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Pinellas County

Bridge Replacement Study (Phase 1)

San Martin Boulevard over Riviera Bay Bridge

Project Number 154371
Pinellas County

Prepared For:

Engineering & Technical Support Division

Department of Environment & Infrastructure, Pinellas County Public Works

Prepared By:

HDR Engineering, Inc.

July 2012

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SECTION 1
EXECUTIVE SUMMARY

1.1 BRIDGE REHABILITATION VERSUS REPLACEMENT

HDR performed an initial evaluation of the following bridge documents:

- Bridge Inspection Reports
- Underwater Inspection Reports
- Load Rating Report
- Work History Work Orders

No Existing Plans were provided for this evaluation.

In evaluating the overall bridge condition, the load ratings showed the bridge had adequate capacity for the various rating vehicles. However, the Sufficiency Rating and NBI Ratings indicated the bridge was deteriorating and can be considered a replacement candidate.

A closer evaluation of the bridge components showed that the structure was exhibiting cracking and delamination due to corrosion. The bridge is classified as Functionally Obsolete. Both the superstructure and substructure need work. Pile tip elevations are not documented; therefore the adequacy of the foundation is unknown.

Based on the information evaluated in Section 4 of this report, a bridge replacement is the recommended alternative.

1.2 NEXT STEP

The next step of this evaluation is to develop a Bridge Replacement/Rehabilitation Report that will evaluate a minimum of two replacement or rehabilitation options, provide documentation for the maintenance of traffic, bridge scour, environmental, utilities and an estimated construction cost.

SECTION 2
INTRODUCTION

2.1 PROJECT LOCATION AND DESCRIPTION

The San Martin Boulevard over Riviera Bay Bridge (No. 154371), **Figures 2.1 and 2.2,** is approximately 1.0 miles east of 4th Street North and 1.3 miles south of Gandy Boulevard in St. Petersburg, Florida. The proposed project is to rehabilitate or replace the existing bridge which serves northbound and southbound two-way traffic for San Martin Boulevard over Riviera Bay.

Figure 2-1 – Bridge Location Map

Figure 2-2 – Bridge Location

2.2 EXISTING SAN MARTIN BOULEVARD OVER RIVIERA BAY BRIDGE (NO. 154371)

The existing two-lane bridge carries a two-way traffic and pedestrian traffic over the Riviera Bay waterway. The existing bridge was built in 1962 consisting of five spans with a maximum span length of 24-ft and a total bridge length of 117.1-ft. The bridge is 32.5-ft wide with a clear roadway width between curbs of 24.6-ft and was designed using precast concrete slab units. The bridge has a 2"± asphaltic wearing surface, **Figure 2.3**. According to the Bridge Inspection Reports, the bridge is classified as "Functionally Obsolete".

Figure 2-3 – View of Bridge Deck

The bridge foundations consist of bent type foundations with concrete caps on 14" precast concrete piles. Pile driving records were not provided and are most likely not available, therefore the bridge requires inspection on a routine basis and following storm events. The bridge is classified as Scour Susceptible- Low Priority even though it crosses Riviera Bay which is tidally influenced during high stage storm events.

Existing bridge plans were not provided as part of a review of the existing documents. Currently, the maintenance responsibility is with Pinellas County. The bridge is not eligible for the National Register of Historic Places.

2.3 PURPOSE OF BRIDGE REHABILITATION/REPLACEMENT STUDY

The purpose of this Bridge Rehabilitation/Replacement Study will be carried out in three phases, and described as follows:

Table 2-1: Phased Approach

Phase	Scope of Work	Status
1	Evaluation to focus on determining if a Bridge Rehabilitation versus Replacement can be considered at this location.	Current Task
2	Develop a Bridge Replacement/Rehabilitation Report that will evaluate a minimum of two bridge options, provide documentation for maintenance of traffic, bridge scour, environmental, utilities and an estimated construction cost.	Future Task Assignment
3	Develop Final Design Plans	Future Task Assignment

SECTION 3
EXISTING CONDITIONS

3.1 ROADWAY

Roadway surface, **Figure 3.1,** consist of an asphalt surface that continues across the bridge. The existing bridge should be rehabilitated or replaced within the current alignment due to the proximity of existing homes and limited right-of-way at the proposed project location. At the approach roadway locations, the right-of-way is 100-ft and restrained due to the existing homes on either side of the Bay, **Figure 3.2**. For this initial Phase 1 work, Right-of-way maps were not provided. The posted speed for this area is 35 mph.

Figure 3-1 – Roadway Typical Section

Figure 3-2 – Right-of-Way

Figure 3-3 – Bridge Deck Section

3.2 SURVEY

No survey work was performed as part of this Phase 1 assignment.

3.3 UTILITIES

Based on our field review, the following utilities were noted: **Figure 3.3**

- City of St. Pete - 12" water main attached to northerly side of the bridge
- City of St. Pete - 24" force main crossing on separate structure on the southerly side of the bridge

There is lighting on the bridge approaches but either goes under the existing channel or terminates at the bridge approaches. There are no other visible utilities on the bridge.

3.4 GEOTECHNICAL

No geotechnical work was performed as part of this Phase 1 assignment.

SECTION 4
CONDITION ASSESSMENT

This section documents the evaluation and condition assessment of the bridge, leading to a rehabilitation or replacement recommendation.

4.1 INITIAL STRUCTURAL EVALUATION

HDR performed an initial evaluation of the following bridge documents:

- Bridge Inspection Reports (9/09/92 - 11/30/05)
- Underwater Inspection Reports (7/28/92 – 1/09/06)
- Load Rating (1/23/86)
- Work History Work Orders (9/28/05 to 11/08/05)
- Phase I Survey and Mapping Section Report (no date)
- Corrosion Condition Evaluation of Piles, Bent Caps, and the Underside of Deck Overhangs on Bridge No. 154371 in Pinellas County (1/06/12)
- Non-Destructive and Load Testing of Pinellas County Bridges Report (1/24/01)
- Gandy Boulevard Causeway Enhancements Conceptual Design Report (11/2001)

Existing plans were not available or provided for this evaluation.

Based on the above documentation, the following assessments can be made as shown in the following sections.

4.2 OVERALL BRIDGE CONDITION

Table 4-1: Overall Bridge Condition

Item	Reference	Comments
Functionally Obsolete Sufficiency Rating (SR) : 66.7	2005 Inspection Report	The "**sufficiency rating**" is a tool that is used to help determine whether a bridge that is structurally deficient or functionally obsolete should be repaired or just replaced. The sufficiency rating considers a number of factors, only about half of which relate to the condition of the bridge itself. The sufficiency ratings for bridges are part of a formula used by the Federal Highway Administration when it allocates federal funds to the states for bridge replacement. Deficient structures with an SR value less than 50 are eligible for replacement, **50 to 80 are eligible for rehabilitation**, and above 80 are not considered eligible. The rating of this bridge is a high value that it is not considered a priority for funding.
NBI Deck/ Superstructure = 5 Fair Substructure Ratings = 6 Satisfactory	2005 Inspection Report	Per FHWA, in order to qualify as "Structurally Deficient", a Rating = "4 Poor" for Deck/ Superstructure and/or Substructure is required. The bridge is in fair (5 "Fair") to satisfactory (6 "Satisfactory") condition.
Load Rating:	2005 Inspection Report	The Bridge Inspection Report has a reported **LFR HS20 Inventory rating factor =1.95** > 1.0, therefore acceptable. No posting requirements.

In summarizing the above observations, the load ratings show the bridge has adequate capacity for the various rating vehicles. However, the Sufficiency Rating and NBI Ratings indicate the bridge is in "Fair" to "Satisfactory" condition and that rehabilitation should be considered. A "Fair" condition for the superstructure means all elements are sound, but may have minor section loss, cracking, spalling and minor rehabilitation is needed. The "Satisfactory" condition means that minor rehabilitation may not be necessary, but major maintenance is required.

The term "functionally obsolete" only means that a bridge does not meet current road design standards. For example, some bridges are "functionally obsolete" because they were built at a time when lane widths were narrower than the current standard. In order to be considered for functionally obsolete classification, a highway bridge must meet the requirements outlined in **Table 4-2**.

As can be seen by the values, what controls the Functionally Obsolete classification is the Deck Geometry. The bridge currently has a substandard typical section, which means the bridge was built too narrow. Two components are key to determine the deck geometry value: (1) The curb-to-curb or face-to-face of rail dimension taken from Item 51 - Bridge Roadway Width, Curb-to-curb and (2) the ADT for the bridge.

Table 4-2: Functionally Obsolete Criteria

Functionally Obsolete Criteria	Inspection Report Value
An appraisal rating of 3 or less for • Item 68 - Deck Geometry; or • Item 69 - Underclearances; or • Item 72 - Approach Roadway Alignment.	2 - Basically intolerable requiring high priority of replacement N - Equal to present desirable criteria 8 - Equal to present desirable criteria
Or an appraisal rating of 3 for • Item 67 - Structural Condition; or • Item 71 - Waterway Adequacy.	5 - Somewhat better than minimum adequacy to tolerate being left in place as is 8 - Equal to present desirable criteria

The curb-to-curb dimension varies in the inspection reports from 24.6-ft and the ADT is 2650. **Figure 4-1** is a Table in the FHWA Coding Guide that is used to determine the deck geometry rating code. Using a width of 24.6-ft (metric value = 7.5) and an ADT of 2650, the deck rating code is 2.

According to the 2006 Inspection Report, the Future ADT for 2025 is forecasted to be 3313. If the bridge is rehabilitated and expected to remain for another 20-25 years before needing replacement, if we estimate the ADT not to exceed 5000, the minimum curb to curb width is 27.9-ft (8.5 m) for a minimum rating code of 4. The minimum widening width needs to be the difference between 27.9-ft and 24.6-ft or 3.3-ft.

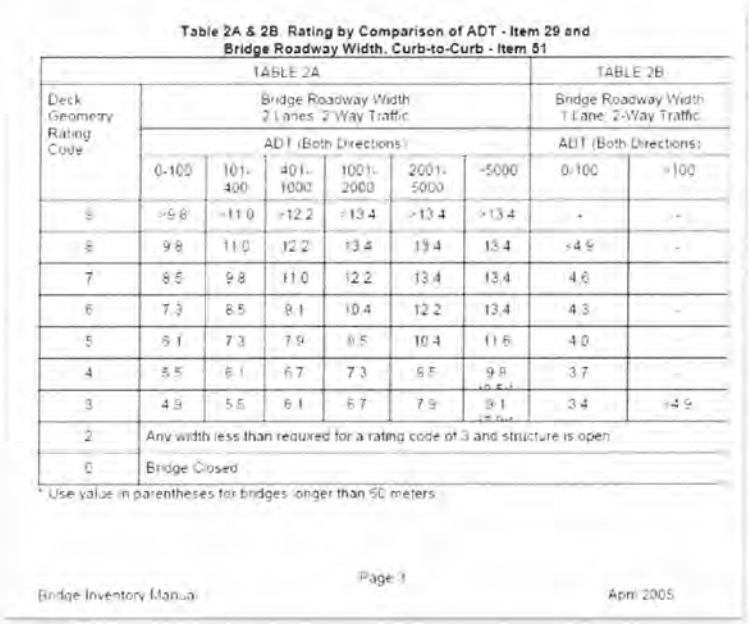

Table 2A & 2B Rating by Comparison of ADT - Item 29 and Bridge Roadway Width, Curb-to-Curb - Item 51

	TABLE 2A						TABLE 2B	
Deck Geometry Rating Code	Bridge Roadway Width 2 Lanes, 2-Way Traffic						Bridge Roadway Width 1 Lane, 2-Way Traffic	
	ADT (Both Directions)						ADT (Both Directions)	
	0-100	101-400	401-1000	1001-2000	2001-5000	>5000	0-100	>100
9	>9.8	>11.0	>12.2	>13.4	>13.4	>13.4	-	-
8	9.8	11.0	12.2	13.4	13.4	13.4	>4.9	-
7	8.5	9.8	11.0	12.2	13.4	13.4	4.6	
6	7.3	8.5	9.1	10.4	12.2	13.4	4.3	-
5	6.1	7.3	7.9	8.5	10.4	11.6	4.0	
4	5.5	6.1	6.7	7.3	8.5	9.8	3.7	
3	4.9	5.5	6.1	6.7	7.9	9.1	3.4	>4.9
2	Any width less than required for a rating code of 3 and structure is open							
0	Bridge Closed							

* Use value in parentheses for bridges longer than 50 meters

Page 3

Bridge Inventory Manual — April 2005

Figure 4-1 – Table from FHWA Coding Guide

In addition to the roadway curb to curb width, the sidewalks on either side of the bridge will need to be increased to a clear width of at least 5-ft. The sidewalks were initially 5-ft wide but with the addition of the guardrails and pedestrian rails, the widths were constrained to 3'-6". Estimating a minimum of 5-ft widening, the construction costs of a 5-ft minimum widening plus some additional improvements that can keep the bridge operational for 20-years, will be more cost effective then a bridge replacement. However, **the major question is: Can the bridge remain operational for 20-years? Can it become "Structurally Deficient" within this period?**

When "**structurally deficient**", it means that the bridge should undergo a series of repairs or replacement within the next six years. The policy is to repair or replace all the structurally deficient state owned bridges during that time. The FDOT also recommends that local governments follow the same schedule for their structurally deficient bridges.

Table 4-3: Structurally Deficient Criteria

Structurally Deficient Criteria	Inspection Report Value
An appraisal rating of 4 or less for • Item 58 - Deck Rating ; or • Item 59 - Superstructure Rating ; or • Item 60 - Substructure Rating	**5** - Fair **5** - Fair 6 - Satisfactory
Or an appraisal rating of 2 or less for • Item 67 - Structural Condition; or • Item 71 - Waterway Adequacy.	5 - Above Min Tolerable 8 - Equal to present desirable criteria

A concern is that both Deck and Superstructure Ratings are one classification away from a "Structurally Deficient" bridge. Therefore, while a widening will eliminate the "Functionally Obsolete" classification, the bridge may become structurally deficient before the estimated life span and need replacement prematurely. Therefore, if an argument can be made that the bridge will have a tendency to become "Structurally Deficient" due to a lowering of the Rating Code from "Fair" to "Poor", a bridge replacement should be considered as the preferred alternative.

4.3 BRIDGE DECK, SUPERSTRUCTURE AND SUBSTRUCTURE CONDITION

This section will outline bridge components and bridge issues that can cause the Deck and/or Superstructure Rating Codes to be lowered by one unit from a "5 Fair" to a "4 Poor" value. In this case, the bridge would be considered "Structurally Deficient" and will need to be replaced.

Table 4-4: Bridge Deck, Superstructure and Substructure Condition

Item	Reference	Comments
Deck cracks	1992, 1998 & 2005 Inspection Reports	The bridge was built in 1962. No inspection reports were provided prior to 1992 for our evaluation. 1992 - underside deck cracking present 1996 – some spalls repaired, beginning to delaminate 2005 – repair areas are delaminated, corrosion stains visible. The structure has been with exposed steel that is corroding, random cracks with corrosion stains and spalls since the 1992 report.
Superstructure Ratings	1992, 1998 & 2005 Inspection Reports	The bridge was built in 1962. No inspection reports were provided prior to 1992 for our evaluation. 1992 - Deck/Superstructure rating of "6 Satisfactory" 1996 - Deck/Superstructure rating of "7 Good". The improvement in the rating could have been because of repairs made prior to 1996. 2002 – Deck/Superstructure rating of "5 Fair". 2005 – Deck/Superstructure rating of "5 Fair". The structure has been with exposed steel that is corroding, random cracks with corrosion stains and spalls since the 1992 report. When repairs were made in 1996, the superstructure rating was increased to "7 Good". However, within six years, the rating dropped to a "5 Fair", which is the current rating. It is expected that the corrosion will continue and that within the next 5-10 years, the deck will need to be repaired again since the rating can become a "4 Poor", which means the bridge will be classified as "Structurally Deficient".
Substructure Capacity concerns	1992, 1998 & 2005 Inspection Reports	The bridge was built in 1962. No inspection reports were provided prior to 1992 for our evaluation. 1996 - Substructure rating of "7 Good" up to 1996. 1998 - Substructure rating of "6 Satisfactory" until today. The substructure had maintained a rating of Satisfactory over the years. Spalls have been repaired with pile jackets, but the repairs have not had cathodic protection.

The major concern about the substructure is that the bridge seems to be in an extremely corrosive environment. The bridge pile sizes are noted as follows:

- 14" sq per 2005 Inspection Report
- 14" sq per 2002 Bridge Underwater Inspection Report

This information conflicts with the following:

- 18" sq per 1994 Scour Evaluation Report

Assuming the piles are 14" sq or even 18" sq, a small amount of section loss will significantly affect the pile capacity. Losing 3" covers on an 18" sq is a reduction of 56% on the area, on a 14" sq the reduction is 67% on the area. FDOT requires a minimum of 24" sq since losing the covers still provides an effective 18" sq pile. The bending capacities are further impacted with section loses since they are functions of the inertias. Therefore, for the environment, the pile sizes are undersized and can have significant capacity issues with spalling or section loss.

Considering the low ratings of the deck and the undersized piles for the corrosive environment of the bridge, the structural capacity of the bridge will remain questionable even after superstructure and substructure repairs. Therefore, these issues can justify a recommendation of a bridge replacement in lieu of rehabilitation.

4.4 OTHER CONDITION CONSIDERATIONS

The following items are used to present the need for a bridge replacement versus rehabilitation. The documents referenced can be found in the Appendix.

Table 4-5: Other Condition Considerations

Item	Reference	Comments
Non-Destructive & Load Testing [1]	Jan 24, 2001 Report by DSA	This report was developed to assess and evaluate the structural integrity of the deck, pier cap and piles. Present damage assessment noted (pg 3-2) was that based on the visual inspection and non-destructive test results, the majority of the elements of the structure did not exhibit deterioration higher than expected for their age. The expected end of structure life was estimated at year 2032. At the time of the evaluation, the 1996 Inspection Report was reviewed and reflected the condition of the bridge. The rating for the deck, superstructure and substructure was "7 Good" and the Sufficiency Rating was 79.5. About a year and 8 months later, the September 4, 2002 Inspection Report had downgraded the deck and superstructure rating to "5 Fair" and the substructure to "6 Satisfactory". Sufficiency Rating remained 79.5.
Corrosion Condition Evaluation [2]	2012 Report by FDOT Materials	• Piles are in good condition, but recommends installing non-structural sacrificial cathodic protection jackets and bulk zinc anodes on ALL piles. • Bent cap recommendations include removing repair concrete and all damaged concrete and installing a metalized zinc cathodic protection system on ALL exposed surfaces. • Deck overhang recommendations include removing repair concrete and all damaged concrete and installing a metalized zinc cathodic protection system on ALL exposed surfaces.

TABLE 4-5 Continues		
Scour [3]	1994 Scour Evaluation	Based on this report, the channel has remained relatively stable between 1985 and 1994. Key issues to consider for a bridge replacement: • Existing bridge piles have unknown embedment, therefore bridge requires frequent inspection following coastal storm events and tidal surges. • Bridge overtopping is likely, therefore a consideration to raise the profile can be considered in a replacement. • Bridge piles are 14" square piles
Pedestrian Trail – Gandy Blvd Causeway Enhancements [4]	November 2001 Report	A pedestrian trail, which serves as an extension of the Pinellas Trail. Missing link is currently the section between the Gandy Blvd and along San Martin over Riviera Bay. The trail is to be 12-ft clear width.

[1] *Non-Destructive & Load Testing – A conclusion that was reached in this evaluation of this report is that it was not a proper assessment of the structure. The downgrading of the structure within a two year period does not make sense with the assessment that the structure was in good condition. It is not clear how much the structure ratings would have influenced the evaluation and calculations within the report in 2001. However, the sudden drop in the downgrading of the structure could only mean that the rate of corrosion increased significantly since the structure was closer to being considered Structurally Deficient.*

[2] *These recommendations are considered a major rehabilitation to deter the corrosion process. A bridge rehabilitation and widening can be performed but the service life of the bridge may not be able to be extended beyond 10- 20 years. Since corrosion can be occurring without it being visible, it is difficult to predict how well the cathodic protection will work and for how long. If replacement is an option and funding is available, replacing the bridge is a viable alternative.*

[3] *A bridge widening and rehabilitation will not eliminate the "unknown foundations". If a storm were to expose the piling or show damage, major substructure retrofit work or replacement would be considered.*

[4] *Due to the bridge being on a horizontal curve, the pedestrian trail is being proposed on the east side of the bridge, in the same location as the 24" force main. To place the trail, either the trail or force main will need to be relocated with the final structure being a separate structure. A bridge replacement allows the new cross-section to accommodate the trail and the laneage, shoulders and pedestrian trail and sidewalk widths that are in compliance with current standards and codes.*

Based on the current rating of the bridge, considering the state of corrosion, unknown foundations, proposed pedestrian trail improvements and other items discussed in this study, a bridge replacement is recommended.

SECTION 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

Based on the items evaluated in Section 4, a bridge replacement is recommended.

5.2 CURRENT RECOMMENDATIONS

The following is the recommended approach to developing the bridge Replacement plan for this project:

Table 5-1: Phased Approach

Phase	Scope of Work	Status
1	Evaluation to focus on determining if a Bridge Rehabilitation versus Replacement can be considered at this location.	Completed
2	Develop a Bridge Replacement Report that will evaluate a minimum of two bridge options, provide documentation for maintenance of traffic, bridge scour, environmental, utilities and an estimated construction cost.	Next Task Assignment
3	Develop Final Design Plans	Future Task Assignment

APPENDIX A