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Pinellas Bayway Bridge Replacement

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ABSTRACT

Pinellas County is comprised of various coastal cities located on the west coast of Florida, U.S. With over 50 kilometres of sandy beaches, this area is a popular destination for regional, national and international visitors. As a result, Pinellas County is very dependant on bridges to provide access to these areas.

Specifically, the Pinellas Bayway Bridge provides a connection between the City of St. Pete Beach and the City of St. Petersburg. This bridge is the primary route used by residents, employees and visitors to access both local beaches and roadway I-275 for regional travel. The Bayway Bridge is a two-lane drawbridge that was constructed in 1962.

Over time, the condition of the bridge began to deteriorate. Areas such as the bridge deck, bridge piers and mechanical systems were only designed for a service life of 50 years. Also, with increased population, bridge traffic and marine activity became more congested. This resulted in expanding the roadway leading up to the bridge from a two-lane roadway to a four-lane roadway in the 1980s.

Currently, construction on a $40 million, four-lane, high level, fixed span replacement bridge is underway. This fast-tracked project started early 2012 and is expected to be open for traffic in early 2015. However, there has been much debate and opposition to this project within the local community.

The following paper will examine the Pinellas Bayway Bridge replacement on the basis of concern, current bridge condition, and benefits. Also, construction of the new bridge and techniques required will be reviewed.

1 INTRODUCTION

Pinellas County is located on the west coast of Florida, US. Bounded by the Gulf of Mexico, Pinellas County consists of an assortment of coastal cities. A variety of these cities are recognized national and international beach destinations including the island of Tierra Verde and Fort DeSoto Park

that averages 2.7 million visitors per year. The combination of coastal communities and large volumes of people, require Pinellas County to rely heavily on bridge transportation. Included on this list of major bridge transportation is the Pinellas Bayway Drawbridge.

Opened to traffic in 1962, the two-lane Pinellas Bayway Drawbridge provides it's annual average daily traffic volume of 22,500 vehicles, the connection between the City of St. Petersburg, and the City of St. Pete Beach. However, after 50 years of service, replacement of this bridge is underway and the location is illustrated below in Figure 1.

Figure 1: Location of the Pinellas Bayway Bridge Replacement (Source: Florida DOT)

2 PROJECT DESCRIPTION

The Pinellas Bayway Bridge replacement is considered Phase II of a project established in 1985 by Florida Department of Transportation (DOT), as a result of increased bridge activity. Phase I, completed in the late 1980's, included widening of the roadway from two-lane to four-lane, on both

sides leading up to bridge. The replacement project consists of replacing the two-lane drawbridge with a four-lane fixed span, high-level bridge. Specific details comparing both bridge dimensions are available in Table 1.

Table 1 Bridge Dimensions Comparison

Bridge Dimension	Drawbridge	Fixed Span Bridge
Length	686 m	793 m
Travel Lane Width	2 lanes, 3.66 m	4 lanes, 3.66 m
Inside Shoulders	N/A	1.83 m
Outside Shoulders	0.30 m	3.05 m
Multi-Use Path	N/A	3.35 m (south side)
Sidewalk	1.04 m	N/A
Minimum Vertical Clearance	6.55 m	19.8 m
Horizontal Clearance	27.4 m	30.5 m
Design Life	50 years	75 years

Together, the recession and residential debate contributed to the delay of this project. However, in late 2011, Orion Marine Group Inc. was finally awarded a 40 million dollar project contract. Construction of this project started in early 2012 and is expected to be complete early 2015.

3 LOCAL CONCERN

As previously mentioned, many people within the local community of Pinellas are in disagreement with the replacement of the bridge. For years, fishermen have used the drawbridge to catch fish to provide food for their families. These fisherman will be unable to cast lines from the railings of the new bridge. Also, the quiet neighbourhoods surrounding the bridge claim that their area will be transformed into a hectic tourist spot. They believe this will take away from their desired image of an old fishing village.

4 PINELLAS BAYWAY DRAWBRIDGE REPAIR

The existing Pinellas Bayway Drawbridge has been in operation for it's complete 50-year design service life. Similar to any structure that has exceeded it's service life, a major rehabilitation project would be required for it to remain in service. In this case, repairs to areas of the bridge deck, piers, and mechanical and electrical systems are necessary. The Florida DOT estimated a cost of $27.4 million in order to maintain the bridge structure and drawbridge systems until 2022.

4.1 Sufficiency Rating

In order to evaluate the quality of a bridge, the Federal Highway Administration (FHWA) uses the tangible indicator referred to as the Sufficiency Rating (SR). This rating is based on the following:

- Structural adequacy and safety of the load carrying of the bridge (55%)
- Serviceability and functionality (30%)
- Essentiality for public use (15%)

The SR can range from 0-100, but any bridge that has a rating less than 50 should be considered for replacement. The most recent SR for the Pinellas Bayway Drawbridge was conducted on June

2009 and resulted in a rating of 42.5. This inspection, also evaluated the deck, superstructure (above water line) and substructure (below water line) based on a rank out of 10. These National Bridge Inventory Ratings are listed below in Table 2. It is evident from the fact that the SR has only been above 50 once since 2003, that a bridge replacement was in desperate need.

Table 2: Pinellas Bayway Yearly Sufficiency Rating

Year of Inspection	Deck	Superstructure	Substructure	SR
2009	6	5	5	42.5
2008	6	5	5	42.5
2007	6	6	6	53.5
2006	6	6	6	42.5
2005	6	5	6	39.3
2004	6	5	6	43.1
2003	7	5	6	43.1

4.2 Concrete Corrosion

While operating in a corrosive marine environment for over 50 years, the Pinellas Bayway Drawbridge has experienced significant corrosion. Chloride ions in salt water can migrate though concrete and corrode reinforcing steel, weakening the structural adequacy of the bridge. In addition, the Florida DOT concrete corrosion study titled, *Characterization of New and Old Concrete Structures Using Surface Resistivity Measurements*, demonstrated that concrete used to construct coastal structures 20 or more years ago, exhibit a higher chloride diffusion coefficient than concrete today. As a result of this study, concrete core samples were collected at pile elevations in the splash zone of the Pinellas Bayway Drawbridge. Test results were in conformance with the study, including a high chloride diffusion coefficient and chloride contents that exceeded corrosion thresholds. Having a low elevation, similar results are expected throughout the entire bridge structure. The effect of reinforcing steel corrosion is not taken into account when evaluating a structure's SR, therefore the previously discussed values may be optimistic.

4.3 Functionally Obsolete

The Pinellas Bayway Drawbridge is referred to as functionally obsolete, by the National Bridge Inventory Ratings. This means that the bridge does not meet current road design standards. Having been constructed in the 1960's, it is expected that the design standards would have changed during that time. However, significant safety features are missing from the Pinellas Bayway Drawbridge such as a bridge median, transitions, approach guardrails, and bridge railings. It is considered unsafe to walk or bicycle across the bridge. Even after repairs, not all safety features could be accomplished. As a result, the Pinellas Bayway Drawbridge would always be classified as a functionally obsolete bridge.

5 BENEFITS

Many people view the new bridge as a "time saver", but fail to see the potential benefits for themselves or the community. This bridge will result in several benefits including economic, safety and

environmental benefits. However, as these topics are complex, this case study will only touch briefly on them.

5.1 Economic

Due to the large influx of tourists in the coastal regions of Florida, primary employment is in retail, guest accommodation and the food service industries. The new bridge will be able to provide faster and easier access to these locations. As a result, a larger demand for these tourist destinations will be created, in turn, increasing economic growth. Also, many jobs will be formed as a direct result of this project. According to Florida DOT, approximately 728 new full-time jobs are expected to be the result of the replacement.

5.2 Safety

Located on the western end of Pinellas County, the Bayway Bridge is a designated Hurricane Evacuation Route. Therefore, it is important that traffic is able to evacuate as efficiently as possible. With the construction of the new bridge replacing two-lanes with four-lanes, a median and wider shoulders, a significant increase in outflow is possible. Also, without the interruption of marine activity the flow of traffic will be constant. As the new bridge will have a designated walking/bicycle path, safe transportation alternatives will be available.

5.3 Environmental

Pollution caused by a motor vehicle is highest when the vehicle is either idling or delayed. From 2004-2009, the Florida DOT recorded an average of 5,687 drawbridge openings per year. These openings last as long as four minutes and result in excessive air pollution. Eliminating the drawbridge will completely remove the pollution created by idling cars.

6 CONSTRUCTION

Having been designed for a 75-year service life, the Pinellas Bayway Bridge Replacement is a labour intensive construction project. First, reinforced concrete piles are to be driven down into hard sand or deeper clay using a diesel pile-driving hammer. It is important that these piles are driven to their corresponding design minimum depth in order to resist appropriate forces caused by scouring. These depths range from 20 to 35 metres. Next, each reinforced concrete footing is to be built on top of 16 piles. The typical footing dimensions are 6.7m x 6.7m with a depth of 1.8m. This process is illustrated in Figure 2. In the background of this figure, a barge containing a crane with a pile-driving hammer is driving down piles. The progress is increased towards the foreground of the figure, with two sets of 16 piles completed and one footing formwork ready for concrete.

After the concrete has been placed for the footings, reinforced concrete columns and pier caps are to be constructed on top of each footing. The heights of these piers vary from 5 to 20 metres, tall enough to allow for marine traffic activity. Figure 2 shows a column/pier that has been completed and a formed column/pier both on top of separate footings.

Figure 2: Pile Driving and Footing Formwork (Source: www.newbaywaybridge.com)

Figure 3: Column/Pier Construction (Source: www.newbaywaybridge.com)

A new specialized pre-stressed structural beam, called the Florida I-Beam, will be used for the girders. This beam is more efficient than older AASHTO beam types and is part of a new Florida DOT statewide standard. In addition shear blocks will be used between these girders to resist the high wave impact. A detail of this is shown in Figure 4. The girders will then be covered with a concrete decking to be paved for the roadway.

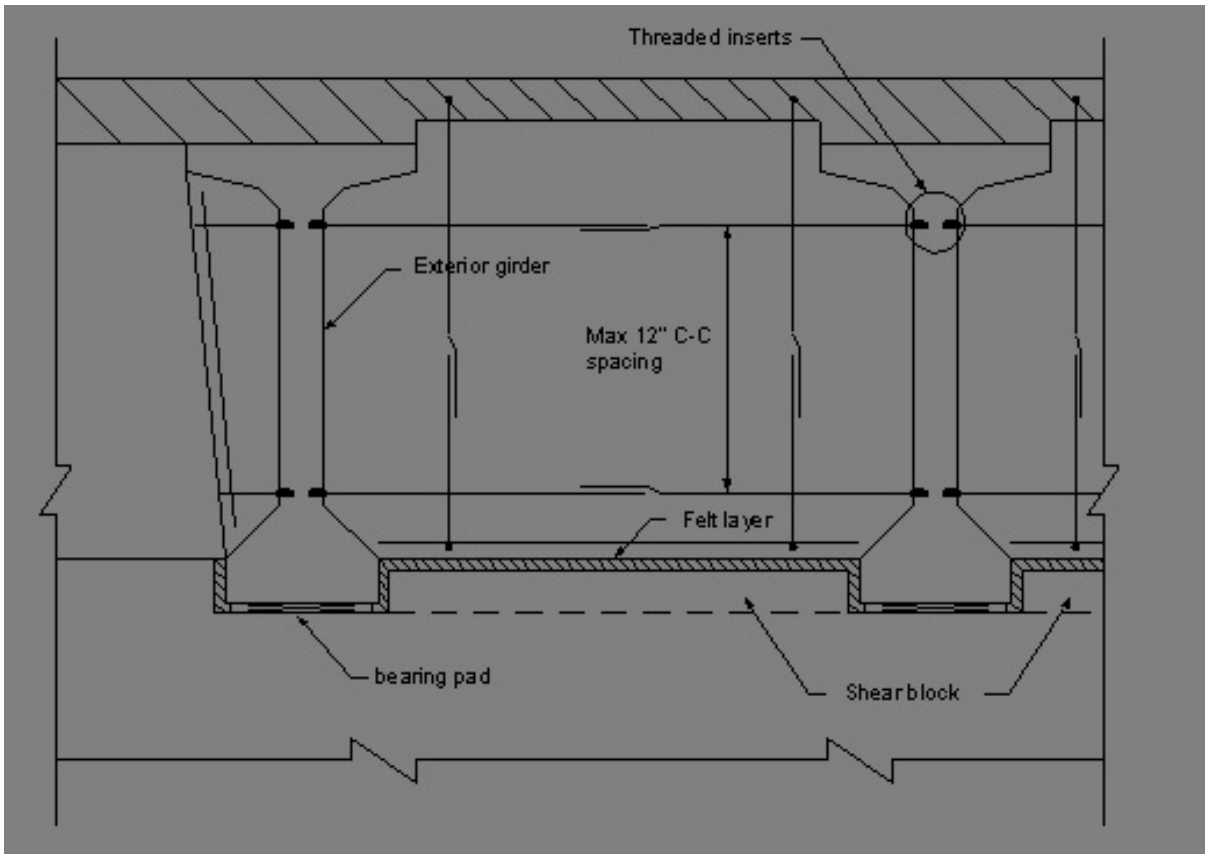

Figure 4: Typical Detail of Bridge Girders and Shear Block (Source: Florida DOT)

In order for traffic to have access across the Gulf, the drawbridge will be used until two lanes of the new bridge are complete. Traffic will then be switched to the two lanes of the fixed bridge. Figure 5, shows the current drawbridge in use next to the current construction of the two lanes of the fixed bridge. When these two lanes are complete, the drawbridge will be demolished and the remaining two lanes of the fixed bridge and walking path will be constructed.

Currently, the project is 40 percent completed. Two-lanes of the new bridge are expected to open for traffic April 2013 and the project is on schedule for a completion date of early 2015.

Figure 5: New and Old Bayway Bridge (Source: www.newbaywaybridge.com)

7 CONCLUSION

It can be seen from this paper, that there were many issues associated with the Pinellas Bayway Drawbridge. Evidently, an upgrade of some extent was required for the bridge. While many of the locals would prefer a repair project, it was shown that this option is not viable compared to a replacement. Not only will the new bridge create the previously explained benefits, the cost of construction will equate to approximately $600,000 per year of use, compared to $2.7 million per year of use when repaired. As decisions regarding large construction projects of this magnitude are mainly influenced by economic value, it is obvious that replacing the bridge was the only practical option.

Also, the complex construction techniques and design used in the fixed bridge, demonstrate the effort required to achieve a 75-year design service life. In addition, as the new bridge will be of high quality, on-going maintenance costs and construction necessary to keep the bridge in service will be greatly reduced.

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