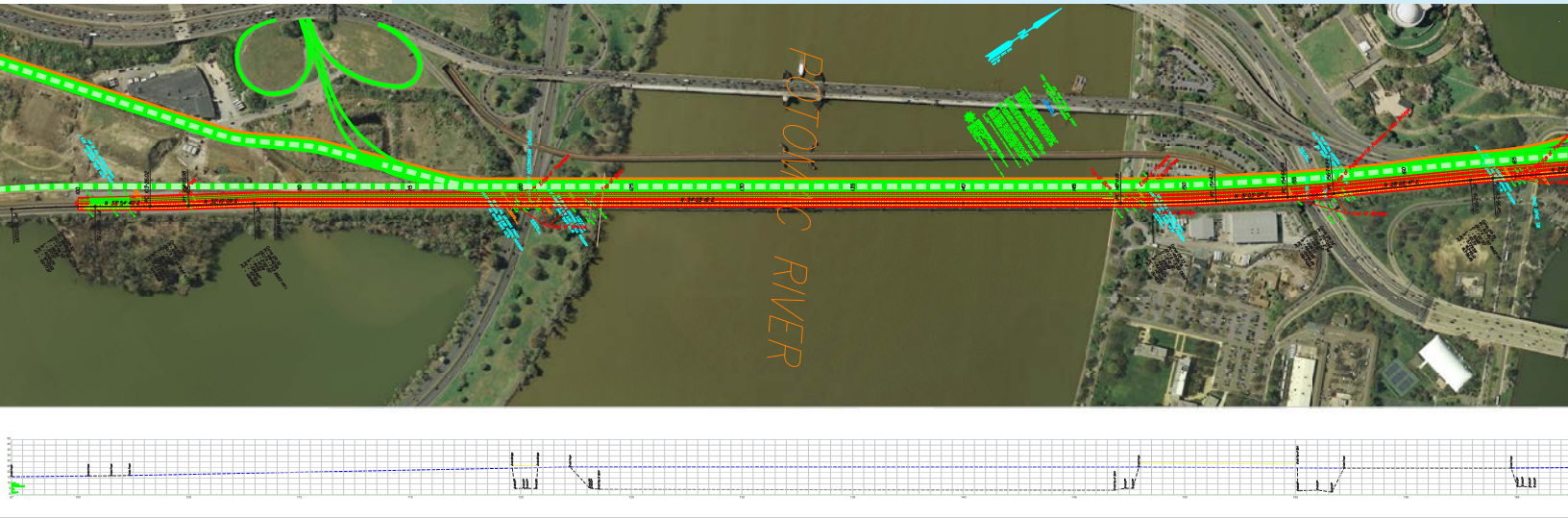
CHAPTER 4: ALTERNATIVES



CHAPTER 4: ALTERNATIVES

To begin alternatives development, the study team conceptualized specific criteria based on the purpose and need to develop alternatives, systematically defining over 180 alternative options and then refining a list of alternatives for further analysis.

This chapter details that process and describes the reduced list of alternatives that were considered for comprehensive transportation analysis.

Alternative Development Process Overview

The criteria were grouped into eight specific elements for alternatives development consideration. Table 4.1 lists the criteria and options under each criterion.

Because safety for each potential user (freight, passenger, commuter, transit, bicycle, and pedestrian) is important for all of the alternatives, safety was not called out as a specific criterion. Safety for any user could be addressed by separating the facilities or including structural elements to protect users. Further invesitgation on ensuring safety for all potential users will be further investigated in later stages of development.

Table 4.1: Criteria for Defining Alternatives

1. Track Configuration	
2 existing rail tracks, rehabilitated	Number of rail tracks needed to accommodate the existing and future freight, commuter, and passenger rail demand
2 existing + 1 new rail track	
2 existing + 2 new rail tracks	
2 existing + 2 new rail tracks + streetcar/transit	
2. Modes	
Freight	Long-term multimodal travel needs in the region and the future operating requirements of freight, high-speed and intercity passenger rail, commuter rail, transit, vehicular traffic, and pedestrian/ bicycle use.
Passenger/Intercity/Commuter	
High Speed Rail (HSR)	
Streetcar	
Bus/Rapid Transit	
General-Purpose	
Bicycle/Pedestrian	

Table 4.1 Continued: Criteria for Defining Alternatives

3. Distance/Travel Market	
Local	Travel markets that would be served by local, regional, and long distance travel patterns. Long Bridge serves as a vital north-south connector on the Eastern Seaboard and freight and passenger trains on the current bridge move commodities and people long distances. Also considers the need for more regional and localized travel as well as expanded long distance service such as high-speed rail.
Regional	
Long Distance	
4. Footprint	
Existing Footprint	Alignment will determine if a new bridge would utilize the existing footprint, expand from the existing bridge or create a new one.
Expanded Footprint	
New Footprint	
5. Alignment	
Options southeast of existing bridge	Will the future Long Bridge use the existing alignment or determine a new one to connect to the railroad network? How does the bridge best serve the desired travel destination and intermodal connections?
Options northwest of existing bridge	
6. Span Types	
Bascule	Will the bridge be fixed or open and what type of span could be utilized?
Swing	
Vertical lift	
Retractable	
Low level fixed	
High level fixed	

Table 4.1 Continued: Criteria for Defining Alternatives

7. Bridge Types	
Deck Arch	What type of bridge could fit the context and environment? A tunnel is also included for analysis to see if it best serves future needs.
Through Arch	
Suspension	
Truss	
Cable Stay	
Girder	
Extradosed/Cable-stayed	
Bi-level Bridge	
Tunnel	
8. Aesthetics and Architecture	
Pier Treatments	What colors, textures, ornamentation, and lighting best suit this location?
Deck Treatments	

Bridge Types, Clockwise from upper left:

Image 4.1: Deck Arch

Image 4.2: Through Arch

Image 4.3: Extradosed

Image 4.4: Vertical Lift

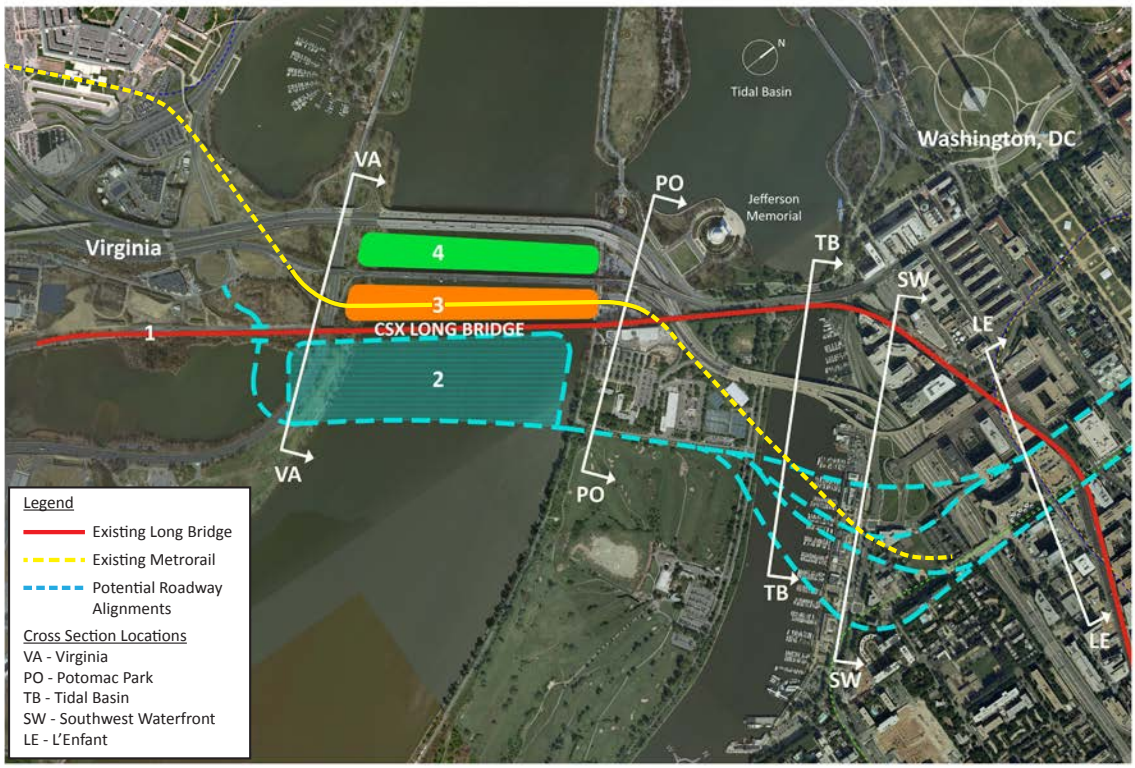
Physical Constraints

The location of any bridge improvement would have to consider physical constraints presented by the current infrastructure and how a new alternative would connect to the existing infrastructure. Figure 4.1 shows two of the constraints identified in Table 4.1: footprint and alignment. The footprint divides the study area into four different footprint areas. Alternatives could (1) use the existing bridge footprint; (2) move to the southeast of the existing bridge; or (3 and 4) move northwest of the existing bridge. The footprint location also considered how wide any given alternative cross section would be since this would be critical to whether or not an alternative would be feasible for construction.

The second physical constraint is the alignment. Figure 4.1 shows the different cross sections that must be considered for the alignment. The alignment determines the connectivity requirements of each alternative to the current transportation system. The specific locations of the alignment considered are: L'Enfant Plaza (LE), the Southwest waterfront (SW), the Tidal Basin Bridge (TB), East Potomac Park (PO), and the Virginia waterfront (VA) along the Mount Vernon Trail/George Washington Memorial Parkway. Because any new transportation infrastructure will have a fixed footprint, all alignments must be able to connect geometrically.

Four railroad tracks would create the widest footprint, so the alignment considered should be able to accommodate the physical space required for four tracks. The District side of the current Long Bridge is constrained on the southeast side and it would be difficult to accommodate two additional tracks connecting to the existing infrastructure. The expansion of rail or modal alternatives can be accommodated on

Figure 4.1: Location of Alternatives and Important Cross Sections

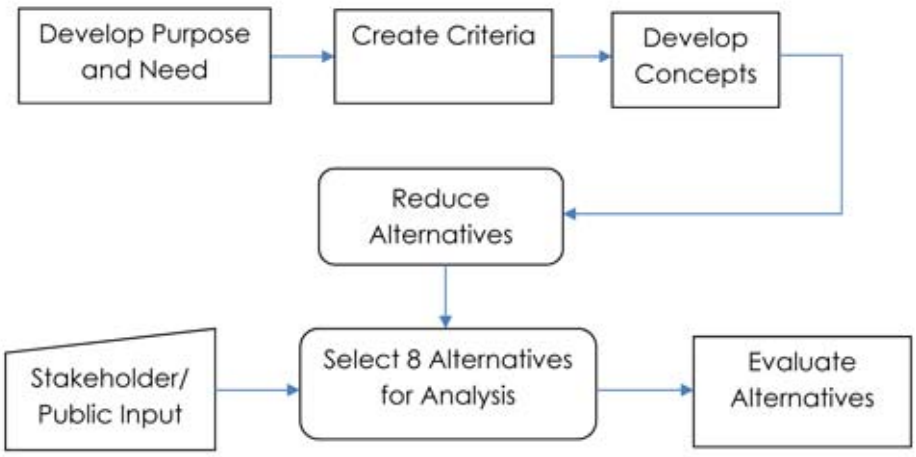


both the northwest and southeast side of Long Bridge. The new track layout on the District side of Long Bridge is more complicated due to the proximity of elevated roadway infrastructure. This is discussed in detail in Chapter 8. On the Virginia landing, a third track (for train siding) already exists on the northwestern side, so it is also preferable. Note that adding two tracks, regardless of the alignment, would require the installation of track switching systems on both sides of the Potomac River to make all tracks available for both passenger and freight trains. The new switching systems required for a four track operation could support future high-speed rail; however, these switching systems would need to be updated in order to support high speeds crossover movements of 80 miles per hour or more. These high speed crossovers would require the analysis of full universal interlockings to accommodate the higher speeds and in turn would require longer interlockings in this area.

Screening of Alternatives

The alternative screening process is captured in Figure 4.2. Initial screening developed the first set of alternatives, considering combinations of modal and alignment options. The project team then considered the physical elements and constraints in the study area. Due to the need to connect back into the existing railroad network for freight, passenger, and commuter traffic and the physical constraints of adding rail tracks, the definition of rail alternatives on a bridge structure required the rail expansion to remain on or adjacent to the current bridge alignment.

Figure 4.2: Alternative Screening Process



Selection of Alternatives for Detailed Analysis

After it was determined that a future alignment for a bridge would need to be parallel to the existing structure, the alternatives list was reduced to 16 options. The options included rail expansion alternatives and alternatives that introduced non-rail modes. This list is shown in Table 4.2.

The alternatives represented a mix of rail-only expansion and introduction of new multimodal options to cross the river. Beyond Alternative 1, which is the No Build option, the alternatives incrementally expanded to include additional rail capacity and modal consideration. Alternatives 2 – 4 were rail-only alternatives and aimed

Table 4.2: List of 16 Alternatives on the Reduced Candidate List

Alternative*	Criteria Elements	Alignment Location
Rail Alternatives		
1	2 existing tracks (No-Build)	1
2	2 tracks (rehabilitation or reconstruction)	1
3	3 tracks	2 or 3
4	4 tracks	2 or 3
Rail with Multimodal Alternatives		
5A, 5B	3 or 4 tracks + pedestrian/bicycle	2 or 3
6A, 6B	3 or 4 tracks + 2 streetcar + pedestrian/bicycle	2 or 3
7A, 7B	3 or 4 tracks + 2 shared streetcar/general-purpose + pedestrian/bicycle	2 or 3
8A, 8B	3 or 4 tracks + 2 streetcar + 2 general-purpose + pedestrian/bicycle	2 or 3
9A, 9B	3 or 4 tracks + 2 shared streetcar/general-purpose + 2 general-purpose + pedestrian/bicycle	2 or 3
10	3-track tunnel	2
11	4-track tunnel	2
*Alternatives in red identify those that were not retained.		

to serve the needs of freight, passenger, and commuter rail. Alternatives 3 and 4 introduced rail expansion to three or four tracks, respectively. Alternative 5 began inclusion of additional modal options with introduction of a pedestrian/bicycle crossing. Alternative 6 retained the previous expansion and added two streetcar lanes. Alternative 7 was the same as Alternative 6 with the exception that the streetcar lanes were now shared with general-purpose vehicles and other surface transit modes. Alternative 8 separated the streetcar and vehicular modes and provided for two exclusive streetcar lanes and two exclusive vehicular lanes. Alternative 9 built upon Alternative 8 by making the streetcar lanes shared with general-purpose vehicles and transit. Alternatives 10 and 11 would leave the existing rail bridge unaffected and introduced the possibility of a tunnel under the Potomac River. For Alternatives 10 and 11, the existing structure could remain in service for rail or could be utilized for a different mode.

The candidate list of 16 alternatives was condensed after the assessment of future rail demand. Projections for freight and passenger operations determined the need for four railroad tracks to meet the demand in 2040. The operational analysis for 2040 determined a three-track system to be "at capacity." A full discussion of the results of the rail operations analysis can be found in Chapter 5. This resulted in the study team eliminating the three-track options for all alternatives.

The remaining 10 alternative concepts were shared with the stakeholders and the public for input and feedback to determine the most important options to carry forward.

Alternatives Considered but Not Retained

Based on input from the operational analysis and conceptual engineering, the alternatives that did not meet the future capacity needs of freight, passenger, and commuter rail and exhibited alignment issues were removed from the list of further analysis. Appendix A-1 provides a matrix of the alternatives that were considered in the study screening process and the successive iterations that screened out alternatives to arrive at the alternatives for detailed analysis.

Of the 16 alternatives in Table 4.2, the alternatives that offered three tracks as a solution for a future Long Bridge were not retained. A three-track system would not accommodate the forecasted demand for rail operations, eliminating Alternatives 3, 5A, 6A, 7A, 8A, 9A, and 10.

Alternative 7B was also not retained. The analyses performed for Alternatives 6 and 8 were sufficient to cover the intent of Alternative 7 (railroad track expansion, pedestrian/bicycle connection, and shared streetcar and general-purpose lanes).

Feedback and engagement on the alternatives from the stakeholders and the public was an important factor for determining the final eight alternatives that moved forward for detailed analysis. Stakeholders were supportive of multimodal options and public meeting participants were also supportive of multimodal options and an expanded network for pedestrian/bicycle activity. The final eight alternatives met the purpose and need of the study and were feasible to build based on the preliminary operations analysis and concept-level engineering. Table 4.3 lists the eight alternatives that moved forward into detailed analysis. To assess the impact of alternatives on both sides of the Long Bridge, Alternatives 5 through 7 were developed on the southeast side of the current bridge and Alternative 8 was developed on the northwest side of the bridge. This provided for the analysis of wide alternative footprints on both sides of the Long Bridge. The northwest side included the most immediate widening restriction with the WMATA Metrorail bridge at a 181'-6'' horizontal clearance from the Long Bridge. Alternative 8, the widest of alternative selected for detailed analysis, was analyzed on the northwest side of the Long Bridge.

The last section of this chapter expands on the description of these eight alternatives. The alternatives are divided into rail alternatives and non-rail alternatives. The description of each includes how the alternative relates to the surrounding environment.

Description of Alternatives for Detailed Analysis

Eight alternatives were selected to move forward into more detailed study, including the No Build Alternative. The rail-only alternatives are Alternatives 1, 2, 3, and 4. Alternatives 5, 6, 7, and 8 expand the rail-only alternatives to four tracks and introduce modes other than freight, passenger, and commuter rail.

Footprint dimensions for each alternative are shown to accommodate the bridge width as dictated by the widest bridge type. The bridge types considered were tied arch, through arch, extradosed, and deck arch. Depending upon the selected bridge type, the overall bridge width, as calculated for engineering and costing purposes for the study, can vary from three to six feet by bridge type. Bridge types are fully described in Chapter 6 of this report.

Table 4.3: List of 8 Alternatives for Detailed Analysis

Alt	Criteria Elements	Aligned Location
1	2 existing tracks (No-Build)	N/A
2	2 tracks (rehabilitation or reconstruction)	N/A
3	4 tracks	Southeast
4	4-track tunnel	N/A
5	4 tracks + pedestrian/bicycle	Southeast
6	4 tracks + 2 streetcar + pedestrian/bicycle	Southeast
7	4 tracks + 2 shared streetcar/general-purpose + pedestrian/bicycle	Southeast
8	4 tracks + 2 shared streetcar/general-purpose + 2 general-purpose + pedestrian/bicycle	Northwest

Railroad Alternatives

Alternative 1: No Build

The No Build alternative assumed no physical modifications to the existing rail bridge, as shown in Figure 4.3. It served as a benchmark for the expansion alternatives and provided a starting point to assess the capacity needs of future freight and passenger service. The No-Build consisted of two tracks with a bridge width of 36 feet 6 inches. The current Long Bridge is comprised of 22 through girder spans and a double span swing (swivel) truss at the locations of the navigable channel for a total of 24 spans over the Potomac River. The double span swing truss has not been in operation since 1969. Consideration of a swing span was included during the study and would require detailed engineering and analysis to select the final bridge design for construction after the completion of this study. The clearance for the swing spans is 20 feet and the two navigable channels are 110 feet. There is no reserve width to add additional tracks on the bridge. Note that on the District side there is an additional two-span bridge that extends the Long Bridge and crosses the Tidal Basin between East Potomac Park and Maine Avenue, SW.

The Long Bridge on the District side is on an elevated structure as it passes over East Potomac Park and Maine Avenue, SW, before it lowers into a rail trench that passes under the roadway and plaza at the Mandarin Oriental Hotel. On the Virginia side of the Potomac River it passes over the Mount Vernon Trail and George Washington Memorial Parkway and then continues along uninterrupted railroad right-of-way to Alexandria and beyond. Figure 4.4 provides the cross section of the alternative. All cross sections provided in this study assume the orientation of looking from the District towards Virginia.

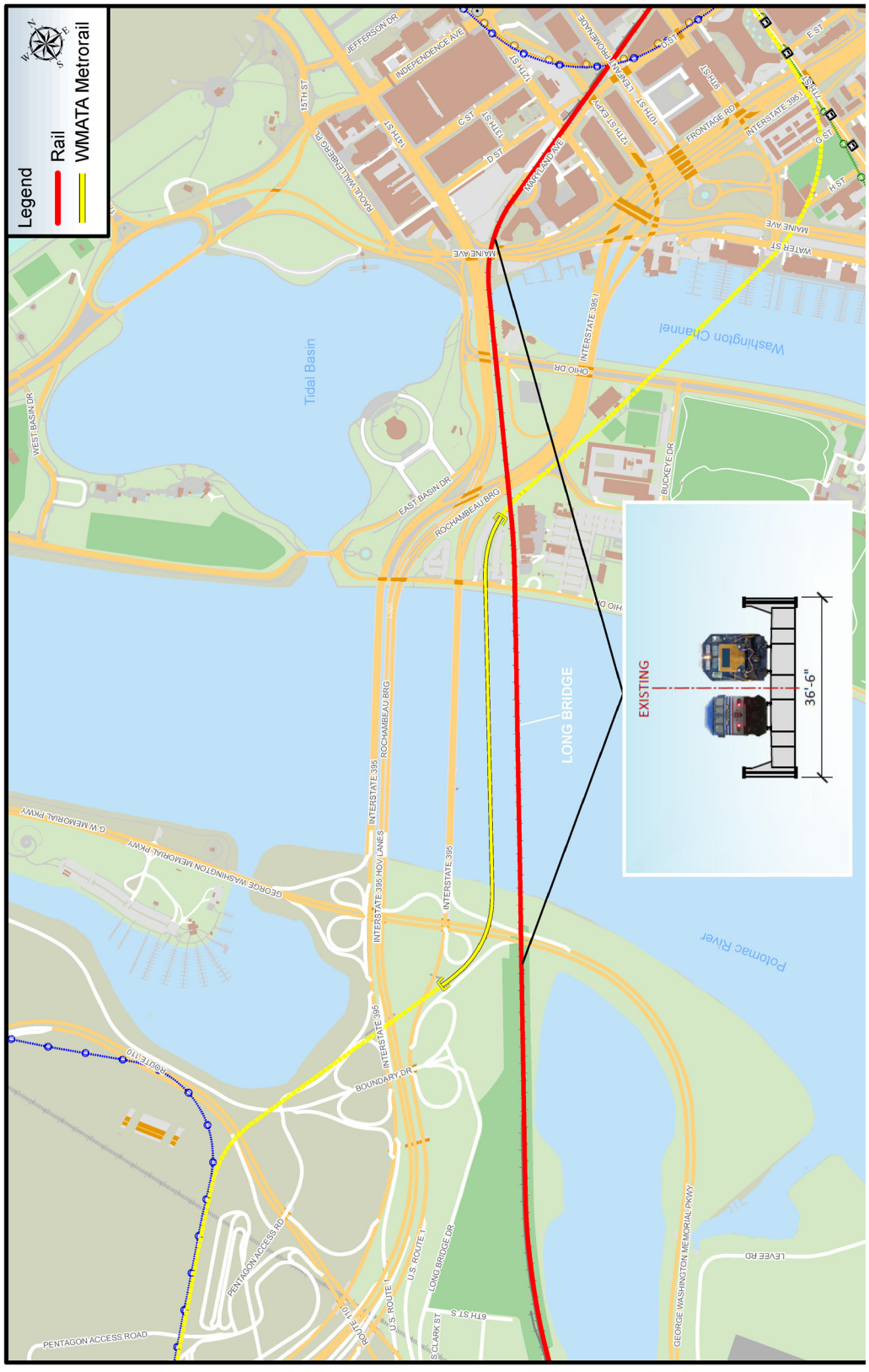
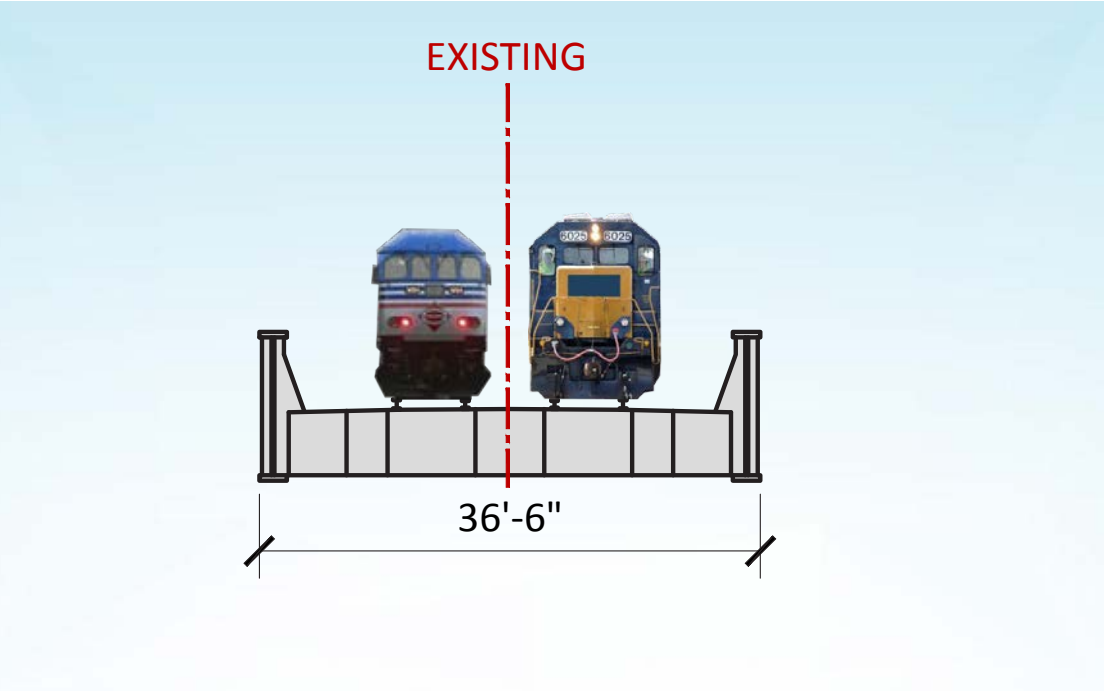


Figure 4.3: Alternative 1 Plan

Figure 4.4: Alternative 1 Section Detail



Alternative 2: Two-Track Bridge (rehabilitation or reconstruction)

Alternative 2 focused on the existing Long Bridge two-track structure for either rehabilitation or a complete reconstruction of the two-track bridge as shown in Figure 4.5. Analysis was performed on the existing bridge to assess its current condition; it is detailed in Appendices C and D and forms the basis of this alternative. To execute the rehabilitation, Alternative 2 would require a number of analyses 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 to protect it from corrosion. The rehabilitation alternative considered the existing failed coating system that has resulted in widespread surface corrosion that needs to be repaired or replaced. Coating options include over-coating techniques with typical success performance of seven to 10 years or three-coat, zinc-rich primer paint systems, which would provide a performance of 15 to 20 years. During rehabilitation, any structural issues in the superstructure would be addressed and corrected.

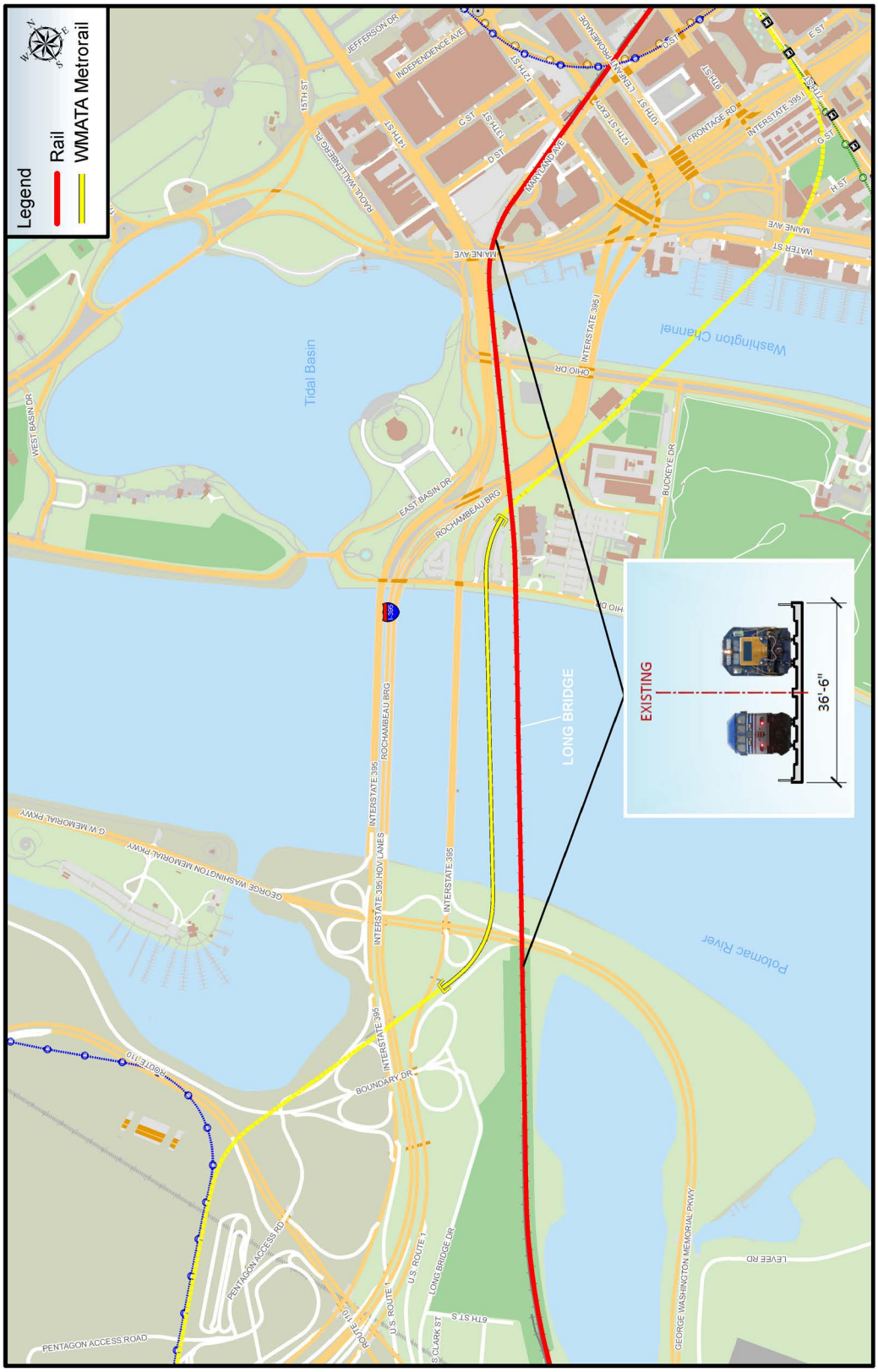


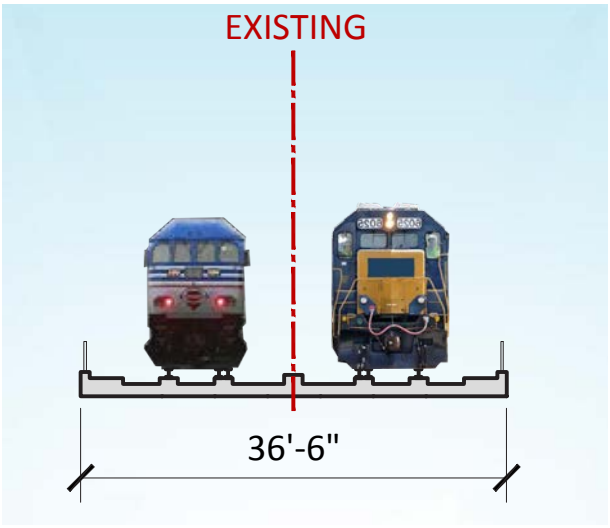
Figure 4.5: Alternative 2 Plan

Rehabilitation to the substructure for Alternative 2 would include the installation of additional vertical batter piles around the existing piers. This would increase the bridge capacity for heavier loads and greater braking forces, allowing trains to run at full speed. Substructure rehabilitation would include installation of cofferdam, excavation, installation of piles, modifications to existing piers, and connection between existing structures and new construction. The rehabilitation alternative assumed that at least one track must remain in service during the rehabilitation.

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 in this study. As shown in Figure 4.6, the bridge width would remain at 36 feet 6 inches, and the track system would remain on an open deck bridge structure. Reconstruction of the rail system would assume the replacement of track work and the reuse of signals that would be removed, protected, and then reconnected to the new structure. This alternative would impact rail operations and may require shutting down operations during reconstruction.

Figure 4.6: Alternative 2 Section Detail

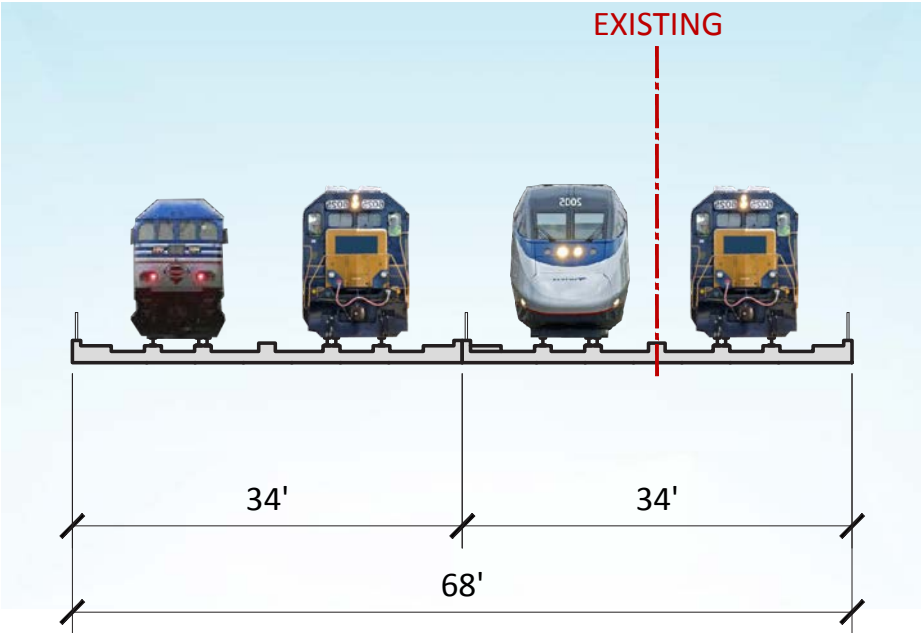
Alternative 3: Four-Track Bridge



Alternative 3 introduced two additional railroad tracks to the existing two-track bridge for a four-track rail system. Figure 4.7 shows the expanded footprint to the southeast side of the existing bridge and figure 4.8 further details the cross sections of the expansion as they would look from the District towards Virginia. The additional rail tracks would add another 34 feet of width to the bridge, doubling the bridge footprint. The expanded four-track bridge would accommodate future rail operations. Any option that included reconstruction of the existing bridge would require that two tracks always remain operational for current operations. Two new tracks could maintain operations while the existing tracks were being reconstructed.

Figure 4.7: Alternative 3 Plan

Figure 4.8: Alternative 3 Section Detail



Alternative 4: Four-Track Tunnel

Alternative 4 presented the only belowground alternative. A single tunnel or combination of tunnels would be used exclusively for four rail tracks. Tunnel options consisted of several types of tunnel designs, including jacked segmental, submersed segmental, or twin bore. These designs are considered different means and methods for constructing tunnels and all require extensive underground assessment for underground obstructions. A jacked segmental tunnel option is utilized for near-surface and soft-ground tunnels beneath existing aboveground facilities such as railways, roadways, and airport runways when disruption or relocation of those aboveground facilities is out of the question. Submersed tunnels are precast concrete segments placed in a trench excavated in the river bottom. Bored tunnels begin by assembling a tunnel boring machine (TBM) in an assembly chamber next to a construction site. The tunnel is then bored through rock or frozen earth to excavate the tunnel for construction.

Development of a rail tunnel option required consideration of numerous physical constraints along the potential alignment as well as knowledge of industry standard operations, equipment performance, and design criteria. The channel bottom in the Potomac River was the control point for the vertical alignment of the tunnel. At the midpoint of the river, the bottom of the tunnel would be 80 feet below grade. Tunnel alternatives for this study required any tunnel option to pass below the Potomac River navigation channel and any landside underground structures such as rail tunnels, utilities, and bridge/building foundations. Alternative 4 would have to avoid known underground obstructions, including the WMATA yellow and green lines and roadway foundations at approximately 25 feet below grade. This essentially required Alternative 4 to assume a deep bore tunnel concept. Figure 4.9 provides the layout of the tunnel; additional details on tunnel types can be found in Appendix E.

The tunnel profiles for Alternative 4 provided a maximum 1 percent grade consideration for freight and a maximum 3 percent grade for passenger. The tunnel would accommodate double-stack freight container cars. The concepts assumed separate tunnels for a two-track freight operation and a two-track passenger operation. The separate tunnels addressed the flatter profile needs of the freight operations and the horizontal clearance requirements at the proposed underground passenger rail station. A 20-foot spacing was used between the two tunnels.

Alternative 4 envisioned an underground rail station between Banneker Circle and 3rd Street, SW, to connect to the L'Enfant Metro Station and allow passengers to access the Southwest waterfront area from below ground. An important consideration for developing the tunnel profiles was the location and length of underground passenger platforms and the interlocking of tracks. Platforms and interlockings require tangent sections of track to minimize issues related to track layout and provide safe passenger boarding and de-boarding functionality. The ability to interlock all tracks requires that the grade remain the same for both tunnels along the interlocking section. The preparation of tunnel profiles assumed that the passenger rail platform would be approximately 800 feet with an additional 100-foot spiral transition on each end of the platform; the interlocking was defined at 2,200 feet in length.

Since diesel-powered trains will be operating through these tunnels, ventilation is an important consideration. Two methods of ventilation were considered for the construction of a tunnel: the installation of vent shafts with fans along the length of the tunnel; and the separate ventilation requirement at an underground passenger station that would require a designed "above ground" ventilation plant.

The tunnel concepts assumed that all tracks could be electrified with the catenary system located at the required height for clearance of double-stack freight trains. A full four-track universal interlocking was envisioned between the Washington Channel and around 9th Street, SW, before the underground passenger station to provide full operational flexibility. It was placed before the station to allow freight trains to bypass the passenger platforms as they traveled towards the Virginia Avenue Tunnel. After passing the underground passenger platform, trains would travel on to Union Station.

Figure 4.10 provides the location of the freight and passenger portals in Virginia and the District. The portal for the freight tunnel in the District would be close to the Anacostia River east of 11th Street, SE. The Virginia portal would be just south of the Ronald Reagan WashingtonNational Airport access road. The Virginia portal for the passenger tunnel would be at the west end of Long Bridge Park. There would be no District portal as the passenger tunnel would tie directly into the current passenger tunnel portal at New Jersey Avenue and the entire length at this end could remain underground to Union Station.

Figure 4.11 shows the detail of the tunnel cross sections that would result in each tunnel at 44 feet wide for two rail tracks and associated air shafts, space for electrification contact wire and catenary installation, and allowance for double-stack train operations.

Alternative 4 also provided the option to construct a tunnel solely for passenger operations. It would retain the current Long Bridge for freight operations.

Figure 4.9: Alternative 4 Plan

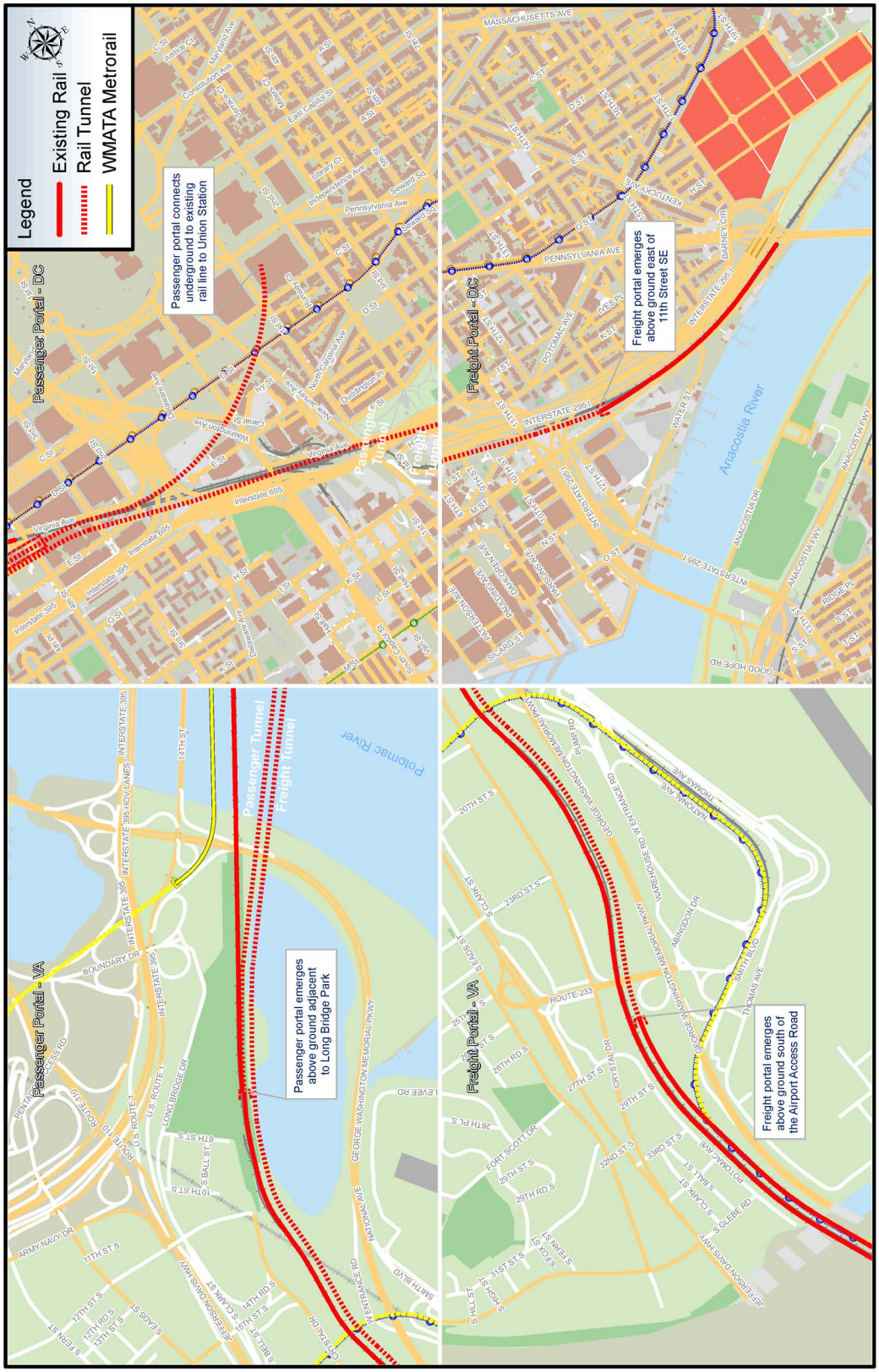
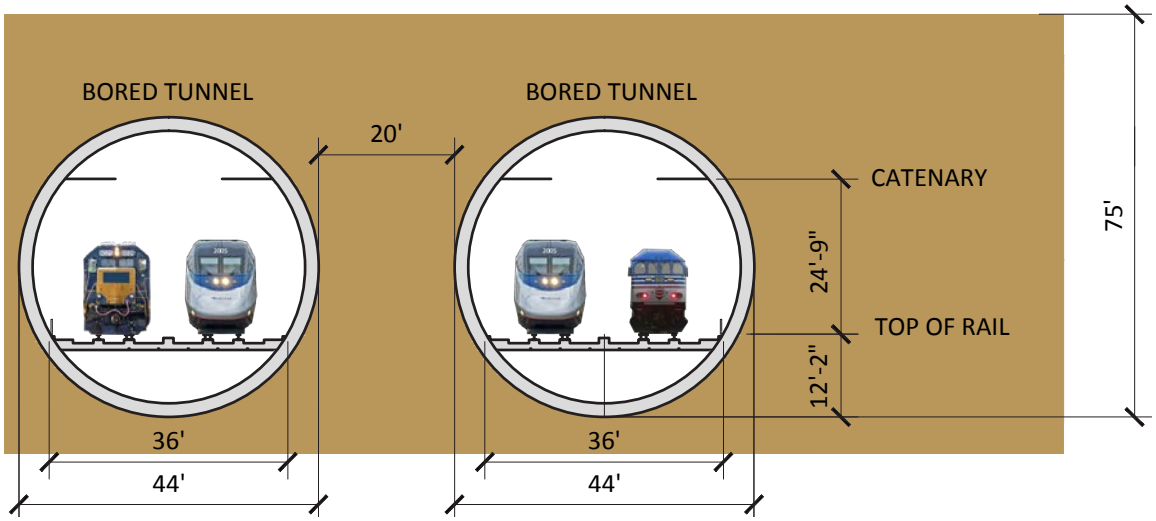


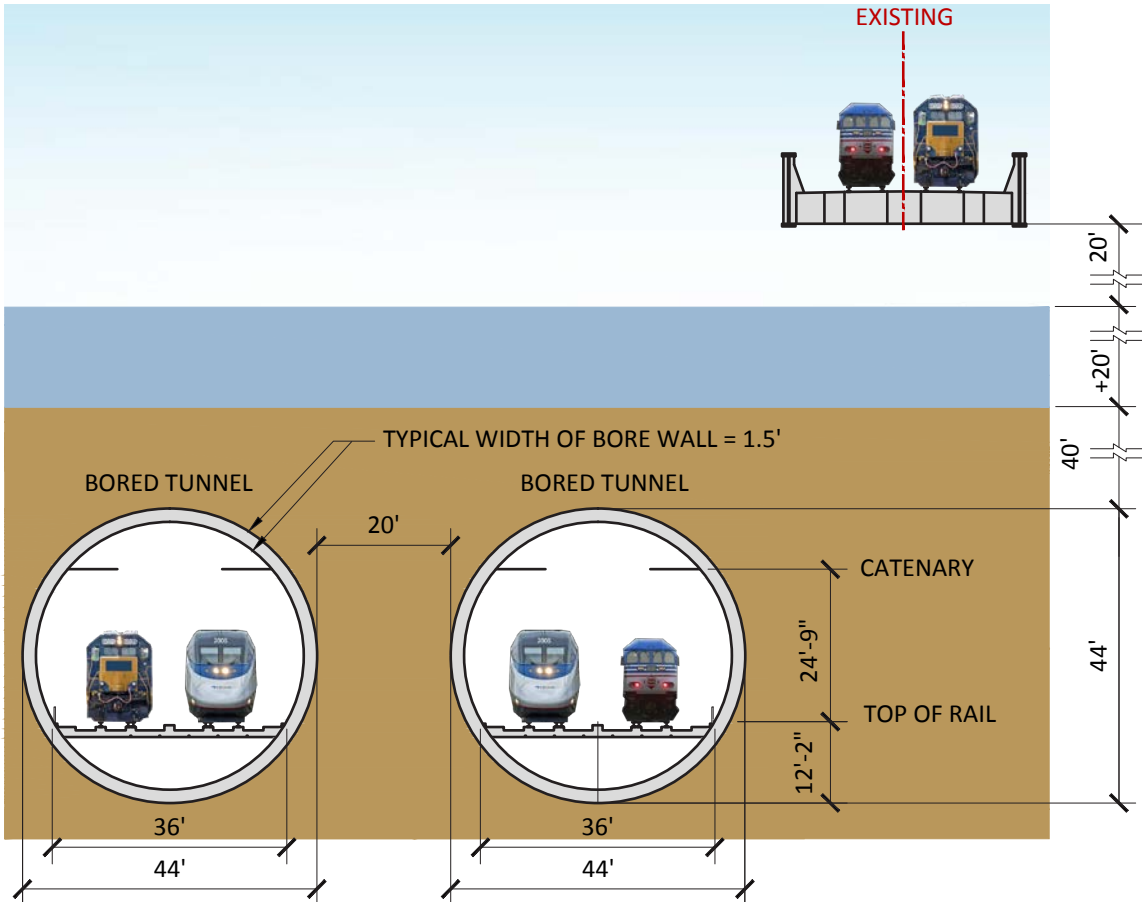
Figure 4.10: Alternative 4 4-Track Tunnel Portals

Figure 4.11: Alternative 4 Section Detail A

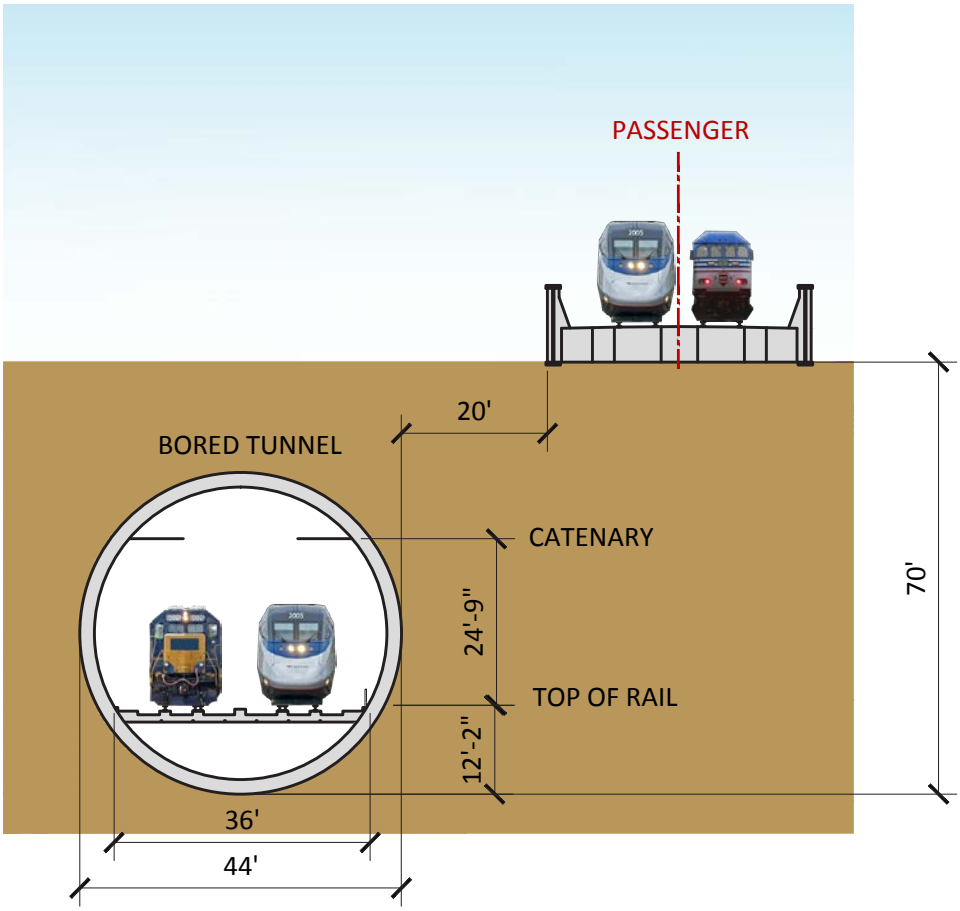


Note: Underground clearance to WMATA Metrorail and any other obstructions would be maintained at 10 to 20 feet.

Alternative 4 Section Detail B



Alternative 4 Section Detail C



Railroad and Other Modal Alternatives

Alternatives 5 through 8 included expansion of the existing two-track rail bridge and the addition of modal combinations for streetcar, general-purpose lanes, and pedestrian/bicycle pathways. Rail expansion options could proceed one of two ways. To build a four-track rail system, two new tracks could be constructed and the exisiting two tracks could be refurbished or rebuilt; alternatively, a new four-track rail system could be constructed and the exisiting structure could be used for other modal considerations. These alternatives and the analysis of bridge expansion options throughout the study provide for these options to be considered beyond the completion of this study.

This study does not preclude a non-railroad mode bridge from being a separate structure. Once detailed alternatives are defined to move beyond those identified in this study, those alternatives and respective construction sequence will provide complete details by mode and location of construction.

Alternative 5: Four-Track Bridge and Pedestrian/Bicycle

Alternative 5 introduced two additional railroad tracks to the existing two-track bridge for a four-track rail system and also introduced a new adjacent pedestrian/bicycle pathway across the Potomac River. Figure 4.12 shows the expanded footprint to the southeast side of the existing bridge and Figure 4.13 displays the cross sections of the expansion as they would look from the District towards Virginia. The pedestrian/bicycle path would add an additional 12 feet; buffering between the pedestrain path and the rail tracks would add another three feet. Like Alternative 2, the additional rail tracks would add another 34 feet of width to the bridge, doubling the bridge footprint. If two railroad tracks were attached to the existing alignment, the rail tracks would be 70 feet 6 inches for a total width, including the pathway, of 85 feet 6 inches. If a new four-track structure was built, the four-track railroad would be 68 feet and the total width would be 83 feet.

The pedestrian/bicycle pathway would make new connections to Long Bridge Park in Virginia, National Park Service (NPS) land at George Washington Memorial Parkway/Mount Vernon Trail on the Potomac River waterfront, NPS land at East Potomac Park that would allow easy access to the amenities at Hains Point,at the Tidal Basin Washington Channel at Maine Avenue, SW, and the Southwest waterfront in the District. The Maine Avenue access point would provide access to the District's monumental core and to the shopping and dining options along the future development at The Wharf. Pedestrian/bicycle access to the plaza at the Mandarin Oriental Hotel is provided by continuing the elevated pathway to the existing plaza.

The addition of a southeastern pedestrian/bicycle trail would be challenging on the Virginia side, as it has to cross over or under the rail tracks to access Long Bridge Park and the planned pedestrian/bicycle network in the park. Connections to Mount Vernon Trail would be facilitated by a ramp. Similarly, ramps from the bridge could be made available at East Potomac Park. Currently, there is a pedestrian staircase at Maine Avenue, SW from the side of the Mandarin Oriental Hotel. The proposed pedestrian/bicycle connection could connect to that location and improvements could be made to the staircase for bicycle use. Note that Alternatives 5 through 8 all have the same pedestrian/bicycle connection option locations.

Rail operators have expressed concerns about the safety of pedestrians and bicycllists using a trail so close to heavy rail on the bridge. This concern has been taken into consideration and a number of options that have been successfully executed on a number of similar bridges are available to provide a separation barrier between the trains and non-motorized users.

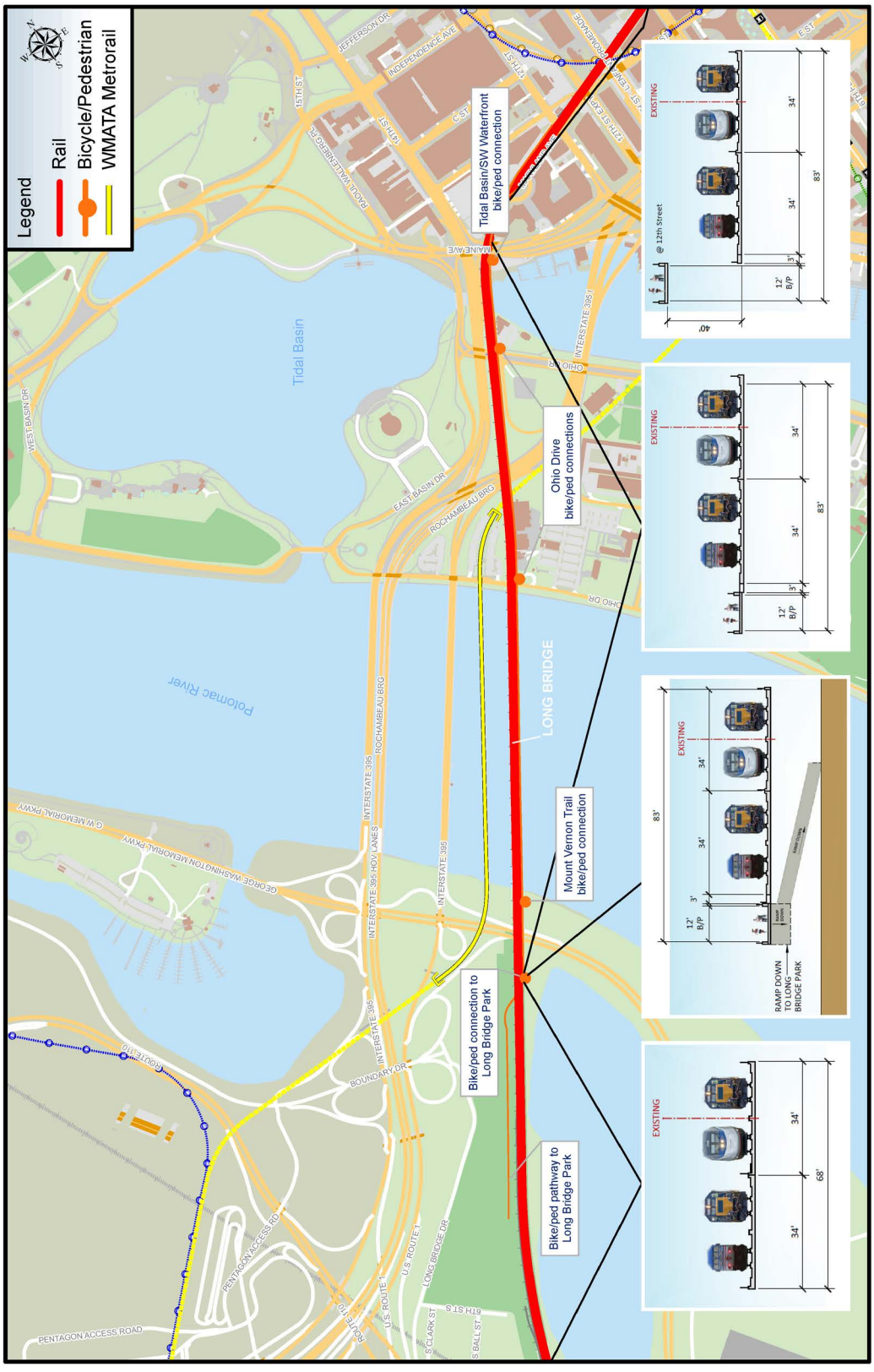
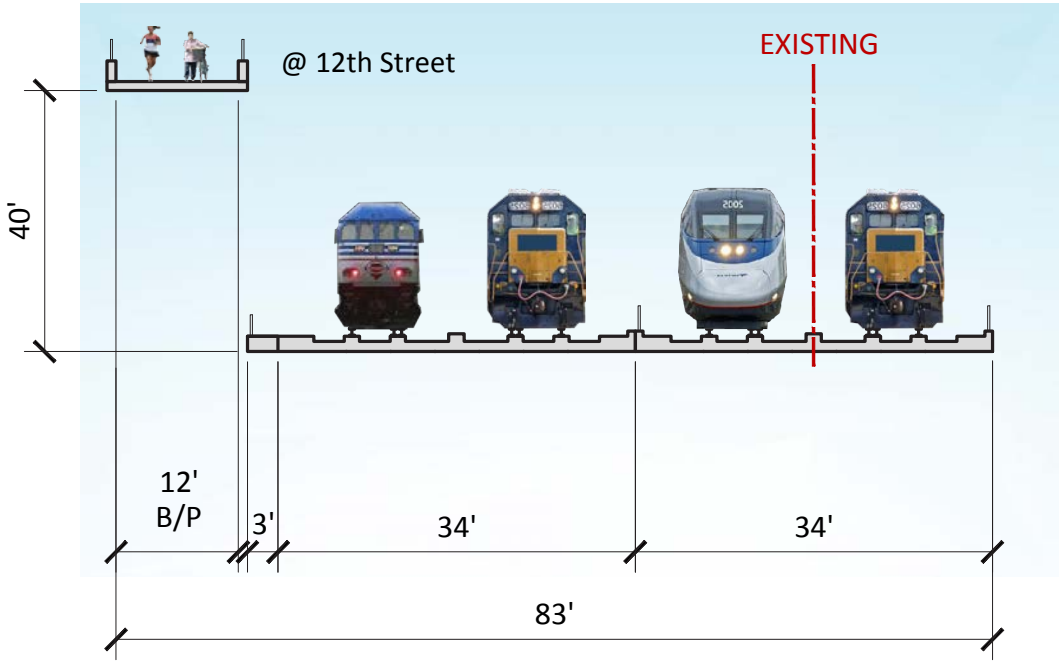
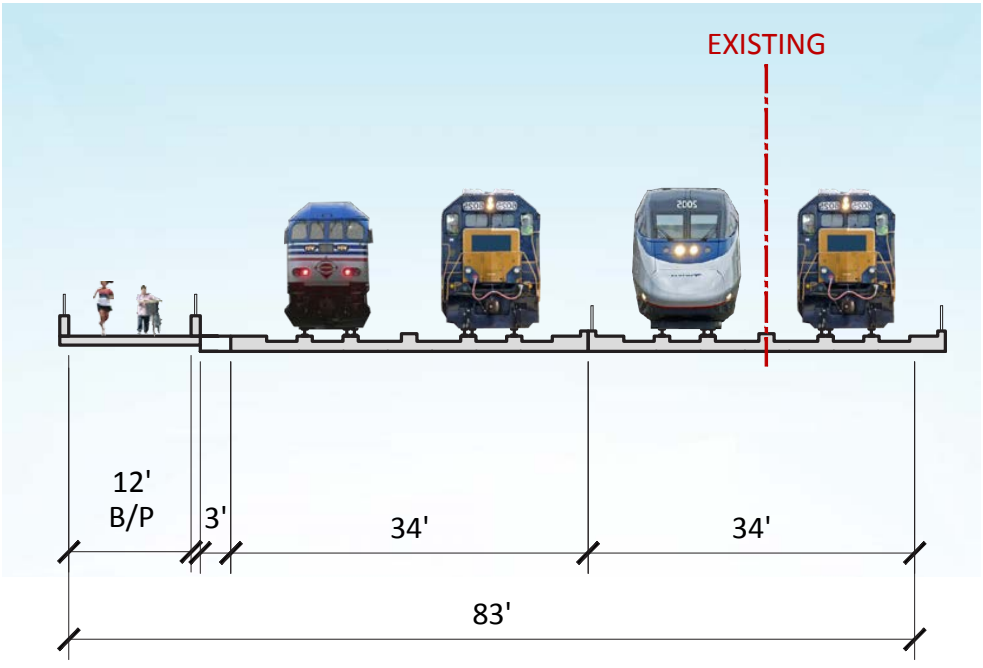


Figure 4.12: Alternative 5 Plan

Figure 4.13: Alternative 5 Section Detail A



Alternative 5 Section Detail B



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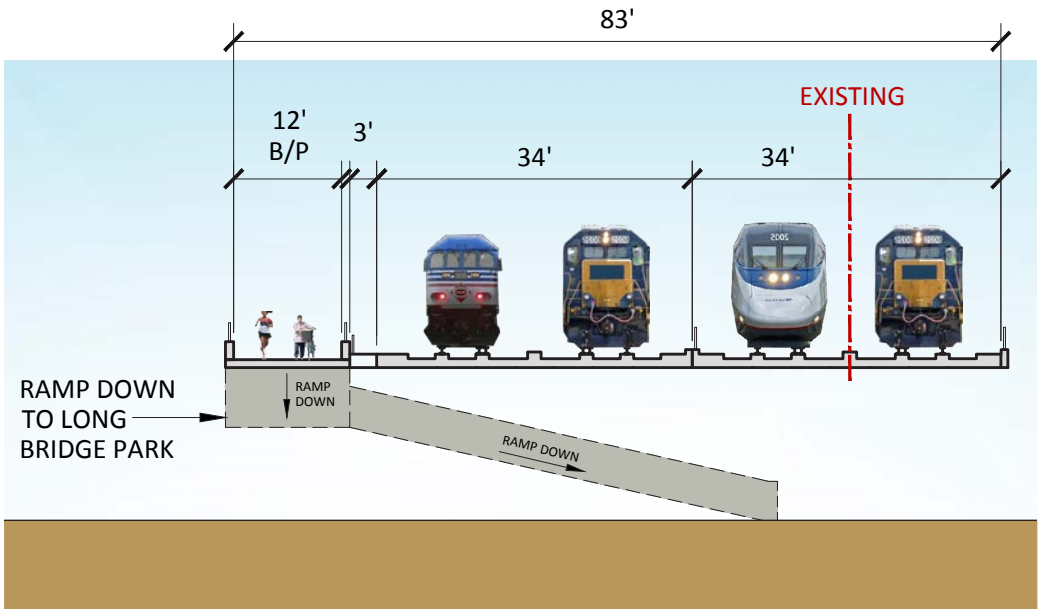
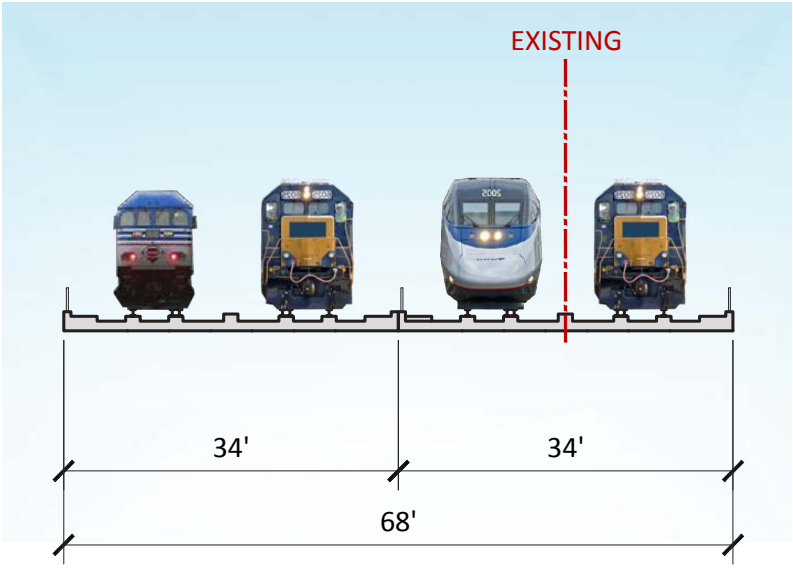


Alternative 5 Section Detail D



Alternative 6: Four-Track Bridge with Pedestrian/Bicycle and Streetcar

Alternative 6 built upon the expansion of the existing bridge as described in Alternative 5 by adding two exclusive streetcar lanes, as shown in Figure 4.14. Two streetcar lanes added an additional 24 feet to the width of the bridge. With the addition of streetcar, the rail expansion to four tracks at 68 feet, buffer areas and the pedestrian/bicycle pathway at 12 feet, the footprint of the bridge would be 109 feet. Figure 4.15 shows the details of the cross sections. This alternative also expanded the bridge to the southeast side of the existing structure.

Figure 4.14: Alternative 6 Plan

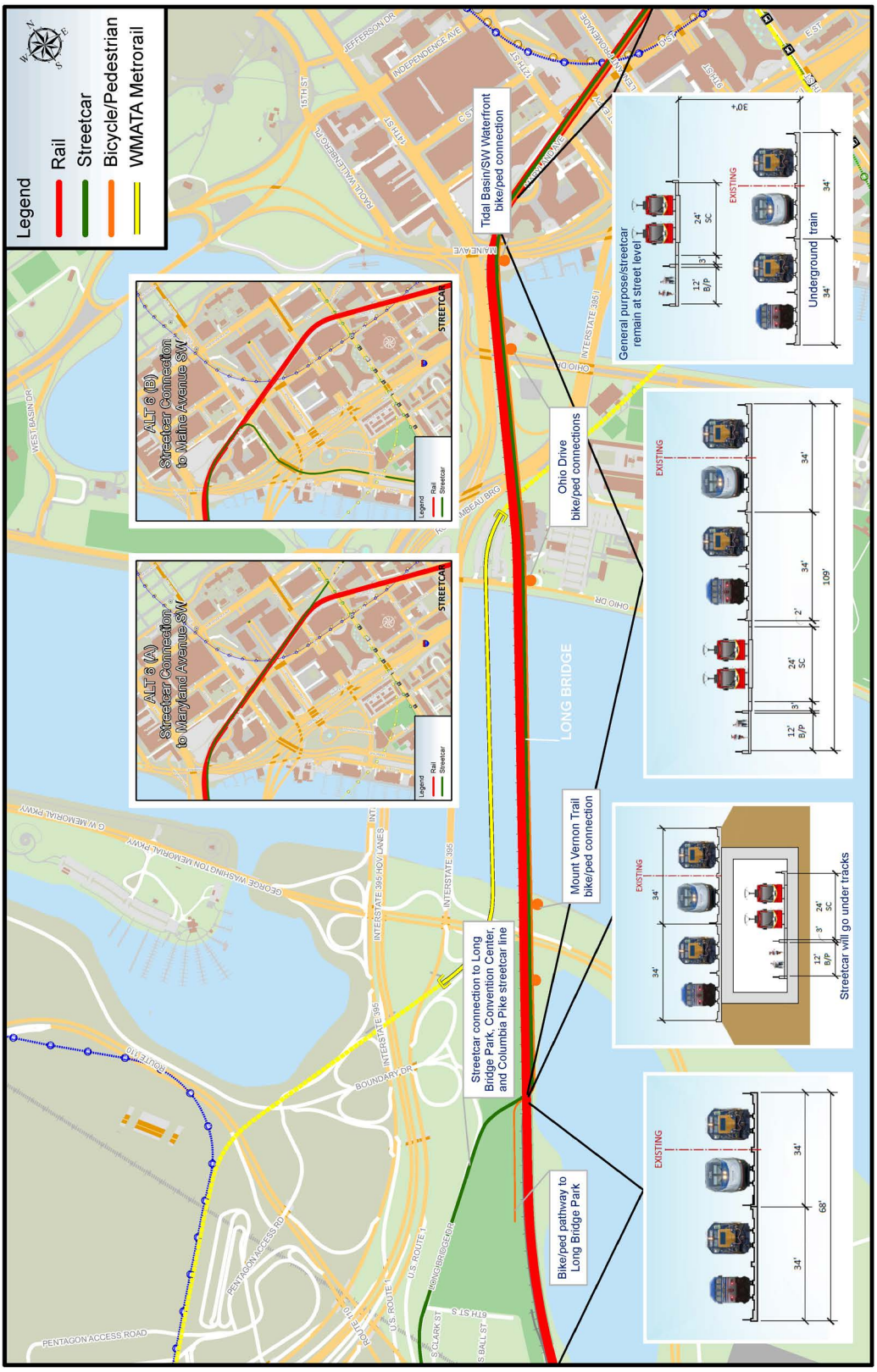
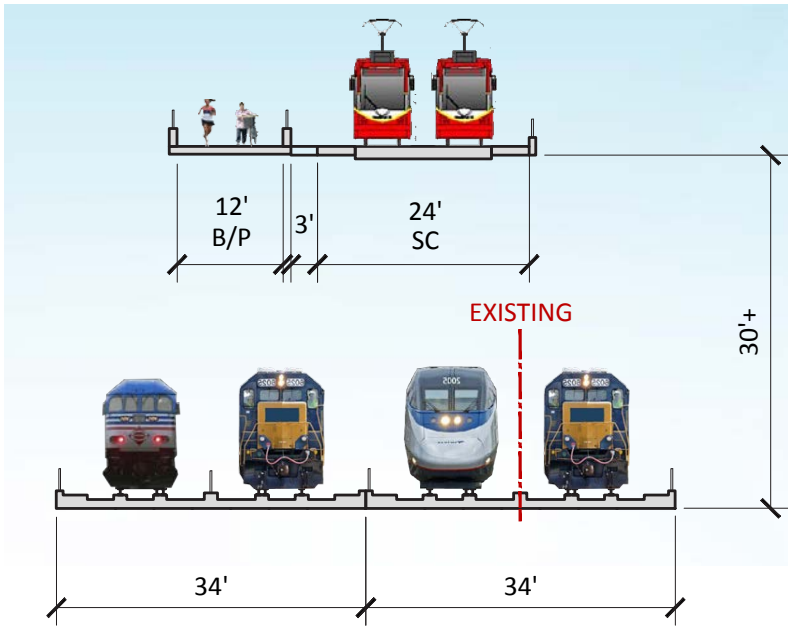
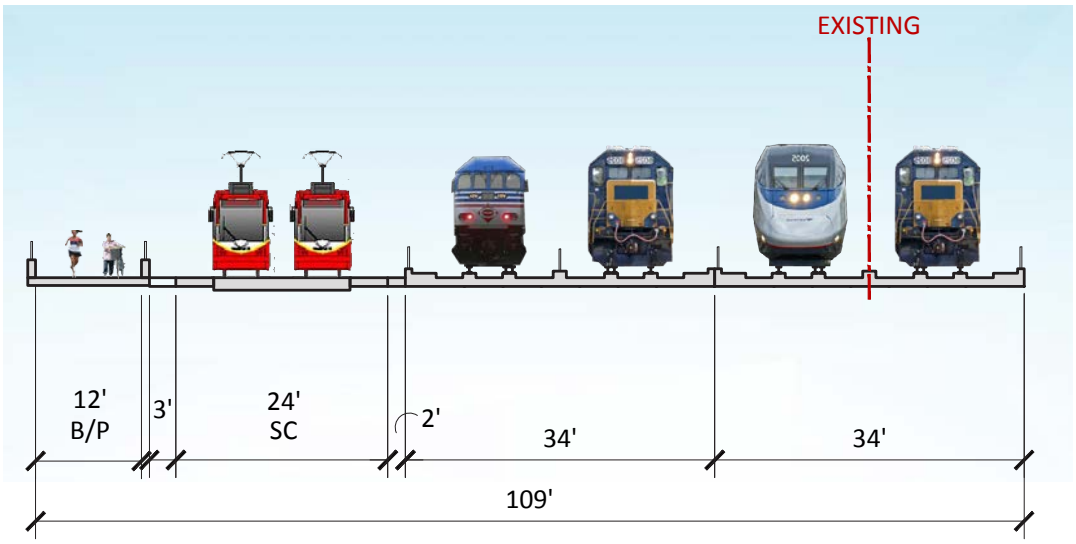


Figure 4.15: Alternative 6 Section Detail A



Alternative 6 Section Detail B

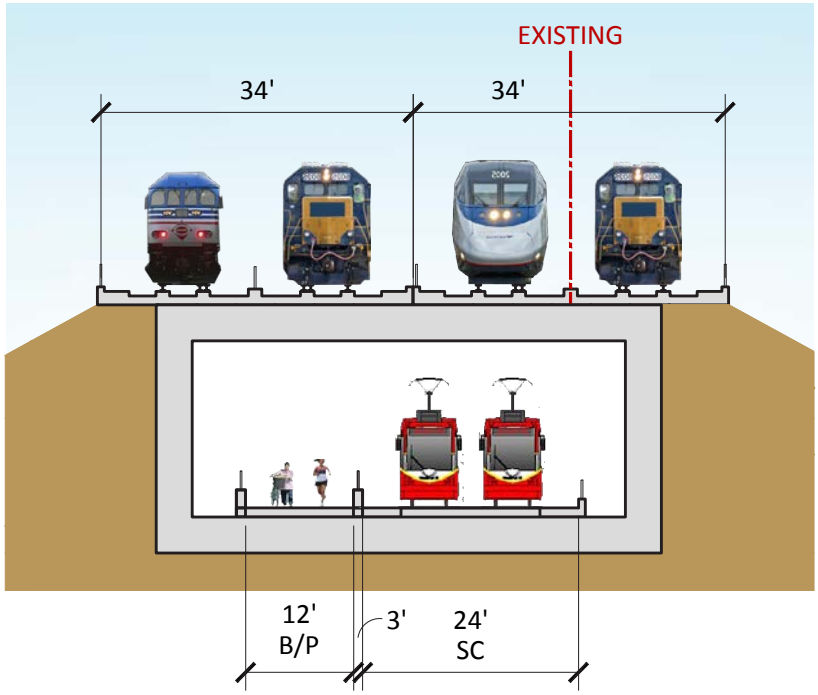


Pedestrian/bicycle pathway connections were the same as Alternative 5 provided to Long Bridge Park and Mount Vernon Trail in Virginia; East Potomac Park, Maine Avenue and the Southwest waterfront at the Tidal Basin in the District; as well as access to the plaza at the Mandarin Oriental Hotel.

The addition of a southeast streetcar and pedestrian/bicycle pathway were complicated on the Virginia side due to having to cross over or under the rail tracks. Figure 4.14 includes a visual for how the streetcar and pedestrian/bicycle facilities pass under the rail tracks after the George Washington Memorial Parkway. Currently, the rail bed sits on a raised earth berm, making an underpass option more viable than a flyover for these modes. The streetcar alignment in Virginia's Long Bridge Park would continue and connect to the Crystal City/Arlington County streetcar network

and have an overlapping station at PenPlace. In the District, at the point where rail tracks pass below the surface streets and plaza at the Mandarin Oriental Hotel, the streetcar would continue onto the Mandarin Plaza and continue to 12th Street, SW. At this point, the streetcar has the option to turn down 12th Street, SW, towards Maine Avenue, SW, or continue to 7th Street, SW, once Maryland Avenue is completed, evenutally connecting to a future streetcar line. Figure 4.16 shows the detail of how the streetcar would connect into the transportation network in the District.

Alternative 6 Section Detail C



Alternative 6 Section Detail D

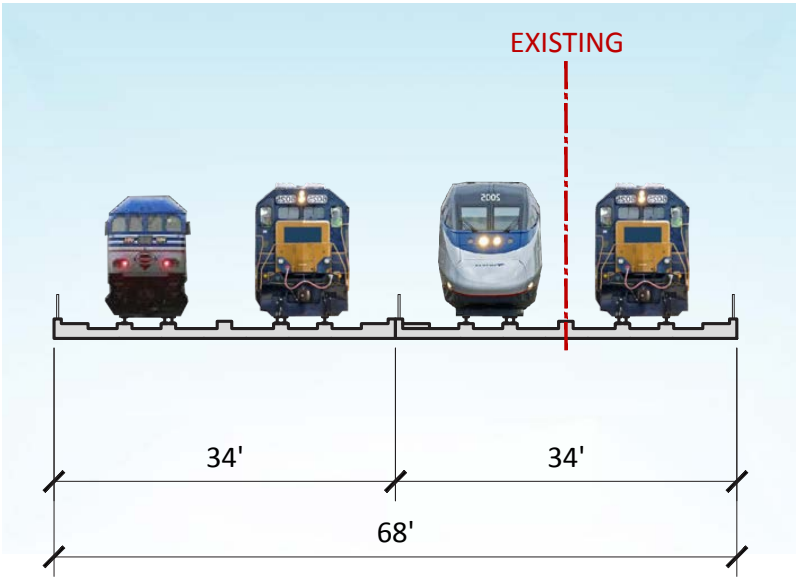
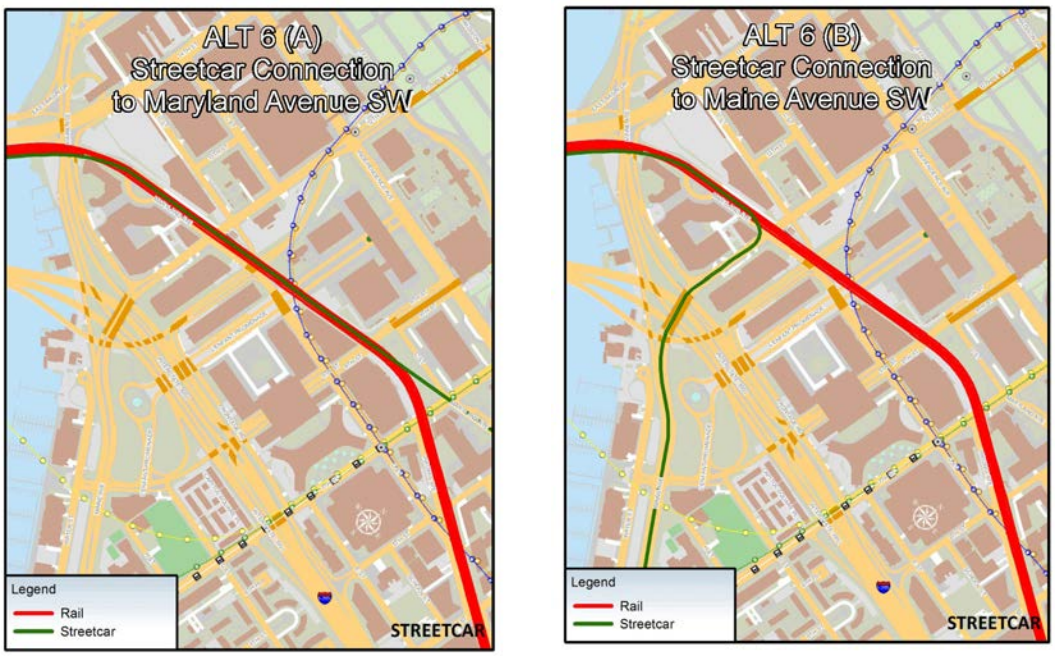


Figure 4.16: Alternative 6

Connection to District Transportation System



Alternative 7: Four-Track Bridge with Pedestrian/Bicycle and Shared Streetcar/General-Purpose Lanes

Similar to the previous two alternatives, Alternative 7 continued to build on the modal options to cross the Long Bridge and introduced shared lanes for streetcar and general-purpose. As shown in Figure 4.17, the expansion was to the southeast side of the existing structure. As shown in figure 4.18, the cross section footprint was identical to Alternative 6 with the exception of additional shoulder buffer areas along the edges of the streetcar/general-purpose lanes. The streetcar/general-purpose lanes and shoulders encompassed 33 feet of width, the rail expansion to four tracks was 68 feet, and the pedestrian/bicycle pathway was 12 feet, for a total footprint width of the bridge of 113 feet.

Pedestrian/bicycle pathway connections were the same as Alternatives 5 and 6 and connected to Long Bridge Park and Mount Vernon Trail in Virginia; East Potomac Park, Maine Avenue, and the Southwest waterfront at the Tidal Basin in the District; as well as access to the plaza at the Mandarin Oriental Hotel.

The addition of downriver shared streetcar/general-purpose lanes and pedestrian/bicycle pathway were complicated on the Virginia side due to having to cross over or under the rail tracks. Figure 4.18 includes a cross section concept showing how streetcar/general-purpose and pedestrian/bicycle pass under the rail tracks. The streetcar/general-purpose alignment in Virginia's Long Bridge Park aligned with Long Bridge Drive for vehicles to access the secondary road system and streetcar to continue and connect to the planned Crystal City/Arlington streetcar system at the PenPlace Station. The PenPlace Station lies along Army-Navy Drive between South Eads and South Fern Streets and is planned as a transit-oriented, mixed-use development.

Figure 4.17: Alternative 7 Plan

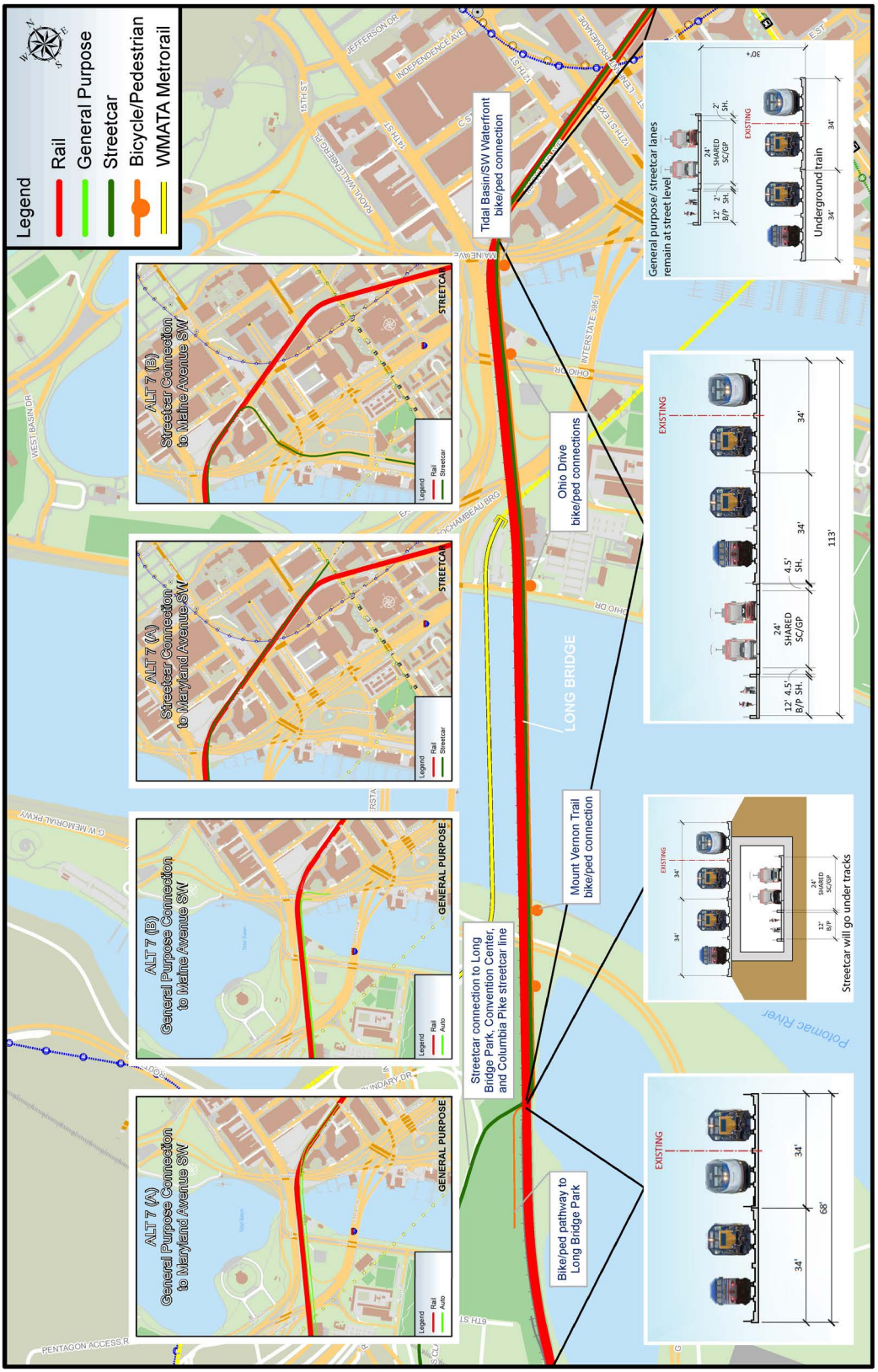
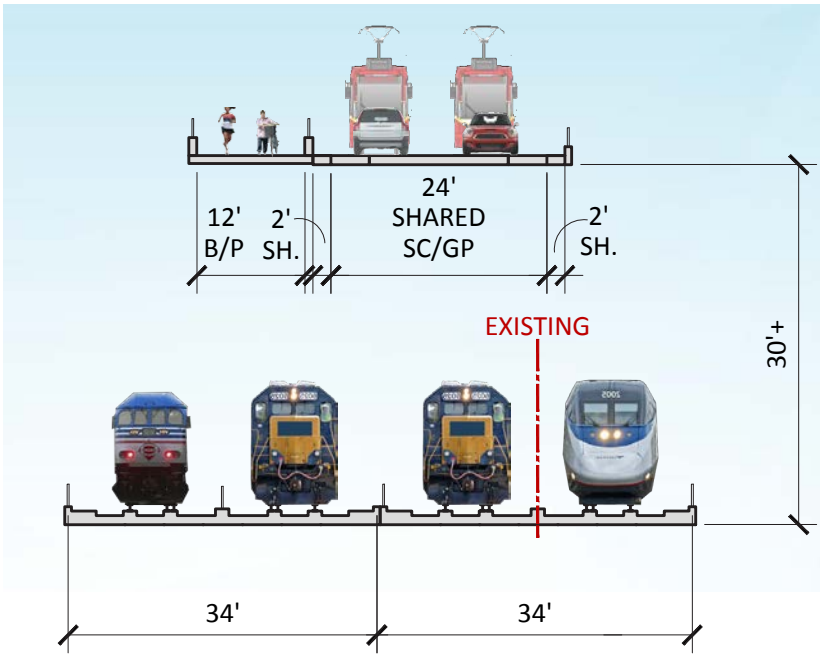
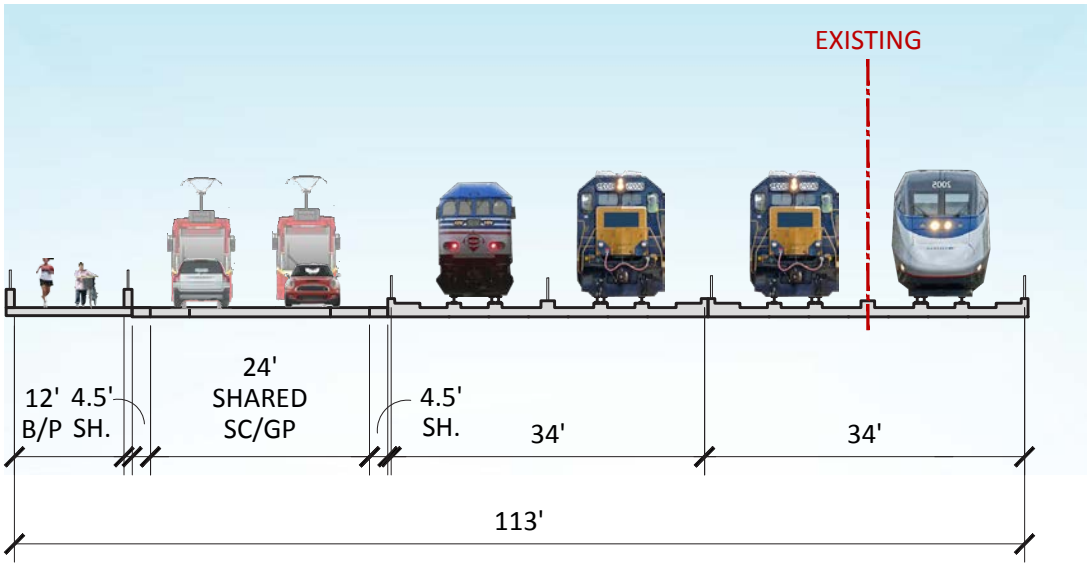


Figure 4.18: Alternative 7 Section Detail A



Alternative 7 Section Detail B

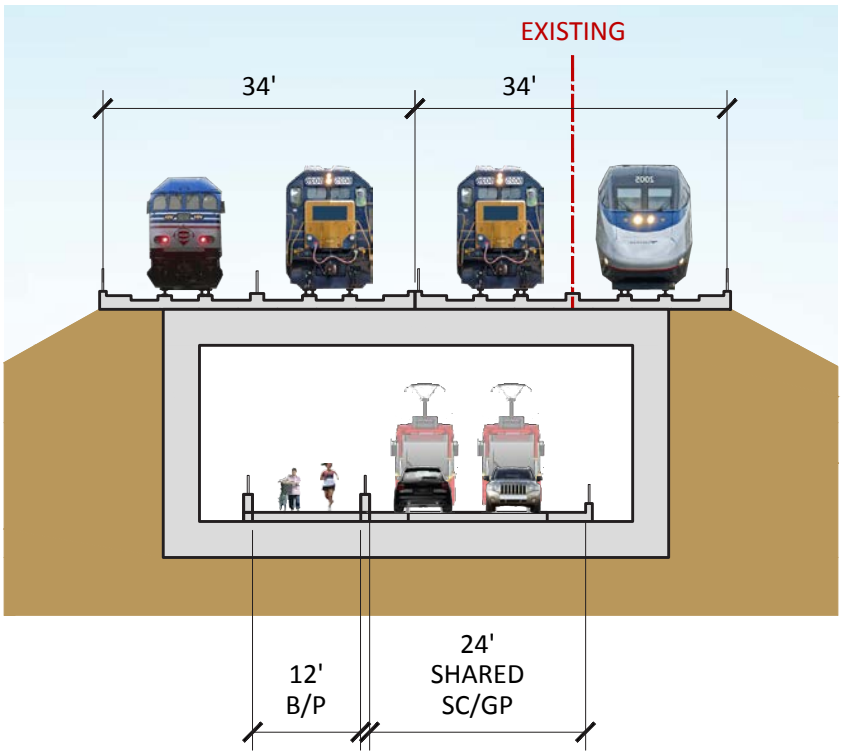


In the District, the rail tracks passed below the surface streets and plaza at the Mandarin Oriental Hotel. Image 4.5 provides an aerial view of the Mandarin Oriental Hotel plaza and rail tracks that pass below the plaza. As shown in Figure 4.19, the streetcar would continue up onto the Mandarin Plaza and continue to 12th Street, SW. At this point the streetcar could to turn right onto 12th Street, SW, and continue onto Maine Avenue where it could travel to 7th Street, SW, and connect into a future streetcar line. A second option would be available with the completion of the Maryland Avenue deck over the rail bed from 12th Street, SW, to 7th Street, SW. This would provide a straight route from the Mandarin Plaza to 7th Street, SW.

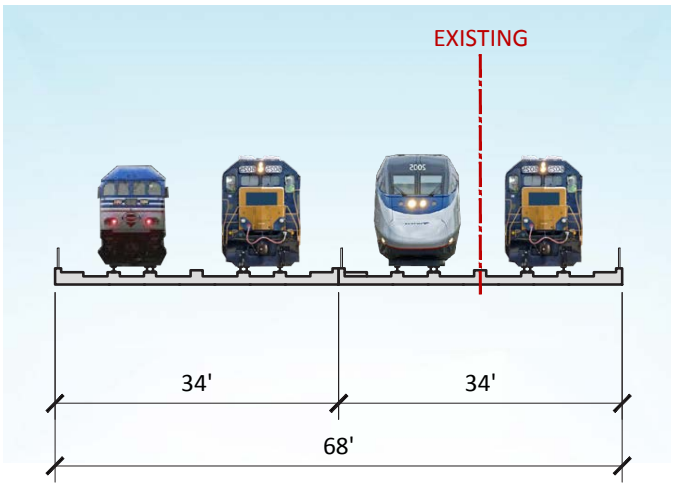
General-purpose traffic options at the Mandarin Oriental Hotel Plaza in the District were the same as those for streetcar. The general-purpose lanes could provide a

local connection access to 12th Street, SW, or D Street, SW, in the District or use the same route as streetcar if the Maryland Avenue decking was completed between 12th Street, SW, and 7th Street, SW. A second option could include vehicular ramp access to Maine Avenue, SW, before reaching the Mandarin Plaza. These would be slip ramps that would most likely have to be signal controlled because of the proximity to the split between Maine Avenue to the Southwest waterfront and the Expressway. Figure 4.19 shows the transportation network connections for the streetcar as well as general-purpose lanes.

Alternative 7 Section Detail C



Alternative 7 Section Detail D



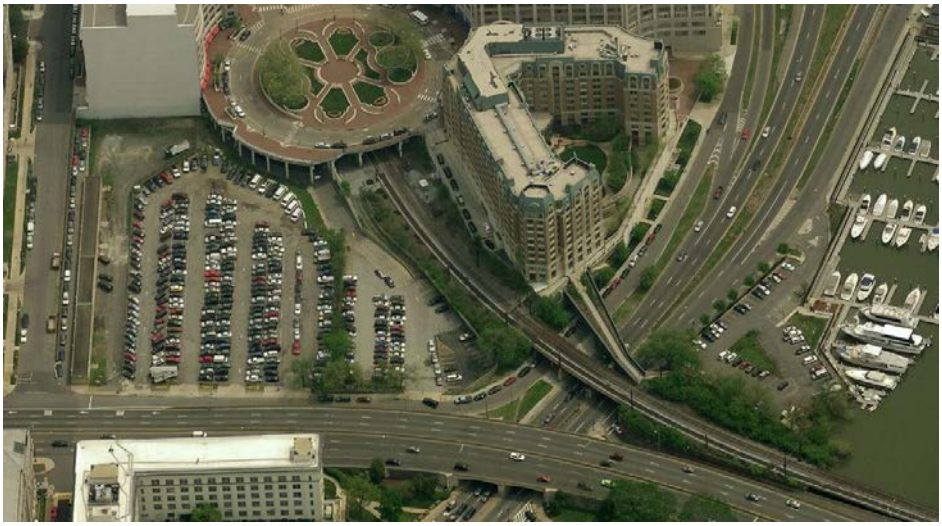
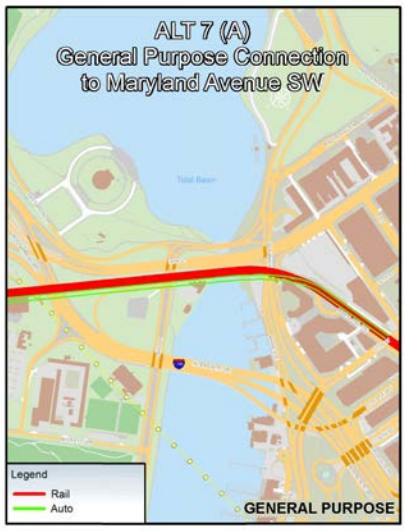


Image 4.5: View of Rail Tracks at Mandarin Oriental Hotel Circle



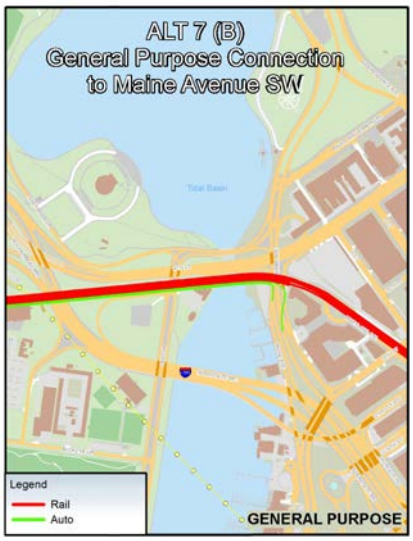


Figure 4.19: Alternative 7 Connection to District Transportation System

Alternative 8: Four-Track Bridge with Pedestrian/Bicycle, Shared Streetcar/General-Purpose Lanes and Additional General-Purpose Lanes

Alternative 8 presented the largest footprint of any of the previous alternatives and was a departure from the location of the footprints shown in Alternatives 5 through 7. Alternative 8 provided for an expansion northwest of the current bridge as shown in Figure 4.20. As shown in Figure 4.21, the cross section at the bridge looking from the District to Virginia, is at 137 feet with 68 feet for current and expanded rail tracks, 57 feet for streetcar and general-purpose lanes with associated shoulders, and a 12-foot pedestrian/bicycle pathway.

Pedestrian/bicycle pathway connections were provided to Long Bridge Park and Mount Vernon Trail in Virginia; East Potomac Park, Maine Avenue, SW, and the Southwest waterfront at the Tidal Basin in the District; as well as access to the plaza at the Mandarin Oriental Hotel.

The analysis of streetcar options was preferred on the upriver side of the current bridge for two reasons: (1) on the District side, an upriver expansion of streetcar aligned well with continuation of streetcar onto the Mandarin Plaza and Maryland Avenue once it was completed. Even without the Maryland Avenue completion, as shown in Figure 4.22, streetcar has options to turn onto 12th Street, SW, and connect to the planned DC Streetcar Plan Phase I at 7th Street, SW, across Maine Ave, SW; and (2) on the Virginia side, it could easily traverse Long Bridge Park to connect to several points on the planned Crystal City/Arlington streetcar system and it would not require the streetcar to pass over or under the existing rail tracks for the connection.

A general-purpose local connection to Maine Avenue on the northwest side in the District would be more difficult than if the expansion were on the southeast side of the bridge. The northwest side general-purpose connection to Maryland Avenue, SW, could act much like the streetcar connection. General-purpose lane access to Maryland Avenue would be the same for a northwest or southeast expansion since the general-purpose lanes (like streetcar) rise above the rail track bed past the Tidal Basin Bridge and are grade separated at Mandarin Plaza with the rail bed passing below the plaza.

The local connection for general-purpose lanes would also be more favorable on the northwest side on the Virginia side for the same reasons as streetcar, including allowing for a local road connection onto Long Bridge Drive at Boundary Drive. Boundary Drive is planned for reconstruction into roundabouts. General-purpose lanes from this alternative could connect to the new roudabout, which in turn would have access to I-395.

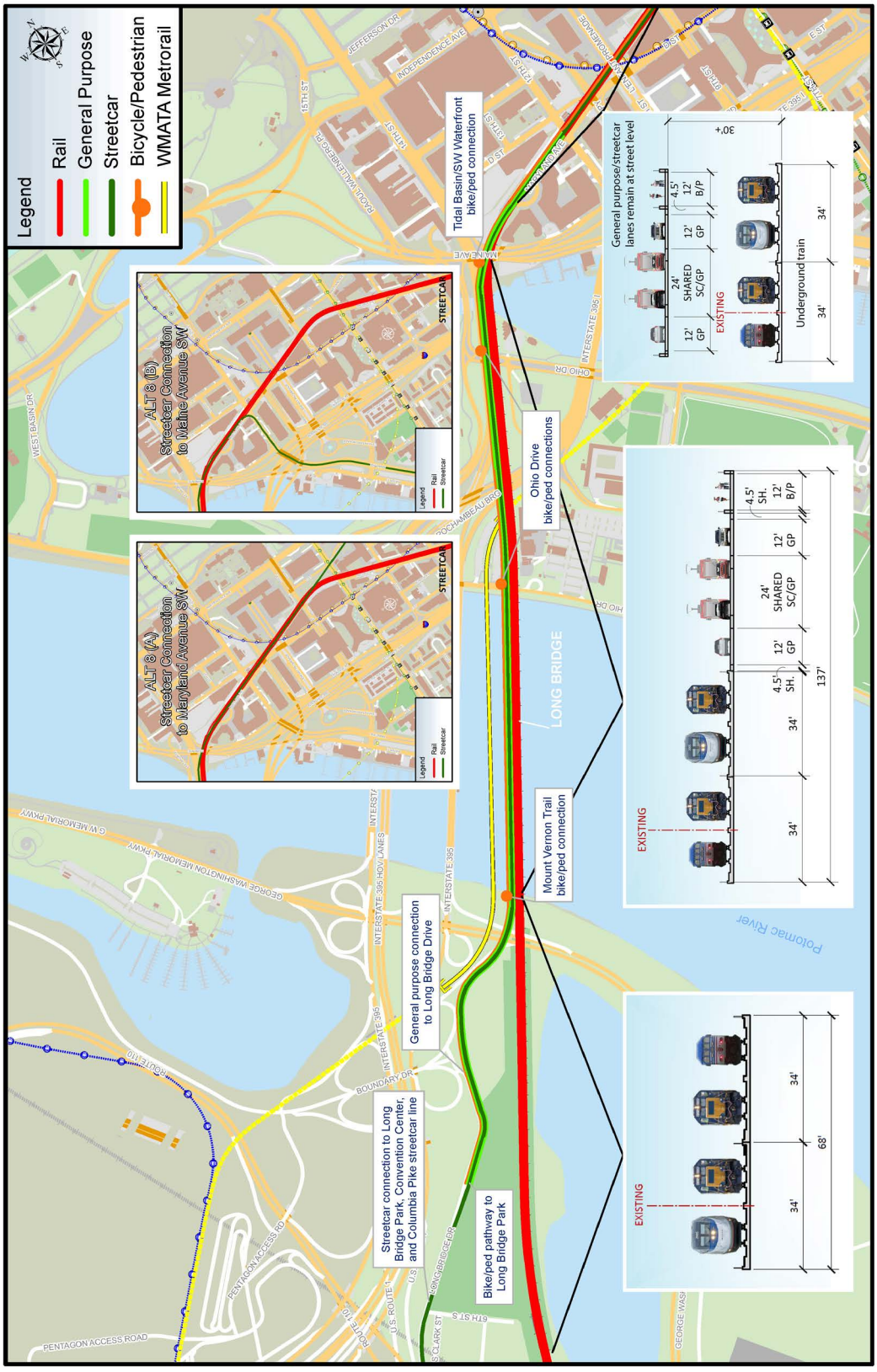
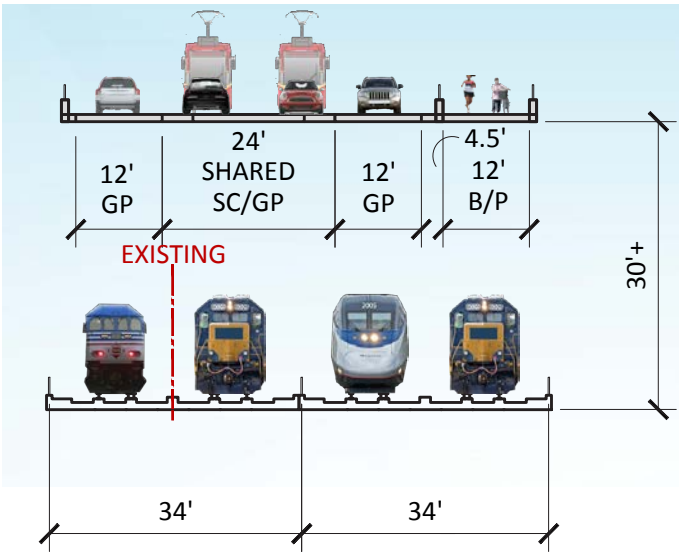
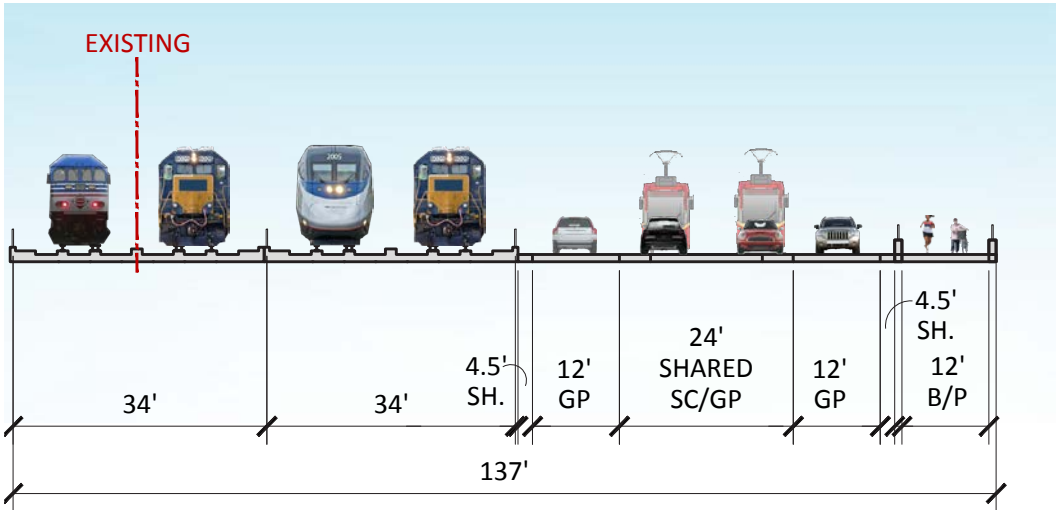


Figure 4.20: Alternative 8 Plan

Figure 4.21: Alternative 8 Section Detail A



Alternative 8 Section Detail B



Alternative 8 Section Detail C

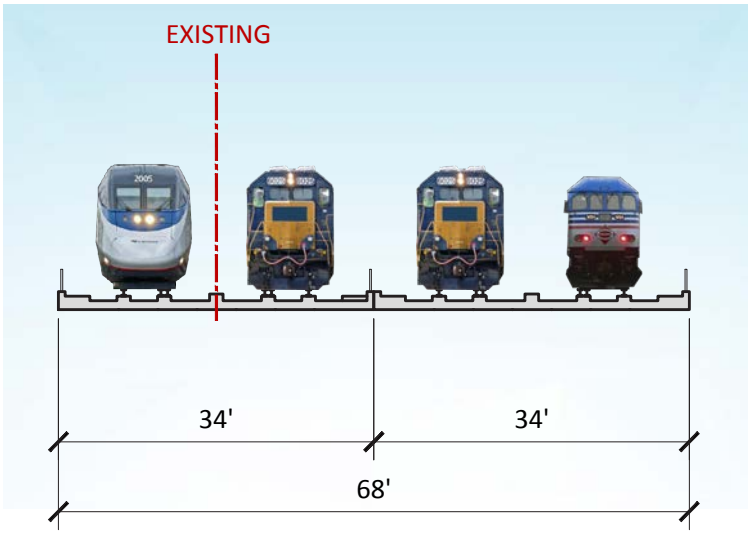
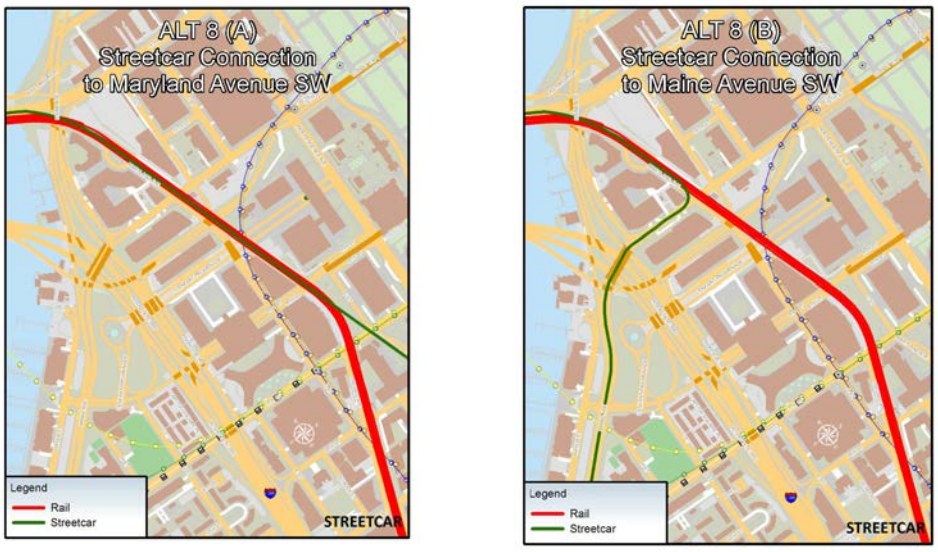


Figure 4.22: Alternative 8 Connection to District Transportation System



The alternative refinement process and the eight alternatives defined for detailed analysis took into account the need for meeting future passenger, commuter, and freight rail demand as well as integrating other modal options to improve the overall transportation infrastructure of the District and the region. The true viability and any fatal flaws of these alternatives will be determined from detailed analysis of rail and multimodal operations, the physical engineering requirement, and how this type of project affects the surrounding environment.

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