

What is the Purpose of the Feasibility Study?

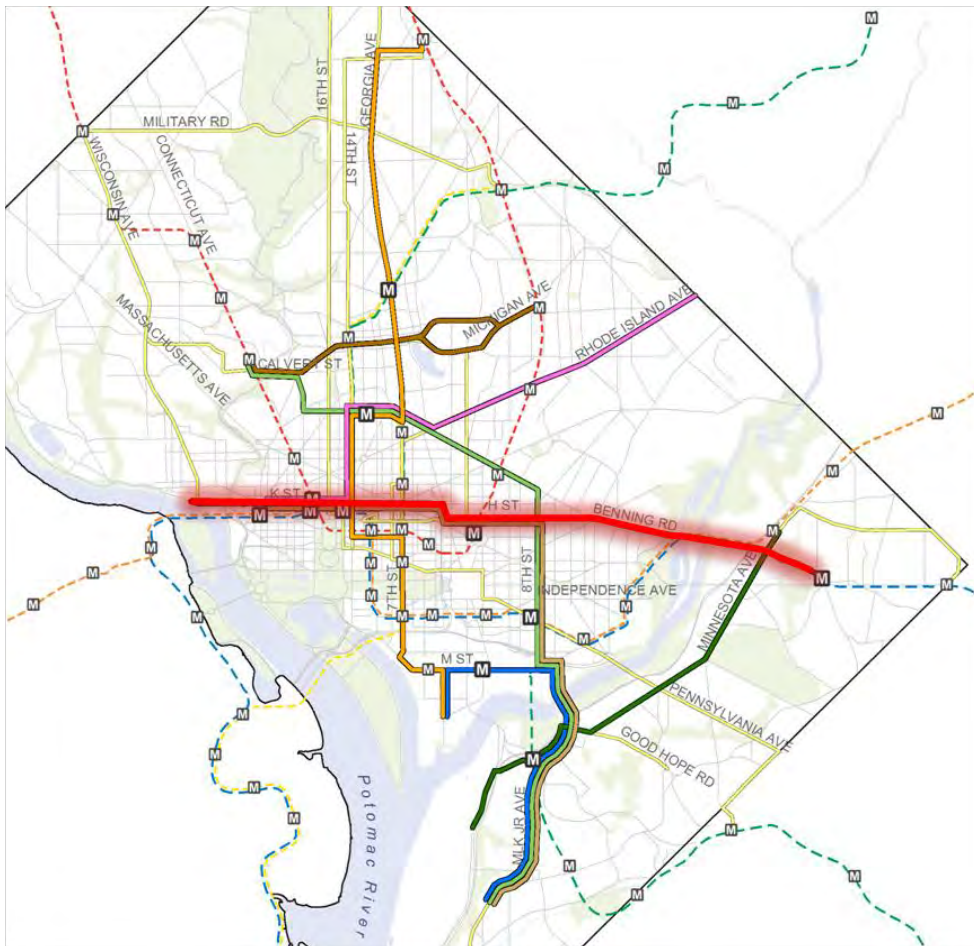
The Benning Road Streetcar Extension is part of the District's larger planned 37-mile streetcar network throughout the region and the 22-mile priority streetcar network. The current H/Benning Road streetcar alignment that is under construction ends at Oklahoma Avenue just west of the Anacostia River. Consistent with the District's planned streetcar network and as one of the earlier phases of reaching the full 37-mile system, this current line could be extended to terminate either at the Minnesota Avenue Metrorail Station or the Benning Road Metrorail Station, both of which are activity centers and transportation hubs. These Metrorail stations constitute the two "Terminus Options" for this study.

The Benning Road Streetcar Extension Feasibility Study investigated the engineering and planning feasibility of



Benning Road Streetcar Extension Terminus Options

extending the H Street/Benning Road Streetcar line east of the Anacostia River in northeast Washington. The proposed streetcar extension would provide high-capacity and high-quality transit service to District residents and invest in infrastructure in an emerging commercial and residential corridor.



DC Streetcar Proposed System Plan

The Benning Road Streetcar Extension aims to achieve the following:

- Provide additional transit capacity to relieve crowded bus lines that serve the corridor;
- Connect Ward 7 neighborhoods with employment and activity centers west of the river;
- Provide connections to the regional Metrorail system as well as to multimodal transportation services at Union Station; and
- Support neighborhood plans for activity centers at the Minnesota Avenue/Benning Road intersection and elsewhere on the corridor.

What are the Existing Conditions of the Study Corridor?

Figure 1: Existing land use, transportation features, and roadway characteristics

	Section Description	Existing Land Use Characteristics and Notable Landmarks	Transportation Features	Roadway Characteristics
A	Benning Rd. – Oklahoma Ave. NE to Anacostia Ave. NE	<ul style="list-style-type: none"> Open space Recreational uses Langston Golf Course, Kingman Island, RFK Stadium access 	<ul style="list-style-type: none"> 2 bridge structures on either side of Kingman Island 	<ul style="list-style-type: none"> Typically has four lanes in each direction divided by a narrow median Classified as Principal Arterial
B	Benning Rd. – Anacostia Ave. NE to Minnesota Ave.	<ul style="list-style-type: none"> Residential neighborhood River Terrace Elementary School Potomac Electric and Power Company (PEPCO) Some commercial to the south 	<ul style="list-style-type: none"> Kenilworth Avenue off-and-on-ramps Benning Road Viaducts over CSX Railroad tracks and I-295 	<ul style="list-style-type: none"> Typically has four lanes in each direction divided by a narrow median, drops to two lanes on Benning Road Viaduct Classified as Principal Arterial
C	Minnesota Ave. – Benning Rd. to Minnesota Ave. Metrorail Station	<ul style="list-style-type: none"> Major retail and community services hub for Ward 7 Department of Employee Services (DOES), Friendship Public Charter School, East River Park Shopping Center, and other existing retail along Minnesota Avenue 	<ul style="list-style-type: none"> Metrorail Station with heavily used bus transfer and layover facility in an active neighborhood 	<ul style="list-style-type: none"> Minnesota Avenue is generally two travel lanes in each direction with on-street parking in this section. Minnesota Avenue is classified as a Minor Arterial
D	Benning Rd. – Minnesota Ave. to Benning Rd. Metrorail Station	<ul style="list-style-type: none"> Residential to the north and south of Benning Road, the Benning Library, Fort Mahan/Fort Circle Park Commercial and residential uses are adjacent to East Capitol Street Several community facilities 	<ul style="list-style-type: none"> Metrorail Station in an active neighborhood with frequent bus service 	<ul style="list-style-type: none"> Benning Road is generally two-lanes in each direction with off-peak on-street parking



What are the Engineering and Planning Considerations for the Project?

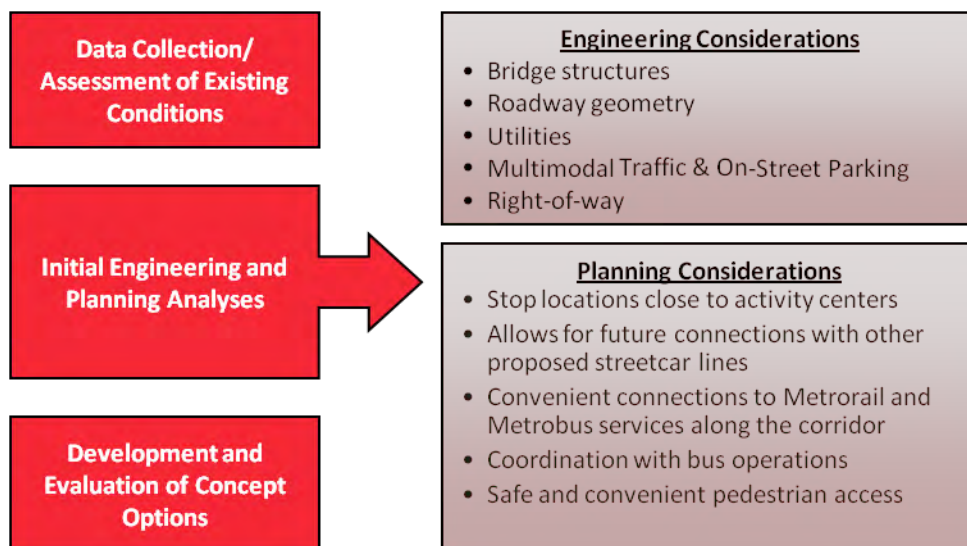
Both engineering and planning considerations were taken into account during the development of the design options. These considerations, including the physical operating environment and urban design principles, affect numerous aspects of the design including the location of the station stops, the streetcar track alignment, the necessity for special track work, etc.

The study area has physical characteristics that constrain the way a streetcar system will operate. The topography and physical features of the study area further affect how streetcar tracks are aligned, where stops and turnaround areas can be located, how traffic operates, and how utilities get impacted. Therefore, a technical assessment was necessary to identify the universe of options and their pros and cons.

Planning considerations consider how the system, such as the stop locations, transit service operating assumptions, and vehicle design considerations, affects the community and the system's riders. Although a design option may be technically feasible, other considerations are important as well such as determining the location of the stations stops and operating plan to best serve the community, attract the highest ridership, and support the community character.

Based on the engineering and planning constraints of the corridor as well as the existing conditions, the following conceptual alternatives (see the following two pages) were developed for each terminus option and assessed in a technically detailed fashion. Letters A through G indicate proposed station stops. For each station, various options were developed. Five options were developed for locations A and B, which are common to both terminus options. Five additional options were developed for the Minnesota Avenue Station Terminus and nine for the Benning Road Station Terminus.

Figure 2: Engineering and Planning Considerations



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Figure 3: Minnesota Avenue Metro Terminus Alternatives

Minnesota Ave Metro Terminus Alternatives

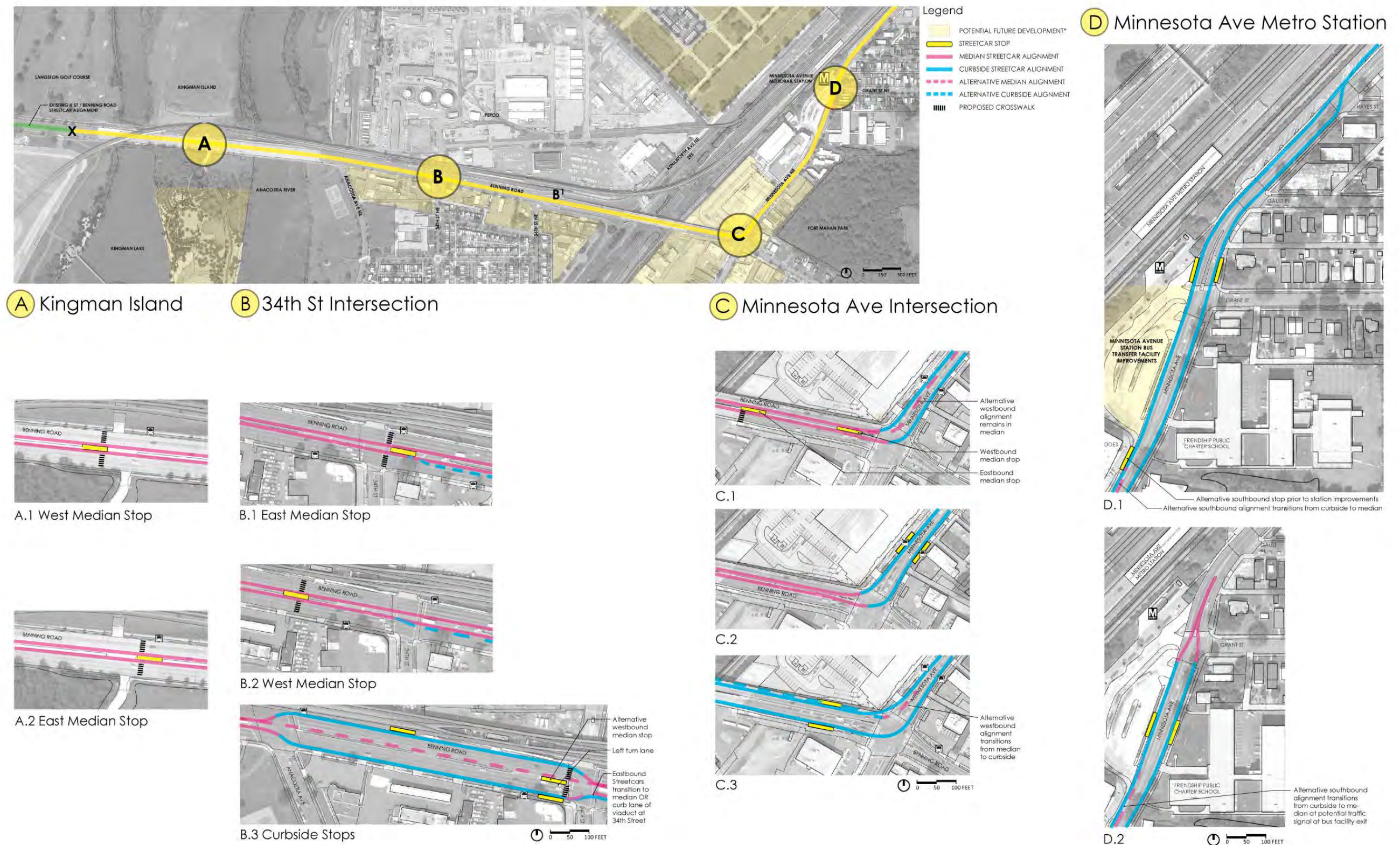
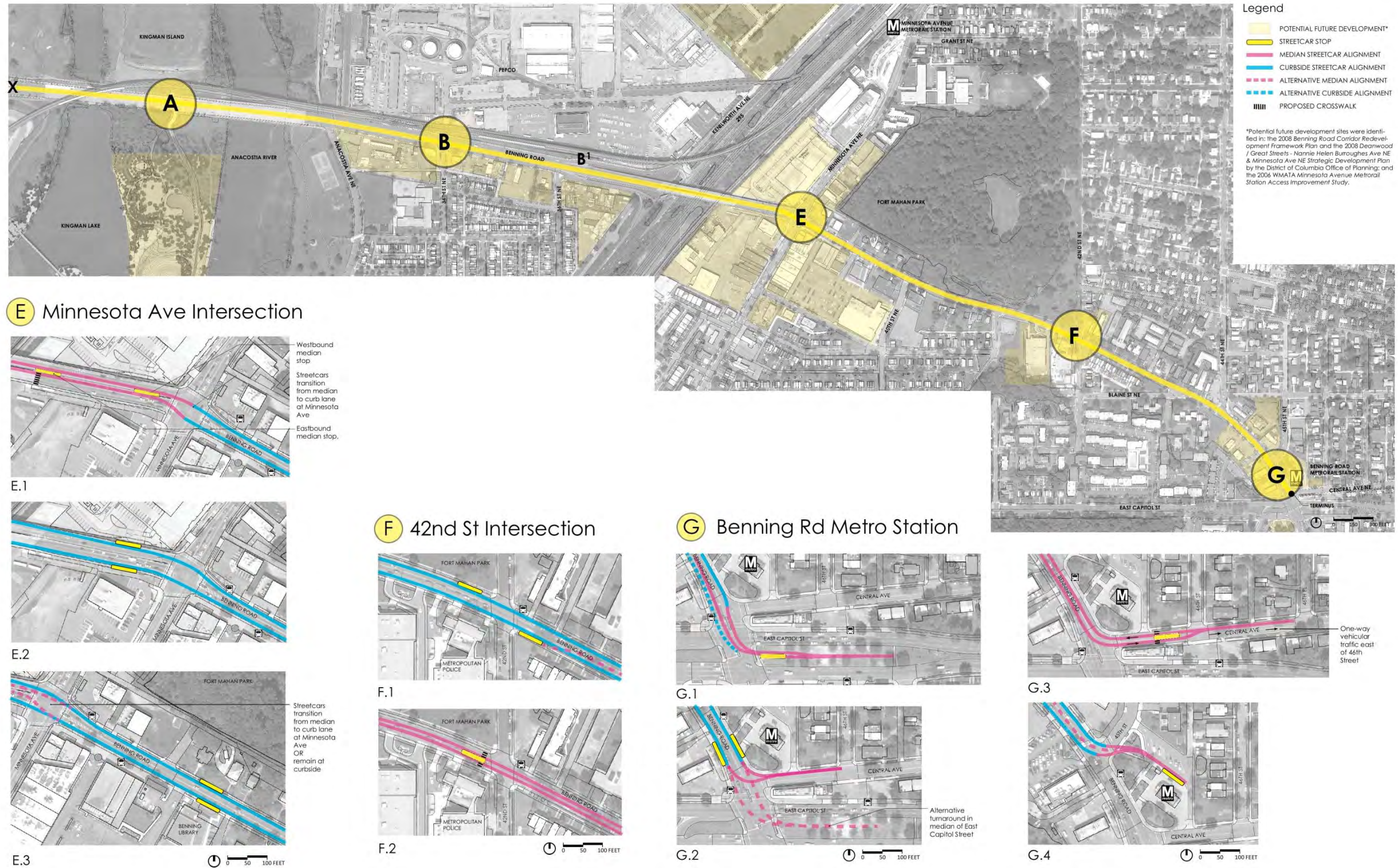


Figure 4: Benning Road Metro Terminus Alternatives

Benning Road Metro Terminus Alternatives



What are the Proposed Service Characteristics and Estimated Ridership?

The proposed frequency of service for the line is every 10 minutes in both directions of service throughout the entire service day. The proposed span of service is as follows:

- Monday through Thursday: 6:00 AM to 12:00 AM
- Friday: 6:00 AM to 2:00 AM
- Saturday: 8:00 AM to 2:00 AM
- Sunday: 8:00 AM to 10:00 PM

Based on the ridership forecasts prepared for the project using the regional forecasting model, the Benning Road Streetcar Extension segment is projected to have approximately 550 and 3,500 daily riders for the Minnesota Avenue Terminus Option and the Benning Road Terminus Option, respectively by 2040. These values are in addition to the projected initial Oklahoma Avenue to Union Station H/Benning Streetcar segment daily ridership of 4,250.

Table 1: 2040 Projected Daily Streetcar Ridership

Streetcar Segment	2040 Daily Streetcar Ridership*
Initial H/Benning Streetcar Line between Oklahoma Avenue and Union Station (under construction)	4,250
1) With Benning Road Metro Station Extension	7,750
2) With Minnesota Avenue Metro Station Extension	4,800

*Assumes that no buses are removed from service as planned; land use reflects 2040 Metropolitan Washington Council of Governments (MWCOG) forecasts.

What are the Estimated Capital and Operating Costs?

The preliminary order-of-magnitude capital cost estimates for the two termini options are estimated for the project as shown below. The preliminary estimates result in costs in the order of \$41 million to \$48 million per mile. They consist of guideway and track elements, station stops, systems, utilities, traffic signals, vehicles, professional services and

contingencies. Operations and maintenance (O&M) costs take into account annual recurring costs associated with labor, material and supplies, utilities, and fuel, and include costs for rail vehicle operations, vehicle maintenance, non-vehicle maintenance, and administrative activities.

Table 2: Preliminary Capital Cost Estimates

Streetcar Segment	Preliminary Cost Estimate (2012 Dollars)
Benning Road Metro Station Extension	\$78,100,000
Minnesota Avenue Metro Station Extension	\$70,800,000

Table 3: Estimated Annual O&M Cost for the Terminus Options

Streetcar Segment	Preliminary Cost Estimate (2012 Dollars)
Union Station to Minnesota Avenue Metrorail Station	\$11,600,000
Minnesota Avenue Metro Station Extension Only (starting from Oklahoma Avenue)	\$4,800,000
Union Station to Benning Road Metrorail Station	\$11,600,000
Benning Road Metro Station Extension Only (starting from Oklahoma Avenue)	\$5,400,000

Where could the Stops be Located?

Curbside and median platforms stops were both considered in the development of the Concept Alternative Plans. Curbside stops can be shared with other bus services as long as the height of the platform is compatible with the buses on the corridor. Median stops would require left-side doors on buses to make them shareable, which is not currently available on the Metrobus. Stops located at the two busiest intersections: Minnesota Avenue & Benning Road, and East Capitol Street / Benning Road, warrant additional discussion.

Proposed Stops at Minnesota Avenue & Benning Road Intersection

Having stop presence on Benning Road such as in Option C1 and C3 would be desirable in providing access to the retail areas south of Benning Road. However, these options require a wider bridge cross section. Furthermore, Option C1 has split stops and may require a new signalized pedestrian crossing for the eastbound stop.

Proposed Stops at East Capitol Street & Benning Road Intersection

Option G1 has the streetcar stop and the turnaround in the median of East Capitol Street. DDOT's East Capitol Street Pedestrian Safety Corridor Study proposes to keep this median to improve the pedestrian environment. Therefore, any potential station design should facilitate improving the pedestrian realm of the median. Options G2 and G3 use Central Avenue for the turnaround area, while G4 uses the kiss & ride area of the Benning Road Metro Station. All options would require a transit-only phase and would equally constrain the traffic operations at this already-busy intersection.

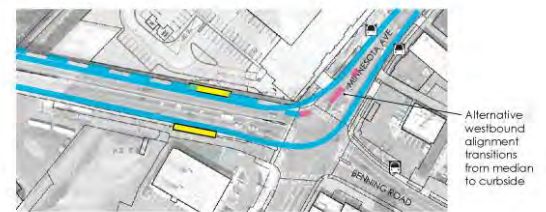
C Minnesota Ave Intersection



C.1



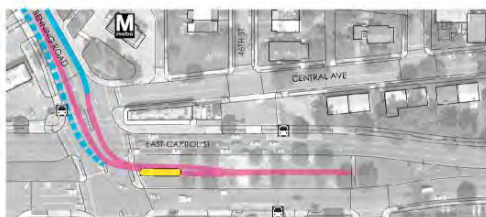
C.2



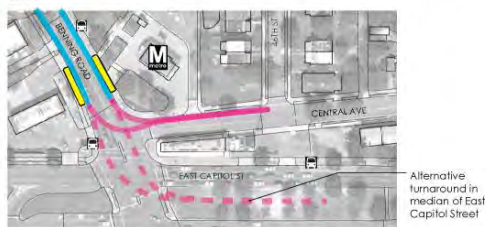
C.3

0 50 100 FEET

G Benning Rd Metro Station

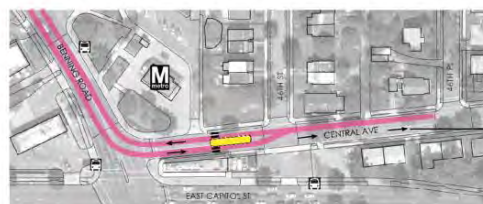


G.1



G.2

0 50 100 FEET



G.3



G.4

0 50 100 FEET

What are the Impacts to Traffic and On-Street Parking?

Implementation of the streetcar will require further assessment of potential impacts to other modes such as pedestrians, bicycles, and automobiles. When in mixed traffic, streetcar operates similar to a public transit bus. However, at certain locations, it may need to transition from a curbside to a center-running configuration. This transition typically happens at a signalized intersection through the use of a transit-only signal phase. During this phase, which could last between 5 to 15 seconds, the concurrent traffic flow is stopped to allow the streetcar movement. Therefore, depending on the streetcar frequency, there is some potential impact to general traffic.

Additionally, median streetcar stops would require a safe crossing environment for pedestrians. Therefore, adequate median space with a safe and accessible walking environment must be provided for median stops. Finally, streetcar track can potentially be hazardous for bicyclists, especially when crossings are at oblique angles. An option is to relocate bicycle accommodations to parallel roadways or off-street facilities when possible.

The two most congested intersections in the study area, Benning Road and Minnesota Avenue, and Benning Road and East Capitol Street, operate with a level of service F, while all the other study intersections operate acceptably under 2040 background (No Build) conditions.

The Benning Road and Minnesota Avenue intersection is proposed to have a right-turn, two through lanes and a left-

turn lane in the southbound direction as part of the Minnesota Avenue Revitalization project. In addition to these capacity improvements, it may be necessary to add a second eastbound left-turn lane to provide adequate capacity by 2040. This improvement needs to be further investigated with the subsequent environmental assessment.

The Benning Road and East Capitol Street intersection would require additional capacity improvements as part of the 2040 No Build conditions. These potential improvements include the provision of the following:

- a westbound left-turn lane,
- dual eastbound left-turn lanes,
- a northbound left-turn lane,
- the restriction of Texas Avenue at East Capitol Street to right-in/right-out access, and
- geometric modifications to the intersection to allow for concurrent left-turns (left-turns occurring at the same time as opposed to the current split phase operation)

At the intersections, which operate acceptably in 2040 background conditions, streetcar operations either did not affect the level of service or worsened it by one letter, while still maintaining acceptable level of service levels (level of service D or better). At the two most congested intersections, because they are already at or beyond their traffic operational capacity, streetcar increased delays by 2 to 17 percent.

Table 4: Intersection LOS Impacts

Intersection	No Build 2040 LOS	Streetcar Build Alternatives
Benning Rd & Minnesota Ave	LOS F	Option C1: Slight increase in traffic delay (2-3%) Option C2: least amount of traffic delay as streetcar follows general traffic Option C3: Increase intersection delay by 9% as streetcar requires transit-only phase E Series: Increase intersection delay similar to Option C3
Benning Rd & East Capitol St	LOS F	Increase intersection delay by 17% as streetcar requires transit-only phase
All Other Intersections	Acceptable LOS	Maintains Acceptable LOS under all Alternatives

On-Street Parking

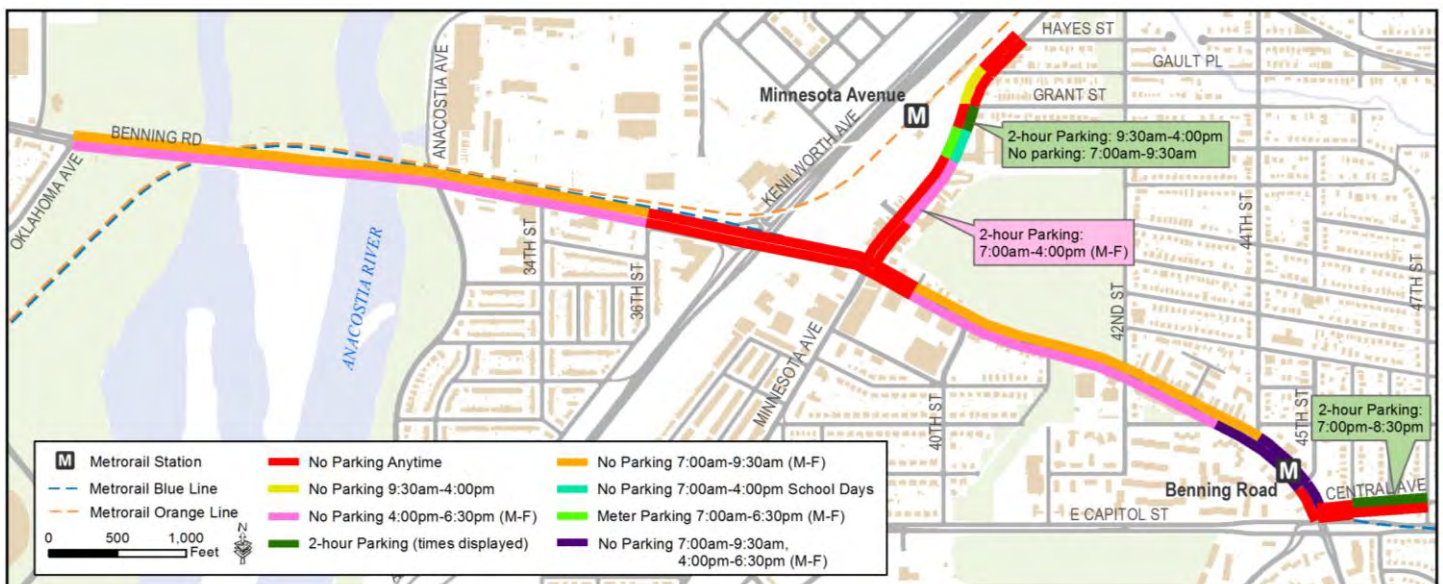
If on-street parking is provided along a roadway segment that is proposed for a curbside-running streetcar track lane, the parking would need to be eliminated. For example, off-peak on-street parking is provided along segments of Benning Road east of Minnesota Avenue; however, it would not be possible to maintain on-street parking during any periods of

the day along roadway segments with curbside-running streetcar tracks. It is possible to have on-street parking with a curbside running alignment, if parking can be provided to the right of the streetcar track as illustrated. However, this would likely result in the widening of the roadways for the Benning Road corridor.



Potential areas of on-street parking to be impacted on Benning Road (left) and Minnesota Avenue (right).

Figure 5: Existing On-Street Parking Conditions



Will there be Impacts to the Existing Transportation Infrastructure, including the Bridges over the Anacostia River and CSXT Tracks?

As part of the Feasibility Study, the sufficiency of the existing bridges to accommodate the streetcar extension was assessed. The three bridges assessed in the study are:

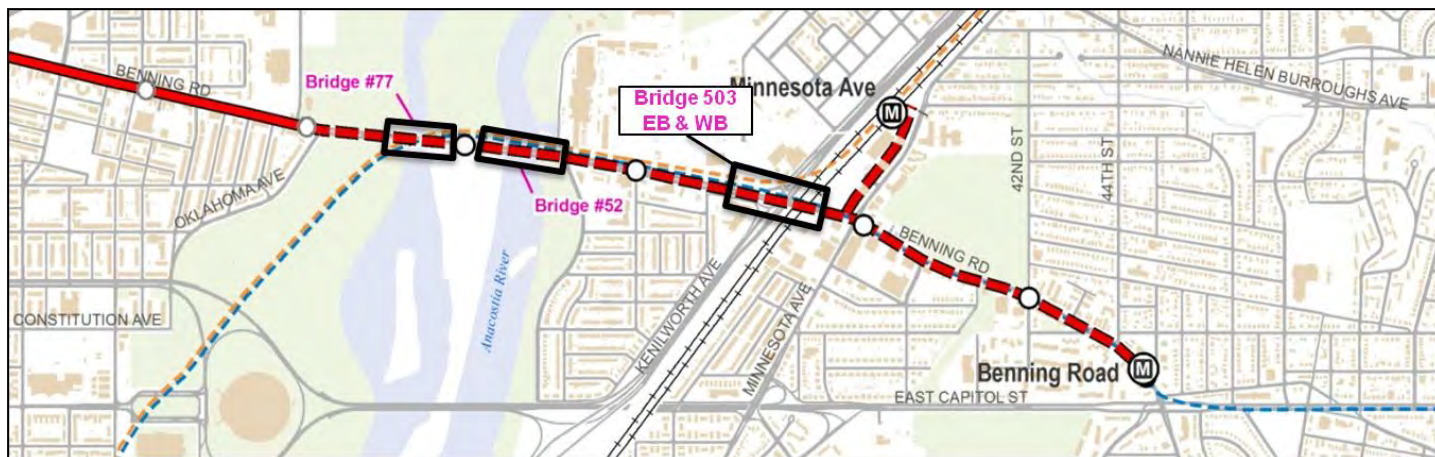
- Benning Road Bridge over the Anacostia River (Bridge No. 52)
- Benning Road Bridge over Kingman Lake (Bridge No. 77)
- Benning Road Viaduct (Bridge No. 503 Eastbound and Bridge No. 503 Westbound) over Kenilworth Avenue and the CSXT Railroad tracks

The Feasibility Study found that the bridge pavement depth must be increased in order to accommodate the streetcar tracks, the loads of the streetcar vehicle, and the streetcar

slab. Strategies to increase the additional depth in the bridge pavement include a “build-up” or a “build-down” approach. Either option would be acceptable, although the build-up option is easier to build. The build-up approach, however, requires the center lanes of the bridge to be dedicated to streetcar only operations due to the increased height above the adjacent general traffic lanes.

DDOT has programmed Bridge 503 – Benning Road Viaduct for reconstruction. Future design efforts for this bridge should include accommodations for streetcar as well as pedestrian and bike facilities. The cross section illustrations (see Figure 7) show how a future bridge could potentially accommodate general travel lanes, streetcar, pedestrian and bike facilities.

Figure 6: Bridge Structures Impacts



Bridge 77: **Bridge over Kingman Lake**

- Dedicated lane is possible (traffic operates acceptably with single lane reduction in both directions)
- Mixed traffic would also work, but more difficult to build

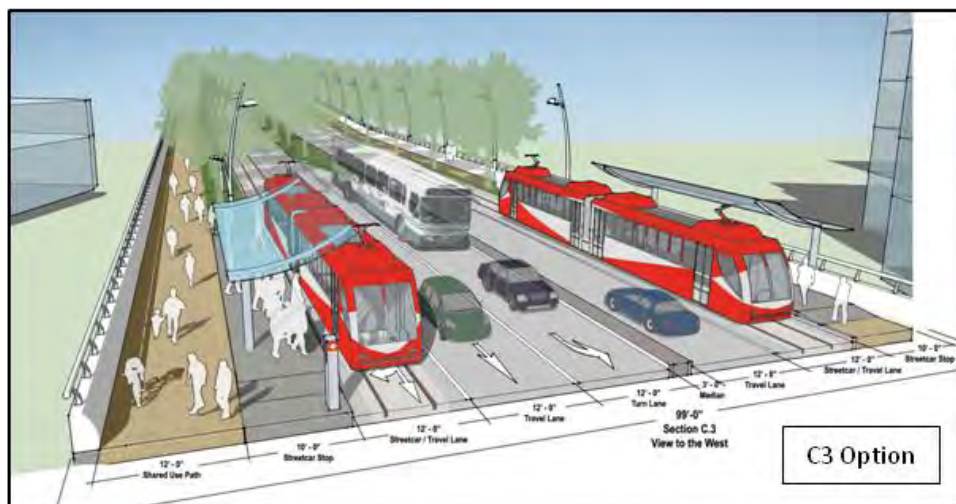
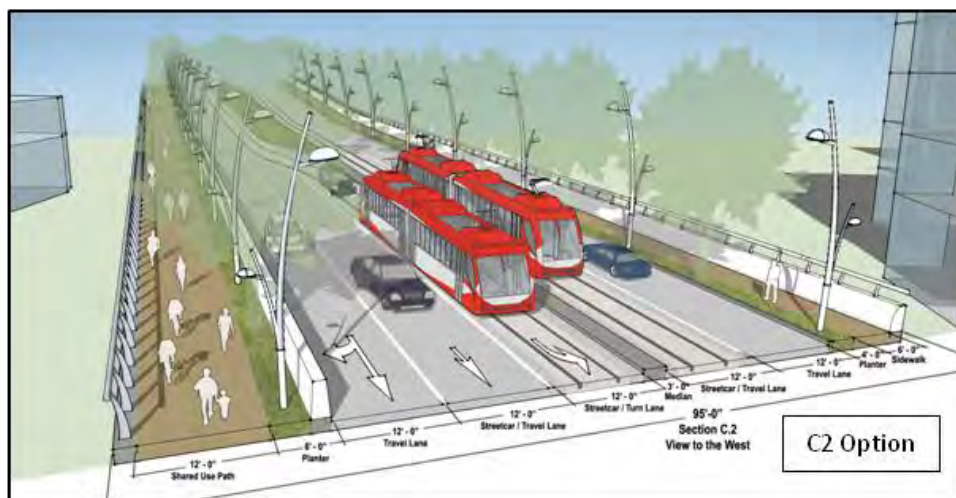
Bridge 52: **Bridge over Anacostia River**

- Dedicated lane is possible (traffic operates acceptably with single lane reduction in both directions)
- Mixed traffic would also work, but more difficult to build

Bridge 503: **Benning Road Viaduct**

- Programmed for reconstruction (see next page for potential cross-section illustrations)

Figure 7: Benning Road Viaduct Cross Section Options



Will the Roadway have to be Widened or Lanes Taken?

Curbside travel lane widths along the corridor are generally 11 feet, except for on the structures (i.e. the three bridges as identified earlier), where they are 10 feet for all lanes. Center lanes are generally 10 feet. For the purposes of this feasibility analysis, 12-foot lanes were used to locate streetcar tracks. Curbside running tracks would require widening of the roadway by 1 foot on either side for a total of 2 feet. Median running tracks would require the roadway to be widened by 2 feet on either side for a total of 4 feet. Additionally, median platforms require 16 feet of widening, if the existing lane configurations are maintained (i.e. the number of lanes). Streetcar turnaround areas in both termini options, if located in the median, would require either lane taking or roadway widening or if located elsewhere, displacement of an existing function such as median space or kiss & ride space (as in Options D1 and G4).

The intersection of Minnesota Avenue and Benning Road would need to be reprofiled (raised and flattened) to



Example of trackwork allowing for north-south and east-west connectivity (Toronto, Ontario).

accommodate special trackwork that allows for north-south and east-west connectivity. This could potentially have visual as well as right-of-way effects.

Table 5: ROW Impacts

Streetcar Design Element	ROW Impacts
Curbside Running	Requires widening of roadway by 1 foot on either side (2 feet total).
Median Running	Requires widening of roadway by 2 feet on either side (4 feet total).
Median Platforms	Requires 16 feet of widening (if maintaining existing number of lanes).
Streetcar Turnaround Areas	Median location requires lane taking or roadway widening; or if located elsewhere, displacement of existing function such as median space or kiss & ride space.
Minnesota Ave & Benning Rd Intersection	Requires roadway reprofiling to accommodate trackwork allowing for north-south and east-west connectivity; potential for ROW and visual impacts.

What will be the Impact to the Existing Utilities?

Based on the assessment of existing utilities through review of available information, the two proposed streetcar terminus alternatives, as well as the individual alignment options, were used to identify potential conflicts. Generally, numerous underground utilities are in conflict with the proposed streetcar throughout the corridor and above ground utilities are impacted at select locations, typically where side running options are proposed. The next phases of design should identify these conflicts in more detail and mitigate them. A list of utilities that could potentially be impacted is seen in Table 6.

Table 6: Existing Utilities

Utility Type	Utility Owner
Gas	Washington Gas
Water	DC Water (WASA)
Electric	Potomac Electric and Power Company (PEPCO)
Telephone	Verizon Communications
Communication/ CATV	TBD
Street Lighting	District Department of Transportation
Traffic Signals/ Enforcement	District Department of Transportation and Metropolitan Police Department
Sanitary Sewer	DC Water (WASA)
Storm Drainage	DC Water (WASA)
Rail	WMATA and CSX

How will the Streetcars be Powered?

The streetcar vehicles are propelled by electric powered traction motors, and draw energy from a source external to the vehicle. The components which deliver this power are defined as the Traction Power Supply and Distribution system. The Traction Power Supply and Distribution system draws power from an outside source, typically a public utility, converts the power to the form required for use by streetcar vehicles at a series of fixed installations known as Traction Power Substations (TPSS), and delivers it to the transit vehicle via an overhead contact wire system (OCS), known as a catenary.

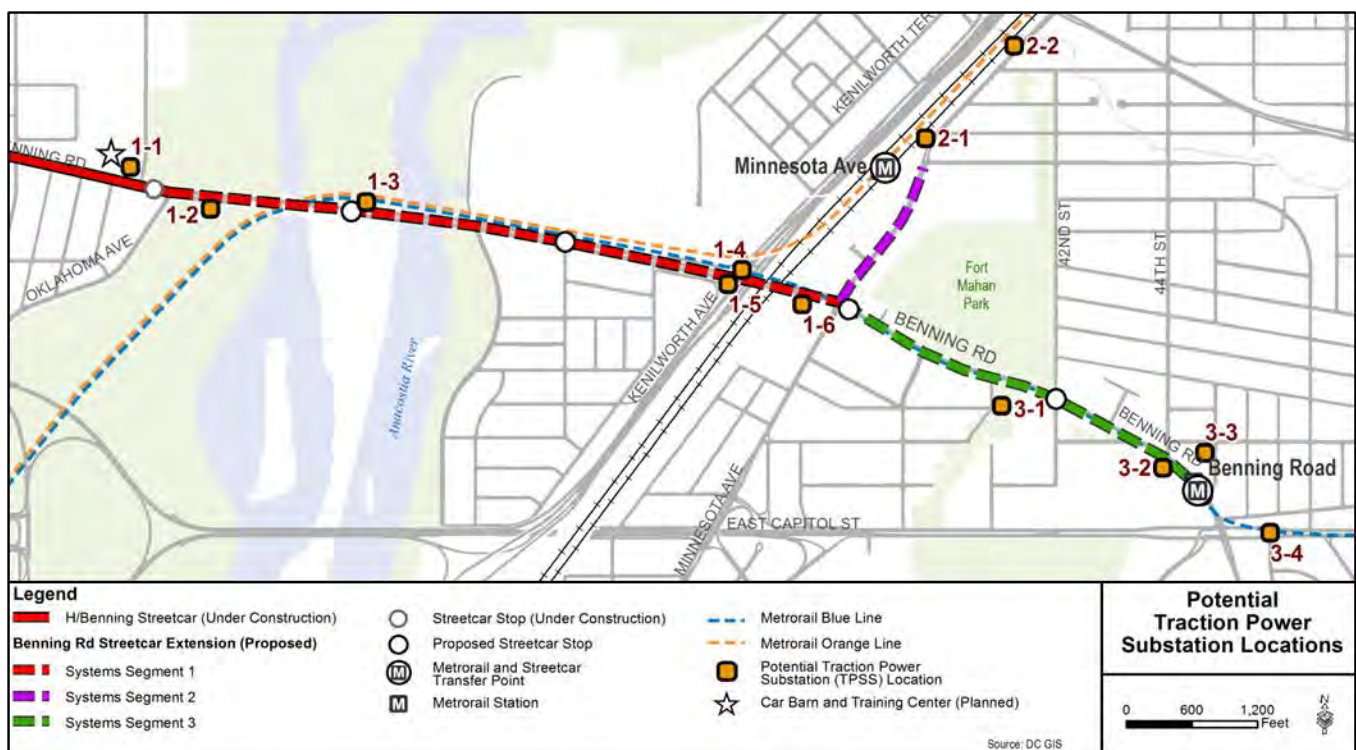
The overall alignment was broken into three “Systems Segments”. The segments are as follows:

- **Systems Segment 1** – Benning Road between the eastern terminus of the H/Benning project and the Benning Road/Minnesota Avenue intersection (approximately 0.6 miles in length);

- **Systems Segment 2** – Benning Road between the Benning Road/ Minnesota Avenue intersection and the Benning Road/East Capitol Street intersection (approximately 0.8 miles in length); and
- **Systems Segment 3** – Benning Road between the Benning Road/ Minnesota Avenue intersection and the Metrorail Station on Minnesota Avenue (approximately 0.3 miles in length).

The system was studied such that one TPSS would be located in each Systems Segment. In terms of the two terminus options considered in the study, Systems Segments 1 and 2 would comprise the Minnesota Avenue Metrorail Station Terminus Option, and System Segments 1 and 3 would comprise the Benning Road Metrorail Station Terminus Option.

Figure 8: Potential TPSS Locations



How will the Streetcar Potentially Affect the Social, Built and Natural Environment?

A preliminary environmental scan was conducted for the two proposed streetcar alignments. The alignments were reviewed for conformance with local land use, zoning and local plans, as well as potential effects on neighborhoods and community resources, environmental justice, parks and parklands, historic and cultural resources, property acquisition and displacements, traffic, hazardous and contaminated materials, air quality, noise and vibration, water resources, protected species and habitats, utilities, and construction impacts.

Key findings of the environmental scan are summarized below:

- **Conformance with Local Plans** – A number of local plans address the Benning Road Streetcar. While these plans refer to extending the Benning Road Streetcar to the Benning Road Metro Station or the Minnesota Avenue Metro Station, none discuss the option for interoperability between the two termini.
- **Parks and Parklands** – The National Park Service (NPS)-owned Fort Mahan Park abutting the Benning Road Metrorail station option, may be affected if any right-of-way for project facilities is needed. Potential impacts would need to be documented as part of a Section 4(f)/ Section 6(f) Evaluation in a later detailed environmental study.
- **Cultural Resources** – The Langston Golf Course located west of the Anacostia River and north of Benning Road and the Fort Mahan Park abutting the proposed



NPS-owned Fort Mahan Park

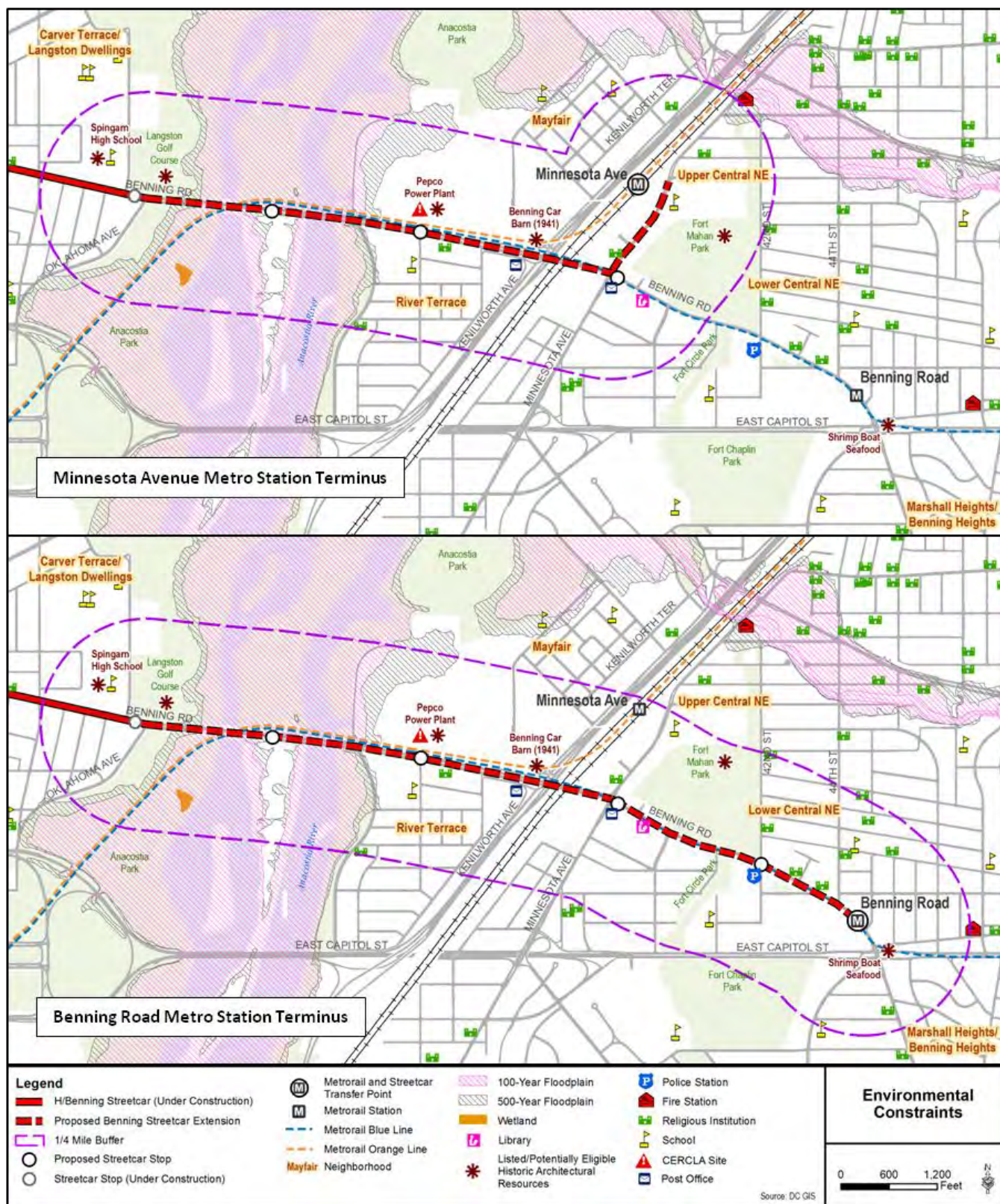
alignment to Benning Road Metrorail station are listed on the National Register of Historic Places. Any potential impacts would require a Section 106 documentation as part of a detailed environmental study.

- **Noise and Vibration** – A number of sensitive noise receptors, i.e., schools, churches and the Benning Library exist along both alignments. Noise and vibration for construction and operation of the streetcar would need to be assessed in a detailed environmental study.
- **Hazardous Materials** – For a PEPCO power plant, which is a CERCLA site, and a number of other RECs (e.g. gas stations) that may exist along both alignments, further assessment during a detailed environmental study would be needed.



Pepco Power Plant

Figure 9: Environmental Constraints



What are the Conclusions and Next Steps?

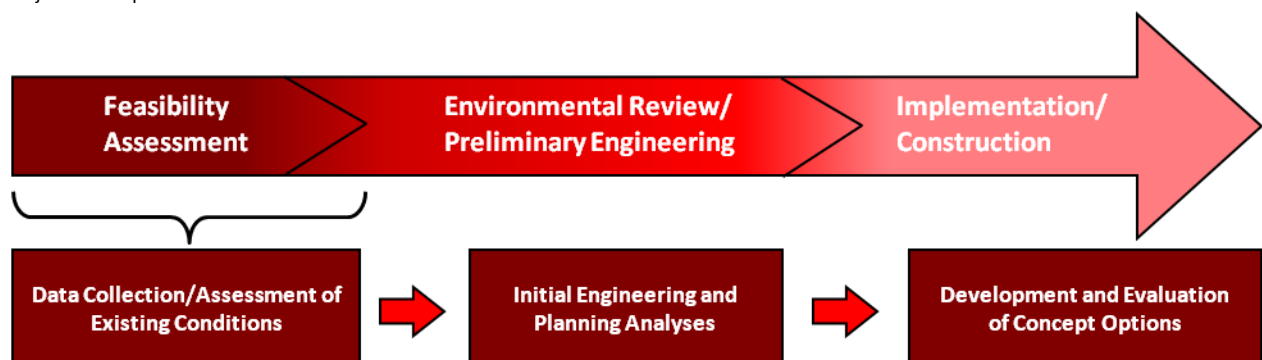
DDOT will study in more detail the options to extend the current H Street/Benning streetcar alignment either to the Minnesota Avenue Metrorail station or the Benning Road Metrorail station. Both terminals are centers of activity and offer multimodal connections. The Benning Road Metrorail station terminus option offers more riders (by about 3,000 daily riders) compared to the Minnesota Avenue Metrorail station terminus option. However, it also comes with a 13-percent higher capital cost and a 17-percent higher O&M cost. Both options require the following accommodations:

- Structural modifications to the existing bridges
- Potential roadway widening
- Significant utility coordination and relocation
- Reprofilng of the Benning Road and Minnesota Avenue intersection
- Several TPSS installations
- Potential right-of-way needs at the termini locations to accommodate stops and turnaround area

There is a need for traffic operations and pedestrian safety improvements at several locations in the study area. The multimodal operations and the needs of streetcar need to be studied in more detail between the intersection and the Minnesota Avenue Metrorail station including the kiss & ride area, which could potentially be used for a streetcar turnaround area.


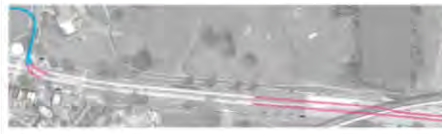

The next steps in project development include an environmental documentation of the various impacts associated with the streetcar and related roadway projects. DDOT's plan to reconstruct the Benning Road Viaduct should be done in a fashion that does not preclude future streetcar plans. Additionally, any future design or construction activities in the study area (on Benning Road or on Minnesota Avenue) should consider the future streetcar alignments.


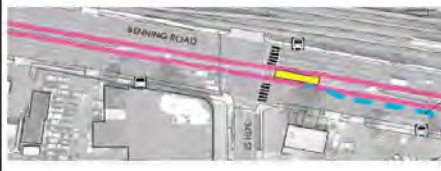
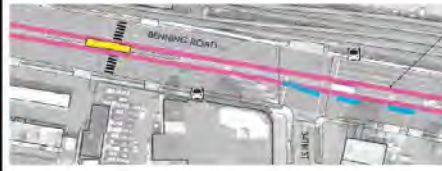

Figure 10: Project Development Process


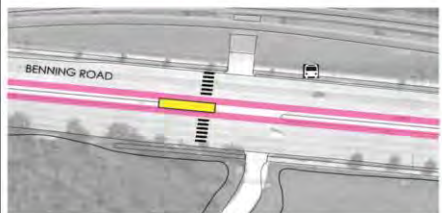
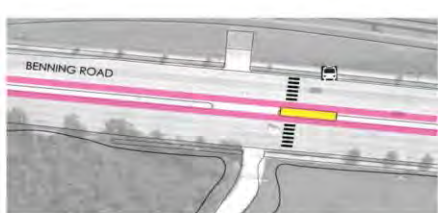






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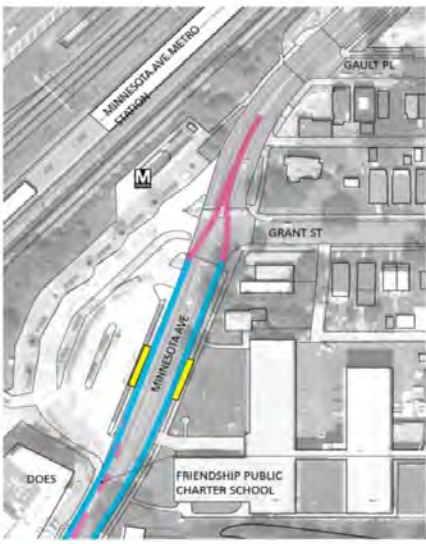
What are the Pros and Cons of each Alternative?





X Series: Oklahoma Avenue Tie-in		
Key to Ranking: Lower Performing  Higher Performing		
	 <p>X.1 Oklahoma West Bound Unsignalized Transition</p>	 <p>X.2 Oklahoma West Bound Signalized Transition</p>
Pedestrian Access		
Pedestrian Access	N/A	N/A
Community and Urban Design		
Provides Multimodal Access	N/A	N/A
Contributes to Public Realm		
Traffic		
Maintains general traffic capacity	Traffic lanes dropped from 4 lanes to 2, capacity reduced by 50%	Maintains four lanes, capacity is maintained
Maintains general traffic turning movements	General traffic turning movements are maintained	General traffic turning movements are maintained
Track Transitions and Signalization		
Requires track alignment transitions	Yes	Yes
Requires new signalization	Does not require signalization	Requires new signalization at the stadium parking lot
Right of Way		
Requires taking of ROW	N/A	N/A




B Series: 34th Street Intersection			
Key to Ranking: Lower Performing  Higher Performing			
	 <p>B.1 East Median Stop</p>	 <p>B.2 West Median Stop</p>	 <p>B.3 Curbside Stops</p>
Pedestrian Access			
Pedestrian Access	Median stop not ideal for pedestrian access	Median stop not ideal for pedestrian access	Curbside stop provides best pedestrian access
Community and Urban Design			
Provides Multimodal Access	Provides improved access for existing community	Provides improved access for existing community	Provides improved access for existing community
Contributes to Public Realm	Central location to activity centers	Not as central location to activity centers	Not as central location to activity centers
Traffic			
Maintains general traffic capacity	Maintains existing travel lanes, but requires shared thru/left-turn lane	Maintains existing travel lanes	Maintains existing travel lanes
Maintains general traffic turning movements	Stop location blocks WB left-turning movements	Maintains existing turning movements	Maintains existing turning movements
Track Transitions and Signalization			
Requires track alignment transitions	Does not require alignment transition	Does not require alignment transition	Requires multiple alignment transitions
Requires new signalization	Does not require new signalization	Requires pedestrian crossing signal	Requires new signal phases for transitions
Right of Way			
Requires taking of ROW	Potential ROW required for median stop	Potential ROW required for median stop	Does not require taking of ROW

A Series: Kingman Island		
Key to Ranking: Lower Performing  Higher Performing		
	 <p>A.1 West Median Stop</p>	 <p>A.2 East Median Stop</p>
Pedestrian Access		
Pedestrian Access	Median stop not ideal for pedestrian access	Median stop not ideal for pedestrian access
Community and Urban Design		
Provides Multimodal Access	Provides connection to existing bus stop	Provides best connection to existing bus stop
Contributes to Public Realm	Provides stop near community facility (Kingman Island)	Provides stop near community facility (Kingman Island)
Traffic		
Maintains general traffic capacity	Maintains general traffic capacity in shared use lane	Maintains general traffic capacity in shared use lane
Maintains general traffic turning movements	Maintains general traffic turning movements	Maintains general traffic turning movements
Track Transitions and Signalization		
Requires track alignment transitions	No	No
Requires new signalization	Requires new pedestrian crossing signal	Requires new pedestrian crossing signal
Right of Way		
Requires taking of ROW	ROW required for median stop	ROW required for median stop

C Series: Minnesota Avenue Intersection (Minnesota Avenue Station Terminus)			
Key to Ranking: Lower Performing  Higher Performing			
	 <p>C.1 Median Stops on Viaduct</p>	 <p>C.2 Curbside Stops on Minnesota Avenue</p>	 <p>C.3 Curbside Stops on Viaduct</p>
Pedestrian Access			
Pedestrian Access	Median stop not ideal; WB stop far from the intersection	Curbside stop provides best Pedestrian Access	Curbside stop provides best Pedestrian Access; EB turn radius may require "pedestrian island" at the NW corner
Community and Urban Design			
Provides Multimodal Access	Split stops are not in a common location	Potential shared stop at existing bus stop	Close to the Benning Road and Minnesota Avenue intersection
Contributes to Public Realm	Provides presence on Benning Road	Close to activity centers on Minnesota Avenue	Provides presence on Benning Road
Traffic			
Maintains general traffic capacity	Maintains general traffic capacity but the EB stop will impede left-turns	Maintains general traffic capacity	Maintains general traffic capacity
Maintains general traffic turning movements	Streetcar uses a "traditional" left turning movement from mixed traffic left turn lane; Split stops allow for EB left turns onto Minnesota Avenue	Streetcar uses a "traditional" left turning movement from mixed traffic left turn lane	"Non-Traditional" left turning movement from right curb lane may impact traffic
Track Transitions and Signalization			
Requires track alignment transitions	Yes	Yes	No
Requires new signalization	Stop location requires pedestrian crossing signalization; "Traditional" turning movement does not require new signalization	"Traditional" turning movement does not require new signalization	"Non-Traditional" turning movement requires new signal phase
Right of Way			
Requires taking of ROW	May require ROW for median running way and stops	May require ROW for median running way	Does not require taking of ROW

D Series: Minnesota Avenue Metrorail Station		
Key to Ranking: Lower Performing  Higher Performing		
		
	D.1 Stops by Station Entrance, Kiss & Ride Turnaround	D.2 Stops by Bus Facility; Minnesota Avenue Turnaround
Pedestrian Access		
Pedestrian Access	Curbside stop provides best Pedestrian Access; Stops located near an existing pedestrian crossing	Curbside stop provides best Pedestrian Access; Stops are not located adjacent to an existing pedestrian crossing
Community and Urban Design		
Provides Multimodal Access	Stops located adjacent to Metrorail Station entrance	Stops located adjacent to Metrobus facility; Stop location may require the reduction in the bus layover area
Contributes to Public Realm	Stops conveniently located at the Metrorail Station entrance	Stops located closer to Minnesota Avenue activity centers
Traffic		
Maintains general traffic capacity	Turnaround facility does not require the taking of travel lanes	Turnaround facility requires the taking of travel lanes or the widening of Minnesota Avenue
Maintains general traffic turning movements	Maintains general traffic turning movements	Maintains general traffic turning movements
Track Transitions and Signalization		
Requires track alignment transitions	Yes	Yes
Requires new signalization	New signal for transition to turnaround facility at Hayes Street	No, transition to turnaround facility at existing Grant Street signal
Right of Way		
Requires taking of ROW	Requires taking of WMATA ROW from Kiss & Ride Lot	Requires taking for ROW for median turnaround facility

E Series: Minnesota Avenue Intersection (Benning Road Station Terminus)			
Key to Ranking: Lower Performing  Higher Performing			
			
	E.1 Median Stops on Viaduct	E.2 Curbside Stops on Viaduct	E.3 Curbside Stops East of Intersection
Pedestrian Access			
Pedestrian Access	Median stop not ideal for Pedestrian Access	Curbside stop provides best Pedestrian Access	Curbside stop provides best Pedestrian Access
Community and Urban Design			
Provides Multimodal Access	Split stops are not in a common location	Close to the Benning Road and Minnesota Avenue intersection	Stops further away from Benning Road and Minnesota Avenue intersection
Contributes to Public Realm	Provides presence on Benning Road	Provides presence on Benning Road	Provides presence on Benning Road; Stops further away from uses on Minnesota Avenue
Traffic			
Maintains general traffic capacity	Transition from median to curbside alignment will have traffic impacts	Maintains curbside alignment, reducing traffic impacts; Stop locations may impact general traffic	Lower roadway levels away from intersection reduce traffic impacts
Maintains general traffic turning movements	Transition from median to curbside alignment may impact EB left turning movements	Maintains general traffic turning movements	Maintains general traffic turning movements
Track Transitions and Signalization			
Requires track alignment transitions	Yes	No	No/Yes (alternative)
Requires new signalization	Split stop requires new pedestrian crossing signal; Transition occurs at existing signal	Does not require new signalization	May require new signal phase for transition alternative
Right of Way			
Requires taking of ROW	ROW required for median running way and stop	Does not require taking of ROW	Does not require taking of ROW

F Series: 42nd Street Intersection		
Key to Ranking: Lower Performing  Higher Performing		
		
	F.1 Curbside Stops	F.2 Median Stop
Pedestrian Access		
Pedestrian Access	Curbside stop provides best Pedestrian Access	Median stop not ideal for Pedestrian Access
Community and Urban Design		
Provides Multimodal Access	Stops near existing bus stop, Fort Mahan Park is sensitive to visual.	Stop near existing bus stop
Contributes to Public Realm	Stop location provides access for recommended future redevelopment	Stop location provides access for recommended future redevelopment
Traffic		
Maintains general traffic capacity	Maintains to travel lanes in each direction	Eliminates one general travel lane to accommodate median stop
Maintains general traffic turning movements	Maintains general traffic turning movements	Median stop would conflict with EB left turning movements
Track Transitions and Signalization		
Requires track alignment transitions	No track alignment transitions required	No track alignment transitions required
Requires new signalization	No new signalization is required	No new signalization is required (alternative requires a new phase)
Right of Way		
Requires taking of ROW	Does not require the taking of ROW. Potential Park property impacts should be investigated further.	Requires the taking of ROW for median stop, Park may be sensitive

G Series: Benning Road Metrorail Station and Turnaround					
<div>Key to Ranking:</div> <div><div>Lower Performing</div><div>Higher Performing</div></div>					
	G.1	G.2	G.3	G.4	
	East Capitol Street Median Stop and Turnaround	Benning Curbside Stops and Central Avenue Turnaround	Central Avenue Median Stop and Turnaround	Kiss & Ride Site Stop and Turnaround	
	Pedestrian Access				
	Pedestrian Access	Median stop not ideal for Pedestrian Access	Curbside stop provides best Pedestrian Access	Median stop not ideal for Pedestrian Access	Stop location separated from the roadway provides a safe location for pedestrians
Community and Urban Design					
Provides Multimodal Access	Stop furthest away from Metrorail station	Stops adjacent to Metrorail Station	Stop adjacent to Metrorail Station	Stops at Metrorail Station Entrance	
Contributes to Public Realm	Provides closest access to activity centers to the south and east of the intersection; Stop location should be coordinated with future studies	Provides good access to activity center north of the intersection	Provides good access to adjacent neighborhood	Geometry of WMATA property limits future streetcar extension	
Traffic					
Maintains general traffic capacity	Median stop is within existing median, reducing impacts to traffic	Turnaround facility will impact traffic operations on Central Avenue	Turnaround facility will impact traffic operations on Central Avenue	Maintains traffic capacity	
Maintains general traffic turning movements	Maintains general traffic turning movements	Maintains general traffic turning movements, but will impact Benning traffic	Maintains general traffic turning movements	Turning radius of streetcar may require redesign of 45th Street intersection	
Track Transitions and Signalization					
Requires track alignment transitions	Yes	Yes	No	Yes	
Requires new signalization	Does not require new signal for track alignment transition	Requires new signal at Central Avenue	Requires new signal at Central Avenue	Does not require new signal for track alignment transition	
Right of Way					
Requires taking of ROW	Existing median allows for the ROW needed for stop and turnaround facility	EB stop may require additional ROW on private property; ROW needed for turnaround facility on Central Avenue	ROW needed for stop location and turnaround facility on Central Avenue	ROW needed for stop and turnaround facility in existing WMATA Kiss & Ride facility	