



FINAL DESIGN SUBMISSION

National Capital Planning Commission
4 May 2018

Arlington Memorial Bridge Rehabilitation

George Washington Memorial Parkway
National Park Service
U.S. Department of the Interior

NPS Project No. NP-GWMP 11(4), 11(7)
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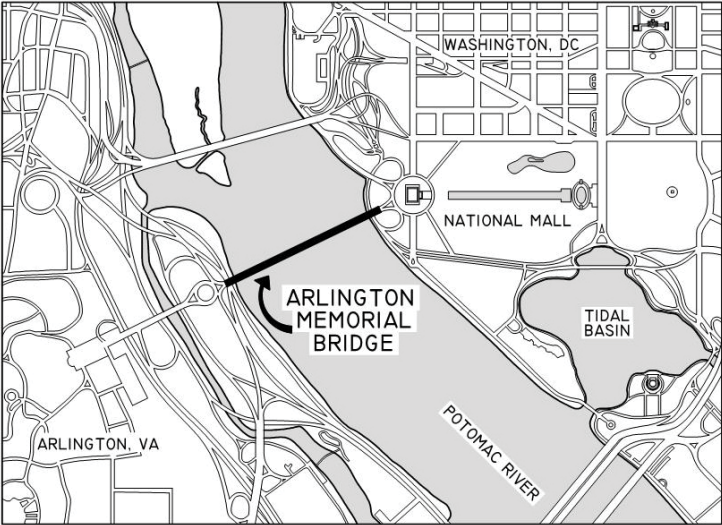


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PROJECT NAME
Arlington Memorial Bridge Rehabilitation

LOCATION
George Washington Memorial Parkway
Washington, DC



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PROJECT SUMMARY



Arlington Memorial Bridge looking east from Arlington Cemetery. Photo: Carol Highsmith, 1980. Library of Congress.

The National Park Service (Department of the Interior) has submitted plans for the rehabilitation of the Arlington Memorial Bridge for final design review. The Arlington Memorial Bridge is a historic structure listed in the National Register of Historic Places for its significant architectural and engineering design as well as its symbolism and place within the Memorial Core of Washington, DC. The bridge, opened to traffic in 1932, was constructed as a memorial to American patriotism and those who have died in military service to the country, as well as a symbolic representation of the reconciliation between the Union and Confederacy following the Civil War by connecting the Lincoln Memorial with Arlington House, the Robert E. Lee Memorial.

The bridge was designed by the famed architectural firm, McKim, Mead & White, and the innovative bascule span was developed by the Strauss Engineering Corporation to fit a working draw span into the monumental design. The bascule span was last opened over 50 years ago. The mechanical equipment and original electrical system is not operational. Modern electrical lines have been installed and are operational.

The Arlington Memorial Bridge (Structure No. 3300-016P) is 2,162 feet long and 94 feet wide. The bridge consists of ten reinforced concrete arch approach spans and a double leaf bascule span at the bridge's center. Eight of the ten approach spans convey the Potomac River under the bridge. Two smaller concrete arches span the George Washington Memorial Parkway (GWMP) and Ohio Drive, SW at each end of the bridge. The bridge has sidewalks on each side measuring 13 feet 9 inches each, and the roadway measures 60 feet from curb to curb, providing six 10-foot-wide vehicle travel lanes.

The double-leaf bascule span consists of riveted steel trusses, supported on riveted steel trunnion posts with the counterweights below the deck. The bascule trusses support a floorbeam/stringer floor system concrete filled grid deck, and pressed metal facade. The main trunnions are spaced 216 feet on center.

There are four cast-in-place deck arch spans, on each approach, leading up to the bascule span. These spans range in length from 166 feet to 180 feet from springline to springline. At the east end, the structure crosses Ohio Drive and at the west end crosses the northbound lanes of GWMP. Each of these spans is constructed as a deck arch with a 50 feet span length from springline to springline followed by the concrete approach frames. The exterior of the longitudinal walls, abutments, and piers are clad with granite ashlar.

The proposed Arlington Memorial Bridge project includes the following elements:

- replacement of the steel bascule span
- rehabilitation and reinstallation of the metal bascule facade
- rehabilitation and reinstallation of the metal bascule railing
- repairs to the deteriorated portions of the abutments, piers, foundations and bearings
- repair of concrete arch approach spans
- replacement of the concrete bridge deck and expansion joints
- resurfacing of the travel lanes
- replacement of the concrete sidewalks and repair/refitting of granite curbs
- repairs to granite bridge railings
- repairs to lamp posts
- repairs to access panels
- installation of an improved drainage system
- repointing and cleaning of granite ashlar, repair and replacement as required
- other minor nonstructural bridge improvements.

The Federal Highway Administration regularly inspects the bridge in accordance with generally recognized structural engineering guidelines and standards. These detailed structural inspections and studies have identified significant amounts of corroded steel and deteriorated concrete. The most critical elements needing repair are the concrete arch approach spans and the steel bascule (drawbridge) span. Therefore, the project is needed to address the ongoing corrosion of steel structural members of the bascule span, deterioration of the concrete on the bridge's approach spans and deterioration of the sidewalks and wearing surface.



Project Summary

NATIONAL PARK SERVICE
U.S. DEPARTMENT OF THE INTERIOR

PROJECT GOALS

Restore the structural integrity of the Arlington Memorial Bridge while protecting and preserving its memorial character and significant design elements.

- The bridge is more than 80 years old and has never undergone a major rehabilitation.
- Comprehensive repairs are needed to ensure its ability to provide adequate traffic service for decades to come.

Rehabilitate the bridge as a commemorative work, important regional transportation connection and significant gateway to the nation’s capital.

- As part of the National Highway System, it carries more than 62,000 vehicles each day.
- The bridge is only one of five that connect Virginia with the District of Columbia.
- The bridge is identified as a vital route in the Washington DC evacuation plan.

Replace the bascule span with new span comprised of variable depth steel girders to balance historic preservation goals with constructibility, maintenance and cost.

- Reflects the original bascule design in its form and the use of steel, without attempting to recreate the historic design.
- Girder shape echoes the original arch of the bascule.
- Variable depth girders would require less effort to maintain due to the reduced number of structural elements and joints.

Minimize the extent and duration of full bridge and/or partial lane closures and overall disruption to traffic during construction.

- Closures are likely to temporarily increase traffic congestion and delays throughout the regional transportation network during construction.

Minimize future maintenance requirements and associated costs

- The design for the new bascule span will allow access for proper maintenance.



Project Goals

NATIONAL PARK SERVICE
U.S. DEPARTMENT OF THE INTERIOR

PART 1: PROJECT REPORT

1.1 PROJECT DATA

Project Area

The Arlington Memorial Bridge spans the Potomac River, connecting Lincoln Memorial Circle with the Memorial Circle on Columbia Island (officially renamed Lady Bird Johnson Park in 1968) in Washington, DC. Further west, the bridge provides access to Memorial Avenue and the ceremonial entrance to Arlington National Cemetery within the Commonwealth of Virginia. The project area for the proposed rehabilitation of the Arlington Memorial Bridge consists of the bridge and surrounding roadways, construction staging areas in the vicinity of the bridge, and the Potomac River channel and shorelines, approximately 1,400 feet upstream and 2,100 feet downstream of the bridge.

Schedule

The project is scheduled to begin immediate repairs in May 2018 with an estimated two-and-a-half year period of construction occurring in two phases. Project milestones include:

Immediate Repairs Start	May 2018
Functional Office/Yard	Aug. 2018
Phase 1 Mgmt of Transportation (MOT) Set-Up	Sept. 2018
Begin Phase 1 Demo Work	Oct. 2018
Begin Phase 1 Precast Set	Jan. 2019
Begin Phase 1 Bascule Girder Install	May 2019
Phase 1 Reconstruction Complete	Oct. 2019
Begin Phase 2 Demo Work	Nov. 2019
Begin Phase 2 Precast Set	Jan. 2020
Begin Phase 2 Bascule Girder Install	June 2020
Phase 2 Reconstruction Complete	Oct. 2020

1.2 PROJECT NARRATIVE

The purpose of the project is to restore the structural integrity of the Arlington Memorial Bridge while protecting and preserving its memorial character and significant design elements. The bridge rehabilitation will be executed in accordance with the *Secretary of the Interior’s Standards for the Treatment of Historic Properties* and specifically the Standards for Rehabilitation.

The Arlington Memorial Bridge requires a comprehensive rehabilitation to address a wide range of deterioration and structural deficiencies. The final design works to preserve the greatest amount of original material possible while balancing cost, constructibility and the necessary replacement of severely deteriorated elements.

The proposed rehabilitation includes:

- replacement of the steel bascule span
- rehabilitation and reinstallation of the metal bascule facade
- rehabilitation and reinstallation of the metal bascule railing
- repairs to the deteriorated portions of the abutments, piers, foundations and bearings
- repair of concrete arch approach spans
- replacement of the concrete bridge deck and expansion joints
- resurfacing of the travel lanes
- replacement of the concrete sidewalks and repair/refitting of granite curbs
- repairs to granite bridge railings
- repairs to lamp posts
- repairs to access panels
- installation of improved drainage system
- repointing and cleaning of granite ashlar, repair and replacement as required
- other minor nonstructural bridge improvements.

Existing Context

The Arlington Memorial Bridge spans the Potomac River connecting Lincoln Memorial Circle with Memorial Circle on Columbia Island. The axis of the bridge, which is angled southwesterly from the east-west Mall axis, is carried on Memorial Avenue across the Boundary Channel Bridge to the Virginia shore where it terminates at the grand renaissance gateway to Arlington National Cemetery and now the location of the Women in Military Service for America Memorial.

An important element in the neoclassical urban design of the National Capital as it evolved during the early 20th century, the Arlington Memorial Bridge has been defined as the final link in the chain of monuments that begins at the Capitol building, and connects the National Mall in Washington, DC with Arlington National Cemetery in Virginia. The bridge was designed to connect, both physically and symbolically, the North and the South on the axis between the Lincoln Memorial and Arlington House, the Robert E. Lee Memorial.

The bridge also crosses the Mount Vernon Trail and the George Washington Memorial Parkway on Columbia Island between the Potomac River and the Boundary Channel, which marks the boundary between the District of Columbia and the Commonwealth of Virginia.

The bridge continues to provide access across the Potomac River for vehicular travel with connections to several heavily traveled roadways in the area. The bridge also provides a crossing for pedestrians and bicyclists on the bridge’s wide sidewalks, provides access to the Mount Vernon Trail, and has been used for many large scale events throughout the years such as parades, marathons, and funeral processions. Ferries, water taxis, dinner cruises, tour boats, private recreational watercraft, and rowers on the Potomac River pass under the bridge to access areas upstream and downstream.

Development History

Construction of the Arlington Memorial Bridge was begun in 1926 and opened for use on January 18, 1932. The bridge is a major element of the system of public buildings, parks, memorials, bridges, and drives that constitutes the memorial core of Washington, D.C. The bridge extends the grandeur and processional qualities of the Mall across the Potomac River by both physically and visually uniting the Lincoln Memorial with Arlington National Cemetery.

While the idea for a bridge over the Potomac River was first proposed during President Andrew Jackson’s presidency and the land purchased for the approaches by an Act of Congress in 1832, it would take a century to plan and build the Arlington Memorial Bridge.

The Memorial Bridge reflects the original intention of the McMillan Commission Plan of 1902 which guided the development of the monumental core of our nation’s capital. The Memorial Bridge was one part of a larger project to construct a formal connection and entrance to Arlington National Cemetery, a connection to the Mount Vernon (now George Washington) Memorial Parkway, an attractive Washington shoreline with a formal entrance to Rock Creek and Potomac Parkway, and a watergate for formal entry to the city from a vessel. The Arlington Memorial Bridge Commission was established in 1913 to oversee the planning and construction which took nearly two decades.

The bridge was listed in the National Register of Historic Places in 1980 for its architectural significance and innovative engineering.



Project Report

NATIONAL PARK SERVICE

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Bridge Design

The Memorial Bridge was designed by William Mitchell Kendall while employed by McKim, Mead & White, a prominent architectural firm based in New York City. Kendall designed the bridge in the neoclassical style to complement the other monumental buildings in Washington, DC. The bridge consists of 10 reinforced concrete arch spans and a double leaf bascule span at the bridge’s center that is uniquely disguised to hide the working mechanisms of the draw span for aesthetic reasons.

The concrete arches are dressed with granite ashlar from the Mount Airy Quarry in North Carolina. Each side of each of the piers and central abutments feature sculpted granite, bas-relief eagle and fasces ornamentation designed by sculptor C. Paul Jennewein. The keystone of each concrete arch is decorated with an approximately 6-foot-tall bison head sculpted by Alexander Phimister Proctor, a renowned American western artist.

Two gilded-bronze equestrian statues entitled *The Arts of War: Sacrifice and Valor*, by American sculptor Leo Friedlander, are mounted on matching pedestals that flank the Washington entrance. These statues, along with the adjacent Rock Creek and Potomac Parkway terminus and the Watergate steps, join with the bridge in constituting a formal western terminus of the National Mall at the edge of the Potomac River.

The bridge’s railing is comprised of ornate, granite balusters and railings. For structural reasons, the bascule span’s railing consists of cast aluminum balusters, bases, and railings shaped to match those of granite on the fixed spans. The roadway and sidewalks are illuminated at night by 40 electric street lamps, four on each river span and two on each roadway span. The current lampposts are replicas of the original ones, which were a standard design by Francis D. Millet that is extensively used throughout Washington, DC.

Bascule Span Design

The decision to include a draw span on the bridge was one of the most controversial aspects of the bridge design. Despite continual decreases in the amount of large ships navigating upriver to Georgetown and despite the fact that the US Army Corps of Engineers wanted to construct a higher bridge to allow large ships to pass without the need to open the bridge, the Arlington Memorial Bridge Commission decided that a draw span was necessary to maintain the bridge’s aesthetics while allowing for the passage of ships. Following a design competition, the Arlington Memorial Bridge Commission selected the Strauss Engineering Company (formerly the J.B. Strauss Bascule Bridge Company) to design the bascule span with the Phoenix Bridge Company as the builder.

The Arlington Memorial Bridge’s bascule span, or draw span, is a movable steel truss span with two leafs that meet centrally over the navigation channel. The bascule span is faced with pressed ornamental molybdenum steel and painted to blend with the concrete arch spans. At 216 feet, it was once the longest draw span in the world, as well as the heaviest and the fastest. Counterweights, each weighing 2,400 tons and consisting of concrete, iron ore, and steel punchings, are concealed in the abutments under the bridge. When the bascule span was operable, the counterweights were used to pivot each leaf upward. Each leaf consists of two main steel trusses that are supported by an axle, or trunnion, that rests on trunnion posts, which carry the load of the bridge down to the bridge abutments. The Arlington Memorial Bridge was the first of its kind to have all of the components of the bascule span that allowed it to rise concealed under the bridge and in the span’s abutments.

During its period of active operation between 1932 and 1961, the bascule span was opened to provide access for large ships to the Georgetown waterfront. Due to decreased shipping traffic on the Potomac River and the later downstream construction of a fixed, low-clearance bridge (currently the 14th Street Bridge Complex), the bascule span was permanently fixed in the closed position in 1965.

Comprehensive Plan for the National Capital

The rehabilitation of the Arlington Memorial Bridge is generally consistent with the Federal Elements of the Comprehensive Plan. The project meets basic goals of the Plan, and in particular those policies related to Urban Design, Transportation and Visitors & Commemoration. Overall, the project is necessary to preserve and protect a vital historic resource and transportation infrastructure, and the proposed design appropriately balances the effect on historic resources with impacts to transportation and urban design, while considering short- and long-term costs.

Temporary Repairs

Emergency repairs done in 2010-11 include the construction of temporary bridges spanning over the deteriorated sidewalk areas in the fixed portion of the bascule span. Additional temporary repairs were performed in 2015 to the concrete bearing seats along the back edge of each bascule abutment, the stringers and truss members under the curbs, the steel columns that support the counterweights, and roadway and sidewalk decks. Emergency repair work is ongoing to shore corroded steel members within the bascule span.

Need for Action

The bridge is administered and maintained by the George Washington Memorial Parkway, a unit of the National Park Service (NPS). Federal Highway Administration (FHWA) has performed scheduled routine inspections of the bridge, including underwater examinations of the bridge piers, since 1978. According to NPS and FHWA, the most recent bridge inspection was performed in 2015, and determined that the “existing structure steel trusses in the bascule span were found to be deteriorating much more rapidly than expected.” NPS, at the recommendation of FHWA, has posted load limits on the bridge which will remain in effect until the rehabilitation project is completed. Further restrictions or limitations, including closures, may be necessary in the future.

Visitor Use and Experience

The Arlington Memorial Bridge is a significant link between the National Mall and Arlington National Cemetery. The bridge is used for many large scale events such as parades, marathons, and funeral processions. From the Arlington Memorial Bridge, visitors are provided the opportunity for scenic views of the Potomac River, Lincoln Memorial, Washington Monument, Arlington House, the Kennedy Center, Theodore Roosevelt Island, Theodore Roosevelt Memorial Bridge, and others. Conversely, the Arlington Memorial Bridge itself is highly visible and is a prominent feature of the District of Columbia’s monumental core, which can be observed from these resources and from numerous other vantage points in Arlington County and the District of Columbia. Beneath the bridge, the Potomac River is used by water taxis, cruise ships, and crew teams.

Rehabilitation of the Arlington Memorial Bridge will require closures that will temporarily disrupt visitor use and experience. During construction, bridge closures will temporarily limit pedestrian and bicycle access, which will disrupt the connectivity between the National Mall and the Arlington National Cemetery. (Refer to pages 29-30 for Bicycle & Pedestrian Detour Plan.) Furthermore, construction activities will temporarily diminish the aesthetics of the bridge, scenic views to the bridge, and eliminate opportunities for scenic views from the bridge. Potomac River users will be required to maintain a safe distance from construction activities, and will be restricted from travel beneath the bridge.



Project Report

NATIONAL PARK SERVICE
U.S. DEPARTMENT OF THE INTERIOR

2.0 TRANSPORTATION MANAGEMENT PROGRAM

The Arlington Memorial Bridge provides a connection between several heavily traveled roadways including the George Washington Memorial Parkway, Washington Boulevard (VA-27), Jefferson Davis Highway (VA-110), Independence Avenue, and others. On average, approximately 62,000 vehicles crossed the bridge each day in 2018. The bridge also provides a favorable route for pedestrians and bicyclists. Long-term lane closures and occasional short-term detours will be required during rehabilitation of the bridge, which will be disruptive to local and regional vehicular traffic. Vehicles are likely to use other bridges to cross the Potomac River. Consequently, traffic volumes and delay times, particularly during peak travel periods, are projected to increase along detour routes at the other Potomac River crossings. During much of the construction period, one of the sidewalks on the bridge will also need to be closed. However, when such sidewalk closures are required, the other sidewalk on the bridge will remain open. Due to the temporary impacts of construction on local and regional roadways and on pedestrians and bicyclists, a Transportation Management Plan has been developed. This document will clearly identify the stages of construction and the steps to be taken to minimize inconvenience for vehicular, pedestrian and bicycle users during construction.

Once construction is completed, the bridge’s vehicular capacity will return to its current level with six travel lanes in place. Sidewalks on both sides of the bridge will also be reopened. Rehabilitation of the bridge will ensure that the bridge is available for vehicles, pedestrians, and bicycles for 75+ additional years. Therefore, this rehabilitation will have a long-term beneficial impact to traffic and transportation.

3.0 ENVIRONMENTAL DOCUMENTATION

NEPA Compliance

The National Park Service (NPS) National Capital Regional Office and the George Washington Memorial Parkway Division has prepared an Environmental Assessment (EA), and NCPC is a cooperating agency for compliance with the National Environmental Policy Act of 1969 (NEPA).

NPS released the EA on April 13, 2016 for public comment. The EA evaluates a no action and four action alternatives (Alternatives 1A, 1B, 2 and 3). Alternative 1B was selected as the NPS-preferred alternative, and has been developed as the final proposed design.

The process was completed in February 2017, resulting in a Final Environmental Assessment (EA) and a signed Finding of No Significant Impacts (FONSI).

4.0 HISTORIC PRESERVATION DOCUMENTATION

Section 106 Compliance

The NCPC designated the NPS as the lead federal agency to fulfill its responsibilities under Section 106 of the National Historic Preservation Act of 1966, as amended. The NPS held NEPA Scoping and Section 106 consultation meetings on April 23, 2013 and April 25, 2013 to inform the public and consulting parties about the project and solicit input. Subsequently, the NPS held Section 106 consultation meetings on September 30, 2013, April 20, 2016, and August 31, 2016. Following an adverse effect determination made in consultation with the District of Columbia Historic Preservation Office (DC SHPO) and Virginia Department of Historic Resources (VA SHPO), a Programmatic Agreement (PA) was prepared and signed on February 14, 2017. The PA for the Arlington Memorial Bridge Rehabilitation Project will remain in effect for a period of 15 years.

5.0 FLOOD PLAINS MANAGEMENT AND WETLANDS PROTECTION

No Impact on Floodplain

Based on a review of FEMA (Federal Emergency Management Agency) Flood Insurance Rate Maps, floodplains are found within 200 feet of Potomac River shores, and in low lying areas surrounding the Lincoln Memorial. The bridge is in Zone AE and is mapped on Flood Insurance Rate Map panel 1100010018C, effective September 27, 2010. The 100-year flood elevation is approximately 13 feet NAVD88 (North American Vertical Datum of 1988) and the 500 year is approximately 17 feet NAVD88.

Construction activities associated with the bridge rehabilitation will not have a measurable effect on the frequency, elevation, intensity, or duration of floods nor will it impact floodplain function. During construction there will be a slight temporary modification to the floodplain due to the addition of falsework adjacent to the bascule span, which will be in place for approximately two to three months. The addition of this structure will result in a negligible change to the ability of the floodplain to convey floodwaters and will not contribute to flooding.

Wetlands Protection

Wetlands associated with this project area are limited to the riverine habitat within the Potomac River below the mean high water line. The Potomac River is considered a riverine wetland, specifically Riverine Tidal Unconsolidated Bottom Vegetated (R1UBV) (USDOI 1979). The riverine system includes both wetland and deep water habitat. The boundary between wetland and deep water habitat in the riverine systems lies at a depth of 6.6 feet below low water (USDOI 1979).

The activity of rehabilitating the bridge will result in unavoidable impacts to 15.4 acres of riverine wetlands (7.4 acres of submerged aquatic vegetation and to 8.0 acres of unconsolidated bottom wetlands). The construction contractor will be required to minimize impacts to wetlands where feasible, and construction methodologies will need to be approved by the National Park Service and the Federal Highway Administration.

6.0 ADDITIONAL AGENCY REVIEW SUMMARY

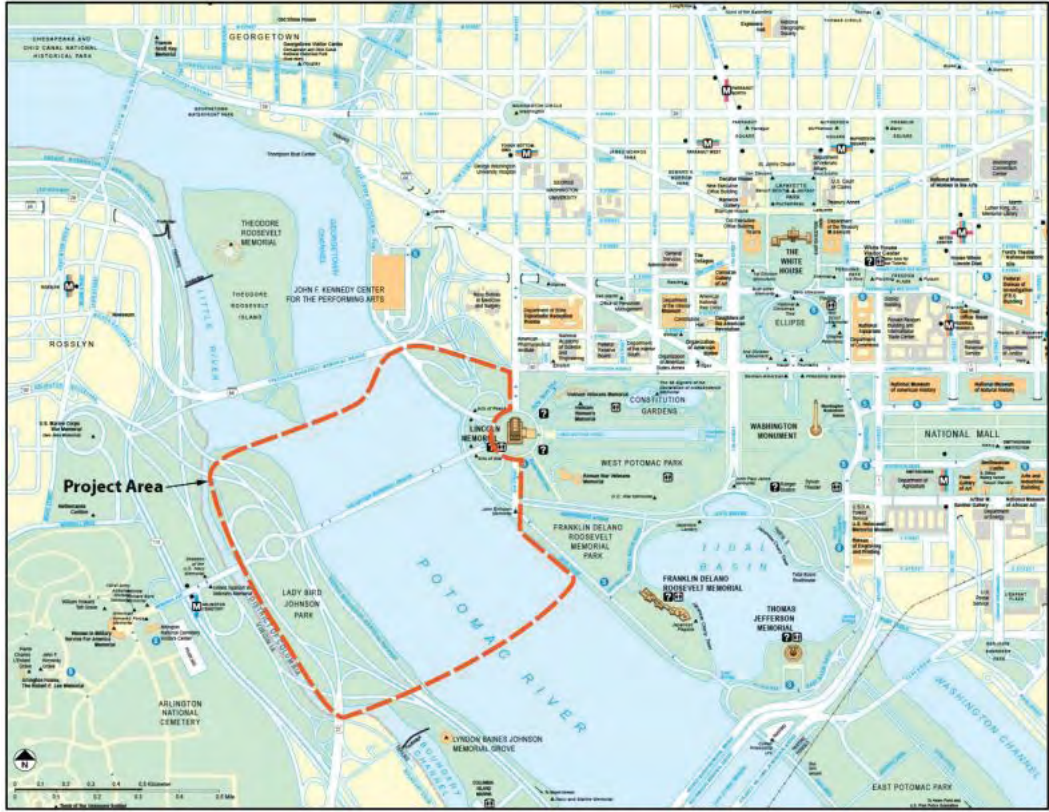
National Capital Planning Commission (NCPC)

The National Capital Planning Commission (NCPC) reviewed the Arlington Memorial Bridge rehabilitation project on May 5, 2016, and approved the concept plans for Alternative 1B.

US Commission of Fine Arts (CFA)

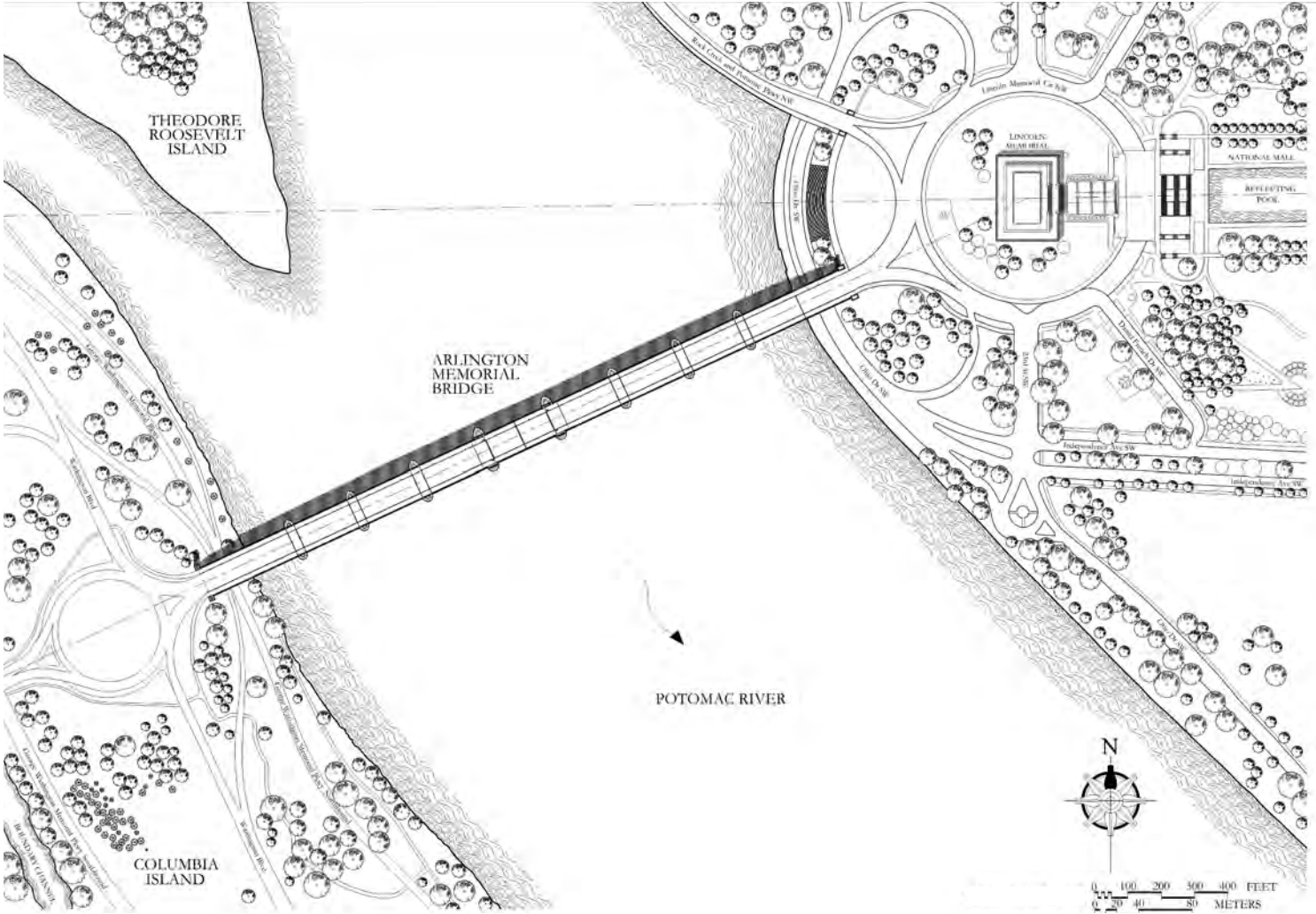
The US Commission of Fine Arts (CFA) reviewed the Arlington Memorial Bridge rehabilitation project on April 21, 2016, and approved the concept plans for Alternative 1B.





VICINITY MAP

--- PROJECT AREA/LIMIT OF DISTURBANCE



CONTEXT MAP

Credit: NPS Historic American Engineering Record, HAER No. DC-7, 2014





Northeastern view from George Washington Memorial Parkway
Credit: Quinn Evans Architects



View looking west toward Arlington Memorial Cemetery
Credit: Quinn Evans Architects



Southern view from Kennedy Center roof terrace
Credit: Quinn Evans Architects



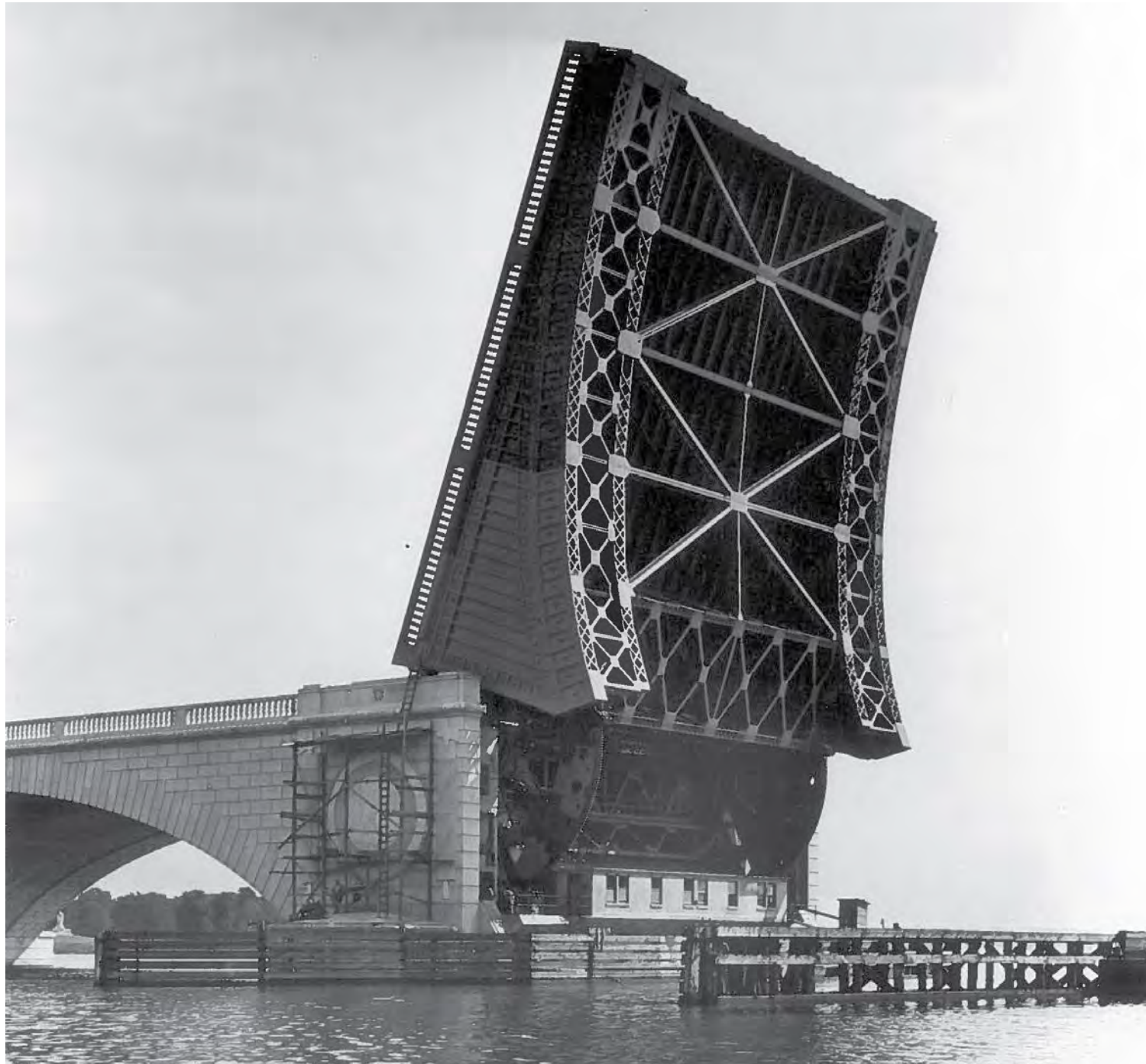
View looking east toward Lincoln Memorial.
Credit: Jack Boucher, NPS, 1991. Library of Congress





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*The east bascule leaf shortly before the completion in 1931.
Credit: NPS. Reproduced in AMB HSR, 1986.*

Bridge History

- A bridge in this location was first proposed in the 1830s.
- McMillan Commission ultimately developed the Senate Park Commission Plan of 1901 and included a memorial bridge in the location that the Arlington Memorial Bridge was ultimately constructed.
- Architects McKim, Mead & White were selected in early 1923.
- Bridge completed in 1932.
- Symbolically links North and South in its alignment between the Lincoln Memorial and Arlington House, the Robert E. Lee Memorial.
- Placed on the National Register of Historic Places in 1980.

Bridge Significance

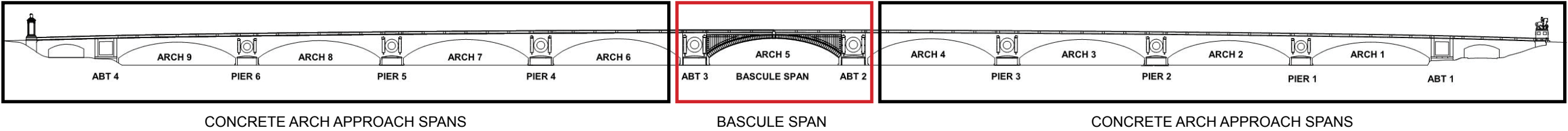
- The location contributes to conveying the significance of the bridge as a part of the monumental core of Washington, DC and is central to establishing the memorial relationship between the Lincoln Memorial and Arlington National Cemetery.
- The design retains a high level of integrity -- both from the standpoint of its architectural composition and its engineering.
- The bridge is an important part of a larger ensemble of natural and man-made features that make up a historically significant and evolving cultural landscape.
- The bridge is part of an important transportation and recreation network in the region.
- The bridge retains almost all of its historic materials from the original period of construction.
- A high level of craft is exhibited in the decorative stone carving in the ornamental granite and statues, as well as considerable workmanship associated with the construction of the bascule span.
- The bridge possesses strong integrity of feeling related to its historic aesthetic from the original period of construction.
- The bridge maintains its association with the memorial core in Washington as part of a "grand promenade" that leaves Lincoln Circle and passes over the bridge and down Memorial Avenue to the Cemetery gates.



Bridge History & Significance

NATIONAL PARK SERVICE

U.S. DEPARTMENT OF THE INTERIOR



South Elevation looking North. Credit: Nathan Holth, courtesy HistoricBridges.org

The Arlington Memorial Bridge is 2,162 feet long and 94 feet wide and consists of ten reinforced concrete arch approach spans and a double leaf bascule span at the bridge's center. Eight of the ten approach spans convey the Potomac River under the bridge. Two smaller concrete arches span the GWMP, SW at each end of the bridge.

The roadway's crown rises from 33'-9" above the water at each end to 45' above the water at the center of the bascule span. To maintain attractive proportions, the main arches increase from 166' to 180' in length and from 32'-6 3/4" to 37'-4 1/2" above the water (at keystones) toward the center, with the central bascule span measuring 184' long and 37'-6" above the water. The two 50'-wide arches spanning shoreline roads are proportioned to suit clearance requirements.

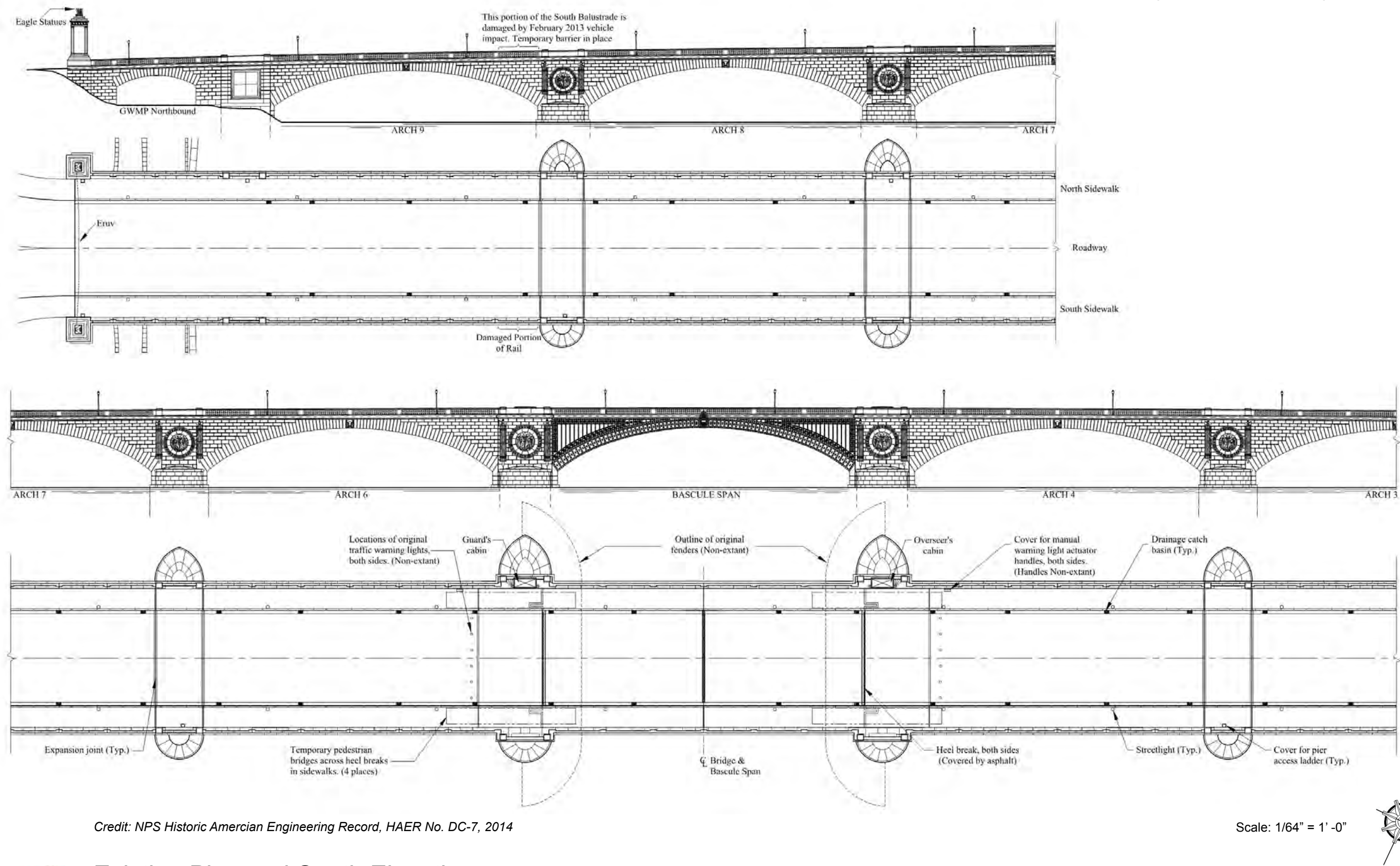
The bridge carries a six-lane, 60'-wide roadway and a 15'-wide sidewalk on each side. The bascule span remained in operation from 1932 to 1961, and it was permanently closed and made inoperable in 1965.

- Character-defining elements of the bridge include:**
- Granite facing on the concrete arch spans
 - Carved granite pier medallions
 - Cast-in-place concrete forming the underside of the arches
 - Granite abutments
 - Granite balustrade including balusters, piers and benches
 - Exposed aggregate sidewalks and granite curbing
 - Guard's Cabin and Overseer's Cabin and associated elements including doors, windows, and circular staircases
 - Ornamental steel fascia panels painted to blend in with the concrete arch spans
 - Cast aluminum keystone on the bascule span
 - Cast aluminum balustrade on the bascule span
 - Bascule span steel structure including the fascia trusses, main trusses, transverse floor beams, bottom lateral bracing, top lateral bracing, and out and inner trunnion posts

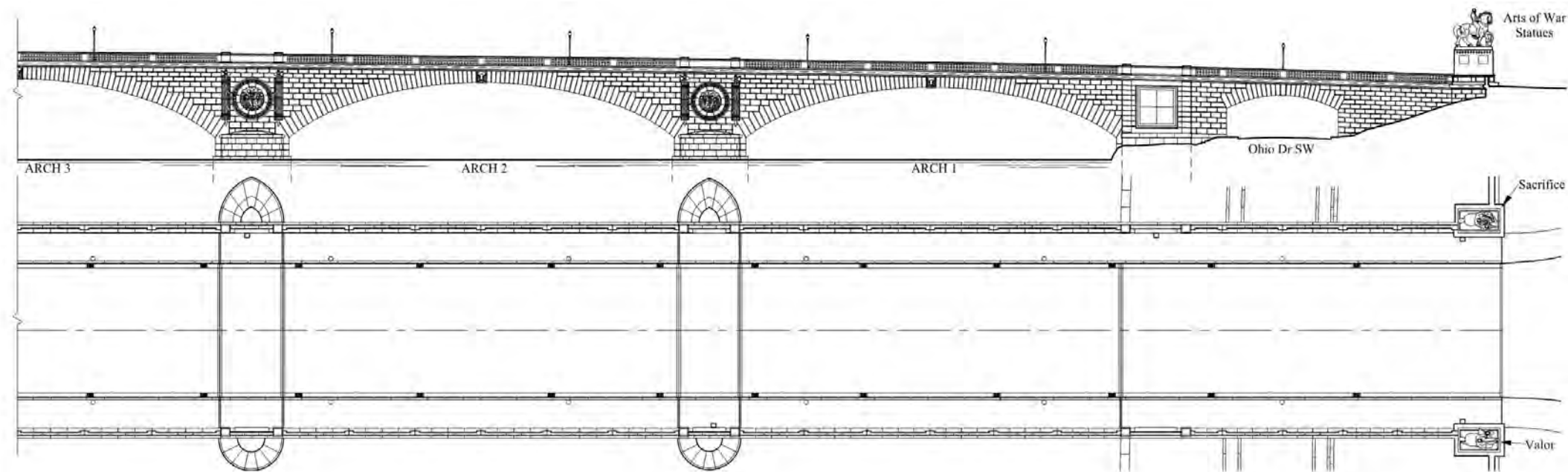
- Bascule span counterweights and operating machinery
- Bascule span Machinery Room and Control Room and associated equipment
- Arts of War Statues - "Sacrifice" and "Valor" and associated granite-clad pedestals
- Eagle and Column Statues and associated granite-clad pedestals
- Cast iron light standards



Existing Conditions
Arlington Memorial Bridge Rehabilitation



Existing Plan and South Elevation
NATIONAL PARK SERVICE
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Credit: NPS Historic American Engineering Record, HAER No. DC-7, 2014

Scale: 1/64" = 1' -0"





Granite facing on the concrete arch spans and cast-in-place concrete forming the underside of the approach span arches. Credit: Nathan Holth, courtesy HistoricBridges.org



Carved granite eagle medallion & fasces
Credit: Nathan Holth, courtesy HistoricBridges.org



Exposed aggregate sidewalk and granite curbing
Credit: Quinn Evans Architects



Granite bench seats. Credit: Quinn Evans Architects



Granite balustrade. Credit: Quinn Evans Architects



Existing Concrete Arch Approach Spans

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The bascule trusses on both sides are faced with ornamental steel fascia panels with decorative cast aluminum stars and buttons
Credit: Nathan Holth, courtesy HistoricBridges.org



A cast aluminum cartouche sits at the center of the bascule span, flanked by red and green navigator lights
Credit: Nathan Holth, courtesy HistoricBridges.org





View of bascule span steel structure and east side of Abutment 3 including operating machinery room. Credit: Kiewit



View of bascule span steel structure and west side of Abutment 2 including operating machinery room. Credit: Federal Highway Administration

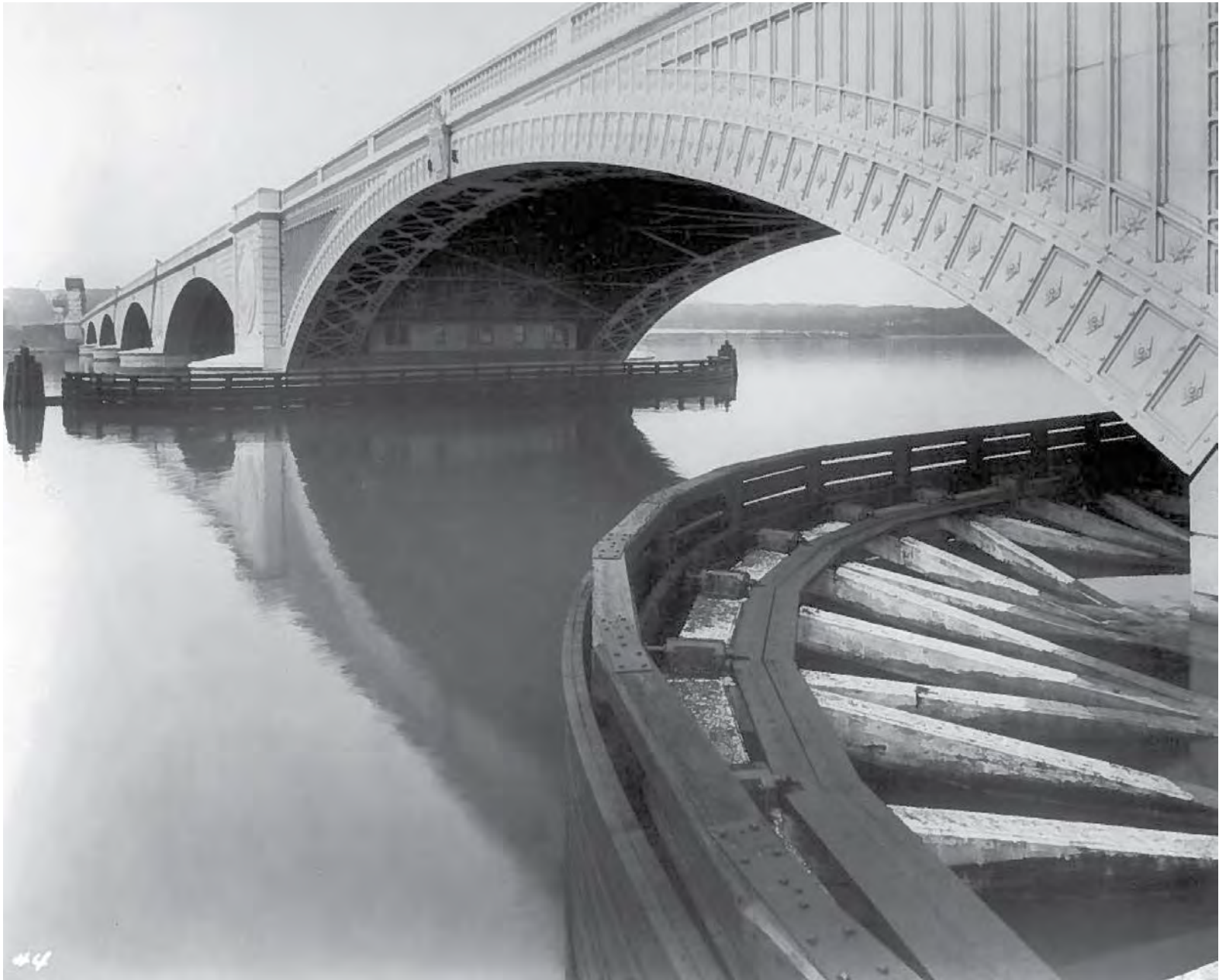


Aluminum balustrade. Credit: Quinn Evans Architects



Transverse floor beams and bottom lateral bracing of the bascule span Credit: Library of Congress. Jet Lowe, Historic American Engineering Record, 1991.





View of the bascule span in the foreground and concrete arch spans beyond. This photograph, taken in 1931, shows the original abutment fenders and underside of the bottom lateral bracing between the main and fascia trusses. The original fenders are no longer extant and have been replaced.
Credit: National Archives, 42-AMB-1-2, as reproduced in AMB HSR, 1986.



An undated photograph of the bascule span in the open position.
Credit: Library of Congress



An undated photograph of the bascule span under construction
Credit: Library of Congress



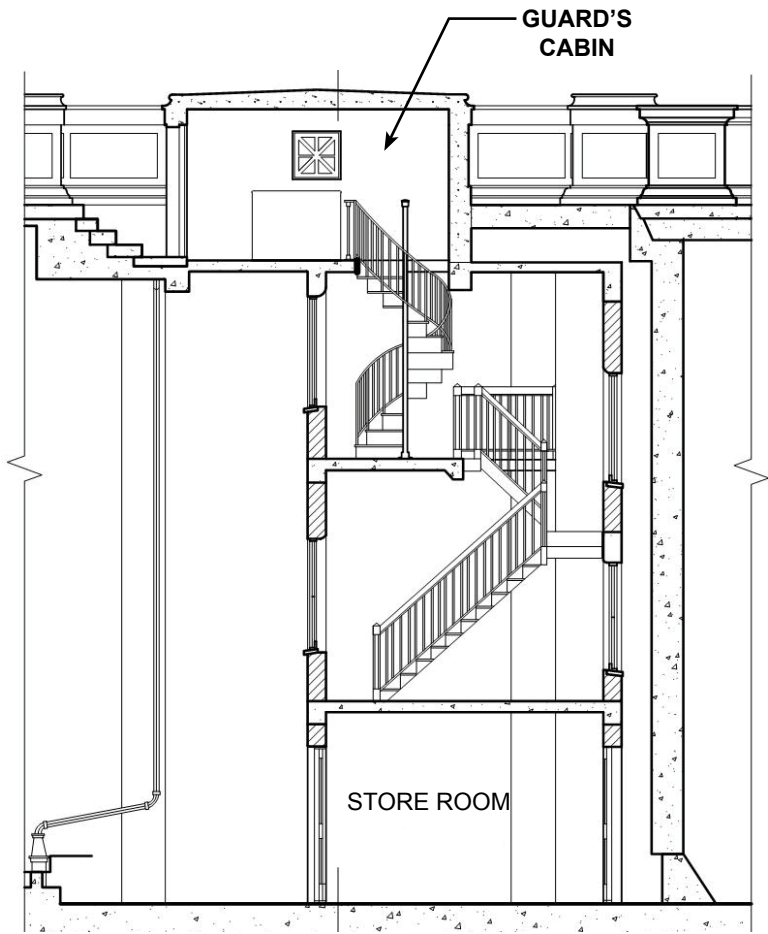
Bascule Span - Historic Images

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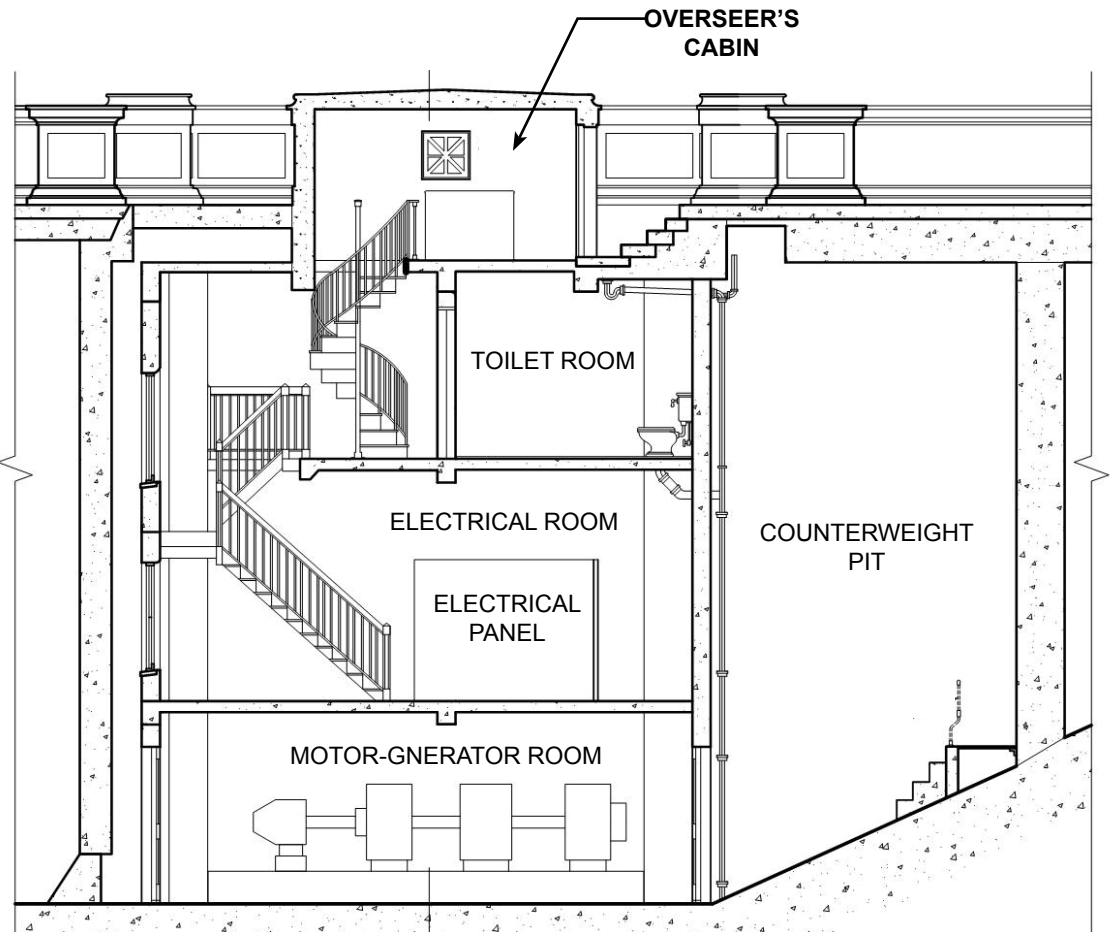


The existing bird nesting and dropping control system is installed at the entire underside of the bascule span along the underside of the existing trusses. The mesh density is 1" x 1" at a 45 degree angle hung using metal pipes. Existing bridge inspection methods involve removal of the bird netting to inspect the bridge elements from a boat lift.





ABUTMENT 3 - SECTION THROUGH GUARD'S CABIN



ABUTMENT 2 - SECTION THROUGH OVERSEER'S CABIN

ROOF OF GUARD'S CABIN (NORTH SIDE)



ABUTMENT 3

BASCULE SPAN

SOUTH SIDE ELEVATION SHOWN. NORTH SIDE IS MIRROR IMAGE
Credit: NPS Historic American Engineering Record, HAER No. DC-7, 2014

ROOF OF OVERSEER'S CABIN (NORTH SIDE)



ABUTMENT 2





Arts of War Statue - Valor (South)
Not shown - Arts of War Statue - Sacrifice (North)

The statues were executed by Leo Friedlander. The pylons were in place when the bridge opened, but the Great Depression and World War II canceled funding for the statues. Following World War II, the Italian government cast the two gilded-bronze statues as a gift from Italy to America. They were the last elements of the bridge to be installed in 1951.

Credit: Quinn Evans Architects



Eagle and Column (South)
North eagle and column is a mirror image of the south

The eagles were carved by C. Paul Jennewein and the columns were designed by William Mitchell Kendall. These were in place when the bridge opened in 1932. A wire between the two stone eagles comprises part of the *eruv* that marks the limit of the Washington domain for orthodox Jews.

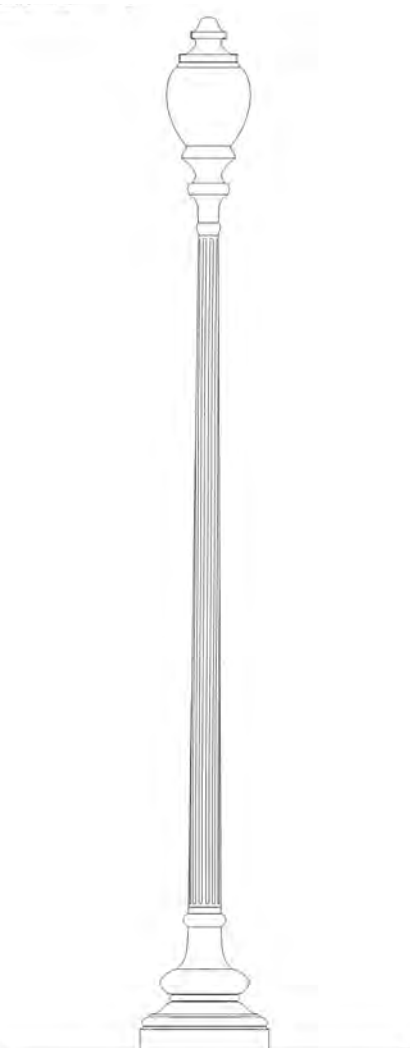
Credit: Quinn Evans Architects



Cast iron lamp post

The forty 15'-high lamp posts are replicas of the original ones, which were a standard used throughout the city of Washington, designed by Francis D. Millet.

Photo Credit: Quinn Evans Architects
Drawing Credit: Sheet 12, HAER DC-7, Provided courtesy of NPS, Historic American Engineering Record, 2013



Existing Statuary & Light Standards

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South Staging Area and Barge Staging Area

Description

The South Staging Area is the land-based staging area designed to serve a Barge Staging Area. The South Staging Area will be located along the west shore of the Potomac River, south of the Arlington Memorial Bridge, encompassing approximately 1.62 acres (refer to site plan on page 27). The Barge Staging Area will be further off-shore and in deeper waters of the Potomac River. A pier barge will connect the South Staging Area and Barge Staging Area. The pier barge will remain fixed in place during construction and secured with multiple spud piles. This configuration has been updated from that shown in the EA report and will eliminate the need for the previously anticipated dredging, lowering impacts to submerged aquatic vegetation (SAV).

The South Staging Area will include a steel ramp which will connect to the pier barge to access the Barge Staging Area, a temporary acceleration/deceleration lane to provide access to the George Washington Memorial Parkway, a temporary access road from the acceleration/deceleration lane to the steel ramp, and a parking area. Fill will be utilized to level the South Staging Area. The steel ramp spans from the bank to the pier barge and is hinged at the pier barge, thereby avoiding disturbances to the shoreline and riverbed. The acceleration/deceleration lane will be constructed with asphalt and will provide entrance and exit from the South staging area. Access to the pier barge will require crossing the Mount Vernon Trail.

The South Staging Area will be located in and temporarily impact the 100-year floodplain (refer to floodplain map on page 26). However, the use of the South Staging Area, in concert with the Barge Staging Area, would eliminate the need for the development and use of the previously proposed Barge Staging Area 2 north of Arlington Memorial Bridge along the west shore of the Potomac (Environmental Assessment page 53, 57), reducing anticipated impacts to the floodplain and submerged aquatic vegetation (SAV).

Benefits Summary

- Eliminates dredging
- Reduced impacts to submerged aquatic vegetation (SAV)

Impacts Summary

- Construction of the South Staging Area may increase water quality impacts due to erosion
- Temporary use of parkland
- Temporary floodplain impacts
- Construction vehicles crossing Mount Vernon Trail may impact visitor use and experience
- Construction equipment exit/entrance onto the George Washington Memorial Parkway may cause transportation and safety impacts

Mitigation Summary

- Erosion and sediment control measures will be put in place at the land-based staging areas to minimize runoff of sediments (Environmental Assessment page 58, FONSI Appendix A, page 11)
- Restoration of the areas to pre-construction elevations and re-establishing submerged aquatic vegetation in the areas previously colonized. (Environmental Assessment page 58, FONSI Appendix A, page 11)
- Tree and vegetation protection will be provided
- Signage and flaggers will be used to safely direct vehicles through the construction zone and into proper lanes
- Flaggers will be stationed at the trail crossing and entrance to George Washington Memorial Parkway (South Staging Area Plans) when tractor trailers are exiting
- Signage and fencing will be used to keep passersby and wildlife out of construction areas (Environmental Assessment page 59, FONSI Appendix A, page 12)
- 8'-0" stockade wood fencing will provide screening for the staging area.

Staging Area B

Description

Staging Area B is located west of the Potomac River in an area south of Memorial Circle between Washington Boulevard and South Washington Boulevard (refer to site plan on page 28). The location of Staging Area B was identified in the EA with an estimate of approximately 2.4 acres of disturbed area (Environmental Assessment page 54). Staging Area B will be the primary staging area and the location of the office trailers for the Design Build team and FHWA. The area will also include parking, laydown areas for tools, materials and equipment, and a maintenance area.

Staging Area B will be modified slightly from its proposed configuration in the EA. An acceleration lane onto Washington Boulevard and a deceleration lane off of South Washington Boulevard have been added to Staging Area B. The acceleration/ deceleration lanes will be constructed with asphalt and will provide entrance and exit from the staging area. These additional changes to Staging Area B will increase the total disturbed area to 2.73 acres and would temporarily increase impacts to the floodplain in this area (refer to floodplain map on page 26).

Impacts of the changes to Staging Area B location

- Construction equipment exit/entrance onto the George Washington Memorial Parkway may cause transportation and safety impacts
- Temporary floodplain impacts

Mitigation Summary

- Signage will be used to safely direct vehicles through the construction zone and into proper lanes into and out of the staging area
- Erosion and sediment control measures will be put in place at the land-based staging areas to minimize runoff of sediments (Environmental Assessment page 58, FONSI Appendix A, page 11)
- Maintenance of traffic plans will be instituted to provide a safe working environment for construction workers and safe passage for motorists during construction (Environmental Assessment page 59, FONSI Appendix A, page 12)
- Signage and fencing will be used to keep passersby and wildlife out of construction areas (Environmental Assessment page 59, FONSI Appendix A, page 12)
- Tree and vegetation protection will be provided.
- 8'-0" stockade wood fencing will provide screening for the staging area.



Staging Areas

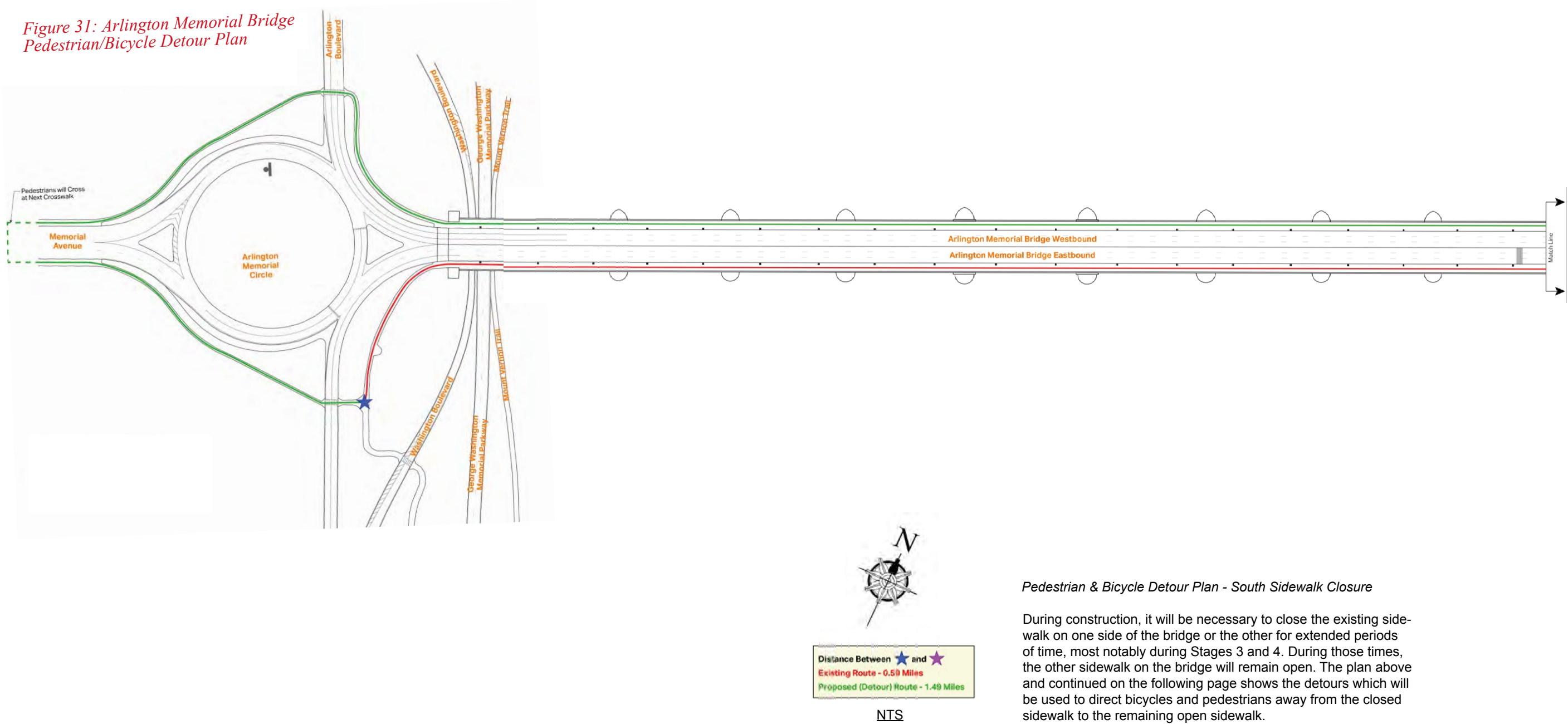
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LEGEND

STAGING AREA
BOUNDARY



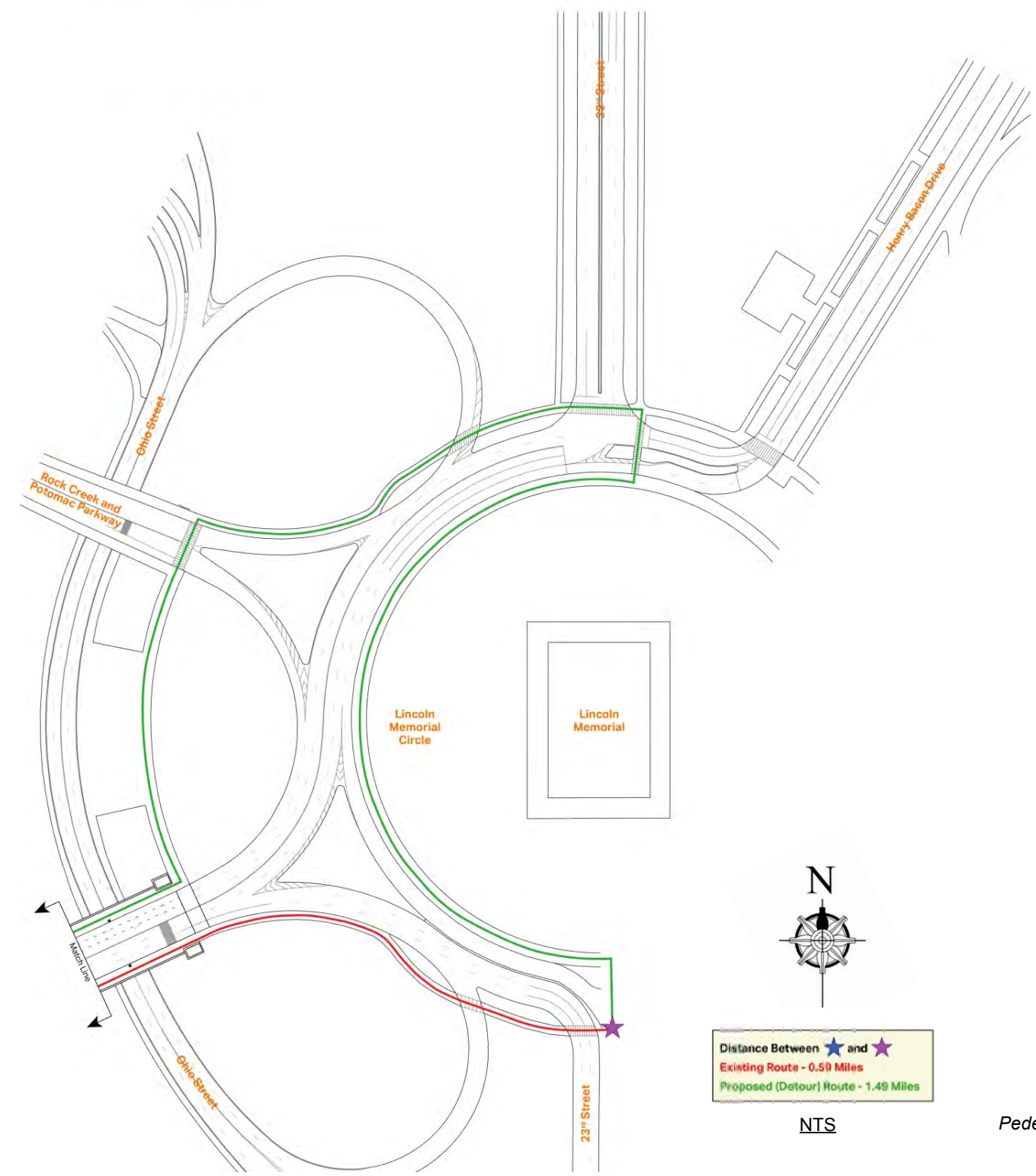
Figure 31: Arlington Memorial Bridge
Pedestrian/Bicycle Detour Plan



Pedestrian & Bicycle Detour Plan - South Sidewalk Closure

During construction, it will be necessary to close the existing sidewalk on one side of the bridge or the other for extended periods of time, most notably during Stages 3 and 4. During those times, the other sidewalk on the bridge will remain open. The plan above and continued on the following page shows the detours which will be used to direct bicycles and pedestrians away from the closed sidewalk to the remaining open sidewalk.





Pedestrian & Bicycle Detour Plan - South Sidewalk Closure





Credit: Nathan Holth, courtesy HistoricBridges.org

The scope of the concrete arch approach spans includes the following structural repairs:

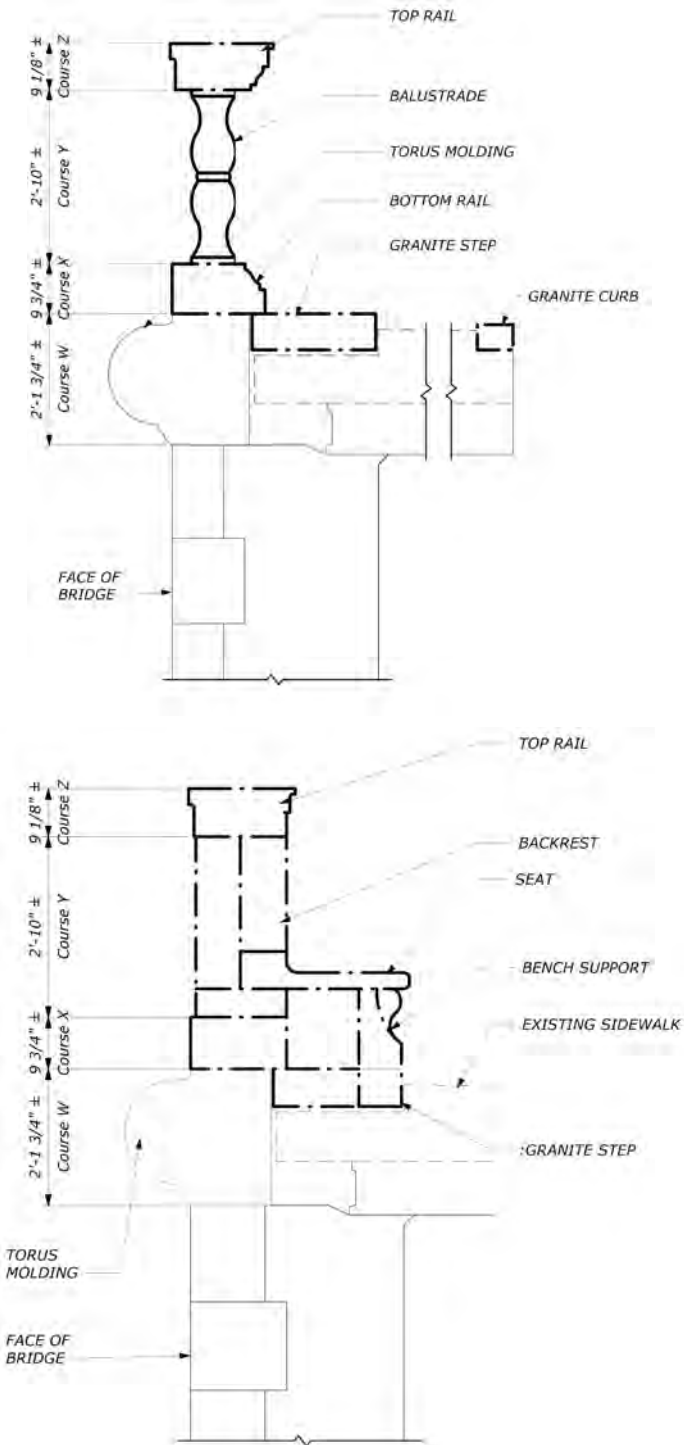
- The ten reinforced concrete arch spans require varying levels of **structural repair**. The work needed to rehabilitate the concrete arch spans includes filling cracks with epoxy, patching concrete spalling with concrete repair compound, and replacing the concrete edge beams.
- Several **concrete bridge piers** have cracking and scouring surrounding the piers that require repair below water. In order for structural repairs to occur, cofferdams will be installed to dewater the area around the bridge piers. This allows concrete repairs to be completed in a dry working environment. Cracks in the bridge piers/abutments will be filled using a material suitable for underwater applications. Undermined footing areas will be filled with grout.
- The bridge's **expansion joints** will be replaced to allow for expansion and contraction that results from changes in temperature and to minimize water intrusion at each joint.
- **Bridge bearings** will be replaced. The bridge bearings support the bridge superstructure, transfer loads from the superstructure to the substructure, and provide the ability for the superstructure to move and rotate.
- The existing **concrete bridge deck** will be removed and replaced with a full depth precast concrete deck panel system designed to minimize water intrusion. An overlay will be installed on top of the deck that will serve as the road surface.
- The existing **exposed aggregate concrete sidewalk** will be replaced with an exposed aggregate concrete/polymer sidewalk to match in-kind the existing finish in texture, color and scored pattern.



Approach Span Rehabilitation - Structural Repairs

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The proposed design scope of the concrete arch approach spans includes the following repair and rehabilitation activities to be performed on nonstructural bridge components:

- The **ashlar granite facing** on the exterior of the structure is in generally good condition. Granite masonry will be cleaned and repointed, with repair or replacement of cracked, broken or damaged blocks as required. Cleaning will include the performance of micro-abrasive cleaning on areas exhibiting heavy soiling, vegetation, foreign material, metallic and organic stains, efflorescence and exudation and paint/graffiti identified in the site survey. Special areas of masonry cleaning may be required for heavy staining. The gentlest method will be selected.
- The existing **granite balustrade** which includes the railing, balustrade piers and granite bench seats, are part of the original construction and important architectural features of the bridge. Each granite element will be carefully labeled, removed, salvaged, and cleaned, with repair or replacement of broken or damaged blocks as required. Each element will be reset in the original positions as part of the new sidewalk construction.
- **Stone restoration repair** is expected to include mortar patching, adhesive bonding of spalled stones, dutchman, and mortar injection at cracks. Particular care will be given to match repair finishes to the color, texture and finish of the adjacent existing stone. Mortar will match the composition, color, and profile of existing.
- The existing **granite curbing and granite lamp post bases** that run along the roadside edge of the sidewalks will need to be removed to install the new bridge deck and sidewalks. Sound blocks will be salvaged and reset, with repair or replacement of broken or damaged blocks as required.

- The **light poles** will be removed prior to the removal of the existing bridge deck and sidewalks. Each light pole will be stripped, painted, and reset as part of the new sidewalk construction. To conform to current electrical standards, an upgraded lighting system will be installed with conduits inside each arch span.
- During construction, improvements will be made to the bridge's existing **drainage system**. The existing system includes pipes, drains, inlets, and grates that will be cleaned or repaired where feasible. The existing bridge uses a series of inlets along the outside curb to drain the roadway. The flow from the inlets travels through a network of pipes under the superstructure where it ultimately discharges through the pier or abutment. The proposed drainage plan is to replace the existing inlets and piping as a part of the bridge rehabilitation work with a fully functioning drainage system. Specific attention will be placed on matching the aesthetics of the existing grates while maintaining adequate spread for vehicular traffic. The project will unclog the drains within the existing abutments and piers. The project will install a drainage trough system under all the expansion joints to guard against any future water leakage through the joints. This trough will be connected to the drainage system mentioned above.
- Throughout the bridge, existing **access hatches, ladders, and personnel platforms** for inspections and maintenance access will be repaired or replaced as needed.
- **Statuary** on the bridge will be protected in place. No-fly zones enforced by flaggers will be used to maintain safe distances between construction equipment and statues until completion of the bridge repairs. Statuary pedestals will be cleaned and repointed, with repair or replacement of cracked, broken or damaged blocks as required.



Approach Span Rehabilitation - Nonstructural Repairs

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Credit: Nathan Holth, courtesy HistoricBridges.org

The scope of the bascule span includes the following:

- **Replacement of the existing bascule span** with a new fixed span comprised of variable depth steel girders and K-frame diaphragm members. The width of the bottom flange of the girders will be 28". The underside of the replacement structure will be arched to mimic the current bascule span arch; however, the bridge will no longer have the appearance of truss construction.
- The **character defining features to be removed** include the steel trusses, bascule leaves, counterweights, and trunnion posts.
- The existing **steel fascia on the exterior face of the span** will be removed at the beginning of construction, refurbished off-site on a barge, and reinstalled on the face of the new span. Reinstalling the existing steel façade on the face of the span will give it the appearance of being an arch span from most vantage points.
- The **bascule span abutments** will remain as part of the new design. The **Guard's Cabin** including **Store Room**, the **Overseer's Cabin** including **Electrical Room** and **Motor-Generator Room**, and the **Machinery Rooms** including **Operator's Room** will remain and be protected in place during construction.
- The existing **aluminum bridge railing** will be removed, repaired, and reinstalled, along with the existing light poles and granite curbs.
- The existing **exposed aggregate concrete sidewalk** will be replaced with an exposed aggregate concrete/polymer sidewalk to match in-kind the existing finish in texture, color and scored pattern.
- The **overlay** that will replace the existing asphalt road surface will be the only element on the top of the replacement span that would not replicate the original bascule span due to the difference in color between the existing black asphalt surface and the traditional gray color of concrete.

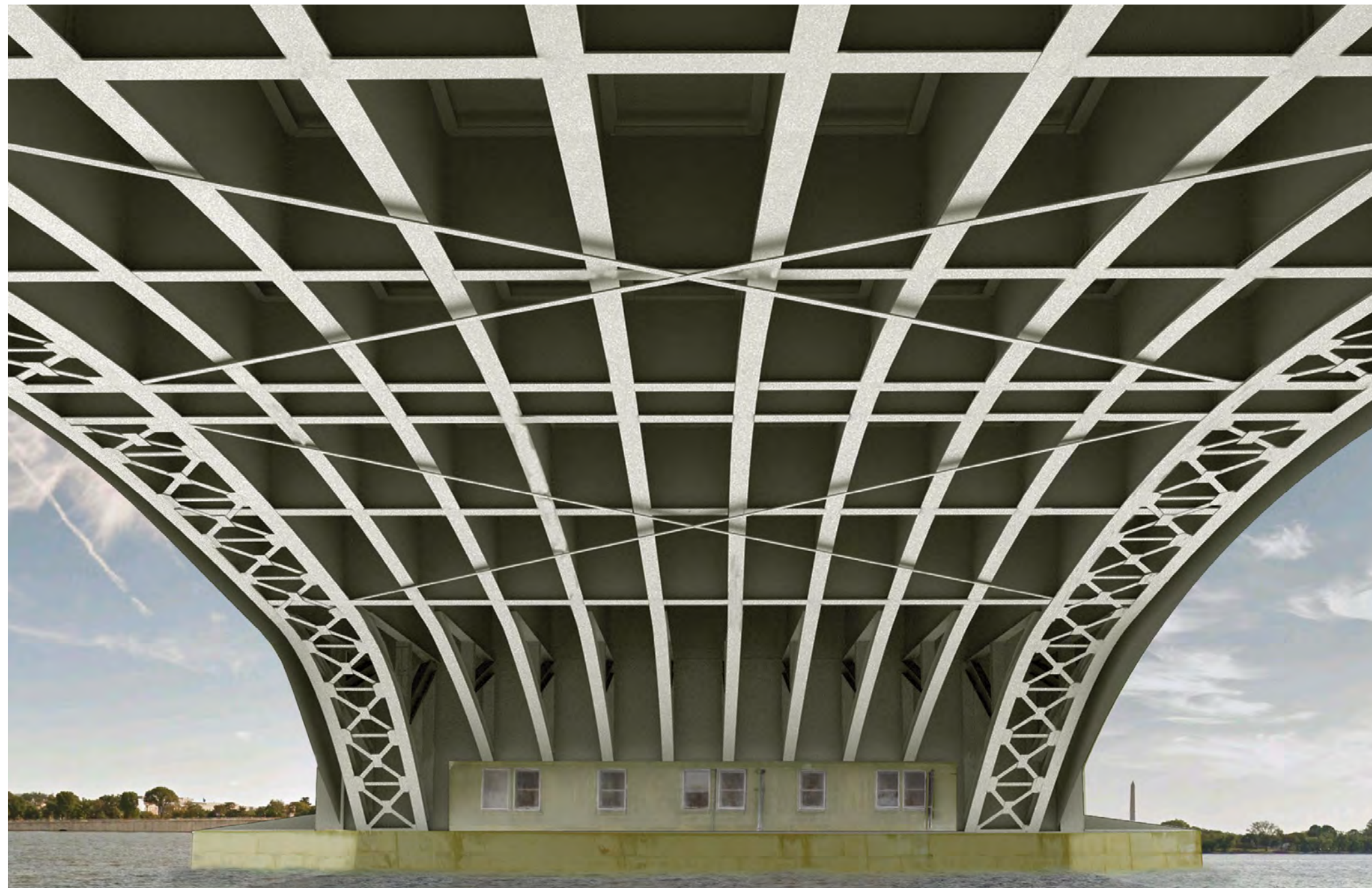
The Federal Highway Administration estimates that the variable depth steel girder replacement span will have a design life of 75 years. During this time, maintenance activities would be required including repainting the structural steel approximately every 25 years, installing new expansion joints and bearings approximately every 20 years, and installing a new overlay approximately 25 years into the life of the structure. Other than scheduled routine inspections of the structure, no additional work would be expected.



Bascule Span Rehabilitation

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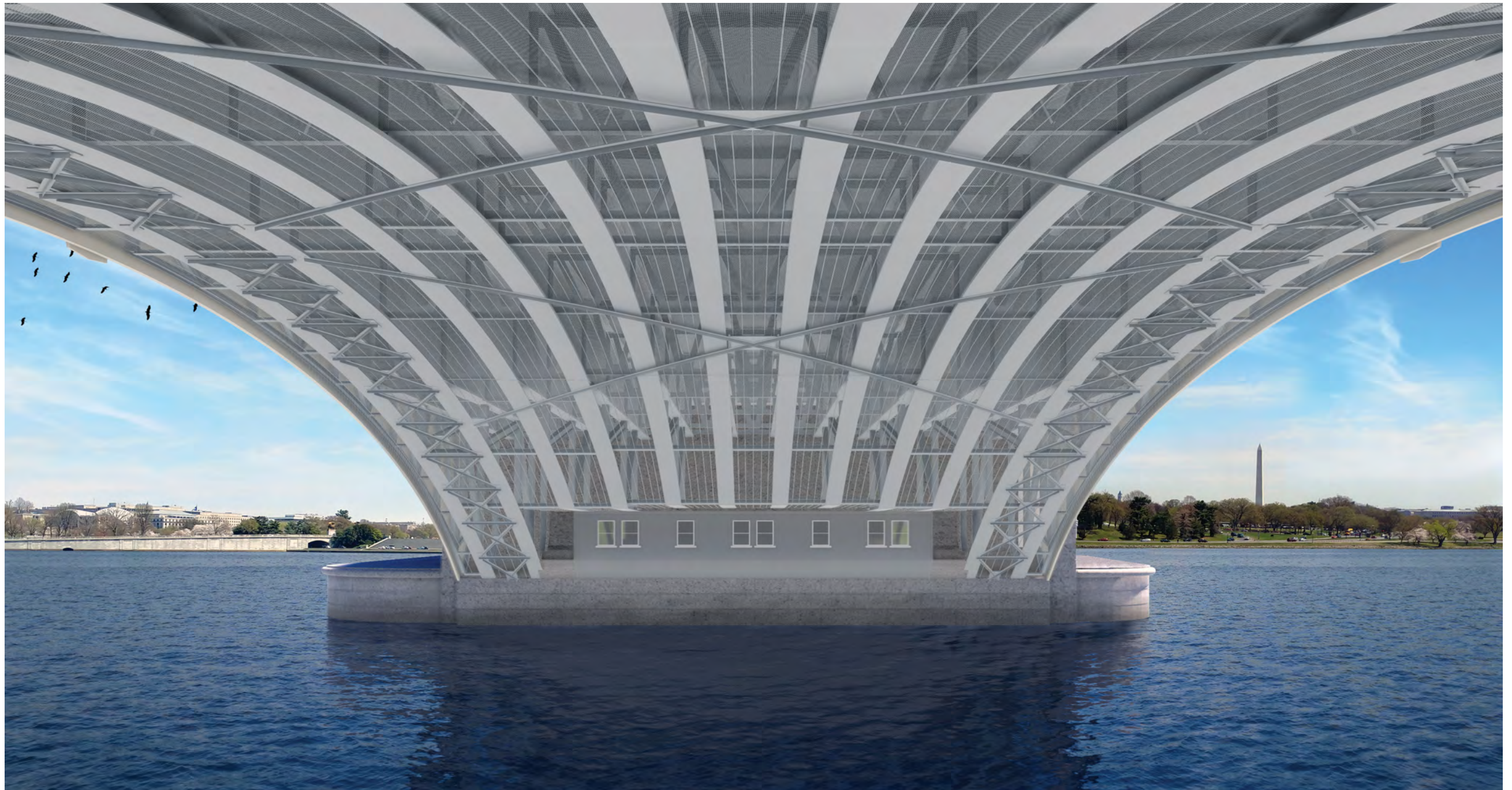
Alternative 1B (preferred option approved at concept review on 5/5/16): Replace bascule span with variable depth girders



Bascule Span Rehabilitation - Approved Concept Design

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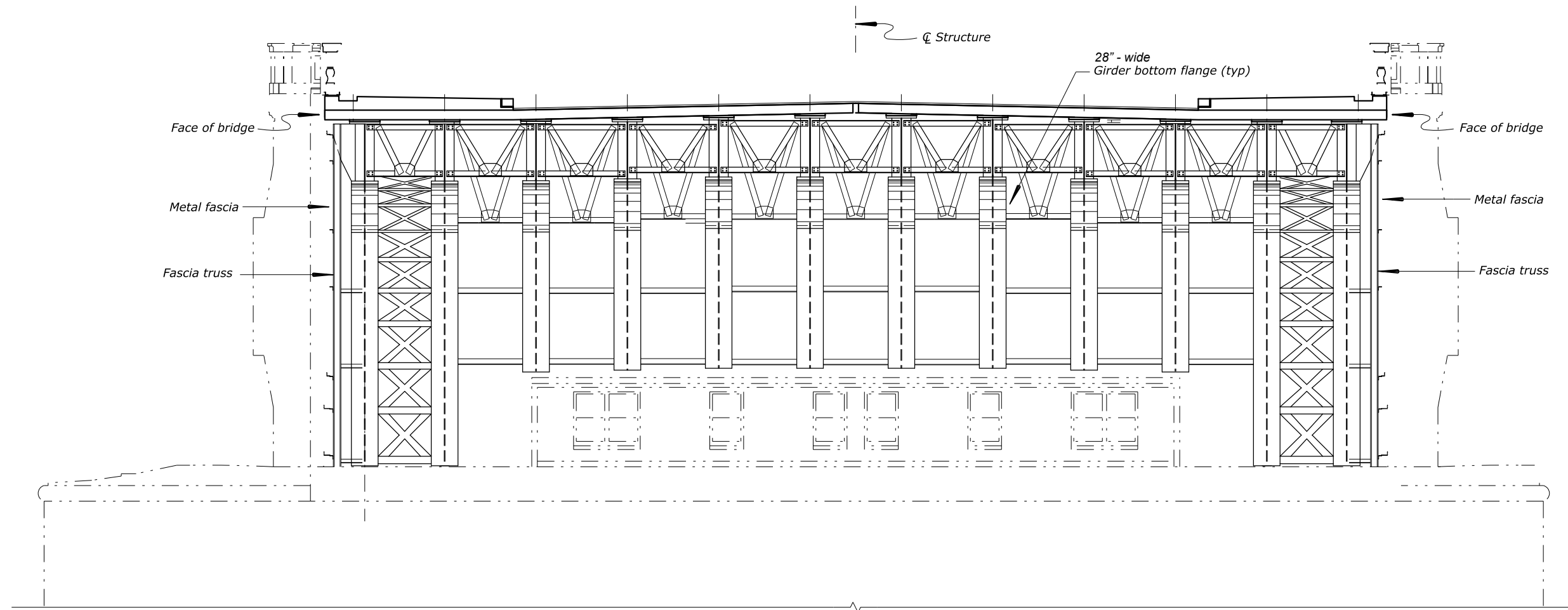
Rendering of final replacement design of bascule span with variable depth girders and K-frame diaphragm members



Bascule Span Rehabilitation - Final Design

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ELEVATION VIEW BELOW BRIDGE DECK

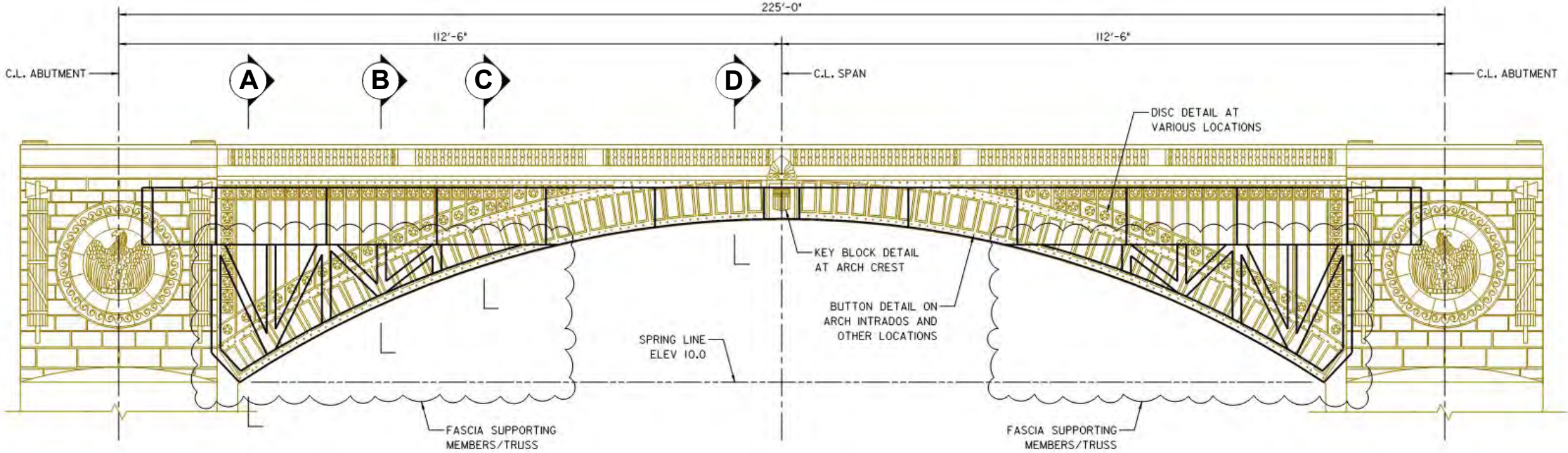
NTS



Bascule Span Rehabilitation - Final Design

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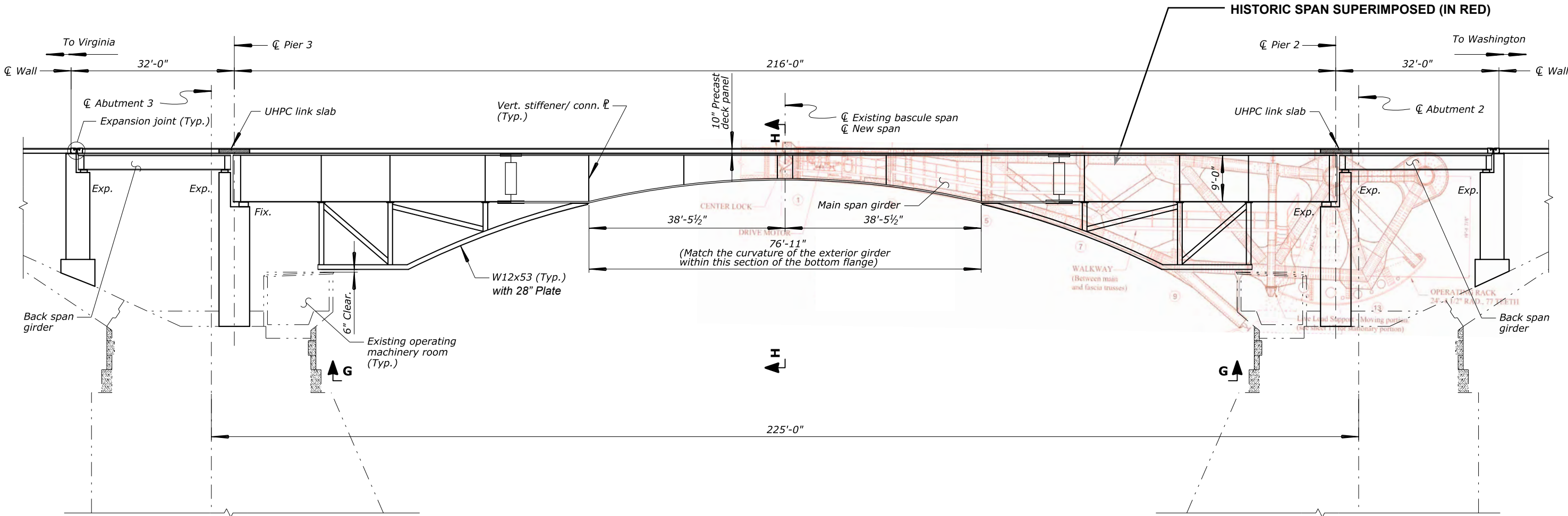
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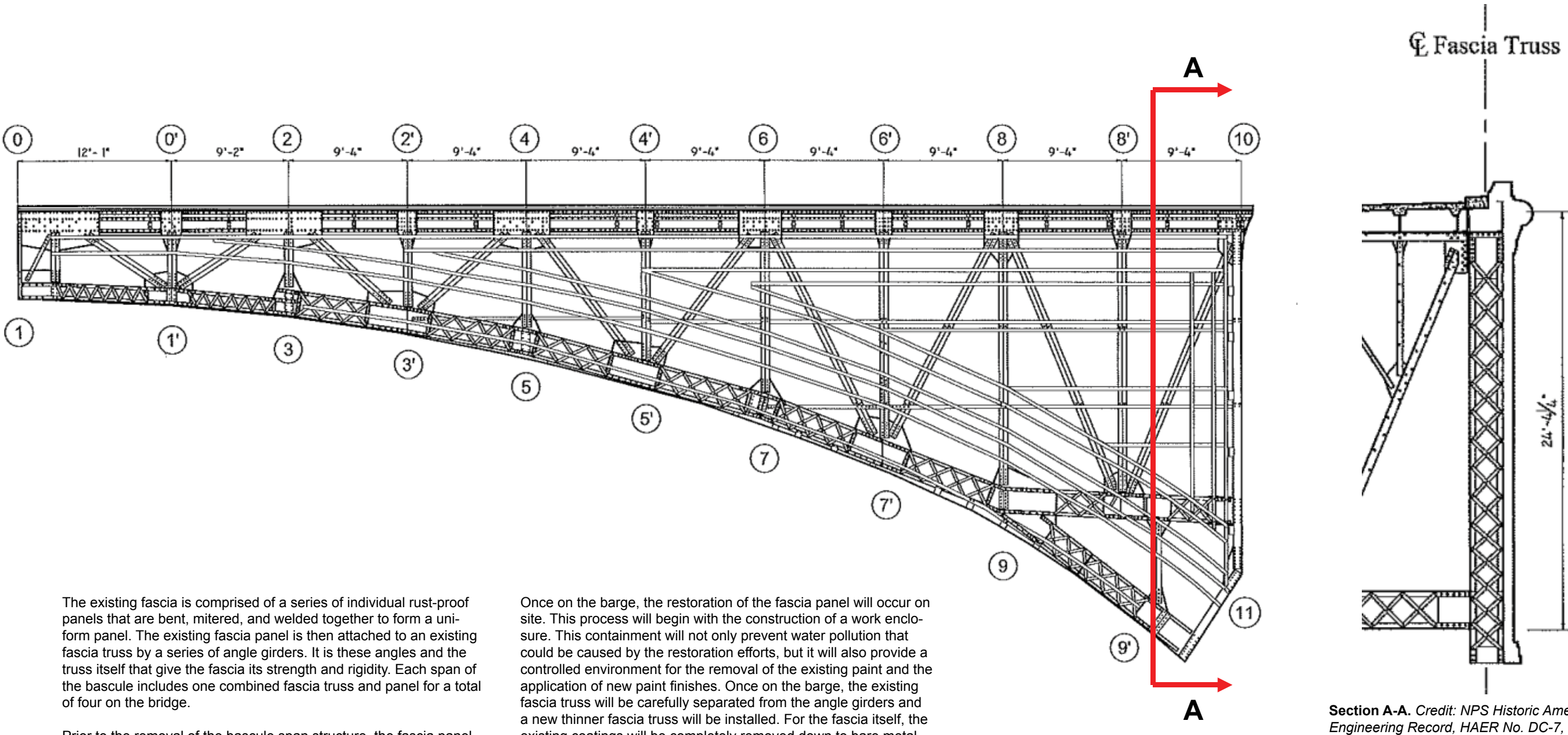


Refer to page 42 for sections through bascule fascia truss

EXTERIOR GIRDER ELEVATION
NTS







The existing fascia is comprised of a series of individual rust-proof panels that are bent, mitered, and welded together to form a uniform panel. The existing fascia panel is then attached to an existing fascia truss by a series of angle girders. It is these angles and the truss itself that give the fascia its strength and rigidity. Each span of the bascule includes one combined fascia truss and panel for a total of four on the bridge.

Prior to the removal of the bascule span structure, the fascia panel and its supporting truss will be cut free from the bascule framing and removed as an entire unit. Once the ties between the fascia panel assembly and the bascule framing are free, a crane will lift the entire truss by the existing panel points and place it on one of the on-site barges. This process will maintain the structural rigidity of the system and prevent warping as the fascia panel is removed.

Once on the barge, the restoration of the fascia panel will occur on site. This process will begin with the construction of a work enclosure. This containment will not only prevent water pollution that could be caused by the restoration efforts, but it will also provide a controlled environment for the removal of the existing paint and the application of new paint finishes. Once on the barge, the existing fascia truss will be carefully separated from the angle girders and a new thinner fascia truss will be installed. For the fascia itself, the existing coatings will be completely removed down to bare metal and any broken welds will be repaired. Additional metal repairs and replacement of missing cast aluminum decorative elements will also be required. Once all repairs are made, the restored fascia panel and truss will be painted. Upon completion of the new bascule structure, the fascia panel assembly will be returned to the bridge with a crane and attached to the new structure.

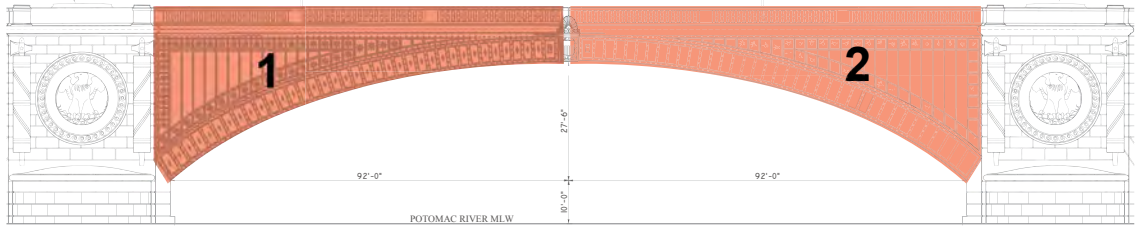
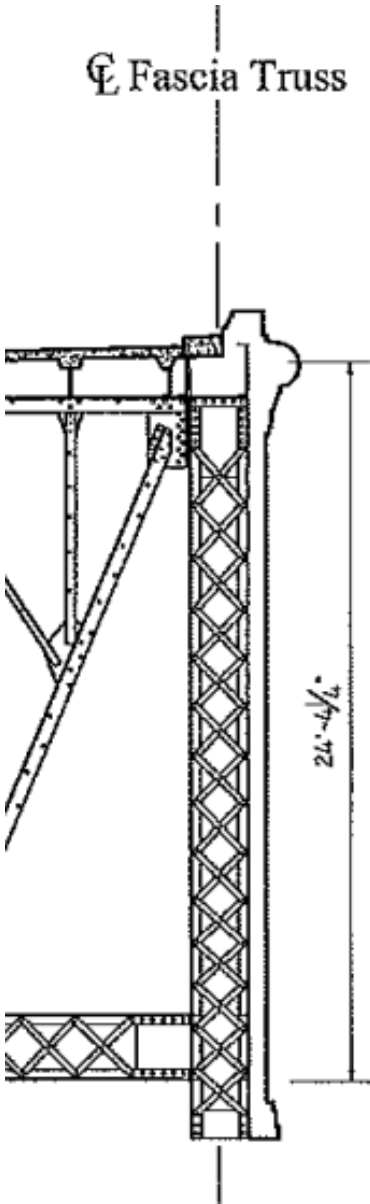
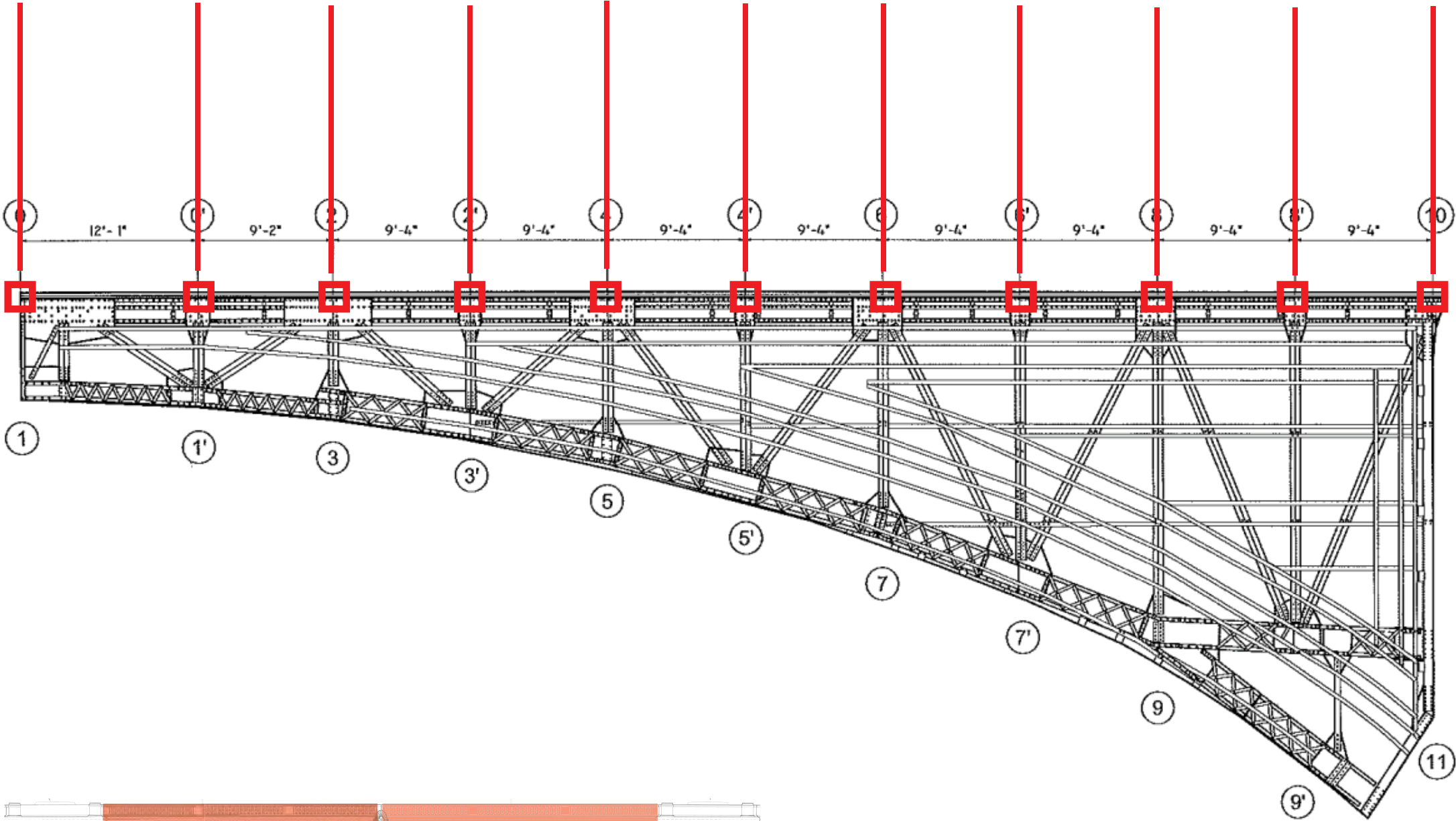
Elevation of south fascia truss, east leaf. West leaf is a mirror image. The north fascia truss is a mirror image. Credit: NPS Historic Amercian Engineering Record, HAER No. DC-7, 2014

Section A-A. Credit: NPS Historic Amercian Engineering Record, HAER No. DC-7, 2014



Bascule Fascia & Fascia Truss Removal Concept

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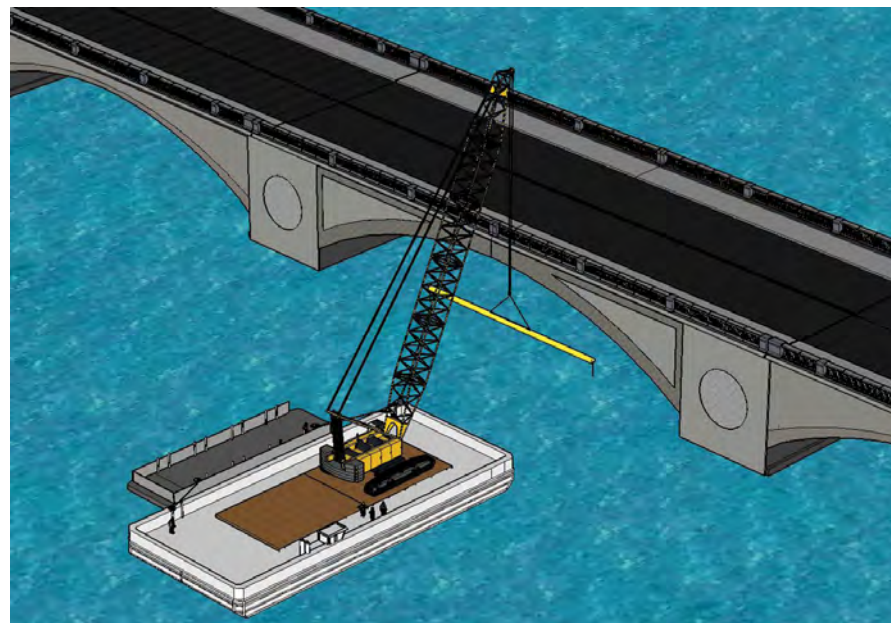


The fascia and fascia truss will be removed by crane as 2 leaves per side

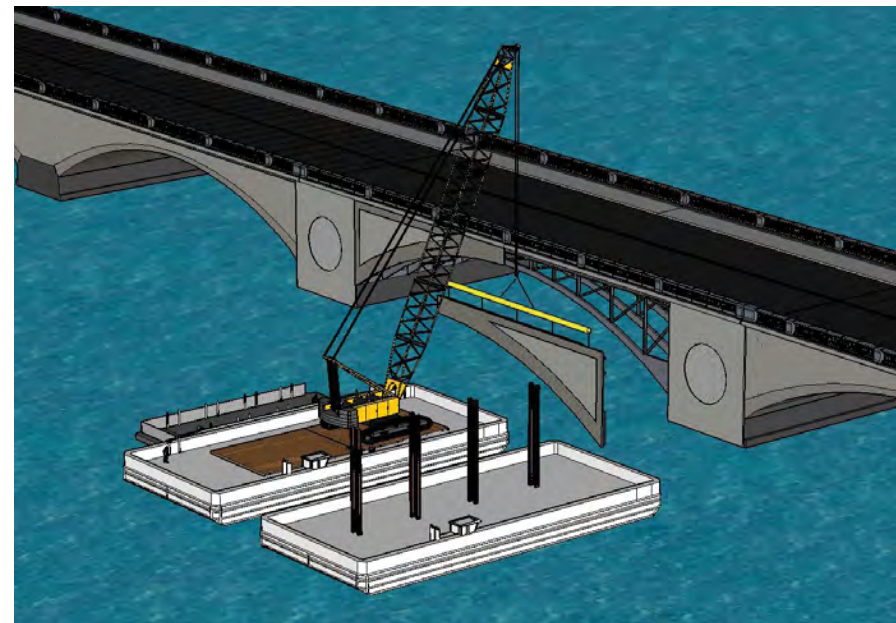
LEGEND

 CRANE PICK POINTS

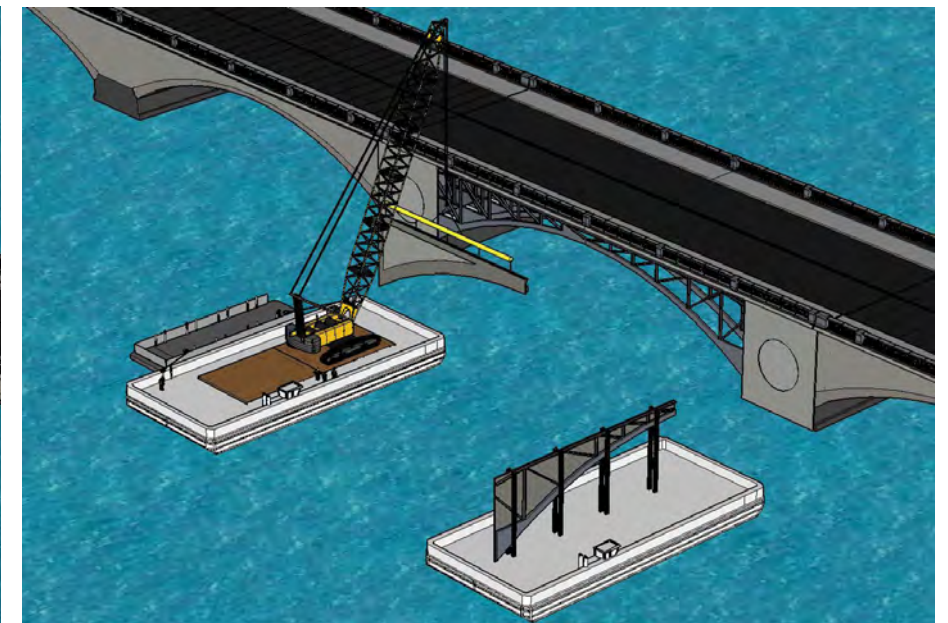




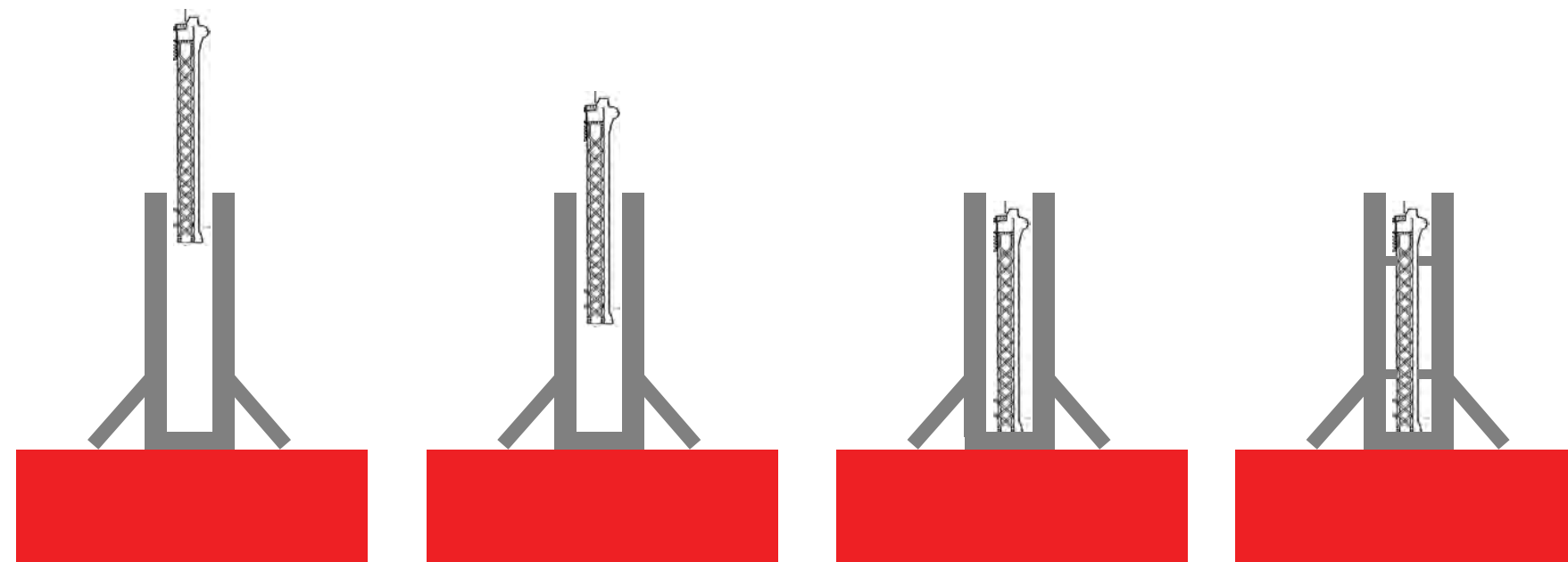
CRANE ON BARGE



FIRST FASCIA LEAF PICK



SECOND FASCIA LEAF PICK

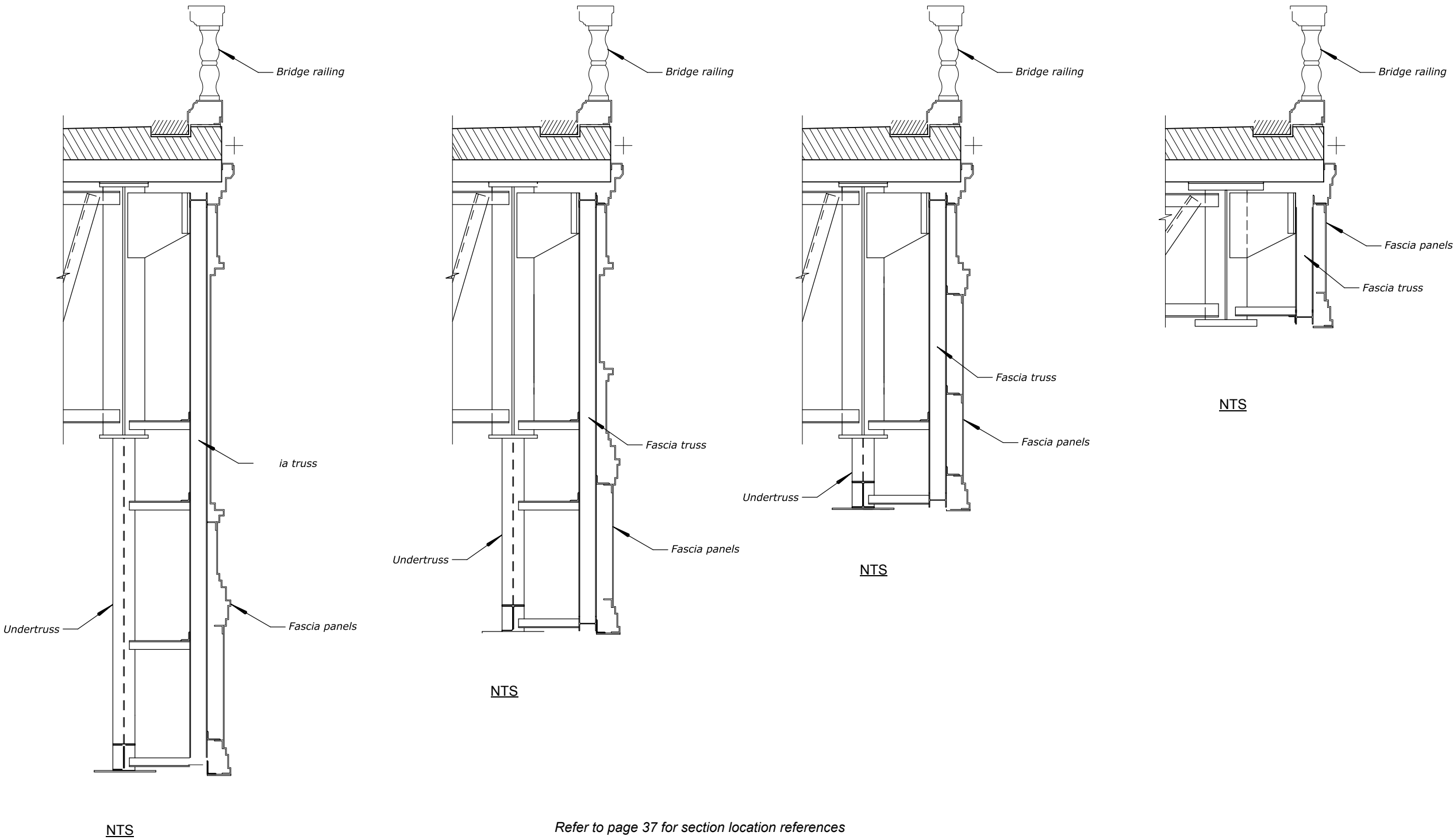


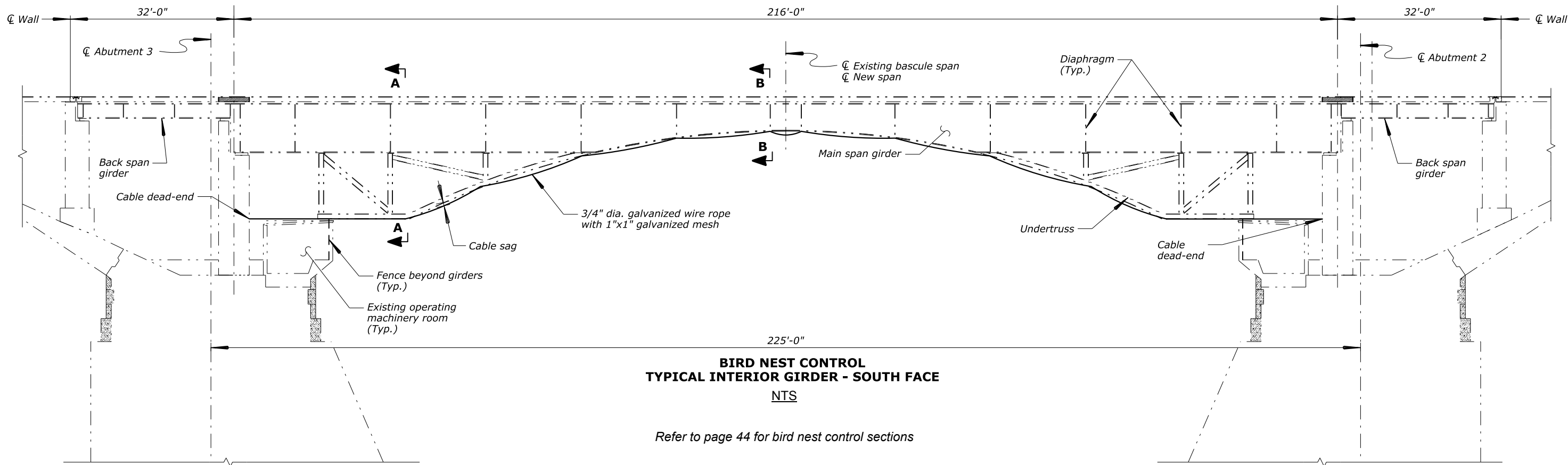
FASCIA AND FASCIA TRUSS LOWERED ONTO BARGE



Bascule Fascia & Fascia Truss Removal Concept

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A bird nesting and dropping control system will be installed at the entire underside of the replacement bascule span. The new mesh will be comprised of 1" x 1" galvanized steel mesh oriented at a 45 degree angle to match the existing. The mesh will be supported by 3/4" diameter galvanized cables which run parallel to the girders and are spaced at approximately 1'-6" o.c. This mesh system is designed for a maximum 2 inches of initial cable sag and provides a load capacity of 50 pounds per square foot. In combination with the open K-frame diaphragm braces, this load capacity will allow for maintenance and inspection personnel to walk directly on the mesh which will allow it to remain in place as opposed to the previous system where it had to be removed during bridge inspections. Overall, this system will require minimum maintenance and provide a 75 year design life.



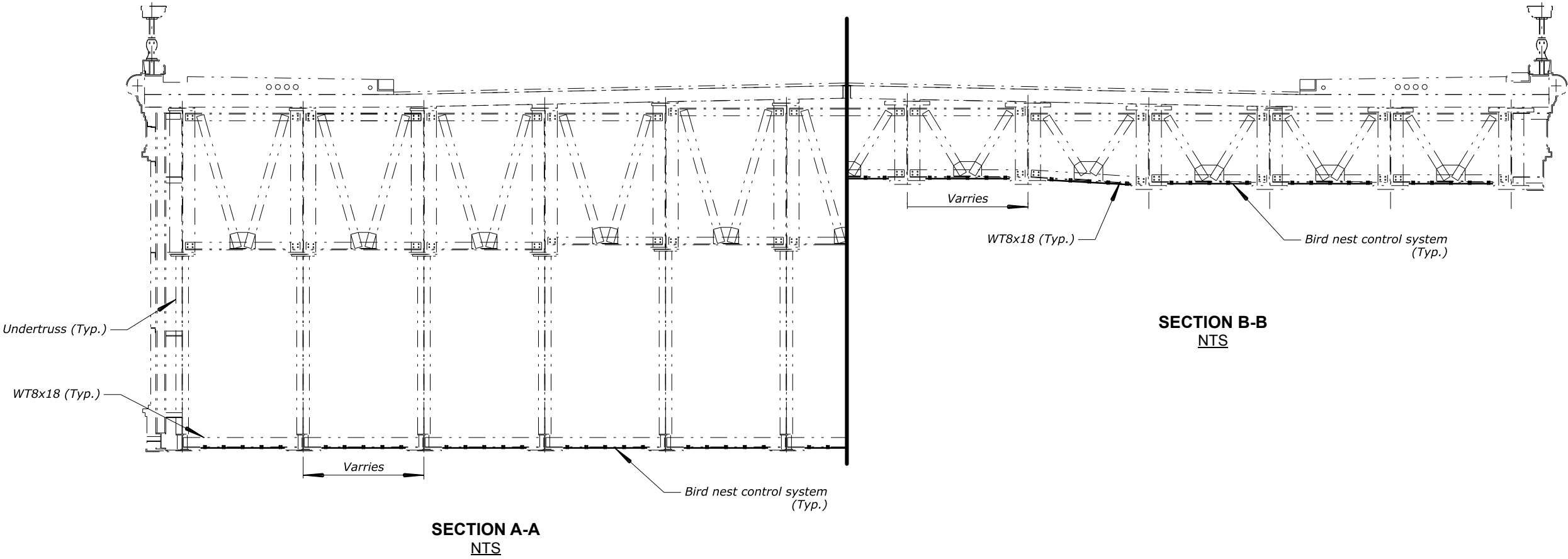
1" X 1" mesh



3/4" diameter cable



Bird Nest Control
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Refer to page 43 for section location references





Bird Nest Control

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View from Mount Vernon Trail

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View from Kennedy Center Roof Terrace

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View from Water Looking Southeast

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