CHAPTER 7: ENVIRONMENTAL REVIEW

CHAPTER 7: ENVIRONMENTAL REVIEW

The environmental review identified potential environmental constraints within the human and natural environment in the study area. For the purposes of this review, a 500-foot wide corridor was established around each of the alternatives, including the No Build Alternative (Alternative 1). The corridors are 250 feet to either side of the centerline of the proposed alternative, providing a total corridor width of 500 feet.

The environmental review and resource identification process provided:

- Identification of sensitive resources within the project area in light of current regulatory requirements;
- Identification of potential fatal flaws for any of the build alternatives; and,
- Identification of and possible future studies necessary to obtain environmental clearances in accordance with the NEPA requirements and related environmental regulations and executive orders.

Areas identified in this environmental review are the same as those typically evaluated during the NEPA process.

This environmental review is intended to highlight the environmental resources present in the study area and help plan a future environmental study to determine the most appropriate NEPA document. Twelve elements are discussed as part of the environmental review including:

Land Use	Section 106 Historic Resources
Community Facilities and Services	Section 4(f) and 6(f) Resources
Environmental Justice	Aesthetics
Air Quality	Water Resources
Noise and Vibration	Protected Species and Critical Habitat
Hazardous Materials	Federal Action and Permits

Land Use

A number of physical characteristics have been identified that would play a part in any environmental analysis. The northern third of the project area is located in the District and includes the National Park Service (NPS) National Mall and Memorial Parks; the middle third of the project area spans the Potomac River; and the southern third of the project area is located in Arlington County, Virginia.

In the District, the Long Bridge reaches the Southwest waterfront area on NPS land adjacent to the Tidal Basin. To the south of the Long Bridge is the Southwest waterfront, including the Gangplank Marina and Fish Market. The railroad continues underneath Maryland Avenue, SW, in front of the Mandarin Oriental Hotel and Federal Communication Commission buildings. It continues further to go underneath L'Enfant Plaza to service the L'Enfant Station for Amtrak and VRE. This is a major hub for federal employment and serves as a major transfer location.

The bridge crosses over East Potomac Park, which is owned by NPS. Beyond East Basin Drive are the Thomas Jefferson Memorial and Tidal Basin and other memorials. East Potomac Park is not part of the National Mall but does house recreational facilities such as tennis courts, pool, and golf course. East Potomac Park is also the home for the NPS's National Capital Park Central Headquarters, maintenance facilities, the US Park Police Headquarters, and parking lots.

The Virginia landing is also owned by NPS, the Mount Vernon Trail facility, and George Washington Memorial Parkway. The railroad continues across the Long Bridge Park.

During the future NEPA process, land use consistency and future land use impacts will need to be evaluated in greater detail. Included in this effort will be coordination and collaboration with localities, stakeholders, landowners, and citizens to develop alternatives that meet the purpose and need.

Community Facilities and Services

Community facilities and services include schools, hospitals, libraries, places of worship, cemeteries, emergency services (police, fire, and emergency response), park and recreation resources, retail centers, businesses, and other facilities and services. As shown in Table 7.1, there are many such resources within the vicinity of the Long Bridge. While the project is an urbanized area, parks, recreation areas, and wildlife and waterfowl refuges are the dominant community facilities and services in the project area.

Table 7.2 provides details on these resources and identifies the jurisdictional authority of each.

Table 7.1: Community Facilities and Services

District of Columbia	Arlington, VA
National Park Service, East Potomac Park (including NCP Central Headquarters, NCP Headquarters, East Potomac Maintenance Facilities, US Park Police Headquarters, East Potomac Tennis Center, East Potomac Public Golf Course, East Potomac Pool)	National Park Service, Lady Bird Johnson Memorial Park, Lyndon B. Johnson Memorial Grove, Navy and Marine Memorial, Mount Vernon Trail, George Washington Memorial Parkway
National Park Service, National Mall and Memorial Parks (including Thomas Jefferson Memorial, Tidal Basin, George Mason Memorial, Franklin Delano Roosevelt Memorial, and West Potomac Park Unit, including West Potomac Park Fields #3 and #4)	Long Bridge Park, Gravelly Point Park, and Crystal City Water Park
Rock Creek Park Trails, Benjamin Banneker Park, and Box Car Willie Park	Roaches Run Waterfowl Sanctuary
L'Enfant Plaza Metro Station	Ronald Reagan Washington National Airport
Federal Office Buildings: US Treasury Department, FCC, USDA, US Postal Service Headquarters, Department of Education, Department of Energy, HUD, USDOT, USDA Graduate School, United States Department of Agriculture Forest Service Headquarters, USDOT-Federal Aviation Administration	The Pentagon
Commercial Retail and Office Buildings, including The Portals II and III, and the Mandarin Oriental Hotel	Crystal City Metro Station
1st District Police Station	Crystal City shops, businesses, hotels, multi-family dwellings
Washington Marina, Southwest Fish Wharf, Capital Yacht Club	Columbia Island Marina

Table 7.2: Parks, Recreation Areas and Wildlife/Waterfowl Refuges within Project Area

Resource	Jurisdictional Authority and Location	Uses & Facilities
East and West Potomac Parks	NPS	• NPS National Capital Region Headquarters • Maintenance Facilities • Access to the National Mall and Memorial Parks • East Potomac Tennis Center • Recreation • Parking Lots
West Potomac Park within National Mall and Memorial Parks	NPS	• Thomas Jefferson Memorial • George Mason Memorial • Tidal Basin • Fields #3 and #4
Rock Creek Park Trails	NPS	• Paved sidewalk for walking and running in vicinity of the Long Bridge
Captain John Smith Chesapeake National Historic Trail	NPS (Potomac River)	• First National Water Trail • Follows the historic routes of Captain Smith's travels • Trail includes 3,000 miles in VA, MD, DE and DC • Trail is still developing
Star-Spangled Banner National Historic Trail	NPS	• Path tracing troop movements through Chesapeake Bay region • In project area, trail follows George Washington Memorial Parkway
George Washington Memorial Parkway	NPS	• Scenic and recreational driving
Mount Vernon Trail	NPS	• 18-mile paved multi-use trail (running, walking, cycling) that runs parallel to George Washington Memorial Parkway and Potomac River

Table 7.2 Continued: Parks, Recreation Areas and Wildlife/Waterfowl Refuges within Project Area

Resource	Jurisdictional Authority and Location	Uses & Facilities
Long Bridge Park	Arlington County Dept. Parks and Recreation	• Recreational destination and gateway to Arlington County • Environmentally sound redevelopment with public green spaces, high-quality outdoor recreation facilities, and environmentally conscious structures that link Crystal City to the Potomac River • Provides for diverse recreation interests: rain garden and public artwork, multi-use fields, community buildings, aquatics center, raised walkway, trails, large public event area, reclaimed land
Roaches Run Waterfowl Sanctuary	Virginia Dept. Game and Inland Fisheries - Arlington	• Popular birding spot for waterfowl observation
Crystal City Water Park	Arlington County Dept. Parks and Recreation	• Small community park with water fountains • Offers a quiet public space/urban oasis within Crystal City

Within the study area, residential communities are limited. The study area is dominated by NPS facilities and lands to the west of Washington Channel and by retail, office buildings, and federal buildings to the east of Washington Channel. On the Arlington side of the bridge, the area is dominated by NPS lands (George Washington Memorial Parkway), Arlington County's Long Bridge Park (trails, aquatics center, ball fields, open space), Arlington County's Roaches Run Waterfowl Sanctuary, Ronald Reagan Washington National Airport, and the Crystal City community.

Construction of any build alternative would be disruptive to adjacent facilities. During the future NEPA process, community facilities, services, and neighborhoods will be a consideration and evaluated in greater detail.

Environmental Justice

The Environmental Protection Agency (EPA) provides an online database, EJView, for the identification of potential Environmental Justice populations and areas of concern. Table 7.3 provides a comparison of the Environmental Justice populations within the project area with the locality as a whole.

Table 7.3: Environmental Justice Areas of Concern in Project Area

EJ Area of Concern	District of Columbia		Arlington County, VA	
	DC	Project Area	Arlington County	Project Area
Minority Populations (greater than 50% of the area's population)	67%	54%	36%	31%
Low-Income Populations (greater than 25% of the area's population)	18%	0% to 5%	7%	0% to 11%
Limited English Proficiency (LE)	2%	10%	4%	13%
Source: Environmental Protection Agency, EJ View				

Environmental Justice populations are present in the District portion of the project area as over 50 percent of the population of the project area is minority (40 percent Black, 5 percent Asian, 5 percent Hispanic, 4 percent Two or More Races). Within the Arlington County portion of the project area, the percentage of minority populations does not exceed the Environmental Justice threshold of 50 percent. Of the minority populations in the Arlington County portion of the project area, 15 percent are black, 11 percent are Asian and 10 percent are Hispanic. The percentage of low-income populations does not exceed the Environmental Justice threshold of 25 percent or greater in the District or Arlington County. Populations with Limited English Proficiency (LEP) are relatively low within the entire project area.

As part of the future NEPA analysis, a thorough Environmental Justice Analysis will be conducted to determine if and where Environmental Justice populations are located in the project area and to determine if these populations would experience disproportionately high and adverse human health or environmental effects, including the interrelated social and economic effects of any of the build alternatives carried forward for further analysis.

Air Quality

The Environmental Protection Agency (EPA) must designate areas as meeting (attainment) or not meeting (nonattainment) the standard. The Clean Air Act requires states to develop a general plan to attain and maintain the National Ambient Air Quality Standards (NAAQS) in all areas of the country and a specific State Implementation Plan (SIP) to attain the standards for each area designated nonattainment for NAAQS. The project area is within the District and Arlington County, Virginia, both of which are within the jurisdiction of the Metropolitan Washington Council of Governments (MWCOG) to complete the required air quality analysis for regionally significant projects such as the rehabilitation or replacement of the Long Bridge. The study corridor is within the MWCOG region, a nonattainment area for ground-level ozone and fine particulates (PM2.5). It is in maintenance of CO levels. [1]

Any alternative selected for the Long Bridge project will need to be part of an approved SIP and a fiscally constrained Long-Range Transportation Plan before air quality requirements can be met. The selected alternative will comply with the Clean Air Act requirements for railroad and transportation projects. This will be addressed during the NEPA process.

Noise and Vibration

The FRA relies on guidance from the FTA for conventional rail noise and vibration impact assessments. The guidance is used by project sponsors seeking funding from FRA to evaluate these impacts during the environmental review process. For the FRA, noise impacts are based on a comparison of the existing outdoor noise levels and the future outdoor noise levels from the proposed project. The analysis considers activity interference caused by the transit project alone, as well as annoyance due to the change in the noise environment caused by the transit project.[2] As shown in Table 7.4, the noise criteria and descriptors depend on land use and are separated into three land use categories. These categories helped identify sensitive noise receptors.

1 Metropolitan Washington Council of Governments, Environment: Air Quality. mwcog.org.
2 Ibid. Page 3-3.

Table 7.4: Land Use Categories for Transit Noise Analyses

Land Use Category	Description of Land Use Category
1	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds and recreational facilities can also be considered to be in this category. Certain historical sites and parks are also included.

There are multiple sensitive noise receptors within the project area. These include, but are not limited to: NPS lands, monuments, NPS outdoor performance spaces at the Thomas Jefferson Memorial, the Franklin Delano Roosevelt Memorial, Long Bridge Park, the Mandarin Oriental Hotel, historic districts and historic resources, and single-family and multi-family residences. As part of the future NEPA analysis, these and other sensitive noise receptors will be evaluated in light of the degree of impact each of the Build Alternatives would have and a detailed noise and vibration analysis will determine if and where impacts occur.

Hazardous Materials

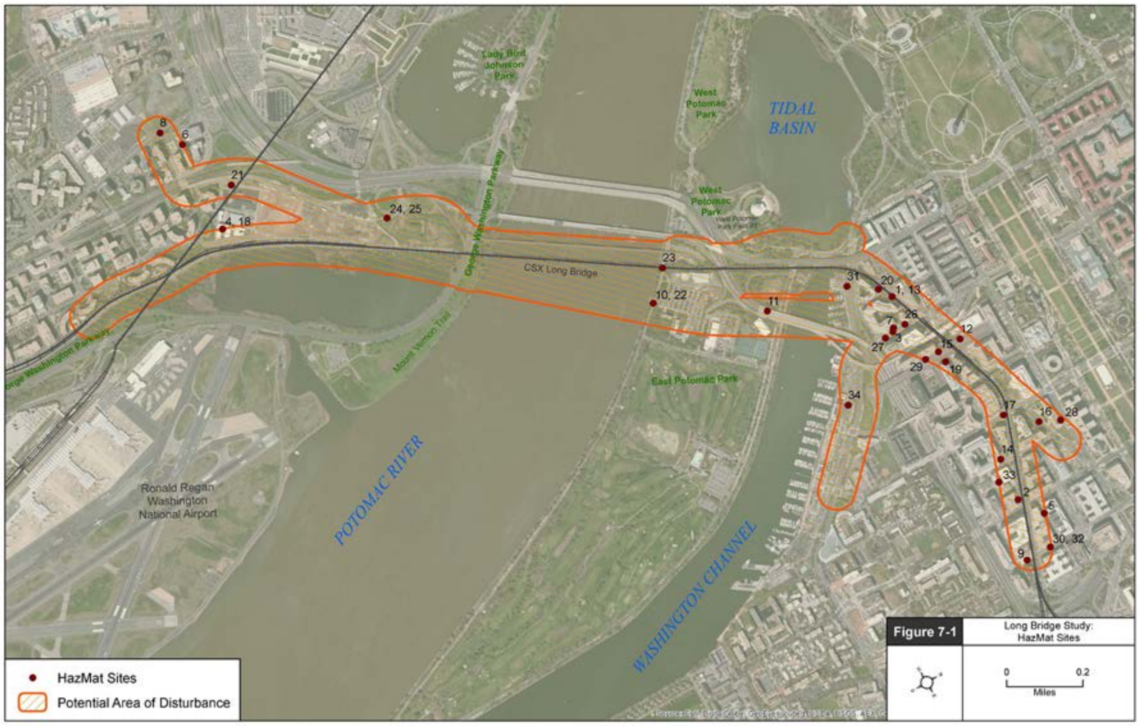
The EPA maintains a database of monitored and regulated hazardous materials (hazmat) sites and generators on its websites, "EnviroMapper for Envirofacts" and "EJVIEW." The websites provide information on six types of pollution-generating facilities: hazardous waste, air emissions, water discharges, toxic releases, Superfund, and brownfields. Both EPA database sites were reviewed to determine the presence of hazardous materials and brownfields within the project area. The two EPA database searches indicate there are no brownfields or radiation-generating facilities in the project area. Table 7.5 provides a list of the various hazardous material sites within the project area. Figure 7.1 illustrates the locations of these sites.

Table 7.5: Hazardous Materials within Project Area

Map Site #	Facility or Site Name	Type of HazMat Site			
		Air	Land	Waste	Water
1	1201 Maryland Avenue		Land	Waste	
2	400 Virginia Avenue, LLC		Land	Waste	
3	445 12th Street		Land	Waste	
4	Aluminum Finishing Co		Land	Waste	
5	American Eye		Land	Waste	
6	Bell Atlantic Virginia 73053		Land	Waste	
7	Blue Cross Blue Shield NCA		Land	Waste	
8	Budget Rent A Car		Land	Waste	
9	Capitol View		Land	Waste	
10	Clark Kiewit Construction		Land	Waste	
11	CSX Transportation, Incorporated		Land	Waste	
12	CVS Pharmacy #1345		Land	Waste	
13	CVS Pharmacy #8359		Land	Waste	
14	Drug Enforcement Administration		Land	Waste	
15	Elite Dry Cleaners & Shoe Repair	Air			
16	Gallery Cleaners & Shoe Repair	Air			
17	GSA National Capital Region - Regional Office Building		Land	Waste	
18	Jorss, A F Works Incorporated		Land	Waste	
19	L'Enfant Plaza Citgo	Air	Land	Waste	
20	Mandarin Oriental Hotel		Land	Waste	
21	Mr. Monument View, LLC		Land	Waste	
22	National Park Service - East Potomac Park – Hain's Point		Land	Waste	
23	National Park Service – President's Park		Land	Waste	
24	Off-Sec Of Defense	Air		Waste	
25	Pent-Marr Exxon Service		Land	Waste	
26	Potomac Center North		Land	Waste	
27	Potomac Center South		Land	Waste	
28	US NASA Headquarters		Land	Waste	
29	US Postal Service	Air			
30	W.O.C. Cleaners	Air			
31	Washington Marina Co		Land	Waste	Water
32	Washington Office Center		Land	Waste	
33	Wrecking Corp Of America		Land	Waste	
34	Yacht Club Incorporated				Water

Source: EPA. EnviroMapper for Envirofacts

Figure 7.1: Location of Hazardous Materials within Project Area



Section 106 Historic Resources

Every jurisdiction maintains a National Register of Historic Places (NRHP). Within the study corridor, the state historic preservation office (SHPO) in the District is the District's State Historic Preservation Office (DC SHPO), which also maintains the DC Inventory of Historic Sites that lists and describes historic landmarks and historic districts. The SHPO in Virginia is the Department of Historic Resources (DHR), which administers Virginia resources in the NRHP program, in addition to those on the Virginia Landmarks Register (VLR).

Four sets of historic resource data were reviewed to identify historic properties: the NPS National Register of Historic Places Program database, the Virginia Department of Historic Resources V-CRIS database, the District's DC Atlas Plus database, and the Arlington County website. Table 7.6 lists the historic resources from these sources that are located within the project area. No properties listed in Arlington County's 2011 Historic Resources Inventory (HRI) are located within or adjacent to the project area.

As part of the future NEPA process, surveys will be conducted to determine historic and archaeological resources in accordance with 36 CFR 800. Section 106 coordination for the Long Bridge Study will be conducted with the NPS, the District SHPO, the Virginia DHR, and other interested parties to determine the potential effects any alternative might have on these resources.

Table 7.6: Historic Properties within Project Area

Resource Name	Location	Register Status
NPS - East and West Potomac Parks Historic District Historic Resources within National Mall: • Thomas Jefferson Memorial • George Mason Memorial • Tidal Basin and its Inlet and Outlet Bridges	District of Columbia	NRHP - Listed
NPS - George Washington Memorial Parkway/Mount Vernon Memorial Parkway *Associated with the Parkways of the National Capital Region 1913-1963*	Arlington County	NRHP - Listed VLR - Listed

Section 4(f) and Section 6(f) Resources

Section 4(f) protects publicly owned parks, recreation areas, and wildlife/waterfowl refuges, as well as historic sites listed or eligible for listing in the NRHP. These lands can only be used for a federally funded transportation project if there is no other feasible and prudent alternative and the project incorporates all possible planning to minimize harm.

The numerous Section 4(f) resources within and adjacent to the project area are:

- East and West Potomac Parks Historic District (NPS)
- Historic Resources within the National Mall:
    - Thomas Jefferson Memorial
    - George Mason Memorial
    - Tidal Basin and its Inlet and Outlet Bridges
- George Washington Memorial Parkway/Mount Vernon Memorial Parkway (NPS)
- Rock Creek Park Trails
- Captain John Smith Chesapeake National Historic Trail
- Star-Spangled Banner National Historic Trail
- George Washington Memorial Parkway

- Mount Vernon Trail
- Long Bridge Park
- Roaches Run Waterfowl Sanctuary
- Crystal City Water Park

These resources range from local, state, and national parks and recreation areas to waterfowl refuges to sites listed or eligible for listing on the NRHP. Given the national significance of the NPS resources potentially affected, Section 4(f) will be a critical component of any future study of the proposed corridor.

Section 6(f) is somewhat related to Section 4(f) in that it also protects park and recreation resources, but it refers to the Land and Water Conservation Fund (LWCF). The program is intended to create and maintain a nationwide legacy of high quality recreation areas and facilities and to stimulate non-federal investments in the protection and maintenance of recreation resources across the United States.[3]

Based on a review of the US Department of Interior's LWCF website, Section 6(f) resources do not appear to be within the project area in the District. However, based on the LWCF listing for Arlington County, it is not clear at this time if LWCF funds were used for Arlington parks and trails within the project area.

Aesthetics

The regional landscape establishes the general visual environment of a project area. The project area has multiple visually sensitive resources of local, state, and national importance. Overall, the visual environment of the Long Bridge corridor includes scenic views of and from undeveloped natural areas; expansive parks and recreation areas; the Potomac River; the National Mall and Memorial Parks; urban development; and multiple bridge crossings, rail crossings, and interstate and urban roadway facilities. Each of these landscape units has its own visual context that will need to be taken into consideration relative to the proposed Build Alternatives.

Given the highly scenic value of the areas surrounding the project area, a thorough visual analysis will be a critical component of the future NEPA process. The visual analysis will examine the potential changes related to the implementation of each of the proposed Build Alternatives into the existing viewshed of the project area

Water Resources

Water resources in Section 404 of the Clean Water Act are regulated by the Environmental Protection Agency (EPA) and the US Army Corps of Engineers (USACE) for activities affecting Waters of the United States (WOUS). The EPA, the USACE, the US Coast Guard (USCG), the District Department of the Environment (DDOE), the Virginia

3 US Department of the Interior – National Park Service. Land and Water Conservation Fund.

Department of Environmental Quality (VDEQ), and the Virginia Marine Resources Commission (VMRC) all issue permits for various activities in, under, and over WOUS.

To comply with Section 404, it is necessary to avoid impacts to WOUS wherever practicable, minimize impacts where unavoidable, and compensate for impacts as required. In addition, for purposes of water conveyance, detailed hydraulic studies need to be conducted to conclusively determine the sizes and types of drainage structures that would be needed to accommodate Build Alternative crossings and associated drainage requirements. Because these agencies determine the compensation requirements for stream impacts on a case-by-case basis, the quantitative requirements for a Build Alternative would be negotiated as part of the permit application process.

Wetlands and Waters of the US

Reviews of the US Fish and Wildlife Service (USFWS) National Wetland Inventory database, as well as the District's and Arlington County's environmental databases, show the presence of multiple wetland types in the project area: Riverine (Potomac River and Washington Channel), Lake (Tidal Basin and the lake at Roaches Run Waterfowl Sanctuary), Freshwater Ponds, Freshwater Forested/Shrub Wetlands, and Freshwater Emergent Wetlands. Streams crossed by the project include the tidal Potomac River and its associated Tidal Basin and Washington Channel, as well as several unnamed, non-tidal streams in Arlington.

During the NEPA process, it will be necessary to conduct a wetlands and streams survey in accordance with state and federal guidelines.

Floodplains

Under Executive Order 11988, the FRA would be responsible for evaluating the potential effects of the Build Alternatives within a floodplain and proposing mitigation to avoid adverse effects resulting from development within a floodplain. Over half of the project area is located within the 100-year floodplain associated with the Potomac River. During the NEPA process, a detailed floodplain analysis would be conducted for each Build Alternative carried forward for further evaluation. Any alternative carried forward would be designed in accordance with local, state, and federal requirements relative to stormwater management practices.

Protected Species and Critical Habitat

The Endangered Species Act (ESA) protects plant and animal species that are in danger of extinction. The ESA establishes a formal process for "listing" a species as threatened or endangered. Based on a review of the USFWS's website, "IPaC – Information, Planning, and Conservation System," there is one federally protected species that could be affected by any of the proposed Build Alternatives[4]. Sensitive joint-vetch (*Aeschynomene virginica*), shown in Image 7.1, is listed as Federally

4 US Fish and Wildlife Service. IPaC – Information, Planning and Conservation System. Initial Project Scoping.

threatened and has the potential to be within the project area. There is no federally listed Critical Habitat within the project area.

If it is determined that these resources may be present, it will be necessary to conduct a survey for the resources to confirm their presence or absence. Should a protected resource be present, it will be necessary to begin Section 7 Consultation with the USFWS to determine the next steps and potential avoidance, minimization, and mitigation measures.

Image 7.1: Aeschynomene virginica. Photo by H. Horwitz

Federal Action and Permits

Under any Build Alternative, federal and state laws would require several permits and authorizations before construction can proceed. These would include those shown in Table 7.7.

Additionally, both East and West Potomac Parks are operated by NPS and are Section 4(f) resources with regard to USDOT actions. NPS is also responsible for the National Register of Historic Places Program. Under that program, the East and West Potomac Parks Historic District is listed as a Historic District in the National Register of Historic Places.

Should a Build Alternative adversely affect historic properties, a Programmatic Agreement (PA) to resolve the adverse effects would need to be executed among the applicable agencies, including the District and/or Virginia SHPO, FRA, DDOT, VDRPT, VDOT, and perhaps other agencies. The Federal Advisory Council on Historic Preservation would be given the opportunity to participate in the development of any such PA.

Table 7.7: Required Permits and Authorizations for Construction

Agency Involved	Action Required	Dictating Federal or State Law
US Army Corps of Engineers	Authorization for discharges of fill material into US waters and wetlands.	Clean Air Act Section 404
District Department of the Environment/ Virginia Department of Environmental Quality	Authorizations for discharges into US waters.	Virginia Water Protection Permit Section 401 Clean Water Act Section 402
Virginia Marine Resource Commission	Authorizations for encroachments on subaqueous state-owned stream bottoms.	Virginia Water Law
US Coast Guard	Permit for construction of a bridge across the Potomac River navigable waterway.	Bridge Permit
District Department of the Environment/ Virginia Department of Conservation & Recreation/Arlington County	Clearance to construct any build alternative within the 100-year floodplain.	Written approval

Summary of Findings

The NEPA process requires the lead federal agency, FRA in this study's case, to determine the appropriate level of NEPA documentation necessary. A bridge rebuilt in its existing footprint could be considered a Categorical Exclusion or Environmental Assessment. The alternatives calling for expansion of the bridge would likely require an Environmental Assessment or Environmental Impact Statement.

FTA's environmental impact regulation (Environmental Impact and Related Procedures (23 C.F.R 771)), issued jointly with FHWA, describes two types of mass transit projects that normally have significant effects on the environment:

- New construction or extension of fixed rail transit facilities (rapid rail, light rail, commuter rail, and automated guideway transit); and
- New construction or extension of a separate roadway for buses or high-occupancy vehicles not located within an existing highway.

Throughout the environmental review for the study, a number of potential environmental issues were identified. Potential and interrelated issues need to be considered for the approval of an environmental document for this project, as they would relate to Section 4(f), Section 106, and NEPA for an expanded or new bridge across the Potomac River.

The NEPA process will build on the collaboration and cooperation established in this study with many federal, state, local, and resource agencies and involve their expertise and oversight of the environmental resources. All the other resources addressed as part of the environmental review for this study are typical of the NEPA process and will be assessed in detail in the NEPA process.

All the resources addressed as part of the environmental review for this study are typical of the NEPA process. The NEPA process is detailed in nature and requires extensive analysis, but the requirements for this project are not seen as insurmountable obstacles that would stop a project to expand or replace the Long Bridge.

CHAPTER 8: COST AND CONSTRUCTABILITY

CHAPTER 8: COST AND CONSTRUCTABILITY

Quantification of cost for this study related to the initial costs for design and construction of a new bridge structure or tunnel. At this stage of a conceptual bridge or tunnel type evaluation, initial cost estimates could only be approximate as they were not based on structural quantities determined from engineering analysis. The initial costs given in this report were based on historical data, preliminary assumptions on general structure dimensions, and preliminary evaluations of likely construction methods associated with each concept. The estimates are in 2013 dollars and include a 35 percent contingency.

A number of currently unknown factors could have a significant impact on initial construction cost, such as: timing of the advertisement and bidding of the construction contract; restrictions on construction schedule or access; effects of rail operations on permissible construction activities; trends in steel, concrete, and precast concrete unit costing; and the number and depth of obstruction locations for the tunnel concepts. More detailed cost estimates will be provided during the preliminary engineering of the feasible concepts, to be conducted following this study. Future cost estimates will be based on breakdowns of structural quantities, assumed unit prices, contingencies, and other estimated costs. Structure costs are a function of determining the linear and square footage of each concept and then estimating the cost based on a "per foot" or "per square foot" basis. These unit costs are considered an initial best estimate prior to the refined cost estimates that will be prepared during the environmental phase of the project.

The simplified methodology of estimating costs on a linear and square foot basis assumes the same unit costs for rail bridge or multimodal bridge construction. Taken into consideration for future cost estimates would be the difference in the substructure and superstructure load requirements of much heavier rail traffic versus a more typical multimodal bridge that would carry vehicles, streetcars and a pedestrian path. Future considerations would also determine if the rail and multimodal uses are constructed on a single bridge or two separate bridge structures.

The initial construction costs were estimated on an "order of magnitude" basis and were not presented as a single value of estimated cost. This approach would still permit the evaluation of relative cost relationships between concepts. Costs associated with the construction of a new moveable span are not included in the estimates.

Each concept was evaluated on the basis of the relative ease of construction and the extent to which complexity and the potential for delays or problems in construction were more or less likely if each concept were pursued. This study also evaluated the extent to which erection of the bridge or tunnel concept would result in significant temporary or permanent impacts on the surroundings.

The use of construction equipment and the delivery of precast elements would require a determination of how access would be accomplished. Access from the shoreline on the northwest side of the Long Bridge would require using federal parkland on either side of the Potomac River, the Virginia side being parkland (Image 8.1) and the District side having a network of roadways at one of the NPS maintenance facilities on East Potomac Park (Images 8.2 and 8.3). Opportunities to temporarily fix the swing span of the existing bridge for limited bridge openings should be considered and could present a potential issue for any construction needs on the northwest side of the bridge.

Construction limited to the southeast side of the bridge would eliminate height clearance issues with moving equipment or bridge sections for constructing a new bridge. There are no obstructions downriver to float sections up to the bridge (there are no other bridges until the Woodrow Wilson Bridge). Locations can be determined for temporary build sites and construction staging on the southeast side.

Compared to the bridge alternatives, a tunnel under the Potomac River would be the most costly alternative. Independent of the costs associated per linear foot of construction, the tunnel would require specialized equipment and the construction of chambers and pits to accommodate the equipment. Tunnels also require venting plants that are built to accommodate airflow from the venting shafts inside the tunnel to the outside. These complicated venting plants are expensive and require aboveground land for construction.

Tunnels also present considerable costs for relocating existing utilities. A detailed underground utility assessment would be required to determine what types of utilities will be encountered and the associated costs of relocating each utility. Often, all utilities are not clearly marked and this adds cost during construction as they are encountered and addressed for relocation. Tunnel costs also include an underground passenger station concept in the District that adds to the overall cost.

Costs presented in this chapter begin with an estimate of short-term repair, maintenance, and serviceability costs; followed by costs for the rehabilitation or replacement of the existing bridge; finishing with the estimate of initial construction costs for the four concept bridge types and tunnels. The constructability discussion includes a description of the construction sequence that can be anticipated with each type of bridge. Additional details of the engineering cost and constructability of each bridge and tunnel type considered can be found in the Bridge and Tunnel Concept Report in Appendix E. Cost details are provided in the appendix for each of the study alternatives by bridge type and tunnel option.

Short-Term Serviceability and Costs

The determination of costs to repair the Long Bridge related to extending the serviceable life of the bridge as an interim solution. Long-term operational demand for additional tracks, as well as analysis that showed the service life of the current bridge will eventually require major rehabilitation or replacement of the bridge. Short-term costs estimates are discussed to assist in the determination of how cost will factor into the future plans for the Long Bridge.

Image 8.1: Virginia Shoreline between the Long Bridge and Metrorail Bridge

Image 8.2: District Shoreline between the Long Bridge and Metrorail Bridge

Image 8.3: The Long Bridge from East Potomac Park looking towards Virginia

Based on the results of the visual survey for the study, short-term options for bridge elements that should be addressed included steel section loss due to corrosion and steel cracking due to fatigue. An additional option to extend the usable life of the bridge and reduce the pace of bridge corrosion would be to paint the bridge. This would require surface preparation to remove mill scale, rust, and the existing paint that increases the chance of failure and peeling of the new coating. Contaminant containment is needed to prevent both lead and other debris generated during surface preparation activities from entering the environment. Typically, up to three coatings of paint are applied to the structure.

The estimated cost of bridge repair for short-term serviceability is approximately $450,000, as shown in Table 8.1. This estimate includes a sizeable contingency that is typically set aside for unforeseen issues that arise during repair. In this case it represents an estimated cost of repair for each of the 22 spans over the Potomac River.

The cost of painting the spans over the Potomac River is shown in Table 8.2. The costs associated with the preparation of the bridge surface and application of paint is estimated at $2,100,000. Additionally, the requirements for containment of lead and other hazardous surface materials of $1,050,000 escalates the cost an estimated 50 percent, for a total of $3,150,000. Projects of this type also require a contingency for unforeseen repair issues, typically 30 percent, adding $945,000 to the total cost and raising the final cost to approximately $4.1 million.

Table 8.1: Short-Term Repair Costs

Type of Repair	Quantity	Unit Cost	Repair Cost
Repair the shear crack in a stringer of Span 20.	1	$20,000	$20,000
Repair pinholes in the web of a floor beam in Span 10.	1	$10,000	$10,000
Assume in the absence of a formal inspection with access to bridge			
Repair deficiencies in each of the remaining 22 spans, resulting from corroded section loss, cracking, pin holes, etc.	22	$15,000	$330,000
ESTIMATED COST			$360,000
CONTINGENCIES, 25%			$90,000
TOTAL ESTIMATED COST			$450,000

Table 8.2: Painting Cost

Segment	Approximate Steel Area per Span (square feet)	No. of Spans	Approximate Total Surface Area (square feet)	Surface Prep and Painting per square foot*	Cost of Surface Prep and Painting	Total Cost of Surface Prep and Painting	Cost of Containment (At 50% of Prep and Painting)	Total Painting Cost**
Through Girder	14,000	22	308,000	$5.00	$1,540,000	$2,100,000	$1,050,000	$3,150,000
Swing Truss	40,000	2	80,000	$7.00	$560,000			

* Cost does not include maintenance of train operations and boat traffic on the Potomac River.

**Cost does not include contingency of unforeseen issues that arise during painting operations.

Rehabilitation or Replacement Costs of Existing Bridge

Analysis was performed on the existing Long Bridge to assess the current bridge condition and is detailed in Appendices C and D. This forms the basis of rehabilitation or reconstruction options. Prior to executing rehabilitation, a number of analyses would be required, including underwater inspection, inspection of the superstructure, reassessment of train load ratings, and the completion of a fatigue life study.

One focus of the rehabilitation would be to extend the service life of the steel superstructure and protect it from corrosion. Bridge rehabilitation takes into consideration the existing deteriorating coating system, which exhibits widespread surface corrosion that needs to be repaired or replaced.

Rehabilitation to the substructure would include the cost of installation of additional vertical batter piles around the existing piers. Substructure rehabilitation costs would include installation of cofferdam, excavation, installation of piles, modifications to existing piers, and connection between existing structures and new construction.

Reconstruction of the existing bridge assumed a two-track replacement of the current bridge structure that could be designed using one of the bridge type concepts analyzed for this study.

Initial Construction Costs

Several of the bridge types discussed in this report actually were of a mix of structure types. The tied arch concepts consist of one or more spans of arch structure combined with spans of standard girder construction. This is an important distinction to be made between concepts, since the expected cost of conventional girder construction is likely to be significantly lower than the more unique bridge types proposed. Concepts that have a higher percentage of standard girder construction are likely to prove more economical than those that consist primarily of a unique structure type.

Costs associated with the construction of rail related to elements of trackwork and earthwork and the placement of track bed ballast. Track estimates included the construction of linear feet of track and the associated turnout and crossover costs. Additional costs were estimated for signal requirements and the construction of interlockings at different locations along the length of the construction. Alternatives that included streetcar included linear costs for trackwork and catenary.

Utility costs were estimated from the surface utility survey completed for the project and detailed in Appendix B. A complete knowledge of underground utilities was not developed for this study.

Right-of-way costs were a function of the width of the bridge expansion and the portion of the bridge and associated elements that traversed over land. The portion of the bridge construction that was considered to be over land was approximately 4,450 feet. This was the linear measurement used to multiply by the bridge width expansion for each alternative to arrive at a square footage above land.

Additional costs were developed as a percentage of the bridge and rail construction costs. These included drainage, signing, landscaping, maintenance of traffic, mobilization, staking/surveying, design of plans, and construction services.

A total of 15.7 miles of new track would need to be constructed to support the proposed four track layout. This overall distance includes the 1.6 miles of track needed to construct the third track across Long Bridge, connecting RO and L'ENFANT interlockings, an additional 14.1 miles of track. The cost for track includes rail, ties, ballast, subballast, and earthwork.

All tunnel options for Alternative 4 would require excavation of assembly and retrieval shafts in crowded urban environments. A number of constraints and specifications were required to determine the passenger and freight rail tunnel alignments that were used to develop the cost of construction. Other items that added to the cost of tunnel construction included consideration for surface portals and approaches; ventilation systems; catwalks for maintenance and evacuation; life/safety escape portals; underground stations and rail interlocking; electrification and associated catenary; and avoiding existing underground Metrorail tunnels, roadway foundations, utilities, and building foundations.

Tables 8.3 and 8.4 show preliminary anticipated costs for each of the structure and tunnel types and each alternative discussed in this report. The bridge structure costs for Alternatives 3 and 5-8 are estimated as new construction. Three costs are provided for different tunnel options under Alternative 4. The cost estimate for

Table 8.3: Initial Construction Costs for Rail Alternatives 2 through 4

<table>
<tr><th colspan="4">(2013 Dollars) - Order of Magnitude Costs*</th></tr>
<tr><th>Structure Type</th><th>Alternative 2</th><th>Alternative 3</th><th>Alternative 4</th></tr>
<tr><td>1. Steel Tied Arch</td><td>$137M - $197M</td><td>$355M - $464M</td><td rowspan="2">(A) Shallow Jacked Segmental Tunnel $6.222 Billion</td></tr>
<tr><td>2. Steel Through Arch</td><td>$151M - $217M</td><td>$378M - $494M</td></tr>
<tr><td>3. Extradosed</td><td>$291M - $393M</td><td>$598M - $762M</td><td rowspan="2">(B) Shallow Submersed Segmental Tunnel $6.243 Billion</td></tr>
<tr><td>3a. Partial Extradosed</td><td>$205M - $289M</td><td>$458M - $594M</td></tr>
<tr><td>4. Concrete Deck Arch</td><td>$160M - $225M</td><td>$402M - $521M</td><td rowspan="2">(C) Twin Bored Tunnel $5.728 Billion</td></tr>
<tr><td>4a. Standard Girder Structure with Concrete Arch Facade Elements</td><td>$154M - $210M</td><td>$365M - $467M</td></tr>
<tr><td colspan="4">*These costs and the bridge and tunnel types discussed herein are conceptual in nature. A 35percent contingency is included in the cost of the bridge and tunnel options.</td></tr>
</table>

rehabilitation of the existing Long Bridge was estimated at $68 million. The numbers shown on these tables should only be used as a basis of comparison between different bridge concepts and should not be considered as complete estimates of final costs. Appendix E provides detailed costs of each bridge and tunnel concept for each alternative.

Table 8.4: Initial Construction Costs for Rail with Multimodal Options for Alternatives 5 through 8

(2013 Dollars) - Order of Magnitude Costs*				
Structure Type	**Alt 5**	**Alt 6**	**Alt 7**	**Alt 8**
1. Steel Tied Arch	$424M - $556M	$607M - $794M	$623M - $816M	$733M - $963M
2. Steel Through Arch	$450M - $590M	$638M - $837M	$655M - $859M	$770M - $1.012B
3. Extradosed	$700M - $893M	$917M - $1.169B	$941M - $1.200B	$1.104B - $1.410B
3a. Partial Extradosed	$535M - $695M	$709M - $919M	$727M - $943M	$849M - $1.104B
4. Concrete Deck Arch	$483M - $628M	$664M - $862M	$686M - $890M	$815M - $1.062B
4a. Standard Girder Structure with Concrete Arch Facade Elements	$431M - $555M	$587M - $758M	$604M - $781M	$710M - $923M

*These costs and the bridge and tunnel types discussed herein are conceptual in nature. A 35 percent contingency is included in the cost of the bridge and tunnel options.

Future Maintenance and Lifecycle Costs

Future lifecycle costs refer to expenses that recur over the life of the structure; they are necessary to maintain the functionality, serviceability, and safety of the structure. A lifecycle analysis typically provides a detailed examination of anticipated ongoing costs for maintenance. The lifecycle analysis identifies specific anticipated capital expenditures at various future years during the life of the structure, and it translates those costs to present-day expenditures using expected inflation rates. These costs are discussed in this chapter to compare the relative maintenance and lifecycle requirements of each bridge and tunnel type.

This type of analysis is generally carried out further into the design process, when more specific characteristics of the design of the bridge or tunnel have been determined. At this stage of the conceptual design, only general differences in expected future maintenance and lifecycle costs between concepts can be identified. The next step of the study process, known as the Type, Size, and Location Report, will refine the field of feasible concepts and provide more specifics relative to the design features of each concept to develop full lifecycle costs.

Potential lifecycle and maintenance issues considered in this evaluation include:

- Requirements for repainting structural elements
- Requirements for bearing and expansion joint maintenance and replacement
- Ease of inspection and accommodation for reasonable access for inspection crews
- Inspection complexity of a nature other than what is typically addressed by the agency maintaining the structure
- Likelihood for positive long-term durability, including tunnel waterproofing
- Potential for fatigue-prone details or introduction of potential fracture-critical structure elements

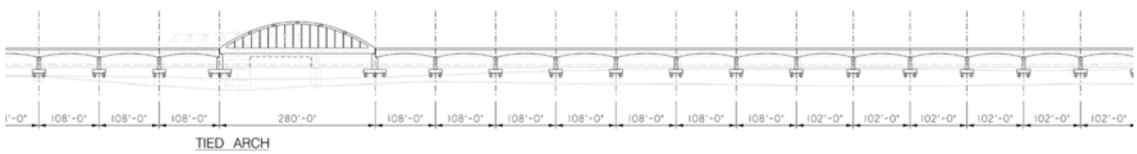
Specific to each of the bridge and tunnel concepts, several factors influence future maintenance and lifecycle costs for each structure type. If post-tensioning is used in the precast arch ribs, the tendons and tendon ducts will need to be protected from water intrusion. Proper grouting of the tendon ducts will be critical to the long-term durability of the structure. If conventional girder construction is used for the majority of the cross-section, periodic inspection will be straightforward and inexpensive. Because the structural elements are below the deck, inspections for this bridge type can typically take place with little impact to rail or passenger traffic and ongoing operations on the bridge. If girder construction is used and steel girders are employed, the steel girders will need to be repainted periodically. If concrete girders are used, there will be no need for future painting of this concept, in contrast to some of the other bridge types under consideration.

Future maintenance and lifecycle costs of tunnels are a function of leakage and deterioration prevention. The precast segmental tunnel and submersed tunnel, by nature of their construction, are watertight. Bored tunnels are excavated and lined with a precast segmental lining that is bolted with gaskets for water tightness. Each type of tunnel has to be inspected periodically for water tightness performance and any other observed issues with cracking or shifting.

The remainder of this chapter is presented in five sections: one section for each of the four bridge types being considered and one section for the tunnel types. Each section includes detail of the initial design and construction costs, discussion of maintenance and lifecycle costs, and presentation of the expected construction sequencing of each structure. The cost of bridge concepts increases from Alternative 2 to Alternative 8 because the alternatives progressively get wider, increasing the cost per unit of construction. Also, it should be noted that, depending upon the bridge type, the overall width of bridge construction can vary. Alternatives defined in Chapter 4 provided typical cross-sections for each alternative. The actual bridge type selected could vary in the width of the structure; this would be prepared in the final design of the structure. Detailed costs as presented in Appendix E include consideration of this varying width by bridge type. Costs were prepared for each of the tunnel concepts independently.

Steel Tied Arch

From an initial cost standpoint, the steel tied arch concept is likely to be the least expensive concept of those being considered. The majority of the bridge is standard construction that can be built with relatively small initial cost. The "unique" portion of the bridge that requires unique fabrication and construction of the tied arch itself is limited to a small portion of the bridge. There is little need for specialized construction equipment or an excessive need for temporary works. The tied arch span represents somewhat unique construction but with the 280-foot span length being contemplated for this main span, the construction of the tied arch will be fairly straightforward. The foundations for the main tied arch span should be relatively smaller than the foundations for the other concepts, since the main span is shorter and transfers smaller loads (and potentially significantly reduced lateral loads) to the subsurface. The tied arch concept results in more piers in the water compared to the extradosed and through arch concepts.



The initial construction cost for the steel tied arch concept is the lowest of the four bridge types. The cost estimates range for Alternative 3 from $355 - $464 million to Alternative 8 at $733 - $963 million. This is a function of the fact that the tied arch itself occupies only 10 percent of the structure and this portion is considered the most complex of the structure. The remainder of the bridge is standard girder construction. Reconstruction of the existing two-track bridge in Alternative 2 is estimated at $137 - $197 million.

The approach spans make up a significant percentage of the overall length of this structure, and these spans will have maintenance requirements that are standard for most conventional bridge structures. The bridge bearings and expansion joints will need to be replaced periodically, as will any required drainage elements on the bridge. If the approach spans consist of steel girders, the girders may require repainting, unless weathering steel is utilized. Concrete elements such as the piers will need to be protected from chloride intrusion and will need to be inspected for cracking, spalling, and delamination.

The steel tied arch span will present additional maintenance requirements that could include future painting of the arch ribs and lateral bracing between the arches. The tied arch span will also have a steel flooring system consisting of floor beams and potentially steel stringers. These elements will need to be inspected and protected from corrosion. The tie girder that connects the ends of the arch ribs is a tension member that will need to be carefully protected from the possibility of any crack development. The tie girder represents a fracture-critical element and, accordingly, should be carefully inspected on a regular basis to ensure safety.

Inspection of the majority of the bridge approach spans will be standard inspection that should not require any specialized equipment or techniques. Inspection of the arch ribs and hangers will require man-lifts that have the capability to access the top of the arch ribs.

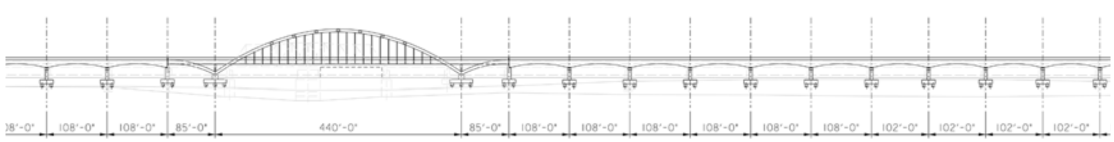
Steel Through Arch

In comparison to the tied arch concept, the through arch concept will be somewhat more expensive since a smaller percentage of the bridge will be a conventional approach span construction. With the longer main span at 440 feet, the size of the arch members will be larger and costlier to fabricate, deliver, and erect. Likewise, the floor system for the arch spans will be much more extensive and will add cost. The longer main span may also increase the likelihood of needing special erection equipment and/or temporary supports in the Potomac River. Erection equipment would have to come from southeast of the current structure. Depending upon whether the new construction is northwest or southeast of the existing structure, a determination will need to be made if the current moveable spans will need to be operational for movement of erection equipment to the northwest side of the current structure. This would require extensive coordination with the operational requirements of the bridge for rail traffic to maintain uninterrupted scheduled flows of rail and passenger trains. The need for large foundations at the ends of the arch ribs to resist horizontal thrust loads, given the depth of bedrock at this location, has the potential to add significant cost to the project.

Evaluation of future maintenance requirements for this bridge type is very similar to that of the tied arch concept. This concept would potentially have slightly fewer bearings to inspect and replace, since it uses fewer approach piers. Inspection of this concept becomes somewhat more difficult with the longer and higher steel arch and more extensive flooring system.

The approach spans make up a significant percentage of the overall length of this structure, and these spans will have maintenance requirements that are standard for most conventional bridge structures. The bridge bearings and expansion joints will need to be periodically replaced, as will any required drainage elements on the bridge. If the approach spans consist of steel girders, the girders may require repainting, unless weathering steel is utilized. Concrete elements such as the piers will need to be protected from chloride intrusion and will need to be inspected for cracking, spalling, and delamination.

Inspection of the majority of the bridge approach spans will be standard inspection that should not require any specialized equipment or techniques. Inspection of the arch ribs and hangers will require man-lifts that have the capability to access the top of the arch ribs.



THROUGH ARCH

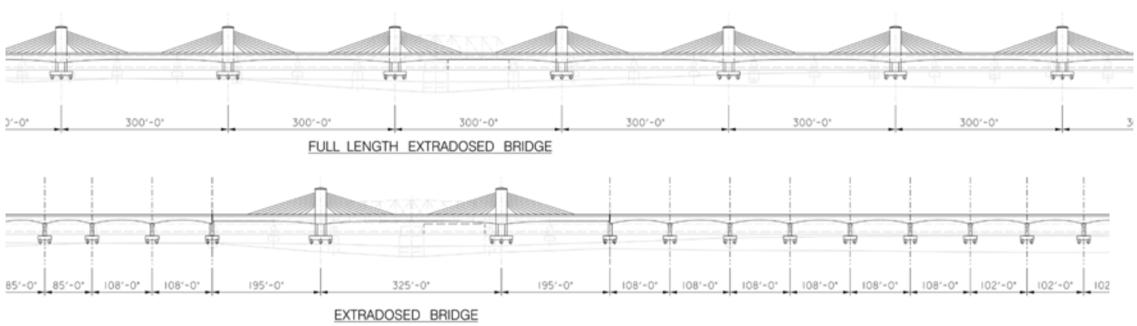
The initial construction cost for the steel through arch concept is higher than the tied arch concept. The cost estimates range for Alternative 3 from $378 - $494 million to Alternative 8 at $770 million to $1.012 billion. This is a function of the fact that the more complex through arch occupies 25 percent of the structure. The remainder of the bridge is standard girder construction. Reconstruction of the existing two-track bridge in Alternative 2 is estimated at $151 - $217 million.

Extradosed/Cable-Stayed

The extradosed/cable-stayed bridge type represents the option with the highest initial cost compared to the other concepts. The unique nature of the structure type and the relative lack of contractors able to build this structure type will force a less competitive bidding environment. A longer percentage of the overall structure consists of unique structure as opposed to less expensive conventional bridge construction. The overall schedule for construction is anticipated to be longer than any of the other concepts. If balanced cantilever construction is used, the foundations are likely to be larger and more expensive than other structure types.

The maintenance activities associated with the extradosed concept are non-typical and include the need to inspect and maintain the stay cables that support the deck. Durability issues have been reported on cable-supported structures where the cables have not been properly grouted and subsequently exposed to salt-laden moisture or water. Considerable care should be taken in the grouting of the cables and the cables should be regularly inspected.

If steel edge girders were used for the superstructure, maintenance activities would be similar to a steel girder bridge. It would require periodic painting of the steel and maintenance or possible periodic replacement of bearings and expansion joints. If a post-tensioned concrete superstructure was utilized, the superstructure could be designed to minimize cracking and enhance durability.



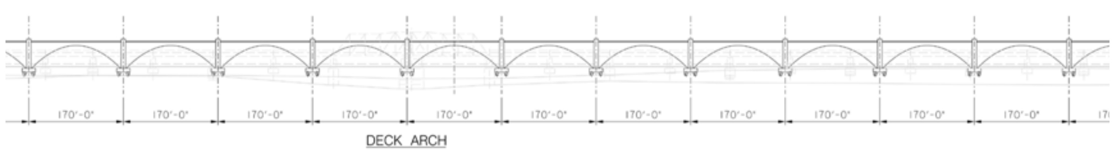
The initial construction cost for the extradosed/cable-stayed is estimated for Alternative 3 from $598 - $762 million to Alternative 8 at $1.104 - $1.410 billion, assuming that 100 percent of the structure consists of extradosed spans. The cost would be reduced if the unique extradosed structure was only used for the main span similar to the tied arch and through arch concepts. This would result in the remainder of the bridge being constructed with conventional girder construction. The cost range estimate for the partial extradosed bridge for Alternative 3 is $458 - $594 million and Alternative 8 at $849 million to $1.104 billion. Reconstruction of the existing two-track bridge in Alternative 2 is estimated at $291 - $393 million for the full extradosed cable/stayed option and $205 - $289 million for the partial extradosed cable/stayed option.

Concrete Deck Arch

The evaluation of initial cost for a deck arch depends heavily on the type of construction used to build the bridge. A variety of options exist for arriving at the final desired architecture of a concrete deck arch, and some of these options are more economical than others. The most significant consideration is whether the bridge will be comprised of true arch members across the entire cross-section or whether conventional girders are used in the cross-section with precast arch façade panels on the outside of the cross-section.

If a decision were made to use precast post-tensioned segmental arch ribs, this would represent a somewhat unique construction type across the entire river and could be somewhat expensive. Economy for these types of structures is often dependent on having a significant length of bridge and an abundance of repetition for fabrication and erection. Additionally, erecting and temporarily supporting large precast elements would require equipment and temporary supports in the river, which could introduce significant costs. The erection of precast elements would also require post-tensioning activities over the river, and the stressing of large post-tensioning tendons near the river could pose challenges and introduce additional costs.

However, this structure type offers the opportunity to employ a very cost-effective concept that would likely represent the least expensive bridge type of those currently under consideration. This concept would consist of standard steel or precast concrete girders on the interior of the cross-section, with precast concrete façade elements on the exterior of the bridge. The use of conventional multi-girder construction for the majority of the bridge would save significant cost and represent the fastest and most economical type of construction. This method of construction has been successfully employed to construct aesthetically pleasing structures for a small aesthetic cost premium over the economical girder-type construction.



The concrete deck arch concept is a reduced variation of the tied arch concept that incorporates conventional girder construction for 100 percent of the bridge length accompanied by precast arch façade elements on each span. The initial cost of the conventional deck arch is estimated for Alternative 3 from $364 - $467 million to Alternative 8 at $710 - $923 million. A deck arch structure that is comprised of all concrete arches would represent a unique structure type that would be more expensive. The cost estimates range for Alternative 3 from $402 - $521 million to Alternative 8 at $815 million to $1.062 billion. Reconstruction of the existing two-track bridge in Alternative 2 is estimated at $154 - $210 million for the precast arch façade option and $160 - $225 million for the all concrete arches option.

Image 8.4: Concrete Deck Arch Example

Image 8.5: Concrete Deck Arch Example

Tunnels

Compared to the bridge alternatives, a tunnel under the Potomac River would be the most costly alternative. Independent of the costs associated per linear foot of construction, the tunnel requires specialized equipment and the construction of chambers and pits to accommodate the equipment. Tunnels also require venting plants that are built to accommodate airflow from the venting shafts inside the tunnel to the outside. These complicated venting plants are expensive and require aboveground land for construction.

Assessment of the vertical alignment and anticipated engineering requirement of a tunnel with the stipulated depth requirements to avoid existing underground structures makes it unlikely that a jacked or submersed tunnel would be constructed. A jacked or submersed tunnel is practical only for a relatively short distance. The grade restrictions for a freight tunnel and the tunnel length require long approach tunnels to the Potomac River crossing. This leaves the hard rock tunnel bore as a practical solution for the linear feet of tunnel that have been estimated. Costs for the jacked and submersed tunnel concepts presented in this study assume a much shorter construction length than the bored tunnel concept. Again, these shallow tunnel options are considered the least feasible based on the depth requirement of any tunnel option to meet the required grades for freight tunnel operations and the need to avoid underground obstructions.

Tunnels also present considerable costs for relocating existing utilities. A detailed underground utility assessment is required to determine what types of utilities will be encountered and the associated costs of relocating each utility. Often, all utilities are not clearly marked, and this adds cost during construction as they are encountered and addressed for relocation. Underground utility assessment for the construction of a tunnel was not conducted as part of this study.

Tunnel costs were prepared for three types of tunnels and include a uniform cost of $120 million in each tunnel concept for the construction of an underground passenger rail station.

- Twin Bored Tunnel- $5.728 billion
- Jacked Segmental Tunnel- $6.222 billion
- Submersed Segmental Tunnel- $6.243 billion

Constructability and Construction Impacts of Bridge Types and Tunnels

Each concept was evaluated on the basis of ease of construction and the extent to which complexity and delays in construction are more or less likely. Factors influencing each concept's evaluation for construction impact include:

- Requirements for demolition and removal of the existing piers, or potential reuse of the existing piers and foundations
- Effect on rail traffic flow or traffic on current or neighboring structures
- Effect on or interruption of boating traffic on the Potomac River
- Number, size, and location of piers in the Potomac River
- Right-of-way requirements and purchase of foundations specifically as they relate to National Park Service land and construction that would affect the promenade and driveways at the Mandarin Oriental Hotel
- Duration of temporary falsework in the Potomac River
- Requirements and feasibility for use of heavy equipment for erection
- Adjacent Metrorail Bridge space and safety issues
- Construction impacts for noise, air quality, or excessive vibrations that might affect nearby structures
- Approach path to Ronald Reagan National Airport that would preclude certain construction equipment or the construction height of the new bridge
- Use of local labor and materials
- Construction method required common to the local contracting community to assure accurate construction bids
- Construction method impact to the construction schedule
- Construction method need for excessive temporary works or non-typical construction equipment that is unfamiliar or unavailable to local contractors
- Requirements for fabrication and delivery of large or unusual-sized bridge elements
- Impact delivery of large or heavy bridge elements would have on all traffic modes in the area of the bridge
- Requirements for out-of-state fabricators and/or specialty contractors

- Extent and number of construction permits
- Depth requirements to avoid underground obstructions and provide a feasible alignment for tunnels

Construction of a new bridge or tunnel in this highly urban location presents construction challenges that obviously would not be of concern in a more rural setting. The construction of new rail tracks requires consideration of how new tracks will be integrated into the existing rail system. The possibility for impacts to commuters, tourists, and a large population base at this location would be significant and is considered as part of the constructability assessment.

Consideration of Track Layout - Potomac River at East Potomac Park to the Mandarin Oriental Hotel

The right of way needs for each alternative were assessed during analysis. Upon selection of a location for new construction, specific right of way constraints will need to be assessed in greater detail.

The length of the study corridor can accommodate new construction for all the alternatives. However, one identified section will require additional considerations in response to adjacent infrastructure and corresponding rights of way.

The analysis identified a specific section of track that runs from the northeast abutment of Long Bridge at East Potomac Park to the Maryland Avenue circle overpass at the Mandarin Oriental Hotel, as shown in Figure 8.1. Due to the proximity of I-395 and other structures, special consideration for construction phasing will be required for any instance of track widening.

The specific construction sequence of the new bridge will be dictated by the total number of tracks to be constructed and the extent of reuse of existing tracks versus a new alignment. As an example, one construction sequence is presented below for consideration in analysis of Long Bridge improvements.

The following construction phasing concept is proposed for a four track right-of-way option that would construct two new tracks and refurbish or reconstruct the existing two tracks. The concept accommodates for the infrastructure proximity of I-395 as well as US Route 1 to 14th Street SW. Figure 8.1 provides the concept with the construction of two new tracks and the reuse of the existing two-track bridge. Construction phasing would include:

1. Two-track construction northeast of existing Long Bridge to East Potomac Park.Transfer of two-track operations to new bridge to continue on existing tracks from East Potomac Park to the Mandarin Oriental Hotel.
2. Rehabilitation or replacement of existing two-track Long Bridge.
3. From the Long Bridge abutment at the Potomac River on East Potomac Park, upgrade three bridge structures for an additional two tracks travelling southeast of the existing track bed over I-395, Ohio Drive SW and the Tidal Basin Bridge into the District.

4. Upgrade the bridge structure for an additional two tracks northwest of the Maine Avenue SW crossing.

5. Realign the four-track system to eliminate reverse curves required during the transition between a two and four track system (identified as locations A and B in Figure 8.1).

Final design will dictate other phasing considerations. This example provides a starting point for considering the construction and phasing of Long Bridge alternatives.

Additional considerations will need to be made for costs associated with reconstruction or new construction of structures and over-grade bridges from Long Bridge to the Mandarin Oriental Hotel. This section of the alignment was considered an approach in costing alternatives. Table 8.5 provides an estimate of the cost that would be incurred for different bridge types above the estimates provides in Tables 8.3 and 8.4. Table 8.5 costs were developed using Alternative 8.

Figure 8.1: Bridge Construction Sequencing Diagram

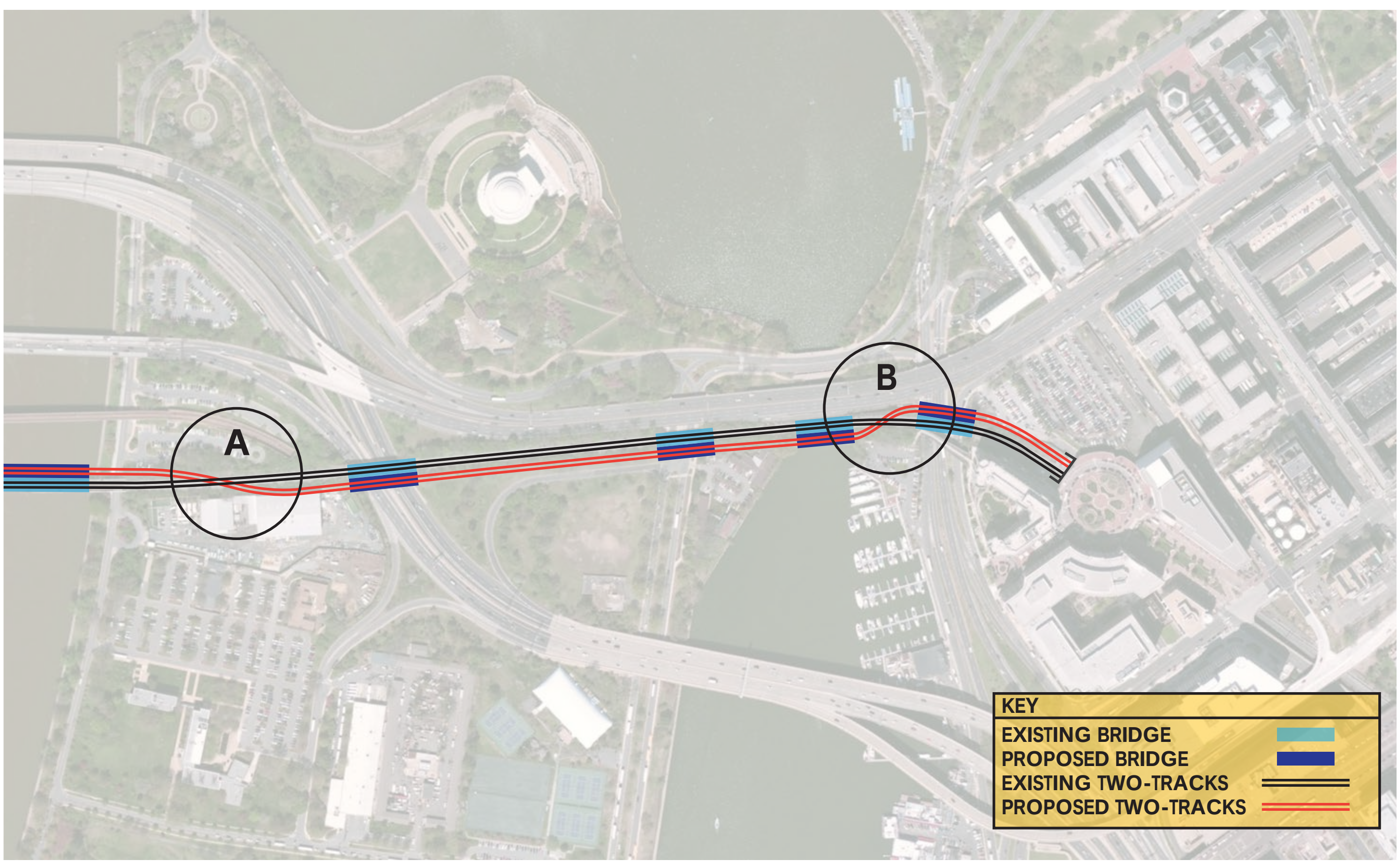


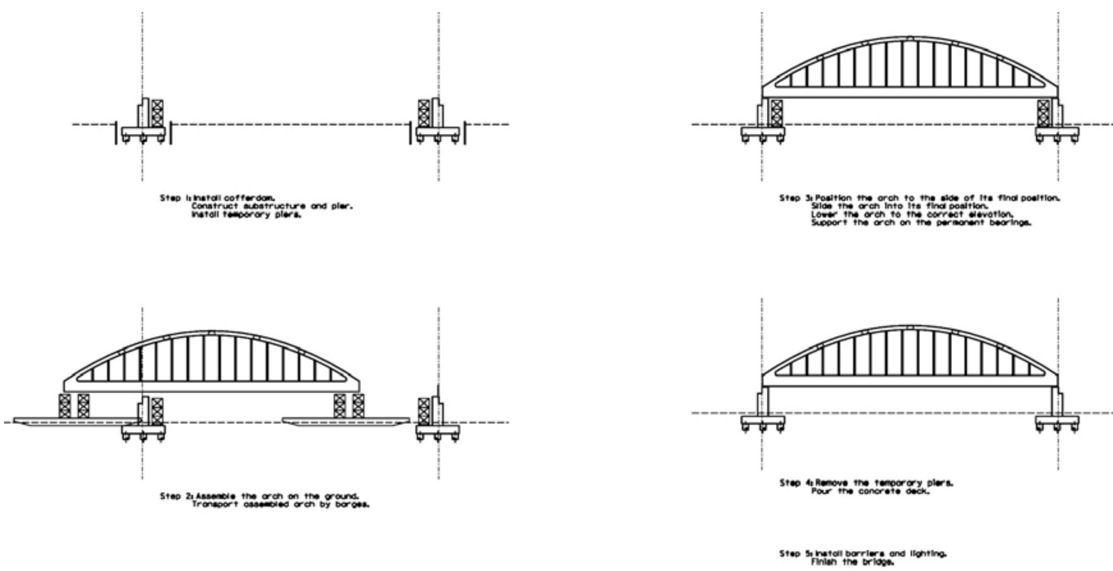
Table 8.5: Additional Structure Costs for Over-Grade Structures Between Long Bridge and Mandarin Oriental Hotel (using Alternative 8)

(2013 Dollars) *

Structure Type	Structure Cost	
	Low	High
1. Steel Tied Arch	$116,240,000	$154,980,000
2. Steel Through Arch	$117,850,000	$157,140,000
3. Extradosed	$204,520,000	$245,430,000
3a. Partial Extradosed	$204,530,000	$245,430,000
4. Concrete Deck Arch	$73,980,000	$92,470,000
4a. Standard Girder Structure with Concrete Arch Facade Elements	Unit costs for the entire structure and approaches were the same.	

Steel Tied Arch

Figure 8.2: Steel Tied Arch Construction Sequence



The steel tied arch, shown in Figure 8.2, represents a fairly common structure type, familiar to most major bridge contractors. The majority of the structure would consist of typical multi-girder approach spans of reasonable length, representing standard bridge construction for contractors.

Assuming the span length of the tied arch span is limited to approximately 280 feet, construction of the tied arch span could either take place in its final location or the arch span could be constructed off site and moved into place using special lifting and moving equipment. The need for temporary shoring for construction of the arch ribs, assuming the arch is constructed in its final location, would be somewhat limited.

Because the tie girder of a tied arch resists horizontal thrust loads from the arch ribs, the loads transmitted to the piers and foundations on the main span would be predominantly vertical loads, thereby making the design and construction of the piers and foundations somewhat more straightforward. The expectation would be that the foundations for this concept would be smaller and more economical than the other concepts.

Of the bridge concepts being considered, this concept likely represents the shortest construction schedule. The approach spans could likely be constructed simultaneously with the main span, reducing construction time. As the approach spans are standard construction elements, construction of these spans is expected to be quick relative to the other concepts. Additionally, construction of this concept does not have high risk of being slowed down during cold weather months. However, this concept has the potential to result in more piers in the river than the other concepts.

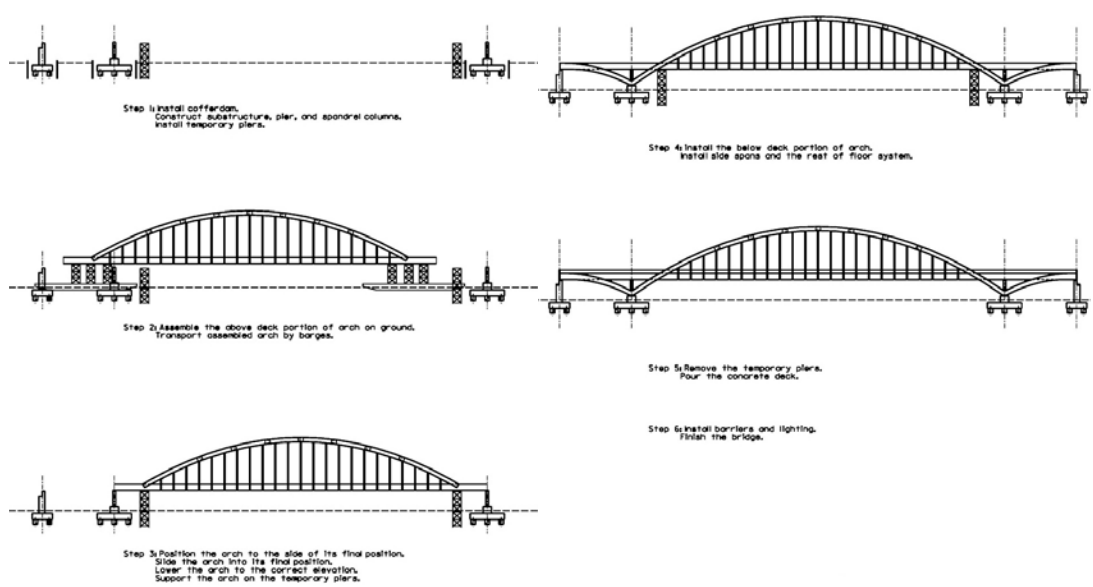


Figure 8.3: Steel Through Arch Construction Sequence

Steel Through Arch

Constructability and construction impact for this bridge type would be similar to the tied arch, as shown in Figure 8.3. There are a few differences that would make the evaluation of the through arch less favorable than the tied arch. Most importantly, the through arch requires the use of large foundations at the base of the arch ribs to resist the horizontal thrust of the arches. In contrast, the tied arch resists these horizontal loads by use of a tie girder. The large horizontal forces at the foundations ultimately need to be resisted by the subsurface material, and for this reason this bridge type is more practical in locations where a strong bedrock layer is close to the surface. In this location, there is a firm sand layer 40 feet or more below the water surface. Therefore, potentially large and expensive foundations, supplemented with driven piles, would be required to carry the thrust loads down to the bearing layer.

Additionally, the span length proposed for the through arch is 160 feet longer than that of the tied arch. This complicates the erection of the arches and could result in a greater need for temporary supports in the Potomac River. It also would result in larger arch rib members, making fabrication, delivery, and erection of the arch ribs more difficult.

Like the tied arch concept, a fairly large percentage of the bridge would consist of standard approach spans, which would require straightforward, conventional construction. In addition, with the longer main span, the through arch would likely have two fewer approach piers, somewhat reducing the amount of foundation work in the river. This advantage is more than offset by the need for large thrust blocks at the ends of the arches.

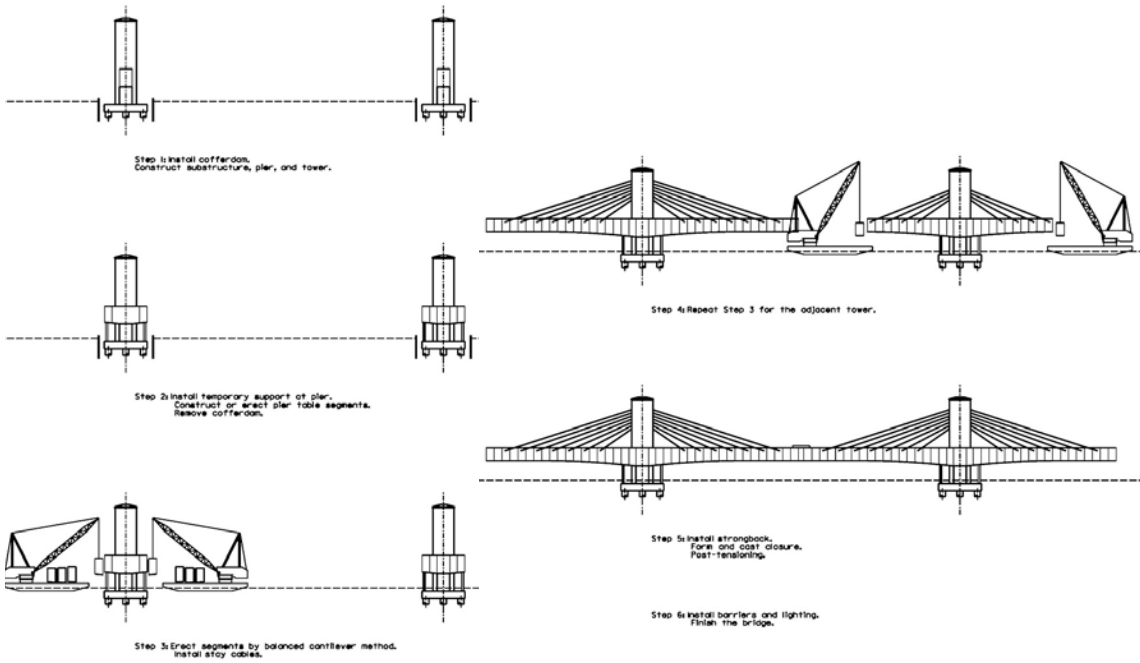


Figure 8.4: Extradosed/Cable-Stayed Construction Sequence

Extradosed/Cable-Stayed

Of all of the bridge types discussed in this report, the extradosed structure, shown in Figure 8.4, represents the bridge type that would be the least familiar to local contractors. This bridge type would likely require the expertise of a national contractor with prior experience with the construction of cable-supported or cable-stayed bridges. Erection of the superstructure would require techniques and equipment that are uncommon for conventional bridge construction.

One advantage of extradosed or cable-stayed construction is that it is possible to perform the construction in a top-down fashion using balanced-cantilever erection. Few, if any, temporary supports would be required in the Potomac River during construction. However, balanced-cantilever construction results in significant unbalanced loads on the piers and foundations during construction, potentially resulting in larger and more expensive foundations. By using 300-foot spans across the river, a significant number of piers that support this balanced-cantilever erection

Figure 8.5: Concrete Deck Arch Cast-in-place Construction Sequence

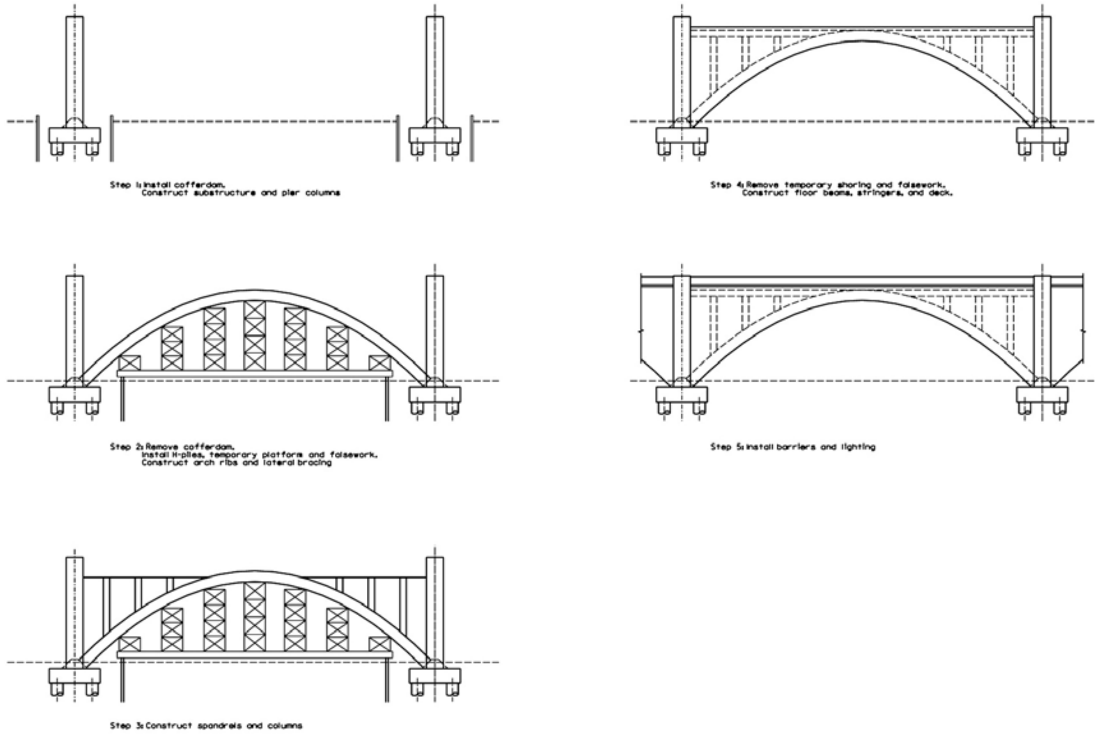
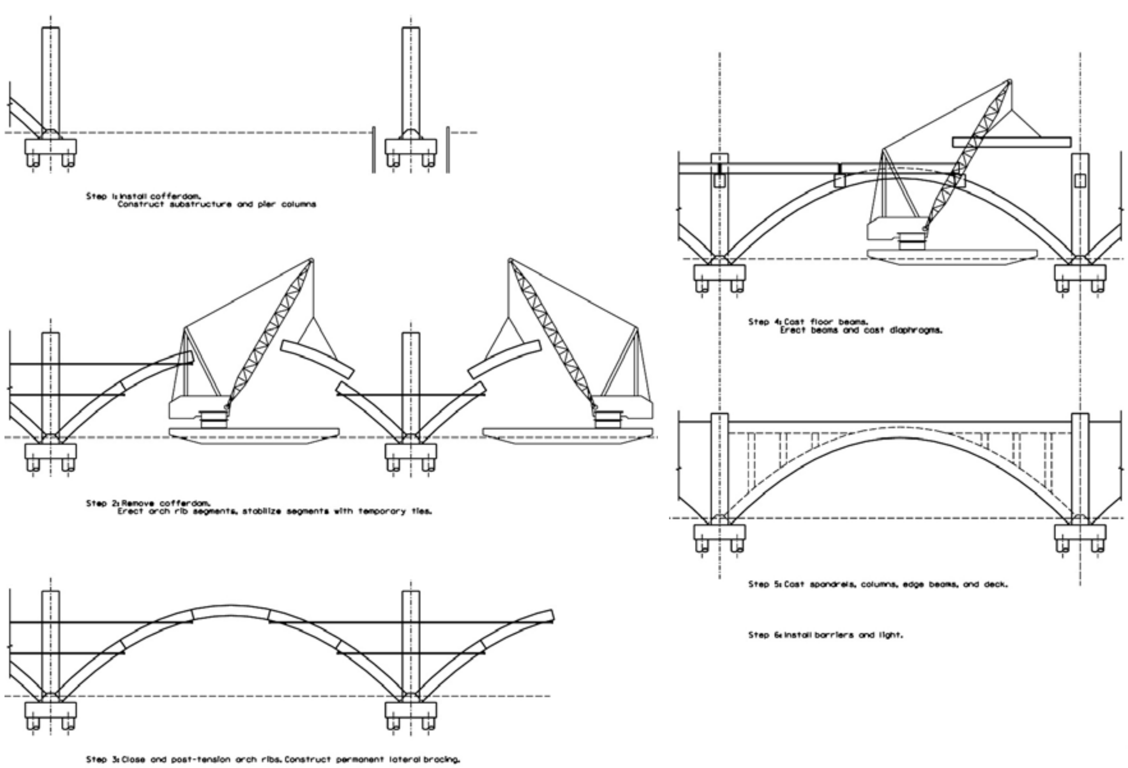


Figure 8.6: Concrete Deck Arch Precast Construction Sequence



would be located in the river. Each pier would include a 48-foot tower that must be cast-in-place on the river, adding cost and complexity.

The unique nature of the construction would result in this concept having the longest anticipated construction schedule. Because of the nature of the step-by-step erection of this bridge type, special design and erection analysis expertise would be required to ensure structural stability at each stage of erection to arrive at the final desired geometry of the structure.

Concrete Deck Arch

The deck arch is a traditional bridge concept for the District. If a standard girder superstructure with cast-in-place façade elements were chosen, this would represent the easiest and most straightforward construction with the shortest anticipated construction schedule of all of the bridge types under consideration. The construction sequence is shown in Figure 8.5. If post-tensioned arch construction was used, the arch sections would need to be comprised of precast elements since casting in place on the river is not practical. Delivery and erection of large curved precast elements in this urban environment would need to be evaluated. The construction sequence of a precast deck arch is shown in Figure 8.6. Depending upon the locations available where precast elements can be constructed, it could be more practical to use segments to comprise the arch and post-tension the segments together. If precast arch ribs were used, there would be potential for a significant amount of temporary shoring to erect the arch ribs. The erection of temporary shoring towers in the river could be difficult and expensive.

Tunnels

Tunnel options consist of several types of tunnel designs including jacked segmental, submersed segmental, and twin bored. These designs are considered different means and methods for constructing tunnels and all require utility relocation and replacement in the areas of the assembly and retrieval shafts and tunnel approaches of several thousand feet.

The jacked segmental tunnel option is utilized for near surface and soft ground tunnels. Tunnel precast concrete segments 40 feet to 60 feet in length and up to 90 feet wide are fabricated in a yard and delivered by truck to the jacking pit. The segments are placed into the jacking pit by crane and landed on rails. For the length of the tunnel, the soft ground is improved with ground freeze, jet grout, or other ground improvement techniques. These techniques force the ground at the open heading of the tunnel to stand up better for safe excavation. At the tunnel heading, a road header machine with a shield grinds out the improved ground in 4-foot drifts immediately ahead of the precast tunnel segment. The excavated material is removed by either truck or conveyor belt to the assembly chamber and stockpiled at the surface for removal by truck at a later time. Once the 4-foot drift is excavated and the tunnel segment is clear of surrounding obstruction, the tunnel segment is advanced with hydraulic jacks the full 4 feet. A roadheader then moves back into position in the tunnel heading and excavates the next 4-foot drift and the operation is repeated until the tunnel reaches the retrieval chamber. Upon completion of the jacking operation, the annulus between the precast segment liner and excavation is grouted.

Submersed segmental tunnels are precast concrete segments placed in a trench excavated in the river bottom. Segments are 60 feet long and up to 90 feet wide and delivered to the placement point by barge. Typically, the river bottom is dredged to a depth that will accommodate segment submersion by barge crane and rock cover for protection from a ship strike. From the shoreline, the tunnel can be sheeted, cut-and-cover to the portal of the assembly and retrieval chambers.

Bored tunnels can be constructed using tunnel-boring machines (TBM – Image 8.6) that can range in outer diameter size from approximately 23 feet to as large as 57.5 feet and begin by assembling the TBM in an assembly chamber. The TBM begins excavation by grinding up the rock and removing the grindings by truck, train, or conveyor belt to the assembly chamber. The TBM advances into the rock an average of 50 feet per day. Tunnel analysis as part of this study estimated the need for two 44-foot outer diameter bores for each of two tunnel bores to accommodate the requirements of freight and passenger service. Depending upon the length of the tunnels, it could be economically beneficial to use either one or two TBMs. For a single TBM, the machine would be disassembled at the retrieval chamber after the first drive under the river, position reversed, reassembled, and then driven back under the river for the second bore to terminate at the original assembly chamber.

Bore tunnel construction requires large aboveground staging areas in close proximity to the construction location. The location of tunnel portals and temporary construction shafts would need to be considered due to the length of the bore tunnels and possible impacts to existing aboveground structures.

Image 8.6: Tunnel Boring Machine

CHAPTER 9: FINDINGS

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The conduct of this study and the associated analysis process identified a number of viable options to meet future freight and passenger rail needs for crossing the Potomac River. The study considered rail options as well as expanded alternative concepts that accommodated new streetcar, vehicular, and pedestrian/bicycle modes.

Image 9.1: Freight Train

Major results from the study are delineated below:

- The Long Bridge is an important railroad crossing in the District. It carries local, regional, and national freight, passenger, and commuter traffic.
- The Long Bridge will continue to play an important role in the national railroad network due to the commuter, passenger, and freight rail needs and future high-speed rail.
- The current Long Bridge structure will continue to have regular inspection and maintenance and likely a major rehabilitation to support the continued operation of passenger, commuter, and freight service.
- The existing bridge has a two-track system, which creates operational challenges, even for existing operations. The existing superstructure and substructure of the bridge cannot accommodate any further addition of tracks due to the limited width available for expansion and inability to support any additional loads. Future passenger, commuter, and freight service will require expansion if the crossing is to meet the future demands.
- The bridge should be able to accommodate double-stacked trains.

- Bridge improvements should not preclude future electrified trains.
- The Long Bridge is part of the future high-speed rail network and provisions should be made to accommodate high-speed rail on the bridge.
- The Long Bridge area possesses high transportation demand for all surface transportation modes. The future Long Bridge could be built to accommodate modes such as transit, general purpose, and pedestrian/bicycle as identified in this study. The study developed a number of alternatives that address the future demand forecasts.
- If non-rail modes are introduced, safety provisions will have to be made to accommodate those modes, which may require physical separation, physical barriers, and separate bridge spans.
- The land use on both sides of the Long Bridge is showing continued growth. Access to and from these sites and connectivity to these land uses should be considered in any future Long Bridge improvements or bridge design.
- The Long Bridge is adjacent to the District's monumental core. Any future bridge improvements should complement the historic and monumental context of the District in design and architecture.
- The Long Bridge area includes several sensitive environmental resources such as national parks, historic landmarks and areas, and water bodies, which will require detailed analysis.

Image 9.2: Amtrak Acela

- A tunnel can be built to provide for the future rail needs in addition to the existing bridge or as a replacement for the bridge.
- Any future extensive improvements to the bridge, such as bridge replacement or reconstruction, would require substantial funding.
- The future of the Long Bridge will require coordination among many stakeholders and users for continued success effectively moving people and goods across the Potomac River.

The Long Bridge is an important railroad crossing in the District and the national railroad network. It carries local, regional, and national freight traffic, along with passenger and commuter traffic. It is the only Potomac River railroad crossing directly connecting Virginia and the District.

Due to future high-speed rail, commuter, passenger, and freight traffic planned in this area, the Long Bridge will remain important to the national railroad network. In order to access the District from Virginia and/or to pass through the District along the Eastern Seaboard, all rail traffic must cross the Long Bridge, making it a key component in the railroad network.

Regular inspection of the Long Bridge will continue in order to determine maintenance needs, including any major rehabilitation work. Due to its age and condition, the inspections and maintenance will help ensure that the bridge remains in working condition. These are important components to maintain the continued operation of passenger, commuter, and freight service across the bridge and to avoid any service disruptions.

Image 9.3: Zefiro 280 High Speed Rail Train (courtesy of Bombadier)

The existing superstructure and substructure of the Long Bridge have constraints that functionally and operationally limit the use of the bridge. The existing bridge has a two-track system, which poses operational challenges even for existing operations. Due to the limited width available on the structure, there is inadequate room for additional tracks on the current structure and inadequate room to expand. The current structure would not be able to hold extra loads from the weight of additional tracks and additional rail service. The structure's lack of ability to hold any additional loads eliminates the option to expand the structure.

Projected freight service shows increased freight demand, and the ability to double-stack freight trains is an important component to accommodate that increased demand. A Potomac River crossing should be able to accommodate future freight service that consists of double-stacked trains.

Future rail plans demonstrate a need for a crossing that accommodates and does not preclude potential future electrification. A bridge across the Potomac River connecting Virginia and the District should be able to accommodate electrified trains at some point in the future. Any conflict between accommodating double-stack trains and containing catenaries to provide electriciation would need to be addressed.

There are currently planning efforts and studies in the Long Bridge area that are considering rail improvements and high-speed rail along the eastern United States. The NEC FUTURE planning effort stretches from Boston, Massachusetts, to Washington, DC, while the Southeast High Speed Rail Corridor runs from Washington, DC, south to Charlotte, North Carolina. The Long Bridge is a component of the future high-speed rail network, moving trains going to and from cities south of Washington, DC. Provisions should be made to accommodate high-speed rail on the bridge.

The travel demand forecast for the areas in close proximity to the Long Bridge show an increase in land use and thus an increase in transportation demand for all surface modes. Numerous alternatives have been developed that include a range of options to address the potential demand in the area, including providing access on the bridge to modes other than rail, such as transit, general purpose, and pedestrian/bicycle, oncle the specifc demand has been identified.

Traditionally, non-rail traffic has not shared the same bridge as rail traffic due to safety issues and concerns. In order to share the same structure, safety issues must be addressed and provisions will have to be made in order to accommodate those modes. Safety provisions could include physical separation, physical barriers, and separate bridge spans. Safety concerns will have to be carefully and adequately addressed if a non-rail mode is considered.

The current and future land use on both the District and Virginia sides of the Long Bridge show continued growth in the area, making connectivity between these sites a crucial element. The growth will bring a need for a greater number of people to access the sites, creating demand for connectivity. This potential increased access need should be considered in any future Long Bridge improvements and future bridge design for both motorized and non-motorized users.

The District's monumental core is located adjacent to the Long Bridge. The monumental core consists of the National Mall, which houses monuments, museums, and national parks that are of national and historic significance. Any future bridge improvements should complement the historic and monumental context of the District in its design and architecture.

There are many environmental resources located in the area of the Long Bridge. Some resources include national parks, historic areas and landmarks, and bodies of water. In an effort to minimize the effects to these sensitive environmental resources, a detailed analysis will need to be conducted of each to identify what the resources are and the best methods to preserve them.

In addition to bridge alternatives, a tunnel alternative was identified as a potential option to address future rail needs. A tunnel alternative may be considered to accommodate the future rail demand in addition to the existing bridge or as a replacement of the bridge.

Reconstruction or replacement of the existing bridge will require substantial funding. Funding sources will need to be developed in order to move forward with a complete reconstruction or replacement.

As the only railroad bridge over the Potomac River, the Long Bridge serves many users. Its location and the historic significance of the surrounding areas attract many users. Coordination with users and stakeholders will be required for determining the future of the Long Bridge. The continued success of effectively and efficiently moving people and goods across the Potomac River is vital for the District and adjacent areas.

Image 9.4: Steel Tied Arch Bridge

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CHAPTER 10: STUDY COORDINATION

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Coordination for this study included multiple approaches to engage stakeholders and the public. Central to the goals for the study was building consensus on the best options for moving forward after completion of the study. This required an exchange of information and realizing shared interests that would benefit all users, jurisdictions, and individuals impacted by potential improvements to the Long Bridge.

Beyond meetings, the study team hosted a site visit, held a bridge workshop, and met with a number of agencies and other project teams that were conducting projects that could affect the Long Bridge Study. Coordination with FRA and CSX was continuous throughout the study. The key coordination and outreach activities are described on the following pages.

Image 10.1: The Long Bridge

Stakeholders and Agency Coordination

- Kick-Off Meeting (September 12, 2012)
- Site Visit (October 10, 2012)
- Passenger Service Providers (December 2012)
- Bridge Design Workshop (January 24, 2013)
- MWCOG Freight Subcommittee Meeting (February 7, 2013)
- Northeast Corridor (NEC FUTURE) High-Speed Rail Meeting (March 21, 2013)
- Stakeholder Meeting (June 5, 2013)
- MWCOG Technical Committee Meeting (September 6, 2013)
- MWCOG TPB Meeting (September 18, 2013)
- Stakeholder Meeting (October 23, 2013)
- Stakeholder Meeting (December 4, 2013)

These meetings were held to ensure that the study team communicated the progress of the study, to receive input on issues and concerns, and to share ideas among those interested in the study.

Image 10.2: Boat Tour of Bridge

Image 10.3: Boat Tour Participants

Regular topics for the meetings included study area; purpose and need of the study; scope of services and work to be performed; location of the alternatives; the modes included in the alternatives; analysis to determine the number of tracks for future freight, passenger, and commuter rail service; safety issues; design and architecture of a future bridge; and the details that need to be considered for any type of multimodal bridge or a rail tunnel.

The agencies and stakeholders that participated were:

- AMTRAK
- City of Alexandria
- Arlington County
- Commission on Fine Arts
- CSX Transportation
- DC State Historic Preservation Office
- DC Water
- Federal Aviation Administration

Image 10.4: Design Workshop (at right)

- Federal Railroad Administration
- Federal Highway Administration
- Federal Transit Administration
- Maryland Area Regional Commuter (MARC)
- Metropolitan Washington Council of Governments
- Metropolitan Washington Airports Authority
- National Capital Planning Commission
- National Park Service
- Department of the Navy
- Norfolk Southern
- Washington Metropolitan Area Transit Authority
- Virginia Department of Transportation
- Virginia Department of Rail and Public Transportation
- Virginia Railway Express

Image 10.5: Design Workshop

Image 10.6: Public Meeting 1

Public Meetings

Public meetings were held in Southwest Washington, DC at the Westminster Presbyterian Church at 400 I Street, SW, and St. Augustine's Episcopal Church at 600 M Street, SW. Meetings were announced on the DDOT website; in ads placed in the Washington Post; in flyers distributed at nearby Metro stations, neighborhoods, and with the Advisory Neighborhood Commission (ANC) in the study area; and through email blasts to the study distribution list. In an effort to include commuters who may travel across the Long Bridge on commuter rail and District residents in the study area, The meetings were held between 4:00 pm – 7:00 pm.

Table 10.1 summarizes the public meetings and their attendance.

Meeting	Date	Location	Attendees	Topics
1	November 13, 2012 4:00 pm-6:00 pm	Westminster Presbyterian Church 401 I Street, SW	29	Study introduction and overview Request for input and issues of interest
2	June 6, 2013 4:00 pm-7:00 pm	Westminster Presbyterian Church 401 I Street, SW	23	Communicate initial alternatives and receive feedback Communicate possible footprint for a new bridge
3	December 5, 2013 4:00 pm-7:00 pm	St. Augustine's Episcopal Church 600 M Street, SW	26	Present results of analysis and demand forecasting Communicate next steps and solicit comments on alternatives

Table 10.1: Public Meeting Schedule

Public Meeting 1 (November 13, 2012)

The purpose of the first public meeting was to introduce the study to the public and get feedback on important attributes in the study area, issues or concerns regarding the study, and ask for direct feedback on the study needs. The venue for the meeting was a large meeting room with presentation boards surrounding a center map table. The boards detailed study purpose and steps, the study schedule, and contact information. Graphical boards included photos of the bridge and the study area. Interactive maps on the center table allowed the public to identify key issues and interests by drawing them on the maps. Additional maps provided land use on the Virginia and District sides of the study area. Participants were provided a brochure with information with some history and overview of the study. The public was encouraged to leave written comments on the provided comment card, on the website, or via mail.

The public was invited to select and identify with a sticker their top three issues or interests at the Project Needs board where eight options, including an "other" option in case the study team overlooked an issue, were presented. The study team posed a number of questions related to these key issues to encourage the public to think carefully about their top three choices:

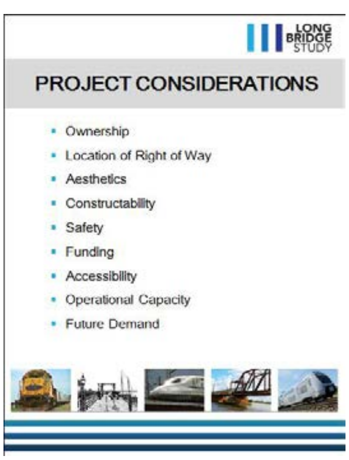

Image 10.7: Project Considerations Board

- Multimodal Access – how important is it for you to be able to access multiple modes of travel?
- Long-Term Capacity – what increases in capacity are needed across the Potomac River?
- Intermodal Connectivity – is moving between different modes of travel a problem?
- Transportation Demand – is increasing demand an important issue?
- Operational Improvements – how can the operations of different travel modes be improved?

Image 10.8: Public Meeting 1

- Assess Structural Conditions – is the CSX Long Bridge safe and does it need aesthetic improvements?

- Support Existing and Future Land Use – is this important to you?

- System Linkages – do you see issues with transit connections?

Elements of the study that were ranked as most important to public participants included: multimodal access, intermodal connectivity, long-term capacity, and transportation demand. Responses related to multimodal access and intermodal connectivity were dominated by interest in additional pedestrian and bicycle options. Responses related to long-term capacity and transportation demand were interested in increasing capacity to support waterfront redevelopment projects and affected roadways, such as Maryland Avenue.

Public Meeting 2 (June 6, 2013)

The purpose of the second public meeting was to communicate the work that had been done to date and obtain feedback on the 10 alternatives or rehabilitation/replacement of the existing bridge presented at the meeting. Ten boards presented each of the alternatives that had been developed. Interactive maps on the center table provided aerials of the study corridor and showed "maximum footprint" of the alternatives on both sides of the existing Long Bridge. The public was able to review these maps and comment on the connectivity and inter-connectivity of the rail and other modal options to facilities on the District and Virginia sides of the study.

The majority of written and verbal comments taken during the public meeting supported bridge rehabilitation, expansion, or new construction. A number of individuals supported rail expansion, specifically as it could add additional passenger service. Pedestrian/bicycle options were also highly supported with some concern for proximity to heavy rail. Streetcar was also supported.

Image 10.9: Public Meeting 2

Image 10.10: Public Meeting 3

Public Meeting 3 (December 5, 2013)

The purpose of the third, and final, public meeting was to present the results of the different elements of the study, provide a complete overview of the study findings, and present the alternatives. The meeting was organized as an open forum with boards illustrating all the elements and alternatives. It also included an animated video of the study corridor and the through arch bridge concept on a four-track rail bridge. Participants were led around the room to review the study elements which included: project process, rail and streetcar operational analysis, six alternative concepts, four bridge type concepts, alternative costs, and schedule. A table map of the study area and limits of the alternatives provided an interactive platform for participants to discuss the alternatives and better understand the limits and impacts of each alternative.

As with the previous two public meetings, the value of providing pedestrian/bicycle options was considered very important for any alternative that moves forward. Participants wanted the opportunity to travel between the District and Virginia and be provided additional options beyond the current 14th Street Bridge.

Throughout the public meeting, the study team reinforced that this study was the first step in developing future options for the Long Bridge. The study provided bridge type and rail/modal options that that would need to be studied in much greater detail to determine which options might be considered for funding and construction. The study team explained how there are still several major steps in the process including preparing an environmental document, developing detailed engineering analysis, and identifying funding sources.

Workshops

The study team held several workshops throughout the Long Bridge Study to fully discuss and understand the technical details required for the study and to allow for stakeholder and industry discussion for the study. The first workshop was held to work through the technical needs of the study, including developing the methodology to perform the transportation analysis on multiple modes of travel. The second workshop was a bridge design workshop to discuss the design and architecture options of a possible future bridge. This workshop was attended by experts in their respective fields and stakeholders with the knowledge of all aspects of this type of study. It produced information that assisted in the execution of the study. A third workshop detailed the rail analysis and operations for the study using the Rail Traffic Controller Operations Analysis Model (RTC).

The Bridge Design Workshop Report is detailed in Appendix F.