SR 934 / NE 79 ST
PD&E STUDY

Bridge Analysis Report

October 2023

FM No. 449007-1-22-01

Bridge No. 870083;-549;-084;-550

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by the Florida Department of Transportation (FDOT) pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated May 26, 2022, and executed by the Federal Highway Administration and FDOT.

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1 Introduction

The Florida Department of Transportation (FDOT) District Six is preparing a Project Development and Environment (PD&E) Study to evaluate the replacement of four bridges (arranged in two locations as parallel pairs) located along NE 79th Street between Pelican Harbor Drive and Adventure Avenue in the incorporated municipalities of the City of Miami and North Bay Village within Miami-Dade County. The NE 79th Street corridor is also designated as State Road (SR.) 934, NE 79th Street Causeway, and John F. Kennedy Causeway within the project limits in Miami-Dade County. NE 79th Street is an east-west regional thoroughfare that has a western terminus at Florida's Turnpike (SR 821) and an eastern terminus at SR A1A. The project corridor carries traffic from the City of Miami to the barrier islands of North Bay Village and Miami Beach

1.1 Project Background

Based on the most recent bridge inspections performed in October 2020, which included routine inspections, all four bridges are structurally deficient. The National Bridge Inventory (NBI) structural conditions ratings for the bridge decks and superstructures are poor (NBI rating of 4). The bridges west of North Bay Island, Bridge No. 870083 (westbound) and Bridge No. 870549 (eastbound), were built in 1971 and 1973, respectively, and have an overall sufficiency rating of 48.7. The bridges east of North Bay Island, Bridge No. 870084 (westbound) and Bridge No. 870550 (eastbound), were built in 1971 and have an overall sufficiency rating of 48.7, respectively. None of the bridges are navigable.

In 2015, NE 79th Street was milled and resurfaced from east of North Bayshore Drive to Bay Drive West as part of Financial Management (FM) No. 431180-1-52-01 and included repairs to the bridges. The bridge abutment approaches and bridge decks west of North Bay Island (Bridge Nos. 870083 and 870549) were paved with new asphalt concrete overlay, and all bridge joints were rehabilitated. The eastern bridge decks and approaches (Bridge Nos. 870084 and 870550) were also repaved, and new bicycle and pedestrian safety railings were installed on the outside travel lanes.

To address impacts related to Hurricane Irma, an emergency roadway embankment stabilization safety project was performed in 2019 along a 0.25-mile-long segment of NE 79th Street from east of Pelican Harbor Park to just west of the western bridges (FM No. 443966-1-52-01). The project included the placement of bedding stone and rubble riprap behind the existing endwall along the south side of NE 79th Street. The roadway shoulder was severely eroded during Hurricane Irma, and the repairs rehabilitated the slope to the original design specifications.

1.2 Project Description

This project involves the potential replacement of four prestressed concrete slab (Sonovoid) bridges (arranged in two locations as parallel pairs connecting three islands within the Cities of Miami and North Bay Village in Miami-Dade County. The bridges are part of SR 934/NE 79th

Street (John F. Kennedy Causeway), a roadway classified as "Urban Principal Arterial - Other", which connects mainland Miami to Miami Beach and North Bay Village. The specific limits of the project extend from milepost (MP) 1.077 (west of Pelican Harbor Drive) to MP 1.947 (east of Adventure Avenue), as shown in Figure 1.1. The western bridge pair, comprised of Bridge Identification (ID) Numbers 870083 (westbound) and 870549 (eastbound), is located just west of North Bay Island/Harbor Island. The eastern bridge pair, comprised of Bridge ID Numbers 870084 (westbound) and 870550 (eastbound), is located between North Bay Island/Harbor Island and Treasure Island. The project is approximately 0.8 mile in length.

Figure 1.1 | Study Limits

The existing western bridge pair consists of six lanes, including four 11-foot-wide travel lanes to the inside and two 13.5-foot-wide travel lanes to the outside, and a raised median connecting the two bridge structures. The outside travel lanes include shared-use markings to accommodate bicycles. In addition, a 5-foot-wide raised sidewalk is present on each side of the bridge pair to the outside. The existing eastern bridge pair consists of six 10-foot-wide travel lanes with a raised median connecting the two bridge structures, as well as a 5.5-foot-wide dedicated bicycle lane and a sidewalk varying between 5 and 6 feet in width (separated by guardrail) on each side of the bridge pair to the outside. The bridge approaches are generally consistent with the typical section of the bridges, except for east of the western bridge pair which includes dedicated bicycle lanes. Crossing over the Biscayne Bay, the bridges have a maximum vertical clearance of 6.78 feet at Mean Low Water and a minimum vertical clearance of 3.05 feet at Mean High Water. Biscayne Bay at the bridge crossings is not deemed a navigable waterway by the United States Coast Guard.

1.2.1 Logical Termini

The project's western study limits fall within the City of Miami, while the eastern study limits fall within North Bay Village. Outside the project limits, NE 79th Street is expected to remain as a six-lane urban principal arterial. Therefore, to align with the existing configuration and accommodate additional lanes being dropped or added at the intersections, the logical termini for this project involve NE 79th Street from west of Pelican Harbor Drive (western terminus) to east of Adventure Avenue (eastern terminus). These logical termini also allow for full inclusion of the intersection footprints.

1.3 Purpose and Need

1.3.1 Purpose

The purpose of this project is to evaluate bridge replacement alternatives to address the structural deficiencies of four existing bridges (arranged in two locations as parallel pairs) along State Road 934 (SR 934)/NE 79th Street (John F. Kennedy Causeway). The project limits extend from Pelican Harbor Drive to Adventure Avenue within the Cities of Miami and North Bay Village in Miami-Dade County. The western bridge pair, comprised of Bridge Identification (ID) Numbers 870083 (westbound) and 870549 (eastbound), is located just west of North Bay Island/Harbor Island. The eastern bridge pair, comprised of Bridge ID Numbers 870084 (westbound) and 870550 (eastbound), is located between North Bay Island/Harbor Island and Treasure Island.

An additional project goal is to maintain emergency evacuation capabilities.

1.3.2 Need

The need for the project is based on the following criteria.

1.3.2.1 Bridge Deficiencies: Address Substandard Structural Elements

The existing bridges were constructed in the early 1970s and have been determined to be Structurally Deficient given the condition of each bridge's superstructure (beams), which is referred to as "Sonovoid" design. Due to the structure type, the number of structural deficiencies, and the low clearance from the water, the bridge superstructures cannot properly be repaired.

As part of the inspection process, several structural components were evaluated and assigned a rank or condition based on the NBI system. The ranks/conditions were based on a scale of zero through nine. A rank of zero generally means that the bridge is out of service, beyond corrective action, and in need of replacement; a rank of nine means the bridge is in excellent condition and no deficiencies have been identified. The ranks/conditions for the structural components examined in the reports are as follows:

Bridge ID Numbers 870083 (westbound) and 870549 (eastbound)

- Deck: 4 (Poor)
- Superstructure: 4 (Poor)
- Substructure: 6 (Satisfactory)

Bridge ID Numbers 870084 (westbound) and 870550 (eastbound)

- Deck: 4 (Poor)
- Superstructure: 4 (Poor)

- Substructure: 7 (Good)

1.3.2.2 Safety: Maintain Evacuation and Emergency Response Times

Serving as part of the emergency evacuation route network designated by the Florida Division of Emergency Management (FDEM) and Miami-Dade County, NE 79th Street (including the bridges) plays a critical role in facilitating traffic between the beaches and the mainland of Miami during emergency evacuation periods. The project area is located in Storm Surge Planning Zone B, which is at risk for storm surge for Category 2 and higher storms. There is a need for the bridges to continue meeting emergency evacuation requirements.

1.4 Related Projects

North Bay Village published a visioning Master Plan, NBV100 Report, in April 2020. This Master Plan includes transforming NE 79th Street within the municipal limits of North Bay Village to a Complete Streets design that would reduce the number of existing travel lanes from six to four. North Bay Village has subsequently prepared and submitted to FDOT a lane repurposing study. The proposed lane reduction would include the eastern bridge pair within the 79th Street PD&E Study limits. Potential improvements include repurposing the outside travel lanes on NE 79th Street to on-street parking, with designated buffer space separating the bicycle lane from the proposed adjacent parking lane. The outside travel lanes on the project's eastern bridges (Bridge Nos. 870084 and 870550) are proposed as 10-foot-wide bicycle lanes. The Master Plan and lane repurposing study states that, since NE 79th Street is an emergency evacuation route, all six lanes (three lanes westbound and three lanes eastbound) would be available for emergency evacuation. The Master Plan notes that several meetings took place with FDOT District Six regional leadership during the plan development. As of September 2023, the lane repurposing study has not been approved by FDOT.

The FDOT is currently rehabilitating the bridges east (Bridge Nos. 870082 and 870554) and west (Bridge Nos. 870085 and 870551) of the PD&E study's logical termini under FPID 436526-1-52-01. These bridges share the same corridor and are movable bridges with mechanical electrical components used to operate the bridge span to open for navigation. The scope of work for the rehabilitation includes replacement of some of the structural and mechanical components (generator, hydraulic span pumps, cylinders, PLC, locks, drives, fender ladder, sewage system, relay backup system and bike treatment). The bridge rehabilitation project is currently under construction and scheduled to be completed in the summer of 2024. This project has no impact on the 79th Street PD&E Study.

2 Existing Structures

2.1 Type of Structure

There are four bridges within the project limits. The locations of these bridges are shown in Figure 2-1 below. The four bridges within this project are the same type. The superstructures consist of prestressed concrete slab units (Sonovoid). The substructures consist of reinforced concrete pier caps supported by prestressed concrete piles.

Figure 2.1 | Existing Bridge Structures

All four bridges have similar geometry characteristics. The bridges west of Harbor Island (870083 & 870549) are 510' long with 17 spans that are 30' long each. The bridges east of Harbor Island (870084 & 870550) are 509' long with 16 spans that are 30' long each and one span that is 29' long. Each pair of parallel bridges are 101'-3" wide combined. Approach slabs are 20' long. Maximum clearance at MLW is 6.78'.

2.2 Condition of Existing Structures

The four bridges were built in 1971 (870083, 870084, & 870550) and 1974 (870549). In general, the bridge superstructures are in poor condition and the substructures have notable deficiencies, as well. Typical deficiencies include sidewalk map cracking, joint spalling, slab delamination and spalling, and pier cap cracks. The spalling concrete with exposed corroded reinforcement on the deck underside is particularly extensive on the bridges East of North Bay Island.

The lateral post tensioning was replaced with stainless steel rods in a 2009 rehabilitation. The stainless-steel rods are all-thread rod and stress is applied by turn of nut. Other repairs performed during this rehabilitation included concrete spall repair, crack repair, sidewalk spall repair, and joint repair. A more recent rehabilitation project in 2015 involved the traffic and pedestrian railing.

Table 2.1 | Summary Table of Existing Bridge Conditions

Bridge Number	870083	870084	870549	870550
Bridge Description	SR 934 (NE 79th St) WB over Biscayne Bay (West of North Bay Island)	SR 934 (NE 79th St) WB over Biscayne Bay (East of North Bay Island)	SR 934 (NE 79th St) EB over Biscayne Bay (West of North Bay Island)	SR 934 (NE 79th St) EB over Biscayne Bay (East of North Bay Island)
Last Inspection Date	10/28/2021 (Special)	10/28/2021 (Special)	10/28/2021 (Special)	10/28/2021 (Special)
NBI Rating - Deck	4 – Poor	4 – Poor	4 – Poor	4 – Poor
NBI Rating - Superstructure	4 – Poor	4 – Poor	4 – Poor	4 – Poor
NBI Rating - Substructure	6 - Satisfactory	7 - Good	6 - Satisfactory	7 - Good
Sufficiency Rating	48.8	48.8	48.8	48.8
Vertical Clearance	6.78′ at MLW	6.78′ at MLW	6.78′ at MLW	6.78′ at MLW
Superstructure Type	PS Conc Slab (Sonovoid)	PS Conc Slab (Sonovoid)	PS Conc Slab (Sonovoid)	PS Conc Slab (Sonovoid)
Substructure Type	RC Conc Pier Cap and PS Conc Piles	RC Conc Pier Cap and PS Conc Piles	RC Conc Pier Cap and PS Conc Piles	RC Conc Pier Cap and PS Conc Piles
Bridge Width	46′-4 ½″	46′-4 ½″	54′-10 ½″	54′-10 ½″
Number of Spans	17	17	17	17
Span length	30′-0″	30′-0″	30′-0″	30′-0″

See below for specific information about each individual bridge.

Bridge 870083 – SR 934 (NE 79th St) WB over Biscayne Bay (West of North Bay Island)

There is efflorescence with some rust staining underneath the area between the exterior and first interior slab unit throughout all spans but there is no evidence of relative movement between the slab units due to failure of the post-tensioning.

There are several miscellaneous deficiencies noted in the latest routine inspection report dated 10/29/2020. These include clogged drainage scuppers, numerous locations with delamination on the underside of deck panels, map cracking throughout previously repaired areas of the sidewalk, corroded sidewalk joint cover plates, and multiple locations with delaminated joint headers.

Figure 2.2 | Representative Photos of Damage at Bridge 870083 (October 2020)

Bridge 870084 – SR 934 (NE 79th St) WB over Biscayne Bay (East of North Bay Island)
There is efflorescence with some rust staining underneath the area between the exterior and first interior slab unit throughout all spans but there is no evidence of relative movement between the slab units due to failure of the post-tensioning.

There are several miscellaneous deficiencies noted in the latest routine inspection report dated 10/28/2020. These include numerous locations with delaminated and/or spalled concrete on the underside of deck panels with exposed corroded reinforcement, delaminated joint header at multiple locations, delaminated areas on bent caps, and numerous locations of horizontal cracking on the bent caps.

The spalling concrete with exposed corroded reinforcement on the deck underside is particularly extensive. In most cases, the deficiency was observed for the first time in 2020 or had increased in severity since the previous inspection.

Figure 2.3 | Representative Photos of Damage at Bridge 870084 (October 2020)

Bridge 870549 – SR 934 (NE 79th St) EB over Biscayne Bay (West of North Bay Island)

There is efflorescence with some rust staining underneath the area between the exterior and first interior slab unit throughout all spans but there is no evidence of relative movement between the slab units due to failure of the post-tensioning.

There are several miscellaneous deficiencies noted in the latest routine inspection report dated 10/29/2020. These include delaminated concrete on the underside of the deck, corroded hardware on the carbon fiber reinforcement strips, map cracking in the sidewalk, corroded sidewalk joint cover plates, damaged pourable joint seal, delaminated joint header in numerous locations, multiple locations of delaminated concrete at the piles and bent caps, and delamination and cracking in the concrete bridge railing.

Figure 2.4 | Representative Photos of Damage at Bridge 870549 (October 2020)

Bridge 870550 – SR 934 (NE 79th St) EB over Biscayne Bay (East of North Bay Island)
There is efflorescence with some rust staining underneath the area between the exterior and first interior slab unit throughout all spans but there is no evidence of relative movement between the slab units due to failure of the post-tensioning.

There are several miscellaneous deficiencies noted in the latest routine inspection report dated 10/29/2020. These include map cracking on the sidewalk, numerous locations of delaminated and spalled concrete on the deck underside with exposed corroded reinforcement, numerous locations of corroded sidewalk joint cover plates, numerous locations of delaminated joint headers, cracks in piles, delamination in bent caps, and cracking in concrete railing.

The spalling concrete with exposed corroded reinforcement on the deck underside is particularly extensive. In most cases, the deficiency was observed for the first time in 2020 or had increased in severity since the previous inspection.

Figure 2.5 | Representative Photos of Damage at Bridge 870550 (October 2020)

2.3 Vertical Clearance

There are several vertical clearance requirements and criteria relevant for these bridges.

In accordance with FDM 260.8.1, the minimum vertical clearance between the design flood stage and all superstructure elements shall be 2 feet. Also, the minimum vertical clearance above the mean high water shall be 6 feet for navigational purposes.

In accordance with SDG 1.4.3, the splash zone is 12-feet above the mean high water. If all superstructure elements are located above this zone, the superstructure can be classified as moderately aggressive if the water chloride content is less than 6,000 ppm.

3 Design Criteria

3.1 Roadway Design Controls and Criteria

Several design standards and manuals were consulted to establish the final design criteria for this study. The design criteria are based on design parameters outlined in the current editions of the following publications:

- Florida Design Manual, FDOT (2023)
- Design Standards, FDOT (FY 2023-24)
- Project Development and Environment Manual, FDOT (July 2023)
- Standard Specifications for Road and Bridge Construction, FDOT (FY 2023-24)
- Structures Design Manual, FDOT (2023)
- AASHTO LRFD Bridge Design Specifications, 8th Edition
- Utility Accommodation Manual, FDOT (2017)

Table 3.1 | Roadway Design Controls

Design Control	Value	Source
Functional Classification	Urban Principal Arterial	Straight Line Diagram
Context Classification	C4 Urban General: 79th Street from Pelican Harbor Drive to west of Harbor Island Drive C5 Urban Center: 79th Street from east of Harbor Island Drive to Adventure Avenue	2022 FDM (Table 201.5.1)
Design Speed	35 mph 30 mph	2022 FDM (Table 201.5.1)
Access Management	Access Class 5	FDOT Access Management Classification kmz file

Table 3.2 | Roadway Design Criteria

Design Criteria	Value	Source/Remark
Lane Width (Minimum)	10 feet	2022 FDM (Table 210.2.1)
Pavement Cross Slopes	2% Min. 3.5% Max.	2022 FDM (Figure 210.2.1)
Median Width	15.5 feet	2022 FDM (Table 210.3.1)
Min. Vertical Clearance for Bridges	16/14.5 feet	FDM Table 260.6.1
Grades	8% Max. (30 mph) 7% Max. (35 mph) 5% to accommodate ADA	2022 FDM (Table 210.10.1)
Superelevation	5% Max	2022 FDM (Section 210.9)
Border Width (Minimum)	12 feet	2022 FDM (Section 210.7.1)
Stopping Sight Distance (Minimum)	Downgrade ≥2% = 250 feet 5% = 266 feet Upgrade ≥2% = 250 feet 5% = 231 feet	2022 FDM Table 210.11.1
Sidewalk Width	6 feet* 10 feet	2022 FDM Table 222.2.1 *(For C5 and C6, when standard sidewalk width cannot be attained, provide the greatest attainable width possible, but not less than 6 feet)
Shared Use Path Width	10 feet to 14 feet	2022 FDM 224.4
Bike Lane Width	7-foot buffered bicycle lane	2022 FDM 223.2.1.1
Bike Lane/Outside Shoulder	8'-4''	2022 FDM (Figure 260.1.4)
Horizontal Alignment		
Min. Length of Horizontal Curves	450 feet (30 mph) 525 feet (35 mph)	2022 FDM (Table 210.8.1)
Max. Deflection Without Curve	2°00'00"	2022 FDM (Section 210.8.1)
Max. Deflection Through Intersection	6°00'00"	2022 FDM Table 212.7.1

Design Criteria	Value	Source/Remark
Max. Deflection Without Curve	2°00'00"	2022 FDM (Section 210.8.1)
Lane Drop Taper	1:50 Min. 1:70 Desirable	AASHTO 2011 (Pg. 10-157)
Vertical Alignment		
Max Change in Grade Without Curve	1.00 (30 mph) 0.90 (35 mph)	2022 FDM (Table 210.10.2)
Min. Length of Crest Curve	90 feet (30 mph) 105 (35 mph)	2022 FDM (Table 210.10.4)
Min. Length of Sag Curve	90 feet (30 mph) 105 (35 mph)	2022 FDM (Table 210.10.4)
Min. Crest K-value	31 (30 mph) 47 (35 mph)	2022 FDM (Table 210.10.3)
Distance between VPIs on Curbed Roadways (Minimum)	250 feet	FDM 210.10.1.1
Grade on Curbed Roadways (Minimum)	0.003	FDM 210.10.1.1
Min. Sag K-value	37 (30 mph) 49 (35 mph)	2022 FDM (Table 210.10.3)

3.2 Bridge Design Criteria

The design standards and manuals mentioned above were also used to establish the bridge design criteria for this study. Select specific criteria are shown in the table below.

Table 3.3 | Bridge Design Criteria

Design Criteria	Value	Source
Vertical Clearance Over Water	2 feet over design flood stage 6 feet over MHW	FDM 260.8.1
Splash Zone	12 feet above MHW	SDG 1.4.3
Span-to-Depth Ratio	≤ 33	SDG 1.2
Environmental Classification	TBD	SDG 1.3

Design Criteria	Value	Source
Concrete Class Requirements	CIP Bridge Deck: Class IV Precast Deck/Beam: Class IV, V, VI, or VII CIP Columns: Class IV Other CIP Substructure Elements: Class IV or V Piling: Class V, VI, or VII	SDG Table 1.4.3-1
Concrete Strength	Class IV (excluding drilled shafts): 5.5 ksi Class V: 6.5 ksi Class VI: 8.5 ksi Class VII: 10.0 ksi	SDG Table 1.4.3-2
Loads and Load Factors	Varies	LRFD SDG Chapter 2
Minimum Prestressed Concrete Pile Size	24″ (Carbon steel) 18″ (CFRP or Stainless Steel)	SDG Table 3.5.1-1
Minimum Pile Spacing	3.0 pile diameters	SDG 3.5.4
Maximum Pile Driving Resistance	450 tons (24-inch) 300 tons (18-inch)	SDG Table 3.5.13-1
Minimum Deck Thickness	8 ½ inches	SDG 4.2.2

3.3 Environmental and Site Considerations

The project is located along NE 79th St. on three islands and associated bridges over Biscayne Bay. The westernmost island is owned predominantly by Miami-Dade County and includes the Pelican Harbor Marina and Boat Ramp as well as a causeway extending to the east. The Pelican Harbor Marina and Boat Ramp is a public park located both north and south of NE 79th St., along the causeway and Pelican Harbor Drive. Most of the causeway is occupied by the NE 79th St. travel lanes, with some vegetation and rip-rap along the waterline. A temporary upland easement will be utilized to the south of eastbound NE 79th St. on the causeway that is part of Pelican Harbor Park and Marina.

On North Bay Island, privacy walls and landscaping vegetation line much of NE 79th St., and a gas station and large high-rise condominium complex are located immediately north of NE 79th St. On Treasure Island, the bridges connecting to North Bay Island touch down next to a multi-story commercial building to the south and a gated entrance to a WSVN Channel 7 News building and parking lot.

The predominant land uses in the project area are Residential and Commercial and Services, including condominiums and vacation rentals, retail strip malls, restaurants, and gas stations. The project area includes North Bay Island, a private gated community. Commercial services, including shopping centers, condominiums, and a gas station are located north of NE 79th St. along East and West Dr. The southern end of North Bay Island includes a residential neighborhood with single-family homes. Within the eastern portion of the project area are a preschool, a television station, and a gas station.

The project will include replacement of existing bridge structures in Biscayne Bay. Biscayne Bay is designated as an Aquatic Preserve, Outstanding Florida Water (OFW), and state-designated nursery area for marine species. Biscayne Bay Aquatic Preserve (BBAP) is also designated as a Habitat Area of Particular Concern as nursery habitat for federally managed species including the snapper-grouper complex and migratory pelagic species. Essential Fish Habitat in the form of unconsolidated estuarine bottom, seagrass, hardbottom, and coral occurs in the vicinity of the project.

3.4 Additional Considerations

3.4.1 Disposition of Existing Structure

The Contractor will be responsible for the disposal of demolished bridge debris in accordance with FDOT specifications unless otherwise directed by the Department. Refer to FDM 110.5.2.3 for further information regarding projects involving bridge demolition.

3.4.2 Ship/Barge Impact Data

The bridges included in this report are non-navigable, but the waterway itself is navigable by recreational and commercial traffic. Consideration for vessel collision shall be in accordance with FDOT SDG 2.11.

3.4.3 Aesthetic Considerations

Aesthetic elements of the bridges won't be significantly altered by this project. Exceptions include the pedestrian railings and bridge color. Both of which can be modified from the existing condition. Details regarding the bridge railing aesthetics will be further coordinated during the Design phase.

3.4.4 Location Hydraulics Report and Drainage Considerations

The bridges will not contain a drainage system. Rainwater will be collected at grade and transferred to the approaches due to the vertical profile of the bridges. Refer to the Location Hydraulics Report and Conceptual Drainage Design Report for additional information.

3.4.5 Geotechnical Data

A field investigation was in progress but not yet completed at the time of this report. Geotechnical information obtained from the field investigation will be provided separately.

4 Alternative Analysis

This report evaluated multiple alternatives for addressing the existing bridge conditions. Alternatives evaluated include No-Build, minor and major rehabilitation, and full replacement. Cost estimations are furnished for each alternative, considering immediate expenditures in addition to future maintenance costs and overall life cycle expenditures. The intricacies of each approach, including potential impacts on existing structures and the environment, are discussed in detail to inform decision-making. The overarching aim of the bridge analysis is to identify a sustainable, cost-effective, and technically feasible solution. The bridge analysis evaluation and results will be further documented in the Preliminary Engineering Report.

4.1 No-Build Alternative

The No-Action or No-Build Alternative retains the existing roadway and bridge. The advantages of the No Build Alternative include:

- No new expenditures for roadway and bridge design, utility relocations, right-of-way acquisition, or construction;
- No inconveniences to the traveling public during construction;
- No impacts to the natural environment; and
- No temporary or permanent use of adjacent or nearby Section 4(f) properties.

The disadvantages of the No-Build Alternative include:

- Continued degradation of the bridges which could restrict roadway safety or evacuation;
- No provisions for addressing the substandard elements of the existing typical section; and
- No improved bike / pedestrian amenities.

Although the No-Build Alternative does not meet the project needs, it provides a baseline condition against which to compare and measure the effects of the Build Alternatives.

4.2 Alternatives Considered but Eliminated

4.2.1 Alternatives 1a and 1b: Rehabilitation

Consideration was given to minor and major rehabilitation options. Rehabilitation of the existing bridges includes the cost of performing repairs, strengthening and replacement of bridge components as needed. For the purposes of this analysis, the following criteria are required for bridge rehabilitation:

- 75-year design life;
- An approved bridge typical section that meets current geometric design criteria; and
- Maintain four lanes of traffic throughout construction.

Alternative 1a: Minor Rehabilitation

A minor rehabilitation would include concrete repair, joint repair, epoxy overlay on sidewalks, and other miscellaneous repairs. Based on the available inspection reports, an approximate scope and cost estimate for the minor repairs that are required are shown in the table below.

Table 4.1 | Minor Rehabilitation Cost Estimate

Pay Item	Pay Item Description	Unit	Quantity (Bridge 870083)	Quantity (Bridge 870084)	Quantity (Bridge 870549)	Quantity (Bridge 870550)	Total Quantity	Unit Cost	Total Cost
401-70-3	RESTORE SPALLED AREAS, LATEX MODIFIED MORTAR-ACRYLIC	CF	670	425	31	212	1338	$850.00	$1,137,300
403-1100	EPOXY CONCRETE OVERLAY FOR CONCRETE BRIDGE DECKS	SY	696	694	696	694	2780	$50.00	$139,000
561-2	COATING EXISTING STRUCTURAL STEEL	SF	56	0	40	56	152	$100.00	$15,200
458-2	POLYMER NOSING FOR BRIDGE DECK EXPANSION JOINT	CF	456	456	456	456	1822.5	$500.00	$911,250
458-1-21	BRIDGE DECK EXPANSION JOINT, REHABILITATION, POURED JOINT WITH BACKER ROD	LF	1823	1823	1823	1823	7290	$60.00	$437,400
411-2	CRACKS INJECT & SEAL-STRUCTURES REHAB	LF	0	0	57	0	57	$80.00	$4,560
								Total:	$2,644,710
								Total +10% Contingency:	$2,909,181

Alternative 1a: Minor Rehabilitation would include the quantity of concrete spall repairs as listed in the latest inspection report, replacement of the entire expansion joint and headers at each joint, epoxy overlay for the sidewalks, cleaning/coating of the structural steel sidewalk joint cover plates as needed, and crack injection on the bent caps as needed in accordance with the latest inspection report. Unit costs were obtained from experience developing push button bridge maintenance contracts for FDOT District 4 and 6.

Alternative 1b: Major Rehabilitation

A major rehabilitation would include replacement of the superstructure deck, installation of pile jackets or cathodic protection, and widening to improve barrier and sidewalk. This option has a high cost (see cost estimate below) for the benefit that is achieved. Benefits include replacing the heavily deteriorated superstructure, making the substructure more resilient via pile jackets and cathodic protection, and having the ability to address some of the geometric deficiencies. However, the elements on the bridge that aren't replaced (e.g., pier caps and piles) will continue to deteriorate and need routine maintenance.

The new superstructure for the major rehabilitation alternative will likely need to consist of Florida Slab Beams due to vertical clearance and to match the existing vertical profile. See proposed cross section below.

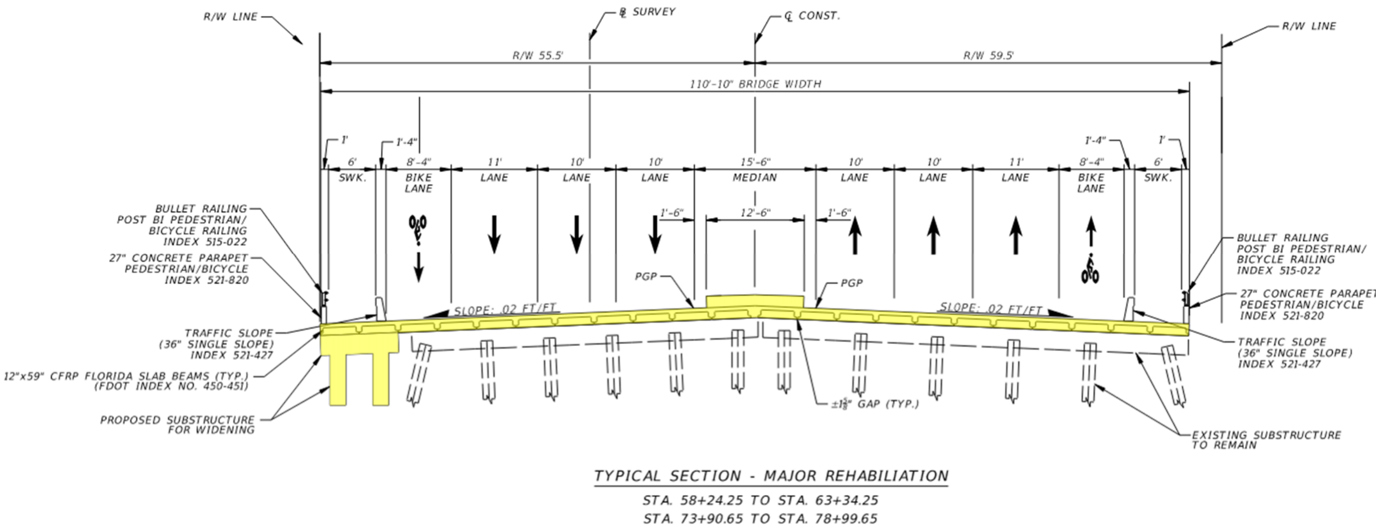


Figure 4.1 | Major Rehabilitation – Proposed Cross Section

The table below shows an estimated construction cost for Alternative 1b: Major Rehabilitation. Unit costs were determined by comparing 12-month historical costs for the pay item with estimated values provided in accordance with SDG 9.2. In some cases, the 12-month historical average was higher than the value provided in SDG 9.2 and in those cases, the larger value was used.

Table 4.2 | Major Rehabilitation Cost Estimate

Pay Item	Pay Item Description	Unit	Quantity (Bridge 870083)	Quantity (Bridge 870084)	Quantity (Bridge 870549)	Quantity (Bridge 870550)	Total Quantity	Unit Cost	Total Cost
0110-3	REMOVAL OF EXISTING STRUCTURES/BRIDGES	SF	26010	26010	26010	26010	104040	$50.00	$5,202,000
450-8-54	PRESTRESSED BEAM: FLORIDA SLAB BEAM, BEAM DEPTH 12" CFRP/SS, WIDTH 58-60"	LF	5610	5610	5610	5610	22440	$350.00	$7,854,000
400148	PLAIN NEOPRENE BEARING PADS	CF	83	83	83	83	332	$1,850.00	$615,022
458-1-11	BRIDGE DECK EXPANSION JOINT, NEW CONSTRUCTION, F&I POURED JOINT WITH BACKER ROD	LF	1008	1008	1008	1008	4032	$45.00	$181,440
400-4-41	CONCRETE CLASS IV, PRECAST DECK OVERLAY	CY	751	751	751	751	3004	$1,000.00	$3,004,000
400-7-1	BRIDGE DECK GROOVING	SY	3173	3173	3173	3173	12693	$8.00	$101,547
400-9-1	BRIDGE DECK PLANING	SY	3173	3173	3173	3173	12693	$6.00	$76,160
400-4-5	CONCRETE CLASS IV, BRIDGE SUBSTRUCTURE	CY	45	45	45	45	178	$1,750.00	$311,500
415-1-5	REINFORCING STEEL- BRIDGE SUBSTRUCTURE	LB	6453	6453	6453	6453	25810	$1.50	$38,715
455-34-3	PRESTRESSED CONCRETE PILING, 18" SQ	LF	954	954	738	738	3384	$185.00	$626,040

Pay Item	Pay Item Description	Unit	Quantity (Bridge 870083)	Quantity (Bridge 870084)	Quantity (Bridge 870549)	Quantity (Bridge 870550)	Total Quantity	Unit Cost	Total Cost
457-2221	CATHODIC PROTECTION INTEGRAL PILE JACKET, STRUCTURAL, 16.1-30.", GALVANIC SYSTEM	LF	80	80	80	80	320	$1,200.00	$384,000
521-6-11	CONCRETE PARAPET, PEDESTRIAN/BICYCLE, 27" HEIGHT	LF	2040	2040	2040	2040	8160	$120.00	$979,200
515-4-2	BULLET RAIL, DOUBLE RAIL	LF	2040	2040	2040	2040	8160	$65.00	$530,400
521-5-13	CONCRETE TRAFFIC RAILING-BRIDGE, 36" SINGLE-SLOPE	LF	2040	2040	2040	2040	8160	$120.00	$979,200
								Total:	$20,883,224
								8% Mobilization:	$1,670,658
								8% Maintenance of Traffic:	$1,670,658
								10% Contingency:	$2,088,322
								Combined Total:	$26,312,862

4.2.2 Recommendation

Based on an evaluation of a minor and major rehabilitation solution, Alternative 1a and 1b are determined to be impractical alternatives for the following reasons.

- Structurally deficient - The bridges are currently classified as "structurally deficient" due to the Poor rating of the superstructure. Minor and major rehabilitation solutions would not effectively address structural deficiency issues long-term.
- Design Life - Rehabilitating the existing bridges is not considered feasible because the structures are at the end of their 50-year design life. Poor corrosion resistance has contributed to the degradation and shortened design life of the bridges.
- Bridge typical section - The existing bridge typical sections do not meet current FDOT design standards. Geometric substandard conditions would still remain including not meeting the vertical clearance criteria describe in section 2.3 of this report.
- Life-cycle costs – The costs of rehabilitation and continued maintenance outweigh the benefit and service life of the bridges. A life cycle cost analysis shows that replacement is less expensive than rehabilitation (refer to Section 4.4 of this report).

4.3 Build Alternatives

4.3.1 Alternatives 2a and 2b: Replacement

General Information:

Both replacement alternatives consider the same typical section and same structure type. The difference between alternative 2a and 2b is the vertical profile. Option 2b meets the vertical clearance criteria described in section 2.3 of this report (except the superstructure will still be within the splash zone) and Option 2a does not meet the criteria. The typical section consists of two 10’ travel lanes, one 11’ travel lane, an 8’-4” bike lane, and a 6’ sidewalk in each direction. There is a concrete traffic barrier between the bike lane and sidewalk.

Superstructure Considerations:
For Alternatives 2a and 2b, there are three viable superstructure types: Florida-I 36 Beams, 12” Florida Flat Slab Beam (FSB), or 12” Florida Flat Slab Beam (FSB) with CFRP prestressing strands. There are benefits and drawbacks to each of the options, but the 12” FSB with CFRP provides the most resiliency and a relatively shallow structural depth. It has a shallow section depth compared to the Florida-I 36 beams to improve vertical clearance without major impacts to the vertical roadway profile. Also, the CFRP prestressing is resistant to corrosion because it doesn’t utilize conventional steel prestressing strands. The primary drawback to using this structure type is the higher construction cost. However, this is offset by the low maintenance costs over time. Refer to Section 4.4 of this report for further information related to construction costs.

Substructure Considerations:
The substructure may consist of driven piles or drilled shafts and there are advantages and disadvantages of each option. Driven piles are less expensive. However, there are a few existing structures in the vicinity of these bridges, and they may be impacted by the vibrations during pile installation. Low vibration foundation like Auger Cast Pile should be considered during design, especially at end bents.

Also, due to phased construction, the existing bridge itself can be impacted by pile driving operations. According to the pile driving records available, existing end bent piles are between approximately 14 ft and 20 ft in length, and piles at interior bents vary from approximately 37 ft to 47 ft long. Vibration monitoring will need to be employed and/or foundation elements adjacent to existing sensitive structures may require drilled shafts instead of driven piles.

The pier caps would typically consist of traditional reinforced concrete. However, to make the structure more resilient, stainless-steel reinforcement can be used. Similarly, the piles can be made with conventional carbon steel prestressing steel or be made more resilient with FRP/stainless steel strands and reinforcing.

Wave Analysis:
Preliminary calculations were performed to assess the vulnerability of proposed alternatives to Wave Forces. Wave height and wave period were determined using analytical methods including the Coastal Engineering Design and Analysis System (CEDAS) Automated Coastal Engineering System (ACES) and methods documented in the Coastal Engineering Manual (CEM). Design water levels were determined using the FEMA Flood Insurance Study (FIS 12086CV001B) and relative sea level rise (RSLR) was determined based on the NOAA 2022 RLSR Intermediate level predictions at the Virginia Key NOAA Gauge. The calculated wave parameters were applied to the loading calculations in AASHTO Guide for design of Bridges Vulnerable to Coastal storms (BVCS). Results are presented in the table below. As a result, we conclude that the wave forces can be resisted with nominal structural connectivity between the

superstructure and substructure and that wave forces do not prevent the advancement of Replacement Alternatives 2a and 2b.

Note that the analysis performed to determine wave conditions was high level (referred to as Level I in BVCS) and did not include 2-dimensionsal wave or hydrodynamic modeling. This analysis is appropriate for assessing feasibility, but 2-dimensional modeling should be performed during final design.

Table 4.3 | Wave Analysis Results Summary

	AASHTO BVCS
Vertical Force	1048 kip
Horizontal Force	16 kip
Moment	87,500 kip-ft

Other Considerations:

The duration of construction is estimated to be approximately 18 months due to phasing and seasonal construction limits. Refer to Section 4.5 of this report for more information related to phase construction impacts.

Refer to the attached sheets for a conceptual plan, elevation, and typical section.

Construction Cost Estimates:

The table below shows an estimated construction cost for Alternatives 2a and 2b. Unit costs were determined by comparing 12-month historical costs for the pay item with estimated values provided in accordance with SDG 9.2. In some cases, the 12-month historical average was higher than the value provided in SDG 9.2 and in those cases, the larger value was used.

Table 4.4 | Replacement Cost Estimate - Resilient Superstructure and Conventional Substructure

Pay Item	Pay Item Description	Unit	Quantity (Bridge 870083)	Quantity (Bridge 870084)	Quantity (Bridge 870549)	Quantity (Bridge 870550)	Total Quantity	Unit Cost	Total Cost
0110-3	REMOVAL OF EXISTING STRUCTURES/BRIDGES	SF	26010	26010	26010	26010	104040	$50.00	$5,202,000
450-8-54	PRESTRESSED BEAM: FLORIDA SLAB BEAM, BEAM DEPTH 12" CFRP/SS, WIDTH 58-60"	LF	5720	5720	5720	5720	22880	$350.00	$8,008,000
400148	PLAIN NEOPRENE BEARING PADS	CF	64	64	64	64	254	$1,850.00	$470,311
458-1-11	BRIDGE DECK EXPANSION JOINT, NEW CONSTRUCTION, F&I POURED JOINT WITH BACKER ROD	LF	784	784	784	784	3136	$45.00	$141,120
400-4-41	CONCRETE CLASS IV, PRECAST DECK OVERLAY	CY	766	766	766	766	3064	$1,000.00	$3,064,000

Pay Item	Pay Item Description	Unit	Quantity (Bridge 870083)	Quantity (Bridge 870084)	Quantity (Bridge 870549)	Quantity (Bridge 870550)	Total Quantity	Unit Cost	Total Cost
400-7-1	BRIDGE DECK GROOVING	SY	3236	3236	3236	3236	12942	$8.00	$103,538
400-9-1	BRIDGE DECK PLANING	SY	3236	3236	3236	3236	12942	$6.00	$77,653
400-4-5	CONCRETE CLASS IV, BRIDGE SUBSTRUCTURE	CY	813	813	813	813	3252	$1,750.00	$5,691,259
415-1-5	REINFORCING STEEL- BRIDGE SUBSTRUCTURE	LB	117890	117890	117890	117890	471561	$1.50	$707,342
455-34-5	PRESTRESSED CONCRETE PILING, 24" SQ	LF	4452	3710	3444	2870	14476	$190.00	$2,750,440
521-6-11	CONCRETE PARAPET, PEDESTRIAN/BICYCLE, 27" HEIGHT	LF	2080	2080	2080	2080	8320	$120.00	$998,400
515-4-2	BULLET RAIL, DOUBLE RAIL	LF	2080	2080	2080	2080	8320	$65.00	$540,800
521-5-13	CONCRETE TRAFFIC RAILING- BRIDGE, 36" SINGLE-SLOPE	LF	2080	2080	2080	2080	8320	$120.00	$998,400
								Total:	$28,753,264
								8% Mobilization:	$2,300,261
								8% MOT:	$2,300,261
								10% Contingency:	$2,875,326
								Combined Total:	$36,229,112

Table 4.5 | Replacement Cost Estimate - Resilient Superstructure and Resilient Substructure

Pay Item	Pay Item Description	Unit	Quantity (Bridge 870083)	Quantity (Bridge 870084)	Quantity (Bridge 870549)	Quantity (Bridge 870550)	Total Quantity	Unit Cost	Total Cost
0110-3	REMOVAL OF EXISTING STRUCTURES/BRIDGES	SF	26010	26010	26010	26010	104040	$50.00	$5,202,000
450-8-54	PRESTRESSED BEAM: FLORIDA SLAB BEAM, BEAM DEPTH 12" CFRP/SS, WIDTH 58-60"	LF	5720	5720	5720	5720	22880	$350.00	$8,008,000
400148	PLAIN NEOPRENE BEARING PADS	CF	64	64	64	64	254	$1,850.00	$470,311
458-1-11	BRIDGE DECK EXPANSION JOINT, NEW CONSTRUCTION, F&I POURED JOINT WITH BACKER ROD	LF	784	784	784	784	3136	$45.00	$141,120
400-4-41	CONCRETE CLASS IV, PRECAST DECK OVERLAY	CY	766	766	766	766	3064	$1,000.00	$3,064,000
400-7-1	BRIDGE DECK GROOVING	SY	3236	3236	3236	3236	12942	$8.00	$103,538
400-9-1	BRIDGE DECK PLANING	SY	3236	3236	3236	3236	12942	$6.00	$77,653
400-4-5	CONCRETE CLASS IV, BRIDGE SUBSTRUCTURE	CY	348	348	348	348	1394	$1,750.00	$2,439,111
415-2-5	STAINLESS REINFORCING STEEL, SUBSTRUCTURE	LB	50524	50524	50524	50524	202098	$8.00	$1,616,782
455-34-25	PRESTRESSED CONCRETE PILING, 24" SQ W/FRP OR STAINLESS STEEL STRAND AND REINFORCING	LF	4452	3710	3444	2870	14476	$350.00	$5,066,600
521-6-11	CONCRETE PARAPET, PEDESTRIAN/BICYCLE, 27" HEIGHT	LF	2080	2080	2080	2080	8320	$120.00	$998,400
515-4-2	BULLET RAIL, DOUBLE RAIL	LF	2080	2080	2080	2080	8320	$65.00	$540,800
521-5-13	CONCRETE TRAFFIC RAILING- BRIDGE, 36" SINGLE-SLOPE	LF	2080	2080	2080	2080	8320	$120.00	$998,400
								Total:	$28,726,716
								8% Mobilization:	$2,298,137
								8% MOT:	$2,298,137
								10% Contingency:	$2,872,672
								Combined Total:	$36,195,662

Note: The cost estimates presented in the preceding tables are for Alternative 2a. The only difference for Alternative 2b is a marginal increase to the pile lengths due to the raised vertical profile. See below for a summary of the construction cost estimates of each alternative.

4.4 Construction Cost Estimates

Detailed construction cost estimates are shown in the preceding sections of the report. See below for a summary of the construction cost estimates for each alternative.

Table 4.6 | Cost Estimate Summary

Alternative	Brief Scope	Total Cost Estimate (All 4 bridges)
Alt 1a: Minor Rehabilitation	Miscellaneous routine maintenance	$2,909,181
Alt 1b: Major Rehabilitation	Replacement of superstructure, widening, and pile jackets	$26,312,862
Alt 2a: Conventional Piling Replacement	Full replacement of superstructure and substructure	$36,229,112
Alt 2b: Conventional Piling Replacement	Full replacement of superstructure and substructure	$36,597,788
Alt 2a: Resilient Piling Replacement	Full replacement of superstructure and substructure	$36,195,662
Alt 2b: Resilient Piling Replacement	Full replacement of superstructure and substructure	$36,874,802

It should be noted that the cost difference between conventional FSB's compared to CFRP FSB's is approximately $95 per linear foot which amounts to roughly a 7% difference in cost. However, the cost of future maintenance is significantly reduced by using CFRP FSB's because the reinforcement in the superstructure is non-corrosive.

A life cycle cost analysis (LCCA) was performed and shows that replacement is the least expensive alternative in the long-term. The rehabilitation alternatives cannot address all the deficiencies as noted earlier in the report and these bridges will need to be replaced in the future. Specifically, this analysis considers that if the minor rehabilitation alternative was pursued then a second minor rehabilitation would be needed in 2028 and a replacement in 2031. Also, the analysis considers that if the major rehabilitation alternative was pursued then a minor rehabilitation would be needed in 2037 and a replacement in 2051. These assumptions lead to the determination that replacing the bridge now is the least expensive option. A summary of the LCCA is shown in the table below. Note that Alternative 2a is used for the replacement life cycle cost and the difference in cost between Alternatives 2a and 2b is marginal as shown above.

Table 4.7 | Life Cycle Cost Analysis (Present Value Adjusted)

Minor Rehab	Major Rehab	Replacement
$32,863,733	$44,021,495	$31,312,699

4.5 Construction Phasing

Bridge replacement will need to occur in phases while maintaining pedestrian and vehicular traffic during construction. There are six lanes of traffic on the existing bridges, three in each direction. Throughout construction, a minimum of two lanes will be maintained in each direction. Pedestrian accommodations will be maintained on at least one side of the bridges throughout construction. A preliminary construction phasing scheme for Alternatives 2a and 2b is provided in **Attachment C**.

5 Summary and Conclusion

5.1 Overview

This report evaluated multiple alternatives for addressing the existing bridge conditions. Alternatives evaluated include No-Build, minor and major rehabilitation, and full replacement with options for construction methods and materials. Cost considerations, long-term viability, potential impact on existing structures, and environmental factors are all incorporated into the analysis. Life Cycle Cost Analysis (LCCA) was also performed to identify the most cost-effective strategy over time.

5.1.1 Evaluation of Alternatives:

Minor Rehabilitation (Alternative 1a): While this is a less expensive option, it fails to address all the structural issues and doesn't provide a long-term solution. Historical records show that minor rehabilitation efforts have had short-lived benefits. This alternative does not meet need of addressing structural deficiencies.

Major Rehabilitation (Alternative 1b): This alternative involves substantial upgrades but also fails to address all deficiencies and still requires ongoing maintenance. The cost of major rehabilitation is high relative to the benefits it delivers. This alternative does not meet need of addressing structural deficiencies.

Replacement (Alternatives 2a and 2b): Replacement alternatives involve using conventional or more resilient construction materials. Although the upfront cost is higher, the LCCA shows that it is the most economical option in the long term. Alternatives 2a and 2b would address the structural deficiencies of the existing bridges and provide a long-term solution.

Cost Estimates:

- Minor Rehabilitation: $2,909,181
- Major Rehabilitation: $26,312,862
- Conventional Piling Replacement (Alt 2a): $36,229,112
- Conventional Piling Replacement (Alt 2b): $36,597,788
- Resilient Piling Replacement (Alt 2a): $36,195,662
- Resilient Piling Replacement (Alt 2b): $36,874,802

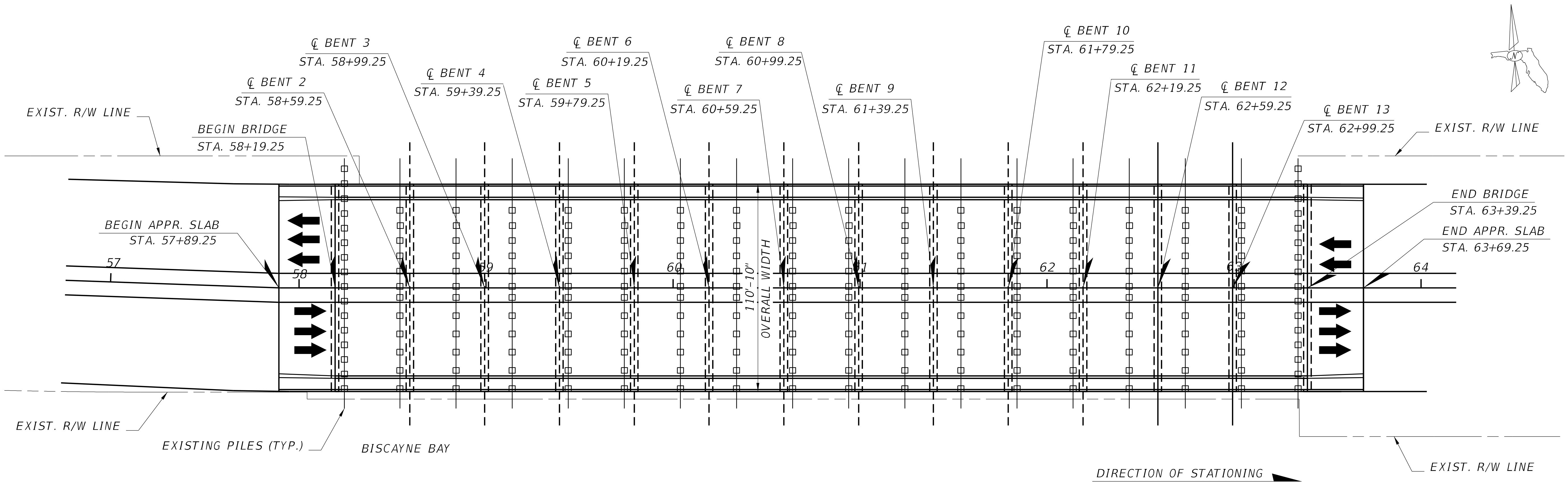
Life Cycle Cost Analysis:

- Minor Rehabilitation: $32,863,733
- Major Rehabilitation: $44,021,495
- Full Replacement: $31,312,699

5.2 Conclusion:

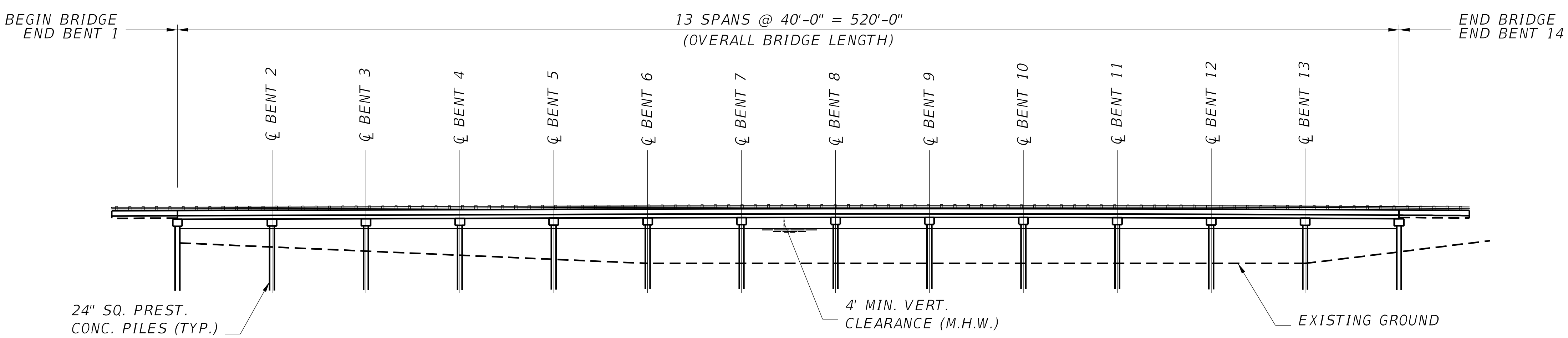
Based on the analysis, replacement of the bridge structures is the most sustainable, cost-effective, and technically viable solution. Despite higher initial costs, the replacement option is the most economical in the long term, according to the LCCA. Therefore, given the aging infrastructure and the inadequacy of the other alternatives in addressing all structural deficiencies (as noted in Section 4.2.2), it is recommended to proceed with a full replacement strategy. Specifically, the use of resilient materials like CFRP FSBs should be considered, as they significantly reduce future maintenance costs and extend the service life of the bridges.

ATTACHMENTS



PLAN

BRIDGE TO THE WEST OF NORTH BAY ISLAND (SHOWN)
BRIDGE TO THE EAST OF NORTH BAY ISLAND (SIMILAR)



ELEVATION

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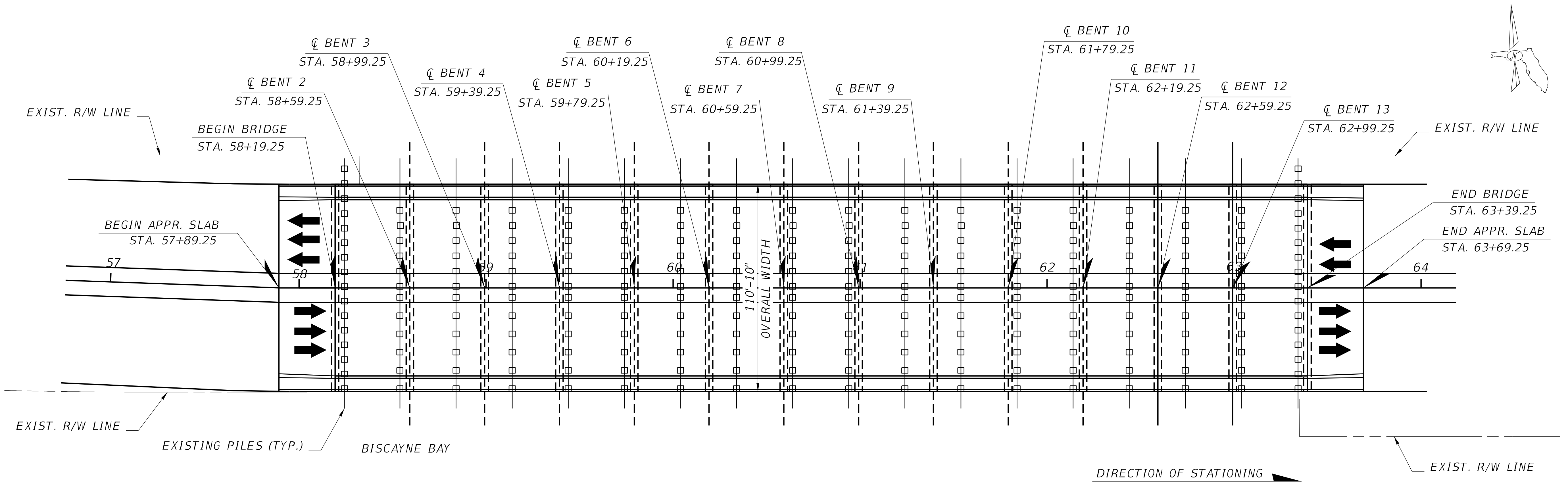
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 934	MIAMI-DADE	449007-1-22-01

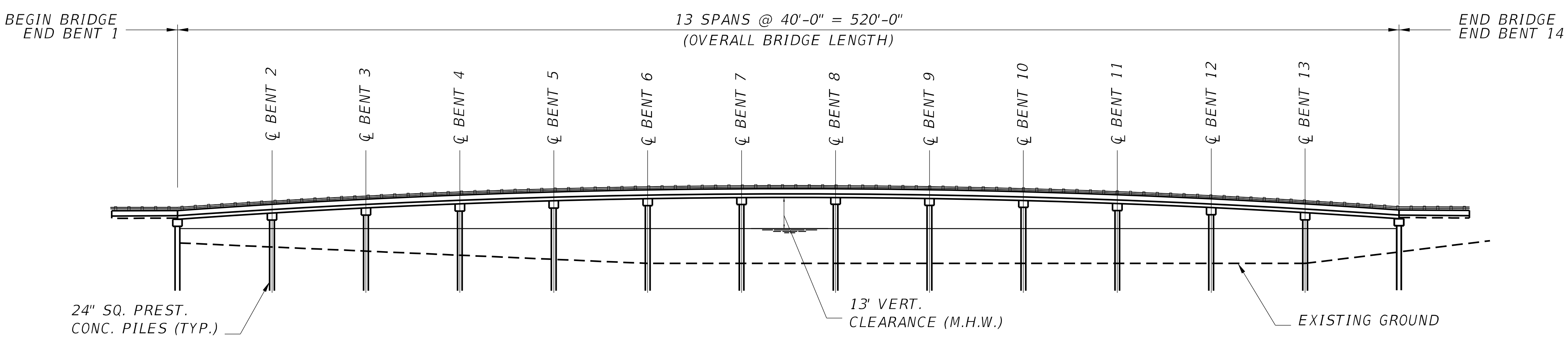
SHEET TITLE:
PLAN AND ELEVATION:
ALTERNATIVE 2A

REF. DWG. NO.
SHEET NO.
B1-1



PLAN

BRIDGE TO THE WEST OF NORTH BAY ISLAND (SHOWN)
BRIDGE TO THE EAST OF NORTH BAY ISLAND (SIMILAR)



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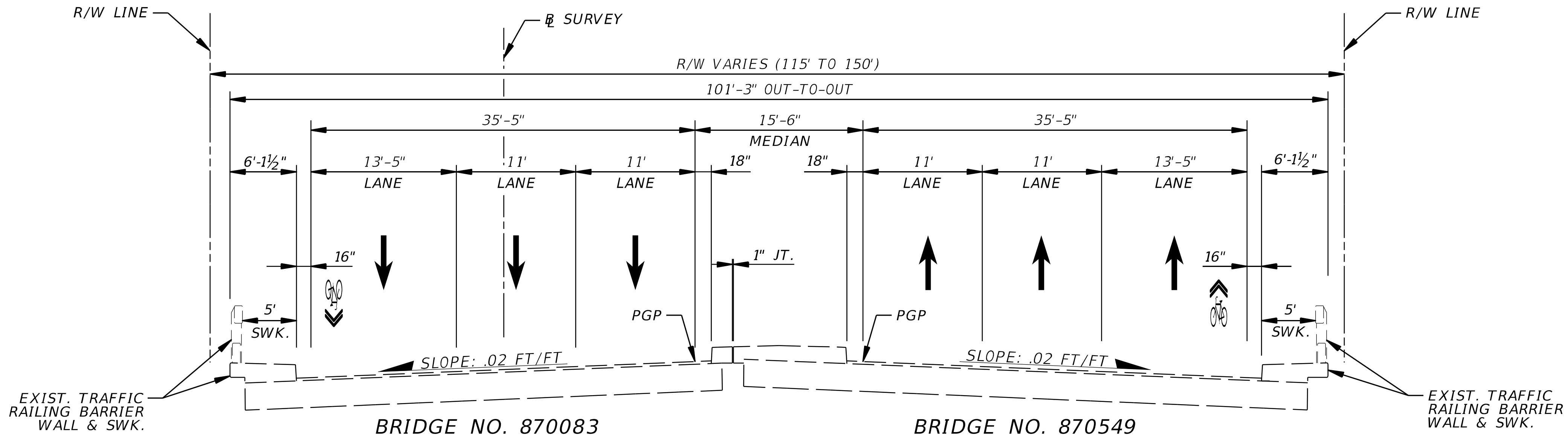
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 934	MIAMI-DADE	449007-1-22-01

SHEET TITLE:

PLAN AND ELEVATION:
ALTERNATIVE 2B

REF. DWG. NO.

SHEET NO.
B1-2



TYPICAL SECTION - EXISTING

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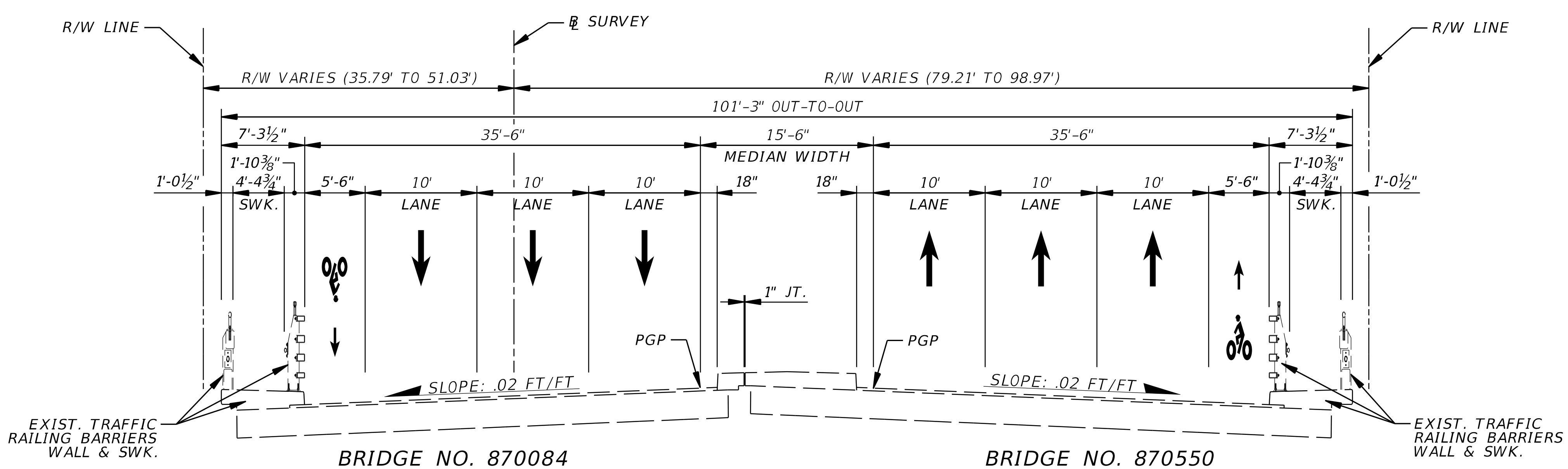

TYPICAL SECTION - EXISTING

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EXISTING TO BE REMOVED

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 934	MIAMI-DADE	449007-1-22-01

TYPICAL SECTION (EXISTING)

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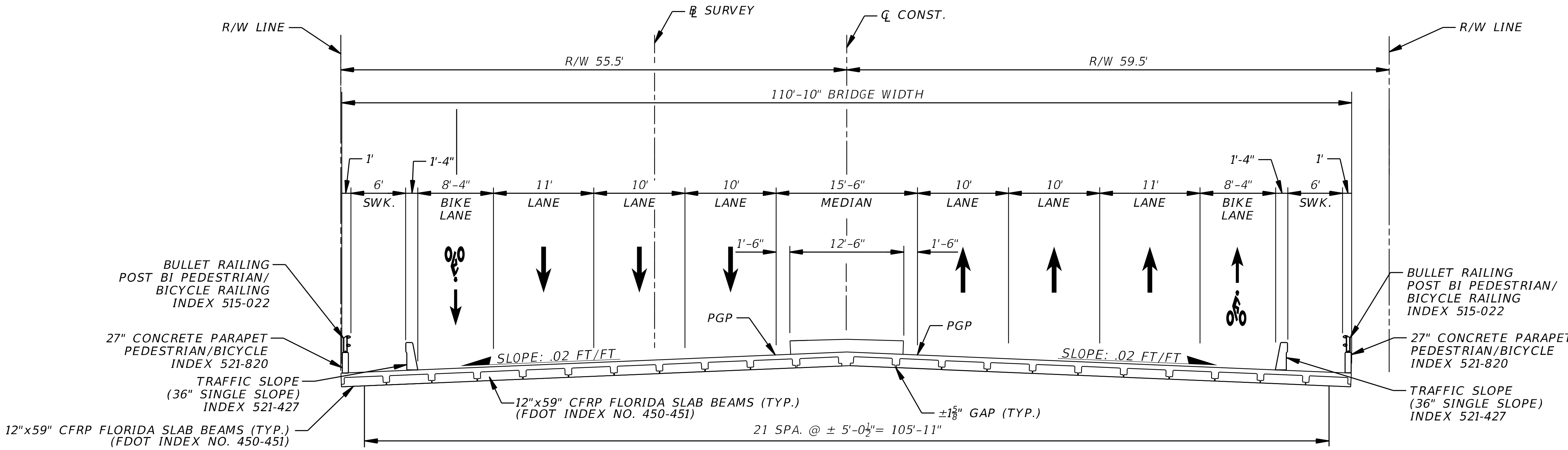

TYPICAL SECTION - PROPOSED

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STA. 73+85.00 TO STA. 79+05.00

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 934	MIAMI-DADE	449007-1-22-01

TYPICAL SECTION ALTERNATIVE 2A

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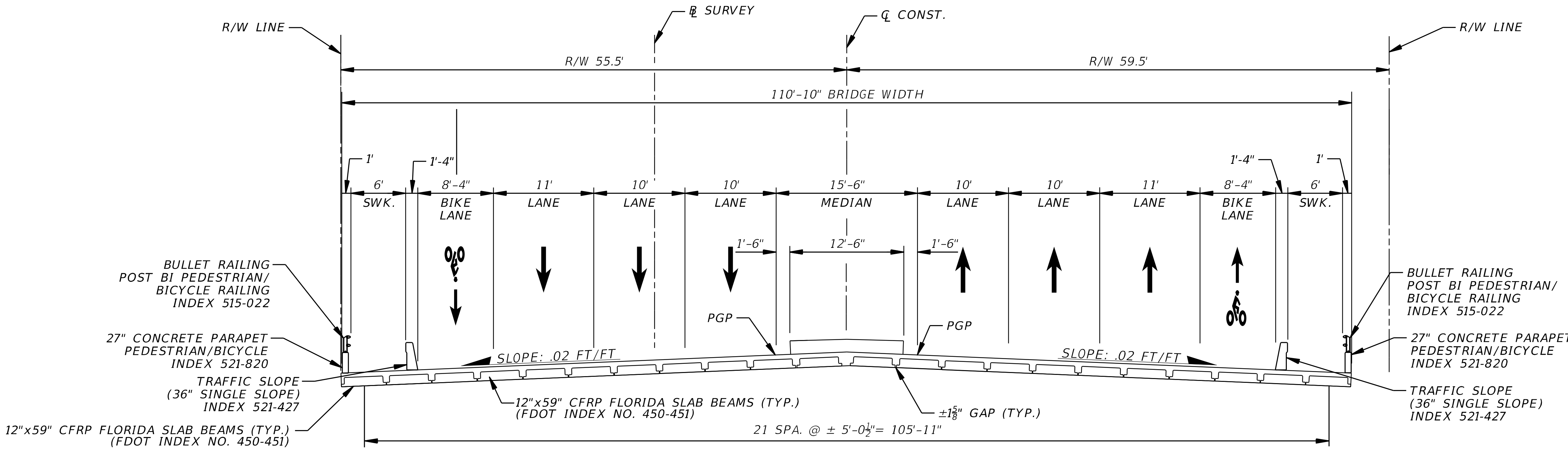

TYPICAL SECTION - PROPOSED

STA. 58+19.25 TO STA. 63+39.25

STA. 73+85.00 TO STA. 79+05.00

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 934	MIAMI-DADE	449007-1-22-01

TYPICAL SECTION ALTERNATIVE 2B

SHEET NO.

Discount rate
3%

Discount rate uses the NISTIR 85-3273-37 published rate as recommended by FLCCA.

	Not Adjusted			LCCA - Present Value Adjusted		
	Minor Rehab	Major rehab	Replacement	Minor Rehab	Major rehab	Replacement
TOTAL COST	$ 39,548,908.30	$ 64,160,000.00	$ 36,300,000.00	$ 32,863,733.60	$ 44,021,495.48	$ 31,312,698.87
2023				$ -	$ -	$ -
2024				$ -	$ -	$ -
2025	$ 2,900,000.00			$ 2,653,910.81	$ -	$ -
2026		$ 31,000,000.00		$ -	$ 27,543,098.49	$ -
2027			$ 36,300,000.00	$ -	$ -	$ 31,312,698.87
2028	$ 3,168,908.30			$ 2,653,910.81	$ -	$ -
2029				$ -	$ -	$ -
2030				$ -	$ -	$ -
2031	$ 36,300,000.00			$ 27,820,927.38	$ -	$ -
2032				$ -	$ -	$ -
2033				$ -	$ -	$ -
2034				$ -	$ -	$ -
2035				$ -	$ -	$ -
2036				$ -	$ -	$ -
2037		$ 2,500,000.00		$ -	$ 1,604,654.87	$ -
2038				$ -	$ -	$ -
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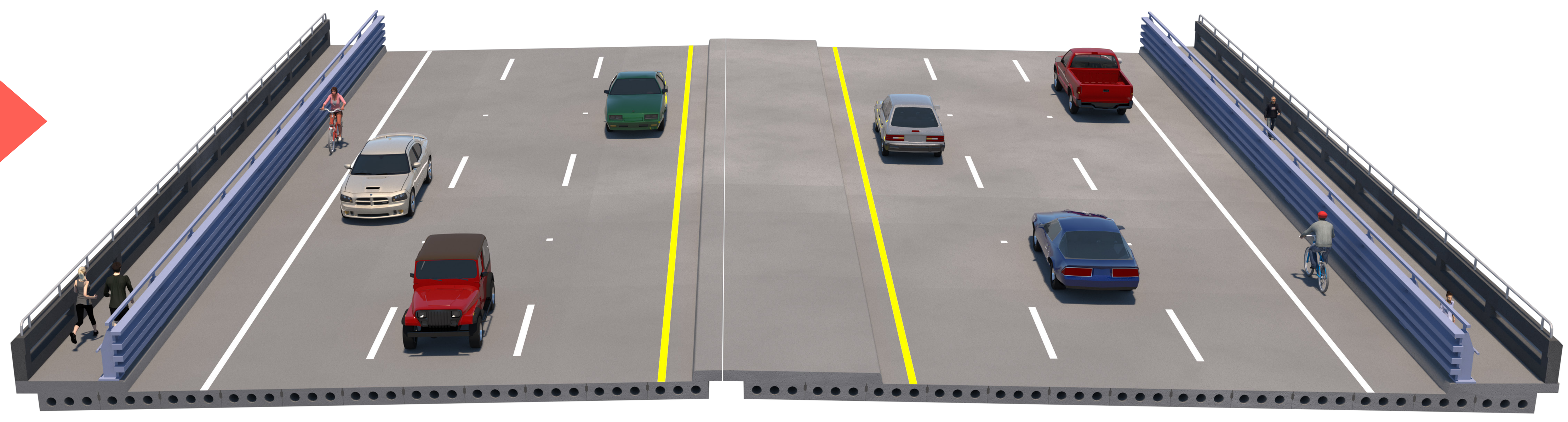
2094				$ -	$ -	$ -	
2095				$ -	$ -	$ -	
2096				$ -	$ -	$ -	
2097				$ -	$ -	$ -	
2098				$ -	$ -	$ -	
2099				$ -	$ -	$ -	
2100				$ -	$ -	$ -	
2101				$ -	$ -	$ -	
2102	$ (2,820,000.00)	$ (5,640,000.00)	$ -	$ (265,015.41)	$ (530,030.82)	$ -	Residual Value

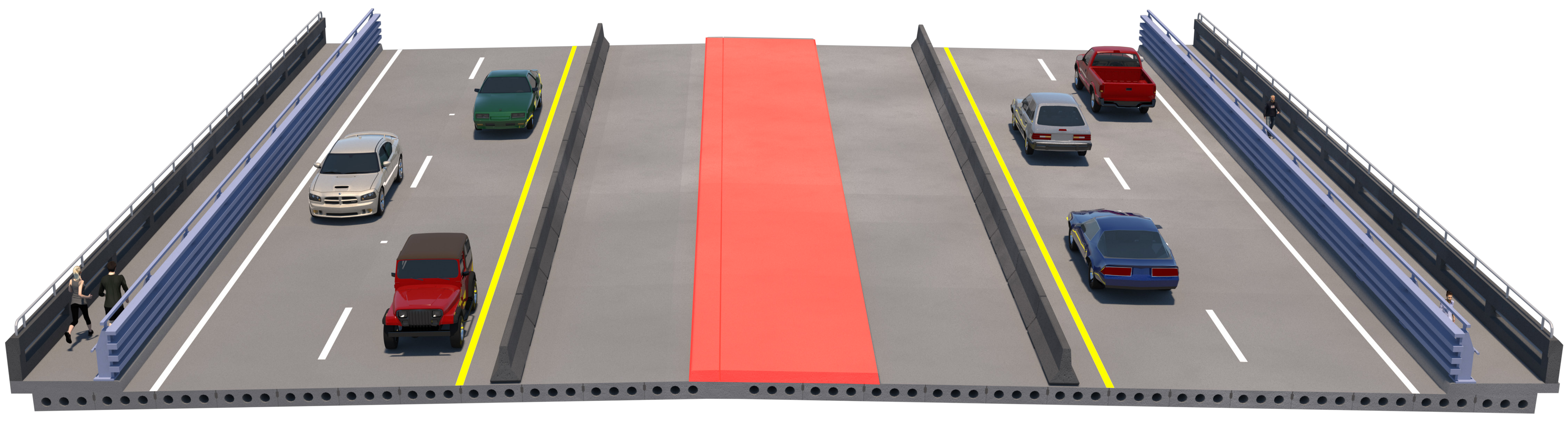
CONSTRUCTION PHASES

SR 934 / NE 79 ST
PD&E STUDY

EXISTING

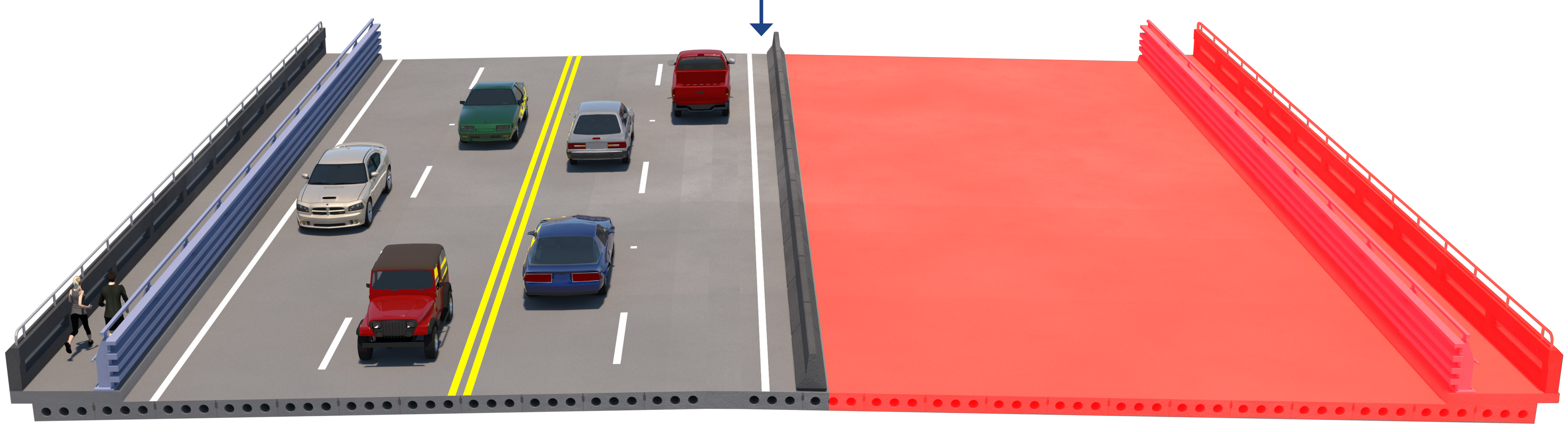


PHASE 1



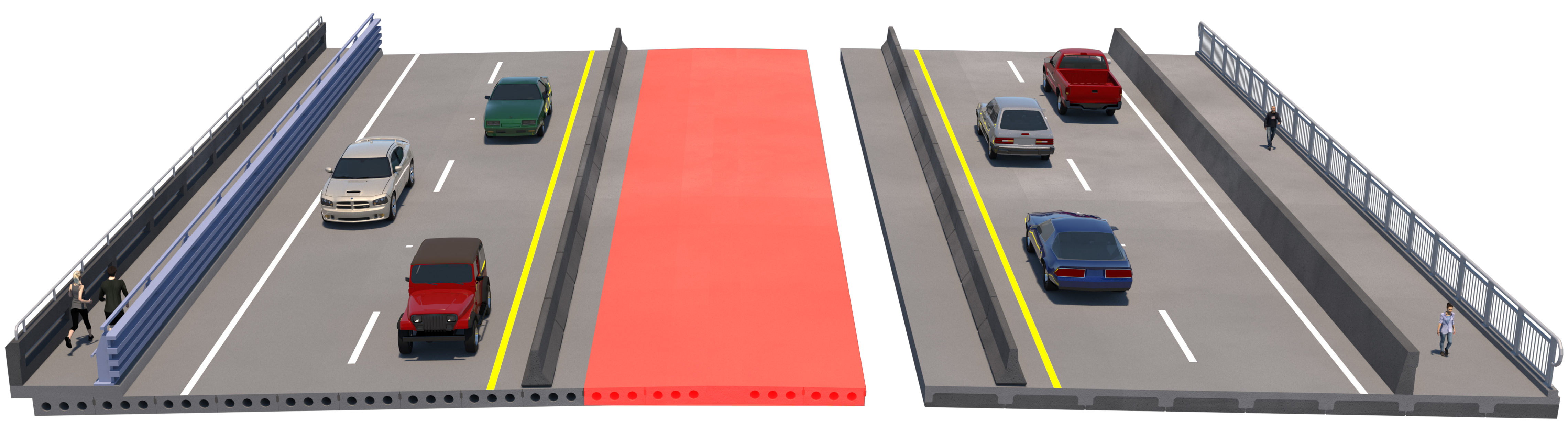
Remove the existing median and "close" the gap between bridges to allow a shift in traffic during future construction phases.

PHASE 2



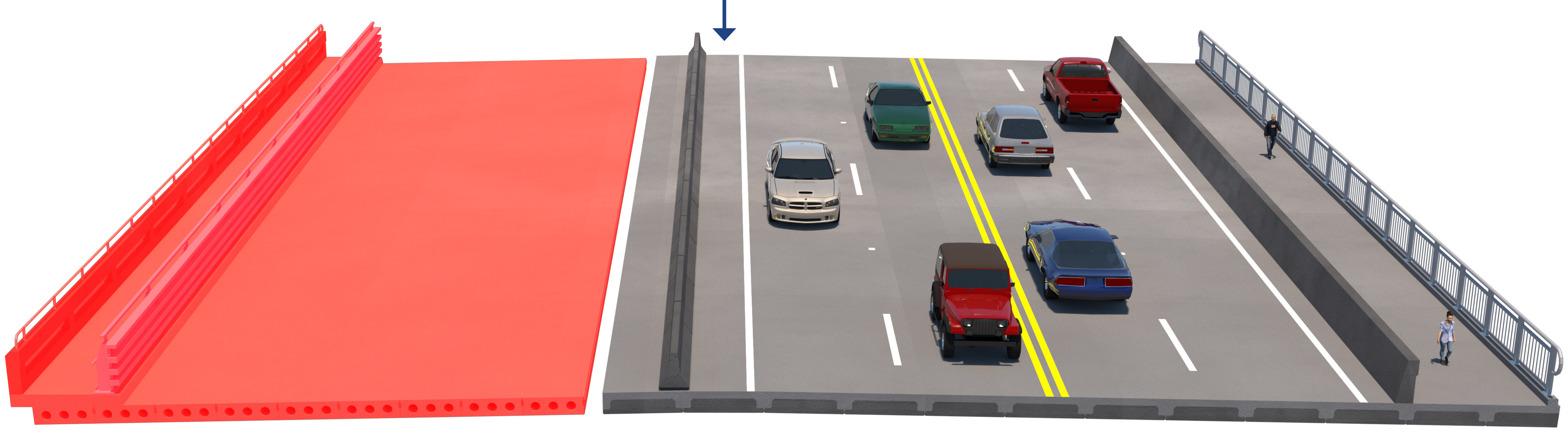
Reduce the number of lanes from 3 to 2 in each direction and shift all traffic to the westbound lanes. Demolish a portion of the existing bridge and construct a new bridge.

PHASE 3



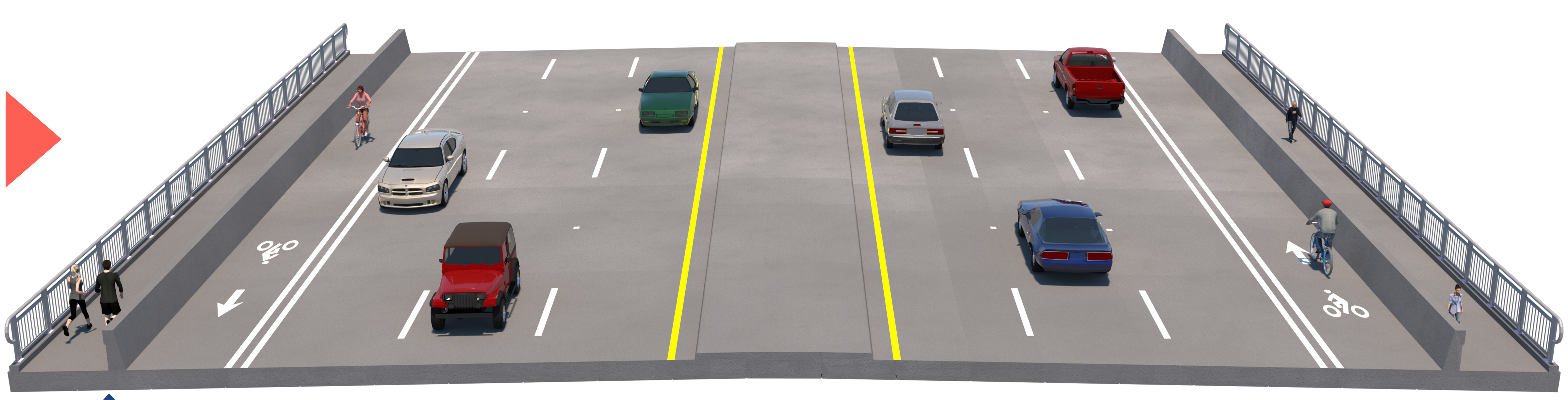
Shift lanes to a split configuration and demolish the middle portion of the existing bridge and construct a new bridge.

PHASE 4



Shift all traffic to the new bridge.
Demolish a portion of the existing bridge and construct a new bridge.

COMPLETE



*Subject to change

ExtremeCase_NorthFetch

Substructure

Summary (factored Loads)

	Lateral Loads	Longitudinal Loads
[redacted]		

Superstructure

Summary (factored Loads)

Lateral Loads

Wave Force Load Factor, γ_W:	1.75
Design Case 1	
Quasi-Static Vertical Force (kip/ft):	25.9
Slamming Vertical Force (kip/ft):	0.3
Total Vertical Force (kip/ft):	26.2
Horizontal Force (kip/ft):	0.4
Moment (kip-ft/ft):	2188.9
Design Case 2	
Quasi-Static Vertical Force (kip/ft):	3.3
Slamming Vertical Force (kip/ft):	0.3
Total Vertical Force (kip/ft):	3.7
Horizontal Force (kip/ft):	1.4
Moment (kip-ft/ft):	66.2
Design Case 3a	
Vertical Force (kip/ft):	0.0
Horizontal Force (kip/ft):	0.2
Design Case 3b	
Vertical Force (kip/ft):	0.0
Horizontal Force (kip/ft):	0.8

Inputs

1a. Lateral Wave Input

Datum:	NAVD
Hs (ft):	7.4
Tp (sec):	4.5
Water Surface Elevation	10.2
Bottom Elevation (ft, Datum):	-8.5
Current Speed (ft/s):	0

1b. Longitudinal Wave Input

Hs (ft):	11.5
Tp (sec):	5.3
Current Speed (ft/s):	0

2. Structure Input

Critical Structure:	Yes
Span Type:	Slab
Coefficients Selection:	21 in. Voided Slab
gW (pcf):	64.3
W (ft):	110.8
W* (ft):	110.8
db (ft):	2
dg (ft):	0
r (ft)	2.25
Pile Cap Height (ft):	1
Deck Elevation (ft, Datum):	9.3
Pedestal (ft):	0
%AIR:	100
Cd, super structure	2.5

Calculation Time Stamp: 9/29/2023 13:22

Lateral

Wsub (ft):	5.5

Longitudinal

Wsub (ft):	45.3

Cd, pile	2
Cm, pile	2.5
A, pile	2.5
V, pile	6.25
n	5
s	9.8

Program Files Location: C:\Users\msadowski\Downloads\LoB\LoB\Function_Files\

ExtremeCase_SouthFetch

Substructure	
Summary (factored Loads)	
[redacted]	

Superstructure	
Summary (factored Loads)	
Lateral Loads	
Wave Force Load Factor, γ_W:	1.75
Design Case 1	
Quasi-Static Vertical Force (kip/ft):	24.3
Slamming Vertical Force (kip/ft):	0.3
Total Vertical Force (kip/ft):	24.6
Horizontal Force (kip/ft):	0.6
Moment (kip-ft/ft):	1997.1
Design Case 2	
Quasi-Static Vertical Force (kip/ft):	5.1
Slamming Vertical Force (kip/ft):	0.3
Total Vertical Force (kip/ft):	5.5
Horizontal Force (kip/ft):	1.4
Moment (kip-ft/ft):	107.8
Design Case 3a	
Vertical Force (kip/ft):	0.0
Horizontal Force (kip/ft):	0.4
Design Case 3b	
Vertical Force (kip/ft):	0.0
Horizontal Force (kip/ft):	0.8

Inputs

1a. Lateral Wave Input

Datum:	NAVD
Hs (ft):	11.5
Tp (sec):	5.3
Water Surface Elevation	10.2
Bottom Elevation (ft, Datum):	-6
Current Speed (ft/s):	0

1b. Longitudinal Wave Input

Hs (ft):	11.5
Tp (sec):	5.3
Current Speed (ft/s):	0

2. Structure Input

Critical Structure:	Yes
Span Type:	Slab
Coefficients Selection:	21 in. Voided Slab
gW (pcf):	64.3
W (ft):	110.8
W* (ft):	110.8
db (ft):	2
dg (ft):	0
r (ft)	2.25
Pile Cap Height (ft):	1
Deck Elevation (ft, Datum):	9.3
Pedestal (ft):	0
%AIR:	100
Cd, super structure	2.5
Lateral	
Wsub (ft):	5.5
Longitudinal	
Wsub (ft):	45.3
Cd, pile	2
Cm, pile	2.5
A, pile	2.5
V, pile	6.25
n	5
s	9.8

Calculation Time Stamp: 9/29/2023 13:20

Program Files Location: C:\Users\msadowski\Downloads\LoB\LoB\Function_Files\

LowChord_NorthFetch

Substructure

Summary (factored Loads)

[redacted]

Superstructure

Summary (factored Loads)

Lateral Loads	
Wave Force Load Factor, γ_W:	1.75
Design Case 1	
Quasi-Static Vertical Force (kip/ft):	15.2
Slamming Vertical Force (kip/ft):	4.7
Total Vertical Force (kip/ft):	19.9
Horizontal Force (kip/ft):	0.2
Moment (kip-ft/ft):	1618.1
Design Case 2	
Quasi-Static Vertical Force (kip/ft):	4.8
Slamming Vertical Force (kip/ft):	4.7
Total Vertical Force (kip/ft):	9.5
Horizontal Force (kip/ft):	2.4
Moment (kip-ft/ft):	270.3
Design Case 3a	
Vertical Force (kip/ft):	0.0
Horizontal Force (kip/ft):	0.1
Design Case 3b	
Vertical Force (kip/ft):	0.0
Horizontal Force (kip/ft):	1.4

Inputs

1a. Lateral Wave Input

Datum:	NAVD
Hs (ft):	6.8
Tp (sec):	4.4
Water Surface Elevation	7.2
Bottom Elevation (ft, Datum):	-8.5
Current Speed (ft/s):	0

1b. Longitudinal Wave Input

Hs (ft):	11.5
Tp (sec):	5.3
Current Speed (ft/s):	0

2. Structure Input

Critical Structure:	Yes
Span Type:	Slab
Coefficients Selection:	21 in. Voided Slab
gW (pcf):	64.3
W (ft):	110.8
W* (ft):	110.8
db (ft):	2
dg (ft):	0
r (ft)	2.25
Pile Cap Height (ft):	1
Deck Elevation (ft, Datum):	9.3
Pedestal (ft):	0
%AIR:	100
Cd, super structure	2.5

Calculation Time Stamp: 9/29/2023 16:34

Lateral

Wsub (ft):	5.5

Longitudinal

Wsub (ft):	45.3
Cd, pile	2
Cm, pile	2.5
A, pile	2.5
V, pile	6.25
n	5
s	9.8

Program Files Location: C:\Users\msadowski\Downloads\LoB\LoB\Function_Files\