City of Fort Lauderdale
Bridges Master Plan Update – A

(Single Ingress/Egress Bridges)

June 30, 2023

TRANSYSTEMS

TABLE OF CONTENTS

EXECUTIVE SUMMARY

TranSystems has been retained by the City of Fort Lauderdale to update the 2014 Structural Bridge Engineering Consulting Services Master Plan through Contract No. 12262-496, Task 2, Project No. P12732. This project includes only the 33 bridges that serve as the single source of entry and exit into neighborhoods in the City of Fort Lauderdale. TranSystems completed the following tasks, which culminate in this master plan document:

- Reviewing the most recent bridge inspection reports
- Performing a site review at each bridge to verify bridge conditions and document any site conditions that would impact construction
- Preparing individual summary reports for each of the bridges

Recommendations for work at each bridge were made based on noted conditions and TranSystems' long history of experience with similar bridges. The recommendations have been grouped into five-year program windows, from 0-5 years, 6-10 years, 11-15 years and 16-20 years from the time of this report. The recommendations focus on anticipated remaining life and the need for rehabilitation or replacement. Opinions of probable costs have been provided for these recommendations.

Future deterioration and methods to address it were based on several factors, including the age of the bridge, the condition of the bridge components, whether or not the bridge was load restricted, and TranSystems' experience with inspection and repair of the types of bridges within the City's inventory.

Of the 33 bridges considered, 22 are recommended for replacement over the next 20 years. Three bridges are expected to require rehabilitation, while the remaining 8 in the study are less than 12 years old and should require no work other than minor routine maintenance during the study period.

Anticipated costs associated with the recommendations for each bridge during each five-year period, including design, construction, CEI and administration and a contingency amount, have been estimated. Costs have been estimated assuming that some grouping of similar work or nearby bridges will be done when contracting the work, in order to take advantage of the efficiencies associated with doing so. The total cost to complete these recommendations is estimated to be $91,770,000.

A table summarizing the estimated total costs for each five-year program window and the bridges associated with each window is presented on the following page.

LONG TERM ANTICIPATED COSTS							
0-5 YEARS $24,950,000.00		6-10 YEARS $13,680,000.00		11-15 YEARS $9,590,000.00		16-20 YEARS $43,550,000.00	
REPLACE	**REHAB**	**REPLACE**	**REHAB**	**REPLACE**	**REHAB**	**REPLACE**	**REHAB**
865765	None	865712	865782	865761	865745	865731	none
865771		865713		865763	865746	865733	
865772		865727				865738	
865773		865760				865739	
865774		865770				865740	
						865741	
						865742	
						865743	
						865762	
						865764	

SCOPE OF WORK

TranSystems has been retained by the City of Fort Lauderdale to update the 2014 Structural Bridge Engineering Consulting Services Master Plan through Contract No. 12262-496, Task 2, Project No. P12732. This project, Bridge Master Plan Update, includes only the City's 33 bridges that provide the only means of access for residents, workers, and visitors in each neighborhood. Eight bridges have been replaced since 2012 and have a design life that extends well beyond the 20-year period considered in this master plan. The inspection reports for these bridges were reviewed to identify any conditions that would warrant a field review. If conditions of concern were noted, a field review was performed. Field reviews were completed for the remaining older bridges to verify bridge deficiencies and note any site conditions that could impact design and construction.

Each Bridge Summary Report includes the findings of the field review if performed, including any potential safety concerns, and evaluates the deficiencies presented in the latest bridge inspection reports, ultimately providing a discussion of short term and long-term recommendations with opinions of probable cost for the recommended work.

The individual bridge summary reports are included in Appendix A.

FACTORS AFFECTING DECISION-MAKING

While there is no formula available to quantify when a bridge should be rehabilitated or replaced, there are several factors that engineers use to evaluate the prudence of making repairs or replacing a bridge, including age, locations of deterioration, load carrying capacity, structure type/material and the condition of neighborhood bridges. Usually, it is not just one of these factors, but a combination of them, that can make replacement of a bridge the prudent solution over making repairs.

AGE

Older bridges are generally accepted to have a 50-year design life, based on the AASHO or AASHTO design specifications in place at the time, as well taking into consideration common construction practices of past eras and common materials used. Current design codes are accepted to produce bridges with 75 to 100-year design life.

In the case of the City's older bridges, which are predominantly of concrete construction, the concrete mixes were more permeable than current mixes, such that the chlorides from salt water or brackish water can, over time, penetrate the concrete and promote corrosion of the internal reinforcing steel. Once the corrosion process has initiated, it is not possible to reverse it and it is very difficult to stop it, particularly when chlorides permeate the entire concrete component. The concrete substructure elements of the City's bridges are likely contaminated with chlorides, which is why there are cracks, delaminations and spalls on the piles, seawalls and abutments.

The City's bridges are close to the water, such that the beams and deck of many of the bridges are within only a few feet of the water and subjected to repeated windblown salt spray that can eventually cause the corrosion process to occur. The primary barrier for this is the thickness of the concrete on top of the internal steel, commonly known as the concrete cover. New bridges have concrete cover that ranges from 2 in. minimum for beams to 4 or 4½ in. for substructure units in water. Older bridges generally don't have more than 2 in. cover over steel in the beams and deck, and frequently it is on the order of 1 to 1½ in. thick. Given lesser concrete cover and the more permeable concretes used at the time of construction, it is expected that the City's bridges have the deterioration noted during field work.

The bridges in this study were constructed in the following decades:

- 1940s: 1 bridge
- 1950s: 8 bridges
- 1960s: 7 bridges
- 1970s: 8 bridges
- 1980s & 1990s: 1 bridge
- Post-2000: 8 bridges

LOCATIONS OF DETERIORATION

Deterioration present on concrete and steel bridges can be repaired in conventional ways, but the locations where the deterioration exists can make performing repairs difficult once the areas have significant deterioration. For example, abutments with concrete panels behind them to retain the fill are very difficult to replace without demolishing the approach slabs above, since just removing the panels will likely result in the fill collapsing into the channel since temporary support is not feasible.

LOAD-CARRYING CAPACITY

Older bridges were designed using lighter loads than current bridges. For very old bridges, the design load may be less than today's Florida legal loads, which are the basis for determining the needs to post bridges with load restrictions. In that case, the structures may not have the ability to be strengthened, and any deterioration to them could cause significant reduction in the allowable truck load limits.

STRUCTURE TYPE/MATERIAL

The type of structure and the materials used play a role in the durability and ability to strengthen and repair. For example, prestressed concrete slab unit bridges close to the water are extremely difficult to provide long term repairs for concrete spalls and exposed prestressing strands, because making repairs creates focal points at the edges where reinforcing steel penetrates sound concrete and the corrosion inducing chloride ions concentrate at those locations. This causes additional spalls that require repair. Using a cathodic protection system to prevent this behavior, while practical on substructure elements, is not feasible for slab unit bridges because it cannot reliably be installed on the vertical faces of the adjacent slab units due to lack of access. This compromises the system, making it ineffective.

CONDITION OF SIMILAR BRIDGES

For the City's single ingress/egress bridges included in this study, the bridges within each neighborhood tend to have been designed and constructed in the same era using similar types of construction materials, with similar type, size, configuration, and proximity to the waterline. Examples of these neighborhood groups are the bridges in the Seven Isles neighborhood, north of Las Olas Boulevard on and around NE 23rd Avenue (865738 & 865739), the neighborhood north of SE 17th Street Causeway on the east side of the Intracoastal Waterway (865770 thru 865774), and the neighborhood south of the New River off Cordova Road (865760 through 865764).

For the purposes of this study, conditions found at some bridges in a particular neighborhood were considered likely to occur at others within the 20-year study period, if not already present. At these groups of bridges, anticipated recommendations are very similar for all bridges, since they behave similarly and will have similar deterioration.

REPAIR OR REPLACEMENT DECISION MAKING

The goal of the decision-making process is to provide the prudent solution for each bridge, considering its age, current and expected future condition, structure type and material, load- carrying capacity and the condition of similar bridges. All bridges were initially evaluated individually based on specific conditions found during the data gathering phase, using engineering judgment and experience to anticipate over what period of time further deterioration would occur. Once the individual evaluations were complete, groups of bridges were evaluated and conditions compared to gain a better understanding of what the deterioration of other bridges would look like, given that all of the study bridges are close to the water and most were constructed prior to 1975, making them at least 50 years old.

While the age of a bridge is an indicator that a bridge may be a candidate for replacement, there is no direct correlation between age and making the decision to replace a bridge. The durability of a concrete bridge is dependent upon the quality of construction and the durability of the concrete. Concrete strength and permeability are highly dependent upon the concrete mix and use of different materials over the years have produced very different results. It is not possible to identify the reasons for the difference in conditions between neighboring bridges of similar construction without significant testing of concrete, which is not part of the scope of this project and is not cost effective, as it is just as likely that the concrete mix was slightly different, the reinforcing steel in the slab units was placed in the formwork differently, or the location of one bridge makes it more susceptible to windblown salt spray.

Recommendations considered the difficulty of making good quality repairs with long lifespan. If repairs were not expected to last long enough to get through the 20-year study period, other alternatives were considered and recommended. Temporary repairs that will require re-repair during the study period were not considered, since they will require constant repetitive maintenance until the bridge is replaced. In some circumstances, difficult elements to repair due to configuration ultimately resulted in recommendations for replacement based on prudence from the cost-effectiveness and maintenance of traffic perspectives.

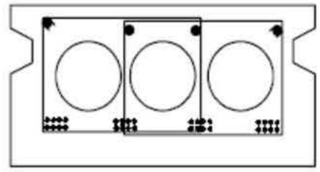
Concrete repairs were not recommended for bridges with significant spalls and cracks that indicate the internal reinforcing steel has significant corrosion, as it is very difficult to make good repairs that will last more than 5-8 years, unless the work was generally done in conjunction with cathodic protection.

If only part of an older bridge is in poor condition, with the remainder of the bridge in satisfactory or better condition, the cost to make repairs to address the poor condition may not be cost-effective if the remaining life of the bridge is less than what the repair would be expected to provide. This decision was made on a case-by-case basis and is discussed within each of the individual bridge inspection reports attached in an appendix. This is most common for the substructure elements. Bridges more than 50 years old with significant deterioration to the concrete substructure elements are recommended for replacement at some point during the next 20 years, using engineering judgment and expertise to project when deterioration may become critical or start to significantly affect the ability of the bridge to carry traffic without major posting efforts.

Groups of these bridges are very similar in terms of bridge type, configuration and age, particularly where bridges are located within a specific community, for example the Harbor Inlet or Nurmi Isles neighborhoods. Additionally, the bridges are predominantly reinforced or prestressed concrete structures. Elements of this type in close proximity to the salt or brackish water present throughout the canals will absorb the chlorides in the water and eventually promote corrosion of the internal steel, causing cracks, delaminations and spalls.

The sections that follow address some of the very common bridge types and problems encountered, in order to provide additional information regarding reasons for the long term recommendations that have been made.

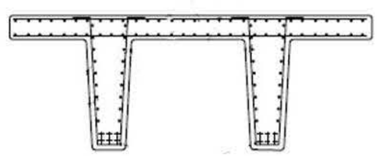
PRESTRESSED CONCRETE SLAB UNITS



The majority of the City's single ingress/egress bridges analyzed in this study are of prestressed concrete slab unit construction. For this type of bridge, 3 ft. to 4 ft. wide slab units are manufactured using standard forms. Prestressing strands are run through the formwork prior to pouring concrete. After the concrete is poured and hardens, the strands are tensioned to improve the structural capacity of the concrete units. All of the City's bridges included in this study constructed after 1962 are of this construction type.

All of the City's bridges are close to the waterline, with less than 9 feet clearance from the underside of the superstructure to the mean high water line. It is highly likely that the concrete is saturated with chlorides. For bridges of this type, where cracks and spalls already exist, making concrete spall repairs to areas where concrete is delaminated will address the primary anodic site (where the corrosion is greatest), but it will also create an anodic ring around the repair, because adjacent secondary anodic locations (areas with less corrosion present) become primary locations, which will eventually cause further concrete deterioration. For low lying coastal bridges on state roads, the FDOT State Materials Office Corrosion Research Laboratory personnel recommend replacement of the bridge once widespread deterioration is found, since the different repair methods they have attempted for such bridges have not stopped or significantly slowed the rate of deterioration.

REINFORCED CONCRETE DOUBLE T-BEAMS



Seven bridges in this study consist of reinforced concrete double T-beams, which have thin webs and top flanges and are fabricated off-site using common forms into which reinforcing steel cages are constructed prior to the concrete being poured. The City's bridges of this type were constructed between 1952 and 1958. These beam types commonly have less concrete between the exterior surface and the reinforcing steel, otherwise known as concrete cover, and are prone to corrosion when close to water due to chloride contamination and infiltration through load-induced cracking. Double T-beams are prone to the same limitations regarding repairs as prestressed concrete slab units but have the additional problem that they tend to have less load carrying capacity. Once corrosion has started on the reinforcing steel and repeated repairs are needed, section loss to the internal reinforcing steel is very difficult to replace, for the main reason that there is often not enough development length available to splice in new bars and there isn't the space available within the think webs to do so.

There are no cost-effective ways to strengthen T-beam bridges. For these reasons and given that all of the double T-beam bridges are over 50 years old with cracks and spalls to superstructure and substructure, all double T-beam bridges are recommended to be replaced during the 20-year study period.

REHABILITATION ACTIVITIES

Of the 33 bridges evaluated, only three of the bridges are recommended for rehabilitation activities:

- 865745, Solar Plaza Drive over Rio Canal
- 865746, Solar Plaza Drive over Rio Placid Canal
- 865782, SE 25th Avenue over Rio Idlewild Canal

The remaining 30 bridges either warrant replacement in the next 20 years or are less than 11 years old and should not require rehabilitation over the next 20 years. Following is a discussion of various repairs and safety improvements required at the three bridges.

CONCRETE REPAIRS

Spall repairs and crack sealing are conventional, very common repairs. When done as part of a design project, concrete repairs should be identified and addressed through the use of plan notes or technical special provisions to dictate the methods of repair and the requirements of materials.

These requirements may vary based on whether the repaired areas are on horizontal, vertical or overhead surfaces. All deteriorated concrete should be removed and the limits of repair squared off, followed by cleaning and preparing the exposed substrate and reinforcing steel in accordance with the requirements of the manufacturer and the design engineer. It is recommended that the FDOT be consulted to ensure the very latest in materials and procedures are incorporated to provide the longest lasting repairs possible.

Crack sealing and injection are covered in the FDOT Standard Specifications for Road and Bridge Construction, Section 411. There are two general categories of materials for crack injection: sealants that provide a structural bond to the concrete on either side of a cracked section to restore structural integrity, and those that do not. For general shrinkage cracks and cracks in the concrete in the tension area of a beam or other element, the non-structural material may be adequate. For beams with shear and flexural cracking that by analysis are not due to overstress in the concrete, the structural sealant may be the preferred material.

Bridges with minor spalls and non-structural cracks without signs of corrosion bleed out were recommended for concrete repairs. A rough cost for repairs to bridges with little to no specific deterioration at this time was also included, as they will deteriorate and are likely to require some repair during the 20-year study period.

PREVENT INDEPENDENT SLAB MOVEMENT

The older prestressed concrete slab unit bridges within the City are designed with transverse tie rods that are intended to compress the slabs together into contact so that they work together and distribute loads to multiple slabs. As the bridges age, it is common for these metal tie roads to corrode or loosen, such that the slabs begin to work independently, so that when a vehicle crosses the bridge the loads are supported by only the units that the wheels are in contact with, rather than distributed to adjacent units. Over the long term, this can cause unwanted overloading of the individual units. The condition is commonly noted by the presence of reflective cracks in the asphalt overlay above the joints between the slabs.

Modern practice for construction of new slab bridges incorporates a shear key and concrete topping to provide better continuity. For slab bridges similar to the City's, retrofits to hydrodemolish the top edges of the slab units and install a shear key filled with ultra-high performance concrete have been developed. It is this type of retrofit that is suggested, although other methods may be more commonplace by the time the bridges require rehabilitation.

OTHER DECK-RELATED REHAB ACTIONS

The three bridges identified for rehabilitation all have asphalt overlays that would require partial removal to install the retrofits described above. Because part of the overlay will be removed, it is prudent and cost-effective to remove and replace the overlay completely in order to waterproof the top surface of the concrete. It is also prudent to replace the expansion joints on the bridge at this time.

SAFETY IMPROVEMENTS

The existing bridge railings do not meet current criteria for height and crashworthiness. At the time of rehabilitation, consideration should be given to upgrade the existing railings to meet the current criteria. A final decision regarding railing upgrading will need to consider the impact of a potentially heavier railing on the load carrying capacity of the bridge. If the railings are not replaced for this or another reason, the existing railings should be retrofit or modified to meet current height and opening requirements.

BRIDGE REPLACEMENT CONSIDERATIONS

Specific recommendations made for each bridge have attempted to take into account the challenges associated with construction. In many cases, bridges will need to be replaced on the same alignment as the existing, requiring careful consideration of phased construction in order to ensure accessibility by residents who have no detour route available.

HISTORICAL BRIDGES

In order to be eligible for the National Register of Historic Places (NRHP), a bridge must be at least 50 years old. Bridges are eligible if they are significant and they meet one or more of the following NRHP criteria for evaluation:

- Criterion A - association with an event or pattern of events that made an important contribution to the historical and physical development of a region.
- Criterion B - historic association with the lives of persons significant in the past. This criterion generally has not been commonly applied to bridges, as the works of noted engineers and builders are usually more appropriately represented under Criterion C.
- Criterion C - embodies distinctive characteristics of a type, period, or method of construction; they are the work of a master; they possess high artistic value; or they contribute to a historic district and appear as they did when the district achieved its significance. This criterion is the most broadly applicable for bridges. The criterion affords recognition of the evolution of bridge types and important design or fabrication variations within those bridge types over time. It also facilitates recognition of the development of new bridge types or designs that go on to have a significant effect on bridge or highway design in the state or nation. Under this criterion, significant bridges are represented by early examples or those with innovative details and that have influenced the general acceptance of an important type or design. Significant bridges may also represent an engineering advance within a long-lived technology, like design variations or new ways to fabricate beams. Bridge building technology is significant when it is first introduced, proves its viability, and then goes on to become a commonly used standard design.
- Criterion D - properties that yield important information in prehistory or history. The criterion is generally used to evaluate archeological resources and is not typically applied to bridges.

As discussed previously in this report, the bridges evaluated during this study have construction dates dating back to 1940. By the end of the 20-year study period, 24 of the 33 bridges will be more than 50 years old. This scope of this study did not include thorough research of which of the City's bridges may be recognized as historic and require greater consideration of repair or rehabilitation options than other bridges. Greater consideration for rehabilitation of select bridges may be needed if they are classified as historic by the State Historic Preservation Officer.

Bridges that are considered historic may still require replacement if they are in poor condition or if remaining in place is intolerable due to safety considerations, like a documented accident history due to the bridge's geometry. Work to repair a bridge is unlikely to affect the historic nature of a bridge, but replacement of the bridge will likely require consultations with historians, the local historical society, and the state historic preservation officer, as well as a study to evaluate no build, rehabilitation and replacement options in order to satisfy federal Section 106 of the National Historic Preservation Act of 1966, the US Department of Transportation Act of 1966, and the National Environmental Policy Act of 1969.

Maintenance of Traffic

These bridges are the only means of access to island neighborhoods, so careful phasing of work and maintenance of traffic is of paramount importance. Many of the bridges are narrow but show no signs of being inadequate for the use, so recommendations to replace have assumed minimal bridge width increases to minimize the possibility of right of way impacts. The scope of this study did not include a review of existing property lines or layouts for possible new bridges.

The maintenance of traffic challenge associated with limited available right of way is that the existing bridges, most of which serve two-lane, two-way traffic, must maintain two-way traffic on a single lane while a new bridge is constructed immediately adjacent. Depending upon the length of the bridge, temporary signals may be required in order to safely maintain traffic during the work, since temporary barriers and the existing vertical geometry would significantly reduce sight distances for vehicles in both directions.

Design engineers will need to carefully consider traffic control, including providing safe access to pedestrians and bicyclists for any construction activities that may occur.

Utilities

Most of the City’s bridges carry utility pipes attached to the deck underside at one or both fascias. Construction activities, whether repairs to the beams, caps or piles, or full bridge replacement, will need to account for these pipes and ensure that they are properly supported and protected throughout construction. For bridge replacements, all avenues should be researched to determine if the utilities can be relocated off of the bridges, although doing so may be difficult due to narrow right of way and deep seawalls. During full bridge replacements, phasing of work must consider how utility service will be maintained throughout construction.

At many bridges, there are overhead utilities crossing just outside of the bridge fascias, parallel to the bridge. These utility lines must be considered during phased construction, to ensure that cranes and other construction equipment can be safely operated. Utility agencies will need to be contacted and those lines relocated in order to perform bridge replacement activities.

Resiliency & Sea Level Rise

Resiliency and sea level rise must be considered in any replacement design. The relatively short bridges, ground elevations at existing touch down points, and proximity of residences and driveways make raising a new bridge much higher than the existing bridge it will replace unlikely. Other methods can be used to provide a longer life span and reduce long term maintenance costs, for example:

- Provide stainless steel or non-metallic carbon fiber reinforcing steel in concrete elements

- Incorporate concrete admixtures to provide improved resistance to chloride intrusion
- Provide additional cover concrete over internal reinforcing
- Use precast elements as much as practical to take advantage of better controlled fabrication in a casting yard or fabrication shop
- Provide tie downs to prevent high water from dislodging the superstructure during high tides

Using the latest design codes and referencing FDOT policies for materials, component design and construction specifications, all while keeping up with the latest research, will define specific actions to incorporate when design is initiated.

RECOMMENDATIONS

Of the 33 bridges in the study, 22 are recommended for replacement and 3 are recommended for rehabilitation over the next 20 years.

New bridges should be designed to meet Florida Department of Transportation design criteria as much as practical, as those criteria are updated annually and will reflect the latest research and data to provide the safest, longest lasting structure.

At the time of this master plan update, the 2018 (latest) edition of the Florida Green Book requires minimum 4 ft. wide sidewalks and 10 ft. wide lanes.

The costs to perform recommended actions have been estimated based on City of Fort Lauderdale past project bid tabulations and FDOT unit cost history using 2023 dollars. The replacement bridge length is assumed to be the same as the existing bridge and the bridge width is assumed to be the minimum required per current geometric criteria. The costs for design, construction, maintenance of traffic, utility work, construction inspection, and a factored contingency, have been broken out below for City budgeting purposes. Right of way costs have not been incorporated into the tabulated probable costs.

In order to account for special site-specific complexities that may be associated with construction, variables were applied to typical square foot unit costs:

- Approach Roadway Work – an increase of 10% was added to the design cost when it appeared likely that the approach roadway work would be more substantial, such as where a new bridge is wider than the existing and harmonization of the approaches to tie into the wider bridge is needed.
- Utilities – a decrease of 15% was accounted for in utility costs when 4 or more utilities are present, since there is overlapping effort to coordinate and relocate them, likely all in a similar manner.
- Construction Staging – an increase of 25% was applied to the new construction cost at locations where an obvious area to stage construction equipment and materials was not apparent, to account for costs associated with storing materials off site and trucking them in as needed,

having to stage deliveries carefully to make use of the available space, or additional costs associated with staging from barges in the waterway.

The following table summarizes the costs associated with each bridge, organized by the five-year program window in which action is likely to be required. Individual summary reports for each bridge are included in Appendix A; each report presents further discussion about bridge conditions and rationale for the long term recommendations associated with each structure.

Bridge No.	Feature Carried	Feature Intersected	Year Built	Construction Type	Recommendation	Timeframe (yrs)	Rehab/Repair Costs				
							Design	CEI/Admin	Construction	Contingency	Total Cost
865783	Harborage Isle Drive	New River Sound	2012	PS Slab	Maintain						
865784	Sunrise Key Blvd	Karen Canal	2016	PS Slab	Maintain						
865785	Isle of Venice Drive	Las Olas Canal	2016	PS Slab	Maintain						
865786	Fiesta Way	Las Olas Canal	2016	PS Slab	Maintain						
865787	Nurmi Drive	Las Olas Canal	2016	PS Slab	Maintain						
865788	Royal Palm Drive	Las Olas Canal	2016	PS Slab	Maintain						
865789	SE 15th Avenue	Marcheta River	2013	PS Slab	Maintain						
865790	SE 15th Avenue	Carlotta River	2013	PS Slab	Maintain						
865765	SE 13th Street	Cerro Gordo River	1952	RC Double-T	Replace	0-5	$ 847,000	$ 815,000	$ 4,461,000	$ 387,000	$ 6,510,000
865771	West Lake Drive	Estelle River	1956	RC Double-T	Replace	0-5	$ 474,000	$ 484,000	$ 2,654,000	$ 228,000	$ 3,840,000
865772	West Lake Drive	Diane River	1956	RC Double-T	Replace	0-5	$ 472,000	$ 488,000	$ 2,669,000	$ 231,000	$ 3,860,000
865773	West Lake Drive	Lucille River	1956	RC Double-T	Replace	0-5	$ 774,000	$ 770,000	$ 4,213,000	$ 363,000	$ 6,120,000
865774	West Lake Drive	Mercedes River	1956	RC Double-T	Replace	0-5	$ 563,000	$ 584,000	$ 3,197,000	$ 276,000	$ 4,620,000
TOTAL COSTS FOR WORK REQUIRED 0-5 YEARS:							**$ 3,130,000**	**$ 3,141,000**	**$ 17,194,000**	**$ 1,485,000**	**$ 24,950,000**
865782	SE 25th Avenue	Rio Idlewild Canal	1993	PS Slab	Rehab	6-10			$ 500,000		$ 500,000
865712	Castle Harbor Isle	Toulon Waterway	1956	RC Double-T	Replace	6-10	$ 250,000	$ 203,000	$ 1,120,000	$ 97,000	$ 1,670,000
865713	NE 41st Street	Toulon Waterway	1956	RC Double-T	Replace	6-10	$ 250,000	$ 188,000	$ 1,033,000	$ 89,000	$ 1,560,000
865727	NE 1st Street	Stranahan Lake	1940	Steel Beam	Replace	6-10	$ 250,000	$ 231,000	$ 1,269,000	$ 110,000	$ 1,860,000
865760	SE 7th Street	Rio Cordova	1972	PS Slab	Replace	6-10	$ 529,000	$ 540,000	$ 2,956,000	$ 255,000	$ 4,280,000
865770	Laguna Terrace	Diane River	1958	RC Double-T	Replace	6-10	$ 471,000	$ 480,000	$ 2,632,000	$ 227,000	$ 3,810,000
TOTAL COSTS FOR WORK REQUIRED 6-10 YEARS:							**$ 1,750,000**	**$ 1,642,000**	**$ 9,510,000**	**$ 778,000**	**$ 13,680,000**
865745	Solar Plaza Drive	Rio Canal	1971	PS Slab	Rehab	11-15			$ 500,000		$ 500,000
865746	Solar Plaza Drive	Rio Placid Canal	1971	PS Slab	Rehab	11-15			$ 500,000		$ 500,000
865761	SE 8th Street	Rio Cordova	1972	PS Slab	Replace	11-15	$ 501,000	$ 522,000	$ 2,860,000	$ 247,000	$ 4,130,000
865763	SE 10th Street	Rio Cordova	1972	PS Slab	Replace	11-15	$ 546,000	$ 563,000	$ 3,085,000	$ 266,000	$ 4,460,000
TOTAL COSTS FOR WORK REQUIRED 11-15 YEARS:							**$ 1,047,000**	**$ 1,085,000**	**$ 6,945,000**	**$ 513,000**	**$ 9,590,000**
865731	South Gordon Road	Las Olas Canal	1970	PS Slab	Replace	16-20	$ 527,000	$ 515,000	$ 2,824,000	$ 244,000	$ 4,110,000
865733	Hendricks Isle Drive	Las Olas Canal	1962	PS Slab	Replace	16-20	$ 527,000	$ 494,000	$ 2,705,000	$ 234,000	$ 3,960,000
865738	SE 23rd Avenue	Rio Del Mar	1966	PS Slab	Replace	16-20	$ 613,000	$ 566,000	$ 3,104,000	$ 267,000	$ 4,550,000
865739	SE 23rd Avenue	Rio Castilla Canal	1966	PS Slab	Replace	16-20	$ 613,000	$ 566,000	$ 3,104,000	$ 267,000	$ 4,550,000
865740	NE 23rd Avenue	Rio Aragon Canal	1968	PS Slab	Replace	16-20	$ 607,000	$ 554,000	$ 3,038,000	$ 261,000	$ 4,460,000
865741	NE 23rd Avenue	Rio Toledo Canal	1969	PS Slab	Replace	16-20	$ 607,000	$ 554,000	$ 3,038,000	$ 261,000	$ 4,460,000
865742	NE 23rd Avenue	Rio Giraldo Canal	1968	PS Slab	Replace	16-20	$ 607,000	$ 554,000	$ 3,038,000	$ 261,000	$ 4,460,000
865743	NE 26th Terrace	Rio De Sota	1969	PS Slab	Replace	16-20	$ 607,000	$ 554,000	$ 3,038,000	$ 261,000	$ 4,460,000
865762	SE 9th Street	Rio Cordova	1972	PS Slab	Replace	16-20	$ 512,000	$ 532,000	$ 2,915,000	$ 251,000	$ 4,210,000
865764	SE 11th Street	Rio Cordova	1972	PS Slab	Replace	16-20	$ 529,000	$ 547,000	$ 2,995,000	$ 259,000	$ 4,330,000
TOTAL COSTS FOR WORK REQUIRED 16-20 YEARS:							**$ 5,749,000**	**$ 5,436,000**	**$ 29,799,000**	**$ 2,566,000**	**$ 43,550,000**
TOTAL COST OVER 20 YEAR STUDY PERIOD:							**$ 11,676,000**	**$ 11,304,000**	**$ 63,448,000**	**$ 5,342,000**	**$ 91,770,000**

APPENDIX A – BRIDGE SUMMARY REPORTS

Bridge No.	Feature Carried	Feature Intersected	Year Built	Construction Type
865712	Castle Harbor Isle	Toulon Waterway	1956	RC Double-T
865713	NE 41st Street	Toulon Waterway	1956	RC Double-T
865727	NE 1st Street	Stranahan Lake	1940	Steel Beam
865731	South Gordon Road	Las Olas Canal	1970	PS Slab
865733	Hendricks Isle Drive	Las Olas Canal	1962	PS Slab
865738	SE 23rd Avenue	Rio Del Mar	1966	PS Slab
865739	SE 23rd Avenue	Rio Castilla Canal	1966	PS Slab
865740	NE 23rd Avenue	Rio Aragon Canal	1968	PS Slab
865741	NE 23rd Avenue	Rio Toledo Canal	1969	PS Slab
865742	NE 23rd Avenue	Rio Giraldo Canal	1968	PS Slab
865743	NE 26th Terrace	Rio De Sota	1969	PS Slab
865745	Solar Plaza Drive	Rio Canal	1971	PS Slab
865746	Solar Plaza Drive	Rio Placid Canal	1971	PS Slab
865760	SE 7th Street	Rio Cordova	1972	PS Slab
865761	SE 8th Street	Rio Cordova	1972	PS Slab
865762	SE 9th Street	Rio Cordova	1972	PS Slab
865763	SE 10th Street	Rio Cordova	1972	PS Slab
865764	SE 11th Street	Rio Cordova	1972	PS Slab
865765	SE 13th Street	Cerro Gordo River	1952	RC Double-T
865770	Laguna Terrace	Diane River	1958	RC Double-T
865771	West Lake Drive	Estelle River	1956	RC Double-T
865772	West Lake Drive	Diane River	1956	RC Double-T
865773	West Lake Drive	Lucille River	1956	RC Double-T
865774	West Lake Drive	Mercedes River	1956	RC Double-T
865782	SE 25th Avenue	Rio Idlewild Canal	1993	PS Slab
865783	Harborage Isle Drive	New River Sound	2012	PS Slab
865784	Sunrise Key Blvd	Karen Canal	2016	PS Slab
865785	Isle of Venice Drive	Las Olas Canal	2016	PS Slab
865786	Fiesta Way	Las Olas Canal	2016	PS Slab
865787	Nurmi Drive	Las Olas Canal	2016	PS Slab
865788	Royal Palm Drive	Las Olas Canal	2016	PS Slab
865789	SE 15th Avenue	Marcheta River	2013	PS Slab
865790	SE 15th Avenue	Carlotta River	2013	PS Slab