business or residential relocations. The improvements will be constructed within the existing right of way. The total construction cost including preliminary engineering cost is estimated to be \$30,317,000. The additional operating cost for the mid level drawbridge is estimated to be \$5,333,000. The total estimated cost for Alternative 3 is \$35,651,000.

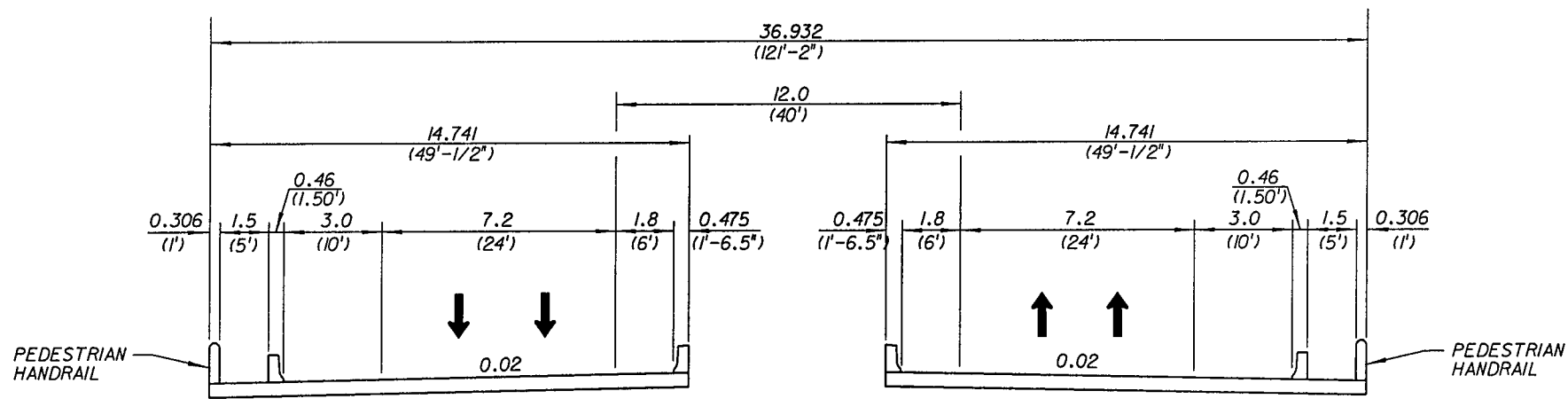
Alternative 4 considers the feasibility of constructing the new bridge structure to the north of the existing bridge. There are no business or residential relocations. The improvements will require the acquisition of right of way at an estimated cost of \$1,270,000. The total construction cost including right of way and preliminary engineering cost is estimated to be \$31,587,000. The additional operating cost for the mid level drawbridge is estimated to be \$5,333,000. The total estimated cost for Alternative 4 is \$36,920,000.

8.3.2.3 Alternatives 5 and 6

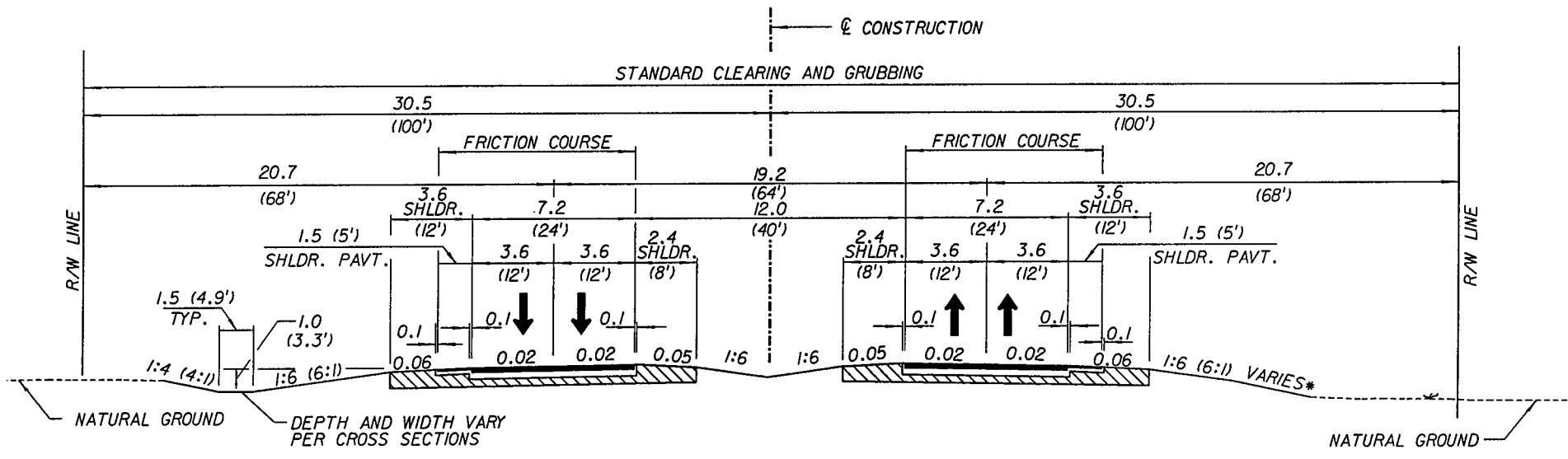
Alternatives 5 and 6 consider the feasibility of constructing a new high level [19.8 m (65 ft) vertical clearance] fixed span bridge. The bridge would be stage constructed with the first two travel lanes

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8-7



MID LEVEL DRAW BRIDGE
13.7 m (45 ft) VERTICAL CLEARANCE



PROPOSED 4-LANE ROADWAY

WPI SEG NO.
256903 01

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679



ALTERNATIVES 3 & 4

FIGURE 8-2

being constructed. The traffic would be rerouted to the new structure and the existing low level drawbridge would be removed. The remaining two lanes would be constructed adjacent to the first stage construction. Figure 8-3 shows the typical sections for Alternatives 5 and 6.

Due to the elevation of the new high level structure, Bahia Del Mar Boulevard would pass under SR 682. Connection to SR 682 for motor vehicle traffic would be via SR 679. The golf cart crossing would pass under SR 682 adjacent to Bahia Del Mar Boulevard.

Alternative 5 considers the feasibility of constructing a new high level fixed span bridge south of the existing structure. There are no business or residential relocations. The improvements will be constructed within the existing right of way. The total construction cost including preliminary engineering cost is estimated to be \$25,952,000. This alternative would have a present worth value for maintenance of the bridge and user delay to the residents on Isla Del Sol of \$1,367,000. The total estimated cost for Alternative 5 is \$27,319,000.

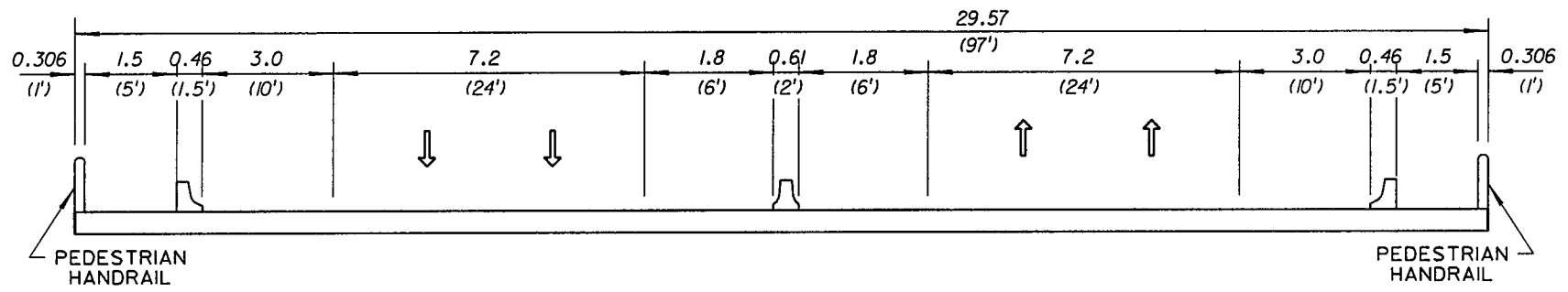
Alternative 6 considers the feasibility of constructing a new high level [19.8 m (65 ft) vertical clearance] fixed span bridge north of the existing structure. There are no business or residential relocations. The improvements would require the acquisition of right of way at an estimated cost of \$1,006,000. The total construction cost including preliminary engineering cost is estimated to be \$26,958,000. Additional operating costs of \$1,367,000 would occur with this alternative. The total estimated cost for Alternative 6 is \$28,325,000.

8.4 ALTERNATIVES EVALUATION MATRIX

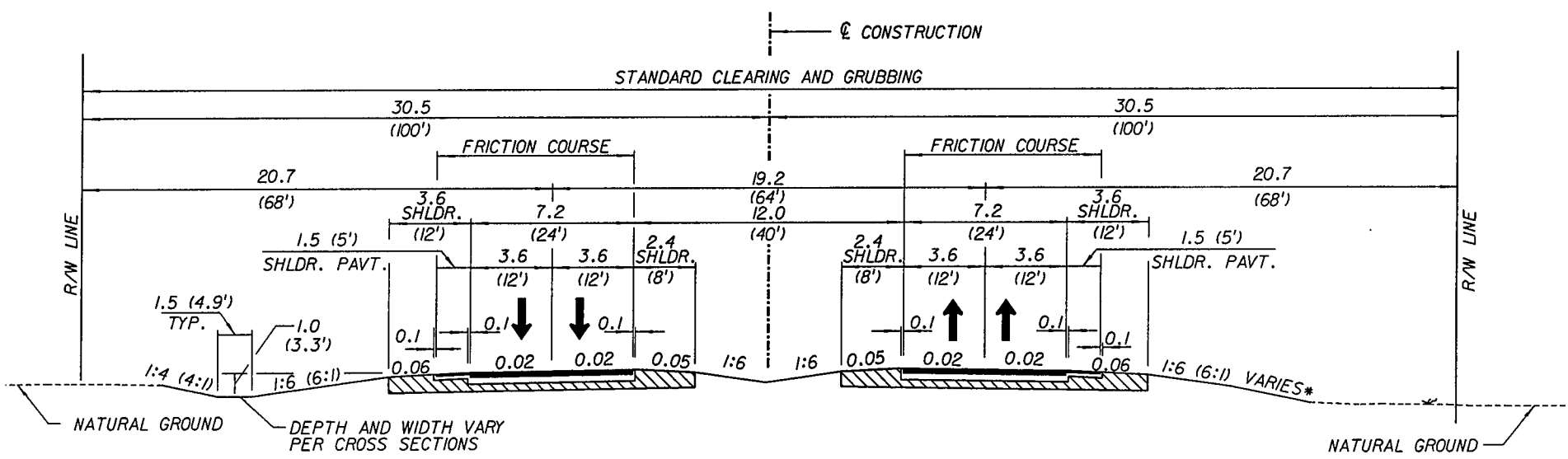
In order to provide a comparison between the alternatives which were developed for this project, an evaluation matrix was prepared. This evaluation matrix, presented in Table 8-1, identifies socioeconomic impacts, right of way cost, construction cost, preliminary engineering cost, and the additional drawbridge cost. This matrix was developed to compare the respective alternatives.

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8-9



HIGH LEVEL FIXED SPAN BRIDGE
19.8 m (65 ft) VERTICAL CLEARANCE



WPI SEG NO.
256903 01

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679



FLORIDA DEPARTMENT OF
TRANSPORTATION
DISTRICT VII

ALTERNATIVES 5 & 6

FIGURE 8-3

Table 8-1 Alternatives Evaluation Matrix

Item	Alternative 1 Low Level South	Alternative 2 Low Level North	Alternative 3 Mid Level South	Alternative 4 Mid Level North	Alternative 5 High Level South	Alternative 6 High Level North
RELOCATIONS						
Business	0	0	0	0	0	0
Residential	0	0	0	0	0	0
SOCIOECONOMIC IMPACT						
	Minimal	Moderate	Minimal	Moderate	Minimal	Moderate
RIGHT OF WAY COST						
	\$0	\$1,990,800	\$0	\$1,269,600	\$0	\$1,005,600
CONSTRUCTION COST						
Roadway	\$1,465,200	\$1,465,200	\$1,899,600	\$1,899,600	\$1,598,400	\$1,598,400
Bridge	\$19,019,840	\$19,019,840	\$21,246,400	\$21,246,400	\$18,085,650	\$18,085,650
Demolition	\$898,190	\$898,190	\$898,190	\$898,190	\$898,190	\$898,190
MOT and Mobilization	\$1,302,239	\$1,302,239	\$1,464,291	\$1,464,291	\$1,253,458	\$1,253,458
PRELIMINARY ENGINEERING (20%)	<u>\$4,276,646</u>	<u>\$4,276,646</u>	<u>\$4,808,838</u>	<u>\$4,808,838</u>	<u>\$4,116,448</u>	<u>\$4,116,448</u>
TOTAL RIGHT OF WAY AND CONSTRUCTION COSTS	\$26,962,115	\$28,952,915	\$30,317,319	\$31,586,919	\$25,952,146	\$26,957,746
ADDITIONAL COSTS						
Maintenance	\$1,416,120	\$1,416,120	\$1,416,120	\$1,416,120	\$90,764	\$90,764
Operation	\$1,380,100	\$1,380,100	\$1,380,100	\$1,380,100	\$0	\$0
User Delay	<u>\$5,073,949</u>	<u>\$5,073,949</u>	<u>\$2,536,975</u>	<u>\$2,536,975</u>	<u>\$1,276,473</u>	<u>\$1,276,473</u>
TOTAL ADDITIONAL COSTS	\$7,870,169	\$7,870,169	\$5,333,195	\$5,333,195	\$1,367,237	\$1,367,237
TOTAL PRESENT WORTH	\$34,832,284	\$36,823,084	\$35,650,514	\$36,920,114	\$27,319,383	\$28,324,983

8.4.1 Relocations

There are no anticipated business, residential, or non-profit relocations for any of the six alternatives being evaluated for the proposed improvements.

8.4.2 Socioeconomic Impact

The socioeconomic impact of each of the alternatives was reviewed. Alternatives 1, 3, and 5 do not require additional right of way acquisition. The existing travel patterns for residential and business properties adjacent to the project remain unchanged for Alternatives 1 and 3. These alternatives were determined to have minimal socioeconomic impacts. Alternative 5 would eliminate access from Bahia Del Mar Boulevard and Sun Boulevard to the Pinellas Bayway. This would cause some change in travel patterns for motorists using these two private roads. The socioeconomic impact for this alternative was also considered minimal.

Alternatives 2, 4, and 6 require additional right of way acquisition on the north side. A community golf course is located between the east end of the drawbridge and SR 679 on the north side. This is a privately owned and operated golf course. Acquisition of right of way from the golf course may potentially require modification to the fairway/green located adjacent to SR 682. Alternative 6 would eliminate access from Bahia Del Mar Boulevard and Sun Boulevard to the Pinellas Bayway. Because of the potential impact to the golf course, socioeconomic impacts for Alternatives 2, 4, and 6 are considered moderate.

8.4.3 Right of Way and Construction Costs

Right of way and construction cost estimates were developed for each alternative. These costs are described below.

8.4.3.1 Right of Way Cost

The right of way cost estimates indicated in Table 8-1 include the amounts to purchase the right of way plus the amount needed for legal fees, and support costs. Alternatives 2, 4, and 6 require the acquisition of additional right of way. However, these alternatives do not impact businesses or residents. Therefore, no relocation costs are required.

8.4.3.2 Construction Cost

Construction costs were developed using FDOT long range estimates for each of the alternatives. Separate costs for roadway and bridge construction were developed as indicated in Table 8-1. A Preliminary Engineering cost estimate of 20% was added to the construction costs to account for design and construction engineering inspection of the proposed improvement.

8.4.3.3 Additional Costs

In order to evaluate the alternatives which were developed, a life-cycle cost analysis was prepared. Significant costs that would accrue to the alternatives over the 50 year design life were identified. A 50 year life was used since bridges are reviewed based on that life expectancy. Future year costs for maintenance, operation, and user delays were calculated for each alternative as applicable. These costs were brought to a present worth value using 7% discount rate. The 7% discount rate was used since that is the rate recommended in the FDOT Office of Value Engineering Report *Life-Cycle Cost Analysis for Transportation Projects* dated July, 1990 which was used to determine methodology for the analysis.

There would be an annual maintenance cost for the low and mid level drawbridges due to their movable mechanisms and for the fixed portions of all the bridges being considered. These maintenance costs were calculated for a single year and converted to a present worth value over the 50 year life of the bridges. The present worth of the maintenance costs for the low and mid level drawbridges is \$1,416,000 and for the high level alternative is \$91,000 as detailed in Table 8-2.

The existing drawbridge has an operating cost of \$100,000 per year which represents the amount needed to have the drawbridge manned for openings to boat traffic 24 hours per day, 365 days per year. This cost will not change with the installation of low or mid level drawbridges. Therefore, this operating cost was projected to continue annually over the 50 year design life. A present worth value to operate the bridge over the 50 year life cycle was calculated at \$1,380,000, as indicated in Table 8-2. The high level alternative would not have an operating cost, since bridge tenders would not be required.

Table 8-2 Additional Costs

1. Maintenance

A. Low Level and Mid Level Draw Bridges

	<u>Length</u>	<u>Width</u>	<u>Cost/SF</u>	<u>Item Cost</u>
Fixed Spans	2,352	2x49	\$0.02	\$4,610
Draw Bridges	200	2x49	\$5.00	\$98,000
				<u>\$102,610</u>

	<u>Annual Cost</u>	<u>PW Factor</u>	<u>Item Cost</u>
Present Worth of Maintenance Cost Two Draw Bridges	\$102,610	13.801	\$1,416,121

B. High Level Fixed Span

	<u>Length</u>	<u>Width</u>	<u>Cost/SF</u>	<u>Item Cost</u>
Fixed Spans	3,390	97	\$0.02	\$6,577

	<u>Annual Cost</u>	<u>PW Factor</u>	<u>Item Cost</u>
Present Worth Fixed Bridge	\$6,577	13.801	\$90,769

2. Operation

A. Low Level and Mid Level Draw Bridges

Annual Operating Cost for Bridgetenders \$100,000

	<u>Annual Cost</u>	<u>PW Factor</u>	<u>Item Cost</u>
Present Worth	\$100,000	13.801	\$1,380,100

B. High Level Fixed Span

No Operating Costs

8-13

Another significant cost that would result from motor vehicle delay that would affect each alternative under consideration. Since the distance would be the same for each of the alternatives, the cost associated with traveling over the roadway segment would be the same. These costs were therefore not identified. For the mid level and high level alternatives, vehicles would be required to climb a grade to get to the top of the bridge and then descend on the other side. The increased cost to travel up the grade would be roughly equated with the cost to travel down the grade. These costs were therefore not included in the analysis.

Significant differences in costs due to motor vehicle delay while the drawbridges are open for boats to pass through would occur and have been identified. The following procedure was used to establish the vehicle delay cost for drawbridge interruptions to the motor vehicle flow. First, the average hourly traffic which would be stopped by bridge openings was determined. The year 2020 traffic projected for this portion of the Pinellas County Bayway as indicated in the project traffic report is 22,600 vpd, peak season. To convert to Annual Average Daily Traffic (AADT), the model output was multiplied by a MOCF conversion of 0.95. It was assumed that this AADT would represent the average traffic on the facility throughout the 50 year design life. To obtain the average number of vehicles per hour, it was assumed that the K factor would be 6.3% and the average heavy truck factor would be 6.3%. This results in 1,353 vehicles per hour crossing in both directions on the bridge. These calculations are detailed in Table 8-3.

The average delay cost per opening was also calculated. This was calculated by determining the number of vehicles delayed per opening in each direction of travel, their average delay, and multiplying the vehicle hours of delay by the delay cost per vehicle hour. Based upon a set of field observations of the existing drawbridge, it was determined that the average opening time was 3 minutes and 40 seconds per opening. The average time for each vehicle being stopped would therefore be one half of the total time the gates are down. (The first vehicle in the queue would be stopped for the entire period and the last vehicle in the queue would arrive at the time the gates would be opened and would have 0 minutes delay.) The value of time per vehicle hour was obtained from the *Life-Cycle Cost Analysis for Transportation Projects* report which identified a cost of \$11.14 in

Table 8-3. Additional Costs (User Delay)

A. Low Level Bridge

Bayway Bridge Project - Analysis of Net Present Worth

Peak Season Weekday Daily Traffic		22,600	
Peak Season Conversion Factor		0.95	
Average Annual Daily Traffic		21,470	vehicles per day
Average Hour K		6.30%	
Average Hourly Volume		1353	vehicles per hour
Average Directional Traffic	Peak Direction	Off Peak Dir.	
	766	587	
Percent Trucks	6%	6%	
Percent Autos	94%	94%	
Number of Trucks	46	35	vehicles per hour
Number of Autos	720	552	vehicles per hour
Total Directional Volume	<u>766</u>	<u>587</u>	
Unit Cost of Trucks	\$	31.85	\$/vehicle-hour
Unit Cost of Autos	\$	15.82	\$/vehicle-hour
Unit Cost of Time	\$	16.78	\$/vehicle-hour
Determination of Delay Per Opening			
Length of Opening (In minutes)	3.67	3.67 minutes	(3 min 40 sec)
Length of Opening (In hours)	0.061	0.061 hours	
Average Queue Discharge Rate	1800	1800	vehicles per lane per hour
Number of Lanes (per direction)	2	2	lanes
Average Flow Rate per Lane	383	293.5	vehicle per hour
Number of Vehicle in Queue 1 per Lane (Qm)	23	18	vehicles per lane
Arrival Delay (Queue 1 Formation)	1.406	1.100	vehicle-hours of delay
Duration of Queue 1 Discharge	0.013	0.01	hours
Queue 1 Departure Delay	0.294	0.180	vehicle-hours of delay
Number of Vehicles in Queue 2	5	3	vehicles
Arrival Delay (Queue 2 Formation)	0.064	0.030	vehicle-hours of delay
Duration of Queue 1 Discharge	0.003	0.002	hours
Queue 2 Departure Delay	0.014	0.005	vehicle-hours of delay
Directional Delay Per Opening	1.78	1.32	vehicle-hours of delay
TOTAL DELAY PER OPENING		3.09	
Unit Cost Per Opening	\$	51.91	\$ per opening
Openings Per Year		7083	
Annual User Cost of Openings	\$	367,657.56	annulized costs
Life-Cycle Period		50	years
Discount Factor		7%	
Present Worth of User Costs		\$5,073,948.74	

Table 8-3. Additional Costs (User Delay) (Continued)

B. Mid Level Drawbridge (1/2 the Openings of the Low-Level Drawbridge)

Annual Cost - $\$367,658 \div \text{Year} \div 2 =$ **\$ 183,829.00**

Present Worth - $\$183,829/\text{Year} \times 13.801 =$ **\$ 2,536,975.00**

C. High Level Fixed Bridge

Annual Cost - $5,512 \text{ Hours} \times \$16.78/\text{hr.} =$ **\$ 92,491.00**

Present Worth - $\$92,491/\text{Year} \times 13.801 =$ **\$ 1,276,473.00**

1987 dollars for passenger cars. The 1987 dollars were updated to 1998 dollars. This resulted in an average hourly cost of \$15.82 for autos and \$31.85 for trucks. Based upon a mix of 94% automobiles and 6% trucks, an hourly delay cost of \$16.78 was determined. A cost of \$51.91 per bridge opening was determined.

It is projected that the number of bridge openings will increase approximately 4% by the 2020 design year, resulting in an average of 7,083 openings per year. The mid level alternatives were assumed to have half the openings of the low level alternatives. The low level alternatives would have user delay with a present worth value of \$5,074,000 and the mid level alternatives would have a value of \$2,537,000.

The low level drawbridge currently allows an at grade intersection of SR 682, Pinellas Bayway, with Sun Boulevard/Bahia Del Mar Boulevard. The high level bridge would require construction of the Pinellas Bayway over Sun Boulevard. This would eliminate any turning movements from these roads to the Pinellas Bayway, however, it would allow the through movement from Sun Boulevard to Bahia Del Mar Boulevard to continue and would also eliminate the stop required at the current at grade intersection. This change in access will affect the travel patterns of some vehicles traveling to and from destinations along Sun Boulevard and Bahia Del Mar Boulevard.

Changes in travel patterns along the public roads, SR 682, and SR 679 are considered as additional costs for the Pinellas Bayway Bridge project. Since Sun Boulevard and Bahia Del Mar Boulevard are private roads, changes in travel patterns are not considered part of this public improvement project.

A 12 hour turning movement count was conducted from 7:00 a.m. to 7:00 p.m. on January 4, 1995 at intersections which would be impacted. Travel patterns will change for vehicles which currently use the SR 682 at Sun Boulevard/Bahia Del Mar Boulevard intersection. Since the condominiums which are served by these two roads have a fluctuation in occupancy based upon the season, with the winter months being the peak season, it was necessary to adjust the traffic count to reflect average trip generation.

In order to define average trip generation for the condominium units, it was necessary to first estimate low season occupancy. Information from the Pinellas County Property Appraiser's Office was obtained to determine the percentage of condominiums which have homestead exemptions and would therefore likely be year round residents. Only 414 of the 2,326 condominium units located west of SR 679 on Isla Del Sol have homestead exemptions (17.8%). This 17.8% was considered the base occupancy. Low season occupancy is expected to consist of the base occupancy plus approximately 50% of the non-homestead units which results in approximately 60% of the units being occupied (see Table 8-4). The peak season occupancy is estimated to consist of the base occupancy plus approximately 75% of the non-homestead units which results in approximately 80% of the total units being occupied during the peak season. The average ratio would be 1.14. Therefore, to convert from the traffic count, which was taken in the peak season, it is necessary to divide by 1.14.

Table 8-4 Peak Season to Annual Average Comparison for Isla Del Sol

Base Occupancy	=	<u>Units with Homestead Exemption</u>
		Total Number of Units
	=	<u>414</u>
		2,326
	=	17.8%
Non-Homestead Units =		100 - 17.8 = 82.2%
Low Season Occupancy =		Base Occupancy + Approx. 50% Non-Homestead = 60%
Peak Season Occupancy =		Base Occupancy + Approx. 75% Non-Homestead = 80%
Average Occupancy =		$\frac{60\% + 80\%}{2} = 70$
Peak Season/Average Annual =		$\frac{80}{70} = 1.14$

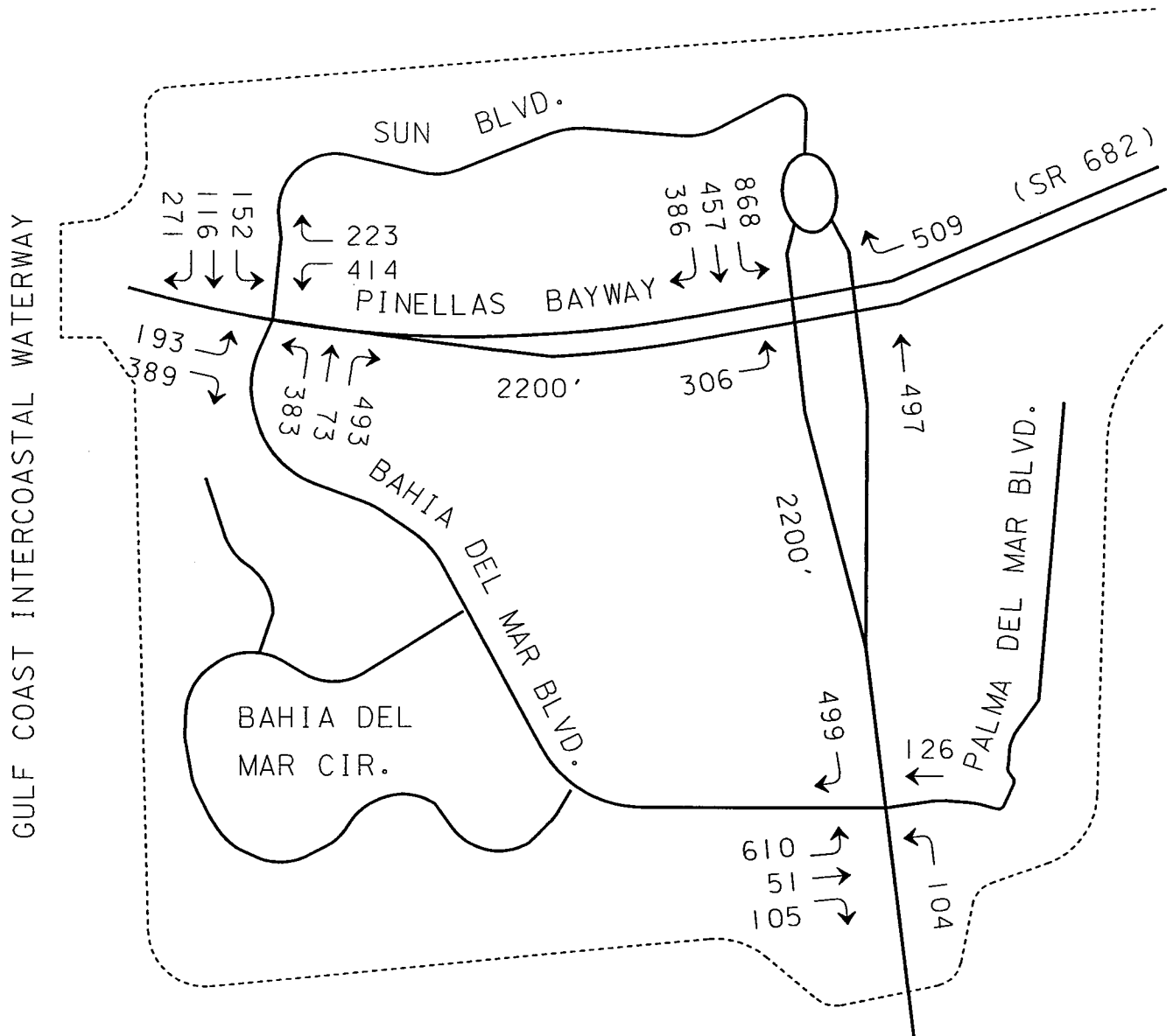
The traffic counts which were taken covered a 12 hour period. In order to convert to a 24 hour period, the following procedure was used. Since Sun Boulevard to the north of SR 682 provides access to the marina, golf course parking, condominiums, and commercial uses, estimating the number of trips to the generated with access to Sun Boulevard would be difficult. Bahia Del Mar Boulevard provides access to condominium units only, south of SR 682 and west of SR 679. Trip generation rates found in the Institute of Transportation Engineers (ITE) informational report, *Trip*

Generation, Fifth Edition were used for comparison with traffic counted on Bahia Del Mar Boulevard. There are a total of 1,414 condominium units located on Bahia Del Mar Boulevard. The *ITE Trip Generation* report indicates that this number of condominium units (Land Use Code 230) should generate 546 PM peak hour trips. Data collected indicates peak hour turning movements in and out of the Bahia Del Mar Boulevard intersections with SR 682 and SR 679 as 313 vehicles in the PM peak hour, 57% of those projected using the ITE information. Daily traffic was assumed to represent trips generated by 57% of the 1,212 units or 806 units. ITE trip generation for 806 condominium units totals 3,840 daily trips. Turning movements into and out of Bahia Del Mar Boulevard in a 12 hour period were 3,617 vehicles. Therefore, daily trips should be 6.2% (3,840/3,617) higher than the 12 hour count. The trips counted were therefore increased by 6.2% to estimate 24 hour Annual Average Daily Traffic (AADT). The 24 hour AADT is indicated in Figure 8-4. These trip estimates are based upon the 1995 traffic count, however, the portion of Isla Del Sol under review is fully developed and traffic estimates were assumed to remain the same for the length of the life cycle cost study.

The distance on SR 682 between the Sun Boulevard/Bahia Del Mar Boulevard intersection and SR 679 is approximately 671 m (2,200 ft). The distance from SR 682 to Bahia Del Mar Boulevard/Palma Del Mar Boulevard on SR 679 is also approximately 671 m (2,200 ft). The posted speed limit on both of these roads is 70 kph (45 mph). The calculation of user costs for this change in travel distance is detailed in Table 8-5 and summarized in Table 8-2. As indicated, the 50 year life cycle cost of this additional travel would be \$1,276,000 and would apply to the high level bridge alternatives.

8.4.3.4 Total Cost

All of the above indicated costs were added to determine the total cost for each alternative as indicated in Table 8-1. The low level drawbridge costs range from \$34,832,000 to \$36,823,000.



WPI SEG. NO.
256903 1

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679



FLORIDA DEPARTMENT OF
TRANSPORTATION
DISTRICT VII

24-HOUR ANNUAL AVERAGE
TURNING MOVEMENTS

FIGURE 8-4

Table 8-5 Change in Travel Distance along SR 682 and SR 679

LOCATION	TO/FROM	TRAFFIC	ROAD LENGTH	TRAVEL TIME (SEC/VEH)	TOTAL TRAVEL TIME (VEH HRS)
A. Low Level Bridge					
Sun Boulevard	West	193+271	0	0	0
	East	152+223	2200	33.3	3.47
Bahia Del Mar Blvd.	West	389+383	0	0	0
	East	414+493	2200	33.3	8.39
Total					11.86
B. High Level Bridge					
Sun Boulevard	West	193+271	2200	33.3	4.29
	East	152+223	0	0	0
Bahia Del Mar Blvd.	West	389+383	4400	66.6	14.28
	East	414+493	2200	33.3	8.39
Total					26.96

NOTES:

Increased Daily Travel Time = 26.96 - 11.86 = 15.10 hours

Annual Travel Time Increase = 15.10 hours x 365 days = 5,512 hours/year

Annual User Cost = 5,512 hours x \$16.78/hr = \$92,491/year

50 Year Life Cycle Cost = \$92,491 x 13.801 = \$1,276,473

The mid level drawbridge costs range from \$35,651,000 to \$36,920,000. The high level fixed bridge alternatives range from \$27,319,000 to \$28,325,000.

8.5 ENVIRONMENTAL CONSIDERATIONS

The primary environmental issues associated with the project west of SR 679 are effects to federally protected species, wetlands (seagrasses and fringe mangrove communities), and air quality. Both the West Indian manatee and five species of sea turtles are known to potentially be located within the vicinity of the study area. The seawalls located on both ends of the bridge were designed to allow for a second bridge to be located south of the existing structure. No transitional or emergent vegetation occurs waterward of the seawall. No fringe mangrove communities occur within the proposed alignment. Small stands of mangroves occur along the causeway on the northwest side of the bridge.

The effect to seagrass and mangrove communities depends upon whether the bridge is located north or south of the existing bridge. The alternative alignments to the north of the existing bridge would affect at least 0.2 ha (0.5 ac) of seagrass and approximately 0.12 ha (0.3 ac) of mangroves. The new bridge would also be within 3 to 6 m (10 to 20 ft) of a 1.6 ac (4.0 ac) seagrass bed located directly north of the existing structure. The alternative alignments to the south of the existing bridge would affect approximately 0.12 ha (0.3 ac) of seagrass and would not affect any mangroves. Any of the proposed bridge types constructed to the south of the existing structure would minimize effects to seagrass and mangrove communities.

An air quality study was performed to evaluate the potential impacts of the bridge alternatives under consideration. FDOT's Air Quality Screening Test (COSCREEN) was used to evaluate carbon monoxide (CO) concentrations and the potential for significant air quality impacts. The study also involved the use of the MOBILE5a emission model to estimate air emissions associated with each of the bridge alternatives. These emissions estimates were used to determine if the drawbridge alternatives would result in substantial increases in CO, hydrocarbons, and nitrogen oxides compared to a high level fixed bridge alternative. Emission estimates for the bridge alternatives were based

on the traffic data used to estimate the average annual vehicle delay cost for drawbridge interruptions to the motor vehicle flow in the year 2020 (see Section 8.4.3.3 and Table 8-2).

All of the bridge alternatives and the No Build Alternative passed FDOT's Air Quality Screening Test. Therefore, none of the project alternatives will have significant adverse effects on air quality. Emission estimates for the drawbridge alternatives were higher than the high level fixed bridge (Table 8-6). Total emissions for the low level drawbridge alternative are estimated to be approximately 6 percent 1,542.2 kilograms (kg) [(1.7 tons)] per year higher than the high level bridge alternative (i.e., 25,945.5 kg [28.6 tons] per year compared versus 24,403.3 kg [26.9 tons] per year). Total emissions for the mid level drawbridge alternative are estimated to be approximately 3 percent [816.5 kg (0.9 tons)] per year higher than the high level bridge alternative (i.e., 25,219.7 kg [27.8 tons] per year compared versus 24,403.3 kg [26.9 tons] per year). The difference in annual emissions between the proposed bridge alternatives, 816.5 kg to 1,542.2 kg (0.9 to 1.7 tons per year), does not represent a substantial contribution to the Tampa Bay Airshed.

8.6 RECOMMENDED ALTERNATIVE

As a result of the information received throughout the study, it is evident that the low level drawbridge south and the high level fixed bridge south alternatives are both feasible. Issues such as evacuation, access, aesthetics, congestion, and water quality were among the many items studied. However, a number of factors favor the implementation of the high level alternative. These include better operation in terms of Level of Service provided to motorists using the structure, a slight reduction in air quality emissions, no delay to boaters, and uninterrupted access to and from the City of St. Pete Beach. Alternative 5 (high level fixed bridge south alignment) was selected as the Recommended Build Alternative.

Since the mid level drawbridge alternatives (Alternatives 3 and 4) have the highest cost and would create cul-de-sacs for the intersections of Sun Boulevard and Bahia Del Mar Boulevard at Pinellas Bayway, it was concluded that these alternatives should be dropped from further consideration. The low level drawbridge (Alternative 2) and the high level fixed bridge (Alternative 6) on the

Table 8-6. Air Emission Estimates

BRIDGE ALTERNATIVE	AIR EMISSIONS in Kilograms per Year (Tons per Year)		
	Emissions Along Highway Link	Emissions due to Drawbridge Openings	Total
Low Level Drawbridge	23,859.0 (26.3)	2,086.5 (2.3)	25,945.5 (28.6)
Mid Level Drawbridge	24,131.1 (26.6)	1,088.6 (1.2)	25,219.7 (27.8)
High Level Fixed Bridge	24,403.3 (26.9)	0.0 (0.0)	24,403.3 (26.9)

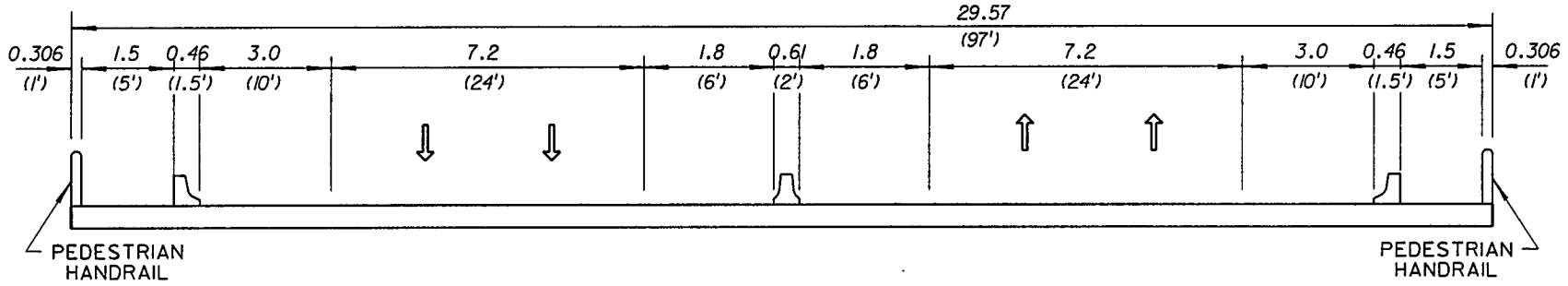
Note: Length of free flow link is 1555.2 m (5,100.9 ft) for the drawbridge alternatives and 1555.6 m (5,102.4 ft) for the high level fixed bridge alternative.

north alignment both require additional right of way, while the south alternatives (Alternatives 1 and 5) do not require additional right of way. The north alternatives, therefore, have higher cost and greater socioeconomic and environmental affects than the south alternatives and were dropped from additional consideration.

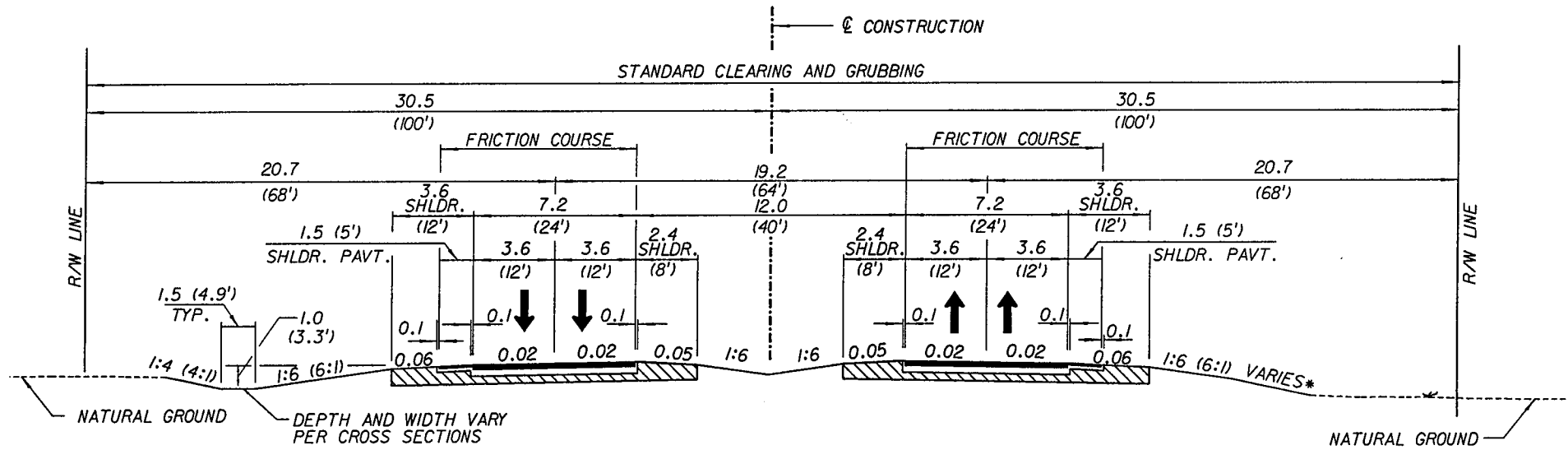
Alternative 1 (low level drawbridge, south alignment) and Alternative 5 (high level fixed bridge) were subject to additional review. The FDOT has completed the public involvement process for the Pinellas Bayway Bridge. After consideration of all issues pertaining to the economic, environmental, and social impacts of the bridge alternatives, the FDOT is recommending to implement the high level fixed bridge on the south side of the existing bridge for implementation. Figure 8-5 shows the Recommended Alternative typical sections for the roadway and bridge.

The public involvement process completed for the reevaluation included a public workshop and meetings of a bridge committee consisting of local residents. There were also presentations to the City of St. Petersburg, the City of St. Pete Beach, and the Pinellas County Metropolitan Planning Organization (MPO). The extensive public input received and the local government concerns expressed throughout the process had considerable bearing on FDOT's decision.

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HIGH LEVEL FIXED SPAN BRIDGE
19.8 m (65 ft+) VERTICAL CLEARANCE



PROPOSED 4-LANE ROADWAY

WPI SEG. NO.
256903 1

SR 682 (PINELLAS BAYWAY)
WEST TOLL BOOTH TO WEST OF SR 679



FLORIDA DEPARTMENT OF
 TRANSPORTATION
 DISTRICT VII

RECOMMENDED BRIDGE AND ROADWAY
TYPICAL SECTIONS

FIGURE 8-5

8-25

However, a number of factors favor the implementation of the high level alternative. These include better operation in terms of Level of Service provided to motorists using the structure, a slight reduction in air quality emissions, no delay to boaters, and uninterrupted access to and from the City of St. Pete Beach. Alternative 5 (high level fixed bridge south alignment) was selected as the Recommended Build Alternative.

9.0 PRELIMINARY DESIGN ANALYSIS

9.1 DESIGN TRAFFIC VOLUMES

Existing traffic volumes along SR 682 within the study limits range from 17,000 AADT at the west end of the drawbridge and 24,500 AADT on the east side of SR 679. It is anticipated that by the 2020 design year, traffic volumes will increase to an estimated 26,600 vehicles between the West Toll Booth and SR 679. East of SR 679, it is anticipated that traffic volumes will increase to 32,000 vehicles by 2020. Without roadway improvements, these anticipated traffic volumes will create LOS F operating conditions on the two lane section by the 2020 design year. Improvements of the highway link on SR 682 from the West Toll Booth to SR 679 will operate at LOS B through the 2020 design year.

9.2 TYPICAL SECTIONS

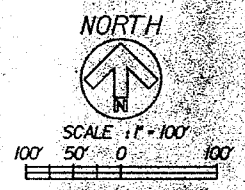
The typical section for the Recommended Alternative, Alternative 5, recommends a four lane roadway section to be constructed within 61 m (200 ft) of right of way. Figure 8-5 shows the dimensions of the recommended bridge and roadway typical sections. This typical section will be used from the West Toll Booth to the west end of the bridge and from the east end of the bridge to west of SR 679. A single four-lane fixed bridge would be provided that would be 29.57 m (97 ft) wide (outside to outside), with 1.5 m (5 ft) wide sidewalks constructed on both sides. A concrete barrier will be used to separate the sidewalk from the motor vehicle travel lanes. The inside shoulder width for the bridge section will be 1.8 m (6 ft) wide and the outside shoulder width will be 3.0 m (10 ft). Figure 9-1 shows an aerial rendering of the Recommended Alternative.

9.3 INTERSECTION CONCEPTS AND SIGNAL ANALYSIS

No improvements to any of the signalized intersections are proposed with this project.

9.4 ALIGNMENT AND RIGHT OF WAY NEEDS

Alternative 5 recommends that a single high-level fixed bridge be constructed south of the existing drawbridge. The recommended alternative will be constructed within the existing right of way. No additional right of way will be acquired.



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 BY: JBO
 CHECKED BY: REC
 SUPERVISED BY:

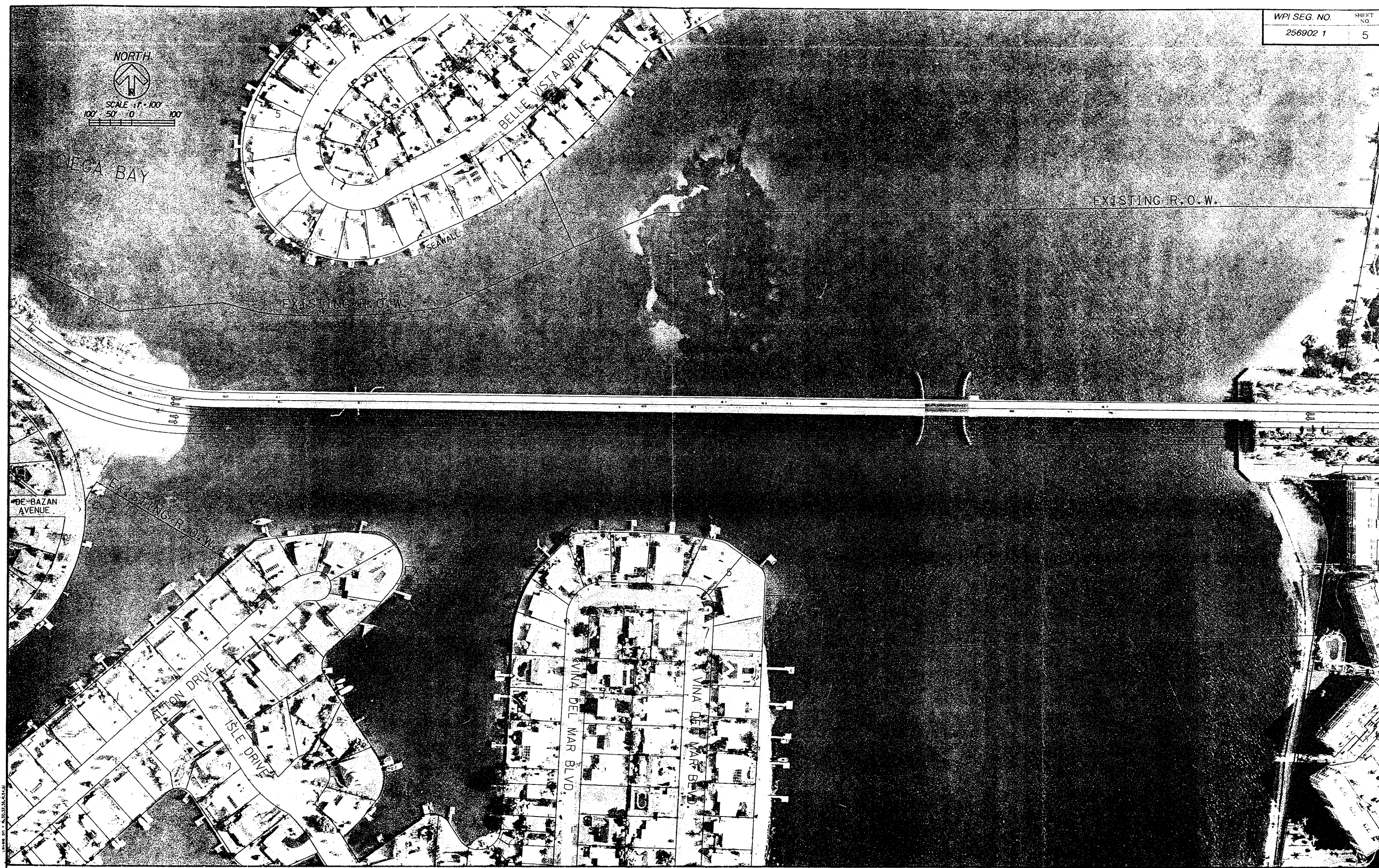
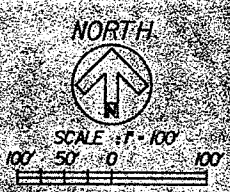
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REVISIONS					

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CHECKED BY	REC	DATE	1/21/93	CHECKED BY		DATE	
SUPERVISED BY							

FLORIDA DEPARTMENT OF TRANSPORTATION
 APPROVED BY: _____
 DATE: _____

SR 682 (BAYWAY BRIDGE)
 WEST TOLL BOOTH
 TO WEST OF SR 679

HIGH LEVEL FIXED BRIDGE
65' VERTICAL CLEARANCE
4% GRADE

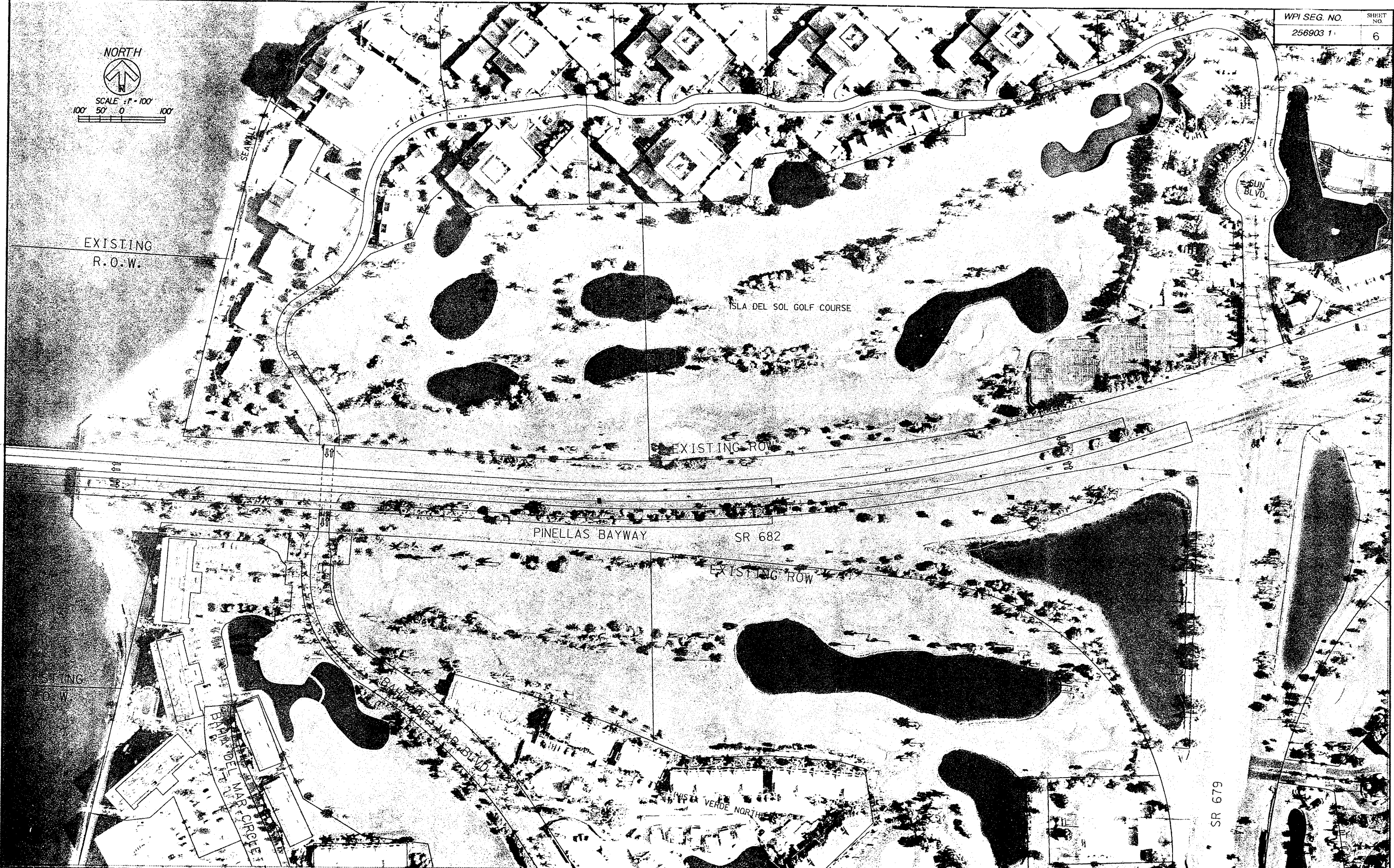


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DATE	BY	DESCRIPTION	DATE	BY	NAME	DATE	NAME	DATE			
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					REC	1/21/93					



SCALE: 1" = 100'
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 LINDA COLEMAN

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DESIGNED BY	NAME	DATE	DRAWN BY	NAME	DATE	APPROVED BY	DATE	PROJECT	DESCRIPTION
												JBO	JBO	1/21/93							SR 682 (BAYWAY BRIDGE) WEST TOLL BOOTH TO WEST OF SR 679
												REC	REC	1/21/93							HIGH LEVEL FIXED BRIDGE 65' VERTICAL CLEARANCE 4% GRADE

9.5 RELOCATION

Alternative 5 will be constructed within the existing right of way. There are no anticipated business, residential, or non-profit relocations for this alternative.

9.6 RIGHT OF WAY COSTS

Alternative 5 will be constructed within the existing right of way. There are no right of way costs associated with this alternative.

9.7 CONSTRUCTION COSTS

FDOT Long Range Estimates (LREs) were prepared for the recommended alternative. The construction cost is estimated to be \$21,836,000.

9.8 PRELIMINARY ENGINEERING COSTS

The preliminary engineering cost was estimated for Alternative 5 using a rate of approximately 20% of the estimated construction cost. Preliminary engineering costs of \$4,116,000 were estimated for the Preferred Alternative.

9.9 ADDITIONAL COSTS

The high level bridge will incur costs for maintenance, operation, and user delay. The present worth of these costs over the 50 year life of the new bridge is \$1,367,000.

9.10 RECYCLING OF SALVAGEABLE MATERIAL

Salvaging the existing pavement will be reviewed during the design phase and where practicable will be used for the improved roadway. Alternative 5 recommends that the existing bridge structure be removed upon completion of the construction of the westbound lanes of the new bridge. The eastbound lanes will be constructed on the alignment of the existing bridge. The existing structure cannot be salvaged.

9.11 USER BENEFITS

Alternative 5 recommends replacing the existing two lane drawbridge with a high-level fixed bridge within the existing right of way. This will improve the capacity of the Pinellas Bayway.

9.12 PEDESTRIAN AND BICYCLE FACILITIES

The bridge typical sections have been developed to include a 1.5 m (5 ft) wide sidewalk on both sides of the roadway. Pedestrians and bicyclists will be required to use the paved shoulders along the roadway and bridge approaches. Bicyclists will be able to use the 3.0 m (10 ft) wide outside shoulders on the proposed bridge.

9.13 SAFETY

The drawbridge is the location of 6.6 accidents and 6.8 injuries per year, of which 85% are rear end collisions. Increasing the roadway from two lanes to four lanes will increase the capacity and spread the traffic over two more lanes. This will reduce vehicle density on the roadway which may reduce the potential for crashes.

9.14 ECONOMIC AND COMMUNITY DEVELOPMENT

Socioeconomic effects for Alternative 5 are considered to be minimal. This alternative does not require the acquisition of additional right of way and does not involve any relocations. Therefore, the existing tax base for the study area is not affected.

9.15 ENVIRONMENTAL EFFECTS

The environmental effects of the Recommended Alternative were evaluated with respect to social, cultural, natural environment, and physical aspects. Impacts of the Recommended Alternative in each of these categories are summarized below.

9.15.1 Social Effects

The Recommended Alternative will not affect community cohesion or churches and schools, and will not require any business or residential relocations. No minority families will be displaced by the

Recommended Alternative, and no one was denied an opportunity to comment on the proposed project alternatives.

9.15.2 Cultural Effects

The proposed action will have no involvement regarding Section 4(f) lands, archaeological sites, or recreation areas. As indicated in Section 9.11, the proposed improvements will enhance pedestrian and bicycle access.

9.15.3 Natural Environment

Potential wetland affects for the Recommended Alternative will result in shading 0.12 ha (0.3 ac) of seagrass habitat, and pile driving within seagrass habitat. These wetland effects are considered minor, given the fact that the action is proposed to occur within the FDOT right of way, and the quantity of wetland area proposed to be affected is a small fraction of Boca Ciega Bay. All practical measures will be taken to avoid and minimize wetland affects during the design and construction phases. Wetland effects will be minimized or avoided if possible, by careful alignment positioning during design. FDOT is committed to consider reasonable levels of wetland compensation to ameliorate the effects of the proposed project. FDOT will obtain necessary regulatory permits during the design phase of the project.

Boca Ciega Bay, which the project traverses, is designated as Boca Ciega Bay Aquatic Preserve and therefore is also an Outstanding Florida Water (OFW) pursuant to Florida Administrative Code (FAC) Chapter 17-302.700(9)(h). Minimal wetland affects associated with shading 0.12 ha (0.3 ac) of seagrass and discharge of stormwater would occur in Boca Ciega Bay Aquatic Preserve as a result of the proposed action. FDOT has coordinated with the FDEP, the agency which retains jurisdiction over the Aquatic Preserve. The necessary wetland permits will be obtained during the project design phase. FAC 17-25.025 prohibits any stormwater discharge facility from causing a violation of applicable water quality standards. Therefore, to prevent any degradation of water quality, this project will provide an equivalent treatment volume for untreated existing impervious areas within the same drainage basin.

As described above, the project traverses waters designated OFW. Therefore, stormwater discharge criteria stipulated in FAC 17-25.025(9) require a treatment volume equal to an additional 50% [the first 3.8 cm (1.5 in) of rainfall instead of the first 2.5 cm (1 in) for wet detention]. FDOT will coordinate with FDEP and SWFWMD in developing a stormwater treatment system to ensure compliance with Chapter 17-25, FAC. The Preferred Alternative does not involve any of the coastal barrier islands protected under the Governor's Executive Order 81-105 and the Coastal Barrier Resources Act of 1982.

Potential wildlife and habitat affects associated with the project were evaluated. Field surveys conducted at the project site from December 1992 through March 1993 did not reveal the presence of any threatened or endangered species of plants or wildlife. The manatee, which is federally and state listed as endangered, is known to inhabit Boca Ciega Bay and can be expected to enter the project corridor during construction. In order to protect manatees and the seagrass beds which provide manatee habitat, the project alignment was designed to minimize seagrass impacts to the greatest degree possible. In addition, five (5) federally listed marine turtle species may enter Boca Ciega Bay. To protect any manatees and sea turtles swimming in the project corridor, the *Special Provisions for Protection of Manatees and Sea Turtles* developed by FDOT and FHWA with USFWS and NMFS assistance, will be adhered to by the project construction contractor. Because these provisions will be implemented to protect manatees and sea turtles, the Recommended Alternative is not expected to impact any threatened or endangered species potentially occurring in the project vicinity. The USFWS correspondence dated October 22, 1993 concurred that "the project is not likely to adversely affect federally listed threatened or endangered species".

9.15.4 Physical Effects

Noise impacts were reevaluated in 1999. The noise study determined that the project is not anticipated to affect any noise sensitive sites in the study area. Therefore, no noise abatement measures are proposed. Construction noise will be minimized by adherence to the FDOT *Standard Specifications for Road and Bridge Construction*, as amended.

An air quality analysis for the SR 682 project has been undertaken. The project passed FDOT's air quality screening test. Thus, it was determined that the Recommended Alternative would not adversely affect the air quality receptor sites or land uses within the project study area.

Potential contamination was evaluated in July 1993 and reviewed again in November 1999. The evaluation identified no sites within or adjacent to the project right of way as a potential concern, and none of the sites required a more detailed risk evaluation. The additional review conducted in 1999 did not identify any additional potential contamination sites. Based on this evaluation, no further contamination investigation has been recommended to occur during subsequent project development phases.

9.16 UTILITY INVOLVEMENT

All companies maintaining utility lines within the study area were contacted to determine potential involvement with existing and future facilities. Section 4.1.12 of this report identifies both public and private existing utilities. Based on the location of these utilities, affects and relocations were identified for all alternatives. It is anticipated that utility relocation affects caused by the new roadway will be minimal.

9.17 TRAFFIC CONTROL PLAN

The new bridge will be stage constructed. Initially, the southern portion of the high level bridge will be constructed while two-way traffic is maintained on the existing drawbridge. The two lanes provided on the new structure will then be striped for two-way traffic and traffic from the existing drawbridge will be rerouted over it. The existing drawbridge will be removed and the second half of the high level bridge will be constructed. Once completed, traffic will be routed to allow two lanes for each direction of travel.

9.18 RESULTS OF PUBLIC INVOLVEMENT PLAN

A public involvement plan was developed for this project in order to establish and maintain communication with individuals and agencies concerned with the project and its potential effects. An

An Advanced Notification (AN) package was provided to state and federal agencies and other interested parties defining the project and describing issues and impacts.

A Public Information Workshop was held on November 9, 1993 in Fox Hall at Eckerd College, 4200 54th Avenue South, St. Petersburg, Florida. The workshop was scheduled from 5 PM to 8 PM. According to official sign in sheets at the registration desk, 158 persons attended the workshop. Comment forms and handouts were available to those who attended the workshop. Comments were received from 78 persons. Of those 78 persons, six wrote letters and 72 filled out comment forms. The high level fixed span bridge was chosen as the Recommended Alternative during the PD&E phase of the project. However, because controversy arose concerning the selected alternative, FDOT committed to conducting additional public involvement at the time the project was to enter the design phase.

A second Public Information Workshop was held on March 19, 1998 and scheduled from 5 PM to 8 PM, but was extended until approximately 11 PM, in Fox Hall at Eckerd College, 4200 54th Avenue South, St. Petersburg, Florida. According to official sign in sheets at the registration desk, 774 persons attended the workshop. Comment forms and handouts were available to those who attended the workshop. Although this was not a formal workshop or hearing, a court reporter was present to take oral statements. The comment period ended on March 30, 1998. Comment formats included letters, petitions, form letters, an exit poll at an election, electronic mail, the comment forms provided at the workshop, and oral statements given at the workshop. The comments were entered into a database and duplicate responses from the same individual were consolidated. Comments were received from 6,785 persons. Seventy-three percent of those submitting comments indicated a preference for the low level drawbridge. Twenty-six percent were in favor of a high level fixed span bridge and the remaining 1% were in favor of the No Build Alternative or a tunnel.

9.19 DRAINAGE

The first 1.3 cm (0.5 in) of increased impervious surface runoff from the new construction will be treated within the right of way. Water quantity storage may not be required because of a direct discharge into the GCIW. It may not be possible or feasible to construct stormwater management

facilities in the area of the project; therefore, it may be possible to treat currently untreated areas located within the same watershed. This will be determined during the design phase of the project. The Location Hydraulics Report prepared for this project is contained in the FDOT project files.

9.20 SPECIAL FEATURES

A new golf cart path will be constructed under SR 682 to replace the one that crosses under the existing bridge.

9.21 ACCESS MANAGEMENT

No driveways will have access to SR 682 from the West Toll Booth to west of SR 679. The high-level bridge will span over the existing Bahia Del Mar Boulevard /Sun Boulevard intersection.

9.22 AESTHETICS AND LANDSCAPING

The replacement of the existing drawbridge with a high-level fixed bridge will result in a change to the visual and aesthetic characteristics of the surrounding area. Architectural design features will be considered during the design phase in order to minimize visual effects.

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