THE JACKSONVILLE SKYWAY ASSESSMENT PROJECT

EXISTING CONDITIONS HEALTH MAP – FIXED FACILITIES

NOVEMBER, 2014

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EXECUTIVE SUMMARY

A portion of the Jacksonville Skyway Technology Assessment Project is to develop an Existing Condition Health Map for the Guideway and Stations, or the fixed facilities. The reports that follow this summary include a detailed description of the findings and recommendations from a site inspection performed between September 30th and October 11th, 2014. G.M. Hill Engineering, Inc. prepared a report for the eight skyway stations, and FIT Engineering, LLC prepared a report for the guideway infrastructure.

This summary gives a brief overview of the findings and recommendations for various structural and non-structural items of the existing infrastructure. Near, mid, and long term recommendations are summarized for each aspect of the skyway system. Near term is considered from 0 to 5 years from today, mid term is 5 to 15 years, and long term recommendations are those which are thought of as being more than 15 years in the future. It should be noted that short term and mid term recommendations may be dependent on the long term alternatives chosen for the skyway system. For a more detailed analysis, please refer to the reports included in this submittal located in Appendix A and Appendix B.
THE JACKSONVILLE SKYWAY TECHNOLOGY ASSESSMENT PROJECT
EXISTING HEALTH MAP FOR THE GUIDEWAY AND FIXED FACILITIES – SUMMARY OF FINDINGS

INFRASTRUCTURE: SUMMARY OF FINDINGS AND RECOMMENDATIONS

SKYWAY GUIDEWAY – GENERAL DESCRIPTION

The guideway was built in five sections beginning in the mid 1980’s. Most of the guideway is built on its own infrastructure and within its own right-of-way, but the segment crossing the St. Johns River is supported by the Acosta Bridge and is barrier separated from the vehicular traffic. The guideway is split into a left guideway and a right guideway, for separate, two directional traffic. “Crossover” segments connect the two sides at strategic locations so that, for example, when a skyway vehicle comes in to a terminal station, it can cross over to the other side to make its way back in the opposite direction.

For much of the system, the two guideways run parallel and are within a few feet from each other. The guideways split apart to flank the stations and then merge back to parallel at locations between the stations. In the areas in which the guideways are close together, they share a substructure unit, typically a hammerhead or “T” shaped pier. Where they are separated, the left and right guideways have individual piers.

The material for all of the substructure units is concrete; typically conventionally reinforced, although there are pier caps on the north side of the river that are post tensioned. In several locations, there are steel cross beams or cross heads, but because they sit above the bearings, they are considered part of the superstructure, not the substructure. The superstructure is framed with two types of beams – concrete tee beams for the shorter spans and steel box girders for the longer spans and most of the curved spans.

SKYWAY GUIDEWAY – FINDINGS AND RECOMMENDATIONS

Drainage System

There are clogged, broken, and missing drain caps at deck level throughout the system. Many of the drain pipes are clogged with dirt and debris. There are multiple locations along the system in which water is ponding on the deck surface due to a variety of issues. It is imperative that maintenance and repairs be done to fix these drainage issues. Refer to the full report for a list of maintenance procedures that should be followed.

Encroachment and Vegetation growth

There are trees encroaching on the Skyway beams at various places. Specific locations cited in the most recent routine inspection report include Span 30 (Bay Street near Broad), Spans 66, 67, 68, 70, 72, 74, 75, 77, 79 (along Hogan Street), and Spans 199 and 200 (at Kings Avenue Station). There is vegetation growing around and on the columns at the O&M Pier 403, and Pier 408 Left. See Photos 4 and 5 in Appendix A for reference.

The growth on Pier 408L should be removed. Trees in contact with the guideway beams or overhanging the sidewalls should be trimmed back. An annual plan to periodically trim trees that are encroaching on the system should be added to the maintenance procedures.
Emergency Walkway

Galvanized emergency walkways are present everywhere throughout the system except at the stations, where passengers can exit directly onto the station platforms.

Overall, the emergency walkway is in good condition. The only structural defect noted in the South Segment is that the grating cover plates are not wide enough over the expansion joints at Acosta Bridge Piers R1 and R6 to fully cover the gap produced by the bridge deck contraction, especially in the winter time. The few minor structural defects noted in the North Segment include missing connectors, loose/missing expansion cover plates, and nuts not fully engaged. There is light to moderate surface corrosion on the emergency walkway grating, grating clips, clip bolts, railings, and support brackets and bolts at various locations throughout the system. Refer to the full report for a list of maintenance procedures that should be followed.

Expansion Joints

The main issue associated with the typical expansion joints are more a function of design as opposed to normal wear and tear. Because the design of the system results in the joint for the guidebeam elements not to line up with the joints for the deck, the guidebeam elements are forced to slide back and forth with the deck expansion and contraction. This design doesn’t have the best practical results as there is a lot of concrete mass expected to move back and forth which often results in cracking and spalling of the moving components.

Another issue with the expansion joints occur when the two beams are no collinear. This presents both longitudinal and lateral movement and the joint must be designed for both. A way to fix this issue includes taking field measurements at full expansion and contraction. Once this data is obtained, an engineered solution detailing these joints should be done to ensure proper movement in all directions are accounted for.

Refer to the full report for a list of maintenance procedures that should be followed.

Deck Elements

Two types of “decks” exist along the guideway system and these “decks” are functions of the superstructure type. In the spans composed of double tee concrete beams, the deck is simply the top flange of the beams. When the spans that are composed of steel boxes, the deck resembles a typical bridge deck – 8” cast-in-place, traditionally reinforced concrete deck.

There is dirt and debris build-up on top of the deck surface throughout the system. The undersides of the deck overhang slab extensions (at the switch beams) have transverse hairline cracks with efflorescence. The conduit support boxes that run along the sidewalls have a minor amount of corrosion at random locations.
Concrete spalling is prevalent throughout the deck area. Most of the spalling on the north section is along the old second pour and the running surfaces.

Refer to the full report for a list of maintenance procedures that should be followed.

Sidewalls

The barriers along the outsides of the typical sections are referred to as “sidewalls”. The sidewalls were cast in place and made integral with the deck. Reinforcement for the sidewalls was cast within the tee beam flanges or within the deck above the steel boxes. See Appendix A - Figure 9 for typical details.

Two prominent deficiencies associated with the sidewalls are typical reinforced concrete defects: cracking and spalling. In the latest routine inspection report, there are comments regarding spalls at 67 locations along the South Segment guideway, 28 of which have exposed reinforcement.

Guidebeam

The guidebeam is essentially a hollow concrete box that sits upon a longitudinal pedestal and runs along the top of the deck surface. It is the riding surface of the skyway vehicle.

The most prominent deficiency associated with the guidebeam is nearly ever-present longitudinal cracking along the centerline of the guidebeam. The widths of these cracks vary, from hardly visible hairline cracks to 1/32” wide. Refer to the full report for a list of maintenance procedures that should be followed.

Concrete Tee Beams

Nearly 70% of the guideway is framed with prestressed concrete tee beams. The beams are typically grouped in three or four span units made continuous over the piers by post tensioning tendons that run through the beam top flanges and through the pier cap.

The primary issue of concern with the tee beams is the diagonal and radial cracking of the stems at the dapped ends. Refer to the full report for a list of maintenance procedures that should be followed, as well as a more detailed review of these cracks, FRP Strengthening that has been done, and crack injection repair work that has been completed.

Steel Box Girders and Cross Beams

86 of the 322 guideway spans are framed with steel box girders; representing about 26% of the superstructure. The steel boxes are used at most curved sections and at the long span tangent sections of the guideway.

Many of the steel box access hatches have hasp latches and most, if not all, are not locked. The starter line hatches are secured with bolts, but there are no nuts on the ends.
A review of the most recent routine inspection report indicates that overall, the steel beams are in good condition. There are no significant structural deficiencies and there are no signs of structural distress. It is apparent, however, that the coating system is reaching, if not past the end of its service life. According to the FHWA Steel Bridge Design Handbook Vol. 19, 3-coat, zinc-rich primer paint systems data suggest performance of 25 years in less aggressive, non-marine environments. With the system being built between the late 80’s and late 90’s, the current coating system is between 25 to 30 years old. The exterior surface coating is breaking down, as evidence by its chalky nature, but fortunately, only a small percentage of the total surface area has succumbed to the corrosion process. Refer to the full report for a list of maintenance procedures that should be followed.

Piers

Pier styles, sizes and shapes vary along the guideway and depend on a number of factors such as station vicinity, surrounding infrastructure and roadway constraints, superstructure type, and required beam continuity.

The piers, for the most part, are in good condition. Hairline cracking is prevalent throughout, on both the pier caps and the pier columns. Please refer to the full report for a detailed discussion on crack locations and types of cracks at the Piers.

Bents and Walls

On the north side of the river, after the guideway crosses the Acosta Bridge, it makes a right turn and goes beneath FDOT Ramps K and G. In this area, for approximately 332 feet, the guideway deck is pile supported with walls along the outer sides and transverse end bents at each end of the span.

In general, the walls surrounding the pile supported slab span are in good condition. Minor structural defects exist such as cracking along cold joints, map cracking of the end bent cheek walls, and spalling up to 8”x6”x1” on the rustications of the wall faces. There is no exposed steel or rust staining to indicate rebar corrosion. The transverse wall faces are stained from runoff through the expansion joints.
SKYWAY STATIONS – FINDINGS AND RECOMMENDATIONS

The eight skyway stations are:

1. Terminal (Convention Center) Station
2. Jefferson Station
3. FSCJ (Rosa Parks) Station
4. Hemming Plaza Station
5. Central Station
6. Kings Avenue (Dupont) Station
7. Riverplace (Flagler) Station
8. San Marco Station

Extensive rust and corrosion at metal surfaces was observed at multiple locations. At some rail posts, the corrosion is extensive and posts either need to be replaced or will need to be replaced in the near future. Rust was noted at concrete spalls with and without exposed rebar.

Surfaces, primarily metal, in need of painting were observed at multiple locations at the stations. Many of the metal surfaces also require removal of minor rust or corrosion prior to painting. Expansion joint material was observed to be damaged, deteriorated, or missing at the stations. This will require regular and ongoing maintenance.

Concrete spalls were observed at multiple locations. Spalls at stair nosings are evident and new spalls may develop near existing spalls or at new locations.

Cracking at concrete surfaces was observed at multiple locations. Cracks at rail posts at stairs are common and contributing to additional damage. These cracks are also contributing to moisture damage and corrosion to the reinforcing steel. These cracks will require regular and ongoing maintenance.

Water intrusion was observed at multiple locations. This water damage causes structural and cosmetic damage, rust/corrosion, mold, and mildew. Every effort should be made to limit water damage and remove the standing water that occurs. Many drains are clogged and improperly installed. Standing water also pose a safety and fall hazard.

Near Term Recommendations

For short term structural serviceability, it has been determined that the current stations are adequate to handle the original design loadings. It should be noted that minor serviceability and structural issues discussed above, and in more detail in the report, can turn into mid or long term issues if they are not handled correctly and in a timely manner. Refer to the report for a detailed description of maintenance procedure that should be carried out to protect the mid and long term sustainability of the stations.
Mid Term Recommendations

For mid term structural serviceability, the maintenance and repairs must continue to be monitored and completed in order to maintain the structure as it is today. More routine maintenance for concrete repairs will be necessary. It has been determined that, if no plans to modify the existing station or to change the current train loadings are put in place, the current station will be adequate to handle the original design loads. If plans to modify the existing station or to change the train loading are put in place, then a detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any expansion or renovation that may be necessary.

Long Term Recommendations

For long term structural serviceability, it is likely that plans to modify the existing station or to change the train loads will occur. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any expansion or renovation that may be necessary.

The Full Reports

It is worth noting again, that the full reports have a more detailed analysis and discussion on all the areas summarized above. The purpose of this summary is to relay the most important issues found during the inspection and to help “drill down” to the most important structural and maintenance issues that the Skyway Infrastructure system faces today.
CONCLUSIONS & RECOMMENDATIONS

Guideway Infrastructure

Based on our preliminary findings we recommend that JTA consider the following improvements for the Guideway Infrastructure:

Near Term (0-5 years):

- Drainage repairs and Maintenance
- Vegetation Trimming
- Perform repairs from recent inspection report
- Cleaning and repairing spalls in Deck elements
- Repairing Expansion Joints
- Spot Painting of the Steel Beams and components and Bearings in necessary locations
- Steel Beam Maintenance access locks
- Cleaning and Repairing Spalls in Pier elements

Mid Term (5-15 years):

- Engineered drainage solution to alleviate ponding issues
- Vegetation Trimming
- Galvanic coating to the walkway
- Crack control maintenance in Deck elements
- Engineered solution to expansion joint problems
- Comprehensive analysis of Tee Beams and Load Bearing Capacity
- Comprehensive coating system for Steel Beams and other steel components
- Map the cracks in Piers

Long Term (15 years +)

Recommendations for the long term will be dependent on the alternative analysis and potential modifications or replacement of existing system and will be provided with the draft final report submittal.

Skyway Stations

Based on our preliminary findings we recommend that JTA consider the following improvements for the Skyway Stations:

Near Term (0-5 years):

- Repair/replace rusted and corroded elements
- Painting of metal elements
- Monitor expansion joints
- Cleaning and repairing spalls in concrete elements (including stair nosings)
- Monitor concrete cracking
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- Eliminate standing water

Mid Term (5-15 years):

- Replace expansion joints that are failed
- Fix concrete cracks as necessary based on prior monitoring (See above)
- Engineered drainage solution to alleviate ponding issues
APPENDIX A
Existing Conditions Health Map – Fixed Facilities
Guideway Infrastructure
The Jacksonville Skyway Technology Assessment Project

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Draft Report Submitted on 10/27/2014
# Existing Conditions Health Map – Fixed Facilities
## Guideway Infrastructure
### The Jacksonville Skyway Technology Assessment Project

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INTRODUCTION

This report is a component of the Jacksonville Skyway Technology Assessment Project, for which Lea + Elliott is the prime consultant and FIT Engineering is a subconsultant. FIT Engineering is part of the infrastructure assessment team lead by RS&H.

Task 1.5 of the Project is to develop an Existing Condition Health Map for the guideway fixed facilities. These facilities include the passenger stations, the guideway infrastructure and the maintenance and storage facilities. This report represents the portion of the Health Map pertaining to the guideway infrastructure – the superstructure and substructure “bridge” components of the guideway.

The data gathered to develop this report comes from two sources – a detailed documents review and a field inspection. The documents that were reviewed include the As-Built plans for all five segments, the most recent routine inspection reports (two volumes, written by TranSystems), and condition reports related to tee beam cracking and the guideway switchbeams. The field inspection was performed between September 30th and October 11th, 2014. Given that the total length of the guideway system is over four miles long (considering the left and right sides independently), and the amount time allotted for the inspection, the field work can more accurately be likened to a “cursory walkthrough” than an in-depth or even routine inspection.

This report presents the findings of the two efforts just mentioned. It is structured such that each element of the guideway infrastructure system is addressed independently starting with non-structural elements, followed by the deck and related components, then by the superstructure elements, and finally those components associated with the substructure. Each section contains a description of the element, a condition assessment summary, and repair or maintenance recommendations.
GENERAL DESCRIPTION OF THE SKYWAY INFRASTRUCTURE

The guideway was built in five sections beginning in the mid 1980’s. Most of the guideway is built on its own infrastructure and within its own right-of-way, but the segment crossing the St. Johns River is supported by the Acosta Bridge and is barrier separated from the vehicular traffic. The guideway is split into a left guideway and a right guideway, for separate, two directional traffic. “Crossover” segments connect the two sides at strategic locations so that, for example, when a skyway vehicle comes in to a terminal station, it can then cross over to the other side to make its way back in the opposite direction.

For much of the system, the two directions run parallel and are within a few feet from each other. The guideways split apart to flank the stations and then merge back to parallel in between the stations. In the areas in which the guideways are close together, they share a substructure unit, typically a hammerhead or “T” shaped pier. Where they are separated, the left and right guideways have separate piers.

The material for all of the substructure units is concrete; typically conventionally reinforced, although there are pier caps on the north side of the river that are post tensioned. There are a few steel cross beams or cross heads, but because they sit above the bearings, they are considered part of the superstructure, not the substructure. The superstructure is framed with two types of beams – concrete tee beams for the shorter spans and steel box girders for the longer spans and most of the curved spans.

The following five sections (lines) are shown in Figure 1 below.

- North Segment: Blue – Starter Line; Red – North Line
- South Segment: Green – O&M Line; Orange – River Line; Purple – South Line

Figure 1. Guideway Map
NON-STRUCTURAL RELATED CONCERNS

Drainage System

Description

Components of the deck drainage system are located at almost every pier. For piers in which the top surface of the pier cap is flush with the deck riding surface (most common), the drainage system is composed of 4” PVC pipes cast within the pier cap and column and runs out at the base of the column.

At locations where the pier cap is not flush with the top of deck (where the steel box girder is continuous over the pier for example), the 4” pipe (either PVC or steel) is cast into the concrete deck and runs down vertically or diagonally (within or outside of the boxes) to meet an open receiver at the top of the pier, and the remainder of the drainage pipe is cast within the pier column. Per design, at deck level all pipes are capped with snap-in drains. See Figure 2 for typical deck drainage details.

Condition

There are clogged, broken and missing drain caps at deck level throughout the system. Many of the drain pipes are clogged with dirt and debris.

There are multiple locations along the system in which water is ponding on the deck surface due to a variety of issues. An example of such location is at Pier 242, Right Guideway. This pier is just north of the San Marco Station and carries a continuous curved section of steel box girders on an incline toward the Acosta Bridge. An excerpt from the As-Built plans in Figure 3 details the drainage scheme at this pier. Notice that the pipe inlets are located on the inside deck of each guideway section. Photo 1 was taken looking back at the right guideway. The flow dam seen in the photo is typical at piers along the system where the guideway profile is sloped, to help control stormwater flow. At this particular
location, the stormwater is ponding on the low side of the deck which is a function of the profile and cross slope and is being trapped by the flow dam.

![Figure 3. Pier 242 Drainage Details](image)

The ponding water at Pier 242 described above is just one example of a situation along the system that is preventing the stormwater from draining properly. There are others.

Another example is the Right Guideway at the San Marco Station. A discussion with Skyway Maintenance indicates that ponding water along this section is a constant. The completely corroded transverse utility pipes shown in Photo 2 that cross the guideway along the deck provide verification to that notion. At this location, the guideway is a three span continuous concrete tee beam unit spanning from Pier 237 to Pier 240. In this area, the profile grade is flat and then begins to incline in Span 240 on the turn.

![Photo 1. Pier 242 Looking Back, Rt. Guideway](image)

![Photo 2. Corroded Utility Pipe on Rt. Guideway at San Marco Station](image)
toward the Acosta Bridge. This means that all of the rain that falls in that span (113’ in length) runs back down to the flat area between Piers 237 and Pier 240. There are scuppers at Piers 237 and 240 (none at 238 and 239). The problem is that the scuppers are located on the exterior (right) side of the guidebeam and the guidebeam pedestal in this area is constant; not intermittent. As such, all the rain that collects on the deck between the interior sidewall and the guidebeam pedestal is trapped, with no way to reach the two scuppers located on the other side of the guidebeam.

There are a few isolated locations in which the exposed pipe at a steel box section is broken, bent, or missing. See Photo 3 below.

Photo 3. Missing Drainage Pipe Segment at Pier 242

Short Term Recommendations (0-5 Years)

A well-functioning deck drainage system helps prevent deterioration of the deck, other structural members, utility components, and guidebeam operational components. The following recommendations should be performed as soon as possible and ought to be part of a regular maintenance program which could coincide with joint and deck cleaning activities.

- Clear the debris from around all deck drains.
- Clean out all clogged drain pipes. The mechanism for doing this will depend on how clogged the pipe is and the drainage design at each location - whether the pipe discharges at ground level or discharges underground into a stormwater control structure.
  Hand tools can be used to remove the debris from the pipe ends where accessible. High pressure water or vacuum units can be used at the top and/or bottom to clear the pipe of debris.
- The drain pipes should be tested and flushed with water to ensure unimpeded flow.
- Replace all broken and missing drain caps and all broken, bent, and missing exposed pipe segments.
Mid Term and Long Term Recommendations

Cleaning out the drain pipes and restoring the caps will relieve some of the water ponding and drainage issues. There are some locations throughout the system which will require more than a maintenance solution however. The following is a list of recommendations that could be implemented to help solve the remaining drainage problems. The first couple steps can be implemented in the near term and then the outcome will determine when the next steps are implemented – depending on complexity and required and available resources.

1. Inventory the locations with long term water ponding issues.
2. Determine the reason for the ponding at each location – what is preventing the water from reaching the drains.
3. At each location, decide if a simple solution is available (like removing a single flow dam or clearing out a thru pipe beneath the guidebeam). Implement, or develop a plan to implement, the solution.
4. If a simple solution is not available, make plans to investigate an engineered solution. Perhaps this entails piping through the guidebeam pedestal or coring through the deck and installing additional means of conveyance.

Encroachment and Vegetation Growth

There are trees encroaching on the Skyway beams at various places. Specific locations cited in the most recent routine inspection report include Span 30 (Bay Street near Broad), Spans 66, 67, 68, 70, 72, 74, 75, 77, 79 (along Hogan Street) and Spans 199 and 200 (at Kings Avenue Station). There is vegetation growing around and on the columns at the O&M Piers 403, and 408 Left. See Photos 4 and 5 below.

The growth on Pier 408L should be removed. Trees in contact with the guideway beams or overhanging the sidewalls should be trimmed back. An annual plan to periodically trim trees that are encroaching on the system should be added to the maintenance procedures.

Photo 4. Tree growth beneath Skyway Beams

Photo 5. Pier 408 Left
Emergency Walkway

Description
The galvanized emergency walkway is present everywhere throughout the system except at the stations, where passengers can exit directly onto the station platforms. The walkways are attached to the sidewalls in two different configurations. Where the clear distance between tops of the left and right guideway interior sidewalls is greater than 5'-6", a separate walkway for each guideway is supported on brackets cantilevered from each interior sidewall. Where the clear distance is 5'-6" or less, a common walkway is present, supported by both sidewalls. See Figure 4.

Condition
Overall, the emergency walkway is in good condition. The only structural defect noted in the South Segment is that the grating cover plates are not wide enough over the expansion joints at Acosta Bridge Piers R1 and R6 to fully cover the gap produced by the bridge deck contraction, especially in the winter time. A few minor structural defects noted in the North Segment include missing connectors, loose/missing expansion cover plates, and nuts not fully engaged. There is light to moderate surface corrosion on the emergency walkway grating, grating clips, clip bolts, railings, and support brackets and bolts at various locations throughout the system. See Figure 5 below.

Figure 4. Typical Emergency Guideway Connection Details

Figure 5. Typical Emergency Walkway Surface Corrosion Locations
**Short Term Recommendations (0-5 Years)**

It is recommended to perform the repairs listed in the most recent routine inspection report. These generally include tightening and installing missing clips and bolts, securing loose expansion plates, and installing new (wider) cover plates at the two Acosta Bridge expansion joints. See the routine inspection reports for specific locations in need of repair.

At every location along the emergency walkway in which the corrosion level is “moderate”, remove the corrosion with a wire brush or rotary tool and spray the area with a cold galvanizing compound. Based on the field inspection and a review of the routine inspection report, this level of corrosion is isolated to a small percentage of support brackets.

**Mid and Long Term Recommendations**

If it is anticipated that this system is going to remain operational for decades to come, then adding walkway maintenance procedures to a regularly scheduled maintenance plan would be beneficial in prolonging the conditional integrity of the system and could perhaps ward off costly repair efforts down the road.

Maintenance-wise, the primary issue with the walkway is the galvanic coating. At present-time, there are numerous locations in which the galvanizing is starting to break down and surface corrosion is beginning to occur. A feasible long term maintenance action could simply be to clean and spray cold galvanizing compound on areas that reach a determined and specified corrosion threshold. This could be done for the entire system on a biennial basis upon receipt of the routine inspection reports. Another possibility could be to perform the work on a continual basis throughout the year by having the JTA Maintenance crew inspect the system and address the issue one section at a time, spread out throughout the year and then starting again the following year.
DECK ELEMENTS

Expansion Joints

Description

There are three sets of expansion joints at most expansion piers. Because the top of pier cap is level with the top of deck, an expansion joint is needed at each deck/cap interface, one for the back span and one for the forward span. These deck joints are compression seals located on either side of the pier cap, adhesively bonded to the pier caps along one edge and to the deck or beam flange along the other. The distance between these joints is three feet (the width of the top of the cap).

The third expansion joint location is at the centerline of the pier and this is where all of the concrete elements above the deck have a joint. This includes the sidewalls, the guidebeam, and either the guidebeam pedestal or for the older lines, the second pour and running surfaces.

Because the joints in the elements above the deck do not line up with the joints in the deck, the design called for neoprene pad bond breakers to be inserted in-between so that the elements above the deck can slide back and forth with the expansion and contraction of the deck itself. See Figure 6.

Condition

The main issue associated with the typical expansion joints are more a function of design than normal wear and tear. Because the design of the system results in the joint for the guidebeam elements not to
line up with the joints for the deck, the guidebeam elements are forced to slide back and forth with the
desk expansion and contraction. This design doesn’t have the best practical results as there is a lot of
concrete mass expected to move back and forth which often results in cracking and spalling of the
moving components.

The design plans call for the top of deck and the top of the pier caps to match in elevation. There are
multiple locations where this requirement was not met and there is a vertical offset between the deck
and cap (See the Deck section of this report for a photo). This offset results in an uneven surface for the
guidebeam components to slide back and forth on and induces moment forces in them, resulting in a
bunching up of the bond breaker and further degradation of the concrete.

Given that the system was designed segmentally over time, there are slight differences in the
configurations at the expansion piers for each segment. Along the South Segment, only the guidebeam
and pedestal slide relative to the deck top. Along the starter line, the guidebeam, guidebeam pedestal,
as well as the old second pour and running surfaces slide relative to the deck top. Along the north line,
the second pour is cut such that there is a 3’ wide piece that sits above the pier cap, thus reducing the
amount of sliding mass to just the guidebeam and pedestal. Note that in all configurations, the
sidewalls also slide relative to the deck top. See Photos 6 thru 8.
Photo 7. Typical Expansion Joint Configuration at a Starter Expansion Pier

Photo 8. Typical Expansion Joint Configuration at a North Expansion Pier
Guidebeam Expansion Joints

As previously mentioned, guidebeam expansion joints are located at every expansion pier. The expansion joints are composed of sliding steel plates on the top surface of the guidebeam and finger joints on the sides of the guidebeam. The steel components are in good condition, with minor surface corrosion noted here and there. See Photo 9.

There are multiple locations in which the concrete closure pours, to which studs for the expansion components are embedded, have spalled and have been patched or are cracked. The spalling issue is especially true in the guidebeam pedestal due to the joints not being aligned as previously mentioned.

Acosta Bridge Expansion Joints

A detailed switch inspection was performed by Mountford Consulting Services in May of this year (2014). Mr. Mountford’s report, submitted in June, should be reviewed for details regarding the condition of the switch components. During his inspection, Mr. Mountford inspected the expansion joints at the Acosta Bridge. Below are his findings:

- Most of the finger plates are not in contact with the embed across the expansion joint
- The most urgent issue is the undermining of the embed on the Left Lane on the South Side of the Bridge (on the Ground/Signal side of the guide beam)

There are 74 piers in the guideway system that have expansion joints. The compression seal deck joints throughout the system are filled with dirt and debris. In addition to the cracking and spalling of the guidebeam elements caused by the unaligned joint configuration, other joint deficiencies include the following: compression seal adhesion failures, over compressed seals, and damaged, short, or missing seal material. See Photos 10 thru 13 below.
Recommendations

Regarding the joint misalignment:

As previously discussed, the misalignment between the deck joints and the guidebeam joint requires the guidebeam components to slide relative to the deck, which in-turn causes cracking and spalling. Spalled off pieces of concrete can get into and disrupt the serviceability of the skyway vehicles. Patching of these spalls has been performed multiple times throughout the service life of the system. Conversations with the maintenance crew indicate that workers patch the concrete in an effort to fix the problem without knowledge of the design and how the components are expected to function with respect to each other. This inadvertently results in joints and gaps being filled in, where they should remain clear.
In the short term, it is recommended to remove all unsecure concrete and thoroughly clean out the joint areas. Any further patching should be performed by a crew knowledgeable in the design and function of these joints.

In the long term, an engineered solution to retrofit the joints should be investigated. Perhaps this could involve retrofitting the guidebeam expansion joint, replacing the single joint with two that coincide with the deck joints. Another option would be to retrofit the current configuration by replacing the bond breakers with thin sliding plate bearings.

Once a solution is designed, it can then be implemented in the locations with the worst conditions. This course of action would only be taken if it is determined that the Skyway shall remain operational long term and that the infrastructure and guidebeam configuration should remain as-is. Also, if the Skyway is extended, the designers should be made well aware of the flaws with this particular joint detail.

Regarding the compression seals in the deck:

Maintaining deck joints by keeping them clean, secure, and waterproof is vital to maintaining the serviceability and prolonging the life of a structure. The purpose of the deck joint is to allow the movement of the deck while preserving the portions of the structure below the joint by preventing water and debris from accumulating on them. Failure to maintain deck joints could result in damage to beam ends, end diaphragms, bearings, and substructure units.

The recommended course of action is dependent upon the anticipated service life of the structure and the superstructure material at the deteriorated joint locations. If the material below the joint is steel – steel box beam and steel bearing components - then it is important to replace the joint sealant to prevent accelerated corrosion and coating degradation.

If the material below the joint is concrete – concrete tee beam with neoprene pads – then replacement of the sealant isn’t as vital. The primary issue in this situation is unsightly debris and water staining. In this case, replacement of the seals should be determined based on location, visibility, and intended service life. Specific recommendations are as follows:

- **Short Term:** Remove all dirt and debris from deck joints. This should be performed as soon as possible and on an annual basis.
- **Mid Term:** Consider replacement of failed compression seals at locations with steel beams and/or steel bearings.
- **Long Term:** If a long term service life is desired, consider replacement of failed compression seals at locations with concrete beams that are visible and in high traffic areas.

Regarding the Acosta Bridge guidebeam joints:

The following recommendation was made by Mr. Mountford in his switchbeam report provided during the summer of this year:

“It is recommended that the JTA review the current condition and begin planning for a repair that will stabilize the embed to prevent further degradation of the closure pour as well as ensure the finger plates have contact on both sides of the expansion joint to minimize noise and deflection of the finger plates under vehicle loading.”
Deck

Description

Two types of “decks” exist along the guideway system and are functions of the superstructure type. In the spans composed of double tee concrete beams, the deck is simply the top flange of the beams. In the spans that are composed of steel boxes, the deck resembles a typical bridge deck – 8” cast-in-place, traditionally reinforced concrete deck.

Both the Starter and North lines were built prior to the conversion to the current bombardier vehicle and guidebeam system. The decks along these lines had to be retrofitted to accommodate the new system – this was done in the late 1990’s.

Figure 7 depicts the typical section prior to the modifications. In this old configuration, there is a 5” second concrete pour on top of the deck, with two 6 ½” x 14” running surfaces, automatic train control rails, a negative return rail, and guiderails connected to the sidewalls.

In the current system, there is a guidebeam that runs along the center of the guideway with low voltage and high voltage power rails attached to the sides of the guidebeam. See Figure 8 (power components not shown).

Condition

There is dirt and debris build-up on top of the deck surface throughout the system.

The undersides of the deck overhang slab extensions (at the switch beams) have transverse hairline cracks with efflorescence. Transverse cracking of the top surface of the cast in place deck (up to 1/32” in the steel box spans) is present at multiple locations on the South Segment of the system. Also, the second pour concrete over the Acosta Bridge exhibits hairline transverse surface cracks. Much of the deck top surface on the north segment is not inspectible because of the presence of the 8’ wide second pour.

The conduit support boxes that run along the sidewalls have a minor amount of corrosion at random locations. Many of the electrical conduits that run transversely across the top of the deck have moderate to severe corrosion due to the prolonged contact with ponding water and wet debris. See Photos 14 thru 17.
Concrete spalling is prevalent throughout the deck area. Most of the spalling on the north section is along the old second pour and the running surfaces. These elements are relics from the previous system, so the spalling isn't very consequential. Spalling is present along the compression joint seals throughout the system. See the previous section of this report for more information regarding the joints.
**Sidewalls**

*Description*

The barriers along the outsides of the typical sections are referred to as “sidewalls”. The sidewalls were cast in place and made integral with the deck. Reinforcement for the sidewalls was cast within the tee beam flanges or within the deck above the steel boxes. See Figure 9 for typical details.

*Condition*

Two prominent deficiencies associated with the sidewalls are typical reinforced concrete defects: cracking and spalling. In the latest routine inspection report, there are comments regarding spalls at 67 locations along the South Segment guideway, 28 of which have exposed reinforcement.

There are comments regarding spalls at 220 locations along the North Segment guideway; 90 with exposed reinforcement. The average spall area is 24 square inches and the average spall depth is 3/4 inch.

Sidewalls along both sections exhibit full depth vertical cracks, hairline to 1/64” wide, some with efflorescence. See Photos 18 thru 21.

![Figure 9. Sidewall Details](image)

Photos 18 thru 21. Typical Sidewall Cracking and Spalling
Guidebeam

Description

The guidebeam is essentially a hollow concrete box that sits upon a longitudinal pedestal and runs along the top of the deck surface. It is the riding surface of the skyway vehicle. Power rails are attached along both sides of the guidebeam. One side is the low voltage side carrying the signal loop, grounding bus rail and 120 volt bus rail. The other side is the high voltage side carrying three bus rails for 3 phase 480 volt power. See Figure 10 for a typical section of the guidebeam itself (power rails not shown).

Switches are located strategically throughout the system to allow for guidebeam directional changes. There are cross-over switches that allow the vehicle to transfer from one track to its parallel counterpart and there are switches to facilitate the merging between the O&M Line and the River Line and the merging between the River Line and the Starter Line.

At the switches, the guidebeams, known as switchbeams rotate on tracks to make the crossover or merge connection. Because of this rotation and beam curvature, the switchbeams are built of painted steel shells, rather than concrete. See Photo 22 for a typical crossover switch configuration.
Condition

The switchbeam coating is subjected to direct UV rays, day in and day out. The paint is very chalky, which is a direct result of UV degradation. Also, there is a minor amount of surface corrosion in various locations on the steel switchbeams and switch components. Recommendations to address the steel coating of the switchbeams are included within the Steel Box section of this report. See that section for further details.

The most prominent deficiency associated with the guidebeam is nearly ever-present longitudinal cracking along the centerline of the guidebeam. The widths of these cracks vary, from hardly visible hairline cracks to 1/32” wide. See Photo 23 below for an example of the worst condition. Additional deficiencies include vertical hairline cracks on the sides of the guidebeam and cracking and spalling of the guidebeam pedestal.

Photo 23. Guidebeam Longitudinal Cracking
Recommendations for Deck Concrete Components

Short Term Recommendations (0-5 Years)

Cleaning: The top surface of the deck should be cleaned and this effort should be added to an annual maintenance plan along with the cleaning of the deck joints previously discussed. When cleaning the deck, remove and collect all debris by hand sweeping, high-pressure water/air, or mechanical devices. Material should be collected and disposed of properly without depositing the material into the deck drains. Cleaning of the sidewalls and guidebeam should be included with the deck cleaning activities to remove the dirt and mineral deposits, moderate to heavy staining, algae growth and efflorescence.

Spalling: Patch all spalls with exposed reinforcement according to the FDOT Bridge Maintenance and Repair Handbook. See the section entitled “Notes on Spalling” toward the end of this report for further information.

Mid Term and Long Term Recommendations

Cracking: Develop and implement a plan to seal cracks where necessary, in the deck, sidewalls and guidebeam. This is especially important if it is deemed that the system will be utilized as-is (and possibly extended) for a long time to come. The FDOT Standard Specifications for Road and Bridge Construction (Spec Book) provides criteria to determine when sealing is necessary and what methods should be used based on three criteria: crack density, crack width, and environmental classification. See the section entitled “Notes on Cracking” toward the end of this report for further information.

In order to develop this crack sealing plan, it will be important to thoroughly document average crack widths and densities on all elements throughout the system because this information will determine the best solutions to implement. Utilizing the latest routine inspection report is a great start, as there is a significant amount of information provided regarding crack size, type, and location. However, given the expansiveness of the Skyway system and the cost associated with treatment, it would be prudent to inspect the system specifically for this purpose. Perhaps this could be done in conjunction with a future routine inspection and a matrix could be pre-developed and the data populated in the field. This type of inspection would document whether the crack densities in specific areas are isolated, occasional, moderate, or severe as defined by the Spec Book. It would also document the ranges of crack widths in the areas based on those outlined in the Specs Book. When the inspection is complete, all of this documented information would yield a matrix directly correlating to the most appropriate repair solutions at specific locations all over the system. The appropriate solution will vary from location to location, but will either be “no treatment required” or to apply a sealer (penetrating sealer or methacrylate) or to epoxy inject.

Spalling: Similar to the cracking plan, the spalls throughout the system should be patched and maintained if it is deemed that the system will be utilized as-is (and possibly extended) for a long time to come. See the section entitled “Notes on Spalling” toward the end of this report for further information.
SUPERSTRUCTURE ELEMENTS

A summary of the superstructure elements is given in Table 1 below.

<table>
<thead>
<tr>
<th>Superstructure Type</th>
<th># of Spans</th>
<th>Avg. Span Length</th>
<th>Max Span Length</th>
<th>Total Length (along BL)</th>
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</thead>
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<td>69.21</td>
<td>93.97</td>
<td>15,018.2</td>
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<td>Double Tee – Conventional Reinf. Concrete</td>
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<td>543</td>
</tr>
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<td>Double Tee – PT Stems (curved stems)</td>
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<td>78.87</td>
<td>91.60</td>
<td>394.34</td>
</tr>
<tr>
<td>Pile Supported Slab</td>
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<td>331.6</td>
<td>331.60</td>
<td>331.6</td>
</tr>
<tr>
<td>Reinforced Concrete Slabs</td>
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<td>Steel Box Girders</td>
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<td>9563.16</td>
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<td><strong>Totals &amp; Averages</strong></td>
<td><strong>322</strong></td>
<td><strong>80.61</strong></td>
<td><strong>331.60</strong></td>
<td><strong>25,956.55</strong></td>
</tr>
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</table>

Tee Beams

Description

Nearly 70% of the guideway is framed with prestressed concrete tee beams. The beams are typically grouped in three or four span units made continuous over the piers by post tensioning tendons that run through the beam top flanges and through the pier cap. See Figures 11 and 12 below. In addition to the typical prestressed tee beams, there are a few special tee beams with stems that are reinforced only with conventional reinforcement, located where a special layout like at a crossover section, is required. There are also a few tee beams with post tensioned curved stems.

Figure 11. Typical Tee Beam Unit Elevation – 3 Continuous Spans
The primary issue of concern with the tee beams is the diagonal and radial cracking of the stems at the dapped ends. See Figure 13 below for a drawing of the typical crack location and orientation.

In beam design, regions in which classic beam theory apply are called B-Regions. The designs of these regions follow Bernoulli’s hypotheses of a straight-line strain profile and the behavior is well understood. Regions of a beam with complex variation in strain are called D-Regions (for disturbed or discontinuity). These regions include areas with abrupt changes in geometry or locations of concentrated forces. The behavior of these regions and associated combined stress states are much less understood and the design is typically based on empirical approaches and common detailing practices.

The dapped end of a beam is a classic case of a D-Region. Because of the reinforcing complexities and the tendency for cracking, the FDOT no longer permits the design of dapped beam ends (See section 4.1.6 of the FDOT Structures Design Guidelines).

The above figure shows cracking at the expansion ends of the beams. Although the cracks at the expansion ends are wider and much more prevalent, it should be noted that these cracks were observed at the fixed, continuous ends as well. In-fact, this type of cracking is present at essentially every visible end of every tee beam in the system. The cracks range in width from hairline to 1/32”. Some of the
cracks are up to 5’ in length and many extend up and into the bottom of the top flange. Also, many of the stem cracks are reflective to the other side of the stem indicating that the crack fully extends through the beam at these locations. See Photos 24 and 25 below for typical beam cracking in the system.

![Photo 24. Beam Stem Cracks in Left Guideway, Span 17](image)

![Photo 25. Beam Stem Cracks in Right Guideway, Span 12](image)

Carbon Fiber Reinforced Polymer (CFRP) wraps have been utilized to strengthen the stems at many of the expansion ends of the tee beams along 4 of the 5 system lines – South, River, O&M, and North. The lengths of the wraps range between 10 and 20 feet at the ends of the beams. There is one span in the North Line that is wrapped full length. (See Photo 26 for a view of the CFRP wraps.)
As a contrast, along the Starter Line, Spans 1 thru 47, only one single beam is wrapped with CFRP at the beam end. The two beam cracking photos above were taken of beams in the Starter line.

Total in the system, there are 140 concrete tee beams with expansions ends. Of those, there are 65 beams with CFRP wraps, representing 46% of the concrete expansion ends in the system. Tables 2a thru 2e detail the locations in which CFRP wraps are currently being utilized on the expansion ends of double tee beams.

Table 2a. Locations of CFRP Wraps on Concrete Beam Expansion Ends – South Line

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<th>Span Number</th>
<th>Span Length (ft)</th>
<th>Number of Spans in Unit</th>
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<th>CFRP On Right Tee Beam?</th>
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<tr>
<td>202</td>
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<td>-</td>
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<tr>
<td>204</td>
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<td>- (CIP)</td>
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<tr>
<td>207</td>
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Table 2e. Locations of CFRP Wraps on Concrete Beam Expansion Ends – North Line

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<tr>
<th>Span Number</th>
<th>Span Length (ft)</th>
<th>Number of Spans in Unit</th>
<th>CFRP On Left Tee Beam?</th>
<th>CFRP On Right Tee Beam?</th>
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<td>3/4</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>51</td>
<td>50</td>
<td>1</td>
<td>✓ (full length)</td>
<td>✓ (full length)</td>
</tr>
<tr>
<td>54</td>
<td>80</td>
<td>4</td>
<td>✓</td>
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</tr>
<tr>
<td>57</td>
<td>90</td>
<td>4</td>
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<td>58</td>
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<tr>
<td>61</td>
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<td>4</td>
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<td>- (PT Stems)</td>
</tr>
<tr>
<td>62</td>
<td>56</td>
<td>4</td>
<td>✓</td>
<td>✓</td>
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<td>3</td>
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<td>84</td>
<td>50</td>
<td>4</td>
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<td>✓</td>
</tr>
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</table>

Delaminations and bulges of the wraps were noted in the following spans:
- South Segment Spans: 199, 204, 209, 210, 212, 218, 227, 228, 258, 260, M2, 406
- North Segment Spans: 50, 66, 78, 81, 84

There is one location in which the wrap is failing altogether (material failure) and that is at Span 227L. The left exterior face of the CFRP is cracked and popping off 1'-6" L x 4" W at Pier 228. There are numerous delaminations on both left and right stems. Attempts to repair these locations with epoxy injection appear to be ineffective. See Photo 27 below.
Additional significant comments in the most recent routine inspection report include the following:

South Segment

- Cast-In-Place Crossover Spans 203/204 - Stems exhibit several vertical, hairline flexural cracks throughout. This was a new comment made; not carried over from the previous inspection.
- Expansion end of prestressed concrete beam in Span 219L - There are several shear cracks up to 3' L x 1/64" W near Pier 219. This was a new comment made; not carried over from the previous inspection.
- Continuous end of prestressed concrete beam in Span 230R - There is a 44" L horizontal hairline crack in the web, starting 5' from Pier 230. This was a new comment made; not carried over from the previous inspection.

North Segment

- Expansion end of prestressed concrete beam in Span 5S - South stem exhibits 3 diagonal cracks 1/64" W x up to 4' L extending from the dapped end notch at Pier 6S. These cracks have propigated/increased since the previous inspection.
- Expansion ends of prestressed concrete beams in Span 12N and 12S - Stems exhibit multiple diagonal cracks 1/32" W x up to 4' L extending from the dapped end notch at Pier 12. These cracks have propigated/increased since the previous inspection.
- Continuous end of prestressed concrete beam in Span 27N - North face of north stem 7' from Pier 27N exhibits a 1/64" W x 7' L horizontal crack at middle of stem. This crack has propigated/increased since the previous inspection.
- Expansion end of prestressed concrete beam in Span 35S - South stem exhibits 5 diagonal cracks up to 1/32" W x up to 5' L extending from the dapped end notch at Pier 35. These cracks have propigated/increased since the previous inspection.
- Continuous end of prestressed concrete beam in Span 73L – A horizontal hairline crack x 3'-1" L exists in west stem beginning 4 1/2' from Pier 73 and continuing to the north. The crack length has increased since the previous inspection.
- Expansion end of prestressed concrete beam in Span 75R - 3 cracks up to 1/32" W x up to 9" L extend from west exterior stem CFRP repair into haunch. These cracks have propigated/increased since the previous inspection.

Skyway Beam Study Report

An engineering study was conducted to evaluate cracking in cast-in-place double tee beams in Spans 41N, 42S, and 47R.

Spans 41N and 42S compose the cross-over section just west of Central Station. Numerous significant wrap around vertical and diagonal cracks were noted in the stems and diaphragms, primarily in the positive moment regions. The study concluded that the internal beam stresses have exceeded the tensile capacity of the concrete material causing visible cracking, however, there is enough flexural reinforcement to continue to support the loading safely. The study recommended treating the cracks to prevent infiltration and corrosion of the reinforcement. A project was recently undertaken to use epoxy injection and sealant to protect the beam stems. See Photo 28 below.
Span 47R is a special curved cast-in-place span just east of Central Station. Numerous significant diagonal cracks (up to 1/32” wide) were noted at both bearing ends of the beam extending from the dapped ends into the top flange. The study concluded that the cracking is a result of torsional shear where the shear stresses have exceeded the shear capacity of the concrete. It also concluded that there is adequate capacity in the reinforcement to resist the combined effect of shear and torsion in the stems. An analysis of the dapped ends however, suggests that both the area of primary reinforcement provided and the development length of the main dapped end reinforcement bars, are less than required by the PCI provisions. The study recommends that remedial strengthening measures be undertaken – CFRP wrapping. This has not been done yet.

The TranSystems report also addressed the diagonal cracking prominently found in the dapped ends of the tee beams. This is an excerpt:

Although outside the scope of this study, we have performed a cursory review of the expansion bearing dapped end reinforcement details along the Starter Line and North Line. We have not performed an analysis of the sufficiency of steel for each possible design condition, but have reviewed the plan for potential detailing issues that could be related to the cracking noted in the inspection report. The inspection report descriptions of the Starter Line and, to a lesser degree, the North Line indicate that a number of dapped ends exhibit diagonal cracking. The most prominent cracks extend diagonally from the dapped end reentrant corner toward the top flange. A significant number of expansion bearings along the North Line have undergone remedial crack repairs using CFRP wraps that cover the dapped end of the beams. Only cracks that extend beyond the repair area are visible during inspection. No such repairs have been undertaken on the Starter Line.

The dapped ends for the expansion bearings were fabricated using a standard reinforcement detail for all expansion piers in each segment of the system. Some aspects of the dapped end details differ between the Starter Line and North Line segments. We have identified the following issues with these elements:
• The development lengths of the main dapped end reinforcement bars, which consist of 3-#9 bars, are less than required by the PCI provisions for dapped end analysis. The magnitude of this deficiency varies depending on the design code utilized.

• Reinforcement for the diagonal tension emanating from the re-entrant corner is provided by the full depth vertical stirrups adjacent to the nib. The theoretical development of the tensile force taken by this reinforcement is dependent on the associated force transfer into equivalent longitudinal reinforcement. According to standard practice, this longitudinal reinforcement should be sufficiently anchored at the end of the beam and placed at the effective depth of the flexural reinforcement. However, this reinforcement is not specified in the details for either section.

At this time, we do not recommend remedial strengthening of these elements. However, the dapped end elements should be closely monitored for continued crack propagation. If further cracking is noted, it may be necessary to consider more comprehensive analysis which may include off site load testing in order to obtain a more accurate measure of the design strength.

In addition to cracking, there are multiple occurrences of spalling on the tee beams. Most of the spalls are present on the underside of the beam flanges, but spalls were noted on the beam stems as well. In the latest routine inspection report there are 86 comments regarding spalling in the South Segment. Of those, 4 contain exposed reinforcement. Along the North Segment, there are 112 comments regarding spalling; 8 of which contain exposed reinforcement. The average spall area is 25 square inches and the average spall depth is 5/8 inch. In addition to the locations that were specifically noted, the North Segment there are spalls up to 2"x2"x 1/2" D with 1/2" of exposed steel at the beam ends throughout.

Short Term Recommendations (0-5 Years)

• Install the CFRP wrapping on Span 47R, as suggested by the TranSystems beam cracking study.

• Replace the failing CFRP wraps at Span 227L.

• As suggested in the TranSystems report, monitor the beam cracking at the dapped ends for continued propagation. Pay close attention to any cracking in the system for which the routine bridge inspection reports indicate an increase in the crack width and/or length, like at the nine locations bulleted earlier in this report section.

• Patch all spalls with exposed reinforcement according to the FDOT Bridge Maintenance and Repair Handbook. See the section entitled “Notes on Spalling” toward the end of this report for further information.

Mid Term to Long Term Recommendations

As mentioned in the TranSystems report, if further cracking is noted in the beam ends, “it may be necessary to consider more comprehensive analysis which may include off site load testing in order to obtain a more accurate measure of the design strength”.

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This necessity is especially true if it is determined that the system shall continue to function as-is for the long term or if it is determined that the system will be upgraded with a new operational system which will require the spans to carry additional dead and/or live load.

Should either of these scenarios play out – the system remains as-is and the cracking problem increases or it becomes necessary to add more load to the system, it is likely that significant measures will have to be taken to ensure the continued safety and serviceability of the system. This could be managed in two ways. The first is to strengthen and add capacity to the beams themselves, through methods such as CFRP wrapping or external post tensioning. The CFRP wrapping is certainly a more economical option, but it does have its issues. The main problem with CFRP wrapping is that it is most effective in situations in which it can wrap around the member and back onto itself; it tends to adhere much better. In the case of a beam wrapped on three sides, the additional strength provided by the wrapping is only as good as the resin adhesion. Adhesion failures of CFRP wrapping of beams is quite common. There are already a number of delaminations present in the wraps in the Skyway system beams.

Another option to manage the concrete beam dapped end strength issue would be to provide additional bearing surface at the piers. Below are two photos taken from the Overland Bridge near the Kings Avenue Skyway Station. Photo 29 depicts a situation in which a concrete blister is attached to the beam cap to provide additional bearing surface to the steel beams. Disregarding the scaffolding left in place in the next shot, Photo 30 depicts a situation in which steel saddle bearing supports are straddled over the pier cap and are used to provide additional bearing surface under the beams on either side of the pier. These photos are just showing examples, but this idea could be used and the design could produce an aesthetic looking corbel support under the beam stems and the size of the bearing pad utilized would determine the distribution of load between the original bearing pad and the new bearing pad.

![Photo 29. Concrete Blister Method for Additional Bearing Support of Beams](image)

![Photo 30. Saddle Pier Extension Method for Additional Bearing Support of Beams](image)
Steel Box Girders and Cross Beams

Description

As indicated in Table 1, 86 of the 322 guideway spans are framed with steel box girders; representing about 26% of the superstructure. The steel boxes are used at most curved sections and at the long span tangent sections of the guideway. See Photo 31. The average span length for these boxes is 111.2', which is longer than the maximum double tee span length. The maximum steel span length is 149.5'. The boxes are roughly seven feet wide and 4'-3" tall and have internal diaphragms spaced about every ten feet with upper lateral bracing framed between them. See Figure 14.

Steel cross beams (or cross heads) are utilized at Piers 241 and 242, on the South Segment approach to the Acosta Bridge, and at Piers 9, 10, 11, 30, and 31 along Bay Street in the North Segment. Figure 15 below shows the basic outlines of these elements. These members may be construed as pier caps, but because they sit above the bearings rather than support the bearings, these members are in-fact part of the superstructure.

Every box beam section in the system can be accessed internally through access hatches. The interior of the cross beams can be accessed through manholes at the box beam connections, or in the case of Pier...
10, an access hatch on top of the cross beam. This is important as all of these components are considered “fracture critical” and thus must be inspected hands-on, inside and out.

**Condition**

Many of the steel box access hatches have hasp latches and most, if not all, are not locked. The starter line hatches are secured with bolts, but there are no nuts on the ends. See Photos 32 and 33 below.

A review of the most recent routine inspection report indicates that overall, the steel beams are in good condition. There are no significant structural deficiencies and there are no signs of structural distress.

It is apparent, however, that the coating system is reaching, if not past the end of it’s service life. According to the FHWA Steel Bridge Design Handbook Vol. 19, 3-coat, zinc-rich primer paint systems data suggest performance of 25 years in less aggressive, non-marine environments. With the system being built between the late 80’s and late 90’s, the current coating system is as much as 25 to 30 years old. The exterior surface coating is breaking down, as evidence by it’s chalky nature, but fortunately, only a small percentage of the total surface area has succumbed to the corrosion process.

There is minor, but active surface corrosion at isolated locations throughout the system. Common locations listed in the most recent routine inspection report include: along the top flange edges of the boxes; along the edges of the steel cross beams; on the interior and exterior splice and connection plates and fasteners; on the top surface of the bottom flange; along the lateral bracing, cross bracing and stiffeners; and on the external diaphragms between boxes.

Also noted in the report are isolated areas without paint or with paint failure, paint holidays with no primer, blistering and peeling paint, chipped paint along welds, unpainted bolts and welds, and thin or missing top coats.

Photo 32. Access Hatch With Hasp Latch

Photo 33. Access Hatch With Bolts

Photo 34. Peeling Paint inside Span 9N (from the recent routine inspection report)
The steel boxes of the Starter Line along Bay Street received a refinishing about ten years ago. Specifically, it included six spans near Convention Center Station (Spans 6 thru 11) and three spans near Broad Street (Spans 29 thru 31). The project entailed cleaning and painting the interior and exterior of the boxes. Cleaning was done using a dry abrasive, coal slag blast and the coating was a two part system composed of one coat of organic zinc-rich epoxy primer (Carbozinc 859) followed by one coat of polyurethane finish (Carbothane 113 HB). Currently, there are a number of defects associated with this coating including the peeling paint showed in Photo 34 above.

Besides the issues associated with coating, common deficiencies noted in the most recent routine inspection report regarding the box girders include:

- Anchor bolt nuts not fully engaged
- Pinhole flaws in the welds
- Small gouges in the steel
- Loose and missing bracing bolts
- Standing water and water staining on the bottom flange
- Slight warps and bulges in the webs and minor bends/deformations in the bottom flanges and bracing members
- Build-up of concrete deck overpour and dirt and debris up to 1” at various locations throughout (rendering some of the internal welds uninspectable) the inside of the boxes.
- Missing or broken portal gates on diaphragm portals (permitting entrance to birds and insects)
- Pigeon debris and feces build-up, up to 3” deep inside the boxes.

See Photo 35 below for typical box girder exterior condition.

![Photo 35. Typical Chalky Paint and Surface Corrosion Around Fasteners](image)

*Short Term Recommendations (0 to 5 years)*

Corrosion is the number one and most costly threat to the long-term integrity of steel bridge components. As such, these components should be adequately protected from the natural and often corrosive environment by maintaining an effective coating system. Given that the system is 20 to 30 years old and that the current coating is breaking down (primarily from UV exposure), it is recommended to begin preparing for a coating overhaul.
In the short term, it is recommended to hire a certified industrial paint expert to assess the current coating system of the steel components in the guideway: steel boxes (inside and out), crossbeams, bearings, and switchbeams. This assessment should include a site visit to investigate the current coating defects including percentage of active corrosion, paint thickness, and adhesive strength to determine if the existing coating system can be over coated. Samples of the paint should be tested in a laboratory for heavy metals (i.e. lead, cadmium, and chromium, etc.). The assessment should conclude with a report detailing the findings of the current coating and make recommendations as to when and how the coating system should be overhauled – whether full removal or over coating. Greenman-Pedersen has provided a scope and fee estimate to perform such an assessment.

Additional short term recommendations are as follows:

1. Secure the steel box access hatches throughout the system. Replace any broken or missing latches. Add locks to all of the hasp latches and screw nuts on the ends of all of bolt fastened hatches.
2. Inside the boxes, tighten all loose anchor bolt and bracing bolt nuts and replace all missing bracing bolts.
3. Clean out the interior of the boxes. Remove all dirt, debris, pigeon debris and feces, and concrete overpour. Remove and collect all debris by hand sweeping, high-pressure water/air, or mechanical devices. Material should be collected and disposed of properly.
4. Ensure that every portal hole has a gate on it to prevent birds from entering the boxes. This will entail repairing bent and broken gates and installing gates where they are currently missing. This is an important and necessary step. The uric acid (white part) in bird droppings is corrosive and can cause accelerated deterioration of the box coating and the structural steel.

Mid Term Recommendations (5 to 10 years)

Some type of coating overhaul will be necessary in the next few years. The type and extent of the overhaul will be determined as part of the coating assessment performed under the short term recommendations. With the system being built in stages and the Starter Line already receiving a new paint coating, it is likely that the coating overhaul can be spread out over multiple years; perhaps addressing one line every couple of years.

Long Term Recommendations (15 years +)

Coating systems have service lives that depend on the type of application, the environment, and the conditions under which the application was performed. If it is intended to utilize the steel box girders over the long term, they will need a refinishing/recoating periodically. This should be accounted for in the overall long term budget.
**Bearings**

Table 3 below outlines the different bearing types found within the guideway system and lists typical deficiencies associated with each.

<table>
<thead>
<tr>
<th>Table 3. Summary of Skyway Bearing Elements and Their Deficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elastomeric Bearing Pad and Pier Mounted Keeper Plate</strong></td>
</tr>
<tr>
<td><strong>LOCATIONS:</strong> All expansion ends of tee beams units, except those specified in the next row of this table</td>
</tr>
<tr>
<td><strong>DEFICIENCIES</strong></td>
</tr>
<tr>
<td>• Minor corrosion on keeper plate and/or shim plate</td>
</tr>
<tr>
<td>• Keeper plate is missing bolts, washers, has loose nuts or is all together missing</td>
</tr>
<tr>
<td>• Gap between beam stem and shim plate</td>
</tr>
<tr>
<td>• Uneven bearing surface</td>
</tr>
<tr>
<td>• Gap between bearing pad and bottom of stem</td>
</tr>
<tr>
<td>• Overcompressed bearing pad</td>
</tr>
<tr>
<td>• Elastomeric pad not fully seated and overhanging grout pad pedestal</td>
</tr>
</tbody>
</table>

| **Elastomeric Bearing Pad with Embedded Bearing Plate and Anchor Bolts** |
| **LOCATIONS** |
| • Tee beam expansion end at Piers 47 Right (special cast-in-place concrete section) |
| • Tee beam fixed end at Pier 52 (slightly different than drawing shown) |
| • Tee beam expansion end at Pier 240 (21’ long beams) |
| **DEFICIENCIES** |
| Nuts not fully engaged |
Table 3 Cont. Summary of Skyway Bearing Elements and Their Deficiencies

Rocker Bearings

LOCATIONS
Fixed piers without pier caps and with continuous steel boxes: Piers 9, 11, 30, 31, 241, and 242

DEFICIENCIES
- Loose anchor bolt nuts
- Minor surface corrosion
- Gouge in casting

Sliding Plate Bearing

LOCATIONS
- All expansion ends of steel box units
- Two expansion piers with continuous short span extensions: Piers 257L and R

DEFICIENCIES
- Minor to moderate surface corrosion on bearing components
- Minor bearing misalignment
- Gap between sole plate and bronze plate
- Gap between masonry plate and top of cap
- Double nuts not fully engaged

Elastomeric Bearing Pads for Steel Boxes

LOCATIONS
Fixed Piers 7 L and R (center piers for units composed of two continuous short spans)

DEFICIENCIES
- Elastomeric pad overhangs grout pad pedestal
- 1/64” crack in grout pad pedestal
Table 3 Cont. Summary of Skyway Bearing Elements and Their Deficiencies

<table>
<thead>
<tr>
<th>Pot Bearings</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATIONS</td>
</tr>
<tr>
<td>Most fixed piers with continuous steel boxes.</td>
</tr>
<tr>
<td>DEFICIENCIES</td>
</tr>
<tr>
<td>• Minor corrosion and peeling paint</td>
</tr>
<tr>
<td>• Loose anchor bolt nuts</td>
</tr>
<tr>
<td>• Gap between masonry plate and top of cap</td>
</tr>
</tbody>
</table>

**Short Term Recommendations (0-5 years)**

The loose anchor bolt nuts should be tightened down and missing keeper plates, nuts, bolts and washers should be replaced.

Spot painting should be performed at locations in which the previous inspection report describes the surface corrosion as “moderate” or “severe”. These locations are at Pier 29, 52 in the North Segment and Piers 207, 237R in the South Segment. Following the FDOT Bridge Maintenace & Repair Handbook and assuming an inorganic zinc paint system and no presence of lead in the existing coating, spot painting should be performed as follows, while taking precautions not to damage the paint system outside the deteriorated area being repaired:

- All corroded areas are to be cleaned by an approved method to a "near-white" condition.
- Coat the cleaned areas by brush or spray with a single coat (3.0 to 5.0 dry mils) of zinc-rich primer.
- 12 to 24 hours after application of the primer coat, apply finish coat to a minimum dry film thickness of 3.0 mils.

**Mid Term and Long Term Recommendations**

Minor corrosion and coating deficiencies should be addressed along with the coating overhaul of the steel boxes. See the Steel Box section of this report for further details.

The most recent routine inspection report notes locations in which the elastomeric pad overhangs the grout pad pedestal and other locations in which gaps exist between the top of the pier caps and the bottom of the masonry plates at some movable bearing and pot bearing locations. Over the long term and with repeated cycles of live loading, these conditions may result in cracking and crushing of the pedestals. Should this be the case, these particular pedestals may need rebuilding.
SUBSTRUCTURE ELEMENTS

There are 220 individual substructure units in the system, as follows.

- 205 Piers
- 6 Acosta Bridge Piers (maintained by the FDOT)
- 7 end and intermediate bents associated with the first two spans of the O&M approach
- 2 end bents flanking Span 253, which is a pile supported slab span

Piers

Description

Pier styles, sizes and shapes vary along the guideway and depend on a number of factors such as station vicinity, surrounding infrastructure and roadway constraints, superstructure type, and required beam continuity. The 205 piers can be classified into 15 groups of similar styles. See Figures 16 and 17.

Figure 16. Typical Pier Elevations
Figure 17. Groups of Pier Types Within The Skyway System

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Condition

The piers, for the most part, are in good condition. Hairline cracking is prevalent throughout, on both the pier caps and the pier columns. In analyzing the latest routine inspection report, there are 275 comments regarding cracks in the South Segment piers and 218 comments in the North Segment piers. 94% of the cracking is hairline in width and most of the cracking is noted within the caps.

There are three types of pier cap cracks that recur quite often throughout the system and are briefly discussed herein. Figure 18 to the right shows the side view of a majority of the pier types in the system; 80% in fact. Every pier type A thru J in the chart above has this inverted-tee section on one or both sides of the pier cap. The design of these inverted-tee type caps (or sections of cap) is more complicated than that of a regular concrete pier cap, especially when it comes to the design of the ledge and detailing a reinforcing scheme that will resist the tendency for cracking to propagate from the $90^\circ$ re-entrant corners.

Along the skyway system, there are numerous pier caps with cracking on the sides similar to that drawn in Figure 18. Most of the cracks are hairline in width, but there are some with widths noted at $1/64''$ in the most recent routine inspection report. These cracks have been found at both expansion and fixed piers (where the tee beam is longitudinally post-tensioned through the pier cap), although the cracks at the expansion piers are typically more prevalent, longer, and wider. See Photos 36 and 37 below.
Another prevalent crack type found throughout the system is negative moment cracking on piers with hammerhead or “T” style pier caps. This type of pier has a single pier column and either carries both the left and right guideway or one guideway on one side and a switchbeam overhang on the other. See Figure 19.

These types of piers are quite common throughout the system (types D, E, F, L, and M, representing about 46% of the 205 piers in the system). There are variations in the shapes, depending on whether the pier is carrying concrete or steel beams, but the forces in the cap are similar and result in negative moment in the cap over the centerline of the column. See Photo 38 below.

The exception to this crack commonality with the “T” shaped piers is in the Starter Section. These caps are essentially the same shape as other caps found throughout the system, yet they were designed with transverse post-tensioning and as a result, do not have the same vertical negative moment cracking in the front and back cap faces.

The third common crack location isn’t associated with a particular pier type, but rather a pier detail – 90° re-entrant corners on the front and back faces of the pier caps. See Figure 20. This detail is present at locations in which the concrete tee beams or dapped steel boxes frame into the cap and the cap transitions from rectangular section to inverted-tee section. This detail occurs on multiple pier types including both one and two column piers. It’s also not just specific to overhangs and negative moment regions; this cracking also occurs at re-entrant corners in positive moment regions of two-
column pier caps. Pier types B, C, D, F, G, H, I and J have this detail, representing about 59% of the 205 piers in the system. See Photos 39 and 40 for examples of this type of cracking.

The worst cracking in the system is located on the pier caps and load bearing struts at the San Marco Station; Piers 237 thru 240. Numerous vertical and diagonal cracks are present along the faces of these members with widths ranging from hairline to 1/32". Cracks are commonly located on re-entrant corners where the caps change to inverted “T” shapes, but they are present along the faces of rectangular sections as well. The major design difference between these piers and those elsewhere throughout the system (including at other stations), is the unsupported length of caps. For nearly the same depth of section, these caps (and struts) are spanning 12’ to 23’ longer distances between centerlines of columns. Elsewhere in the system, the maximum cap length between column centerlines is about 35’. At the San Marco Station, the cap lengths, in order, are: 51'-8", 51'-8", 47'-4", and 57'-6".
This is quite a distance to cover for a cap that is about 5’ deep. Photos 41 thru 45 show various crack locations on the pier caps and struts at the San Marco Station.
Of the 493 total comments in the latest routine inspection report related to cracking of the piers, only 37 were associated with the pier columns. These column cracks are mostly vertical in orientation although there are locations in which the cracks are horizontal or map/random. Map cracking is prevalent on the San Marco Station pier columns.

A distinctive column crack location to point out is on the back side of cantilever pier columns (types B and D'). These are flexure cracks and manifest themselves horizontally across the back side which of course is the tension side of the cantilever stem. See Photo 46. All incidences of this type of cracking are hairline in width.

A marginal amount of concrete spalling and delaminations are noted on the piers as well. In the South Section, there are 29 incidences of spalls or delaminations in the concrete, with 10 noted on the columns and 19 on the caps. The average depth of spall is 1/2 inch and the typical spalled surface area is 18 square inches on average. Three of the spalls contain exposed steel.

Also of note in the South Section are three incidences of delaminations on the pier caps at sliding plate bearings for the steel boxes. These are likely the result of the bearing anchor bolts being cast too close to the front face of the cap and when the steel beams contract in the winter time, they pull forward on the bolts, which in-turn is causing the concrete to delaminate.

The three locations in which a large delamination is noted at the bearings are:

1. 1'-4" L x 1'-4" W at Pier 235 (This has been patched already)
2. 2'-9" L x 1'-1" W at Pier 258L (See Photo 47.)
3. 4'-0L L x 4" W at Pier 258R
In the North Section, there are 33 incidences of spalls or delaminations in the concrete, with 9 noted on the columns and 24 on the caps. The average depth of spall is 3/4 inch and the typical spalled surface area is 26 square inches on average, although there are four locations with spalls measure more than one square foot in area. Two of the spalls on the North Section contain exposed steel.

Water staining and organic growth (green or black algae, mold, or mildew) are common on the pier caps and to a lesser extent, on the columns, especially in shady areas.

Many of the piers along Hogan Street have electrical outlets on the pier columns and a number of these are missing the outlet cover. There is also a missing street light on the Pier 53 column.

*Short Term Recommendations (0-5 Years)*

**Cleaning:** Although not a structural issue, it is recommended to remove the moderate to heavy staining and algae growth from the pier caps and columns, especially in highly visible areas like around the stations, at street corners, and along streets with a high volume of pedestrian traffic. This can be accomplished using a pressure washer or a low-pressure or pump type sprayer with a diluted store bought product such as “Wet & Forget”.

**Spalling:** Patch all spalls with exposed reinforcement according to the FDOT Bridge Maintenance and Repair Handbook. See the section entitled “Notes on Spalling” toward the end of this report for further information.

**Additional Short Term Recommendations:**

1. Monitor the large pier cap delaminations for growth or spalling that are related to the sliding bearing anchor bolts mentioned above.
2. Install electrical outlet covers where missing on the pier columns along Hogan Street.

*Mid Term and Long Term Recommendations*

The following recommendations are the same as those outlined for the concrete deck elements.

**Cracking:** Develop and implement a plan to seal cracks where necessary, in the deck, sidewalls and guidebeam. This is especially necessary if it is deemed that the system will be utilized as-is (and possibly extended) for a long time to come. The FDOT Standard Specifications for Road and Bridge Construction (Spec Book) provides criteria to determine when sealing is necessary and what methods should be used based on three criteria: crack density, crack width, and environmental classification. See the section entitled “Notes on Cracking” toward the end of this report for further information.
In order to develop this crack sealing plan, it will be important to thoroughly document average crack widths and densities on all elements throughout the system because this information will determine the best solutions to implement. Utilizing the latest routine inspection report is a great start, as there is a significant amount of information provided regarding crack size, type, and location. However, given the expansiveness of the Skyway system and the cost associated with treatment, it would be prudent to inspect the system specifically for this purpose. Perhaps this could be done in conjunction with a future routine inspection and a matrix could be pre-developed and the data populated in the field. This type of inspection would document whether the crack densities in specific areas are isolated, occasional, moderate, or severe as defined by the Spec Book. It would also document the ranges of crack widths in the areas based on those outlined in the Specs Book. When the inspection is complete, all of this documented information would yield a matrix directly correlating to the most appropriate repair solutions at specific locations all over the system. The appropriate solution will vary from location to location, but will either be “no treatment required” or to apply a sealer (penetrating sealer or methacrylate) or to epoxy inject.

**Spalling:** Similar to the cracking plan, the spalls throughout the system should be patched and maintained if it is deemed that the system will be utilized as-is (and possibly extended) for a long time to come. See the section entitled “Notes on Spalling” toward the end of this report for further information.
Bents and Walls

Description

On the north side of the river, after the guideway crosses the Acosta Bridge, it makes a right turn and goes beneath FDOT Ramps K and G. In this area, for approximately 332 feet, the guideway deck is pile supported with walls along the outer sides and transverse end bents at each end of the span. See Figure 21 below, for a typical wall elevation.

At the Operations and Maintenance (O&M) Facility, the first three guideway substructure units are pile bents, as shown in Figure 22 below.

![Figure 21. Typical Wall Elevation for Pile Supported Slab Span](image)

Condition

In general, the walls surrounding the pile supported slab span are in good condition. Minor structural defects exist such as cracking along cold joints, map cracking of the end bent cheek walls, and spalling up to 8"x6"x1" on the rustications of the wall faces. There is no exposed steel or rust staining to indicate rebar corrosion. The transverse wall faces are stained from runoff through the expansion joints. See Photo 48 below.
The bents near the O&M building are also in good condition. The only deficiency noted was hairline cracking on the faces of the caps and some efflorescence. Again, there is no exposed steel or rust staining to indicate rebar corrosion.

**Recommendations**

There are no short term recommendations associated with the walls and bents at this time. As mentioned above, these elements are generally in good condition.

Over the service life of the structure however, it will be necessary to maintain the walls and bents by following the same recommendations listed in the Piers section of this report.
NOTES ON CRACKING

The following information comes from two FDOT sources: the 2015 Standard Specifications for Road and Bridge Construction (Spec Book) and the Bridge Maintenance and Repair Handbook (Handbook). The information presented herein is not complete, but rather a summary or set of general guidelines surmised from these two references – sometimes presented verbatim and sometimes summarized. For further detail, both references can be downloaded from the FDOT website at no cost.

Cracks in any type of reinforced concrete member allow moisture and chlorides to penetrate the rebar cover and attack the steel causing it to corrode. It is important to keep cracks sealed to prevent this process and preserve the concrete integrity. There are many types of surface protections available to deal with cracking.

Penetrating sealants impregnate the concrete, reduce its surface porosity and stabilize the outer layer. Coatings adhere to the concrete, seal the surface, fill small cracks, and provide some resistance to chloride attacks. Membranes fill cracks and provide maximum protection from chlorides.

- Sealants include Silane, Silicate, Siloxane, and High Molecular Weight Methacrylate (HMWM)
- Coatings include Epoxy resins, hard urethane, and methacrylate.
- Membranes include elastomeric urethane, vinylester, and polyester.

Small cracks can be filled with a liquid sealer which, depending on the manufacturer recommendations, can be applied by spray on, brush on, or roll on applications. For larger cracks, a crack sealing material (such as epoxy or polyurethane) can be pressure injected into them. This is done by drilling port holes along the crack and injecting the sealant into the ports. This method was used to seal cracks in the CIP beams just to the west of Central Station.

The Spec Book provides criteria to determine the best recourse with respect to cracking of new concrete. For cracks severe enough, the best recourse may be to reject the concrete altogether. That is obviously not an option for an existing structure, but nonetheless, the criterion provides a good starting point or base from which to make decisions and recommendations. The criterion is set forth in a table in Section 400-21 of the Spec Book which gives instruction based on crack density, crack width, and environmental classification.

Crack Significance Range (Density)

There are four categories of crack densities in the specs table. They are: Isolated (less than 0.005%), Occasional (0.005% to <0.017%), Moderate (0.017% to <0.029%), and Severe (0.029% or greater). The densities are determined by computing the ratio of total cracked surface area to total surface area.

Crack Width Range:

There are eight sets of crack width ranges in the specs table extending from less than 0.004” to greater than 0.028”; increasing in increments of 0.004”. In the latest routine inspection report, three crack widths were specified: hairline (typically < 0.004”), up to 1/64” (0.015”), and up to 1/32” (0.03”).
Environmental Category:

According to the FDOT SDG, for design purposes both superstructure and substructure should be classified as extremely aggressive because the system is within 2,500 feet of a body of water (St. Johns River) with chloride concentration in excess of 6000 ppm.

Given the three factors mentioned above, one can enter the table in Section 400-21 of the Spec Book and determine an appropriate method to contend with the cracking of concrete members. There are four repair methods defined, the first of which is “No Treatment Required”. The remaining are: Penetrating Sealer, Methacrylate, and Epoxy Injection.

PENETRATING SEALER (Section 413 of the Spec Book)

Surface Preparation – Remove substances such as dust, grime, dirt, stains, mineral deposits, oil, debris and all other deleterious material by using water blasting equipment. Take care to minimize the removal of the concrete matrix.

Application Timing – Allow the concrete surfaces to dry for 48 hours and apply only when the air temperature is between 50 and 90°F and when winds are blowing less than 25 mph.

Application Equipment – Apply sealer using a suitable air or airless sprayer with an operating pressure of approximately 20 psi. When applying, maintain pressure sufficiently low so that atomization or misting of the material does not occur.

Application – Apply penetrating sealer in a uniform manner without puddling and skips. Use a squeegee to redistribute any sealer which puddles in low areas. Generally, begin the application of the penetrant at the lowest elevation and proceed upward toward higher elevations.

HIGH MOLECULAR WEIGHT METHACRYLATE (HMWM) SEALANT (Section 413-3 of the Spec Book)

HMWM can be used to seal cracks on horizontal or slightly sloped concrete surfaces.

Surface Preparation – Remove substances such as dust, grime, dirt, stains, mineral deposits, oil, debris and all other deleterious material by using water blasting equipment. Take care to minimize the removal of the concrete matrix.

Application Timing – Allow the concrete surfaces to dry for 48 hours and apply only when the air temperature is between 50 and 90°F and when winds are blowing less than 25 mph.

Application – Distribute the material by hand over the work area using pails or other suitable containers adequate for the size of the area.

Sealing of Cracks – Immediately after the material is applied to the surface, work the material back and forth over the cracks to maximize the amount of material to be absorbed by the cracks. Move the material over the cracks using brooms, squeegees or paint brushes as appropriate, based on the size of the area. Continue until no additional material is flowing inside the cracks or the material begins to exhibit signs of polymerization.
EPOXY INJECTION OF CRACKS IN CONCRETE STRUCTURES (Section 411 of the Spec Book and 4.5.1 of the Handbook)

Crack Surface Preparation and Cleaning – Clean the area surrounding the cracks of all deteriorated concrete, efflorescence and other contaminants detrimental to the adhesion of the surface sealing epoxy compound. Clean the interiors of the cracks with pressured air.

Sealing Cracks for Epoxy Injection – Drill port holes approximately 4 to 8 inches apart with hollow drill bits and vacuum attachment to a minimum depth of 5/8 inch. Insert the injection ports into the drilled holes allowing for a small reservoir below the injection port. Seal the crack surface and the injection ports with suitable epoxy.

Epoxy Injection – Inject the epoxy in accordance with the epoxy manufacturer’s instructions. In general, begin pumping epoxy into the first port that is normally the lowest port. Continue pumping until the epoxy flows from a second port. Seal the first port and begin pumping at the second port. Repeat these steps until all ports are full. Remove ports and surface seal after epoxy has cured.
NOTES ON SPALLING

The following information comes from the FDOT Bridge Maintenance and Repair Handbook (Handbook). The information presented herein is not complete, but rather a summary or set of general guidelines surmised from this reference – sometimes presented verbatim and sometimes summarized. For further detail, the Handbook can be downloaded from the FDOT website at no cost.

The methods used to patch spalled concrete are based on depth; not just of the visible spall, but the depth of the concrete contaminated with chlorides. These methods can be grouped into three categories:

- **Type A** is above the top layer of reinforcing steel
- **Type B** is from the deck surface to at least 1 inch below the top mat of reinforcing steel
- **Type C** is full depth (typically for bridge decks)

Preparing the area to be patch is a crucial step in the process because unless the area is sufficiently prepared – all contaminated concrete and materials removed – the patch will likely just be temporary and will spall back off. The spalled area should be outlined with straight lines to facilitate sawing. A concrete saw should be used to cut into the concrete about ¾ inch deep around the full perimeter. This is important so that the patch has a shoulder to bear against; the edges should not be feathered. Care must be taken not to cut any reinforcing steel in the deck. Once the perimeter is established, hand tools or a pneumatic hammer should be used to remove the concrete within the perimeter. The area should then be thoroughly cleaned using sandblasting or water blasting to remove any loose concrete, rust, oil, or other contaminants that would prevent a proper bond. Any exposed reinforcing steel should be cleaned with a wire brush.

For **Type A** patching, the patch material will depend on the depth. Epoxy mortars can be used to patch thin spalls and concrete can be used for deeper spalls. (The maximum layer thickness for an epoxy patch may be ¾ to 1 inch thick.)
APPENDIX B
INSPECTION REPORT COVERING
JTA SKYWAY STATION INFRASTRUCTURE ASSESSMENT
JTA Proposal No. P-14-1014
October 20, 2014

Prepared by:
G.M. Hill Engineering, Inc.
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Prepared for:
Lea & Elliott, Inc.
5200 Blue Lagoon Drive, Suite 250
Miami, FL 33126
Subject: Inspection Report Covering JTA Skyway Station Infrastructure Assessment
JTA Proposal No. P-14-1014
G.M. Hill Engineering Project No. 10-4007-14

Dear Mr. Shah:

G.M. Hill Engineering, Inc. is pleased to provide you with the enclosed copy of our Inspection Report Covering JTA Skyway Station Infrastructure Assessment dated October 9, 2014. This report details the information collected during site inspections of (8) JTA skyway stations conducted by G.M. Hill Engineering from 9/30/2014 to 10/3/2014. The purpose of these inspections was to identify short, mid and long term structural and/or serviceability issues at the skyway stations. These general inspections identified various ongoing maintenance and repair items that must be addressed to maintain the overall structural integrity and serviceability of the skyway stations. The stations included in this report include: Terminal (Convention Center) Station, Jefferson Station, FSCJ (Rosa Parks) Station, Hemming Plaza Station, Central Station, King’s Avenue (DuPont) Station, Riverplace (Flagler) Station and San Marco Station. The maintenance facility at the Terminal (Convention Center) Station and the O & M Center are not included in the scope of this report.

Structural elements not clearly visible during the site visits were not inspected and are not included in the scope of this report. All structural elements supporting the actual JTA Skyway tram/train or track (bents, columns, etc.) are being inspected by others and are not included in the scope of this report. See “JTA Skyway Station Inspection General Maintenance and Repair Summary” for common maintenance and repair items observed during the inspections. General maintenance and repair recommendations and instructions given in this report are intended to be guidelines only. Additional or alternate repair and maintenance methods and/or materials may be required.

A summary of the short, mid and long term structural and/or serviceability issues at each station can be found in the report sections titled “JTA Skyway Station Infrastructure Structural/Serviceability Summary”. For general notes and comments pertaining to possible structural limitations for future expansion or renovation of the JTA Skyway stations to accommodate newer and larger trams/trains, see “Skyway Station Future Expansion Structural Limitations Summary”. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion or renovation.

Station photos and inspection structural comments are provided for each individual station. Structural drawings labeled with approximate photo locations are also included for your reference.
We appreciate this opportunity to provide you with this report, if you have questions, please feel free to contact our office at any time.

Sincerely,

Gina M. Hill, P.E.
FL. Reg. No. 52225
President
G.M. Hill Engineering
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TERMINAL - 1

INSPECTION REPORT COVERING
JTA SKYWAY STATION INFRASTRUCTURE ASSESSMENT
JTA Proposal No. P-14-1014

Terminal (Convention Center) Station

Prepared by:
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TERMINAL-1
JTA Skyway Station Infrastructure Executive Summary:

JTA Skyway Station: Terminal (Convention Center) Station

Address: West Bay Street
Jacksonville, FL 32204

Date of Inspection: 10/3/2014
Inspector(s): Alexa Mieses, Kim Murphy

Overview:

The purpose of this inspection is to identify short, mid and long term structural and/or serviceability issues at specific JTA Skyway stations. This general inspection will identify ongoing maintenance and repair items that must be addressed to maintain the overall structural integrity and serviceability of the station. Structural elements not clearly visible during the site visit were not inspected and are not included in the scope of this report. All structural elements supporting the actual JTA Skyway tram/train or track (bents, columns, etc.) are being inspected by others and are not included in the scope of this report. See “JTA Skyway Station Inspection General Maintenance and Repair Summary” for common maintenance and repair items observed during this inspection. General maintenance and repair recommendations and instructions given in this section are intended to be guidelines only. Additional or alternate repair and maintenance methods and/or materials may be required.

For a summary of the short, mid and long term structural and/or serviceability issues, see the “JTA Skyway Station Infrastructure Structural/Serviceability Summary”. For general notes and comments pertaining to possible structural limitations for future expansion or renovation of the JTA Skyway stations to accommodate newer and larger trams/trains, see “Skyway Station Future Expansion Structural Limitations Summary”. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion or renovation.

See report photos and inspection structural comments for additional information. See included original station structural drawings for approximate photo locations.

JTA Skyway Station Inspection General Maintenance and Repair Summary:

- Rust and Corrosion: Extensive rust and corrosion at metal surfaces was observed at multiple locations at this station. At some rails posts, corrosion is extensive and posts either need to be replaced or will need to be replaced in the near future. Rust at concrete spalls with and without exposed rebar was also noted. Attachments and/or connections to cameras, lights, etc. are rusted. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
  1. Monitor all surfaces for rust and corrosion. Replace badly rusted rail posts, equipment connection clips, angles and bolts. Paint and seal surfaces as required after properly removing corrosion. Use corrosion resistant hardware, paint, etc. to reduce incidence of rust/corrosion.
  2. Where corrosion is encountered, sand blast to remove all contaminants, rust and loose material and coat surface as required with appropriate sealant or paint. As an alternative, power tool wire brush may also be used.

- Painting/Sealing: Surfaces, primarily metal, in need of painting were observed at multiple locations at this station. Many of the metal surfaces also require removal of minor rust or corrosion prior to painting. It is evident that many surfaces have been painted in the past without properly removing corroded surfaces. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

1. Monitor all painted surfaces for wear. Properly remove all rust, corrosion and debris prior to painting surfaces. Paint surfaces regularly to prevent corrosion and protect surfaces from moisture damage.
2. Use a safe, lead free paint with high level of moisture and corrosion protection. Apply per manufacturer’s recommendations.

- **Expansion Joints/Sealant**: Expansion joint material was observed to be damaged, deteriorated or missing at multiple locations at the station. This item will require regular and ongoing maintenance.
  1. Expansion joint material should be closely monitored and maintained or replaced as required.
  2. Completely clean joint or failed sealant, dirt, debris, etc. Prepare and prime edges per sealant manufacturer’s criteria. If applicable, replace backer rod where displaced or missing. Size of backer rod to ensure tight fit at all temperatures. When applicable, where concrete spall is located at a joint, repair concrete as required. Install new sealant, Sikaflex – 15LM low-modulus elastomeric sealant (or equivalent).

- **Spalled Concrete**: Concrete spalls were observed at multiple locations at the station. Spalls at stair nosings are evident or may develop. New spalls may develop near existing spalls or at new locations. This item will require regular and ongoing maintenance.
  1. Repair all spalled areas as required and monitor structure for new spalls.
  2. Properly prepare concrete surface by saw-cutting 1/2” deep at perimeter of spalled area to provide an edge 90 degrees to surface at which to terminate patch. Mechanically remove all loose and damaged concrete to provide a sound substrate with a rough profile with 1/16” to 1/8” deep irregularities. Do not chip any deeper than necessary to expose sound concrete. Should more than 1/3 the circumference of reinforcing be exposed, chip out behind the reinforcing steel to a depth of 1/2” (minimum). Where reinforcing with corrosion is encountered, sand blast to remove all contaminants and rust and coat with Sika Armatec 110 (or equivalent). Otherwise, power tool wire brush and coat with Sika Armatec 110 (or equivalent). If corrosion has reduced the section by 15% or more, additional reinforcement must be installed – contact engineering professional for further recommendations.
  3. Repair using Sikatop 123 polymer-modified Portland cement non-sag repair mortar (or equivalent) hand troweled into place (Note: Sikatop 122 (or equivalent) may be used on deck surfaces). Mix using component “A” liquid co-polymer in accordance with manufacturer’s recommendations. Substrate surface must be in a saturated surface dry condition. Apply Sika Armatec 110 (or equivalent) to concrete surface. For repairs deeper than 1 1/2”, apply multiple lifts. Scratch surface or initial lifts to provide for bonding of subsequent lifts. After final finishing, cure by taping sheet plastic over repair to retard loss of moisture. Leave in place for three days. Follow manufacturer’s recommendations in all respects.
  4. Spalls at cast-in-place or precast connections also require two coats (minimum) of Galvicon high quality zinc rich cold galvanization paint (or equivalent) at connection plates after all rust, corrosion and debris has been removed.
  5. Very extensive or significant concrete spall repairs should be reviewed and monitored by an engineering professional.

- **Cracking Concrete**: Cracking at concrete surfaces was observed at multiple locations at this station. Cracks at rails posts at stairs are common and contributing to additional damage, cracking and/or spalling at stairs and landings. These cracks are also contributing to moisture damage and corrosion to the rebar at these locations. In some cases, it appears that rebar or ties were placed with too little clearance cover to the concrete edge of beams, and hairline cracks have developed at those locations. Cracks at stair nosings are evident or may develop. New cracks may develop near existing cracked areas or at new locations. These items will require regular and ongoing maintenance.
  1. Cracks in concrete should be repaired and station should be monitored for worsening of existing cracks or formation of new cracks.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

2. Repair cracks after properly pressure washing or sandblasting area to remove any loose debris from edges of crack. For gravity fed crack, chip out “vee” notch along the crack with a router and use compressed air to blow debris out of crack. Layout location of injection ports with spacing required to ensure complete filling of voids. Drill and install a one way valve injection tube. Drill one vent hole to top of surface intersecting with crack. Seal surface of cracks and anchor injection ports, and any visible cracks at underside for gravity fed crack repair, with Sikadur 31 hi-mod gel (or equivalent).

3. After crack has cured, inject cracks with Sikadur 52 low viscosity moisture-insensitive epoxy injection adhesive (or equivalent). Begin injection at one end of the crack and move from port to port toward the opposite end. Proceed slowly to allow injection gel to migrate into narrow portions of the crack. Monitor the top vents to avoid injecting excess material from below. For gravity fed crack repair, Sikapronto 19 (or equivalent) may be used – proceed slowly to allow gel to migrate into narrow portions of the crack. After injection gel has cured for 24 hours, cut off injection ports and grind off seal material flush with bottom of surface. Follow manufacturer’s recommendations.

4. Repair cracks in CMU and precast at mechanical/electrical/storage buildings as required to avoid moisture intrusion and further damage.

5. Very extensive or significant crack repairs should be reviewed and monitored by an engineering professional.

- Water Damage and Intrusion: Water intrusion was observed at multiple locations at this station. This water intrusion causes structural and cosmetic damage, deterioration, rust/corrosion, mold and mildew. Although the station is open, every effort should be made to limit exposure to water damage. Standing water was observed at stair landings and at roof tops of low building structures. In many cases, the drains in these areas were clogged or improperly installed. Standing water and leaks also pose a safety and fall hazard.

  1. Wherever possible, limit water intrusion into open station structure.
  2. Clean clogged drains and repair drains that are damaged or non-functional.
  3. Maintain slip proof surfaces and stair nosings as required.
  4. Maintain roof and canopy structures as required to avoid water intrusion.
  5. Water intrusion at storage, electrical and mechanical rooms should be investigated and corrected immediately.

- General Safety Concerns: Many general safety concerns were noted at this station. These safety concerns could cause falls and/or injuries if not corrected and/or monitored. Some items noted here are also maintenance issues that need to be monitored and repaired as needed.

  1. At the tram entrance, there is no fall protection at the outer edge of the track. Although there is an alarm system in place should a passenger move beyond the yellow line when no train is parked at the station, someone could easily climb on to the tracks and fall. It is recommended that additional safety measures be considered.
  2. In some instances, it may be possible to climb from the top deck and stairs onto the roof of the low structures below. It is recommended that additional safety measures be taken to keep passengers from accessing these roof areas.
  3. Due to moisture, cracking and spalling, some stair tread nosings are damaged and in poor condition. These nosings need to be carefully monitored and repaired or replaced as needed. Other slip resistant surfaces and tile also need to monitored and replaced as needed. These items present a significant slip and fall hazard if not properly maintained.
  4. Standing water presents a significant fall hazard and should be removed.
  5. Water intrusion has caused the growth of mold and mildew at many locations. This moisture will damage the structural components over time and is also a health hazard. Mold and mildew should be treated and removed.
JTA Skyway Station Infrastructure Structural/Serviceability Summary:

JTA Skyway Station: Terminal (Convention Center) Station

Address: West Bay Street
Jacksonville, FL 32204

Skyway Station Structural/Serviceability Summary:

- **Short Term Structural/Serviceability:**
  Minor safety, damage and deterioration of structural elements or connections that do not compromise load carrying capacity or overall serviceability. Minor repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Minor serviceability and maintenance issues that are not repaired or monitored may turn into mid or long term structural and/or serviceability issues. There are currently no immediate plans to modify the existing station or to change the current tram/train loadings, so current station is adequate to handle original design loadings.

- **Mid Term Structural/Serviceability:**
  Minor to moderate safety and damage and deterioration of structural elements or connections that are unlikely to compromise the load carrying capacities or overall serviceability. Minor to moderate repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Issues listed in the above referenced summary are likely to progress and require more routine maintenance and repair. Other structural and serviceability issues may occur and the cost to maintain the station structure will likely increase. It is also likely that canopy structures and other items will need to be replaced. Minor to moderate serviceability and maintenance issues that are not repaired or monitored may turn into long term structural and/or serviceability issues. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station is adequate to handle original design loadings. If plans to modify the existing station or to change current tram/train loadings, a detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.

- **Long Term Structural/Serviceability:**
  Moderate to significant safety and damage and deterioration of structural elements or connections that may compromise load carrying capacities or overall serviceability. These items will need to be properly examined and monitored by an engineering professional. The cost for moderate to significant repairs and maintenance will continue to increase. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station should be structurally evaluated to determine if it is adequate to handle original design loadings. It is likely that plans to modify the existing station or to change current trams/trains will be needed. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.
JTA Skyway Station Future Expansion Structural Limitations Summary:

JTA Skyway Station: Terminal (Convention Center) Station

Address: West Bay Street
Jacksonville, FL 32204

Based on the inspections conducted, possible structural limitations to the JTA Skyway station future expansion include, but are not limited to:

- **Increase in Required Design Loadings:**
  Load bearing members are sufficient to carry current design loadings. Expansion of the JTA Skyway station will likely increase the required loadings for these load bearing members. An extensive and comprehensive structural analysis will be required to evaluate the station infrastructure for the additional loadings. Increased loadings could require larger structural members or modification to the reinforcement of existing structural members. Any increase in vibration or other movement as a result of upgrading to larger trams/trains will also need to be evaluated. It should also be noted that continued exposure to the highly corrosive and moist outdoor environment may compromise and decrease the long term serviceability and safety of the current structure.

- **Clearance Limitations:**
  Larger trams/trains or increased structural members sizes will likely present clearance issues during JTA Skyway future expansions. The most likely clearance issues will take place at tram/train entrances and will be most significant if higher loadings require larger bent beams or wider tram rail and track widths. Taller trams/trains may present clearance issues at the main roof and covered canopies. If roof or canopy elevations must be raised or widened to accommodate larger or taller trams/trains, a full lateral load analysis for the station must be completed to evaluate possible increases in wind loads and dynamic loads. Increased lateral and wind loads may increase structural member sizes.

- **Code Changes, Additional Life Safety and Accessibility Requirements:**
  Future building code changes, additional life safety and accessibility requirements could require significant safety upgrades and heavier structural design loadings. These potential changes could increase the size of the structural members required and may also have a significant impact on the overall cost of any future JTA Skyway station expansion. Careful consideration should be given to structural code changes, life safety and accessibility requirements moving forward.
Photo of Required Maintenance/Repairs/Monitoring Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 1:

- Photo 2:

Inspection Structural Comments:

- Comments for Photo 1:
  Exterior/security fencing – significant rust and corrosion (multiple locations).

- Comments for Photo 2:
  Cracks at concrete beams under west side stair. Cracks may be due to reinforcement being placed too close to bottom face of beam. Monitor/repair cracks as required (multiple locations).
### Photo of Required Maintenance/Repairs/Monitoring

**Terminal/Convention Center Station**

Note: See Attached Structural Drawings for location clarification.

- **Photo 3:**
  ![Photo 3](image1)

- **Photo 4:**
  ![Photo 4](image2)

### Inspection Structural Comments:

- **Comments for Photo 3:**
  Water intrusion under stair on west side of building. Mold and mildew growing and damage to wall facing.

- **Comments for Photo 4:**
  Loose sewer cap under west side stair – safety hazard.
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 5:

- Photo 6:

Inspection Structural Comments:

- Comments for Photo 5:
  Spalled concrete with exposed rebar under west stair (lower portion). Rusting noted at exposed rebar.

- Comments for Photo 6:
  Spalling concrete under 2nd level at west side stair (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 7:

- Photo 8:

Inspection Structural Comments:

- Comments for Photo 7:
Crack in concrete under west stair at landing/stair above 1st floor. Exposed rebar with rust/corrosion and spalled concrete also noted at this location.

- Comments for Photo 8:
Cracks under west side stair – landing to 2nd floor.
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 9:

- Photo 10:

Inspection Structural Comments:

- Comments for Photo 9:
  Crack from handrail post and exposed rebar on south face of west end stair (landing to 2nd floor). Rust/corrosion at exposed rebar noted (multiple locations).

- Comments for Photo 10:
  Bent beam at column through building at west side stair has shear cracks (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 11:

- Photo 12:

Inspection Structural Comments:

- Comments for Photo 11:
  Exposed rebar at west side stair upper landing. Rust/corrosion noted at exposed rebar. Extremely humid environment is likely cause of spalling.

- Comments for Photo 12:
  At south side of west end stairs - cracking at handrail/slab edge at 2nd level (multiple locations). Repair and monitor as required.
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 13:

![Photo 13: Major spalling/cracking and exposed rebar at handrail on north side of station at west end stair. Rust/corrosion noted at exposed rebar. Monitor and repair as required.](image1)

- Photo 14:

![Photo 14: Cracked tile/rust at pipe at metal columns at 2nd floor/terminal level at west side of station.](image2)

- Comments for Photo 13:
  Major spalling/cracking and exposed rebar at handrail on north side of station at west end stair. Rust/corrosion noted at exposed rebar. Monitor and repair as required.

- Comments for Photo 14:
  Cracked tile/rust at pipe at metal columns at 2nd floor/terminal level at west side of station.
Photo of Required Maintenance/Repairs/Monitoring Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 15:

- Photo 16:

Inspection Structural Comments:

- Comments for Photo 15:
  Rust/moisture damage at painted surfaces (multiple locations).

- Comments for Photo 16:
  No fall protection at outside rail of skyway tram/train access area – safety hazard.
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 17:

- Photo 18:

Inspection Structural Comments:

- Comments for Photo 17:
  Crack/hole in precast at elevator shaft at 2nd floor. Cracks and holes will allow excess moisture/water intrusion.

- Comments for Photo 18:
  Rust at handrails and handrail hardware (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 19:

- Photo 20:

Inspection Structural Comments:

- Comments for Photo 19:
  Cracks at edge of 2nd floor between handrail posts on east side of station (multiple locations). Repair and monitor as required.

- Comments for Photo 20:
  Cracks/spalled concrete at edge of 2nd floor at handrail posts – east end stairs (multiple locations). Repair and monitor as required.
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 21:

![](image1)

- Photo 22:

![](image2)

Inspection Structural Comments:

- Comments for Photo 21:

Ponding water with significant mold/mildew at roof area of building at east side of station.

- Comments for Photo 22:

Cracks/spalling at east end stair at lower/inside landing (multiple locations). Repair and monitor as required.
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 23:

- Photo 24:

Inspection Structural Comments:

- Comments for Photo 23:
  Crack at bearing/column under east side stair at upper landing. Monitor and repair crack as required.

- Comments for Photo 24:
  Concrete beam under east side stair (lower) – cracks along member. Cracks appear to occur at tie locations and are most likely the result of placing rebar too close the outside face of the beam (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

- Photo 25:

- Photo 26:

Inspection Structural Comments:

- Comments for Photo 25:
  Cracks at east side stair – lower beam (see notes at Photo 24).

- Comments for Photo 26:
  Crack at east end of the station at building wall.
Photo of Required Maintenance/Repairs/Monitoring
Terminal/Convention Center Station
Note: See Attached Structural Drawings for location clarification.

• Photo 27:

Inspection Structural Comments:

• Comments for Photo 27:
  Damaged or missing expansion joint material noted (multiple locations). Expansion joint material must be monitored and replaced as needed.
INSPECTION REPORT COVERING
JTA SKYWAY STATION INFRASTRUCTURE ASSESSMENT
JTA Proposal No. P-14-1014

Jefferson Station

Prepared by:
G.M. Hill Engineering, Inc.
10199 Southside Boulevard, Suite 103A
Jacksonville, Florida 32256

Prepared for:
Lea & Elliott, Inc.
5200 Blue Lagoon Drive, Suite 250
Miami, FL 33126

JEFFERSON-1
JTA Skyway Station Infrastructure Executive Summary:

JTA Skyway Station: Jefferson Station

Address: West Bay Street
Jacksonville, FL 32204

Date of Inspection: 9/30/2014
Inspector(s): Gina Hill, Kim Murphy

Overview:

The purpose of this inspection is to identify short, mid and long term structural and/or serviceability issues at specific JTA Skyway stations. This general inspection will identify ongoing maintenance and repair items that must be addressed to maintain the overall structural integrity and serviceability of the station. Structural elements not clearly visible during the site visit were not inspected and are not included in the scope of this report. All structural elements supporting the actual JTA Skyway tram/train or track (bents, columns, etc.) are being inspected by others and are not included in the scope of this report. See “JTA Skyway Station Inspection General Maintenance and Repair Summary” for common maintenance and repair items observed during this inspection. General maintenance and repair recommendations and instructions given in this section are intended to be guidelines only. Additional or alternate repair and maintenance methods and/or materials may be required.

For a summary of the short, mid and long term structural and/or serviceability issues, see the “JTA Skyway Station Infrastructure Structural/Serviceability Summary”. For general notes and comments pertaining to possible structural limitations for future expansion or renovation of the JTA Skyway stations to accommodate newer and larger trams/trains, see “Skyway Station Future Expansion Structural Limitations Summary”. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion or renovation.

See report photos and inspection structural comments for additional information. See included original station structural drawings for approximate photo locations.

JTA Skyway Station Inspection General Maintenance and Repair Summary:

- Rust and Corrosion: Extensive rust and corrosion at metal surfaces was observed at multiple locations at this station. At some rails posts, corrosion is extensive and posts either need to be replaced or will need to be replaced in the near future. Rust at concrete spalls with and without exposed rebar was also noted. Attachments and/or connections to cameras, lights, etc. are rusted. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
  3. Monitor all surfaces for rust and corrosion. Replace badly rusted rail posts, equipment connection clips, angles and bolts. Paint and seal surfaces as required after properly removing corrosion. Use corrosion resistant hardware, paint, etc. to reduce incidence of rust/corrosion.
  4. Where corrosion is encountered, sand blast to remove all contaminants, rust and loose material and coat surface as required with appropriate sealant or paint. As an alternative, power tool wire brush may also be used.

- Painting/Sealing: Surfaces, primarily metal, in need of painting were observed at multiple locations at this station. Many of the metal surfaces also require removal of minor rust or corrosion prior to painting. It is evident that many surfaces have been painted in the past without properly removing corroded surfaces. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

3. Monitor all painted surfaces for wear. Properly remove all rust, corrosion and debris prior to painting surfaces. Paint surfaces regularly to prevent corrosion and protect surfaces from moisture damage.

4. Use a safe, lead free paint with high level of moisture and corrosion protection. Apply per manufacturer’s recommendations.

- **Expansion Joints/Sealant**: Expansion joint material was observed to be damaged, deteriorated or missing at multiple locations at the station. This item will require regular and ongoing maintenance.
  3. Expansion joint material should be closely monitored and maintained or replaced as required.
  4. Completely clean joint or failed sealant, dirt, debris, etc. Prepare and prime edges per sealant manufacturer’s criteria. If applicable, replace backer rod where displaced or missing. Size of backer rod to ensure tight fit at all temperatures. When applicable, where concrete spall is located at a joint, repair concrete as required. Install new sealant, Sikaflex – 15LM low-modulus elastomeric sealant (or equivalent).

- **Spalled Concrete**: Concrete spalls were observed at multiple locations at the station. Spalls at stair nosings are evident or may develop. New spalls may develop near existing spalls or at new locations. This item will require regular and ongoing maintenance.
  6. Repair all spalled areas as required and monitor structure for new spalls.
  7. Properly prepare concrete surface by saw-cutting 1/2” deep at perimeter of spalled area to provide an edge 90 degrees to surface at which to terminate patch. Mechanically remove all loose and damaged concrete to provide a sound substrate with a rough profile with 1/16” to 1/8” deep irregularities. Do not chip any deeper than necessary to expose sound concrete. Should more than 1/3 the circumference of reinforcing be exposed, chip out behind the reinforcing steel to a depth of 1/2” (minimum). Where reinforcing with corrosion is encountered, sand blast to remove all contaminants and rust and coat with Sika Armatec 110 (or equivalent). Otherwise, power tool wire brush and coat with Sika Armatec 110 (or equivalent). If corrosion has reduced the section by 15% or more, additional reinforcement must be installed – contact engineering professional for further recommendations.
  8. Repair using Sikatop 123 polymer-modified Portland cement non-sag repair mortar (or equivalent) hand troweled into place (Note: Sikatop 122 (or equivalent) may be used on deck surfaces). Mix using component “A” liquid co-polymer in accordance with manufacturer’s recommendations. Substrate surface must be in a saturated surface dry condition. Apply Sika Armatec 110 (or equivalent) to concrete surface. For repairs deeper than 1 1/2”, apply multiple lifts. Scratch surface or initial lifts to provide for bonding of subsequent lifts. After final finishing, cure by taping sheet plastic over repair to retard loss of moisture. Leave in place for three days. Follow manufacturer’s recommendations in all respects.
  9. Spalls at cast-in-place or precast connections also require two coats (minimum) of Galvicon high quality zinc rich cold galvanization paint (or equivalent) at connection plates after all rust, corrosion and debris has been removed.
  10. Very extensive or significant concrete spall repairs should be reviewed and monitored by an engineering professional.

- **Cracking Concrete**: Cracking at concrete surfaces was observed at multiple locations at this station. Cracks at rails posts at stairs are common and contributing to additional damage, cracking and/or spalling at stairs and landings. These cracks are also contributing to moisture damage and corrosion to the rebar at these locations. In some cases, it appears that rebar or ties were placed with too little clearance cover to the concrete edge of beams, and hairline cracks have developed at those locations. Cracks at stair nosings are evident or may develop. New cracks may develop near existing cracked areas or at new locations. These items will require regular and ongoing maintenance.
  6. Cracks in concrete should be repaired and station should be monitored for worsening of existing cracks or formation of new cracks.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

7. Repair cracks after properly pressure washing or sandblasting area to remove any loose debris from edges of crack. For gravity fed crack, chip out “vee” notch along the crack with a router and use compressed air to blow debris out of crack. Layout location of injection ports with spacing required to ensure complete filling of voids. Drill and install a one way valve injection tube. Drill one vent hole to top of surface intersecting with crack. Seal surface of cracks and anchor injection ports, and any visible cracks at underside for gravity fed crack repair, with Sikadur 31 hi-mod gel (or equivalent).

8. After crack has cured, inject cracks with Sikadur 52 low viscosity moisture-insensitive epoxy injection adhesive (or equivalent). Begin injection at one end of the crack and move from port to port toward the opposite end. Proceed slowly to allow injection gel to migrate into narrow portions of the crack. Monitor the top vents to avoid injecting excess material from below. For gravity fed crack repair, Sikapronto 19 (or equivalent) may be used – proceed slowly to allow gel to migrate into narrow portions of the crack. After injection gel has cured for 24 hours, cut off injection ports and grind off seal material flush with bottom of surface. Follow manufacturer’s recommendations.

9. Repair cracks in CMU and precast at mechanical/electrical/storage buildings as required to avoid moisture intrusion and further damage.

10. Very extensive or significant crack repairs should be reviewed and monitored by an engineering professional.

- Water Damage and Intrusion: Water intrusion was observed at multiple locations at this station. This water intrusion causes structural and cosmetic damage, deterioration, rust/corrosion, mold and mildew. Although the station is open, every effort should be made to limit exposure to water damage. Standing water was observed at stair landings and at roof tops of low building structures. In many cases, the drains in these areas were clogged or improperly installed. Standing water and leaks also pose a safety and fall hazard.
  6. Wherever possible, limit water intrusion into open station structure.
  7. Clean clogged drains and repair drains that are damaged or non-functional.
  8. Maintain slip proof surfaces and stair nosings as required.
  9. Maintain roof and canopy structures as required to avoid water intrusion.
  10. Water intrusion at storage, electrical and mechanical rooms should be investigated and corrected immediately.

- General Safety Concerns: Many general safety concerns were noted at this station. These safety concerns could cause falls and/or injuries if not corrected and/or monitored. Some items noted here are also maintenance issues that need to be monitored and repaired as needed.
  6. At the tram entrance, there is no fall protection at the outer edge of the track. Although there is an alarm system in place should a passenger move beyond the yellow line when no train is parked at the station, someone could easily climb on to the tracks and fall. It is recommended that additional safety measures be considered.
  7. In some instances, it may be possible to climb from the top deck and stairs onto the roof of the low structures below. It is recommended that additional safety measures be taken to keep passengers from accessing these roof areas.
  8. Due to moisture, cracking and spalling, some stair tread nosings are damaged and in poor condition. These nosings need to be carefully monitored and repaired or replaced as needed. Other slip resistant surfaces and tile also need to monitored and replaced as needed. These items present a significant slip and fall hazard if not properly maintained.
  9. Standing water presents a significant fall hazard and should be removed.
  10. Water intrusion has caused the growth of mold and mildew at many locations. This moisture will damage the structural components over time and is also a health hazard. Mold and mildew should be treated and removed.
**JTA Skyway Station Infrastructure Structural/Serviceability Summary:**

**JTA Skyway Station: Jefferson Station**

**Address:** West Bay Street
Jacksonville, FL 32204

**Skyway Station Structural/Serviceability Summary:**

- **Short Term Structural/Serviceability:**
  Minor safety, damage and deterioration of structural elements or connections that do not compromise load carrying capacity or overall serviceability. Minor repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Minor serviceability and maintenance issues that are not repaired or monitored may turn into mid or long term structural and/or serviceability issues. There are currently no immediate plans to modify the existing station or to change the current tram/train loadings, so current station is adequate to handle original design loadings.

- **Mid Term Structural/Serviceability:**
  Minor to moderate safety and damage and deterioration of structural elements or connections that are unlikely to compromise the load carrying capacities or overall serviceability. Minor to moderate repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Issues listed in the above referenced summary are likely to progress and require more routine maintenance and repair. Other structural and serviceability issues may occur and the cost to maintain the station structure will likely increase. It is also likely that canopy structures and other items will need to be replaced. Minor to moderate serviceability and maintenance issues that are not repaired or monitored may turn into long term structural and/or serviceability issues. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station is adequate to handle original design loadings. If plans to modify the existing station or to change current tram/train loadings, a detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.

- **Long Term Structural/Serviceability:**
  Moderate to significant safety and damage and deterioration of structural elements or connections that may compromise load carrying capacities or overall serviceability. These items will need to be properly examined and monitored by an engineering professional. The cost for moderate to significant repairs and maintenance will continue to increase. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station should be structurally evaluated to determine if it is adequate to handle original design loadings. It is likely that plans to modify the existing station or to change current trams/trains will be needed. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.
JTA Skyway Station Future Expansion Structural Limitations Summary:

JTA Skyway Station: Jefferson Station

Address: West Bay Street
Jacksonville, FL 32204

Based on the inspections conducted, possible structural limitations to the JTA Skyway station future expansion include, but are not limited to:

- **Increase in Required Design Loadings:**
  Load bearing members are sufficient to carry current design loadings. Expansion of the JTA Skyway station will likely increase the required loadings for these load bearing members. An extensive and comprehensive structural analysis will be required to evaluate the station infrastructure for the additional loadings. Increased loadings could require larger structural members or modification to the reinforcement of existing structural members. Any increase in vibration or other movement as a result of upgrading to larger trams/trains will also need to be evaluated. It should also be noted that continued exposure to the highly corrosive and moist outdoor environment may compromise and decrease the long term serviceability and safety of the current structure.

- **Clearance Limitations:**
  Larger trams/trains or increased structural members sizes will likely present clearance issues during JTA Skyway future expansions. The most likely clearance issues will take place at tram/train entrances and will be most significant if higher loadings require larger bent beams or wider tram rail and track widths. Taller trams/trains may present clearance issues at the main roof and covered canopies. If roof or canopy elevations must be raised or widened to accommodate larger or taller trams/trains, a full lateral load analysis for the station must be completed to evaluate possible increases in wind loads and dynamic loads. Increased lateral and wind loads may increase structural member sizes.

- **Code Changes, Additional Life Safety and Accessibility Requirements:**
  Future building code changes, additional life safety and accessibility requirements could require significant safety upgrades and heavier structural design loadings. These potential changes could increase the size of the structural members required and may also have a significant impact on the overall cost of any future JTA Skyway station expansion. Careful consideration should be given to structural code changes, life safety and accessibility requirements moving forward.
Photo of Required Maintenance/Repairs/Monitoring
Jefferson Station
Note: See Attached Structural Drawings for location clarification.

- Photo 1:

- Photo 2:

Inspection Structural Comments:

- Comments for Photo 1:
  Exposed rebar with rust/corrosion noted at west end stairs (multiple locations).

- Comments for Photo 2:
  Cracks at concrete beam under west side stair. Monitor/repair cracks as required (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Jefferson Station
Note: See Attached Structural Drawings for location clarification.

- Photo 3:

- Photo 4:

Inspection Structural Comments:

- Comments for Photo 3:
  At west end stair, crack in concrete bearing to second floor (underside).

- Comments for Photo 4:
  At west end stair, exposed rebar at landing/stair. Rust noted at exposed rebar (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Jefferson Station
Note: See Attached Structural Drawings for location clarification.

- Photo 5:

- Photo 6:

Inspection Structural Comments:

- Comments for Photo 5:
  At top of west end stair, significant cracking/spalling in concrete at handrail post locations (multiple locations).

- Comments for Photo 6:
  No fall protection at outer rail of skyway tram/train access area – safety hazard.
Photo of Required Maintenance/Repairs/Monitoring
Jefferson Station
Note: See Attached Structural Drawings for location clarification.

- Photo 7:

- Photo 8:

Inspection Structural Comments:

- Comments for Photo 7:
  Cracks in concrete at flanges of steel wide flange columns (typical at opening columns – wide flange column bearing at column cap and high stresses at flange locations are likely causes of cracking).

- Comments for Photo 8:
  At east side stair, spalled concrete with exposed rebar. Rust and corrosion noted at exposed rebar.
Photo of Required Maintenance/Repairs/Monitoring
Jefferson Station
Note: See Attached Structural Drawings for location clarification.

- Photo 9:

- Photo 10:

Inspection Structural Comments:

- Comments for Photo 9:
  Extensive rust/corrosion at handrails. Rust/corrosion must be removed properly and handrails must be repainted (multiple locations).

- Comments for Photo 10:
  Extensive rust/corrosion at handrails. Rust/corrosion must be removed properly and handrails must be repainted (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring

Jefferson Station

Note: See Attached Structural Drawings for location clarification.

- Photo 11:

- Photo 12:

inspection Structural Comments:

- Comments for Photo 11:

  Exposed rebar/spalling concrete at east side elevator equipment room. Rust/corrosion at exposed rebar noted.

- Comments for Photo 12:

  Exposed rebar/spalling concrete at west side equipment room. Rust/corrosion at exposed rebar noted.
INSPECTION REPORT COVERING
JTA SKYWAY STATION INFRASTRUCTURE ASSESSMENT
JTA Proposal No. P-14-1014

FSCJ (Rosa Parks) Station

Prepared by:
G.M. Hill Engineering, Inc.
10199 Southside Boulevard, Suite 103A
Jacksonville, Florida 32256

Prepared for:
Lea & Elliott, Inc.
5200 Blue Lagoon Drive, Suite 250
Miami, FL 33126

FSCJ-1
JTA Skyway Station Infrastructure Executive Summary:

JTA Skyway Station:  FSCJ (Rosa Parks) Station

Address: West State Street
        Jacksonville, FL 32202

Date of Inspection:  10/01/2014
Inspector(s):  Alexa Mieses, Kim Murphy

Overview:

The purpose of this inspection is to identify short, mid and long term structural and/or serviceability issues at specific JTA Skyway stations. This general inspection will identify ongoing maintenance and repair items that must be addressed to maintain the overall structural integrity and serviceability of the station. Structural elements not clearly visible during the site visit were not inspected and are not included in the scope of this report. All structural elements supporting the actual JTA Skyway tram/train or track (bents, columns, etc.) are being inspected by others and are not included in the scope of this report. See “JTA Skyway Station Inspection General Maintenance and Repair Summary” for common maintenance and repair items observed during this inspection. General maintenance and repair recommendations and instructions given in this section are intended to be guidelines only. Additional or alternate repair and maintenance methods and/or materials may be required.

For a summary of the short, mid and long term structural and/or serviceability issues, see the “JTA Skyway Station Infrastructure Structural/Serviceability Summary”. For general notes and comments pertaining to possible structural limitations for future expansion or renovation of the JTA Skyway stations to accommodate newer and larger trams/trains, see “Skyway Station Future Expansion Structural Limitations Summary”. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion or renovation.

See report photos and inspection structural comments for additional information. See included original station structural drawings for approximate photo locations.

JTA Skyway Station Inspection General Maintenance and Repair Summary:

- Rust and Corrosion: Extensive rust and corrosion at metal surfaces was observed at multiple locations at this station. At some rails posts, corrosion is extensive and posts either need to be replaced or will need to be replaced in the near future. Rust at concrete spalls with and without exposed rebar was also noted. Attachments and/or connections to cameras, lights, etc. are rusted. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
  5. Monitor all surfaces for rust and corrosion. Replace badly rusted rail posts, equipment connection clips, angles and bolts. Paint and seal surfaces as required after properly removing corrosion. Use corrosion resistant hardware, paint, etc. to reduce incidence of rust/corrosion.
  6. Where corrosion is encountered, sand blast to remove all contaminants, rust and loose material and coat surface as required with appropriate sealant or paint. As an alternative, power tool wire brush may also be used.

- Painting/Sealing: Surfaces, primarily metal, in need of painting were observed at multiple locations at this station. Many of the metal surfaces also require removal of minor rust or corrosion prior to painting. It is evident that many surfaces have been painted in the past without properly removing corroded surfaces. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

5. Monitor all painted surfaces for wear. Properly remove all rust, corrosion and debris prior to painting surfaces. Paint surfaces regularly to prevent corrosion and protect surfaces from moisture damage.

6. Use a safe, lead free paint with high level of moisture and corrosion protection. Apply per manufacturer’s recommendations.

- **Expansion Joints/Sealant:** Expansion joint material was observed to be damaged, deteriorated or missing at multiple locations at the station. This item will require regular and ongoing maintenance.
  5. Expansion joint material should be closely monitored and maintained or replaced as required.
  6. Completely clean joint or failed sealant, dirt, debris, etc. Prepare and prime edges per sealant manufacturer’s criteria. If applicable, replace backer rod where displaced or missing. Size of backer rod to ensure tight fit at all temperatures. When applicable, where concrete spall is located at a joint, repair concrete as required. Install new sealant, Sikaflex – 15LM low-modulus elastomeric sealant (or equivalent).

- **Spalled Concrete:** Concrete spalls were observed at multiple locations at the station. Spalls at stair nosings are evident or may develop. New spalls may develop near existing spalls or at new locations. This item will require regular and ongoing maintenance.
  11. Repair all spalled areas as required and monitor structure for new spalls.
  12. Properly prepare concrete surface by saw-cutting 1/2” deep at perimeter of spalled area to provide an edge 90 degrees to surface at which to terminate patch. Mechanically remove all loose and damaged concrete to provide a sound substrate with a rough profile with 1/16” to 1/8” deep irregularities. Do not chip any deeper than necessary to expose sound concrete. Should more than 1/3 the circumference of reinforcing be exposed, chip out behind the reinforcing steel to a depth of 1/2” (minimum). Where reinforcing with corrosion is encountered, sand blast to remove all contaminants and rust and coat with Sika Armatec 110 (or equivalent). Otherwise, power tool wire brush and coat with Sika Armatec 110 (or equivalent). If corrosion has reduced the section by 15% or more, additional reinforcement must be installed – contact engineering professional for further recommendations.
  13. Repair using Sikatop 123 polymer-modified Portland cement non-sag repair mortar (or equivalent) hand troweled into place (Note: Sikatop 122 (or equivalent) may be used on deck surfaces). Mix using component “A” liquid co-polymer in accordance with manufacturer’s recommendations. Substrate surface must be in a saturated surface dry condition. Apply Sika Armatec 110 (or equivalent) to concrete surface. For repairs deeper than 1 1/2”, apply multiple lifts. Scratch surface or initial lifts to provide for bonding of subsequent lifts. After final finishing, cure by taping sheet plastic over repair to retard loss of moisture. Leave in place for three days. Follow manufacturer’s recommendations in all respects.
  14. Spalls at cast-in-place or precast connections also require two coats (minimum) of Galvicon high quality zinc rich cold galvanization paint (or equivalent) at connection plates after all rust, corrosion and debris has been removed.
  15. Very extensive or significant concrete spall repairs should be reviewed and monitored by an engineering professional.

- **Cracking Concrete:** Cracking at concrete surfaces was observed at multiple locations at this station. Cracks at rails posts at stairs are common and contributing to additional damage, cracking and/or spalling at stairs and landings. These cracks are also contributing to moisture damage and corrosion to the rebar at these locations. In some cases, it appears that rebar or ties were placed with too little clearance cover to the concrete edge of beams, and hairline cracks have developed at those locations. Cracks at stair nosings are evident or may develop. New cracks may develop near existing cracked areas or at new locations. These items will require regular and ongoing maintenance.
  11. Cracks in concrete should be repaired and station should be monitored for worsening of existing cracks or formation of new cracks.
12. Repair cracks after properly pressure washing or sandblasting area to remove any loose debris from edges of crack. For gravity fed crack, chip out “vee” notch along the crack with a router and use compressed air to blow debris out of crack. Layout location of injection ports with spacing required to ensure complete filling of voids. Drill and install a one way valve injection tube. Drill one vent hole to top of surface intersecting with crack. Seal surface of cracks and anchor injection ports, and any visible cracks at underside for gravity fed crack repair, with Sikadur 31 hi-mod gel (or equivalent).

13. After crack has cured, inject cracks with Sikadur 52 low viscosity moisture-insensitive epoxy injection adhesive (or equivalent). Begin injection at one end of the crack and move from port to port toward the opposite end. Proceed slowly to allow injection gel to migrate into narrow portions of the crack. Monitor the top vents to avoid injecting excess material from below. For gravity fed crack repair, Sikapronto 19 (or equivalent) may be used – proceed slowly to allow gel to migrate into narrow portions of the crack. After injection gel has cured for 24 hours, cut off injection ports and grind off seal material flush with bottom of surface. Follow manufacturer’s recommendations.

14. Repair cracks in CMU and precast at mechanical/electrical/storage buildings as required to avoid moisture intrusion and further damage.

15. Very extensive or significant crack repairs should be reviewed and monitored by an engineering professional.

- Water Damage and Intrusion: Water intrusion was observed at multiple locations at this station. This water intrusion causes structural and cosmetic damage, deterioration, rust/corrosion, mold and mildew. Although the station is open, every effort should be made to limit expose to water damage. Standing water was observed at stair landings and at roof tops of low building structures. In many cases, the drains in these areas were clogged or improperly installed. Standing water and leaks also pose a safety and fall hazard.

11. Wherever possible, limit water intrusion into open station structure.
12. Clean clogged drains and repair drains that are damaged or non-functional.
13. Maintain slip proof surfaces and stair nosings as required.
14. Maintain roof and canopy structures as required to avoid water intrusion.
15. Water intrusion at storage, electrical and mechanical rooms should be investigated and corrected immediately.

- General Safety Concerns: Many general safety concerns were noted at this station. These safety concerns could cause falls and/or injuries if not corrected and/or monitored. Some items noted here are also maintenance issues that need to be monitored and repaired as needed.

11. At the tram entrance, there is no fall protection at the outer edge of the track. Although there is an alarm system in place should a passenger move beyond the yellow line when no train is parked at the station, someone could easily climb on to the tracks and fall. It is recommended that additional safety measures be considered.
12. In some instances, it may be possible to climb from the top deck and stairs onto the roof of the low structures below. It is recommended that additional safety measures be taken to keep passengers from accessing these roof areas.
13. Due to moisture, cracking and spalling, some stair tread nosings are damaged and in poor condition. These nosings need to be carefully monitored and repaired or replaced as needed. Other slip resistant surfaces and tile also need to monitored and replaced as needed. These items present a significant slip and fall hazard if not properly maintained.
14. Standing water presents a significant fall hazard and should be removed.
15. Water intrusion has caused the growth of mold and mildew at many locations. This moisture will damage the structural components over time and is also a health hazard. Mold and mildew should be treated and removed.
JTA Skyway Station Infrastructure Structural/Serviceability Summary:

JTA Skyway Station: FSCJ (Rosa Parks) Station

Address: West State Street
Jacksonville, FL 32202

Skyway Station Structural/Serviceability Summary:

- **Short Term Structural/Serviceability:**
  Minor safety, damage and deterioration of structural elements or connections that do not compromise load carrying capacity or overall serviceability. Minor repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Minor serviceability and maintenance issues that are not repaired or monitored may turn into mid or long term structural and/or serviceability issues. There are currently no immediate plans to modify the existing station or to change the current tram/train loadings, so current station is adequate to handle original design loadings.

- **Mid Term Structural/Serviceability:**
  Minor to moderate safety and damage and deterioration of structural elements or connections that are unlikely to compromise the load carrying capacities or overall serviceability. Minor to moderate repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Issues listed in the above referenced summary are likely to progress and require more routine maintenance and repair. Other structural and serviceability issues may occur and the cost to maintain the station structure will likely increase. It is also likely that canopy structures and other items will need to be replaced. Minor to moderate serviceability and maintenance issues that are not repaired or monitored may turn into long term structural and/or serviceability issues. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station is adequate to handle original design loadings. If plans to modify the existing station or to change current tram/train loadings, a detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.

- **Long Term Structural/Serviceability:**
  Moderate to significant safety and damage and deterioration of structural elements or connections that may compromise load carrying capacities or overall serviceability. These items will need to be properly examined and monitored by an engineering professional. The cost for moderate to significant repairs and maintenance will continue to increase. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station should be structurally evaluated to determine if it is adequate to handle original design loadings. It is likely that plans to modify the existing station or to change current trams/trains will be needed. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.
JTA Skyway Station Future Expansion Structural Limitations Summary:

JTA Skyway Station: FSCJ (Rosa Parks) Station
Address: West State Street
Jacksonville, FL 32202

Based on the inspections conducted, possible structural limitations to the JTA Skyway station future expansion include, but are not limited to:

- **Increase in Required Design Loadings:**
  Load bearing members are sufficient to carry current design loadings. Expansion of the JTA Skyway station will likely increase the required loadings for these load bearing members. An extensive and comprehensive structural analysis will be required to evaluate the station infrastructure for the additional loadings. Increased loadings could require larger structural members or modification to the reinforcement of existing structural members. Any increase in vibration or other movement as a result of upgrading to larger trams/trains will also need to be evaluated. It should also be noted that continued exposure to the highly corrosive and moist outdoor environment may compromise and decrease the long term serviceability and safety of the current structure.

- **Clearance Limitations:**
  Larger trams/trains or increased structural members sizes will likely present clearance issues during JTA Skyway future expansions. The most likely clearance issues will take place at tram/train entrances and will be most significant if higher loadings require larger bent beams or wider tram rail and track widths. Taller trams/trains may present clearance issues at the main roof and covered canopies. If roof or canopy elevations must be raised or widened to accommodate larger or taller trams/trains, a full lateral load analysis for the station must be completed to evaluate possible increases in wind loads and dynamic loads. Increased lateral and wind loads may increase structural member sizes.

- **Code Changes, Additional Life Safety and Accessibility Requirements:**
  Future building code changes, additional life safety and accessibility requirements could require significant safety upgrades and heavier structural design loadings. These potential changes could increase the size of the structural members required and may also have a significant impact on the overall cost of any future JTA Skyway station expansion. Careful consideration should be given to structural code changes, life safety and accessibility requirements moving forward.
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 1:

- Photo 2:

Inspection Structural Comments:

- Comments for Photo 1:
  Rusted and damaged steel member above south end signal equipment room door (door facing westward).

- Comments for Photo 2:
  Cracks in CMU at south end signal equipment room. Evidence of water damage/water intrusion.
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 3:

- Comments for Photo 3:
  Cracks in CMU at south end signal equipment room. Evidence of water damage/water intrusion.

- Photo 4:

- Comments for Photo 4:
  Evidence of water damage/water intrusion at multiple locations.

FSCJ-12
**Photo of Required Maintenance/Repairs/Monitoring**  
**FSCJ/Rosa Parks Station**  
Note: See Attached Structural Drawings for location clarification.

- **Photo 5:**

- **Photo 6:**

<table>
<thead>
<tr>
<th>Inspection Structural Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comments for Photo 5:</td>
</tr>
<tr>
<td>Large crack in concrete and spalling at underside of south end stair landing. Monitor and repair crack as required.</td>
</tr>
<tr>
<td>Comments for Photo 6:</td>
</tr>
<tr>
<td>Cracks in concrete and evidence of rust/corrosion under south end stair landing. Monitor and repair cracks as required.</td>
</tr>
</tbody>
</table>
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 7:

- Photo 8:

Inspection Structural Comments:

- Comments for Photo 7:
  Spalled concrete and exposed rebar at underside of south end stair. Rust noted at exposed rebar.

- Comments for Photo 8:
  Cracks in concrete and spalling at handrail posts at south end stair (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 9:

- Photo 10:

- Comments for Photo 9:
  Rust at handrail post (multiple locations). Most significant rust/corrosion located at base of posts.

- Comments for Photo 10:
  Cracks and spalling at concrete - base of handrail posts and beam/stair bearing at south stair. Repair and monitor as required.
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 11:

- Photo 12:

Inspection Structural Comments:

- Comments for Photo 11:
  Ponding water at south stair landing. Clean/maintain drains to avoid clogging.

- Comments for Photo 12:
  Rusted steel with spalled/damaged/cracked concrete at handrail at south stair. Damage at this location is severe and needs immediate repair.
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 13:

- Photo 14:

Inspection Structural Comments:

- Comments for Photo 13:
  Cracks in concrete handrail curbs at midspan (multiple locations) at south stair 2nd floor platform level. Monitor and repair as required.

- Comments for Photo 14:
  Severe rust/corrosion a base of handrail posts (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 15:

- Photo 16:

Inspection Structural Comments:

- Comments for Photo 15:
  No fall protection in place at tram entrances at outside track – safety hazard.

- Comments for Photo 16:
  All painted surfaces must be maintained as required (multiple locations). All rust must be properly removed/treated before repainting.
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 17:

- Photo 18:

Inspection Structural Comments:

- Comments for Photo 17:
  Corrosion at canopy beams and roofing material at south stair area (multiple locations).

- Comments for Photo 18:
  Corrosion at canopy beams and roofing material at north stair area (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 19:

- Photo 20:

Inspection Structural Comments:

- Comments for Photo 19:
 
Cracks in concrete and spalling at handrail posts at north stairs (multiple locations). Repair and monitor as required.

- Comments for Photo 20:

Cracks in concrete and spalling at handrail posts at north stairs (multiple locations). Damage at this location is severe and requires immediate repair.
Photo of Required Maintenance/Repairs/Monitoring
FSCJ/Rosa Parks Station
Note: See Attached Structural Drawings for location clarification.

- Photo 21:

- Photo 22:

Inspection Structural Comments:

- Comments for Photo 21:
  Ponding water at north stair landing. Clean/maintain drains to avoid clogging.

- Comments for Photo 22:
  Cracks in concrete and spalling at north end stair at landing. Evidence of rust/corrosion at cracked area. Repair and monitor as required.
Photo 23:

Inspection Structural Comments:

- Comments for Photo 23:
  
  Cracks in concrete and spalling at north end stair at landing. Evidence of rust/corrosion at cracked area. Repair and monitor as required.
INSPECTION REPORT COVERING
JTA SKYWAY STATION INFRASTRUCTURE ASSESSMENT
JTA Proposal No. P-14-1014

Hemming Plaza Station

Prepared by:
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HEMMING PLAZA-1
Overview:

The purpose of this inspection is to identify short, mid and long term structural and/or serviceability issues at specific JTA Skyway stations. This general inspection will identify ongoing maintenance and repair items that must be addressed to maintain the overall structural integrity and serviceability of the station. Structural elements not clearly visible during the site visit were not inspected and are not included in the scope of this report. All structural elements supporting the actual JTA Skyway tram/train or track (bents, columns, etc.) are being inspected by others and are not included in the scope of this report. See “JTA Skyway Station Inspection General Maintenance and Repair Summary” for common maintenance and repair items observed during this inspection. General maintenance and repair recommendations and instructions given in this section are intended to be guidelines only. Additional or alternate repair and maintenance methods and/or materials may be required.

For a summary of the short, mid and long term structural and/or serviceability issues, see the “JTA Skyway Station Infrastructure Structural/Serviceability Summary”. For general notes and comments pertaining to possible structural limitations for future expansion or renovation of the JTA Skyway stations to accommodate newer and larger trams/trains, see “Skyway Station Future Expansion Structural Limitations Summary”. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion or renovation.

See report photos and inspection structural comments for additional information. See included original station structural drawings for approximate photo locations.

JTA Skyway Station Inspection General Maintenance and Repair Summary:

- Rust and Corrosion: Extensive rust and corrosion at metal surfaces was observed at multiple locations at this station. At some rails posts, corrosion is extensive and posts either need to be replaced or will need to be replaced in the near future. Rust at concrete spalls with and without exposed rebar was also noted. Attachments and/or connections to cameras, lights, etc. are rusted. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
  7. Monitor all surfaces for rust and corrosion. Replace badly rusted rail posts, equipment connection clips, angles and bolts. Paint and seal surfaces as required after properly removing corrosion. Use corrosion resistant hardware, paint, etc. to reduce incidence of rust/corrosion.
  8. Where corrosion is encountered, sand blast to remove all contaminants, rust and loose material and coat surface as required with appropriate sealant or paint. As an alternative, power tool wire brush may also be used.

- Painting/Sealing: Surfaces, primarily metal, in need of painting were observed at multiple locations at this station. Many of the metal surfaces also require removal of minor rust or corrosion prior to painting. It is evident that many surfaces have been painted in the past without properly removing corroded surfaces. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

7. Monitor all painted surfaces for wear. Properly remove all rust, corrosion and debris prior to painting surfaces. Paint surfaces regularly to prevent corrosion and protect surfaces from moisture damage.

8. Use a safe, lead free paint with high level of moisture and corrosion protection. Apply per manufacturer’s recommendations.

- **Expansion Joints/Sealant**: Expansion joint material was observed to be damaged, deteriorated or missing at multiple locations at the station. This item will require regular and ongoing maintenance.

  7. Expansion joint material should be closely monitored and maintained or replaced as required.

  8. Completely clean joint or failed sealant, dirt, debris, etc. Prepare and prime edges per sealant manufacturer’s criteria. If applicable, replace backer rod where displaced or missing. Size of backer rod to ensure tight fit at all temperatures. When applicable, where concrete spall is located at a joint, repair concrete as required. Install new sealant, Sikaflex – 15LM low-modulus elastomeric sealant (or equivalent).

- **Spalled Concrete**: Concrete spalls were observed at multiple locations at the station. Spalls at stair nosings are evident or may develop. New spalls may develop near existing spalls or at new locations. This item will require regular and ongoing maintenance.

  16. Repair all spalled areas as required and monitor structure for new spalls.

  17. Properly prepare concrete surface by saw-cutting 1/2” deep at perimeter of spalled area to provide an edge 90 degrees to surface at which to terminate patch. Mechanically remove all loose and damaged concrete to provide a sound substrate with a rough profile with 1/16” to 1/8” deep irregularities. Do not chip any deeper than necessary to expose sound concrete. Should more than 1/3 the circumference of reinforcing be exposed, chip out behind the reinforcing steel to a depth of 1/2” (minimum). Where reinforcing with corrosion is encountered, sand blast to remove all contaminants and rust and coat with Sika Armatec 110 (or equivalent). Otherwise, power tool wire brush and coat with Sika Armatec 110 (or equivalent). If corrosion has reduced the section by 15% or more, additional reinforcement must be installed – contact engineering professional for further recommendations.

  18. Repair using Sikatop 123 polymer-modified Portland cement non-sag repair mortar (or equivalent) hand troweled into place (Note: Sikatop 122 (or equivalent) may be used on deck surfaces). Mix using component “A” liquid co-polymer in accordance with manufacturer’s recommendations. Substrate surface must be in a saturated surface dry condition. Apply Sika Armatec 110 (or equivalent) to concrete surface. For repairs deeper than 1 1/2”, apply multiple lifts. Scratch surface or initial lifts to provide for bonding of subsequent lifts. After final finishing, cure by taping sheet plastic over repair to retard loss of moisture. Leave in place for three days. Follow manufacturer’s recommendations in all respects.

  19. Spalls at cast-in-place or precast connections also require two coats (minimum) of Galvicon high quality zinc rich cold galvanization paint (or equivalent) at connection plates after all rust, corrosion and debris has been removed.

  20. Very extensive or significant concrete spall repairs should be reviewed and monitored by an engineering professional.

- **Cracking Concrete**: Cracking at concrete surfaces was observed at multiple locations at this station. Cracks at rails posts at stairs are common and contributing to additional damage, cracking and/or spalling at stairs and landings. These cracks are also contributing to moisture damage and corrosion to the rebar at these locations. In some cases, it appears that rebar or ties were placed with too little clearance cover to the concrete edge of beams, and hairline cracks have developed at those locations. Cracks at stair nosings are evident or may develop. New cracks may develop near existing cracked areas or at new locations. These items will require regular and ongoing maintenance.

  16. Cracks in concrete should be repaired and station should be monitored for worsening of existing cracks or formation of new cracks.
17. Repair cracks after properly pressure washing or sandblasting area to remove any loose debris from edges of crack. For gravity fed crack, chip out “vee” notch along the crack with a router and use compressed air to blow debris out of crack. Layout location of injection ports with spacing required to ensure complete filling of voids. Drill and install a one way valve injection tube. Drill one vent hole to top of surface intersecting with crack. Seal surface of cracks and anchor injection ports, and any visible cracks at underside for gravity fed crack repair, with Sikadur 31 hi-mod gel (or equivalent).

18. After crack has cured, inject cracks with Sikadur 52 low viscosity moisture-insensitive epoxy injection adhesive (or equivalent). Begin injection at one end of the crack and move from port to port toward the opposite end. Proceed slowly to allow injection gel to migrate into narrow portions of the crack. Monitor the top vents to avoid injecting excess material from below. For gravity fed crack repair, Sikapronto 19 (or equivalent) may be used – proceed slowly to allow gel to migrate into narrow portions of the crack. After injection gel has cured for 24 hours, cut off injection ports and grind off seal material flush with bottom of surface. Follow manufacturer’s recommendations.

19. Repair cracks in CMU and precast at mechanical/electrical/storage buildings as required to avoid moisture intrusion and further damage.

20. Very extensive or significant crack repairs should be reviewed and monitored by an engineering professional.

- Water Damage and Intrusion: Water intrusion was observed at multiple locations at this station. This water intrusion causes structural and cosmetic damage, deterioration, rust/corrosion, mold and mildew. Although the station is open, every effort should be made to limit exposure to water damage. Standing water was observed at stair landings and at roof tops of low building structures. In many cases, the drains in these areas were clogged or improperly installed. Standing water and leaks also pose a safety and fall hazard.
   16. Wherever possible, limit water intrusion into open station structure.
   17. Clean clogged drains and repair drains that are damaged or non-functional.
   18. Maintain slip proof surfaces and stair nosings as required.
   19. Maintain roof and canopy structures as required to avoid water intrusion.
   20. Water intrusion at storage, electrical and mechanical rooms should be investigated and corrected immediately.

- General Safety Concerns: Many general safety concerns were noted at this station. These safety concerns could cause falls and/or injuries if not corrected and/or monitored. Some items noted here are also maintenance issues that need to be monitored and repaired as needed.
   16. At the tram entrance, there is no fall protection at the outer edge of the track. Although there is an alarm system in place should a passenger move beyond the yellow line when no train is parked at the station, someone could easily climb on to the tracks and fall. It is recommended that additional safety measures be considered.
   17. In some instances, it may be possible to climb from the top deck and stairs onto the roof of the low structures below. It is recommended that additional safety measures be taken to keep passengers from accessing these roof areas.
   18. Due to moisture, cracking and spalling, some stair tread nosings are damaged and in poor condition. These nosings need to be carefully monitored and repaired or replaced as needed. Other slip resistant surfaces and tile also need to monitored and replaced as needed. These items present a significant slip and fall hazard if not properly maintained.
   19. Standing water presents a significant fall hazard and should be removed.
   20. Water intrusion has caused the growth of mold and mildew at many locations. This moisture will damage the structural components over time and is also a health hazard. Mold and mildew should be treated and removed.
JTA Skyway Station Infrastructure Structural/Serviceability Summary:

JTA Skyway Station: Hemming Plaza Station
Address: North Hogan Street
Jacksonville, FL 32202

Skyway Station Structural/Serviceability Summary:

- **Short Term Structural/Serviceability:**
  Minor safety, damage and deterioration of structural elements or connections that do not compromise load carrying capacity or overall serviceability. Minor repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Minor serviceability and maintenance issues that are not repaired or monitored may turn into mid or long term structural and/or serviceability issues. There are currently no immediate plans to modify the existing station or to change the current tram/train loadings, so current station is adequate to handle original design loadings.

- **Mid Term Structural/Serviceability:**
  Minor to moderate safety and damage and deterioration of structural elements or connections that are unlikely to compromise the load carrying capacities or overall serviceability. Minor to moderate repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Issues listed in the above referenced summary are likely to progress and require more routine maintenance and repair. Other structural and serviceability issues may occur and the cost to maintain the station structure will likely increase. It is also likely that canopy structures and other items will need to be replaced. Minor to moderate serviceability and maintenance issues that are not repaired or monitored may turn into long term structural and/or serviceability issues. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station is adequate to handle original design loadings. If plans to modify the existing station or to change current tram/train loadings are proposed, the current station is adequate to handle original design loadings. If plans to modify the existing station or to change current tram/train loadings are proposed, a detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.

- **Long Term Structural/Serviceability:**
  Moderate to significant safety and damage and deterioration of structural elements or connections that may compromise load carrying capacities or overall serviceability. These items will need to be properly examined and monitored by an engineering professional. The cost for moderate to significant repairs and maintenance will continue to increase. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station should be structurally evaluated to determine if it is adequate to handle original design loadings. It is likely that plans to modify the existing station or to change current trams/trains will be needed. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.
JTA Skyway Station Future Expansion Structural Limitations Summary:

JTA Skyway Station: Hemming Plaza Station

Address: North Hogan Street
Jacksonville, FL 32202

Based on the inspections conducted, possible structural limitations to the JTA Skyway station future expansion include, but are not limited to:

- **Increase in Required Design Loadings:**
  Load bearing members are sufficient to carry current design loadings. Expansion of the JTA Skyway station will likely increase the required loadings for these load bearing members. An extensive and comprehensive structural analysis will be required to evaluate the station infrastructure for the additional loadings. Increased loadings could require larger structural members or modification to the reinforcement of existing structural members. Any increase in vibration or other movement as a result of upgrading to larger trams/trains will also need to be evaluated. It should also be noted that continued exposure to the highly corrosive and moist outdoor environment may compromise and decrease the long term serviceability and safety of the current structure.

- **Clearance Limitations:**
  Larger trams/trains or increased structural members sizes will likely present clearance issues during JTA Skyway future expansions. The most likely clearance issues will take place at tram/train entrances and will be most significant if higher loadings require larger bent beams or wider tram rail and track widths. Taller trams/trains may present clearance issues at the main roof and covered canopies. If roof or canopy elevations must be raised or widened to accommodate larger or taller trams/trains, a full lateral load analysis for the station must be completed to evaluate possible increases in wind loads and dynamic loads. Increased lateral and wind loads may increase structural member sizes.

- **Code Changes, Additional Life Safety and Accessibility Requirements:**
  Future building code changes, additional life safety and accessibility requirements could require significant safety upgrades and heavier structural design loadings. These potential changes could increase the size of the structural members required and may also have a significant impact on the overall cost of any future JTA Skyway station expansion. Careful consideration should be given to structural code changes, life safety and accessibility requirements moving forward.
Photo of Required Maintenance/Repairs/Monitoring
Hemming Plaza Station
Note: See Attached Structural Drawings for location clarification.

- Photo 1:

- Photo 2:

Inspection Structural Comments:

- Comments for Photo 1:
  Spalled/cracked concrete with exposed rebar under north end stair. Rust noted at exposed rebar.

- Comments for Photo 2:
  Excessive moisture and water damage/intrusion at electrical room at north end of station. Joint sealant is damaged and needs maintenance/repair (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Hemming Plaza Station
Note: See Attached Structural Drawings for location clarification.

- Photo 3:

![Photo 3: Cracks in brick along top of electrical room at north end of station.](image)

- Photo 4:

![Photo 4: Heavy rust and corrosion at fencing posts-evidence of water damage/water intrusion (multiple locations).](image)

Inspection Structural Comments:

- Comments for Photo 3:
  
  Cracks in brick along top of electrical room at north end of station.

- Comments for Photo 4:
  
  Heavy rust and corrosion at fencing posts-evidence of water damage/water intrusion (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Hemming Plaza Station
Note: See Attached Structural Drawings for location clarification.

- Photo 5:

- Photo 6:

Inspection Structural Comments:

- Comments for Photo 5:
  Crack in concrete at north end stair at handrail post. See Photo 1 for additional comments. Repair and monitor as required.

- Comments for Photo 6:
  Canopy steel needs to be properly cleaned of rust/corrosion and painted (multiple locations).
<table>
<thead>
<tr>
<th>Photo of Required Maintenance/Repairs/Monitoring</th>
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<tbody>
<tr>
<td>Hemming Plaza Station</td>
</tr>
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<td>Note: See Attached Structural Drawings for location clarification.</td>
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</tbody>
</table>

- Photo 7:
  ![Image](image1.png)

- Photo 8:
  ![Image](image2.png)

<table>
<thead>
<tr>
<th>Inspection Structural Comments:</th>
</tr>
</thead>
</table>

- Comments for Photo 7:
  Rust and corrosion at fencing posts at tram/platform level (multiple locations).

- Comments for Photo 8:
  Missing bolts at fencing at tram/platform level (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Hemming Plaza Station
Note: See Attached Structural Drawings for location clarification.

- Photo 9:

- Photo 10:

Inspection Structural Comments:

- Comments for Photo 9:
  No fall protection in place at tram entrances at outside tracks – safety hazard.

- Comments for Photo 10:
  Textured surface material at south stair landing is damaged and lifting up – trip/fall hazard.
Photo of Required Maintenance/Repairs/Monitoring
Hemming Plaza Station
Note: See Attached Structural Drawings for location clarification.

- Photo 11:

- Photo 12:

Inspection Structural Comments:

- Comments for Photo 11:
  Cracks and minor spalled concrete at handrail posts at south end stair (multiple locations). Repair and monitor as required.

- Comments for Photo 12:
  Cracks and some minor spalling at handrail posts at south end stair (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Hemming Plaza Station
Note: See Attached Structural Drawings for location clarification.

- Photo 13:

- Photo 14:

Inspection Structural Comments:

- Comments for Photo 13:
Cracks in concrete from handrail posts evident at underside of south end stair. Evidence of rust/corrosion due to water intrusion. Repair and monitor as required.

- Comments for Photo 14:
Rust and corrosion at bolts, connection clips, angles and fixtures (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Hemming Plaza Station
Note: See Attached Structural Drawings for location clarification.

- Photo 15:

- Photo 16:

Inspection Structural Comments:

- Comments for Photo 15:
  Significant moisture issues at brick signal equipment room on south end of station. Heavy mold and mildew on pipes and brick (multiple locations).

- Comments for Photo 16:
  Rust and corrosion at bolts, connection clips, angles and fixtures (multiple locations).
INSPECTION REPORT COVERING
JTA SKYWAY STATION INFRASTRUCTURE ASSESSMENT
JTA Proposal No. P-14-1014

Central Station

Prepared by:
G.M. Hill Engineering, Inc.
10199 Southside Boulevard, Suite 103A
Jacksonville, Florida 32256

Prepared for:
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5200 Blue Lagoon Drive, Suite 250
Miami, FL 33126

CENTRAL-1
Overview:

The purpose of this inspection is to identify short, mid and long term structural and/or serviceability issues at specific JTA Skyway stations. This general inspection will identify ongoing maintenance and repair items that must be addressed to maintain the overall structural integrity and serviceability of the station. Structural elements not clearly visible during the site visit were not inspected and are not included in the scope of this report. All structural elements supporting the actual JTA Skyway tram/train or track (bents, columns, etc.) are being inspected by others and are not included in the scope of this report. See “JTA Skyway Station Inspection General Maintenance and Repair Summary” for common maintenance and repair items observed during this inspection. General maintenance and repair recommendations and instructions given in this section are intended to be guidelines only. Additional or alternate repair and maintenance methods and/or materials may be required.

For a summary of the short, mid and long term structural and/or serviceability issues, see the “JTA Skyway Station Infrastructure Structural/Serviceability Summary”. For general notes and comments pertaining to possible structural limitations for future expansion or renovation of the JTA Skyway stations to accommodate newer and larger trams/trains, see “Skyway Station Future Expansion Structural Limitations Summary”. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion or renovation.

See report photos and inspection structural comments for additional information. See included original station structural drawings for approximate photo locations.

JTA Skyway Station Inspection General Maintenance and Repair Summary:

- Rust and Corrosion: Extensive rust and corrosion at metal surfaces was observed at multiple locations at this station. At some rails posts, corrosion is extensive and posts either need to be replaced or will need to be replaced in the near future. Rust at concrete spalls with and without exposed rebar was also noted. Attachments and/or connections to cameras, lights, etc. are rusted. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
  9. Monitor all surfaces for rust and corrosion. Replace badly rusted rail posts, equipment connection clips, angles and bolts. Paint and seal surfaces as required after properly removing corrosion. Use corrosion resistant hardware, paint, etc. to reduce incidence of rust/corrosion.
  10. Where corrosion is encountered, sand blast to remove all contaminants, rust and loose material and coat surface as required with appropriate sealant or paint. As an alternative, power tool wire brush may also be used.

- Painting/Sealing: Surfaces, primarily metal, in need of painting were observed at multiple locations at this station. Many of the metal surfaces also require removal of minor rust or corrosion prior to painting. It is evident that many surfaces have been painted in the past without properly removing corroded surfaces. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

9. Monitor all painted surfaces for wear. Properly remove all rust, corrosion and debris prior to painting surfaces. Paint surfaces regularly to prevent corrosion and protect surfaces from moisture damage.

10. Use a safe, lead free paint with high level of moisture and corrosion protection. Apply per manufacturer’s recommendations.

- **Expansion Joints/Sealant:** Expansion joint material was observed to be damaged, deteriorated or missing at multiple locations at the station. This item will require regular and ongoing maintenance.
  
  9. Expansion joint material should be closely monitored and maintained or replaced as required.
  
  10. Completely clean joint or failed sealant, dirt, debris, etc. Prepare and prime edges per sealant manufacturer’s criteria. If applicable, replace backer rod where displaced or missing. Size of backer rod to ensure tight fit at all temperatures. When applicable, where concrete spall is located at a joint, repair concrete as required. Install new sealant, Sikaflex – 15LM low-modulus elastomeric sealant (or equivalent).

- **Spalled Concrete:** Concrete spalls were observed at multiple locations at the station. Spalls at stair nosings are evident or may develop. New spalls may develop near existing spalls or at new locations. This item will require regular and ongoing maintenance.
  
  21. Repair all spalled areas as required and monitor structure for new spalls.
  
  22. Properly prepare concrete surface by saw-cutting 1/2” deep at perimeter of spalled area to provide an edge 90 degrees to surface at which to terminate patch. Mechanically remove all loose and damaged concrete to provide a sound substrate with a rough profile with 1/16” to 1/8” deep irregularities. Do not chip any deeper than necessary to expose sound concrete. Should more than 1/3 the circumference of reinforcing be exposed, chip out behind the reinforcing steel to a depth of 1/2” (minimum). Where reinforcing with corrosion is encountered, sand blast to remove all contaminants and rust and coat with Sika Armatec 110 (or equivalent). Otherwise, power tool wire brush and coat with Sika Armatec 110 (or equivalent). If corrosion has reduced the section by 15% or more, additional reinforcement must be installed – contact engineering professional for further recommendations.
  
  23. Repair using Sikatop 123 polymer-modified Portland cement non-sag repair mortar (or equivalent) hand troweled into place (Note: Sikatop 122 (or equivalent) may be used on deck surfaces). Mix using component “A” liquid co-polymer in accordance with manufacturer’s recommendations. Substrate surface must be in a saturated surface dry condition. Apply Sika Armatec 110 (or equivalent) to concrete surface. For repairs deeper than 1 1/2”, apply multiple lifts. Scratch surface or initial lifts to provide for bonding of subsequent lifts. After final finishing, cure by taping sheet plastic over repair to retard loss of moisture. Leave in place for three days. Follow manufacturer’s recommendations in all respects.
  
  24. Spalls at cast-in-place or precast connections also require two coats (minimum) of Galvicon high quality zinc rich cold galvanization paint (or equivalent) at connection plates after all rust, corrosion and debris has been removed.
  
  25. Very extensive or significant concrete spall repairs should be reviewed and monitored by an engineering professional.

- **Cracking Concrete:** Cracking at concrete surfaces was observed at multiple locations at this station. Cracks at rails posts at stairs are common and contributing to additional damage, cracking and/or spalling at stairs and landings. These cracks are also contributing to moisture damage and corrosion to the rebar at these locations. In some cases, it appears that rebar or ties were placed with too little clearance cover to the concrete edge of beams, and hairline cracks have developed at those locations. Cracks at stair nosings are evident or may develop. New cracks may develop near existing cracked areas or at new locations. These items will require regular and ongoing maintenance.
  
  21. Cracks in concrete should be repaired and station should be monitored for worsening of existing cracks or formation of new cracks.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

22. Repair cracks after properly pressure washing or sandblasting area to remove any loose debris from edges of crack. For gravity fed crack, chip out “vee” notch along the crack with a router and use compressed air to blow debris out of crack. Layout location of injection ports with spacing required to ensure complete filling of voids. Drill and install a one way valve injection tube. Drill one vent hole to top of surface intersecting with crack. Seal surface of cracks and anchor injection ports, and any visible cracks at underside for gravity fed crack repair, with Sikadur 31 hi-mod gel (or equivalent).

23. After crack has cured, inject cracks with Sikadur 52 low viscosity moisture-insensitive epoxy injection adhesive (or equivalent). Begin injection at one end of the crack and move from port to port toward the opposite end. Proceed slowly to allow injection gel to migrate into narrow portions of the crack. Monitor the top vents to avoid injecting excess material from below. For gravity fed crack repair, Sikapronto 19 (or equivalent) may be used – proceed slowly to allow gel to migrate into narrow portions of the crack. After injection gel has cured for 24 hours, cut off injection ports and grind off seal material flush with bottom of surface. Follow manufacturer’s recommendations.

24. Repair cracks in CMU and precast at mechanical/electrical/storage buildings as required to avoid moisture intrusion and further damage.

25. Very extensive or significant crack repairs should be reviewed and monitored by an engineering professional.

- **Water Damage and Intrusion:** Water intrusion was observed at multiple locations at this station. This water intrusion causes structural and cosmetic damage, deterioration, rust/corrosion, mold and mildew. Although the station is open, every effort should be made to limit expose to water damage. Standing water was observed at stair landings and at roof tops of low building structures. In many cases, the drains in these areas were clogged or improperly installed. Standing water and leaks also pose a safety and fall hazard.

  21. Wherever possible, limit water intrusion into open station structure.
  22. Clean clogged drains and repair drains that are damaged or non-functional.
  23. Maintain slip proof surfaces and stair nosings as required.
  24. Maintain roof and canopy structures as required to avoid water intrusion.
  25. Water intrusion at storage, electrical and mechanical rooms should be investigated and corrected immediately.

- **General Safety Concerns:** Many general safety concerns were noted at this station. These safety concerns could cause falls and/or injuries if not corrected and/or monitored. Some items noted here are also maintenance issues that need to be monitored and repaired as needed.

  21. At the tram entrance, there is no fall protection at the outer edge of the track. Although there is an alarm system in place should a passenger move beyond the yellow line when no train is parked at the station, someone could easily climb on to the tracks and fall. It is recommended that additional safety measures be considered.
  22. In some instances, it may be possible to climb from the top deck and stairs onto the roof of the low structures below. It is recommended that additional safety measures be taken to keep passengers from accessing these roof areas.
  23. Due to moisture, cracking and spalling, some stair tread nosings are damaged and in poor condition. These nosings need to be carefully monitored and repaired or replaced as needed. Other slip resistant surfaces and tile also need to monitored and replaced as needed. These items present a significant slip and fall hazard if not properly maintained.
  24. Standing water presents a significant fall hazard and should be removed.
  25. Water intrusion has caused the growth of mold and mildew at many locations. This moisture will damage the structural components over time and is also a health hazard. Mold and mildew should be treated and removed.
JTA Skyway Station Infrastructure Structural/Serviceability Summary:

JTA Skyway Station: Central Station

Address: West Bay Street
Jacksonville, FL 32202

Skyway Station Structural/Serviceability Summary:

- **Short Term Structural/Serviceability:**
  Minor safety, damage and deterioration of structural elements or connections that do not compromise load carrying capacity or overall serviceability. Minor repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Minor serviceability and maintenance issues that are not repaired or monitored may turn into mid or long term structural and/or serviceability issues. There are currently no immediate plans to modify the existing station or to change the current tram/train loadings, so current station is adequate to handle original design loadings.

- **Mid Term Structural/Serviceability:**
  Minor to moderate safety and damage and deterioration of structural elements or connections that are unlikely to compromise the load carrying capacities or overall serviceability. Minor to moderate repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Issues listed in the above referenced summary are likely to progress and require more routine maintenance and repair. Other structural and serviceability issues may occur and the cost to maintain the station structure will likely increase. It is also likely that canopy structures and other items will need to be replaced. Minor to moderate serviceability and maintenance issues that are not repaired or monitored may turn into long term structural and/or serviceability issues. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station is adequate to handle original design loadings. If plans to modify the existing station or to change current tram/train loadings are proposed, a detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.

- **Long Term Structural/Serviceability:**
  Moderate to significant safety and damage and deterioration of structural elements or connections that may compromise load carrying capacities or overall serviceability. These items will need to be properly examined and monitored by an engineering professional. The cost for moderate to significant repairs and maintenance will continue to increase. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station should be structurally evaluated to determine if it is adequate to handle original design loadings. It is likely that plans to modify the existing station or to change current trams/trains will be needed. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.
JTA Skyway Station Future Expansion Structural Limitations Summary:

JTA Skyway Station: Central Station

Address: West Bay Street
Jacksonville, FL 32202

Based on the inspections conducted, possible structural limitations to the JTA Skyway station future expansion include, but are not limited to:

- **Increase in Required Design Loadings:**
  Load bearing members are sufficient to carry current design loadings. Expansion of the JTA Skyway station will likely increase the required loadings for these load bearing members. An extensive and comprehensive structural analysis will be required to evaluate the station infrastructure for the additional loadings. Increased loadings could require larger structural members or modification to the reinforcement of existing structural members. Any increase in vibration or other movement as a result of upgrading to larger trams/trains will also need to be evaluated. It should also be noted that continued exposure to the highly corrosive and moist outdoor environment may compromise and decrease the long term serviceability and safety of the current structure.

- **Clearance Limitations:**
  Larger trams/trains or increased structural members sizes will likely present clearance issues during JTA Skyway future expansions. The most likely clearance issues will take place at tram/train entrances and will be most significant if higher loadings require larger bent beams or wider tram rail and track widths. Taller trams/trains may present clearance issues at the main roof and covered canopies. If roof or canopy elevations must be raised or widened to accommodate larger or taller trams/trains, a full lateral load analysis for the station must be completed to evaluate possible increases in wind loads and dynamic loads. Increased lateral and wind loads may increase structural member sizes.

- **Code Changes, Additional Life Safety and Accessibility Requirements:**
  Future building code changes, additional life safety and accessibility requirements could require significant safety upgrades and heavier structural design loadings. These potential changes could increase the size of the structural members required and may also have a significant impact on the overall cost of any future JTA Skyway station expansion. Careful consideration should be given to structural code changes, life safety and accessibility requirements moving forward.
Photo of Required Maintenance/Repairs/Monitoring
Central Station
Note: See Attached Structural Drawings for location clarification.

- Photo 1:

- Photo 2:

- Comments for Photo 1:
  Cracked concrete at east end stair landing underside. Monitor and repair as required.

- Comments for Photo 2:
  Rusted/corroded fencing posts. Evidence of water intrusion (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring Central Station

Note: See Attached Structural Drawings for location clarification.

- Photo 3:

- Photo 4:

Inspection Structural Comments:

- Comments for Photo 3:
  
  Exposed rebar with rust at landing under east side stair (multiple locations).

- Comments for Photo 4:
  
  Small cracks in concrete under east side stair beam. Cracks appear to occur at tie locations – ties/rebar may have been placed too close to outside face of beam (occurs at multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Central Station
Note: See Attached Structural Drawings for location clarification.

- Photo 5:

- Photo 6:

Inspection Structural Comments:

- Comments for Photo 5:
  Canopy sections are rusted and damaged (multiple locations). Canopy repairs should be made as required.

- Comments for Photo 6:
  No fall protection at outside track at tram/train entrance – safety hazard.
Photo of Required Maintenance/Repairs/Monitoring
Central Station
Note: See Attached Structural Drawings for location clarification.

- Photo 7:

- Photo 8:

Inspection Structural Comments:

- Comments for Photo 7:
  Rust and corrosion at base of tube steel columns (multiple locations).

- Comments for Photo 8:
  Surfaces must be regularly painted – prepare surface and remove all rust/corrosion/debris before painting (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Central Station
Note: See Attached Structural Drawings for location clarification.

- Photo 9:

- Photo 10:

Inspection Structural Comments:

- Comments for Photo 9:
  Spalled concrete with exposed rebar at west end stair landing. Rust/corrosion noted at exposed rebar (multiple locations).

- Comments for Photo 10:
  Heavily corroded base plate at steel column (located at signal equipment room at east end of station). Evidence of significant water damage/water intrusion. Base plate must be replaced.
Photo of Required Maintenance/Repairs/Monitoring
Central Station
Note: See Attached Structural Drawings for location clarification.

- Photo 11:

- Comments for Photo 11:
  Corrosion and rusting at metal frame and baseplate at west end electrical room. Evidence of significant water damage/water intrusion.

- Photo 12:

- Comments for Photo 12:
  Cracks at exterior facing of west end electrical room. Deteriorating joint material noted.
Photo of Required Maintenance/Repairs/Monitoring Central Station
Note: See Attached Structural Drawings for location clarification.

- Photo 13:

![Photo of Corrosion at Weld Locations](image)

Inspection Structural Comments:

- Comments for Photo 13:
  Corrosion at weld locations at canopy frame (ground level – multiple locations).
INSPECTION REPORT COVERING
JTA SKYWAY STATION INFRASTRUCTURE ASSESSMENT
JTA Proposal No. P-14-1014

Kings Avenue (DuPont) Station

Prepared by:
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Jacksonville, Florida 32256

Prepared for:
Lea & Elliott, Inc.
5200 Blue Lagoon Drive, Suite 250
Miami, FL 33126

KINGS AVENUE-1
JTA Skyway Station Infrastructure Executive Summary:

JTA Skyway Station: Kings Avenue (DuPont) Station

Address: Onyx Street
          Jacksonville, FL 32207

Date of Inspection: 9/30/2014
Inspector(s): Gina Hill, Kim Murphy

Overview:

The purpose of this inspection is to identify short, mid and long term structural and/or serviceability issues at specific JTA Skyway stations. This general inspection will identify ongoing maintenance and repair items that must be addressed to maintain the overall structural integrity and serviceability of the station. Structural elements not clearly visible during the site visit were not inspected and are not included in the scope of this report. All structural elements supporting the actual JTA Skyway tram/train or track (bents, columns, etc.) are being inspected by others and are not included in the scope of this report. See “JTA Skyway Station Inspection General Maintenance and Repair Summary” for common maintenance and repair items observed during this inspection. General maintenance and repair recommendations and instructions given in this section are intended to be guidelines only. Additional or alternate repair and maintenance methods and/or materials may be required.

For a summary of the short, mid and long term structural and/or serviceability issues, see the “JTA Skyway Station Infrastructure Structural/Serviceability Summary”. For general notes and comments pertaining to possible structural limitations for future expansion or renovation of the JTA Skyway stations to accommodate newer and larger trams/trains, see “Skyway Station Future Expansion Structural Limitations Summary”. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion or renovation.

See report photos and inspection structural comments for additional information. See included original station structural drawings for approximate photo locations.

JTA Skyway Station Inspection General Maintenance and Repair Summary:

- Rust and Corrosion: Extensive rust and corrosion at metal surfaces was observed at multiple locations at this station. At some rails posts, corrosion is extensive and posts either need to be replaced or will need to be replaced in the near future. Rust at concrete spalls with and without exposed rebar was also noted. Attachments and/or connections to cameras, lights, etc. are rusted. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
  11. Monitor all surfaces for rust and corrosion. Replace badly rusted rail posts, equipment connection clips, angles and bolts. Paint and seal surfaces as required after properly removing corrosion. Use corrosion resistant hardware, paint, etc. to reduce incidence of rust/corrosion.
  12. Where corrosion is encountered, sand blast to remove all contaminants, rust and loose material and coat surface as required with appropriate sealant or paint. As an alternative, power tool wire brush may also be used.

- Painting/Sealing: Surfaces, primarily metal, in need of painting were observed at multiple locations at this station. Many of the metal surfaces also require removal of minor rust or corrosion prior to painting. It is evident that many surfaces have been painted in the past without properly removing corroded surfaces. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

11. Monitor all painted surfaces for wear. Properly remove all rust, corrosion and debris prior to painting surfaces. Paint surfaces regularly to prevent corrosion and protect surfaces from moisture damage.

12. Use a safe, lead free paint with high level of moisture and corrosion protection. Apply per manufacturer’s recommendations.

- **Expansion Joints/Sealant:** Expansion joint material was observed to be damaged, deteriorated or missing at multiple locations at the station. This item will require regular and ongoing maintenance.
  11. Expansion joint material should be closely monitored and maintained or replaced as required.
  12. Completely clean joint or failed sealant, dirt, debris, etc. Prepare and prime edges per sealant manufacturer’s criteria. If applicable, replace backer rod where displaced or missing. Size of backer rod to ensure tight fit at all temperatures. When applicable, where concrete spall is located at a joint, repair concrete as required. Install new sealant, Sikaflex – 15LM low-modulus elastomeric sealant (or equivalent).

- **Spalled Concrete:** Concrete spalls were observed at multiple locations at the station. Spalls at stair nosings are evident or may develop. New spalls may develop near existing spalls or at new locations. This item will require regular and ongoing maintenance.
  26. Repair all spalled areas as required and monitor structure for new spalls.
  27. Properly prepare concrete surface by saw-cutting 1/2” deep at perimeter of spalled area to provide an edge 90 degrees to surface at which to terminate patch. Mechanically remove all loose and damaged concrete to provide a sound substrate with a rough profile with 1/16” to 1/8” deep irregularities. Do not chip any deeper than necessary to expose sound concrete. Should more than 1/3 the circumference of reinforcing be exposed, chip out behind the reinforcing steel to a depth of 1/2” (minimum). Where reinforcing with corrosion is encountered, sand blast to remove all contaminants and rust and coat with Sika Armatec 110 (or equivalent). Otherwise, power tool wire brush and coat with Sika Armatec 110 (or equivalent). If corrosion has reduced the section by 15% or more, additional reinforcement must be installed – contact engineering professional for further recommendations.
  28. Repair using Sikatop 123 polymer-modified Portland cement non-sag repair mortar (or equivalent) hand troweled into place (Note: Sikatop 122 (or equivalent) may be used on deck surfaces). Mix using component “A” liquid co-polymer in accordance with manufacturer’s recommendations. Substrate surface must be in a saturated surface dry condition. Apply Sika Armatec 110 (or equivalent) to concrete surface. For repairs deeper than 1 1/2”, apply multiple lifts. Scratch surface or initial lifts to provide for bonding of subsequent lifts. After final finishing, cure by tapeing sheet plastic over repair to retard loss of moisture. Leave in place for three days. Follow manufacturer’s recommendations in all respects.
  29. Spalls at cast-in-place or precast connections also require two coats (minimum) of Galvicon high quality zinc rich cold galvanization paint (or equivalent) at connection plates after all rust, corrosion and debris has been removed.
  30. Very extensive or significant concrete spall repairs should be reviewed and monitored by an engineering professional.

- **Cracking Concrete:** Cracking at concrete surfaces was observed at multiple locations at this station. Cracks at rails posts at stairs are common and contributing to additional damage, cracking and/or spalling at stairs and landings. These cracks are also contributing to moisture damage and corrosion to the rebar at these locations. In some cases, it appears that rebar or ties were placed with too little clearance cover to the concrete edge of beams, and hairline cracks have developed at those locations. Cracks at stair nosings are evident or may develop. New cracks may develop near existing cracked areas or at new locations. These items will require regular and ongoing maintenance.
  26. Cracks in concrete should be repaired and station should be monitored for worsening of existing cracks or formation of new cracks.
27. Repair cracks after properly pressure washing or sandblasting area to remove any loose debris from edges of crack. For gravity fed crack, chip out “vee” notch along the crack with a router and use compressed air to blow debris out of crack. Layout location of injection ports with spacing required to ensure complete filling of voids. Drill and install a one way valve injection tube. Drill one vent hole to top of surface intersecting with crack. Seal surface of cracks and anchor injection ports, and any visible cracks at underside for gravity fed crack repair, with Sikadur 31 hi-mod gel (or equivalent).

28. After crack has cured, inject cracks with Sikadur 52 low viscosity moisture-insensitive epoxy injection adhesive (or equivalent). Begin injection at one end of the crack and move from port to port toward the opposite end. Proceed slowly to allow injection gel to migrate into narrow portions of the crack. Monitor the top vents to avoid injecting excess material from below. For gravity fed crack repair, Sikapronto 19 (or equivalent) may be used – proceed slowly to allow gel to migrate into narrow portions of the crack. After injection gel has cured for 24 hours, cut off injection ports and grind off seal material flush with bottom of surface. Follow manufacturer’s recommendations.

29. Repair cracks in CMU and precast at mechanical/electrical/storage buildings as required to avoid moisture intrusion and further damage.

30. Very extensive or significant crack repairs should be reviewed and monitored by an engineering professional.

- Water Damage and Intrusion: Water intrusion was observed at multiple locations at this station. This water intrusion causes structural and cosmetic damage, deterioration, rust/corrosion, mold and mildew. Although the station is open, every effort should be made to limit expose to water damage. Standing water was observed at stair landings and at roof tops of low building structures. In many cases, the drains in these areas were clogged or improperly installed. Standing water and leaks also pose a safety and fall hazard.

   26. Wherever possible, limit water intrusion into open station structure.
   27. Clean clogged drains and repair drains that are damaged or non-functional.
   28. Maintain slip proof surfaces and stair nosings as required.
   29. Maintain roof and canopy structures as required to avoid water intrusion.
   30. Water intrusion at storage, electrical and mechanical rooms should be investigated and corrected immediately.

- General Safety Concerns: Many general safety concerns were noted at this station. These safety concerns could cause falls and/or injuries if not corrected and/or monitored. Some items noted here are also maintenance issues that need to be monitored and repaired as needed.

   26. At the tram entrance, there is no fall protection at the outer edge of the track. Although there is an alarm system in place should a passenger move beyond the yellow line when no train is parked at the station, someone could easily climb on to the tracks and fall. It is recommended that additional safety measures be considered.
   27. In some instances, it may be possible to climb from the top deck and stairs onto the roof of the low structures below. It is recommended that additional safety measures be taken to keep passengers from accessing these roof areas.
   28. Due to moisture, cracking and spalling, some stair tread nosings are damaged and in poor condition. These nosings need to be carefully monitored and repaired or replaced as needed. Other slip resistant surfaces and tile also need to monitored and replaced as needed. These items present a significant slip and fall hazard if not properly maintained.
   29. Standing water presents a significant fall hazard and should be removed.
   30. Water intrusion has caused the growth of mold and mildew at many locations. This moisture will damage the structural components over time and is also a health hazard. Mold and mildew should be treated and removed.
JTA Skyway Station Infrastructure Structural/Serviceability Summary:

JTA Skyway Station: Kings Avenue (DuPont) Station
Address: Onyx Street
Jacksonville, FL 32207

Skyway Station Structural/Serviceability Summary:

• **Short Term Structural/Serviceability:**
  Minor safety, damage and deterioration of structural elements or connections that do not compromise load carrying capacity or overall serviceability. Minor repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Minor serviceability and maintenance issues that are not repaired or monitored may turn into mid or long term structural and/or serviceability issues. There are currently no immediate plans to modify the existing station or to change the current tram/train loadings, so current station is adequate to handle original design loadings.

• **Mid Term Structural/Serviceability:**
  Minor to moderate safety and damage and deterioration of structural elements or connections that are unlikely to compromise the load carrying capacities or overall serviceability. Minor to moderate repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Issues listed in the above referenced summary are likely to progress and require more routine maintenance and repair. Other structural and serviceability issues may occur and the cost to maintain the station structure will likely increase. It is also likely that canopy structures and other items will need to be replaced. Minor to moderate serviceability and maintenance issues that are not repaired or monitored may turn into long term structural and/or serviceability issues. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station is adequate to handle original design loadings. If plans to modify the existing station or to change current tram/train loadings are proposed, a detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.

• **Long Term Structural/Serviceability:**
  Moderate to significant safety and damage and deterioration of structural elements or connections that may compromise load carrying capacities or overall serviceability. These items will need to be properly examined and monitored by an engineering professional. The cost for moderate to significant repairs and maintenance will continue to increase. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station should be structurally evaluated to determine if it is adequate to handle original design loadings. It is likely that plans to modify the existing station or to change current tram/train loadings will be needed. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.
JTA Skyway Station Future Expansion Structural Limitations Summary:

JTA Skyway Station: Kings Avenue (DuPont) Station

Address: Onyx Street
Jacksonville, FL 32207

Based on the inspections conducted, possible structural limitations to the JTA Skyway station future expansion include, but are not limited to:

- **Increase in Required Design Loadings:**
  Load bearing members are sufficient to carry current design loadings. Expansion of the JTA Skyway station will likely increase the required loadings for these load bearing members. An extensive and comprehensive structural analysis will be required to evaluate the station infrastructure for the additional loadings. Increased loadings could require larger structural members or modification to the reinforcement of existing structural members. Any increase in vibration or other movement as a result of upgrading to larger trams/trains will also need to be evaluated. It should also be noted that continued exposure to the highly corrosive and moist outdoor environment may compromise and decrease the long term serviceability and safety of the current structure.

- **Clearance Limitations:**
  Larger trams/trains or increased structural members sizes will likely present clearance issues during JTA Skyway future expansions. The most likely clearance issues will take place at tram/train entrances and will be most significant if higher loadings require larger bent beams or wider tram rail and track widths. Taller trams/trains may present clearance issues at the main roof and covered canopies. If roof or canopy elevations must be raised or widened to accommodate larger or taller trams/trains, a full lateral load analysis for the station must be completed to evaluate possible increases in wind loads and dynamic loads. Increased lateral and wind loads may increase structural member sizes.

- **Code Changes, Additional Life Safety and Accessibility Requirements:**
  Future building code changes, additional life safety and accessibility requirements could require significant safety upgrades and heavier structural design loadings. These potential changes could increase the size of the structural members required and may also have a significant impact on the overall cost of any future JTA Skyway station expansion. Careful consideration should be given to structural code changes, life safety and accessibility requirements moving forward.
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 1:

- Photo 2:

Inspection Structural Comments:

- Comments for Photo 1:
  General photo – south end stairs (from east side).

- Comments for Photo 2:
  General photo – 2nd level south stairs from underside.
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 3:

- Photo 4:

Inspection Structural Comments:

- Comments for Photo 3:
  General photo – top/platform at south end stairs.

- Comments for Photo 4:
  General photo – escalator view (south end).
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 5:

- Photo 6:

Inspection Structural Comments:

- Comments for Photo 5:
  Cracked and spalled concrete at handrail post at bottom of south end stairs (multiple locations).

- Comments for Photo 6:
  Cracked concrete at handrail posts at south end stairs from ground level (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 7:

- Photo 8:

Inspection Structural Comments:

- Comments for Photo 7:
  Cracked concrete at handrail post at south end stairs at west face of 2nd level platform (multiple locations).

- Comments for Photo 8:
  Cracked concrete at south end stairs 2nd level at west face (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 9:

- Photo 10:

Inspection Structural Comments:

- Comments for Photo 9:
  Rust and corrosion at steel roof beams and connections (multiple locations).

- Comments for Photo 10:
  Nosing at north end stair is a tripping/safety hazard (this area was blocked off during inspection as to prevent use). Repairs required at this area.
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 11:

- Photo 12:

Inspection Structural Comments:

- Comments for Photo 11:
  General photo – elevator at north end of station.

- Comments for Photo 12:
  Corrosion and deterioration at base of handrail posts (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 13:

- Photo 14:

Inspection Structural Comments:

- Comments for Photo 13:
  North end of station – janitor/electrical rooms not accessible during inspection. Evidence of water issues – monitor and repair as required.

- Comments for Photo 14:
  1st floor at south side of escalator - expansion joint material must be monitored and replaced as required (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 15:

![Photo 15](image)

- Photo 16:

![Photo 16](image)

Inspection Structural Comments:

- Comments for Photo 15:

  North end equipment room – top beam has crack at centerline all the way around. Monitor and repair cracks as required.

- Comments for Photo 16:

  North end of station at west side – mechanical room area concrete beam is cracked (multiple locations). Monitor and repair cracks as required.
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 17:

- Photo 18:

Inspection Structural Comments:

- Comments for Photo 17:
  South end building area shows significant water damage and intrusion. Metal lintel angle is corroded and damaged. Heavy mold and mildew noted.

- Comments for Photo 18:
  South end of station – south side of building: steel framing at roll-up door is corroded and damaged.
Photo of Required Maintenance/Repairs/Monitoring
Kings Avenue/DuPont Station
Note: See Attached Structural Drawings for location clarification.

- Photo 19:

- Photo 20:

Inspection Structural Comments:

- Comments for Photo 19:
  South end building area – expansion joint material is damaged. Monitor expansion joint material and replace as required (multiple locations).

- Comments for Photo 20:
  South end building area – cracks in CMU (multiple locations). Evidence of possible water intrusion.
**Photo of Required Maintenance/Repairs/Monitoring**

**Kings Avenue/DuPont Station**

Note: See Attached Structural Drawings for location clarification.

- Photo 21:

![Image of the building area with a crack in CMU/brick](image)

**Inspection Structural Comments:**

- Comments for Photo 21:

  South end building area at southeast corner – crack at CMU/brick above office area.
INSPECTION REPORT COVERING
JTA SKYWAY STATION INFRASTRUCTURE ASSESSMENT
JTA Proposal No. P-14-1014

Riverplace (Flagler) Station

Prepared by:
G.M. Hill Engineering, Inc.
10199 Southside Boulevard, Suite 103A
Jacksonville, Florida 32256

Prepared for:
Lea & Elliott, Inc.
5200 Blue Lagoon Drive, Suite 250
Miami, FL 33126

RIVERPLACE-1
JTA Skyway Station Infrastructure Executive Summary:

JTA Skyway Station: Riverplace (Flagler) Station

Address: Flagler Avenue
Jacksonville, FL 32207

Date of Inspection: 9/30/2014
Inspector(s): Gina Hill, Kim Murphy

Overview:

The purpose of this inspection is to identify short, mid and long term structural and/or serviceability issues at specific JTA Skyway stations. This general inspection will identify ongoing maintenance and repair items that must be addressed to maintain the overall structural integrity and serviceability of the station. Structural elements not clearly visible during the site visit were not inspected and are not included in the scope of this report. All structural elements supporting the actual JTA Skyway tram/train or track (bents, columns, etc.) are being inspected by others and are not included in the scope of this report. See “JTA Skyway Station Inspection General Maintenance and Repair Summary” for common maintenance and repair items observed during this inspection. General maintenance and repair recommendations and instructions given in this section are intended to be guidelines only. Additional or alternate repair and maintenance methods and/or materials may be required.

For a summary of the short, mid and long term structural and/or serviceability issues, see the “JTA Skyway Station Infrastructure Structural/Serviceability Summary”. For general notes and comments pertaining to possible structural limitations for future expansion or renovation of the JTA Skyway stations to accommodate newer and larger trams/trains, see “Skyway Station Future Expansion Structural Limitations Summary”. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion or renovation.

See report photos and inspection structural comments for additional information. See included original station structural drawings for approximate photo locations.

JTA Skyway Station Inspection General Maintenance and Repair Summary:

- Rust and Corrosion: Extensive rust and corrosion at metal surfaces was observed at multiple locations at this station. At some rails posts, corrosion is extensive and posts either need to be replaced or will need to be replaced in the near future. Rust at concrete spalls with and without exposed rebar was also noted. Attachments and/or connections to cameras, lights, etc. are rusted. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
  13. Monitor all surfaces for rust and corrosion. Replace badly rusted rail posts, equipment connection clips, angles and bolts. Paint and seal surfaces as required after properly removing corrosion. Use corrosion resistant hardware, paint, etc. to reduce incidence of rust/corrosion.
  14. Where corrosion is encountered, sand blast to remove all contaminants, rust and loose material and coat surface as required with appropriate sealant or paint. As an alternative, power tool wire brush may also be used.

- Painting/Sealing: Surfaces, primarily metal, in need of painting were observed at multiple locations at this station. Many of the metal surfaces also require removal of minor rust or corrosion prior to painting. It is evident that many surfaces have been painted in the past without properly removing corroded surfaces. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

13. Monitor all painted surfaces for wear. Properly remove all rust, corrosion, and debris prior to painting surfaces. Paint surfaces regularly to prevent corrosion and protect surfaces from moisture damage.

14. Use a safe, lead-free paint with high level of moisture and corrosion protection. Apply per manufacturer’s recommendations.

- **Expansion Joints/Sealant:** Expansion joint material was observed to be damaged, deteriorated, or missing at multiple locations at the station. This item will require regular and ongoing maintenance.
  13. Expansion joint material should be closely monitored and maintained or replaced as required.
  14. Completely clean joint or failed sealant, dirt, debris, etc. Prepare and prime edges per sealant manufacturer’s criteria. If applicable, replace backer rod where displaced or missing. Size of backer rod to ensure tight fit at all temperatures. When applicable, where concrete spall is located at a joint, repair concrete as required. Install new sealant, Sikaflex – 15LM low-modulus elastomeric sealant (or equivalent).

- **Spalled Concrete:** Concrete spalls were observed at multiple locations at the station. Spalls at stair nosings are evident or may develop. New spalls may develop near existing spalls or at new locations. This item will require regular and ongoing maintenance.
  31. Repair all spalled areas as required and monitor structure for new spalls.
  32. Properly prepare concrete surface by saw-cutting 1/2” deep at perimeter of spalled area to provide an edge 90 degrees to surface at which to terminate patch. Mechanically remove all loose and damaged concrete to provide a sound substrate with a rough profile with 1/16” to 1/8” deep irregularities. Do not chip any deeper than necessary to expose sound concrete. Should more than 1/3 the circumference of reinforcing be exposed, chip out behind the reinforcing steel to a depth of 1/2” (minimum). Where reinforcing with corrosion is encountered, sand blast to remove all contaminants and rust and coat with Sika Armatec 110 (or equivalent). Otherwise, power tool wire brush and coat with Sika Armatec 110 (or equivalent). If corrosion has reduced the section by 15% or more, additional reinforcement must be installed – contact engineering professional for further recommendations.
  33. Repair using Sikatop 123 polymer-modified Portland cement non-sag repair mortar (or equivalent) hand troweled into place (Note: Sikatop 122 (or equivalent) may be used on deck surfaces). Mix using component “A” liquid co-polymer in accordance with manufacturer’s recommendations. Substrate surface must be in a saturated surface dry condition. Apply Sika Armatec 110 (or equivalent) to concrete surface. For repairs deeper than 1 1/2”, apply multiple lifts. Scratch surface or initial lifts to provide for bonding of subsequent lifts. After final finishing, cure by taping sheet plastic over repair to retard loss of moisture. Leave in place for three days. Follow manufacturer’s recommendations in all respects.
  34. Spalls at cast-in-place or precast connections also require two coats (minimum) of Galvicon high quality zinc rich cold galvanization paint (or equivalent) at connection plates after all rust, corrosion and debris has been removed.
  35. Very extensive or significant concrete spall repairs should be reviewed and monitored by an engineering professional.

- **Cracking Concrete:** Cracking at concrete surfaces was observed at multiple locations at this station. Cracks at rails posts at stairs are common and contributing to additional damage, cracking and/or spalling at stairs and landings. These cracks are also contributing to moisture damage and corrosion to the rebar at these locations. In some cases, it appears that rebar or ties were placed with too little clearance cover to the concrete edge of beams, and hairline cracks have developed at those locations. Cracks at stair nosings are evident or may develop. New cracks may develop near existing cracked areas or at new locations. These items will require regular and ongoing maintenance.
  31. Cracks in concrete should be repaired and station should be monitored for worsening of existing cracks or formation of new cracks.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

32. Repair cracks after properly pressure washing or sandblasting area to remove any loose debris from edges of crack. For gravity fed crack, chip out “vee” notch along the crack with a router and use compressed air to blow debris out of crack. Layout location of injection ports with spacing required to ensure complete filling of voids. Drill and install a one way valve injection tube. Drill one vent hole to top of surface intersecting with crack. Seal surface of cracks and anchor injection ports, and any visible cracks at underside for gravity fed crack repair, with Sikadur 31 hi-mod gel (or equivalent).

33. After crack has cured, inject cracks with Sikadur 52 low viscosity moisture-insensitive epoxy injection adhesive (or equivalent). Begin injection at one end of the crack and move from port to port toward the opposite end. Proceed slowly to allow injection gel to migrate into narrow portions of the crack. Monitor the top vents to avoid injecting excess material from below. For gravity fed crack repair, Sikapronto 19 (or equivalent) may be used – proceed slowly to allow gel to migrate into narrow portions of the crack. After injection gel has cured for 24 hours, cut off injection ports and grind off seal material flush with bottom of surface. Follow manufacturer’s recommendations.

34. Repair cracks in CMU and precast at mechanical/electrical/storage buildings as required to avoid moisture intrusion and further damage.

35. Very extensive or significant crack repairs should be reviewed and monitored by an engineering professional.

- Water Damage and Intrusion: Water intrusion was observed at multiple locations at this station. This water intrusion causes structural and cosmetic damage, deterioration, rust/corrosion, mold and mildew. Although the station is open, every effort should be made to limit exposure to water damage. Standing water was observed at stair landings and at roof tops of low building structures. In many cases, the drains in these areas were clogged or improperly installed. Standing water and leaks also pose a safety and fall hazard.
  31. Wherever possible, limit water intrusion into open station structure.
  32. Clean clogged drains and repair drains that are damaged or non-functional.
  33. Maintain slip proof surfaces and stair nosings as required.
  34. Maintain roof and canopy structures as required to avoid water intrusion.
  35. Water intrusion at storage, electrical and mechanical rooms should be investigated and corrected immediately.

- General Safety Concerns: Many general safety concerns were noted at this station. These safety concerns could cause falls and/or injuries if not corrected and/or monitored. Some items noted here are also maintenance issues that need to be monitored and repaired as needed.
  31. At the tram entrance, there is no fall protection at the outer edge of the track. Although there is an alarm system in place should a passenger move beyond the yellow line when no train is parked at the station, someone could easily climb on to the tracks and fall. It is recommended that additional safety measures be considered.
  32. In some instances, it may be possible to climb from the top deck and stairs onto the roof of the low structures below. It is recommended that additional safety measures be taken to keep passengers from accessing these roof areas.
  33. Due to moisture, cracking and spalling, some stair tread nosings are damaged and in poor condition. These nosings need to be carefully monitored and repaired or replaced as needed. Other slip resistant surfaces and tile also need to monitored and replaced as needed. These items present a significant slip and fall hazard if not properly maintained.
  34. Standing water presents a significant fall hazard and should be removed.
  35. Water intrusion has caused the growth of mold and mildew at many locations. This moisture will damage the structural components over time and is also a health hazard. Mold and mildew should be treated and removed.
JTA Skyway Station Infrastructure Structural/Serviceability Summary:

JTA Skyway Station: Riverplace (Flagler) Station

Address: Flagler Avenue
Jacksonville, FL 32207

Skyway Station Structural/Serviceability Summary:

- **Short Term Structural/Serviceability:**
  Minor safety, damage and deterioration of structural elements or connections that do not compromise load carrying capacity or overall serviceability. Minor repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Minor serviceability and maintenance issues that are not repaired or monitored may turn into mid or long term structural and/or serviceability issues. There are currently no immediate plans to modify the existing station or to change the current tram/train loadings, so current station is adequate to handle original design loadings.

- **Mid Term Structural/Serviceability:**
  Minor to moderate safety and damage and deterioration of structural elements or connections that are unlikely to compromise the load carrying capacities or overall serviceability. Minor to moderate repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Issues listed in the above referenced summary are likely to progress and require more routine maintenance and repair. Other structural and serviceability issues may occur and the cost to maintain the station structure will likely increase. It is also likely that canopy structures and other items will need to be replaced. Minor to moderate serviceability and maintenance issues that are not repaired or monitored may turn into long term structural and/or serviceability issues. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station is adequate to handle original design loadings. If plans to modify the existing station or to change current tram/train loadings, a detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.

- **Long Term Structural/Serviceability:**
  Moderate to significant safety and damage and deterioration of structural elements or connections that may compromise load carrying capacities or overall serviceability. These items will need to be properly examined and monitored by an engineering professional. The cost for moderate to significant repairs and maintenance will continue to increase. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station should be structurally evaluated to determine if it is adequate to handle original design loadings. It is likely that plans to modify the existing station or to change current trams/trains will be needed. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.
JTA Skyway Station Future Expansion Structural Limitations Summary:

JTA Skyway Station: Riverplace (Flagler) Station
Address: Flagler Avenue
Jacksonville, FL 32207

Based on the inspections conducted, possible structural limitations to the JTA Skyway station future expansion include, but are not limited to:

- **Increase in Required Design Loadings:**
  Load bearing members are sufficient to carry current design loadings. Expansion of the JTA Skyway station will likely increase the required loadings for these load bearing members. An extensive and comprehensive structural analysis will be required to evaluate the station infrastructure for the additional loadings. Increased loadings could require larger structural members or modification to the reinforcement of existing structural members. Any increase in vibration or other movement as a result of upgrading to larger trams/trains will also need to be evaluated. It should also be noted that continued exposure to the highly corrosive and moist outdoor environment may compromise and decrease the long term serviceability and safety of the current structure.

- **Clearance Limitations:**
  Larger trams/trains or increased structural members sizes will likely present clearance issues during JTA Skyway future expansions. The most likely clearance issues will take place at tram/train entrances and will be most significant if higher loadings require larger bent beams or wider tram rail and track widths. Taller trams/trains may present clearance issues at the main roof and covered canopies. If roof or canopy elevations must be raised or widened to accommodate larger or taller trams/trains, a full lateral load analysis for the station must be completed to evaluate possible increases in wind loads and dynamic loads. Increased lateral and wind loads may increase structural member sizes.

- **Code Changes, Additional Life Safety and Accessibility Requirements:**
  Future building code changes, additional life safety and accessibility requirements could require significant safety upgrades and heavier structural design loadings. These potential changes could increase the size of the structural members required and may also have a significant impact on the overall cost of any future JTA Skyway station expansion. Careful consideration should be given to structural code changes, life safety and accessibility requirements moving forward.
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 1:

- Photo 2:

Inspection Structural Comments:

- Comments for Photo 1:

  Exterior/security fencing – significant rust and corrosion (multiple locations).

- Comments for Photo 2:

  East side of station at janitor building – cracks/seal at doorway needs maintenance. Expansion joint material must be monitored and replaced as required (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 3:

- Photo 4:

Inspection Structural Comments:

- Comments for Photo 3:
  East side of station at janitor building – cracks/seal at doorway needs maintenance. Expansion joint material must be monitored and replaced as required (multiple locations).

- Comments for Photo 4:
  General photo – east end of station at stairs (1st floor to intermediate landing).
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 5:

- Photo 6:

Inspection Structural Comments:

- Comments for Photo 5:
  Cracked and spalled concrete at handrail posts at east end stairs (multiple locations).

- Comments for Photo 6:
  At east end stairs – crack at northeast side at intermediate landing (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 7:

- Photo 8:

Inspection Structural Comments:

- Comments for Photo 7:
  Significant crack in concrete at handrail post at east end stairs. Monitor and repair crack as required.

- Comments for Photo 8:
  Spalled concrete at east end stairs up from second level (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 9:

- Photo 10:

Inspection Structural Comments:

- Comments for Photo 9:
  Southeast corner of station at building area – ponding on roof. Roof drain is not functioning and overflow it too high. Excessive mold and mildew noted.

- Comments for Photo 10:
  Nosing at east end stairs is rusted and damaged. Cracks and spalls are developing in concrete under nosing. Repairs required at this area (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 11:

- Photo 12:

Inspection Structural Comments:

- Comments for Photo 11:
  At west end stairs near the top – significant cracking at handrail. Monitor and repair cracks as required.

- Comments for Photo 12:
  At west end stairs near the top – significant cracking at handrail. Monitor and repair cracks as required.
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 13:

- Photo 14:

Inspection Structural Comments:

- Comments for Photo 13:
  At west end stairs– crack through concrete stair beam at handrail at intermediate landing. Monitor and repair as required.

- Comments for Photo 14:
  At west end stairs – nosing is damaged and may present a trip hazard near intermediate landing (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 15:

- Photo 16:

Inspection Structural Comments:

- Comments for Photo 15:

  At west end stairs – significant cracks/spalling at handrail post at intermediate landing (multiple locations). Repairs should be made immediately.

- Comments for Photo 16:

  At west end stairs – cracks/spalling at underside of landing (see Photos 11 and 12). Monitor and repair cracks as required.
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 17:

- Photo 18:

Inspection Structural Comments:

- Comments for Photo 17:
  At west end stairwell – crack at underside of beam at 2nd level. Monitor and repair cracks as required.

- Comments for Photo 18:
  At west end stairwell – crack at underside of beam at 2nd level. Monitor and repair cracks as required.
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 19:

- Photo 20:

Inspection Structural Comments:

- Comments for Photo 19:
  Rust showing through at underside of escalator – evidence of water intrusion. Cracks also noted at this area (multiple locations).

- Comments for Photo 20:
  Crack in concrete beam at ATM building under escalator. Monitor and repair cracks as required.
Photo of Required Maintenance/Repairs/Monitoring
Riverplace/Flagler Station
Note: See Attached Structural Drawings for location clarification.

- Photo 21:

- Photo 22:

- Comments for Photo 21:
  Crack in concrete at maintenance building – east side of station above CMU.

- Comments for Photo 22:
  At east side stairwell – hole/opening through the landing slab with water seeping (not visible in this photo) and crack at handrail at intermediate landing. Monitor and repair crack as required.
INSPECTION REPORT COVERING
JTA SKYWAY STATION INFRASTRUCTURE ASSESSMENT
JTA Proposal No. P-14-1014

San Marco Station

Prepared by:
G.M. Hill Engineering, Inc.
10199 Southside Boulevard, Suite 103A
Jacksonville, Florida 32256

Prepared for:
Lea & Elliott, Inc.
5200 Blue Lagoon Drive, Suite 250
Miami, FL 33126

SAN MARCO-1
JTA Skyway Station Infrastructure Executive Summary:

JTA Skyway Station: San Marco Station

Address: Mary Street
Jacksonville, FL 32207

Date of Inspection: 9/30/2014
Inspector(s): Gina Hill, Kim Murphy

Overview:

The purpose of this inspection is to identify short, mid and long term structural and/or serviceability issues at specific JTA Skyway stations. This general inspection will identify ongoing maintenance and repair items that must be addressed to maintain the overall structural integrity and serviceability of the station. Structural elements not clearly visible during the site visit were not inspected and are not included in the scope of this report. All structural elements supporting the actual JTA Skyway tram/train or track (bents, columns, etc.) are being inspected by others and are not included in the scope of this report. See “JTA Skyway Station Inspection General Maintenance and Repair Summary” for common maintenance and repair items observed during this inspection. General maintenance and repair recommendations and instructions given in this section are intended to be guidelines only. Additional or alternate repair and maintenance methods and/or materials may be required.

For a summary of the short, mid and long term structural and/or serviceability issues, see the “JTA Skyway Station Infrastructure Structural/Serviceability Summary”. For general notes and comments pertaining to possible structural limitations for future expansion or renovation of the JTA Skyway stations to accommodate newer and larger trams/trains, see “Skyway Station Future Expansion Structural Limitations Summary”. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion or renovation.

See report photos and inspection structural comments for additional information. See included original station structural drawings for approximate photo locations.

JTA Skyway Station Inspection General Maintenance and Repair Summary:

- Rust and Corrosion: Extensive rust and corrosion at metal surfaces was observed at multiple locations at this station. At some rail posts, corrosion is extensive and posts either need to be replaced or will need to be replaced in the near future. Rust at concrete spalls with and without exposed rebar was also noted. Attachments and/or connections to cameras, lights, etc. are rusted. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
  15. Monitor all surfaces for rust and corrosion. Replace badly rusted rail posts, equipment connection clips, angles and bolts. Paint and seal surfaces as required after properly removing corrosion. Use corrosion resistant hardware, paint, etc. to reduce incidence of rust/corrosion.
  16. Where corrosion is encountered, sand blast to remove all contaminants, rust and loose material and coat surface as required with appropriate sealant or paint. As an alternative, power tool wire brush may also be used.

- Painting/Sealing: Surfaces, primarily metal, in need of painting were observed at multiple locations at this station. Many of the metal surfaces also require removal of minor rust or corrosion prior to painting. It is evident that many surfaces have been painted in the past without properly removing corroded surfaces. Exposure to water and moisture at the open station will continue to promote rusting and corrosion and require regular and ongoing maintenance.
JTA Skyway Station Inspection General Maintenance and Repair Summary (cont.):

15. Monitor all painted surfaces for wear. Properly remove all rust, corrosion and debris prior to painting surfaces. Paint surfaces regularly to prevent corrosion and protect surfaces from moisture damage.
16. Use a safe, lead free paint with high level of moisture and corrosion protection. Apply per manufacturer’s recommendations.

- **Expansion Joints/Sealant**: Expansion joint material was observed to be damaged, deteriorated or missing at multiple locations at the station. This item will require regular and ongoing maintenance.
  15. Expansion joint material should be closely monitored and maintained or replaced as required.
  16. Completely clean joint or failed sealant, dirt, debris, etc. Prepare and prime edges per sealant manufacturer’s criteria. If applicable, replace backer rod where displaced or missing. Size of backer rod to ensure tight fit at all temperatures. When applicable, where concrete spall is located at a joint, repair concrete as required. Install new sealant, Sikaflex – 15LM low-modulus elastomeric sealant (or equivalent).

- **Spalled Concrete**: Concrete spalls were observed at multiple locations at the station. Spalls at stair nosings are evident or may develop. New spalls may develop near existing spalls or at new locations. This item will require regular and ongoing maintenance.
  36. Repair all spalled areas as required and monitor structure for new spalls.
  37. Properly prepare concrete surface by saw-cutting 1/2" deep at perimeter of spalled area to provide an edge 90 degrees to surface at which to terminate patch. Mechanically remove all loose and damaged concrete to provide a sound substrate with a rough profile with 1/16” to 1/8” deep irregularities. Do not chip any deeper than necessary to expose sound concrete. Should more than 1/3 the circumference of reinforcing be exposed, chip out behind the reinforcing steel to a depth of 1/2" (minimum). Where reinforcing with corrosion is encountered, sand blast to remove all contaminants and rust and coat with Sika Armatec 110 (or equivalent). Otherwise, power tool wire brush and coat with Sika Armatec 110 (or equivalent). If corrosion has reduced the section by 15% or more, additional reinforcement must be installed – contact engineering professional for further recommendations.
  38. Repair using Sikatop 123 polymer-modified Portland cement non-sag repair mortar (or equivalent) hand troweled into place (Note: Sikatop 122 (or equivalent) may be used on deck surfaces). Mix using component “A” liquid co-polymer in accordance with manufacturer’s recommendations. Substrate surface must be in a saturated surface dry condition. Apply Sika Armatec 110 (or equivalent) to concrete surface. For repairs deeper than 1 1/2”, apply multiple lifts. Scratch surface or initial lifts to provide for bonding of subsequent lifts. After final finishing, cure by taping sheet plastic over repair to retard loss of moisture. Leave in place for three days. Follow manufacturer’s recommendations in all respects.
  39. Spalls at cast-in-place or precast connections also require two coats (minimum) of Galvicon high quality zinc rich cold galvanization paint (or equivalent) at connection plates after all rust, corrosion and debris has been removed.
  40. Very extensive or significant concrete spall repairs should be reviewed and monitored by an engineering professional.

- **Cracking Concrete**: Cracking at concrete surfaces was observed at multiple locations at this station. Cracks at rail posts at stairs are common and contributing to additional damage, cracking and/or spalling at stairs and landings. These cracks are also contributing to moisture damage and corrosion to the rebar at these locations. In some cases, it appears that rebar or ties were placed with too little clearance cover to the concrete edge of beams, and hairline cracks have developed at those locations. Cracks at stair nosings are evident or may develop. New cracks may develop near existing cracked areas or at new locations. These items will require regular and ongoing maintenance.
  36. Cracks in concrete should be repaired and station should be monitored for worsening of existing cracks or formation of new cracks.
37. Repair cracks after properly pressure washing or sandblasting area to remove any loose debris from edges of crack. For gravity fed crack, chip out “vee” notch along the crack with a router and use compressed air to blow debris out of crack. Layout location of injection ports with spacing required to ensure complete filling of voids. Drill and install a one way valve injection tube. Drill one vent hole to top of surface intersecting with crack. Seal surface of cracks and anchor injection ports, and any visible cracks at underside for gravity fed crack repair, with Sikadur 31 hi-mod gel (or equivalent).

38. After crack has cured, inject cracks with Sikadur 52 low viscosity moisture insensitive epoxy injection adhesive (or equivalent). Begin injection at one end of the crack and move from port to port toward the opposite end. Proceed slowly to allow injection gel to migrate into narrow portions of the crack. Monitor the top vents to avoid injecting excess material from below. For gravity fed crack repair, Sikapronto 19 (or equivalent) may be used – proceed slowly to allow gel to migrate into narrow portions of the crack. After injection gel has cured for 24 hours, cut off injection ports and grind off seal material flush with bottom of surface. Follow manufacturer’s recommendations.

39. Repair cracks in CMU and precast at mechanical/electrical/storage buildings as required to avoid moisture intrusion and further damage.

40. Very extensive or significant crack repairs should be reviewed and monitored by an engineering professional.

- Water Damage and Intrusion: Water intrusion was observed at multiple locations at this station. This water intrusion causes structural and cosmetic damage, deterioration, rust/corrosion, mold and mildew. Although the station is open, every effort should be made to limit exposure to water damage. Standing water was observed at stair landings and at roof tops of low building structures. In many cases, the drains in these areas were clogged or improperly installed. Standing water and leaks also pose a safety and fall hazard.

- General Safety Concerns: Many general safety concerns were noted at this station. These safety concerns could cause falls and/or injuries if not corrected and/or monitored. Some items noted here are also maintenance issues that need to be monitored and repaired as needed.

- At the tram entrance, there is no fall protection at the outer edge of the track. Although there is an alarm system in place should a passenger move beyond the yellow line when no train is parked at the station, someone could easily climb on to the tracks and fall. It is recommended that additional safety measures be considered.

- In some instances, it may be possible to climb from the top deck and stairs onto the roof of the low structures below. It is recommended that additional safety measures be taken to keep passengers from accessing these roof areas.

- Due to moisture, cracking and spalling, some stair tread nosings are damaged and in poor condition. These nosings need to be carefully monitored and repaired or replaced as needed. Other slip resistant surfaces and tile also need to monitored and replaced as needed. These items present a significant slip and fall hazard if not properly maintained.

- Standing water presents a significant fall hazard and should be removed.

- Water intrusion has caused the growth of mold and mildew at many locations. This moisture will damage the structural components over time and is also a health hazard. Mold and mildew should be treated and removed.
Skyway Station Structural/Serviceability Summary:

- **Short Term Structural/Serviceability:**
  Minor safety, damage and deterioration of structural elements or connections that do not compromise load carrying capacity or overall serviceability. Minor repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Minor serviceability and maintenance issues that are not repaired or monitored may turn into mid or long term structural and/or serviceability issues. There are currently no immediate plans to modify the existing station or to change the current tram/train loadings, so current station is adequate to handle original design loadings.

- **Mid Term Structural/Serviceability:**
  Minor to moderate safety and damage and deterioration of structural elements or connections that are unlikely to compromise the load carrying capacities or overall serviceability. Minor to moderate repairs and maintenance are described in “Skyway Station Inspection General Maintenance and Repair Summary” and individual station photos and structural comments are provided. Issues listed in the above referenced summary are likely to progress and require more routine maintenance and repair. Other structural and serviceability issues may occur and the cost to maintain the station structure will likely increase. It is also likely that canopy structures and other items will need to be replaced. Minor to moderate serviceability and maintenance issues that are not repaired or monitored may turn into long term structural and/or serviceability issues. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station is adequate to handle original design loadings. If plans to modify the existing station or to change current tram/train loadings, a detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.

- **Long Term Structural/Serviceability:**
  Moderate to significant safety and damage and deterioration of structural elements or connections that may compromise load carrying capacities or overall serviceability. These items will need to be properly examined and monitored by an engineering professional. The cost for moderate to significant repairs and maintenance will continue to increase. If no immediate plans to modify the existing station or to change the current tram/train loadings are proposed, the current station should be structurally evaluated to determine if it is adequate to handle original design loadings. It is likely that plans to modify the existing station or to change current trams/trains will be needed. A detailed and comprehensive structural analysis must be conducted to properly evaluate each station for any future expansion and/or renovation.
JTA Skyway Station Future Expansion Structural Limitations Summary:

JTA Skyway Station: San Marco Station
Address: Mary Street
Jacksonville, FL 32207

Based on the inspections conducted, possible structural limitations to the JTA Skyway station future expansion include, but are not limited to:

- **Increase in Required Design Loadings:**
  Load bearing members are sufficient to carry current design loadings. Expansion of the JTA Skyway station will likely increase the required loadings for these load bearing members. An extensive and comprehensive structural analysis will be required to evaluate the station infrastructure for the additional loadings. Increased loadings could require larger structural members or modification to the reinforcement of existing structural members. Any increase in vibration or other movement as a result of upgrading to larger trams/trains will also need to be evaluated. It should also be noted that continued exposure to the highly corrosive and moist outdoor environment may compromise and decrease the long term serviceability and safety of the current structure.

- **Clearance Limitations:**
  Larger trams/trains or increased structural members sizes will likely present clearance issues during JTA Skyway future expansions. The most likely clearance issues will take place at tram/train entrances and will be most significant if higher loadings require larger bent beams or wider tram rail and track widths. Taller trams/trains may present clearance issues at the main roof and covered canopies. If roof or canopy elevations must be raised or widened to accommodate larger or taller trams/trains, a full lateral load analysis for the station must be completed to evaluate possible increases in wind loads and dynamic loads. Increased lateral and wind loads may increase structural member sizes.

- **Code Changes, Additional Life Safety and Accessibility Requirements:**
  Future building code changes, additional life safety and accessibility requirements could require significant safety upgrades and heavier structural design loadings. These potential changes could increase the size of the structural members required and may also have a significant impact on the overall cost of any future JTA Skyway station expansion. Careful consideration should be given to structural code changes, life safety and accessibility requirements moving forward.
Photo of Required Maintenance/Repairs/Monitoring
San Marco Station
Note: See Attached Structural Drawings for location clarification.

- Photo 1:

![Photo 1](image1.png)

- Photo 2:

![Photo 2](image2.png)

Inspection Structural Comments:

- Comments for Photo 1:
  Landing/column gridline 237 on structural drawings – cracks in concrete evident with water damage and mold.

- Comments for Photo 2:
  Landing/column gridline 237 on structural drawings – cracks in concrete evident with water damage and mold.
Photo of Required Maintenance/Repairs/Monitoring
San Marco Station
Note: See Attached Structural Drawings for location clarification.

- Photo 3:

- Photo 4:

Inspection Structural Comments:

- Comments for Photo 3:
  Landing/column gridline 237 on structural drawings – cracks in concrete evident with water damage and mold.

- Comments for Photo 4:
  Landing/column gridline 237 on structural drawings – cracks in concrete evident with water damage and mold. Expansion joint issues/damage noted.
Photo of Required Maintenance/Repairs/Monitoring
San Marco Station
Note: See Attached Structural Drawings for location clarification.

- Photo 5:

- Photo 6:

Inspection Structural Comments:

- Comments for Photo 5:
  Crack at concrete platform above/near landing in photos 1 to 4. Monitor and repair crack as required.

- Comments for Photo 6:
  Netting/fall protection missing at elevator shaft – safety hazard.
## Photo of Required Maintenance/Repairs/Monitoring

### San Marco Station

Note: See Attached Structural Drawings for location clarification.

- **Photo 7:**

![Photo 7](image.jpg)

- **Comments for Photo 7:**

At top level, large crack with water penetration at pier cap (guideway/escalator level near column at gridline 238). Monitor and repair crack as required.

- **Photo 8:**

![Photo 8](image.jpg)

- **Comments for Photo 8:**

Cracks in concrete and spalling at stair near landing/handrail near 2nd intermediate level (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
San Marco Station
Note: See Attached Structural Drawings for location clarification.

- Photo 9:

![Photo 9](image-url)

- Photo 10:

![Photo 10](image-url)

Inspection Structural Comments:

- Comments for Photo 9:
  Top of second level stairs at column – significant water damage/water intrusion with large amounts of mold present.

- Comments for Photo 10:
  Second level at handrail by column – crack/honeycomb due to water damage.
### Photo of Required Maintenance/Repairs/Monitoring
**San Marco Station**  
Note: See Attached Structural Drawings for location clarification.

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<table>
<thead>
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<tbody>
<tr>
<td><strong>• Photo 11:</strong></td>
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<td><img src="image1.png" alt="Photo 11" /></td>
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<td><strong>• Photo 12:</strong></td>
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<td><img src="image2.png" alt="Photo 12" /></td>
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### Inspection Structural Comments:

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<tbody>
<tr>
<td><strong>• Comments for Photo 11:</strong></td>
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<tr>
<td>Rust/corrosion at railing/glass screen at 2nd level due to water damage/water intrusion.</td>
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<tr>
<td><strong>• Comments for Photo 12:</strong></td>
<td></td>
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<tr>
<td>Corrosion and deterioration at stair nosings at multiple locations. Continued damage will cause trip/fall hazard.</td>
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Photo of Required Maintenance/Repairs/Monitoring
San Marco Station
Note: See Attached Structural Drawings for location clarification.

- Photo 13:

- Photo 14:

Inspection Structural Comments:

- Comments for Photo 13:
  No fall protection at outside rail of tram/train – safety hazard.

- Comments for Photo 14:
  Cracked concrete and spalling at top of stairs at handrail at top level (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
San Marco Station
Note: See Attached Structural Drawings for location clarification.

- Photo 15:

- Photo 16:

Inspection Structural Comments:

- Comments for Photo 15:
  Cracked concrete and spalling at top of stairs at handrail at top level (multiple locations).

- Comments for Photo 16:
  Cracked/spalling concrete at top level stair (see Photo 15 - multiple locations).
### Photo of Required Maintenance/Repairs/Monitoring

**San Marco Station**

Note: See Attached Structural Drawings for location clarification.

- Photo 17:

- Photo 18:

### Inspection Structural Comments:

- Comments for Photo 17:

  Cracks in concrete at top level between handrail posts near stairs/landings (multiple locations).

- Comments for Photo 18:

  Intermittent vertical cracks at stair landing walls (multiple locations).
**Photo of Required Maintenance/Repairs/Monitoring**

**San Marco Station**

Note: See Attached Structural Drawings for location clarification.

- **Photo 19:**

![Image of badly damaged stair at nosing with significant spalling](image19.png)

- **Comments for Photo 19:**

  Badly damaged stair at nosing with significant spalling. Fall/tripping hazard – repairs are required at this location immediately.

- **Photo 20:**

![Image of exposed rebar at beam](image20.png)

- **Comments for Photo 20:**

  Exposed rebar at beam. Rusting noted at exposed rebar (multiple locations).
Photo of Required Maintenance/Repairs/Monitoring
San Marco Station
Note: See Attached Structural Drawings for location clarification.

- Photo 21:

![](image)

Inspection Structural Comments:

- Comments for Photo 21:
  
  Large crack at underside of slab at mezzanine level. Monitor and repair crack as required.