FINAL

Final Report

Analysis and Technical Review of Bridge Options for Passenger Rail to Cross the New River

September 2024

BROWARD COUNTY FLORIDA | TYLin

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Executive Summary

STUDY PURPOSE

Broward County is considering alternatives to accommodate the expansion of passenger rail capacity across the New River in downtown Fort Lauderdale. The New River is used by recreational boaters and commercial vessels. The growth in rail traffic over the existing Florida East Coast Railway (FEC) bascule bridge has increased delays to marine traffic, which would continue to increase with additional passenger trains.

Two recent studies were recently conducted to evaluate a new passenger rail bridge crossing over the New River.

- Broward County and Fort Lauderdale Joint Study, Whitehouse Group, August 2023
- Technical Memorandum New River Crossing Alternatives, HDR, FDOT District 4, March 2023

Both of these studies evaluated new passenger rail bridge options at various heights over the New River from a high-level fixed bridge to low-level bascule bridge. The Joint Study Consultant also identified an alternative for the passenger rail bascules bridges to be on both sides of the existing FEC bridge in order to maintain most of the passenger rail alignment within FEC right-of-way.

The purpose of this analysis is to refine a new passenger rail bridge option over the New River to facilitate and provide connectivity for passenger rail expansion in the region in a socially, economically, and environmentally responsible manner with broad based community support. The bridge concept must meet the following criteria:

- 40 feet clearance over Mean High Water
- Minimize street closures including SW 2nd Street for both vehicular and pedestrian traffic
- No impacts/effects to the Fort Lauderdale Brightline Station
- Passenger track at-grade at Broward Boulevard
- Minimize right-of-way (ROW) acquisition
- Minimize disruption to existing trains during construction through maintaining two operational tracks across New River at all times
- Flexibility to incorporate aesthetic features compatible with the area

In order to more quickly assess alignment options, information and analysis was used from the recent studies . No new field data was gathered for the analysis.

PROPOSED CONCEPT

An important consideration in developing this study is the number of future tracks needed to service freight and passenger rail service. This issue directly affects cost, schedule and complexity for construction staging. For the purposes of this study, an assumption was made to include four tracks, two for freight and two for passenger. This reflects the highest complexity in design and implementation. If fewer tracks are needed in the immediate future, then cost and complexity are lessened.

In order to accommodate the four tracks and minimize additional ROW requirements, a revised concept was developed to remove and replace the existing freight bascule bridge. This approach allows for more efficient use of the 100-foot FEC ROW for the four tracks, and it creates the opportunity for the new bascule bridges to be of similar or complimentary design.

The proposed concept expands the FEC corridor to four tracks, with two passenger tracks on the west and two freight tracks on the east. The passenger tracks would cross the New River on a new bascule bridge with 40 feet of clearance above Mean High Water. The two freight tracks would remain at-grade and cross the New River on new bascule bridge(s) at approximately the same height over the New River as the current bridge. Since there are many more passenger trains than freight trains, the freight bascule bridge(s) would close much less frequently. The alignment of the tracks in the FEC corridor is shown on below.

Freight and Passenger Rail Bridges over the New River, Plan and Profile

An important element of the plan was the construction staging to remove the existing bascule bridge and construct the new bridges while maintaining two operational tracks over the New River

at all times. A concept was developed that allows this to occur through the use of a temporary bascule bridge for 3 stages of construction. The construction stages are described in Section 4.5 of this report.

Various factors regarding the constructability of the concept based on this preliminary level of design were reviewed. These include:

- Right-of-way – The only permanent ROW needed will be a strip along the Broward County Transit terminal, east of the Brightline Station. This is needed to accommodate an additional freight track through the area. Temporary construction easements and a land lease for material storage will also be needed.
- Environmental – A desktop review of existing environmental conditions was conducted using the Environmental Screening Tool in FDOT's Environmental Transportation Decision Making (ETDM) database. This included an initial identification of required environmental permits and approvals.
- Traffic – An overview of any traffic issues to be addressed during construction.
- Contracting Options – A list of factors and contracting mechanisms to consider should the project move forward.

For the purposes of the concept design and analysis, a basic rolling lift bascule bridge was assumed for both the new freight and passenger rail bridges. Should a bridge option move forward into project development, a closer investigation of bascule type based on a possible enhanced aesthetic design will be possible.

An initial estimate of 3 to 5 years will be needed for construction of this concept. It should be noted that the estimated construction timeframe does not include NEPA and final design phases. The actual construction duration will be determined by the contracting mechanism, the construction staging and sequences, the final aesthetic design of the bridges and other similar factors.

A conceptual cost estimate was developed for rolling lift rail bascule bridges using Association for the Advancement of Cost Engineering (AACE) International Cost Estimate Classification System (Class 4). This estimate is based on plans and details with a development level of less than 15% design. The expected accuracy range for Class 4 varies between -20% and +30% as indicated in AACE's estimate classification table (AACE International Recommended Practice No. 56R-08, Table 1 - Section 3, August 2020). The capital cost model structure for Federal Transit Administration's (FTA) Standard Cost Categories (SCC) published May 24, 2023 was used and is shown below. It reflects Year 2024 dollars.

Capital Cost Estimate (in 2024 dollars)

SCC	Activity Line Item	Cost (in 2024 dollars)	% Share
10	Guideway and Track Elements	$188,869,125	
20	Stations, Stops, Terminals, Intermodal (Not in scope)	$0	
30	Support Facilities (Not in scope)	$0	
40	Site work & Special Conditions	$20,477,980	
50	Systems	$20,300,000	
60	Right of Way	$12,200,000	
70	Vehicles (Not in scope)	$0	
80	Professional Services	$79,809,545	33% (SSC 10 to 70)
		$321,656,650	
	Allocated Contingency	$66,612,731	21% (SSC 10 to 80)
	Unallocated Contingency	$32,165,665	10% (SSC 10 to 80)
	Grand Total	**$420,435,045**	***Class 4 Ranges***
AACE International Cost Estimate Classification System - **Class 4 Ranges**		$336,348,036	**-20%**
		$378,391,541	**-10%**
		$504,522,054	**+20%**
		$546,565,559	**+30%**

Sample renderings were developed to show possible aesthetic options for the bridges and are included in **Appendix B**. As stated earlier, a more detailed investigation of an enhanced bascule design would also result in an update of theses cost estimates.

Below is a summary of key features of the proposed bridge concept.

- ✓ 40' height over Mean High Water
- ✓ SW 2nd Street remains open
  - No changes to traffic or pedestrian flow except for closing of SW 5th Street
- ✓ No impacts/effects on Fort Lauderdale Brightline Station
  - FEC/Brightline concurrence to date
- ✓ Maintain at-grade crossing at Broward Boulevard
- ✓ Minimize ROW acquisition
  - No private ROW acquisition
- ✓ Incorporate aesthetic features compatible with the area
  - Riverwalk pedestrian crossing remains
  - Open views under the structure

1. Introduction

1.1 Background And Study Purpose

The City of Fort Lauderdale and Broward County collaboratively engaged the Whitehouse Group ("Joint Study Consultant") to conduct a study of alternatives for passenger rail to cross the New River on the Florida East Coast Railway (FEC) corridor. One of the key issues identified by the Joint Study Consultant was the need for river crossing alternatives to avoid, minimize, and mitigate impacts to the existing conditions at the site (including but not limited to minimization of FEC and Brightline service disruptions) to an acceptable level during and after construction, while maximizing the vertical clearance to facilitate movement of marine traffic at the crossing. It should be noted that since 2019, the Florida Department of Transportation and Broward County have conducted several studies to evaluate the feasibility of passenger rail crossing alternatives in this corridor.

The purpose of the Analysis and Technical Review of Bridge Options for Passenger Rail to Cross New River (a.k.a. "study") is to propose a new passenger rail bridge that maximizes vertical clearance over the New River while minimizing disruptions to existing rail operations leveraging the analysis and the recommendations developed in previous studies. Additional key study parameters include SW 2nd Street to remain open, no impacts on the Fort Lauderdale Brightline Station, maintain at-grade crossing at Broward Boulevard, minimize right-of-way (ROW) acquisition, and incorporate aesthetic features compatible with the surrounding area.

The TYLin team reviewed the following previous studies.

- Broward County and Fort Lauderdale Joint Study, Whitehouse Group, August 2023
- Technical Memorandum New River Crossing Alternatives, HDR, FDOT District 4, March 2023
- Broward Commuter Rail New River Navigational Survey Final Report, Corradino/HDR, FDOT District 4, November 2021
- Broward Commuter Rail Project Development and Environmental (PD&E) Study, Corradino/HDR, FDOT District 4, November 2021
- Subsurface Exploration Report No. J-21116.001, City of Fort Lauderdale, Quest Engineering, August 2021
- New River Crossing Feasibility Study, Corradino/HDR, FDOT District 4, January 2020

This report is organized as follows:

1: Introduction – provides project background and purpose of this study.

2: Existing Conditions – provides description of existing FEC bridge and urban context for the bridge site.

3: Concept Design – describes proposed rail corridor improvements including movable bridge, approach structures, superstructure and foundations as well as aesthetics.

4: Constructability Issues – include a review of variety of factors related to the constructability of a mid-level passenger bridge option.

5: Capital Cost Estimate – discusses the assumptions, methodology, capital cost model structure and resulting project capital costs as well as comparison of cost for the proposed bridge concept with bridge alternatives prepared in previous studies.

6: Stakeholder Meetings – provides a documentation of input received from key stakeholders on the proposed bridge concept.

2. Existing Conditions

2.1 Existing FEC Bridge

The existing FEC bridge at the New River in downtown Fort Lauderdale was completed in 1978. This structure is the second documented structure in this location, with the first built in 1912 by the Florida East Coast Railway Company. It is unknown what components of the original 1912 structure may remain at the bridge site, particularly below the mudline. The original and current existing bridges span north-south over the river. The existing bridge design drawings/as-builts were not provided to the TYLin consultant team for this study. Information on the design of the existing bascule bridge was obtained from previous the studies.

The original bridge from 1912 was a 1-track structure, 188 ft long with a 58 ft bascule span providing a 48 ft wide horizontal space in the channel. The approach spans for the original structure consisted of eight approach spans on the north side, each approximately 15 ft long, and one 16 ft span on the south side. The original bascule span was set on the south bank of the New River. The bascule and rest piers were founded on sealed footings that were supported on timber piles. The approach span bents were of timber-pile construction with a steel pier cap which supported a deck span system of two rolled steel stringers.

Since the existing bascule bridge lies in the middle of the ROW, the study team began developing options that included the replacement of the existing bridge. This was done in order to make better use of the ROW for the future 4-track condition. Since reuse or adaptation of the existing bridge was not analyzed as an option, no further structural analysis of the bridge was needed.

2.2 Existing FEC Bridge Site

The existing bridge crosses the New River in downtown Fort Lauderdale at milepost (MP) 2.5 as shown in **Figure 2-1** which depicts an aerial view of the FEC bridge site. The FEC ROW is approximately 100 ft wide at the channel and extends approximately 50 ft on either side of the existing east track.

The channel at the bridge site is defined by a permitted navigational width bordered by the fenders. The horizontal clearance at the fenders is 60 ft. The distance from the north shore to the south shore is approximately 170 ft.

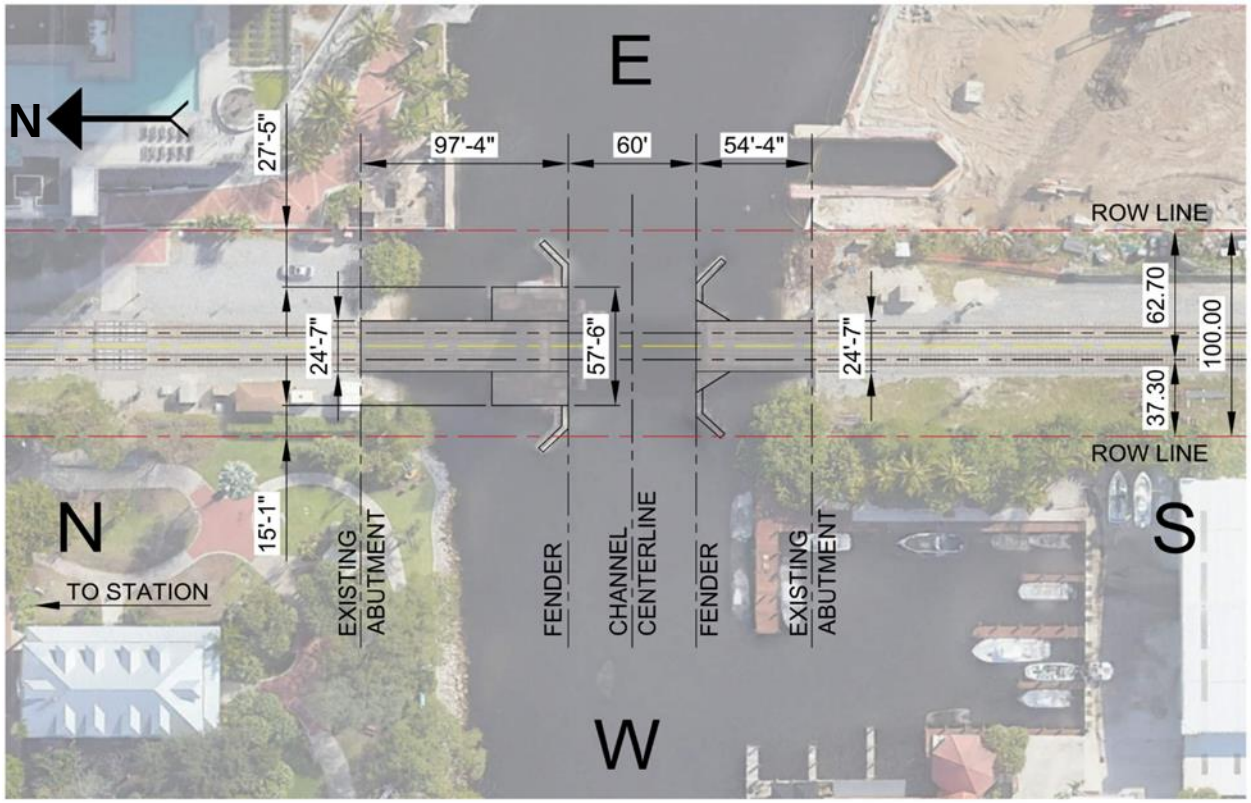


Figure 2-1: Existing Bridge Site Aerial View

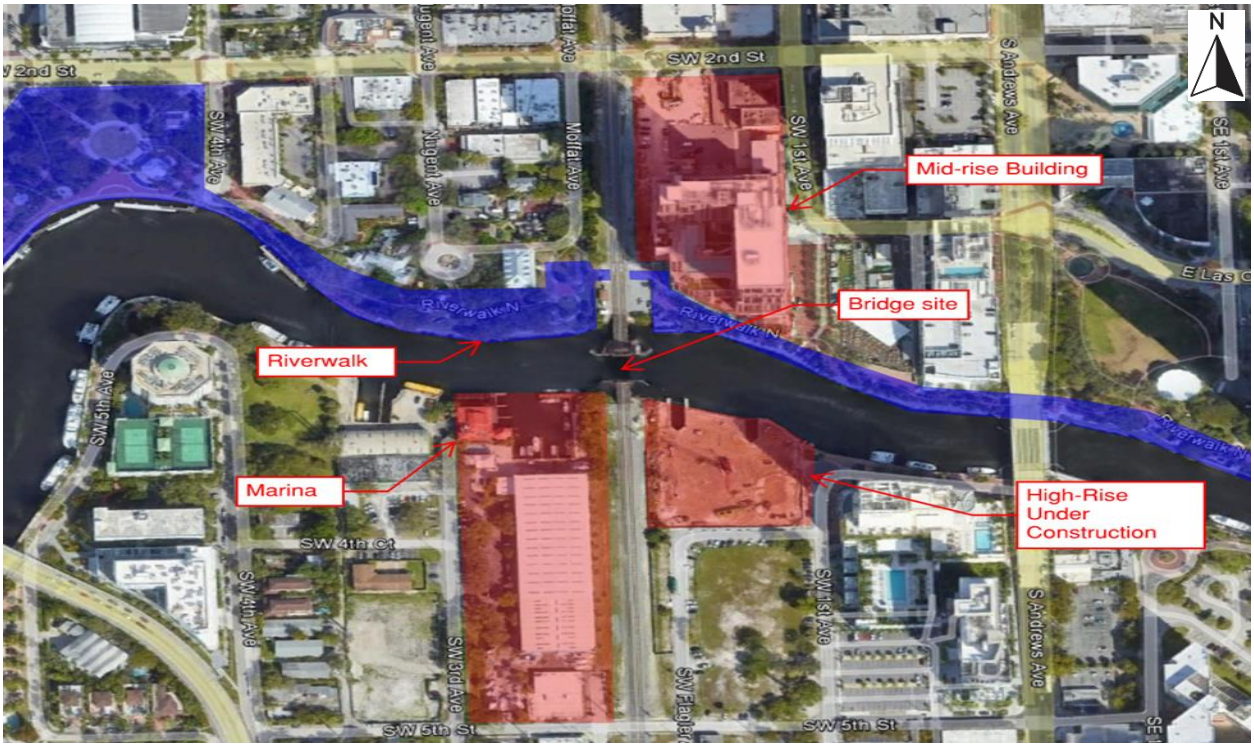


Figure 2-2: Bridge Site in Urban Context

As illustrated in **Figure 2-2**, the bridge site immediately north and south of the movable span are developed with existing public facilities (Riverwalk Park) and privately owned buildings. All four corners of the bridge site adjacent to the north and south riverbanks are developed within the Fort Lauderdale urban center. Riverwalk Park and the historic Old Fort Lauderdale section of downtown lies to the northwest of the bridge. A midrise mixed-used building is constructed along the FEC ROW on the northeast corner of the site. To the southeast, a new high-rise condominium is currently under construction. The South Florida Boat Club, with a small marina and docks, is located southwest of the bridge. The South Florida Boat Club is potentially planned to be sold to a developer which has plans for another high-rise condominium structure. Both structures to the south, are adjacent to the FEC ROW.

Figure 2-3: FEC Corridor, Views facing South
Left- showing high-rise condominium under construction on the south bank east side
Right- showing the existing marina on the south bank west side.

Figures 2-3 and **2-4** show the conditions and infrastructure abutting the bridge site.

Figure 2-4: FEC Corridor, Multiple Views
Left-View facing south at the bridge showing the existing constraints on the north bank
Middle- View facing north showing the western edge of ROW from the grade crossing
Right- View facing north showing the eastern edge of ROW from the grade crossing

2.2.1 Existing Wayside Conditions

The current two-track bascule bridge is shared by FEC freight and Brightline trains. Three tracks run through the Fort Lauderdale Brightline Station, then narrow to two tracks via an interlocking located between W Broward Boulevard and SW 2nd Street. An interlocking consisting of two sets of absolute signals, one near SW 2nd Street and one on the west side of the bridge, control train traffic approaching the bridge from both directions. Bridge use must be requested from an employee located at the bridge control room and the signals will not clear until the bridge is locked in its closed position. There are three existing at-grade crossings within this area at Broward Boulevard, SW 2nd Street, and Riverwalk N pedestrian path.

2.2.2 Current Coast Guard Operation Restrictions at the FEC Bridge

The Coast Guard has implemented a set of stringent restrictions on the movable bridges including the FEC along the New River to ensure safe and efficient navigation. Mandatory openings are scheduled for 10 minutes of each hour between 5:00 am and 11:59 pm, with an additional 10-minute opening window from 12:00 pm to 2:59 pm.

For the FEC rail bridge, a maximum limit of 36 Brightline trains per day is enforced. The FEC bridge is operated by a full time 24-hour on-site bridge tender and special lighting is provided to enhance visibility. Notably, the FEC bridge remains open until train activities necessitate closure, with specific nonoperation periods during rush hours from 7:30 am to 9:00 am and 4:30 pm to 6:00 pm, particularly at the Andrews and SE 3rd Avenue crossings. These restrictions aim to balance the needs of maritime and vehicular traffic while ensuring the safety and efficiency of vessel movements along the New River.

3. Concept Design

3.1 Proposed Rail Corridor

An important consideration is the number of future tracks needed to service freight and passenger rail service. This issue very directly affects cost, schedule and complexity in the construction staging. For purposes of this study, a conservative assumption was made for four tracks through the study area. This reflects the highest complexity in design and implementation. If fewer tracks are needed in the immediate future, then cost and complexity are lessened.

From the south, just north of the SW 11th Street, the rail corridor is proposed to expand to four ballasted tracks. The two track alignments on the west are proposed for passenger rail operations while the two east tracks are proposed for the FEC operation. The four-ballasted tracks then proceed north, through new bascule bridges. The two FEC tracks cross the New River on lower-level bascule bridge(s) crossing at approximately the same vertical clearance as the existing bascule bridge. The two FEC tracks on the east side then proceed north at-grade.

Meanwhile, the two passenger tracks on the west side begin climbing at a 3.75 percent grade to cross the New River over a bascule bridge with a 40-foot vertical clearance from the MHW. These two passenger track alignments begin their grade separation at the SW 6th Street at-grade crossing south of New River. The SW 5th Street at-grade crossing must be permanently closed to through traffic due to the new grade separation and physical installation of retaining walls to support the elevated passenger tracks. North of the bascule bridge, the four track alignments will ultimately tie into the three-track alignments north of the Brightline Station.

Just south of Broward Boulevard, there is a constrained section of the alignment where the existing parking garage is on the east side of the right-of-way, and the eastern FEC track is running adjacent to it. Guard rails will be installed along the running rails adjacent to the parking garage, to minimize impacts from any derailment that could occur in this area.

Similarly, the two passenger track alignments on the west start descending after crossing the bascule bridge. The tracks meet grade just before the Broward Boulevard at-grade crossing. One study parameter required that SW 2nd Street must stay open, under the passenger track alignment meeting a minimum 14.5 ft required vertical clearance and the concept design meets this objective. Once the passenger track alignments meet grade, the proposed four track alignment crosses Broward Boulevard at the same grade as the existing track geometry. Minor adjustments to the easterly FEC tracks would also need to be made to the at-grade crossing.

At the Brightline Station, the two existing passenger tracks would remain at their existing locations, with increased horizontal separation just south of the station to accommodate the center platform. One of the FEC tracks would maintain the existing alignment on the east of the passenger track alignment, the second FEC track would move to a new eastern alignment within the right-of-way. This proposed FEC track alignment would require a portion of the BCT Central Terminal property. The two FEC tracks would connect into the existing four track section immediately south of the Brightline Station, two tracks for freight and two tracks for passenger

rail. The four-track section would tie into the existing three track section north of the Fort Lauderdale Brightline Station.

A plan and profile of the proposed rail alignment and bridge configuration as well as typical sections is included in the **Appendix A**.

3.2 MOVABLE BRIDGE

In selecting the appropriate type of movable bridge to produce a viable bridge option, the TYLin team considered the following key factors.

- One primary consideration is the minimum required vertical clearance from MHW, which must be balanced against the constraints posed by traveling train grade limitations due to the limited distance available to meet necessary tie-in elevations.
- The second primary consideration is maintaining the existing horizontal channel clearance. Given the narrow horizontal width of the FEC ROW at the channel and the imperative to maintain FEC and commuter service during construction, the choice of bridge type must also consider overall bridge widths in both temporary and final conditions at the site.

The proposed bridge concept solution incorporates opposing directions of rotation/roll for bascule bridges and careful planning the placement of rest piers and bascule piers to ensure adequate space for their construction and installation.

Another crucial aspect to address is the control and operation of the various bridge structures at the site. While the development or refinement of the control house was not included in this study, it is likely that control and operation for all bridges will need to be at a centralized location. Given the varying heights of the bridges and potential visual obstructions of the channel from the bridges, CCTV systems will be essential for operators to ensure safe operation. Since coordination and consultation with United States Coast Guard (USCG) was outside the scope of this study, it was assumed that the new bridges would adhere to similar operating rules as the current structure. It is expected that low-level FEC bridge(s) will typically remain in the open position until freight train passage necessitates closure, while bridges utilized by passenger rail services may require more frequent closure due to higher train volumes. A recent navigation study showed that with the increased clearance to 40 ft above MHW provided by the proposed passenger train bridge in the span closed (lowered position), disruptions to marine traffic are projected to be significantly reduced with approximately 95% of vessels able to pass under the bridge without necessitating a bridge opening. Further study could investigate the advantage of keeping the passenger bridge to normally be left in the span closed position.

3.2.1 Rolling Lift Bascule Bridge

This study conducted a qualitative assessment of a variety of movable bridge types documented in **Technical Memorandum #1** based on several factors, such as horizontal site constraints to effectively navigate the spatial limitations of the project site, vertical clearance requirements to ensure sufficient clearance for waterway traffic while also adhering to safety standards, and aesthetics considerations as to how the chosen bridge type will harmonize with its surroundings. This included not only the immediate environment of the crossing but also the broader context

of the urban center in which the structure would reside, particularly in areas characterized by high-rise structures. The desire to maintain visual cohesion with existing bridge types and architectural styles further informed the selection criteria.

Consequently, rolling lift bascule bridge was found optimal that met these selection criteria. A rolling lift bascule rail bridge is a type of movable bridge commonly used to facilitate passage of trains over waterways and is often considered a type of bascule bridge. Characterized by its unique structural/mechanical operation, this bridge simultaneously rotates and translates about a horizontal center of gravity. This type of bridge requires a shorter span to achieve the same vertical channel clearance and typically operates in a slightly quicker manner than a simple trunnion bascule bridge mostly due to the combination of translation and rotation when operating.

The foundations and supports of a rolling lift bascule rail bridge must be robust to withstand the forces exerted during operation. The rolling lift bascule dead loads translate requiring larger piers and incorporation of moving dead loads. Live loads are typically taken through the segmental castings and some heel restraint whether a physical stop or mechanical break/ live load device.

Typically, a rolling lift bridge would be narrower than a simple trunnion bascule bridge alternative. The rack support is outboard of the main girders, but this would be the only element outboard of the structure providing the narrower form. Based on the horizontal ROW constraints at the bridge site, a narrower structure type would be recommended.

3.2.2 Through Girder Span Type

The movable span(s) over the river are approximately 100 ft in length, suggesting several typical structure types suitable for this span length, including deck-girder spans and through-girder spans. While the study analyzed both steel deck-girder spans and steel-through girder spans, the latter option ultimately emerged as the most optimal structure type for the river crossing considering factors such as construction sequencing, the required number of tracks crossing the river, vertical profile constraints at SW 2nd Street to the north of the channel and maintaining a minimum vertical clearance of 40 ft from MHW in the channel. A detailed evaluation of both types of girder types and spans is provided in **Technical Memorandum #1**.

Steel through-girders can accommodate longer spans with less impact on clearance below the bridge due to the support framing of this superstructure type. The elevated design of through-girder bridges provides greater clearance underneath the bridge. Through-girder structures typically comprise two longitudinal girders (or three if a center girder is employed) positioned outside the clearance envelope. The anticipated span length for the steel through-girder alternative is approximately 100 ft over the channel and approximately 50 ft for the track girder back span (**Figure 3-1**).

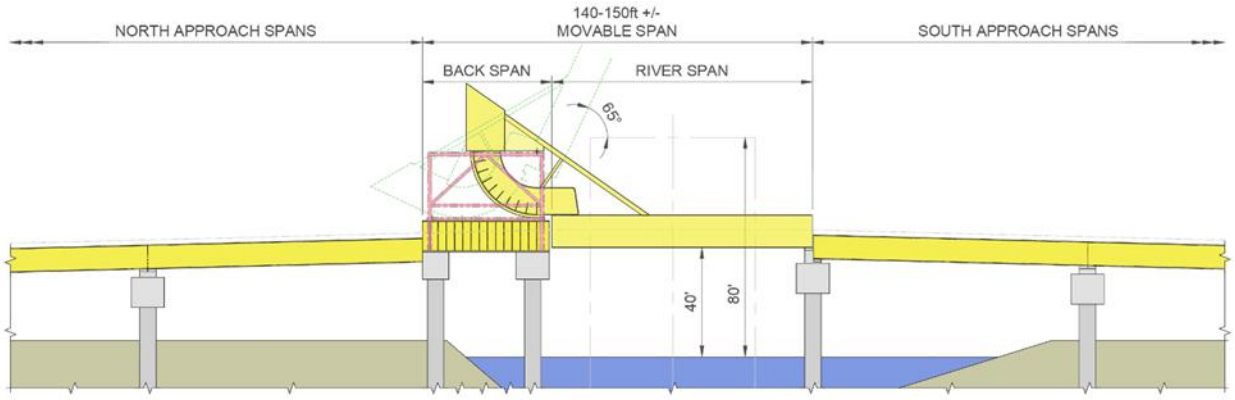


Figure 3-1: Rolling Lift Through-Girder Bridge

The through-girder bridge superstructure alternative encompasses both 1-track and 2-track span types, each incorporating two through-girders spaced at 21'-4" or 35'-4" on-center for a 1-track and 2-track bridges respectively. The floor system of the through-girder span follows a typical floor beam and stringer arrangement. The floor beams span transversely between the main longitudinal girders and would be spaced approximately 8'-0" on center to minimize floor system depth. Stringers, supporting the ties and rails, span from floor beam to floor beam and would be set lower on the floor beam than typical, providing a gap from base-of-rail to top of floor beam of approximately 2", thus optimizing the structure depth from top-of-rail to bottom of structure. A floor system arrangement as described, can be as shallow as 5 ft from top of rail (TOR) to bottom of structure. The deck system utilized for the movable span would be an open-deck arrangement.

While through-girder superstructures would be utilized for the movable spans, they may also be utilized for fixed spans up to approximately 150 ft in length or where shallow structure depth is imperative. For the movable span application, an open deck system supports the rails, complemented by a lateral bracing system on the track stringers and main span to enhance lateral and longitudinal load transfer on the bridge. Consideration for a tighter floor beam spacing than the 8'-0" would be a trade-off between achieving a shallower floor system and incurring a heavier, less efficient system, necessitating more counterweighting on the movable span. This trade-off, weighing vertical clearance over the MHW against additional steel and counterweighting costs, may be explored in future design stages.

On single leaf bascule bridges and in particular rail structures, the locking mechanisms are more a safety feature and have no true structural function. The span locks will prevent an unwanted opening and serve as a rail interlocking device signal. They will not reduce vibrations to any significant degree. The reduction of vibrations is more related to proper span seating protocols which apply brakes after the span is driven down and all mechanical backlash is removed.

Figure 3-2 shows plan and profile for proposed rolling lift freight and passenger rail bridges over the New River.

Figure 3-2: Freight and Passenger Rail Bridges over the New River, Plan and Profile

3.2.3 Fabrication and Erection

Both steel deck-girder and through-girder spans would be shop-fabricated assuring fabrication accuracy prior to erection and facilitating transportation to the construction site. In the case of steel spans, they can be delivered to the site fully fabricated whole or in part, minimizing on-site assembly requirements. With conceptual calculations indicating a maximum span length of 100 ft for the river span, built-up plate girders are anticipated to be shop fabricated and ready for placement. The project site's proximity to the Atlantic Ocean, with unhindered access along the New River, alleviates concerns regarding the lengths of steel girders based on delivery access. Moreover, the existing FEC freight rail access at the site further promotes the utilization of this infrastructure for delivery or removal of elements to and from the project site.

Placement of preassembled spans can be efficiently achieved through float-in methods in the navigation channel. Considering the navigational traffic in the channel, a stick-building method of erection for the movable span(s) is unlikely due to the anticipated allowed construction windows. Therefore, the float-in method emerges as the recommended installation approach for erecting the movable span over the channel.

The float-in method is widely favored in new movable bridge construction due to its numerous advantages. This approach allows for the superstructure to be built off-site with greater quality control and construction efficiency, cost-effective fabrication and erection, reduced time spent in the channel, and accelerated bridge erection to an operational state. Essentially, the float-in construction method involves transporting the nearly complete structure to the bridge site, where a prepared substructure awaits. During a brief marine outage, the span is lifted or jacked into place, followed by final connection of preassembled machinery to bring the bridge to operation swiftly. Furthermore, the float-out method could be employed for the removal of the existing FEC bridge superstructure offering an efficient alternative to minimize disruption to marine traffic. Alternatively, the existing FEC bridge could be anchored in the open position and dismantled piece by piece while not impeding marine traffic.

3.3 APPROACH STRUCTURES

The design methodology for the bridge approaches, to the bascule bridge, was to provide an optimal span arrangement considering factors such as cost, constructability, maintenance, and project specific criteria. Providing a superstructure and substructure layout that allows for a visually open area underneath the structure was an important criterion considered in the proposed design of the approach spans.

The elevated approach spans were designed using ballasted deck on simply supported spans. Simply supported spans are the preferred industry standard for rail bridges with ballasted decks. Simply supported spans are easier for fabrication and erection which reduce construction time and are well suited for repetitive spans versus its continuous system counterpart.

The northern limits of the approach spans were set to maintain existing traffic over SW 2nd Street and up to the proposed bascule bridge. The southern limits of the approach spans were set from

the bascule bridge to just north of SW 6th Street. SW 5th Street is proposed to be closed so there is no requirement to provide a span over the crossing.

3.3.1 Superstructure

The following two (2) types of superstructure systems were utilized for the elevated approach spans:

- Precast, Prestressed, Florida-I Beams
- Steel Through Girders

The use of Florida-I Beams provides a cost-effective solution, minimizes maintenance, offers ease of construction and is the Florida Department of Transportation's standard beam. The goal was to optimize the design of the typical section and keep the number of spans to a minimum. Minimizing the number of spans allows for an open visual across the elevated structure by reducing the number of piers. Based on the ballast deck design, live loading and bridge limit constraints, an optimal span length of 119'-3" was provided. The same span length was utilized on both the northern and southern approaches to maintain a consistent appearance.

The northern approach consists of a total of five (5) concrete spans at 119'-3" for a total length of 596'-3", excluding the span over SW 2nd Street. The southern approach consists of a total of six (6) concrete spans at 119'-3" for a total length of 715'-6". As shown in **Figure 3-3**, the typical section consists of 78-inch Florida-I beams with ballast deck for a superstructure depth of 9'-10" measured from top of rail to bottom of beams. The out-to-out dimension is 34'-0" and accommodates two (2) lines of tracks and walkways on both sides. The superstructure depth utilizing Florida-I beams was not a primary factor in the design given there are no roadways or constraints underneath. As mentioned earlier, use of a shallower Florida-I beam would result in shorter and more spans, which is against the open visual concept.

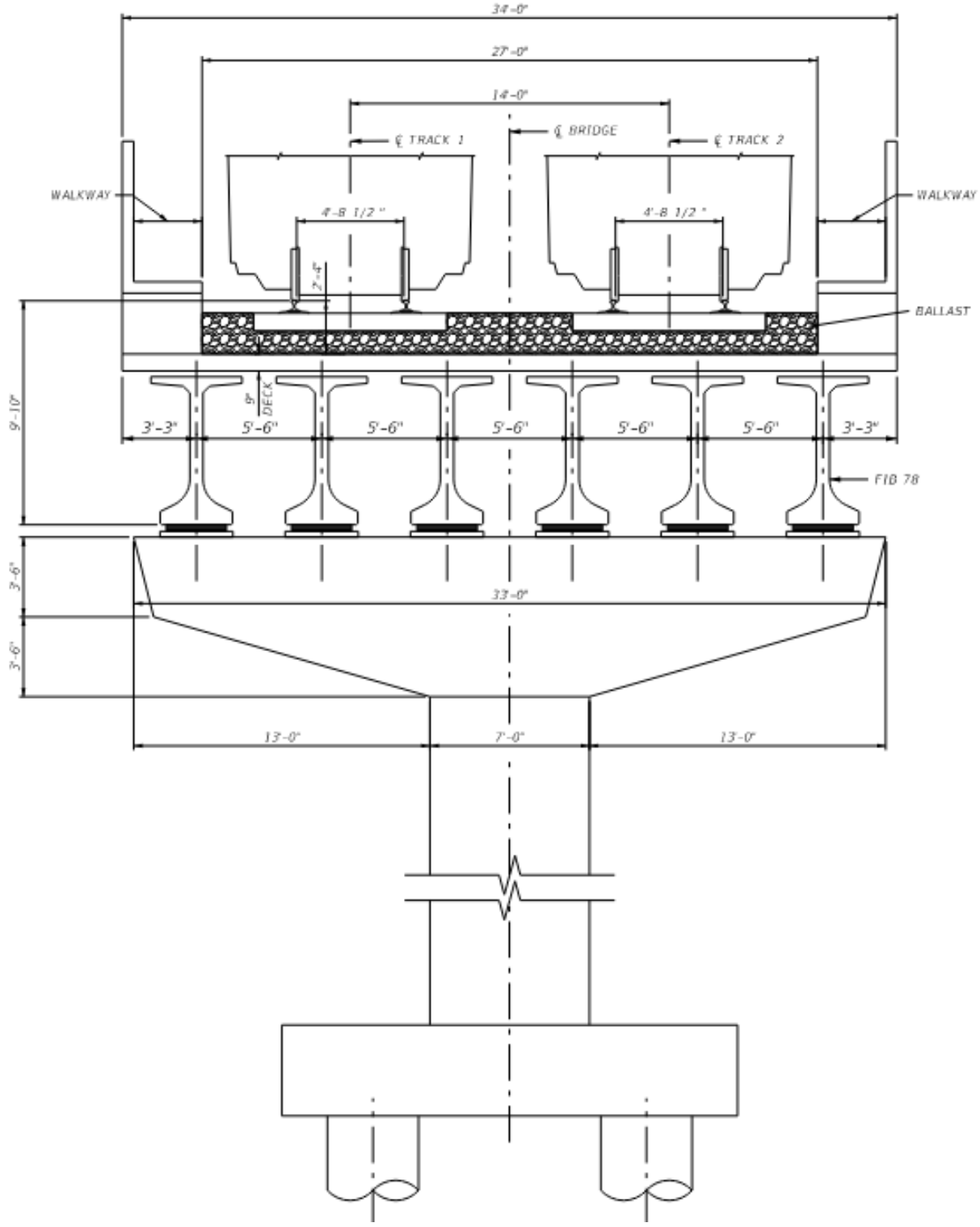


Figure 3-3: Guideway North & South Approaches FIB 78 – 119′-3″ FT Spans

The span over SW 2nd Street required a shallower superstructure depth to provide the minimum vertical clearance of 14′-6″. Use of the shallowest Florida I-beams would not meet the vertical clearance. **Figure 3-4** shows a typical section over SW 2nd Street. A single span steel through structure type with ballast deck and a superstructure depth of 5′-6″ measured from top of rail to bottom of main steel girders was utilized to meet the vertical clearance requirements. The out-to-out dimension is 34′-0″ and accommodates two (2) lines of tracks and walkways on both sides. The single steel through span was keep to a minimum length of 75′-0″ given the maintenance and cost is higher than its concrete Florida-I beam counterpart. The 75′-0″ span accommodates four (4) – 12′-0″ travel lanes and sidewalks on both sides.

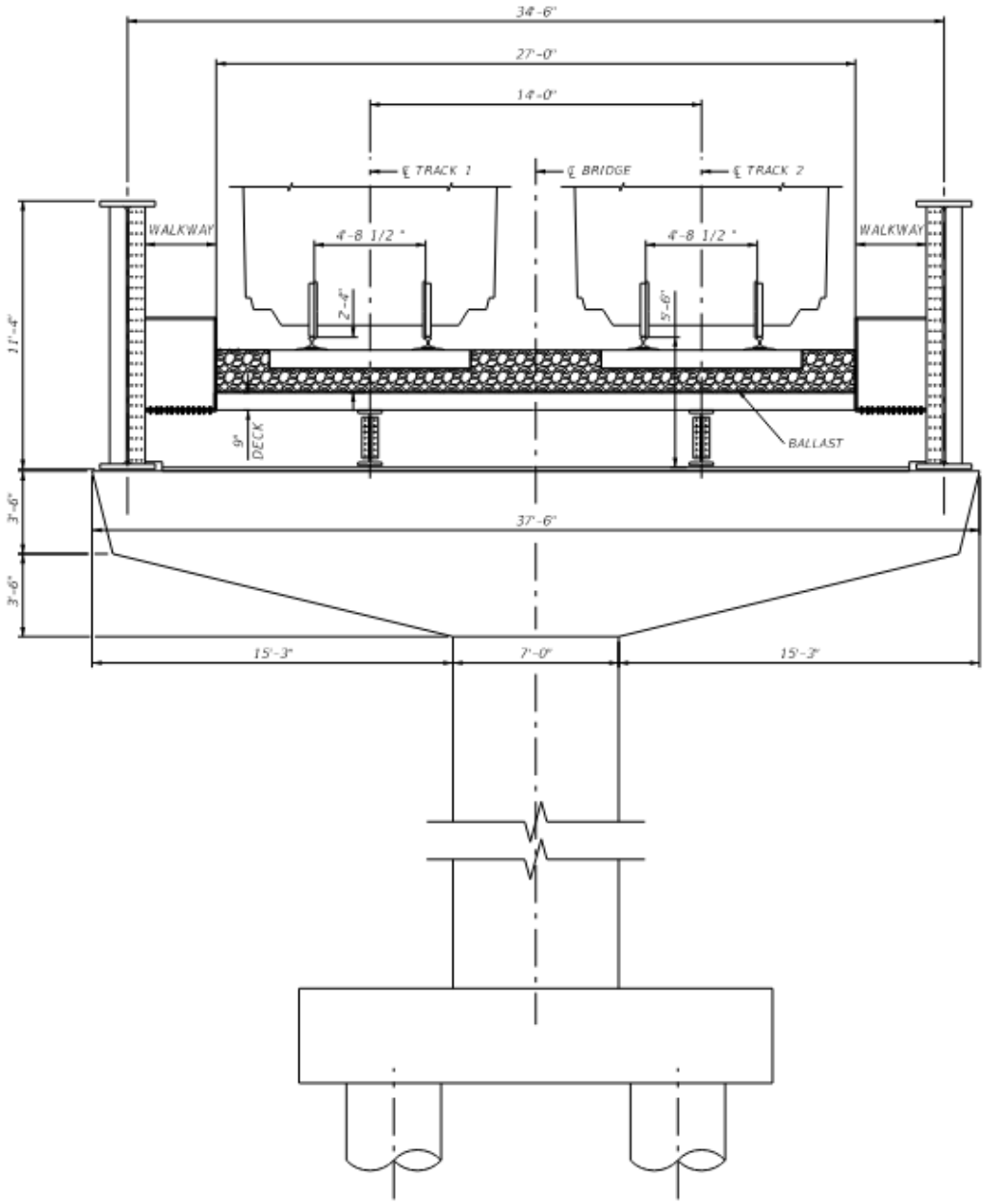


Figure 3-4: Guideway Over SW 2nd Street with 75′-0″ FT Span

3.3.2 Retained Fill

Mechanically earth stabilized (MSE) walls are proposed to be utilized at both ends of the approach spans to tie-in back at grade. **Appendix A** includes plan and profile of the proposed rail alignment and bridge configuration as well as typical sections. On the northern end, the MSE wall starts at grade just south of Broward Blvd and transitions up to the steel through span over SW 2nd Street. The approximate maximum height of the MSE wall is 20'-0" with an approximate length of 450'-0". On the southern end, the MSE wall starts just north of SW 5th Street and transitions down to at grade before the SW 6th Street crossing. The approximate maximum height of the MSE is 18'-0" with an approximate length of 600'-0". The use of MSE walls versus additional spans provides cost savings to the overall project and their proposed locations and associated heights do not create a "barrier boundary" effect from one side to the other. In addition to cost savings, MSE walls minimize security risks by eliminating areas of refuge or hidden locations under the approach structures. From a visual perspective, the MSE walls can offer the opportunity for aesthetically pleasing panels or areas for potential artistic murals.

3.4 Foundation and Substructure Types

The evaluation of substructure and foundation alternatives in this technical analysis provides a qualitative overview of potential options. It's important to highlight that detailed soil borings have not been collected for this assessment. Such investigations are typically reserved for the preliminary and/or final design phase of project development. A key focus during these phases will be ensuring constructability near active rail structures while minimizing environmental impacts, particularly in sensitive areas such as the New River and any adjacent wetlands. Additionally, considerations must account for the proximity to historic structures and high-rise condominiums, necessitating special attention focused on foundation types and installation procedures in this urban setting.

The complexity of designing piers and foundations requires comprehensive analysis of various loading scenarios. These include vertical dead and live loads, as well as eccentric loading resulting from train operations. Lateral loading from train nosing and traction/braking forces, wind-induced loading, scour and hydraulic effects, and centrifugal loading due to alignment curvature are also critical factors. Furthermore, at locations featuring flyover structures, crash analysis is imperative to safeguard against potential derailments and vehicular impacts when crossing roadways.

In conclusion, the foundation and substructure considerations for this project extend beyond mere structural integrity. They encompass a holistic approach that integrates environmental concerns, urban context, and the dynamic forces at play in a rail and vehicular transportation network. Through careful analysis and design, the proposed structures can not only withstand operational demands but also contribute to the resilience and safety of the overall infrastructure system.

3.4.1 Movable Bridge

Since no geologic testing was performed at this time, existing information from adjacent bridges, such as NW 3rd Avenue Bridge over New River was used to assess foundation types for the new bridge. Both pile alternatives and drilled shaft alternatives were qualitatively evaluated as potential

foundation types for the movable bridge. Due to the project site constraints which include buildings adjacent to the existing active bridge structure, the active railway, and possibly more critically, the nearby high-rise condominiums, a pile supported foundation system was not recommended for this project without further investigation.

3.4.1.1 Drilled Shaft Alternative for Foundation

Drilled shaft foundations are a more likely type of foundation at this project to support the substructure, or more economically, can become itself a primary substructure unit due to their large lateral capacities. Drilled shafts are typically installed in open drilled holes or steel casings. Large diameter shafts, typically larger than 10 ft. require specialized equipment which will limit the number of contractors able to perform the work and ultimately bid on the project. This specialized equipment for large diameter drilled shafts is not anticipated to be needed for the construction at the bridge site for this project.

If drilled shafts are used, O-Cell would be needed to verify the shaft capacity. Thermal Integrity Profiler (TIP) testing and caliper testing will also be required for drilled shafts to evaluate the shaft integrity.

3.4.1.2 Pier Type Alternatives

For the moveable span substructures, it is anticipated that perched or floating footing concepts will be investigated for the project so large cofferdam, tremie placements and dewatering are not required. These large concrete foundation elements will support whatever substructure type the new movable span bridge demands.

For the flanking spans, simple pier caps were assumed which transfer the loads from the superstructure through the bearings and substructure to the foundations. The pier caps may be constructed of reinforced concrete or steel. The most comment type of pier caps, reinforced concrete pier caps, are anticipated for this project. To facilitate staged construction, reinforcing could be extended beyond the finished edge of concrete to splice into the final portion of the placement or mechanical reinforcing couplers may be used to provide a similar splicing function. Coordination with the approach span foundations will be conducted in the next phase for both design continuity as well as aesthetics.

3.4.2 Approach Structures

Based on the proposed alignment and criteria to provide open space underneath, concrete single column hammerhead piers are proposed for the support of the approach spans. The use of single column piers provides the largest horizontal clearance to adjacent FEC tracks and developments in comparison to multi-column piers.

A concrete cap under the columns using deep foundations consisting of four (4) – auger cast or drilled shafts is proposed to support the substructure loading. Multiple deep foundations provide greater stability, eliminate non-redundancy, and reduces the size of the elements which facilitates construction and associated equipment. The use of driven concrete piles is not preferred since their construction triggers vibration concerns for the adjacent developments and FEC tracks.

3.5 AESTHETICS

The concept design was developed so as to have the flexibility to incorporate aesthetic features that would be compatible with the area. This included minimizing the use of MSE or retaining walls so as not to block views across the corridor or to the New River. For the bascule bridges, the technical analysis and cost estimates were based on a basic rolling lift bascule bridge. In order to assess and discuss the art of what may be possible with incorporating additional aesthetics into the bascule bridge design, several concepts and renderings were developed. These images are conceptual only. Further technical analysis is needed to refine the concept design, staging and other constructability issues for these or any other concepts.

The concepts were developed by incorporating inspiration from a multitude of architectural, maritime, and natural contextual elements that visually anchor it to the site by the New River. They include:

- Architecture

  Some notable buildings adjacent to the proposed site include Natiivo to the northwest, Nautica to the southwest, the New River Yacht Club to the southeast, and the Society Las Olas to the northeast. Each structure exemplifies modern design with its use of glass, bright and off-white cladding systems, terracing floors and balconies, and even the subtle use of curves as seen in Natiivo's balconies and Nautica's undulating façade.

- Maritime

  Known as the yacht capital of the world, Fort Lauderdale's maritime industry is comprised of world-class shipyards, marinas, and manufacturing contributing upwards of $9 billion annually in Broward County and $12 billion in the South Florida region. Fittingly, yachts and sailboats display complex curved surfaces, reflective surfaces and contemporary color combinations, and dynamic forms driven by style and performance.

A. Nature

With the New River flowing through downtown, and the city's adjacency to the Atlantic, it is impossible to separate Fort Lauderdale's identity from the water. The design team took inspiration in a few ways including wave forms, fishhooks, ripples on the surface, sea glass, and even caustic shadows projected onto the river and sea floor below.

Each of the developed alternatives focused on injecting one or more themes into its architectural and structural design. Renderings and drawings of the three concepts are provided in **Appendix B.**

The first alternative, known as The Mast, was derived from the basic rolling lift bascule bridge which was very squat and disproportionate in relation to its length versus height and cluttered due to its visible structural systems. The design team started to look at the maritime industry, specifically, sailboat masts and yacht spoilers and hulls to shape its signature pylon and girder. Ultimately the design utilizes sleek curves and creases along with an elongated pylon to capture the dynamic form and movement of boats. At night this alternative features perforations in its

pylon and girder skin that have direct view lens illuminated from within that is in line with the lighting design strategy planned on other adjacent movable bridges.

The second alternative, referred to as Sea Glass, again focuses on elongating the pylon to better its proportions and undulates the front edge of the pylon and top edge of the girder while creating a polyhedral like teal pattern that spans between the upper and lower edges. The result is a geometry where its edges flutter like the surface of the water and the pattern is reminiscent of sea glass and the caustic patterns projected onto the sea floor by the rippling above. Teal anodized aluminum cladding drives home the connection between teal and the blue water of the ocean and provides surfaces for illumination to give the structure a uniquely different identity at nighttime.

The third alternative, referred to as the Fish Hook, is directly inspired by fishing hooks as displayed in its curved portal frame that bends up and over the track creating a portal-like experience and a very identifiable silhouette. This concept is also heavily influenced by the curved creases and sleek geometry of yachts as seen in the girder crease that jogs from low to high from the girder into the pylon cutting shadows off in a dynamic manner. The “hook” that curves up and around the rail clearance also functions structurally as the counterweight to facilitate movement while giving the structure a signature profile. A direct view light is embedded into the jogging crease such that at night it can be traced from the approach structure into the main span allowing that edge to come alive even at night when there are no shadows from the sun.

4. Constructability Evaluation

4.1 Right-of-Way

4.1.1 General

The project corridor lies within the City of Fort Lauderdale's Downtown Regional Activity Center (RAC). The project limits were established as follows:

A. 20' from East Side of FEC Right-of-Waw (ROW) from the north side of Broward Blvd. to NE 2 St.

B. 20' from West Side of FEC ROW from Broward Blvd. to New River.

C. 20' from East/West Sides of FEC ROW from New River SW 7th St.

4.1.2 Acquisition

The proposed project is located within the FECR ROW from just south of NE 2nd Street to SW 6th Street. The proposed project track alignments lie within FEC ROW except for a portion of a new freight track east of the Fort Lauderdale Brightline Station. Approximately twelve (12) feet of additional property is needed for a short distance to accommodate the new track. The affect parcel is a Broward County Transit (BCT) site, utilized as the downtown bus terminal.

4.1.3 Temporary Construction Easements

Properties fronting along the west side of SW 2nd Avenue to the New River are affected by temporary construction easements. These 20-foot temporary easements needed for construction would be within existing public right of way. As such, agreements with local stakeholders are being considered and it is assumed no compensation would be necessary unless the team is informed otherwise. The property located at the northwest intersection of the river and corridor will be impacted by a temporary construction easement for a temporary bridge location. This property is an improved property owned by the Fort Lauderdale Historical Society. These improvements include a museum and historical houses. The easement may impact some site improvements, but no major improvements are affected.

Properties fronting along the west side of SW 2nd Avenue and fronting along the east side of SW Flagler Avenue from SW 5th to SW 7th Streets would generally not be impacted by construction if access to those properties is provided. In this section of the alignment, most of the 20-foot temporary construction easements needed for construction would be within existing public right of way. As previously stated, agreements with local stakeholders are being considered and it is assumed no compensation would be necessary unless the team is informed otherwise. However, the property located at the southwest intersection of the river and corridor may be impacted by an easement for a temporary bridge location. This property is improved with a marina, restaurant (Pirate Republic Restaurant), boat storage barn and small office/warehouse. However, development plans are under review for a mixed used redevelopment of this site and an adjacent site to the west. The portion affected by the temporary construction easement will be on the

waterfront next to the marina. The easement may impact some site improvements, but no major improvements are affected.

4.2 ENVIRONMENTAL REVIEW

4.2.1 General

A desktop review was conducted on the existing environmental conditions and potential impacts associated with the proposed New River Bridge Project. This included identification of regulatory requirements and permits that may be applicable for the project, as well as the required coordination efforts with relevant agencies and stakeholders. It should be noted that since the proposed Project would require a federal permit, this project has to follow the NEPA process to get all the necessary environmental clearances regardless of federal funding participation. Each section presents an environmental resource evaluation, which assesses the potential impacts to socioeconomic and land use, recreational and historic, natural, and physical resources within the project study area, which includes a 500-foot buffer of the project study area. Further details, including a general discussion of mitigation measures and best management practices (BMPs) that may be implemented to avoid or minimize adverse impacts are provided in **Technical Memorandum #2.**

4.2.2 Socioeconomic & Land Use

The project study area primarily consists of Commercial and Services land uses, accounting for 76% of the project area. Within the 500-foot buffer of the project area there are two (2) homeowner associations, and one (1) cemetery.

A review of the 2020 American Community Survey 5-Year Estimates for census block groups within the corridor was conducted to identify environmental justice populations within the project area. Census block groups within the 500-foot buffer area along the corridor were compared to the demographic characteristics of Broward County. Compared to the demographic characteristics of Broward County, the census block groups within the study area contain a notably higher White population, and lower percentages of Black, Asian, Other, and Hispanic populations than the county overall. The population within the corridor aged over 65 was also noted to be higher than the overall county population. The median household income for the corridor is $63,856, while the County median household income is $63,406. In addition to a slightly higher median household income, there is a small increase in the percentage of households without vehicles when compared to the County percentage.

The project area primarily consists of Commercial and Services land use. The direct footprint of the project area is within the railroads and railyards sector. The southwest quadrant of the study area contains several multiple dwelling units and low-rise units. Since this project is proposed along an existing railway, the project is not anticipated to directly affect land use. Future land use designated by the county is predominantly Mixed Use – Neighborhood/Activity Center, with a small portion of the southwest quadrant of the project area being designated as Residential High. The project is not anticipated to change the land use or interfere with future land use planning.

4.2.3 Recreational and Historical

4.2.3.1 Section 4(f) Potential/Recreation Areas

Section 4(f) of the Department of Transportation Act (DOT Act) of 1966 stipulates that all United States Department of Transportation (USDOT) agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historic sites unless there is no feasible and prudent alternative to the use of the land and the action includes all possible planning to minimize harm to the property resulting from use.

Three (3) recreational resources were identified within the 500-foot buffer area: Florence C Hardy Park at the southeast quadrant of the project area, Riverwalk Park North, and Riverwalk Park South. The Riverwalk Parks are located on the north side of the river within the project area along the seawall and on the southeast portion of the river's edge along the seawall. During construction, the Riverwalk Parks will remain accessible outside of the immediate vicinity of construction, and pedestrians will be able to access the facilities to the west and east of the project area. It is anticipated that the project will have negligible temporary effects on these Section 4(f) resources. A Section 4(f) evaluation may also need to be conducted to determine the effect of the project on historic resources. The proposed project has the potential of temporarily impacting historical structures during the construction phasing. Temporary and permanent impacts to the viewshed, air quality, vibration, and noise may also have an effect on adjacent historical properties.

4.2.3.2 Historic and Archaeological Sites

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations at 36 CFR Part 800 (Protection of Historic Properties) requires federal agencies to consider the effects of their undertakings and programs on historic properties in the planning and delivery of a proposed action. The federal agency must consider the effects of the action on the property; evaluate all available avoidance, minimization, and mitigation options; and offer the consulting parties an opportunity to comment on the effects of the undertaking on historic properties.

Based on data from the Florida Master Site File, previous project surveys have been conducted as recent as 2020 for the southern half of the study area, and 2006 for the northern part of the project area. Within the study area, there are three recorded resources that are eligible for the National Register of Historic Places (NRHP). The Fort Lauderdale Historic District is located adjacent to the project corridor in the northwest quadrant. The Fort Lauderdale Historic District is roughly bounded by the FEC on the east, New River on the south, SW 5th Avenue on the west, and the back side of the parcels north of SW 2nd Street, and Commodore Brook Avenue on the west. The FEC is also a NHRP eligible State Historic Preservation Office (SHPO) resource. The Bryan Building at 220-230 Brickell Avenue in the northeast quadrant of the project is NHRP eligible, as well. Lastly, there are four potentially eligible resources in the northwest quadrant, also located within the Fort Lauderdale Historic District.

Coordination with SHPO will be required for the resources within the project area as there is potential for the project to affect the historic character of the area. No known archaeological sites exist within the project area. In addition to the potential effect to the historic character of the area, temporary

impacts during construction such as noise, vibration, and air quality impacts may occur. Detailed noise and vibration studies and coordination will occur in future project and will be addressed within the cultural review by SHPO for the project. A cultural resource assessment report and effect determination letter are anticipated for coordination with SHPO. If adverse effects are anticipated for the project, agencies will need to coordinate and agree on appropriate minimization and mitigation measures.

4.2.4 Natural

4.2.4.1 Wetlands and Surface Waters

The National Wetlands Inventory (NWI) database reports 3.83 acres of other surface waters (OSWs) classified as estuarine/marine deepwater within the study area. This area solely consists of the New River within the study area as no wetlands or additional OSWs exist within the project area.

Work within OSWs of the New River will be required. Therefore, permits will likely be needed from the Army Corps of Engineers (ACOE) the South Florida Water Management District (SFWMD), and Broward County Environmental Protection and Growth Management Department (BCEPGMD). The crossing should be within the existing footprint to the greatest extent practical to reduce impacts. The work will consist of demolishing the existing bridges, creating new spans, and installing piles in a sequence of phases. Best management practices (BMPs) will be required to avoid impacts to the OSWs.

4.2.4.2 Water Quality and Quantity

The disturbance of sediment during construction is anticipated to cause temporary impacts to surface water quality. The project should employ construction best management practices and sediment and erosion control measures to avoid impacts to water quality during construction. The Project will require a National Pollutant Discharge Elimination System (NPDES) permit and a Stormwater Pollution Prevention Plan (SWPPP) to ensure regulations for the discharge of pollutants to water and stormwater runoff are met, and impacts are avoided. Stormwater management would be designed to meet the requirements of the applicable regulations of the SFWMD and BCEPGMD and will be coordinated with regulatory agencies through the permitting process. A water quality certification should be obtained from the SFWMD as part of the Environmental Resource Permit (ERP).

4.2.4.3 Floodplains

According to the Digital Flood Insurance Rate Map (DFIRM) Special Flood Hazard Area (SFHA) 100 Year Flood Zones data, 95.26 acres of the study area is located within the 100-year floodplain with a base elevation of 5 feet. The floodplain is found from north of Southwest 6th Street though the study area. Additional fill within the floodplain may require floodplain compensation and coordination with the water management district.

4.2.4.4 Navigable Waterways

Section 9 of the Rivers and Harbors Act of 1899 and the General Bridge Act of 1946 gives the U.S. Coast Guard (USCG) the regulatory authority to prevent interference of navigable waters by

bridges or other obstructions. The New River is a navigable waterway and therefore will require coordination and a permit from the USCG. Construction during the project should avoid delays within the navigable waterway, avoid peak boating hours and allow vessel passage whenever possible.

4.2.4.5 Endangered Species and Habitat

The project is within the USFWS Consultation Area of the Florida bonneted bat (*Eumops floridianus*). The project is also within the core foraging area for wood stork (*Mycteria americana*). The project area is not within the consultation areas of the West Indian manatee (*Trichechus manatus*) nor the American crocodile (*Crocodylus acutus*) but is accessible to these species. Each species is listed below. Further discussion on the project's potential effect on the species is described in **Technical Memorandum #2**.

- Florida bonneted bat – Federally Endangered (USFWS Jurisdiction)
- West Indian manatee – Federally Threatened (USFWS Jurisdiction)
- Wood stork – Federally Threatened (USFWS Jurisdiction)
- American crocodile – Federally Threatened (USFWS Jurisdiction)
- Essential Fish Habitat

4.2.5 Physical

4.2.5.1 Noise

Community features that may be sensitive to noise were identified via geographic information systems (GIS) datasets and property type. Noise sensitive properties include schools, healthcare facilities, parks, and churches. All properties within the study area are currently exposed to industrial noise from the existing land use of existing rail operations within the project area. Permanent noise impacts to surrounding properties may occur from raising the bridge elevation. Additional noise studies are recommended in future phases to determine noise impacts. The potential for noise impacts and mitigation requirements will be coordinated and reviewed by SHPO. Impacts will be minimized by conducting noise and vibration generating work during typical working hours and avoiding early mornings and late nights as to not disturb the residential areas.

4.2.5.2 Vibration

The project area is surrounded by Commercial and Services land uses. These features already exist within 500 feet of utilized rail lines. Vibration sensitive facilities typically include those that operate fine scale lasers such as hospitals or healthcare facilities. The nearest healthcare facility is approximately 0.33 miles east of the project, well outside of the 500-foot analysis buffer. However, the nearest residential buildings are within 350 feet of the corridor. An increase in temporary vibration impacts during construction is anticipated. Although no healthcare facilities will be affected, the residential community may be affected. The ambient noise and vibration due to the commercial nature of the area may mask the temporary vibration that would be associated with construction, but impacts should be evaluated in future phases. Construction vibration may also temporarily affect recreational and historical resources which should be coordinated and reviewed by SHPO. Impacts

will be minimized by conducting excessive noise and vibration work during working hours and avoiding early mornings and late nights to not disturb the residential areas.

Vibration criteria will be established during the permitting phase and then seismographs installed at critical areas established during the design phase. Vibration criteria is site by site based on the adjacent building types and the geology. Various techniques for reducing potential vibration are developed during a project's engineering and environmental analysis phase. Examples include the use of drilled shafts rather than pile driving and heavier bridge structures to dampen vibration.

4.2.5.3 Air Quality

The project is not located within a United States Environmental Protection Agency (USEPA) designated Air Quality Maintenance Area or Non-Attainment Area for any of the six pollutants [ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, lead, and small particulate matter] specified by the USEPA in National Ambient Air Quality Standards (NAAQS); therefore, the Clean Air Act conformity requirements do not currently apply to this project. Localized impacts to air quality could occur because of fugitive dust and exhaust emissions generated from equipment during project construction. No permanent effects to air quality are anticipated.

4.2.5.4 Contamination

Within 500 feet of the project study area, there are five (5) open and thirteen (13) closed storage tank contamination monitoring sites, 11 compliance and enforcement tracking locations for hazardous tracking facilities, one (1) eligible and five (5) ineligible petroleum contamination monitoring sites, 11 National Pollutant Discharge Elimination System (NPDES) Stormwater Facilities and Activities, one (1) Superact Risk Site, ten (10) Environmental Protection Act (EPA) Resource Conservation and Recovery Act sites, and one (1) Department of Environmental Protection (DEP) Cleanup Site. The list of facilities and potential contamination sites within the project area are detailed further in **Technical Memorandum #2**.

4.2.6 Resiliency Goals

Sea level rise is a significant environmental challenge that affects the coastal areas of Florida, including the New River. Sea level rise increases the risk of flooding, erosion, saltwater intrusion, and damage to infrastructure and ecosystems. It is essential to design the project with consideration of the current and projected sea level rise scenarios.

To address sea level rise, it is recommended to follow the requirements and guidelines of Broward County and the City of Fort Lauderdale ordinances, which state that by 2050, the minimum seawall and top of bank elevations shall be five (5) feet NAVD. The existing FEC bridge elevation is 4.5 feet above MHW. The proposed passenger rail bridge will be built 40 feet above MHW. The freight rail bascule bridge will remain generally at 4.5 feet above MHW. Further development of a replacement freight rail bascule bridge will need to confirm that its clearance over MHW will meet the five (5) feet NAVD requirement.

By incorporating these higher elevations into planning, the project will aim to provide resiliency and adaptation to the effects of sea level rise in the New River area and enhance the safety and functionality of the bridge and waterway.

4.3 PERMITTING

The project may require the following environmental permits and approvals from federal, state, and local agencies for construction of this project:

- Section 404 permit from the U.S. Army Corps of Engineers (USACE) for the discharge of dredged or fill material into waters of the United States.
- Bridge permit from the U.S. Coast Guard (USCG) for work within navigable waters.
- Environmental Resource Permit (ERP) from South Florida Water Management District (SFWMD).
- Broward County Environmental Resource License (ERL) from the Environmental Protection and Growth Management Department (EPGMD).
- Broward County Tree Removal License from the Environmental Protection and Growth Management Department (EPGMD) Tree Preservation Program if trees are to be impacted.
- National Pollutant Discharge Elimination System (NPDES) permit from the Florida Department of Environmental Protection (FDEP) for the discharge of stormwater associated with construction activities.
- Section 106 coordination with the State Historic Preservation Office (SHPO) for the potential effects to historic properties within the Area of Potential Effects (APE).
- Potential Section 4(f) evaluation and coordination with the U.S. Department of Transportation for the use of land from a publicly owned park, recreation area, wildlife refuge, or historic site.
- Section 7 coordination with USFWS and NOAA Fisheries for the potential effects to federally listed threatened or endangered species.
- Building permits from the City of Fort Lauderdale.

4.4 MATERIAL EQUIPMENT AND STORAGE

There are currently limited vacant sites that may provide staging areas, as shown in **Figure 4-1**. However, this area of Fort Lauderdale has been undergoing redevelopment for many years and there are various planned sites where the owners have submitted plans for development. A review of vacant parcels has identified locations south of SW 6th Street along the east side of the FEC ROW for potential material and equipment storage.

Much of the movable bridge materials will be preassembled off site and floated to the site as the foundations are constructed and made available. Materials such as piles and drilled shaft shells are likely to be stored on barges in the river. Typically, the USCG will permit barges stored against the bulkheads and not near the active channel. Agreements would be negotiated during

the design phase with owners with waterside access rights. This is typical.

For the larger aspects of the work on the at-grade approaches it is likely that some of the materials will also be stored on barges particularly approach spans for the movable bridge.

It is also highly likely that materials will be stored linearly along and within the RR ROW. This would need to be explored during the final design phase as the staging becomes more developed.

Also, there are several potential sites south of the project that can be investigated for staging and storage and then the materials can be moved to the site by rail. On many other rail projects switches and complex rail assemblies are made up off site and taken to the site by rail. The sites noted above are likely for this assembly as well

Figure 4-1: Potential Staging Area

4.5 CONSTRUCTION PHASING

4.5.1 General

An important requirement in developing the construction phasing in allowance for continued operations of existing FEC freight trains and the Brightline passenger trains. During initial discussion, FEC and Brightline stated that two tracks over the New River was needed through all stages of construction. Another important requirement was for the future freight and passenger bascule bridges to be located within existing FEC right-of-way.

The study aims to identify the most effective and least disruptive construction sequencing to meet the evolving needs of FEC and passenger rail operations while ensuring the safety and reliability of the infrastructure over the New River in Fort Lauderdale. The general concepts for feasible construction sequencing will be presented herein although the contractor's means and methods for final construction would need to be analyzed to ensure the basic needs of FEC and passenger are met during construction. All sequences provide a final arrangement of bridges within the existing FEC ROW and require a temporary construction easement only where noted.

For the movable span the work will most likely be performed all from waterborne equipment. Both demolition as well as new construction will be sequenced mainly from the water and the major permitting issues will be negotiated between the owner and marine community with the USCG.

For the at grade approach construction of walls and fixed bridge the work must be carefully staged east to west following the river crossings as they are constructed. The work will be done in longitudinal corridors so that track can be installed as the structural elements are made available. Equipment access will be most likely be thru local city streets. The largest equipment will be for pile driving and setting superstructure elements whether steel or concrete girders. Outriggers and local storage of materials will all be set to permit rail passage, again east to west. For the construction of fill and retained structures there will be a need for temporary retaining walls which are likely to be tied together because driving sheets seems impractical here.

Five initial staging options were developed for consideration.

- 1 Freight Track West
- 2 Freight Tracks West with 1 Track Temporary Operation
- 1 Freight Track East
- 2 Freight Tracks East with 1 Track Temporary Operation
- 2 Freight Tracks East with 2 Tracks Temporary Operation

Each option offers a unique approach to efficiently replace the in-service infrastructure while accommodating both FEC and passenger rail services. However, only the final option provides two freight tracks and two passenger tracks in the final condition and two tracks at all times through the construction stages. This is the option used for developing the construction and operation stages.

4.5.2 Movable Bridge Staging

The proposed construction sequencing outlines a detailed approach to replace the freight railroad bascule bridge within the FEC Railway's ROW while accommodating both FEC and passenger rail services (**Figure 4-2**). At the project's conclusion for this construction sequence option, the new infrastructure will feature two low-level 1-track FEC bascule bridges on the east and one mid-level 2-track passenger bascule bridge with 40 ft clearance from MHW on the west.

This plan involves temporary 2-track operations utilizing one temporary 1-track bridge west of the existing FEC bridge and a permanent 1-track bridge to the east of existing, both low-level

structures matching the existing FEC bridge's clearance of 4 ft above MHW. The temporary west bridge would extend approximately 10 ft outside the existing western ROW limit and a temporary construction easement would need to be acquired for this structure. The temporary bridge could be any temporary movable bridge type (e.g., bascule, vertical lift, etc.) so long as it provides the minimum vertical clearance required by the USCG in the New River at the bridge location.

Stage 1 begins with the construction of the fender and the installation of track and approach spans to establish temporary and permanent bridge locations. A 1-track permanent span is built east of the existing FEC bridge, while a 1-track temporary span is constructed on the west. The order of this construction is not critical for future stages and operations. The 1-track permanent span will be utilized by FEC in the final state. Train operations will then commence on both bridges to maintain service continuity.

During Stage 2, the existing FEC bridge and associated structures are removed to facilitate the transition to the new permanent bridges.

In Stage 3, new track works are installed west of the permanent 1-track FEC east bridge, along with approach structures for the new permanent 1-track FEC west bridge, maintaining low-level designs to match the existing FEC bridge. Tracks are switched from the temporary west bridge to the new permanent 1-track FEC west bridge to ensure smooth operations. At this stage both FEC and passenger trains are utilizing the two permanent 1-track FEC bridges.

Stage 4 involves the removal of the temporary bridge and track works.

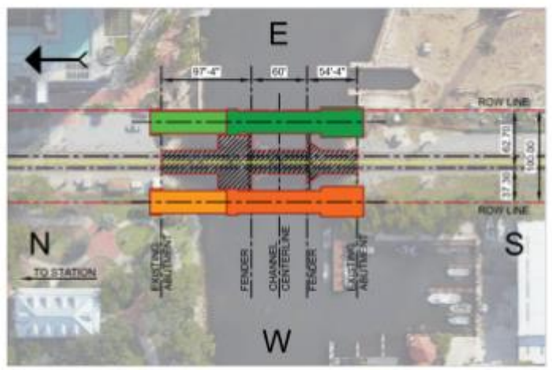
During Stage 5, approach spans and bascule piers are constructed for the new permanent west passenger bridge, designed to be mid-level with higher clearance than the FEC bridge. Tracks are installed for the new permanent 2-track west bridge, further preparing the infrastructure for passenger operations.

In the final stage, Stage 6, the new permanent west passenger bascule span is installed, and tracks are switched for service onto the new bridge. FEC service continues on the permanent east bridges, while passenger service operates on the newly constructed permanent west bridge, offering increased clearance of 40 ft above MHW.

Stage 1

1. Extend fender.
2. Install track and approach spans as needed to temporary bridge location on west and permanent bridge location on east.
3. Build 1-track permanent span east of existing FEC bridge and 1-track temporary span west of existing FEC.
   3.1. These bridges should be low level to match existing FEC bridge.
4. Switch over tracks to the new 1-track bridges.

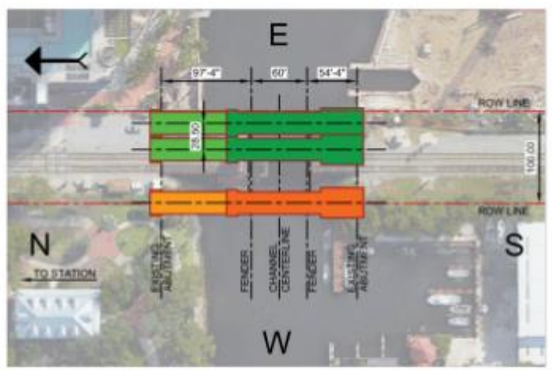
Train Operations
FEC & commuter rail service on permanent east bridge and temporary west bridge.
- Note this bridge is similar clearance as existing FEC bridge 4ft clear of MHW.



Stage 2

1. Remove existing FEC bridge.
2. Remove existing track and approach structures as needed.

Train Operations
FEC & commuter rail service on permanent east bridge and temporary west bridge.
- Note this bridge is similar clearance as existing FEC bridge 4ft clear of MHW.



Stage 3

1. Install new track works for new span to the west of to the permanent east bridge.
   1.1. These bridges should be low level to match existing FEC bridge.
2. Build approach structures for new permanent west bridge.
   2.1. These bridges should be low level to match existing FEC bridge.
3. Switch over tracks from the temporary west bridge to the to the new 1-track bridge.

Train Operations
FEC & commuter rail service on new permanent east bridges.
- Note this bridge is similar clearance as existing FEC bridge 4ft clear of MHW.

Stage 4

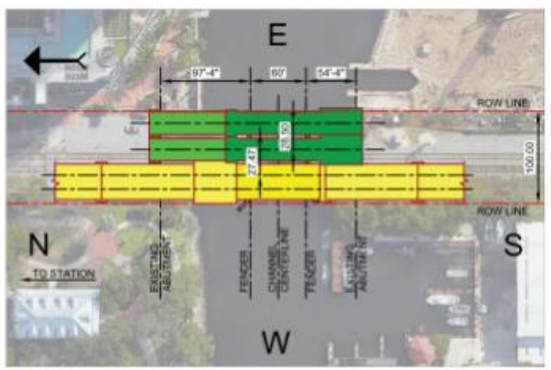
1. Remove temporary bridge.
2. Switch tracks for commuter rail for the new bridge.

Train Operations
FEC & commuter rail service on new permanent east bridges.
- Note this bridge is similar clearance as existing FEC bridge 4ft clear of MHW.

Stage 5

1. Construct approach spans and bascule piers for new west commuter rail bridge.
   1.1. These are for a mid-level bridge for commuter rail.
   1.2. Higher clearance than the FEC bridge.
2. Install tracks for the new permanent west commuter rail bridge.

Train Operations
FEC & commuter service on new permanent east bridges.
- Note this bridge is similar clearance as existing FEC bridge 4ft clear of MHW.



Stage 6

1. Install new permanent west commuter rail bascule span.
   1.1. This bridge is the mid level bridge for commuter rail.
2. Switch tracks for commuter rail for the new bridge.

Train Operations
FEC service on new permanent east bridges.
- Note this bridge is similar clearance as existing FEC bridge 4ft clear of MHW.

Commuter rail service on new permanent west bridge.
- Note this bridge is mid level bridge approx 40ft clear of MHW.

TEMPORARY SPAN APPROACH/MOVABLE SPAN | NEW FEC APPROACH/MOVABLE SPAN | NEW BRIGHTLINE APPROACH/MOVABLE SPAN | EXISTING FEC BRIDGE | REMOVAL

Figure 4-2: Construction Staging Plan

Throughout each stage, careful planning ensures minimal disruption to train operations and adherence to safety standards. By systematically implementing this construction sequencing, the FEC trains and passenger trains will maintain 2-track service across the river throughout construction and in the final state will modernize its infrastructure while meeting the evolving needs of FEC and passenger services within the existing ROW over the New River in Fort Lauderdale.

4.6 SEQUENCING TO MAINTAIN RAIL SERVICE

Through coordination with Brightline and FEC, it is required that operation to both the Brightline and FECR must be always maintained. The longest allowable track outage is only for 12 hours. This 12-hour construction window and maintaining operations for both Brightline and the FEC are the criteria that are used to develop the construction phasing for this study. In the construction sequence below, three outages are required to realign tracks to the bridges; prior to Stages 1 and 3 and at the completion of Stage 6.

The bascule bridge staging option titled "FEC 2-Track East Staging B – Two Track Temporary Operation" has been selected to evaluate impacts to track alignments and operation. This option provides the flexibility of allowing the operation of two tracks over the river throughout construction. The following is a description of the track configuration at each stage. Diagrams are included as **Appendix C**.

Stage 1:

- Maintain the rail traffic on existing main line tracks.
- Construct the low-level FEC movable bridges on both east and west sides of the existing bascule bridge. The eastern bascule bridge is situated as the final location of the bascule bridge configuration, while the western movable bridge is for temporary condition.
- South of the FEC bascule bridge, construct both the eastern and western track alignments that align with the new FEC bascule bridges configuration. Only construct the eastern track to just south of SW 7th Street, while construct the western track only to just north of SW 10th Street. Connection to the existing main line tracks is not proposed at this point.
- North of the western FEC temporary bridge, construct the western track to align with the western passenger track at the station. This alignment is constructed only just south of Broward Boulevard. The eastern track alignment is constructed to the new freight track alignment that lies on the east side of the Brightline Station. This eastern track alignment is also only constructed south of Broward Boulevard. The turnout and track that would connect to the second passenger track is also constructed at this point. Connection to the existing track has still not occurred at this point.
- At the Brightline Station, construct the new eastern track alignment on the eastern portion of the right-of-way. This FEC track alignment is constructed to just north of NW 2nd Street.
- During a 12-hour construction window for this phase: connect both the eastern and western tracks to the existing tracks in the south. North of the bascule bridge, connect

the western track alignment with the western Brightline track alignment, while connecting the second passenger track with the alignment that coming off the turnout. During this 12-hour window, no train service will occur. Also in this vicinity, construct the eastern at-grade crossing at Broward Boulevard and connect it with the eastern FEC track alignment. At the Brightline Station, complete the connection of the eastern FEC track alignment with the existing eastern track.

Stage 2:

- Activate the new track alignments for both passenger and FEC rail operation.
- Remove the existing two-track bridge.
- Remove the existing mainline tracks in the south.
- Remove the existing mainline tracks north of the bridge, and the segment between the bridge and Broward Boulevard.

Stage 3:

- Construct the second FEC bridge.
- Construct the western FEC track alignment south of the second FEC bridge.
- Construct the western FEC track alignment north of the second FEC bridge. This segment is located between the bascule bridge and Broward Boulevard. Connection to the existing track has not yet occurred at this stage.
- In the Brightline Station area, re-align the western FEC track to align with the final configuration. Connection to the existing track has not yet occurred at this phase.
- During a 12-hour construction window for this phase: connect the western FEC track to both the passenger tracks in the area between the bascule bridge and Broward Boulevard. Also re-adjust the at-grade crossing at Broward Boulevard is readjusted for this phase so the western FEC track aligns with the final track configuration. Then, just north of the Brightline Station, connect the western FEC track alignment with the number 15 turnout at the existing middle track.

Stage 4:

- Shift both passenger and FEC rail traffic onto the eastern bascule bridge and the eastern track alignments.
- Remove the western temporary bridge.
- Remove the western track alignment to the south and the portion of western track alignment between the bascule bridge and Broward Boulevard.

Stage 5:

- Both passenger and FEC rail traffic are utilizing the eastern bridges at this phase.
- Construct the two-track bascule and fixed bridge approaches for passenger rail.
- Construct the wall segment and two-track alignment to the south of the bridge.
- Construct the two-track alignment to the south of the bridge.
- Construct the wall segment and the two-track alignment to the north in the area between the bridge and Broward Boulevard.

Stage 6:

- FEC rail traffic utilizes the eastern low-level bascule bridges, while the passenger rail traffic utilizes the western bascule bridge.
- Complete and connect the eastern passenger track alignment. This alignment connects the eastern passenger rail track alignment at the station.

4.7 TRAFFIC MANAGEMENT

As important as it is to ensure existing passenger and freight rail operations in the FEC corridor are maintained during construction phase with appropriated phasing and sequencing of activities, it is equally important to identify, minimize and mitigate any impacts to vehicular and pedestrian traffic in the corridor including emergency services, such as police, fire and medical responders.

At this initial conceptual phase, it is anticipated that there would be periodic but temporary closure of at-grade railroad crossings at Broward Boulevard, SW 2nd Street, Riverwalk N pedestrian crossing, SW 5th Street and SW 6th Street. Due to construction staging and falsework needs partial closure of Moffat Avenue, SW 2nd Avenue, NW Flagler Avenue and SW Flagler Avenue is expected during the construction phase. However, Nugent Avenue, SW 3rd Avenue, and SW 1st Avenue should be able to remain open and provide access to area businesses and residents.

In addition to the constraints of construction within an active rail corridor, some of the key challenges unique to downtown Fort Lauderdale area include, restrictions of nighttime work to avoid impacts to area residents; accommodating constraints posed by future development projects in the corridor both north and south of the New River; impacts to several BCT bus routes providing connections at Central Terminal; coordinating with City of Fort Lauderdale for special events in the entertainment district during weekends to maintain appropriate traffic circulation; access to area businesses, loading/unloading zones as well as parking; and accommodating peak hour traffic demand in Fort Lauderdale's Central Business District (CBD) .

A comprehensive Traffic Control Plan (TCP) or Maintenance of Traffic (MOT) plan would be developed as part of the Project Development & Environment (PD&E) Study phase to maintain vehicular, pedestrian, and bicycle access in and across the FEC corridor. It should be noted that preparation of TCP or MOT plans would be supported with traffic data collection and operational analysis using microsimulation tools, such as Synchro, SimTraffic and Rail Traffic Control (RTC) to evaluate capacity impacts of temporary road closures and develop appropriate mitigation measures. During the construction phase, TCP or MOT plans would include potential mitigation measures, such as a robust communications plan led by public involvement professionals to notify key stakeholders, area businesses and residents regarding temporary road closures and alternative routes/detour routes; phased closures to minimize the duration of disruption during peak hours; traffic signal adjustments and real-time traffic management to accommodate changes in traffic patterns caused reduction in capacity; alternative temporary parking and loading zones, if needed; clear signage; emergency access plans; and access management amongst others.

4.8 CONTRACTING ISSUES TO CONSIDER

A unique feature with any subsequent project is that the railroad corridor is privately owned and operated. In addition to the design and contracting options for consideration for project delivery, another factor is which organization will award and manage construction, Broward County, FEC, Brightline or Florida DOT. For purposes of this Technical Memo, award and management of the construction by a public agency is assumed.

As the project moves into more detailed design, the determination can be made on the most effective method of project delivery. By selecting methods that are efficient, safe, and well-suited to the project's specific requirements, the team can reduce construction costs and minimize waste.

Table 4-1 summarizes the types, benefits, and limitations of different project delivery methods. More information of the methods is located in **Technical Memorandum #2**.

Table 4-1: Benefits and Limitations of Project Delivery Methods

Project Delivery Method	Benefits	Limitations	Best Suited
Design-Bid-Build (DBB)	• Familiar process for all stakeholders • Detailed design phase ensures thorough planning • Competitive bidding may lead to cost savings • Clear division of responsibilities	• Longer overall project timeline • Limited contractor input during design • Potential for change orders and disputes • Less opportunity for innovation in construction methods	• Well-defined, straightforward projects • Projects where design changes are unlikely • When the lowest initial cost is a priority • When the owner wants maximum control over design
Design-Build (DB)	• Faster project delivery through overlapping phases • Single point of responsibility • Potential for innovative solutions • Improved communication between design and construction teams	• Requires clear, comprehensive initial requirements • Less owner control over design details • Potential learning curve if market lacks DB experience • May limit competition in some markets	• Complex projects with potential for innovation • When faster delivery is a priority • Projects benefiting from contractor input in design • When single-point of responsibility is desired

Project Delivery Method	Benefits	Limitations	Best Suited
Progressive Design-Build (PDB)	• Early contractor involvement without detailed design • Collaborative approach to design development • Flexibility to adjust scope and budget • Facilitates creative problem-solving for complex issues	• Requires strong owner engagement throughout • May not provide early price certainty • Less common, potential procurement challenges • Relies on effective team dynamics	• Complex projects with undefined scope • When early contractor involvement is crucial • Projects likely to evolve during design • When owner wants involvement in design decisions
Construction Manager/General Contractor (CM/GC)	• Early contractor involvement in design phase • Collaborative approach with designer and owner • Ability to fast-track certain project elements • Owner retains more control compared to DB	• Potential for misalignment between CM/GC and designer • Success heavily dependent on team chemistry • May not provide price certainty until later stages • Less common, might face procurement challenges	• Complex projects requiring constructor expertise • When schedule acceleration is needed • Projects benefiting from constructability input • When owner wants significant involvement throughout

Each project delivery method offers distinct advantages and challenges for the New River Passenger Rail Bridge project. The choice should be based on a careful evaluation of project priorities, risk tolerance, market conditions, and the specific technical challenges presented by this unique rail bridge project. Factors such as the need for innovation, schedule constraints, budget certainty, and the complexity of the New River Passenger Rail Bridge construction should inform the final decision.

Other factors that can affect contracting complexity and construction time include:

- Construction in a physically constrained area.
- Construction window availability in the FEC rail corridor, including the availability of flaggers.
- Careful construction methods and sequencing that adheres to strict safety requirements when constructing next to live tracks.

- The demolition sequence of the existing bridge, the construction of the new bascule bridge substructure and superstructure, and the installation and removal of temporary bridges.
- Removal of the temporary bridge upon completion of the new bascule bridge construction.
- Identify potential disruptions to traffic, rail operations, and the surrounding community. By developing strategies to minimize these disruptions, such as implementing effective detour routes and coordinating with stakeholders, the project team can avoid unnecessary delays and keep the project on schedule.
- Long-lead items, such as specialized equipment or materials, that may require additional time for procurement. By identifying these items early in the project, the team can initiate the procurement process in advance, minimizing potential delays to the construction schedule. Items to be considered:
    - Bascule Bridge Mechanical Components
    - Structural Steel
    - Electrical and Control Systems
    - Customized Bridge Machinery
    - Specialty Materials
    - Permits and Approvals
    - Utility Relocation Materials

A well-planned construction sequence that considers the constructability of each phase can optimize the project timeline. By identifying the most efficient order of construction activities and minimizing potential delays, the project team can streamline the schedule and reduce overall project duration.

5. Capital Cost Estimate

The TYLin team prepared the order of magnitude estimate using conceptual level of design and details developed for this study. Federal Transit Administration's (FTA) Standard Cost Categories (SCC) were used for the cost breakdown. The study estimate is prepared according to International Cost Estimate Classification System (Class 4), reflecting 2024 dollars.

5.1 METHODOLOGY

This conceptual estimate is developed per Association for the Advancement of Cost Engineering (AACE) International Cost Estimate Classification System (Class 4). This estimate is based on plans and details with a level of less than 15% design. The expected accuracy range for Class 4 varies between -20% and +30% as indicated in AACE's estimate classification table (AACE International Recommended Practice No. 56R-08, Table 1 - Section 3, August 2020).

5.1.1 Assumptions

5.1.1.1 Design

- Concrete bridge approach spans are assumed to be supported on concrete piers over drilled shaft foundations.
- Bascule spans are assumed to be steel superstructure supported on concrete piers
- Ballasted track has been assumed for the bridge approaches.
- ROW costs include permanent takes adjacent to the Brightline Fort Lauderdale Station (including BCT Terminal) and the lease of one staging site south of the river.
- The use of the public ROW adjacent to construction has not been evaluated.

5.1.1.2 Exclusions

- Project finance costs
- Project O&M Costs
- Hazardous material removal or environmental mitigation costs
- Noise mitigation or sound barrier systems
- Rock excavation

5.1.1.3 Additional Considerations

Additional engineering/design is needed to determine refinements/costs associated with the following elements, so these are not included at this time:

- New River pump house
- Tender house
- Contamination mitigation
- Associated community-related improvement
- Aesthetics

5.1.1.4 Train Operations

Operational analysis using Rail Traffic Control (RTC) modelling is needed to evaluate the following:

- R/R operations sequencing
- Brightline loading on east platform only during Stage 5 of construction sequencing
- Simultaneous construction elements during various stages
- Interim signaling modifications during various stages

5.1.2 Estimate Format

The capital cost model structure for Federal Transit Administration's (FTA) Standard Cost Categories (SCC) published May 24, 2023 are shown in **Table 5-1**.

Table 5-1: Standard Cost Category (SCC) codes

Category Code	Activity Line Item
SCC 10	Guideway and Track Elements
SCC 20	Stations, Stops, Terminals, Intermodal (Not in scope)
SCC 30	Support Facilities (Not in scope)
SCC 40	Site work & Special Conditions
SCC 50	Systems
SCC 60	Right of Way
SCC 70	Vehicles (Not in scope)
SCC 80	Professional Services
SCC 90	Unallocated Contingency

5.1.3 Cost Basis

As this is a conceptual design, a combination of different pricing methodologies is applied using parametric historical unit prices escalated as appropriate, assembly unit costs, percentages, and lump sum costs. Quantities are shown for parametric quantities taken off from the conceptual plans.

Unit prices – Composite unit prices shown for some items include Labor, Material, and Equipment. Parametric unit prices or assembly unit costs are applied in this estimate. These unit costs are based on TYLin's historical data from other similar projects escalated as appropriate. Some unit costs are developed using to Florida Department of Transportation's (FDOT) statewide average unit cost.

Markups – Markups for General Conditions, Overhead & Profit, and Bonds & Insurances are included with the unit prices or lump sum values.

Contingency – Allocated and Unallocated contingencies are included as given below for the different SCC codes.

1. Allocated contingency varies per category as follows
    - SCC 10, SCC 40, SCC 50 add a 25% contingency.
    - SCC 60 and SCC 80 add a10% contingency
2. Unallocated contingency
    - SCC 90 – 10% additional contingency to be added to the total of all categories

5.1.4 Movable Bridge Cost

Historical data were used to establish a cost estimate for the bascule bridges. The average unit prices from three previous projects were used to calculate the cost for the three new bridges (two single track FEC bridges and one double track commuter rail/Brightline bridge) and the temporary bridge. **Table 5-2** provides a summary of the historical data and the resulting total cost.

Table 5-2: Historical Cost Estimates - Station with a Single-Track Temporary Bridge

	Project Example 1		Project Example 2		Project Example 3		Average	
Bridge/ Component	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost
2-Track Passenger Movable Bridge[1]	$55,955,320	$10,155	$56,014,660	$10,166	$64,315,475	$11,673	$58,761,818	$10,665
1-1 FEC Movable Bridge[2]	$63,714,940	$8,788	$64,090,000	$8,840	$73,587,500	$10,150	$67,130,813	$9,259
Shared Assets	$39,140,300	$39,140,300	$36,092,328	$36,092,328	$24,192,700	$24,192,700	$33,141,776	$33,141,776
Total Cost (in 2024 dollars)	$158,810,560		$156,196,988		$162,095,675		**$159,034,408**	

Notes

[1]Shared asset costs includes items common to both bridge(s) including the control house, fenders, and demolition of existing bridge.

[2]Project 3 -the control house cost in is embedded within the bridge cost and not the shared asset costs.

The total cost of approximately $159.0M indicated in **Table 5-2** includes the cost of the new passenger rail bascule bridge, demolition of existing FEC bridge, construction and removal of temporary bascule bridge, and construction of two low level bascule bridges for freight (FEC).

It should be noted that two rail tracks across the river are available throughout construction with the use of a temporary bascule bridge. The total cost carried over to Category 10.04 Guideway is $159.0M. **Table 5-3** summarizes the assumptions for the other categories.

Table 5-3: Cost Basis per SCC

Category Code	Activity Line Item	Cost Basis
SCC 10	Guideway and Track Elements	SCC 10.04: For the approaches a unit cost of $180/SF of bridge deck area is applied as the superstructure cost and $220/SF of deck area is applied as the substructure cost. Bascule bridge cost basis is shown in Table 5-2. SCC 10.05: Earth fill quantity is calculated using MSE wall lengths based on plan and profile for the proposed bridge concept included in Appendix A. SCC 10.11 & 10.12: Estimate includes 19,767 TF of ballasted tracks, 50% is assumed as track removal quantity, and includes 3 #15 turnouts. SCC 10.01 to SCC10.03, SCC10.06 to SCC10.10, SCC10.13: Not used.
SCC 20	Stations, Stops, Terminals, Intermodal	(Not in scope)
SCC 30	Support Facilities	(Not in scope)
SCC 40	Site work & Special Conditions	SCC 40.01: Cost is included with other sections. SCC 40.02, SCC 40.06, SCC 40.07, and SCC 40.08: Design details were not developed; estimates are based on percents or lump sum. SCC 400210: Utility – 5% SCC 400810: Mobilization – 3% SCC 400820: Allowance for Maintenance and Protection of Traffic – 1% SCC 40.03, SCC 40.04: Excluded. SCC 40.05: MSE Walls are priced at $110/SF

Category Code	Activity Line Item	Cost Basis
SCC 50	Systems	SCC 50.01, SCC 50.02: Cost included as lump sum, and per each. SCC 50.05: Cost included with SCC 50.01
SCC 60	Right of Way	SCC 60.01: Lump sum base cost of $12.2M is included for purchase of real estate ROW[1].
SCC 70	Vehicles	(Not in scope)
SCC 80	Professional Services	Line items are included in the estimate as percentages.
SCC 90	Unallocated Contingency	Unallocated Contingency is calculated as 10% of total of Base cost which includes the allocated contingency.

[1]Right-of-way cost includes lump sum acquisition costs for temporary construction easements for temporary bridge placements on the river, materials and equipment storage area as well as permanent easement at BCT Central Terminal based on a range of property values (fee values) using data available from Broward County Property Appraiser.

5.1.5 Taxes

Unit Prices in the estimate include 6% sales tax on materials & equipment rentals.

5.2 CAPITAL COST

Table 5-4 includes a summary cost using FTA's SCC breakdown for the proposed bridge concept based on the methodology and assumptions described in **Section 5.1**. It should be noted that the capital cost is consistent with AACE International Cost Estimate Classification System (Class 4). **Appendix D** includes a summary of capital cost estimates as well as a detailed breakdown for various cost categories.

Table 5-4: Capital Cost Estimate (in 2024 dollars)

SSC	Activity Line Item	Cost (in 2024 dollars)	% Share
10	Guideway and Track Elements	$188,869,125	
20	Stations, Stops, Terminals, Intermodal (Not in scope)	$0	
30	Support Facilities (Not in scope)	$0	
40	Site work & Special Conditions	$20,477,980	
50	Systems	$20,300,000	
60	Right of Way	$12,200,000	
70	Vehicles (Not in scope)	$0	
80	Professional Services	$79,809,545	33% (SSC 10 to 70)
		$321,656,650	
	Allocated Contingency	$66,612,731	21% (SSC 10 to 80)
	Unallocated Contingency	$32,165,665	10% (SSC 10 to 80)
	Grand Total	**$420,435,045**	***Class 4 Ranges***
ASCE International Cost Estimate Classification System - **Class 4 Ranges**		$336,348,036	**-20%**
		$378,391,541	**-10%**
		$504,522,054	**+20%**
		$546,565,559	**+30%**

5.3 Cost Comparison With Previous Studies

Below is a discussion comparing the capital cost estimate for the proposed bridge alternative relative to the bridge alternatives considered in previous studies. It should be noted that since 2019, the Florida Department of Transportation and Broward County have conducted several studies to evaluate the feasibility of passenger rail crossing alternatives in this corridor. The TYLin team reviewed the following previous studies.

- Broward County and Fort Lauderdale Joint Study, Whitehouse Group, August 2023
- Technical Memorandum New River Crossing Alternatives, HDR, FDOT District 4, March 2023
- Broward Commuter Rail New River Navigational Survey Final Report, Corradino/HDR, FDOT District 4, November 2021
- Broward Commuter Rail Project Development and Environmental (PD&E) Study, Corradino/HDR, FDOT District 4, November 2021
- Subsurface Exploration Report No. J-21116.001, City of Fort Lauderdale, Quest Engineering, August, 2021
- New River Crossing Feasibility Study, Corradino/HDR, FDOT District 4, January 2020

The City of Fort Lauderdale and Broward County collaboratively engaged the Whitehouse Group ("Joint Study Consultant") to conduct a study of alternatives for passenger rail to cross the New River on the Florida East Coast Railway (FEC) corridor. **Table 5-5** shows Broward County and City of Fort Lauderdale Joint Study Report's Exhibit 11[1].

Table 5-5: Construction Cost Estimate for Bridge Alternatives, Joint Study Report, 2023

Standard Cost Categories		Alternative 1 Low-Level Bascule Bridge	Alternative 2 Mid-Level Bascule Bridge	Alternative 3 High-Level Fixed-Span Bridge
10	Guideway & Track Elements	$88,149,103	$189,012,845	$185,222,436
20	Stations, Stops, Terminals, Intermodal	$8,960,767	$26,082,497	$37,730,045
40	Sitework & Special Conditions	$19,536,301	$31,565,618	$32,080,218
50	Systems	$33,638,969	$42,468,854	$40,984,454
80	Professional Services	$44,247,536	$82,036,017	$83,521,737
Total		$194,532,676	$371,165,831	$379,538,890
Allotted Contingency (20%)		$38,906,535	$74,233,166	$75,907,778
Unallocated Contingency (5%)		$9,726,634	$18,558,292	$18,976,945
Total Base Year (2023)		**$243,165,845**	**$463,957,288**	**$474,423,613**

Source: Joint Study Report, Broward County and City of Fort Lauderdale, 2023

TYLin team's estimate has a comparable design to Alternative 1 of the Joint Study estimate shown in **Table 5-5**. However, TYLin team's proposed bridge project scope includes demolition of the existing FEC bascule bridge, construction of and demolition of a temporary bridge, construction of two new low level FEC bascule bridges, and construction of one two-track mid-level passenger bridge with approach spans for each of the three bridges whereas the bridge alternatives cost estimates in all the other previous studies include only demolition and construction of one new bascule bridge with two flanking spans. There are also differences in construction staging and phasing.

When compared to TYLin team's proposed bridge concept, while Alternative 1 is similar to TYLin's design, Alternative 2 (56.5 ft vertical clearance) and Alternative 3 (80 ft vertical clearance) do not have similar scope. The total length of bridge structure for Alternative 1 is 1,426 ft which is comparable to the TYLin team's proposed bridge concept at approximately 1,312 ft. The total length for Alternatives 2 and 3 is not comparable as the total length of bridge structure is longer (8,050 ft) and the supporting structural elements for superstructure and foundations differ extensively from the TYLin team's proposal.

[1]Construction Cost Estimates for the Bridge Alternatives ($2023) extracted from the previous Joint Study report (Ref: Technical Memorandum No. 3, Capital Costs – 'Assessment of Alternatives for Enabling Commuter Rail to Cross the New River on the FEC Corridor' (Draft: July 14, 2023, Update: August 8, 2023)).

Structural scope elements of Alternative 1 of the Joint Study that are comparable to TYLin team's proposed bridge concept are shown in **Table 5-6**.

Table 5-6: Structural Components Comparison – Joint Study vs. TYLin Team

Major Structural Components	Joint Study (Alternative 1) Bascule Bridge (25' Clearance)	TYLin Team Bascule Bridge (40' Clearance)
Vertical Clearance	25' vertical clearance over the river	40' vertical clearance over the river
Concrete bridge Approach spans	Total length – 1306'	Total length – 1312'
Bascule span	Bascule span – 120'	Bascule span – 150'
Flanking span	Two sides - 120'	Not Applicable
Steel Through Girders	Not Applicable	One span on North side
Concrete approach span supports	Concrete approach spans are assumed to be supported on piers over drilled shaft foundations	Same assumption as in previous study
Retaining walls	Total length – 1000'	Total length - 1050'
Track Improvement	Total length - 5,457'	Total length – 22,772'

Even though there are similarities in bridge structural elements, as shown in **Figure 5-7,** TYLin team's estimate is higher than the previous one because the overall scope includes additional bridges and construction means and methods for the proposed bridge concepts are different from Alternative 1 in the Joint Study.

Table 5-7: Joint Study vs TYLin Team Cost Estimate Summary

Description	Joint Study (Alternative 1) Bascule Bridge (25' Clearance)	TYLin Team Bascule Bridge (40' Clearance)
Updated Level 4 Cost Estimate (from Joint Study) (2023 dollars with no escalation)	$243,165,845	
TYLin Team Estimate (2024 dollars with no escalation)		$420,435,045

6. Stakeholder Meetings

Broward County conducted the following stakeholder meetings to review and seek input on the proposed concept for new elevated rail alignment and crossing over the New River.

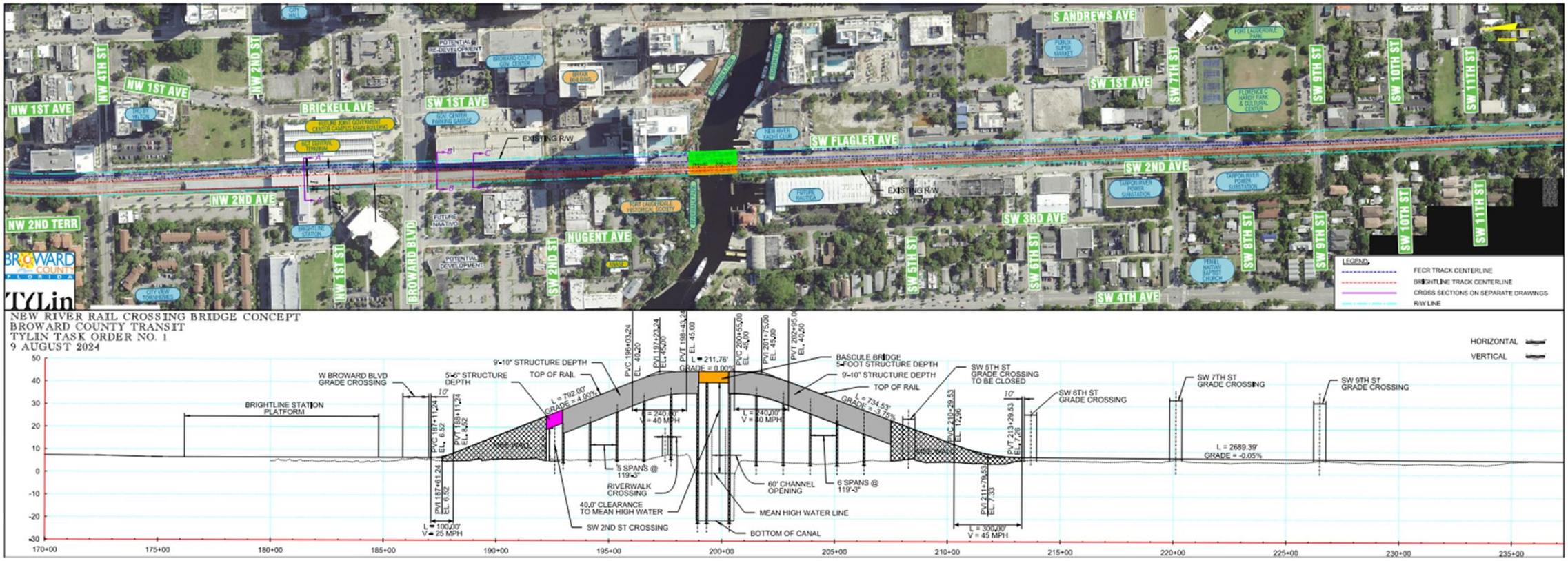
- Focused Stakeholder Group, July 31, 2024
    - Marine Industry of South Florida
    - Greater Fort Lauderdale Alliance
    - Urban League of Broward County
    - Council of Fort Lauderdale Civic Associations
    - Fort Lauderdale Downtown Civic Association
    - Broward Workshop
    - Broward MPO
- City of Fort Lauderdale, August 7, 2024
- Florida Department of Transportation (FDOT), District Four, August 9, 2024
- Cymbal DLT Companies, August 13, 2024
- Marine Industries Association of South Florida (MIASF), August 20, 2024
- Alan Hooper, Hooper Construction/Urban Street Development, September 5, 2024
- Mayor Dean Trantalis, City of Fort Lauderdale, September 9, 2024

Appendix E includes meeting notes documenting comments, concerns and suggestions received from various stakeholders. In addition, Broward County and the TYLin team also consulted with Brightline and FEC during the development of the proposed bridge concept.

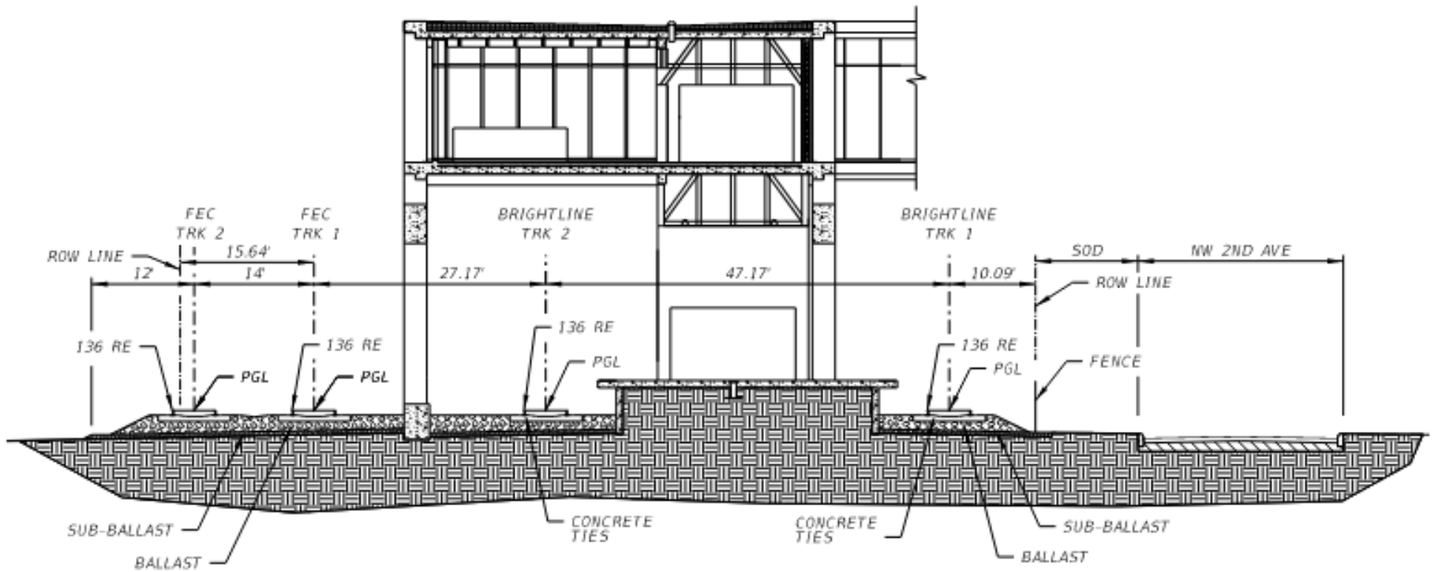
Appendix A

Proposed Rail Corridor Plan & Profile and Typical Sections

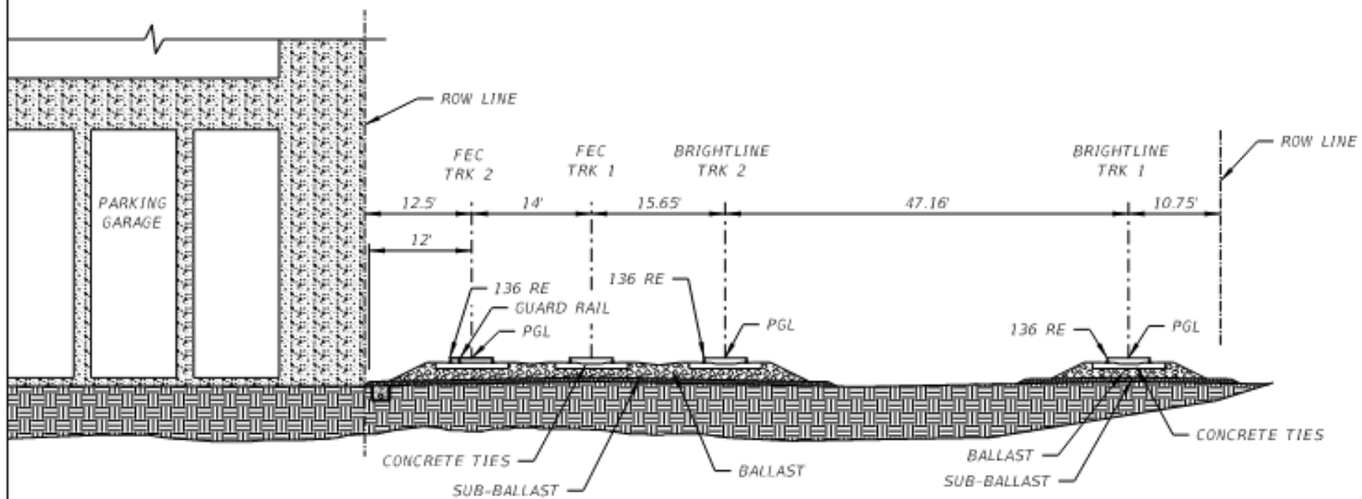
PLAN & PROFILE



FINAL



SECTION A-A
N.T.S



SECTION B-B
N.T.S

REVISIONS DATE	DESCRIPTION

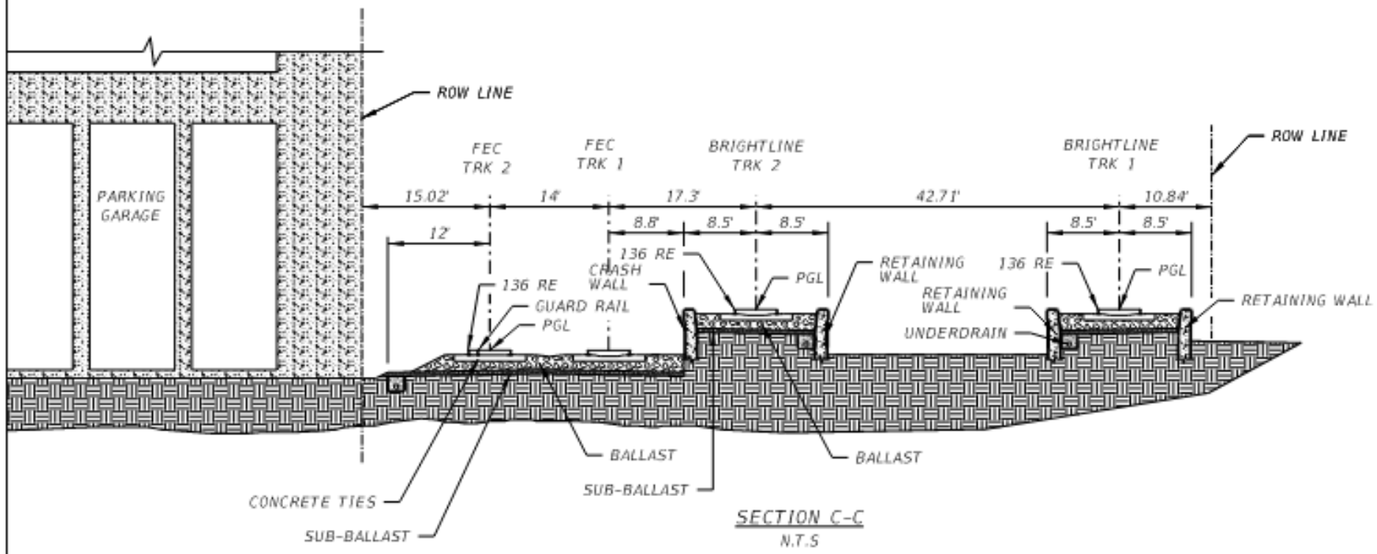
BROWARD COUNTY FLORIDA

TYLin
100 W. CYPRESS CREEK ROAD, SUITE 860
FORT LAUDERDALE, FL 33309
CERTIFICATE OF AUTHORIZATION NO. 0000207

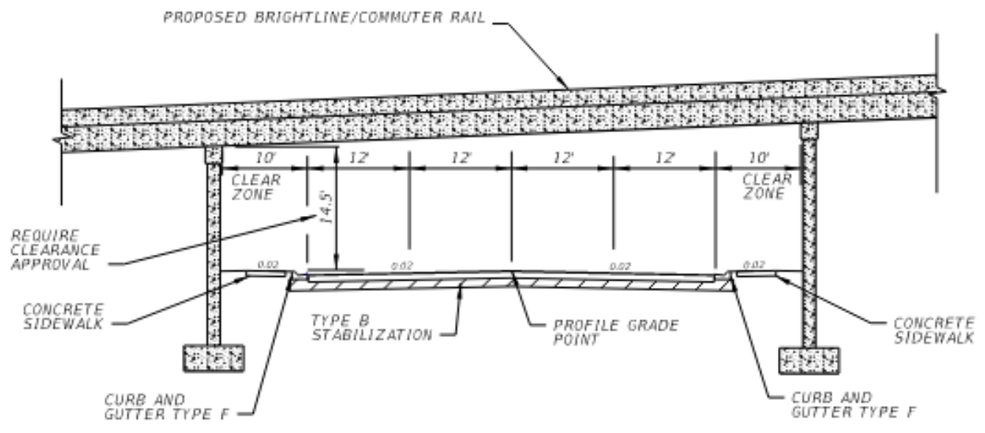
NEW RIVER RAIL CROSSING BRIDGE CONCEPT
BROWARD COUNTY TRANSIT
TYLIN TASK ORDER NO. 1
CRITICAL SECTIONS - 1 OF 2

SCALE: AS SHOWN	SHEET NO.
05/17/2024	

FINAL



SECTION C-C
N.T.S



SECTION AT SW 2ND STREET - LOOKING EAST
N.T.S

REVISIONS					
DATE	DESCRIPTION	BROWARD COUNTY FLORIDA	TYLin 300 W. CYPRESS CREEK ROAD, SUITE 860 FORT LAUDERDALE, FL 33309 CERTIFICATE OF AUTHORIZATION NO. 00002017	NEW RIVER RAIL CROSSING BRIDGE CONCEPT BROWARD COUNTY TRANSIT TYLIN TASK ORDER NO. 1 CRITICAL SECTIONS - 2 OF 2	SCALE: AS SHOWN 05/17/2024	SHEET NO.

SUSERS SDATES STIMES SFILES

Appendix B

3D Renderings

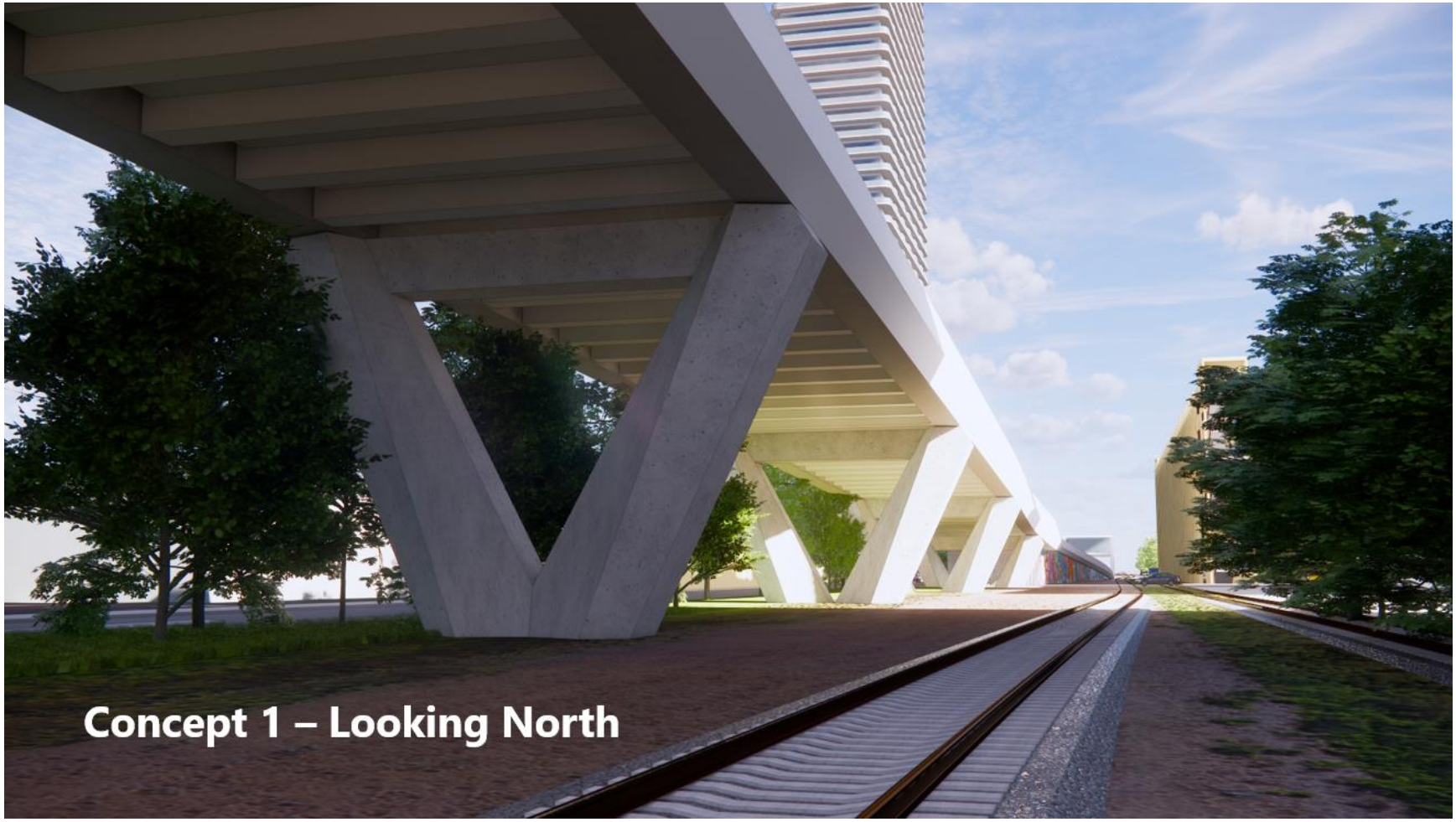
Concept 1 Mast Arm

Concept 1 Mast Arm

Concept 1 Mast Arm

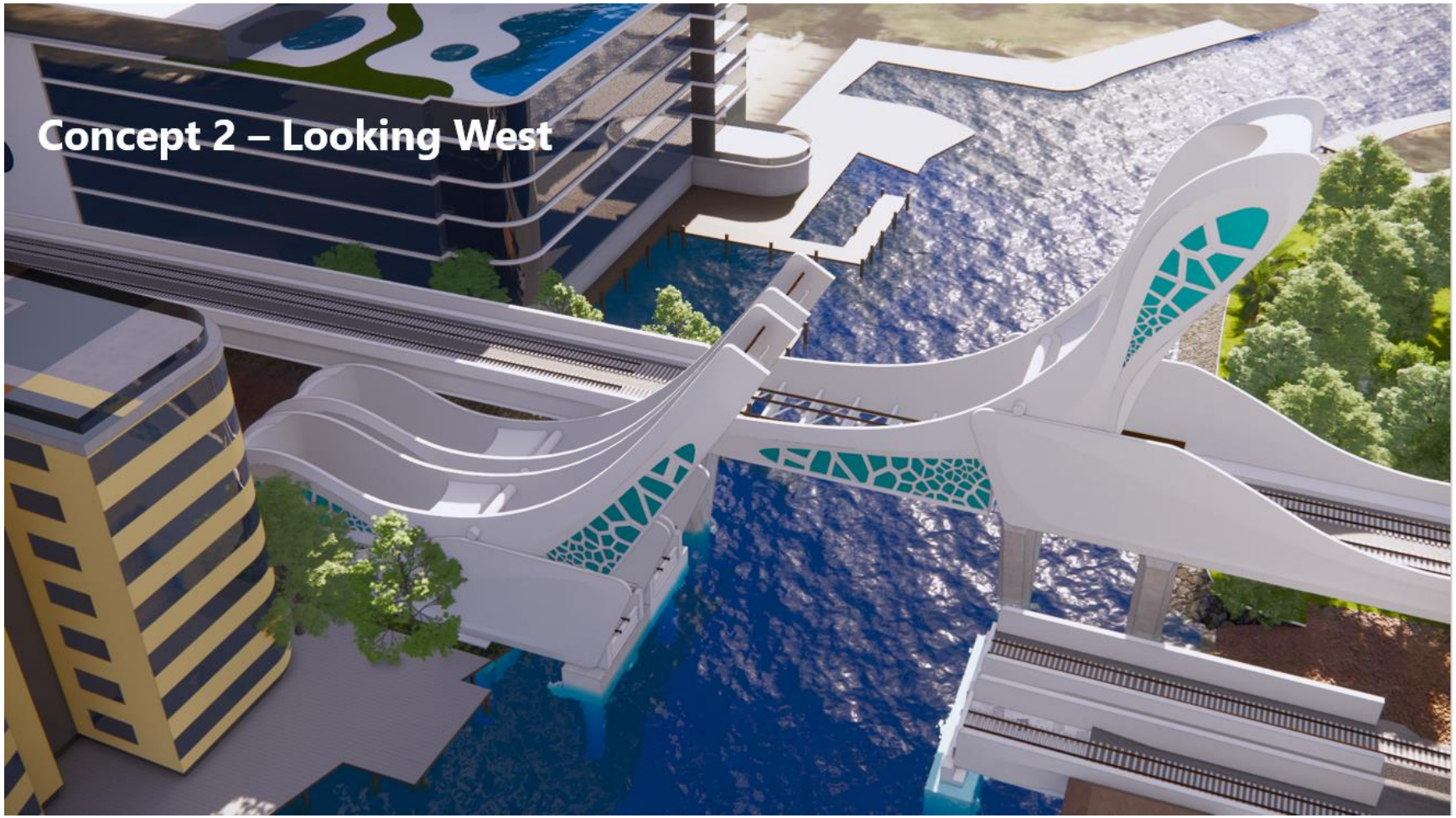
Concept 1 Mast Arm

Concept 1 Mast Arm

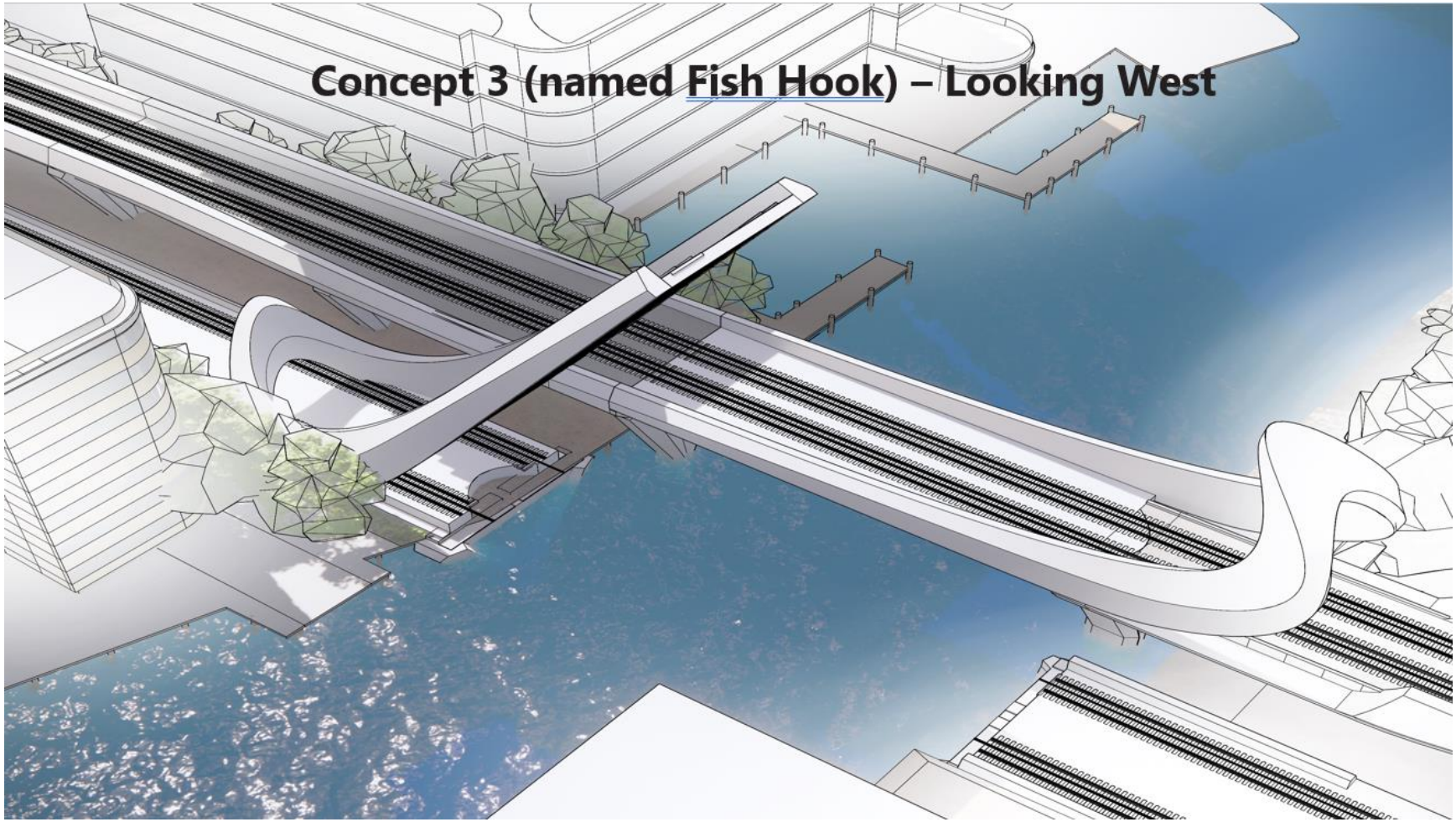


Concept 1 Mast Arm

Concept 1 Mast Arm (Nighttime)



Concept 2 Sea Glass

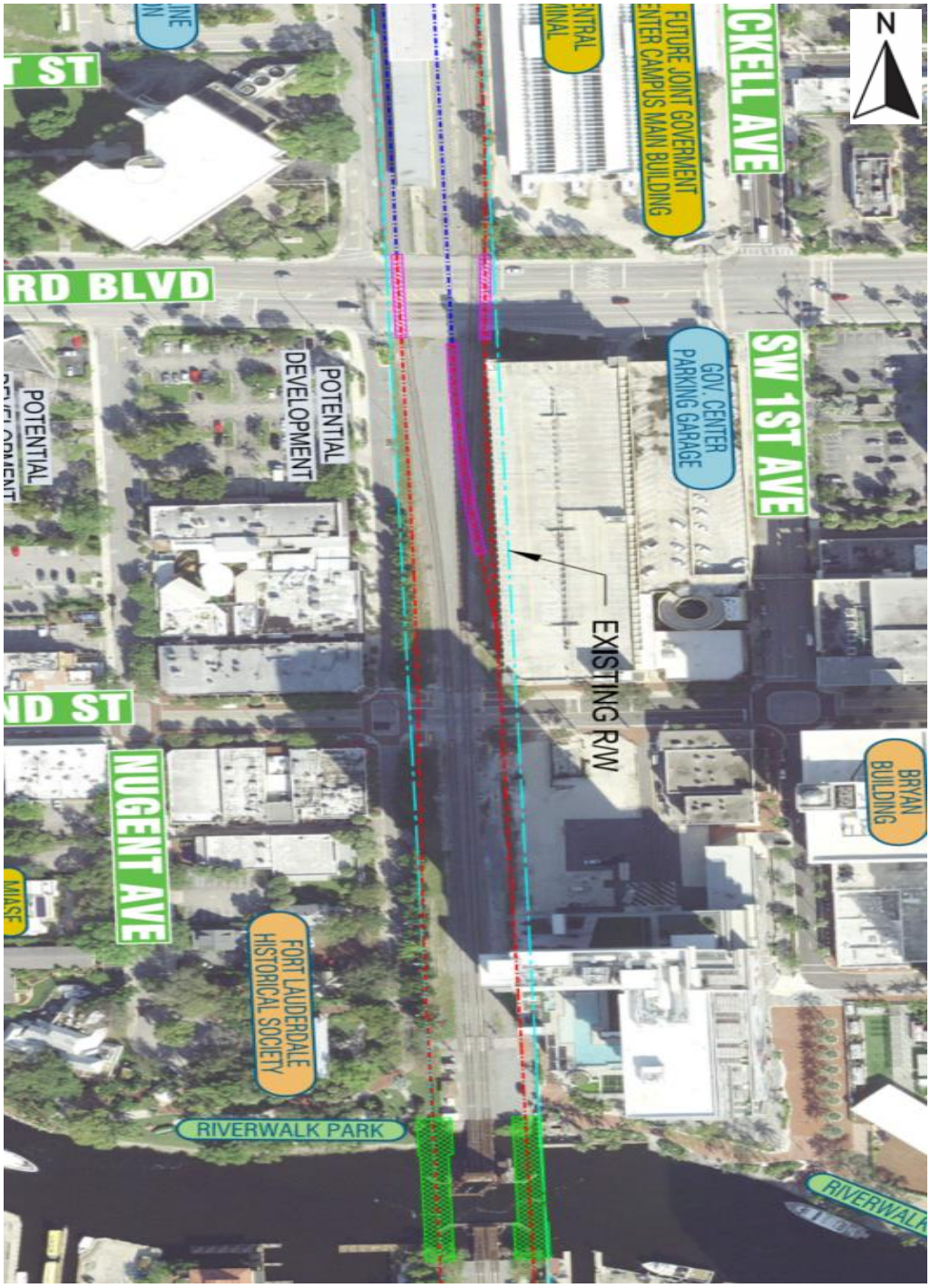


Concept 3 Fish Hook

Appendix C

Construction Sequence

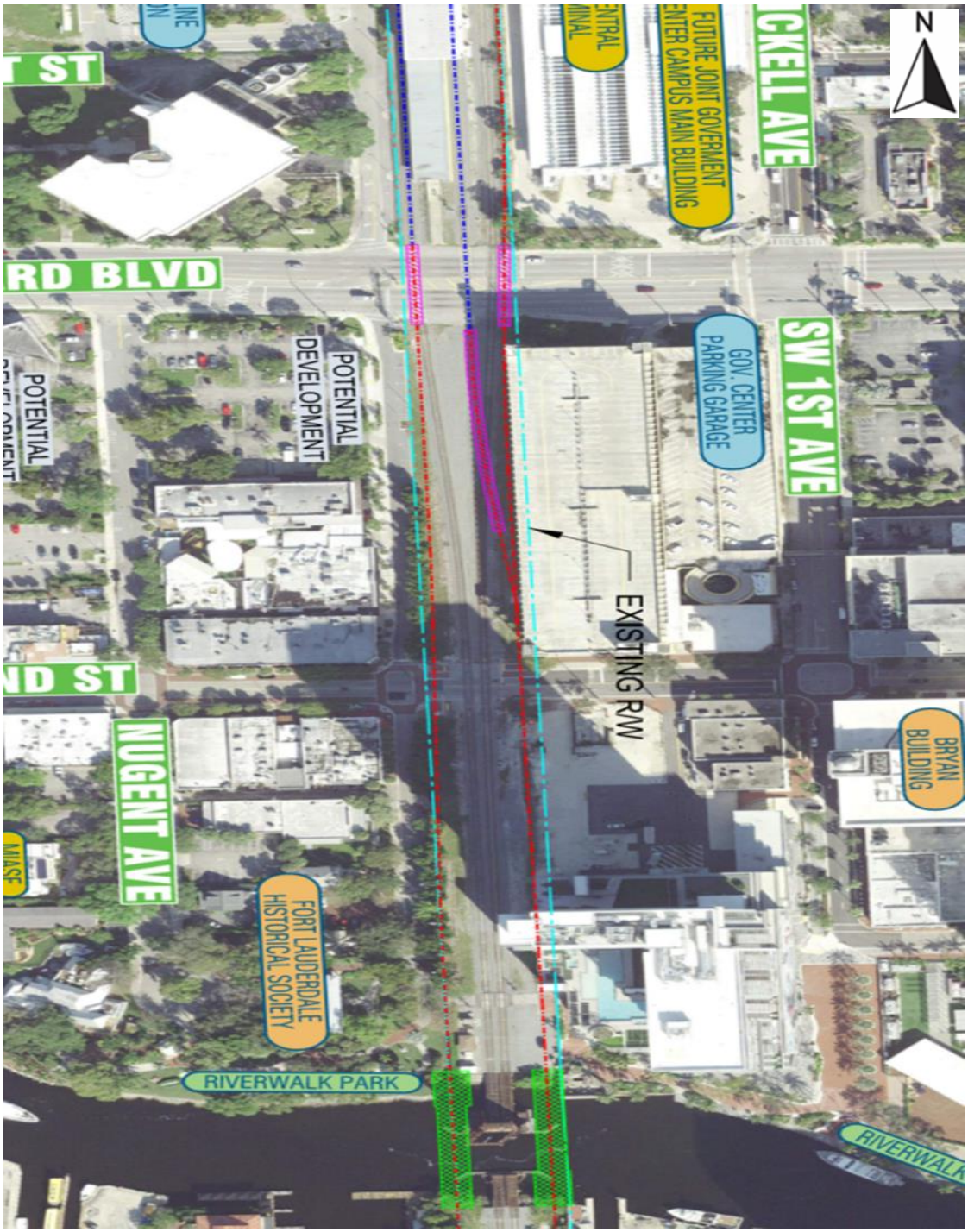
CONSTRUCTION SEQUENCE



Stage 1

- Install temporary track approaches
- Build the single track PERMANENT FEC bascule bridge (green). Build the TEMPORARY single track BL bascule bridge at low level (green to the west)
- Switch tracks

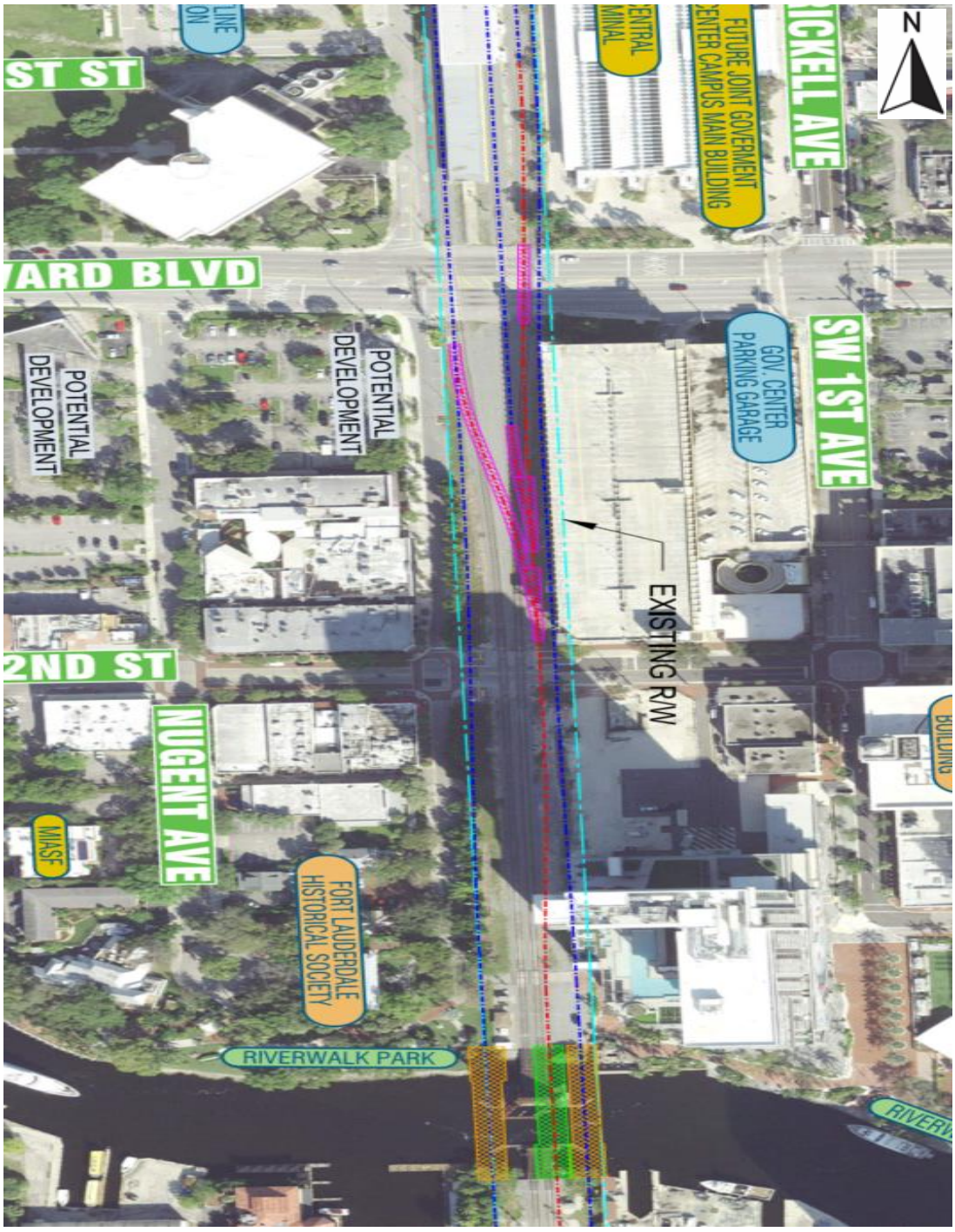
CONSTRUCTION SEQUENCE



Stage 2

- Demolition of the existing FEC bridge

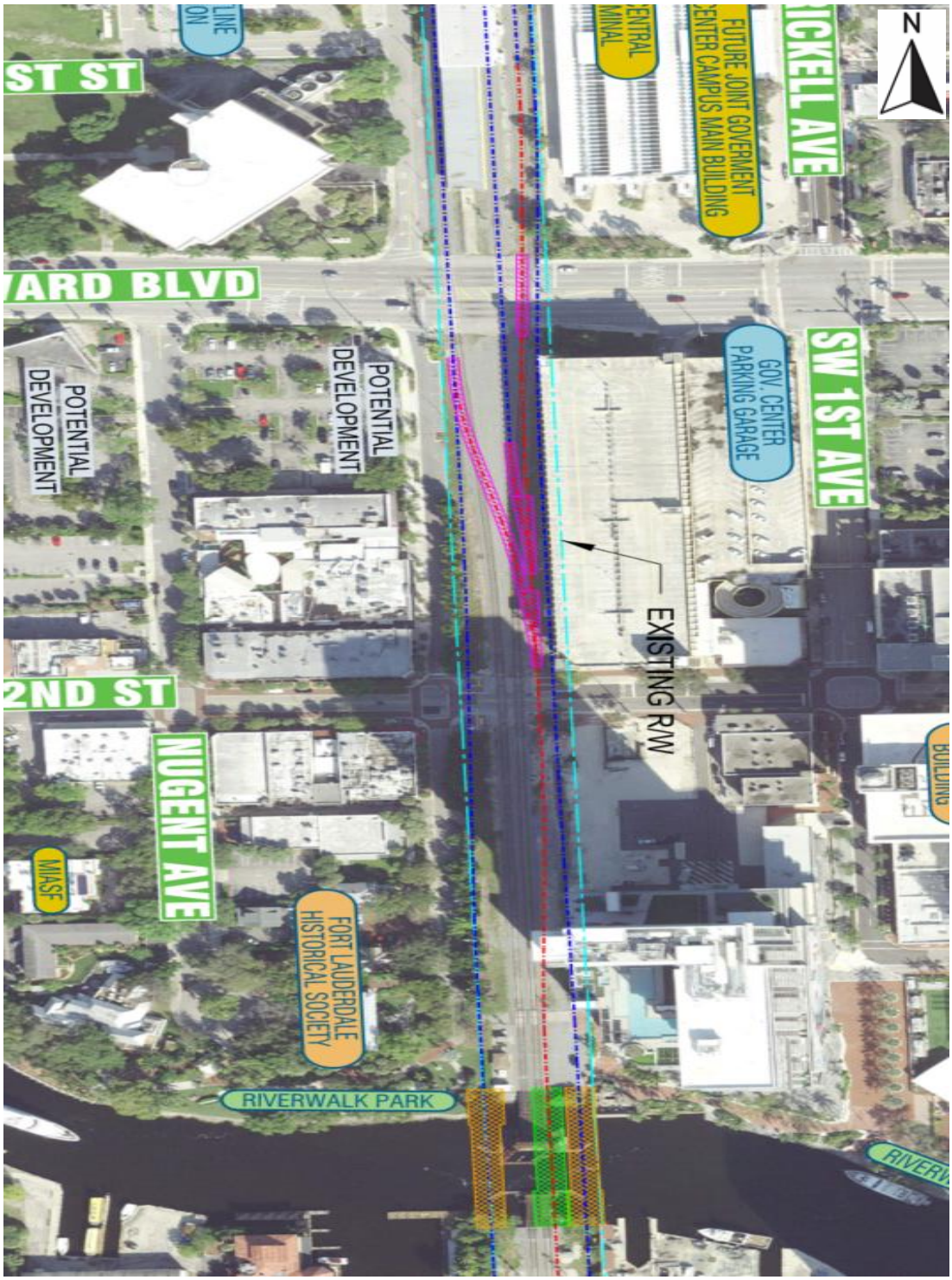
CONSTRUCTION SEQUENCE



Stage 3

- Install second PERMANENT FEC bascule bridge (green)
- Install temporary track approach to the new bascule bridge. BL track to new low- level bridge.
- Switch tracks

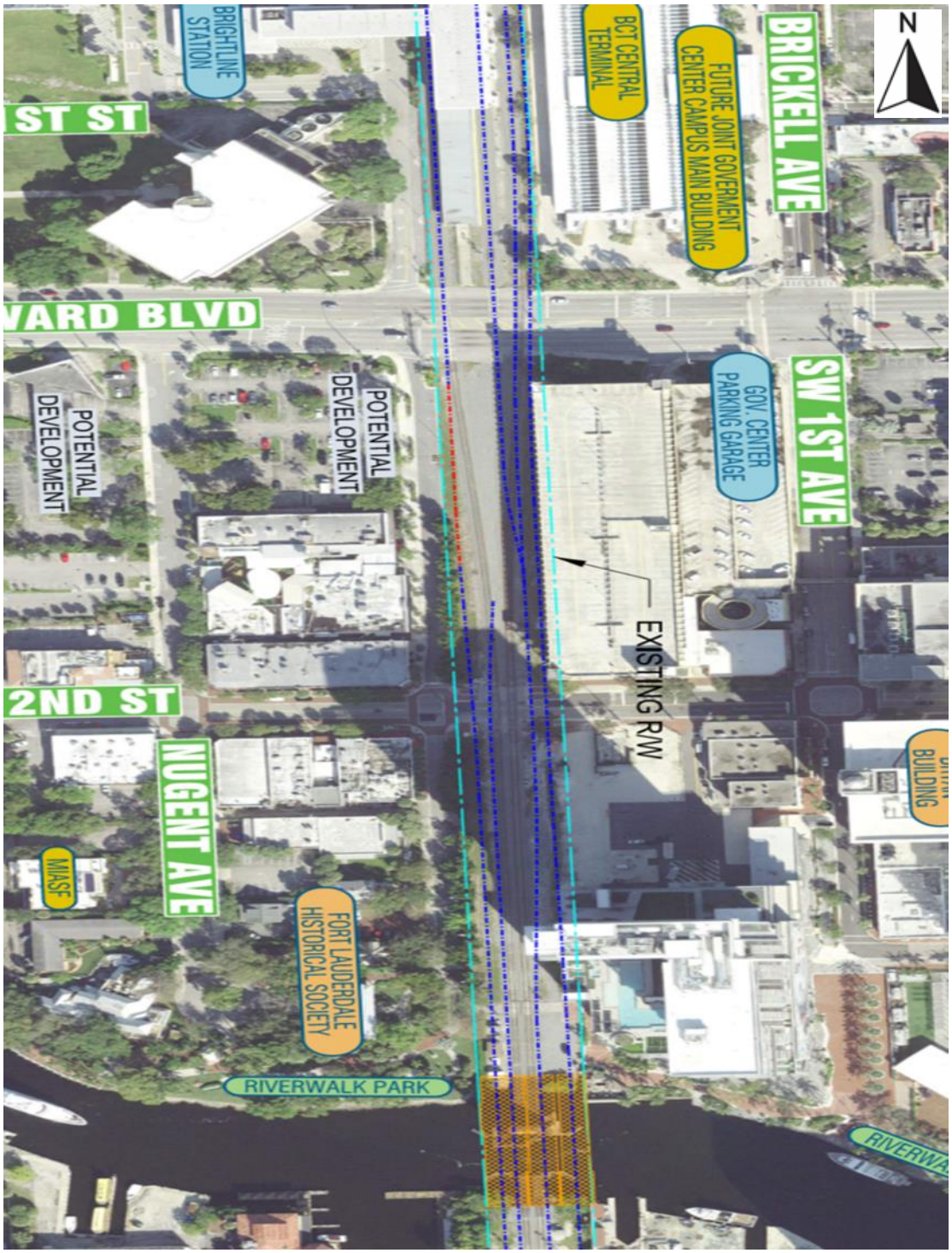
CONSTRUCTION SEQUENCE



Stage 4

- Remove temporary bridge

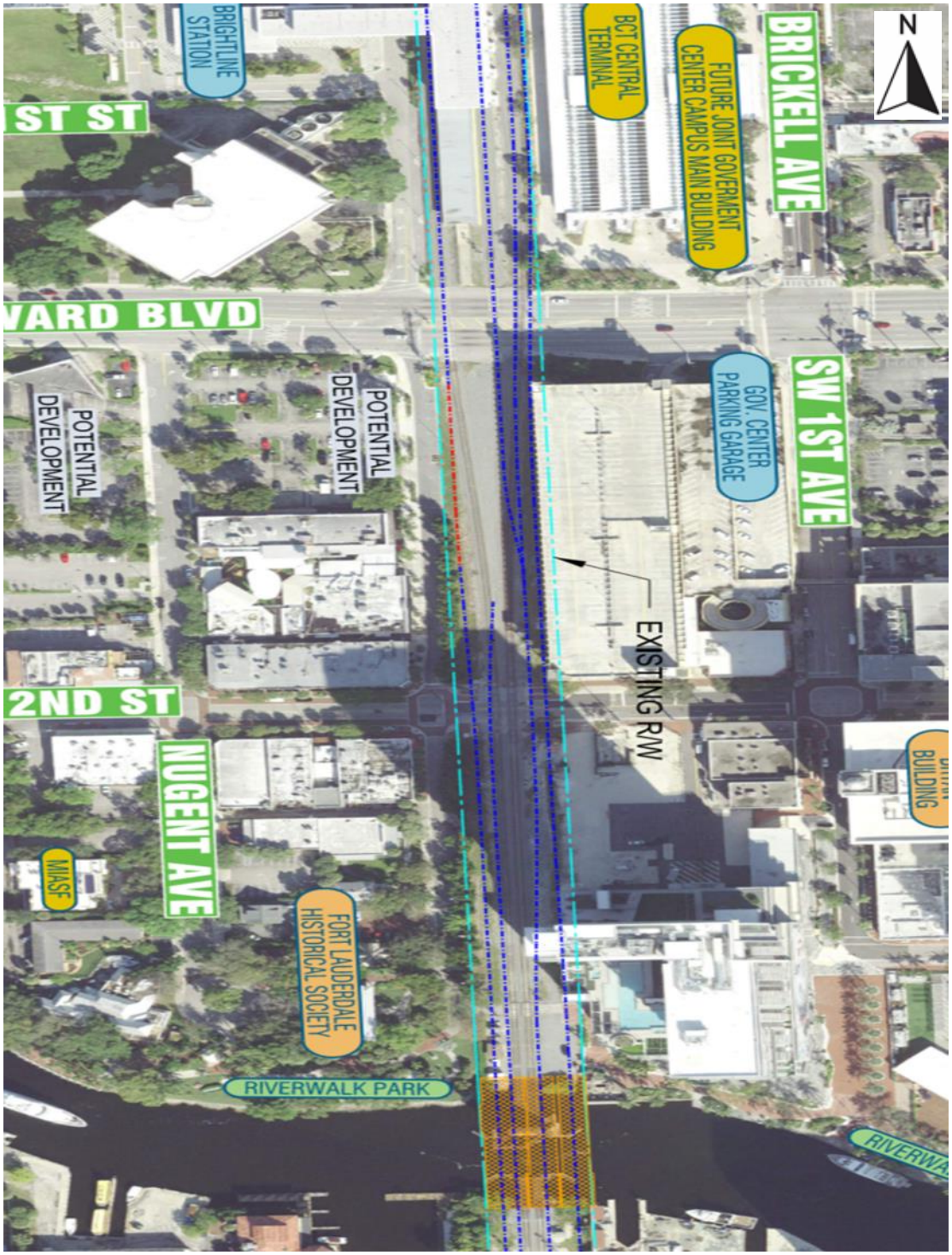
CONSTRUCTION SEQUENCE



Stage 5

- Initiate construction of the passenger train bridge south of SW 2nd Street

CONSTRUCTION SEQUENCE



Stage 6

- Realign BL tracks between BB and 2nd to open the MSE wall construction area.
- This track configuration would remain until completion of the MSE Wall.

Appendix D

Capital Cost Estimate

Estimate Summary

SCC CODE	SCC CATEGORY - DESCRIPTION	BASE COST	ALLOCATED CONTINGENCY	UNALLOCATED CONTINGENCY	TOTAL Base Year COST
10.	**GUIDEWAY & TRACK ELEMENTS**				**$254,973,319**
10.04	Guideway:Aerial Structure	$178,117,800	$44,529,450	$17,811,780	$240,459,030
10.05	Guideway: Built-Up Fill	$1,106,175	$276,544	$110,618	$1,493,336
10.11	Track: Ballasted	$8,895,150	$2,223,788	$889,515	$12,008,453
10.12	Track: Special (Switches, Turnouts)	$750,000	$187,500	$75,000	$1,012,500
20	**STATIONS, STOPS, TEMINALS, INTERMODAL**				**$ -**
	Not in Scope				
30	**SUPPORT FACILITIES: YARDS, SHOPS ADMIN BLDGS**				**$ -**
	Not in Scope				
40	**SITEWORK & SPECIAL CONDITIONS**				**$27,645,273**
40.01	Demolition, Clearing, Earthwork (Included in other sections)				
40.02	Site Utilities, Utility Relocation	$9,500,000	$2,375,000	$950,000	$12,825,000
40.03	Haz. Mat'L, Contam'D Soil Removal/Mitigation, Ground Water Treatments (Excluded)				
40.04	Environmental Mitigation, E.G. Wetlands, Historic/Archeologic, Parks (Excluded)				
40.05	Site Structures Including Retaining Walls, Sound Walls	$2,652,980	$663,245	$265,298	$3,581,523
40.06	Pedestrian / Bike Access And Accommodation, Landscaping	$25,000	$6,250	$2,500	$33,750
40.07	Automobile, Bus, Van Accessways Including Roads, Parking Lots	$250,000	$62,500	$25,000	$337,500
40.08	Temporary Facilities And Other Indirect Costs During Construction	$8,050,000	$2,012,500	$805,000	$10,867,500
50	**SYSTEMS**				**$27,405,000**
50.01	Train Control And Signals	$20,000,000	$5,000,000	$2,000,000	$27,000,000
50.02	Traffic Signals And Crossing Protection	$300,000	$75,000	$30,000	$405,000
50.05	Communications (Included above)				
60	**ROW, LAND, EXISTING IMPROVEMENTS**				**$14,640,000**
60.01	Purchase Or Lease Of Real Estate - Excluded	$12,200,000	$1,220,000	$1,220,000	$14,640,000
70	**VEHICLES**				**$0**
70.03	Commuter Rail - Excluded				
80	**PROFESSIONAL SERVICES**				**$95,771,454**
80.01	Project Development	$12,092,355	$1,209,236	$1,209,236	$14,510,826
80.02	Engineering	$21,766,239	$2,176,624	$2,176,624	$26,119,487
80.03	Project Management For Design And Construction	$19,347,768	$1,934,777	$1,934,777	$23,217,322
80.04	Construction Administration & Management	$19,347,768	$1,934,777	$1,934,777	$23,217,322
80.05	Professional Liability And Other Non-Construction Insurance	$2,418,471	$241,847	$241,847	$2,902,165
80.06	Legal; Permits; Review Fees By Other Agencies, Cities, Etc.	$2,418,471	$241,847	$241,847	$2,902,165
80.07	Surveys, Testing, Investigation, Inspection	$1,209,236	$120,924	$120,924	$1,451,083
80.08	Start Up	$1,209,236	$120,924	$120,924	$1,451,083
TOTAL COST		**$321,656,650**	**$66,612,731**	**$32,165,665**	**$420,435,045**

Estimate Detail (1 or 4)

SCC CODE		DESCRIPTION	QTY	UNIT	UNIT PRICE	BASE COST	%	ALLOCATED CONTINGENCY	%	UNALLOCATED CONTINGENCY	TOTAL Base Year COST
10		GUIDEWAY & TRACK ELEMENTS									
10.04		Guideway:Aerial Structure									
	100410	Bridge 4 - North Approach Spans	20,280.00	SF	$400	$8,112,000	25%	$2,028,000	10%	$811,200	$10,951,200
	100415	Bridge 4 - South Approach Spans	24,327.00	SF	$400	$9,730,800	25%	$2,432,700	10%	$973,080	$13,136,580
	100420	Bridge 4 - North Approach Spans - Thru Girder	2,550.00	SF	$500	$1,275,000	25%	$318,750	10%	$127,500	$1,721,250
	100425	Bridge 4 - South Approach Spans - Thru Girder	-	SF	$500	$0	25%	$0	10%	$0	
	100430	FEC RR Bascule Bridge 1 (STV Pricing for the 3 bridges, includes approaches, demo, substructure, etc)	1.00	LS	$139,000,000	$139,000,000	25%	$34,750,000	10%	$13,900,000	$187,650,000
		FEC RR Bascule Bridge 2									
		Commuter RR Bascule Bridge 3									
	100450	Temporary Bascule Bridge 4 (STV Pricing temporary bridge includes approaches, demo, substructure, etc)	1.00	LS	$20,000,000	$20,000,000	25%	$5,000,000	10%	$2,000,000	$27,000,000
		Subtotal - Guideway:Aerial Structure				***$178,117,800***		***$44,529,450***		***$17,811,780***	***$240,459,030***
10.05		Guideway: Built-Up Fill									
	100510	Earthfill - North (MSE Wall portion)	5,808.00	CY	$75	$435,600	25%	$108,900	10%	$43,560	$588,060
	100520	Earthfill - South (MSE Wall portion)	8,941.00	CY	$75	$670,575	25%	$167,644	10%	$67,058	$905,276
		Subtotal - Guideway: Built-Up Fill				***$1,106,175***		***$276,544***		***$110,618***	***$1,493,336***
10.11		Track: Ballasted									
	101110	Ballasted Track	19,767.00	TF	$400	$7,906,800	25%	$1,976,700	10%	$790,680	$10,674,180
	101120	Ballasted Track - Removal	19,767.00	TF	$25	$494,175	25%	$123,544	10%	$49,418	$667,136
	101120	Ballasted Track - Realignment	9,883.50	TF	$50	$494,175	25%	$123,544	10%	$49,418	$667,136
		Subtotal - Track: Ballasted				***$8,895,150***		***$2,223,788***		***$889,515***	***$12,008,453***
10.12		Track: Special (Switches, Turnouts)									
	101210	#15 Turnout	3.00	EA	$250,000	$750,000	25%	$187,500	10%	$75,000	$1,012,500
		Subtotal - Track: Special (Switches, Turnouts)				***$750,000***		***$187,500***		***$75,000***	***$1,012,500***
		SUBTOTAL GUIDEWAY & TRACK ELEMENTS				**$188,869,125**		**$47,217,281**		**$18,886,913**	**$254,973,319**

Estimate Detail (2 or 4)

SCC CODE		DESCRIPTION	QTY	UNIT	UNIT PRICE	BASE COST	%	ALLOCATED CONTINGENCY	%	UNALLOCATED CONTINGENCY	TOTAL Base Year COST
20		STATIONS, STOPS, TEMINALS, INTERMODAL									
		Not in Scope									
		SUBTOTAL STATIONS, STOPS, TEMINALS, INTERMODAL				$0		$0		$0	$0
30		SUPPORT FACILITIES: YARDS, SHOPS ADMIN BLDGS									
		Not in Scope									
		SUBTOTAL SUPPORT FACILITIES: YARDS, SHOPS ADMIN BLDGS				$0		$0		$0	$0
40		SITEWORK & SPECIAL CONDITIONS									
40.01		Demolition, Clearing, Earthwork									
		Included in other sections									
		Subtotal - Demolition, Clearing, Earthwork				*$0*		*$0*		*$0*	*$0*
40.02		Site Utilities, Utility Relocation									
	400210	Utility Allowance - New & Relocation	1.00	LS	$9,500,000	$9,500,000	25%	$2,375,000	10%	$950,000	$12,825,000
		Subtotal - Site Utilities, Utility Relocation				*$9,500,000*		*$2,375,000*		*$950,000*	*$12,825,000*
40.03		Haz. Mat'L, Contam'D Soil Removal/Mitigation, Ground Water Treatments									
		Excluded									
		Subtotal - Haz. Mat'L, Contam'D Soil Removal/Mitigation, Ground Water Treatments				*$0*		*$0*		*$0*	*$0*
40.04		Environmental Mitigation, E.G. Wetlands, Historic/Archeologic, Parks									
		Excluded									
		Subtotal - Environmental Mitigation, E.G. Wetlands, Historic/Archeologic, Parks				*$0*		*$0*		*$0*	*$0*
40.05		Site Structures Including Retaining Walls, Sound Walls									
	400510	MSE Walls - North	9,718.00	SF	$110	$1,068,980	25%	$267,245	10%	$106,898	$1,443,123
	400520	MSE Walls - South	14,400.00	SF	$110	$1,584,000	25%	$396,000	10%	$158,400	$2,138,400
		Subtotal - Site Structures Including Retaining Walls, Sound Walls				*$2,652,980*		*$663,245*		*$265,298*	*$3,581,523*

Estimate Detail (3 or 4)

SCC CODE		DESCRIPTION	QTY	UNIT	UNIT PRICE	BASE COST	%	ALLOCATED CONTINGENCY	%	UNALLOCATED CONTINGENCY	TOTAL Base Year COST
40.06		**Pedestrian / Bike Access And Accommodation, Landscaping**									
	400610	Landscaping - Allowance	1.00	LS	$25,000	$25,000	25%	$6,250	10%	$2,500	$33,750
		Landscaping				***$25,000***		***$6,250***		***$2,500***	***$33,750***
40.07		**Automobile, Bus, Van Accessways Including Roads, Parking Lots**									
	400710	Asphalt Pavement, Sidewalks, Pavement Markings - Allowance	1.00	LS	$150,000	$150,000	25%	$37,500	10%	$15,000	$202,500
	400720	Traffic Signals, Traffic Signage - Allowance	1.00	LS	$100,000	$100,000	25%	$25,000	10%	$10,000	$135,000
		Subtotal - Automobile, Bus, Van Accessways Including Roads, Parking Lots				***$250,000***		***$62,500***		***$25,000***	***$337,500***
40.08		**Temporary Facilities And Other Indirect Costs During Construction**									
	400810	Mobilization	1.00	LS	$6,000,000	$6,000,000	25%	$1,500,000	10%	$600,000	$8,100,000
	400820	Allowance for MPT	1.00	LS	$2,000,000	$2,000,000	25%	$500,000	10%	$200,000	$2,700,000
	400830	Temp Erosion Control	1.00	LS	$50,000	$50,000	25%	$12,500	10%	$5,000	$67,500
		Subtotal - Temporary Facilities And Other Indirect Costs During Construction				***$8,050,000***		***$2,012,500***		***$805,000***	***$10,867,500***
		SUBTOTAL SITEWORK & SPECIAL CONDITIONS				**$20,477,980**		**$5,119,495**		**$2,047,798**	**$27,645,273**
50		**SYSTEMS**									
50.01		**Train Control And Signals**									
	500110	Train Control And Signals	1.00	LS	$20,000,000	$20,000,000	25%	$5,000,000	10%	$2,000,000	$27,000,000
		Subtotal - Train Control And Signals				***$20,000,000***		***$5,000,000***		***$2,000,000***	***$27,000,000***
50.02		**Traffic Signals And Crossing Protection**									
	500210	Grade Crossing	4.00	EA	$75,000	$300,000	25%	$75,000	10%	$30,000	$405,000
		Subtotal - Traffic Signals And Crossing Protection				***$300,000***		***$75,000***		***$30,000***	***$405,000***
50.05		**Communications**									
		Included									
		Subtotal - Communications				***$0***		***$0***		***$0***	***$0***
		SUBTOTAL SYSTEMS				**$20,300,000**		**$5,075,000**		**$2,030,000**	**$27,405,000**

Estimate Detail (4 or 4)

SCC CODE		DESCRIPTION	QTY	UNIT	UNIT PRICE	BASE COST	%	ALLOCATED CONTINGENCY	%	UNALLOCATED CONTINGENCY	TOTAL Base Year COST
60		**ROW, LAND, EXISTING IMPROVEMENTS**									
60.01		**Purchase Or Lease Of Real Estate**									
		(Excluded)	1.00	LS	$12,200,000	$12,200,000	10%	$1,220,000	10%	$1,220,000	$14,640,000
		Subtotal - Purchase Or Lease Of Real Estate				***$12,200,000***		***$1,220,000***		***$1,220,000***	***$14,640,000***
		SUBTOTAL ROW, LAND, EXISTING IMPROVEMENTS				**$12,200,000**		**$1,220,000**		**$1,220,000**	**$14,640,000**
70		**VEHICLES**									
70.03		**Commuter Rail** (Not in Scope)									
		(Excluded)					-				
		Subtotal - Commuter Rail				***$0***		***$0***		***$0***	***$0***
		SUBTOTAL VEHICLES				**$0**		**$0**		**$0**	**$0**
80		**PROFESSIONAL SERVICES**									
80.01		Project Development									
	800110	Project Development	5.00	%	$12,092,355	$12,092,355	10%	$1,209,236	10%	$1,209,236	$14,510,826
80.02								10%			$0
	800210	Engineering	9.00	%	$21,766,239	$21,766,239	10%	$2,176,624	10%	$2,176,624	$26,119,487
80.03		Project Management For Design And Construction									
	800310	Project Management For Design And Construction	8.00	%	$19,347,768	$19,347,768	10%	$1,934,777	10%	$1,934,777	$23,217,322
80.04		Construction Administration & Management									
	800410	Construction Administration & Management	8.00	%	$19,347,768	$19,347,768	10%	$1,934,777	10%	$1,934,777	$23,217,322
80.05		Professional Liability And Other Non-Construction Insurance									
	800510	Professional Liability And Other Non-Construction Insurance	1.00	%	$2,418,471	$2,418,471	10%	$241,847	10%	$241,847	$2,902,165
80.06		Legal; Permits; Review Fees By Other Agencies, Cities, Etc.									
	800610	Legal; Permits; Review Fees By Other Agencies, Cities, Etc.	1.00	%	$2,418,471	$2,418,471	10%	$241,847	10%	$241,847	$2,902,165
80.07		Surveys, Testing, Investigation, Inspection									
	800710	Surveys, Testing, Investigation, Inspection	0.50	%	$1,209,236	$1,209,236	10%	$120,924	10%	$120,924	$1,451,083
80.08		Start Up									
	800810	Start Up	0.50	%	$1,209,236	$1,209,236	10%	$120,924	10%	$120,924	$1,451,083
		Subtotal - Professional Services				***$79,809,545***		***$7,980,955***		***$7,980,954***	***$95,771,454***
		SUBTOTAL PROFESSIONAL SERVICES				**$79,809,545**		**$7,980,955**		**$7,980,954**	**$95,771,454**
		PROJECT TOTAL				**$321,656,650**		**$66,612,731**		**$32,165,665**	**$420,435,045**

Appendix E

Stakeholder Meeting Minutes

FINAL

TYLin

BCT Rail GEC TO #01 New River Rail Crossing Study
Focused Stakeholder Meeting
Meeting Summary
July 31, 2024

ATTENDEES:

Client
Broward County: Vince Ruddy

Project Consultants
TYLin: Joe Yesbeck, Pedro Gonzalez, Vikas Jain
STV: Eric Root (Virtual)
Holt Communications: Yvette Holt and Rosanna Gonzalez
Botek Thurlow Engineering: Stephen Botek

Stakeholders
Broward MPO: Bryan Caletka
Broward Workshop: Randall Vitale
Downtown Civic Association: Melinda Bowker (Virtual)
Ft. Lauderdale Civic Association: Mary Peloquin (Virtual)
Greater Fort Lauderdale Alliance: Bob Swindell
Marine Industry of South Florida: Philip Purcell
Urban League of Broward County: Germain Smith-Baugh

1. **Purpose of the Meeting**
   To review and seek input on the proposed concept for new elevated rail alignment and crossing over the New River.

   The County and consultant discussed the study parameters and explained potential concepts and renderings, potential timeline, and cost estimates. The team made clear that the study was to examine possibilities for a rail bridge option and there was no comparative analysis with a tunnel option.

2. **Stakeholder Discussion**
   Comments:
   - No acceptable option for the business community that maintains the rail crossing at grade level at Broward Boulevard due to disruptions to traffic.
   - Concerned about the total amount of commuter trains passing through and disrupting traffic. Their expectation is for more than 100 commuter trains per day.
   - The MPO received a grant to study underpasses at four of the crossings including Broward Boulevard.
   - Concerned about what could happen under the bridges 15-20 years from now and would like to ensure that the County is intentional in developing desirable activity.

- Will there be any noise and vibration impact on existing and future developments given the proximity of rail tracks to the buildings.
- The closing of SW 5th Street and pushing the pedestrian experience further away from the River Walk.

Suggestions:

- Costing out a Broward Blvd underpass into the project for more support.
- Look at other crossings for underpasses, as far south as Davie or as far north as Sunrise to gain support from the communities. This includes incorporating the Broward MPO study.
- County and Consultant team to be prepared to answer questions related to potential noise and vibration impacts in general and broad terms based on industry standards and readily available data.
- Look at the long term and plan to use the shade structures (under the bridge) for desirable activities i.e. parks.
- Coordinate with FEC to create pedestrian access across the tracks on the south side of the New River and north of SW 5th Street.

Overall:

- Stakeholders overall shared that they were surprisingly pleased with and impressed by the concepts and had positive reactions to the presentation.
- For some of the stakeholders who did not like the idea of a bridge, they liked the iconic designs presented.

Next Steps:

- County will share the presentation after the County Commission briefings are complete.

Photos:

FINAL

BCT Rail GEC TO #01 New River Rail Crossing Study
Briefing on New River Bridge Concepts with City of Fort Lauderdale
Meeting Summary
August 7, 2024

ATTENDEES:

Client

Broward County: Vince Ruddy

BCT Acting Assistant General Manager of Capital Programs: Jie Bian

Broward County Director Highway Construction and Engineering: Richard Tornese

Project Consultants

T. Y. Lin: Joe Yesbeck, Vikas Jain

Holt Communications: Rosanna Gonzalez

City Of Fort Lauderdale

Transportation Service Division Manager: Ekaete Ekwere

Transportation & Mobility Acting Director: Milos Majstorovic

Interim Assistant City Manager: Ben Rogers

BDO Director Infrastructure Advisory: Umer Yaqub

BDO Infrastructure, Public-Private Partnerships - Seth Miller Gabriel

BDO Head of Infrastructure, Public Infrastructure – Thomas John

1. Purpose of the Meeting

To brief the city on the bridge option for crossing the New River.

The County and consultant presented the study parameters, potential concepts and renderings, potential timeline, and cost estimates. The team made clear that this study was solely focused on developing an option for a mid-level bridge.

2. Key Discussion Topics

Concerns:

- City wanted clarification on the angle and width of the opening of the bascule bridge movable span and asked as an example could a sailboat navigate straight through the channel without having to move left or right.
- City wanted to know what grade or slope (percentage) was acceptable to Brightline and mentioned that there was a prior concern that it may exceed an allowable slope.
- City wanted clarification on the position and location of the tracks.

- City's consultant wanted clarification on what would happen to the existing bascule bridge pilings during the building stages. They did not feel there was enough room for the removal.
- City's consultant inquired if FEC/Brightline raised any concern about the impact of reducing the speed of their trains during construction in an active rail corridor.
- City's consultant stated that there is telecommunications infrastructure underneath the FEC corridor and if the County and its consultant had investigated potential impacts to it during construction.
- City's consultant wanted to know how many staging areas would be needed and the size of those staging areas as well as the width of each track.
- City's consultant inquired if the proposed bridge concept capital cost estimate included a commuter rail station in downtown Fort Lauderdale.
- City was concerned that the tunnel study vs. the bridge study was not an "apples to apples" comparison and that bridge option is more cost effective because the tunnel design had considered other major items with a downtown commuter rail station in particular.
- County assured the City that all appropriate adjustments would be made when presenting information comparing the tunnel and bridge options.
- County commented that the bridge solution allows for flexibility in alternatives for the Broward Commuter Rail (BCR) north river crossing and potential station location, whereas the tunnel design may not have had those options.
- City's consultant was concerned that during and after construction the tracks would be too close to buildings and asked if crash protection was being considered.

Suggestions:

- City's consultant suggested the County to reach out to existing property owners and developers.

Overall:

- The City's main concern is related to the existing bascule bridge and how construction would affect existing infrastructure during stage one and stage two.

Next Steps:

- County will share the presentation after one-on-one County Commissioner briefings are completed.
- City asked if this presentation could be shared with City Commission at their next meeting on August 20th.
- County' consultant to follow up with City with the information on the total width of the tracks at the bridge site and approach to address existing bridge piles/foundation during construction.

FINAL

BCT Rail GEC TO #01 New River Rail Crossing Study
Briefing on New River Bridge Concepts with FDOT District Four
Meeting Summary
August 9, 2024

ATTENDEES:

Client

Broward County: Vince Ruddy, Omar Medina, Jie Bian

Project Consultants

T. Y. Lin: Joe Yesbeck, Vikas Jain

Holt Communications: Rosanna Gonzalez

Florida Department of Transportation District Four

Phil Schwab

John Olson

John Krane

Birgit Olkuch

1. Purpose of the Meeting

To brief the Florida Department on the bridge option for crossing the New River.

The County and consultant presented the study parameters, potential concepts and renderings, potential timeline, and cost estimates. The team made clear that this study was solely focused on developing an option for a mid-level bridge. The team also wanted to focus on the technical aspects of the study with this FDOT team of engineers.

2. Key Discussion Topics

Concerns/Questions:

The FDOT representatives provided the following comments:

- Suggested updating the colors on the graphic (slide #9) to accommodate visually impaired audience.
- Suggested evaluating a commuter rail station location option in downtown Fort Lauderdale to better address concerns and gain support.
- Inquired about the approach grade/slope percentage and asked if the County received confirmation from Brightline regarding the 4% used on north approach.
- Asked about the profile tangent lengths between the vertical curves.
- Asked about the bascule piers support and the length of the leaf.

- Expressed concern regarding availability of space for a tender house and machinery to fit under the bridge.
- Asked who would be responsible for maintaining the bridge.
- Suggested not showing trees growing under the bridge.
- Mentioned that the City of Fort Lauderdale may have an issue with lighting design element of the bridge. Who will maintain it?
- Expressed concern with the angle of the leaf at the opening of the bridge and the impact on sailboats. Asked if there's a different way to deal with the counterweights, so the leaf could rise higher and be less imposing to the boating community
- Suggested looking at a minimalistic bridge design that blends with the environment, not so Iconic.
- Confirmed that the cost estimate is for all stages of construction and bascule bridges.
- Mentioned that the right-of-way for temporary easements can be costly even if it was under public jurisdiction.

Overall:

- FDOT is pleased with the presentation and that study is getting positive feedback from stakeholders.
- FDOT offered to conduct an independent technical review of the plan and profile and provide more feedback, if needed.

Next Steps:

- County will share the presentation after one-on-one County Commissioner briefings are completed.
- Consultant to follow up with the information regarding profile tangent lengths between the vertical curves.

FINAL

BCT Rail GEC TO #01 New River Rail Crossing Study
Briefing on New River Bridge Concepts with Cymbal DLT Companies
Meeting Summary
August 13, 2024

ATTENDEES:

Project Consultants

T. Y. Lin: Joe Yesbeck, Vikas Jain

Cymbal DLT Companies

Chairman: Asi Cymbal

Senior Developer Manager: David Udine

1. **Purpose of the Meeting**

To brief the Cymbal DLT Companies on the bridge option for crossing the New River.

The consultant presented the study parameters, potential concepts and renderings and potential timeline. The team made clear that this study was solely focused on developing an option for a mid-level bridge.

2. **Key Discussion Topics**

Concerns/Questions:

The representatives from Cymbal DLT Companies provide the following comments:

- Asked about the height of the bridge in open position and frequency of trains.
- Stated that closing NW 5th Street at-grade crossing was not acceptable to them, but NW 6th Street closure would work.
- Inquired about the mechanism for getting temporary construction easement on their property.
- Expressed concerns with the aesthetics of bridge concepts presented by the consultant team.
- Asked questions regarding the project timeframe/schedule.
- Requested a PDF version of the PPT slide deck used for this meeting.
- Requested the consultant to provide examples of TYLin's bridge design/projects.

Overall:

- Cymbal DLT Companies' main concern is related to closure of NW 5th Street and bridge aesthetics. They would like to learn more about the process of obtaining temporary construction easements.

Next Steps:

- Consultant will share the presentation after one-on-one County Commissioner briefings are completed.
- Consultant to send TYLin's bridge design project experience.

FINAL

BCT Rail GEC TO #01 New River Rail Crossing Study

Briefing on New River Bridge Concepts with Marine Industries Association of South Florida

Meeting Summary

August 20, 2024

ATTENDEES:

Client

Broward County: Vince Ruddy

Project Consultants

T. Y. Lin: Joe Yesbeck, Vikas Jain

Marine Industries Association of South Florida (MIASF)

MIASF Board Members

1. Purpose of the Meeting

To brief the MIASF on the bridge option for crossing the New River.

The County and consultant presented the study parameters, potential concepts and renderings, potential timeline, and cost estimates. The team made clear that this study was solely focused on developing an option for a mid-level bridge.

2. Key Discussion Topics

Concerns/Comments/Questions:

- What is the full cycle for bridge opening and closing?
- Did the County study 56-feet high bridge?
- What would be the noise impacts on the surrounding properties?
- Expressed concern with the area under the bridge/structure, which could be attractive to less desirable activities.
- Was it possible to raise the FEC freight bridge to make it more resilient given the sea level rise and extreme weather events.
- Inquired about the grade for passenger rail bridge on both the north and south side of New River.

Overall:

- The MIASF supports the concept of an iconic bridge option that provides 40-feet clearance over Mean High Water (MHW), replacing the existing FEC bascule bridge along with other key features such as SW 2nd Street and Riverwalk pedestrian crossing remaining open. They would like the County to consider providing a new pedestrian crossing across the FEC corridor between NW 5th Street and New River similar to the pedestrian crossing on the north side of the river.

FINAL

BCT Rail GEC TO #01 New River Rail Crossing Study
Briefing on New River Bridge Concepts - Stakeholder Meeting
Meeting Summary

September 5, 2024

ATTENDEES:

Project Consultants

TYLin: Joe Yesbeck and Vikas Jain

Hooper Construction / Urban Street Development

Alan Hooper

1. Purpose of the Meeting

To review and seek input on the proposed concept for new elevated rail alignment and crossing over the New River.

The consultant discussed the study parameters and explained potential concepts and renderings, potential timeline, and cost estimates. The team made clear that the study was to examine possibilities for a rail bridge option and there was no comparative analysis with a tunnel option.

2. Key Discussion Topics

Concerns/Questions:

- Does the construction cost estimate for the bridge(s) include continency?
- Would a temporary bascule bridge be required during construction to maintain FEC and Brightline rail operations?
- What is the grade or slope on north and south bridge approaches?
- Recognized traffic impacts resulting from commuter rail operations in the entire corridor at all at-grade railroad crossing and that downtown Fort Lauderdale had higher traffic volumes compared to other locations.

Suggestions:

- Suggested to include more items for construction cost, especially contingency for transparency and clarity.

Overall:

- Found the presentation to be highly informative and appreciated the effort towards iconic bridge design. Still supports the tunnel option while recognizing the difference in the costs between the bridge and tunnel options.

Next Steps:

- To share the presentation slide deck with Alan.

FINAL

BCT Rail GEC TO #01 New River Rail Crossing Study
Briefing on New River Bridge Concepts with City of Fort Lauderdale
Meeting Summary

September 9, 2024

ATTENDEES:

Client
Broward County: Vince Ruddy (via Teams)

Project Consultants
TYLin: Joe Yesbeck, Vikas Jain

City Of Fort Lauderdale
Mayor Dean Trantalis
Acting City Manager: Susan Grant
Interim Assistant City Manager: Ben Rogers
City Invited Guest: Russ Klenet
BDO: Scott Wyman, Narsi Munfah, Umer Yaqub, Seth Miller Gabriel, Thomas John (via Teams)

1. Purpose of the Meeting

To brief the Mayor's office on the bridge option for crossing the New River.

The County and consultant presented the study parameters, potential concepts and renderings, potential timeline, and cost estimates. The team made clear that this study was solely focused on developing an option for a mid-level bridge.

2. Key Discussion Topics

Concerns/Questions:

- City wanted to know how the consultant team was able to meet the 40-ft clearance requirement over the MHW while maintaining the at-grade crossing on Broward Blvd.
- City inquired if SW 5th Street railroad crossing needs to be closed.
- Requested information position and location of the tracks in the corridor and the width of the bridge including foundations.
- City asked if the width of the channel was narrow at the bascule bridge location.
- City's consultant wanted clarification on what would happen to the existing bascule bridge pilings during the construction phases.
- City asked if the commuter rail would be able to use the existing Brightline station.

- City inquired if the study considered or identified a commuter rail station in downtown Fort Lauderdale. City commented that right-of-way would be required for new parking areas and mobility hub/terminal.
- City's consultant asked if the team had investigated construction sequencing for the MSE walls while maintaining FEC and Brightline operations.
- City inquired if FEC was concerned about the impact of reducing the speed of their trains during construction in an active rail corridor.
- City wanted clarification on the angle and width of the opening of the bascule bridge movable spans in open position.
- City inquired if the proposed bridge concept capital cost estimate included a commuter rail station in downtown Fort Lauderdale and/or cost of constructing an underpass at Broward Boulevard.
- City inquired about potential noise impacts and noise resulting from the closing and opening of bascule bridge leaves.
- City's consultant inquired about the clearance at SW 2nd Street.
- Expressed concern with the impact of bridge on property values, especially for the residential units in the adjacent buildings.

Overall:

- The City's main concerns included noise and property value impacts, accommodating commuter rail station, as well as getting a better understanding of construction sequence both for the MSE wall and bascule bridge.

Next Steps:

- County to share the final report with the City.