RED LINE PROJECT
BALTIMORE COUNTY AND CITY, MARYLAND

FINAL ENVIRONMENTAL IMPACT STATEMENT and DRAFT SECTION 4(f) EVALUATION

Prepared pursuant to the National Environmental Policy Act of 1969, §102 (42 U.S.C. §4332); and Federal Transit Laws (49 U.S.C. §5323(b) and §5309; 49 U.S.C. §303 (formerly Department of Transportation Act of 1966, §4(f)); National Historic Preservation Act of 1966, §106 (16 U.S.C. §470f); Executive Order 11990 (Protection of Wetlands); Executive Order 11988 (Floodplain Management); Section 402 of the Clean Water Act; Executive Order 12898 (Environmental Justice); the Endangered Species Act of 1973, 16 USC §1531, Federal Clean Air Act; and the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, 42 U.S.C. §4601.

by the
FEDERAL TRANSIT ADMINISTRATION
US DEPARTMENT OF TRANSPORTATION

and the
MARYLAND TRANSIT ADMINISTRATION
MARYLAND DEPARTMENT OF TRANSPORTATION

in cooperation with the
FEDERAL HIGHWAY ADMINSTRATION
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ABSTRACT

This Final Environmental Impact Statement (FEIS) and Draft Section 4(f) Evaluation for the Red Line project describes and summarizes the transportation and environmental impacts for the implementation of a new east-west light rail transit alignment in Baltimore County and Baltimore City, Maryland. The Red Line project is proposed to:

- Improve transit efficiency by reducing travel times for transit trips
- Increase transit accessibility by providing improved transit access to major employment and activity centers
- Provide transportation choices for east-west commuters by making transit a more attractive option
- Enhance connections among existing transit routes
- Support community revitalization and economic development opportunities
- Help the region improve air quality by increasing transit use and promote environmental stewardship

The corridor limits for the study extend from western Baltimore County at the Centers for Medicare & Medicaid Services through the downtown central business district to the Johns Hopkins Bayview Medical Center campus in eastern Baltimore City. The corridor is approximately 14 miles in length.

This FEIS includes a description of the alternatives, as well as a comparative evaluation of the No-Build Alternative and the Preferred Alternative benefits and effects. These alternatives were analyzed for both long-term (operational) and short-term (construction-related) impacts to: public transportation; traffic; parking; freight rail service; neighborhoods and community facilities; environmental justice; property acquisition and displacements; economic activity; land use; parks, recreation, and open space; visual quality; air quality; noise and vibration; energy; hazardous materials; utilities; historic structures and archeological resources; Section 4(f) resources; habitat and species; rare, threatened, and endangered species; surface and groundwater resources; waters of the US including wetlands; floodplains; critical area; safety and security; indirect and cumulative effects; and irreversible and irretrievable resources. Measures to avoid, reduce, or mitigate impacts are identified.

In August 2011, the President issued a memorandum entitled *Speeding Infrastructure Development Through More Efficient and Effective Permitting and Environmental Reviews*, which required federal agencies to identify and expedite a set of priority projects. In October 2011, the Red Line project was selected as one of 14 infrastructure projects around the country for an expedited permitting and environmental review process.

To encourage transparency during the project development process, the Federal Infrastructure Projects Dashboard allows the public to track the progress of each priority project. The dashboard, which is part of the government's performance.gov website, highlights best practices and successful coordination efforts that result in an efficient federal permitting process and review decisions which can benefit all projects. The performance.gov website informs the public of actions that require cooperation between federal agencies for the Red

Line project. It summarizes the substantial public involvement and outreach activities to refine and improve the project.

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This FEIS is available for viewing on the project website, located at www.baltimoreredline.com, and may be reviewed at public libraries throughout the project study corridor. A 45-day review period has been established for this document, beginning on the publication date of this FEIS. Comments may be submitted in writing to Henry Kay at the address above, via e-mail at feis@baltimoreredline.com or through the project website. The date of the comment deadline is posted on the project website.

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This Final Environmental Impact Statement (FEIS) is divided into two volumes: Volume 1 presents the analysis of the No-Build Alternative and the Preferred Alternative, and contains nine chapters and appendices A through K. Volume 2 includes mapping of transportation and environmental features in the project study corridor, including a set of six Environmental Plate Series, and the Preferred Alternative Plans and Profiles.

The DVD contains all content of Volumes 1 and 2, including all appendices. Appendix A and Appendix I are only included on the enclosed DVD.

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ES. Executive Summary

The Red Line project's Final Environmental Impact Statement (FEIS) and Draft Section 4(f) Evaluation describes and summarizes the transportation and environmental effects for the implementation of a new east-west light rail transit (LRT) alignment in Baltimore County and Baltimore City, Maryland. The Federal Transit Administration (FTA) is the lead federal agency for this project, while the Maryland Transportation Administration (MTA) is serving as the project sponsor. The Federal Highway Administration (FHWA) is a cooperating agency.

In August 2011, the President issued a memorandum entitled *Speeding Infrastructure Development Through More Efficient and Effective Permitting and Environmental Reviews*, which required federal agencies to identify and expedite a set of priority projects. In October 2011, the Red Line project was selected as one of 14 infrastructure projects around the country for an expedited permitting and environmental review process.

To encourage transparency during the project development process, a Federal Infrastructure Projects Dashboard allows the public to track the progress of each priority project. The dashboard, which is part of the government's performance.gov website, highlights best practices and successful coordination efforts that result in an efficient federal permitting process and review decisions. The performance.gov website informs the public of actions that require cooperation between federal agencies for the Red Line project. It summarizes the substantial public involvement and outreach activities to refine and improve the project.

ES.1 Purpose of the Final Environmental Impact Statement

The FEIS builds upon the analysis in the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS), (September 2008) prepared for the Red Line project. The FEIS provides a comparative analysis between the No-Build Alternative and the Preferred Alternative for the Red Line project so that interested citizens, elected officials, government agencies, businesses, and other stakeholders can assess the potential environmental and socioeconomic effects of the Red Line project.

The FEIS was developed in accordance with the National Environmental Policy Act of 1969 (NEPA) and serves as documentation on the coordination conducted in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the Draft Section 4(f) Evaluation prepared pursuant to Section 4(f) of the US Department of Transportation Act of 1966. The FEIS has been prepared to address comments received on the 2008 AA/DEIS, guide decision-making and meet the federal and state regulatory obligations of the FTA and MTA.

ES.2 Organization of the FEIS

The FEIS is divided into two volumes: **Volume 1** presents the analysis of the No-Build Alternative and the Preferred Alternative, and **Volume 2** includes mapping of transportation and environmental features in the project study corridor and the Plans and Profile Drawings of the Preferred Alternative. **Volume 1** of the FEIS contains nine chapters and appendices A through K:

- **Chapter 1** presents the project study corridor and the purpose and need for the project.
- **Chapter 2** presents a chronology of the alternatives development and analysis for the project. It includes a description of the alternatives considered in the FEIS: the No-Build and Preferred Alternative. The alignment, stations, and project components of the Preferred Alternative are described.
- **Chapter 3** discusses the probable construction methods and activities for the Preferred Alternative.
- **Chapter 4** presents the existing and future transportation conditions in the project study corridor under the No-Build and Preferred Alternative, and discusses commitments and mitigation measures for potential transportation effects.
- **Chapter 5** presents the existing and future environmental conditions in the project study corridor under the No-Build and Preferred Alternative, and discusses commitments and mitigation measures for potential environmental effects.
- **Chapter 6** presents the Draft Section 4(f) evaluation, which discusses the effects of the Preferred Alternative on public parks, recreational areas, and historic properties in compliance with Section 4(f) of the US Department of Transportation Act of 1966.
- **Chapter 7** presents an evaluation of the No-Build Alternative and Preferred Alternative in meeting the project’s purpose and need.
- **Chapter 8** presents a summary of the public outreach and agency coordination for the Red Line project that has occurred since the publication of the AA/DEIS in September 2008.
- **Chapter 9** presents a summary of the comments received on the AA/DEIS and responses to those comments, as presented in **Appendix A**.

The appendices are included after **Chapter 9** with the exception of **Appendix A** and **I**, which are included on the DVD.

ES.3 Project Study Corridor

The Red Line project study corridor extends approximately 14 miles from the Centers for Medicare & Medicaid Services (CMS) in the west, in Woodlawn (Baltimore County), to the Johns Hopkins Bayview Medical Center campus in the east (Baltimore City). Eleven miles of the project study corridor are in Baltimore City. The proposed Red Line light rail alignment would utilize a combination of existing transportation rights-of-way for at-grade and aerial segments and underground tunnels as identified in **Figure ES-1**.

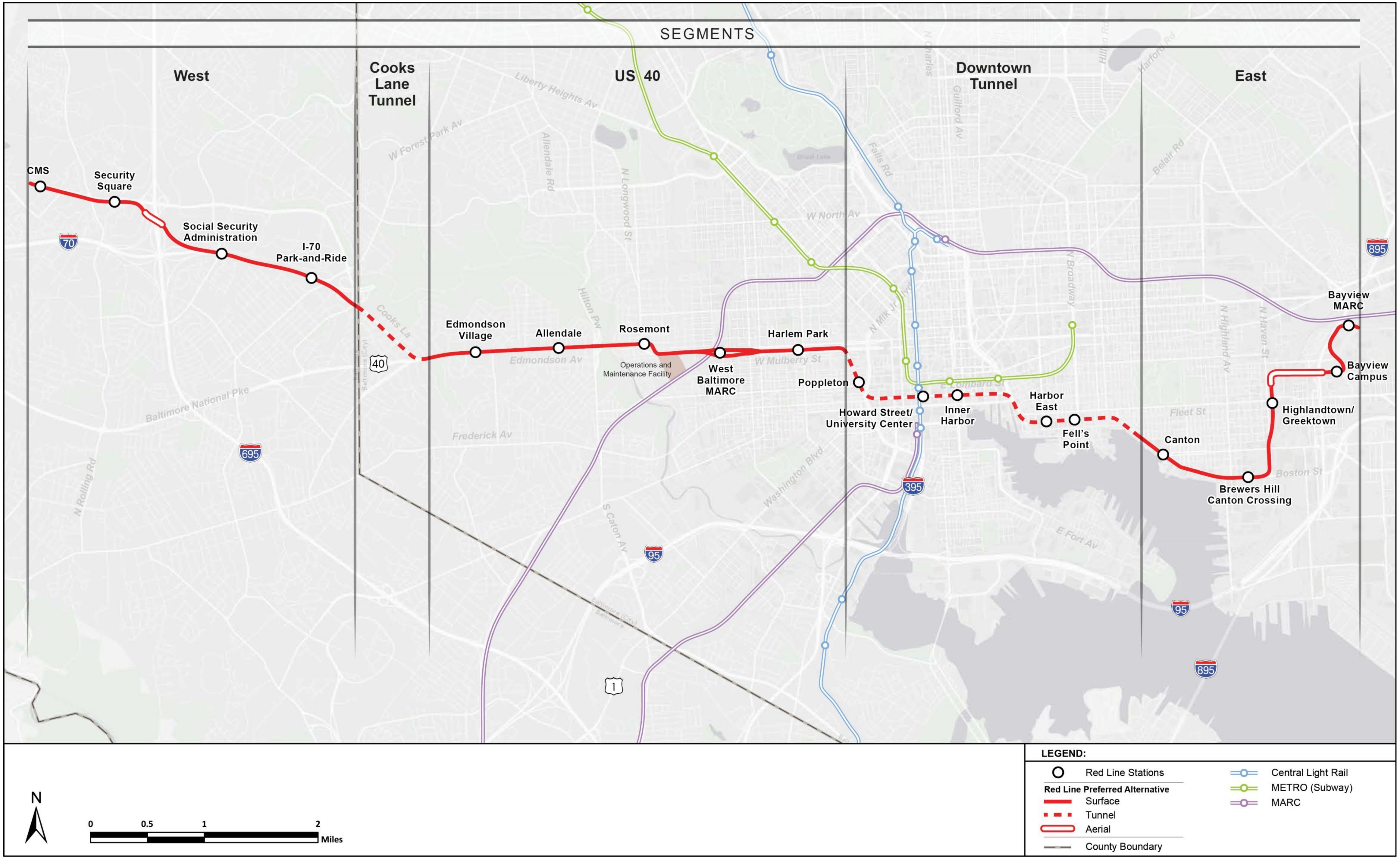


Figure ES-1: Preferred Alternative

BALTIMORE RED LINE

ES.4 Project Purpose and Need

The purpose and need for the Red Line project is summarized in **Table ES-1**.

Table ES-1: Project Purpose and Need

Purpose of the Project	Project Need
Improve transit efficiency by reducing travel times for transit trips in the project study corridor	Roadway congestion contributes to slow travel times for automobiles and buses in the project study corridor
Increase transit accessibility in the project study corridor by providing improved transit access to major employment and activity centers	Lack of convenient transit access to existing and future activity centers in the project study corridor, including downtown Baltimore, Fell's Point, and Canton, as well as employment areas in Baltimore County to the west of Baltimore
Provide transportation choices for east-west commuters in the project study corridor by making transit a more attractive option	Lack of viable transit options for east-west commuters in the project study corridor
Enhance connections among existing transit routes in the project study corridor	Lack of connections from existing transit routes (including Central Light Rail, Metro, MARC, and bus network) to the I-70 travel market on the west side of the project study corridor, and to the I-95 and East Baltimore travel markets on the east
Support community revitalization and economic development opportunities in the project study corridor	Need for economic development and community revitalization in communities along the project study corridor, both in Baltimore County and in Baltimore City
Help the region improve air quality by increasing transit use and promoting environmental stewardship	Need to support the regional goal of improving air quality by providing alternatives to automobile usage

ES.5 Alternatives Development

The alternatives development process summarized below is further described in **Chapter 2** of the FEIS and in **Appendix I**, *Alternatives Technical Report – 2012 Update.*

The *2002 Baltimore Regional Rail System Plan* recommended a 109-mile Regional Rail System with 66 new miles added to the existing 43 miles of Metro Subway and Light Rail lines. The finished system could have as many as 122 stations, including 68 new stations in addition to the 54 stations that exist now. The Red Line, as now proposed with 19 stations, was identified as one of the priority projects for the Plan's implementation.

In 2003, the FTA issued a Notice of Intent to prepare an AA/DEIS for the Red Line, followed by Scoping and Alternatives Development. Based on public and agency input, the FTA and MTA developed a range of alternatives for consideration as part of the alternatives screening process.

Between 2005 and 2007, FTA and MTA conducted an alternatives screening process which identified a range of alternatives for detailed study in the AA/DEIS including: No-Build, Transportation Systems Management (TSM), Bus Rapid Transit (BRT), and LRT. The AA/DEIS was circulated for public and agency comment between October 3, 2009 and January 5, 2010. Although the AA/DEIS did not identify a Preferred Alternative, the FTA New Starts Process requires that the local project sponsor identify a Locally Preferred Alternative (LPA).

In August 2009, the State of Maryland, with consensus from Baltimore City and Baltimore County, identified an LPA which consists of an approximately 14-mile LRT alignment from CMS in Baltimore County to Johns Hopkins Bayview Medical Center in Baltimore City, with tunnel alignments under Cooks Lane and through downtown from Martin Luther King, Jr. Boulevard to Boston Street.

Since the announcement of the LPA, the MTA has conducted technical studies, refined the LPA, and continued public involvement and agency coordination activities, including the Station Area Advisory Committees (SAACs). The results of these studies and definition of the Preferred Alternative are presented in the FEIS and supporting technical reports.

In accordance with 23 CFR 771.129, the MTA prepared a reevaluation because more than three years had passed since publication of the AA/DEIS for this project. MTA submitted the reevaluation to FTA on August 16, 2012. The reevaluation compared the current Preferred Alternative as examined in the FEIS to the build alternatives considered in the AA/DEIS, and concluded that a Supplemental Environmental Impact Statement (EIS) of the AA/DEIS is not required because there are no new significant environmental impacts beyond those evaluated in the AA/DEIS. In correspondence dated September 17, 2012, FTA concurred with the findings in the reevaluation but indicated that the FEIS should include the information on the changes in the project so that these changes could be subject to public review.

ES.6 Alternatives Evaluated in the FEIS

ES.6.1 No-Build Alternative

The No-Build Alternative represents the future conditions of transportation facilities and services in 2035 if the Red Line is not built. The No-Build Alternative consists of the transit service levels, highway networks and traffic volumes, and forecasted demographics for the year 2035 that are projected in the 2011 Baltimore Regional Transportation Board's Constrained Long Range Plan (CLRP), *Plan It 2035*. The No-Build Alternative provides a baseline by which the environmental effects of the Preferred Alternative are compared.

ES.6.2 Preferred Alternative

The Preferred Alternative is a 14.1-mile light rail transit line that would operate from the CMS in Baltimore County to the Johns Hopkins Bayview Medical Center campus in Baltimore City. For presentation purposes, the project study corridor has been divided into five segments (**Figure ES-1**). Approximately 3 miles of the Preferred Alternative would be in Baltimore County following this general alignment: adjacent to the south side of Security Boulevard; on an aerial structure over I-695; adjacent to existing parking lots at the Social Security Administration and along the north side of the I-70 ramp to I-695; on existing excess pavement of westbound I-70; and on a new alignment across the southwest quadrant of the existing interchange at the end of I-70.

The Preferred Alternative would enter into a tunnel through a portal on the northwest side of the intersection of Cooks Lane/Forest Park Avenue/Security Boulevard. The Cooks Lane Tunnel would be approximately 1.3 miles centered underneath Cooks Lane to Coleherne Avenue curving left towards Edmondson Avenue to a tunnel portal in the median of Edmondson Avenue west of Swann Avenue (**Figure ES-2**). The Red Line would continue for approximately 3.3 miles in median of US 40 along Edmondson Avenue/Franklin Street/US 40 lower level roadway right-of-way.

Figure ES-2: Rendering of Tunnel Portal of Edmondson Avenue

The Red Line would enter the Downtown Tunnel alignment within the median of US 40 immediately west of North Schroeder Street bridge and continue in a tunnel alignment underneath Fremont Avenue, Lombard Street, President Street, Fleet Street and Boston Street for approximately 3.4 miles to a tunnel portal in the median of Boston Street east of the intersection with Montford Avenue/Hudson Street. The Red Line would continue the remainder of the 3.2 miles of the project along the median of Boston Street; transitioning on new right-of-way to the west side of Haven Street continuing north across Haven Street into Norfolk Southern (NS) railroad right-of-way; continuing north over Eastern Avenue ascending and turning east onto a new aerial structure over the NS railroad, CSX railroad, and local city streets to the Johns Hopkins Bayview Medical Center campus; traversing the campus on a future Cassell Drive, Alpha Commons Boulevard, and Bayview Boulevard; the alignment continues north and east adjacent to I-895 terminating at the Bayview MARC Station.

ES.6.3 Stations and Park-and-Ride Facilities

The Preferred Alternative has 19 stations: 14 surface and five underground. There are five park-and-ride facilities proposed for the Preferred Alternative, all of which would be surface parking lots. Two of the five park-and-ride lots would be constructed by separate initiatives (West Baltimore MARC and Bayview MARC) but passengers would be able to park at these facilities and ride the Red Line or the MARC. **Figure ES-3** depicts the concept plan for the I-70 Park-and-Ride.

Figure ES-3: I-70 Park-and-Ride Concept

ES.6.4 Operations and Maintenance Facility

The Operations and Maintenance Facility (OMF), as proposed, would be comprised of 11 parcels, consisting of a total of 20.8 acres, in Baltimore City along the south side of US 40/Franklin Street centered on Calverton Road between Franklintown Road and Warwick Avenue, and referred to as the Calverton Road site. The OMF is where light rail cars would be stored, maintained, and dispatched each day on their daily routes. The facility would accommodate administrative functions and light rail operation functions for the Preferred Alternative. Example operations and maintenance facilities are shown in the photos below.

Maintenance Facility in Tampa, Florida

Maintenance Facility in a historic industrial neighborhood in Charlotte, North Carolina

ES.6.5 System Components

Traction power substations (TPSS), signal central instrument houses (CIH), and an overhead catenary system (OCS) would be placed along the alignment to provide electricity and operating signals for the Red Line light rail vehicles. For the underground portion of the Red Line, mechanical ventilation systems would be required, including a combination of fans, air plenums, and air shafts that connect the tunnels and station platform areas to outside air.

ES.7 Construction of the Preferred Alternative

Construction of the Preferred Alternative is anticipated to begin in 2014 and finish in 2021. The various work activities to be performed over an estimated 7-year construction period would include the following facility and system items:

- Demolition of existing structures, as needed
- Construction of a double-track alignment beginning at the CMS Station, the west terminus, and ending at Bayview MARC Station, the east terminus
- Construction of tail tracks for light rail vehicles at the CMS Station and Bayview MARC Station beyond the operating limits of the Red Line
- Construction of an OMF for storage of up to 38 light rail vehicles
- Construction of TPSS, OCS, and CIH
- Construction of track crossovers to enable single track operations, as needed

- Construction/modification of aerial structures: I-695, Woodlawn Drive, Ingleside Avenue, Eastern Avenue, NS/CSX/I-895
- Construction of 19 stations (14 surface and 5 underground)
- Construction of ventilation system elements including ventilation buildings, fans, air plenums, and shafts for the underground sections
- Construction of three park-and-ride lots: Security Square, I-70 and Brewers Hill/Canton Crossing Construction of protective measures for adjacent utilities and structures
- Construction of retaining walls for bridges and tunnel portals approaches
- Construction of tunnel segments by tunnel boring machines (TBMs)
- Cut-and-cover or open-cut construction of portal structures, tunnel sections, and underground stations
- Relocation, modification, or protection of utilities in conflict or impacted by excavations for street-level track work, tunnels, bridge, and station construction
- Construction of level boarding station platforms at street-level locations
- Construction of both surface drainage and sub-drainage systems
- Installation of intersection controls including traffic signals, pedestrian signals, flashers, and gates
- Construction of station finishes, such as canopies, shelters, ticket vending equipment, agent booths, station furniture, ramps, escalators, etc.
- Modifications to existing buildings, as required, to protect them from the effects of adjacent construction

The types of equipment that would be used for construction activities include various earth-moving apparatus (excavators, graders, bulldozers, loaders, etc.), cranes, pile drivers, augers, drilling equipment, compaction rollers and tampers, concrete trucks, pumping equipment, generators/compressors, and various types of trucks (flat bed, dumps, trailers, etc.).

To enable construction of the underground segments of the project, several different tunneling construction methods for different portions of the tunnel are being considered, including excavation of the running tunnels by TBMs, cut-and-cover excavation for underground stations and tunnel portals, as well as some drilling and blasting at certain areas. The photo identifies an example of the drilling and blasting process.

Example of drilling and blasting process

The FEIS identifies the location of proposed construction staging areas throughout the project study corridor that may be used for the storage of materials and equipment, and other construction-related activities.

Concurrent with FEIS preparation, the Red Line project is undergoing Preliminary Engineering, and detailed project design and construction information is being developed. Thus, construction methods and activities described in **Chapter 3** of the FEIS are based on conceptual studies, as well as other projects of a similar nature with regard to construction methods and activities. As such, these methods and activities will continue to be refined during Final Design, which will occur after completion of the NEPA process. For example, some of the initial construction methodologies may change as the design develops, particularly since the construction contracts for the project could be issued as Design-Build or Design-Bid-Build, or other delivery methods.

The MTA construction specifications will require that construction contractors comply with applicable environmental regulations and obtain necessary permits for the duration of construction. Construction of the project will follow applicable federal, state, and local laws for building and safety, as well as local noise ordinances, as appropriate.

In an effort to avoid and/or minimize potential adverse effects during construction of the project, a number of environmental commitments and mitigation measures have been identified, which construction contractors will be required to follow. As such, these environmental commitments and mitigation measures will be included as part of the project's construction contracts and/or permit conditions. These environmental commitments and mitigation measures are identified as applicable, within the construction impact discussions of the transportation and environmental resource sections in **Chapters 4** and **5** of the FEIS.

ES.8 Summary of Potential Transportation, Socioeconomic and Environmental Effects

The discussion that follows is a summary of the anticipated long- and short-term effects as a result of construction and operation of the Preferred Alternative. Long-term effects with and without the Preferred Alternative have been assessed for 2035, while short-term effects are those associated with construction activities, which have been assessed for a peak construction year of 2016. Details on anticipated long-term effects of the No-Build Alternative are included in **Chapters 4** and **5** of the FEIS along with a more detailed discussion of effects for the Preferred Alternative. Details on short-term effects of both alternatives are detailed in **Chapters 3**, **4** and **5** of this FEIS.

ES.8.1 Transportation (FEIS Chapter 4)

a. Public Transportation (FEIS Section 4.1)

Under the Preferred Alternative, the type and quality of transit service in the project study corridor would be improved by adding a new LRT line. A fixed transitway with dedicated right-of-way would provide faster and more reliable service than current bus service, which runs in mixed traffic. The Preferred Alternative would provide park-and-ride facilities and bus service that would expand the ridership market by providing access to the proposed Preferred

Alternative service. In addition, the Preferred Alternative would introduce a new east-west LRT service in the project study corridor, which would be served by a network of feeder bus routes. Feeder bus services increase ridership on rail systems by providing connections between rail stations and homes, businesses, or other destinations.

The total daily boardings for the Preferred Alternative in 2035 is estimated to be 54,520 at the 19 proposed stations located throughout the project study corridor. Close to 226,000 daily linked trips are estimated by 2035 with the No-build Alternative. With the Preferred Alternative, this estimate would increase by 8 percent, adding an additional 18,410 transit trips. An analysis was done by station of individual boardings and alightings (passengers getting on and off a light rail vehicle, respectively) (**Table ES-2**). This analysis identified the Inner Harbor Station located in the central business district (CBD) area as the station with the highest number of boardings, approximately 13,000 per day.

Other stations with significant activity (boardings greater than 4,000 per day) include: Howard Street/University Center Station, West Baltimore MARC Station, and Brewers Hill/Canton Crossing Station. The high use of these stations is not surprising, as they provide connections to other primary transit routes, as well as access to major employment centers, residential areas, and tourist attractions. The Social Security Administration and the Bayview Campus Station show substantial activity with station boardings greater than 1,800 per day.

Table ES-2: Light Rail Daily Boardings Projections (2035)

Station	Daily Boardings (On)		Daily Boardings (Off)		Total Boarding
	Eastbound	Westbound	Eastbound	Westbound	
CMS Station[1]	1,249	0	0	771	1,010
Security Square Station	2,747	30	30	1,627	2,220
Social Security Administration Station	1,751	26	166	3,212	2,580
I-70 Park-and-Ride Station	2,905	74	34	1,230	2,120
Edmondson Village Station	1,546	174	131	442	1,150
Allendale Station	1,343	99	61	493	1,000
Rosemont Station	3,079	351	297	1,537	2,630
West Baltimore MARC Station	4,480	1,410	763	2,441	4,550
Harlem Park Station	892	270	197	217	790
Poppleton Station	304	284	703	751	1,020
Howard Street/University Center Station	2,745	2,729	5,180	4,203	7,430
Inner Harbor Station	4,879	4,130	9,690	7,165	12,930
Harbor East Station	119	831	2,481	599	2,020
Fell's Point Station	187	1,142	793	298	1,210
Canton Station	164	1,370	1,117	218	1,430
Brewers Hill/Canton Crossing Station	276	5,945	1,906	206	4,170

Table ES-2: Light Rail Daily Boardings Projections (2035)

Station	Daily Boardings (On)		Daily Boardings (Off)		Total Boarding
	Eastbound	Westbound	Eastbound	Westbound	
Highlandtown/Greektown Station	14	3,176	2,106	147	2,720
Bayview Campus Station	0	871	2,519	277	1,830
Bayview MARC Station[1]	0	2,923	504	0	1,710
Total	**28,680**	**25,840**	**28,680**	**25,830**	**54,520**

Note: [1] Station Termini

During construction, local area transit would be affected by lane closures and restrictions within the project study corridor. These disruptions could include: bus stop closures, provision of temporary bus stops, schedule delays, and bus route detours. Affected transit stops would be temporarily relocated to the nearest possible location.

b. Roadways and Traffic (FEIS Section 4.2)

The roadway network assumed for the Preferred Alternative would include the existing roadway and transit network, as well as planned and programmed improvements in the region's adopted and financially constrained Long-Range Plan (*Plan It 2035*), the Baltimore Region Transportation Improvement Program (TIP), and approved developer projects along the project study corridor. The improvements that would directly impact travel demand in the project study corridor are:

- Security Boulevard Extension Existing Terminus to Fairbrook Road
- Uplands Development
- US 40/Edmondson Avenue Bridge expansion over Gwynns Falls/CSX Railroad
- West Baltimore MARC Station Improvements
- Boh-Donnell Connector
- Bayview MARC and Intermodal Station

In addition, the Preferred Alternative would include the following:

- Security Square park-and-ride (375 spaces)
- New I-70 park-and-ride (700 spaces)
- Operations and Maintenance Facility at US 40/Calverton Road (200 employee parking spaces)
- Brewers Hill/Canton Crossing park-and-ride (600 spaces)

Constructing the Preferred Alternative would require permanent changes to a number of roadways along the proposed alignment to allow for the LRT to operate in an exclusive guideway and thereby provide a time advantage to transit vehicles. The Preferred Alternative also includes a re-configuration of the I-70 roadway between I-695 and Security

Boulevard/Cooks Lane. The reconfiguration of I-70 includes three connections. These connections are with Parallel Drive, the proposed I-70 Park-and-Ride Station, and a new re-configured signalized intersection at the end of I-70 with Security Boulevard, Cooks Lane, and Forest Park Avenue. The reconfiguration of I-70 and the new connections would alter the traffic flows that exist today, but all traffic movements would be able to be maintained that exist today.

To construct the Preferred Alternative while minimizing property impacts along the project study corridor, the number of traffic lanes would have to be reduced in certain areas. The roadways that would experience a reduction because of the allocation of exclusive lanes for the Preferred Alternative include: Security Boulevard, I-70, Edmondson Avenue, West Franklin Street, Franklintown Road, US 40 lower level roadway section, and Boston Street.

Alpha Commons Drive would be closed (but this is being done as part of the Johns Hopkins Master Plan for the Johns Hopkins Bayview Medical Center campus), and therefore access to the existing buildings would be from Cassell Drive and Bayview Boulevard.

Besides reducing the number of traffic lanes, street patterns would be modified in a number of other ways, including: regulating new turn restrictions, closing some accesses, and removing or installing new traffic signals at several intersections along the alignment where the LRT crosses high-volume side streets.

Construction of the Preferred Alternative would result in roadway closures, detours, and disruption of traffic during peak and non-peak times. Access to local businesses through existing or temporary driveways would be provided where possible; however, there may be some times when access cannot be maintained.

c. Parking (FEIS Section 4.3)

The implementation of the Preferred Alternative would require the permanent elimination of 741 parking spaces along the project study corridor, and would provide 1,134 new parking spaces at park-and-ride facilities. Approximately 400 vehicles which are currently parking in the eliminated spaces could be accommodated nearby (relocated to the adjacent blocks), leaving 380 spaces that would be permanently displaced by the project, and that could not be accommodated at nearby locations on adjacent streets. The locations where parking loss would be the greatest include:

- Social Security West parking lot adjacent to I-70 (30 parking spaces eliminated)
- Edmondson Avenue from Cooks Lane to Franklintown Road (58 parking spaces eliminated)
- Calverton Road because of Red Line OMF (105 parking spaces eliminated)
- Boston Street from Chester Street to Conkling Street (126 parking spaces eliminated)

On-street parking along Edmondson Avenue, Franklintown Road, Franklin Street, Mulberry Street, Boston Street, and Haven Street, as well as in the proposed station and tunnel portal construction areas within the downtown tunnel corridor would be lost during construction. Off-street parking spaces would also be affected during construction at various locations throughout the project study corridor.

MTA will work with the contactor to develop a plan to minimize the temporary loss of parking during construction. MTA will coordinate with stakeholders and businesses affected by the loss of loading zones to identify alternate or temporary loading areas during construction.

d. Pedestrian and Bicycle Facilities (FEIS Section 4.4)

It is MTA policy that all future MTA transit systems accommodate bicycles. The Preferred Alternative would provide bicycle access to stations by perpendicular access streets that comprise the bicycle network in the project study corridor. The Preferred Alternative would provide sidewalk widths of 5 to 6 feet where possible. Lighting and landscaping would help create a safe and attractive environment that is bicycle and pedestrian-friendly; enhance visibility between bicyclists and pedestrians and other traffic; and increase access to transit and destinations throughout the region.

e. Freight Railroad Facilities (FEIS Section 4.5)

There would be no long-term permanent effects to freight railroad facilities or services. Activities associated with the construction of the Preferred Alternative will be coordinated with NS, CSX, Amtrak, and Canton Railroad to minimize effects to their facilities and services during construction.

f. Safety (FEIS Section 4.6)

Strategies such as crime prevention through environmental design and the use of police, private security patrols, and security cameras would be employed as appropriate to make the LRT facilities as safe and secure as possible. Design considerations such as platform location and length, pedestrian crossings, and alignment design would be used to ensure that the project operates to the safest extent possible.

The introduction of construction equipment and activities throughout the project study corridor could result in potential safety hazards for pedestrians and motorists. In addition, construction workers operating or working in concert with equipment at various surface and underground construction locations could create increased risk to safety and security.

ES.8.2 Environment (FEIS Chapter 5)

Transportation projects have the potential to cause direct, indirect, or cumulative impacts to natural and human environments. The Preferred Alternative is anticipated to have limited potential adverse effects while having beneficial effects related to increased mobility and improved access along the project study corridor. Findings of the impact analyses are summarized in this section. The intent of this section is to summarize key resource effects, both adverse and beneficial.

a. Land Use (FEIS Section 5.2)

Long-term effects to land use in the project study corridor resulting from the Preferred Alternative would be minimal because the current land use plans and zoning for Baltimore

County and Baltimore City have been developed to anticipate the Red Line project, and to maximize the potential benefits from the project.

Overall short-term effects to land use during construction are expected to be minimal and short in duration, as most parcels in the study area would not be directly affected by construction, except to the extent that there is traffic congestion or lane and sidewalk closures that would affect vehicular or pedestrian access. Pedestrian and vehicular access restrictions to some properties throughout the project study corridor would range from several hours to up to 4 years. Overall, however, while the construction activities may affect access to individual parcels or businesses, these activities are not expected to affect or change land use.

b. Neighborhoods and Community Facilities (FEIS Section 5.3)

The Red Line would not substantially alter neighborhood character within the project study corridor. The Preferred Alternative would provide mobility benefits to neighborhood residents by improving access to transit and destinations within the project study corridor.

The Preferred Alternative will not require any acquisition of real property that would result in an involuntary residential displacement (Md. Laws Chapter 569, 2009). Physical effects to neighborhoods would include business displacements, property acquisitions, changes to the visual environmental and setting of neighborhood areas, loss of parking, and noise and vibration impacts. The new LRT system and accompanying features would be carefully designed to be harmonious, to the maximum extent practicable, with the surrounding environment, where feasible.

The Preferred Alternative is not anticipated to have long-term effects on neighborhood cohesion because the proposed transit service would operate almost entirely on existing roadways and thoroughfares or in a tunnel. The Preferred Alternative would serve as a catalyst for greater pedestrian activity and would provide improved accessibility for pedestrians and bicyclists in many areas.

The implementation of the Preferred Alternative would require both temporary and permanent loss of parking spaces within the project study corridor. On-street parking losses would be greatest along portions of Edmondson Avenue and Boston Street because of the need to widen these roadways to accommodate the proposed alignment.

The Preferred Alternative would not result in the displacement of community facilities such as schools, libraries, places of worship, emergency services, or park and recreation areas. Increased access and reduced congestion resulting from the Preferred Alternative are anticipated to improve emergency response times overall within the project study corridor.

Construction of the Preferred Alternative would result in the temporary intrusion of through traffic into local neighborhoods because of congestion and/or detours, disruption of access by motorized and non-motorized modes to local businesses, and the temporary loss of on-street parking. Local businesses could be affected by temporary changes in vehicular and pedestrian access during construction. Local area transit service could be temporarily diverted or relocated to provide service affected by construction activities.

c. Environmental Justice (FEIS Section 5.4)

The project study corridor for the Preferred Alternative includes all or parts of 55 US Census tracts (47 in Baltimore City and 8 in Baltimore County). Forty-three out of 55 census tracts (78 percent) were identified as minority and/or low-income areas using the 50 percent threshold or the “meaningfully greater” threshold criteria for presence of a minority population, a low-income population or both. These locations were considered environmental justice (EJ) areas for the purposes of the FEIS impact analysis.

The MTA and FTA have concluded that the Preferred Alternative as a whole would not have “disproportionately high and adverse effects” on EJ populations. The Preferred Alternative has the potential to cause adverse effects on EJ populations, while also benefiting EJ populations. Potential adverse effects on EJ populations in the study corridor include:

- Business property acquisitions, including some business relocations
- Partial residential property acquisitions (no residential displacements)
- Parking impacts
- Noise and vibration impacts during construction and operation

While these adverse effects would occur on EJ populations, the EJ populations in the corridor benefit from the project. The Preferred Alternative would provide a much-needed improvement in transit service in Baltimore, creating much faster and more direct transit access from residential neighborhoods in EJ areas to employment and commercial centers in Baltimore City and in Baltimore County. This improvement would benefit low-income and minority areas throughout the project corridor, including transit-dependent residents of those areas. Some of the EJ areas that would be most directly affected, such as neighborhoods along Edmondson Avenue, would be among the principal beneficiaries of the project; the Preferred Alternative would greatly improve access to residences and businesses along Edmondson Avenue, helping to promote economic growth.

d. Property Acquisitions and Displacements (FEIS Section 5.5)

The majority of the property acquisitions would be “sliver takes,” or narrow strips of property located directly adjacent to the proposed project, meaning the majority of the property would remain with the current owner and, in most cases, the acquisition would not affect the use of the property. It is estimated that 192 properties would require either a partial or total right-of-way acquisition, totaling approximately 1,840,801 square feet (42 acres) of property. Of these properties, 169 would require partial property acquisition. The majority of these partial acquisitions would occur within the US 40 segment, where narrow strips of right-of-way acquisition from 97 residential properties would be required.

The remaining 23 properties would require total property acquisition and displacement (13 commercial, three industrial, one institutional, and six governmental). Any property that is not currently vacant and would be acquired in full, or a property where the access is permanently eliminated because of the Preferred Alternative, would be considered a displacement. Ten of the displacements are located within the proposed OMF site. The Preferred Alternative will not require any acquisition of real property that would result in an involuntary residential displacement (Md. Laws Chapter 569, 2009).

The MTA is working with Baltimore City on a Memorandum of Understanding (MOU) for the Red Line project, which would allow the City to conduct acquisition activities for the Preferred Alternative. At the request of the MTA, the City may acquire property rights needed to widen the public right-of-way to accommodate the project. Prior to construction, the City shall convey rights to MTA for the MTA to own, operate, and maintain the Preferred Alternative within the dedicated public right-of-way.

By removing tax-paying properties from the tax base, and converting them to a non-tax-paying public use, some property tax revenues would be permanently lost. However, these acquisitions would result in a negligible loss of property tax revenue to the State, Baltimore County, and Baltimore City when compared to overall tax revenues as detailed in **Chapter 5** of the FEIS and in the *Property Acquisition and Displacements Technical Memorandum (*refer to **Appendix D** of the FEIS).

Temporary surface easements are necessary for project construction, and access is granted for a certain period of time (typically the time of construction activities). Specific activities requiring temporary surface easements may include grading, building formwork for concrete, structural erection, vehicular/equipment access, worker access, etc. A total of approximately 538,568 square feet (12 acres) of temporary easements would be needed for the Preferred Alternative. The temporary easement requirements would impact 269 properties.

During construction, it would be necessary to limit vehicular and pedestrian access in certain areas to address public safety and to accommodate the variety of machinery, storage areas, and construction activities that would occur. Generally, the method of construction would determine the extent of access limitation that would occur along the various lengths of the alignment. It would be necessary to restrict access to buildings for periods ranging from several hours to up to 4 years. The MTA will coordinate with the occupants concerning the affected locations and relocation options.

For example, at the proposed Fell's Point station, the properties located on the south side of Fleet Street between Bethel Street and Broadway would have prohibited access for approximately 9 to 12 months during station excavation and slurry wall construction. Therefore, the MTA conservatively assumes building occupants would need to relocate temporarily during the construction period. While MTA will coordinate with the occupants concerning temporary relocation options, the building occupants could choose not to return to their former building locations.

In other locations, construction-related activities might need to occur in the basements of certain buildings to minimize potential damage during construction. Though access to the ground and upper floors would generally be provided, access to some basements might be temporarily restricted. In such cases, it is not anticipated that MTA would need to acquire the buildings or permanently displace the residents and businesses from the buildings adjacent to the construction work.

e. Economic Activity (FEIS Section 5.6)

The Preferred Alternative would result in new permanent MTA employment positions in operations and maintenance during and after construction, when open for service. Regionally, the Red Line would provide economic benefits by improving transit access and mobility for the work force and consumers within the corridor. Job opportunities would fall into two categories; new jobs and better access to existing jobs.

The MTA has begun work on an initiative that would lead to future employment and training opportunities for local area residents as well as expanded opportunities for local disadvantaged businesses. The initiative will outline a policy and identify potential programs to "put Baltimore to work on the Red Line" as summarized in the *Baltimore City Red Line Community Compact* (see right). The *Compact* is available on the project website. The MTA anticipates having a policy and program in place before construction contracts are advertised (*Economic Activity Technical Memorandum,* 2012).

Red Line Community Compact

In the long-term, better access to existing jobs within the project study corridor would occur. Major employers such as the CMS, Social Security Administration and companies located downtown and at Harbor East would benefit from higher quality transit access and service. Residents who live within the project study corridor not only would have better access to jobs within the project study corridor but to jobs that can be reached via new connections to MARC, Central Light Rail, and Metro. Implementation of the Preferred Alternative would provide access to employment to a greater number of people, and would potentially allow employers to draw upon a larger worker pool within the region.

The *Economic and Job Impacts of the Construction of the Red Line Mass Transit System on Baltimore City* (Baltimore City study) was completed in November 2009 on behalf of Baltimore City. The report concluded that the construction of the Red Line would generate substantial economic benefits to Baltimore City and the portion of Baltimore County within the study corridor. The following is a summary of anticipated Red Line construction effects to local employment and economy:

- The construction of the Red Line would create or support approximately 9,800 direct construction and related jobs earning $539.7 million in salaries and wages over the construction period
- Including multiplier effects, the construction of the Red Line would create or support approximately 15,000 jobs earning $775.2 million in salaries and wages over the construction period

- The initial 3-year design and planning phase of the Red Line project would generate \$273.4 million in economic activity in Baltimore City and create or support approximately 2,050 jobs earning \$102.7 million in salaries and wages
- The construction phase of Red Line project would generate \$1.8 billion in economic activity and create or support approximately 12,950 jobs earning \$672.5 million in salaries and wages

Operation and maintenance of the Preferred Alternative could create an additional 200 MTA jobs. The construction phase of the Red Line would likely create job opportunities specifically for residents of in the project study corridor.

In the short-term, disruptions to businesses adjacent to the construction site may occur. Temporary effects from construction to adjacent businesses would include:

- Alterations to property access
- Loss of parking, especially short-term street parking
- Airborne dust
- Noise and vibrations from construction equipment and vehicles

f. Visual and Aesthetic Resources (FEIS Section 5.7)

The introduction of an LRT system into the project study corridor would introduce new visual features that have been assessed in detail in the FEIS. An example of a new visual feature would be the tunnel portal proposed on Boston Street, as shown in **Figure ES-4.** Effects on visual and aesthetic resources were based on the amount of change the introduction of light rail transit components and operation would have on existing visual conditions, and rated as low, medium, or high. Of 16 visual districts or sub-districts identified throughout the project study corridor, the Preferred Alternative would have an overall visual effect of "high" on one sub-district, and an overall visual effect of "medium to high" on five sub-districts. It should be noted that while a component that contrasts substantially from the existing context may be characterized as having a high visual effect, the effect may be considered positive or negative by the community.

Introduction of construction equipment, trucks, fencing, or walls surrounding proposed construction staging and laydown areas, as well as fugitive dust, would create a temporary aesthetic/visual effect to neighborhoods surrounding or adjacent to where these activities would occur.

Figure ES-4: Rendering of Tunnel Portal on Boston Street

g. Parks, Recreation Land and Open Space (FEIS Section 5.8)

Eleven parks, recreation lands, or open space areas are located within or adjacent to the Preferred Alternative. Long-term and short-term effects to park, recreation and open space areas are limited and include:

- Chadwick Elementary School – Of the 13.4-acre parcel, 0.7 acre of the property would be required for construction of and access to a proposed TPSS;
- Uplands Park – Of the 33.6-acre property, a temporary easement of 0.1 acre would be required to accommodate two eastbound lanes of traffic on the south side of Edmondson Avenue during construction, as well as a temporary sidewalk to maintain pedestrian access during construction.
- Edmondson-Westside High School – Of the 26.0-acre property, approximately 150 square feet of school property near the Edmondson Avenue and Athol Avenue intersection would be purchased in fee simple to accommodate intersection improvements and stormwater management. A temporary easement of 0.1 acre along Edmondson Avenue would be required for grading, and erosion and sediment control measures.
- Boston Street Pier Park – Of the 0.8-acre property, a fee-simple area of less than 0.1 acre would be required from this park to accommodate stormwater management for the Preferred Alternative. A temporary easement of less than 0.1 acre would be required for grading, sidewalk reconstruction and erosion and sediment control along Boston Street.

- St. Casimir's Park – Of the 1.4-acre property, a fee-simple area of less than 0.1 acre would be required to accommodate stormwater management for the project. A temporary easement of less than 0.1 acre would be required for curb and sidewalk reconstruction and mill and overlay work on Boston Street.
- Canton Waterfront Park – A temporary easement of 0.1 acre would be required from the 1.4-acre park property for curb and sidewalk reconstruction and erosion and sediment control facilities along Boston Street.
- Canton Park/Du Burns Arena – A temporary easement of less than 0.1 acre would be needed from the 2.5-acre property for sidewalk repairs and modifications.

Each affected park, recreation land, and open space identified above would experience temporary impacts because of nearby construction activities.

h. Built Historic Properties (FEIS Section 5.9)

Seventy-eight historic properties were identified within the Red Line project's Area of Potential Effect (APE). One historic property, the Franklintown Road over Dead Run Bridge (SHA #B0096), is located within Baltimore County. Other historic properties are located in Baltimore City. Two of the National Register (NR)-listed properties, Davidge Hall and the Star-Spangled Banner Flag House, are National Historic Landmarks (NHL). In accordance with Section 106, the Preferred Alternative would have:

- *no effect* on 45 individual historic properties;
- *no adverse effect* on 28 individual historic properties; and
- an *adverse effect* on five individual historic properties, located in Baltimore City: Poppleton Fire Station (Engine House No. 38) – see photo, Business and Government Historic District, South Central Avenue Historic District, Fell's Point Historic District, and Public School No. 25 (Captain Henry Fleete School).

Poppleton Fire Station (Engine House No. 38)

Therefore, an overall finding of adverse effect on historic properties has been proposed for the Preferred Alternative. The historic properties that have proposed adverse effects by the Preferred Alternative are located within Baltimore City. The proposed findings have been submitted to the Maryland Historic Trust (MHT) and consulting parties for their review.

Short-term noise, vibration, visual, and traffic effects would occur during construction. Historic buildings located adjacent to construction activities may be monitored to avoid unanticipated adverse effects. Special attention would be paid to potential effects for historic properties that may require underpinning.

A consulting party meeting was held on September 25, 2012 to share project information and listed/eligible historic properties within the APE identified. A second meeting was held on

October 17, 2012 to provide an overview of potential effects, and to discuss potential avoidance, minimization, and mitigation measures. Additional consulting party meetings are being planned to continue discussions on the effects, potential avoidance, minimization and mitigation measures, and the Programmatic Agreement.

In a letter dated November 6, 2012, the FTA notified the Advisory Council on Historic Preservation (ACHP) of the proposed finding of adverse effect on historic properties. The FTA asked the ACHP to review information attached to the letter, to determine if the agency wishes to join the consultation process.

FTA has identified and contacted nine federally-recognized Native American tribes in October 2012, including the Absentee-Shawnee Tribe of Oklahoma, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe, Oneida Indian Nation, Onondaga Nation, Saint Regis Mohawk Tribe, Shawnee Tribe, and Tuscarora Nation. In addition, FTA has identified and contacted state-recognized tribes with cultural ties to the project area, including the Piscataway Indian Nation, Inc., Piscataway Conoy Confederacy and Subtribes, Inc., and the Cedarville Band of Piscataway Indians.

Additional tasks are required to complete the Section 106 process. Comments on the proposed effects determinations in the *Section 106 Assessment of Effects for Built Historic Properties* from MHT, consulting parties, and the public will be incorporated into a final *Section 106 Assessment of Effects for Built Historic Properties.* Additional consulting parties meetings will be held in December and January, as appropriate, to discuss comments on the effects determinations and finalize the Programmatic Agreement (refer to FEIS **Appendix H** for the Draft Programmatic Agreement). Following formal concurrence on the effects determination and Programmatic Agreement, the Programmatic Agreement will be circulated for signatures. The executed Programmatic Agreement will be completed prior to the Record of Decision (ROD).

i. Archeological Resources (FEIS Section 5.10)

The archeological analysis completed to date has identified 22 areas of sensitivity within six archeological study zones in the limit of disturbance of the Preferred Alternative with the potential to contain archeological resources.

The proposed archeological field effort will be undertaken in two stages:

- Stage 1 - which is currently underway, includes testing of permeable, accessible surface alignment segments within areas of archeological sensitivity in the limit of disturbance. Field surveys include hand-excavated shovel test pits. It is anticipated that this effort, including archival research, shovel test pits, and geomorphological investigations, would be completed prior to the issuance of the ROD based on access to properties.
- Stage 2 - would be undertaken after the issuance of the ROD. It is anticipated that this effort would include Phase IB identification survey of below-ground alignment section, potential Phase II archeological evaluation studies of archeological sites identified within Stage 1, and Phase III archeological data recovery efforts for National Register-eligible sites that cannot be avoided by the effects of the Preferred Alternative. The draft

Section 106 Programmatic Agreement outlines these work efforts (refer to FEIS **Appendix H**).

Potential archeological resources that would be affected by the Preferred Alternative would be documented prior to construction. Once the Preferred Alternative is constructed and operational, it is anticipated that no further effects to archeological resources would occur.

j. Air Quality (FEIS Section 5.11)

Impacts to air quality from Environmental Protection Agency (EPA)-designated criteria pollutants were assessed for compliance with EPA Transportation Conformity Rule (40 CFR 93), consistent with the National Ambient Air Quality Standards (NAAQS). No long-term air quality impacts would result from the Preferred Alternative. The Preferred Alternative is predicted to decrease regional pollutant burdens by approximately 1.5 to 1.9 percent. No violations of the NAAQS are predicted, and the project is not considered a project of air quality concern regarding fine particulate matter ($PM_{2.5}$) emissions. This has been confirmed through the interagency consultation process finalized in November 2012. Mobile source air toxic emissions will likely be lower than present levels in the design year as result of EPA's national control programs. Therefore, this project will comply with the conformity requirements established by the Clean Air Act.

Air pollutant emissions from the Preferred Alternative construction would occur as a result of earth excavation and grading, handling and transport of excavated materials, debris, operation of diesel construction equipment and trucks. These impacts would be mitigated with diesel emission and dust, and soil erosion/sediment control plans.

k. Energy (FEIS Section 5.12)

The direct energy use in terms of passenger miles, total daily direct energy would decrease under the Preferred Alternative by 1.7 percent, as compared to the No-Build Alternative. The greater decrease in energy use, when comparing in terms of passenger miles, is because of the fact that the LRT would carry more passengers than a typical roadway vehicle.

l. Noise and Vibration (FEIS Section 5.13)

Corridor-wide project noise exposure levels along the Preferred Alternative are predicted to exceed the FTA *moderate* impact criteria at 96 residences and the FTA *severe* impact criteria at one residence (The Shipyard condominium building at the corner of Boston Street and Lakewood Avenue). These impacts are because of LRT pass-bys, warning bells and switches. For areas identified with moderate or severe impacts for noise during LRT operations, MTA will identify mitigation measures where practicable and reasonable during Final Design.

Corridor-wide vibration levels are predicted to exceed the FTA *frequent* criterion of 72 velocity level in decibels (VdB) at 45 residences. Many of these effects are because of the proximity of residences to proposed switches. Ground-borne noise levels are predicted to exceed the FTA *frequent* criterion of 35 A-weighted decibels (dBA) at 49 residences. Project vibration levels are not predicted to exceed the FTA frequent impact criteria at non-residential land-uses except the proposed University of Maryland Proton Building. For areas identified with the potential for vibration impacts during LRT operations, MTA will identify mitigation measures that are both feasible and reasonable during Final Design.

Noise and vibration effects are expected during construction of the Red Line at residences and other sensitive receptors along the Preferred Alternative. Construction activities are predicted to exceed both the Maryland Department of the Environment (MDE) daytime and nighttime noise limits. MTA will provide noise and vibration control measures during construction whenever feasible and reasonable in accordance with applicable local and MDE noise ordinances.

m. Ecological Resources (FEIS Section 5.14)

This section summarizes the long- and short-term effects, avoidance and minimization measures, and mitigation to ecological resources, including terrestrial habitat, terrestrial wildlife, aquatic habitat and species, and endangered and threatened species.

Effects to terrestrial habitat would be generally synonymous to forest and hedgerow impacts. The Preferred Alternative alignment has been designed to minimize the effect on the higher value terrestrial habitat that forested areas provide. Unavoidable effects to forest would be mitigated in accordance with state requirements as described below for Forests, which is further described **Section 5.15** of the FEIS**.**

Long-term effects to wildlife resources are unlikely because the Preferred Alternative would follow existing roadway alignments, and wildlife corridors, such as along Gwynns Falls, would remain intact. Construction may temporarily displace species such as birds and mammals (which would likely move to existing adjacent habitat), but they typically quickly relocate back to their former habitat post-construction. Forest interior dwelling species (FIDS) habitat would be affected by minor encroachment since only slight widening of existing roadways would be necessary to accommodate the Preferred Alternative. Mitigation would not be required since long-term effects would be avoided.

Effects to aquatic habitats and species are related to the permanent or temporary loss of approximately 1,941 linear feet of aquatic stream habitat within the project study corridor, largely as a result of proposed culvert extensions. Extension of culverts could lead to direct loss of fish and macroinvertebrates within the construction zone and would permanently alter the available habitat. However, the species expected to be affected are acclimated to disturbed settings and would likely recolonize to temporarily disturbed areas, though the communities are unlikely to be identical to those present prior to construction.

During operation, the Preferred Alternative would have the potential to increase water quality degradation from stormwater runoff because greater impervious surfaces created by the Preferred Alternative could affect water quality. However, overall net increases in impervious surfaces are expected to be minimal, amounting to an approximately 7-acre increase in impervious area for the approximately 340 total acres of the Preferred Alternative. Because the affected watersheds have already exceeded impervious thresholds for aquatic degradation, the small incremental impervious effects that could be expected from the Preferred Alternative are unlikely to affect overall aquatic habitat or the makeup of biological communities to an appreciable degree.

Long- and short-term effects to rare, threatened, or endangered species would not be anticipated since rare, threatened, or endangered species are not known to occur within the project study corridor. Short-term effects may occur to species of interest during construction including peregrine falcon and certain fishes. Further consultation with Maryland Department of Natural Resources (DNR) would be required as design proceeds to provide for their review of project details and the need for any mitigation.

n. Forests (FEIS Section 5.15)

The Preferred Alternative would result in 34.8 acres of ***forest*** effect and the removal of 39 specimen trees. The majority of the long-term forest effects would occur within the West and Cooks Lane Tunnel segments (28.5 acres) in the western reaches of the project study corridor, where most of the resources exist (see photo below). Short-term forest/hedgerow effects would be limited since temporary staging and stockpile areas during construction would be sited primarily in non-forested areas, or within forests to be permanently affected. Staging and stockpiling areas located within forests would be replanted whenever possible following construction.

Typical forest stand within project study corridor

Mitigation for forest impacts would be required to meet state regulations. The final forest conservation obligation for the project will be negotiated between MTA and DNR, during Final Design.

o. Street Trees/Individual Trees (FEIS Section 5.16)

The Preferred Alternative would affect 315 street trees within Baltimore County and 948 in Baltimore City. Long-term street/individual tree effects would result from permanent design elements. Because tree removal would require mitigation, regardless of long-term or short-term effect, all tree effects have been quantified. Short-term effects would result from removal and replacement of trees to accommodate maintenance of traffic during construction, underground utility relocations, erosion and sediment control devices, and staging and stockpiling areas.

Baltimore City requires mitigation for removal of trees located on parkland or City property including street trees and specimen trees. Trees planted in Baltimore City to meet the tree replacement requirement would be applied to the project-wide forest planting obligation. The *Park Master Plans for Baltimore City* may assist in the identification of potential planting sites

Street tree inventory

within City limits. In addition, coordination with DNR and City Planning and Division of Forestry staff would help to identify street tree planting locations within road right-of-way in the immediate vicinity of the affected areas, parks, schools and other City property. Mitigation for individual trees on private property would be provided where possible, as negotiated by MTA and the property owner. Private property tree effects in Baltimore City total 411 and Baltimore County total 182. The 133 trees affected within roadway right-of-way in Baltimore County would be mitigated to meet state requirements as described in **Section 5.15** of the FEIS. Photo (above) depicts street tree inventory being conducted within the project study corridor.

p. Chesapeake Bay Critical Area (FEIS Section 5.17)

Long-term effects to the Chesapeake Bay Critical Area would occur in the Downtown Tunnel and East segments. Conversion of 1.28 acres of unpaved area to impervious surfaces would occur in the East segment from the construction of the Canton Station and expansion of roadway to accommodate the track in the current median of Boston Street (including within the 100-foot buffer at Harris Creek). The impervious area within the Critical Area would increase from 56 percent cover (existing conditions) to approximately 61 percent cover under the Preferred Alternative. Long-term vegetation effects would occur to landscaping plants, street trees, and park trees within the Critical Area in both the Downtown Tunnel and East segments. The Downtown Tunnel segment tree effects would total 149. The East segment tree effects would total 232, with nine additional trees affected within the 100-foot buffer.

Short-term effects related to increase in impervious area would occur in the Downtown Tunnel and East segments from temporary construction activities such as staging areas, stockpiling and erosion/sediment controls. Short-term effects within these segments would include street tree effects within the Critical Area during maintenance of traffic and for stockpile areas used temporarily during construction. Effects resulting from short-term construction activities require the same mitigation, and therefore have been quantified together with long-term effects.

The Project would adhere to the “10 Percent Rule,” to meet required pollutant load reductions through installation of approved stormwater management facilities and implementation of best management practices. Because of the highly developed nature of the project study corridor and very limited available space within the right-of-way, stormwater management is anticipated primarily through linear micro-bioretention planter boxes. The micro-bioretention planter box facilities provide landscaped areas to temporarily store and filter impervious runoff through the planting media prior to introduction to the closed pipe storm drain network. The micro-bioretention planter boxes are proposed within the existing public right-of-way, and are generally located between the back of sidewalk and right-of-way line.

Street tree replacement required by Baltimore City would fulfill the replacement required by Critical Area, and buffer effects (near Harris Creek Bridge crossing) would have to be mitigated with tree planting within the buffer as coordinated through DNR and Baltimore City during Final Design. Trees affected at staging areas that are not designated for permanent facilities would be replaced on-site to mitigate for short-term construction effects at those locations.

q. Wetlands and Waters of the United States (FEIS Section 5.18)

Effects to waters of the US, including wetlands would only occur within the West segment, Cooks Lane Tunnel segment and East segment. Photo below shows one waters of the US system in the West segment. The majority of the waterway effects would occur where existing roads would be reconfigured or expanded to accommodate the Preferred Alternative, particularly in the West segment where these roads would cross or closely parallel Dead Run and its tributary drainages. There are no effects to tidal waterways, as the only tidal resource crossed by the project study corridor is the Jones Falls, and this would be crossed by the Downtown Tunnel segment, well below the stream bottom.

Waters of the US in West segment

Total effects to wetlands and waterways from all project segments amount to 0.23 acre of palustrine forested wetlands, 0.99 acre palustrine emergent wetlands, 1,941 linear feet of perennial and intermittent streams, and 324 linear feet of ephemeral channel. Based on these impacts, the project would require an Individual Permit from the US Army Corps of Engineers (USACE) and an Individual Non-tidal Wetlands and Waterways Permit from the MDE.

Mitigation measures employed to compensate for unavoidable project effects to waters of the US, including wetlands, will follow applicable federal and state regulations and guidelines, as well as other recommendations from federal and state resource agencies.

A *Phase I Conceptual Mitigation Plan* (October 2012) has been prepared to fulfill the mitigation requirements. As the preliminary step, research and coordination was performed to determine the potential to contribute to an established wetland mitigation bank or in lieu program in accordance with the Mitigation Rule hierarchy. Based on coordination with EPA, USACE, Baltimore County Department of Environmental Protection and Sustainability (BCDEPS), Baltimore City Department of Public Works (BCDPW), and other mitigation banking organizations, it has been determined that there are no active mitigation banks located within or near the targeted watersheds for this project, and that a fee in lieu program for mitigation is not the preferred mitigation approach for this project.

After completion of desktop site identification and ranking and on-site field investigations, the most viable sites were presented to agency representatives (see photo below). The potential mitigation sites presented in the *Phase I Conceptual Mitigation Plan* total 19.91 acres of potential wetland mitigation and 22,560 linear feet of potential stream mitigation. The *Phase I Conceptual Mitigation Plan* has been completed as part of the FEIS phase of the Red Line project. In a letter dated November 1, 2012, the USACE acknowledged their review of the *Phase I Conceptual Mitigation Plan*, and determined that it is acceptable for inclusion in and evaluation of this FEIS **(Appendix G)**. Furthermore, the USACE acknowledged that the *Phase I Conceptual Mitigation Plan* documents acceptable sites and opportunities to adequately mitigate for anticipated Preferred Alternative impacts to waters of the US, including jurisdictional wetlands. FTA anticipates that the USACE intends to use this FEIS for fulfilling their NEPA requirements related to permit issuance. Coordination with MDE will continue until concurrence on proposed mitigation is obtained.

Compensatory mitigation field review

The *Phase II Final Mitigation Plan* will be initiated following the ROD, and is required to be complete prior to issuance of the federal wetlands and waterways permit.

r. Surface Waters: Water Quality, Scenic and Wild Rivers, Floodplains and Navigable Waterways (FEIS Section 5.19)

Long-term water quality effects associated with the operation of the Preferred Alternative after construction are mainly based on the potential for contamination of surface waters by run-off from new impervious surfaces. The Preferred Alternative would result in approximately:

- 300 acres of transit alignment;
- 95.7 acres of undisturbed or maintained impervious area (e.g., roadway re-striping, mill and overlay, undisturbed impervious, etc.);
- 60.1 acres of reconstructed impervious area (e.g., full depth roadway replacement, or existing impervious area replaced with different proposed land use such as sidewalk to roadway, or roadway to transitway track bed);
- 23.1 acres of impervious area removal; and
- 30.5 acres of new impervious area, resulting in a net increase of 7.4 acres of impervious area throughout the project study corridor.

The current design results in a net impervious increase of approximately 7 acres over the entire length of the project. Increased site imperviousness associated with the Preferred Alternative could result in increased site runoff volumes and downstream peak discharge rates.

Although the potential for effects to Total Maximum Daily Load (TMDL) management are minimal, potential effects would be addressed through the MDE stormwater and sediment and erosion control permitting process as required under Maryland's Sediment and Erosion Control (COMAR 26.17.01) and Stormwater Management regulations (COMAR 26.17.02). Stormwater management would be implemented to manage runoff for project disturbances in accordance with criteria established by the MDE.

Based on current MDE Stormwater Management (SWM) Guidelines, an estimated 63 acres of impervious surface would need to be treated to meet stormwater management requirements. Stormwater management would be required to intercept, filter, and attenuate runoff from project disturbances through a combination of linear bioretention and underground quantity management. Water quality treatment must be provided through environmental site design (ESD) practices to provide temporary storage and filtration of the contaminants from surface runoff. Increases to peak discharge rates associated with high frequency storm events would be managed through implementation of ESD features to the maximum extent practicable to mimic pre-development hydrology.

There are no designated scenic and wild rivers within the Red Line project study corridor; therefore, no long- or short-term effects would occur.

Table ES-3 shows the acres of combined long- and short-term floodplain effects for each segment of the Preferred Alternative. Analysis of potential project related changes to hydraulic function and elevation of the 100-year floodplain would be determined using hydraulic and hydrologic floodplain modeling as part of the engineering process for each structure in later phases of design. In general, the majority of the floodplain encroachments would be from traverse crossings of floodplains.

Table ES-3: Summary of Short- and Long-Term Floodplain Effects

Project Segment	Non-tidal 100-Year Floodplain (Acres)	Tidal 100-Year Floodplain (Acres)
West Segment	0.7	–
Downtown Tunnel Segment	–	0.8
East Segment	–	0.2
Total	**0.7**	**1.0**

Construction occurring within the FEMA designated 100-year floodplain must comply with FEMA approved local floodplain construction requirements. If, after compliance with the requirements of Executive Order 11988 and US DOT Order 5650.2, new construction of structures or facilities are to be located in a floodplain, accepted floodproofing and other flood protection measures would be applied to new construction or rehabilitation. To achieve flood protection, wherever practicable, structures should be elevated above the base flood level rather than filling for culvert placement.

No short- or long-term effects to navigable waters are anticipated from the Preferred Alternative. The Jones Falls, the only designated navigable waterway within the project study corridor, is not anticipated to be affected. While no effects to the Jones Falls are anticipated because of the tunnel, the Red Line project would require authorization under Section 10 of the Rivers and Harbors Act, which states that authorization is required for activities "in, upon, over, and/or under navigable waters of the US." The Downtown Tunnel segment passes beneath this navigable water and is therefore subject to USACE (and potentially US Coast Guard, USCG) navigable waters permitting requirements. MTA will coordinate with USACE and USCG to receive the appropriate approvals.

s. Groundwater (FEIS Section 5.20)

Where aboveground, the Preferred Alternative would primarily occupy existing paved surfaces and other existing transportation rights-of-way. Long-term effects to groundwater resources are anticipated in these highly urbanized areas as runoff would be directed to surface waters through stormwater management or treated as it is being infiltrated into the local groundwater through ESD stormwater facilities.

No mitigation would be required for groundwater; however, construction of both the Cooks Lane and Downtown Tunnel segments may require some level of pumping of groundwater discharge during the tunnel boring activities. A general permit granted by MDE would be obtained prior to disposal into the city sewer system.

t. Soils and Geology (FEIS Section 5.21)

Soil and rock affected by the Preferred Alternative would be excavated and disturbed during construction. Once the Preferred Alternative is operational, no further potential long-term effects to the underlying soils and rock would be anticipated as a result of either Preferred Alignment tunnel or surface alignment design elements. No long-term changes would be expected to geologic structures or faults, to rock or soil stability, to seismicity, or to the rock and soil units surrounding the excavation and underlying and supporting the surface structures.

u. Hazardous Materials (FEIS Section 5.22)

Given the historic and current land uses in the project study corridor, the information obtained during the records review, and the observations made during the site inspections, there is a potential for the presence of hazardous materials to be encountered along the Preferred Alternative. Construction workers would be more likely than the general public or local residents to have complete exposure to soil and groundwater contaminants. Construction contractors will be required to develop and implement a site-specific health and safety plan (HASP)that would address the anticipated contamination including: equipment and procedures to protect the workers and general public, monitoring of contaminant exposures, and identifying the contractor's chain of command for health and safety.

v. Utilities (FEIS Section 5.23)

All utility-related effects would be addressed in advance of, or in conjunction with, the proposed Preferred Alternative construction. Therefore, there is no required long-term mitigation associated with the anticipated utility effects resulting from the proposed Red Line construction activities. As is typical for utility infrastructure, there would be ongoing system preservation efforts which include periodic maintenance and construction that would affect distribution and service. However, these efforts are independent of the proposed construction and operation of the Red Line project. The replacement or relocation of some of the aging utilities to current engineering standards should help reduce the probability and frequency of failures and other problems in providing service.

w. Indirect and Cumulative (FEIS Section 5.24)

Indirect effects focus on planned development or land use changes that can only occur if the Preferred Alternative is constructed and if the project changes the rate of development. Coordination with Baltimore City and Baltimore County planning agencies has determined that there are no development projects dependent on the construction of the Red Line project. Cumulative effects include impacts on environmental resources which would result from incremental effects of the Preferred Alternative when added with other past, present, and reasonably foreseeable future actions. Typically, cumulative effects would result from public or private development that may or may not be associated with the Red Line.

As part of the indirect and cumulative effects analysis, direct effects of the Preferred Alternative were evaluated. Potential indirect and cumulative effects were assessed within the overall indirect and cumulative effects analysis boundary by either the subwatershed area in which they are located or by the station area they are located closest to.

Potential indirect negative effects resulting from the project have been and would continue to be minimized through the alignment design and station area planning process, which will continue to include public outreach to residents and communities surrounding station locations.

The Council on Environmental Quality (CEQ) regulations, which implement NEPA, requires that Environmental Impact Statements include the consideration and discussion of possible mitigation for project impacts. Measures that would be appropriate to offset most indirect and cumulative effects will be beyond the control and funding capability of the MTA and FTA. The pace and extent of future development within the indirect and cumulative effects analysis boundary will be influenced and controlled by the state, county and city land use plans and policies. MTA will encourage state and local planning agencies that can influence development patterns and promote the benefits of controls that incorporate environmental protection into all planned development.

Possible mitigation strategies for indirect and cumulative effects could be considered by the responsible parties, including state and local planning agencies. These strategies may include low-impact development measures, land use management through planning regulations and zoning, and public education on the benefits of environmental conservation and smart growth.

Possible mitigation measures include specific zoning recommendations to minimize effects on notable features and area neighborhoods, and discourage development within adjacent neighborhoods located outside of the station areas or other areas where development is slated to occur.

Specific environmental commitments and mitigation measures for direct effects from the Preferred Alternative are identified in **Chapter 5**, when applicable and summarized in **Section 5.27**.

ES.8.3 Short-Term Effects/Long-Term Benefits (FEIS Section 5.25)

NEPA requires that environmental analyses include identification of "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity." The FEIS compares the short-term uses of the environment (effects of the Preferred Alternatives) with the long-term benefits of the Preferred Alternative. Short-term refers to the period of construction – the time when the largest number of temporary environmental effects is most likely to occur. Long-term refers to the period following the completion of construction activities.

The No-Build Alternative would not involve project-related construction; therefore, short- and long-term project-related effects from the No-Build Alternative would not be anticipated.

Construction activities associated with the Preferred Alternative would have short-term effects by disrupting traffic flow, travel routes, and parking in the project study corridor. However, the inconveniences to residents, motorists, and transit patrons would be offset by the improved transit system once construction is completed. Short-term uses of human, physical, socio-economic, or cultural and natural resources would contribute to the long-term benefits of improved access to employment centers, improvements in both transit accessibility and availability in the project study corridor, and improved air quality in the region. The long-term benefits of implementing transit supportive land use policies and supporting economic development opportunities would be realized.

ES.9 Draft Section 4(f) Evaluation

A Draft Section 4(f) Evaluation included within **Chapter 6** of this FEIS has been prepared pursuant to federal regulations contained in 23 CFR 774 that implements 49 U.S.C. 303, which were originally enacted as Section 4(f) of the United States Department of Transportation Act of 1966 and are still commonly referred to as "Section 4(f)."

Based upon the Preliminary Engineering undertaken for the Red Line project, it is anticipated that the Preferred Alternative would result in:

- The temporary occupancy of three parklands and one historic property during construction;
- De minimis impacts to 2 parklands and 9 historic properties; and
- The permanent use of two contributing properties within the Business and Government Historic District under the proposed Inner Harbor Station Preferred Alternative, requiring both avoidance and least overall harm analyses.

The Draft Section 4(f) Evaluation provides notification of FTA's intent to pursue de minimis impact findings for park and recreation properties and historic sites that would be affected by the construction and operation of the Preferred Alternative. The proposed de minimis findings are based on preliminary coordination with the officials with jurisdiction. Final de minimis impact determinations would be made following continued coordination with the officials with jurisdiction over the resource(s). Pursuant to 23 CFR 774.5(b)(2), all potential de minimis impacts are being presented for public review and comment with the FEIS, in conjunction with the requirements of NEPA. The 45-day comment period for the FEIS also applies to comments on the proposed de minimis impact findings.

The proposed Inner Harbor Station has the potential to result in a permanent, non-de minimis use of land within the Business and Government Historic District, as a result of the demolition of two historic resources that would be required for the construction of the station ancillary building (see photo below).

Proposed Section 4(f) permanent use of two contributing properties within the Business and Government Historic District

In accordance with Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations at 36 CFR Part 800, the undertaking would result in an "adverse effect" to the Business and Government Historic District, so a finding of de minimis impact cannot be made. Therefore, an avoidance alternative evaluation and least overall harm analysis for the properties was conducted and is included the Draft Section 4(f) Evaluation (**FEIS Chapter 6**). A final analysis and conclusion would be included in the Final Section 4(f) Evaluation, based on the views of the official with jurisdiction, Section 106 consulting parties, and comments on the Draft Section 4(f) Evaluation. The Final Section 4(f) Evaluation will be completed and included as part of the ROD.

ES.10 Summary of Preferred Alternative Long-Term Effects

Table ES-4 below summarizes the long-term effects to resources that would result from the Preferred Alternative. Specific commitments and mitigation measures for the effects from the Preferred Alternative are identified in **Chapters 4 and 5**, when applicable and summarized in **Sections 4.7 and 5.27** of the FEIS.

Table ES-4: Summary of Preferred Alternative Long-Term Effects

Summary of Preferred Alternative Long-Term Effects
Land Use
• Minimal because the current land use plans and zoning for Baltimore County and Baltimore City have been developed to anticipate the Red Line project, and to maximize the potential benefits from the project.

Table ES-4: Summary of Preferred Alternative Long-Term Effects

Summary of Preferred Alternative Long-Term Effects
Neighborhoods and Community Facilities
• No displacement of community facilities such as schools, libraries, places of worship, emergency services, or park and recreation areas. • Neighborhood cohesion effects are not anticipated because the proposed transit service would operate almost entirely on existing roadways and thoroughfares. • Greater pedestrian activity and would provide improved accessibility for pedestrians and bicyclists.
Parking
• Permanent elimination of 741 parking spaces, and would provide 1,134 new parking spaces at park-and-ride facilities. • 380 spaces that would be permanently displaced by the project and that could not be accommodated nearby.
Environmental Justice
• No disproportionately high and adverse impact on environmental justice (EJ) populations.
Property Acquisitions and Displacements
• No acquisition of real property that would result in an involuntary residential displacement • An estimated 192 properties would require either a partial (169 of 192) or total (23 of 192) right-of-way acquisition totaling approximately 42 acres. The majority of the partial acquisitions are within the US 40 segment, where sliver takes from 97 residential properties would be required. • The 23 total takes include 13 commercial, three industrial, one institutional, and six governmental properties, primarily at the OMF.
Economic Activity
• Regional economic benefits by improving transit access and mobility for the work force and consumers within the project study corridor. • Better access to existing jobs. • Creation of approximately 200 permanent MTA jobs.
Visual and Aesthetic Resources
• New visual features introduced; of 16 visual districts or sub-districts identified throughout the project study corridor, an overall visual effect of "high" on one sub-district, and an overall visual effect of "medium to high" on five sub-districts

Table ES-4: Summary of Preferred Alternative Long-Term Effects

Summary of Preferred Alternative Long-Term Effects
Parks, Recreation and Open Space
• Long-term effects to park, recreation and open space areas are limited and include: o Chadwick Elementary School – 0.7 acre of the property would be required for construction of and access to a proposed TPSS; o Edmondson-Westside High School – approximately 150 square feet of school property near the Edmondson Avenue and Athol Avenue intersection would be purchased in fee simple to accommodate intersection improvements and stormwater management; o Boston Street Pier Park – a fee-simple area of less than 0.1 acre would be required from this park to accommodate stormwater management; o St. Casimir's Park – a fee-simple area of less than 0.1 acre would be required to accommodate stormwater management.
Historic Properties
• Proposed effects findings include: o no effect on 45 individual historic properties; o no adverse effect on 28 individual historic properties; and o an adverse effect on five individual historic properties, located in Baltimore City: Poppleton Fire Station (Engine House No. 38), Business and Government Historic District, South Central Avenue Historic District, Fell's Point Historic District, and Public School No. 25 (Captain Henry Fleete School). • An overall finding of adverse effect on historic properties has been proposed.
Archeological Resources
• The archeological analysis completed to date has identified 22 areas of sensitivity. Potential archeological resources that would be affected would be documented prior to construction and once operational, no further effects to archeological resources are anticipated.
Air Quality
• Predicted to decrease regional pollutant burdens by approximately 1.5 to 1.9 percent. • No violations of the NAAQS are predicted • Not considered a project of air quality concern regarding $PM_{2.5}$ emissions.
Noise and Vibration
• Corridor-wide project noise exposure levels are predicted to exceed the FTA moderate impact criteria at 96 residences and the FTA severe impact criteria at one residence (The Shipyard condominium building at the corner of Boston Street and Lakewood Avenue). • Vibration levels are predicted to exceed the FTA frequent criterion of 72 VdB at 45 residences. Ground-borne noise levels are predicted to exceed the FTA frequent criterion of 35 dBA at 49 residences. • Vibration levels are not predicted to exceed the FTA frequent impact criteria at non-residential land-uses (Category 1 or 3) except the proposed University of Maryland Proton Building.

Table ES-4: Summary of Preferred Alternative Long-Term Effects

Summary of Preferred Alternative Long-Term Effects
Ecological Resources (terrestrial habitat, terrestrial wildlife, aquatic habitat/species, and rare, threatened and endangered species)
• Impacts to 34.8 acres of forests with minimal effects to higher value terrestrial habitat. • Long-term effects to terrestrial wildlife resources are unlikely because on existing roadway alignments, and wildlife corridors, such as along Gwynns Falls, would remain intact. • FIDS habitat would be affected by minor encroachment since only slight widening of existing roadways would be necessary. • Permanent or temporary loss of approximately 1,941 linear feet of aquatic stream habitat, largely as a result of proposed culvert extensions. • Greater impervious surfaces could affect water quality. However, overall net increases in impervious surfaces are expected to be minimal, amounting to an approximately 7-acre increase in impervious area. Incremental impervious effects that could be expected are unlikely to affect overall aquatic habitat or the makeup of biological communities to an appreciable degree. • Long-term effects to rare, threatened, and endangered species would not be anticipated since none are known to occur within the project study corridor.
Forests
• Impacts to 34.8 acres of forest and removal of 39 specimen trees. • The majority of the long-term forest effects would occur within the West and Cooks Lane Tunnel segments (28.5 acres) in the western reaches of the project study corridor, where most of the resources exist.
Street Trees/ Individual Trees
• Impacts to 315 street trees within Baltimore County and 948 in Baltimore City.
Chesapeake Bay Critical Area
• Conversion of 1.28 acres of unpaved area to impervious surfaces would occur in the East segment from the construction of the Canton Station and expansion of roadway to accommodate the track in the current median of Boston Street (including within the 100-foot buffer at Harris Creek). • The impervious area within the Critical Area would increase from 56 percent cover (existing conditions) to approximately 61 percent cover. • Long-term vegetation effects would occur to landscaping plants, street trees, and park trees within the Critical Area in both the Downtown Tunnel and East segments. The Downtown Tunnel segment tree effects would total 149. The East segment tree effects would total 232, with nine additional trees affected within the 100-foot buffer.

Table ES-4: Summary of Preferred Alternative Long-Term Effects

Summary of Preferred Alternative Long-Term Effects
Wetlands and Waters of the United States
• Total effects to wetlands and waterways: o 0.23 acre of palustrine forested wetlands o 0.99 acre palustrine emergent wetlands o 1,941 linear feet of perennial and intermittent streams o 324 linear feet of ephemeral channel. • MTA intends to apply for a Section 404 Individual Permit from the USACE and an Individual Non-tidal Wetlands and Waterways Permit from the MDE.
Surface Waters: Water Quality, Scenic and Wild Rivers, Floodplains and Navigable Waterways
• Net impervious increase of approximately 7 acres. • No designated scenic and wild rivers within the project study corridor; therefore, no long- or short-term effects would occur. • 0.7 acre of nontidal and 1.0 acre of tidal floodplain effects (combined long- and short-term). In general, the majority of the floodplain encroachments would be from traverse crossings of floodplains. • No long- or short-term effects to navigable waters are anticipated. While no effects to the Jones Falls are anticipated because of the tunnel, would require authorization under Section 10 of the Rivers and Harbors Act. The Downtown Tunnel segment passes beneath this navigable water and is therefore subject to USACE (and potentially USCG) navigable waters permitting requirements.
Groundwater
• Runoff would be directed to surface waters through stormwater management or treated as it is being infiltrated into the local groundwater through ESD stormwater facilities.
Soils and Geology
• Once operational, no long-term effects to the underlying soils and rock would be anticipated.
Hazardous Materials
• There is a potential for the presence of hazardous materials to be encountered
Utilities
• Utility-related effects would be addressed in advance of, or in conjunction with construction.
Draft Section 4(f) Evaluation
• The temporary occupancy of three parklands and one historic property during construction; • De minimis impacts to two parklands and nine historic properties; and • The permanent use of two contributing properties within the Business and Government Historic District under the proposed Inner Harbor Station.

ES.11 Next Steps

This FEIS has been signed by the MTA and FTA and distributed to federal, state, and local agencies, as well as organizations and other interested parties (refer to the Distribution List in **Appendix C** for a complete list of recipients). There will be a 45-day review period for the FEIS; the comment deadline is posted on the project website (www.baltimoreredline.com). During this 45-day review period, the FEIS is available in local libraries throughout the project study corridor and on the project website. Following the 45-day review period, the FTA will consider the comments received on the FEIS and will prepare a ROD. The ROD will summarize the comments received during the 45-day review period and responses to those comments, alternatives considered, factors that support the selection of the recommended alternative, and commitments and mitigations measures to be carried forth during Final Design and construction.

1. Purpose and Need

1.1 Introduction

The need for an east-west transit route through the Baltimore Region was identified in the 2002 *Baltimore Regional Rail System Plan* where the Red Line was designated as a priority project. The purpose and need for the Red Line project was first defined and presented to the public during the scoping process in 2003.

The Maryland Transit Administration (MTA), in coordination with the Federal Transit Administration (FTA), is considering the implementation of the Red Line light rail transit line from western Baltimore County, through the central business district (CBD), to eastern Baltimore City. The Red Line project is intended to improve system connectivity, transportation choices, and mobility in the project study corridor, as well as support economic development efforts and help improve regional air quality.

Changes to this Chapter since the DEIS

Similar to the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS), this chapter presents the purpose and need for the project and summarizes the context of the project study corridor. The Final Environmental Impact Statement (FEIS) is a condensed document. Therefore the supporting documentation that was included in Chapter 1 of the AA/DEIS, such as corridor land use, corridor transportation, and agency goals, can now be found in the *Purpose and Need Technical Report* located in **Appendix I**.

The purposes of the project remain the same. However, the wording of the purpose statement has been slightly revised for clarification. The wording of the needs has also been revised to better express needs rather than purposes/goals. Additionally, this chapter includes updated data in support of the purpose and need. Traffic data and forecast data have been updated from 2030 to 2035, which is the FEIS Design Year. The FEIS also assumes the Opening Year for service would be 2021.

Corridor Overview

The project study corridor extends approximately 14 miles from the Centers for Medicare & Medicaid Services (CMS) on the west in Woodlawn (Baltimore County) to the Johns Hopkins Bayview Medical Center campus on the east (Baltimore City). The majority of the project study corridor falls within Baltimore City. The downtown CBD is comprised of commercial and institutional land uses, with densely developed residential areas radiating out toward the city/county boundary.

The 3-mile section of the project study corridor in Baltimore County contains major employment centers, shopping centers, interstate highways, and housing. One of the region's largest employment centers, Social Security Administration, is located in the Woodlawn area. The residential development in Baltimore County is somewhat less dense compared to that of the city.

Traveling east toward the city line, residential densities increase where the pattern of development resembles a grid. Leakin Park and Gwynns Falls Park, large city-owned resources, lie just within the city limits, north of the project study corridor. Moving toward the downtown area, the project study corridor includes the West Baltimore MARC Station, schools, and shopping centers, all within residential neighborhoods.

The CBD is a major employment center for government, healthcare, and businesses. It includes not only the Inner Harbor, a nationally-known tourist destination, but it is also home to major league baseball, football, indoor soccer teams, universities and professional schools, hospitals, government agencies, and several financial institutions. Recently, the CBD has also become a residential area and offers a number of opportunities to connect with MARC, Metro, Central Light Rail, and the MTA core bus system.

Moving toward the eastern portion of the project study corridor, the Fell's Point and Canton areas are undergoing intense infill development, creating even greater residential density and numerous business opportunities. The easternmost edge of the project study corridor is comprised mostly of industrial and institutional uses, including Johns Hopkins Bayview Medical Center campus.

1.2 Purpose of the Project

The Red Line project is just one step in the ongoing development of an interconnected regional transit system that would improve the quality of transit service in the Baltimore Region. The purpose of the Red Line project is to provide the following improvements in the project study corridor, which extends from the Centers for Medicare & Medicaid Services in Baltimore County to the Johns Hopkins Bayview Medical Center campus in Baltimore City:

- Improve transit efficiency by reducing travel times for transit trips in the corridor
- Increase transit accessibility in the corridor by providing improved transit access to major employment and activity centers
- Provide transportation choices for east-west commuters in the corridor by making transit a more attractive option
- Enhance connections among existing transit routes in the corridor
- Support community revitalization and economic development opportunities in the corridor
- Help the region improve air quality by increasing transit use and promoting environmental stewardship

1.3 Project Need

The needs that exist in the project study corridor are:

- Roadway congestion contributes to slow travel times for automobiles and buses in the corridor
- Lack of convenient transit access to existing and future activity centers in the corridor, including downtown Baltimore, Fell's Point, and Canton, as well as employment areas in Baltimore County to the west of Baltimore
- Lack of viable transit options for east-west commuters in the corridor

- Lack of connections from existing transit routes (including Central Light Rail, Metro, MARC, and bus network) to the I-70 travel market on the west side of the corridor, and to the I-95 and East Baltimore travel markets on the east
- Need for economic development and community revitalization in communities along the corridor, both in Baltimore County and in Baltimore City
- Need to support the regional goal of improving air quality by providing alternatives to automobile usage

These needs are described in detail in **Sections 1.3.1** through **1.3.6** below.

1.3.1 Roadway Congestion and Slow Travel Times

The project study corridor currently faces traffic congestion, affecting both automobiles and buses. The main link in the project study corridor, US 40, is a heavily traveled arterial with high density residential and commercial activities throughout much of its length into downtown. There are many aspects of US 40 that contribute to the congestion and slow travel speeds, but most significant are the numerous and closely spaced traffic signals along the length of the project study corridor.

During peak travel periods, traffic speeds on US 40 range between 10-42 miles per hour (mph) on sections of roadway with posted speeds between 35-40 mph. Currently, traveling by car from the western end of the project study corridor (I-695) to downtown (Pratt Street), a distance of approximately 9 miles, can take as long as 20 minutes during the peak rush hour. This would worsen by Design Year 2035 with a projected increase in traffic of 20 percent over current conditions. By 2035, it may take as long as 28 minutes to travel the same corridor during the peak rush hour, with traffic speeds ranging between 4-32 mph.

Through the CBD and east of downtown, travel in the east-west direction is even slower and more congested. Main east-west streets such as Fayette, Lombard, Eastern, and Fleet Streets are narrow and signalized at nearly every intersection. Traffic speeds downtown range between 4-22 mph during peak travel periods on streets posted at 25 mph. Traffic through downtown and in eastern Baltimore City is projected to increase by 25-35 percent by Design Year 2035. In 2035, during rush hours, the travel time in the west-east direction from Martin Luther King, Jr. Boulevard to Conkling Street via Fleet Street and Boston Street would increase from approximately 7 minutes currently to 12 minutes by 2035. It is also anticipated that the travel time along Lombard Street would increase from 9 minutes to 26 minutes during peak travel periods, thus worsening delays experienced today.

Buses in the project study corridor are subject to the same traffic congestion as automobiles, but have longer travel times because of frequent stops. For most bus routes, speeds during the busiest travel times average only about 9 mph. For example, current bus travel times between Edmondson Village and downtown takes approximately 27 minutes. The US 40 Quick Bus currently makes the trip in approximately 20 minutes. In 2035, the same trip on the US 40 Quick Bus would take approximately 39 minutes.

1.3.2 Access to Employment and Major Activity Centers

Many people live, work, shop, and visit in the project study corridor, which leads to complex travel patterns and a large need for road and transit services that function well. Many major activity centers are located along the east-west corridor. To the west are University of Maryland, University Center, the redevelopment at the West Baltimore MARC Station, and the Social Security Complex in Woodlawn (see photo); to the east are the Johns Hopkins Bayview Medical Center campus (see photo), Canton, Fell's Point, and Harbor East.


Social Security Administration office


Johns Hopkins Bayview Medical Center campus

Many residents rely on public transit to access jobs, services, and activities within Baltimore City and surrounding counties. However, it is difficult for the existing transit system to serve outlying, suburban locations. Buses must share the same congested roads with other vehicles. Sometimes, transit riders must transfer to several buses to reach their destination. In some cases, the Central Light Rail Line and Metro do not extend to the major employment areas that are developing in the suburbs. As a result, travel by transit is sometimes inconvenient and time consuming, making access to jobs and activity centers difficult without an automobile.

Despite long travel times and limited access to suburban locations, the demand for transit is high in the project study corridor. Twenty-three bus routes provide east-west service in the project study corridor, carrying over 131,600 riders per day. Four of these 23 routes (15, 20, 23, and 40) have some of the highest ridership in the MTA bus network. The US 40 Quick Bus operates throughout the project study corridor providing limited-stop service and resulting in some travel time savings (approximately 7 to 10 minutes) over local bus service. However, the US 40 Quick Bus is subject to the same roadway congestion as automobiles and other buses. The project study corridor is an area with a demonstrated demand for transit, despite the constraints to the service currently provided.

1.3.3 Transportation Options for East-West Commuting

Travel choices along the project study corridor are currently limited to driving on congested roads or taking a bus that travels along those same congested roads. Although bus service operates throughout the project study corridor, a high-quality transportation alternative would give east-west travelers a greater choice of travel modes.

1.3.4 Transit System Connections

Connectivity between modes is important in building a transit system that moves passengers efficiently and conveniently. Since public transit cannot provide direct service to each individual origin-destination, service should connect the highest density of origin destinations without transfers. Limited, convenient transfers (one at most is desirable) should also be provided to other origin-destinations.

West Baltimore MARC Park-and-Ride Lot, looking east toward Franklin Street

Connections which can be made today among some transit modes include:

- MARC Camden Line and Central Light Rail at Camden Yards
- MARC/Amtrak and Central Light Rail at Penn Station
- Metro and Central Light Rail at Lexington Market or Cultural Center stations (approximately one block apart)
- Many MTA bus routes with Metro and Central Light Rail directly at rail stations

However, these connections could be improved. The Red Line project offers the opportunity for better connections between the existing MARC system, Central Light Rail, Metro, and bus service.

Park-and-ride lots are one type of connection linking drivers to transit. Park-and-ride lots near transit stations allow commuters to drive to a transit station, park their vehicles, and take transit to their destinations. In the case of rail services such as MARC and Metro, they also save travel time, allowing travelers to avoid traffic in particularly congested areas. Kiss-and-ride areas at stations offer safe and convenient facilities for drivers to drop off and pick up passengers at transit stations. Such facilities enable some households to reduce the number of cars needed, saving on travel expenses.

West Baltimore MARC Station, looking west along Franklin Street

Safe and attractive pedestrian and bike paths can be important features for transit riders to access transit stops from their homes and jobs. Safe, well-lit, and weather-protective shelters and stations are also important in providing a comfortable experience for transit users as they wait for buses and trains.

It is vital that there are easy bus to bus transfers and convenient connections to Metro, Central Light Rail, and the MARC Camden and Penn Line stations within the project study corridor. Bus connections are currently available to these lines: the MARC Penn line at the West Baltimore MARC Station (see photos on previous page); the Metro at the Charles Center and Shot Tower Stations; Central Light Rail at the Camden Yards and Lexington Market Stations; and a number of local and commuter north-south bus routes.

1.3.5 Economic Development and Community Revitalization

The project study corridor spans various communities, with diverse economic conditions. Improved transit connections and services could encourage new development around transit stations that can revitalize surrounding neighborhoods and provide shops and other amenities that would benefit residents and commuters. Multi-use development at a transit station can provide many daily commuter needs and services without the use of a car. Market forces and other variables that are not directly related to transit strongly influence development patterns. However, improved transportation could enhance currently unrealized opportunities for growth and redevelopment within existing communities along the project study corridor.

Communities within the project study corridor identified for revitalization by Baltimore City, include Rosemont; the communities surrounding the West Baltimore MARC station; the communities in the vicinity of Carey and Calhoun Streets near US 40; Central Avenue; and Highlandtown (see photos below). Areas within the project study corridor that encourage redevelopment or support planned development include the Security Square Mall area, Edmondson Village, downtown, Canton, and Bayview.

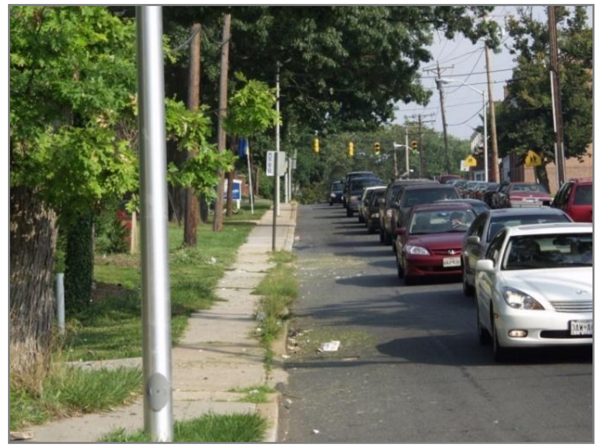
West Franklin Street at Carey Street

Highlandtown Neighborhood, looking southwest along Conkling Street

1.3.6 Improve Air Quality

The project study corridor encompasses both Baltimore City and Baltimore County. Baltimore City is classified as a maintenance area for carbon monoxide (CO), whereas Baltimore County is classified as attainment for CO. Both areas are classified as nonattainment areas for particulate matter ($PM_{2.5}$) and as serious nonattainment areas for Ozone (O_3). Ozone is a gas formed by the combination of nitrogen oxides, volatile organic compounds, and sunlight. Particulate matter is made of the tiny particles that float in the air from industrial and residential sources and vehicle exhausts.

According to data from the Maryland Department of the Environment (MDE), cars, trucks, buses, and other mobile sources result in emissions of nitrogen oxides and volatile organic compounds, which contribute to ground-level ozone formation. Vehicle emissions and traffic congestion, as shown in the photo, also contribute to the amount of fine particulate matter.



Traffic congestion in project study corridor

2. Project Alternatives

2.1 Introduction

The purpose of this chapter is to summarize the alternatives development and evaluation that was included in the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) and to present the two alternative, the No-Build Alternative and the Preferred Alternative – that are analyzed in detail in this Final Environmental Impact Statement (FEIS).

Changes to this Chapter since the AA/DEIS

This chapter summarizes the information presented in the AA/DEIS and also presents new information, as described below.

Section 2.2 of this chapter summarizes the development and evaluation of the alternatives that were documented in the AA/DEIS. This section summarizes and incorporates by reference the information presented in two chapters of the AA/DEIS, Chapter 2: Alternatives Considered, and Chapter 6: Evaluation of Alternatives. It covers planning studies carried out prior to National Environmental Policy Act (NEPA) planning studies, the scoping process, the development process and screening of alternatives, and the evaluation of the alternatives carried forward for detailed study in the AA/DEIS.

Section 2.3 describes the steps that have occurred since the publication of the AA/DEIS, including the identification of the Locally Preferred Alternative (LPA) in August 2009, as well as changes made to the LPA since it was originally announced. The revised LPA is referred to in this FEIS as the "Preferred Alternative."

Section 2.4 describes the No-Build Alternative and the Preferred Alternative, including its proposed alignment, stations, park-and-ride facilities, ventilation facilities related to the tunnel portions of the alignment, system components, operations and maintenance facility (OMF), and rail and bus operations.

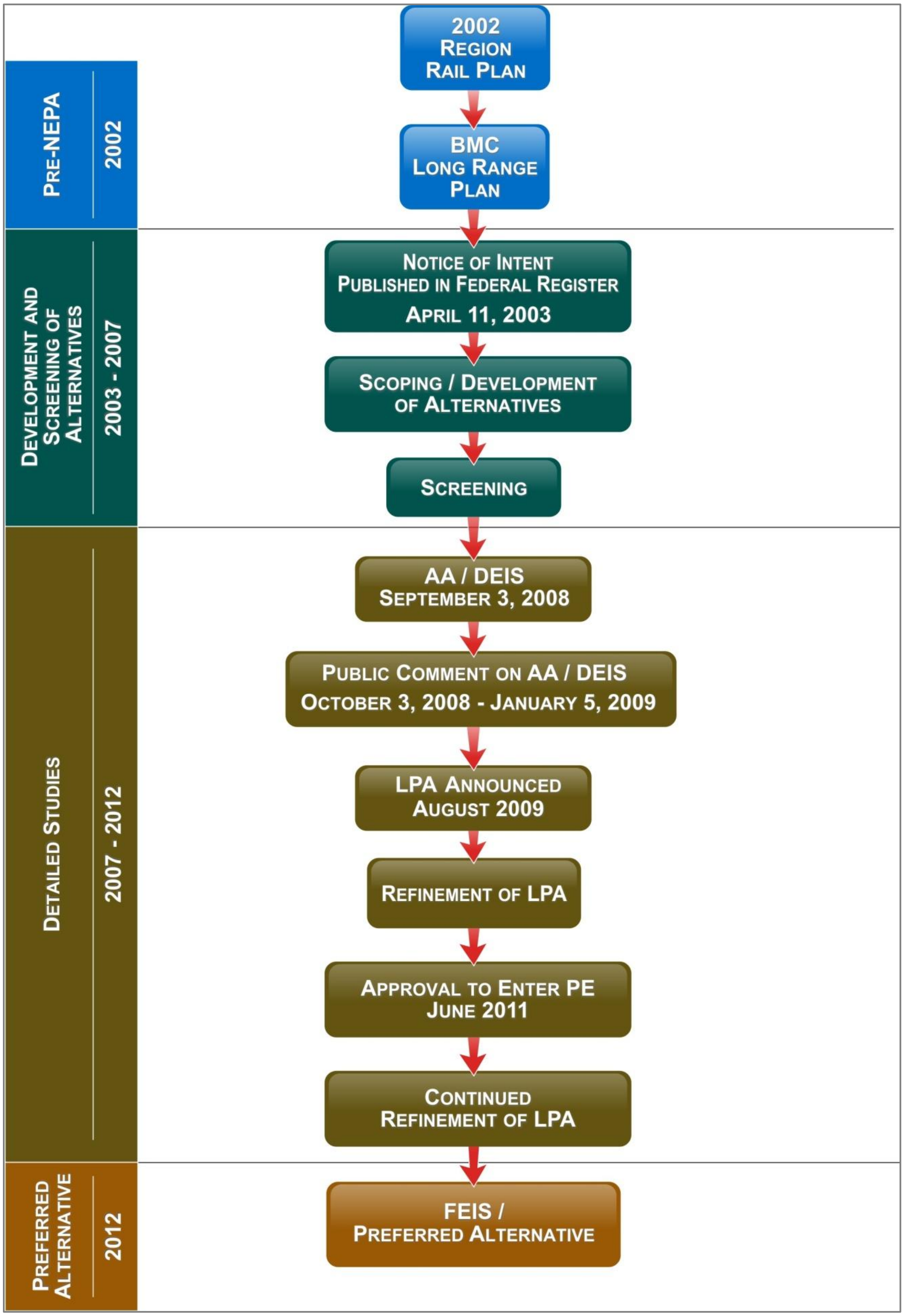
Section 2.5 describes the operating plan for the Preferred Alternative that includes both a light rail operating plan and a feeder bus service plan.

Section 2.6 presents the latest capital cost estimates for the Preferred Alternative. This section updates the information that was presented in Chapter 5: Cost and Funding in the AA/DEIS. The cost estimates in this section are based on the Preferred Alternative, as described in **Section 2.4**, and reflect all engineering necessary to compile and complete the NEPA process.

2.2 Alternatives Development and Evaluation

Alternatives development and evaluation included initial development of alternatives, screening of alternatives, detailed study, selection of an LPA, and refinement of the LPA, resulting in identification of a Preferred Alternative in the FEIS. Throughout the development and evaluation processes, alternatives were reviewed based on a range of factors, including their ability to meet the project's Purpose and Need, their cost effectiveness, and their environmental impacts. (Refer to **Chapter 1** for the project Purpose and Need.) **Figure 2-1** illustrates the chronology of alternatives development and evaluation for the Red Line.

Figure 2-1: Chronology of Alternatives Development and Evaluation for the Red Line



This section summarizes the key steps in the alternatives development and evaluation process for the Red Line project, which are described in greater detail in the *2008 Alternatives Technical Report* and the *Alternatives Technical Report – 2012 Update*. The 2008 Report describes the alternatives analyses that led up to publication of the AA/DEIS; the 2012 Update summarizes the earlier studies, but focuses primarily on the additional analyses that occurred after the AA/DEIS was published. The 2008 Report and the 2012 Update are included in **Appendix I**.

2.2.1 Regional Transportation Planning

In 2002, the Baltimore Region Rail System Plan was completed. The plan recommended the expansion of the existing system into a complete regional rail system composed of six lines. **Figure 2-2** shows the 2002 Regional Rail System Plan with the current Red Line project.

The existing system consists of two lines: the Baltimore Metro and the Central Light Rail line. Metro is a heavy-rail subway line; it currently operates from Owings Mills in Baltimore County to Johns Hopkins Medical Center in downtown Baltimore. The Central Light Rail line operates from Hunt Valley in Baltimore County to Baltimore/Washington Thurgood Marshall International (BWI) Airport.

Under the 2002 plan, the current Metro would become the Green Line and the Central Light Rail would become the Blue Line. The 2002 plan recommended expanding the existing system with the following additions:

1. Construct the Red Line, which would provide the first east-west rail transit line in Baltimore;

2. Extend the Green Line from Johns Hopkins Medical Center (the existing eastern terminus) to Martin State Airport;

3. Construct the Yellow Line from Hunt Valley to Columbia, which would provide an additional north-south transit line through Baltimore;

4. Establish a new local rail service, known as the Purple Line, in the rail corridor used by the MARC Penn Line, on a parallel track; and

5. Establish a new local rail service, known as the Orange Line, in the rail corridor used by the MARC Camden Line, on a parallel track.

The plan recommended that work begin immediately on implementation of three priority projects: the Red Line, the Green Line extension, and the Purple Line.

The Baltimore Region Transportation Board (BRTB) is the official Metropolitan Planning Organization (MPO) for the Baltimore region. The Baltimore Metropolitan Council (BMC) is responsible for enacting long-range transportation planning for the BRTB. One of the BMC's responsibilities is to maintain a long-range, financially-constrained transportation plan which includes projects for implementation over a 20-year horizon. After the 2002 Baltimore Region Rail System Plan was developed, the BMC placed the Red Line on the Long-Range

Transportation Plan. The Red Line project remains in the current version of the long-range plan, Plan It 2035, dated November 11, 2011.

Figure 2-2: Baltimore Regional Rail System Plan Map, Adopted March 2002

2.2.2 Initiation of AA/DEIS

In April 2003, the FTA issued a Notice of Intent (NOI) to prepare an AA/DEIS for a Red Line Corridor Transit project, extending from the Centers for Medicare & Medicaid Services (CMS) in Baltimore County through the Baltimore City central business district (CBD) to Patterson Park in Baltimore.[1] The notice stated that the proposed project "would connect eastern and western communities of Baltimore City and Baltimore County, providing the first east-west fixed rail or

[1] During the alternatives screening process, the eastern terminus was extended to the Johns Hopkins Bayview Medical Center campus, as described in **Section 2.2.4.**

bus rapid transit connection in Baltimore, and would provide convenient and efficient access to major employment centers in downtown and in Woodlawn" (68 Fed. Reg. 17855). The notice also stated that the AA/DEIS would "examine and evaluate rail, bus rapid transit (BRT), transportation systems management and transportation demand management (TSM/TDM) strategies, and a No-Build Alternative. Tunnel, surface, and/or aerial construction options will be considered for rail and BRT alternatives."

New Starts is a term used by the Federal Transit Administration (FTA) for the discretionary program that is the federal government's primary financial resource for supporting locally planned, implemented, and operated transit "guideway" capital investments. Eligible fixed-guideway projects include, but are not limited to, rapid rail, light rail, commuter rail, automated guideway transit, people movers, and exclusive facilities for buses (such as BRT) and other high occupancy vehicles. To receive such funding, agencies must conduct a series of planning and analysis steps that meet specific guidelines and may also include a full environmental impact statement (*http://www.fta.dot.gov/12347_5221.html).*

2.2.3 Scoping and Alternatives Development

Following publication of the NOI, the FTA and Maryland Transit Administration (MTA) initiated a scoping process, which included a series of public scoping meetings, meetings with regulatory agencies, and an ongoing public outreach process. The scoping process identified initial alignments and transit modes to consider for the Red Line. During the scoping process the public, resource agencies, and local stakeholders had an opportunity to comment on initial alignments and modes that would meet the goals for a new east-west transit alignment. Public and agency comments were reviewed and considered when developing alternatives to carry forward to the screening process.

Based on public and agency input during scoping, the FTA and MTA developed a range of alternatives for consideration in the alternatives screening process. These alternatives included a range of modes and alignments for providing improved transit service in the project study corridor. The alternatives advanced for consideration in the scoping process included various combinations of alignments for BRT and light rail transit (LRT) service, as well as a TSM Alternative and a No-Build Alternative. Commuter rail and heavy rail also were considered, but were eliminated, based on the following considerations:

- Commuter rail is primarily applicable to longer distance travel from suburban or rural areas into higher density employment areas. The project study corridor does not incorporate the distances appropriate to commuter rail. Therefore, commuter rail is not a reasonable alternative for this project.
- Heavy rail (a technology used in the Metro rail system in Baltimore) allows for higher operating speeds and greater capacities, but it requires total grade separation, meaning it must be located in tunnels and/or aerial structures at all roadway crossings. As a result, heavy rail is far more costly to construct than a bus or light rail system. Based on analysis of this alternative, MTA concluded that heavy rail would not meet FTA's cost-effectiveness requirements for funding under the New Starts program. Even if it had been able to meet those requirements, MTA would not have sufficient funding to cover

its share of the cost of a heavy rail project. Because of these cost and cost-effectiveness concerns, heavy rail also is not a reasonable alternative for this project.

2.2.4 Screening of Alternatives

Between 2005 and 2007, FTA and MTA conducted an alternatives screening process, which was intended to identify a range of alternatives for detailed study in the AA/DEIS. The screening process included consideration of a large number of potential alignments for BRT and LRT service within the project study corridor (refer to **Figure 2-3**). This process occurred in two stages. The first stage involved a preliminary screening of conceptual alignments. The results of this analysis were documented in the May 2005 report, *Screening of Preliminary Alternatives*, and were presented at a series of public workshops in November 2005. After those workshops, further analysis was performed to address several additional alignments and other options based on input received from the public. As part of this second stage, MTA decided to extend the eastern terminus of the project from Patterson Park to the Johns Hopkins Bayview Medical Center campus, and considered a range of alignments for connecting to the campus.[2]

Throughout the screening process, alignments were evaluated based on a consistent set of evaluation criteria, which are documented in Table 1 of the *2008 Alternatives Technical Report* and in Appendix 1 of the *2005 Preliminary Screening Report*. As summarized in the AA/DEIS, the evaluation criteria included:

- Ability to address project Purpose and Need (refer to **Chapter 1**);
- FTA New Starts criteria;
- Engineering & cost - such as meets engineering design requirements and avoids higher capital cost;
- Extent of environmental impacts to parklands, air quality, noise, historic properties, and other resources;
- Mobility & operational factors such as travel time, traffic, transit connections
- Accessibility for population & jobs; and
- Public input.

Given the large number of potentially reasonable alternatives for completing a BRT or LRT project in the project study corridor, the screening process focused on weighing the relative advantages and disadvantages of the various alignments under consideration. As stated in the AA/DEIS, "The task for the Red Line Corridor Transit Study has been to identify potential modes and alignments, analyze each of these, and narrow them down to a reasonable number of alternatives for study in the AA/DEIS" (AA/DEIS, page 21).[3] The alignments eliminated in the screening process are shown in **Figure 2-4**.

[2] Refer to the *Red Line Extension to Bayview Feasibility Study*, August 6, 2007 included in the *Alternatives Technical Report – 2012 Update*

[3] This approach is consistent with the Council on Environmental Quality's (CEQ) guidance for determining the range of alternatives for detailed analysis in an EIS when the number of potential alternatives is very large or even infinite. As stated in the CEQ's guidance, "When there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in the EIS." See CEQ, Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18026 (Mar. 23, 1981), response to Question 1b.

The alignments considered in the screening process consisted of alternative routes for BRT and/or LRT service within specific sections of the project study corridor. Within each geographic area, the alignments were considered in comparison to one another, based on their relative advantages and disadvantages. This comparative analysis resulted in identification of representative alignments within each geographic section of the project study corridor. These representative alignments were then combined into a series of "end-to-end" alternatives for detailed analysis in the AA/DEIS. The alignments retained for detailed study are shown in **Figure 2-5.**

The alternatives advanced for detailed study in the AA/DEIS were intended to serve as examples representing the full range of reasonable alternatives. As stated in the *2008 Alternatives Technical Report*, "other combinations of options may be combined, but due to the number of options under consideration, representative options had to be identified to manage the number analyzed."

Consideration of Heavy Rail

The MTA has considered heavy rail transit, or Metro, throughout multiple stages in the project due to continued public interest. Heavy rail transit must be physically separated from its surrounding environment because of its power source, the electrified third rail. For the Red Line corridor, heavy rail would require significant tunnels or bridges for total separation from the surrounding environment, since at-grade rights-of-way do not generally exist except at I-70 and US 40 east of the West Baltimore MARC.

MTA conducted additional analysis of heavy rail during the screening process, and confirmed that it did not warrant detailed study because it was too costly and could not meet the cost-effectiveness requirements for New Starts funding.[4] Two specific heavy rail alternatives were proposed by members of the public during this stage and were discussed in Chapter 2, page 29, of the AA/DEIS.

The first of the two alternatives was a full Heavy Rail Alternative from the Social Security Administration (SSA) to Greektown, 14.3 miles. This alternative was estimated to cost $2.383 billion in 2007 dollars. The alternative was not carried forward through full analysis in the AA/DEIS because of its high capital cost as compared to LRT and BRT alternatives being studied. The Preferred Alternative for the Red Line in the FEIS has a cost of $2.575 billion in year-of-expenditure dollars. The year-of-expenditure dollars are based on a schedule that has the Red Line opening in 2021 and escalation occurring at a rate of +3.1 percent per year. Escalating the previously studied Heavy Rail Alternative capital cost at the same rate that is being used for the Preferred Alternative, with a project opening in 2021 and a mid-point of construction in the year 2018, yields a year-of-expenditure capital cost of $3.334 billion. This cost estimate for heavy rail is $759 million higher than the Preferred Alternative. This 30 percent cost differential still renders the Heavy Rail Alternative as too costly when compared with the Preferred Alternative. In addition, there are other aspects of this proposed Heavy Rail Alternative that could bring into question its feasibility, could lead to higher capital costs, or create

[4] For further information regarding the consideration of the heavy-rail mode, refer to the *2008 Alternatives Technical Report* and the *Alternatives Technical Report – 2012 Update.*

environmental impacts that would need to be addressed with associated costs, if the alternative were to be studied more thoroughly. These include constructing adjacent to the Amtrak Northeast corridor and within Amtrak right-of-way, construction to make connections with the existing Metro and the need to shut down Metro service while that construction occurred, likely 6 to 9 months at a minimum; additional property takes along Amtrak right-of-way; visual impacts of aerial alignment from Orangeville to Greektown; potential impacts from being in a tunnel under Leakin Park because of associated ventilation or emergency egress that may be required; and viability of an at-grade alignment along I-70.

The second of the two alternatives was not a full Heavy Rail Alternative, but a combination of three modes – heavy rail, light rail, and streetcar. The heavy rail component extended the existing Metro from Johns Hopkins Hospital to the Bayview Medical Center. From CMS to the western portion of downtown, the Alternative would be light rail similar to the Preferred Alternative. Upon entering downtown, the light rail would be surface to Camden Yards, and then would be located in a tunnel to the existing Charles Center Metro Station. The third component would be a streetcar from Camden Yards to with surface operations along Pratt Street and through Harbor East, Fell's Point, Canton, Canton Crossing, and Haven Street to the Amtrak right-of-way, ending at Edison Highway. The streetcar alternative would run in mixed traffic along the surface. This alternative was estimated to have a capital cost of $1.8 billion in 2007 dollars. Escalated at 3.1 percent per year yields a cost of $2.518 billion in year-of-expenditure dollars. This cost is comparable to the Preferred Alternative, just as it was similar to the costs of the light rail and bus rapid transit alternatives in the AA/DEIS. The reasons this alternative were not studied further in the AA/DEIS are:

- Many east-west trips through the corridor would require transfers because of the multiple modes, increasing transit travel time and decreasing ridership.
- All of the streetcar components require sharing lanes with traffic, which degrades both vehicular traffic movements, as well as transit travel times, and would reduce ridership.
- Introducing a new mode, streetcar, requires an additional new maintenance facility for streetcars and introduces a new mode of transit to Baltimore, which does not improve transit efficiency.

The results of the entire screening process are documented in the, *2008 Alternatives Technical Report* and in the *Alternatives Technical Report – 2012 Update.*

2.2.5 Alternatives Evaluated in Detail in the AA/DEIS

The screening process resulted in identification of four overall alternatives for detailed study in the AA/DEIS, these four alternatives which were described in detail in Chapter 2 of the AA/DEIS (pages 30-40) and are summarized below.

- Alternative 1: No-Build
- Alternative 2: Transportation Systems Management (TSM)
- Alternative 3: Bus Rapid Transit (BRT)
- Alternative 4: Light Rail Transit (LRT)

a. Alternative 1 (No-Build)

The No-Build Alternative represents the future conditions of transportation facilities and services if the Red Line is not built. The No-Build Alternative did not meet the Purpose and Need, but was advanced for detailed study, as required by NEPA. It provides a point of comparison for assessing the benefits and impacts of the other detailed-study alternatives. Refer to **Section 2.4.1** for a description of the No-Build Alternative.

b. Alternative 2 (TSM)

The TSM Alternative represents transit improvements that can be implemented for mobility in the project study corridor without constructing a new transit guideway. This alternative emphasizes upgrades to existing transit service through operational and minor physical improvements. It could also include selected street upgrades, such as intersection improvements, minor widenings, and other focused traffic engineering solutions. The TSM Alternative also did not meet the Purpose and Need, but was advanced for detailed study in the AA/DEIS because consideration of a TSM Alternative is required by FTA as part of an Alternatives Analysis under the New Starts program.

c. Alternative 3 (BRT)

The AA/DEIS considered six representative combinations of alignments for the BRT alternative:

- Alternative 3A – BRT, dedicated surface
- Alternative 3B – BRT, downtown tunnel + dedicated surface
- Alternative 3C – BRT, downtown tunnel + Cooks Lane tunnel + dedicated surface
- Alternative 3D – BRT, maximum tunnel + dedicated surface
- Alternative 3E – BRT, dedicated surface with Johnnycake Road alignment
- Alternative 3F – BRT, shared and dedicated surface + downtown tunnel

d. Alternative 4 (LRT)

The AA/DEIS considered four representative combinations of alignments for the LRT alternative:

- Alternative 4A – LRT, dedicated surface
- Alternative 4B – LRT, downtown tunnel + dedicated surface
- Alternative 4C – LRT, downtown tunnel + Cooks Lane tunnel + dedicated surface
- Alternative 4D – LRT, maximum tunnel + dedicated surface

The AA/DEIS analyzed these ten alternatives in depth for transportation benefits, environmental effects, costs, and possible trade-offs. The trade-offs comparison of the alternatives are summarized in Table 6-4 in the AA/DEIS, which compares the ten alternatives based on 22 evaluation measures. The measures were grouped into three broad categories: cost and cost-effectiveness; transportation and connectivity; and equity, economic, and environmental.

The AA/DEIS provided information about the trade-offs among the alternatives, but did not identify a preferred alternative. The public, stakeholders, and regulatory agencies had a 90-day comment period between October 3, 2008 and January 5, 2009 on the document. A total of 729 comments, including six petitions, were received on the AA/DEIS. The majority of the comments stated either support for Alternative 4C or concerns about surface transit on Edmondson Avenue and Boston Street. Refer to **Chapter 9** of this FEIS for additional information on the comments received on the AA/DEIS, and responses to those comments.

2.3 Identification and Refinement of the Locally Preferred Alternative

The FTA New Starts Process requires the local project sponsor to identify a Locally Preferred Alternative (LPA) as part of the application to enter into Preliminary Engineering. In August 2009, the State of Maryland, with consensus from Baltimore City and Baltimore County governments, announced an LPA that was similar to Alternative 4C as presented in the AA/DEIS document, but included several modifications to address public comments, to optimize cost effectiveness, and to meet engineering and transit operation requirements. Refer to **Figure 2-6**. The LPA as announced in August 2009 included the following refinements to Alternative 4C:

- Eliminated a station between Security Square Mall Station and the SSA Station
- Shifted the entrance to the downtown tunnel at Martin Luther King, Jr. Boulevard south of the Poppleton Station
- Eliminated a station between the Poppleton Station and the Howard Street/University Center Station
- Refined the downtown tunnel alignment to continue under Fleet Street instead of shifting underneath Aliceanna Street

2.3.1 Rationale for Selecting the LPA

In selecting an LPA based on Alternative 4C, the State made two important decisions: selecting LRT as the mode for the project; and selecting an alignment that includes surface-running transit for most of the length of the project, with the exception of a tunnel segment under Cooks Lane and a tunnel segment downtown. The State's reasons for selecting the LPA are summarized below. The data used in this analysis was taken from Chapter 6: Evaluation of Alternatives in the AA/DEIS. Refer to Table 6-4: Evaluation of Alternatives Matrix (page 118). The analysis compared LRT and BRT alternatives and specifically analyzed the differences between Alternative 4C and Alternative 3C. Alternative 3C had the same alignment as Alternative 4C; the only difference was that 3C was BRT and 4C was LRT.

a. Selecting LRT as the mode for the LPA

<u>LRT had higher projected ridership</u> – For the Red Line, LRT alternatives had consistently higher projected ridership than BRT alternatives. All of the LRT alternatives had higher projected ridership than the corresponding BRT alternatives – i.e., those with similar amounts of tunnel and at-grade sections. In the AA/DEIS, LRT Alternative 4C had a projected daily ridership of 42,100. The corresponding BRT Alternative 3C had a projected ridership of 37,400.

<u>LRT had faster travel times than BRT</u> – All of the LRT alternatives had a faster projected travel time than the corresponding BRT alternatives. In the AA/DEIS, Alternative 4C had an end-to-end

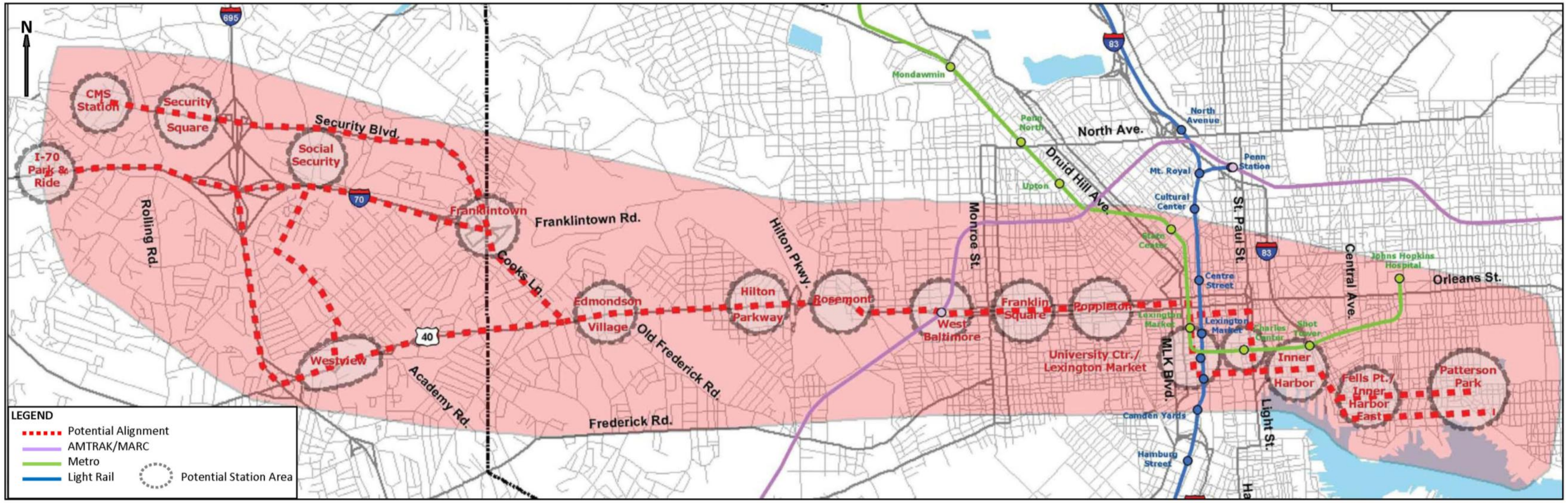


Figure 2-3: Alternatives Considered in the Scoping Report (2004)

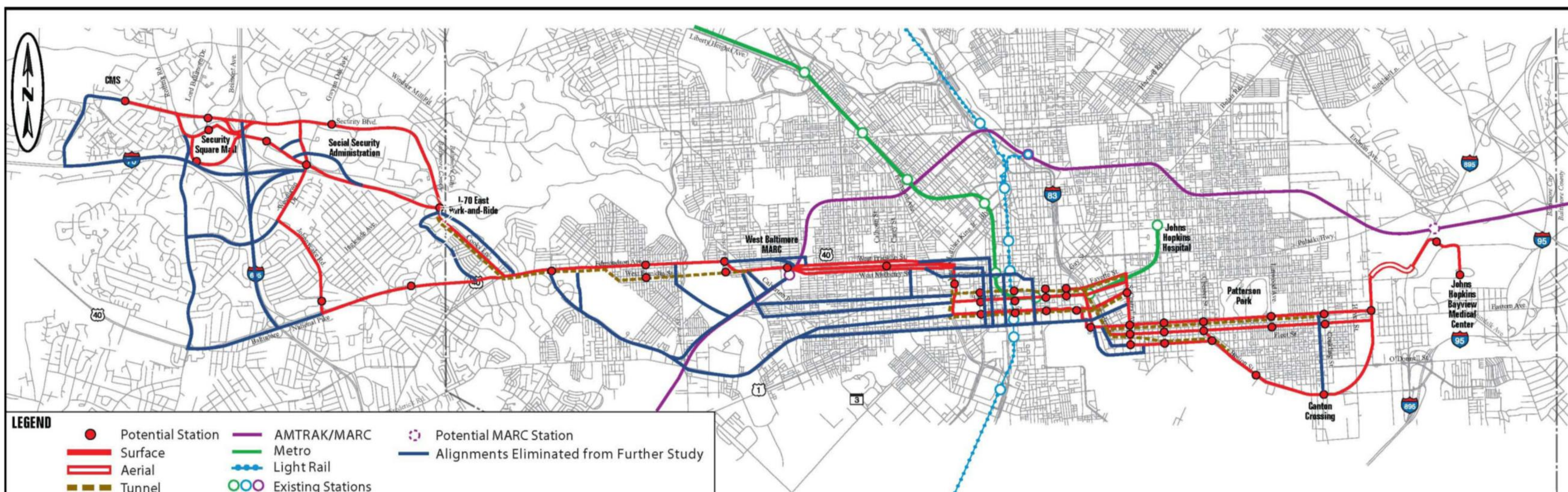


Figure 2-4: Screening of Preliminary Alternatives (2005-2007)

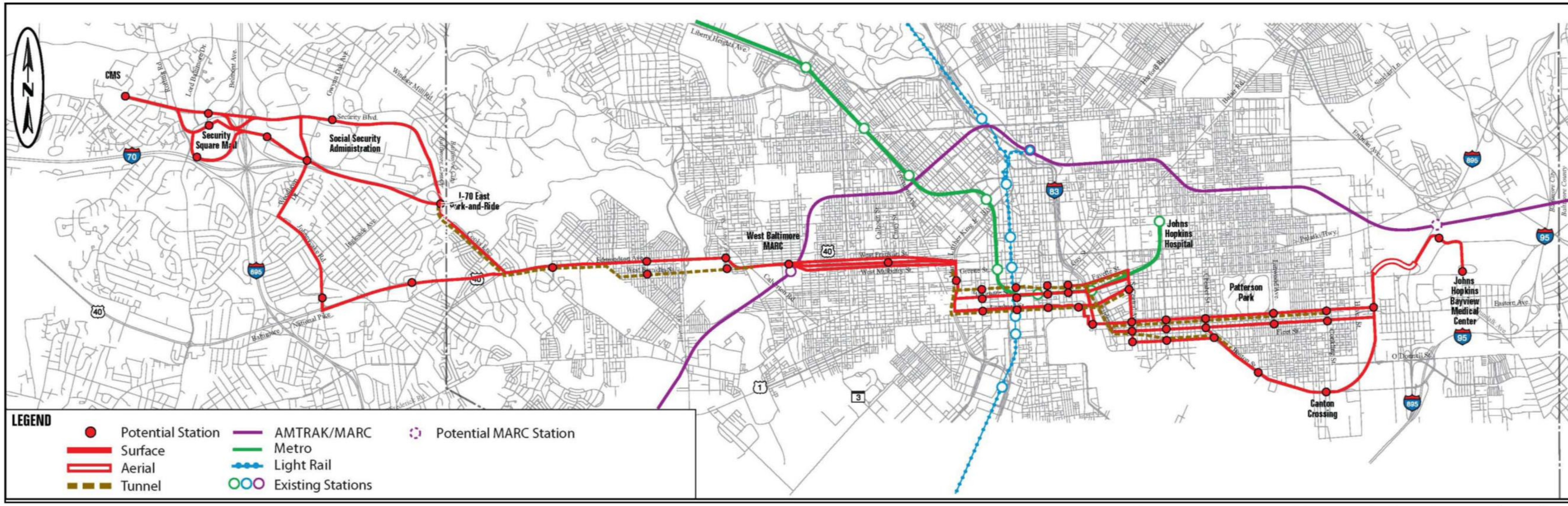


Figure 2-5: Alternatives Retained for Detailed Study in AA/DEIS (2008)

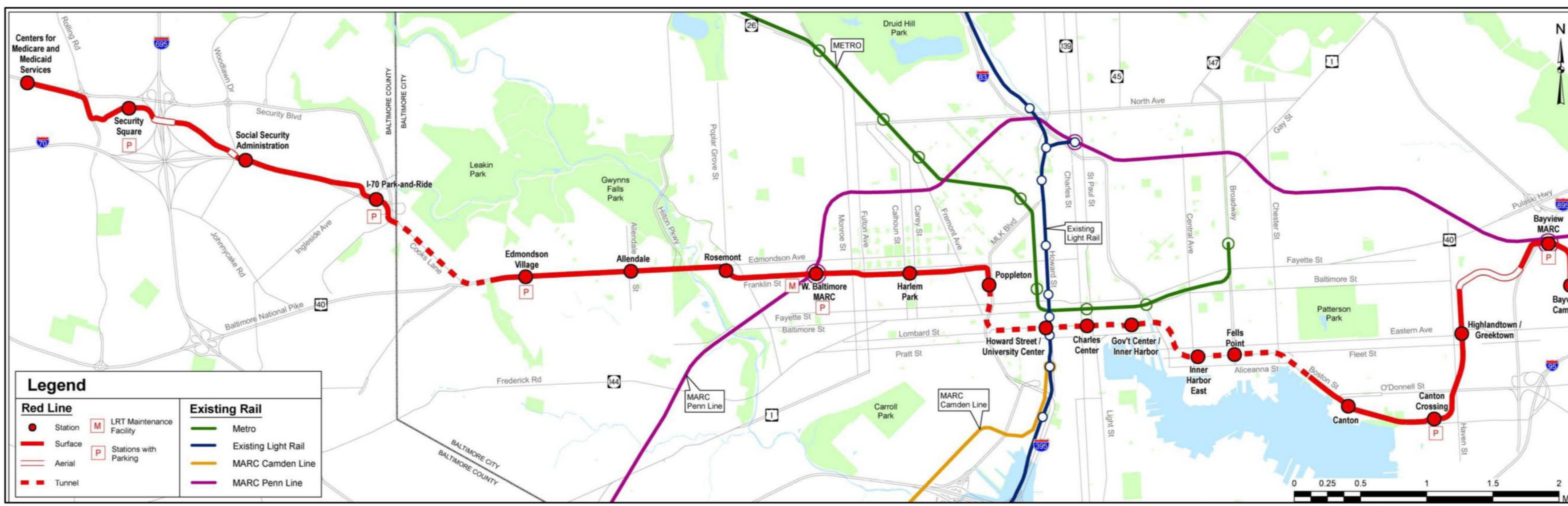


Figure 2-6: Locally Preferred Alternative (2009)

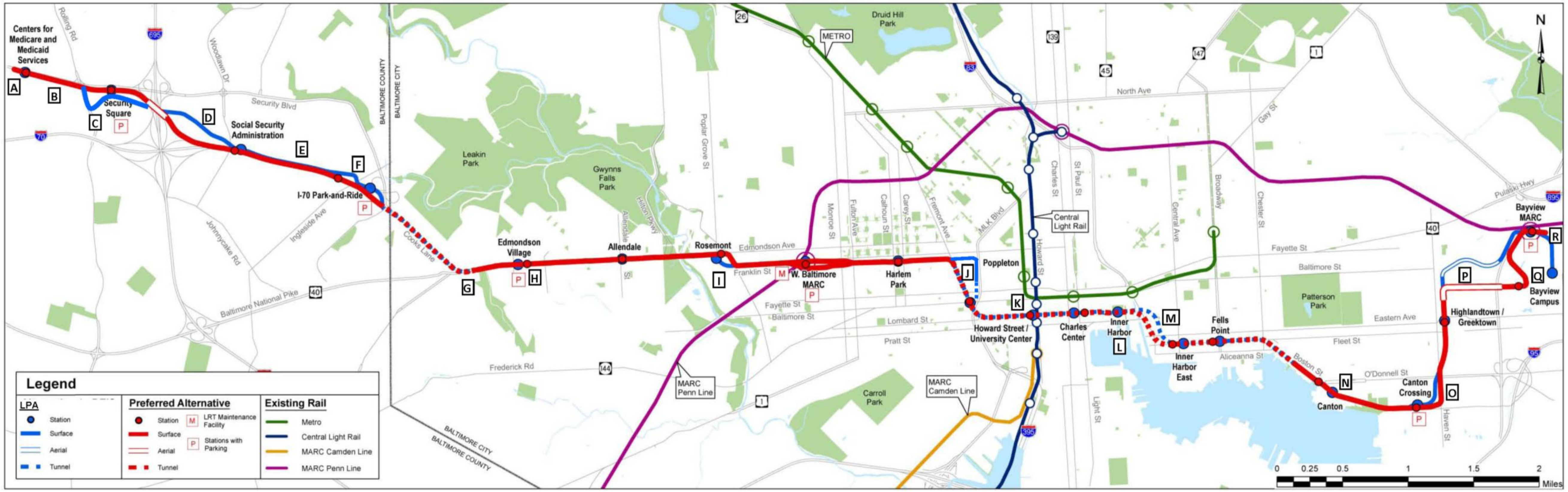


Figure 2-7: Refinements to the LPA (2009-2010)

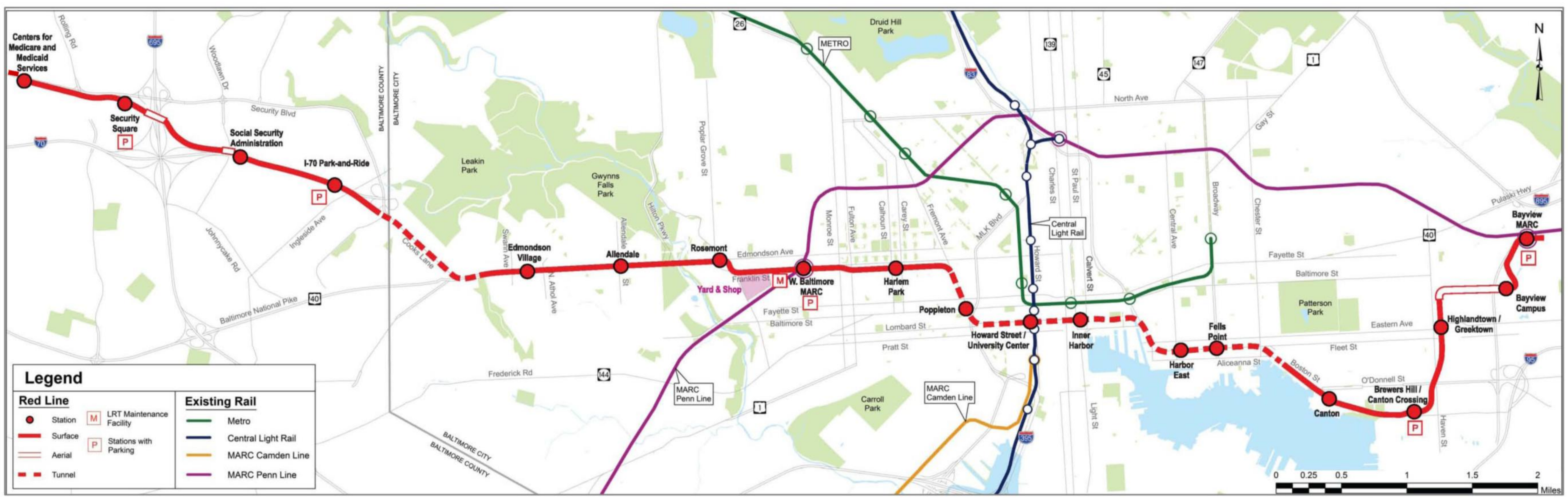


Figure 2-8: Preferred Alternative (2012)

travel time of 41 minutes, while the corresponding BRT Alternative 3C had a projected end-to-end travel time of 53 minutes.

Strong public support for LRT and virtually no public support for BRT – Of the approximately 729 individual comments received on the AA/DEIS, approximately 400 individuals supported some form of a transit improvement in the project study corridor. One-hundred-and-forty individuals specifically supported LRT Alternative 4C, 28 supported another LRT alternative, and only seven people expressed support for any of the BRT alternatives. The remainder of the transit supporters did not specify LRT or BRT.

In addition to comments from the general public, leadership throughout the region expressed support for LRT. LRT supporters included Baltimore City Mayor Sheila Dixon, Baltimore County Executive Jim Smith, the Greater Baltimore Committee and other leaders of the business community, major institutions such as University of Maryland professional schools and hospital, Johns Hopkins medical institution, Baltimore City Community College, and non-profit organizations such as the Chesapeake Bay Foundation and the Citizens Planning Housing Association.

Cost-effectiveness better for LRT Alternatives than for BRT alternatives, under FTA criteria – The key criterion for obtaining New Starts funds from FTA for a transit project at that time was the FTA cost-effectiveness rating. Cost-effectiveness is measured in cost per passenger mile, and is a comparison of the capital and operating cost of the transit improvement to the projected user benefit. Even under the current rules a lower cost per passenger mile contributes to a better FTA rating. The cost per passenger mile for Alternative 4C was $31.98 in the AA/DEIS, while the cost per passenger mile was $49.06 for BRT Alternative 3C.

User benefit was higher for LRT than BRT – This evaluation measure looks at the number of hours of user benefits per day. All of the LRT alternatives had a higher annual user benefit than the corresponding BRT alternatives. For example, in the AA/DEIS, Alternative 4C had an annual user benefit of more than 4 million hours, whereas Alternative 3C's annual user benefit was 2.4 million hours.

LRT attracts more new transit riders than BRT – All of the LRT alternatives attract more new transit riders than the corresponding BRT alternatives. For Alternative 4C, 12,720 more transit riders per day were projected compared to 7,100 more transit riders per day with Alternative 3C, and 4,000 with the TSM Alternative were projected.

The No-Build and TSM Alternatives did not meet the Purpose and Need – The No-Build Alternative does not improve transportation conditions and therefore does not meet the Purpose and Need for the project. The TSM Alternative provides some transportation benefit, but it also does not meet the Purpose and Need for the project. The TSM Alternative was only marginally better than the No-Build Alternative in improving travel times (a savings of 4 minutes). Also, since the buses under the TSM Alternative would still operate in shared traffic lanes, the TSM Alternative would have done little to improve the mobility in the project study corridor. The TSM Alternative would carry significantly fewer riders than the other build alternatives, even though the operating costs are similar to (and in some cases higher than) the operating costs for the other build alternatives.

b. Selecting Alternative 4C as the LRT alignment for the LPA

In selecting an LRT alternative for the project study corridor, the most important considerations involved the locations and lengths of tunnel alignment. Alternative 4A included an all surface alignment with no tunnel alignments. Alternative 4B included surface alignments and a downtown tunnel alignment. Alternative 4C included surface alignments and Cooks Lane and downtown tunnel alignments. Alternative 4D included surface alignments, a tunnel alignment under Cooks Lane, tunnel alignment under US 40 from Cooks Lane to Longwood Street, and a tunnel extending under downtown and along Eastern Avenue to the Norfolk Southern (NS) railroad right-of-way. The Red Line LPA, like Alternative 4C, included two tunnel segments: one tunnel would extend under Cooks Lane, and the downtown tunnel would extend from MLK Jr. Boulevard to Boston Street.

Cooks Lane Tunnel

Cooks Lane is currently a two-lane residential street with one-lane in each direction and on-street parking, as shown in the photograph on the right. In addition to the residential street character of Cooks Lane, the roadway is hilly with numerous grade-changes over the approximate one mile roadway.

Existing Cooks Lane

The Cooks Lane alignment was selected as part of the LPA because it most directly serves major activity centers such as the SSA, Security Square Mall, and CMS.

A tunnel was selected for Cooks Lane because there was not a viable surface transit option. A surface alignment was not viable primarily because it would have been incompatible with the residential character of Cooks Lane. As noted, Cooks Lane is a residential street with one travel lane in each direction plus parking. It is essential to maintain each of the travel lanes for access to the adjacent residences, and all surface options would have eliminated one on-street parking lane. More than 100 parking spaces would be eliminated with the loss of one parking lane on Cooks Lane, where off-street parking is limited for residents. In addition the grade of Cooks Lane would result in slower operation of the light rail vehicles. The surface alignments would result in travel times that were two minutes longer than a tunnel alignment on Cooks Lane. Taking these factors into account, the MTA concluded that a tunnel was required along the Cooks Lane alignment.

Downtown Tunnel

The downtown tunnel extends from MLK Jr. Boulevard to Boston Street, approximately 3.4 miles, traveling beneath the CBD and the residential neighborhoods of Little Italy, Fell's Point, and Canton.

Within the CBD, the downtown tunnel extends from MLK Jr. Boulevard to Central Avenue. This section of the project study corridor extends through the highly congested streets of downtown Baltimore. Due to the large number of cross streets, any surface alignment would have been required to stop at numerous intersections, resulting in slower transit travel times. Surface options analyzed in the AA/DEIS showed transit travel times of approximately 13 minutes, where as the transit travel time with the tunnel option was 5 minutes, a transit travel time savings of approximately 8 minutes. Surface options in the CBD, with associated crossing of major north-south streets and traffic lights would not only increase transit travel times, but would also add to the traffic congestion in this area. The tunnel option beneath the CBD avoided the impacts to traffic lanes and reduces congestion downtown. The tunnel option was selected through the CBD due to travel time savings and that it avoids at-grade crossing of transit with all major north-south streets downtown.

The downtown tunnel extends from the CBD eastward into the residential neighborhoods of Little Italy, Fell's Point and Canton from Central Avenue to Boston Street. A tunnel was selected in this area because of the lack of viable surface options. A surface alignment was not viable in this area for several reasons. As in the CBD, this portion of the corridor is highly congested and has multiple cross streets, which would result in slower transit travel times. In addition, the streets in the historic Fell's Point neighborhood have a narrow right-of-way with buildings located close to the edge of the street. A surface alignment would require over 200 on-street parking spaces between Central Avenue and Chester Street. Therefore, the tunnel continues through Fell's Point returning to the surface on Boston Street, where the roadway is wider and there is sufficient room to accommodate transit in the median.

Existing Fleet Street

Surface transit options in the Eastern Avenue/Fleet Street corridor were studied in the AA/DEIS. The surface options were not selected because the options either significantly reduced roadway capacity and affected access to residents and businesses, or resulted in a significant loss of on-street parking spaces where these residents have no off-street parking option. Therefore, the most benefit with the least amount of impact would be gained by tunneling from the CBD and Fell's Point to Canton.

For additional information refer to the *Alternatives Technical Report – 2012 Update*.

2.3.2 Refinements to the LPA

Subsequent to the announcement of the LPA in August 2009, MTA has continued to refine the LPA. A summary of the refinements is presented in **Table 2-1**. The refinements were made based on: public and stakeholder input, station planning, and additional engineering (including ridership, transit operations and constructability), which resulted in reduced environmental impacts, reduced project costs, and improved safety. These refinements have been incorporated in the Preferred Alternative that is presented in this FEIS (refer to **Figure 2-7** and **Figure 2-8**). These refinements were presented to the public at the Summer 2012 Public Open House Meetings held June 6th, 9th, 12th, and 16th, 2012. **Table 2-1** summarizes the refinements to the LPA and the reasons for the refinements. A more detailed explanation of the refinements follows **Table 2-1**.

In accordance with 23 CFR 771.129, the MTA prepared a reevaluation because more than three years had passed since publication of the AA/DEIS for this project. MTA submitted the reevaluation to FTA on August 16, 2012. The reevaluation compared the current Preferred Alternative as examined in the FEIS to the build alternatives considered in the AA/DEIS, and concluded that a Supplemental Environmental Impact Statement (EIS) of the AA/DEIS is not required because there are no new significant environmental impacts beyond those evaluated in the AA/DEIS. In correspondence dated September 17, 2012, FTA concurred with the findings in the reevaluation but indicated that the FEIS should include the information on the changes in the project so that these changes could be subject to public review.

Table 2-1: Summary of Refinements to the LPA

Refinement	Reasons for Refinement					Key to Figure 2-7
	Ridership/ Transit Operations	Environmental Factors	Public/ Stakeholder Input	Capital Costs	Constructability	
Security Boulevard						
Added tail track at west terminus	✓					A
Shifted alignment on Security Boulevard at west end to stay within existing roadway		✓	✓			B
Modified alignment at Security Square Mall to continue along Security Boulevard, as opposed to traversing Mall property	✓		✓	✓		C
I-70						
Modified alignment between Beltway and Woodlawn Drive, adjacent to ramp from I-70 to I-695	✓	✓	✓	✓		D
Shifted alignment to use portions of existing I-70	✓	✓	✓	✓	✓	E
New location for I-70 Park-and-Ride lot and Station		✓	✓	✓		F
Cooks Lane						
Shifted Cooks Lane tunnel portal 400 feet east on Edmondson Avenue		✓			✓	G

Table 2-1: Summary of Refinements to the LPA

Refinement	Reasons for Refinement					Key to Figure 2-7
	Ridership/ Transit Operations	Environmental Factors	Public/ Stakeholder Input	Capital Costs	Constructability	
US 40						
Shifted Edmondson Village Station to mid block between Swann and Athol Avenues			✓			H
Shifted Rosemont Station and alignment from US 40 to Edmondson Avenue and Franklintown Road	✓	✓	✓			I
Downtown Tunnel						
Downtown tunnel alignment shifted from MLK Jr. Blvd to Fremont Avenue; Poppleton station placed underground and further south	✓	✓	✓		✓	J
Shifted Howard Street Station to east of Howard Street				✓	✓	K
Eliminated Government Center/ Inner Harbor Station				✓		L
Shifted tunnel alignment to under President Street		✓	✓	✓	✓	M
Lowered tunnel depth for downtown tunnel		✓			✓	Not shown
Eliminated underground crossover				✓		Not shown
Boston Street						
Shifted Canton Station to west of Lakewood Ave	✓		✓			N
Shifted alignment near Boston and Haven Streets			✓			O
Bayview Campus Area						
New location for bridge over CSX and I-895	✓		✓	✓	✓	P
New alignment and station location on Bayview Campus	✓		✓	✓		Q
Added tail track at eastern terminus	✓					R

a. Security Boulevard from Western Terminus to Security Square Mall

With the LPA, the alignment was located on south side of Security Boulevard and then turned south along the west side of Rolling Road. At the intersection of Rolling Road/Rolling Bend Road, the alignment turned east following Rolling Bend Road on the north side until reaching a reconstructed portion of the mall loop road. The dedicated alignment and station with parking was inside the reconstructed portion of the mall loop road. The alignment crossed the mall loop road at grade before rising over I-695 on structure.

At the western terminus, the Preferred Alternative alignment includes a 380-foot “tail track.” Tail track is an additional section of track at the terminus of the project, and is added for operational flexibility. This extension would be required for all LRT alternatives previously shown in the AA/DEIS.

The Preferred Alternative alignment was shifted to the north to maintain some vegetative buffer between the residences, the Red Line and Security Boulevard. The alignment now continues west adjacent to the south side of Security Boulevard through the Rolling Road intersection and along the north edge of the Security Square Mall property. This alignment shift reduces the impacts to businesses along Security Boulevard and the mall property.

The Security Mall station was shifted to the west between Lord Baltimore Drive and Belmont Avenue at the request of community input to have the station closer to residential areas and existing bus stops, but still adjacent to the Mall.

b. I-70 Area from I-695 to Cooks Lane

From the Security Square Mall area the LPA alignment continued to the east in a strip of land between the mall parking lot and the interchange ramp to I-695, crossing over the beltway and traversing through the SSA’s West Campus parking lot, continuing east through a strip of forested land between Parallel Drive and the I-70 westbound lanes to the I-70 park-and-ride lot that was proposed in the northwest quadrant of the I-70/Security Boulevard interchange.

Continued coordination with the State Highway Administration (SHA), Baltimore County, Social SSA, and the communities resulted in some refinements to the alignment adjacent to I-70. The proposed Red Line bridge crossing I-695 was refined to accommodate future widening of I-695. On the SSA West Campus the alignment was refined to follow the I-70/I-695 ramp. This avoided the Red Line crossing the entrance road to the SSA West Campus. After coordination with SHA, the Red Line alignment transitions to the excess pavement of I-70 sooner than the LPA alignment in order to take advantage of the existing underutilized pavement of I-70 for the track bed for the Red Line and to reduce impacts to forests and streams.

The Preferred Alternative alignment continues on existing westbound I-70 and uses the existing structure over Woodlawn Drive. In the Preferred Alternative alignment, the I-70 Park-and-Ride Station was relocated from the northwest quadrant of the I-70/Security Boulevard interchange to west of Ingleside Avenue. This change was made because the previous location would require significant excavation to create the parking area, while the current proposed location has less topography relief to overcome. The LPA alignment would have also required low-speed curves and street grade crossings, while the current Preferred Alternative alignment enables a faster travel time through the area and more parking spaces at full development of the station. The Preferred Alternative recommends that I-70 be reconfigured to transition from an interstate at I-695 to a 40 mph boulevard. Intersection and roadway improvements would be required on Security Boulevard, Ingleside Avenue, and Parallel Drive. The Preferred Alternative alignment utilizes the existing structure over Ingleside Drive and continues south of I-70.

The Preferred Alternative includes a re-configuration of the I-70 roadway between I-695 and Security Boulevard/Cooks Lane. The reconfiguration of I-70 includes three connections. These connections are with Parallel Drive, the proposed I-70 Park-and-Ride Station, and a new re-configured signalized intersection at the end of I-70 with Security Boulevard, Cooks Lane, and Forest Park Avenue. The reconfiguration of I-70 and the new connections would alter the traffic flows that exist today, but all traffic movements would be able to be maintained that exist today. The existing partial interchange of I-70 and Security Boulevard would no longer operate.

FTA and MTA will continue to work with the Federal Highway Administration (FHWA) and SHA concerning any actions necessary related to the design changes to this section of I-70, which could include the de-desgination of interstate status in the area. A Memorandum of Understanding (refer to **Appendix G**) was prepared to outline the procedures and coordination that may be necessary with FHWA and SHA concerning the de-designation effort for this portion of I-70. Following completion of the Red Line, this section will continue to be the responsibility of SHA.

Immediately inside I-695, I-70 would have three lanes eastbound (inbound) and three lanes westbound (outbound). In the inbound direction, a double left turn lane would be provided at a new connection with Parallel Drive. This connection would allow for inbound traffic to access Parallel Drive and the SSA. The connection between I-70 and Parallel Drive would allow vehicular movements in either direction on Parallel Drive, either towards SSA or towards Ingleside Avenue. One lane would continue inbound to a new signalized intersection with Security Boulevard/Cooks Lane/Forest Park Avenue. In the outbound direction, one lane would be provided westbound from the signalized intersection of Security Boulevard/Cooks Lane/Forest Park Avenue. A second lane would be added at an egress from the Red Line I-70 Station and a third outbound lane will be added at the new connection from Parallel Drive.

From the I-70 Park-and-Ride Station, access and egress would be provided at two separate entrances/exits along Parallel Drive. There would also be an egress-only exit provided from the I-70 Park-and-Ride Station onto I-70 westbound.

A new four-legged signalized intersection would be provided between the end of I-70, and Security Boulevard, Cooks Lane, and Forest Park Avenue. All turning movements and through movements would be allowed at this new intersection. Access to I-70 would be from a right turn lane from Security Boulevard, a through lane from Cooks Lane, and a left turn lane from Forest Park Avenue. A double left turn would be provided from the end of I-70 to Security Boulevard, a through lane would be provide from I-70 to Cooks Lane, and a right turn lane would be provided from I-70 to Forest Park Avenue. The vehicular movement that exists today between Security Boulevard and Cooks Lane would still be provided. However, as opposed to a through movement, vehicles from Cooks Lane to Security Boulevard would utilize a free right turn lane and vehicles travelling from Security Boulevard would utilize a left turn lane from Security Boulevard to Cooks Lane. All other movements between each leg of the intersection would also be provided.

c. Cooks Lane Tunnel

Like the LPA, the Preferred Alternative alignment is also under Cooks Lane; however, the eastern portal on Edmondson Avenue was shifted within the median further east. The shift to the east was approximately 400 feet and was done to lower the vertical alignment of the tunnel under the residences on the corner of US 40 and Cooks Lane. This change in profile allows for the tunnel crown to be maintained in solid bedrock and is a refinement based on additional geological data obtained since the AA/DEIS.

d. US 40 from Cooks Lane to West Baltimore MARC Station

The Preferred Alternative in the median of US 40 is the same as Alternative 4C in the AA/DEIS. The Edmondson Village station was relocated to mid-block between Swann Avenue and Athol Avenue based on input from the community as part of the ongoing public involvement process. The community strongly supported the station location in this location based on its service to both intersecting roadways, the reduction in congestion around Swann Avenue, and its effect as a natural barrier to pedestrian crossings. This location also maintains service to the existing commercial development and the planned Uplands Community.

The LPA alignment reflected the Rosemont Station on Franklin Street as the Red Line alignment followed the existing traffic flow of the US 40 corridor. Under the current Preferred Alternative alignment, the Rosemont Station would be located on Edmondson Avenue between Poplar Grove Street and North Franklintown Road. The station location was relocated to Edmondson Avenue to improve the sight distance and pedestrian safety by increasing the visibility of the platform and removing it from the existing higher speed traffic flow. As a result, the Red Line alignment would continue along Edmondson Avenue to Franklintown Road and then turn east back into the median of US 40/Franklin Street. This section of Edmondson Avenue was evaluated as part of the AA/DEIS, but did not include the alignment on North Franklintown Road. Additional community outreach was undertaken to present this refinement of the alternative and the community has supported the station relocation.

e. Downtown Tunnel

Fremont Tunnel Alignment

The LPA alignment for the western portal to the downtown tunnel section included a number of surface treatments and tunneling techniques. At that time, the Red Line tracks would transition from surface running in the median of US 40 at the North Schroeder Street overpass and begin to descend with respect to the US 40 roadway. Once the Red Line reached the MLK Jr. Boulevard, the Red Line tracks would traverse a curve to clear under the eastbound US 40 overpass. Upon clearing the overpass abutment, the tracks would cross at-grade with West Mulberry Street and continue along the west side of MLK Jr. Boulevard.

The tracks would continue south across West Saratoga Street and into the surface Poppleton Station. Upon departing the station, the tracks would descend into a portal area, which would include the two tracks with varying height retaining walls on either side until the tracks entered into a tunnel structure.

The tunnel would continue alongside MLK Jr. Boulevard and then curve underneath MLK Jr. Boulevard and the Old St. Paul's Cemetery. The radius of this curve was approximately 400 feet. Due to the tight curvature, two methods of tunnel construction were proposed. The first method involved cut-and-cover construction adjacent to and underneath MLK Jr. Boulevard. This technique would have required the relocation of existing utilities (one of which is a deep large storm sewer); installation of roadway decking; multiple maintenance of traffic stages; and construction of the permanent tunnel structure. The second method included tunneling underneath MLK Jr. Boulevard and Old St. Paul's Cemetery by Sequential Excavation Method (SEM). In this method, the ground is first supported from a tunneling "face" and sequentially excavated. It can be a slow process and requires initial ground support. Due to the existing soil conditions present at this location and depth of the proposed tunnels, ground freezing was considered to be the selected method of initial ground support. At the end of the SEM tunnels, the alignment would be located beneath West Lombard Street near the intersection with Penn Street. At this point, tunnel excavation by tunnel boring machines (TBMs) could proceed. In order to commence TBM operation, "starter tunnels" would need to be mined to assemble and launch each TBM. These starter tunnels were planned to be mined by SEM and incorporated at the end of the SEM tunnels underneath the cemetery.

As an alternative to the complexities described above, a proposal was made to shift the alignment away from MLK Jr. Boulevard and locate the tunnels underneath Fremont Avenue. By doing so, the radius connecting Fremont Avenue to West Lombard Street could be increase to 650 feet thereby allowing tunnel construction by TBM. This method eliminates the utility relocation, roadway realignment on MLK Jr. Boulevard, decking, and cut-and-cover construction within MLK Jr. Boulevard and eliminates the SEM tunneling underneath Old St. Paul's Cemetery.

In order to tunnel beneath Fremont Avenue, the transition between surface alignment and the tunnels had to be located to the median of US 40 in the vicinity of the North Schroeder Street overpass. The US 40 median will serve as the launching point of the TBMs and the construction staging area for the tunneling through the Downtown Section. A consequence of this alignment refinement is that the Poppleton Station is to be shifted southward and westward, and requires the station to be located underground.

The refined alignment provides for a simpler, more uniform method of tunneling. It avoids a significant construction impact in the MLK Jr. Boulevard area. It eliminates lengthy and difficult SEM mining and associated ground improvement beneath an historic cemetery. The option requires an additional underground station, but the station location is situated more centrally in the area and addresses a number of comments and suggestions by the Station Area Advisory Committee (SAAC) and adjacent University of Maryland concerns. The revised tunnel limits allows for the launching of the TBMs and the associated construction staging area to be located within the median of US 40, which provides for a larger staging area and a buffer to the surrounding residential community.

Howard Street Station

The LPA located the Howard Street Station on the west side of Lombard Street to provide a station entrance in close proximity to the Howard Street Central Light Rail Station recognizing the priority for connectivity between the two transit systems. Since the AA/DEIS, foundation plans for the Bromo Seltzer tower where obtained that showed the tall tower was supported on shallow spread footings. It was recognized that constructing the station box excavation adjacent to the tower foundations introduced significant risk in completing a costly underpinning of the entire building foundation system. Recognizing this risk, the Howard Street Station was moved from the west side of Howard Street to the east side with the Preferred Alternative.

Inner Harbor Station

The LPA included two underground stations along the east portion of the Lombard Street corridor. These two stations were the Charles Center Station and the Government Center/Inner Harbor Station. A double crossover was proposed on the east side of the Government Center Station.

Since the AA/DEIS, a search was conducted for a suitable station entrance and ancillary facility building sites, and additional assessments were made relative to the ridership catchment area for each station. Given the developed nature of the downtown CBD area, which limited the number of suitable sites for locating the entrance and ancillary building facilities, it was determined that a single station could adequately service this portion of the downtown area. This single station located between Light Street and Calvert Street is referred to as the Inner Harbor Station. An underground pedestrian corridor connecting to the Charles Center Metro Station is still included as part of the Inner Harbor Station design under the Preferred Alternative.

After the AA/DEIS, the single track run times through the length of downtown tunnel were evaluated and it was determined that acceptable single track run times would occur between the crossovers outside the tunnel portals, thereby allowing for the elimination of the crossover that was included with the Government Center Station.

President Street Alignment

The LPA alignment located the Red Line tunnel beneath approximately 80 residences and other properties in the Little Italy Historic District. The Preferred Alternative alignment shifted the tunnel to the west under President Street. The LPA underneath Little Italy was based on the concern that foundation depths for a building located at the corner of Lombard Street and President Street were unknown. Based on review of the building design plans following the AA/DEIS, this was determined not to be an issue and allowed the realignment of the tunnel in this area. This refinement reduced the number of homes and businesses the tunnel would be under (including the historic district). Additionally, the tunnel under President Street places the tunnel foundations in rock instead of under the older homes and businesses founded on soils.

f. Boston Street and Haven Street to Norfolk Southern/Canton Railroad

The LPA and the Preferred Alternative are generally the same in the section north of O’Donnell Street and utilize the in-active portion of the NS Railroad. The Preferred Alternative alignment at the Exxon site near Haven Street was shifted to the east onto Haven Street to avoid pumping wells on this site. This information was identified through continued coordination with Exxon and Baltimore City since the AA/DEIS.

g. Norfolk Southern/Canton Railroad at Eastern Avenue to Bayview MARC Station

The LPA considered a curved aerial structure over the active freight rail yard and I-895. The Preferred Alternative alignment was refined to a straight aerial structure south of Lombard Street. This refinement results in a lower cost to the project and avoidance of the freight rail yard. Additionally, this enables the Bayview Campus station to be closer to the heart of the Johns Hopkins Bayview Medical Center campus, as requested through ongoing coordination with Johns Hopkins University since the completion of the AA/DEIS. With the relocation of the Bayview Campus station the Preferred Alternative alignment ends at the Bayview MARC Station, instead of looping back to Bayview Campus after reaching the MARC station. At the eastern terminus of the Preferred Alternative a 380-foot tail track was added beyond the Bayview MARC station for the purpose of operational flexibility. This would be required for any of the LRT alternatives previously shown in the AA/DEIS.

2.4 Alternatives Evaluated in the FEIS

This section describes the two alternatives that remain under consideration in this FEIS: the No-Build Alternative and the Preferred Alternative (Refer to **Figure 2-8** and **Figure 2-9)**.

2.4.1 No-Build Alternative

The No-Build Alternative represents the future conditions of transportation facilities and services in 2035 if the Red Line is not built. This alternative provides a baseline by which the environmental impacts of the Preferred Alternative are compared. The description of the No-Build Alternative has been updated since publication of the AA/DEIS.

The No-Build Alternative consists of the transit service levels, highway networks and traffic volumes, and forecasted demographics for the year 2035 that are projected in the 2011 Baltimore Regional Transportation Board's Constrained Long Range Plan (CLRP), *Plan It 2035*. The CLRP consists of the existing highway and transit network, as well as planned and programmed (committed) transportation improvements. The regional transit and highway projects and the local projects within the study corridor that are included in the CLRP are summarized in **Table 2-2**.

Table 2-2: 2035 Planned and Programmed Transportation Improvements Included in the No-Build Alternative

Facility	Location	Description
Transit Projects		
Bayview MARC and Intermodal Station	Lombard Street at Bayview Boulevard	New station to connect with Red Line
MARC Camden Line	MARC Growth and Investment Plan Improvements	Capital Investment through 2020
MARC Green Line	Johns Hopkins Hospital to North Avenue	Extension of Metro
MARC Growth and Investment (2016-2025 and 2016-2035)	West Baltimore, Odenton, Martin State and others	Improvements to capacity, maintenance facilities and station areas

Table 2-2: 2035 Planned and Programmed Transportation Improvements Included in the No-Build Alternative

Facility	Location	Description
MTA Bus	Statewide	Fleet Improvement
MTA Bus and Rail Improvements	Statewide	Preservation and improvements to bus, Central Light Rail, Metro facilities, MTA offices, and park-and-ride lots
MTA Transit	Statewide	Preservation and improvements to Central Light Rail fleet
Regional Highway Projects		
I-95, JFK Hwy (Section 100)	I-895 to north of MD 43	Add two Express Toll Lanes in each direction, upgrade interchanges at I-895, I-695, and MD 43
MD 295	I-695 to I-195	Widen from 4 to 6 lanes
I-695	I-83 to I-95	Widen from 6 to 8 lanes
Local Projects in the Project Study Corridor		
Reconnecting West Baltimore	West Baltimore	Bicycle/pedestrian facilities at Fulton Street Bridge and between Harlem Park and University of Maryland, SWM/landscaping
Edmondson Avenue Bridge	Over Gwynns Falls/CSX Railroad	Bridge widening from 8 to 10 lanes to accommodate dual track light rail
Boston Street Realignment	Between Boston Street and O'Donnell Street	New, extended roadway
Citywide Street and Urban Reconstruction	North Avenue streetscape, West Baltimore MARC neighborhood improvements, etc.	Road resurfacing/reconstruction
Old Ingleside Avenue Bridge	Bridge #96 over Dead Run	Bridge repair/deck replacement
Rolling Road Bridge	Bridge #358 over Branch of Dead Run	Bridge repair/deck replacement
Ingleside Avenue Bridge	Bridge # 97 over Dead Run and Dogwood Road	Bridge repair/deck replacement
Canton Truck Bypass	Clinton Street to Haven Street	New two lane roadway to accommodate truck traffic from Port
Security Boulevard	Existing terminus to Fairbrook Road	New two lane roadway
Bicycle/Pedestrian Projects		
Haven Street Trail (Red Line Rail with Trail)	Highlandtown to Canton Waterfront Park	Multimodal trail
MLK Jr. Side Path	Jones Falls Trail at Maryland Avenue to Gwynns Falls Trail sidewalk at ramp to Russell Street	Rehabilitation/widening of existing sidepath
Red Line Trail	Baltimore City to Red Line terminus in County	Off-road trail linking City and County major employment destinations

Sources: Baltimore Region Transportation Improvement Program 2012-2015, Baltimore Regional Transportation Board "Plan It 2035"

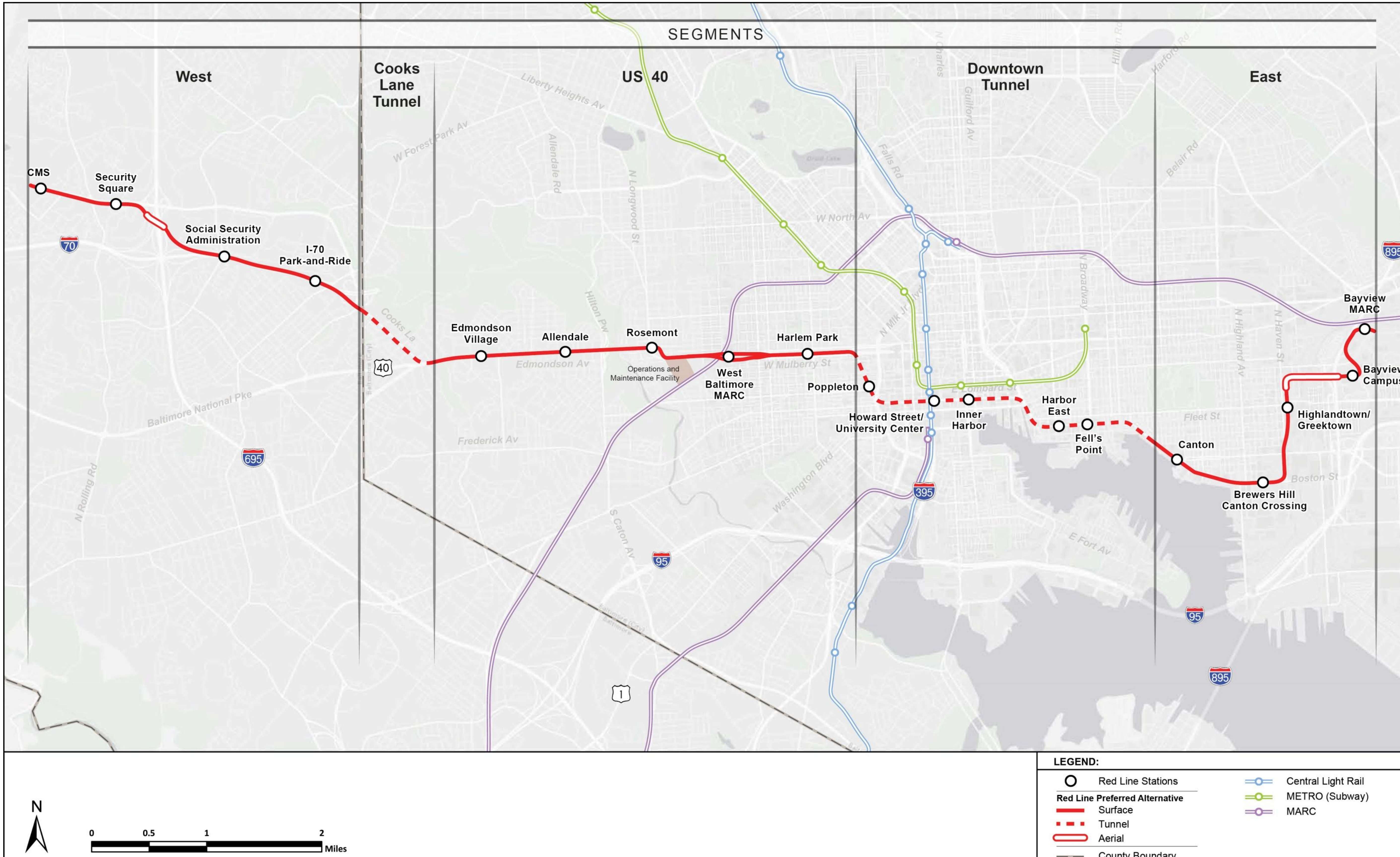


Figure 2-9: Preferred Alternative

The No-Build Alternative represents a continued investment in regional and local transportation projects, but does not address the Purpose and Need of reducing travel times, increasing transit accessibility, providing transportation choices for east-west commuting, or supporting community revitalization and economic development opportunities. Refer to **Chapter 1**.

2.4.2 Preferred Alternative

The Preferred Alternative is a 14.1-mile light rail transit line that would operate from the CMS in Baltimore County to the Johns Hopkins Bayview Medical Center campus in Baltimore City. Refer to **Figure 2-8** and **Figure 2-9**. The transitway includes a combination of surface, tunnel, and aerial segments. The alignment, stations, park-and-ride facilities, system elements, tunnel ventilation, light rail vehicles, operations and maintenance facility, and rail and bus operations plans are described in this section.

a. Alignment

For presentation purposes, the project study corridor has been divided into five segments consisting of three at-grade/aerial segments and two tunnel segments totaling approximately 14.1 miles. From west to east, these segments are: (1) West, (2) Cooks Lane Tunnel, (3) US 40, (4) Downtown Tunnel, and (5) East. Refer to **Figure 2-9**. These segments have been identified for analysis purposes only; they are not intended to correspond to construction phases or construction contracts, nor do they represent projects with independent utility.

West Segment (2.9 miles)

The west segment begins in Baltimore County at the CMS Station, a center-platform station, located west of Rolling Road on the south side of Security Boulevard. At the western end of the Preferred Alternative, 380 feet of tail track would be provided beyond the station for the purpose of operation flexibility. The Preferred Alternative would continue east in an exclusive right-of-way adjacent to the south side of Security Boulevard. The Preferred Alternative would continue east with at-grade crossings at Greengage Road, Brookdale Road, Boulevard Place Shopping Center entrance, and Rolling Road. From Rolling Road, the Preferred Alternative would run adjacent and parallel to the south side of Security Boulevard and along the northern boundary of Security Square Mall crossing Lord Baltimore Drive at grade. The Preferred Alternative would continue to the center platform Security Square Station located immediately west of Belmont Avenue. A park-and-ride lot is proposed at this station and at full development would have 325-375 parking spaces.

The Preferred Alternative would extend east across Belmont Avenue at grade to the west side of I-695 (Baltimore Beltway), continuing southeast and crossing the interchange diagonally on an aerial structure over I-695. The Preferred Alternative would continue adjacent to the existing parking lots at the SSA west campus and along the north side of the I-70 ramp to I-695. The Preferred Alternative would continue east transitioning onto the existing excess pavement of westbound I-70, just west of Woodlawn Drive, to the center platform SSA Station just east of Woodlawn Drive. (Refer to **Section 2.3.2.b** for a description of the roadway operation on I-70 under the Preferred Alternative.)

Continuing east, the Preferred Alternative would cross at grade with a roadway connection from I-70 to Parallel Drive and continues on the former roadway pavement to the I-70 Park-and-Ride Station. The station and park-and-ride facility are located west of Ingleside Avenue occupying the on-ramps to the former westbound I-70. Initially, the I-70 Park-and-Ride lot would have 650-700 parking spaces with the opportunity for expansion in the future.

Continuing east of the I-70 Park-and-Ride Station, the Preferred Alternative would cross over Ingleside Avenue on an existing bridge and curves in a southeast direction to the tunnel portal for the Cooks Lane Tunnel segment.

Cooks Lane Tunnel Segment (1.3 miles)

The Preferred Alternative surface alignment would transition to a 734-foot portal section in the southwest quadrant of the existing cloverleaf interchange at the end of I-70. This existing interchange loop ramp would be removed as part of the project. This tunnel section would begin through the portal on the northwest side of the intersection of Cooks Lane/Forest Park Avenue/Security Boulevard. The tunnel alignment would continue southeast under the intersection in a twin-bore tunnel beneath Cooks Lane crossing into Baltimore City. The tunnel would continue southeast centered under Cooks Lane to north of Coleherne Road; then curve left towards Edmondson Avenue and continues east following the centerline of Edmondson Avenue. The tunnel would continue along the centerline of Edmondson Avenue ascending through a portal section to meet grade approximately 400 feet west of Swann Avenue (**Figure 2-10**).

Figure 2-10: Rendering of the Tunnel Portal on Edmondson Avenue

US 40 Segment (3.3 miles)

The US 40 segment would begin after the tunnel portal, continuing east in an exclusive right-of-way along the median of Edmondson Avenue crossing Swann Avenue at grade to the Edmondson Village Station. This center-platform station is located mid-block between Swann Avenue and North Athol Avenue.

The Preferred Alternative would continue east in the median of US 40 with at-grade crossings at traffic signal-controlled intersections at North Athol Avenue, Wildwood Parkway, and North

Louden Avenue to the Allendale Station at the intersection of US 40 and Allendale Street. The Allendale Station would have a split platform with the westbound platform located on the west side of Allendale Street and the eastbound platform located on the east side of the intersection. The Preferred Alternative would continue east at grade across Denison Street and Hilton Street. The Preferred Alternative would cross over the Hilton Parkway and Gwynns Falls in the center of an existing bridge. Baltimore City is currently developing plans to replace the existing Edmondson Avenue Bridge designed to include accommodations for the Red Line.

The Preferred Alternative would continue east at grade through the Edmondson Avenue (US 40)/Franklin Street intersection and Poplar Grove Streets. The Rosemont Station platform would be located in the center of Edmondson Avenue east of Poplar Grove Street. East of the Rosemont Station, the Preferred Alternative would turn right and traverse south along the center of Franklintown Road. At the intersection of Franklintown Road and Franklin Street, the Preferred Alternative would turn left and continue east along the median of US 40/Franklin Street. This is also the proposed location for the OMF site on the south side of Franklin Street. Following the existing roadway, the Preferred Alternative would split near Wheeler Avenue and continue east diverging to cross under the Amtrak Northeast Corridor. The Preferred Alternative would maintain the existing structures over West Franklin Street and West Mulberry Street with minor modifications to the bridge structures, roadway, and utilities to protect the structures. The eastbound track would be adjacent to the north side of Mulberry Street, crossing under the existing Amtrak bridge to the West Baltimore MARC Station eastbound platform located at the northwest corner of Smallwood Street and Mulberry Street. The West Baltimore MARC Station westbound platform is located at the southwest corner of Smallwood Street and Franklin Street. The westbound track is adjacent to the south side of Franklin Street. The split tracks would continue east along the edge of the West Baltimore MARC parking lots with separate at-grade crossings of Pulaski Street and Payson Street. The tracks diverge from Franklin and Mulberry Streets and rejoin just west of the North Fulton Avenue Bridge.

The Preferred Alternative would continue east in the median of the existing US 40 lower level roadway corridor. The Preferred Alternative tracks would split east of the Stricker Street pedestrian bridge onto the eastbound left lane of the US 40 corridor. The Harlem Park Station, a center platform station, would be located between Calhoun Street and Carey Street. East of Carey Street the tracks would merge back to double-track before passing under the existing pedestrian bridge at Carrollton Avenue. The Preferred Alternative would continue under the Arlington Avenue Bridge to the portal for the downtown tunnel.

Downtown Tunnel Segment (3.4 miles)

The tunnel would begin in the median of US 40 immediately west of the North Schroeder Street Bridge and would continue east descending into a 1,200-foot tunnel portal within the median of US 40. The tunnel would then curve underneath Mulberry Street and continue south, beneath Fremont Avenue to the proposed underground Poppleton Station located immediately north of Baltimore Street. The entrance to the underground Poppleton Station would be located at the northeast corner of the intersection of Fremont Avenue and Baltimore Street.

The tunnel alignment would continue south and curves east crossing underneath MLK Jr. Boulevard to the center of Lombard Street. The tunnel would continue east beneath Lombard Street to the underground Howard Street/University Center Station, located immediately east of Howard Street. The entrance to the underground station would be located at the northeast corner of Howard and Lombard Streets. The Preferred Alternative would cross under the existing CSX railroad tunnel beneath Howard Street just west of the proposed station.

The tunnel alignment would continue east to the underground Inner Harbor Station located underneath Lombard Street between Light and Calvert Streets. The entrance to the station would be located at the northeast corner of Lombard and Light Streets and along the north side of Lombard Street west of Calvert Street. From this station there would also be a pedestrian tunnel underneath Light Street to provide a direct connection to the Charles Street Metro Station located underneath Baltimore Street.

The downtown tunnel alignment would continue underneath Lombard Street until Market Place where the alignment curves south centered underneath President Street to Fleet Street. The tunnel alignment would then turns east, underneath Fleet Street to the underground Harbor East Station located east of Central Avenue.

The alignment would continue east centered underneath Fleet Street to the underground Fell's Point Station on the west side of Broadway. The entrance to the station would be located in the median of Broadway north of Fleet Street.

The tunnel alignment would continue east underneath Fleet Street to Washington Street and would turn southeast under Chester Street to Boston Street. The tunnel would continue southeast underneath Boston Street to a tunnel portal east of the intersection with Montford Avenue/Hudson Street ascending to the median of Boston Street at surface (**Figure 2-11**).

Figure 2-11: Rendering of Tunnel Portal on Boston Street

East Segment (3.2 miles)
The Preferred Alternative would continue southeast at grade in the median of Boston Street to the Canton Station. The Canton Station would be a center platform station located west of the signalized intersection at South Lakewood Avenue.

Boston Street would be developed as one lane in each direction from Montford Avenue to Conkling Street. The Preferred Alternative would continue along the center of Boston Street with at-grade crossings at the signalized intersections of South Lakewood Avenue, South Kenwood Street, Potomac Street (pedestrians only), South East Street, South Clinton Street, and South Conkling Street to the Brewers Hill/Canton Crossing Station. This center platform station would be located between South Conkling and South Eaton Streets and includes a park-and-ride lot with approximately 500-600 parking spaces.

The Preferred Alternative would continue east, at grade across Eaton Street and would transition diagonally on new right-of-way turning north on the west side of Haven Street. The Preferred Alternative would continue north adjacent to the west side of Haven Street crossing under the O'Donnell Street Bridge into the Canton Railroad right-of-way. The Preferred Alternative would then turn northeast crossing South Haven Street at grade into the NS right-of-way. The Preferred Alternative would continue north within the NS right-of-way to the Greektown/Highlandtown Station, a side platform station, which would be located south of Old Eastern Avenue. The Preferred Alternative would occupy the western portion of the NS right-of-way, a currently inactive railroad right-of-way, referred to as Bear Creek Branch.

The Preferred Alternative would continue north over Eastern Avenue on the existing freight railroad bridge and then ascend and turn east onto a new aerial structure, passing overhead of the NS right-of-way. The structure would cross above Janney Street, Kresson Street, CSX railroad, NS railroad, Oldham Street, Ponca Street, and I-895 to the Johns Hopkins Bayview Medical Center campus property. The alignment would continue east at grade along the alignment of Alpha Commons Drive to the Bayview Campus Station. This center platform station would be located immediately west of Bayview Boulevard. The Preferred Alternative would turn north at grade on the east side of Bayview Boulevard continuing north adjacent to Bayview Boulevard with at-grade crossings of Nathan Shock Drive, a National Institutes of Health (NIH) driveway, and Lombard Street. The Preferred Alternative would continue north turning northeast along the eastside of I-895 to the proposed Bayview MARC Station, the eastern terminus of the Preferred Alternative. A park-and-ride lot with approximately 650 parking spaces is proposed as part of a new Bayivew MARC Station, which is separate project to be implemented by the MTA and Baltimore City. At the eastern end of the alignment, 380 feet of tail track would be provided beyond the station for the purpose of operational flexibility.

b. Stations

The Preferred Alternative would include 19 stations, 14 surface and 5 underground, to provide access and connections to the light rail service. The proposed Red Line station locations have been identified based upon compatibility with surrounding site conditions, intended passenger catchment areas, site circulation, site services and amenities, transit oriented development opportunities, public space availability, future urban plan visioning, community input through the SAACs, and other public outreach (refer to **Chapter 8** for additional information concerning Public Involvement).

Stations along the alignment would have one of three types of platforms: center, side, and split. All surface station platforms would be approximately 194 feet long, regardless of the type of platform. **Figure 2-12** provides plan views of examples of prototypical surface station platforms.

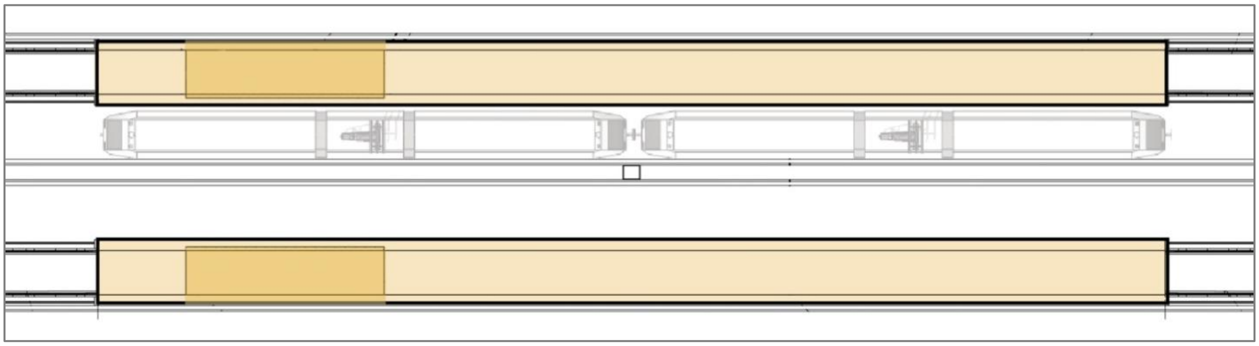
Two of the surface stations would be grade-separated from the pedestrian access areas. The SSA would be located on an existing bridge embankment with pedestrian access from below. The Harlem Park station would be located in the lower level of US 40, and pedestrians would access the station from Calhoun Street above. These stations would include vertical circulation access elements such as stairs and ramps, and/or elevators to access the platform. The entire project, including the stations, would be designed and constructed in accordance with the Americans with Disabilities Act (ADA) to be fully accessible, with barrier-free and user-friendly access for transit customers and personnel.

Two stations would provide connections to the existing MARC Penn Line: the West Baltimore MARC Station and the proposed Bayview MARC Station. The Inner Harbor Station would provide a connection to existing Charles Center Metro Station. The Howard Street Station would provide a connection to the existing Central Light Rail Line and the MARC Camden Line station three blocks to the south.

For the underground stations, there are two-level and three-level stations being considered. Three-level stations are proposed in areas where the tunnel alignment is deep because of street utilities, geological conditions, and/or structural requirements. The depth of the tunnel and station vary with the unique site conditions at each of the five underground stations. Patrons enter from street level entrances and descend to the public mezzanine level by elevator, escalator, or stairs; pay their fare; and then descend another level to the station platform. Refer to **Figures 2-13** and **2-14** for illustrative sections of two-level and three-level stations. Each underground station also has an accompanying ancillary building, which houses mechanical equipment, traction power substations (TPSS), and ventilation shafts (Refer to **Section 2.4.2.g** for additional information on the ventilation system). For the three-level underground stations, the ventilation system and station equipment is located in upper and lower mezzanine levels; refer to **Figure 2-14**.

Figure 2-12: Examples of Typical Surface Station Platforms

Typical Side Platform Layout – Surface Station



Typical Split Platform Layout – Surface Station

Typical Center Platform- Surface Station

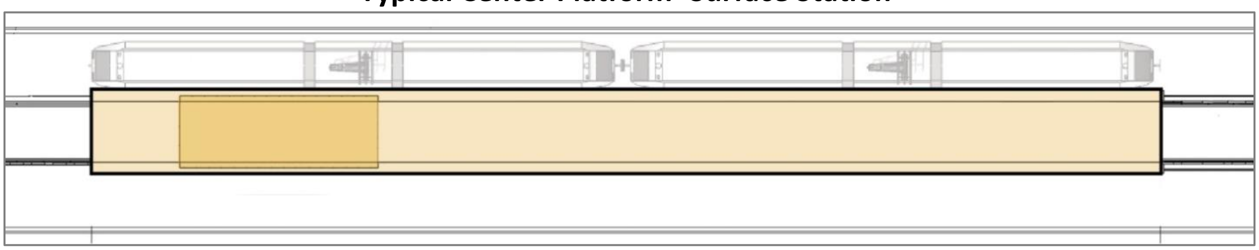


Figure 2-13: Two-Level Underground Station Sections

Two-Level Underground Station – Cross Section

Two-Level Underground Station – Longitudinal Section

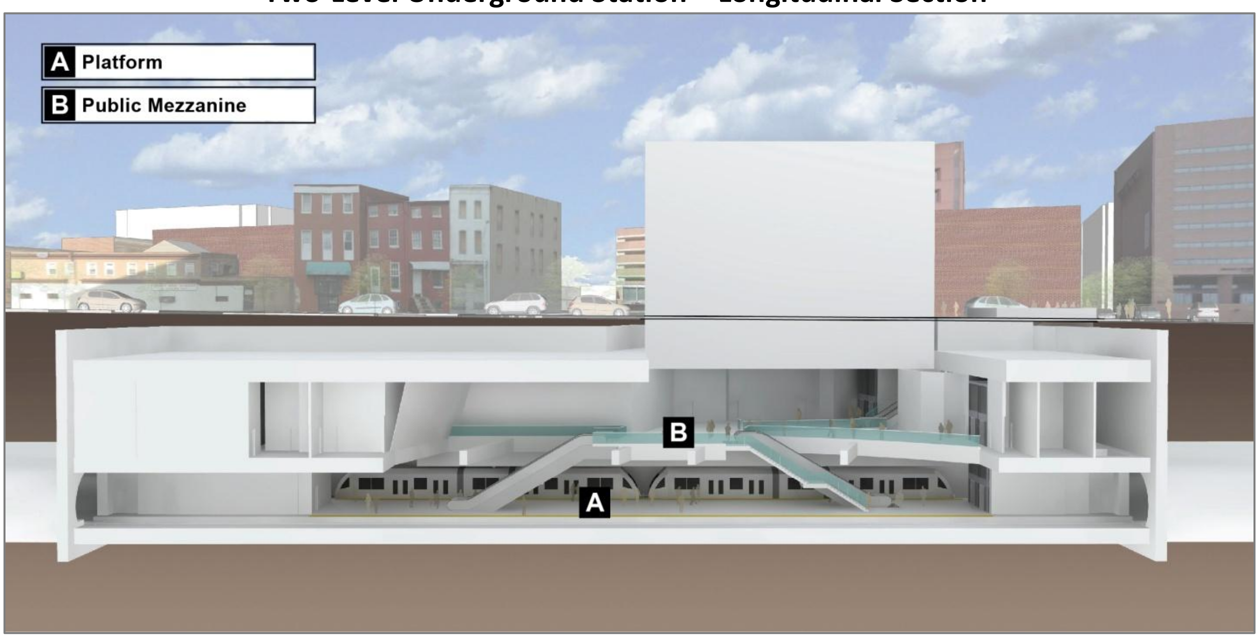
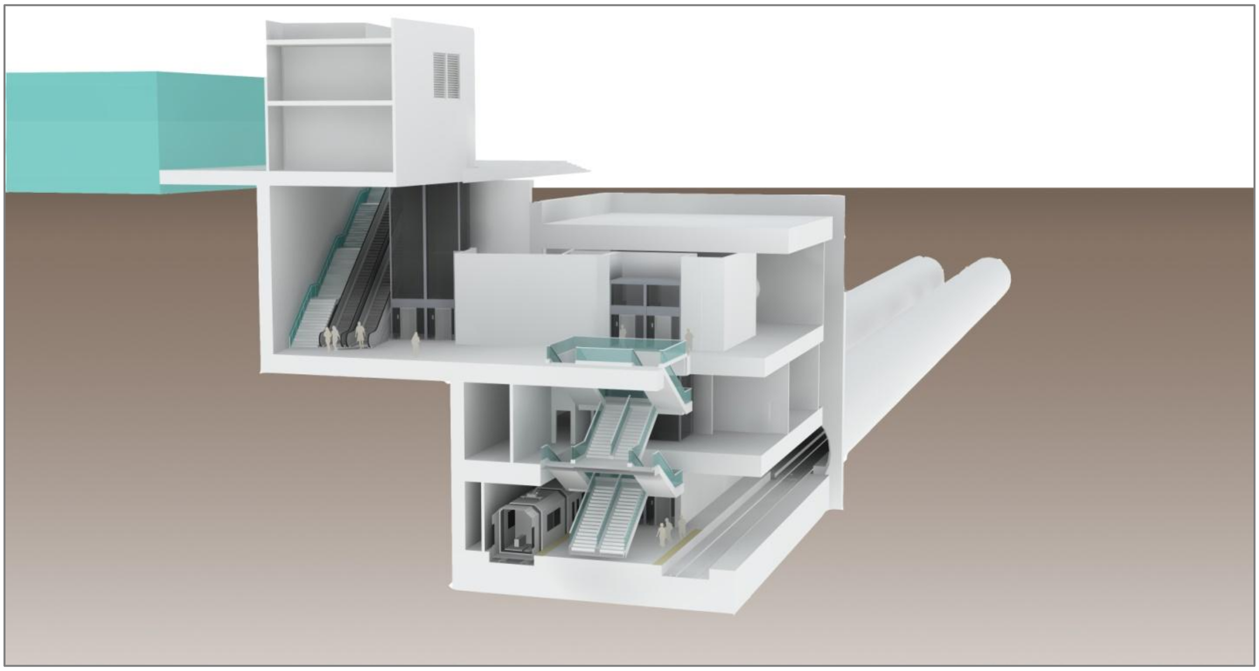
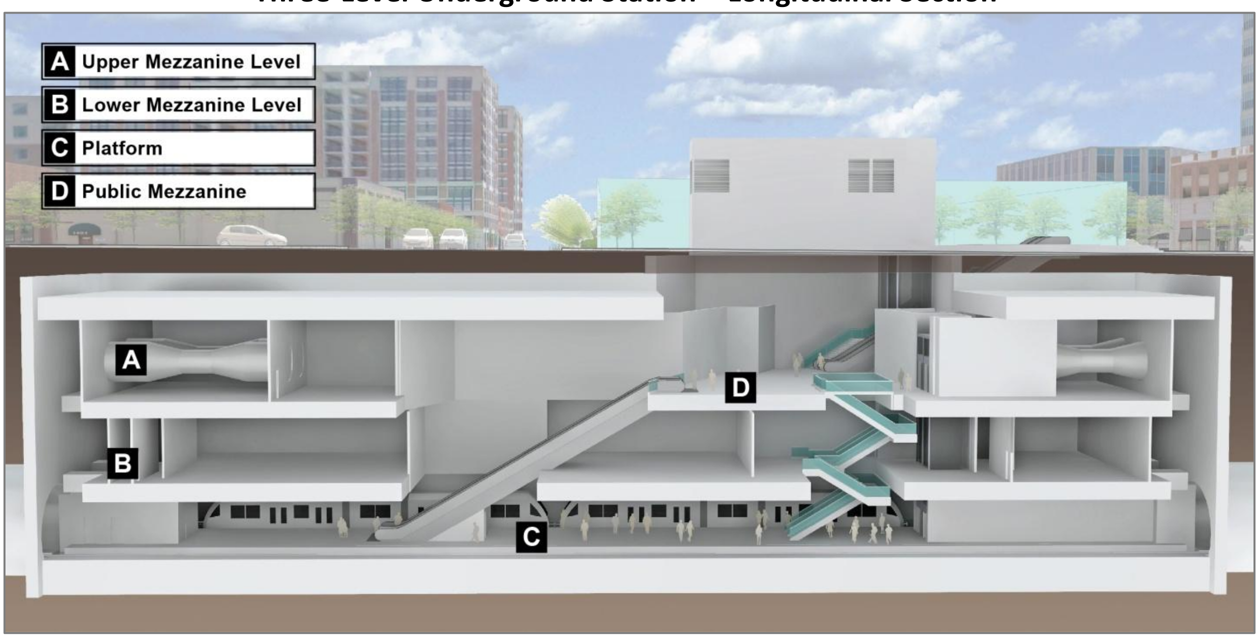


Figure 2-14: Three-Level Station Sections

Three-Level Underground Station – Cross Section



Three-Level Underground Station – Longitudinal Section



The proposed Red Line Stations are summarized in **Table 2-3**.

Table 2-3: Red Line Station Summary

Station Name[1]	Surface Station Type	Platform Type
CMS	At grade	Center
Security Square	At grade with park-and-ride	Center
Social Security Administration	Grade separated	Center
I-70 Park-and-Ride	At grade with park-and-ride	Center
Edmondson Village	At grade	Center
Allendale	At grade	Split Side
Rosemont	At grade	Center
West Baltimore MARC	At grade with park-and-ride	Side
Harlem Park	Grade separated	Center
Poppleton	Underground, 2-level	Center
Howard Street/ University Center	Underground, 3-level	Center
Inner Harbor	Underground, 2-level	Center
Harbor East	Underground, 3-level	Center
Fell's Point	Underground, 3-level	Center
Canton	At grade	Center
Brewers Hill/ Canton Crossing	At grade with park-and-ride	Center
Highlandtown/Greektown	At grade	Side
Bayview Campus	At grade	Center
Bayview MARC	At grade with park-and-ride	Center

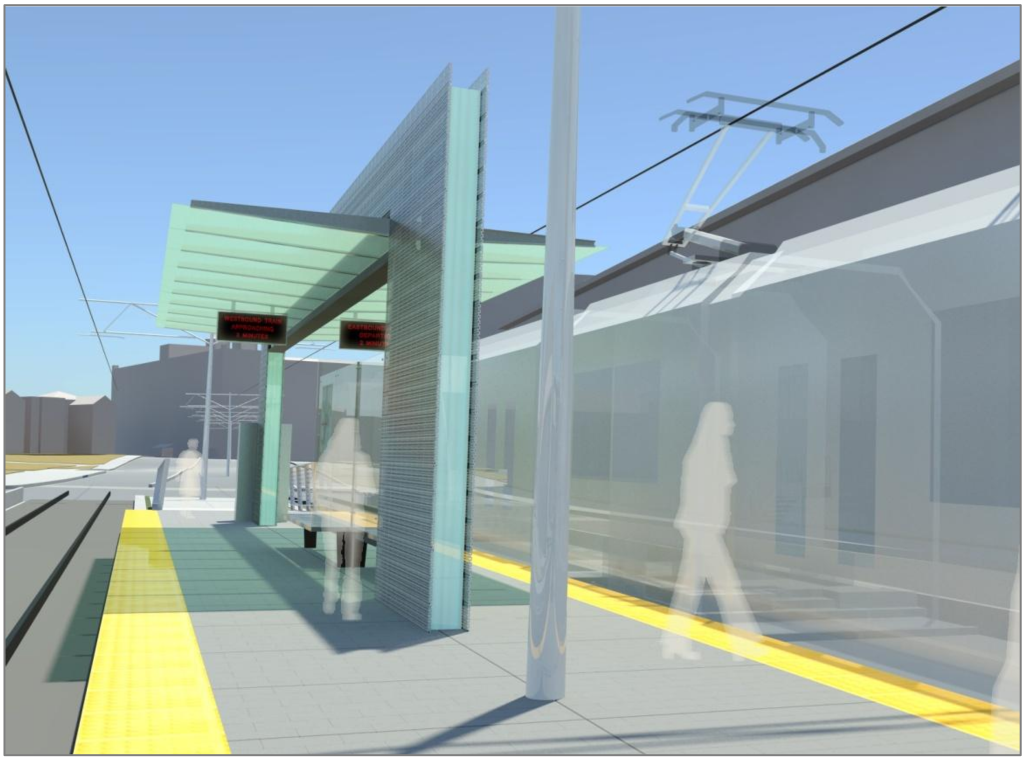
Note: [1] The station names are not final and would be determined with input from the communities as the design process continues.

c. Station Elements

Each station would contain elements and amenities dedicated to the transit operation and convenience and safety of the transit user including: ticket vending machines; shelters or canopies at surface stations; emergency telephones, closed-circuit television; seating, bicycle racks and/or lockers; system signage; and recycling/trash receptacles. **Figure 2-15** through **Figure 2-17** present renderings of what typical surface and underground stations may look like.

Figure 2-15: Typical Surface Station – Center Platform Renderings

Center Platform Station – Option A



Center Platform Station – Option B

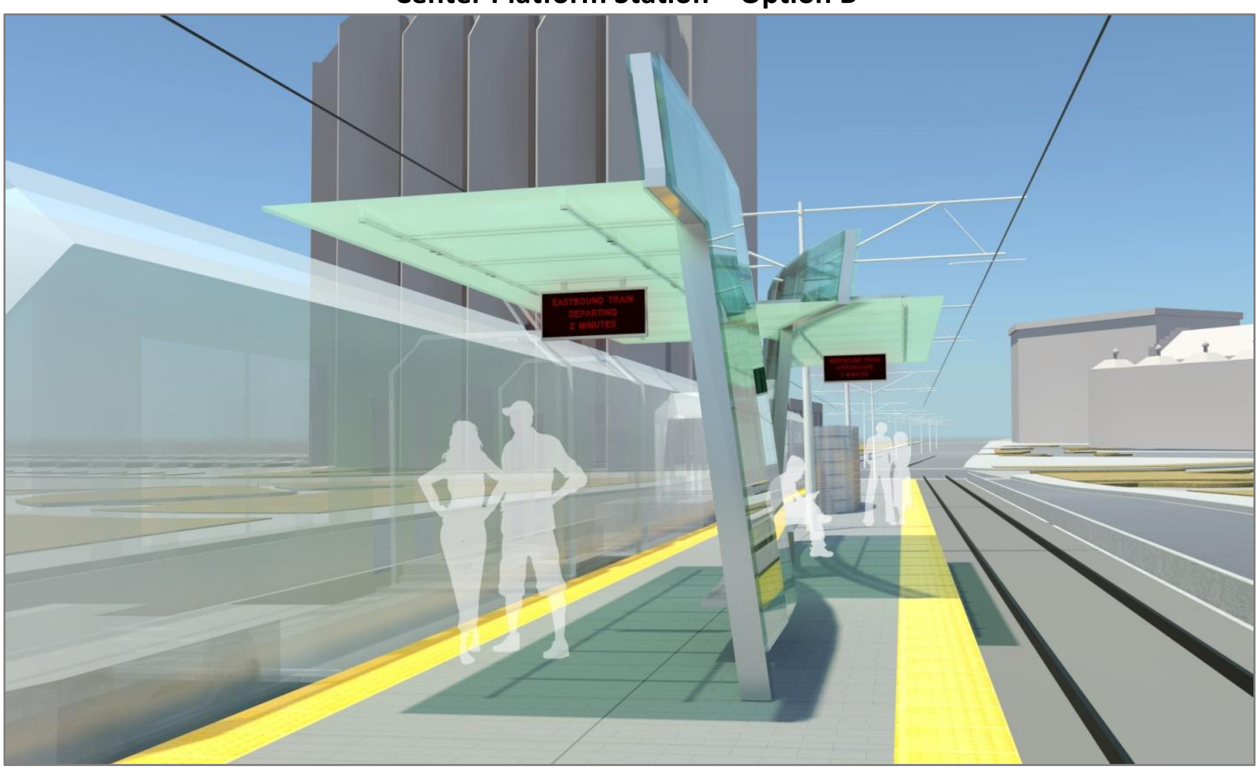
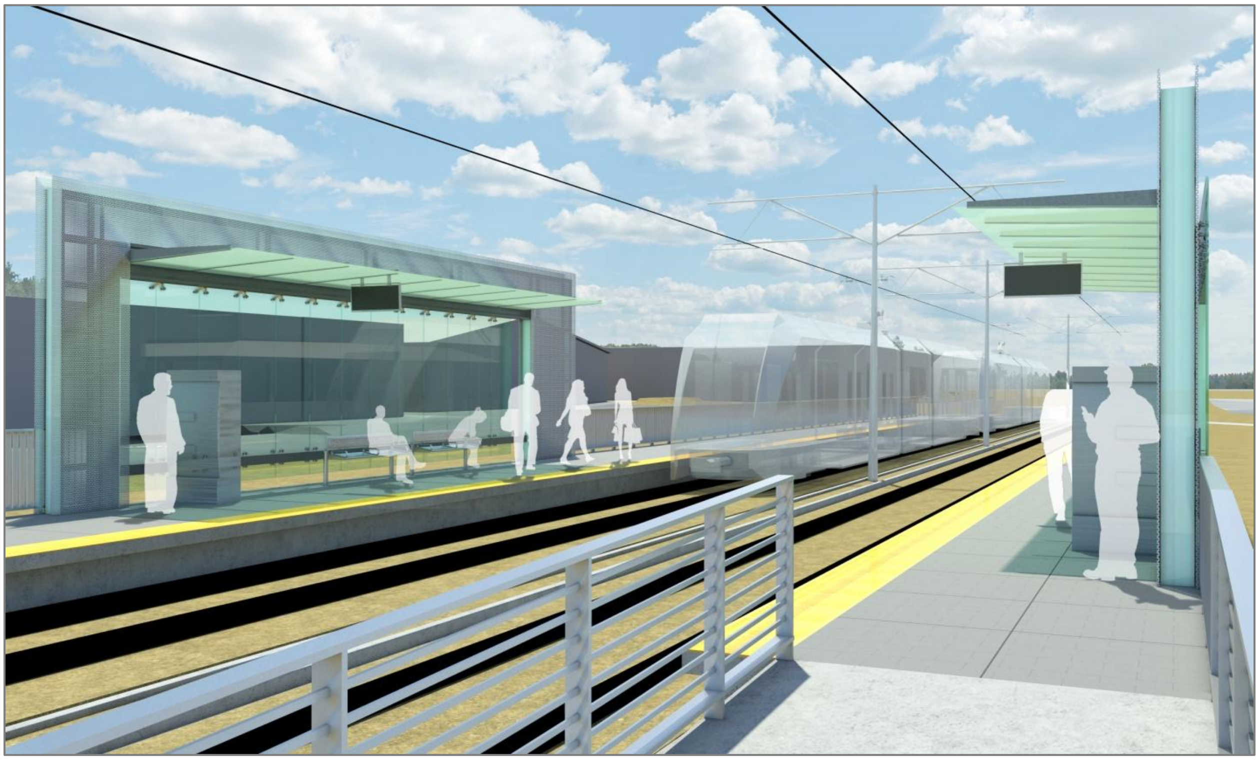


Figure 2-16: Typical Surface Station – Side Platform Renderings

Side Platform Station – Option A



Side Platform Station – Option B

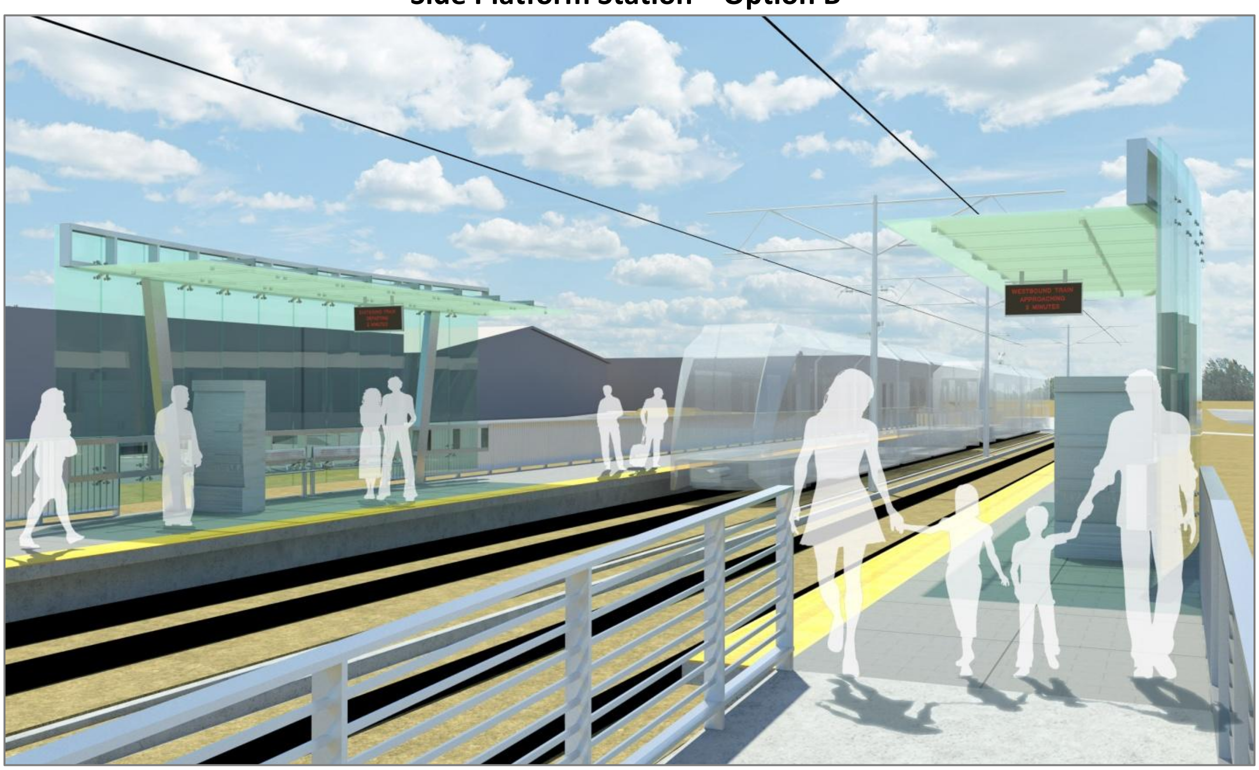
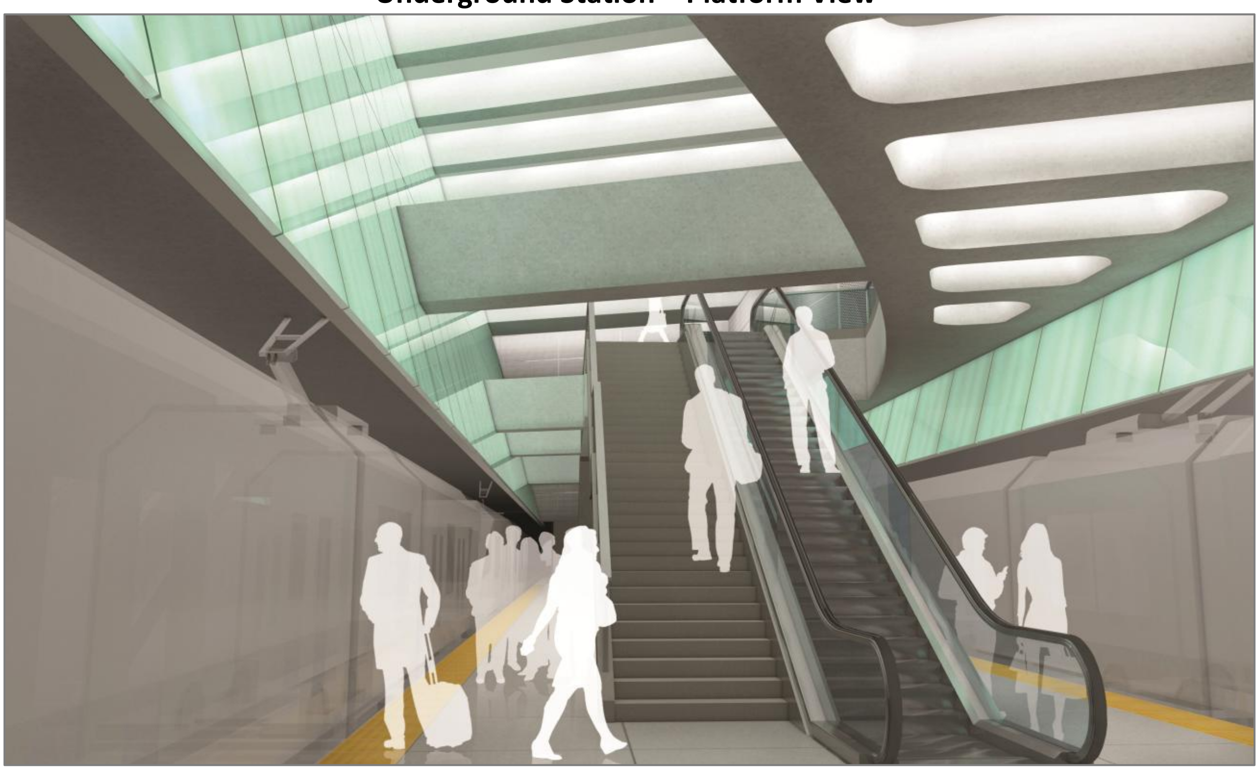


Figure 2-17: Typical Underground Station Renderings

Underground Station – Mezzanine View

Underground Station – Platform View



Architecture

Station canopies, surface stations, shelters, and underground station entrances would be some of the most noticeable elements within the system. Refer to **Figure 2-18** for a rendering of a typical underground station entrance. The station design methodology is based on a multi-step process that includes a contextual investigation of the project study corridor and its surrounding neighborhoods, identifying land uses, the areas served, its historical significance, and materials that define the fabric of the community. The process also includes analysis of the functional elements of the stations such as: finishes, weather protection, lighting, bike storage, and transit-specific elements including communications, system operations and maintenance, safety and security, wayfinding, and customer information. The station design would consider a modular "kit of parts" maintaining the transit system identity while allowing a level of "customization" to recognize neighborhood context and integration. The station architecture would incorporate materials that provide system recognition, ease of maintenance and operations, durability, aesthetic quality, while reflecting neighborhood context.

Figure 2-18: Typical Underground Station Entrance

Station Access

Each station would need to accommodate various access modes: pedestrian, bicycle, bus, and vehicular drop-off. ADA-compliant, accessible routes connecting to each of these modes would be provided and integrated into the topography of the site. Ramps, elevators, and stairs would be incorporated, as required, for access requiring grade change.

Landscape/Site Design

Station design would incorporate landscape and site design to integrate the station into its surroundings. Materials for hardscape surfaces such as walkways, entry plazas, and retaining walls would be treated similar to, and in conjunction with, architectural elements. Stormwater management and parking facilities would be considered integral parts of the station design and may provide opportunities for sustainable features, environmental site design and landscape focal points.

Lighting

Lighting at the stations would be provided at various levels. An overall system of lighting consistent throughout the corridor would provide general illumination for safety and wayfinding at the stations. Pedestrian level lighting at sidewalks, pathways, and at the station itself would provide a more focused lighting source and could provide the opportunity to highlight the individual neighborhood identity through the style and location of the fixtures. Feature lighting enhancing particular design elements, such as landscape and art features, would also be considered. A balance between safety, sustainable design practices, and impact on adjacent neighborhoods would be a consideration in lighting design.

Wayfinding

The primary wayfinding tool in the station is signage. The objective of the system signing is to direct persons to, through, and out of the system in an efficient, safe, and user-friendly manner using straightforward, clear, and precise methods of organized, logical, and reasonable layouts. Sign communication would be placed carefully and would be standard in dimensions and quantities throughout the Red Line system. The signing would emphasize the Red Line system identity and be consistent with existing MTA signage. Stations, when appropriate, would incorporate signage directing patrons to other modes of transportation, connecting bicycle and pedestrian trails, neighborhood destinations, neighborhood landmarks and historic references, or may also include advertisements.

Safety and Security at Stations

Station safety and security would include general lighting, passive security, traffic calming, and wayfinding signage. For additional information on safety refer to **Chapter 4, Section 6**.

Transit Art Program

The Red Line project is committed to providing seamless integration of art, engineering, landscape architecture, signage, graphic design, and architecture of its facilities. Through a collaborative process with artists, engineers and designers, the MTA, and the community, art will be incorporated in and around a station area. The Red Line will establish an art program that incorporates works of art within its passenger facilities and surrounding sites. The application may vary by neighborhood and local ordinances.

d. Park-and-Ride Facilities

Park-and-ride facilities would be constructed at the stations where there is the highest demand for drive-to-transit access. There are five park-and-ride facilities proposed for the Red Line, all of which would be surface parking lots. Two of the five park-and-ride lots would be constructed as separate projects (West Baltimore MARC and Bayview MARC) but Red Line passengers would be able to park at these facilities and ride the Red Line or the MARC.[5] Refer to **Figures 2-19** through **2-21** for a plan of the Security Square Station, the I-70 Park-and-Ride Station, and the

[5] The West Baltimore MARC Parking Expansion and Bayview MARC Station are separate projects from the Red Line. These projects are being implemented through a collaborative effort from the MTA and Baltimore City. These projects are included in the 2011 CLRP.

Brewers Hill/Canton Crossing Station and associated park-and-ride areas. Park-and-ride capacity may be built in phases as demand grows. **Table 2-4** lists the locations and total built-out capacity anticipated of the five park-and-ride facilities.

Figure 2-19: Security Square Station Park-and-Ride Concept

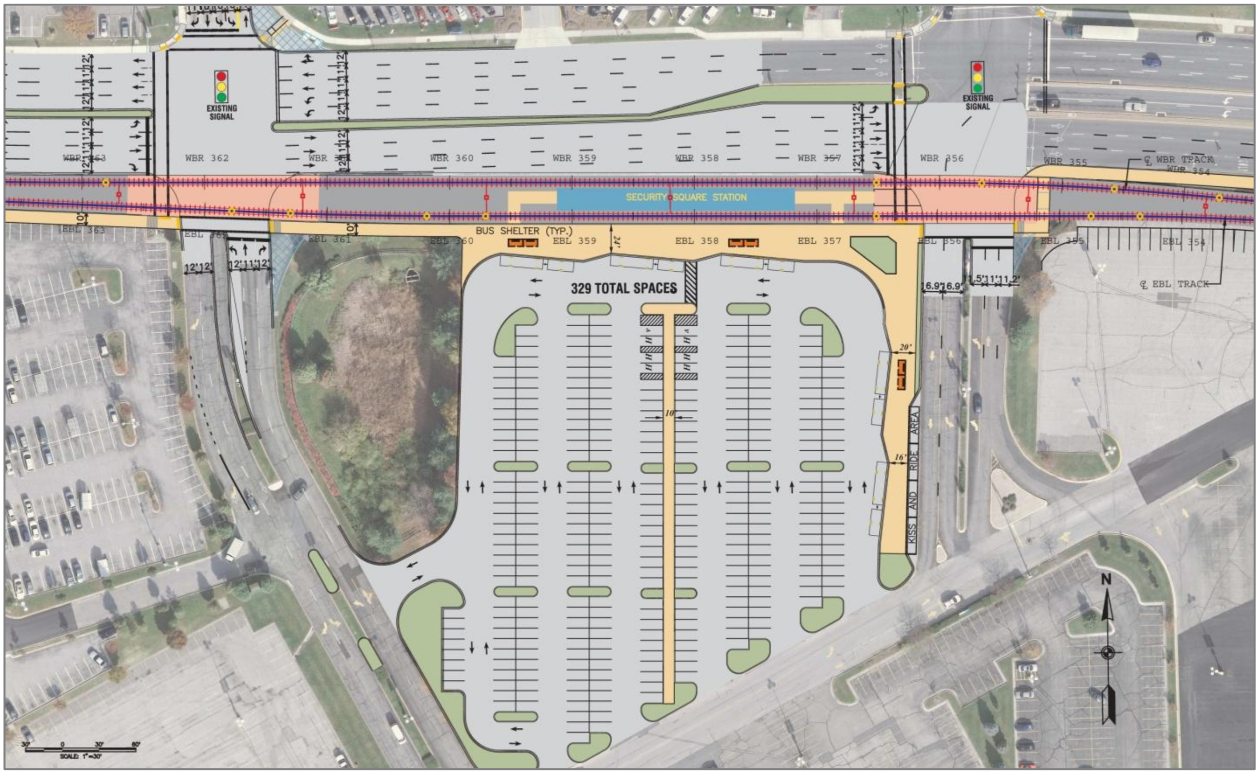


Figure 2-20: I-70 Park-and-Ride Concept

Figure 2-21: Canton Crossing/Brewers Hill Park-and-Ride Concept

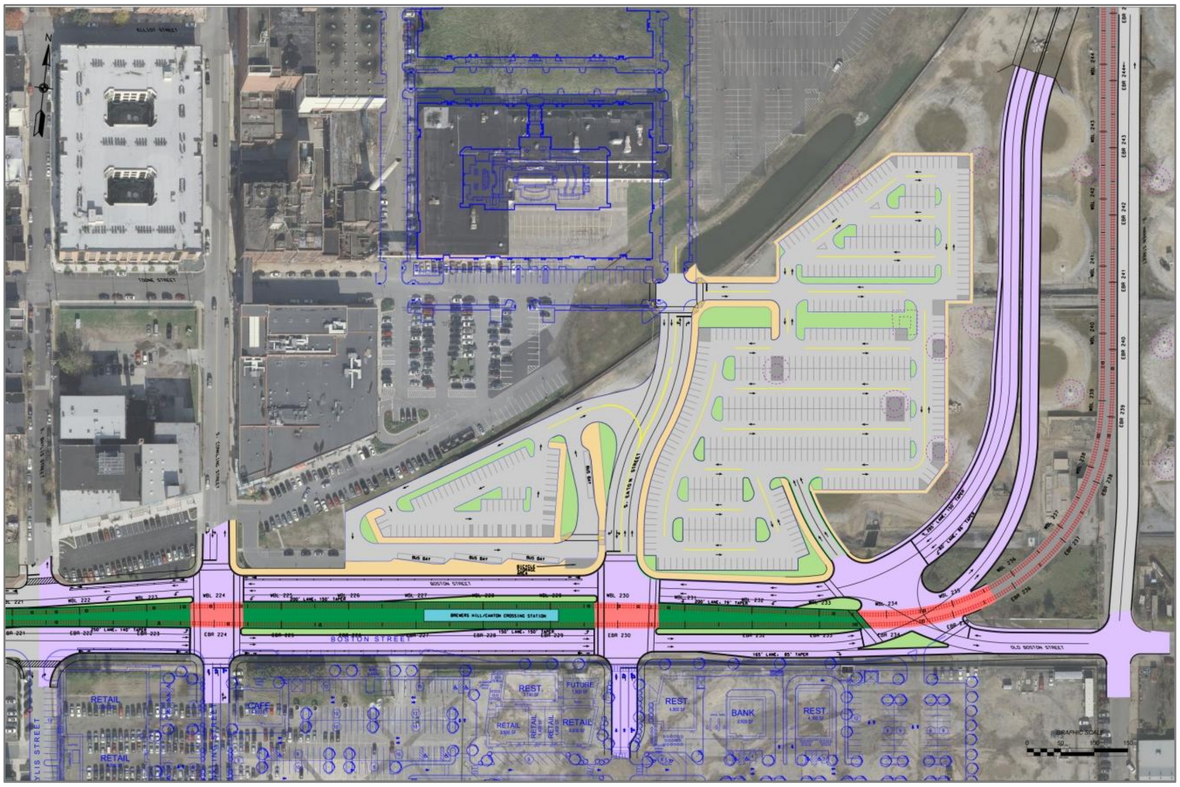


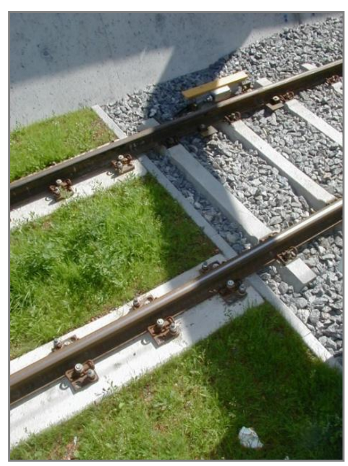
Table 2-4: Approximate Number of Parking Spaces Proposed at the Park-and-Ride Lots

Park-and-Ride Facility	Approximate Number of Parking Spaces
Security Square	325-375
I-70	650-700
West Baltimore MARC	700
Brewers Hill/Canton Crossing	500-600
Bayview MARC	650
Approximate total	**2825-3025**

e. Track Types

Four types of track are being considered for this project: ballasted, embedded, direct fixation, and green track.

- Ballasted track – consist of rail, fasteners, crossties, and the ballast/subballast bed and would be used in areas in the project study corridor such as on the I-70 right-of-way and along the NS freight tracks on the east side of the project study corridor.
- Embedded track – is completely covered/embedded, except for the top of the rail and would be used at roadway grade crossings such as intersections.



Green track transitioning to ballasted track

- Direct fixation – is a track construction method in which the rails are directly affixed to a concrete deck or base slab, and would be used for tracks on aerial structures and in tunnels.
- Green track – is defined as a transitway designed for plant material to grow alongside and in between the rails. Green track is being considered in the portions of the project study corridor through residential communities such as along US 40/Edmondson Avenue and in Canton.

f. Systems

In order to achieve effective, efficient operation of the Red Line, the Preferred Alternative would include traction power substations, communications, video surveillance, signaling, overhead catenary system, and fare collection.

Traction Power Substations

To provide electricity along the line for the light rail vehicles, 17 TPSSs are proposed and would be located along the alignment. The TPSS require approximately 45-foot by 85-foot sites plus access roads or driveways. A typical TPSS would be constructed of steel housing and depending on the location, could be surrounded by fencing, a brick wall, landscaping, or other forms of aesthetic barriers. Examples of existing TPSS for other light rail projects in the US are shown below.



The TPSS would be spaced along the alignment, approximately one mile apart. Two TPSS locations would be within underground stations and one location would be within the proposed OMF. Preliminary locations for TPSS sites have been identified for analysis in the FEIS document. These locations are shown on **Figure 2-22** and shown in greater detail in the plans included in **Volume 2**. Final substation locations would be determined during Final Design for the project.

Communications System

The MTA Red Line LRT would be designed with an integrated and robust voice, data, video, and wireless network system to fulfill the communications requirements of the project including connection to the Operations Control Center and supervisory control and data acquisition system. The communication system also includes passenger information system, passenger emergency assistance telephones and intrusion detection system being transported over wide area and local area networks fiber optic and copper cabling systems.

Video Surveillance System

A closed circuit television video surveillance system would provide security camera coverage as follows:

- Station ramps with cameras fixed at each end
- Station platforms with controllable pan-tilt-zoom cameras providing overall platform coverage
- Passenger assistance telephones included in the view of the PTZ station platform cameras
- A fixed camera for each cluster of ticket vending machines

The video surveillance system would be designed with sufficient scalability so that it may be expanded in the future by increasing the number of cameras and/or adding new camera locations as MTA determines necessary.

Signaling and Train Control

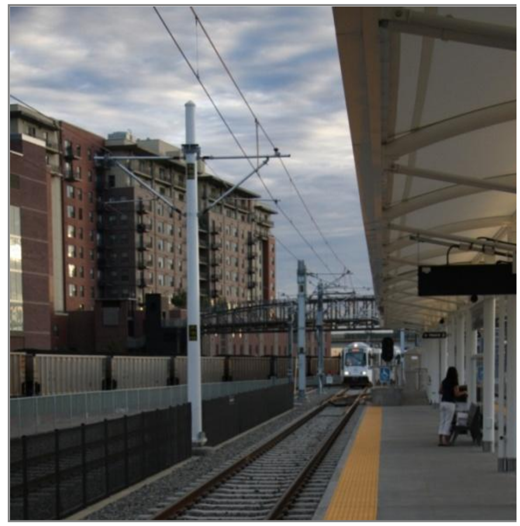
Cab signals, communication-based train control, or a combination of both would control the train on surface alignments, aerial sections and tunnels. In areas where no signaling is present (shared right-of-way, for example), these areas would be line-of-sight operation, where the light rail vehicle operator is responsible for the safe operation of the light rail vehicle.

Crossovers and Signal Central Instrument Houses

The signal central instrument house (CIH) contains elements of the signaling control system, circuits and equipment required for safe vehicle operation (see photo). Currently, eight CIHs are planned along the alignment. The distances between the signal houses vary and are based on the locations of the crossover tracks where light rail vehicles can switch tracks. Another factor that determines the location of the CIHs is the ability to have an unobstructed view between them. The CIH structures are prefabricated steel structures approximately 10 feet by 40 feet and 10 feet high. Preliminary locations for the CIH have been identified for analysis in the FEIS document. The CIH locations are shown on **Figure 2-22** and shown in greater detail on the plans included in **Volume 2**.

Overhead Catenary System

A continuous supply of electrical power is provided to the light rail vehicle by means of the overhead catenary system (OCS). This is achieved by the use of overhead conductors (electrified wires) centered over each track and supported by cantilever frame or support wire assemblies attached to steel poles, bolted to concrete foundations. The light rail vehicles collect current from the OCS by means of pantographs affixed to the top of the vehicles that are in continuous contact with the overhead conductors as the vehicles move along the alignment.


Center painted tapered tubular OCS pole – Denver Union Station

The configuration that is anticipated for the OCS throughout the Red Line alignment would be a "simple catenary" system, consisting of a contact wire suspended via hangers from a messenger wire. Refer to **Figure 2-23**. The standard system height (vertical distance from the contact wire to the messenger wire) is set to maximize the span lengths between supporting poles. The standard wire heights for the Red Line would be 18 feet for the contact wire and 21 feet-6 inches for the messenger wire. Utilizing this configuration, the maximum span length between poles on straight track would be 220 feet. This span length between supports would be reduced, as required, to accommodate track curvature, roadway intersections and other constraints along the alignment. Additionally, the wire heights would vary along the alignment based on local constraints, particularly low vertical clearances. In areas of restrictive vertical clearance, such as in tunnels and under bridges, the contact wire and messenger wire heights would be reduced to accommodate the restricted height. Typical OCS pole styles proposed for the Red Line would be tapered tubular and wide flange, depending on the surrounding alignment features. Wide flange poles with a galvanized finish would be utilized along industrial and open route sections of the alignment. In residential and commercial sections, tapered tubular steel poles would be employed. The tapered tubular poles would be painted to be consistent with surrounding features, including traffic signal poles and station elements, as shown in the photo example from Denver Union Station and in **Figure 2-23**.

The range of tapered tubular pole diameters is expected to be between 9 inches and 15 inches, depending on loading and electrical conduit space requirements. Wide flange poles between 8 inches and 14 inches deep are anticipated. While the heights of the poles would vary based on support and wire configuration, the standard pole height for center supported OCS is expected to be 24 feet.

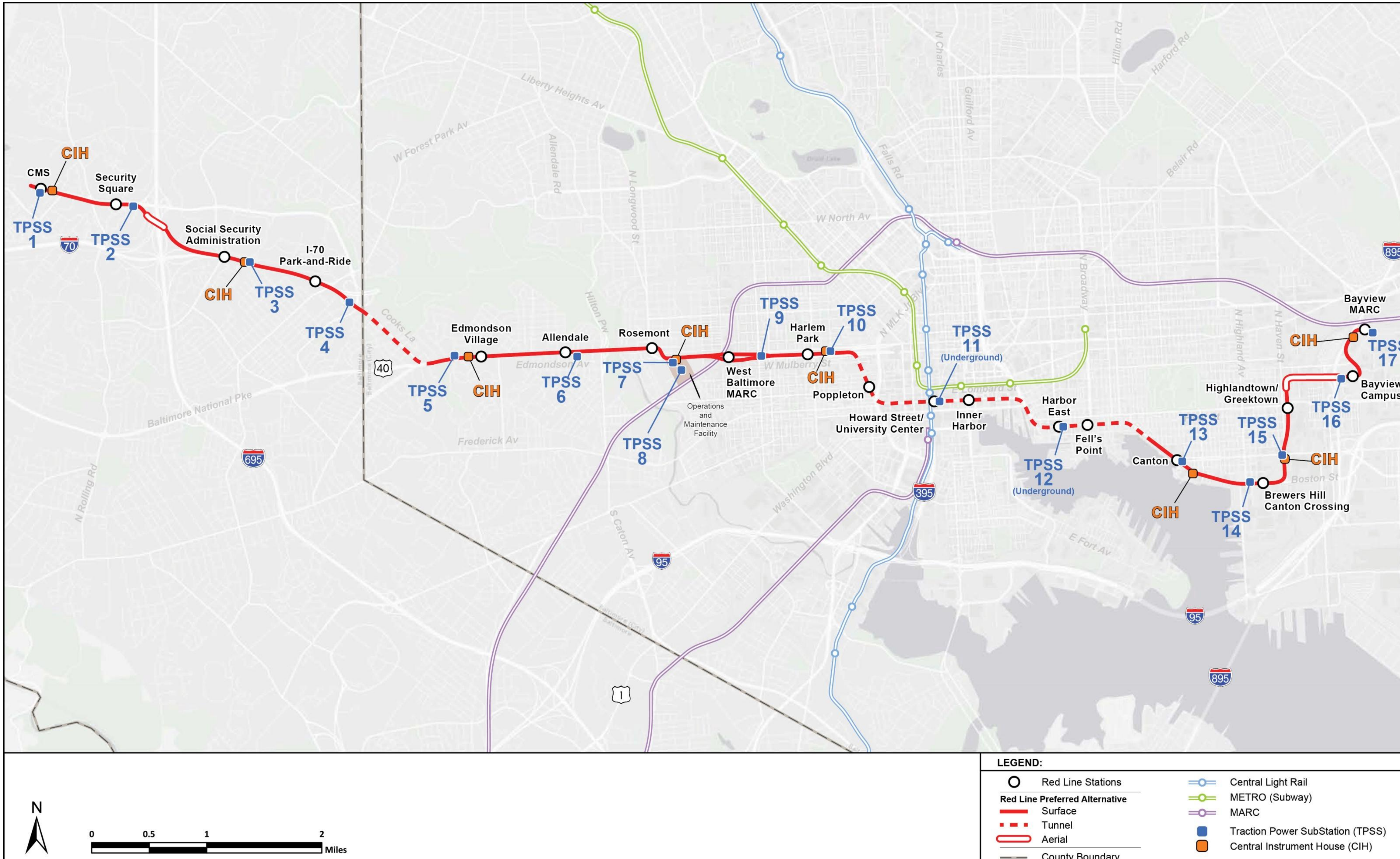
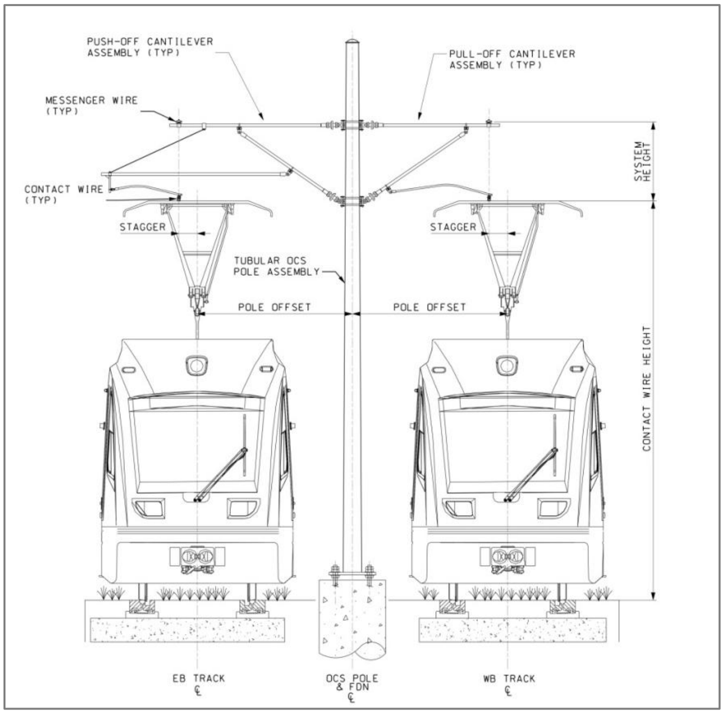


Figure 2-22: Proposed Locations for Traction Power Substations and Central Instrument Houses along the Red Line Project Study Corridor

Figure 2-23: Typical Simple Catenary with Tapered Center Support

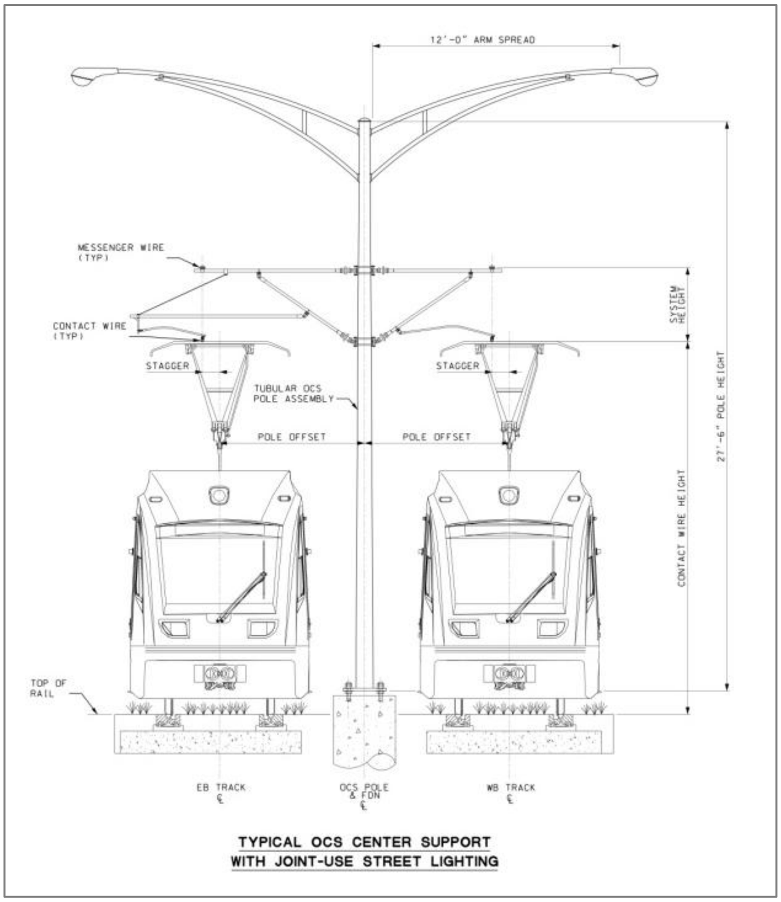


Wherever possible along the Red Line alignment, OCS poles would be located between the tracks allowing one pole, with back-to-back cantilever arms, to support the overhead conductors for both tracks. Additionally, to maximize efficiency and minimize visual impacts to the travelling public, street lighting luminaires and mast arms would be co-located on OCS poles wherever feasible and advantageous along the alignment. At these joint-use support locations, the OCS pole height would be increased to 27 feet-6 inches to accommodate the 30-foot standard luminaire height. The joint use OCS and Street Light are shown in the photo example from Portland, Oregon and in **Figure 2-24.**

Joint use OCS/street lighting pole – Portland LRT

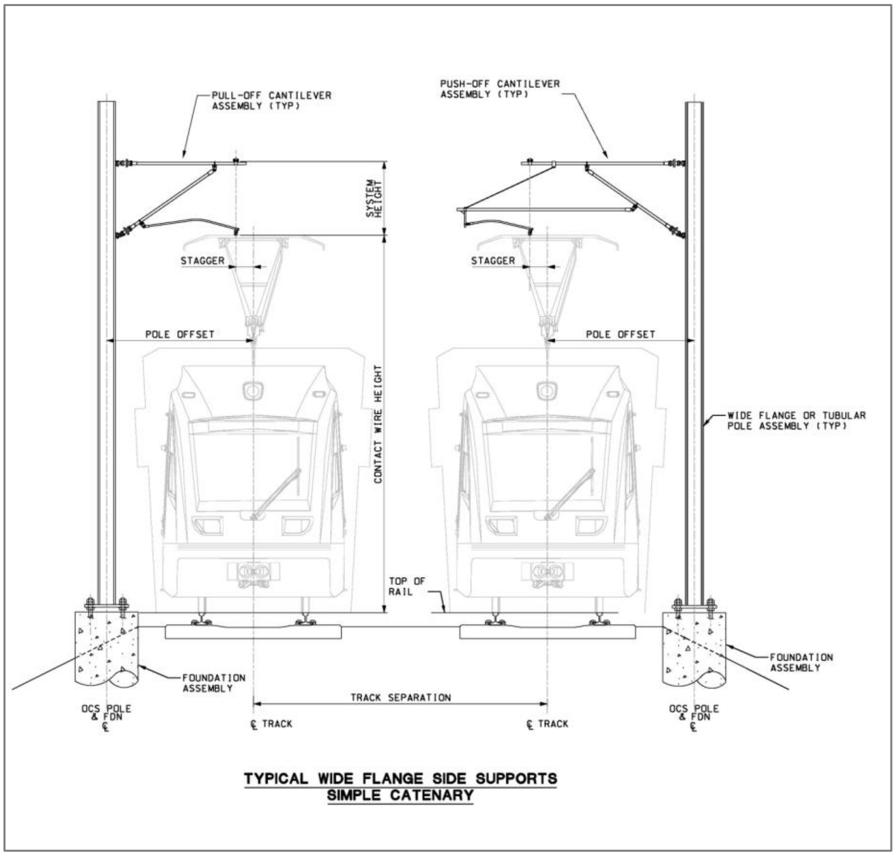
At locations where it is not feasible to place center supports, such as at locations where the tracks curve through an intersection, side poles with span wire support arrangements would be utilized to support the OCS. In these locations, the traffic signals and street lighting would be co-located with OCS poles, wherever practical, to reduce the impacts to the sidewalk areas. In tunnel sections, the OCS support structures would be affixed to the tunnel roof.

Figure 2-24: Typical Catenary with a Center Support and Joint-use Street Lighting



At locations where it is not feasible to place center supports, such as at locations where the tracks curve through an intersection and some station locations, side poles with span wire support arrangements would be utilized to support the OCS. Refer to **Figure 2-25**. In these locations, the traffic signals and street lighting would be co-located with OCS poles, wherever practical, to reduce the impacts to the sidewalk areas. In tunnel sections, the OCS support structures would be affixed to the tunnel roof.

Figure 2-25: Typical Catenary with Side Supports



Fare Collection

Red Line fare collection would use a similar methodology that exists for Baltimore's Central Light Rail Line. Ticket Vending Machines (TVMs) would be placed at all stations. The TVMs would be designed for the purchase of magnetic stripe tickets which could be in the form of a single trip ticket, round trip ticket, day pass, weekly pass, or monthly pass. The TVMs would be designed to accept cash, credit cards, or MTA Charm Card. For surface stations, the machines would be either on the platforms or pedestrian approaches to the platforms. Specific locations for each station would be determined in later design phases of the project. The number of TVMs would also be determined further into design. For underground stations, TVMs would be placed at station levels below the surface but above the level of the station platforms. The ability to place turnstiles in underground stations to allow for separation of the TVM area from the platform area would also be incorporated into the design of the stations. Should the MTA change their tariff or systemwide fare collection methodology in the future, the Red Line fare collection system would be adjusted accordingly.

f. Tunnel Ventilation and Fan Plant Facilities

Since the AA/DEIS, one of the key components further developed from additional engineering studies and a requirement for operation and safety underground, is a mechanical ventilation system. A mechanical ventilation system includes a combination of fans, air plenums, and air shafts that connect the tunnels and station platform areas to outside air. The tunnel ventilation system for the Red Line would provide acceptable air temperatures throughout the tunnels and underground stations under normal and congested operating conditions. During emergency conditions, such as a fire incident on a train in either the tunnel or the station, the ventilation system would assist in the movement of smoke and heat, facilitate passenger evacuation, and firefighting operations.

The emergency ventilation system would be developed in accordance with the latest edition of National Fire Protection Association (NFPA) 130, Standard for Fixed Guideway Transit and Passenger Rail Systems.

Under normal operating conditions, when trains are moving freely through the tunnels and stations during the warmer months, the ventilation approach would rely on the piston effect of moving trains to generate airflows that would exchange tunnel air with outside air and remove train-generated heat.

Under congested or perturbed conditions, when trains are stopped or moving slowly, the ventilation system would prevent tunnel air from reaching temperatures above the maximum design operating temperatures of the onboard equipment.

In the event of a tunnel fire involving a stopped train, the ventilation system would be operated to move fresh outside air toward evacuating passengers, thereby clearing the egress path of smoke. The egress path would lead to points of safety either in the adjacent tunnel, through cross-passageways spaced no more than 800 feet apart, outdoors via a portal or a station. Since the direction of passenger evacuation depends upon the location of the fire relative to the train, the ventilation system would be designed to move air over the length of the train, in either direction.

Cooks Lane Tunnel Segment

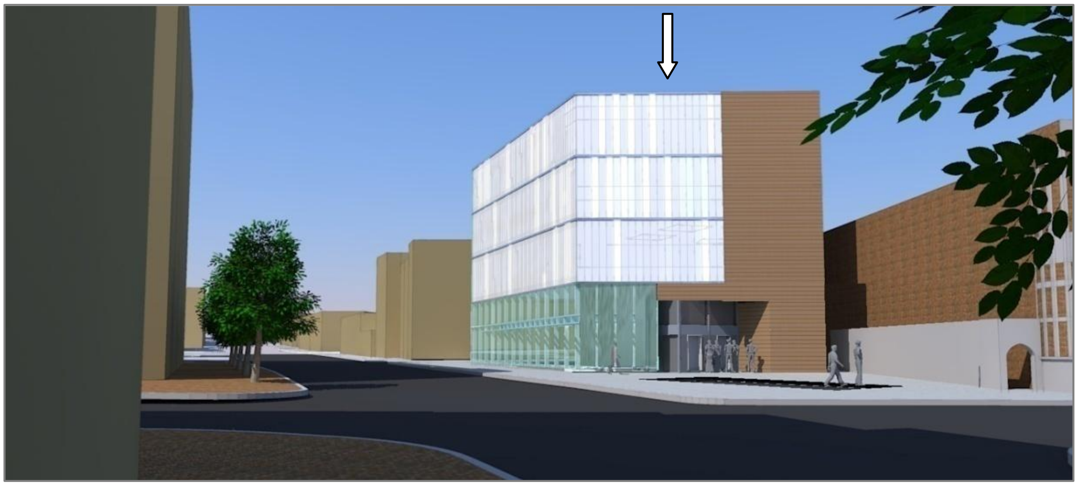
The ventilation system for the Cooks Lane Tunnel segment would utilize a jet fan system. Jet fans would be located over the length of the tunnel spaced no closer than 300 feet apart. Because of limited space in the tunnel above the light rail vehicle, the jet fans and sound attenuators would be located on the tunnel side wall, on the opposite side of the safety walkway. The jet fan system generates longitudinal airflow by intaking low velocity tunnel air and discharging it at high velocity (about 6,000 feet per minute). The jet fans would be reversible to allow airflow to be generated in either direction.

Downtown Tunnel Segment

To meet the ventilation objectives, the Downtown Tunnel segment would implement a design concept that employs station end fan plants. Each station facility would house two independent shafts, each containing two fans. Each shaft would connect to the tunnels at opposite ends of the station. The fans would be reversible to either supply air to, or exhaust air from, the tunnels. To remove train-generated heat during normal operations when trains are moving freely throughout the system, each shaft would include a fan by-pass system to allow the exchange of tunnel air with outside air.

The fan plant buildings would be up to 60 feet high depending on the station and the ventilation requirements. Each fan plant would be designed to be compatible with surrounding structures. The fan plants would contain the following internal components: transformers for power supply, staircases for access/egress, four fans, a battery room, and a series of silencers above the fans to attenuate their noise. Refer to **Figure 2-26** for a rendering of a typical ventilation structure.

Figure 2-26: Rendering of a Typical Ventilation Structure

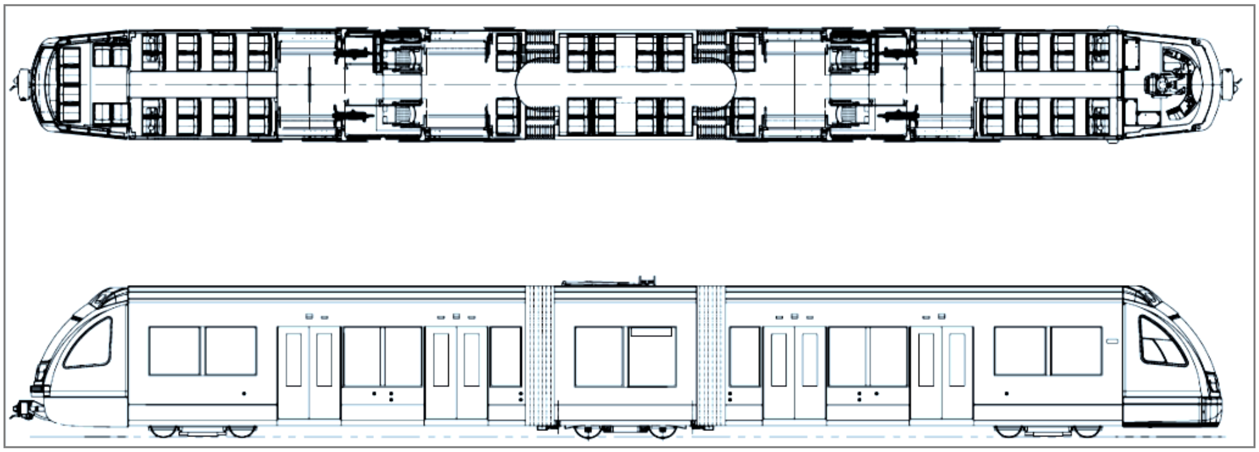


g. Light Rail Vehicles

The vehicles recommended for the Red Line are 70 percent low floor vehicles. The vehicle threshold, or floor, sits 14 inches above the rails at the same height of the station platforms. The 70 percent relates to the amount of passenger floor space within the vehicle that is the same height as the 14-inch station platform. The remaining 30 percent of floor space in the vehicle is located in higher sections at the ends of the vehicle which can be reached by steps or an inside ramp. These higher floor areas house the operator cabs and provide space for additional passenger seating. All doors would be located at the lower level.

In general, various parameters of an existing light rail vehicle design can be modified to best suit a particular customer's needs. The vehicles come in various sizes and can range from 92 to 95 feet in length. The width of the vehicles would be 8.7 feet. The number of doors varies, although three to six doors per vehicle side are typical arrangements. Most light rail vehicles today utilize sliding plug doors, which open to the outside of the vehicle, sliding along the vehicle side. **Figure 2-27** shows the seat and door arrangement of the light rail vehicle currently in operation in Portland, Oregon.

Figure 2-27: Seat and Door Arrangement of a Light Rail Vehicle Currently in Operation in Portland, Oregon



Seating arrangement possibilities are limited only by door locations and accessibility requirements for aisle widths, as well as under seat enclosures covering the wheels of the vehicle or equipment. Otherwise, the seating can be arranged to maximize vehicle capacity or passenger comfort. It is assumed that each Red Line vehicle would have 68 passenger seats, with additional room for over 100 standing passengers.

The exterior appearance of a vehicle can vary widely. Vehicle colors or wrapping can be customized to an agency's specific needs. Most car manufacturers also offer a variety of cab end designs for vehicles. The interior design of a light rail vehicle is somewhat flexible, and tends to be modern and vibrant, and featuring large windows throughout the vehicle. Examples of light rail vehicles in other US cities are shown below.

Minneapolis, Minnesota

Charlotte, North Carolina

Phoenix, Arizona

h. Operations and Maintenance Facility

The OMF is where light rail cars would be stored, maintained, and dispatched on their daily routes each day. The OMF would accommodate administrative and light rail operation functions for the Red Line. The site, as currently proposed, would be comprised of 11 existing parcels totaling 20.8 acres in Baltimore City. The OMF would be located along the south side of US 40/Franklin Street centered around Calverton Road between Franklintown Road and Warwick Avenue, and referred to as the Calverton Road site. Currently, these parcels support light industrial uses and would be compatible with the use as the OMF. Refer to the **FEIS Volume 2** for a plan of the proposed OMF.

Five locations for a Red Line OMF were studied in the AA/DEIS (refer to the *2008 LRT Storage and Maintenance Facility Technical Report*). The Calverton Road site was identified as part of the LPA. The Calverton Road site best met the operations and maintenance requirements of the proposed service and was selected because the site is:

- Compatible with existing Baltimore City zoning (Class M, manufacturing/industrial);
- Involves infill development not green field development;
- Centrally located along the alignment;
- Adjacent to an active railroad which offers the possibility of a rail connection to the Red Line, and construction and maintenance materials can be delivered by rail;
- Of adequate size to provide the required features of two lead tracks from the main track, parking for MTA employees, and stormwater management; and
- The majority of the parcels are State and City owned, reducing the number of business relocations required.

At the Calverton Road site, the Red Line OMF would be comprised of three main buildings, light rail track into and out of the facility site, three CIHs, and two TPSSs for the mainline and the site, and a covered fuel station. There would be an area for employee and visitor parking totaling approximately 200 spaces, and the site would be secured and fenced.

The primary activities of the OMF would include:

- Primary access for trains into and out of the yard from the eastbound and westbound mainlines for insertion into revenue service, mid-day storage of vehicles and end-of-day storage of vehicles;
- Train storage for 26 vehicles in the yard that can be expanded to 34 and another ten vehicles inside the maintenance building;
- Train wash facility;
- Yard control on the 2nd floor of the Facilities Maintenance and Transportation Building;
- Welfare facilities for personnel;
- Service and inspection tracks;
- Heavy repair tracks;
- Yard storage that allows for sanding and interior cleaning;
- Fueling for support vehicles;
- Storage for equipment and material;
- Access roadways and parking; and
- Stormwater management.

The maintenance building would include the administrative functions for the Red Line including: operations staff offices, dispatcher work stations, information center, employee break room and/or lunchroom, driver area with lockers, showers, and restrooms. Drivers would use the maintenance building as their home base.

The storage yard portion of the facility is the point of origin and termination for Red Line service. The storage yard includes storage for up to 34 light rail vehicles and MTA support vehicles and a covered exterior storage building.

The maintenance building would include maintenance and repair shops, a body shop, paint booth, interior vehicle cleaning, and exterior car washing. All LRT drivers and other MTA employees would report to this building every time they come to work.

The overall storage and maintenance facility site as currently programmed would include approximately 77,000 square feet of parking, 12,000 square feet of exterior support spaces, 62,700 square feet of light rail vehicle storage, and 251,000 square feet of lead tracks. The MTA would operate three shifts at this facility for some departments. Approximately 300 employees could work out of this facility. Examples of light rail OMFs in other US cities are shown below.


Tampa, Florida


Denver, Colorado


Charlotte, North Carolina

2.5 Operations

The operating plan for the Preferred Alternative includes a light rail operating plan and a feeder bus service plan.

2.5.1 Rail Operations Plan

The development of the Red Line Operating Plan required the project team to set a number of assumptions upon which to build the plan. The basic assumptions that were established are as follows:

- Peak headways would be 7 minutes.
- All trains would stop at all stations.
- Station dwell times would be either 15 seconds or 20 seconds, depending on forecasted ridership at the specific station.
- Terminal recovery time would be between 6 and 10 minutes depending on time of day.
- No other rail service would operate on or across the alignment.
- Train operator change point would be at a passenger station.
- All vehicles would be stored and serviced at the OMF each day/night.

- Vehicle requirements would meet current design criteria for acceleration and deceleration.
- Trains departing and returning to the yard would carry passengers between the OMF and initial terminal.
- Portions of the MTA Red Line surface alignment, aerial sections and tunnels would be controlled by either cab signals, communication based train control or a combination of both. Other portions of the alignment would be line of sight operation.
- Mainline universal crossovers would be located to provide 10 minute run times for single track operations, where practicable.
- Vehicles would have low-level boarding floors with 70 percent low floor.
- Tail tracks would be provided at east and west end terminals.

The Red Line would operate seven days per week. Monday through Saturday service would run from 5:00 AM to 1:00 AM, and on Sunday service would run from 10:00 AM to 10:00 PM. There would be 243 trains operating every weekday and 139 trains operating on each weekend day. Headways would be between 7 minutes and 15 minutes, depending upon time of day. **Table 2-5** presents proposed service headway for Design Year 2035.

Table 2-5: Proposed Design Year 2035 Service Headways for Weekday and Weekend/Holiday Service

Monday - Saturday		Sundays and Holidays	
5:00 AM to 6:00 AM	15 minute headways	–	–
6:00 AM to 9:00 AM	7 minute headways	–	–
9:00 AM to 3:30 PM	10 minute headways	10:00 AM to 3:30 PM	10 minute headways
3:30 PM to 6:30 PM	7 minutes headways	3:30 PM to 6:30 PM	10 minute headways
6:30 PM to 9:00 PM	10 minutes headways	6:30 PM to 10:00 PM	10 minutes headways
9:00 PM to 1:00 AM	15 minutes headways	–	–

The proposed operating schedule has been developed to accommodate approximately 55,000 daily riders in 2035. The end-to-end travel time is estimated at 45 minutes. The station-to-station travel times assumed for a weekday in the opening year (2021) of the Preferred Alternative are shown in **Table 2-6**.

Table 2-6: Station-to-Station Travel Times – Weekday 2021 (shown in minutes)

Station	Eastbound Travel Times	Westbound Travel Times
CMS	–	4
Security Square	3	2
Social Security Administration	3	2
I-70 Park-and-Ride	2	4
Edmondson Village	3	2
Allendale	3	4
Rosemont	3	3
West Baltimore MARC	4	3
Harlem Park	3	2

Table 2-6: Station-to-Station Travel Times – Weekday 2021 (shown in minutes)

Station	Eastbound Travel Times	Westbound Travel Times
Poppleton	2	2
Howard Street/University Center	1	1
Inner Harbor	1	2
Harbor East	3	1
Fell's Point	1	2
Canton	2	4
Brewers Hill/Canton Crossing	3	3
Highlandtown/Greektown	3	2
Bayview Campus	3	2
Bayview MARC	2	–
Total End-to-End	**45**	**45**

All trains would consist of two light rail vehicles. Each train would be staffed with one train operator. All station platforms would accommodate the two car trains.

There would be 54 at-grade crossings in the project study corridor controlled by traffic signal, pedestrian signal, stop sign, or flashers and gates. The flashers and gates would be used at the entrance to the Operations and Maintenance Facility, at the Parallel Drive connector, on Haven Street, on Cassell Drive, and on Bayview Boulevard at Alpha Commons Transitway. For additional information on the intersection controls proposed for Red Line operation, refer to **Chapter 4**.

2.5.2 Bus Operations Plan

Refer to **Chapter 4, Section 1** of this FEIS for a summary of the bus operations plan proposed for the Red Line.

2.5.3 Fare Structure

Red Line light rail service would be integrated into MTA's systemwide transit service in the Baltimore Region, complementing existing MTA Bus, Metro, Central Light Rail, and MARC service. In addition to service integration, it is intended that the fare structure for the Red Line, as well as the methods of fare collection, would be consistent with the fare structure and collection within the MTA transit system.

Fares for the Red Line would be consistent with systemwide fares in place at the time of opening. Currently those fares are $1.60 per single trip, $3.50 for a day pass, $16.50 for a weekly pass, and $64.00 for a monthly pass. Reduced fares for seniors, persons with disabilities, and students would apply, consistent with reduced fares in place at the time of opening. For connections with other MTA services such as Local Bus, Central Light Rail, or Metro, Red Line patrons would need a day pass, weekly pass, or monthly pass, or additional $1.60 single trip fares would need to be paid. For connections with MARC, appropriate MARC fare media would be needed.

2.6 Summary of Project Costs

The cost estimate for the Preferred Alternative in 2012 dollars is $2.223 billion. A cost estimate is also developed based on the construction schedule, escalation, and inflation while the Red Line is being constructed. The cost estimate at the start of Red Line service in 2021 is $2.575 billion in year of expenditure dollars. A detailed breakdown of the project costs in current and year of expenditure dollars according to the FTA standard cost categories (SCC) is shown in **Table 2-7** below.

Table 2-7: Project Cost Estimate in 2012 and 2021 Year of Expenditure Dollars by FTA Standard Cost Categories

FTA Standard Cost Category	2012 Dollars Total (in millions)	2021 Year of Expenditure Dollars (in millions)
10 Guideway & Track Elements (14.1 miles)	$777	$900
19 Stations, Stops Terminals Intermodal	$378	$452
30 Support Facilities: Yard, Shops, Admin. Buildings	$74	$86
40 Sitework & Special Conditions	$163	$185
50 Systems	$177	$216
60 Right-of-Way Land, Existing Improvements	$67	$70
70 Vehicles (28)	$126	$146
80 Professional Services (applies to Categories 10-50)	$387	$430
90 Unallocated Contingency	$74	$89
100 Finance Charges	$0	$0
Total Project Costs (10-100)	**$2,223**	**$2,574**

For additional information on the project cost refer to the *Red Line Project Re-Baseline Report*, **Appendix D**.

3. Construction Methods and Activities

3.1 Introduction and Methodology

This chapter describes the anticipated construction methods, activities, and sequencing that are reasonably expected by the Maryland Transit Administration (MTA) to be employed and undertaken during the construction of the proposed Baltimore Red Line project (also, referred to as the Preferred Alternative in **Chapter 2** of this Final Environmental Impact Statement (FEIS)). This chapter describing construction methods and activities is new and was not included within the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS). Detailed discussions of the potential environmental effects and impacts that may be associated with construction activities and recommended measures to mitigate or minimize such effects are identified in the subsequent transportation and environmental resource chapters of this FEIS (**Chapters 4** and **5**).

A number of construction methods could be used to build the Light Rail Transit (LRT) system, depending on geological and environmental conditions, cost, schedule, alignment, and other factors. At the time of preparation of this FEIS, the Red Line project is undergoing Preliminary Engineering and detailed project design and construction information is still being developed. Thus, construction methods and activities described in this chapter are based on conceptual studies, as well as other projects of a similar nature with regard to construction methods and activities. As such, these methods and activities will continue to be refined during Final Design, which occurs after completion of the National Environmental Policy Act (NEPA) process. For example, some of the initial construction methodology may change as the design develops, particularly since the construction contracts for the project could be issued as Design-Build or Design-Bid-Build, as well as other delivery methods.

This chapter presents a description of the construction process for the purposes of quantification of environmental-effect causing activities only. ***This FEIS chapter is not intended to describe the precise construction methods that may ultimately be used, nor is it intended to dictate or confine the construction process.*** Actual construction methods and materials may vary, depending in part on how the construction contractors choose to implement their work to be most cost effective, within the requirements set forth in bid, contract, and construction documents, as well as to comply with mitigation requirements.

The construction of the Preferred Alternative would generally use conventional construction techniques and equipment currently used in the Baltimore-Washington DC region and throughout the United States. Major project elements include new construction of surface track, aerial guideway, at-grade station platforms, an operations and maintenance facility (OMF), tunnels, portals, underground stations, ventilation facilities, crossovers, and installation of specialty system work such as traction power, communications, and signaling.

The MTA construction specifications will require that construction contractors comply with applicable environmental regulations and obtain necessary permits for the duration of construction. Construction of the project will follow applicable federal, state, and local laws for building and safety, as well as local noise ordinances, as appropriate.

In an effort to avoid and/or minimize potential adverse effects during construction of the project, a number of environmental commitments and mitigation measures have been identified, which construction contractors will be required to follow. As such, these environmental commitments and mitigation measures will be included as part of the project's construction contracts and/or permit conditions. These environmental commitments and mitigation measures are identified as applicable, within the construction impact discussions of the transportation and environmental resource chapters of this FEIS (**Chapters 4** and **5**).

This chapter is organized as follows:

Section 3.1 – provides a description of construction analysis year, peak construction years, schedule, and working hours.

Section 3.2 – presents an overview of the proposed construction methods of the project's surface and aerial design segments.

Section 3.3 – presents a description of the construction methods of the underground design segments and activities.

Section 3.4 – presents an overview of the construction staging areas and access shafts, including muck removal operations in support of the underground construction elements

Section 3.5 – provides a description of how and where access could be limited during construction activity periods.

Section 3.6 – includes a general description of the improvements that would be made after the LRT construction is completed.

Section 3.7 – presents a description of the environmental compliance plan that would be prepared to identify and describe the management of environmental commitments and mitigation measures during the Final Design and Construction phases of the project.

Section 3.8 – includes a list of commitments and mitigation measures related to the proposed construction methods and activities, as described within this chapter.

3.1.1 Construction Analysis Year – 2016

For construction projects that extend over multiple years, a peak year is identified to isolate the greatest potential for adverse effects.

Construction of the Preferred Alternative is anticipated to begin in 2014 and to finish in 2021, with revenue operations beginning in 2021. The peak construction year for construction impact analyses has been identified as 2016, which is based upon the greatest manpower and diesel-equipment utilization estimates including the greatest number of truck trips to and from the various construction sites through the project study corridor – the general study area for the Preferred Alternative including the project's proposed limit of disturbance. As design of the project progresses, the construction schedules and assumptions may be refined.

Construction of the tunnels and underground stations (cut-and-cover construction of the openings for each underground station), along with related LRT systems construction, are the longest duration activities within the overall project schedule and comprise the project's critical path to completion. It should be noted that construction methods and sequences would be left to the discretion of the construction contractors. However, contractors will be required to comply with environmental commitments and mitigation measures that are included in this FEIS and Record of Decision (ROD), unless modified with approval of the Federal Transit Administration (FTA) and other appropriate regulatory agencies.

3.1.2 Study Area for Construction Activities and Effects

The areas that may be most affected by construction activities generally comprise the area immediately bordering the construction activity. However, in some cases, effects from construction activities extend beyond the immediate area surrounding construction sites. For these reasons, the project study area for construction impact analyses may vary for each construction-related activity and each FEIS discipline as further discussed in the respective transportation and environmental discipline sections within FEIS **Chapters 4** and **5**. For example, the traffic effects of delivering or transporting material off site includes a bigger study area than the study area for the noise effects of constructing a station box.

3.1.3 General Description of Major Construction Activities and Equipment

The various work activities to be performed over an estimated 7-year construction period would include the following facility and system items:

- Construction of a double-track alignment beginning at the Centers for Medicare & Medicaid Services (CMS), the west terminus, and ending at Bayview MARC, the east terminus
- Construction of tail tracks for light rail vehicles at CMS Station and Bayview MARC beyond the operating limits of the Red Line
- Construction of an OMF for storage of up to 38 light rail vehicles
- Construction of a traction power system including overhead catenary system (OCS), traction power substation (TPSS), and central instrument houses (CIH)
- Construction of track crossovers to enable single track operations, as needed
- Construction/modification of aerial structures: I-695, Woodlawn Drive, Ingleside Avenue, Eastern Avenue, Norfolk Southern (NS)/CSX/I-895
- Construction of 19 stations (14 surface and 5 underground)
- Construction of ventilation system elements including ventilation buildings, fans, air plenums, and shafts for the underground sections
- Construction of three park-and-ride lots: Security Square, I-70 and Brewers Hill/Canton Crossing
- Demolition of existing structures
- Construction of protective measures for adjacent utilities and structures
- Construction of retaining walls for bridges and tunnel portals approaches

- Construction of tunnel segments by tunnel boring machines (TBMs)
- Cut-and-cover or open-cut construction of portal structures, tunnel sections, and underground stations
- Relocation, modification, or protection of utilities in conflict or impacted by excavations for street-level track work, tunnels, bridge, and station construction
- Construction of level boarding station platforms at street-level locations using typical “cast-in-place” or pre-cast concrete construction methods
- Construction of both surface drainage and sub-drainage systems
- Installation of intersection controls including traffic signals, pedestrian signals, flashers, and gates
- Construction of station finishes, such as canopies, shelters, ticket vending equipment, agent booths, station furniture, ramps, escalators, etc.
- Modifications to existing buildings, as required, to protect them from the effects of adjacent construction

The types of equipment that would be used for construction activities include various earth-moving apparatus (excavators, graders, bulldozers, loaders, etc.), cranes, pile drivers, augers, drilling equipment, compaction rollers and tampers, concrete trucks, pumping equipment, generators/compressors, and various types of trucks (flat bed, dumps, trailers, etc.).

3.1.4 Proposed Construction Scenario and Schedule

The LRT construction could involve an approximately 7-year period. This includes 18 months for utility relocations, 6 years of construction and approximately 9 months of testing and pre-revenue service activities.

LRT construction is likely to begin simultaneously at several locations within the project study corridor to accommodate areas requiring lengthy construction times, such as tunnels, underground stations, and aerial segments. Surface streets throughout the project study corridor could be impacted for a total of approximately 48 months.

A representative sequence of construction is shown in **Table 3-1.** The time necessary for each activity would vary depending upon such factors as work hours, traffic restrictions, and contractors’ means and methods. Other factors would include the number and type of utilities requiring relocation, and location and condition of nearby surface and subsurface structures.

3.1.5 Construction-Working Hours

- <u>Surface Segments</u>: Typical construction activities will generally be limited to 6 days a week, 15 hours per day. There would be times when certain construction activities could take place during weekends or other times.
- <u>Underground Segments</u>: Typical construction activities for the underground sections, which include portal areas, stations, ancillary buildings, and tunneling, will be performed

7 days a week, 24 hours per day. Work activities will be performed both at surface and below ground and may include areas in between station and portal sites.

- Trucking: Trucking will be permitted only on designated truck routes and may occur up to 24 hours a day, 7 days a week.

Table 3-1: Typical Sequence of Construction Activities

Activity	Tasks	Average Time Required (months)
Pre-construction Survey	Locate utilities, establish right-of-way and project control points and centerlines and relocate survey monuments	6 months
Site Preparation	Relocate utilities and clear and grub right-of-way (demolition), widen streets, establish detours and haul routes, erect safety devices and mobilize special construction equipment, prepare construction equipment yards and stockpile materials, install monitoring instrumentation for tunneling, implement ground improvements, underpin existing building, and establish maintenance of traffic	18 months
Heavy Construction	Excavate and construct the tunnel portals, tunnels, and underground stations Construct the aerial structures, including foundation elements, construct surface trackway, reconstruct adjacent roadways and sidewalks	52 months
Medium Construction	Lay track work, construct surface stations, install drainage, minor earthwork, and roadway paving	26 months
Light Construction	Finish work, install system elements (electrical, signal and communications), street lighting, landscaping, signage and striping, close detours, clean-up and test system	24 months
Pre-revenue service	Test communications, signaling and ventilation systems, training of operators and maintenance personnel	9 months

3.2 Overview of Construction Methods and Activities – Surface Segments

As described in detail in **Chapter 2** of this FEIS, the proposed LRT system includes three surface segments oriented in a west-to-east direction: West segment, US 40 segment and East segment. These surface design segments include construction of surface and aerial guideways and trackwork (including crossovers), station platforms, an OMF, and installation of specialty system elements such as traction power substations, communications facilities, and signals equipment. The following sections describe the proposed construction activities to be undertaken within these surface segments, including construction staging areas to support these activities.

3.2.1 Construction Staging Areas for LRT Surface and Aerial Segments

Construction staging areas, also referred to as "laydown areas," are sites that are used for the storage of materials and equipment, and other construction-related activities, such as assembly of concrete forms and reinforcing steel cages. Work zones are those areas where the construction is occurring. Field offices for contractors and construction managers would be situated in temporary job site trailers at staging areas or existing office space near the work areas.

Staging areas are typically fenced and are often lit for security. Staging areas of adequate size and proximity to the alignment are essential to minimize construction traffic through the project study corridor and to provide adequate space and access for construction activities. Because of the dense urban environment of Baltimore, very few vacant parcels are available within close proximity to the proposed alignment that could be used for staging areas.

Potential construction staging areas for the LRT surface design segments are identified below in **Table 3-2** and shown on **Figures 3-1** through **3-3**. If the contractors choose to obtain and use additional staging areas, they will be required to obtain the necessary permits and approvals from applicable federal, state, and local regulatory agencies.

3.2.2 Utility Relocations

Utilities impacted by project construction typically include water, sewer, gas, electric conduits and ductbanks, telephone conduits and ductbanks, steam, chilled water, cable television, and fiber optic. As such, prior to beginning construction activities it is necessary to relocate, support, or protect utilities and underground structures, which conflict with excavations for street-level trackwork, stations, and systems elements.

Depending on the extent of utility relocation work, estimated construction durations for utility relocation activities are 12 to 18 months for each surface segment of the Preferred Alternative alignment. Temporary interruptions in services could be experienced during re-location or re-routing of utilities. To minimize scheduling conflicts and coordination issues during construction, it is anticipated that numerous utility relocations would occur prior to the start of major construction activities. Please refer to FEIS **Section 5.20** for more details as to the anticipated construction-related effects and mitigation to utility services and providers within the project study corridor.

Table 3-2: Proposed Construction Staging Areas – LRT Surface and Aerial Segments

Staging and Site Designation	Staging Area	Location	Construction Activities and/or Work Area Supported
West Segment (Refer to Figure 3-1)			
1-1	CMS	Wooded area at the end of Security Boulevard behind Chadwick Elementary School	Road widening; track and TPSS construction
1-2	Security Square Mall	Existing paved area between Lord Baltimore and Belmont Drives (future park-and-ride)	Road widening; track, I-695 Bridge, and TPSS construction
1-3	East of I-695	Existing parking area for Social Security Administration West	Road widening; track and I-695 Bridge construction
1-4	Proposed I-70 Park-and-Ride	Wooded area between Parallel Drive and I-70 (future park-and-ride)	Road widening; track and TPSS construction
1-5	Existing I-70 near Security Boulevard	Excess pavement between east and westbound lanes	Road widening; track, and TPSS construction
US 40 Segment (Refer to Figure 3-2)			
3-1	Operations and Maintenance Facility	Between Franklintown Road and Warwick Avenue on Franklin Street	Construction of proposed operations and maintenance facility
3-2	US 40 Lower Level	Between North Fulton Avenue to North Schroeder Street – on north side of proposed LRT alignment	Road widening; track and TPSS construction
3-3	Median of US 40 Lower Level	Between North Fulton Avenue to North Schroeder Street – on south side of proposed LRT alignment	Road widening; track and TPSS construction
East Segment (Refer to Figure 3-3)			
5-1	Proposed Traction Power Substation	Boston Street between South Highland Avenue and South Baylis Street	Road widening, track, and TPSS construction
5-2	Brewers Hill/Canton Crossing Park-and-Ride	Former Exxon Tank Farm bounded at intersection of South Conkling Street and South Boston Street	Road widening, track, and park-and-ride lot construction
5-3	Norfolk Southern Rail Right-of-Way	Norfolk Southern Right-of-Way east of South Haven Street, south of Eastern Avenue	Track and Greektown viaduct construction

Table 3-2: Proposed Construction Staging Areas – LRT Surface and Aerial Segments

Staging and Site Designation	Staging Area	Location	Construction Activities and/or Work Area Supported
5-4	Viaduct West	Norfolk Southern Right-of-Way and Cross Wiping Cloth Company, 4201 E. Pratt Street	Track and Greektown viaduct construction
5-5	Viaduct East 1	Grass area between Ponca Street and Oldham Street, south of Lombard Street	Greektown viaduct construction
5-6	Viaduct East 2	MTA parking lot east of Ponca Street, south of I-895 ramps	Greektown viaduct construction

3.2.3 Roadway Widening, Reconstruction, At-Grade Crossing Construction and Trackwork

Roadway work along the surface alignments would include the reconfiguration of the existing medians, travel and parking lanes, as well as construction of at-grade crossings to accommodate the LRT alignment. Along portions of these surface segments, roadways would need to be widened/shifted or reconstructed to accommodate the alignment. The locations of street widening, reconstruction, and at-grade crossing construction are illustrated in **Volume 2 Environmental Plate Series, Plate Series 1**.

Street reconstruction at the proposed at-grade crossing locations allows for the placement of the track slab and rails, as well as for modification of existing curbs, gutters, and sidewalks to accommodate the rail crossings. Where applicable, existing curbs, gutters, and sidewalks would need to be demolished and reconstructed. LRT track construction would include the installation of fixed guideway elements, such as ballast, railroad ties, steel rails, and other related track items.

Roadway widening, reconstruction, and at-grade crossing construction work would include lane closures, sidewalk closures, access and parking restrictions, turn restrictions, and temporary roadway closures. Street and lane closures may be necessary during construction of the project including closures during nights and weekend. More details regarding operational effects to the roadways along the surface segments of the project are contained in **Section 4.2** of this FEIS.

Property owners and access to residences and businesses located immediately adjacent to these work areas would be affected. MTA will develop and implement a property access management plan working with the contractors and the affected property owners. The duration of LRT construction within the roadways is estimated at 24 to 30 months for each surface design segment.

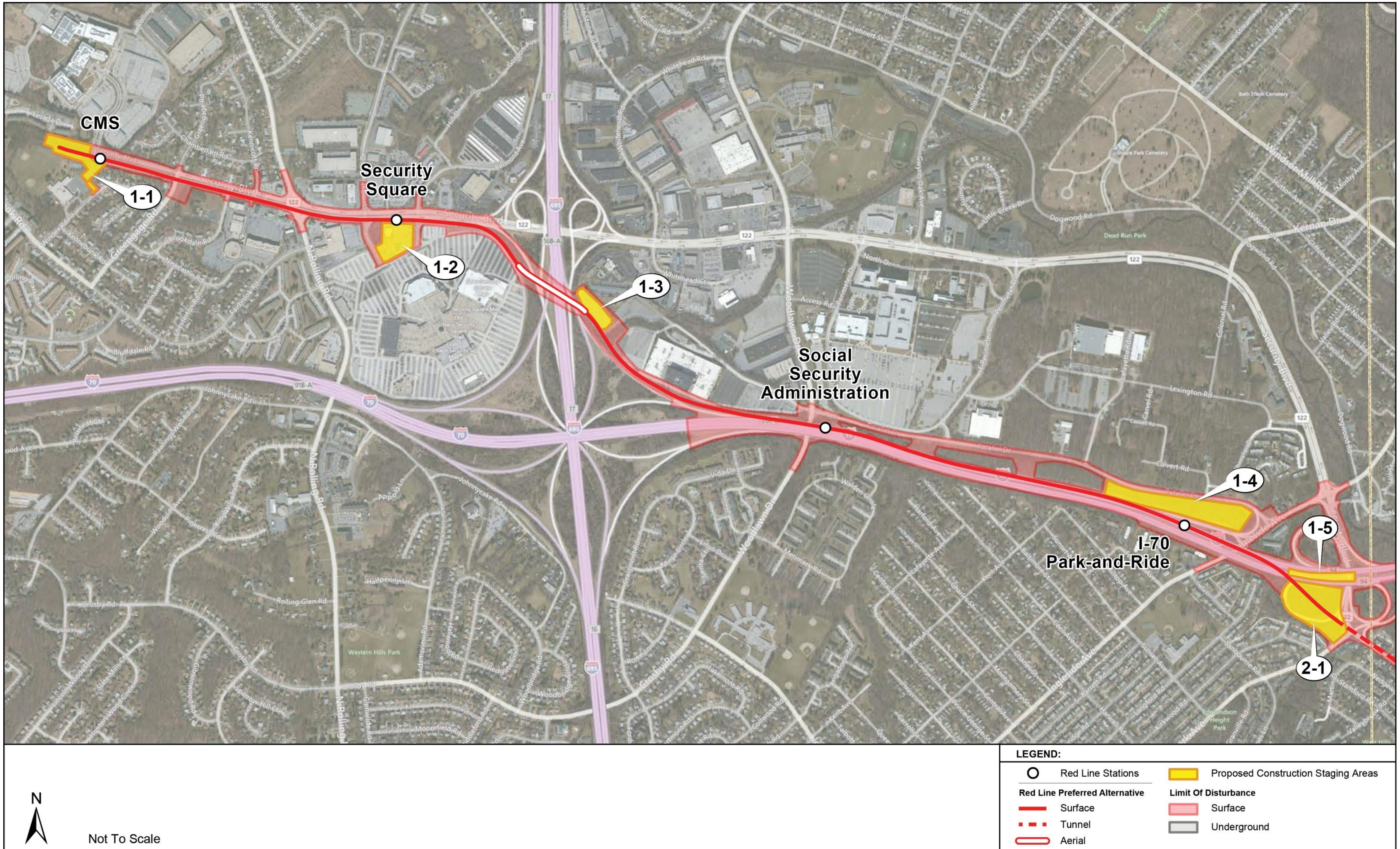


Figure 3-1: Proposed Construction Staging Areas – West Segment

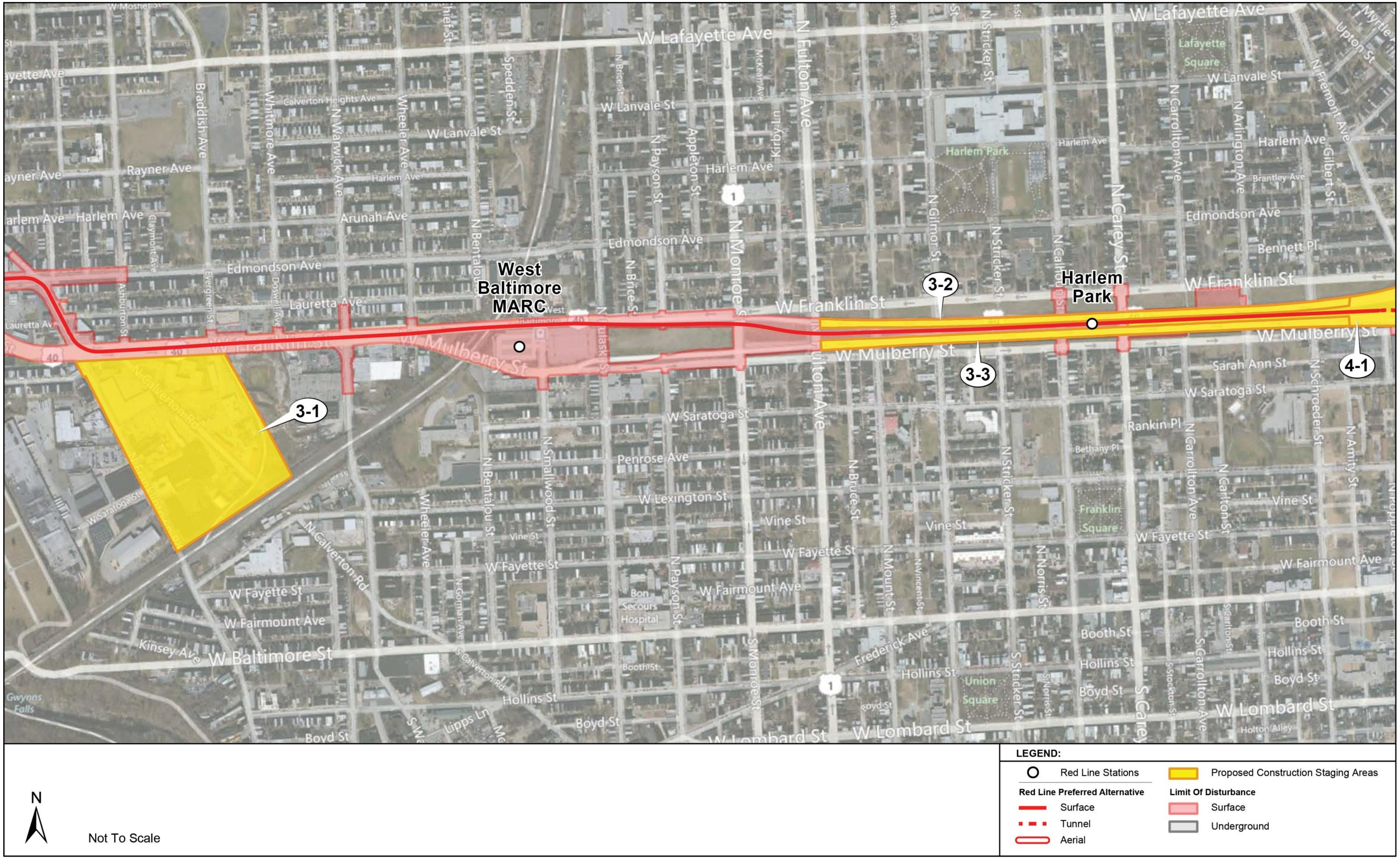


Figure 3-2: Proposed Construction Staging Areas – US 40 Segment

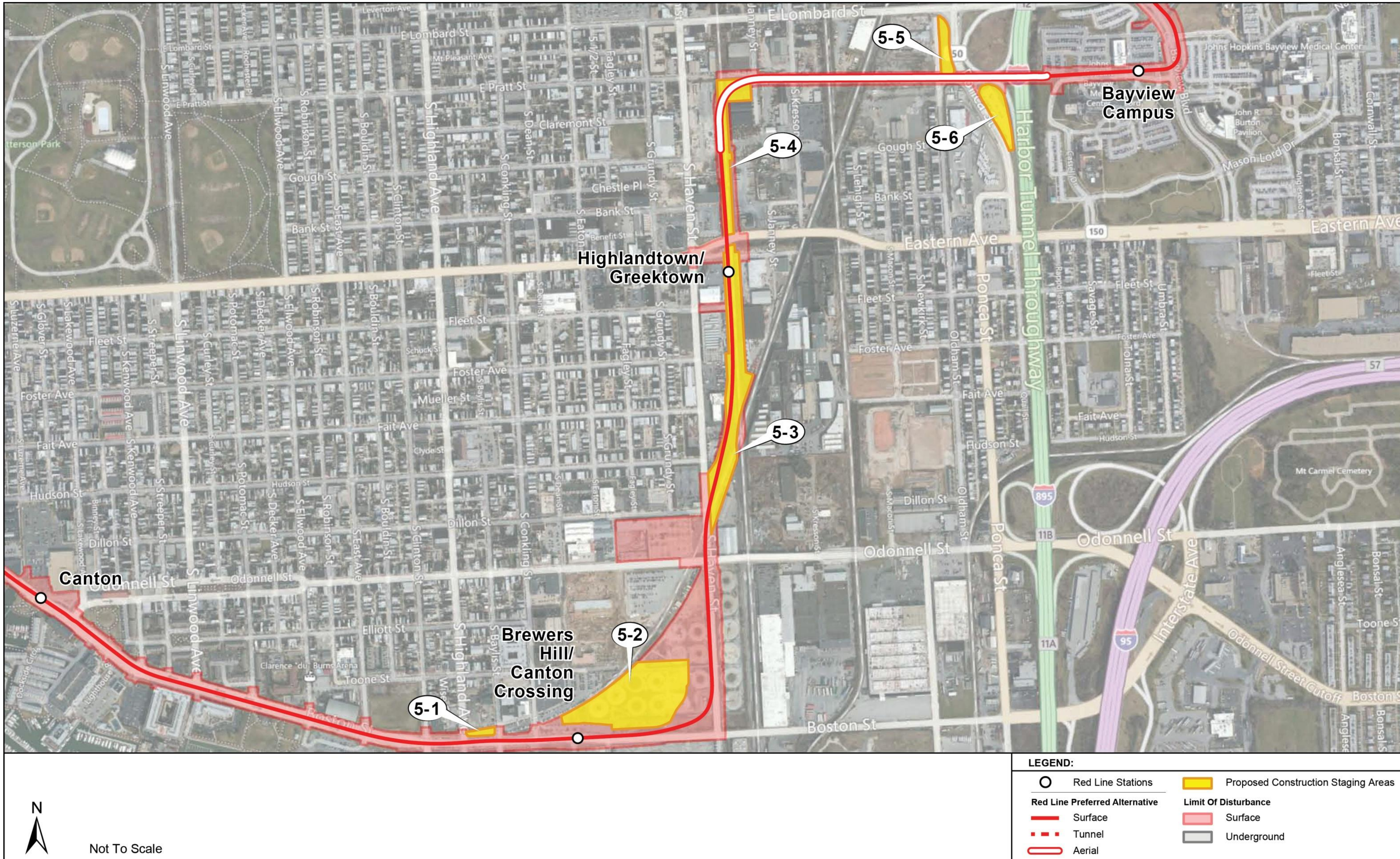


Figure 3-3: Proposed Construction Staging Areas – East Segment

3.2.4 At-Grade (Surface) Stations

The at-grade station platforms would be located approximately 14 inches above top of rail. Access walkways would cross the tracks at grade to connect to the platforms meeting Americans with Disabilities Act (ADA) criteria. The at-grade stations would have either a center platform configuration, where one platform is located between the two tracks, or a side platform configuration where two platforms are constructed opposite of each other, one serving each track. A split platform is a type of a side platform station where the two platforms are not opposite each other. These station configurations are described and illustrated in **Chapter 2**.

Construction of the at-grade stations involves excavation, placement of cast-in-place concrete, installation of canopies, railings, lighting, seating, signage, fare vending equipment, etc.

At-grade stations could be constructed simultaneously with other LRT work within that section. Alternately, they may be constructed sequentially. The estimated construction duration for each surface station is approximately 9 to 12 months.

3.2.5 LRT Operating System Installation

The LRT operating system includes TPSSs, the OCS, communications, and train control.

The OCS, also referred to as catenary, consist of foundations, poles and/or structures, and overhead wires to supply power to the trains. Construction of the OCS would generally involve excavation, placement of concrete, erection of poles and or structures, and installation of wires, cables and other equipment.

Seventeen TPSSs are proposed along the alignment at designated locations, approximately 1 mile apart, to provide the electrical power needed to run the light rail vehicles. The proposed locations of the TPSSs to be constructed are identified in **Volume 2 Environmental Plate Series, Plate Series 1**. The final locations are subject to refinement during the Final Design phase. Examples of existing TPSS for other light rail projects in the United States are provided in **Chapter 2** of this FEIS.

3.2.6 Park-and-Ride Facilities

Surface park-and-ride facilities would be constructed at three stations: Security Square, I-70 Park-and-Ride, and Brewers Hill/Canton Crossing.

Construction of the surface park-and-ride facilities would involve demolition and removal of existing structures, including the removal of trees and other vegetation, as necessary. Utility relocation, grading and paving would follow. Installation of concrete curbs, lighting, driveways, sidewalks, erosion and sediment control measures, stormwater management, and landscaping would be undertaken as necessary.

The duration of this construction work is estimated at 9 to 12 months for each park-and-ride facility.

3.2.7 Bridge Construction

Aerial structures (aerial and elevated approach sections) required for the Preferred Alternative would be constructed over I-695 (the Baltimore Beltway) within the West segment and over industrial and railroad uses, as well as I-895 (the Harbor Throughway) within the East segment. These structures would vertically elevate the tracks above roadways, freight tracks, and other surface features. Construction of these aerial structures would be similar to other typical bridge construction projects and consists of precast structures and other materials that would be stored at construction laydown areas. The existing bridges along the project study corridor would be rehabilitated to accommodate the LRT trackway.

3.2.8 Operations and Maintenance Facility

The Red Line project includes the construction of an OMF along the south side of US 40 (Franklin Street), between Franklintown Road and Warwick Avenue. The facility, referred to as the Calverton Road site, would include a maintenance and transportation building, an area for vehicle storage, a train car wash, and a storage building. The OMF would have a storage capacity of up to 38 light rail vehicles and would also accommodate parking for up to 200 employees.

The current site houses a variety of existing buildings and roadways that would have to be demolished to facilitate the construction of the OMF. The site has several underground fuel storage tanks that may require removal.

Construction for the OMF would include excavation and grading, installation of underground utilities, paving and site work, installation of trackwork and other systems elements, and the construction of the facility buildings.

The duration of the overall construction work for the OMF is estimated at 30 to 36 months.

3.3 Overview of Construction Methods and Activities – Tunnel Segments

This section describes the anticipated construction methods and activities associated with the Preferred Alternative’s two tunnel segments: the Cooks Lane Tunnel and the Downtown Tunnel, which are described in **Chapter 2** of this FEIS. To enable construction of the underground segments of the project, several different tunneling construction methods for different portions of the tunnel are being considered, including excavation of the running tunnels by TBMs, cut-and-cover excavation for underground stations and tunnel portals, as well as some drilling and blasting at certain areas.

Some of these excavation techniques and ground support methods would require the use of ground modification methods, such as dewatering, soil mixing, ground freezing, as well as various types of grouting. The underground structures of the Preferred Alternative would be constructed in a variety of geologic conditions, ranging from rock to soils and would be located adjacent to existing structures and utilities that may be sensitive to ground movements and vibration. Therefore, it would be necessary to use protective measures to support building foundations as part of tunnel or station excavation. These measures are often utilized to reduce potential for damage caused by construction-induced movement. Such protective measures are described in more detail in **Section 3.3.4** of this chapter. Above-ground activities associated with protection of existing facilities during excavation of the tunnels could occur at locations along the alignment.

A general description of underground construction methods is provided in the following sections. A discussion of how these methods might be used for the Red Line project is also described.

Construction of the Cooks Lane and downtown tunnels would require disturbance on above-ground sites for the removal and temporary stockpiling of spoils (muck) from the tunnels and station areas, and for construction materials, machinery, and workers to enter and exit the areas being excavated. Also, above-ground construction sites would be required for underground station entrances and exits and for ancillary facility building that incorporate ventilation equipment. Construction staging areas for construction equipment and personnel would be required. These locations and associated construction-related activities are described in **Section 3.4** of this chapter.

Underground construction-related effects would include increased traffic because of street or lane closures, restricted access to businesses or residences, increased noise and vibration, exposure to hazardous materials, and air quality effects. These effects and measures to minimize or mitigate the effects to the local community are described in subsequent resource chapters of this FEIS (**Chapters 4** and **5**).

3.3.1 Tunnel Boring Machine Excavation

TBMs are used to excavate rock and soils in predominantly circular tunnel sections. TBMs consist of a cutterhead followed by several hundred feet of machinery; the machinery powers the cutter head, conveys the spoils, and propels the TBM forward (see photo). TBMs are powered by electricity brought to the machine from substations, specifically constructed near or along the tunnel route.

Typical tunnel boring machines

Tunnel construction with the use of a TBM consists of a series of repetitive activities. The TBM is advanced by means of hydraulic jacks, which push against the installed tunnel lining. The tunnel lining consists of pre-cast concrete segments that are bolted together in place. Gaskets are placed at segment joints, which result in a relatively watertight structure. The machine is advanced in increments of approximately 5 feet and the process is repeated until the entire length of the tunnel has been excavated. A typical tunnel advance rate is about 20 to 60 feet per day.

Twin-bore tunnels may be drilled with a single TBM or with two TBMs. If a single TBM is used, it would be assembled and driven to excavate one tunnel. Then it would be dismantled and reassembled to drive and excavate the second tunnel. Alternatively, two TBMs could be used simultaneously to construct adjacent tunnels.

Different TBM types are designed for different geologic conditions. For example, in areas where the tunnel would be excavated primarily in rock, a "Rock TBM" is used, while, in areas of soil and weathered rock, a different type of TBM is used that is specifically designed for mining through soil-like materials that are unstable and are not self supporting. These latter TBMs are referred to as "Pressure Face TBMs." "Hybrid" machines are now available that combine the attributes of both Rock TBMs and Pressure Face TBMs, so that a single machine can be used through both ground types, as well as through "mixed face" conditions. Mixed-face conditions are expected where the tunnels transition into and out of bedrock into soil-like materials, where a combination of both rock and soil are present at the same location.

Pressure Face TBMs utilize two different technologies: "Earth-Pressure Balance" (EPB) TBMs and "Slurry Face" TBMs, as described below.

An Earth Pressure Balance TBM has a cutting chamber filled with excavated ground under a predetermined pressure (i.e., "face pressure" or "earth pressure"). The face pressure is controlled by balancing the rate of advance of the TBM with the rate of discharge of the excavated material. A screw conveyor provides the mechanism to adjust pressure in the chamber at the muck discharge point. Material excavated through the EPB system emerges from the screw conveyor and is emptied into muck cars or a continuous conveyor for transport to the surface back at the launch site.

A Slurry Face TBM supplies liquid slurry under pressure to the face of the TBM. Excavated material is mixed with the slurry fluid and is pumped out of the excavated tunnel using pipelines back to the launch site. The soil is then separated from the slurry fluid at a separation plant built nearby the launch site. The separation plant is referred to as the "slurry plant," as shown in the photo below. After separation, the soil can be transported in lined dump trucks to a disposal site. The separated reclaimed slurry is then reused at the TBM face.

Typical TBM slurry plants and their associated operations

To efficiently launch a TBM, an excavated or underground space of up to 300 to 400 feet long is generally required, although in some situations it could be shorter. These “launch pits” would be used to assemble the multiple pieces of the boring machines, begin tunnel excavation, and to remove excavated materials that would be generated as the machine progresses forward. Launch pits would be needed to permit workers to enter and exit the tunnels and to transport materials, such as tunnel lining segments into and out of the tunnels. In close proximity to the launch pits would be space for numerous support services to the tunneling operation, including substations to provide electricity to power the TBMs, ventilation equipment for workers in the tunnel, employee facilities, and equipment repair shops, as well as areas for spoils (muck) storage and lining segment staging.

Once the TBMs complete the tunnel excavations, they need to be disassembled. This occurs at what is referred to as a “retrieval pit or chamber”. Here, cranes could be used to remove pieces of the machines as they are dismantled. Often, portions of the TBMs are hauled back through the excavated tunnels to the launch area. In total, a TBM disassembly and removal process often takes approximately 3 to 4 weeks.

a. Tunnel Boring Machine Excavation for the Red Line Project

This FEIS assumes that the TBMs that would be used to excavate the Cooks Lane and downtown tunnels would operate three 8-hour shifts for 24 hours each day, resulting in tunneling advances of an average rate of approximately 20 to 60 feet per day, per machine, depending upon ground conditions.

TBM components and pre-cast concrete tunnel liners would be shipped to the tunnel construction sites by truck. Several oversize deliveries would be required, some during nights and weekends, especially during the initial set up period for the TBM assembly, as well during their removal period upon completion of the tunnel excavation.

Cooks Lane Tunnel

The Cooks Lane Tunnel is proposed to include two twin-bored tunnels approximately 23 feet in diameter, two portal sections, and mined cross passages between the twin-tunnel bores. Twin-bored tunnels are two tunnels that are constructed parallel to one another. The two Cooks Lane tunnels would typically be located within a range of 30 to 45 feet apart (centerline to centerline). Depths of the Cooks Lane Tunnel would range from 11 feet to 115 feet. At this stage of the project’s design it is envisioned that the twin-bore Cooks Lane tunnels would be excavated using a single Earth-Pressure Balance TBM, which would excavate one tunnel at a time.

The approximately one-mile tunnel alignment would be excavated primarily under the entire length of Cooks Lane and a portion of Edmondson Avenue (US 40) with cut-and-cover and retained-cut sections at both the west and east ends at the tunnel portals to transition to the adjacent LRT surface alignments.

The total duration of TBM excavation of both bores of the Cooks Lane Tunnel is estimated at 18 months.

Downtown Tunnel

The Downtown Tunnel is proposed to also include two twin-bored tunnels approximately 23 feet in diameter, two portal sections, five underground stations, mined cross passages, a pedestrian tunnel, and station entrances and ancillary facilities. The two downtown tunnels would typically be located approximately 40 feet apart (centerline to centerline). The tunnels would converge at each end of the underground stations. At these points, the tunnels would be approximately 14 feet apart. Depths to the crown of the Downtown Tunnel would range from 25 to 90 feet. At this stage of the project's design it is envisioned that the twin-bore tunnels would be excavated using two Slurry Face TBMs that would excavate the two tunnels simultaneously.

The Downtown Tunnel would begin in the median of the US 40 Expressway and continue for approximately three miles to a portal in the center of Boston Street near the intersection of Hudson Street. The tunnels would be located beneath Fremont Avenue, Lombard Street, President Street, Fleet Street, and Boston Street. The tunnels would be located underneath private properties where they transition from one street to another. The Downtown Tunnel segment includes five underground stations; Poppleton, Howard Street/University Center, Inner Harbor, Harbor East, and Fell's Point.

The duration of the concurrent TBM excavation of both bores of the Downtown Tunnel is estimated at 30 months. It is anticipated that the five underground stations identified above and further described in **Chapter 2** of this FEIS are expected to be excavated prior to the arrival of the TBMs.

Since the downtown tunnels would be excavated using two Slurry Face TBMs, a slurry plant is proposed within a staging area located in the median of the US 40 Expressway. The slurry plant would consist of a pump, a mixer, several silos, and different types of separators. The muck, after it is separated from the slurry would be transported in lined dump trucks to a disposal site. The photo above depicts typical TBM slurry plants and their operations.

3.3.2 Drilling and Blasting Excavation

Drill-and-blast mining, involves drilling holes in the rock surface and detonating explosives that have been inserted in the holes. The explosion fractures and loosens the rock, which is then excavated by mechanical means and transported to the spoils removal location (muck pile) by belt conveyor or muck car or directly by dump trucks to a disposal site. The photo identifies an example of the drilling and blasting process.

Example of drilling and blasting process

Inherent with drill-and-blast operations are noise and vibration caused by detonating explosive charges. These effects can be limited by altering the matrix of holes in which explosives are placed and by changing the strength of the explosive charges, which is referred to as "controlled drilling and blasting."

a. Drilling and Blasting Excavation for the Red Line Project

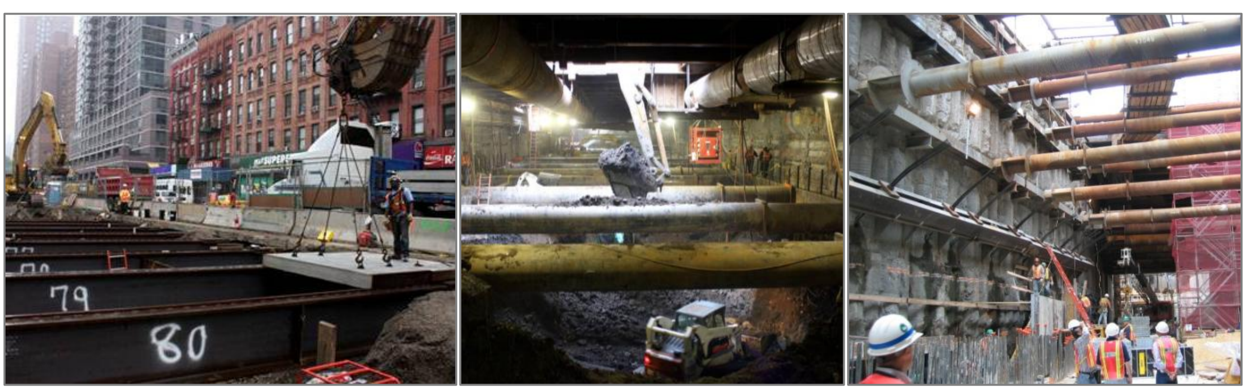
For the Red Line project, drilling and blasting excavation is proposed in the following areas:

- Cross-passages between the twin-bores along the Cooks Lane and Downtown tunnels
- Downtown Tunnel Western Portal
- Poppleton Station, Howard Street/University Center Station and Inner Harbor Station

In these sections of the alignment, where controlled drill-and-blast methods would be used, there may be typically be two to three controlled blasts per day, each lasting for only a few seconds. Properties along the alignment in proximity to drilling and blasting activities would be surveyed and monitored before, during, and following each blast, as necessary. In addition, to safety procedures that would be established and maintained, blasting activities will be conducted in accordance with the appropriate building code requirements and agency approvals.

3.3.3 Cut-and-Cover Excavation

Cut-and-cover construction involves excavation of soil and/or rock from the surface, extending to the depth of a finished trench. Before excavation commences, support of excavation (SOE) walls are typically constructed to retain the adjacent soil to prevent collapse. Several techniques are employed for construction of these SOE walls, depending on site and geologic conditions and the specific requirements of the wall. The underground stations would most likely require a slurry wall type of construction, which would occur along Fremont, Lombard, and Fleet Streets. When sufficient depth is reached to allow excavation to proceed below the surface, the area is temporarily decked over, typically with steel beams and precast reinforced concrete decking panels, while a reduced traffic pattern is maintained through the work area. It is anticipated that the decking beams would be installed in full lengths spanning between the slurry walls, requiring temporary suspension of through traffic. This would normally occur during night times or other off-peak hours. When excavation and construction of the underground station elements are completed, the remaining trench would be filled, the temporary decking system removed, and the original surface restored. Cut-and-cover construction requires vehicle and sidewalk closures to permit access and egress by workers, equipment, and materials and to accommodate material removal. These photos show typical cut-and-cover operations.



Typical cut-and-cover operations in an urban environment

a. Cut-and-Cover Excavation for the Red Line Project

For the Red Line project, the tunnel portals of both the Cooks Lane and downtown tunnels would be excavated by cut-and-cover and open-cut methods. In addition, the Downtown Tunnel's five underground stations and associated ancillary buildings would be excavated using cut-and-cover and open-cut excavation methods. These underground stations are approximately 75 feet deep; 300 feet long, and 63 feet wide.

The stations would accommodate a variety of passenger and ancillary spaces. When completed, each of the stations would accommodate:

- The station platform at the lowest level, approximately 65 to 70 feet below street level, where people would board and exit the trains;
- A mezzanine level where passengers would transition from the platform level and access the street level;
- At least one street level station entrance;
- At least one elevator, two escalators, and stairs between these levels;
- Emergency egress paths to surface;
- Station and tunnel ventilation facilities; and,
- Non-public spaces to accommodate station equipment and functions.

The following is a description of a typical cut-and-cover excavation that would be undertaken at each of the Preferred Alternative's five underground stations and tunnel portals. The tunnel portal construction would include portions of cut-and-cover and open-cut. As shown in the previous photos and described below, the work typically consist of several sequential steps. It is estimated that the duration of cut-and-cover construction activities for each station would be 18 months and approximately 15 months for each of the Cooks Lane and downtown tunnels' portals.

Step 1: Lane Closures and Maintenance of Traffic Plans

The first step in cut-and-cover construction for the Preferred Alternative would involve closing off approximately half of the Lombard Street and Fleet Street right-of-ways in the areas near the proposed stations using barriers and sidewalk sheds, or street and sidewalk protection. At the Howard Street/University Center and Inner Harbor Stations on Lombard Street, three vehicular lanes would need to be closed along a length of between two and three blocks for each station area. For the Harbor East and Fell's Point Stations along Fleet Street, two parking lanes would need to be closed along a length of approximately three blocks for each station area.

During construction, it may also be necessary to close off portions of north-south cross streets adjacent to the proposed station areas on Lombard and Fleet Streets; limited construction would occur on these side streets for slurry walls (described below) and portions of these streets might be needed for construction staging areas to store construction materials that are trucked to the site, accommodate worker support areas, accommodate utility diversions, and other similar activities. There would be a loss of parking in the vicinity of the construction sites.

Because traffic lanes would be reduced within the construction areas, buses would not be permitted to stop to pick up or discharge passengers within the construction zones. Traffic would be maintained in the construction zone through the implementation of curb parking prohibitions and signal timing modifications. Some traffic diversions to parallel streets and avenues could be expected. Cross-street traffic flows may also be restricted across the construction zone, which may limit use of these streets to local traffic only. Delivery and service vehicles (such as garbage trucks) would also not be permitted to stop in construction work areas; instead, designated delivery, pickup, and drop-off areas would be established on the nearest side streets. For more information on the effects of construction on traffic, refer to **Section 4.2** of this FEIS.

In construction zones, sidewalk widths on each side of Lombard Street and Fleet Street in the vicinity of the proposed station area would also typically be reduced from the existing 15 feet to 5 feet. Pedestrian circulation paths would typically be maintained and temporary signage highlighting entrances to stores, businesses, or other uses would be provided, as required. Emergency access for fire trucks and ambulances would be provided at all times.

In some locations access to buildings along the alignment may not be feasible because of the extent of construction activities and equipment required within the narrow right-of-way immediately adjacent to the property lines. For example, at the Fell's Point Station access to the properties located on the south side of Fleet Street, between Bethel Street and Broadway, would be prohibited access and require temporary relocation for approximately 9-12 months during station excavation and slurry wall construction, which is further described below.

Unlike the underground stations proposed along Lombard and Fleet Streets, at the proposed Poppleton Station, vehicular and parking lanes along Fremont Avenue between West Fayette Street and Baltimore Street would be closed for the duration of station construction; including during excavation and station construction. The duration of the full closure of North Fremont Avenue between West Fayette Street and West Baltimore Street is anticipated to be 3 to 4 years. Access to the adjacent University of Maryland and other buildings would be maintained, however intermittent restrictions may be necessary.

The following full roadway closures and durations are anticipated in support of the cut-and-cover excavations of the Cooks Lane and downtown tunnel's portals:

- <u>Cooks Lane Tunnel West Portal</u>: Construction of the running tunnels by tunnel boring machines and the retained cut structure would require the closure of the existing interchanges' southwest loop ramp from southbound Security Boulevard to westbound I-70 throughout the duration of construction. This loop ramp would be ultimately removed as part of the Preferred Alignment.
- <u>Downtown Tunnel West Portal</u>: Construction of the cut-and-cover tunnel would require the closure of eastbound Mulberry Street for 10 to 12 months. Through traffic would be diverted to the US 40 Expressway. Local traffic would be diverted using the local street network. Additionally, construction of the running tunnels by tunnel boring machines and the retained-cut structure would require the closure of the entire US 40 Expressway. This closure is anticipated to be in place for approximately 3 years. Traffic would be diverted to

the one-way pair of Mulberry and Franklin Streets. The closure of Mulberry Street and the US 40 Expressway would not occur concurrently.

- Downtown Tunnel East Portal: Construction of the cut-and-cover tunnel and retained-cut structure would require the closure of Boston Street from immediately west of the intersection with Montford Avenue to immediately west of the Harris Creek culvert under Boston Street near the driveway entrance to Starbucks. This full closure would be necessary because of the transitioning width of the cut-and-cover tunnel walls and the placement of construction equipment needed to install the walls and temporary support of excavation with respect to remaining areas available for travel lanes. The closure is anticipated to be in place for approximately 1 year. Through traffic would be diverted away using parallel main roadways, such as Eastern Avenue and Fleet Street. Local traffic would be diverted using the local street network. Local access to the adjacent properties would be provided through each end of the work area.

  A temporary roadway is being evaluated as an alternative to the full closure of a portion of Boston Street, as described above. The temporary roadway would provide one lane per direction, with a sidewalk on the south side of Boston Street. The temporary roadway would be located closer to the parking lots for the Anchorage Marina and Anchorage Towers properties. This temporary placement would likely result in traffic circulation restrictions. Access to the Can Company parking lot on the north side of the work zone would be restricted. A decision concerning Maintenance of Traffic along Boston Street would be completed during Final Design. Public outreach efforts will continue prior to making this decision.

Step 2: Relocation of Utilities

After closing off portions of the right-of-way, the contractor would need to relocate affected utility lines. In most cases, utilities would be relocated within the same general area of their existing locations. However, this may not be possible in all cases because of construction or operational constraints. In such instances, utilities would be relocated to adjacent streets.

Utility work would also require street, traffic, lane, and sidewalk closures. For more information on the effects of construction on utilities, refer to **Section 5.20** of this FEIS.

Step 3: Construction of Slurry Walls, Secant Pile, or Soldier Pile Walls

Excavation of stations and portals can only begin once SOE walls are in place. The SOE walls would likely be constructed using a method commonly called slurry wall construction, as shown in the photo below. Slurry walls are often part of the permanent station or portal structure. The slurry wall method of construction involves cutting a narrow vertical trench and filling the trench with liquid slurry as excavation progresses. The slurry stabilizes the trench. Each slurry wall is divided into multiple panels or segments. Each panel is typically 10 to 20 feet in length. Once excavation of each panel is complete, a steel reinforcement cage (or "rebar cage," see photo below) is inserted into the excavation. The result is a completed reinforced concrete wall panel. Each rebar cage is likely to measure approximately 100 feet in length.

Example of activities associated with slurry wall excavation

Example of Rebar Cage Installation

Because of their size, it would be necessary to construct the rebar cages at a nearby construction staging area. Once completed, the rebar cages would be transported on special flatbed trailers and would be lowered by two cranes into the specific panel location. The panel trench would then be filled with concrete. The rising level of concrete in the panel would displace the slurry. The result is a reinforced concrete wall panel. The displaced slurry would be pumped to a slurry plant near the site. At the slurry plant, excavated particles would be removed from the slurry, so that it could be reused at another panel. It is anticipated that a slurry plant would be needed at each station or portal excavation site in support of the slurry wall construction. It may be possible that the construction contractor utilize a single slurry plant between nearby adjacent stations, e.g. Inner Harbor and Howard Street. The actual number and location of these slurry plants would be refined during the Final Design and Construction phases of the project. Typical Station Slurry Plant equipment is shown in the photo.

Typical Station Slurry Plant Equipment and Operations

Slurry wall construction would occur in stages working on one side of the street at a time. The concreting operation is very time sensitive and panels have to be completed swiftly (typically within 15 hours or less). In total, it may take 2 to 3 days to complete excavation and concreting of each panel.

Completing the entire slurry wall phase in support of cut-and-cover excavation on both sides of the street at an entire station area would take approximately 12 to 18 months per station. Construction of slurry walls at each of the five underground stations is likely to occur for approximately 24 hours each day.

Step 4: Street Excavation and Decking

Once the SOE walls are installed, temporary decking beams and panels would be installed. After the decking is complete, station excavation would begin. Excavation at each station area is estimated to be between 7 and 9 months.

Upon completion of construction below the deck, the station structure would be completed and the area above the structure would be backfilled. During the backfilling operation, the utilities would be restored to their permanent location. After which, the permanent street would be reconstructed.

3.3.4 Protective Measures for Existing Structures

Both the Cooks Lane and downtown tunnel alignments and stations have been planned to avoid construction beneath existing buildings and other structures wherever possible. However, there are several areas where this cannot be avoided. In addition, in other areas, existing structures would be in close proximity to excavation or the tunnel's alignment. In these cases, a variety of measures, including underpinning, grouting, and building external support frames or bracing structures could be used to protect nearby structures during and following construction.

The selection of the choice of protective measures depends upon a number of factors, including:

- Proximity of the structure to the construction excavation
- Ground conditions
- Groundwater conditions and ground control techniques
- Foundation types and physical conditions of existing structures
- Type of structure, its use, and sensitivity to ground displacements/vibrations
- Type of excavation/tunneling methods used
- Loads carried by the existing structure
- Dimensions of excavation
- Sequence of construction
- Rock quality (if present)
- Materials used to construct the existing structure

In most cases, it would not be possible to determine which support measures would be required until structural surveys, soil/rock borings, and information on usage are completed in areas where protective measures may be required. These surveys and soil borings would be undertaken during the Final Design phase of the project.

Following is a brief summary of the types of protective methods that could be employed along the Red Line tunnel segments.

a. Types of Protective Measures for the Red Line Project

Ground Improvement

One type of protective measure that may be employed is ground improvement by “grouting”. The purpose of grouting would be to increase the strength and decrease the permeability of the soil near the tunnels, stations, buildings, or utilities. Several types of grouting methods exist and include:

- Compensation grouting: With compensation grouting, grout is injected between the tunnel excavation and overlying structure. This operation is performed continuously and concurrently with excavation to compensate for settlement that may occur. To conduct this operation, an excavation pit must be created for access. Often, this pit is located within a building’s basement.
- Jet grouting: This method involves injecting cement grout at high pressure through rotating nozzles into the zone of soil that requires improvement. The grout is injected from street level through small-diameter (approximately 4 inch) holes. Facilities to support jet grouting operations include a batch plant to mix and pump the cement grout mixture. The batch plant would measure about 50 feet by 100 feet and could be located up to 150 feet away from the area being treated. The plant would require a variety of equipment, including a cement silo, tanks for storing liquid, a mixing plant, and a pump house.

At present, based on the geological data currently available, jet grouting would be undertaken at each of the five underground station locations. However, additional locations along the downtown tunnel alignment could be identified in the future as engineering continues.

At locations along the downtown tunnel alignment in which jet grouting operations would be occur, partial lane, sidewalk closures, and traffic diversions would occur. The time required to complete the work would depend on the extent of the area to be treated and the number of drill rigs used; usually between 2 and 4 months at each location.

Continuous monitoring would occur during this process to limit the damage to building foundations and underground utilities, and sewer and water main pipes during the ground improvement process.

Bracing Structures

Other protective measures include external support frames, often referred to as bracing structures. These external building frames can be erected around a building’s façade during construction activities.

Underpinning nearby Structures

Underpinning is a common construction technique that involves supporting foundations of an existing building to protect the building once work begins in the soil near the foundation. It is a method of construction that permanently extends the foundation of a structure adjacent to a construction activity site to an appropriate lower soil level or stratum beyond the range of influence of activities. The purpose of underpinning is to protect structures adjacent to a construction area from major settlement or lateral movement.

Underpinning work would typically be constructed from the street surface in front of an affected building or within basements of affected buildings. Underpinning may cause temporary suspension of access to buildings.

Construction of the Downtown Tunnel segment's underground stations could require underpinning of buildings immediately adjacent to and surrounding the areas of station excavation.

3.3.5 Settlement and Other Possible Effects

Even with the measures identified above, some movement or settlement could occur. Acceptable limits of movement would be determined before construction for each building; these would be determined based on the foundation design, condition, construction method, and functionality of each building. Prior to construction, baseline surveys and visual inspections and photographic documentation would be completed for buildings that are directly adjacent to the alignment to establish and document pre-construction conditions. These surveys would determine whether additional protection work, such as special excavation support systems described above, underpinning or grouting, would be necessary to mitigate settlement.

During final design and construction, a geotechnical instrumentation program will be developed to monitor the performance of braced excavations, tunneling operations, and the identified critical structures. This program would be conducted for both the Cooks Lane and Downtown tunnel alignments.

3.3.6 Station and Tunnel Portal Finishes

Upon completion of construction of the SOE system and excavation at each underground station, the work site would continue to be used to construct the permanent station structure and "fit-out" of interior elements of the underground station environment. Similarly, work would continue at each tunnel portal with the construction of the permanent portal structure and installation of trackway elements.

3.3.7 Ancillary Facilities

The underground environments in the tunnels and stations would be designed in accordance with applicable Life/Safety requirements. Among these requirements is a tunnel and station ventilation system. The primary function of this system is the management of heat and smoke conditions during fire emergencies.

Ancillary facility buildings would be constructed at each of the five underground stations. These facilities would serve a number of station-related functions, but primarily serve as the ventilation system for the stations and tunnels. These would be comprised of fans, air plenums, and air shafts that would connect the tunnels and station areas to the atmosphere.

Ancillary facility buildings would be constructed partially above and below ground. The heights of these buildings could be approximately 60 feet high. The exact locations and heights of these facilities will be determined during the Final Design phase of the project.

Ventilation for the Cooks Lane Tunnel would be provided by jet fans located within the tunnels. Construction of each ancillary facility and associated components is estimated to be 2 years.

3.3.8 Light Street Connector

The proposed pedestrian tunnel connecting the Red Line Inner Harbor Station with the Charles Center Metro station is referred to as the Light Street Connector. It would be located beneath the right-of-way of Light Street between Lombard Street and Baltimore Streets. The Light Street Connector would be constructed using cut-and-cover excavation, including drilling and blasting, both methods are described earlier in this chapter.

Access to businesses on the east side of Light Street between Lombard Street and Baltimore Street will be restricted during construction of the Light Street Connector, which is estimated at 21 months.

3.3.9 Dewatering

Construction of underground portions of the Red Line project would occur beneath the water table. The water table varies between 5 and 10 feet below the ground surface along the alignment, and is as close as 1 foot below the surface at the Cooks Lane Tunnel.

Excavation and construction that occurs below the water table may encounter groundwater. During excavation, groundwater could seep into the work area. In such instances, the groundwater could be removed before excavation commences in a process known as dewatering. The purpose of dewatering is to maintain relatively dry working conditions during construction. Possible methods of dewatering include pumps, deep wells, and sumps (submersed pumps). Prior to excavation, watertight cut-off barriers would be installed to minimize potential for lowering groundwater in adjacent areas. As water is pumped from the excavation area, sediments would be separated from the water and the water pumped into the existing sewer system.

Prior to implementing treatment system or discharge of groundwater, samples would be collected and analyzed, a treatment system would be designed, and the information included in the permit applications. Approval from the responsible regulatory agency, in the form of a permit would be obtained prior to construction activities. Depending on the quantity of water to be discharged, permits would require sampling on a regular basis to confirm that treatment is effective. Discharging activities would be performed in accordance with the terms and conditions specified by permit, including the discharge rate, the sampling frequency, and duration. For information regarding contaminated groundwater encountered during construction, refer to **Section 5.19** of this FEIS.

3.3.10 Site Preparation and Building Demolition

Prior to underground construction, some work sites would require clearing and building demolition; in particular at locations of stations and ancillary building sites. Building removal could be achieved via a process of controlled demolition termed “deconstruction.” Deconstruction involves planning and contained removal of building elements to minimize environmental effects such as dust, vibration, and traffic disruption. Affected buildings would be vacated and stripped of internal furnishings.

Pre-deconstruction activities would include the identification of utilities, building condition surveys, and hazardous materials assessments. A comprehensive process of contaminants assessment would then follow to determine the level of potential airborne particles from deconstruction activities and to assess the nature of construction debris for disposal. Hazardous materials, such as lead or asbestos, present in buildings or structures proposed for deconstruction would be identified and removed prior to deconstruction in compliance with Maryland Department of Environment regulations and MTA’s requirements for hazardous materials removal.

3.3.11 Removal of Underground Piles

As engineering for the project continues, a number of natural and man-made obstructions have been identified in several locations in the vicinity of underground construction. These natural and man-made obstructions include building foundations, wharves, quay walls, utility foundations, debris abandoned in urban fill, etc. along the downtown tunnel alignment. These obstructions could require their removal prior to excavation activities for the LRT tunnels and stations.

3.3.12 Rodent Control

Construction contractors will be required to implement rodent control programs during the construction phase, as necessary, the contractor will carry out the rodent control program in coordination with the community and affected stakeholders.

3.4 Underground Segments – Construction Staging Areas, Access Sites, and Spoils Removal Operations

As tunnel and station excavation progresses, it will be necessary to transport rock, soil and material by truck out of the work areas to appropriate disposal sites. In addition to removing excavated spoils from the tunnel segments, it would be necessary to deliver a wide variety of materials into the tunnel and station work areas. In the vicinity of these construction access sites, various staging areas need to be set up where construction machinery and other equipment and materials would be delivered, stored, and operated. At each portal or station site, there needs to be adequate room for various equipment including, but not limited to, slurry plants, muck bins, conveyors, trucks, substations, ventilation fans, sidewalk sheds, construction fencing, and other similar equipment.

Construction access sites and their associated construction staging areas serve various purposes. Depending upon the site, they could be used to:

- Insert, assemble, launch and remove TBMs
- Remove excavated soil and rock
- Store materials needed for construction
- Provide ventilation for excavated spaces
- Enable workers to enter and exit the tunnels, stations and portals
- Provide power to the TBM and other operations via electrical service equipment or substation
- Accommodate maintenance, truck loading and unloading, and rebar cage assembly

For the Red Line project, preliminary construction staging areas have been identified at the tunnel portals and station locations. These construction staging areas are identified in **Table 3-3** and are shown on **Figure 3-4** and **Figure 3-5**.

While the contractors may or may not choose to use these sites, they are likely candidates and provide a reasonable scenario to assess the potential environmental and community effects that may occur from the activities and operations of construction staging areas. Any staging area that is ultimately used for construction of the project, the contractor would be required as part of contract specifications to comply with applicable local zoning laws and other applicable federal, state and local rules and regulations, and obtain necessary permits and approvals. The following sections describe the types, scale, and duration of the activities that would typically take place at various construction staging areas and access shaft locations along the Cooks Lane and Downtown Tunnel segments.

Table 3-3: Proposed Construction Staging Areas – Cooks Lane and Downtown Tunnel Segments

Staging and Site Designation	Staging Area	Location	Construction Activities and/or Work Area Supported
Cooks Lane Tunnel Segment (Figure 3-4)			
2-1	Western Tunnel Portal Site	Existing I-70 Southwest Interchange Ramp	• Staging area for the launching and operation of the TBM open-cut and cut-and-cut tunnel construction • Construction activities would include the daily delivery of equipment, concrete, tunnel lining segments, and removal of excavated spoils

Table 3-3: Proposed Construction Staging Areas –
Cooks Lane and Downtown Tunnel Segments

Staging and Site Designation	Staging Area	Location	Construction Activities and/or Work Area Supported
2-2	Eastern Tunnel Portal Site	Just west of Brookwood Road to just east of Old Frederick Road	• Open-cut and cut-and-cut tunnel construction • Daily delivery of equipment and concrete, and removal of excavated materials • Site would also serve as the retrieval chamber for the TBM
Downtown Tunnel Segment (Figure 3-5)			
4-1	Western Portal Site	Median of US 40 Expressway	• Staging area for the launching and operation of the two TBMs • Construction activities would include the daily delivery of equipment, concrete, tunnel lining segments, and removal of excavated spoils • Slurry plant operations
4-2	Poppleton Station	Entire width of North Fremont Avenue between West Fayette and West Baltimore Street Two off-street parcels located between Fairmount Avenue and West Baltimore Street	• Cut-and-cover station construction and erection of ancillary facility buildings • Daily delivery of equipment, steel and concrete, and removal of excavated materials via trucks
4-3	Howard Street Station	Arena Parking Garage located on West Lombard Street between South Howard Street and Hopkins Place	
4-4	Howard Street Station	Lombard Street between Hopkins Place and Hanover Street	
4-5	Howard Street Station/Inner Harbor Station	Lombard Street between Hanover Street and Charles Street	

Table 3-3: Proposed Construction Staging Areas – Cooks Lane and Downtown Tunnel Segments

Staging and Site Designation	Staging Area	Location	Construction Activities and/or Work Area Supported
4-6	Inner Harbor Station	Lombard Street between Charles and Light Street	• Cut-and-cover station construction and erection of ancillary facility buildings • Daily delivery of equipment, steel and concrete, and removal of excavated materials via trucks
4-7	Inner Harbor Station	Eastside of Light Street between East Lombard and East Baltimore Street; East Lombard between Light Street and Hollingsworth Street Two off-street properties (vacant buildings) on the north side of Lombard Street between Grant Street and Hollingsworth Street	
4-8	Inner Harbor Station	East Lombard Street South Calvert Street to South Street	
4-9	Harbor East Station	Fleet Street between South Central Avenue and South Eden Street Off street warehouse located on southeast corner of Fleet Street and Central Avenue	
4-10	Fell's Point Station	Bank of America parking lot at northeast corner of South Bethel and Fleet Streets Median of Broadway between Fleet Street and Eastern Avenue	

Table 3-3: Proposed Construction Staging Areas – Cooks Lane and Downtown Tunnel Segments

Staging and Site Designation	Staging Area	Location	Construction Activities and/or Work Area Supported
4-11	Eastern Portal Site	Boston Street just west of South Montford Avenue to the Boston Street structure over Harris Creek	• Open-cut and cut-and- cover tunnel construction • Daily delivery of equipment and concrete, and removal of excavated materials • Site would also serve as the retrieval chamber for the two TBMs

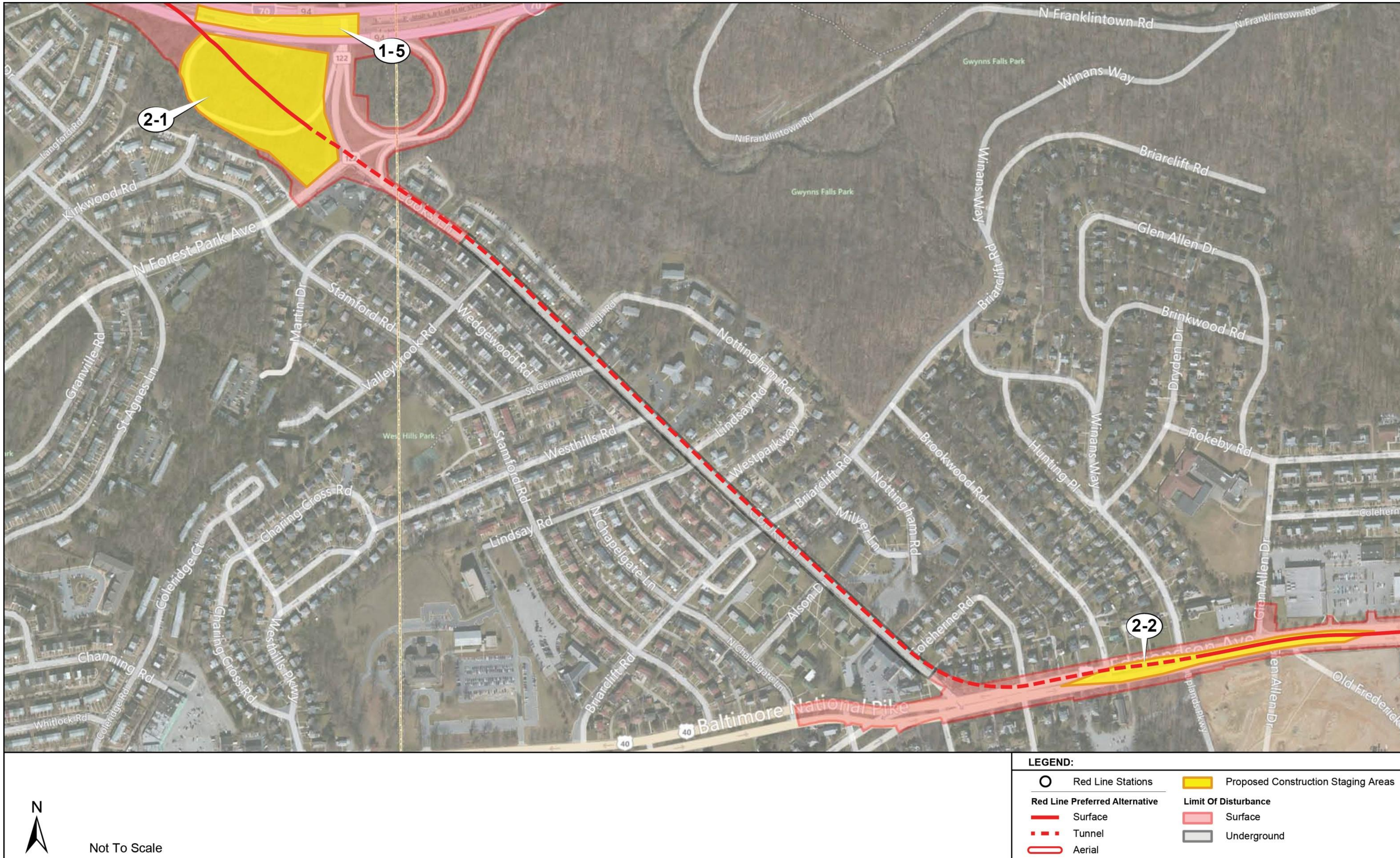


Figure 3-4: Proposed Construction Staging Areas – Cooks Lane Tunnel Segment

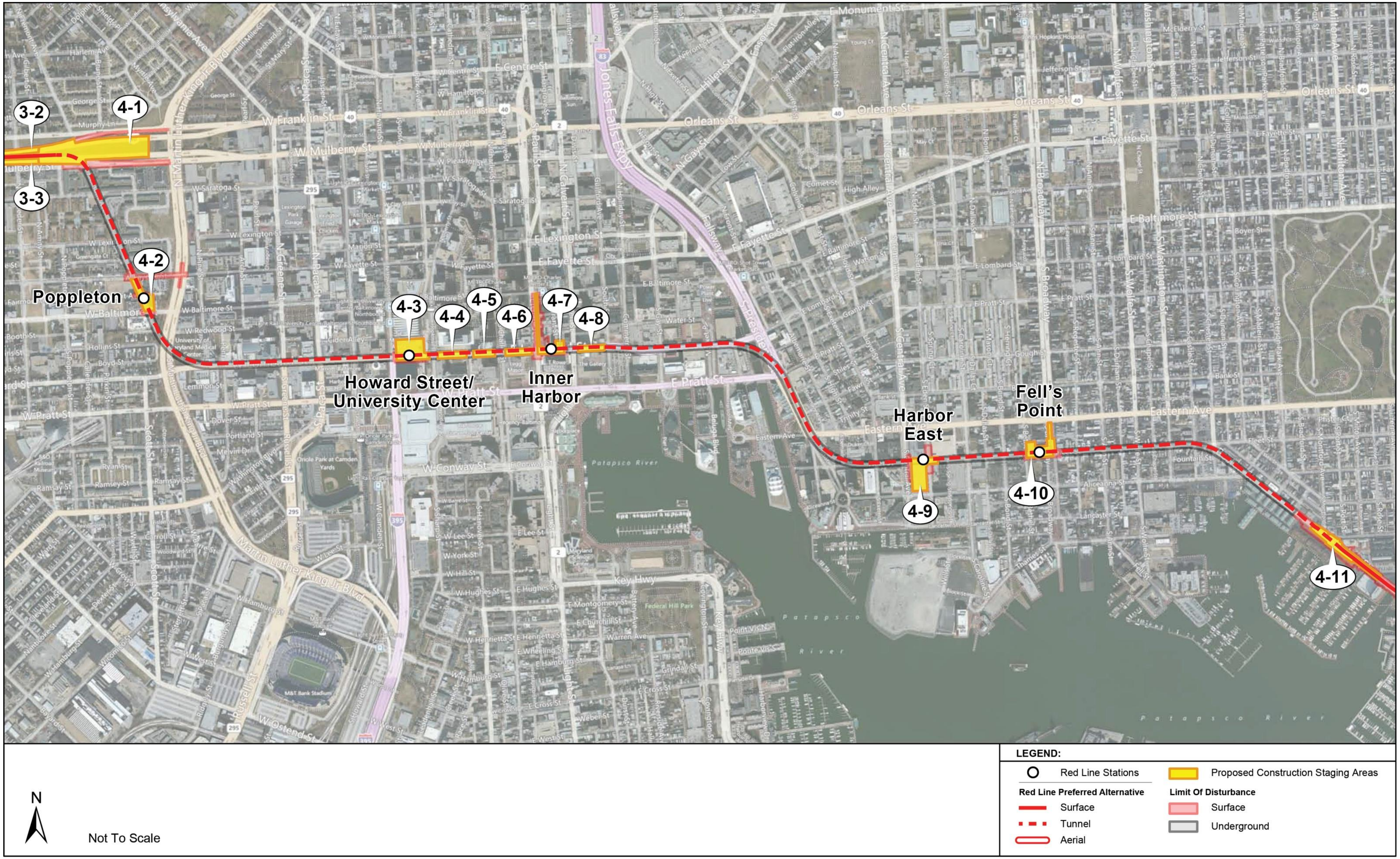


Figure 3-5: Proposed Construction Staging Areas – Downtown Tunnel Segment

3.4.1 Construction Access Sites, Staging Areas for Assembling and Removing Tunnel Boring Machines

Construction access sites that would be used for assembling, launching, and removing each TBM would be located at the beginning and end of each tunnel segment. These locations are often referred to as “launch pits” and “retrieval pits or chambers.”

For the Cooks Lane Tunnel, one TBM may be used to construct the two twin-bored tunnels. For each mining operation, the TBM is anticipated to be launched at the western portal area (launch pit), and recovered at the eastern portal area (retrieval pit) within the center of Edmondson Avenue.

Two TBMs will likely be used to construct the downtown tunnels. The TBMs will be assembled at the western portal in the median of the US 40 Expressway and could be retrieved at the eastern portal in the center of Boston Street.

3.4.2 Construction Access Sites and Staging Areas at Station Locations

At each station, materials for that station would be removed from construction access sites within the station’s cut-and-cover areas. The work areas would be used to deliver equipment and materials to the excavation. The areas would also serve the construction of the permanent station structures and ancillary building.

3.4.3 Hazardous Materials and Soil Re-Use Options

Construction activities may require the use and storage of potentially hazardous materials. It is anticipated that a portion of each staging area would be designated for the storage of such materials.

Hazardous materials encountered during underground construction may be solids, liquids, or gases. Materials that are typically referred to as “subsurface contaminants” are considered man-made hazardous materials that have been placed as fill (if solid) or leaked into the ground (if liquid).

Cooks Lane Tunnel muck may contain naturally occurring hazardous materials, such as asbestiform minerals or hazardous materials, including radon gas and volatile contaminants. The Downtown Tunnel may also contain radon gas, as well as heavy metals, petroleum products, and dry cleaning solvents.

Therefore, sampling and testing of the muck would be performed prior to disposal and/or re-use as fill material. Based upon the results of the testing, the material would be removed to an appropriate disposal location. Disposal and/or recycling facilities would require pre-approval by the MTA and would be contingent on verifying the facilities environmental compliance with federal and state agencies. Potential disposal and/or recycling facilities in the project region that are approved for disposal of non-hazardous and/or hazardous materials would need to be further investigated as the project’s design progresses.

Construction contractors will be required to develop, institute and maintain a Waste Management Plan during construction of the project, which may include:

- Identification of disposal sites
- Identification of quantities to be excavated and disposed of
- Identification of amounts intended to be stored temporarily on site and location of such storage
- Identification of intended transport means
- Organization of the contractor's approach to waste management, including permit details

Section 5.19 of this FEIS provides more information on the procedure to be used to identify contaminated spoils and manage them at appropriate locations.

3.4.4 Excavated Spoils Removal and Material Delivery By Truck

Most materials that would exit and enter a tunnel or station would likely be moved by crane or vertical conveyor to and from the street. In most cases, spoils would be removed and loaded directly onto trucks. This could occur for up to 24 hours each day. However, in some cases, spoils could be loaded into containers while still underground; these containers could be stored below ground at night to avoid disrupting the surrounding communities overnight or they could be stored above-ground for subsequent transfer to trucks.

At any given point, there could be a line of trucks at the construction areas for loading of spoils and unloading of construction materials, such as tunnel concrete liners. The line of trucks could be formed in a location designated for the purposes to minimize impact on other traffic in the construction area. The *Traffic and Parking Technical Report* included in **Appendix I** of this FEIS identifies the estimated number of trucks associated with activities at each of the tunnel and underground station excavation sites, as well as a discussion of the effects of these truck trips to the local roadway network.

In general, the machinery that would be used to move spoils above ground is typical of that found at other construction sites and would include cranes ranging in size approximately 160 feet tall, as well as vertical conveyors averaging approximately 25 feet tall to enable loading into 13-foot-tall trucks. If a storage hopper or muck bin is used to store spoils before loading into the trucks, the vertical conveyor could be 10 feet to 20 feet higher. To control dust and noise, the conveyors and hopper could be covered, the hopper could be lined with rubber and the trucks be enclosed.

3.4.5 Designated Truck Routes

Trucks transporting the spoils and construction materials could take various routes to and from the alignment. It has been assumed three-axle dump trucks would haul approximately 20 cubic yards of material. Trucking will be permitted only on designated truck routes and may occur up to 24 hours a day, 7 days a week.

The preliminary designated truck routes for the Cooks Lane and the downtown tunnels and underground stations spoils removal are described below and are identified on **Figures 3-6** and **3-7**, respectively.

a. Cooks Lane

Western Portal
Trucks would access the site by I-695 and I-70.

Eastern Portal
Trucks would access the site by US 40, I-695, and I-70.

b. Downtown Tunnel

Western Portal
Trucks would access the site via the one-way pair of Franklin and Mulberry Street, and utilize Martin Luther King, Jr. Boulevard to make the connection to I-395 and continue onto the Interstate highway network.

Poppleton Station
Trucks would access the site via Fayette and Baltimore Streets, and utilize MLK Jr. Boulevard to make the connection to I-395 and continue onto the Interstate highway network.

Howard Street/University Center Station
Trucks would access the site via the one-way pair of Lombard and Pratt Streets, along with Howard and Hanover Streets between the one-way pair. The contractor would have the option of using either I-83 or I-95 to continue onto the Interstate highway network. For access to I-95, trucks would utilize Howard Street and connect to I-395 and continue onto I-95. For access to I-83, trucks would utilize Lombard and Pratt Street east of the work site to connect to President Street and continue onto I-83.

Inner Harbor Station
Trucks would access the site via the one-way pair of Lombard and Pratt Streets, along with Light, Calvert, and South Streets between the one-way pair. The contractor would have the option of using either I-83 or I-95 and onto the Interstate highway network. For access to I-95, trucks would utilize Lombard and Pratt Streets west of the work site to connect to Howard Street to I-395 and continue onto I-95. For access to I-83, trucks would utilize Lombard and Pratt Streets east of the work site to connect to President Street and continue onto I-83.

Harbor East Station
Trucks would access the site via either Fleet Street or Eastern Avenue. Trucks would utilize Central Avenue, Eden Street, or Caroline Street to access Eastern Avenue. The contractor would have the option of using either I-83 or I-95 and continue onto the Interstate highway network. For access to I-95, trucks would utilize Eastern Avenue east of the work site and connect directly to I-95. For access to I-83, trucks would utilize either Fleet Street or Eastern Avenue west of the work site and connect to President Street and continue onto I-83.

Fell's Point Station

Trucks would access the site via either Fleet Street or Eastern Avenue. Trucks would utilize Broadway, Bond Street, or Ann Street to access Eastern Avenue. The contractor would have the option of using either I-83 or I-95 and onto the Interstate highway network. For access to I-95, trucks would utilize Eastern Avenue east of the work site and connect directly to I-95. For access to I-83, trucks would utilize either Fleet Street or Eastern Avenue west of the work site and connect to President Street and continue onto I-83.

Eastern Portal Area

Trucks would access the site via Eastern Avenue or Boston Street. Trucks would use the Interstate highway network via I-95. Both above streets access I-95 east of the work site. Trucks connecting to Eastern Avenue would utilize a short stretch of Chester Street at the north end of Boston Street.

3.5 Access Limitations

During construction, it will be necessary to limit or curtail vehicular and pedestrian access in certain areas to address public safety and to accommodate the variety of machinery, storage areas, and construction activities. Generally, the method of construction will determine the extent of access limitation that may occur along the various lengths of the alignment. It may be necessary to restrict access to buildings for periods ranging from several hours to up to 4 years.

For example, at the proposed Fell's Point station, the properties located on the south side of Fleet Street between Bethel Street and Broadway would be prohibited access for approximately 9 to 12 months during station excavation and slurry wall construction. The FEIS assumes that temporary relocations will be required during the construction period. In addition to Fell's Point, others access restrictions could occur intermittently during cut-and-cover construction for underground stations.

In some locations, construction-related activities might need to occur in the basements of certain buildings as part of underpinning or ground stabilization activities. Access to the ground and upper floors may be required; access to some basements might be temporarily restricted. In such cases, it is not anticipated that the MTA would need to acquire the buildings or permanently displace the residents and businesses from the buildings adjacent to the construction work for these activities.

In certain areas, the need to close traffic lanes and sidewalk areas at various times would result in temporary restrictions to vehicular and pedestrian access. The extent of these disruptions would depend upon the type of construction required.

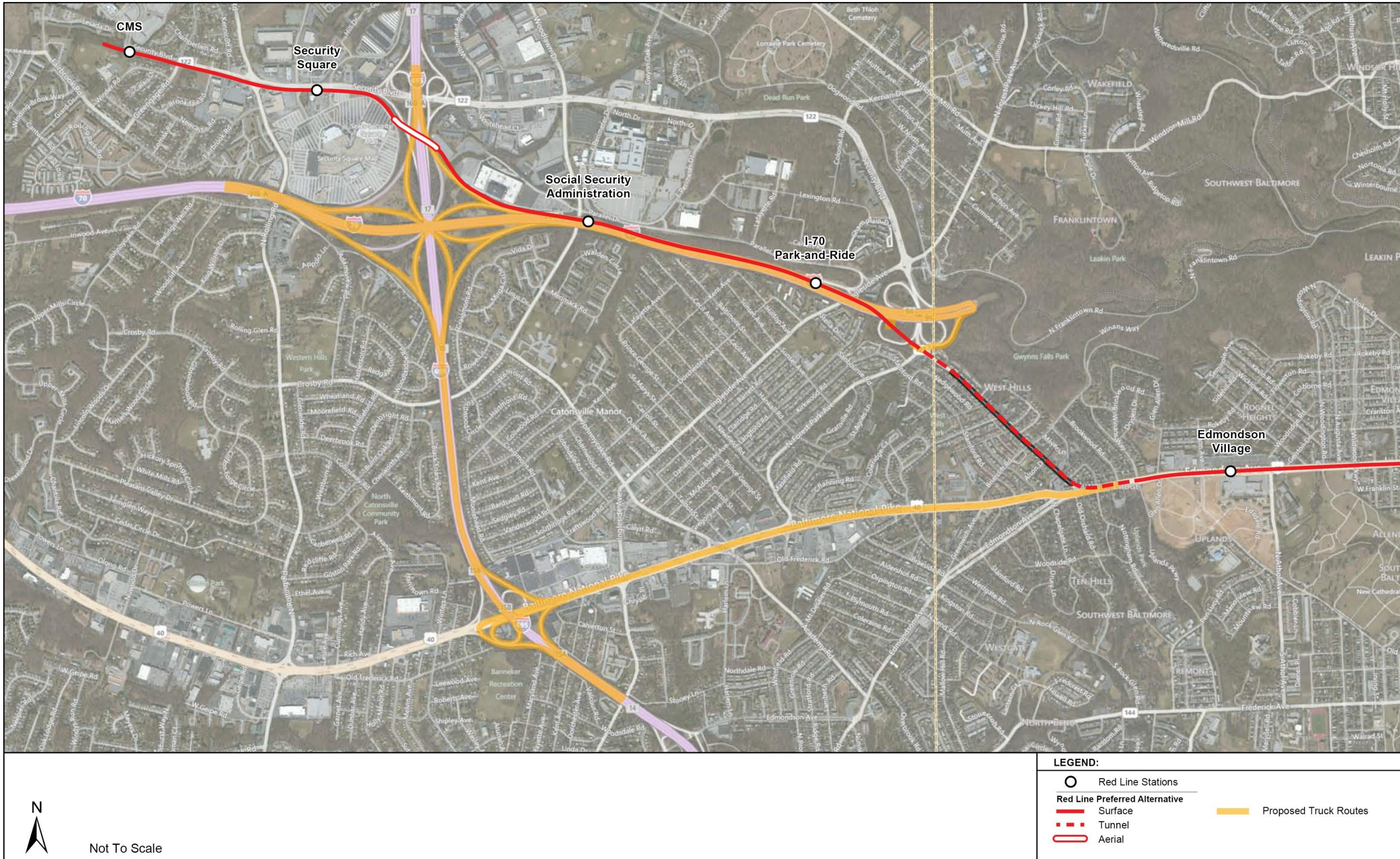


Figure 3-6: Proposed Truck Routes – Cooks Lane Tunnel Segment

Figure 3-7: Proposed Truck Routes – Downtown Tunnel Segment

Vehicles would be prohibited from stopping, standing, or parking within the construction zones. Bus stops located within the work areas will be temporarily relocated. Drop-offs and deliveries for residences and businesses may have to be relocated to nearby locations outside of the construction areas.

A variety of measures would be taken to minimize the effects of access restrictions on residential and commercial properties. For example, in each zone where heavy construction would occur (such as station locations, cut-and-cover tunnel construction areas, and portals), a evaluation would be conducted prior to construction to identify the access needs of the affected properties and a plan would be prepared that responds to the specific needs of the individual properties to the degree possible. At this stage in project design, it is not feasible to provide specific proposals for each construction zone.

MTA will develop and implement a property access management plan working with contractors and the affected property owners. In addition, as construction progresses, if specific issues arise that require modifications to the access management plan, MTA and its contractors would continue to communicate with local residents and businesses to ensure that concerns are addressed when feasible and reasonable.

3.6 Improvements Following Construction

When substantial construction of the project is complete; streets, sidewalks, and other areas disturbed by construction will be returned to acceptable conditions. This reconstruction will be conducted in coordination with the Maryland State Highway Administration (SHA), Baltimore County Department of Transportation (DOT), and Baltimore City DOT.

3.7 Environmental Compliance Plan

MTA will develop and implement an environmental compliance plan after the issuance of the project's ROD and prior to the initiation of construction activities. The plan will identify and describe the management of environmental commitments and mitigation measures during the Final Design and Construction phases of the project. The objectives of the plan are to:

- Identify environmental requirements of the Red Line project that require compliance to Federal, State, and local regulatory permit conditions and the procedures defined to meet them
- Incorporate environmental commitments and mitigation measures stipulated with the FEIS, ROD, and *Section 106 Programmatic Agreement* (**Appendix H**), to ensure that these requirements are identified in Construction Contract documents
- Define responsibilities and actions required to maintain compliance with environmental requirements during design and construction, and to effectively respond to problem situations or agency/public concerns
- Establish necessary procedures for communication, documentation, and review of environmental compliance for each construction contract
- Describe protected resources within the project study corridor and types of mitigation measures needed to protect them

- Ensure that contractors' submittals properly document the work required in the Contractor Documents
- Ensure that contractors employ means and methods to avoid or minimize impacts to the environment and general public in compliance with the construction Contract Documents

The plan would be updated as design and construction progresses, and if further environmental effects are identified. Periodic reviews of the plan and procedures would be performed to ensure continual improvement of the plan's adequacy and it would be expanded and updated during the project duration.

Because the Red Line project could potentially involve Design-Build and Design-Bid-Build contracts, or other delivery methods, the plan would be flexible and tailored to match each type of construction contract. The plan would provide a general framework for methods that would be employed to reduce environmental impacts from construction activities. Specific environmental requirements and controls would be tailored to the various construction contracts and would be included in the contract specifications and documents.

3.8 Commitments and Mitigation Measures

The section identifies a list of commitments and mitigation measures related to the proposed construction methods and activities, as described within this chapter of the FEIS. Additional commitments and mitigation measures for long-term operation and short-term construction-related impacts to transportation and environmental resources are identified within FEIS **Chapters 4** and **5**, respectively.

3.8.1 Working Hours

- Surface Segments: Construction activities will generally be limited to 6 days a week, 15 hours per day. There would be times when certain construction activities could take place during weekends or other times.
- Underground Segments: Typical construction activities for the underground sections, which include portal areas, stations, ancillary buildings, and tunneling, will be performed 7 days a week, 24 hours per day.

3.8.2 Trucking

- Trucking will be permitted only on designated truck routes and may occur up to 24 hours a day, 7 days a week.

3.8.3 Rodent Control

- Construction contractors will be required to implement rodent control programs.

3.8.4 Access Limitations

- MTA will develop and implement a property access management plan working with contractors and the affected property owners.

- When substantial construction of the project is complete, streets, sidewalks, and other areas disturbed by construction will be returned to acceptable conditions.

3.8.5 Environmental Compliance Plan

- MTA will develop and implement an environmental compliance plan after the issuance of the project's ROD and prior to the initiation of construction activities. The plan will identify and describe the management of environmental commitments and mitigation measures during the Final Design and Construction phases of the project.

4. Transportation

This chapter describes existing transportation conditions in which the Preferred Alternative would be located, as well as probable positive and negative effects of the Preferred Alternative on the future setting. Included is a description of: 1) existing transportation conditions within the project study corridor; 2) future No-Build Alternative conditions; 3) future Preferred Alternative conditions; and 4) measures to mitigate effects.

The analysis year for the long-term assessment of the No-Build Alternative and the Preferred Alternative is 2035, when full development of the Preferred Alternative would be completed and its operational goals and objectives realized. For analysis of construction-related transportation effects, an earlier analysis year of peak construction activity is 2016, as identified in **Chapter 3** of this Final Environmental Impact Statement (FEIS).

The organization of **Chapter 4** is by transportation category. Under each category, the discussion is organized by Introduction and Methodology, Existing Conditions, Future No-Build Conditions, and Preferred Alternative including Long-Term Effects, Short-Term Effects and Mitigation.

Changes to this Chapter since the AA/DEIS

This chapter, previously Chapter 3: Transportation System and Consequences in the Alternative Analysis/Draft Environmental Impact Statement (AA/DEIS), has been updated since publication of the AA/DEIS. This chapter reflects revisions to station and parking facility locations, travel forecasting and ridership, and commensurate changes to the bus operating plan. The future year of analysis has been advanced to 2035 from the AA/DEIS study year of 2030. Additionally, more detail is provided concerning effects on traffic on the roadways in the vicinity of the Preferred Alternative, operations and the construction-related activities, as compared to the No-Build Alternative.

4.1 Public Transportation

4.1.1 Introduction and Methodology

This section summarizes existing transit services, as well as transit services under the future No-Build and the Preferred Alternative, describing the potential long-term effects on the transit system within the project study corridor. The results of operations and service planning efforts following issuance of the DEIS, including the evaluation of potential feeder bus service and estimated ridership levels, are also summarized in this section. Additional details regarding the information presented in this section of the FEIS can be found in the *Bus Operations Plan Technical Report* and *Operating Plan Technical Report*, both located in **Appendix I**, as well as the *Public Transportation Technical Memorandum* (**Appendix D**) prepared in support of this FEIS.

4.1.2 Existing Transit Service

The existing public transit service in the project study corridor is largely provided by fixed-route, fixed-schedule buses operating in mixed traffic on local streets; and rail service, specifically the Central Light Rail Line, Metro (heavy rail), and MARC (commuter rail). The Maryland Transit Administration (MTA) operates six types of local and regional transit services: Local Bus, Commuter Bus, Metro, Central Light Rail, MARC, and Paratransit (Mobility) services, with annual ridership among all six types of over 109 million in Fiscal Year (FY) 2011. Details regarding these services and ridership are contained in the separate *Public Transportation Technical Memorandum* prepared in support of this FEIS.

a. Bus Service

The MTA provides 56 local and express bus routes that travel throughout Baltimore City, and Baltimore and Anne Arundel Counties, with average daily ridership of 242,000. These routes include major radial routes, cross-town routes, circumferential routes, and local circulator routes. In addition to local and express bus service, the MTA provides five commuter bus lines that connect Baltimore City with surrounding Maryland counties. The commuter bus service operates from select park-and-ride locations with over 1,300 average daily trips. In total, the 61 MTA bus lines served over 72 million passengers in FY 2011.

The Charm City Circulator (CCC) offers free shuttles that travel four bus routes in Baltimore City. The Orange Route travels east-west from the Hollins Market to Little Italy, the Purple Route runs north-south between Federal Hill and Mount Vernon, the Green Route connects City Center with Fell's Point and The Johns Hopkins Hospital, and the Banner Route operates between the Inner Harbor and Locust Point. Assuming all of these routes are still operational, they would connect with the Preferred Alternative as it travels along the corridor. CCC is operated in partnership with the Baltimore City Department of Transportation, has a fleet of 21 vehicles, offers 15 minute headways, and connects with existing transit services.

b. Metro Service

MTA's Metro travels in a northwest-to-southeast direction from Owings Mills in Baltimore County to downtown Baltimore City, continuing northeast from downtown to The Johns Hopkins Hospital complex in east Baltimore City. The 15.5-mile system provided service to over 14.5 million passengers in FY 2011. The Metro operates in a combination of tunnel, aerial, and exclusive surface sections. A one-way trip from end-to-end along all 14 stations takes approximately 30 minutes.

c. Light Rail Service

The Central Light Rail operates north-south across the project study corridor from Hunt Valley in Baltimore County to Baltimore/Washington International Thurgood Marshall Airport (BWI) and Glen Burnie in Anne Arundel County. The Central Light Rail also provides direct service to Amtrak's Penn Station in Baltimore City on select trips. The Central Light Rail is 30 miles in length with 32 stations located along the line, many of which have parking available or are designed to include access to connecting bus lines. The Central Light Rail carried over 8.5 million passengers in FY 2011.

d. MARC Commuter Rail Service

MARC provides commuter rail service along two railroad corridors in the Baltimore region – the Penn Line and Camden Line. The two lines carried over 8.2 million riders in FY 2011, most travelling to Washington, DC or to Baltimore City. There are three MARC stations in Baltimore City: Camden Station, West Baltimore Station, and Pennsylvania Station. Like most suburban MARC stations, these downtown MARC stations have park-and-ride lots.

e. Paratransit Service

For transit riders who have a disability, the MTA provides paratransit services to supplement the core transit services. The MTA transports nearly 1.35 million passengers each year in lift-equipped mobility vans, vans, and sedans. In addition, the MTA provides taxi vouchers to eligible disabled riders for trips through approved taxi operators. Approximately 309,000 taxi trips were provided in FY 2011.

4.1.3 Public Transit in the Red Line Corridor

There is a high density of existing transit services within the project study corridor. Twenty-three bus routes (Routes #1, 7, 10, 11, 13, 15, 16, 20, 21, 22, 23, 24, 30, 38, 40, 44, 47, 51, 57, 77, 99, 150, and 160) provide bus service and serve over 131,600 riders per day. These 23 routes (shown in **Figure 4-1**) do not include other MTA bus routes that cross through downtown perpendicular to the Red Line. Four of the 23 routes (15, 20, 23, and 40) are among the highest ridership bus routes in the MTA bus network.

While the project study corridor contains an extensive bus network serving east-west travel, bus service can be slow. Buses operate on local streets, which are subject to the same traffic signals and traffic congestion as other vehicles. The fact that ridership is high in the project study corridor despite slow speeds emphasizes the strong transit market in this corridor. For travel demand forecast results, see the detailed analysis in **Section 4.2** of this FEIS.

Metro, Central Light Rail, and MARC serve the project study corridor on north-south routes (**Figure 4-2**). Generally, rail transit service does not serve east-west trips along the corridor, other than Metro, which serves some east-west trips through downtown.

4.1.4 Future No-Build Conditions

The No-Build condition is comprised of existing transit services identified in **Section 4.1.2**, plus planned and programmed transit improvements. MTA transit service initiatives within the project study corridor are summarized below.

- <u>Bus</u>: The MTA continually reviews existing bus services and makes adjustments to optimize performance and reliability. These adjustments are made as frequently as three times per year. The future No-Build does not include these changes as they are dynamic and are not identifiable at this time.
- <u>MARC</u>: The *MARC Growth and Investment Plan (September 2007)* and Baltimore Metropolitan Council's Long Range Plan, *Plan It 2035* include system enhancements to meet existing and future demand. The West Baltimore MARC Station is undergoing a parking expansion from the existing 327 parking spaces to 660 to meet the existing MARC ridership demand. MARC ridership is growing, and plans are underway to increase the number of trains traveling on the Penn and Camden lines, as well as to add a station in the Johns Hopkins Bayview Medical Center campus area.

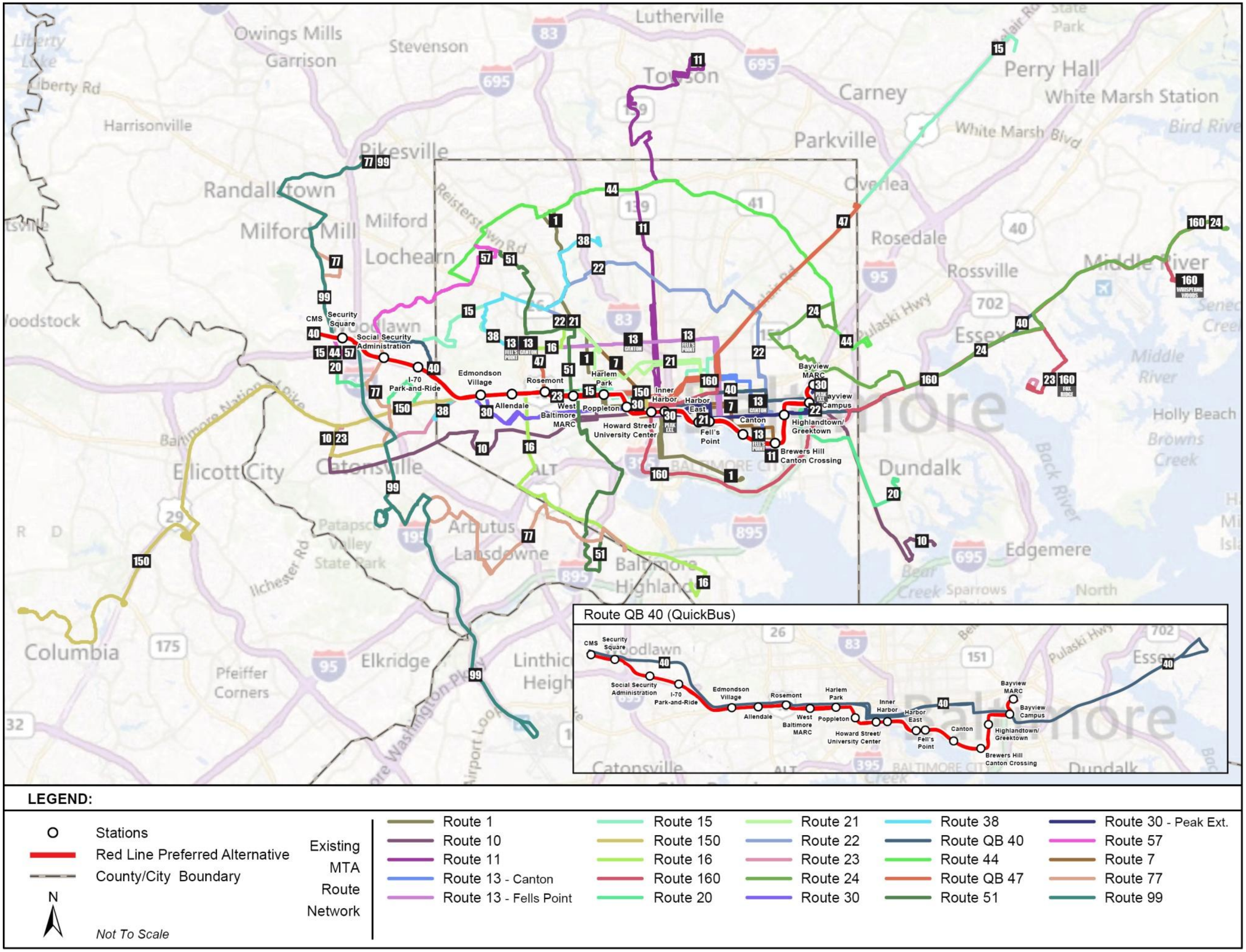


Figure 4-1: Existing Transit Service in the Project Study Corridor

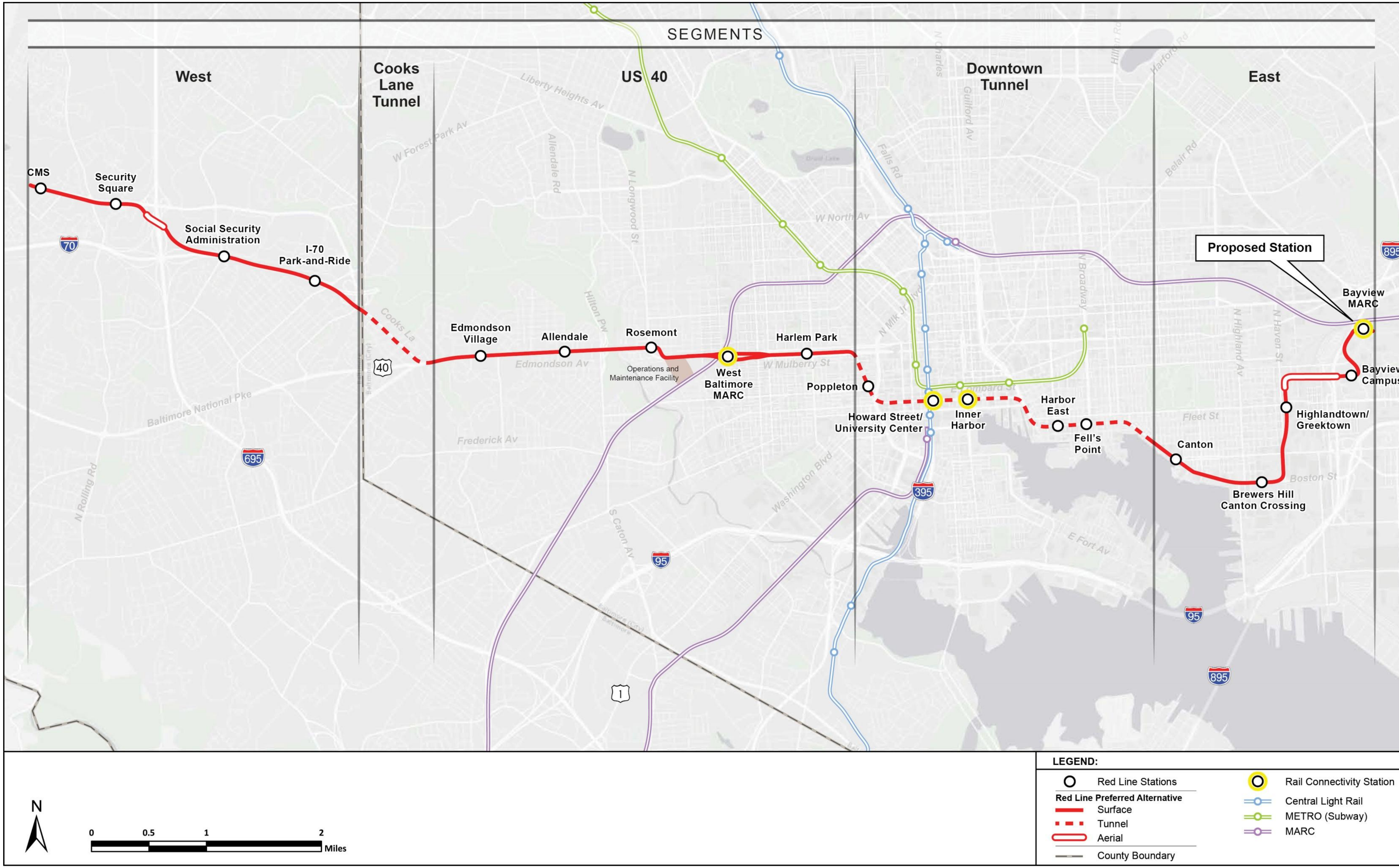


Figure 4-2: Preferred Alternative Alignment with Station Locations

- Metro: The Baltimore Metropolitan Council's Long Range Plan, *Plan It 2035*, includes an additional rail line, known as the Green Line Extension. This project would be an extension of the existing heavy rail transit system from the current terminus at The Johns Hopkins Hospital to North Avenue. This line would be the initial phase of a Green Line extension further northeast into Baltimore County. Refer to **Chapter 2**, **Table 2-1** for the Planned and Programmed Transportation Improvements included in the No-Build Alternative.

Under the No-Build Alternative, the MTA would continue to monitor transit system performance and make service modifications, identify service deficiencies, and make schedule adjustments to the existing transit services to address system needs. With the anticipated increased highway traffic volume along the project study corridor, travel times for bus services are expected to increase under the No-Build Alternative.

4.1.5 Preferred Alternative

Under the Preferred Alternative, the type and quality of transit service in the project study corridor would be improved by adding a new light rail transit (LRT) line. A fixed transitway with dedicated right-of-way would provide faster and more reliable service than current bus service, which runs in mixed traffic. The Preferred Alternative would also provide park-and-ride facilities and bus service that would expand the ridership market by providing access to the proposed Preferred Alternative service. The combination of the Preferred Alternative, increased bus service and additional park-and-ride facilities adds sufficient service in the corridor that additional mobility features for the service area are not needed.

The Preferred Alternative alignment and stations are shown on **Figure 4-2**. A detailed description of the alignment is included in **Chapter 2**.

a. Proposed Transit Service

The Preferred Alternative would assume the same MARC, Metro, and Central Light Rail services described in the No-Build Alternative. In addition, the Preferred Alternative would introduce a new east-west LRT service in the project study corridor, which would be served by a network of "feeder" bus routes. Feeder bus service increases ridership on rail systems by providing connections between rail stations and homes, businesses, or other destinations.

LRT and feeder bus operations under the Preferred Alternative are summarized in the sections below. Additional detail is available in the *Operating Plan Technical Report* and the *Bus Operations Plan*.

b. Light Rail Transit

The physical characteristics of the Preferred Alternative would be as follows:

- Track: Overall length of the Preferred Alternative is 14.1 miles
    - A full, double track alignment beginning at the west end at the Centers for Medicare & Medicaid Services (CMS) station and ending at the east end at Bayview MARC station
    - Tail tracks at the CMS and Bayview MARC stations

- Two tunnel segments – the Downtown Tunnel and the Cooks Lane Tunnel
- Two new aerial structures: over I-695 and NS/CSX/I-895

- Stations: 19 LRT stations (14 surface and five underground)
  - Stations would be designed to allow transfers to nearby rail stations and bus routes, with some stations providing bus turn-arounds and parking bays
  - Station platforms would be 194 feet in length to accommodate the two-car light rail trains
- Operations and Maintenance: An operations and maintenance facility (OMF) is proposed near Calverton Road (see **Figure 4-2**).
  - The facility yard would allow for storage of up to 38 light rail vehicles
- Power system: A traction power system including overhead contact system and traction power substations
- Park-and-ride lots: There would be park-and-ride lots at five of the LRT stations:
  - Three park-and-ride lots would be built as part of the Preferred Alternative, at Security Square, I-70, and Brewers Hill/Canton Crossing
  - There is a park-and-ride lot at the West Baltimore MARC station, which would be expanded under both the No-Build and the Preferred Alternative
  - One proposed park-and-ride lot is anticipated to be built by Baltimore City at the proposed Bayview MARC station under both the No-Build and the Preferred Alternative
  - A total of approximately 2,985 parking spaces would be provided among these five park-and-ride lot locations, as shown in **Table 4-1**:

Table 4-1: Proposed Park-and-Ride Station and Parking Spaces

Station	Spaces
Security Square	375
I-70	700
West Baltimore MARC	660*
Brewers Hill/Canton Crossing	600
Bayview MARC	650
Total	2,985

*Existing park-and-ride location to be expanded

LRT Operating Characteristics

LRT service would operate 7 days a week, Monday through Saturday from 5:00 AM to 1:00 AM and Sundays from 10:00 AM to 10:00 PM. With the proposed operating schedule, it is projected that there would be 55,000 daily riders in 2035. For a detailed description of the operating plan see **Chapter 2**, **Section 2.4.1** of this FEIS and the *Operating Plan Technical Report*.

In 2021, the opening year of the system, the LRT would operate with 10-minute headways (the wait time between trains) during the morning and evening peak periods and 10 to 15 minute headways during the off-peak periods in the opening year of service. In the design year 2035, the Preferred Alternative would operate with 7-minute headways during peak periods.

All light rail vehicles would consist of two light rail cars and would stop at all stations. Twenty-two in-service vehicles would be required to provide service at 2021 opening year levels. Six additional vehicles (28 total) would be required as spares in opening year 2021 to enable reliable service to run 20 to 22 hours per day while vehicles undergo scheduled and unscheduled maintenance.

An additional eight vehicles (36 total) would be required to meet the 7-minute peak headways for the year 2035.

To develop an operating plan for the Red Line, a number of assumptions have been established as noted below:

- One-way travel time from CMS to the Bayview MARC Station would be 45 minutes
- The LRT would be designed for a maximum speed of 55 miles per hour but actual operating speeds vary by segment
- For surface, street-running sections of the alignment, the LRT would not exceed the posted speed limit for vehicular traffic on an adjacent roadway
- All trains would stop at all stations (there would be no express trains or skipped stations)
- Pre-emption/LRT priority at traffic signals – Pre-emption and priority treatments at traffic signals for the light rail vehicles were selected based on the roadway segment and intersection conditions. Additional information is available in the *Operating Plan Technical Report*.
    - For the most part, the LRT is expected to receive priority treatment along the project study corridor, meaning that traffic signal phases can be shortened or lengthened by 10 seconds to accommodate an LRT movement.
    - At some locations along the corridor, pre-emption operations to reduce delay and facilitate light rail vehicles progression along the street-running portions of the alignment would be used. These locations include grade crossings with gates and flashers (i.e., the intersections that are not fully signalized), and along Franklintown Road and Bayview Boulevard, because of the close spacing of a number of intersections at these locations.

c. Supporting Bus Service

The Preferred Alternative would be supported by the extensive existing local bus network based on 23 existing bus lines (Routes #1, 7, 10, 11, 13, 15, 16, 20, 21, 22, 23, 24, 30, 38, 40, 44, 47, 51, 57, 77, 99, 150, and 160) that parallel or cross the project study corridor.[1] The majority of the bus service operating in the project study corridor would terminate at or otherwise serve a proposed LRT station stop, providing easy transfer connections to the Preferred Alternative and other LRT, heavy, and commuter rail services at select station locations.

Many of the 23 existing bus routes parallel to the Preferred Alternative would be realigned to better serve LRT station locations, or undergo schedule changes to facilitate transfers or support expected ridership growth. As part of the realignments, 11 new bus routes would be added to provide service along core segments of existing bus lines. Some routes would experience an increase in service of feeder buses, whereas other routes may be shortened or eliminated due to this duplication. The changes that most affect bus trips occur at the stations because this is where the new and improved bus routes converge to "feed" the Red Line. These and other changes are summarized as follows:

- Portions of Route 40 Quick Bus would be eliminated. The eastern portion of this route's alignment would be retained with local (L) and express (X) service options (40L and 40X);
- Bus routes 1, 7, 10, 11, 13, 15, 16, 20, 21, 22, 23, 24, 30, 38, 44, 47, 51, 57, 77, 99, 150 and 160 would connect with the proposed Preferred Alternative;
- New bus lines, 10 East, 10 West, 15B, 15 East, 15 West, 20 East, 20 West, 23 East, 23 West would be implemented to supplement existing bus service to meet projected demand for connections to/from the Preferred Alternative; and,
- The proposed new services are within the existing mobility service area and an expansion of them is not anticipated with the addition of the new bus lines.

Figure 4-3 shows the proposed Preferred Alternative alignment, station locations, and the connecting bus network. For more detailed information on proposed operational changes for each of the routes and mapping, refer to the *Red Line Bus Operations Plan*.

Where bus routes terminate at proposed stations, the Preferred Alternative stations have been designed to include a turnaround loop and the required number of bus bays. No buses would share the LRT tunnel or aerial sections.

As the Preferred Alternative continues to proceed through Preliminary Engineering and Final Design, proposed bus operations plans would continue to be adjusted. The MTA will hold meetings to inform the public on proposed bus route changes prior to the initiation of bus revenue service.

[1]Bus lines operating across the corridor within the central business district (CBD) were not included in proposed transit service because of the existing high frequency of service and connectivity to the Preferred Alternative.

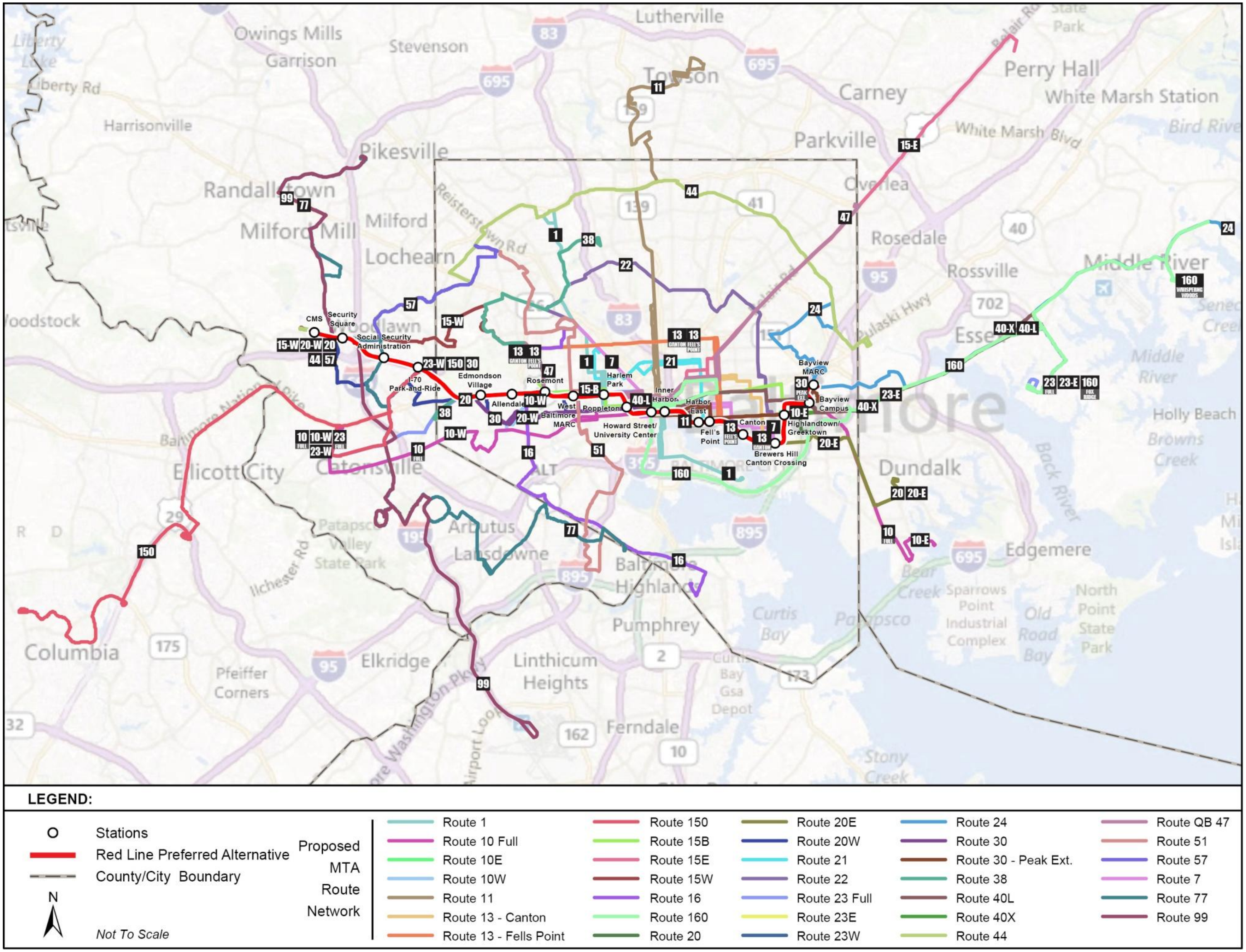


Figure 4-3: Proposed Feeder Bus Service with Preferred Alternative

d. Long-Term Operational Effects

Ridership

Travel Patterns and Trends

Travel by all modes is expected to increase in the Baltimore region, with or without the Preferred Alternative, because of the expected growth in population and employment. The travel demand model estimates for the No-Build (shown in **Table 4-2**) indicate that auto trips would increase by 17 percent between 2005 and 2035, while transit trips would increase by 34 percent. The largest increase in transit trips is estimated to occur in the "urban rail" mode, which includes Metro and Central Light Rail.

Table 4-2: Regional Daily Person-Trips by Mode

Purpose and Mode	2005 Base Year		2035 No-Build Alternative	
	Person-Trips	Percent Total	Person-Trips	Percent Total
Highway Person-Trips	**7,167,080**	**94.8%**	**8,384,230**	**94.8%**
Single Occupant	3,524,720	49.2%	4,206,030	50.2%
Double Occupant	1,969,030	27.5%	2,266,840	27.0%
3+ Occupant	1,673,330	23.3%	1,911,360	22.8%
Transit Person-Trips	**168,720**	**2.2%**	**225,980**	**2.6%**
Bus	96,760	57.3%	129,640	57.4%
Walk to Bus	91,350	54.1%	123,620	54.7%
Drive to Bus	5,410	3.2%	6,020	2.7%
Urban Rail[1]	50,350	29.8%	70,480	31.2%
Walk to Urban Rail	32,470	19.2%	49,370	21.8%
Drive to Urban Rail	17,880	10.6%	21,110	9.3%
Commuter Rail	21,610	12.8%	25,860	11.4%
Walk to Commuter Rail	2,140	1.3%	3,140	1.4%
Drive to Commuter Rail	19,470	11.5%	22,720	10.1%
School Bus	**222,900**	**2.9%**	**229,660**	**2.6%**
Total Non-Motorized Person-Trips (walk/bike)	**125,960**	**1.7%**	**176,130**	**2.0%**
Total	**7,558,700**		**8,839,870**	

Note: [1]Urban Rail includes Metro, Central Light Rail, and Preferred Alternative.

Transit and Auto Travel Times

With the projected growth in travel in the region and in the project study corridor, congestion levels would continue to increase, resulting in slower travel speeds and increased travel times with the No-Build Alternative (compared to existing conditions). In the No-Build Alternative, corridor transit service would continue to be provided through buses running with traffic, and therefore would be subject to the same increase in levels of congestion as other vehicular traffic.

Transit Ridership

The measures used to indicate the impact of the Preferred Alternative on transit ridership are discussed below and include: change in transit trips; mode shift from auto to transit; bus ridership on routes serving the corridor; fixed guideway ridership and daily number of boardings by station.

Total and New Transit Trips

Using the travel demand model, the impact of the Preferred Alternative on transit ridership in the region was evaluated. Linked trips, shown in **Table 4-3**, are trips from origin to destination, regardless of the number of transfers.

Close to 226,000 daily linked transit trips are estimated by 2035 with the No-Build Alternative. With the Preferred Alternative, this estimate would increase by 8 percent, adding an additional 18,410 transit trips. The largest increase in the number of transit trips with the Preferred Alternative would be on the urban rail modes, which would increase by 28,900 riders on an average day. The bus trips would drop as many riders who would use a bus in the No-Build Alternative would use the Preferred Alternative.

Table 4-3: Daily Transit Trips Comparison (Linked Trips)

Purpose and Mode	2035 No-Build Alternative		2035 Preferred Alternative		Difference Preferred Alternative vs. No-Build	
	Person-Trips	Percent Total	Person-Trips	Percent Total	Person-Trips	Percent Total
Transit Person-Trips	225,980	2.6%	244,390	2.8%	18,410	8.1%
Bus	129,640	57.4%	117,040	51.8%	-12,600	-9.7%
Walk to Bus	123,620	54.7%	110,970	49.1%	-12,650	
Drive to Bus	6,020	2.7%	6,070	2.7%	50	
Urban Rail[1]	70,480	31.2%	99,380	44.0%	28,900	41.0%
Walk to Urban Rail	49,370	21.8%	72,910	32.3%	23,540	
Drive to Urban Rail	21,110	9.3%	26,470	11.7%	5,360	
Commuter Rail	25,860	11.4%	27,970	12.4%	2,110	8.2%
Walk to Commuter Rail	3,140	1.4%	4,940	2.2%	1,800	
Drive to Commuter Rail	22,720	10.1%	23,030	10.2%	310	

Note: [1] Urban Rail includes Metro, Central Light Rail, and (for the Preferred Alternative) Red Line LRT.

Transit Mode Share

The impact of the Preferred Alternative on the mode that travelers choose for their trips can be seen in **Table 4-4**. Close to 18,170 person-trips would shift mode from auto to transit once the Preferred Alternative is operational, resulting in a reduction in highway trips in the region.

Table 4-4: Comparison of Total Trips by Mode (2035)

Purpose and Mode	2035 No-Build Alternative		2035 Preferred Alternative		Difference Preferred Alternative vs. No-Build	
	Person-Trips	Percent Total	Person-Trips	Percent Total	Person-Trips	Percent Total
Highway Person-Trips	8,384,230	94.8%	8,366,060	94.6%	-18,170	-0.2%
Transit Person-Trips	225,980	2.6%	244,390	2.8%	18,410	8.1%
School Bus	229,660	2.6%	229,420	2.6%	-240	-0.1%
Total Non-Motorized Person-Trips (walk/bike)	176,130	2.0%	188,820	2.1%	12,690	7.2%
Total	**8,839,870**		**8,839,870**			

Bus Ridership

With the Preferred Alternative added to the regional transit network, bus routes in the project study corridor are estimated to carry 8,960 riders per day less than under the No-Build Alternative. This reduction is a result of some of the bus riders switching from the local bus service to the more efficient service of the light rail line. **Table 4-5** summarizes the number of bus riders (unlinked trips) with the No-Build Alternative (41,350) and the Preferred Alternative (32,390) on the routes providing service in the corridor. Unlinked trips are equivalent to the number of boardings where each passenger trip is counted regardless of transfers (e.g., someone taking a bus to the LRT to get downtown would count as two unlinked trips, but only one linked trip).

Ridership on some routes would increase, such as Route 23 (below), which would serve as a feeder route, bringing riders to the Preferred Alternative, while others would decrease as riders shifted to rail for their entire trip.

Table 4-5: Corridor and Region-Wide Bus Ridership (Unlinked Trips)

Route	2035 No-Build Alternative		2035 Preferred Alternative	
	Daily Boardings	Peak Period Boardings	Daily Boardings	Peak Period Boardings
Route 15	13,770	7,910	10,090	6,050
Route 20	7,930	3,360	8,400	4,380
Route 23	9,650	4,000	10,490	4,040
Route 40	10,000	5,570	3,410	1,510
Total Average Bus Ridership	**41,350**		**32,390**	

Urban Rail Ridership

Under the No-Build Alternative, 70,480 person-trips are estimated to use the urban rail system in the region (Metro and Central Light Rail). With the Preferred Alternative in operation, that number would increase to 99,380, or an additional 28,980 person-trips per day (**Table 4-2**).

Daily Station Boardings

An analysis was done by station of individual boardings and alightings (passengers getting on and off a light rail vehicle, respectively) (**Table 4-6**). This analysis identified the Inner Harbor Station located in the central business district (CBD) area as the station with the highest number of boardings, approximately 13,000 per day.

Other stations with significant activity (boardings greater than 4,000 per day) include: Howard Street/University Center Station, West Baltimore MARC Station, and Brewers Hill/Canton Crossing Station. The high use of these stations is not surprising, as they provide connections to other primary transit routes, as well as access to major employment centers, residential areas, and tourist attractions. The Social Security Administration (SSA) and the Bayview Campus Station also show substantial activity with station boardings greater than 1,800 per day.

Peak Hour Line Volumes

Figure 4-4 summarizes the 2035 projected peak hour volumes by station and by line segment. Examining the number of riders getting on and off during peak hours provides the peak hourly "passenger load," or the maximum number of passengers that travel past a single point on a particular transit line or route during the peak hour. Examining peak passenger loading is important in setting train frequencies (the time between trains) to make sure that trains are not running either empty or overcrowded.

The highest volume in the westbound direction is between the Fell's Point, Harbor East, and Inner Harbor stations, where the trains would carry approximately 1,350 passengers during the peak period. In the eastbound direction, the point with the highest volume is between the Harlem Park and Poppleton stations. In that segment, the Preferred Alternative would carry an estimated 1,810 passengers during the peak period.

Preferred Alternative Passenger Mode of Access and Egress

With the Preferred Alternative, close to 30 percent of the transit riders would walk to the station, and another 28 percent would take a bus and transfer to it (**Table 4-7**). Of the 20 percent who would access the Preferred Alternative via automobile, 9 percent would be dropped off and 11 percent would use the park-and-ride. An estimated 5 percent would access the Preferred Alternative via the Central Light Rail Line, 11 percent via Metro, and 6 percent via the MARC routes.

Along the Preferred Alternative, the Howard Street/University Center and the Inner Harbor stations would have the highest number of riders accessing the stations by walking. The station with the highest number of riders driving to the Red Line would be Brewers Hill/Canton Crossing Station, while the highest number of riders being dropped off would occur at the West Baltimore MARC Station. Highest bus access activity is estimated to occur at the Rosemont Station.

Table 4-6: Light Rail Daily Boardings Projections (2035)

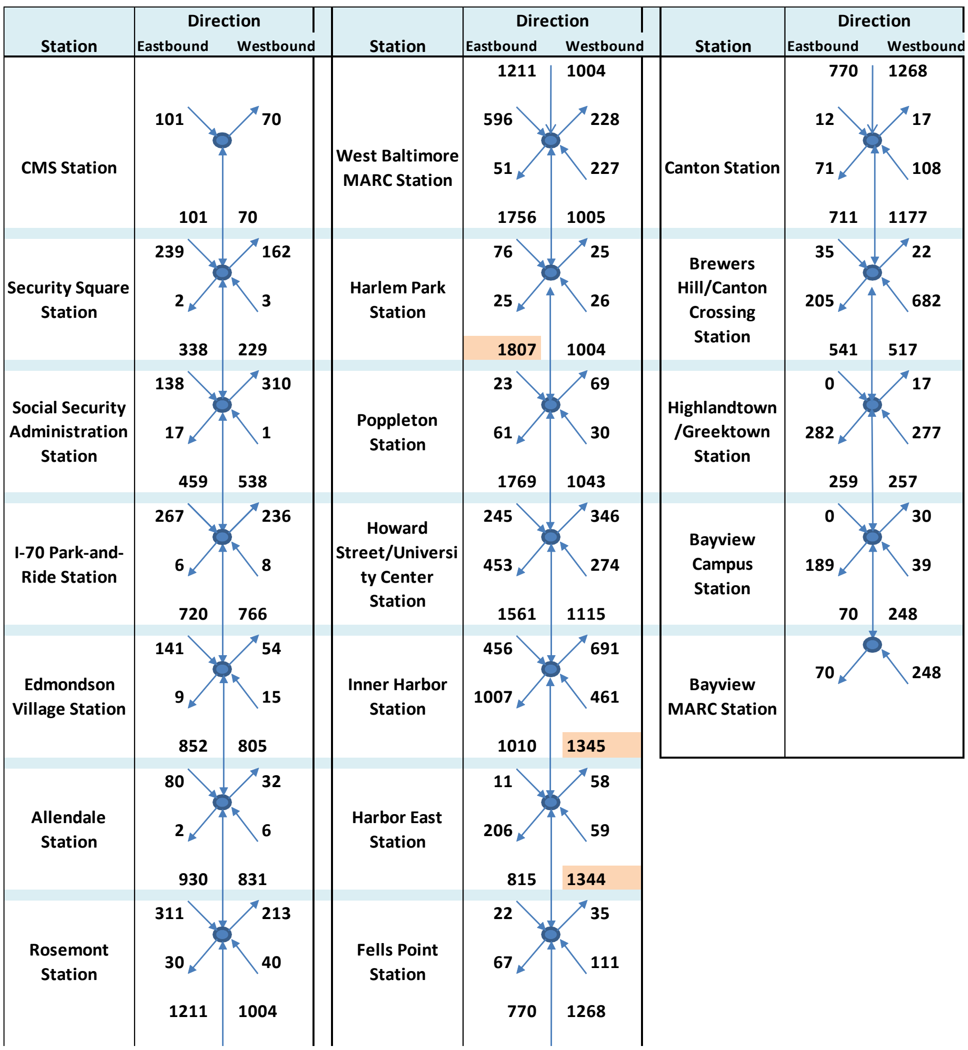
Station	Daily Boardings (On)		Daily Boardings (Off)		Total Boarding
	Eastbound	Westbound	Eastbound	Westbound	
CMS[1]	1,249	0	0	771	1,010
Security Square	2,747	30	30	1,627	2,220
Social Security Administration	1,751	26	166	3,212	2,580
I-70 Park-and-Ride	2,905	74	34	1,230	2,120
Edmondson Village	1,546	174	131	442	1,150
Allendale	1,343	99	61	493	1,000
Rosemont	3,079	351	297	1,537	2,630
West Baltimore MARC	4,480	1,410	763	2,441	4,550
Harlem Park	892	270	197	217	790
Poppleton	304	284	703	751	1,020
Howard Street/University Center	2,745	2,729	5,180	4,203	7,430

Table 4-6: Light Rail Daily Boardings Projections (2035)

Station	Daily Boardings (On)		Daily Boardings (Off)		Total Boarding
	Eastbound	Westbound	Eastbound	Westbound	
Inner Harbor	4,879	4,130	9,690	7,165	12,930
Harbor East	119	831	2,481	599	2,020
Fell's Point	187	1,142	793	298	1,210
Canton	164	1,370	1,117	218	1,430
Brewers Hill/Canton Crossing	276	5,945	1,906	206	4,170
Highlandtown/Greektown	14	3,176	2,106	147	2,720
Bayview Campus	0	871	2,519	277	1,830
Bayview MARC[1]	0	2,923	504	0	1,710
Total	**28,680**	**25,840**	**28,680**	**25,830**	**54,520**

Note: [1] Station Termini

Figure 4-4: 2035 Peak Hour Station and Line Volumes



Note: Arrows indicate the number of riders getting on and off the LRT at each station. The numbers on the left represent passengers getting on and off the eastbound light rail trains and the numbers on the right represent passengers getting on and off of westbound light rail trains.

Table 4-7: Light Rail Passenger Mode of Access (2035)

Station	Walk to Red Line	Park-and-Ride to Red Line	Kiss-and-Ride to Red Line	Bus to Red Line	Central Light Rail Line to Red Line	Metro to Red Line	MARC to Red Line	Total On
CMS	1,248	–	1	–	–	–	–	1,250
Security Square	322	1,074	518	863	–	–	–	2,780
Social Security Administration	906	–	7	865	–	–	–	1,780
I-70 Park-and-Ride	–	713	455	1,811	–	–	–	2,980
Edmondson Village	1,442	–	2	273	–	–	–	1,720
Allendale	993	–	9	441	–	–	–	1,440
Rosemont	36	–	27	3,368	–	–	–	3,430
West Baltimore MARC	629	1,061	1,214	248	–	–	2,736	5,890
Harlem Park	1,100	–	3	60	–	–	–	1,160
Poppleton	416	–	48	124	–	–	–	590
Howard Street/University Center	1,690	–	404	508	2,871	–	–	5,470
Inner Harbor	1,742	–	474	731	–	6,062	–	9,010
Harbor East	950	–	1	–	–	–	–	950
Fell's Point	1,267	–	4	59	–	–	–	1,330
Canton	1,534	–	1	–	–	–	–	1,540
Brewers Hill/Canton Crossing	257	2,145	996	2,824	–	–	–	6,220
Highlandtown/Greektown	360	–	87	2,743	–	–	–	3,190
Bayview Campus	871	–	–	–	–	–	–	870
Bayview MARC	22	1,218	675	441	–	–	567	2,920
Total	**15,790**	**6,210**	**4,930**	**15,360**	**2,870**	**6,060**	**3,300**	**54,520**
Percent Access of Total	**29%**	**11%**	**9%**	**28%**	**5%**	**11%**	**6%**	

e. Short-Term Construction Effects and Mitigation

Bus Service

During construction, local area transit would be affected by lane closures and restrictions within the project study corridor. These disruptions could include: bus stop closures, provision of temporary bus stops, schedule delays, and bus route detours. Affected transit stops will be temporarily relocated to the nearest possible location. Americans with Disabilities Act (ADA) access and signage for bus stops will be maintained throughout construction. Pedestrian areas will be provided for bus stops maintained in construction areas. The *Public Transportation Technical Memorandum* presents a list of bus routes and stops that could be affected by construction activities.

Information will be provided in advance of and throughout the service disruptions indicating the purpose and duration of the impact. Information will be posted at bus stops, bus shelters, and other transit locations with suggested short-term alternatives during construction. The MTA will also post detour information on its website.

Metro Rail Service

During construction of the Light Street Connector as described in **Chapter 3**, the proposed pedestrian connection between the Inner Harbor Station at Lombard and Light Streets and the Charles Center Metro Station at Baltimore and Light Street may result in temporary changes in access and circulation within the station facility. Disruption to existing Metro services at this station is not anticipated as a result of construction activities. MTA will maintain access and circulation within the Charles Center Metro Station during construction.

4.2 Roadway Facilities and Traffic

The section describes the effects to roadway facilities and traffic during the Design Year (2035). Also, presented are impacts during 2016, the identified year of peak construction activity. The section concludes with a discussion of measures to mitigate the identified impacts. The methodology used in the impact analyses is summarized, as well as the existing roadway facilities and traffic conditions within the project study corridor. The *Traffic and Parking Technical Report*, located in **Appendix I** of this Final Environmental Impact Statement (FEIS), contains additional detail and supporting documentation.

4.2.1 Introduction and Methodology

Traffic analyses for the No-Build and Preferred Alternative were performed using the *Plan It 2035* Long Range Plan and the latest Baltimore Regional Transportation Board (BRTB) transportation model. The data associated with the model is Round 7C, which was approved in November 2011 by the BRTB.

Levels of service (LOS) were defined per the Highway Capacity Manual (HCM), 2000 edition, to provide a quantitative measure to characterize operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. For signalized intersections, LOS is directly related to the average control delay per vehicle in seconds. **Table 4-8** is from the HCM and defines the criteria as:

Table 4-8: LOS Criteria for Signalized Intersections

LOS	Control Delay per Vehicle (s/vehicle)
A	≤ 10
B	> 10-20
C	> 20-35
D	>35-55
E	>55-80
F	>80

Source: Exhibit 16-2 Highway Capacity Manual, 2000, Transportation Research Board

For unsignalized intersections, LOS is directly related to the computed control delay per vehicle for minor movements only. **Table 4-9** from the HCM defines the criteria as:

Table 4-9: LOS Criteria for Two-Way Stop-Controlled Intersections

LOS	Average Control Delay (s/vehicle)
A	0-10
B	> 10-15
C	> 15-25
D	>25-35
E	>35-50
F	>50

Source: Exhibit 17-2 Highway Capacity Manual, 2000, Transportation Research Board

Travel times and LOS were developed using the Synchro/SimTraffic Version 7.0 software program, with VISSIM Version 5.3 models used to test pre-emption intersection treatments. For this FEIS, both the AM and PM peak periods were included in the analysis for the project study corridor, whereas only the PM peak was included in the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) study. For the FEIS, the peak hours were determined to be the highest hour between 7:00 and 9:00 for the AM peak hour and 4:00 and 6:00 for the PM peak hour.

4.2.2 Existing Conditions

Roadway capacity for east-west travel is limited in the Baltimore region today. The lack of direct, limited-access, east-west connections requires dependence on arterial roadways to handle the growth in traffic volumes. These arterials tend to experience congestion at signalized intersections. Furthermore, there is a limited ability to expand roadway capacity because of right-of-way constraints in the area.

There are numerous roadways along the project study corridor, and they have a wide range of characteristics. The roads range from freeways to local streets; the number of lanes on these roadways varies from two to six; and parking is allowed on some of the roadways while prohibited on others. Information on the total number of lanes for various roadways along the project study corridor, existing traffic volumes, travel times, and levels of service (a measure of traffic congestion) at various times of day are summarized below, with more detail available in the *Traffic and Parking Technical Report.*

a. Traffic Volumes

Traffic counts were obtained from Baltimore City Department of Transportation, Baltimore County Department of Transportation, and the Maryland State Highway Administration (SHA) Highway Information Services Division. The data was supplemented with count data collected by the MTA in 2011, to update and verify the AA/DEIS traffic information for intersections along and in the vicinity of the Red Line alignment. **Table 4-10** presents a summary of traffic volumes in the project study corridor.

Table 4-10: Average Daily Traffic for Roadways within the Project Study Corridor

Location	Average Daily Traffic (ADT)
I-70, east of I-695	25,000
Security Boulevard, west of I-695 to Rolling Road	48,000
US 40, from Rolling Road to I-695	53,000
US 40, west of Cooks Lane	24,000
Edmondson Avenue, west of Swann Avenue	39,000
Frederick Avenue, west of Hilton Drive	15,000
Franklin Street, east of Franklintown Road	33,000
Martin Luther King, Jr. Boulevard, south of Pratt Street	58,000
Lombard Street, west of Greene Street	10,000
Lombard Street, east of Charles Street	30,000
Lombard Street, west of Market Place	29,000
President Street, north of Lombard Street	35,000
Fleet Street, east of President Street	21,000
Boston Street, north of Montford Avenue	27,000
Boston Street, east of Conkling Street	16,000
I-895, north of Boston Street	70,000
I-895, north of Lombard Street	64,000
Interstate Avenue, east of I-95 ramps	8,500
O'Donnell Street, east of Conkling Street	22,500
Eastern Avenue, east of Bayview Boulevard	22,000
Bayview Boulevard, south of Alpha Commons Drive	7,000

Source: Maryland State Highway Administration, Baltimore City, MTA, Red Line Traffic and Parking Technical Report, 2012

b. Travel Time

One of the various measures of how well a roadway operates is the duration of time it takes to traverse a section of that roadway. This was determined by conducting a travel time study in 2011. The field travel times for some segments are listed in **Table 4-11**.

The travel time analysis for Existing Conditions showed that congestion occurs within the project study corridor, particularly in the Downtown area, along Edmondson Avenue between Franklin Street and Cooks Lane, and along Lombard Street between President Street and Martin Luther King, Jr. (MLK Jr.) Boulevard.

Table 4-11: Existing AM and PM Peak Period Travel Times

From/To	EB/SB Travel Time[1] (minutes)	WB/NB Travel Time[1] (minutes)
Greengage Road to Woodlawn Drive, along Security Boulevard	3.8 (4.8)	4.7 (4.8)
Woodlawn Drive to Ingleside Avenue, along I-70	1.1 (1.1)	1.0 (1.0)
Woodlawn Drive to Ingleside Avenue along Parallel Drive	2.5 (1.8)	1.6 (1.6)
Forest Park Avenue to Edmondson Avenue, along Cooks Lane	3.1 (2.2)	1.8 (1.8)
I-695 Outer Loop to Cooks Lane, along US 40	3.8 (5.8)	4.7 (5.5)
Cooks Lane to Franklin Street, along Edmondson Avenue	4.5 (5.8)	4.8 (5.3)
Edmondson Avenue to Pulaski Street, along Franklin Street	2.2 (2.3)	2.2 (2.1)
Pulaski Street to Martin Luther King, Jr. Boulevard, along US 40	2.3 (3.2)	1.9 (3.4)
US 40 to Lombard Street, along Martin Luther King, Jr. Boulevard	1.8 (3.3)	2.5 (4.2)
Martin Luther King, Jr. Boulevard to President Street, along Lombard Street	N/A	6.2 (7.4)
Pratt Street to Fleet Street, along President Street	1.0 (0.8)	3.3 (2.5)
President Street to Boston Street, along Fleet Street	3.9 (6.9)	3.9 (3.9)
Fleet Street to Conkling Street, along Boston Street	3.7 (4.6)	2.7 (4.8)

Note: [1] AM (PM) peak hours
Source: MTA, Traffic and Parking Technical Report, 2012

c. Levels of Service

A total of 144 intersections along the project study corridor were included in the study. This includes 125 signalized intersections within the proposed Red Line alignment and in its vicinity, and 19 unsignalized intersections that would be modified either to a signal or would have access closed/modified under the Preferred Alternative.

According to the SHA's and Baltimore City's traffic engineering standards, intersections that operate below a LOS D are considered to have operational deficiencies. As shown in **Table 4-12**, five signalized intersections during the AM peak hour, and ten signalized intersections during PM peak hour, operate below LOS D. Three unsignalized intersections during the AM peak hour and four during the PM peak hour currently operate below LOS D.

Table 4-12: Existing Levels of Service E and/or F

No.	Signalized Intersections	Existing[1]	
		AM	PM
1	MD 122 (Security Boulevard) at Woodlawn Drive	D	**E**
2	MD 122 (Security Boulevard) at Ingleside Avenue	**E**	**E**
3	US 40 at Ingleside Avenue	D	**E**
4	Mulberry Street at Pulaski Street	**E**	C
5	Martin Luther King, Jr. Boulevard at Mulberry Street	**F**	C
6	Martin Luther King, Jr. Boulevard at Saratoga Street	**E**	D
7	Martin Luther King, Jr. Boulevard at Baltimore Street	C	**E**
8	Martin Luther King, Jr. Boulevard at Lombard Street	C	**E**
9	Lombard Street at Penn Street	B	**E**
10	Lombard Street at Hopkins Place	**F**	**F**
11	Lombard Street at Hanover Street	B	**E**
12	Lombard Street at St. Paul Street	C	**F**
13	Boston Street at Aliceanna Street	B	**E**
Total – LOS E OR F		**5**	**10**
No.	**Unsignalized Intersections**	**Existing[1]**	
		AM	**PM**
1	Security Boulevard at Greengage Road	**E**	D
2	Parallel Drive at Social Security Administration Access	B	**F**
3	Edmondson Avenue at Denison Street	**F**	**F**
4	US 40 (Mulberry Street) at Smallwood Street	**F**	**F**
5	Boston Street at Leakin Street	D	**F**
Total – LOS E OR F		**3**	**4**

Note: [1] AM (PM) peak hours

Source: MTA, Traffic and Parking Technical Report, 2012

4.2.3 Future No-Build Conditions

This section discusses the effects of the No-Build Alternative in 2035 to roadways facilities and traffic. The future No-Build conditions consists of the existing roadway and transit network, as well as planned and programmed improvements in the region's adopted and financially constrained Long-Range Plan (*Plan It 2035*), the Baltimore Region Transportation Improvement Program (TIP), and approved developer projects along the project study corridor. The improvements that would directly impact travel demand in the project study corridor are:

- Security Boulevard Extension Existing Terminus to Fairbrook Road: being completed by Baltimore County and would extend Security Boulevard west of the existing terminus near the Centers for Medicare & Medicaid Services (CMS) complex. Completion is anticipated by 2018.
- Uplands Development: would add new access on Edmondson Avenue at its site. Completion is anticipated by 2016.
- US 40/Edmondson Avenue Bridge expansion over Gwynns Falls/CSX Railroad: would include widening the bridge from 8 to 10 lanes. Completion is anticipated by 2018.

- West Baltimore MARC Station Improvements: would connect Payson Street between Franklin Street and Mulberry Street and relocate the US 40 ramps from Pulaski Street to Payson Street. The MARC station would extend the existing parking lot. Completion is anticipated by 2015.
- Boh-Donnell Connector: would divert traffic moving along Boston Street through the new connector onto O'Donnell Street to I-95. It is anticipated that a number of motorists along Boston Street east of Conkling Street that are traveling towards the I-95 ramps would divert onto the new Boh-Donnell connector to avoid the CSX at-grade rail crossing east of Haven Street on Boston Street. Completion is anticipated by 2015.
- Bayview MARC and Intermodal Station: geometric improvements are still under review and not approved as of now. Completion is anticipated by 2014.

a. Traffic Volumes

Travel demand forecasts were developed for the No-Build conditions using the BMC's Model, which were modified to provide enhancements to the transit network. The socio-economic data associated with the model is Round 7C.

The resulting average daily traffic volumes are shown in **Table 4-13**. The highest volume roadways in 2035 are anticipated to be similar to the highest volume roadways in 2011. Traffic volumes on almost all roads are anticipated to increase with the only decrease in volume anticipated along I-895 between Boston Street and President Street, north of Lombard Street.

These roadways were analyzed for peak hour operation. The highest corridor volumes during the AM peak are projected for eastbound US 40, eastbound Edmondson Avenue, southbound MLK Jr. Boulevard and northbound President Street. They are anticipated to exceed over 2,500 vehicles in AM peak hour. The largest percent increases are expected to occur along I-70 (44 percent), Boston Street (48 percent), and Bayview Boulevard (141 percent).

The highest corridor volumes during the PM peak hour are projected for westbound Security Blvd, westbound US 40, westbound Edmondson Avenue, and northbound MLK Jr. Boulevard. They are anticipated to exceed over 3,000 vehicles in PM peak hour. The largest increases are expected to occur along I-70 (44 percent), Boston Street (58 percent) and Bayview Boulevard (188 percent).

Table 4-13: Existing and No-Build 2035 Average Daily Traffic

Location	Existing	No-Build	Percent Growth (+/- %)
I-70, east of I-695	25,000	34,500	+38%
Security Boulevard, west of I-695 to Rolling Road[1]	48,000	48,500	+1%
US 40, from Rolling Road to I-695	53,000	69,000	+30%
US 40, west of Cooks Lane	24,000	29,000	+21%
Edmondson Avenue, east of Swann Avenue	39,000	46,000	+18%
Frederick Avenue, west of Hilton Drive	15,000	17,000	+13%
Franklin Street, east of Franklintown Road	33,000	40,000	+21%
MLK Jr. Boulevard, south of Pratt Street	58,000	87,500	+51%
Lombard Street, west of Greene Street	10,000	16,000	+60%
Lombard Street, east of Charles Street	30,000	34,500	+15%
Lombard Street, west of Market Place	29,000	47,000	+62%
President Street, north of Lombard Street	35,000	34,500	-1%
Fleet Street, east of President Street	21,000	23,000	+10%
Boston Street, north of Montford Avenue	27,000	36,000	+33%
Boston Street, east of Conkling Street	16,000	25,000	+56%
I-895, north of Boston Street	70,000	60,000	-14%
I-895, north of Lombard Street	64,000	60,000	-6%
Interstate Avenue, east of I-95 ramps	8,500	15,500	+82%
O'Donnell Street, east of Conkling Street	22,500	32,500	+44%
Eastern Avenue, east of Bayview Boulevard	22,000	22,500	+2%
Bayview Boulevard, south of Alpha Commons Drive	7,000	19,500	+178%

Note: [1]Baltimore County Road Extension forecasts are under development. 2035 volumes are subject to change.
Source: MTA, Traffic and Parking Technical Report, 2012

b. Travel Time

As traffic volumes on a section of roadway increase, travel speeds decrease and travel times increase. Operational improvements such as interconnecting signals or adjusting signal timing may make the roadway operate more efficiently. Travel times give a relative comparison between today's operation and how the roadway is projected to operate in the year 2035.

Modeled travel times in minutes for the 2035 No-Build conditions, shown in **Table 4-14**, indicate that increases in travel times would occur throughout the project study corridor over the Existing Conditions because of regional traffic growth. Travel times shown in **bold** are the travel times that are expected to increase by over 100 percent in the 2035 No-Build versus 2011 existing levels.

Table 4-14: Existing and 2035 No-Build Peak Hour Travel Times

From/To	Existing		No-Build		Percent Change Between Existing and No-Build	
	EB/SB Travel Time[1] (minutes)	WB/NB Travel Time[1] (minutes)	EB/SB Travel Time[1] (minutes)	WB/NB Travel Time[1] (minutes)	EB/SB Travel Time[1] (+/-)	WB/NB Travel Time[1] (+/-)
Security Boulevard, from Greengage Road to Woodlawn Drive	3.8 (4.8)	4.7 (4.8)	4.9 (11.1)	5.4 (9.5)	+29 **(+131)**	+15 (+98)
Parallel Drive, from Woodlawn Drive to Ingleside Avenue	2.5 (1.8)	1.6 (1.6)	3.0 (3.5)	3.8 (3.7)	+20 (+94)	**+138 (+131)**
Cooks Lane, from Forest Park Avenue to Edmondson Avenue	3.1 (2.2)	1.8 (1.8)	2.7 (2.3)	2.0 (2.1)	-13 (+5)	+11 (+17)
US 40, from I-695 Outer Loop to Cooks Lane	3.8 (5.8)	4.7 (5.5)	4.5 (6.9)	5.9 (12.7)	+18 (+19)	+26 **(+131)**
Edmondson Avenue, from Cooks Lane to Franklin Street	4.5 (5.8)	4.8 (5.3)	7.4 (7.2)	11.0 (10.0)	+64 (+24)	**+129** (+89)
Franklin Street, from Edmondson Avenue to Pulaski Street	2.2 (2.3)	2.2 (2.1)	4.9 (2.7)	2.9 (2.4)	**+123** (+17)	+32 (+14)
Martin Luther King, Jr. Boulevard, from US 40 to Lombard Street	1.8 (3.3)	2.5 (4.2)	4.4 (6.3)	3.2 (4.3)	**+144 (+91)**	+28 (+2)
Lombard Street, from Martin Luther King, Jr. Boulevard to President Street	N/A	6.2 (7.4)	N/A	6.3 (9.2)	N/A	+2 (+24)
President Street, from Pratt Street to Fleet Street	1.0 (0.8)	3.3 (2.5)	0.8 (1.4)	8.0 (2.2)	-20 (+75)	**+142** (-12)
Fleet Street, from President Street to Boston Street	3.9 (6.9)	3.9 (3.9)	3.7 (7.6)	7.3 (4.7)	-5 (+10)	+87 (+21)
Boston Street, from Fleet Street to Conkling Street	3.7 (4.6)	2.7 (4.8)	7.8 (6.0)	4.8 (4.6)	**+111** (+30)	+78 (-4)

Notes: [1] AM (PM) peak hours

Source: MTA, Traffic and Parking Technical Report, 2012

c. Levels of Service

A total of 152 intersections (132 signalized and 20 unsignalized) were analyzed for the 2035 No-Build scenario to determine AM and PM peak hour LOS. There are eight new intersections (seven signalized and one unsignalized) that would be built by 2035 along the project study corridor under the No-Build.

The results of the 2035 No-Build analysis showed that the overall LOS would decrease over existing conditions throughout the entire corridor, as a result of traffic volume growth in the region between 2011 and 2035.

It is anticipated that all intersections that are failing in existing conditions would continue to fail in the future No-Build conditions with improvements as listed in the *Plan It 2035*.

Table 4-15 provides the total number of intersections that are operating at acceptable LOS (LOS D or better) and worse (LOS E or F) in the existing and 2035 No-Build conditions during the AM and PM peak hours.

Table 4-15: Summary of Existing and 2035 No-Build Levels of Service

Intersection Type	Number of Intersections Existing/ No-Build	Existing[1]		No-Build[1]	
		Acceptable LOS (LOS D)	LOS E or F	Acceptable LOS (LOS D)	LOS E or F
Signalized	125/132	120 (115)	5 (10)	113 (106)	19 (26)
Unsignalized (worst approach)	19/20	16 (15)	3 (4)	12 (12)	8 (8)

Note: [1]AM (PM) peak hours
Source: MTA, Traffic and Parking Technical Report, 2012

The following traffic impacts are generally defined as "significant" and all Intersections that meet the criteria are listed in **Table 4-16**:

1) Deterioration in intersection operations from LOS D or better to LOS E or F, deterioration from LOS E to LOS F, or substantial deterioration in vehicle delays within LOS F; or
2) Deterioration in intersection operations from LOS A or B to LOS D or worse (i.e., a change of at least two levels of service when the existing is operating at an optimal level.

As shown in **Table 4-16** a greater number of intersections would fail in the 2035 No-Build Year (19 signalized and eight unsignalized during AM peak hour, 26 signalized and eight unsignalized during PM peak hour) when compared with the Existing Conditions (five signalized and three unsignalized during AM peak hour, 10 signalized and four unsignalized during PM peak hour), as a result of traffic volume growth in the region between 2011 and 2035.

A detailed analysis table with delay and volumes at studied intersections in both existing and No-Build is included in *Traffic and Parking Technical Report*.

Table 4-16: Existing and 2035 No-Build Levels of Service for Selected Intersections

No.	Signalized Intersections	Existing		No-Build	
		AM	PM	AM	PM
1	MD 122 (Security Boulevard) at Belmont Avenue	B	D	C	**E**
2	MD 122 (Security Boulevard) at Woodlawn Drive	D	**E**	D	**F**
3	MD 122 (Security Boulevard) at Ingleside Avenue	**E**	**E**	**E**	**E**
4	Johnnycake Road at Ingleside Avenue	C	C	**E**	**F**
5	US 40 at Ingleside Avenue	D	**E**	D	**F**
6	Mulberry Street at Pulaski Street	**E**	C	B	C
7	Franklin Street at Payson Street	N/A[1]	N/A[1]	C	**F**
8	Martin Luther King, Jr. Boulevard at Franklin Street	D	D	**F**	**F**
9	Martin Luther King, Jr. Boulevard at Mulberry Street	**F**	C	**F**	**F**
10	Martin Luther King, Jr. Boulevard at Saratoga Street	**E**	D	**F**	**F**
11	Martin Luther King, Jr. Boulevard at Fayette Street	B	B	**F**	**E**
12	Martin Luther King, Jr. Boulevard at Baltimore Street	C	**E**	**F**	**F**
13	Martin Luther King, Jr. Boulevard at Lombard Street	C	**E**	**F**	**F**
14	Lombard Street at Penn Street	B	**E**	B	**E**
15	Lombard Street at Greene Street	C	C	C	**F**
16	Lombard Street at Penn Street	B	C	C	**E**
17	Lombard Street at Hopkins Place	**F**	**F**	**F**	**F**
18	Lombard Street at Hanover Street	B	**E**	**E**	**E**
19	Lombard Street at St. Paul Street	C	**F**	D	**F**
20	Lombard Street at Calvert Street	C	C	D	**F**
21	Lombard Street at South Street	C	C	C	**E**
22	Lombard Street at President Street	D	C	**E**	**E**
23	President Street at Eastern Avenue	C	D	D	**E**
24	Fleet Street at Caroline Street	B	B	**E**	**E**
25	Boston Street at Aliceanna Street	B	**E**	C	**F**
26	Boston Street at Montford Avenue	B	B	**E**	A
27	Boston Street at Clinton Street	D	C	**F**	C
28	Boston Street at Conkling Street	B	B	**E**	C
29	Conkling Street at O'Donnell Street	D	D	**F**	**F**
30	O'Donnell Street at New Boston Street (Boh-Donnell Connector)	N/A[2]	N/A[2]	**E**	D
31	O'Donnell Street at Interstate Avenue	C	C	**E**	C
32	Bayview Boulevard at Lombard Street	C	C	**E**	**F**
	Total – LOS E OR F	**5**	**10**	**19**	**26**

Table 4-16: Existing and 2035 No-Build Levels of Service for Selected Intersections

No.	Unsignalized Intersections	Existing		No-Build	
		AM	PM	AM	PM
1	Security Boulevard at Greengage Road	**E**	D	D	**E**
2	Woodlawn Drive at Security Road	B	D	B	**E**
3	Parallel Drive at Social Security Administration Access	B	**F**	C	**F**
4	Edmondson Avenue at Denison Street	**F**	**F**	**F**	**F**
5	US 40 (Mulberry Street) at Smallwood Street	**F**	**F**	**F**	**F**
6	Boston Street at Leakin Street	D	**F**	**F**	**F**
7	Boston Street at Kenwood Avenue	D	C	**F**	**F**
8	Boston Street at East Avenue	A	B	**F**	D
9	Boston Street at Baylis Street	C	B	**F**	B
10	Conkling Street at Toone Street	C	C	**F**	C
11	Bayview Boulevard at Alpha Commons Drive	B	B	**F**	**F**
	Total – LOS E OR F	**3**	**4**	**8**	**8**

Note: [1] Unsignalized in Existing Conditions
[2] Intersection does not exist today
Formatting: No-Build conditions were compared to Existing Conditions. Red – LOS worsens; Green – LOS improves; Black – No change in LOS; **Bold** text – LOS E or F

Source: MTA, Traffic and Parking Technical Report, 2012

4.2.4 Preferred Alternative

This section studies the long-term operational effects of the Preferred Alternative to roadways in its vicinity. Impacts to traffic operations were analyzed for the design year in 2035 and the peak year of construction in 2016.

a. Roadway Network

Building the Preferred Alternative would require changes to be made to a number of roadways along the Preferred Alternative. This would allow for the light rail transit (LRT) to operate in an exclusive guideway and thereby provide a time advantage to transit vehicles. Besides reducing the number of traffic lanes, street patterns would be modified in a number of other ways, including: regulating new turn restrictions, closing some accesses, and removing or installing new traffic signals at several intersections along the alignment where the LRT crosses high-volume side streets.

The roadway network assumed for 2035 Build conditions would include all network improvements listed under the No-Build conditions. In addition, the Preferred Alternative would include the following changes:

- New I-70 park-and-ride (700 spaces)
- Security Square Mall park-and-ride (375 spaces)
- Operations and Maintenance Facility (OMF) at Edmondson Avenue (200 employee parking spaces)
- Brewers Hill/Canton Crossing park-and-ride (600 spaces)

To construct the Preferred Alternative with minimal property impacts along the corridor, the number of traffic lanes would have to be reduced in certain areas. The roadways that would experience a reduction because of the allocation of exclusive lanes for Preferred Alternative are:

- Security Boulevard
- I-70
- Edmondson Avenue
- West Franklin Street
- Franklintown Road
- US 40 lower level roadway section
- Boston Street

Alpha Commons Drive would be closed (but this is being done as part of the Johns Hopkins Master Plan for the Bayview Campus), and therefore access to the existing buildings would be from Cassell Drive and Bayview Boulevard.

Table 4-17 identifies the lane use changes for each of the project's design segments, as identified in **Chapter 2** of the FEIS.

Table 4-17: Number of Lanes: 2035 No-Build vs. Preferred Alternative

Segments	Geographic Limits	LRT Alignment Description (surface unless otherwise noted)	2035 No-Build Number of Lanes	2035 Preferred Alternative Number of Lanes	Change
West	Security Boulevard: CMS to Rolling Road	Dedicated transit south side of Security Boulevard	2EB 2WB		No change
	Security Boulevard: Rolling Road to Lord Baltimore Drive		3EB 3WB	2EB 3WB	-1EB
	Security Boulevard: Lord Baltimore Drive to I-695 Ramps		3EB 3WB		No change
	Over and across I-695 Lanes/Ramps	Aerial transit structure across I-695 ramps	N/A		No change

Table 4-17: Number of Lanes: 2035 No-Build vs. Preferred Alternative

Segments	Geographic Limits	LRT Alignment Description (surface unless otherwise noted)	2035 No-Build Number of Lanes	2035 Preferred Alternative Number of Lanes	Change
	I-70 ramps	Dedicated transit north side of WB I-70 off-ramps onto I-695/ south side of SSA parking lot	2EB 3 to 1WB	2 to 3EB 3 to 1WB	+1EB
	I-70	Dedicated transit north side of I-70: Woodlawn Drive-Parallel Drive/SSA Connector	4EB 3WB	3EB 3WB	-1EB
		Dedicated transit north side I-70 from Parallel Drive/SSA Connector to Forest Park Ave/Cooks Lane	3 to 1EB 1 to 2WB	1EB 1 to 2WB	-2EB No Change WB
Cooks Lane Tunnel	Cooks Lane: Forest Park Avenue to Edmondson Avenue	Tunnel: Forest Park Ave. Edmondson Ave.	1EB 1WB		No Change
	Edmondson Avenue: Cooks Lane to Glen Allen Drive	Tunnel: Cooks Lane to Glen Allen Drive	3EB 3WB	2EB 2WB	-1EB -1WB
US 40	Edmondson Avenue: Glen Allen Drive to Franklintown Road	Dedicated transit in the median	3EB 3WB	2EB 2WB	-1EB -1WB
	Franklintown Road: Edmondson Avenue to Franklin Street	Dedicated transit in the median	1EB 1WB		No Change
	Franklin Street: Franklintown Road to Wheeler Avenue	Dedicated transit in the median	3EB 3WB	2EB 2WB	-1EB -1WB
	Franklin Street/Mulberry Street: Wheeler Ave. to Pulaski Street	EB: Dedicated transit on north side of Mulberry St. Westbound: Dedicated transit on south side of Franklin St.	3EB	2EB	-1EB
			3WB	2WB	-1WB
	Franklin Street/Mulberry Street: Pulaski	EB: Dedicated transit on north side of Mulberry Street approaching US 40	2 to 3EB	2 to 1 EB	No Change to -2EB

Table 4-17: Number of Lanes: 2035 No-Build vs. Preferred Alternative

Segments	Geographic Limits	LRT Alignment Description (surface unless otherwise noted)	2035 No-Build Number of Lanes	2035 Preferred Alternative Number of Lanes	Change
	Street to Fulton Avenue	WB: Dedicated transit on south side of Franklin Street continuing from US 40	3 to 2WB	3 to 1WB	-1WB
	US 40: Fulton Avenue to Carey Street	Dedicated transit in the median. EB lanes reduced by one from Fulton Avenue to Stockton Street /WB total number of lanes remains the same	3EB	2EB	-1EB
			3WB		No Change
	US 40: Arlington Avenue to North Fremont Avenue	Dedicated transit in the median/ total number of travel lanes remain the same	3EB 3WB		No Change
Downtown Tunnel	North Fremont Avenue: US 40 to MLK Jr. Boulevard	Tunnel: no impact on travel lanes	1EB 1WB		No Change
	Lombard Street: MLK Jr. Boulevard to President Street	Tunnel: no impact on travel lanes and parking	5 to 4 to 2 WB		No Change
	President Street from Lombard Street to Fleet Street	Tunnel: no impact to travel lanes and parking	3NB 3SB		No Change
	Fleet Street: President Street to Chester /Boston Streets	Tunnel: no impact to travel lanes	1EB 1WB		No Change
East	Boston Street: Chester Street to Montford Avenue	Tunnel: no impact on travel lanes	2EB 2WB		No Change
	Boston Street: Montford Avenue to South Haven/New Boston Streets	Dedicated transit in the median (would require reducing one lane each direction	2EB 2WB	1EB 1WB	-1EB -1WB
	South Haven Street : Old Boston Street to Dillon Street	Dedicated transit west side Haven Street from Old Boston Street to Dillon Street	1EB 1WB		No Change
	South Haven Street	Dedicated transit in the median on east side of Haven Street from Dillon Street to Pratt Street	N/A		No Change

Table 4-17: Number of Lanes: 2035 No-Build vs. Preferred Alternative

Segments	Geographic Limits	LRT Alignment Description (surface unless otherwise noted)	2035 No-Build Number of Lanes	2035 Preferred Alternative Number of Lanes	Change
	Over several streets and I-895	Aerial transit structure across South Kresson Street, Oldham Street, NS /CSX Rail Lines, I-895 to Bayview Boulevard	N/A		No Change
	Bayview Boulevard: Alpha Commons Drive to Bayview MARC Station	Dedicated transit on east side of Bayview Boulevard from Alpha Commons Drive to Bayview MARC station	2NB 2SB		No Change

b. Long-Term Operational Effects and Mitigation

The project study corridor is part of the larger Baltimore region, and changes in the traffic operations within the corridor can result in impacts in other parts of the metropolitan area. Three types of traffic operational impacts are explained below: Regional, Corridor, and Local.

Regional Impacts

Regional impact is a measure of the change in highway travel within the project study corridor, measured in Vehicles Miles Traveled (VMT). Regional is defined as the entire region covered by the BRTB, for which they track and measure VMT. This measure is calculated from the regional BMC Travel Demand model's average weekday traffic volumes and link lengths.

Average weekday regional VMT is forecast to increase from 32 million in 2011 to 36 million in 2035. The Preferred Alternative would result in slightly lower VMT than the No-Build (refer to **Table 4-18**). While the expected differences would be small (less than one percent) compared to the regional totals, their absolute values are in the thousands of miles. The full LRT would result in a daily savings of 77,000 VMT in the region compared to the No-Build Alternative.

Table 4-18: Daily Vehicle Miles Traveled (VMT)

Scenario	Regional Vehicle Miles Traveled (000's)	Corridor Vehicle Miles Traveled (000's)
Base Year (2011)	31,757	3,759
No-Build Alternative (2035)	36,482	4,335
Preferred Alternative (2035)	36,405	4,320

Corridor Impacts

Average weekday VMT was developed for the sub-region centered along the project study corridor. The sub-region was defined by comparing the volume differences for the Build and No-Build models and assessing roadways with a change of about 10 percent or more. The sub-regional VMT for the project study corridor is forecast to increase from 3,759,000 in 2011 to 4,335,000 in 2035. As with the Regional reductions, the Preferred Alternative would result in slightly lower VMT than the No-Build (refer to **Table 4-18**). The LRT would result in a daily reduction of 15,000 VMT in the project study corridor compared to No-Build Alternative.

In addition to the VMT changes, the transit share mode shift was investigated, using the regional travel demand model. **Table 4-19** presents the changes to the auto, bus and rail mode shares as a result of the Red Line project. As indicated in this table, the addition of the Red Line transit project would increase rail ridership by over 30,000 trips per day. Sixty-three percent of these riders would shift from bus modes, and 37 percent would shift from auto modes.

Table 4-19: Anticipated Mode Shift No-Build vs. Preferred Alternative (in trips per day)

Mode	2035 No-Build Alternative	2035 Preferred Alternative	Change in Trips
Auto	8,377,209	8,366,057	-11,152
Bus	365,487	346,565	-18,922
LRT	97,314	127,351	30,037

Localized Impacts

Localized traffic impact analysis examines specific streets and intersections to determine the effect of changes in traffic at those points. Key signalized and unsignalized intersections in the vicinity of the Red Line alignment, and which would impact the project study corridor, have been analyzed for 2035 No-Build (discussed above), and for the 2035 Build, as well as the 2016 peak Construction Year, discussed in the sections below.

Traffic Volumes

Travel demand forecasts were developed for the Preferred Alternative through the use of the BMC's regional model for the year 2035, with modifications made to reflect the changes to the transit network and roadway network as a result of the Preferred Alternative.

In general, the Preferred Alternative would result in decreased traffic volumes on most roadways (e.g., Edmondson Avenue, Boston Street, and Bayview Boulevard) and increased volumes on a few roadways (e.g., I-70) when compared with the No-Build conditions.

The decrease in vehicular trips would be caused by those users that would switch to transit under the Preferred Alternative and/or to other roadways as a result of the reduction in the number of lanes (capacity) on the roadway segments with the Preferred Alternative. **Table 4-20** identifies these anticipated diversion routes.

Table 4-20: Potential Diversion Routes

Roadway Segment	Diversion Routes (Not Detour Routes)
Edmondson Avenue (west of Hilton Parkway)	• Frederick Avenue
Franklin Street (east of Hilton Parkway)	• Edmondson Avenue • Baltimore Street • Pratt Street
US 40 (lower-level section)	• Franklin Street (WB) • Mulberry Street(EB)
Boston Street	• Eastern Avenue • Fleet Street • O'Donnell Street

The average daily traffic volumes are shown in **Table 4-21** for Existing (2011), 2035 No-Build and 2035 Build, along with the anticipated percent growth. Because of the potential shifts in the travel patterns discussed above, the highest volume roadways from an average daily traffic standpoint in 2035 Build conditions, are somewhat different than the highest volume roadways in the No-Build.

Table 4-21: Existing, 2035 No-Build and Preferred Alternative Average Daily Traffic

Location	Existing (2011)	No-Build (2035)	Percent Growth (Existing) vs. No-Build)	Preferred Alternative (2035)	Percent Growth (No-Build vs. Preferred Alternative)
I-70, east of I-695	25,000	34,500	+38%	45,000	+30%
Security Boulevard, west of I-695 to Rolling Road	48,000	48,500	+1%	48,500	0%
US 40 from Rolling Road to I-695	53,000	69,000	+30%	67,500	-2%
US 40, west of Cooks Lane	24,000	29,000	+21%	25,500	-12%
Edmondson Avenue east of Swann Avenue	39,000	46,000	+18%	38,500	-16%
Frederick Avenue west of Hilton Drive	15,000	17,000	+13%	17,500	+3%
Franklin Street, east of Franklintown Road	33,000	40,000	+21%	33,500	-16%
Martin Luther King, Jr. Boulevard, south of Pratt Street	58,000	87,500	+51%	87,000	-1%
Lombard Street, west of Greene Street	10,000	16,000	+60%	15,500	-3%
Lombard Street, east of Charles Street	30,000	34,500	+15%	34,500	0%
Lombard Street, west of Market Place	29,000	47,000	+62%	46,500	-1%

Table 4-21: Existing, 2035 No-Build and Preferred Alternative Average Daily Traffic

Location	Existing (2011)	No-Build (2035)	Percent Growth (Existing) vs. No-Build)	Preferred Alternative (2035)	Percent Growth (No-Build vs. Preferred Alternative)
President Street, north of Lombard Street	35,000	34,500	-1%	36,000	+4%
Fleet Street, east of President Street	21,000	23,000	+10%	24,500	+7%
Boston Street, north of Montford Avenue	27,000	36,000	+33%	33,000	-8%
Boston Street, east of Conkling Street	16,000	25,000	+56%	20,000	-20%
Interstate Avenue, east of I-95 ramps	8,500	15,500	+82%	15,500	0%
O'Donnell Street, east of Conkling Street	22,500	32,500	+44%	31,000	-5%
Eastern Avenue, east of Bayview Boulevard	22,000	22,500	+2%	22,500	0%
Bayview Boulevard, south of Alpha Commons Drive	7,000	19,500	+178%	12,500	-36%

Source: MTA, Traffic and Parking Technical Report, 2012

With the Preferred Alternative in place, MLK Jr. Boulevard, Lombard Street (west of Greene Street and west of Market Place), Boston Street (east of Conkling Street), Interstate Avenue (east of the I-95 ramps), and Bayview Boulevard are anticipated to grow by more than 50 percent in 2035 when compared with the Existing 2011 Average Daily Traffic (ADT). In comparison, Interstate Avenue and Bayview Boulevard (south of Alpha Commons Drive) would have the largest increases under 2035 No-Build conditions.

Based on the Design Year forecast, it is anticipated that with the Preferred Alternative the total number of vehicles on all roadways within the vicinity of the alignment would be generally less than under No-Build conditions. The travel demand model predicts that some of the motorists on these roadways would either ride LRT or take alternate routes to avoid delays because of the LRT along various routes. For example, along Boston Street, the Build volumes would be 20 percent less than the No-Build volumes, with the addition of the Red Line and the reduction in total number of lanes from four to two lanes to accommodate LRT track.

I-70 (+30 percent) and Fleet Street (+7 percent) would have an increase in ADT in the Build condition versus No-Build, whereas most of the other roadways along the proposed LRT alignment, such as Edmondson Avenue, Franklin Street, Boston Street, and Bayview Boulevard, are anticipated to have lower ADTs. With the expansion and relocation of park-and-ride on I-70 in the Preferred Alternative, it is anticipated that there would be significant increase in ADT on I-70. Fleet Street and President Street would have a minimal increase in ADT because of the change in traffic patterns to utilize transit.

The 2035 Build AM and PM peak hour directional traffic volumes along the project study corridor were analyzed; the highest volume roadways in the peak direction for AM and PM peak hours are shown in **Table 4-22** and **Table 4-23**, respectively.

Table 4-22: Existing, 2035 No-Build and Preferred Alternative, AM Peak Hour Peak Direction Highest Volumes and Percent Growth

Location	Existing (2011)	No-Build (2035)	Preferred Alternative (2035)	Growth (No-Build) vs. Preferred Alternative)
Security Boulevard – Rolling Road to I-695	1,940 (WB)	2,150 (WB)	2,395 (WB)	+11%
Rolling Road – South of Security Boulevard	1,295 (NB)	1,530 (SB), 1,210 (NB)	1,455 (SB)	-5%[1]
Security Boulevard – I-695 to Woodlawn Drive	2,035 (EB)	2,225 (EB)	2,210 (EB)	-1%
I-70 – Woodlawn Drive to I-70 Park-and-ride	1,280 (EB)	1,840 (EB)	1,650 (EB)	-10%
Cooks Lane – East of Forest Park Avenue	955 (EB)	905 (WB), 880 (EB)	1,005 (EB)	+14%[1]
US 40 – Winters Lane to Cooks Lane	2,600 (EB)	3,150 (EB)	3,015 (EB)	-4%
Edmondson Avenue – Cooks Lane to Franklin Street	2,625 (EB)	2,935 (EB)	2,375 (EB)	-19%
Franklin Street – Edmondson Avenue to Pulaski Street	2,590 (EB)	2,820 (EB)	2,285 (EB)	-19%
Martin Luther King, Jr. Boulevard – Mulberry Street to Lombard Street	2,720 (SB)	3,365 (SB)	3,595 (SB)	+7%
Lombard Street – Martin Luther King Jr. Boulevard to President Street	2,085 (WB)	2,630 (WB)	2,680 (WB)	+2%
President St. – Lombard Street to Fleet Street	2,225 (NB)	2,670 (NB)	2,690 (NB)	+1%
Fleet St. – Wolfe Street to Boston Street	855 (WB)	1,060 (WB)	920 (WB)	-13%
Boston Street – Aliceanna Street to Conkling Street	1,545 (NB)	2,305 (NB), 1,920 (SB)	1,575 (SB)	-18%[1]
Bayview Boulevard – Lombard Street to Eastern Avenue	895 (SB)	1,570 (SB)	1,490 (SB)	-5%

Note: [1]Peak direction is not the same, percent growth is calculated for the same directional volume as noted in the Preferred Alternative column.

Source: MTA, Traffic and Parking Technical Report, 2012

Table 4-23: Existing, 2035 No-Build and Preferred Alternative, PM Peak Hour Peak Direction Highest Volumes and Percent Growth

Location	Existing (2011)	No-Build (2035)	Preferred Alternative (2035)	Growth (No-Build) vs. (Preferred Alternative)
Security Boulevard - Rolling Road to I-695	**2,250 (EB)**	**3,060 (WB),** 2,550 (EB)	**3,010 (WB)**	-2%[1]
Rolling Road-South of Security Boulevard	1,335 (NB)	1,585 (NB)	1,515 (NB)	-4%
Security Boulevard - I-695 to Woodlawn Drive	2,270 (WB)	2,785 (WB)	2,160 (WB)	-10%
I-70 - Woodlawn Drive to I-70 park-and-ride	1,930 (WB)	2,770 (WB)	2,655 (WB)	-4%
Cooks Lane-East of Forest Park Avenue	1,200 (WB)	1,165 (WB)	895 (WB)	-23%
US 40 - Winters Lane to Cooks Lane	2,475 (WB)	3,250 (WB)	3,045 (WB)	-6%
Edmondson Avenue-Cooks Lane to Franklin Street	2,535 (WB)	3,120 (WB)	2,535 (WB)	-19%
Franklin Street-Edmondson Avenue to Pulaski Street	1,885 (WB)	2,445 (WB)	1,930 (WB)	-21%
Martin Luther King, Jr. Boulevard Mulberry Street to Lombard Street	2,535 (NB)	3,590 (NB)	3,555 (NB)	-1%
Lombard Street-Martin Luther King Jr. Boulevard to President Street	2,345 (WB)	2,835 (WB)	2,735 (WB)	-4%
President Street-Lombard Street to Fleet Street	2,545 (NB)	2,965 (NB)	2,925 (NB)	-1%
Fleet Street-Wolfe Street to Boston Street	815 (EB)	1,025 (EB)	1,210 (EB)	+18%
Boston Street-Aliceanna Street to Conkling Street	1,375 (SB)	1,895 (SB)	1,160 (SB)	-39%
Bayview Boulevard-Lombard Street to Eastern Avenue	785 (NB)	1,495 (NB)	1,325 (NB)	-11%

Note [1]Peak travel direction is not the same at this location; percent growth is calculated for the travel directional noted in the Preferred Alternative column.

Source: MTA, Traffic and Parking Technical Report, 2012

The highest reduction in volume during the AM peak hour is projected to be along northbound Boston Street, a reduction of more than 1,000 vehicles (from 2,305 to 1,255 vehicles in northbound direction and from 1,920 to 1,575 vehicles in the southbound direction) in the 2035 Build conditions when compared with 2035 No-Build conditions. Some roadways, such as Security Boulevard between Rolling Road and I-695 and Cooks Lane, would have an increase in volume of more than 10 percent.

The largest reductions in traffic volumes during the PM peak hour are projected to be along southbound Boston Street, westbound Cooks Lane, westbound Edmondson Avenue, and westbound Franklin Street. They are anticipated to decrease by over 500 vehicles in the PM peak hour in the Build versus No-Build. The largest percent decreases are along Boston Street (-39 percent), Cooks Lane (-23 percent), Edmondson Avenue (-19 percent), and Franklin Street (-21 percent). However, the PM peak hour direction of Fleet Street is anticipated to have an increase in volume versus AM peak hour, compared to a decrease in volume in Build conditions.

The fluctuations in the growth rates mentioned above are the result of several factors. Diversion of trips on the roadways from auto use to transit use under the Preferred Alternative result in some volume decreases. Diversion to other roadways as a result of the reduction in the number of lanes (capacity) on these roads with the Preferred Alternative also contributes to the decrease in auto trips on these roadways. In addition, some new connections are being provided (such as the new I-70 intersection at Parallel Drive). These diversions to other roadways have been taken into account in both the volumes and analysis of the project study corridor, and in the assessment of impacts to diversion routes.

Travel Time

Auto travel times were calculated for the 2035 Build conditions to provide a relative comparison between today's operation and operations in 2035 with and without the Preferred Alternative. Similar to the Existing Conditions analysis and the 2035 No-Build analysis, travel times were developed by using the Synchro/SimTraffic Version 7 models. For locations with pre-emption signal treatment, the VISSIM Version 5.3 model was used (refer to the *Travel Forecasts Results Report*, **Appendix I**).

Pre-emption of intersection signal control by the light rail vehicle is proposed at eight locations along the project study corridor. At a few locations, signalized intersections would be converted to stop-controlled intersections with left turn restrictions, to reduce conflict points with the LRT alignment in the median. Similarly, some currently unsignalized intersections would be signalized to accommodate a shift in traffic patterns or to provide pedestrian crossing accommodations. Signal timing splits and offsets were optimized to regulate the progression of traffic along the coordinated system of signals. Pedestrian phasing and timings were modified for future conditions to accommodate revised crosswalk lengths.

Table 4-24 provides a list of intersections along the alignment with proposed modifications to the existing traffic control devices as part of the Preferred Alternative. Refer to **Figure 4-5** for existing and proposed traffic control devises.

Table 4-24: Intersections with Proposed Modifications in Traffic Control Devices

Design Segment	Location	Existing	Preferred Alternative	Pre-emption
West	Greengage Road at Security Boulevard	Stop	Traffic Signal	No
	Brookdale Road at Security Boulevard	Stop	Traffic Signal	No
	Kennicott Road/Shopping Center at Security Boulevard	Stop	Traffic Signal	No
	New I-70/Social Security Administration Access Road	Does not Exist	Traffic Signal Flashers & Gates	No
	Parallel Drive at park-and-ride access	Does not Exist	Stop	N/A
	New I-70 at park-and-ride access	Does not Exist	Flashers & Gates	Yes
Cooks Lane and Downtown Tunnels	No modifications (tunnel segments)			
US 40	Glen Allen Drive at Edmondson Avenue	Traffic Signal	Stop	N/A
	Edmondson Shopping Center at Edmondson Avenue	Traffic Signal	Stop	N/A
	Edmondson Village Station Platform Access	Does not Exist	Pedestrian Signal	No
	Loudon Avenue at Edmondson Avenue	Stop	Traffic Signal	No
	Mt. Holly Street at Edmondson Avenue	Traffic Signal	Pedestrian Signal	No
	Edgewood Street at Edmondson Avenue	Traffic Signal	Pedestrian Signal	No
	Denison Street at Edmondson Avenue	Stop	Traffic Signal	No
	Franklin Street at west track connector to Calverton Yard (EB lanes only)	Does not Exist	Flashers & Gates	Yes
	Franklin Street at east track connector to Calverton Yard (EB lanes only)	Does not Exist	Flashers & Gates	Yes
	Evergreen Avenue at Franklin Street	Stop	Pedestrian Signal	No
	Smallwood Street at Mulberry Street (EB track)	Stop	Traffic Signal	No
	Smallwood Street at Franklin Street (WB track)	Stop	Traffic Signal	No
	Payson Street at Mulberry Street (EB track)	Stop	Traffic Signal	No
	Payson Street at Franklin Street (WB track)	Stop	Traffic Signal	No
East	Safeway Driveway at Boston Street	Stop	Traffic Signal	No
	Lakewood Avenue at Boston Street	Stop	Traffic Signal	No
	Kenwood Avenue at Boston Street	Stop	Traffic Signal	No
	Potomac Avenue at Boston Street	Traffic Signal	Pedestrian Signal	No

Table 4-24: Intersections with Proposed Modifications in Traffic Control Devices

Design Segment	Location	Existing	Preferred Alternative	Pre-emption
	Ellwood Street at Boston Street	Traffic Signal	Stop	N/A
	East Avenue at Boston Street	Stop	Traffic Signal	No
	Eaton Street at Boston Street	Does not Exist	Traffic Signal	No
	Relocated Boston Street at Boh-Donnell Connector	Does not Exist	Traffic Signal	No
	Haven Street south of Dillon Street	Stop	Flashers & Gates	Yes
	Cassell Drive Crossing	Does not Exist	Flashers & Gates	Yes
	Bayview Boulevard at Alpha Commons Transitway	Does not Exist	Flashers & Gates	Yes
	Nathan Shock Drive at Bayview Boulevard	Stop	Traffic Signal & Gates	Yes
	NIH driveway / Cassell Drive at Bayview Boulevard	Stop	Traffic Signal & Gates	Yes
	Lombard Street at Bayview Boulevard	Traffic Signal	Traffic Signal & Gates	Yes

Figure 4-5: Existing and Proposed Traffic Control Devices — Sheet 1 of 4

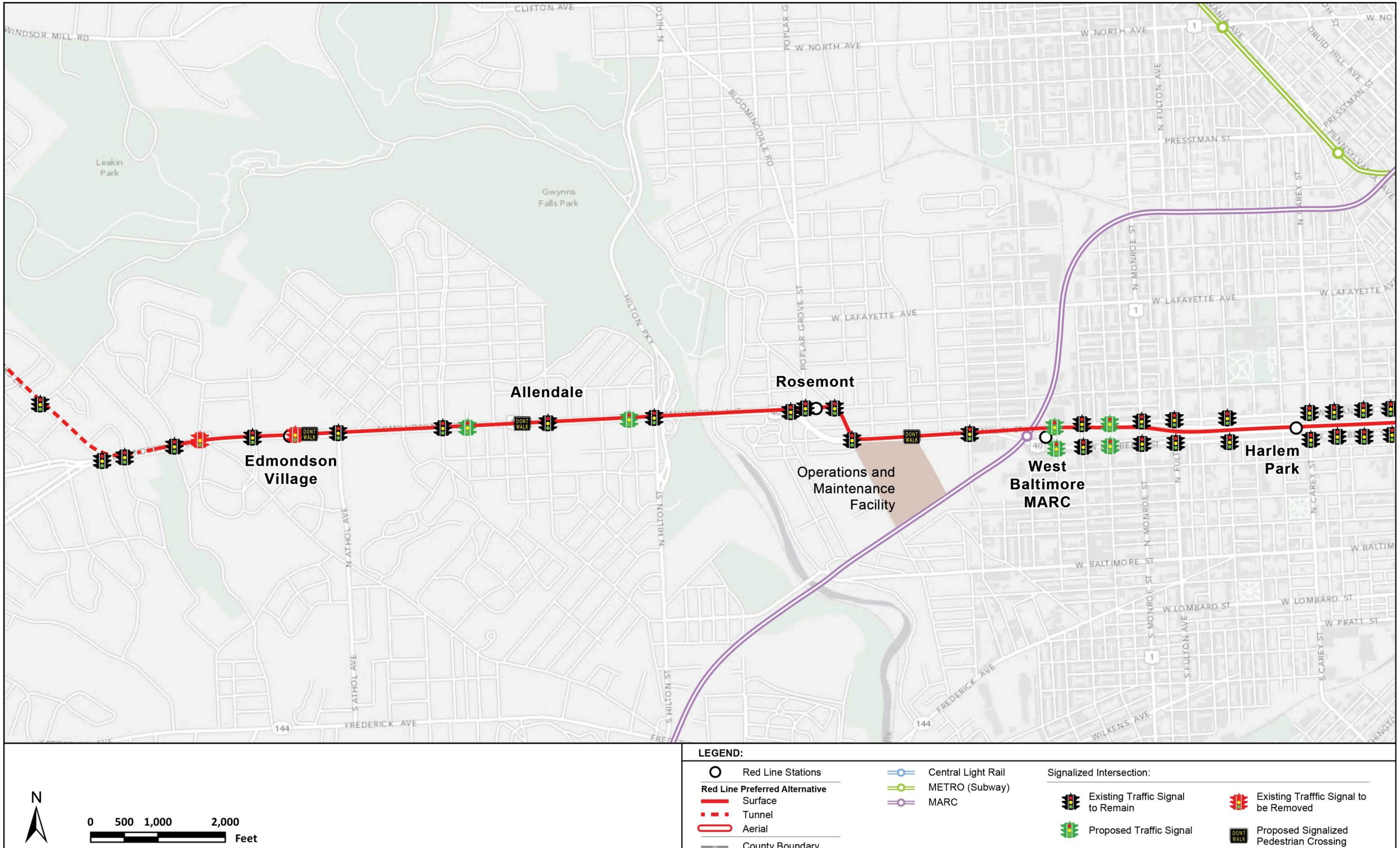


Figure 4-5: Existing and Proposed Traffic Control Devices — Sheet 2 of 4

Figure 4-5: Existing and Proposed Traffic Control Devices — Sheet 3 of 4

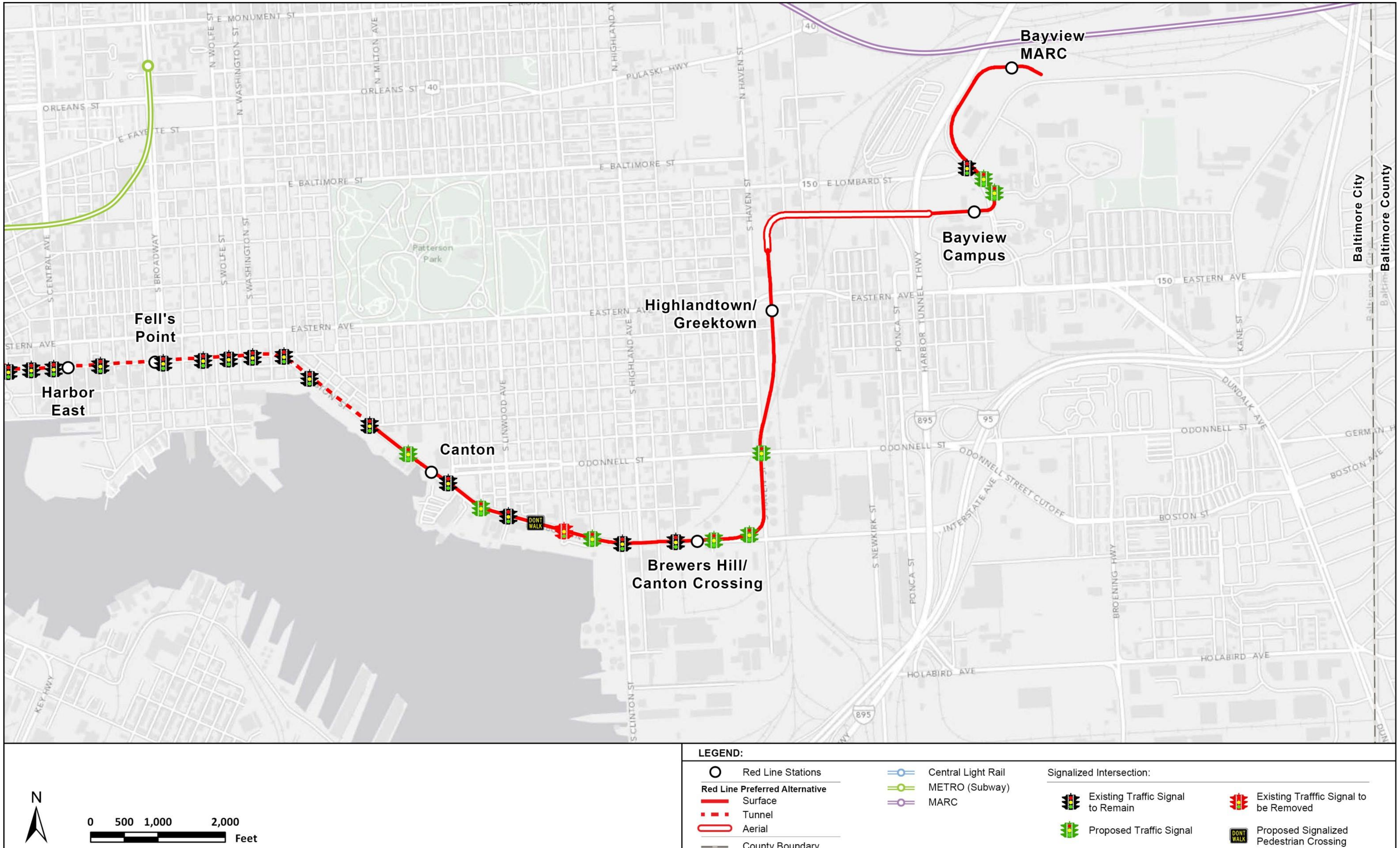


Figure 4-5: Existing and Proposed Traffic Control Devices — Sheet 4 of 4

Auto travel times were calculated for the entire length of the project study area. **Table 4-25** shows the travel time comparison for the Existing, 2035 No-Build, and 2035 Build. Similar to 2035 No-Build conditions, it is anticipated that auto travel times under the Preferred Alternative would increase along the project study corridor roadways when compared with the Existing Conditions, because of regional growth.

When comparing 2035 No-Build to 2035 Build conditions, it is anticipated that there would be a decrease in auto travel times along some of the corridor roadways, because of the decrease in volumes from No-Build to Build conditions, and an increase in auto travel times on some roadways, because of a reduction in roadway capacity as a result of the Red Line project.

A comparison between No-Build and Build auto travel times showed that decreases in travel time by 50 percent or more are expected to occur during the AM peak hour along:

- MLK Jr. Boulevard (-61 percent in southbound direction)
- President Street between Pratt Street and Fleet Street (-50 percent in northbound direction)

An increase in travel time by 50 percent or more is expected to occur during the AM peak hour along:

- President Street between Pratt Street and Fleet Street (+175 percent in southbound direction)

In the PM peak hour, decreases in auto travel time by 50 percent or more is not estimated to occur along the corridor. Increases in auto travel time by 50 percent or more are anticipated to occur along various corridors during the PM peak hour. These are:

- Parallel Drive between Woodlawn Drive to Ingleside Avenue (+143 percent in westbound direction), which may be a result of changes in travel patterns along Parallel Drive because of the relocation of I-70 Park-and-Ride as part of the park-and-ride construction)
- Franklin Street between Edmondson Avenue and Pulaski Street (+58 percent in westbound direction)
- President Street between Pratt Street to Fleet Street (+55 percent in westbound direction)

Table 4-25: Existing, 2035 No-Build, and Preferred Alternative Estimated AM and PM Peak Hour Travel Times in Minutes [1]

From/To	Existing (2011)		No-Build (2035)		Preferred Alternative (2035)		Percent Change (No-Build vs. Preferred Alternative)	
	EB/SB	WB/NB	EB/SB	WB/NB	EB/SB	WB/NB	EB/SB	WB/NB
Security Boulevard - Greengage Road to Woodlawn Drive	3.8 (4.8)	4.7 (4.8)	4.9 (11.1)	5.4 (9.5)	5.1 (9.5)	5.0 (11.6)	+4 (-14)	-7 (+22)
Parallel Drive - Woodlawn Drive to Ingleside Avenue	2.5 (1.8)	1.6 (1.6)	3.0 (3.5)	3.8 (3.7)	3.1 (3.6)	4.1 (9.0)	+3 (+3)	+8 **(+143)**
Cooks Lane - Forest Park Avenue to Edmondson Avenue	3.1 (2.2)	1.8 (1.8)	2.7 (2.3)	2.0 (2.1)	2.5 (2.1)	1.8 (1.8)	-7 (-9)	-10 (-14)
US 40 - I-695 Outer Loop to Cooks Lane	3.8 (5.8)	4.7 (5.5)	4.5 (6.9)	5.9 (12.7)	4.3 (6.4)	6.1 (8.6)	-4 (-7)	+3 (-32)
Edmondson Avenue - Cooks Lane to Franklin Street	4.5 (5.8)	4.8 (5.3)	7.4 (7.2)	11.0 (10.0)	10.8 (9.6)	7.0 (9.8)	+46 (+33)	-36 (-2)
Franklin Street - Edmondson Avenue to Pulaski Street	2.2 (2.3)	2.2 (2.1)	4.9 (2.7)	2.9 (2.4)	3.6 (3.0)	3.2 (3.8)	-27 (+11)	+10 **(+58)**
Martin Luther King, Jr. Boulevard - US 40 to Lombard Street	1.8 (3.3)	2.5 (4.2)	4.4 (6.3)	3.2 (4.3)	1.7 (5.9)	4.6 (3.6)	**-61** (-6)	+44 (-16)
Lombard Street - Martin Luther King, Jr. Boulevard to President Street	N/A	6.2 (7.4)	N/A	6.3 (9.2)	N/A	8.7 (10.3)	N/A	+38 (+12)
President Street - Pratt Street to Fleet Street	1.0 (0.8)	3.3 (2.5)	0.8 (1.4)	8.0 (2.2)	2.2 (2.0)	4.0 (3.4)	**+175** (+43)	**-50 (+55)**
Fleet Street - President Street to Boston Street	3.9 (6.9)	3.9 (3.9)	3.7 (7.6)	7.3 (4.7)	3.6 (7.8)	4.2 (3.5)	-3 (+3)	-42 (-26)
Boston Street - Fleet Street to Conkling Street	3.7 (4.6)	2.7 (4.8)	7.8 (6.0)	4.8 (4.6)	9.1 (6.8)	4.5 (5.1)	+17 (+13)	-6 (+11)

Note: [1] AM (PM) peak hours

Source: MTA, Traffic and Parking Technical Report, 2012

c. Preferred Alternative Levels of Service

A total of 156 intersections (143 signalized and 13 unsignalized) were analyzed in the 2035 Build condition to determine LOS. There would be an increase in the number of signalized intersections in the Build versus the No-Build because some intersections would be converted from stop control to signal control (refer to **Table 4-24** for the list of intersections).

As part of the Red Line project, a number of operational improvements were identified in the assessment of the design concepts to facilitate roadway traffic operations. In some cases, this includes additional or modified turn lanes, in other cases, the signal timing or other traffic controls were modified to accommodate the Red Line and improve auto travel through the intersections. These improvements are included in the analysis of the 2035 Build traffic. A list of the improvements is provided in the *Traffic and Parking Technical Report*. MTA will work with Maryland State Highway Administration, Baltimore County DOT and Baltimore City DOT, concerning design improvements to integrate LRT operations with roadway operations throughout the project study corridor.

Table 4-26 provides the total number of intersections that would operate at LOS E or F in the Existing, 2035 No-Build, and Build conditions. The total number of failing intersections would be reduced between the No-Build and Build conditions.

Table 4-26: Number of Intersections with LOS E or F (Existing, 2035 No-Build, and Preferred Alternative) – AM and PM Peak Hours

Intersection Type	Number of Intersections[1]	Existing[2] (2011)	No-Build[2] (2035)	Preferred Alternative[2] (2035)
Signalized	125/132/143	5 (10)	19 (26)	14 (25)
Unsignalized (worst approach)	19/20/13	3 (4)	8 (8)	3 (3)
Totals	144/152/156	8 (14)	27 (34)	17 (28)

Notes: [1] Existing/No-Build/Build number of intersections
[2] AM (PM) peak hours

Source: MTA, Traffic and Parking Technical Report, 2012

The results of the 2035 No-Build and Build analysis showed that the overall LOS would worsen compared to the existing conditions throughout the entire corridor, as a result of traffic volume growth in the region between 2011 and 2035. However, when compared with No-Build conditions, 2035 Build conditions would have improved LOS at some locations because of the decrease in volumes along some roadways in the project study corridor.

It is anticipated that most of the intersections that are failing in the existing conditions would continue to fail in the future 2035 Build conditions except at the following signalized intersections:

- PM LOS at Security Boulevard at Woodlawn Drive (from E to D)
- AM (PM) LOS at Security Boulevard at Ingleside Avenue (from E (E) to D (D))
- AM LOS of Mulberry Street at Pulaski Street (from E to C)
- AM LOS of Lombard Street at Hopkins Place (from F to C)
- PM LOS of Boston Street at Aliceanna Street (from E to B)

A small number of unsignalized intersections that would be converted to signalized intersections with the Preferred Alternative (as listed in **Table 4-24**) are estimated to have improved LOS.

Intersections with notable changes to peak hour levels of service are listed in **Table 4-27**. The criteria for "notable" are provided below:

- Intersection that has an improved LOS in Build conditions versus No-Build conditions, such as an intersection that no longer operates at LOS E or F
- Intersections that show deterioration in operations from marginally acceptable LOS "D" to unacceptable LOS E or F, deterioration from LOS E to LOS F, or substantial deterioration in vehicle delays within LOS F
- Intersections that show deterioration in operations from acceptable LOS A or B to LOS D or worse (i.e., a change of at least two levels of service when the existing is operating at an optimal level)

It is anticipated that the total number of failing intersections (LOS E or F) in 2035 under Build conditions are less than the 2035 No-Build conditions. This would occur for several reasons: because of the reduction in traffic volumes along the Red Line corridor caused by diversions of auto trips to Red Line transit; some failing unsignalized intersections in the No-Build conditions would be converted to signalized intersections that improve the overall LOS; and some corridors experience improved progression along the mainline because with the transit priority and preemption treatments provided for the rail line.

Additionally, several mitigation measures were proposed at various intersections that improve operations in the Build conditions when compared with No-Build conditions. Some intersections were relocated, while a few were removed because of at-grade crossing with the LRT alignment. Signal timing optimization for Red Line transit provided progression preference to the main line with heavy vehicular traffic when compared to lighter side street vehicular traffic and improved the overall intersection LOS.

Table 4-27: Existing, 2035 No-Build, and Preferred Alternative with Notable Peak Hour Level of Service Changes

No.	Segment	Signalized Intersections	Existing		2035 No-Build		2035 Preferred Alternative	
			AM	PM	AM	PM	AM	PM
1	West	MD 122 (Security Boulevard) at Rolling Road	D	D	D	D	D	**E**
2		MD 122 (Security Boulevard) at Belmont Avenue	B	D	C	**E**	D	**E**
3		MD 122 (Security Boulevard) at Woodlawn Drive	D	**E**	D	**F**	D	D
4		MD 122 (Security Boulevard) at Ingleside Avenue	**E**	**E**	**E**	**E**	D	D
5		Woodlawn Drive at Parallel Drive	C	D	D	D	D	**E**

Table 4-27: Existing, 2035 No-Build, and Preferred Alternative with Notable Peak Hour Level of Service Changes

No.	Segment	Signalized Intersections	Existing		2035 No-Build		2035 Preferred Alternative	
			AM	PM	AM	PM	AM	PM
6		Parallel Drive at Ingleside Avenue	B	A	B	C	B	B
7	Cooks Lane Tunnel	Johnnycake Road at Ingleside Avenue	C	C	E	F	D	F
8		US 40 at Ingleside Avenue	D	E	D	F	D	F
9		Edmondson Avenue at Winans Way	C	B	B	A	D	C
10		Edmondson Avenue at Swann Avenue	B	B	D	D	B	D
11		Edmondson Avenue at Edmondson Shopping Center	A	A	A	A	B[3]	C[3]
12		Edmondson Avenue at Wildwood Parkway	A	B	B	B	D	D
13		Edmondson Avenue at Allendale Street	A	B	A	C	C	D
14		Edmondson Avenue at Hilton Drive	A	B	A	B	D	B
15		US 40 (Franklin Street) at Franklintown Road	C	B	B	B	E[4]	E[4]
16	US 40	US 40 (Franklin Street) at Warwick Road	B	B	C	C	E	C
17		Edmondson Avenue at Franklintown Road	C	C	B	C	D[4]	E[4]
18		Edmondson Avenue at Bentalou Street	B	C	B	B	C	D
19		Edmondson Avenue at Payson Street	B	C	C	C	A	A
20		Edmondson Avenue at Fulton Avenue	B	B	B	D	B	D
21		Mulberry Street at Pulaski Street	E	C	B	C	C	C
22		Franklin Street at Payson Street	N/A[1]	N/A[1]	C	F	D	E
23		Franklin Street at Monroe Street	B	D	B	D	A	B
24		Franklin Street at Fulton Avenue	A	C	B	D	A	A
25		MLK Jr. Boulevard at Franklin Street	D	D	F	F	E	F
26		MLK Jr. Boulevard at Mulberry Street	F	C	F	F	F	F
27		MLK Jr. Boulevard at Saratoga Street	E	D	F	F	F	F
28		MLK Jr. Boulevard at Lexington Street	A	A	B	D	B	C
29		MLK Jr. Boulevard at Fayette Street	B	B	F	E	E	E
31		MLK Jr. Boulevard at Baltimore Street	C	E	F	F	F	F
32		MLK Jr. Boulevard at Lombard Street	C	E	F	F	D	F
33		Lombard Street at Penn Street	B	E	B	E	B	F
34	Downtown Tunnel	Lombard Street at Greene Street	C	C	C	F	D	F
35		Lombard Street at Paca Street	B	C	C	E	B	D
36		Lombard Street at Hopkins Place	F	F	F	F	C	F
37		Lombard Street at Hanover Street	B	E	E	E	B	E
38		Lombard Street at St. Paul Street/Light Street	C	F	D	F	E	F
39		Lombard Street at Calvert Street	C	C	D	F	C	F
40		Lombard Street at South Street	C	C	C	E	C	D
41		Lombard Street at Commerce Street	A	A	C	B	A	B
42		Lombard Street at Market Place	B	B	B	D	C	C

Table 4-27: Existing, 2035 No-Build, and Preferred Alternative with Notable Peak Hour Level of Service Changes

No.	Segment	Signalized Intersections	Existing		2035 No-Build		2035 Preferred Alternative	
			AM	PM	AM	PM	AM	PM
43	Downtown Tunnel	Lombard Street at President Street	D	C	**E**	**E**	**E**	**E**
44		President Street at Eastern Avenue	C	D	D	**E**	C	**E**
45		Fleet Street at Caroline Street	B	B	**E**	**E**	B	C
46		Fleet Street at Washington Street	B	C	B	A	A	B
47	East	Boston Street at Aliceanna Street	B	**E**	C	**F**	B	B
48		Boston Street at Montford Avenue	B	B	**E**	A	D	A
49		Boston Street at Linwood Avenue	A	A	D	B	D	C
50		Boston Street at Ellwood Avenue	A	A	A	A	A[3]	D[3]
51		Boston Street at Clinton Street	D	C	**F**	C	**E**	D
52		Boston Street at Conkling Street	B	B	**E**	C	**E**	D
53		Boston Street at Old Boston Street	N/A[2]	N/A[2]	D	C	**E**	**E**
54		Conkling Street at O'Donnell Street	D	D	**F**	**F**	**F**	**F**
55		O'Donnell Street at New Boston Street (Boh-Donnell Connector)	N/A[2]	N/A[2]	**E**	D	D	D
56		O'Donnell Street at Inter-State Avenue	C	C	**E**	C	D	C
57		O'Donnell Street at I-895 SB Ramp	B	B	C	C	B	A
58		Bayview Boulevard at Lombard Street	C	C	**E**	**F**	**F**[4]	**F**[4]
		Total – LOS E OR F	**5**	**10**	**19**	**26**	**14**	**25**

Table 4-27: Existing, 2035 No-Build, and Preferred Alternative with Notable Peak Hour Level of Service Changes (*Continued*)

No.	Segment	Unsignalized Intersections	Existing		2035 No-Build		2035 Build	
			AM	PM	AM	PM	AM	PM
1	West	Security Boulevard at Greengage Road	**E**	D	D	**E**	B[1]	C[1]
2		Woodlawn Drive at Security Road	B	D	B	**E**	B	**E**
3		Parallel Drive at Social Security Administration Access	B	**F**	C	**F**	**F**	**F**
4	US 40	Edmondson Avenue at Denison Street	**F**	**F**	**F**	**F**	A[1]	B[1]
5		US 40 (Mulberry Street) at Smallwood Street	**F**	**F**	**F**	**F**	A[1]	B[1]
6	East	Boston Street at Leakin Street	D	**F**	**F**	**F**	**F**	**F**
7		Boston Street at Safeway	B	C	B	D	A[1]	A[1]
8		Boston Street at Kenwood Avenue	D	C	**F**	**F**	D[1]	D[1]
9		Boston Street at East Street	A	B	**F**	D	C[1]	C[1]
10		Boston Street at Potomac Street	B	B	D	B	D[1]	C[1]
11		Boston Street at Baylis Street	C	B	**F**	B	B	B

Table 4-27: Existing, 2035 No-Build, and Preferred Alternative with Notable Peak Hour Level of Service Changes (*Continued*)

No.	Segment	Unsignalized Intersections	Existing		2035 No-Build		2035 Build	
			AM	PM	AM	PM	AM	PM
12		Conkling Street at Toone Street	C	C	F	C	**F**	C
13		Bayview Boulevard at Alpha Commons Drive	B	B	F	F	N/A [2]	
		Total – LOS E OR F	**3**	**4**	**8**	**8**	**3**	**3**

Formatting: No-Build conditions were compared to Existing conditions. Build conditions were compared to No-Build conditions.
Red – LOS worsens; Green – LOS improves; Black – No change in LOS; **Bold text** – LOS E or F

Notes:
[1] Unsignalized in Existing conditions
[2] Intersection does not exist
[3] Unsignalized in Build Conditions
[4] Modeled in VISSIM for LRT preemption
[1] Signalized Intersection with LOS D or better
[2] Intersection does not exist in Build Conditions

Source: MTA, Traffic and Parking Technical Report, 2012

d. Short-Term Construction Effects and Mitigation

Several modes of transportation would be affected during construction. These effects are estimated to occur between 2014 and 2021 at various times and locations in the project study corridor. The following section discusses the anticipated construction impacts and the efforts that would be taken to mitigate these impacts.

Construction of the Preferred Alternative would involve subsurface and at-grade construction along the project study corridor as described in **Chapter 3** of this FEIS. The impacts of the tunnel construction activities on roadway traffic are typically limited to the areas surrounding the Cooks Lane and downtown tunnel portals and the downtown stations.

Construction of the surface-running sections of the Preferred Alternative would be accomplished through construction phases that can be generally outlined as follows:

- relocation of existing utilities
- removal of existing surface features within the right-of-way or between the curbs
- excavation and construction of new subsurface features required for both the LRT system and the adjacent roadway including drainage conduits and various electrical duct banks
- construction of new LRT track, stations, traction power, and roadway facilities
- installation of all above-ground LRT system facilities

Details on the proposed construction staging and haul route locations are provided in **Chapter 3** of this FEIS and in the *Traffic and Parking Technical Report.* Trucking would occur 24 hours a day, seven days a week on designated haul routes. **Table 4-28** below identifies the proposed construction staging areas for the underground construction segments of the project, as well as the anticipated number of hourly trucks at these locations.

Table 4-28: Proposed Hourly Truck Volume Summary at Underground Construction Staging Areas

Construction Staging Area	Proposed Location	Hourly Volumes			
		Haul Trucks		Material Trucks	
		In	Out	In	Out
Cooks Lane Western Portal / TBM Launch Pit	I-70 Loop Ramp (southwest quadrant of interchange)	6	6	12	12
Cooks Lane Eastern Launch Pit / TBM Receiving Pit	Edmondson Avenue area of Brookwood Road and the Winans Way/Uplands Parkway intersection	2	2	2	2
Downtown Tunnel Western Portal	Median of US Route 40	10	10	20	20
Poppleton Station	Northeast corner of Fremont and West Baltimore Streets	4	4	4	4
Howard Street / University Center Station	Northeast corner of Lombard and Howard Streets	4	4	4	4
Inner Harbor Station	Northeast corner of Lombard and Light Streets	4	4	4	4
Harbor East Station	Southeast corner of Fleet and Central Streets	4	4	4	4
Fell's Point Station	Broadway and Fleet Street	4	4	4	4
Downtown Tunnel Eastern Portal	Middle of Boston Street between South Montford Avenue / Hudson Street	4	4	4	4

The peak number of truck trips generated was estimated to be 36 per hour (18 in each direction) at the western portal of the Cooks Lane Tunnel. The peak number of truck trips generated was estimated to be 60 per hour (30 in each direction) at the western portal of the Downtown Tunnel. All other construction staging areas would generate between four and eight one-way truck trips per hour.

Since the number of trucks is relatively small in relation to the overall traffic on these roadways, construction truck traffic is not expected to have a significant impact on traffic operations along the haul routes. For the key intersections in the study area, the addition of the construction trucks does not lower the LOS for most intersections. At the intersections which do experience a reduction in LOS, the added delay per vehicle because of the additional construction truck traffic is very small (less than 5 seconds). These locations and delays are:

- Security Boulevard at Forest Park Avenue: From B to C during PM peak hour, 2.3 seconds of delay added.
- MLK Jr. Boulevard at Fayette Street: From B to C during AM peak hour, 2.9 seconds of delay added.
- Boston Street at Potomac Street: From A to B during AM peak hour, 4.3 seconds of delay added.

- Boston Street at East Avenue: From D to E during PM peak hour, 4.0 seconds of delay added.
- Boston Street at Clinton Street: From C to D during AM peak hour, 2.3 seconds of delay added.

Construction of the Preferred Alternative would result in temporary impacts to local transportation operations. These impacts could potentially include lane closures, temporary signals, roadway closures, detours, and disruption of traffic during peak and nonpeak times. Potential outcomes of these impacts could result in the temporary intrusion of through traffic into adjacent areas because of congestion and/or detours, disruption of access by motorized and non-motorized modes to local businesses, and the temporary loss of parking (discussed in **Section 4.3**) during various construction activities and phases along the alignment.

There would be additional congestion and delays in areas of street closures, including adjacent parallel streets and cross-streets. Access to local businesses through existing or temporary driveways would be provided where possible; however, there may be some times where access cannot be maintained. In these cases, other accommodations will be coordinated with the property owner during the Final Design and Construction phase of the project.

Lane Closures, Shoulder Closures and Turning Movement Restrictions

Lane closures and turn movement restrictions are anticipated throughout the project study corridor during construction along the following roadways:

- Security Boulevard
- I-695
- I-70
- Cooks Lane
- Cooks Lane Tunnel East Portal
- Edmondson Avenue
- West Franklin Street
- Lombard Street at Howard Street/University Center Station
- Lombard Street at Inner Harbor Station
- Fleet Street at Harbor East Station
- Fleet Street at Fell's Point Station
- Downtown Tunnel East Portal
- Boston Street
- Haven Street
- Eastern Avenue
- I-895

- Bayview Boulevard

A comprehensive list of anticipated lane closures in the project study area during peak periods is included in the *Traffic and Parking Technical Report*.

Some drivers may use diversion routes to avoid congestion because of lane closures and turning movement restrictions. The anticipated diversion routes, which are expected to capture overflow traffic from congested construction work zones are identified in **Table 4-29**.

Table 4-29: Potential Diversion Routes from Construction Activities

Roadway Segment	Diversion Routes (not detour routes)
Edmondson Avenue (west of Hilton Parkway)	• Frederick Avenue
Franklin Street (east of Hilton Parkway)	• Edmondson Avenue • Baltimore Street • Pratt Street
US 40 (lower-level section)	• Franklin Street (WB) • Mulberry Street(EB)
Lombard Street	• Fayette Street
Boston Street	• Eastern Avenue • Fleet Street • Donnell Street

Grade-Crossing Construction

Maintenance of traffic plans will be prepared in support of the construction of grade crossings (locations where traffic lanes cross over LRT tracks). It is anticipated that minor intersections would be closed for approximately 2 to 3 weeks for grade crossing construction. These closures would restrict turn movements from the mainline and turn- and through-movements on the side streets. Consideration will be given to staging work such that adjacent intersections are not closed during the same time period, if possible. Traffic would be detoured to appropriate alternate routes on the local street network during these closures.

Major intersections, such as Rolling Road at Security Boulevard, Boston Street at Future Old Boston Street, and Lombard Street at Bayview Boulevard, would not be closed during grade crossing construction because of the potential for traffic disruption at these locations and lack of sufficient alternate routes. Grade crossing construction may be phased at these intersections using temporary lane closures. Lane closures may occur during peak and off-peak hours for grade crossing construction at major intersections.

Construction of the grade crossing at Nathan Shock Drive would be coordinated with Johns Hopkins since it is the primary access to the Emergency Room for ambulances.

Roadway Closures

In addition to lane closures and intersection closures, in some cases, entire sections (i.e., all lanes) of some roadways would need to be temporarily closed to traffic.

Maintenance of traffic options are limited in areas where open-cut and cut-and-cover activities are undertaken (e.g., tunnel portals, underground stations, and tunnel ventilation facility locations). Because of limited right-of-way and space requirements for equipment and storage, roadway closures are anticipated at several locations. Additionally, short duration, overnight roadway closures may be required for some construction activities, such as erecting girders. Significant roadway closures are anticipated for construction at the following locations:

- <u>Security Boulevard/I-70/Cooks Lane/Forest Park Avenue Intersection:</u> A temporary overnight closure is anticipated to shift traffic from the existing intersection to the relocated intersection. Local traffic would be diverted using the local street network.
- <u>Cooks Lane Tunnel West Portal:</u> Construction of the running tunnels by tunnel boring machines and the retained cut structure would require the closure of the loop ramp from southbound Security Boulevard to westbound I-70 throughout the duration of tunnel construction and permanently, as this loop ramp would be ultimately removed.
- <u>Downtown Tunnel West Portal:</u> Construction of the cut-and-cover tunnel portal area would require the temporary closure of eastbound Mulberry Street for ten to 12 months. Through traffic would be diverted to the US 40 Expressway. Local traffic would be diverted using the local street network. Additionally, construction of the running tunnels by tunnel boring machines and the retained cut structure would require the closure of the US 40 Expressway between Pulaski Street and North Greene Street. This closure is anticipated to be in place for approximately 3 years. Traffic would be diverted to the one-way pair of Mulberry and Franklin Streets. The closure of Mulberry Street and the US 40 Expressway would not occur concurrently.
- <u>Poppleton Station:</u> Construction of this station would require the temporary closure of Fremont Avenue between Baltimore Street and Fayette Street. This closure is anticipated to be in place for three to 4 years. Local traffic would be diverted using the local street network.
- <u>Downtown Tunnel East Portal:</u> Construction of the cut-and-cover tunnel and retained-cut structure would require the closure of Boston Street from immediately west of the intersection with Montford Avenue to immediately west of the Harris Creek culvert under Boston Street near the driveway entrance to Starbucks. This full closure would be necessary because of the transitioning width of the cut-and-cover tunnel walls and the placement of construction equipment needed to install the walls and temporary support of excavation with respect to remaining areas available for travel lanes. The closure is anticipated to be in place for approximately 1 year. Through traffic would be diverted away using parallel main roadways, such as Eastern Avenue and Fleet Street. Local traffic would be diverted using the local street network. Local access to the adjacent properties would be provided through each end of the work area.

  A temporary roadway is being evaluated as an alternative to the full closure of a portion of Boston Street, as described above. The temporary roadway would provide one lane per direction, with a sidewalk on the south side of Boston Street. The temporary roadway would be located closer to the parking lots for the Anchorage Marina and Anchorage Towers properties. This temporary placement would likely result in traffic circulation restrictions. Access to the Can Company parking lot on the north side of the work zone would also be restricted. A decision concerning Maintenance of Traffic along Boston Street would be completed during Final Design. Public outreach efforts would continue prior to making this decision.

- Alpha Commons Drive: Alpha Commons Drive would be closed during construction and permanently, as the Preferred Alternative would be placed in Alpha Commons Drive's current location. This concept is included in the on-going master planning process by the campus. Traffic would be shifted to future Cassell Drive, which is to be constructed by Johns Hopkins concurrent with the Red Line project and in accordance with the Memorandum of Understanding (MOU) between MTA and Johns Hopkins.
- Girder Erection: For erection or removal of bridge girders, temporary closures of I-695, Security Boulevard, Janney Street, Kresson Street, CSX Rail, Norfolk Southern (NS) Rail, Oldham Street, Ponca Street, and I-895 would be required. It is anticipated these closures would be of a short duration, and occur overnight.
- Cut-and-Cover Decking System: The entire width of Lombard Street and Fleet Street would need to be closed for several hours per night over a series of nights at the station locations and on the roadway blocks to either side of the station to install full-length decking beams and a decking system at each station structure.

In addition, other minor local roadways would be closed and detoured during construction of the grade crossing through those intersections. These closures would be limited to a few weeks and would be coordinated with the local communities during the development of Maintenance of Traffic Plans and Transportation Management Plans for the project.

Tables 4-30 through **4-34** provide a summary of the potential construction impacts for each of the respective design segments, as identified in **Chapter 2** of this FEIS.

Table 4-30: Summary of Anticipated Construction Impacts – West Design Segment

Street Segment			Impacts During Construction							
On	From	To	Existing Number of Lanes		Number of Lanes During Construction		Turn Movement Restrictions*	Loss of Off-Street Parking Spaces	Loss of On-Street Parking Spaces	Sidewalk Impacts
			EB/NB	WB/SB	EB/NB	WB/SB				
Security Boulevard	CMS Entrance	Brookdale Road	2	2	1	2	No	None	N/A	South side
Security Boulevard	Brookdale Road	Rolling Road	2	2	2	2	No	67	N/A	North and South sides
Security Boulevard	Rolling Road	Lord Baltimore Drive	3	3	2	3**	No	23	N/A	South side
Security Boulevard	Lord Baltimore	Belmont Avenue	3	3	3	3	No	244	N/A	South side
I-695	Security Boulevard	I-70	3	3	3	3	No	26	N/A	N/A
I-70	I-695	Security Boulevard/Cooks Lane	3	3	3***	3***	No	386	N/A	N/A
Parallel Drive	Woodlawn Drive	West of Perimeter Drive	1	2	1	2	No	None	N/A	No Impacts
Parallel Drive	West of Perimeter Drive	Ingleside Avenue	2	1	2	1	No	None	N/A	North side
Ingleside Ave	I-70	Security Boulevard	2	2	2	2	No	None	N/A	West side
Security Boulevard	Forest Park Avenue	Cooks Lane	1	1	1	1	No	None	N/A	N/A

Construction Duration: 36 months (3 years)

Work Hours: Six days a week; 15 hours per day

Temporary Roadway Closures:

- The loop ramp from southbound Security Boulevard to eastbound I-70 would be closed for west portal construction for the Cooks Lane Tunnel and would be permanently closed upon completion of the project.
- Short duration closures of I-695 are anticipated for erecting steel girders.

Temporary Lane Closures:

- **Short duration (2-3 week) lane reconfigurations may be required on westbound Security Boulevard during some phases of construction. In general, westbound lanes on Security Boulevard would be maintained in their current configuration.
- Temporary off-peak lane closures may be needed for some work activities, including utility relocations along Security Boulevard.
- Additional off-peak lane closures may be required for the intersection reconfiguration at Security Boulevard / Cooks Lane / Forest Park Drive.
- Lane closures may be required along Rolling Road during certain phases of construction.
- Shoulder closures on I-695 are anticipated for pier construction.
- ***I-70 would be reduced to its ultimate lane configuration during construction (Three lanes eastbound and westbound between I-695 and Parallel Drive; one lane eastbound and two lanes westbound between Parallel Drive and the park-and-ride exit; one lane in each direction between the park-and-ride exit and Cooks Lane)

Intersection Grade Crossing Construction:

- Temporary intersection closures (up to 2 weeks) may be required for construction of the grade crossings.
- These closures would restrict turn movements from the mainline and turn and through movements on the side streets. Detours would be required.
- Major intersections, such as Rolling Road, would be constructed in stages to the extent possible to minimize impacts to traffic.

Parking: No on-street parking impacts.

Sidewalks and Crosswalks:

- Sidewalk and crosswalk impacts could include either full closure and/or reduced widths to be further determined during Final Design and Construction. Pedestrian access would be maintained through existing, temporary or ultimate sidewalks and crosswalks to the extent possible. Pedestrian detours would be needed and would be finalized during the Design and Construction phases of the project, with input from the communities.

Bus Stops:

- Bus stops on Security Boulevard would need to be relocated during construction. A plan would be developed for relocating bus routes and stops as needed throughout construction.
- Pedestrian areas would be provided for bus stops maintained in construction areas such that persons waiting for buses are not standing in the road or work area.

***Intersection and Turn Movement Restrictions:**

- In general, existing left and right-turn movements would be maintained during the peak hours on Security Boulevard. Some phases of construction may require some turn-lane reductions during peak and off-peak hours for short durations (2-3 weeks).
- The eastbound approach right-turn lane at several intersections would be closed and a shared through/right lane would be maintained, along with a dedicated left turn lane. The following intersections would be affected in this way:
  - Security Boulevard / North Rolling Road
  - Security Boulevard / Lord Baltimore Drive
  - Security Boulevard / Belmont Avenue

Table 4-31: Summary of Anticipated Construction Impacts – Cooks Lane Design Segment

Street Segment			Impacts During Construction							
On	From	To	Existing Number of Lanes		Number of Lanes During Construction		Turn Movement Restrictions	Loss of Off-Street Parking Spaces	Loss of On-Street Parking Spaces	Sidewalk Impacts
			EB/NB	WB/SB	EB/NB	WB/SB				
Security Boulevard	I-70	Forest Park Avenue	2	2	2	2	No	N/A	0	N/A
Cooks Lane	Forest Park Avenue	Edmondson Avenue	1	1	1	1	No	N/A	0	No Impacts
US 40 (Edmondson Avenue)	Cooks Lane	East of Glen Allen Drive	3	3	2	2	Yes	N/A	47	North and South sides

Construction Duration: 48 months (4 years); Cut-and-cover on Edmondson: 34 months (2.9 years)

Work Hours: Daytime and Nighttime work (24/7)

Temporary Roadway Closures:
- The loop ramp from southbound Security Boulevard to eastbound I-70 would be closed throughout the duration of construction and would be permanently closed upon completion of the project.

Temporary Lane Closures:
- Number of through lanes on Edmondson Avenue would be reduced to ultimate condition during construction (2 lanes in each direction).
- In addition to the lane restrictions listed above, temporary off-peak lane closures may be needed for some work activities.
- Temporary off-peak lane closures may be needed on Cooks Lane, Forest Park Drive and Security Boulevard for utility work. Additional off-peak lane closures along these roads may be required for the intersection reconfiguration at Security Boulevard/ Cooks Lane / Forest Park Drive.

Parking:
- Parking on Cooks Lane would not be impacted during construction.
- All on-street parking on Edmondson Ave. would be lost during construction. A plan to provide alternate parking options during construction would be developed.

Sidewalks and Crosswalks:
- Sidewalk and crosswalk impacts could include either full closure and/or reduced widths to be further determined during Final Design and Construction. Pedestrian access would be maintained through existing, temporary or ultimate sidewalks and crosswalks to the extent possible. Pedestrian detours would be needed and would be finalized during the Design and Construction phases of the project, with input from the communities.

Bus Stops:
- Bus stops on Edmondson Avenue would need to be relocated during construction. A plan would be developed for relocating bus routes and stops as needed throughout construction.
- Pedestrian areas would be provided for bus stops maintained in construction areas such that persons waiting for buses are not standing in the road or work area.

Intersection and Turn Movement Restrictions:
- During construction of the tunnel portal on Edmondson Ave, several intersections would be closed to mainline left turn, side street through, and side street left turn movements, including:
  - Brookwood Road
  - Winans Way / Uplands Parkway
  - Glen Allen Drive *
  - Detours would be provided as needed.

- Glen Allen Drive would remain closed to mainline left turn, side street through, and side street left turn movements in the ultimate condition.

Table 4-32: Summary of Anticipated Construction Impacts –US 40 Design Segment

Street Segment			Impacts During Construction							
On	From	To	Existing Number of Lanes		Number of Lanes During Construction		Turn Movement Restrictions	Loss of Off-Street Parking Spaces	Loss of On-Street Parking Spaces	Sidewalk Impacts
			EB	WB	EB	WB				
US 40 (Edmondson Avenue)	East of Glenn Allen Drive	Franklintown Road	3	3	2	2	Yes	None	340	North and South sides
Franklintown Road	US 40 (Edmondson Avenue)	US 40 (Franklin Street)	1	1	1	1	Yes	45	5	West and East sides
US 40 (Franklin Street)	Franklintown Road	Warwick Avenue	3	3	2	2	Yes	None	N/A	North and South sides
WB US 40 (Franklin Street)	Warwick Avenue	Pulaski Street	-	3	-	2	No	27	46	North and South sides
WB US 40 (Expressway corridor)	Pulaski Street	North Mount Street	-	2	-	2	No	None	N/A	South side
EB US 40 (Mulberry Street)	Warwick Avenue	Smallwood Street	3	-	2	-	No	None	N/A	North and South sides
EB US 40 (Mulberry Street)	Smallwood Street	Payson Street	2	-	2	-	No	None	N/A	North side
EB US 40 (Expressway corridor)	Payson Street	North Mount Street	2	-	2	-	No	None	N/A	N/A
US 40 (Expressway corridor)	North Mount Street	Fremont Avenue	3	3	0*	0*	N/A	None	N/A	N/A

Construction Duration: 42 months (3.5 years)
- Civil: 24 months (2 years); Station/Trackwork/Systems: 18 months (1.5 years)

Work Hours: Six days a week; 15 hours per day

Temporary Road Closures:
- *Closure of eastbound US 40 and westbound US 40 in the expressway corridor is proposed for portal construction (see Segment 4) for the downtown tunnel (approximately 3 years).

Temporary Lane Closures:
- Number of through lanes on Edmondson Avenue would be reduced to ultimate condition (two lanes in each direction) during construction.
- In addition to the lane restrictions listed above, temporary off-peak lane closures may be needed for some work activities.

Intersection Grade Crossing Construction:
- Temporary intersection closures (up to 2 weeks) may be required for construction of the grade crossings.
- These closures would restrict turn movements from the mainline and turn and through movements on the side streets. Detours would be required.
- Major intersections would be constructed in stages to the extent possible to minimize impacts to traffic.

Parking:
- All on-street parking would be lost during construction. A plan to provide alternate parking options during construction would be developed.
- To stagger the parking reductions, consideration would be given to longitudinal staging of work such that the entire roadway would not be under construction at the same time.

Sidewalks and Crosswalks:
- Sidewalk and crosswalk impacts could include either full closure and/or reduced widths to be further determined during Final Design and Construction. Pedestrian access would be maintained through existing, temporary or ultimate sidewalks and crosswalks to the extent possible. Pedestrian detours would be needed and would be finalized during the Design and Construction phases of the project, with input from the communities.

Bus Stops:
- Bus stops would need to be relocated during construction. A plan would be developed for relocating bus routes and stops as needed throughout construction.
- Pedestrian areas would be provided for bus stops maintained in construction areas such that persons waiting for buses are not standing in the road or work area.

Intersection and Turn Movement Restrictions:
- Turn bays would not be provided for **most** mainline turn movements during construction. Mainline turn bays would be provided at key intersections along the corridor to the extent possible to maintain access. These intersections may change throughout construction based on longitudinal staging of work.
- Mainline turn bays would be maintained to the extent possible at locations with high left turn volumes, including:
  - Eastbound Edmondson Avenue at Swann Avenue
  - Westbound Edmondson Avenue at Athol Avenue
  - Eastbound Edmondson Avenue at Wildwood Parkway
  - Westbound Edmondson Avenue at Hilton Street
  - Westbound Franklin Street at Franklintown Avenue
  - Westbound Franklin Street at Pulaski Street
  - Eastbound Mulberry Street at Pulaski Street
- Detours would be provided as needed.

Table 4-33: Summary of Anticipated Construction Impacts

Downtown Tunnel Design Segment

Street Segment			Impacts During Construction							
On	From	To	Existing Number of Lanes		Number of Lanes During Construction		Turn Movement Restrictions	Loss of Off-Street Parking Spaces	Loss of On-Street Parking Spaces	Sidewalk Impacts
			EB/NB	WB/SB	EB/NB	WB/SB				
US 40 (expressway corridor)	Pulaski Street	North Greene Street	3	3	0*	0*	N/A	None	N/A	N/A
Mulberry	Poppleton Street	East of Fremont Avenue	2	-	0**	-	No	None	3	No Impacts
Fremont Avenue	Mulberry Street	Fayette Street	1	1	1	1	No	None	13	East and West sides
Fremont Avenue	Fayette Street	Baltimore Street	1	1	0***	0***	Yes	None	14	East and West sides
Fayette Street	Fremont Avenue	MLK Jr. Boulevard	-	2	-	2	No	None	0	North and South sides
Lombard Street	Howard Street	Hopkins Place	-	5	-	2	Yes	888	N/A	North and South sides
Lombard Street	Hopkins Place	Hanover Street	-	5	-	3	Yes	None	N/A	No Impacts
Lombard Street	Light Street	Calvert Street	-	6	-	3	Yes	None	N/A	North and South sides
Lombard Street	Calvert Street	South Street	-	6	-	3	Yes	None	0	South side
Light Street	Lombard Street	Baltimore Street	-	5	-	2	Yes	None	14	West side
Fleet Street	Exeter Street	Caroline Street	1	1	1	1	N/A	None	55	North and South sides
Fleet Street	Bethel Street	Broadway	1	1	1	1	N/A	25	29	North and South sides
Broadway	Fleet Street	Eastern Avenue	2	2	1	1	Yes	None	24	No Impacts
Boston Street	West of Montford Avenue	Driveway Ent. (Starbucks)	2	2	0 / 1****	0 / 1****	Yes	None	58	North and South sides

Construction Duration: 54 months (4.5 years)

Work Hours: Daytime and Nighttime work (24/7)

Temporary Roadway Closures:

- *Close eastbound and westbound US 40 (expressway corridor) for approx. Three years during portal construction and tunnel boring operations.
- **Close eastbound Mulberry between Poppleton Street and east of Fremont Street for 10-12 months to complete cut-and-cover operations. Eastbound US 40 would remain open during this phase of construction.
- ***Close Fremont Avenue between Fayette and Baltimore for approximately 3-4 years.
- ****Potential closure of Boston Street from west of Montford to East of Hudson (approximately 12 months). Under the closure scenario, local traffic access only would be provided to the Anchorage Marina. Options for maintaining one lane of traffic in each direction would be explored. It is anticipated that one lane of traffic in each direction would be maintained in the retained cut section from east of Hudson Street to immediately east of the Starbucks Driveway Entrance. Turning movements would be restricted.

Temporary Lane Closures:

- In addition to the lane restrictions listed above, temporary off-peak lane closures may be needed for some work activities.
- Lane closures for station box construction along Lombard and Fleet would be long-term (3-4 years).

Parking:

- In the station and portal areas, all parking would be eliminated during construction. Parking along Boston Street in the portal area would be eliminated in the ultimate condition.
- A plan to provide alternate parking options during construction would be developed for the Boston Street Corridor.

Sidewalks and Crosswalks:

- Thru sidewalk would be maintained on one side of the street only, unless property access is required. Sidewalk detours would be provided if a route is unable to be maintained.
- Temporary sidewalk connections to storefront entries would be provided as needed; at some locations, however, there would be periods when access cannot be provided. Other accommodations would be explored for these locations.
- Sidewalk and crosswalk impacts could include either full closure and/or reduced widths to be further determined during Final Design and Construction. Pedestrian access would be maintained at all times through existing, temporary or ultimate sidewalks and crosswalks to the extent possible. Pedestrian detours would be needed and would be finalized during the design and construction phases of the project, with input from the communities.

Bus Stops:

- Bus stops on Lombard Street and Boston Street would need to be relocated during construction. A plan would be developed for relocating bus routes and/or stops during construction.
- Pedestrian areas would be provided for bus stops maintained in construction areas such that persons waiting for buses are not standing in the road or work area.

Intersection and Turn Movement Restrictions:

- Where station boxes or tunnel portals cross an intersection, the cross street may have lane restrictions during construction.
- Eden, Montford and Hudson would "dead end" at the cut-and-cover work areas for the duration of the station work (no thru traffic).
- Turn movements along streets without dedicated turn lanes (Fleet Street, Boston Street, etc.) may need to be restricted to allow for through traffic flow.
- Dedicated turn lanes along Lombard, Light, Fleet and Boston Street would be reduced or eliminated during construction. The following modifications to lane configurations are anticipated:
    - Westbound Lombard at Howard: Shared Left-Thru, Shared Thru-Right
    - Westbound Lombard at Hopkins: Left, Shared Left-Thru, Thru
    - Southbound Light at Lombard: Thru, Shared Thru-Right
    - Westbound Lombard at Light: Left, Shared Left-Thru, Thru
    - Westbound Lombard at Calvert: Thru, Thru, Shared Thru-Right
    - Northbound / Southbound Broadway at Fleet: Shared Left-Thru-Right
    - Westbound Fleet at Broadway: Shared Left-Thru, Right
    - Eastbound Fleet at Broadway: Shared Left-Thru-Right

Table 4-34: Summary of Anticipated Construction Impacts – East Design Segment

Street Segment			Impacts During Construction							
On	From	To	Existing Number of Lanes		Number of Lanes During Construction		Turn Movement Restrictions	Loss of Off-Street Parking Spaces	Loss of On-Street Parking Spaces	Sidewalk Impacts
			EB/NB	WB/SB	EB/NB	WB/SB				
Boston Street	West of Montford Avenue	Driveway Ent. (Starbucks)	2	2	0 / 1	0 / 1	Yes	None	58	North/East and South/West sides
Boston Street	Safeway Driveway	Conkling Street	2	2	1	1	Yes	17	181	North and South sides
Boston Street***	Conkling Street	Future Old Boston Street	2	2	1	1	Yes	None	N/A	N/A
Haven Street	Future Old Boston Street	Hudson Street	1	1	1**	0	Yes	None	5	N/A
Dillon Street	Grundy Street	Haven Street	1	1	0*	0*	N/A	None	0	N/A
Eastern Avenue	Haven Street	Janney Street	2	2	2	2	No	None	N/A	No Impacts
Alpha Commons Drive	Future Cassell Drive	Bayview Boulevard	1	1	0	0	N/A	52	N/A	North and South sides
Bayview Boulevard	Alpha Commons Drive	Lombard Street	2	2	2	2	Yes	52	N/A	East and West sides

***Roadway improvements on Boston Street from Baylis Street to Future Old Boston Street would be constructed under a separate contract

Construction Duration: 42 months (3.5 years)
- Civil: 27 months (2.25 years); Stations/Track work/Systems: 15 months (1.25 years)

Work Hours: Six days a week; 15 hours per day

Temporary Roadway Closures:
- *Dillon Street would be closed at Haven Street (~3 months). Local traffic would be able to access Dillon Street by taking Hudson to Grundy to Dillon.
- Boston Street would be closed from West of Montford Ave to the entrance to Starbucks parking lot for portal construction.
- Short duration closures of Janney Street, Kresson Street, CSX Rail, Norfolk Southern Rail, Oldham Street, Ponca Street, and I-895 are anticipated for erecting steel girders.

Temporary Lane Closures:
- Number of through lanes on Boston Street would be reduced to ultimate condition during construction (one lane in each direction).
- In addition to the lane restrictions listed above, temporary off-peak lane closures may be needed for some work activities.
- **Haven Street would operate in a reversible, one-lane configuration for several stages of construction. Temporary signals would be installed for traffic control.
- Shoulder closures along I-895 are anticipated for pier construction.

Intersection Grade Crossing Construction:
- Temporary intersection closures (up to 2 weeks) may be required for construction of the grade crossings. These closures would restrict turn movements from the mainline and turn and through movements on the side streets. Detours would be required.
- Major intersections, including Boston Street at Future Old Boston Street and Lombard Street at Bayview Boulevard/I-895 Ramps, would be constructed in stages to the extent possible to minimize impacts to traffic.

Parking:
- All on-street parking would be lost during construction. A plan to provide alternate parking options during construction would be developed.
- To stagger parking restrictions, consideration would be given to longitudinal staging of work such that the entire roadway would not be under construction at the same time.

Sidewalks and Crosswalks:
- Sidewalk and crosswalk impacts could include either full closure and/or reduced widths to be further determined during Final Design and Construction. Pedestrian access would be maintained to the extent possible through existing, temporary or ultimate sidewalks and crosswalks. Sidewalk and crosswalk detours would be provided if a route is unable to be maintained. Pedestrian detours would be finalized during the design and construction phases of the project, with input from the communities.

Bus Stops:
- Bus stops would need to be relocated during construction. A plan would be developed for relocating bus routes and/or stops as needed throughout construction.
- Pedestrian areas would be provided for bus stops maintained in construction areas such that persons waiting for buses are not standing in the road or work area.

Intersection and Turn Movement Restrictions:
- Turn movements would be restricted during certain phases of construction.
- Turn bays would not be provided for **most** mainline turn movements during construction. Mainline turn bays would be provided at key intersections along the corridor to the extent possible to maintain access. These intersections may change throughout construction based on longitudinal staging of work.
- Mainline left turn movement would be maintained during all but short duration closures at the following intersections:
  - Westbound Boston Street at Clinton
  - Eastbound Boston Street at Conkling
  - Westbound Boston Street at Kenwood
  - Eastbound Boston Street at Kenwood
  - Westbound U-Turn on Boston Street at Lakewood

e. Levels of Service

To understand the impacts of the lane reductions and closures during construction, LOS at key intersections in the project study corridor were calculated for an assumed peak construction year of 2016.

Table 4-35 contains a list of intersections with an LOS of E or F during any of the following conditions: the Existing Condition, the No-Build Alternative in 2016, and the Preferred Alternative in 2016.

Table 4-35: 2016 Construction Year Levels of Service AM and PM Peak Hours (For Intersections with LOS E or F during Existing Conditions or Peak Construction Year)

No.	Section	Signalized Intersections	Existing		2016 No-Build		2016 Construction	
			AM	PM	AM	PM	AM	PM
1	West	MD 122 (Security Boulevard) at Woodlawn Drive	D	**E**	C	D	C	D
2	West	MD 122 (Security Boulevard) at Ingleside Avenue	**E**	**E**	D	**E**	D	**E**
3	US 40	US 40 at Ingleside Avenue	D	**E**	D	**E**	D	**E**
4	US 40	US 40 at Swann Avenue	B	B	B	**F**	**A**	C
5	US 40	West Mulberry Street at Gilmor Street	C	B	C	B	**E**	B
6	US 40	West Mulberry Street at Carey Street	B	B	B	B	**E**	B
7	US 40	West Mulberry Street at Arlington Street	A	B	A	B	**F**	A
8	US 40	West Mulberry Street at Pulaski Street	**E**	C	B	B	C	C
9	Downtown Tunnel	Mulberry Street at Martin Luther King, Jr. Boulevard	**F**	C	**F**	**E**	**F**	**F**
10	Downtown Tunnel	Martin Luther King, Jr. Boulevard at Saratoga Street	**E**	D	D	D	**F**	**E**
11	Downtown Tunnel	Martin Luther King, Jr. Boulevard at Baltimore Street	C	**E**	D	D	D	**F**
12	Downtown Tunnel	Lombard Street at Martin Luther King, Jr. Boulevard	C	**E**	B	**F**	C	**F**
13	Downtown	Lombard Street at Penn Street	B	**E**	B	**E**	B	D
14	Downtown	Lombard Street at Greene Street	C	C	D	D	C	**F**
15	Downtown	Lombard Street at Howard Street	C	C	C	**F**	B	**F**
16	Downtown	Lombard Street at Hopkins Place	**F**	**F**	**F**	**F**	**F**	**F**
17	Downtown	Lombard Street at Hanover	B	**E**	C	**F**	B	D
18	Downtown	Lombard Street at Light Street	C	**F**	C	**F**	**F**	**F**
19	Downtown	Lombard Street at Calvert Street	C	C	C	D	C	**F**
20	East	Boston Street at Aliceanna Street	B	**E**	B	D	C	D
21	East	Boston Street at East Street	A[1]	B[1]	B[1]	B[1]	B	**E**

Table 4-35: 2016 Construction Year Levels of Service AM and PM Peak Hours (For Intersections with LOS E or F during Existing Conditions or Peak Construction Year)

No.	Section	Signalized Intersections	Existing		2016 No-Build		2016 Construction	
			AM	PM	AM	PM	AM	PM
22	East	Boston Street at Clinton Street	D	C	**E**	D	D	D
23	East	Eastern Avenue at Patterson Park Avenue	C	C	**E**	C	**F**	**E**
24	East	O'Donnell Street at Conkling	D	D	**F**	**F**	**F**	**E**
		Total – LOS E OR F	**5**	**10**	**5**	**11**	**9**	**14**

Note: [1]Unsignalized Intersection in worst approach LOS in the Existing and 2016 No-Build conditions; Shading in 2016 Construction Year Columns indicates LOS better or worse than 2016 No-Build.

More intersections would fail in 2016 during construction, than in the 2016 No-Build condition. Lombard Street shows the most deterioration in LOS because of the lane closure restrictions associated with the cut-and-cover station construction. Because of the detour associated with the closure of Boston Street, the intersections of Eastern Avenue at Patterson Park Avenue and O'Donnell Street at Conkling Street see deteriorations in the LOS. The LOS for each key intersection analyzed during the construction year can be found in Appendix A of the *Traffic and Parking Technical Report*, along with the data on traffic volumes and travel delay during construction.

f. Mitigation of Construction-Related Impacts

Mitigation measures will be implemented along the affected roadways and sidewalks throughout the project study corridor during construction. The most common measures would be traffic signal timing modifications at existing signalized intersections, the installation of temporary traffic signals at existing unsignalized intersections, and temporary detours of vehicle and pedestrian traffic. MTA will work with Maryland State Highway Administration, Baltimore County Department of Public Works and Baltimore City Department of Transportation, to develop a Maintenance of Traffic (MOT) plan and Transportation Management Plan (TMP) for each construction phase of the project. The MOT and TMP are described below.

Maintenance of Traffic Plan

The MOT plan will address the effects on streets and highways, transit, businesses, residences, pedestrians, and bicycles, including roadway closures and turning movement restrictions for affected streets and intersections. Specific mitigation will be developed during Final Design to identify the maximum number of lanes closed during peak traffic hours, maintenance and removal of traffic control devices, efficient traffic rerouting measures, and scheduling of construction activities within the roadways for times other than peak traffic periods.

Transportation Management Plan

The TMP will include site-specific traffic control measures and will be developed in conjunction with final design of the Preferred Alternative. The key objectives of this plan are to minimize impacts to mobility while maintaining safety. The mitigation measures required by the city/county for roadway access and traffic control apply to the disruption of area businesses, schools, and other community facilities. Permits will be acquired by project contractors from the appropriate city offices for roadway disruptions and blockages.

The following is a list of potential mitigation strategies to be developed as part of the TMP:

- Traffic Mitigation: Optimization of signal timing, including modifications to cycle lengths and splits, will be implemented to improve traffic progression and reduce delay. Where feasible, temporary lane closures will occur during off-peak hours to minimize effects on commuter traffic.
- Traffic Mitigation on Diversion Routes: The need for traffic mitigation on detour and/or diversion routes will be assessed during Final Design. Mitigation strategies to be investigated include temporary parking restrictions, lane modifications, and signal re-timing.
- Emergency Services: During Final Design and construction, coordination with emergency service providers will be undertaken to identify effects and potential mitigation measures for emergency service routes.
- Public Outreach: A public outreach program will be developed to inform local residents and businesses of potential delays and impacts because of construction.

4.3 Parking

4.3.1 Introduction and Methodology

This section identifies existing parking facilities within the project study corridor, as well as the effects to such facilities as a result of the construction and operation of the Preferred Alternative. Additional details regarding parking are contained in the *Traffic and Parking Technical Report* located in **Appendix I**.

Available on-street and off-street parking spaces and uses during weekday and weekend periods were inventoried in November 2011 and January 2012 for on-street and off-street parking along the project study corridor that could be directly impacted by the Preferred Alternative. On-street parking spaces are defined as public parking spaces that are available on the sides of a roadway during some hours of the day along the Preferred Alternative, and off-street parking spaces are defined as public or private surface lot and garage spaces that are adjacent to a roadway and are impacted due to the Preferred Alternative.

Also, documented as part of this inventory were the different types of parking restrictions, such as truck loading and unloading areas, handicapped reserved spaces, peak period restrictions, No Stopping, and No Parking Anytime.

An analysis of existing parking spaces and uses in proximity to the spaces that would be removed by the project was undertaken to determine the impact of this parking loss. The study considered not just the actual number of parking spaces lost because of the project, but the number of vehicles currently using those parking spaces and whether adjacent parking is available to fill that need. An assumption was made that if parking was available on an adjacent block to either side of the spaces that were being eliminated, motorists would be able to use those spaces instead. This approach is consistent with the guidance adopted by New Jersey Transit[2] and published by the Victoria Transport Policy Institute[3] and the National Parking Association[4] regarding reasonable walking distances for most trip types.

4.3.2 Existing Conditions

The majority of on-street parking in the Baltimore City portion of the project study corridor is in the downtown area, along Edmondson Avenue, and along Boston Street in the Fell's Point/Canton area. In the Baltimore County portion of the project study corridor, parking is allowed along MD 122 (Security Boulevard) adjacent to the Social Security Administration (SSA).

A summary of the available parking spaces within the Preferred Alternative project study corridor is provided in **Table 4-36**.

Table 4-36: Existing On-Street and Off-Street Lot Parking Spaces along the Red Line Corridor

Design Segment Vicinity	On-Street Parking	Off-Street Parking
Security Boulevard, I-70	0	2,768
Cooks Lane Tunnel Corridor	233	0
US 40	739	325
Downtown Tunnel Corridor	682	210
Boston St, Haven St, and Bayview Boulevard	311	1,858

Source: Traffic and Parking Technical Report, 2012

4.3.3 Future No-Build Conditions

It was assumed that there are no parking impacts to the current on-street parking spaces in the 2035 future under the No-Build condition, as per the *Plan It 2035* Long-Range Transportation Plan for the Baltimore Region. All of the on-street parking spaces that were inventoried in the Existing Conditions therefore remain in the 2035 No-Build conditions.

With respect to off-street parking, the surface parking lots at the existing West Baltimore MARC Station and the proposed Bayview MARC Station would be expanded by others and would be completed before the opening year for the Red Line (2021). According to the West Baltimore MARC expansion study, it is expected that the total number of parking spaces at that station would increase from 325 to 700 parking spaces. Construction of the station parking lot would be completed by 2015.

The future parking lot at Bayview MARC station is anticipated to have about 650 parking spaces. It should be noted that the Bayview MARC Station expansion study is in progress. Construction of the station parking lot would be completed by 2018.

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[2] NJ Transit (1994). Planning for Transit-Friendly Land Use: A Handbook for New Jersey.
[3] Online TDM Encyclopedia. (2012). Retrieved November 14, 2012, from http://www.vtpi.org/tdm/tdm89.htm.
[4] Smith, M. and Butcher, T. (2008, May). How Far Should Parkers Have to Walk" *Parking,* 28-31.

4.3.4 Preferred Alternative

As part of the Preferred Alternative, additional parking facilities are proposed to provide parking for the Red Line and other transit users along the project study corridor. These parking facilities, as described in **Chapter 2** of this Final Environmental Impact Statement (FEIS), include an expanded park-and-ride lot adjacent to the Security Square Mall, relocation and expansion of the existing I-70 Park-and-Ride, and a new park-and-ride lot in Canton along Boston Street, adjacent to the Brewers Hill/Canton Crossing Station. The existing and proposed number of parking spaces at each of these facilities is identified in **Table 4-37**.

Table 4-37: Park-and-Ride Facilities along the Red Line Project Study Corridor

Facility	Existing Spaces	Proposed Spaces (2035)
Security Square Park-and-Ride	296	375
I-70 Park-and-Ride	245	700
Brewers Hill/Canton Crossing Park-and-Ride	0	600

Source: Traffic and Parking Technical Report, 2012

a. Long-Term Operational Effects and Mitigation

The implementation of the Preferred Alternative would require the permanent elimination of 741 parking spaces along the project study corridor and would provide 1,134 new parking spaces at park-and-ride facilities. Approximately 400 vehicles which are parking in the eliminated spaces could be accommodated nearby (relocated to the adjacent blocks), leaving 380 spaces that would be permanently displaced by the project and that could not be accommodated nearby. The locations where parking loss would be the greatest include:

- Social Security West parking lot adjacent to I-70 (30 parking spaces eliminated)
- Edmondson Avenue from Cooks Lane to Franklintown Road (58 parking spaces eliminated)
- Calverton Road due to Red Line yard and shop (105 parking spaces eliminated)
- Boston Street from Chester Street to Conkling Street (126 parking spaces eliminated)

The number of parking spaces eliminated as a result of the Preferred Alternative would have varying impacts to the residents and businesses. This would be determined by the availability of parking spaces on adjacent blocks. For example, vehicles using the parking spaces being eliminated along Franklin Street could be accommodated in open/available parking spaces along adjacent blocks. Conversely, vehicles using eliminated spaces along Edmondson Avenue and Boston Street may not find enough spaces in the adjacent blocks to accommodate the loss (based on current use patterns).

In addition, the 888-space Arena Garage on Lombard Street would be impacted by the construction of the Howard Street/University Center Station. A portion of each floor of the garage would be required for ventilation shafts, displacing approximately 20 spaces per floor for a total permanent parking loss of 120 spaces (14 percent reduction). Temporary impacts to this garage are discussed in **Section 4.3.4b**.

The permanent effects to existing parking spaces are summarized in **Table 4-38**. Impacts on restricted parking areas would include the elimination of two of the 12 truck loading zones (one located on Edmondson Avenue between Poplar Grove Road and Franklintown Road, and one on Boston Street adjacent to Anchorage Towers, which also serves as a passenger loading zone) (**Table 4-39**). These loading zones are not being replaced by the project, but Baltimore City will work with adjacent property owners to evaluate options to accommodate additional parking and loading zones as a separate effort. No permanently designated handicapped parking spaces would be eliminated as a result of the Preferred Alternative***.***

The Maryland Transit Administration (MTA) is not proposing mitigation measures for replacing permanent loss of parking as a result of the Red Line project. Any changes to parking spaces or parking policies on City streets will be made by the City and will be separate from the Red Line project.

Table 4-38: Permanent Effects to Existing Parking Spaces

Geographic Limits within Project Study Corridor	Description of Preferred Alternative Component	Effects on Parking Spaces *(+ gained or – lost)*[1]	Currently Used Spaces That Would be Displaced [2]
Security Boulevard from Rolling Road to I-695	Dedicated transit on south side of Security Boulevard	-1 space at the former Super Fresh lot +79 spaces at new park-and-ride between Lord Baltimore and Belmont	1
I-695 to Woodlawn Drive	Dedicated transit alignment transitioning from Security Boulevard to north of I-70	-30 private parking spaces for Social Security Administration West Total parking required by lease = 2130, Build condition = 2100 spaces	30
I-70 Park-and-Ride to west of Cooks Lane	Surface parking lot facility at the terminus of I-70. Parking to be replaced with new Park-and-Ride lot between Parallel Drive and I-70. Parking for Gwynns Falls Trail provided in proposed lot. Baltimore County may also retain parking at current trail head parking location.	+455 spaces	None

Table 4-38: Permanent Effects to Existing Parking Spaces

Geographic Limits within Project Study Corridor	Description of Preferred Alternative Component	Effects on Parking Spaces *(+ gained or – lost)*[1]	Currently Used Spaces That Would be Displaced [2]
US 40/Edmondson Avenue from Cooks Lane to Franklintown Road	Dedicated transit in median, two traffic lanes in each direction with dedicated parking at some locations	-3 spaces at Bank of America -11 at Inner City Crab/Seafood -10 at Lion of the Tribe Judah Daycare (along Franklintown Road) -214 spaces along Edmondson Avenue	58
US 40/Franklin Street from Franklintown Road to West Baltimore MARC	Dedicated transit in median, two traffic lanes in each direction with dedicated parking at some locations	-27 spaces in MARC Lot A, -17 spaces along Franklin Street, parking is available nearby to replace these spaces, +335 spaces at West Baltimore MARC Park-and-Ride (by others), -105 spaces on Calverton Street due to Red Line Operations and Maintenance Facility	132
Fremont Avenue from US 40 to Lombard Street	Downtown Tunnel (Poppleton Station)	-13 spaces. Parking is available nearby to replace these spaces	None
Lombard Street from Martin Luther King, Jr. Boulevard to President Street	Downtown Tunnel (Howard Street/University Station)	-120 spaces in the Arena Garage. Parking is available nearby to replace these spaces	None
Fleet Street from President Street to Chester Street	Downtown Tunnel	- 6 spaces. Parking is available nearby to replace some of these spaces	4
Broadway (Median) from Fleet Street to Eastern Avenue	Downtown Tunnel	-1 space. Parking is available nearby.	None
Fleet/Boston Streets from Chester Street to Conkling Street	Downtown tunnel portal, then dedicated transit in the median, one traffic lane in each direction with dedicated parking at some locations	-6 at Safeway Lot -22 at Baltimore City Parking Lot -13 at Canton Crossing II -13 at Merritt Athletic Club -72 spaces along Boston Street	126
Canton Crossing Park-and-Ride	Dedicated transit in median, two traffic lanes in each direction	+600 spaces	None

Table 4-38: Permanent Effects to Existing Parking Spaces

Geographic Limits within Project Study Corridor	Description of Preferred Alternative Component	Effects on Parking Spaces *(+ gained or – lost)*[1]	Currently Used Spaces That Would be Displaced [2]
Haven Street from Boston Street to Gough Street	Dedicated transit along Haven Street and elevated structure to Bayview Boulevard	-29 at Monumental Supply	29
Bayview MARC Station to Johns Hopkins Bayview	Alignment on new right-of-way to Bayview Drive, dedicated transit on east side of Bayview Boulevard and I-895	+ 650 spaces at the Bayview MARC Park-and-Ride lot (by others) - 91 spaces at the Johns Hopkins Bayview parking lot	None
TOTAL		**741 spaces removed by the project; 1,134 spaces added by the project; 985 spaces added by others**	**380 spaces displaced by the project**

Notes: [1] Indicates the number of parking spaces added (+) or removed (-) because of the Red Line project.
[2] Indicates the number of parking spaces displaced because of the Red Line project, considering the current parking demand and the availability of free spaces in the adjacent block to either side of the impacted parking spaces.
Source: Traffic and Parking Technical Report, 2012

Table 4-39: Permanent Impacts to Loading Zones

Geographic Limits of Project Study Corridor	Description of Preferred Alternative Component	Effects on Loading Zones
US 40/Edmondson Avenue from Cooks Lane to Franklintown Road	Dedicated transit in median, two traffic lanes in each direction w/ dedicated parking on both sides	One truck loading zone in this segment on the north side of Edmondson Avenue between Poplar Grove Street and Franklintown Road would be eliminated. One passenger loading zone between Walnut Avenue and Woodington Road would not be affected
Fleet/Boston Streets from Chester Street to Conkling Street	Fleet Street tunnel to a portal in median of Boston Street	One shared truck and passenger loading zone, on the west side of Boston Street, north of Luzerne Avenue – would be eliminated and not replaced

Source: Traffic and Parking Technical Report, 2012

b. Temporary Construction Effects and Mitigation

On-Street Parking

As identified above in the Existing conditions section, on-street parking spaces are located on roadways that parallel and intersect the proposed construction activities. There would be no impacts to existing on-street parking areas within the project study corridor as a result of construction activities along Security Boulevard, I-70, or Cooks Lane. On-street parking along the alignment of the Preferred Alternative would be lost during the construction of the following at-grade sections: Edmondson Avenue, Franklintown Road, Franklin Street, Mulberry Street, Boston Street, and Haven Street. Parking in the proposed station and tunnel portal construction areas within the downtown tunnel corridor would be lost during construction. **Table 4-40** identifies the various locations where on-street parking would be temporarily unavailable within the project study corridor because of at-grade or below-grade construction. MTA will work with the contactor to develop a plan to minimize the loss of parking during construction.

Off-Street Parking

Off-street parking areas within the project study corridor would be affected by construction activities. During construction of the West segment, access to the park-and-ride facility at the eastern terminus of I-70 would be maintained until a new park-and-ride facility is constructed. There are several off-street parking lots serving retail uses along the southern side of Security Boulevard between Brookdale Road and Belmont Avenue. It is possible that some off-street parking spaces adjacent to Security Boulevard would temporarily be affected during construction; however, this would be determined during Final Design. The 386 parking spaces in the SSA surface lot adjacent to the westbound I-70 ramp to northbound I-695 would need to be closed for approximately three years during construction of this segment.

In the Downtown Tunnel segment of the project study corridor, access to the 4-space parking lot adjacent to the Bank of America on the corner of Broadway Street and Fleet Street would be restricted during underground station construction. It is anticipated that the 21-space parking lot adjacent to the same Bank of America building would be used for construction staging, resulting in temporary loss of 25 parking spaces for about 2 years.

Also in the Downtown Tunnel segment, the Arena Garage on Lombard Street would be closed for the duration of construction of the Howard Street/University Center station, approximately 2 years. This includes the temporary displacement of 888 spaces in this garage. Once the station is complete, the garage would be reopened, with a permanent loss of 120 spaces (see **Section 4.3.4a**). The MTA has met with the operator of this garage to discuss the construction and permanent impacts.

In the East segment, there is an 86-space surface parking lot adjacent to Ponca Street and the loop ramp to southbound I-895 that has been identified as a potential construction staging area. This lot would be impacted during construction for a duration of approximately 2 years.

Table 4-40: Effects to Off-Street and On-Street Parking Spaces from Construction Activities

Geographic Limits	Description of Preferred Alternative Component	Off-Street Parking Loss	On-Street Parking Loss
Security Boulevard from CMS to Rolling Road	Dedicated transit on south side of Security Boulevard	67 spaces at Boulevard Place	None
Security Boulevard from Rolling Road to I-695	Dedicated transit on south side of Security Boulevard	23 spaces at former Super Fresh, 270 spaces at Security Square	None
I-695 to Woodlawn Drive	Dedicated transit alignment transitioning from Security Boulevard to north of I-70	386 spaces at Security West	None
US 40/Edmondson Avenue from Cooks Lane to Franklintown Road	Dedicated transit in median, two traffic lanes in each direction with dedicated parking at some locations	None	378 spaces
Franklintown Road from Edmondson Avenue to Franklin Street	Dedicated transit in median, one traffic lane in each direction	45 spaces total at three businesses along Franklintown	5 spaces
US 40/Franklin Street from Franklintown Road to West Baltimore MARC	Dedicated transit in median, two traffic lanes in each direction with dedicated parking at some locations	27 spaces in Lot A of MARC Station	46 spaces
Mulberry Street from Poppleton Street to Fremont Avenue	Dedicated transit in median of US 40 to a portal to Fremont Avenue tunnel	None	3 spaces
Fremont Avenue from US 40 to Lombard Street	Downtown Tunnel (Poppleton Station)	None	27 spaces
Lombard Street from Martin Luther King, Jr. Boulevard to President Street	Downtown Tunnel (Howard Street/Inner Harbor Station)	888 spaces in Arena Garage	None
Light Street from Lombard Street to Baltimore Street	Downtown Tunnel	None	14 spaces
Fleet Street from President Street to Chester Street	Downtown Tunnel	25 spaces at Bank of America lot	84 spaces
Broadway from Fleet Street to Eastern Avenue	Downtown Tunnel	None	24 angled spaces along median

Table 4-40: Effects to Off-Street and On-Street Parking Spaces from Construction Activities

Geographic Limits	Description of Preferred Alternative Component	Off-Street Parking Loss	On-Street Parking Loss
Fleet/Boston Streets from Chester Street to Conkling Street	Downtown tunnel portal, then dedicated transit in the median, one traffic lane in each direction with dedicated parking at some locations	17 spaces total in seven public and private lots along Boston Street	239 spaces
Conkling Street to Norfolk-Southern-Canton Railroad	Boston Street to west of Haven Street and along abandoned N-S railroad right-of-way	86 spaces at I-895 loop ramp from Ponca Street for construction staging	5 spaces
Bayview MARC Station to Johns Hopkins Bayview Medical Center	Alignment on new right-of-way to Bayview Drive, dedicated transit on east side of Bayview Boulevard and I-895	104 spaces total in Johns Hopkins Bayview Medical Center lot and National Institute of Health lot	None

Source: Traffic and Parking Technical Report, 2012

Loading Zones

There would be impacts to the truck and passenger loading zones during construction of the Preferred Alternative. **Table 4-41** lists the locations and regulations of existing loading zones that would be eliminated during construction. Mitigation efforts such as loading zone alternatives and temporary accommodations will be assessed during the Final Design phase of the project.

MTA will coordinate with stakeholders and businesses affected by the loss of loading zones to identify alternate or temporary loading areas during construction and Final Design.

Table 4-41: Loading Zones Eliminated During Construction

Road Name	Block (West to East)	Location	Zone Type	Existing Regulations
US 40 (WB) (Edmondson Ave)	Walnut Avenue to North Woodington Road	Front of Edmondson Village Medical Center, Mid-block	Passenger Loading	20 Min Parking 24 hours/7 days
Light Street (NB)	Redwood Street to Lombard Street	Front of Residence Inn	Passenger Loading	10 Min Parking 6:00 PM – 11:00 PM (M-Sa)
Lombard Street (WB)	Light Street to Calvert Street	Front of Brookshire Suites	Passenger Loading	10 Min Parking 9:00 AM – 3:00 PM, 6:30 PM – 11:00 PM (M-F) 8:00 AM – 11:00 PM (Sa-Su)
Fleet Street (EB)	South Eden Street to South Spring Street	East Side of block	Passenger Loading	15 min Parking 7:00 AM – 4:00 PM (M-F)
Fleet Street (WB)	South Spring Street to South Caroline Street	Front of Fell's Fulton, East Side of block	Truck Loading	8:00 AM – 6:00 PM (M-Sa)
Broadway Street (NB)	Fleet Street to Eastern Avenue	Front of Carolina's Tex Mex, North Side of block	Passenger Loading	10 min Parking 5:00 PM – 1:00 AM (M-Sa)
Broadway Street (SB)	Eastern Avenue to Fleet Street	Front of Love Zone/Ritz Cabaret, North Side of block	Passenger Loading	10 Min Parking 6:00 PM – 12:00 AM (Th-Sa)
Fleet Street (WB)	South Broadway Street to South Regester Street	Front of Another Period in Time and Super Linens, Mid-block	Truck Loading	7:00 AM – 6:00 PM (M-Sa)
Boston Street (EB)	Hudson Street to South Lakewood Avenue	Front of Anchorage Towers	Truck/ Passenger Loading	24 hours/7 days
Boston Street (EB)	South Linwood Avenue to South Potomac Street	Front of Canton Cove Apartments, Mid-block	Passenger Loading	5 Min Parking, 24 hours/7 days

Source: Traffic and Parking Technical Report, 2012

4.4 Pedestrian and Bicycle Facilities

This section documents existing and planned pedestrian and bicycle facilities located within the project study corridor and presents potential benefits and impacts during operations and construction of the Preferred Alternative (compared with the No-Build Alternative). Mitigation measures are discussed. Additional details regarding pedestrian and bicycle facilities within the project study corridor can be found in the *Pedestrian and Bicycle Facilities Analysis Technical Memorandum* in **Appendix D**.

4.4.1 Introduction and Methodology

The project study corridor for pedestrian facilities extends 0.5 mile from the proposed alignment and stations. A 3-mile radius was used as the project study corridor for bicycle facilities. The Federal Transit Administration (FTA) has determined that these distances for pedestrian and bicycle facilities have physical and functional relationships to public transportation (FTA, August 2011). Pedestrian facilities may be paved, shared use paths. Unpaved paths – if not compacted to a smooth surface and maintained as such – are not Americans with Disabilities Act (ADA) accessible.

Data on existing conditions was compiled from the State of Maryland, Baltimore City, Baltimore County, the Baltimore Metropolitan Council, and other sources. A review of pedestrian and bicycle planning documents and maps from regional, state, and local jurisdictions was undertaken to identify the existing and planned facilities in the project study corridor, as well as local jurisdictions' goals and standards for bicycle and pedestrian activities.

Potential effects to bicycle and pedestrian facilities were evaluated through an analysis of Preliminary Engineering plans that have been prepared for the project, along with a field review of existing bicycle and pedestrian facilities, GIS data, and public policies established by Baltimore County, Baltimore City, and the Baltimore Metropolitan Council. The analysis addressed the potential for the Preferred Alternative to affect these facilities during construction activities and light rail operations. The following criteria were used to determine potential effects of the Preferred Alternative on community bicycle and pedestrian facilities:

- Whether the construction or operation of the Preferred Alternative would temporarily or permanently displace or alter bicycle or pedestrian facilities
- Whether the construction or operation of the Preferred Alternative would temporarily or permanently restrict access or use of the facilities
- Whether the project would improve pedestrian and/or bicycle connections (through providing new or enhanced pedestrian and bicycle facilities)

4.4.2 Existing Conditions

Figure 4-6 presents the locations of existing bicycle and shared-use facilities in the project study corridor. Sidewalks are located throughout the project study corridor and are not shown on the figure.

Pedestrian count data were measured or gathered from previous studies for the vehicular PM peak hour, at several intersections for pedestrian movements that cross the proposed track alignment. Peak hourly pedestrian volumes for individual crosswalks were generally very low on the west end of the project study area (<10 per hour), with up to 50 pedestrians/hour crossing Security Boulevard immediately adjacent to Security Square Mall. Crossing Edmondson Avenue, Boston Street, and Bayview Boulevard, pedestrian volumes were less than 10 pedestrians per hour at many intersections, with counts at some intersections ranging as high as 35 pedestrians per hour. The highest volumes of pedestrians crossing where tracks are proposed were found to be across Alpha Commons Drive on the Johns Hopkins Bayview Medical Center campus, with up to 65 pedestrians per hour using a single crosswalk.

A pedestrian compliance evaluation of use of crosswalks and traffic signals suggest a non-compliance (jaywalking) rate of less than 20 percent for the project study corridor; approximately 80 percent of pedestrians cross roadways at crosswalks and follow traffic signals. Additional information is presented in the *Pedestrian and Bicycle Facilities Analysis Technical Memorandum* (2012).

4.4.3 Future No-Build Conditions

Under future No-Build conditions, bicycle and pedestrian facilities include numerous planned improvements. Future improvements to bicycle, pedestrian, and shared-use facilities are in various stages of planning and development, and are not dependent on the construction of the Preferred Alternative.

The *Western Baltimore County Pedestrian and Bicycle Access Plan* (2012) and Baltimore City's *Bicycle and Pedestrian Master Plan* (2006) identify the programmed and planned future improvements considered under the No-Build Alternative. The master plans do not reflect specific dates for completion of the future improvements; many of these projects would be completed as funding becomes available. **Figure 4-7** presents the locations of pedestrian, bicycle, and shared-use facilities planned in the project study corridor.

The No-Build Alternative would not have short-term construction effects, or long-term adverse impacts to pedestrian and bicycle travel. According to established master plans in Baltimore County and Baltimore City, the No-Build Alternative would be expected to fill identified gaps in the bicycle and pedestrian network that would connect existing and future facilities as well as connect to transit stations.

4.4.4 Preferred Alternative

It is the MTA policy that future MTA transit systems accommodate bicycles. Therefore, the Preferred Alternative would provide bicycle access to stations by perpendicular access streets that make up the bicycle network in the project study corridor.

The Preferred Alternative would provide sidewalk widths of 5 to 6 feet where available. Lighting and landscaping would help create a safe and attractive environment that is bicycle and pedestrian-friendly; enhance visibility between bicyclists and pedestrians and other traffic; and increase access to transit and destinations throughout the region.

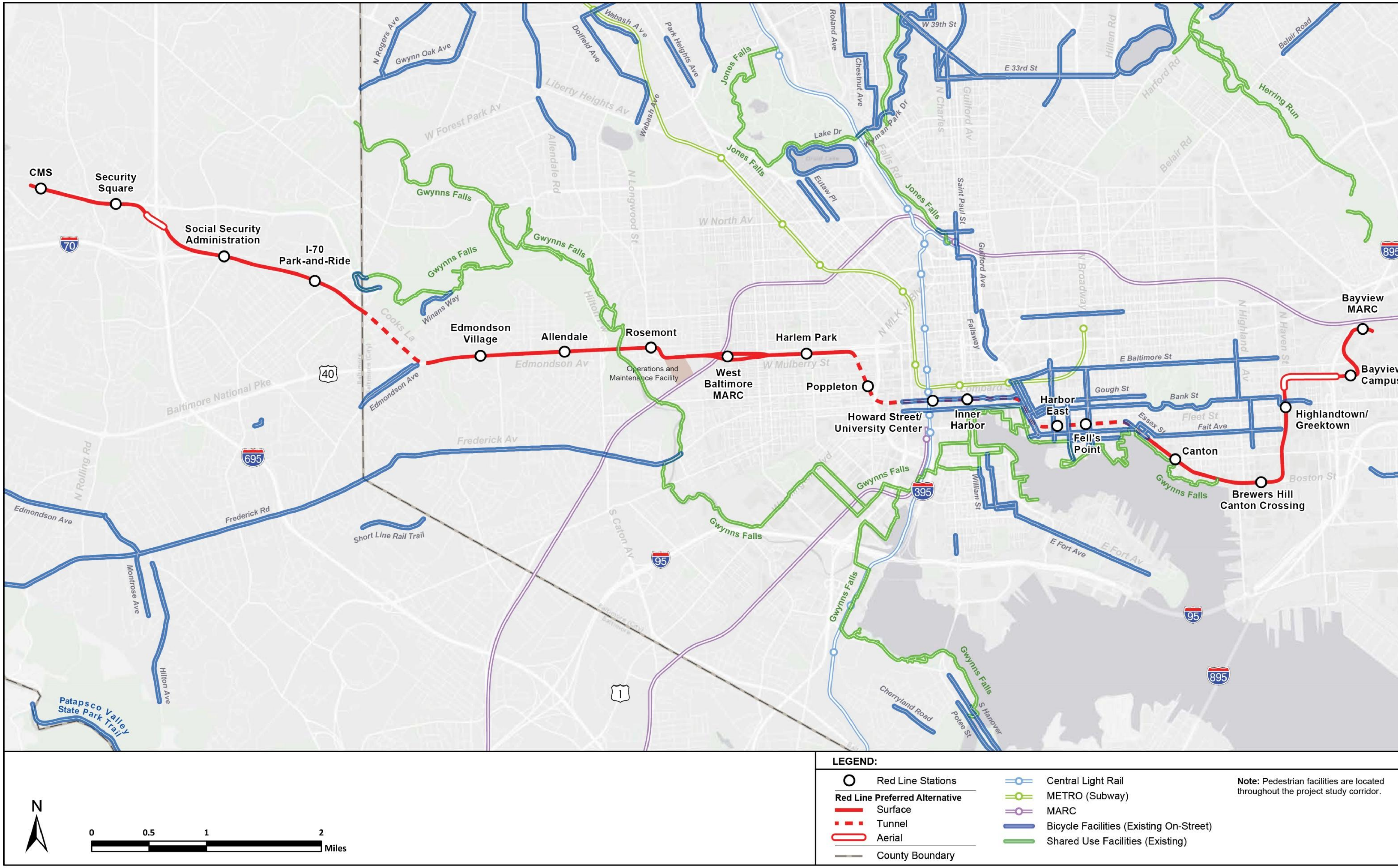


Figure 4-6: Existing Bicycle and Shared Use Facilities in the Project Study Corridor

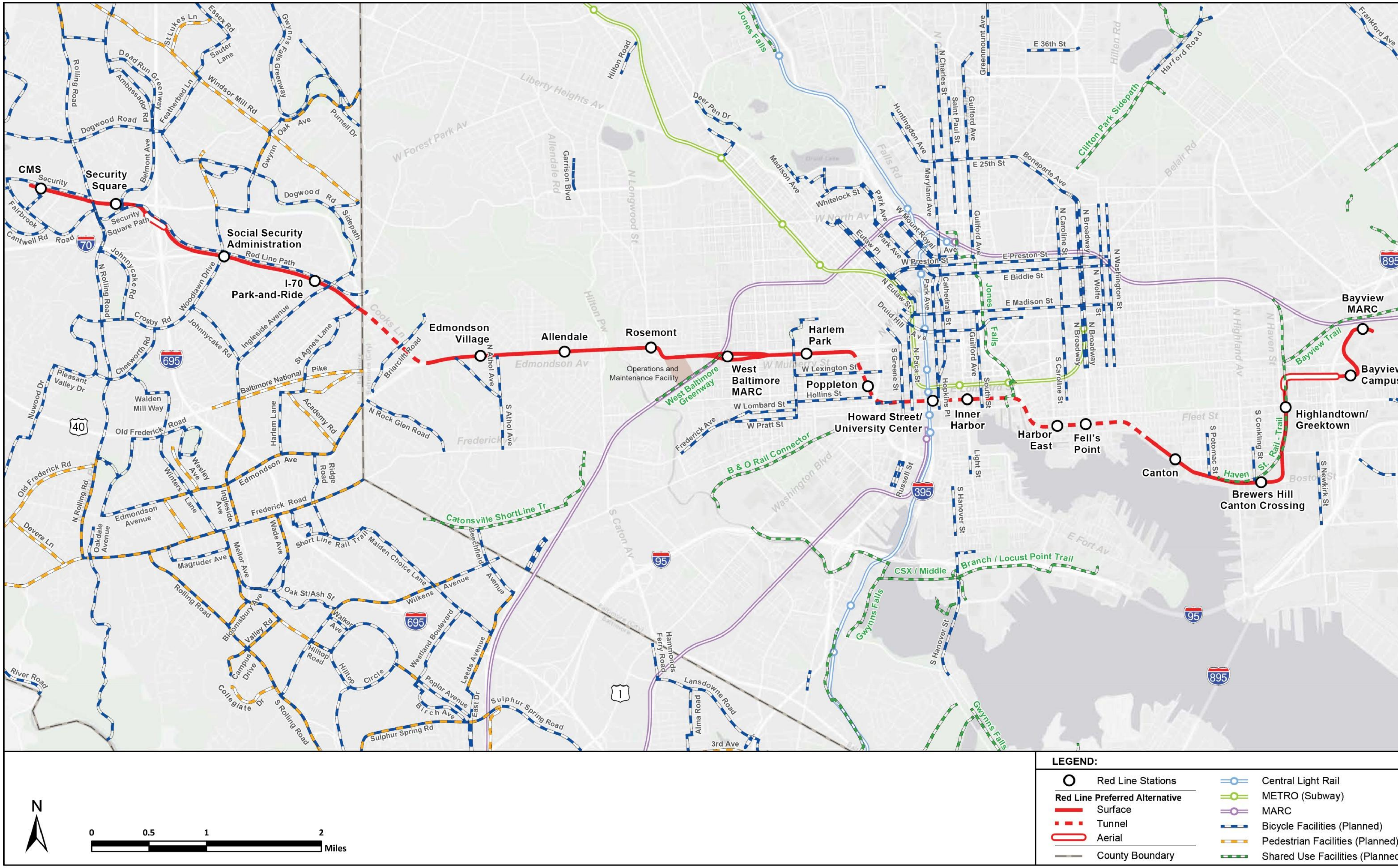


Figure 4-7: Planned Pedestrian, Bicycle and Shared Use Facilities in the Project Study Corridor

The Preferred Alternative would support pedestrian and bicycle access as the project proposes a number of non-motorized amenities in station areas. Pathways and accessible routes connecting to each station for all modes would be provided and integrated into the site design. Ramps, elevators, and/or stairs would be incorporated as required for access. Transit facility designs would be flexible, allowing each station to reflect and fit into the community it serves, while providing standard features to facilitate smooth and accessible transfers from one type of transportation to another, for transit passengers. The Preferred Alternative would incorporate the following pedestrian- and bicycle-related design features to comply with established professional standards, MTA policy, and to address public comments and Station Area Advisory Committees (SAACs) recommendations for each station area:

- Easy-to-read and consistent signs
- Pedestrian-friendly design and full access for people with disabilities
- Sidewalks immediately adjacent to stations
- Crosswalks and accessible pedestrian signals
- Bicycle access and storage, including racks and lockers, at each station, where possible
- Station site design would incorporate wayfinding signage to local destinations near the particular station
- Security and safety design standards

The Preferred Alternative would provide full traffic signal control at each intersection within the project study corridor where automobile, bicycle, and pedestrian traffic movements are proposed to cross the tracks. Some intersections would be modified to prohibit vehicular, bicycle, or pedestrian movements across the tracks. Pedestrian “Walk” and flashing “Don’t Walk” clearance timing would be provided at pedestrian crossing locations so that pedestrians could safely cross the entire width of the main street at every signalized intersection. There would be medians at some locations to provide pedestrian refuge on a case-by-case basis. These would be refined in Final Design as needed. Bicycles would continue to follow the rules of the road, and adhere to signals that correspond to vehicular traffic.

Many intersections in the project study corridor have existing traffic signals, while at other locations new signals would be installed. Coupled with the planned light rail operating speed of 35 mph or less, the provision of traffic signals allows crossings to operate without the use of flashing light signals or automatic gates under the provisions of the 2009 Federal *Manual on Uniform Traffic Control Devices* (which provides national standards for the use and design of traffic control devices). Please refer to the *Pedestrian and Bicycle Facilities Analysis Technical Memorandum* for a detailed discussion of the traffic signal controls at various intersections in the project study corridor.

a. Long-Term Operational Effects and Mitigation

The Preferred Alternative would not require a permanent closure of pedestrian or bicycle facilities. The Preferred Alternative includes proposed signals and crosswalks at multiple intersections that would change pedestrian and bicycle circulation and safety.

At a few locations, signalized intersections would be converted to stop-controlled intersections with left turn restrictions, to reduce conflict points with the light rail alignment in the median. Similarly, some unsignalized intersections would be signalized to accommodate a shift in traffic patterns or to provide pedestrian crossing accommodations. The Preferred Alternative would include signal pre-emption at selected locations along the project study corridor and would modify pedestrian phasing and timings to accommodate revised crosswalk lengths. **Table 4-42** and **Figure 4-8** identify locations with proposed changes to level of intersection controls along the Preferred Alternative study corridor. **Table 4-43** summarizes the potential long-term operational effects to bicycle and pedestrian circulation.

Two proposed stations under the Preferred Alternative would provide connections to the existing MARC system: the West Baltimore MARC Station and the Bayview MARC Station. The Inner Harbor Station would provide an underground pedestrian connection to the existing Metro Charles Center Station. The Howard Street/University Center Station would provide a connection to the existing Central Light Rail Line. The Preferred Alternative would enhance flexibility and increased mobility for bicyclists or pedestrians beyond the operating transit network and improve safety concerns of non-motorized travelers at signalized intersections.

The *Pedestrian and Bicycle Facilities Analysis Technical Memorandum* provides an analysis of growth in pedestrian volumes (counts) for the Preferred Alternative. The analysis was done for station areas along the surface-running segments of the Preferred Alternative alignment. Ridership forecasts for peak hour boardings and alightings for each station were distributed at each station according to adjacent land uses and mode share projections. These additional ridership volumes were added to the existing volumes to estimate the projected Preferred Alternative volumes. Where provided, crosswalks would typically be 10 feet wide; however, crosswalk widths may vary based on the length of the crossing and anticipated crossing volumes. At high volume crosswalks, walk times were increased to accommodate the peak surges in demand.

b. Short-Term Construction Effects and Mitigation

The construction of the Preferred Alternative would impact bicycle and pedestrian circulation along streets where construction activities would require temporary closure of sidewalks and crosswalks. The Preferred Alternative is not expected to affect bicycle or pedestrian facilities beyond the construction areas. Access to existing bicycle and pedestrian facilities would be maintained during phases of construction or alternative options provided. Temporary sidewalks may be used in some areas with limited right-of-way. Please refer to the *Traffic and Parking Technical Report* in **Appendix I** and the *Pedestrian and Bicycle Facilities Analysis Technical Memorandum* for additional detail regarding construction effects on the circulation of bicycles and other vehicles.

Table 4-44 summarizes the potential short-term construction effects, proposed design improvements and potential mitigation measures to be evaluated during Final Design and Construction for existing bicycle and pedestrian facilities that are located within the defined limits of disturbance for the Preferred Alternative. Please refer to **Volume 2 Environmental Plate Series, Plate Series 3** of this Final Environmental Impact Statement (FEIS) for locations of areas that contain existing bicycle and pedestrian facilities within the defined limits of disturbance.

Table 4-42: Proposed Intersection Controls with the Preferred Alternative

Item No.	Location	Existing Control	Proposed Control with Preferred Alt.	Pre-emption*
1	Greengage Road at Security Boulevard	Stop	Traffic Signal	No
2	Brookdale Road at Security Boulevard	Stop	Traffic Signal	No
3	Kennicott Road/Panera Bread	Stop	Traffic Signal	No
4	Rolling Road at Security Boulevard	Traffic Signal	Traffic Signal	
5	Lord Baltimore Drive at Security Boulevard	Traffic Signal	Traffic Signal	
6	Belmont Avenue at Security Boulevard	Traffic Signal	Traffic Signal	
7	New I-70 / SSA Access Road	—	Traffic Signal	No
8	Parallel Drive / Park-and-Ride Access	—	Stop	N/A
9	New I-70 / Park-and-Ride Access	—	Flashers & Gates	Yes
10	Parallel Drive / Ingleside Avenue	Traffic Signal	Traffic Signal	
11	Ingleside Avenue / Security Boulevard	Traffic Signal	Traffic Signal	
12	New I-70 / Cooks Lane / Forest Park Avenue	Traffic Signal	Traffic Signal	
13	Upland Parkway / Winans Way at Edmondson Avenue	Traffic Signal	Traffic Signal	
14	Glen Allen Drive at Edmondson Avenue	Traffic Signal	Stop	N/A
15	Swann Avenue at Edmondson Avenue	Traffic Signal	Traffic Signal	
16	Edmondson Shopping Center at Edmondson Avenue	Traffic Signal	Stop	N/A
17	Edmondson Village station platform access	—	Pedestrian Signal	No
18	Athol Avenue at Edmondson Avenue	Traffic Signal	Traffic Signal	
19	Wildwood Parkway at Edmondson Avenue	Traffic Signal	Traffic Signal	
20	Loudon Avenue at Edmondson Avenue	Stop	Traffic Signal	No
21	Mt. Holly Street at Edmondson Avenue	Traffic Signal	Pedestrian Signal	No
22	Allendale Street at Edmondson Avenue	Traffic Signal	Traffic Signal	
23	Edgewood Street at Edmondson Avenue	Traffic Signal	Pedestrian Signal	
24	Denison Street at Edmondson Avenue	Stop	Traffic Signal	

Table 4-42: Proposed Intersection Controls with the Preferred Alternative

Item No.	Location	Existing Control	Proposed Control with Preferred Alt.	Pre-emption*
25	Hilton Street at Edmondson Avenue	Traffic Signal	Traffic Signal	
26	Edmondson Avenue at Franklin Street	Traffic Signal	Traffic Signal	Yes
27	Poplar Grove Street at Edmondson Avenue	Traffic Signal	Traffic Signal	Yes
28	Edmondson Avenue at Franklintown Road	Traffic Signal	Traffic Signal	Yes
29	Franklin Street at west track connector to Calverton Yard (EB lanes only)	—	Flashers & Gates	Yes
30	Franklin Street at east track connector to Calverton Yard (EB lanes only)	—	Flashers & Gates	Yes
31	Evergreen Avenue at Franklin Street	Stop	Pedestrian Signal	No
32	Warwick Avenue at Franklin Street	Traffic Signal	Traffic Signal	
33	Smallwood Street at Mulberry Street (EB track)	Stop	Traffic Signal	No
34	Smallwood Street at Franklin Street (WB track)	Stop	Traffic Signal	No
35	Pulaski Street at Mulberry Street	Traffic Signal	Traffic Signal	
36	Pulaski Street at Franklin Street	Traffic Signal	Traffic Signal	
37	Payson Street at Mulberry Street (EB track)	Stop	Traffic Signal	No
38	Payson Street at Franklin Street (WB track)	Stop	Traffic Signal	No
39	Montford/Hudson at Boston Street	Traffic Signal	Traffic Signal	N/A
40	Safeway Driveway at Boston Street	Stop	Traffic Signal	No
41	Lakewood Avenue at Boston Street	Traffic Signal	Traffic Signal	
42	Kenwood Avenue at Boston Street	Stop	Traffic Signal	No
43	Linwood Avenue at Boston Street	Traffic Signal	Traffic Signal	
44	Potomac Avenue at Boston Street	Traffic Signal	Pedestrian Signal	No
45	Ellwood Street at Boston Street	Traffic Signal	Stop	N/A
46	East Avenue at Boston Street	Stop	Traffic Signal	No
47	Clinton Street at Boston Street	Traffic Signal	Traffic Signal	
48	Conkling Street at Boston Street	Traffic Signal	Traffic Signal	

Table 4-42: Proposed Intersection Controls with the Preferred Alternative

Item No.	Location	Existing Control	Proposed Control with Preferred Alt.	Pre-emption*
49	Eaton Street at Boston Street	—	Traffic Signal	No
50	Relocated Boston Street at Boh'donnell Connector	—	Traffic Signal	No
51	Haven Street south of Dillon Street	—	Flashers & Gates	Yes
52	Cassell Drive Crossing	—	Flashers & Gates	Yes
53	Bayview Boulevard at Alpha Commons Transitway	—	Flashers & Gates	Yes
54	Nathan Shock Drive at Bayview Boulevard	Stop	Traffic Signal	Yes
55	NIH driveway / Cassell Drive at Bayview Boulevard	Stop	Traffic Signal	Yes
56	Lombard Street at Bayview Boulevard	Traffic Signal	Traffic Signal	Yes

Note: Highlighted rows show locations with changes in intersection control under the Preferred Alternative
* The current signal phase would be modified to allow the light rail vehicle to cross the intersection without stopping.

Table 4-43: Summary of Potential Long-Term Operational Effects on Bicycle and Pedestrian Facilities and Proposed Design Improvements and Potential Mitigation Measures

Existing Facilities	
West Segment	
Proposed Design Improvements	• No long-term, adverse operational effects on existing bicycle and pedestrian facilities • Benefits: ○ Improve pedestrian connections by providing a continuous sidewalk along the south side of Security Boulevard (no sidewalk currently exists between Greengage Road and Brookdale Road) ○ Enhance a pedestrian connection to the Gwynns Falls Trail with a sidewalk from the I-70 Park-and-Ride Station to the trail along Parallel Drive and Ingleside Avenue
Potential Mitigation Measures	• See "Potential Mitigation Measures (All Segments)" • Proposed amenities, such as wayfinding signage, to direct patrons to the nearby Gwynns Falls trailhead • The Federal Highway Administration (FHWA) has determined that, if major reconstruction would occur on a state roadway, all non-compliant sidewalks and driveway aprons must be brought up to ADA standards. Therefore, State Highway Administration (SHA) standards would apply on Security Boulevard from Rolling Road to I-695
Cooks Lane Tunnel Segment	
Proposed Design Improvements	• No long-term, adverse operational effects on existing bicycle and pedestrian facilities because the Preferred Alternative would be underground • Change bicycle and pedestrian circulation in areas where the alignment transitions from surface to underground (portal) near Security Boulevard/Forest Park Avenue
Potential Mitigation Effects	• See "Potential Mitigation Measures (All Segments)" • Fencing and/or railing at portal location. A fence, to be installed on top of a concrete barrier, would prevent pedestrians from accessing the electrical lines

Table 4-43: Summary of Potential Long-Term Operational Effects on Bicycle and Pedestrian Facilities and Proposed Design Improvements and Potential Mitigation Measures

Existing Facilities	
US 40 Segment	
Proposed Design Improvements	• Change bicycle and pedestrian circulation where the alignment transitions from underground to surface (portal) on Edmondson Avenue • The reduction in the number of lanes on Edmondson Avenue from three to two lanes would affect bicycle circulation • Removal of traffic signals at Glen Allen Drive, Edmondson Village Shopping Center Entrance, Mount Holly Street, and Edgewood Street would change circulation • Benefits: Increases pedestrian safety (traffic signals, crosswalks, sidewalks to connect to stations)
Potential Mitigation Measures	• See "Potential Mitigation Measures (All Segments)" • Fencing and/or railing at portal locations. A fence, to be installed on top of a concrete barrier, would prevent pedestrians from accessing the electrical lines • Proposed pedestrian-activated signals and striped crosswalks: Mount Holly, Edgewood, and Evergreen Streets for safe crossing of Edmondson Avenue • New traffic signals at Loudon, Denison, Smallwood, and Payson Streets to maintain bicycle and pedestrian circulation within the community • Pedestrian crosswalks at all signalized intersections • Gates to increase safety for bicycle and pedestrian circulation in front of the proposed Calverton Operations and Maintenance Facility
Downtown Tunnel Segment	
Proposed Design Improvements	• No long-term, adverse operational effects on existing bicycle and pedestrian facilities because the alignment would be underground through the downtown area • Benefits: A pedestrian tunnel under Light Street between Lombard Street and Baltimore Street to provide a direct connection to the Charles Street Metro Station
Potential Mitigation Measures	See "Potential Mitigation Measures (All Segments)"

Table 4-43: Summary of Potential Long-Term Operational Effects on Bicycle and Pedestrian Facilities and Proposed Design Improvements and Potential Mitigation Measures

Existing Facilities	
East Segment	
Proposed Design Improvements	• Change bicycle and pedestrian circulation where the alignment transitions from underground to surface (portal) near Boston Street/Montford Avenue/Hudson Street • Reduce the number of traffic lanes on Boston Street to one lane in each direction from Montford Avenue to Clinton Street. The reduction in the number of lanes would affect bicycle circulation this area • Removal of full traffic signal at the intersection of Ellwood Avenue and Boston Street
Potential Mitigation Measures	• See "Potential Mitigation Measures (All Segments)" • Includes shared/dedicated bicycle lanes on either side of Boston Street (becoming shared lanes at intersections) from Hudson Street to Clinton Street. Baltimore City has further promised to extend the bicycle lanes further west of Hudson Street to continue the infrastructure (under a separate project) • Both sides of Boston Street would have sidewalks • New traffic signals and crosswalks along Boston Street at South Kenwood Avenue, South East Avenue, South Eaton Street, and the future Old Boston Street (to be completed by Baltimore City) to maintain bicycle and pedestrian circulation within the community. • Provides a pedestrian area in the median adjacent to the light rail tracks where feasible • New crosswalks at several intersections and provide crosswalks on either end of each proposed station platform along Boston Street. Roadways crossing the tracks on the Johns Hopkins Bayview Medical Center campus would also have adjacent crosswalks • Includes a pedestrian signal at South Potomac Street, a pedestrian walkway at Old Eastern Avenue from the Highlandtown/Greektown Station to South Janney Street, and a pedestrian ramp south of South Janney Street. Railings would be provided along the backside of platforms at the Highlandtown/Greektown Station and on ramps and walkways

Table 4-43: Summary of Potential Long-Term Operational Effects on Bicycle and Pedestrian Facilities and Proposed Design Improvements and Potential Mitigation Measures

	Existing Facilities
Potential Mitigation Measures (All Segments)	• Close coordination with Baltimore City, Baltimore County, the SAACs, and other stakeholders • Bicycle access and storage, including racks and lockers, at each station, where feasible • Mobility & access accommodations for pedestrians (stairs, elevators, escalators, etc.) in compliance with the ADA • Improve pedestrian facilities (new sidewalks) to provide access from station platforms to the existing pedestrian facilities. Support pedestrian safety by providing a minimum sidewalk width of 5 feet along the alignment. Sidewalk widths would be increased to meet building facades, as necessary • Fencing, signing, pavement markings, warning bells, and/or traffic signals, as needed, for safety • Strategically-located pedestrian and traffic control devices (signing, signals, road markings, gates, fencing, etc.); safety/warning devices; special operating procedures (e.g., reduced speeds); or other methods that are consistent with state and local standards • Audible Pedestrian Train Warning Signals in compliance with the MUTCD

Table 4-44: Summary of Potential Short-Term Construction Effects on Bicycle and Pedestrian Facilities

Short-Term Construction Effects
West Segment
• Temporarily remove access to the existing undesignated walking route on the south side of Security Boulevard that leads to the Chadwick neighborhood and elementary school during construction activities (It is likely that pedestrians would use another undesignated route in an alternate location to shorten walk distances as desired) • Relocate parking and possibly close a portion of the bank drive-thru for a period of 4 to 6 weeks to construct a retaining wall along portions of the Boulevard Place shopping center and at the 1st Mariner Bank (southeast corner of Security Boulevard and Rolling Road). Temporary impacts for bicycle and pedestrian access are expected to extend 2 months at the Boulevard Place shopping center and 4 months at the Security Square Mall • Remove sidewalks for the retaining wall and alignment construction. Pedestrians would be directed to other existing sidewalks or through closed parking areas to access area businesses • Construct grade crossings at Greengage Road, Brookdale Road, Boulevard Place entrance, Lord Baltimore Drive, and Belmont Drive by closing every other roadway and installing detour signs. Each grade crossing would require approximately 2 to 3 weeks to construct • Construct grade crossing at Rolling Road one or two lanes at a time with traffic being temporary shifted to new pavement (duration anticipated to be 4 months). Crosswalks would be maintained if possible or pedestrian traffic would be detoured
Cooks Lane Tunnel Segment
• Maintain open sidewalks to the extent possible (since surface construction activities would be limited to the areas immediately adjacent to the station and tunnel portals). Where not feasible, sidewalks would be temporarily closed for safety reasons and reopened following completion of construction
US 40 Segment
• Temporarily disrupt existing pedestrian and bicycle connections (because of sidewalk replacement) along Edmondson Avenue, Franklintown Road, Franklin Street, and Mulberry Street. The duration of this effort is anticipated to be 26 months. Individuals could experience between 2 weeks to 4 months of construction-related impacts depending on the extent of the improvement • Edmondson Avenue would be reduced to two lanes each direction at the beginning of construction. With barriers, this may create a constrained environment for bicyclists for the duration of construction. • Require temporary closure of and detours at intersections and crosswalks for grade crossing construction, which may lead to an increase in mid-block pedestrian crossings. The street closures and detours may cause temporary increases in walking distances and wait times at crosswalks

Table 4-44: Summary of Potential Short-Term Construction Effects on Bicycle and Pedestrian Facilities

Short-Term Construction Effects
Downtown Tunnel Segment
• Maintain open sidewalks to the extent possible. Surface construction activities would be limited to areas immediately adjacent to the stations and tunnel portals • Require temporary road and sidewalk closures of between 6 and 48 months along Fremont Avenue between Fayette and Baltimore Streets; Mulberry Street between Schroeder Street and Martin Luther King, Jr. Boulevard; and Boston Street west of and east of Hudson Street. Would require the following road closures (night-time over multiple weeks) to construct temporary decking structures at each station: along Lombard Street between Howard Street and Hopkins Place and between Light Street and Calvert Street; along Fleet Street between Central Avenue and east of Eden Street and between Bethel Street and Broadway • During construction of the station boxes for the Downtown Tunnel, sidewalk would be provided on one side of the street only. Provide temporary sidewalk connections to local business and storefront entries as needed; at some locations, however, there would be periods when access cannot be provided
East Segment
• Temporarily disrupt existing bicycle and pedestrian circulation on Boston Street during the construction period. Sidewalks would be maintained on at least one side of Boston Street during construction, and, to the extent possible, bicycle and pedestrian connections would be maintained at intersections. • Access to business and community facilities would be maintained; however crossings of the Preferred Alternative would be closed for up to 2 weeks to construct the track slab for grade crossings along Boston Street and Bayview Blvd. These closures would be staggered to allow access at the next intersection. • Boston Street would be reduced to one lane each direction at the beginning of construction. With barriers, this may create a constrained environment for bicyclists during the approximately 24 months of construction. • Alpha commons would be converted from a street to a transit-way, creating impacts to the existing pedestrian crossings during construction. Temporary crosswalks would be provided where feasible, although crosswalk closures may be required for short durations • Relocate sidewalks on the east side of Bayview Boulevard for alignment construction. Sidewalk closures may be required. Sidewalks would be maintained on the west side of Bayview Boulevard. • Construct grade crossing at Lombard Street one or two lanes at a time with traffic being temporary shifted to new pavement. Crosswalks would be maintained if possible or pedestrian traffic would be detoured • The remainder of the East segment is off-street and anticipated to produce little effect to bicyclists and pedestrians

Table 4-44: Summary of Potential Short-Term Construction Effects on Bicycle and Pedestrian Facilities

Short-Term Construction Effects
Mitigation Measures (All Segments)
• Close coordination with Baltimore City, Baltimore County, the SAACs, and other stakeholders • Maintain access to existing bicycle and pedestrian facilities during all phases of construction, to the greatest extent possible, as safety allows. Temporary sidewalks and/or pathways to replace any sidewalks and/or trails adjacent to the project that are affected by construction. Sidewalk replacement and/or relocation would be performed in stages to maintain pedestrian and bicycle access. Depending on the situation, it is expected that either temporary walking/riding paths would be provided for residents, pedestrians, and bicyclists, or that detours would be provided around the construction areas via the opposite side of the street • Provide temporary sidewalk connections to local business and storefront entries as needed; at some locations, however, there would be periods when access cannot be provided. Other accommodations would be explored with the property owners for these locations during Final Design • Submit proposed pedestrian detours to the local traffic engineering authorities (Baltimore City Department of Transportation, Baltimore County Department of Public Works, and Maryland State Highway Administration) for review and approval • Proper deterrents, such as barriers or fencing, would be placed to prevent access (shortcuts) through construction areas. In some cases, a through sidewalk would be maintained on one side of the street only, unless property access is required • Provide warning and/or notification signs of modification to bicycle and pedestrian facilities during construction. Pedestrian detours would be signed according to the Manual on Uniform Traffic Control Devices. Bicyclists would be notified through signage and public notice that bike lanes are detoured. Other temporary disruption to bicycle facilities would be managed according to the Maintenance of Traffic plan developed during Final Design

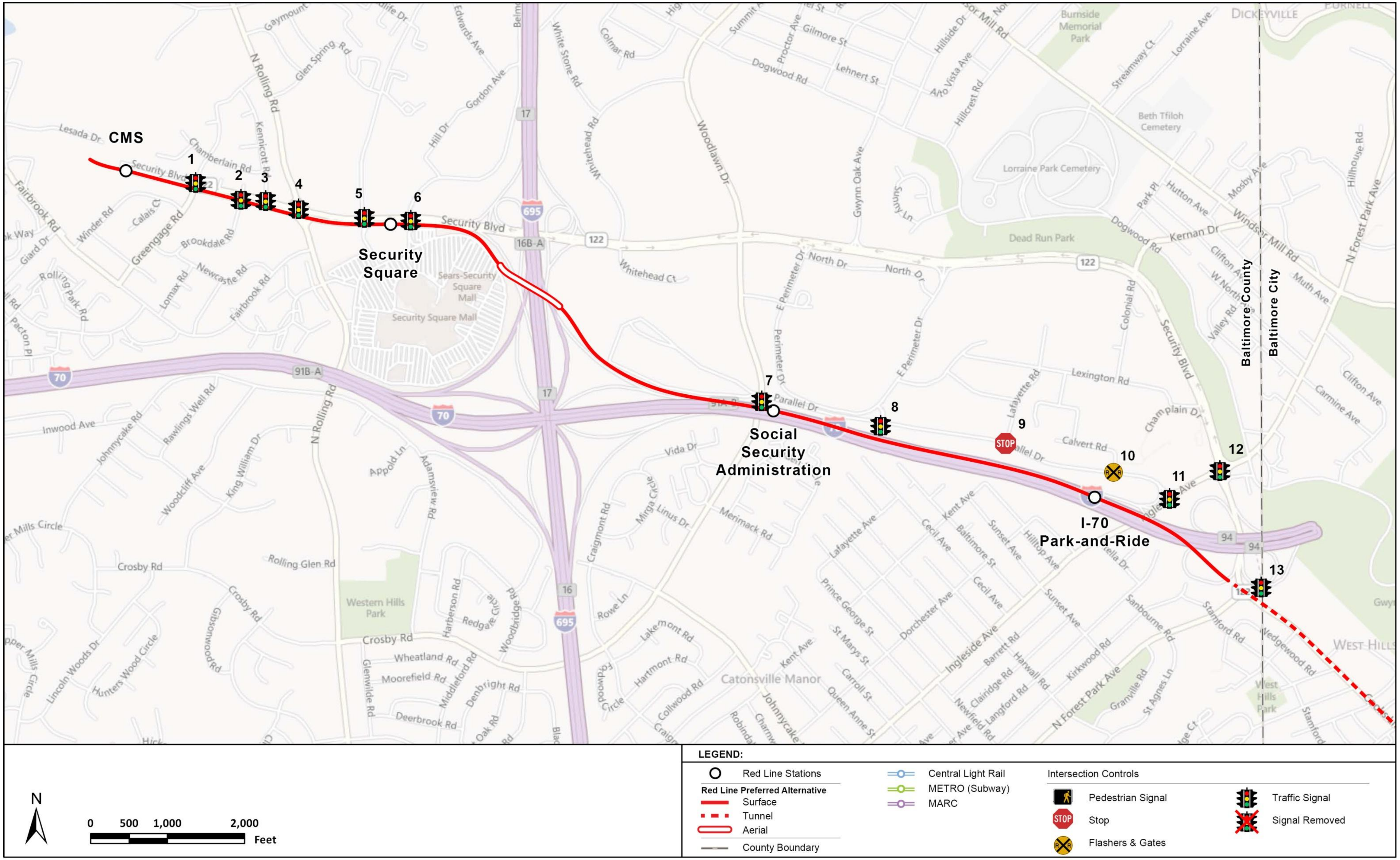


Figure 4-8: Proposed Pedestrian and Bicycle Intersection Controls — Sheet 1 of 3

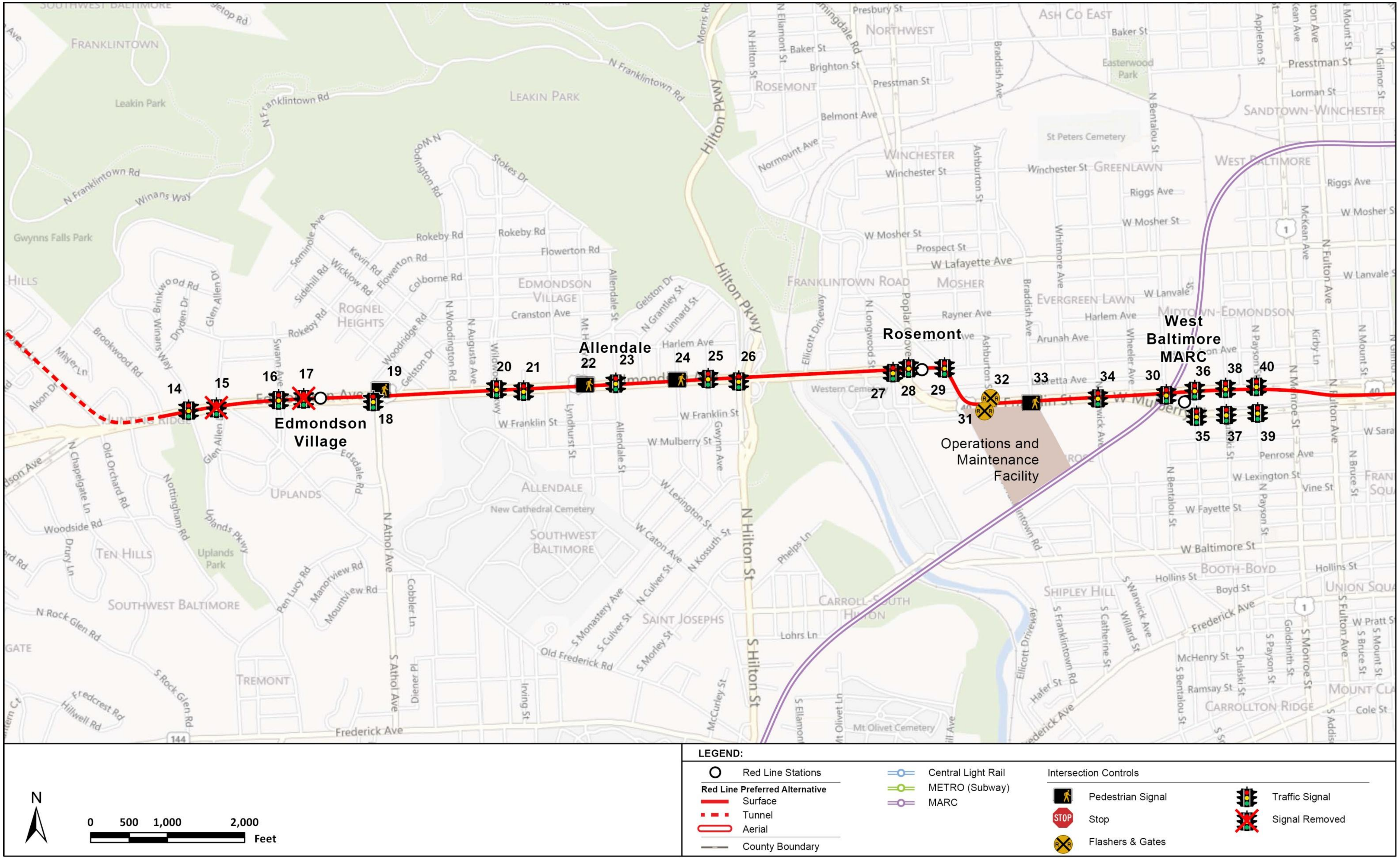


Figure 4-8: Proposed Pedestrian and Bicycle Intersection Controls — Sheet 2 of 3

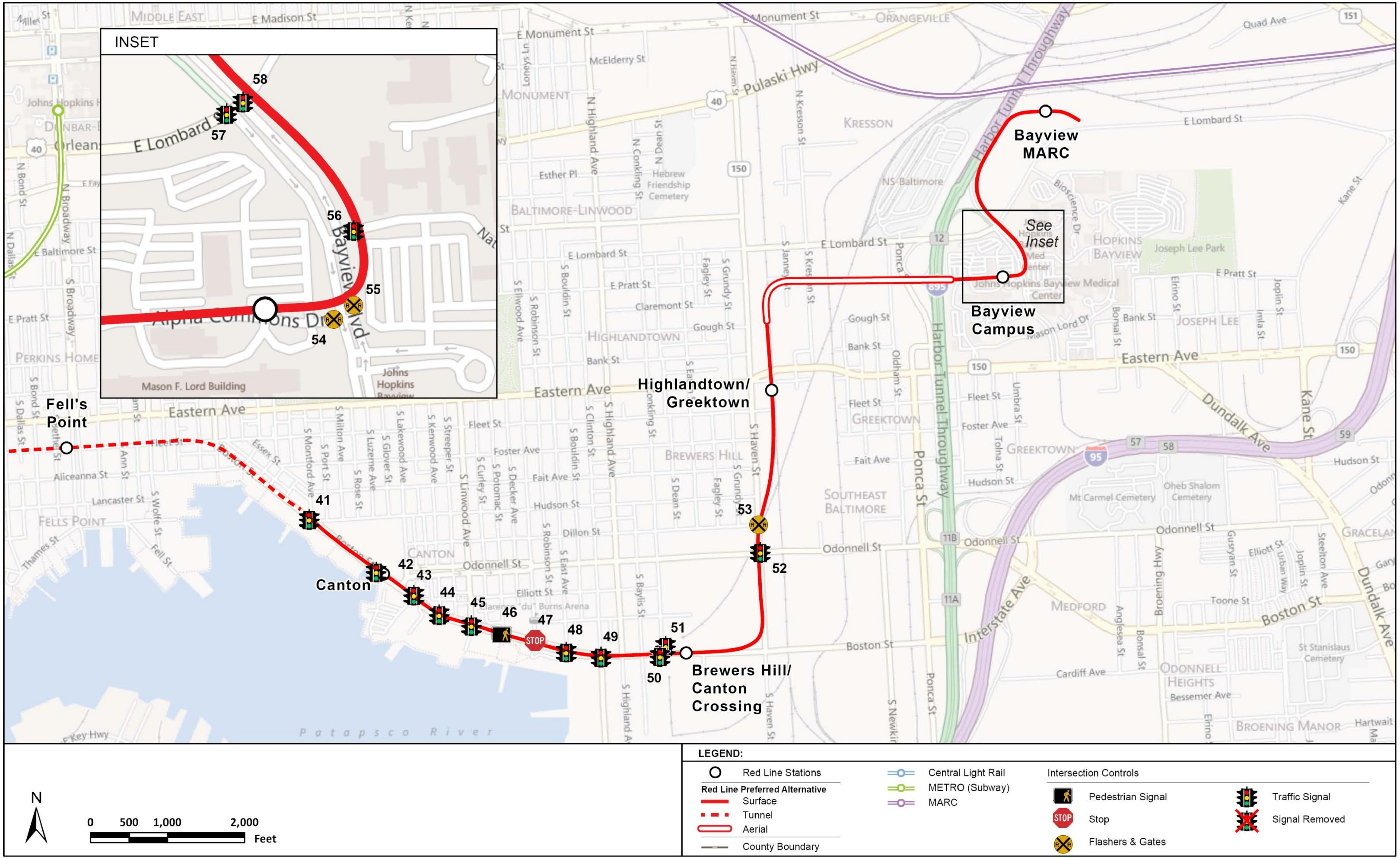


Figure 4-8: Proposed Pedestrian and Bicycle Intersection Controls — Sheet 3 of 3

4.5 Freight Railroad Facilities

4.5.1 Introduction

There are a number of active and inactive freight rail facilities within the project study corridor. The sections below describe the freight rail services and operations within the project study corridor, and the future long-term and short-term impacts to freight rail facilities as a result of both the No-Build and the Preferred Alternative. Because MARC commuter rail and Amtrak passenger rail share rail corridors with freight services, the discussion includes these two passenger services as well.

Additional detail on freight facilities and impacts is available in the *Freight Rail Facilities Technical Memorandum* (refer to **Appendix D**).

4.5.2 Existing Conditions

a. Active Freight Rail Corridors

There are five railroad service providers with lines through the project study corridor, generally in a north-south direction:

- CSX Transportation, Incorporated (CSX) – a Class I[5] freight line
- Norfolk Southern (NS) – a Class I freight line
- Amtrak – a Class I[5] passenger rail line
- MARC – a commuter rail line
- Canton Railroad (CTN) – a Class III[5] freight line

The majority of Maryland's freight rail tracks are owned by CSX and NS. CSX operates 557 miles of track as part of five interstate mainlines and NS operates approximately 120 miles in Maryland.

The active freight services in the project study corridor are shown on **Figure 4-9** and are discussed by design segment. No active freight rail corridors are in the West and Cooks Lane Tunnel segments.

US 40 Segment

Two freight rail lines are in the US 40 segment. These freight lines are the CSX line in the Gwynns Falls Park area, and Amtrak's Northeast Corridor (NEC) service.

The CSX freight rail line traverses the project study corridor north to south immediately west of Gwynns Falls, crossing under the structure that carries Edmondson Avenue (US 40) over Gwynns Falls.

[5] The Surface Transportation Board defines railroad classifications as Class I, II, and III based on operating revenue of: Class I - $250 Million+, Class II - $20 Million+ and Class III - $0 to $20 Million. These revenues are based on 1991 levels, which are then adjusted for inflation to current dollars. (http://www.stb.dot.gov/stb/faqs.html#econ)

Amtrak primarily owns the fully electrified NEC railway that serves the northeastern part of the United States from Boston, Massachusetts in the north to Washington, DC in the south, with several branches serving other cities. The NEC tracks run generally southwest to northeast, crossing the Preferred Alternative in the vicinity of the West Baltimore MARC Station. This segment of the NEC line is used by MARC for commuter rail services, as well as by NS for freight rail transport. The NEC tracks are considered eligible for listing in the National Register of Historic Places, under the name Baltimore & Potomac Railroad (Philadelphia, Baltimore, and Washington Railroad), refer to **Chapter 6** for additional information.

Downtown Tunnel Segment

The Downtown Tunnel segment of the Preferred Alternative contains one freight rail corridor, the CSX Howard Street Tunnel. Within the project study corridor, this tunnel generally travels north-south directly below Howard Street and carries CSX's main line through Baltimore City. This freight rail tunnel was constructed in the 1890s and is listed on the National Register of Historic Places (FEIS, **Section 5.9**).

East Segment

There are numerous active freight rail corridors crossing the East segment of the project study corridor. The CTN is an industrial switching carrier located in east Baltimore City and southeastern Baltimore County providing freight services to industrial, manufacturing and port-related shippers in the area. CTN connects the Seagirt Terminal of Baltimore with the two Class I railroads, CSX and NS, which also operate in this segment.

As in the US 40 segment, some of the rail corridors in the East segment are shared by different rail providers. A joint NS/CTN corridor is parallel to Haven Street on the east side; refer to the inset in **Figure 4-9**. The western-most track in this segment is a CTN track which currently ends at the former Bruning Paint facility at Haven and Foster Streets, then switches back and runs parallel to an inactive NS right-of-way in a southwesterly direction to cross Haven Street and terminates at the Overflo Warehouse at Haven and Dillon Streets. Approximately four trains per week serve the Overflo Warehouse.

The active NS tracks in this segment, the active portion of the Bear Creek Branch and the President Street Branch, serve the NS Lombard Street Intermodal Terminal. Currently NS operates between 10 and 12 trains per day between the Bayview Yard and Perryville, north of Baltimore City; these trains use the active portion of the Bear Creek Branch and the President Street Branch. The NS Bear Creek Branch is considered eligible for listing in the National Register of Historic Places, under the name Union Railroad, refer to **Chapter 6** for additional information.

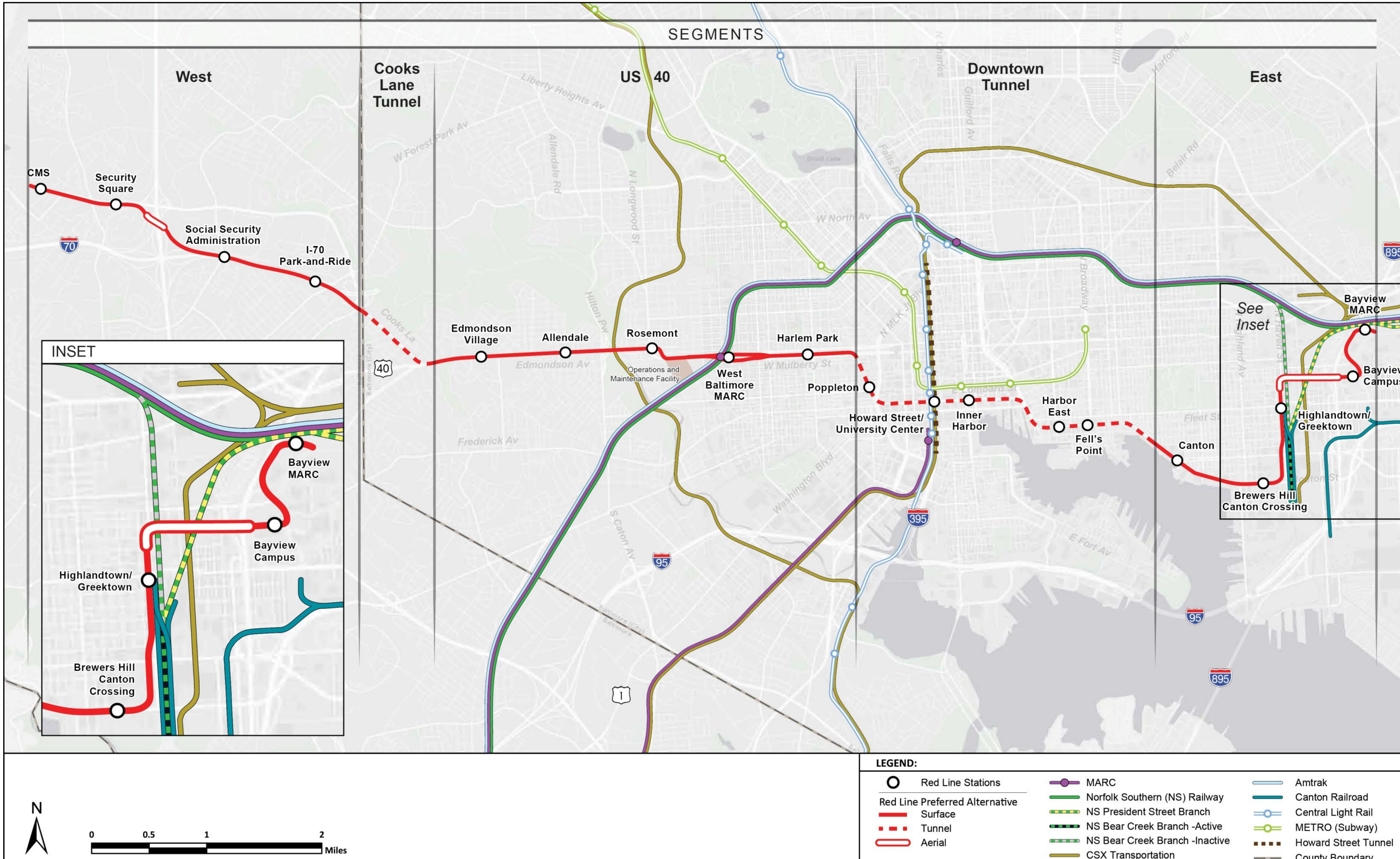


Figure 4-9: Existing Freight Rail Facilities

The CSX active track in this segment currently provides access to the Seagirt Marine Terminal and the former Bethlehem Steel plant at Sparrows Point.

A single CTN track runs on a separate freight corridor just east of the project study corridor. The CTN operates one train each way three to four days per week on this segment.

The NEC is north of the project study corridor in this segment, carrying Amtrak, MARC and NS freight service.

b. Inactive Freight Rail Corridors

The inactive freight rail right-of-way of the Bear Creek Branch, owned by NS, is located one-half block east of Haven Street between Foster Street and Pulaski Highway (refer to **Figure 4-9**). This segment has remained inactive since approximately 1980.

4.5.3 Future No-Build Conditions

Under the No-Build Alternative there would be no transportation improvements beyond those already planned and programmed. The No-Build Alternative would result in no impact (adverse or beneficial) to freight rail within the project study corridor. Under the No-Build Alternative, existing freight rail routes and traffic patterns would not be altered and there would be no changes in access to existing freight rail yards or freight-related businesses in the area. Similarly, there would be no construction-related effects on freight rail services within the project study corridor under the No-Build Alternative.

4.5.4 Preferred Alternative

a. Long-Term Operational Effects and Mitigation

As described in the previous sections, freight rail facilities are in three of the five Red Line Preferred Alternative segments (US 40, Downtown Tunnel and East segments). This section details the long-term (permanent) impacts that would occur as a result of the Preferred Alternative.

US 40 Segment

There would be no long-term impacts to the passenger or freight rail lines within the US 40 segment as a result of the Preferred Alternative. The Preferred Alternative light rail transit (LRT) tracks would be located on existing aerial structures over the CSX rail line near Gwynns Falls. The Preferred Alternative would split near Wheeler Avenue and continue east diverging to cross under the Amtrak NEC. The Preferred Alternative would maintain the existing structures over West Franklin Street and West Mulberry Street with minor modifications to the bridge structures, roadway, and utilities to protect the structures.

Downtown Tunnel Segment

The top of the proposed downtown tunnel would be approximately 25 feet from the bottom of the CSX tunnel. Therefore, there would be no long-term impacts to existing freight rail service within this segment as a result of the implementation of the Preferred Alternative.

East Segment

There would be no long-term impacts to active NS, CSX, or Amtrak track service in this segment because of the implementation of the Preferred Alternative. There would be an impact to CTN operations with one freight customer.

One switching lead and spur track to the Overflo Warehouse property, belonging to CTN, conflicts with the operations of the Preferred Alternative. The current condition of the receiving track is extremely poor and it is unknown how long operations can continue without upgrading this track. Freight service to this property would be discontinued regardless of whether the Red Line is implemented, if the condition of the track is not improved. If freight service is anticipated to be in operation at the time of Red Line service, the project would relocate the Overflo Warehouse operations to another location also served by rail.

The Preferred Alternative would not impact freight or passenger rail operations on the NEC, which passes north of the proposed Bayview MARC station.

The Preferred Alternative would occupy the western portion of the NS right-of-way of the Bear Creek Branch. During construction, the Red Line project would clear the right-of-way of track remnants and vegetation that currently exists. The Preferred Alternative would not preclude NS from reactivating this segment of rail line.

The Preferred Alternative would cross the remaining two north-south freight rail lines in the East segment on an aerial structure (shown on **Figure 4-9**) with a minimum 25 feet of vertical clearance, and thus would have no long-term impact on freight service on these lines.

b. Short-Term Construction Effects and Mitigation

This section details the temporary construction-phase impacts that would occur as a result of the Preferred Alternative. MTA will continue to coordinate with NS, CSX, Amtrak and Canton Railroad to minimize any potential impacts to freight operations resultant from construction activities that are identified below.

US 40 Segment

The Preferred Alternative LRT tracks would be located on existing aerial structures over the CSX rail line near Gwynns Falls, and it would pass under the existing elevated NS/Amtrak/MARC tracks at the West Baltimore MARC Station. Construction of the Preferred Alternative is therefore anticipated to have no affect on the active freight rail lines within the US 40 segment. Coordination with CSX would be part of the Edmondson Avenue Bridge Replacement Project by Baltimore City.

Regarding construction near the West Baltimore MARC Station, NS would be included in the coordination with Amtrak to minimize impacts to structures within the NEC.

Downtown Tunnel Segment

The proposed Red Line downtown tunnel would be located beneath the CSX Howard Street tunnel. Some construction activities would take place within the Howard Street tunnel to monitor and possibly reinforce the existing structure. Construction activities specific to the CSX tunnel include ground improvements beneath and adjacent to the tunnel, and modifications to the existing tunnel liner may be required. The project would minimize disruptions to freight rail service during construction and continue to coordinate with CSX during the Final Design and construction.

East Segment
The Preferred Alternative would cross one of the CSX and one of the NS rail corridors on a new aerial structure (shown on **Figure 4-9**). As such, there may be temporary interruptions to NS and CSX operations beneath the aerial structure during the construction. The placement of superstructure beams would be coordinated with train movements to minimize impacts to operations.

Coordination would be required with NS and CTN during construction activities east of Haven Street. It is assumed that the CTN switching lead would be removed from service at the start of construction. No physical incursion on active NS right-of-way would be necessary.

There would be no construction-related impacts to the other rail lines in the East segment, as the Preferred Alternative does not cross over or under these lines.

4.6 Safety

4.6.1 Introduction

This section identifies general safety and security considerations related to the design, construction and operation of the Preferred Alternative light rail transit (LRT) system including new tracks, at-grade crossings, stations, tunnels, and the Operations and Maintenance Facility (OMF). The project would feature current safety and security systems and procedures to protect passengers and workers, as well as the community. This section addresses general safety procedures to be implemented during the Preferred Alternative construction phase, as well as those that would be in place once the new LRT system is in operation. Additional detail is available in the *Safety and Security Technical Memorandum* (**Appendix D**).

Safety requirements come from state and federal authorities. The Federal Transit Administration (FTA) guidelines for “New Start” projects and “Major Capital Projects” include specific provisions for system safety and security. The system safety, fire and life safety and security design criteria development process is governed by the Maryland Transit Administration (MTA) multi-modal System Safety Program Plan (SSPP), and by the Maryland Department of Transportation (MDOT) State Safety Oversight Standard and oversight process. MTA also participates in programs managed by other federal departments such as the Department of Homeland Security (DHS).

The safety and security process and activities for this project from planning, through Preliminary Engineering, Final Design, construction, testing and verification, and pre-revenue operations, leading to commencement of revenue service, are governed by the FTA’s requirements in circular C 5800.1 entitled “Safety and Security Management Guidance for Major Capital Projects” (2007). This document identifies specific safety and security activities that a transit agency must perform and document in a Safety and Security Management Plan (SSMP).

MTA has developed and periodically updates the Red Line SSMP, based on FTA comments, Project Management Plan (PMP) updates, and project safety and security activities, organizational updates, work scope changes and assignment of responsibilities among project participants.

Potential impacts are assessed by identifying whether or not adequate provisions for safe and secure operations would be made; if the project is expected to alter the patterns of auto, transit or pedestrian accidents, and what design features are included to minimize these accidents and whether or not the Preferred Alternative would improve safety and security compared to existing conditions within the project study corridor.

4.6.2 Existing Safety Policy

The following documents were reviewed to describe existing procedures:

- MTA's System Safety Program Plan
- MTA's System Security and Emergency Preparedness Plan
- MTA's LRT Design Criteria Manual, April 2012

The MTA has developed and implemented a policy to provide a safe and secure transit environment in modes of MTA's transportation facilities and services. As part of the continuous effort to render its transit services and facilities safe, MTA has developed a SSPP and a System Security and Emergency Preparedness Plan (SSEPP).

The SSPP has been developed as a means of integrating safety into MTA operations and services. The SSPP establishes mechanisms for identifying and addressing hazards associated with MTA operations and services, and provides a means of ensuring that proposed system modifications are implemented with thorough evaluation of their potential effect on safety. The SSPP is revised annually and submitted to the MDOT, as part of the state safety oversight process.

The MTA, under the authority of the State of Maryland Secretary of Transportation, has developed the SSEPP as a tool to securely operate their transit systems and to coordinate with local, state, and federal agencies regarding security and emergency preparedness issues. The MTA participates in programs managed by the DHS, the Office for Domestic Preparedness (ODP), the Transportation Security Administration (TSA), and the Transit Security Grant Program (TSGP) which require a SSEPP.

a. Passenger Safety

The SSPP gives MTA employees and departments the responsibility of upholding the highest level of safety for passengers. The MTA promotes safety and security through passenger and public awareness programs.

b. Stations and Facilities

The SSPP provides the framework for ensuring passenger and employee safety at MTA stations and facilities. The MTA has established a Hazard Identification and Resolution Process to identify and eliminate as many hazardous conditions or situations as possible. As part of the Hazard Identification and Resolution Process, the MTA performs frequent inspections of its facilities, tracks, systems and station areas to provide transit service in the most safe and reliable manner possible.

The MTA employs police personnel as well as security guards and fare inspectors, who provide armed and unarmed security on their existing transit services.

c. Vehicles

MTA transit vehicles are equipped with physical safety and security measures to support the overall operation of the transportation system, including use of Closed Circuit Television (CCTV) equipment and Automatic Vehicle Locaters (AVL) that use global positioning system (GPS) units to provide the location of any operating vehicle at any time. In addition, buses, MARC, mobility, light rail and Metro vehicles are regularly inspected for unsafe or unhealthy items or situations.

d. Employees and Contractors (Construction Safety)

The MTA’s SSPP contains provisions for an Employee Safety Program that include a wide range of occupational safety and health, injury and illness prevention, hazard communication, industrial hygiene, fire and life safety, emergency preparedness, operational safety, environmental, and security programs. These programs have been developed in accordance with federal, state, and local regulatory requirements, and are implemented by MTA and construction contractors.

e. Emergency Preparedness Plan for Transit Operations

The overall objective of emergency preparedness and planning is to ensure fast and efficient response to emergencies or disasters in a manner that minimizes risk to the safety and health of passengers, employees, and emergency response personnel, as well as unnecessary property loss. To meet this objective, the MTA has written comprehensive emergency preparedness operations plans (EPOPs) for the organization as a whole, and for each of its modal operations (i.e., Metro, Light Rail, MARC, Bus, and Mobility). An EPOP also includes the involvement of many offices that provide support functions such as MTA Media Relations, Police, Safety, Engineering, Human Resources (HR) and Procurement offices. These plans establish the roles and responsibilities to be carried out by MTA personnel, as well as by various emergency response agencies during an emergency or disastrous event. The EPOPs are supplemented by the comprehensive SSEPP, Standard Operating Procedures (SOPs), Emergency Operating Procedures (EOPs), and the emergency operating rules used by each mode.

f. Police and Security Operations

The MTA's Security Program has been developed and coordinated by the MTA Police Force, with input from all MTA departments. The SSEPP emphasizes that the security of customers, employees and property is not solely the responsibility of the police force, but the responsibility of every employee and department within the MTA.

The MTA employs a police force dedicated to providing security to MTA customers, employees and property. MTA’s police force consists of personnel who possess police officer authority extending throughout the State of Maryland as established through Maryland Transportation Article Section 7-207 and the Annotated Code of Maryland Article 27, Section 594B. The force conforms to all training requirements set forth by the Maryland Police and Correctional Training Commissions (MPCTC), and all officers are certified through this commission. MTA police officers receive additional track access training specific to working within the transit environment. Training includes response to incidents in accordance with the MTA's Emergency Plan and dealing with transit-specific criminal activity.

The MTA employs security guards and fare inspectors, who provide unarmed security and enforce the fare payment system on the LRT system.

g. Pedestrian and Motorist Safety

The MTA makes every effort to reduce or eliminate pedestrian and motorist conflicts with transit vehicles at MTA stations and facilities. However, conflicts still do occur, especially at station areas where pedestrians must cross streets at-grade to access platforms and parking lots.

Many safety measures including crosswalks, signals, and lighting help reduce the number of conflicts and incidents. In addition, basic design elements are used to enhance safety, including use of platform and parking lot layouts that avoid or reduce pedestrian/vehicle and vehicle/vehicle conflicts, as well as careful use of landscaping to eliminate blind spots and provide openness for security surveillance.

MTA stations and facilities are designed to comply with Americans with Disabilities Act (ADA) standards, to improve safety and ease of movement for handicapped individuals. For this corridor, which runs through dense residential, shopping and business districts, operator training and public outreach is important in contributing to pedestrian and motorist safety.

4.6.3 Proposed Safety Policy

a. Future No-Build Conditions

The No-Build Alternative for Safety and Security would include the same policies as the existing conditions described above. The No-Build Alternative would have no impact on safety and security within the project study corridor.

b. Preferred Alternative

General Design Principles and Programs for the LRT System

The Preferred Alternative would be designed, constructed and operated in accordance with the MTA’s SSPP and SSEPP, both of which would be updated to include specific requirements for the Red Line project, and submitted to the State Oversight Agency (SOA) for approval, prior to revenue service. The project would be designed in accordance with the MTA’s LRT Design Criteria Manual, which is being prepared for both the Red and Purple Line LRT systems.

The rail system design would be based, in part, on a preliminary hazard analysis (PHA) and a threat and vulnerability analysis (TVA). The results of these analyses would be used to help determine risk mitigation and implementation priorities. MTA would prioritize risks and select sets of countermeasures for the Red Line that provide the best overall risk reduction for the MTA rail transportation system as a whole. The basis of design for the Preferred Alternative is predicated on compliance with local, state, and federal design standards and requirements, as referenced in the Red Line Design Criteria Manual. These design standards mitigate and control potential safety and security hazards and risks to an acceptable level in accordance with transit industry practices and experience from similar light rail transit systems in the United States.

In compliance with the National Fire Protection Association (NFPA) 130, Standard for Fixed Guideway Transit and Passenger Rail Systems 2010 Edition, each segment of the Red Line project would incorporate appropriate fire/life safety requirements into all aspects of the project design and construction.

Strategies such as crime prevention through environmental design and the use of police, private security patrols, and security cameras would be employed as appropriate to make the light rail facilities as safe and secure as possible. MTA's existing light rail operations policies and procedures, which are designed to address potential catastrophic events and to prevent terrorist activities, would be expanded to include the Red Line. Design considerations such as platform location and length, pedestrian crossings, and alignment design would be used to ensure that the project operates safely.

Station Platforms and Park-and-Ride Facilities

The station platforms are being designed using MTA design principles to increase natural surveillance opportunities. CCTV cameras would be placed on every platform and within park-and-ride facilities, and monitored by MTA's Transit Police and Operations personnel. Blue light emergency phones would be available at regular intervals at park-and-ride locations. The ticket vending machines would contain passenger assistance telephones that link to the central control center. MTA's transit police force would provide roving patrols along the LRT alignment, at stations and at park-and-ride facilities. MTA personnel would monitor proof of payment.

Additional safety features would include public address systems on transit vehicles and on station platforms to make emergency announcements. Safety elements that would be put in place for multi-use paths and access to the station and park-and-ride lots would include walkways, emergency phones, limited entry and exit points, and provisions for persons with disabilities.

Rail Safety

Following MTA operating practices, onboard warning devices or bells would be sounded within five seconds of an LRT vehicle approaching a grade crossing. Similarly, in accordance with current MTA procedures, onboard warning bells would be sounded for approximately five seconds as trains approach the station.

At grade crossings with flashers and gates, stationary crossing bells would also ring for approximately five seconds while the gate arms are lowered. At-grade crossings with traffic or pedestrian controls (e.g., traffic signals), no crossing flashers, bells or gates are proposed.

Emergency Ventilation System

The emergency ventilation system for the Cooks Lane and Downtown Tunnels would be developed in accordance with NFPA 130 fire safety standards.

Vehicular, Bicycle and Pedestrian Safety

As noted in **Section 4.2** and **Section 4.4**, safety provisions would be made to minimize conflicts between transit vehicles, automobiles, bicyclists, and pedestrians. Crossings would be clearly marked with signage and pavement markings, and would be limited to dedicated locations. At some locations, rail crossing gates would be used to stop vehicles at the railroad tracks. The gates would include an active warning system that would alert the control center of interference with the gates. Bicycle and pedestrian crossings would be provided at select street and rail crossings.

Safety and Security during Construction Activities

The safety and security of construction workers and the general public would be a key element of construction activities associated with the Red Line project. Introduction of on-site construction equipment including heavy industrial cranes and trucks hauling excavated material from access shafts on local roads would create potential safety hazards for pedestrians and motorists. Numerous construction workers operating or working in concert with equipment at the various construction staging area locations would also create increased opportunities for safety and security breaches. The construction sites and related equipment would be potentially vulnerable to safety and security violations, particularly during times of construction equipment shutdown and construction site closure. Construction sites would be fenced off to reduce these hazards. MTA will work with the construction contractors to ensure adherance to applicable federal and state safety protocols as well as the following:

- MTA's Red Line Safety and Security Management Plan (SSMP), dated April 2012, Section 8;
- MTA System Safety Program Plan (SSPP), dated December 2011, Section 18; and,
- MTA's Contractor's Safety and Health Guidelines (CSHG), dated March 2011.

The MTA's Red Line SSMP, MTA's multi-modal SSPP and the MTA's CSHG require that contractors develop a project-specific Safety and Health Plan. The overall goal of the plan would be to identify, eliminate, minimize and/or control safety hazards and related risks by establishing requirements, clear lines of authority and levels of responsibility and accountability. Examples of safety- and security-related mitigation for construction activities include:

- MTA contractors would install fencing and shielding at all construction sites to reduce the vulnerability to trespassing and vandalism and to protect adjacent walkways and streets.
- MTA contractors would install warning and guide signage to alert the public to the presence of work areas. MTA contractors would physically separate work areas from

public spaces during construction, including at times of equipment shutdown and site closure. MTA contractors would install signage to enable the affected public to seek alternative routes of travel in the vicinity of the construction sites.

- Traffic on affected streets adjacent to construction sites would be managed through enactment and enforcement of approved maintenance of traffic (MOT) plans that would include lane closures, travel lane shifts, bus stop relocations, and relocated and protected sidewalks and/or bicycle lanes. These plans would be developed during the final design and construction phases of the project, through coordination with both the Baltimore County and the City transportation departments.
- The Contractor would prepare and implement Crane Safety Plans, among other project specific items specified in MTA's Contractor's Safety and Health Guidelines (CSHG), dated March 2011.
- Detailed provisions for Contractor's security requirements during construction are provided in MTA's Red Line Safety and Security Management Plan (SSMP), dated April 2012, Section 8.

Effects on Emergency Services

- There are several emergency service providers located in the project study area, as identified in the Final Environmental Impact Statement (FEIS) **Chapter 5, Section 5.3**. These facilities are identified in **Volume 2 Environmental Plate Series, Plate Series 1**. Among the community resources shown are: fire stations, police stations, and medical facilities. During Final Design and construction, MTA will coordinate with emergency service providers (police, fire, etc.) to minimize impacts and identify potential mitigation measures for affected emergency service routes.

4.7 Transportation Commitments and Mitigation Measures

This section identifies commitments and mitigation measures for transportation-related disciplines described and analyzed within this chapter of this Final Environmental Impact Statement (FEIS). Additional commitments and mitigation measures for long-term operation and short-term construction-related impacts to environmental resources are identified within FEIS **Chapter 5**.

4.7.1 Public Transportation

- Maryland Transit Administration (MTA) will hold meetings to inform the public on proposed bus route changes prior to the initiation of bus revenue service.
- MTA will develop and implement a plan to mitigate impacts to bus stops and routes during construction. Specific mitigation measures could include:
    - Temporarily relocate affected transit stops;
    - Provide pedestrian areas for bus stops maintained in construction areas;
    - Provide information along bus routes and on MTA's website concerning any changes to bus service and bus stops during construction activities; and,

- MTA will maintain access and circulation within the Charles Center Metro Station during construction of the Light Street Connector.

4.7.2 Roadways and Traffic

- MTA will work with the Maryland State Highway Administration, Baltimore County Department of Public Works and Baltimore City Department of Transportation concerning the integration of light rail operations with roadway operations throughout the project corridor.
- MTA will coordinate with Johns Hopkins to maintain access to the Emergency Room at the Johns Hopkins Bayview Medical Center during construction.
- MTA will work with Maryland State Highway Administration, Baltimore County Department of Public Works and Baltimore City Department of Transportation to develop a Maintenance of Traffic Plan and Transportation Management Plan for construction.
- MTA will provide a public outreach program to inform residents and businesses of roadway delays and impacts related to construction activities.

4.7.3 Parking and Loading Zones

- MTA will work with the contactor to develop a plan to minimize the temporary loss of parking during construction.
- MTA will coordinate with stakeholders and businesses affected by the loss of loading zones to identify alternate or temporary loading areas during construction and final design.

4.7.4 Pedestrian and Bike Access

- MTA will work with the construction contractors to maintain or provide notice of alternative routing for pedestrian and bicycle access during construction.

4.7.5 Freight

- MTA will continue to coordinate with Norfolk Southern (NS), CSX, Amtrak and Canton Railroad to minimize any potential impacts to freight operations resultant from construction activities.

4.7.6 Safety

- MTA will work with the construction contractors to ensure adherence to applicable federal and state safety standards.
- During Final Design and construction, MTA will coordinate with emergency service providers (police, fire, etc.) to minimize impacts and identify potential mitigation measures for affected emergency service routes.

5. Environmental Resources, Consequences, and Mitigation

5.1 Introduction

This chapter presents the environmental resources, anticipated effects to those resources, and measures that have been taken to avoid, minimize, and mitigate unavoidable effects. Additional opportunities to avoid and minimize impacts will be considered as the project continues through Final Design. Both adverse and beneficial effects are described for the No-Build Alternative and for the Preferred Alternative, including short-term construction related effects and long-term operational effects. Because much of the documentation of existing resources and assessment methodologies are included in project technical reports and/or memoranda, this chapter focuses on the effects and mitigation of resources that would occur if the Preferred Alternative is selected for implementation. A brief summary of existing resources and methods is included and the full details can be found in the project technical reports and/or memoranda. Several of the technical reports have been included in **Appendix I**, and other references have been identified in **Appendix D**. These project technical reports and/or memoranda include additional information related to the inventory and assessment of resources and methodologies.

Chapter 3 of this Final Environmental Impact Statement (FEIS), Construction Methods, and Activities provides further detail on how the Preferred Alternative could be built based on the level of engineering prepared to date.

a. Changes to this Chapter since the AA/DEIS

A number of changes have occurred since the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) was issued including level of engineering detail, legislation and guidance, available data, and additional efforts concerning the inventory of resources and potential effects to those resources, as well as mitigation measures. The following is a listing of key changes that have resulted in revisions to the assessment of resource effects and are described in detail by resource in the reminder of this chapter:

- Environmental Justice Circular, effective August 15, 2012, on incorporating environmental justice principles into plans, projects, and activities that receive funding from Federal Transit Administration
- Publication of guidance by Maryland Department of Environment (MDE) in 2010 and 2011 on the technical procedures and calculations for the environmental site design (ESD) requirements under the Stormwater Management Act of 2007.
- Field surveys and delineations of wetlands, trees and forested areas specific to the Preferred Alternative
- Short-term construction effects assessed for a peak construction activity year of 2016
- Long-term effects assessed for the No-Build and Preferred Alternative for 2035
- Use of available 2010 Census data
- Detailed noise and vibration monitoring and assessments for locations along the Preferred Alternative

- Identification of property needs for construction and implementation of the Preferred Alternative
- Identification of locations for traction power substations (TPSSs) and central instrument houses (CIHs) locations as part of additional design for systems elements
- Identification of locatons for above ground elements related to underground station location, such as ventilation buildings and station entrances
- Identification of the operations and maintenance facility location
- Corridor-wide visual assessments, now that more engineering detail is known for stations and other above-ground elements
- Complete Draft Section 4(f) Evaluation (**Chapter 6**)
- Additional historic resource investigations including a refined Area of Potential Effect (APE), coordination with Consulting Parties and meetings, and archeological field investigations
- Further geological field investigations
- Additional investigation of potential contaminated soils
- More detail on utilities along the project study corridor

The following sections present the environmental resources, anticipated effects to those resources, and measures that have been taken to avoid, minimize, and mitigate unavoidable effects. Existing resources were identified, and environmental effects were assessed for the entire project study corridor, which is generally defined as the study area for the Preferred Alternative, including the project's proposed limit of disturbance. The No-Build Alternative was also assessed as a baseline condition.

5.2 Land Use and Zoning

5.2.1 Introduction and Methodology

The section characterizes and documents the land use, zoning, and development trends in the project study corridor. For assessment purposes, an area extending approximately 200 feet on both sides of the centerline of the Preferred Alternative alignment and within a one-half mile radius surrounding proposed stations, park-and-ride lots and other ancillary facilities, including tunnel portals and ventilation buildings, have been considered.

Information about land use was gathered by reviewing the comprehensive plans and zoning maps for Baltimore County and City, as well as through verification from field visits to the project study corridor. Additional details related to this Final Environmental Impact Statement (FEIS) subject area can be found in the 2012 *Land Use, Zoning, and Public Policy Technical Memorandum* (**Appendix D)**.

For the purposes of this chapter, it should be understood that a change in use of a single parcel is not the same as a change in the land use of the surrounding neighborhood. A commercial district that loses one commercial building is still a commercial district. Similarly, a residential neighborhood that gains higher density residential uses, or compatible commercial development, would still be a residential land use.

5.2.2 Existing Conditions

a. Land Use

General land use is described for the project study corridor beginning in the west in Baltimore County and ending in the east in Baltimore City (**Figure 5-1**). The western end of the alignment would be located entirely within Baltimore County where the land use is suburban in nature. This area includes large federal employment centers, an indoor shopping mall, shopping centers, and medium-density residential development.

At the City/County border, land use is dominated by the Gwynns Falls Greenway and Gwynns Falls Trail. The greenway consists of more than 2,000 acres of publicly-owned land within the Gwynns Falls stream valley and includes Leakin Park, one of the largest wilderness woodland parks in the Eastern United States (www.gwynnsfallstrail.org, 2012).

Further east, the land use begins to shift to become more urban in nature and is characterized by a mixture of medium density single-family attached and detached dwelling units, and multi-family garden apartments. This area contains clusters of commercial, institutional, and industrial uses.

Between Amtrak's Northeast Corridor at the West Baltimore MARC Station and downtown Baltimore, the land use within the project study corridor is primarily residential (single-family attached dwelling units and multi-family apartments). The units are publicly and privately owned, and many were constructed in the late 1990s as part of the HOPE VI project. HOPE VI is a funding program sponsored by the US Department of Housing and Urban Development (HUD) designed to eradicate severely distressed public housing areas. Continuing along Fremont Avenue, south of Fayette Street, there are mostly older, vacant commercial buildings, some vacant lots, and institutional uses (e.g., University of Maryland).

East of Martin Luther King, Jr. Boulevard is Baltimore's central business district (CBD). Land uses in the CBD are predominantly commercial (retail and office), but include a number of institutional uses (government offices, educational facilities, health care facilities, and places of worship) and some high-density residential areas.

East of the CBD is the Harbor East area which has been redeveloped within the past 15 years and includes a mix of hotels, commercial, office, and mid-rise and high-rise residential uses. At Central Avenue the land use changes to one- and two-story industrial uses mixed with some commercial areas. At Broadway, the land use becomes more mixed with some first floor retail and upper floor residential interspersed with single-family attached residential.

Further east in Canton, the land use become more industrial, including former industrial uses, and are surrounded by single-family attached residential areas. Commercial uses are located along Boston Street. Further east and northeast the land use consists predominantly of residential neighborhoods with "main street" commercial uses along Eastern Avenue. At the easternmost edge of the project study corridor is the Johns Hopkins Bayview Medical Center campus. The Bayview area is mostly industrial and institutional, with some adjacent residential areas.

b. Zoning

Baltimore County and Baltimore City each have established zoning codes to designate permitted uses of the land. To reflect the need for transit oriented development (TOD) near the Red Line, Baltimore County re-zoned the Security Square Mall area to a “town center” designation allowing mixed-uses. The I-70 Park-and-Ride Station area zoning has not changed and remains zoned residential and a sliver of land east of Security Boulevard and north of I-70 is zoned residential-office.

Within Baltimore City, the Department of Planning is presently revising the Zoning Code to define mixed-use districts throughout Baltimore. As part of the city-wide zoning code revision effort, *TransForm Baltimore: The Zoning Code Rewrite*, current zoning districts may be redefined to more strongly encourage mixed-use development and more specialized zoning districts and regulations, such as TOD.

5.2.3 Future No-Build Conditions

Planned and proposed development within the project study corridor for the future No-Build Alternative includes projects currently under construction; projects that have been approved, but not yet been constructed, and projects in the planning phase that have not yet been submitted for approval. Planned and proposed development within the project study corridor is identified below in **Table 5-1** and is shown on **Figure 5-2**.

In addition, to the developments listed in **Table 5-1**, the No-Build Alternative includes already planned and programmed transit and highway projects in the Baltimore Region (see **Table 2-2**).

Future development is expected to occur in the project study corridor regardless of whether or not the Red Line is constructed. However, the No-Build Alternative would not be consistent with adopted land use plans. Baltimore City and Baltimore County are anticipating the Red Line project and structured area land use plans so that the benefits of the Red Line project may be maximized. In addition, the proposed development and growth anticipated in this corridor under the No-Build would continue to place an increased burden on the No-Build transportation network.

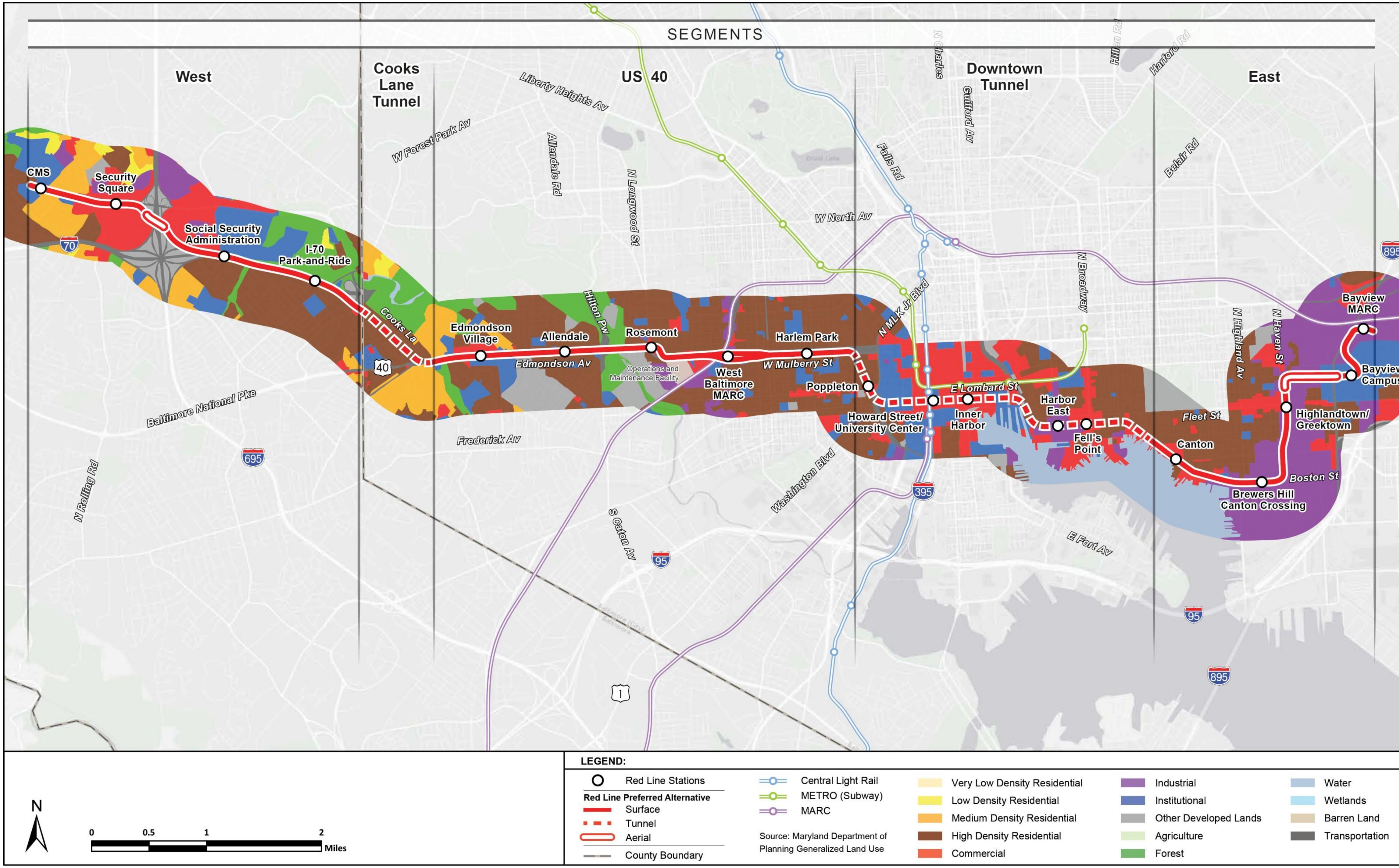


Figure 5-1: General Land Uses in the Project Study Corridor

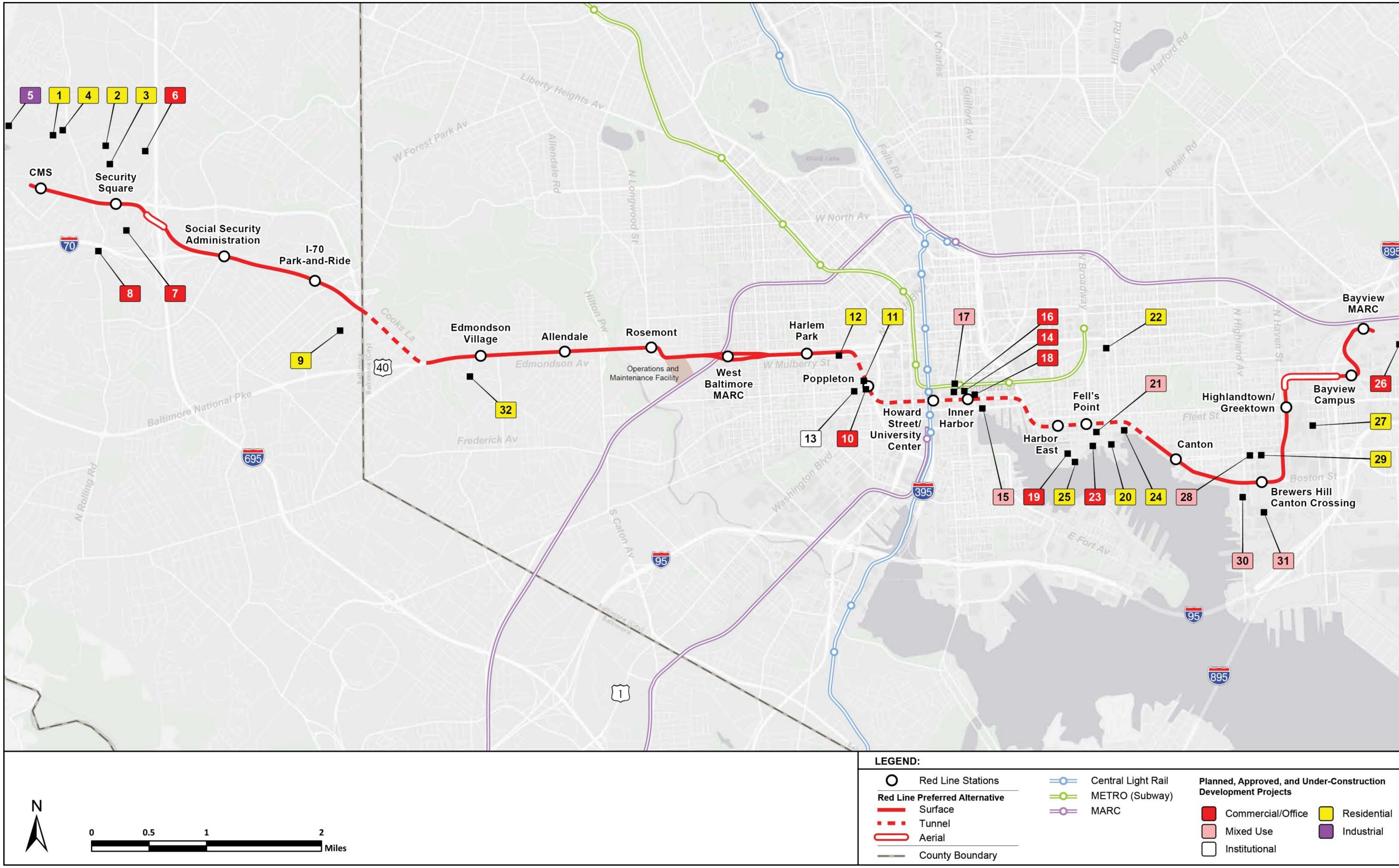


Figure 5-2: Planned and Proposed Development

Table 5-1: Planned and Proposed Development in the Project Study Corridor by Station Area (By 2035)

Proposed Light Rail Transit (LRT) Station	ID # on Figure 5-2	Project Name/Project Sponsor	Location	Project Type	Status	Project Size
CMS/ Security Square	1	7118 Dogwood Road	7118 Dogwood Road	Residential	Approved	Subdivide single dwelling unit lot into three lots
	2	Assgari Property	6910 Richarts Avenue	Residential	Approved	
	3	Assgari Property 2	7008 Glen Spring Road	Residential	Approved	
	4	Lillis Landing	2308 Rolling Road	Residential	Approved	
	5	Angelozzi Property	7312 Dogwood Road	Warehouse	Approved	36,000 square foot warehouse
	6	Hampton Inn	1806 Belmont Avenue	Hotel	Approved	Proposed Hampton Inn
	7	Security Square Shopping Center	Security Square Shopping Center	Office	Approved	Two office buildings: each 121,800 square feet
	8	Rolling Crossroads Professional Park	Southeast corner of Rolling Road and Johnnycake Road	Office	Approved	Three offices buildings: 36,000 square feet, 32,090 square feet, and 18,450 square feet
I-70 Park-and-Ride	9	Gonzalez-St. Agnes Property	1301 St. Agnes Lane	Residential	Approved	16-unit apartment building
Edmond-son Village	32	Uplands/ Penrose, LLC	On US 40/ Edmondson Avenue, near Swann Avenue	Residential	Under construction	1,100 mixed income housing units on 100 acres
Poppleton	10	UM BioPark/ MD Proton Therapy Center	800 block of West Baltimore Street	Medical/ Hotel	Approved	203,000 square feet
	11	Poppleton Cooperative/ The Hampstead Companies	800 block of Fayette Street	Residential	Approved	22,000 square feet
	12	Poppleton Phase I/Daniel Bythewood	Schroeder and Mulberry Streets	Residential	Planning	1,800 dwelling units; 100,000 square feet retail
	13	UM BioPark	873 West Baltimore Street	Institutional	Planning	200,000 square feet
Inner Harbor	14	One Light Street/ Joseph Clarke	Southeast corner of Redwood and Light Streets	High-Rise/ 410 parking spaces	Approved (On Hold)	298 hotel rooms and parking garage
	15	New American Site	Pratt and South Streets (News America Site)	Hotel/ Residential/ Parking Garage	Approved (On Hold)	100 hotel rooms and parking garage

Table 5-1: Planned and Proposed Development in the Project Study Corridor by Station Area (By 2035)

Proposed Light Rail Transit (LRT) Station	ID # on Figure 5-2	Project Name/Project Sponsor	Location	Project Type	Status	Project Size
	16	One East Redwood Hotel/ C. Etherington	1 East Redwood Street	Hotel	Approved (On Hold)	150 hotel rooms and 5,000 square feet retail space (planned)
	17	Mechanic Center/ David S. Brown	Charles and Baltimore Streets	Mixed-use	Approved (On Hold)	100,000 square foot retail; 120,000 square foot hotel; 250,000 square foot residential; and associated parking
	18	Hyatt Place at City Center/Mark Sapperstein	Northwest corner of Calvert & Water Streets	Hotel	Approved (On Hold)	300 hotel rooms; total of 450,000 square feet
Harbor East	19	Harbor Point (Allied)/ Harbor East Development	Caroline and Thames Streets	Offices/ Retail	Approved	1.8 million square feet; Phase I 200,000 square feet
Fell's Point	20	Union Wharf/ Bozzuto	Northeast corner of Wolfe and Thames Streets	Residential/ parking Garage	Under Construction	280 dwelling units; 500 parking spaces
	21	Market Place at Fell's Point/ Winner Holmes	Broadway, Fleet, Aliceanna, and Regester Streets	Mixed-use Residential/ office & retail	Approved	155 dwelling units
	22	Chapel/ South Broadway Properties, LLC	Fayette and Wolfe Streets	Residential	Approved (On Hold)	725 dwelling units
	23	Recreation Pier - Aloft Hotel/ Harbor East Development	Thames and Broadway Streets	Hotel	Approved (On Hold)	130 hotel rooms; total of 92,675 square feet
	24	Aliceanna St. Project/ Elm Street Development	Aliceanna, Wolfe, and Castle Streets	Residential/ Retail	Approved (On Hold)	284 apartment units; 13,000 square feet retail
	25	Bond St. Wharf/ Harbor East Development	Thames and Caroline Streets and the water	Residential	Planning	100 apartment units and parking

Table 5-1: Planned and Proposed Development in the Project Study Corridor by Station Area (By 2035)

Proposed Light Rail Transit (LRT) Station	ID # on Figure 5-2	Project Name/Project Sponsor	Location	Project Type	Status	Project Size
Brewers Hill/ Canton Crossing	28	Bayview (NIH)	O'Donnell and Conkling Streets	Residential/ Office/ Commercial	Partially Built	1.9 million sq ft. total build out; 430 dwelling units, 600,000 sq ft. retail; 650,000 sq ft. office
	29	Greektown/ Kettler	3701 O'Donnell Street	Residential	Partially built; Proposed	220 - 440 apts., 5,000 - 19,000 square feet retails
	30	Brewers Hill Project/ Obrecht	South of Boston Street and east of Baylis Street	Mixed-use; Parking Garage	Under Phase I Const.	107,000 square feet total; 700 parking spaces
	31	Brewers Hill Apartments/ Obrecht / Hanover Co	North Boston Street, South Danville Avenue, East Haven Street, and West Baylis Street	Mixed-use; shopping center	Approved	480,000 square feet retail
Highland-town/ Greek-town	27	Canton Crossing/ Canton Crossing, LLC	Foster Avenue, Oldham Street, O'Donnell Street, and CSX Street, and CSX right-of-way	Residential	Approved	Total project site is 17.9 acres; Phase I, which is partially built, is 4.5 acres
Bayview Campus	26	District of Canton Crossing/BCP Investors, LLC	Eastern Avenue, Lombard Street, and Kane Street	Office (PUD)	Approved	5 million square feet office; 3 phases of development

Source: Baltimore City Department of Planning and Baltimore County Department of Planning

5.2.4 Preferred Alternative

a. Long-Term Operational Effects

The Preferred Alternative would have the potential to impact existing land uses primarily at proposed station areas, where the local access would change (e.g., more transportation choices and/or faster travel times), which could attract residential, commercial, retail, or other forms of development. Ancillary facility locations, where traction power substations or ventilation buildings are located, as well as locations along the alignment where full and partial acquisitions would be required to construct the project, have the potential to impact development and land use. **Section 5.5** of this FEIS chapter provides more detailed information on right-of-way requirements of the project.

Because of the predominantly urban environment in which the Preferred Alternative would be located, much of the corridor is developed and land use is not expected to substantially change as a result of the Preferred Alternative. However, the intensity of the land use could change as a result of development occurring around the proposed stations. This redevelopment would be consistent with local plans, policies, and zoning, which were developed with the assumption that a major transit improvement would be made along the Red Line corridor. Both Baltimore County and Baltimore City support the proposed Red Line project and their plans indicate that the project is expected to (and would be encouraged to) attract new development at station areas. As an example, many of the station areas have been designated as TOD on the draft zoning map, reflecting Baltimore City's interest in TOD at the Red Line stations.

The effects of the Preferred Alternative to future land use within the project study corridor are described below by segment, after a general discussion of the potential impacts of specific surface elements.

Surface System Elements

The Preferred Alternative would introduce the following system elements to the surface portions of the project study corridor: traction power substation (TPSS), control instrument houses, catenary poles, and wires. New surface track would be installed along with at-grade crossing and traffic control devices on existing roadways. These elements are described in **Chapter 2** of this FEIS and are identified within in **Volume 2 Environmental Plate Series** of this FEIS. The control instrument houses and the catenary poles and wires would primarily be located along existing transportation right-of-way (i.e., roads and railroad corridors), and would not impact existing land use.

West Segment

In addition to the surface system elements described above, the project would add two park-and-ride facilities in this segment (at the Security Square and I-70 stations). These elements are described in **Chapter 2** of this FEIS and are identified within **Volume 2 Environmental Plate Series** of this FEIS.

There are four stations proposed in this segment. At the western end of this segment, the CMS Station would be located directly adjacent to Security Boulevard and would require minor property acquisition from the adjacent residential area on the south side of Security Boulevard. The Security Square Station would be located adjacent to Security Boulevard and the Security Square Mall. The Security Square Park-and-Ride and a nearby TPSS would be located within the current parking area of the Security Square Mall.

The Social Security Administration Station, the I-70 Station and Park-and-Ride and TPSS would be located between and within the I-70 right-of-way and its interchange at Security Boulevard and Parallel Drive. The I-70 Park-and-Ride would represent and change in land use from a large wooded parcel to a surface parking lot. As described above, the area is zoned residential. Given the suburban nature of the station vicinity, a surface parking lot in itself would not change the nature of the area.

Impacts to land use within this segment of the project study corridor would be minimal. The trackway and stations are largely built within or adjacent to existing transportation corridors. As noted above, the addition of new stations could create pressure for new development nearby. However, the majority of the western segment is privately owned. To the extent that the Preferred Alternative causes increased development in the vicinity of stations, those changes would be consistent with Baltimore County's plans, policies, and zoning for the area, which were developed with the assumption that a major transit improvement would be made along the Red Line corridor.

Cooks Lane Tunnel Segment

Land use effects to this segment of the project study corridor would be minimal as the Preferred Alternative would be located underground, and there are no nearby stations to make the area a more attractive location for additional development/re-development. Further, there are no control instrument houses or TPSSs locations in this segment.

Tunnel portals would be located within the existing roadway right-of-ways, reducing the potential for impact to surrounding land uses. The western tunnel portal would be located within the existing I-70 southwest interchange ramp that would be removed as part of the Red Line project. The eastern tunnel portal would be located in the median of Edmondson Avenue west of Brookwood Road to east of Old Frederick Road. These portals would be constructed in retained-cut sections and transition from underground to surface segments.

Effects to land use within this segment of the project study corridor would be minimal. Much of the area developed and to the extent that the Preferred Alternative causes increased development in the vicinity of stations, those changes would be consistent with Baltimore County's plans, policies, and zoning.

US 40 Segment

In the US 40 segment the Preferred Alternative track would be in the median of the roadway right-of-way, requiring few displacements, and minimizing the potential for impacts to surrounding land uses. Many of the system elements would be located within the median of the roadway.

Edmondson Village, Allendale, and Rosemont Stations would be located in the median of Edmondson Avenue. The Red Line West Baltimore MARC Station is split along Franklin and Mulberry Streets at the West Baltimore MARC Station. The Harlem Park Station would be located within the lower level of US 40.

The Operations and Maintenance Facility (OMF) would be located in the US 40 segment. The OMF would include a storage yard that would accommodate approximately 38 low-floor light rail vehicles, administration and transportation/operations areas, maintenance areas, a drive-through train wash, maintenance of way support areas, and other functions needed for the operation of the Preferred Alternative. Development of the OMF would require 21 acres from 11 parcels that currently consist of commercial and city-owned properties. The nearest residents to the site are located approximately 100 feet away on Franklin Street. The proposed facility would not affect the type of land use on the site. It is currently used for commercial and industrial operations and will continue to function as an industrial site.

Impacts to land use within this segment of the project study corridor would be minimal. Much of the project in the segment would be built within existing transportation corridors, and much of the area is developed, reducing the potential for major land use changes. The areas within walking distance of the proposed stations may develop more intense uses due to proximity to the station, although, as explained above, to the extent that the Preferred Alternative causes increased development in the vicinity of stations, those changes would be consistent with Baltimore County's plans, policies, and zoning.

Downtown Tunnel Segment

This portion of the alignment would be underground, and would include two tunnel portals; the western tunnel portal would be located within the median of US 40 between Schroeder Street and Martin Luther King, Jr. Boulevard. The eastern tunnel portal would be located within Boston Street west of the intersection of South Montford Avenue and Hudson Street.

In this segment, the following five stations would be located underground, with entrances and ventilation and ancillary buildings on the surface.

- The Poppleton Station entrance and ancillary building would be located on the northeast corner of Baltimore Street and Fremont Avenue adjacent to the Poppleton Firehouse.
- The Howard Street/University Center Station entrance and ancillary building would be located on the north side of Lombard Street between Howard Street and Hopkins Place.
- The Inner Harbor Station entrance and ancillary building would be located on the northeast corner of Light and Lombard Streets, and the ancillary building would be located mid-block between Lombard and Fayette Streets.
- The Harbor East Station entrance and ancillary building would be on the south side of Fleet Street between Central Avenue and Eden Street.
- The Fell's Point Station entrance and ancillary building would be in the median of South Broadway on the north side of the intersection with Fleet Street.

Station entrances would be at street level and would generally include two escalators and one stair covered by a canopy structure. Two elevators would be provided, either in a freestanding structure or associated with the ancillary structure. The ancillary structure would contain station entrances and tunnel ventilation buildings, service rooms, and emergency egress. These structures could be approximately 60 feet tall (see description in **Section 2.4.2**) and would be designed to be compatible with surrounding land uses.

While the underground trackway would have no impact on land use in this segment, the areas within walking distance of the proposed stations may develop more intense uses due to proximity to the stations. Negative impacts to land use within this segment of the project study corridor would be minimal. Much of the area is developed, reducing the potential for major land use changes. To the extent that the Preferred Alternative causes increased development in the vicinity of stations, those changes would be consistent with Baltimore County's plans, policies, and zoning.

East Segment

This segment would be above-ground, emerging from the Downtown Tunnel into the median of Boston Street. Most of this segment is at-grade, with some track elevated above existing roads and freight rail corridors (see **Figure 5-1**). There would be five LRT stations in this segment of the project study corridor.

The Canton and Brewers Hill/Canton Crossing Stations are located in areas that contain some vacant and abandoned properties, as well as low intensity land uses such as surface parking lots. The areas surrounding these two stations are zoned for TOD. Between these two stations, south of Boston Street, much of the land is zoned commercial with a waterfront overlay district. North of Boston Street the land is primarily residential. East of the Canton Crossing Station some of the land is zoned Open Space.

The Brewers Hill/Canton Crossing Station would have an associated park-and-ride lot east of the station and is identified TOD area in Baltimore City's plans. This lot would be built on land that is largely vacant, and is adjacent to existing parking lots.

East and north of the Canton Crossing Station TOD area, the alignment would be located within the Norfolk-Southern right-of-way (an existing transportation use). North of the Highlandtown/Greektown Station the alignment would proceed east along Pratt Street on a new aerial structure. With the exception of the area around the Highlandtown/Greektown Station area, which is zoned for TOD, industrial and mixed-use, the alignment is in an industrially zoned area until it reaches additional right-of-way owned by Norfolk-Southern. Between the Norfolk-Southern right-of-way and Oldham Street the land is zoned residential. Between Oldham Street and Johns Hopkins Bayview Medical Center campus is the I-895 corridor, which is another existing transportation use.

The Bayview Campus Station and surrounding area is zoned Hospital Campus. The area where the Preferred Alternative would cross East Lombard Street to the Bayview MARC Station is zoned Office-Industrial Campus.

Areas within walking distance of the proposed stations may develop more intense uses. As noted above, to the extent that the Preferred Alternative causes increased development in the vicinity of stations, those changes would be consistent with Baltimore County's plans, policies, and zoning for the area, which were developed with the assumption that a major transit improvement would be made along the Red Line corridor.

Zoning for the Canton Station, the Brewers Hill/Canton Crossing Station, and the Highlandtown/ Greektown Station are primarily TOD, indicating that transit oriented development is expected and supported in this area. Zoning for the two Bayview stations is appropriate to the type of development that exists and is expected in the vicinity (Hospital Campus and Industrial-Office Campus). Impacts to land uses in the East segment should therefore be minimal.

b. Short-Term Construction Effects

Overall impacts to land use during construction are expected to be minimal and short in duration, as most parcels in the study area would not be directly affected by construction, except to the extent that there is traffic congestion or lane closures.

Construction of the Preferred Alternative would result in pedestrian and vehicular access restrictions to some properties for periods ranging from several hours to several months. Overall, however, while the construction activities may impact individual parcels or businesses (as described in **Chapter 4** and other sections of **Chapter 5**), these activities are not expected to impact land use.

c. Avoidance and Minimization

The Preferred Alternative was developed largely along existing transportation corridors (roads, sidewalks, and rail corridors) to minimize land use and other impacts. Traction power substations, control instrument houses, and stations are located in existing transportation corridors where possible.

To ensure that local land use issues were considered and that the project was developed with an understanding of how each station would fit into its surrounding communities, Station Area Advisory Committees (SAACs) were formed in 2011. The SAACs, described in **Chapter 8**, were part of an 18-month community-based initiative to provide design input on the Red Line project development including a visioning process for the surrounding communities.

d. Mitigation

As noted above, long-term impacts to land use in the corridor resulting from the Preferred Alternative would be minimal because the current land use plans and zoning for Baltimore County and Baltimore City have been developed to anticipate the Red Line project, and to maximize the potential benefits from the project. With no substantial negative impacts to existing land uses expected, mitigation is not proposed.

Short-term impacts are expected to be minimal, as temporary impacts to individual properties are not expected to impact land use along the corridor.

5.3 Demographics, Neighborhoods and Community Facilities

5.3.1 Introduction and Methodology

The Red Line project study corridor is over 14 miles in Baltimore County and Baltimore City and would directly intersect or be adjacent to 36 neighborhoods (**Figure 5-3**).

The Preferred Alternative was evaluated to assess the effects it would have on the project study corridor neighborhoods including community facilities and services. Existing demographic data on population, income, age, and transportation characteristics within the project study corridor were gathered using US Census tracts. General effects to the following seven neighborhood attributes/resources are provided for the five segments and the Operations and Maintenance Facility (OMF):

- Property Acquisition
- Neighborhood Cohesion
- Mobility and Access
- Parking

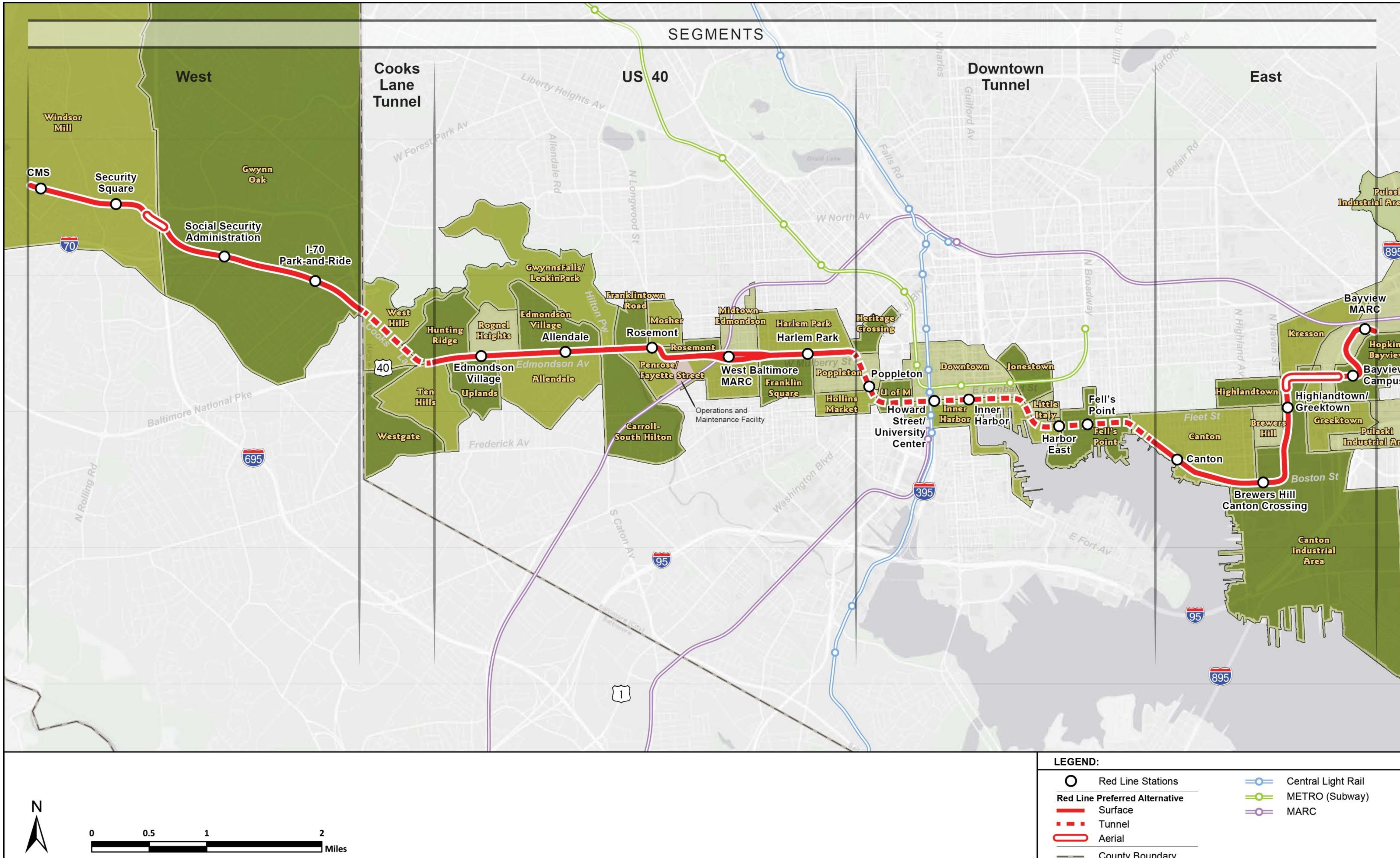


Figure 5-3: Project Study Corridor Neighborhoods

- Noise and Vibration
- Neighborhood Character and the Visual Environment
- Community Facilities and Services
- Construction Effects

More details on these effects can be found in the *Neighborhoods Technical Report* (**Appendix D**).

5.3.2 Existing Conditions

a. Population and Housing

Population and housing data was gathered from the most recent available sources including the 2010 US Census, the 2010 American Community Survey, and the Maryland Department of Planning State Data Center. For demographic purposes, the project study corridor is defined as the 2010 US Census tracts that traverse the area included within a 1,000-foot buffer surrounding the Red Line's limit of disturbance boundary. The limit of disturbance is identified in the **Volume 2 Environmental Plate Series** of this Final Environmental Impact Statement (FEIS).

In the 2010 Census, the total population of the project study corridor was 162,287. Of the total population within the project study corridor, 30,951 people (19.1 percent) resided in Baltimore County and 131,336 people (80.9 percent) resided in Baltimore City. A summary of the population statistics can be found in **Table 5-5**, in **Section 5.4** of this chapter.

While many races and ethnicities are represented within the project study corridor, the majority of the population in the project study corridor in the 2010 Census consisted of African-Americans representing 97,314 individuals (60.0 percent). A total of 44,787 individuals (27.6 percent) were classified as White with the remaining 12.4 percent of the population classified as either American Indian/Alaskan Native, Asian/Pacific Islander, Asian, Hispanic, Other, or Two or More Races.

Typically elderly, disabled, and low-income populations have a higher degree of transit dependency as it is more likely these populations do not have access to a vehicle. People without access to a vehicle are generally dependent on other forms of transportation, such as walking, biking, or transit, to travel to desired destinations. In the 2010 Census, approximately 28 percent of the people residing in the project study corridor did not have access to a vehicle.

The housing profile throughout the project study corridor is diverse. Housing types vary in age and condition and consist of rowhomes, single-family homes, apartments, and condominiums. In the 2010 Census, 106,072 housing units existed within the Red Line project study corridor. Of this total, 16,927 are located in Baltimore County while 89,145 are located in Baltimore City. In 2010, approximately 83 percent of the housing units in the project study corridor were occupied; approximately 17 percent were vacant. Vacant housing was dispersed throughout the project study corridor. Of the occupied units, approximately 45 percent were owner-occupied, while 55 percent were rented.

b. Neighborhood Profiles and Community Facilities

The demographic neighborhood profiles and community facilities within each of the 36 neighborhoods included in the project study corridor, along with access to transit via bus routes, are identified in **Table 5-2**. Additional details are provided in the *Neighborhoods Technical Report*.

Table 5-2: Neighborhood Profiles and Community Facilities within the Project Study Corridor

Neighborhood	Housing Vacancy Rate	Population with No Vehicle Available	Number of Bus Routes
Windsor Mill	5%	5%-9%	6
Gwynn Oak	2%-7%	4%-12%	2-3
West Hills	4%	21%	3
Westgate	5%	9%	4
Ten Hills	5%	13%	4
Hunting Ridge	9%	9%	4
Rognel Heights	8%	23%	4
Uplands	7%	Unknown	5
Allendale	12%	23%	5
Edmondson Village	13%	30%	4
Gwynns Falls/Leakin Park	N/A	N/A	4
Carroll-South Hilton	17%	18%	6
Franklintown Road	18%	52%	5
Mosher	30%	48%	2
Penrose/Fayette Street Outreach	26%	50%	6
Rosemont Homeowners/Tenants	22%	35%	5
Midtown-Edmondson	51%	71%	5
Harlem Park	40%	62%	7
Franklin Square	37%	64%	4
Poppleton	22%	74%	5
Heritage Crossing	2%	Unknown	4
Hollins Market	25%	53%	3
University of Maryland	10%	Unknown	4
Downtown	19%	52%	10+
Inner Harbor	32%	8%	6
Jonestown	12%	43%	7
Little Italy	18%	28%	2
Fell's Point	17%	17%	3
Canton	12%	26%	4
Highlandtown	15%	39%	3
Brewers Hill	11%	9%	3
Canton Industrial Area	8%	Unknown	2
Kresson	30%	44%	2
Greektown	13%	26%	4
Hopkins Bayview	9%	69%	3
Pulaski Industrial Area	70%	Unknown	2

Sources: 2010 US Census, mtamaryland.com

5.3.3 Future No-Build Conditions

The No-Build Alternative represents a continued investment in regional and local transportation projects, but does not address the Red Line Project purpose and need of reducing travel times, increasing transit accessibility, providing transportation choices for east-west commuting, or supporting community revitalization and economic development opportunities. The Red Line would not be implemented but other planned and programmed transportation and development projects would proceed. Based on Baltimore Regional Transportation Board's *Plan It 2035* Constrained Long Range Plan, the future conditions of transportation facilities and/or improvements that would directly impact the project study corridor are:

- Security Boulevard Extension, existing terminus to Fairbrook Road
- West Baltimore MARC Station Improvements
- Uplands Development
- US 40 Edmondson Avenue Bridge expansion over Gwynns Falls/CSX Railroad
- Boh Donnell Street Connector
- Bayview MARC and Intermodal Station

Under the No-Build Alternative, mobility is projected to decrease due to an increase in travel times within the project study corridor. The No-Build Alternative end-to-end transit travel time is 79 minutes. The Preferred Alternative would operate with an end-to-end transit travel time of 45 minutes providing faster service in nearly half the time of the No-Build Alternative. The current roadway and transit systems would not be able to accommodate new anticipated development and associated population growth, and service levels and travel times would decline.

The No-Build Alternative would not have a long-term effect on neighborhood cohesion and isolation. Under the No-Build Alternative, no improvements would be made; therefore, the same conditions that exist today throughout the project study corridor would remain.

Under the No-Build Alternative no existing on-street parking would be removed. The surface parking lots at the West Baltimore MARC and Bayview MARC stations are separate projects from the Red Line and therefore are included in the No Build Alternative. These projects will be implemented through a collaborative effort between the Maryland Transit Administration (MTA) and Baltimore City.

Future noise and vibration levels under the No-Build Alternative are anticipated to be similar to those under existing conditions as described in the *Noise and Vibration Technical Report* located in **Appendix I,** as well as **Section 5.13**. The project study corridor is characterized by urban communities that include major highways (such as I-70 and US 40 lower level) and arterials (such as Lombard Street and Edmondson Avenue). Under the No-Build Alternative ambient noise is anticipated to be the same as the existing noise condition.

Because no Red Line project related construction is associated with the No-Build Alternative, there would be no short-term effects to property (easements), neighborhood cohesion and isolation, access and mobility, noise and vibration, neighborhood character and the visual environment, or community resources and services.

5.3.4 Preferred Alternative

The following sections describe the direct effects to neighborhoods and community facilities. The introduction of the physical elements of the Preferred Alternative, when proximate to neighborhoods and community facilities would have the potential to cause both positive and negative impacts. The Preferred Alternative would include track, aerial guideways, at-grade station platforms, an operations and maintenance facility, tunnels, portals, underground stations, ventilation facilities, crossovers, and installation of specialty system work such as traction power, communications, and signaling. These facilities would be located along the project study corridor in neighborhoods that would result in a permanent physical change of the corridor, as well as changes to local traffic operations and street patterns.

Physical impacts would include business displacements, changes to access, visual changes, or noise and vibration impacts. While some negative effects would result from these physical changes, the Preferred Alternative would provide mobility benefits to neighborhoods residents by improving access to transit and destinations within the project study corridor.

Through the implementation of the *Baltimore City Red Line Community Compact*[1], the Station Area Advisory Committees (SAACs) were developed in an effort to create a more community-centered public involvement process for station design; and a collaborative working committee of community stakeholders, designers, planners, architects, and land-use experts to plan and design the stations and ensure that the stations and station areas enhance communities and provide a mutually safe environment for everyone. There were 17 SAACs established that planned for the 20 proposed Red Line stations that were responsible for developing design concepts for each station. SAAC membership represented all aspects of the community including commercial, institutional, and residential interests as it was essential to keep all stakeholders updated about the process and products developed. At major milestones in the planning process, public meetings were held to inform, as well as solicit input from, the community regarding all aspects of the plan. Refer to **Chapter 8** for additional information on the SAAC and public outreach.

a. Long-Term Operational Effects

Property Acquisition

Property acquisitions will be required for development of the Preferred Alternative primarily for the development of station areas and park-and-ride lots. Twenty displacements of commercial and industrial properties are proposed in addition to the temporary and permanent easements required for construction of the Preferred Alternative. Specific details on these required acquisitions and resulting displacements can be found in **Section 5.5** and the *Property Acquisition & Displacement Technical Memorandum (***Appendix D)***.* The property effects by neighborhood are included in **Table 5-3**.

[1] The Compact, included in **Appendix F**, is an agreement among the communities along the Red Line corridor, Baltimore City, the MTA, and other stakeholders to make the Red Line a catalyst for economic and environmental benefits in the project's neighborhoods.

Table 5-3: Property Effects by Neighborhood under the Preferred Alternative

Neighborhood	Property Acquisitions (Number/ sq. feet)	Permanent Easements (Number/ sq. feet)	Community Facilities Affected
West Segment			
• Windsor Mill • Gwynn Oak	1[1]/0	11/281,061	• Chadwick Elementary School • Episcopal Church of Christ the King
Cooks Lane Tunnel Segment			
• West Hills • Westgate • Ten Hills • Hunting Ridge	0/0	4,968	• St. Bartholomew's Episcopal Church and Head Start • Fire Station #53
US 40 Segment			
• Rognel Heights • Uplands • Allendale • Edmondson Village • Gwynns Falls/Leakin Park • Carroll-South Hilton • Franklintown Road • Mosher • Penrose/Fayette Street Outreach • Rosemont Homeowners/Tenants • Midtown-Edmondson • Harlem Park	2[2]/8,870	130/41,420	• Enoch Pratt Library • Central Church of Christ • Edmondson-Westside High School • Travelers Rest Bible Church • Olivet Bible School • Western Cemetery • Lion Tribe of Judah
Downtown Tunnel Segment			
• Franklin Square • Poppleton • Heritage Crossing • Hollins Market • University of Maryland • Downtown • Inner Harbor • Jonestown • Little Italy • Fell's Point	6/63,809	2/56,205	• St. Paul's Cemetery • Baltimore City Community College
East Segment			
• Canton • Highlandtown • Brewers Hill	3/219,517	24/308,998	• St. Casimir's Park • Boston Street Pier Park • Canton Waterfront Park

Table 5-3: Property Effects by Neighborhood under the Preferred Alternative

Neighborhood	Property Acquisitions (Number/ sq. feet)	Permanent Easements (Number/ sq. feet)	Community Facilities Affected
• Canton Industrial Area • Kresson • Greektown • Hopkins Bayview • Pulaski Industrial Area			• Johns Hopkins Bayview Medical Center
Operations and Maintenance Facility			
• Penrose/Fayette Street Outreach	11/855,532	1/421	• none
Total	**23/1,147,728**	**169/693,073**	n/a

Notes: [1] Commercial parcel under Total Acquisition is to reflect relocation of existing Bank of America ATM from private property being totally acquired as part of the Security Mall Park-and-Ride

[2] Commercial parcel under Total Acquisition is to reflect 2 businesses located on the same property.

Neighborhood Cohesion

The Preferred Alternative is not anticipated to have long-term effects on neighborhood cohesion because the proposed transit service would operate almost entirely on existing roadways and thoroughfares or in a tunnel. While gentrification can be a concern for neighborhoods near major planned transportation and development projects, MTA will work with Baltimore County and Baltimore City to minimize this potential secondary effect. The Preferred Alternative would create an activity node that would serve as foci within the communities it traverses. Pathways and accessible routes connecting pedestrians and bicyclists to each station will be provided. The Preferred Alternative may serve as a catalyst for greater pedestrian activity and provide in many areas improved accessibility for pedestrians and bicyclists.

Mobility and Access

To construct the Preferred Alternative with minimal property effects, the existing number of traffic lanes will be reduced in some areas along the project study corridor. The roadways that would experience a reduction in capacity because of the allocation of exclusive lanes for the Preferred Alternative would be: Security Boulevard; I-70; Edmondson Avenue; West Franklin Street; Franklintown Road; US 40, “lower level segment,” and Boston Street (refer to **Chapter 2** for a more detailed description of the Preferred Alternative).

Parking

Park-and-ride facilities will be constructed at three light rail transit (LRT) stations: Security Square, I-70 Park-and-Ride, and Brewers Hill/Canton Crossing. As such, the Gwynn Oak, Canton, Canton Industrial Area, and Pulaski Industrial neighborhoods would experience an increase in available parking because of the proposed park-and-ride stations.

The implementation of the Preferred Alternative would require both temporary and permanent loss of parking spaces within the project study corridor. On-street parking losses would be greatest along portions of Edmondson Avenue and Boston Street because of the need to widen these roadways to accommodate the proposed alignment. MTA will work with the contactor to develop a plan to minimize the temporary loss of parking during construction. Details on parking and parking space utilization are provided in the *Traffic and Parking Technical Report* located in **Appendix I***,* as well as **Chapter 4** of this FEIS.

Noise and Vibration

The Preferred Alternative has the potential to create increases in noise and vibration that would affect neighborhoods within the project study corridor. Noise effects would be the result of the operation of the proposed transit service, the bus activities occurring at proposed stations and activities occurring at proposed OMF. Noise and vibration effects are described in detail in the Red Line *Noise and Vibration Technical Report*, as well as **Section 5.13.**

Neighborhood Character and the Visual Environment

The visual environment would be altered by the following components. The effects are described as changes that result from the construction of the Preferred Alternative or its components that would change the perception of an outside observer in a substantial way. Specific effects to the visual environment can be found in **Section 5.7**, as well as within the *Visual and Aesthetic Resources Technical Report*, see **Appendix D**.

At-grade and Aerial Transitway Alignments

The tracks used for the transitway, would yield visual effects ranging from low to high based upon the following factors: nature of project component, contextual compatibility changes to visual landscape, and viewer sensitivity. At-grade transitways within the West, US 40 and East segments yield a moderate visual impact (as described in **Section 5.7**). Aerial structures (aerial and elevated approach sections) required for the Preferred Alternative would be constructed over I-695 within the West segment, and over industrial and railroad uses, as well as I-895 within the East segment. These structures would vertically separate the LRT tracks from roadways and/or freight tracks, and alter the visual environment of the project study corridor by adding a new structural visual element to the landscape. Design details of the bridges will be considered during Final Design to fit within the context of the existing surroundings.

Overhead Catenary System (OCS)

The OCS would be a new visual element introduced by the Preferred Alternative and would be visible from vehicles traveling along the at-grade segments of the project study corridor and pedestrians. While the OCS would alter the viewshed of the project study corridor neighborhoods, the neighborhood character would not be substantially affected.

Stations

Design of surface stations and entrances to underground stations is influenced by traffic patterns, local topography, and neighborhood character including surrounding neighborhoods, land uses, areas served, historical significance, and materials that define the fabric of the community.

Traction Power Substations (TPSSs)

Each of the 14 proposed above ground TPSS facilities were evaluated for their effect on the visual quality of the surrounding environment. Of the 14 facilities evaluated, six would have a low visual effect, four facilities were found to have a medium visual effect, and the remaining four would have a high visual effect. The four TPSS locations designated as having a high visual effect are located in the US 40 and East design segments. Overall, the combined impacts are visible via vehicle and pedestrian routes, located near residential and commercial properties and community facilities (parks, religious institutions) and visible from the proposed Preferred Alternative platform. Each TPSS will be designed in accordance with the MTA's system-wide design criteria to minimize noise effects to the community. As a result, no exceedances of the Federal Transit Administration noise impact criteria because of the TPSS are predicted at receptors along the Preferred Alternative. Specific effects to the visual environment can be found in **Section 5.7**, as well as within the *Visual and Aesthetic Resources Technical Report*.

Operations and Maintenance Facility (OMF)
The proposed facility is currently used for commercial and industrial operations and would continue to function as an industrial site. Approximately 6.5 million cubic feet of the existing industrial buildings would be demolished at the site for the improvements. The addition of this building would be a change to the viewshed within the neighborhood. The OMF provides a number of new elements with low compatibility to surrounding residential properties but is generally compatible with the existing adjacent industrial area. The MTA is committed to provide landscaping at the OMF site to offset the impacts to the viewshed.

Ventilation Facilities
Ventilation facilities, referred to as fan plants, would be constructed at each of the five underground stations. These facilities would be comprised of fans, air plenums and air shafts that would ventilate the tunnels and station platform areas to the atmosphere. The height of these facilities could potentially be approximately 60-feet high. The exact locations, heights, design, and visual impacts of these facilities within the station areas would be determined during the Final Design phase of the project.

Neighborhood Character
In general, the Red Line would not substantially alter neighborhood character within the project study corridor. While the new LRT system and accompanying features described previously would create changes in the visual environment, these changes would be carefully designed to be harmonious, to the maximum extent practicable with the surrounding environment where feasible.

Community Facilities and Services
The Preferred Alternative would not result in the displacement of community facilities such as schools, libraries, places of worship, emergency services, or park and recreation areas. Portions of the properties of community resources may be acquired permanently, used under a permanent easement, or used during construction through temporary easements. Effects to community resources and property effects are shown in **Volume 2 Environmental Plate Series, Plate Series 1**. A summary of these effects is provided in **Table 5-3**. Additional details are provided in the *Neighborhoods Technical Report*.

Delays from gated crossings at the I-70 Park-and-Ride, Franklin Street, Haven Street, Cassell Drive Crossing, and Bayview Boulevard at Alpha Commons Transitway could increase response times along the emergency service provider routes. As such, MTA will coordinate with emergency services providers to ensure the design of the proposed project allows access for these services. Coordination with emergency service providers will occur during Final Design and construction to identify potential impacts to services and identify mitigation measures for affected emergency service routes. This would include both surface emergency services (police, ambulance, fire) as well as aerial services (which could be affected by tall equipment such as cranes). Helipad locations for hospitals and other services within the project study corridor would be identified and coordination with the Federal Aviation Administration during the Final Design and construction phases of the project, if required.

b. Short-Term Construction Effects and Mitigation

There is the potential for effects such as air quality (result of emissions from construction equipment and fugitive dust), noise and vibration (construction equipment), temporary interruptions to vehicular and pedestrian traffic and access, temporary loss of on-street parking and utility services to local neighborhoods resulting from construction activities. Detailed information on construction activity can be found in **Chapter 3** of this FEIS. Discussions of the effects of construction activities to each of the FEIS disciplines are contained in **Chapters 4** and **5** of this FEIS.

Proposed construction staging areas would be required throughout the project study corridor to provide storage for equipment and materials. During construction trucks and large mobile equipment will be required to use only designated haul routes to the greatest extent possible. Staging areas and truck haul routes have been identified for the purpose of the FEIS are described in **Chapter 3** of this FEIS.

Construction of the Preferred Alternative would result in temporary short-term effects to local and regional transportation operations. These effects could potentially include lane closures, temporary signals, temporary roadway closures, detours, and disruption of traffic in adjacent parallel streets and cross-streets during peak and nonpeak times. Potential outcomes of these effects could result in the temporary intrusion of through traffic into local neighborhoods because of congestion and/or detours, disruption of access by motorized and non-motorized modes to local businesses, and the temporary loss of on-street parking. Access to local businesses could be affected by temporary changes in access during construction; however, every effort would be made to maintain access during construction. Local area transit would be impacted but they could be temporarily diverted or relocated to provide reliable service near areas where construction activities would take place.

MTA will develop and implement a plan to mitigate impacts to bus stops and routes during construction. Specific mitigation measures could include:

- Affected transit stops would be temporarily relocated
- Pedestrian areas would be provided for bus stops maintained in construction areas
- Information would be provided along bus routes and on MTA's website concerning changes to bus service and bus stops during construction activities

c. Avoidance and Minimization

Measures to maintain access to neighborhoods and community facilities would include:

- Property acquisition activities, including relocations, will be performed in accordance with the US Department of Transportation (USDOT) Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) as amended and FTA Circular 5010.1D, Grants Management Requirements and all applicable Maryland State laws that establish the process through which MTA may acquire real property through a negotiated purchase or through condemnation.
- Communicating with the public in advance to notify them of partial sidewalk or street closures and other related actions; and,
- Enacting measures to minimize dust and noise and vibration associated with construction activities.

d. Mitigation

Mitigation measures will be incorporated throughout the project to minimize the impacts to the community. A list of mitigation efforts include:

- MTA will develop and present to the adjacent communities alternative aesthetic treatments for the OMF that address visual impacts and shall consider the comments of those communities when determining the final design
- MTA will seek community input regarding the aesthetic treatments of ancillary facilities and tunnel portals along the project alignment to address visual impacts
- MTA will seek input from community organizations and businesses regarding methods to maintain access to neighborhoods, community facilities, and businesses during construction
- MTA will develop a Tree Protection Plan to protect existing tree buffers and street trees where disturbance is not required for construction
- MTA will prepare a Landscape Plan for all facilities, including park-and-ride facilities
- MTA will design lighting to minimize light pollution to the surrounding areas
- Disturbance to park properties as a result of construction activities, including areas requiring grading, will be restored to acceptable conditions through coordination with the park owners
- Roadway or sidewalk closures will be staged to maintain pedestrian and vehicular access to parks
- MTA will implement measures to minimize construction-phase air quality emissions. Such measures could include the following:
    - Minimizing land disturbance
    - Implementing dust control measures in accordance with the Maryland Department of the Environment (MDE) requirements

  - Using emission control devices, such as diesel particulate filters, for up to 80 percent of applicable construction equipment
  - Covering trucks when transporting excavated materials or other loose materials
  - Using ultra-low sulfur diesel fuel for diesel equipment
- For areas identified with moderate or severe impacts for noise during LRT operations, MTA will identify mitigation measures where practicable and reasonable during final design
- For areas identified with the potential for vibration impacts during LRT operations, MTA will identify mitigation measures that are both feasible and reasonable during final design
- MTA will provide noise and vibration control measures during construction whenever feasible and reasonable in accordance with applicable local and MDE noise ordinances. Such measures could include the following:
  - Construction methods that avoid pile-driving at locations containing noise- and vibration-sensitive receptors, such as residences, schools, and hospitals. Whenever possible, cast in place drilled hole (CIDH) or drilled piles rather than impact pile drivers will be used to reduce excessive noise and vibration
  - Development and implementation of a vibration monitoring program during construction.
  - Where practical, erect temporary noise barriers between noisy construction activities and noise-sensitive receptors.
  - Locate construction equipment and material staging areas away from sensitive receptors, where applicable.
  - Use best available control technologies to limit excessive noise and vibration when working near residences.
  - Notify the public of construction operations and schedules. Methods such as construction-alert publications or a Noise Complaint Hotline could be used to handle complaints quickly.

5.4 Environmental Justice

5.4.1 Introduction and Methodology

Executive Order 12898 – *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations* requires all Federal agencies to "develop an agency-wide environmental justice strategy that identifies and addresses disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." The United States Department of Transportation (USDOT) and the Federal Transit Administration (FTA) policies on environmental justice are included in USDOT Order 5610.2(a), *Final DOT Environmental Justice Order* (USDOT 2012) and in FTA Circular 4703.1, *Environmental Justice Policy Guidance for Federal Transit Administration Recipients* (FTA 2012).

The strategies developed under Executive Order 12898 and the USDOT and FTA policies on environmental justice are intended to ensure that there is no discrimination based on race, color, or national origin; that communities are provided the opportunity to provide input on the planning and design of a project, as well as potential effects and mitigation measures; and that any disproportionately high and adverse effects on minority or low-income populations are appropriately addressed.

The environmental justice (EJ) analysis in this chapter describes the potential human health and environmental effects on minority and low-income neighborhoods that would result from the construction and operation of the Preferred Alternative, and evaluates whether those effects would be disproportionately high and adverse.

a. Definitions of "Minority" and "Low-Income"

Executive Order 12898, itself does not define the terms "minority" or "low-income," but these terms have been defined in the USDOT and FTA orders on environmental justice. The USDOT and FTA Orders provide the following definitions, which have been used in this analysis:

- Minority Individual – The US Census Bureau classifies a minority individual as belonging to one of the following groups: American Indian or Alaskan Native, Asian American, Native Hawaiian or Other Pacific Islander, Black (not of Hispanic Origin), and Hispanic or Latino.
- Minority Populations – Any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed FTA program, policy, or activity.
- Low-Income Individual – A person whose household income is at or below the US Department of Health and Human Services poverty guidelines.
- Low-Income Population – Any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed DOT program, policy, or activity.

b. Identifying Minority and Low-Income Populations in the Project Study Area

As a tool for evaluating the proportionality of impacts and benefits, this analysis identifies "EJ areas" and "non-EJ areas" within the project study corridor. An "EJ area" was defined to include any census tract in which the minority or low-income population meets either of the following thresholds:

a) the minority or low-income population in the census tract exceeds 50 percent, or

b) the percentage of a minority or low-income population in the affected area is "meaningfully greater" than the percentage of minority population in the general population.

For this study, "meaningfully greater" was defined to mean a census tract in which the percentage of minority or low-income residents was at least 10 percentage points more than the corresponding percentage in the surrounding jurisdiction (Baltimore City or Baltimore County) within the project study corridor.

The use of thresholds for identifying EJ areas was based on the Council on Environmental Quality (CEQ) guidance document, *Environmental Justice Guidance under the National Environmental Policy Act* (NEPA) (CEQ 1997). This approach was used in the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS), which identified EJ and non-EJ areas bases on the criteria described above. On August 15, 2012, FTA issued Circular 4703.1, which does not adopt the CEQ's approach and instead calls for EJ analyses to include "reasonable efforts to identify the presence of distinct minority and/or low-income communities residing both within, and in close proximity to, the proposed project, or activity." The guidance also cautions that "While the minority or low-income population in an area may be small, this does not eliminate the possibility of a disproportionately high and adverse effect of a proposed action."

For consistency with the approach used in the AA/DEIS, this Final Environmental Impact Statement (FEIS) continues to identify EJ areas based on a threshold approach. In accordance with Circular 4703.1, this FEIS also considers the potential for EJ populations outside areas identified as "EJ areas."

c. Data Sources

- *Minority Populations*. The US Census 2010 tract level data provided the basis for establishing the location of minority populations in the project study corridor.
- *Low-Income Populations*. Income data was obtained from the American Community Survey (ACS) 2010 5-year estimate at the census tract level.
- Other data sources that were used to confirm the location of minority and low-income populations included information and data from the National Center for Educational Statistics (NCES), government assisted housing programs, historical references, City and County officials, field visits, community meetings and interviews and a review of revitalization efforts within the project study corridor.

5.4.2 Existing Conditions

The project study corridor for the Preferred Alternative includes all or parts of 55 census tracts (47 in Baltimore City and 8 in Baltimore County). The total population in the project study corridor is 162,287 persons, with 117,500 of these persons (72.4 percent) identifying themselves as minorities and 33,798 persons (20.8 percent) meeting the definition of low-income. **Figure 5-4** presents the EJ areas and non-EJ areas within the project study corridor, and also illustrates the 1,000 foot potential impact area beyond the project's limit of disturbance. The impact area was used in the analysis to estimate impacts that extend beyond the limit of disturbance.

Table 5-4 presents a summary of population data including the percentages for minority and low-income persons. The census data revealed that the project study corridor census tracts located within Baltimore County contained a percentage of minority persons (15.5 percent) which is significantly lower than the countywide average of 37.3 percent. For the study area census tracts located in Baltimore City, the minority percentage was 56.9 percent, which is lower than the City average (72 percent).

The project study corridor census tracts located within Baltimore County contained a percentage of low-income persons (1.6 percent) that is significantly lower than the countywide average of 7.9 percent. For the study area census tracts located in Baltimore City, the low-income percentage was 19.2 percent which is lower than the City average (20.5 percent).

Of the 55 census tracts in the project study corridor, 42 census tracts contain minority populations of 50 percent or more and 16 census tracts contain low-income populations of 50 percent or more. Fourteen census tracts met the “meaningfully greater” test for the presence of minority or low-income populations but did not meet the 50 percent threshold. **Table 5-5** and **Figure 5-4** present the census tracts that meet or exceed the EJ thresholds. Forty-three out of 55 census tracts (78 percent) were identified as minority and/or low-income areas using the 50 percent threshold or the “meaningfully greater” threshold criteria for presence of a minority population, a low-income population, or both. These locations were considered EJ areas for the purposes of the impact analysis.

Twelve of the 55 census tracts — located in the Inner Harbor, Fell’s Point, Canton, Canton Industrial Area, Brewers Hill, Greektown and Hopkins Bayview neighborhoods — did not meet the criteria for an “EJ area” based the threshold calculations. However, these areas were reviewed for the presence of minority and low-income populations as defined by USDOT and consistent with the FTA EJ Circular to determine approximate locations and to consider potential effects. The Canton Industrial Area, Greektown and Hopkins Bayview neighborhoods were determined not to have residential dwellings within the analysis area. Potential impacts to EJ populations located in the four other “non-EJ” areas (Inner Harbor, Fell’s Point, Canton and Brewers Hill) are discussed as applicable in the **Section 5.4.4** and **Section 5.4.5**. As used in this chapter, the term “non-EJ area” does not imply the absence of EJ populations living in that area. The distinction between EJ areas and non-EJ areas is used in this report only as one tool for assessing the potential for disproportionate impacts on EJ populations.

Table 5-4: Population Statistics

Category	Maryland	Baltimore City	Baltimore County	Project Study Corridor	Baltimore City portion of Project Study Corridor	Baltimore County portion of Project Study Corridor
Total Population	5,773,552	620,961	805,029	162,287	131,336 (80.9%)	30,951 (19.1%)
White Alone[1]	3,157,958 (54.7%)	174,120 (28.0%)	504,556 (62.7%)	44,787 (27.6%)	38,944 (24.0%)	5,843 (3.6%)
Black Alone[1]	1,674,229 (29.0%)	392,938 (63.3%)	206,913 (25.7%)	97,314 (60.0%)	77,346 (47.7%)	19,968 (12.3%)
Asian Alone[1]	316,694 (5.5%)	14,397 (2.3%)	39,865 (5.0%)	5,751 (3.5%)	3,411 (2.1%)	2,340 (1.4%)
Other Alone[1,2]	28,199 (0.5%)	3,018 (0.5%)	3,807 (0.5%)	917 (0.6%)	743 (0.5%)	174 (0.1%)
2 or more races Alone[1]	125,840 (2.2%)	10,528 (1.7%)	16,153 (2.0%)	2,810 (1.7%)	2,066 (1.3%)	744 (0.5%)
Total Hispanic[3]	470,632 (8.2%)	25,960 (4.2%)	33,735 (4.2%)	10,708 (6.6%)	8,826 (5.4%)	1,882 (1.2%)
Total Minority	**2,615,594 (45.3%)**	**446,841 (72.0%)**	**300,473 (37.3%)**	**117,500 (72.4%)**	**92,392 (56.9%)**	**25,108 (15.5%)**
Low-Income Persons[4,5]	**476,732 (8.3%)**	**127,590 (20.5%)**	**63,465 (7.9%)**	**33,798 (20.8%)**	**31,136 (19.2%)**	**2,662 (1.6%)**

Notes: [1] These categories do not include Hispanic or Latino individuals
[2] Other includes American Indian/ Alaskan Native, Native Hawaiian and Other Pacific Islander and some other race alone
[3] Hispanic can be any race
[4] Poverty status is determined for all people except institutionalized people, people in military group quarters, people in college dormitories, and unrelated individuals under 15 years old (American Fact Finder, factfinder.census.gov).
[5] Because of the unavailability of Poverty data from the 2010 US Census, current poverty status data has been derived from the American Community Survey (ACS), 5-Year Estimate. Please note that ACS data has a margin of error and does not cover 100 percent of the geographies used for this report.

Source: US Census 2010, 2010 American Community Survey– 5-Year Estimate

5.4.3 Future No-Build Conditions

The No-Build Alternative would consist of a future scenario with no changes to transportation services or facilities within the project study corridor, beyond the projects that are included in the Baltimore region's financially constrained long-range transportation plan (CLRP), *Plan It 2035*.

Most of the impact analyses in this FEIS identified few effects to EJ populations under the No-Build Alternative. However, the results of the EJ analysis showed there would be negative effects under the No-Build Alternative, in comparison to existing conditions with regard to delays at intersections, as well as travel times throughout the project study corridor. Under the No-Build Alternative, the overall traffic levels-of-service (LOS) would worsen from the existing conditions throughout the entire project study corridor, including those within EJ areas, as a result of traffic volume growth in the region between 2011 and 2035. In addition, travel times are expected to increase under the No-Build Alternative, and mobility is expected to decrease within the project study corridor. The current roadway and transit systems would not be able to accommodate the population growth associated with the new development; therefore, service levels are expected to worsen. In addition, under the No-Build Alternative, EJ populations would not benefit from enhanced access to transit that would be associated with the implementation of the Preferred Alternative. As such, transit dependent EJ populations would continue to endure long commutes in the east-west direction and increased headways for transit trips.

5.4.4 Preferred Alterantive

The Preferred Alternative is expected to be constructed and in service by 2021. This section identifies long-term operational effects of the Preferred Alternative relative to Design Year 2035 on EJ populations.

a. Long-Term Effects from Property Acquisition

Property impacts are assessed by determining if a transportation improvement requires the purchase of land outside of existing public right-of-way or includes easement on the property. Any property that is acquired in full, or a property where the access is eliminated because of the Preferred Alternative, is considered a displacement. The Preferred Alternative would require no property acquisitions that result in residential displacements. A total of 23 displacements and 169 partial property acquisitions are required corridor-wide. The 23 displacements all involve non-residential properties. Of the 169 partial property acquisitions corridor-wide, 101 are residential properties. Of the 101 residential partial acquisitions required, 97 properties are located in EJ areas. Eighty-seven of these properties are along Edmondson Avenue between Wildwood Parkway and North Hilton Street, and ten of the properties are along West Franklin Street, and involve “sliver takes” totaling 7,321 square feet, and average of 84 square feet per property. The majority of the partial residential acquisitions required in EJ neighborhoods are from single-family residential properties or single-family properties that may have been converted to multi-family units.

In most cases, the property acquired in EJ areas for the partial acquisitions would consist of a narrow strip or “sliver” of land along the edge of the alignment of the Preferred Alternative and would necessitate the reconfiguration of existing front yards, and/or steps in several EJ areas. The two neighborhoods with the highest number of such impacts are the Allendale and Edmondson Village neighborhoods (Census Tracts 1608.01, 1608.02 and 2007.01). These impacts include the partial acquisition of 87 residential properties along Edmondson Avenue between Wildwood Parkway and North Hilton Street. Ten additional partial property acquisitions would be required along West Franklin Street in the Rosemont Homeowners/Tenants neighborhood (Census Tract 1605.00). The property would be used to provide a dedicated lane for the Preferred Alternative along Edmondson Avenue.

Twelve non-residential displacements along North Franklintown Road, which likely include minority-owned businesses and property owned by government and institutional entities, are required to construct the guideway and the operations and maintenance facility (OMF). One of these 12 parcels currently houses a daycare facility and a restaurant.

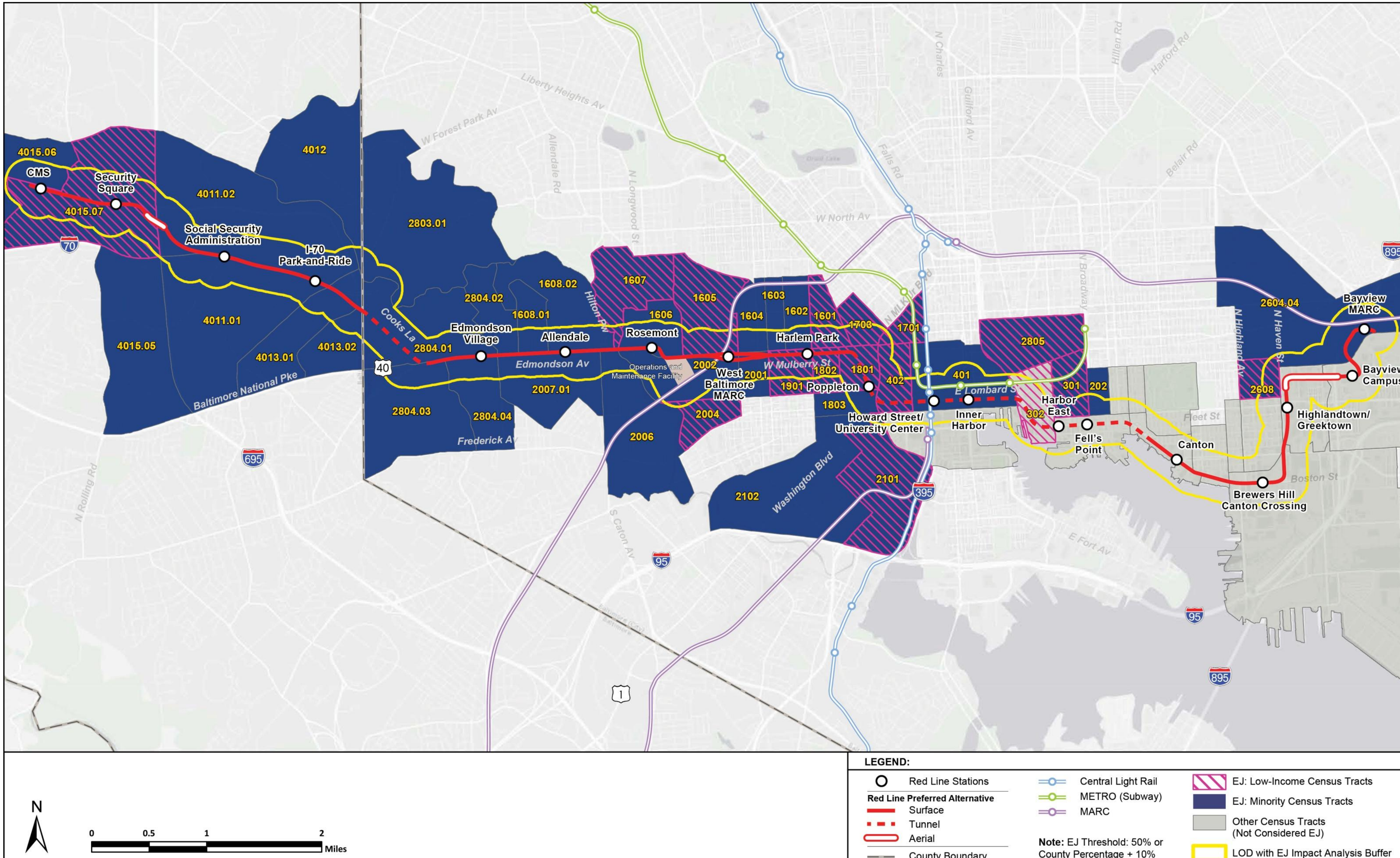


Figure 5-4: Environmental Justice Areas within the Project Study Corridor

Table 5-5: Project Study Corridor Census Tracts that Meet Environmental Justice Category Definitions

Census Tract	Total	White	% White	Black or African American	% Black or African American	Asian	% Asian	Other	% Other	Two or More Races	% Two or More Races	Hispanic	% Hispanic	Jurisdiction Total Minority %	Total Minority	Total Minority %	EJ Category: Minority	Jurisdiction Total Low-Income %	Census Tract Low-Income%	EJ Category: Low Income	Jurisdiction
0202.00	2,087	901	43.2%	300	14.4%	132	4.4%	14	0.7%	40	1.9%	700	33.5%	72.0%	1,186	56.8%	Yes	20.5%	22.0%	No	Baltimore City
0301.00	3,065	349	11.4%	2,349	76.6%	83	2.7%	22	0.7%	42	1.4%	220	7.2%	72.0%	2,716	88.6%	Yes	20.5%	49.8%	Yes	Baltimore City
0302.00	2,342	1,193	50.9%	784	33.5%	165	5.5%	9	0.4%	44	1.9%	147	6.3%	72.0%	1,149	49.1%	No	20.5%	35.4%	Yes	Baltimore City
0401.00	4,006	1,844	46.0%	968	24.2%	830	27.5%	29	0.7%	110	2.7%	225	5.6%	72.0%	2,162	54.0%	Yes	20.5%	26.3%	No	Baltimore City
0402.00	838	371	44.3%	238	28.4%	168	5.6%	4	0.5%	36	4.3%	21	2.5%	72.0%	467	55.7%	Yes	20.5%	59.0%	Yes	Baltimore City
1601.00	2,388	34	1.4%	2,280	95.5%	12	0.4%	3	0.1%	26	1.1%	33	1.4%	72.0%	2,354	98.6%	Yes	20.5%	49.5%	Yes	Baltimore City
1602.00	2,515	26	1.0%	2,424	96.4%	8	0.3%	9	0.4%	39	1.6%	9	0.4%	72.0%	2,489	99.0%	Yes	20.5%	30.9%	Yes	Baltimore City
1603.00	1,558	27	1.7%	1,503	96.5%	0	0.0%	3	0.2%	9	0.6%	16	1.0%	72.0%	1,531	98.3%	Yes	20.5%	20.0%	No	Baltimore City
1604.00	2,525	21	0.8%	2,453	97.1%	9	0.3%	7	0.3%	26	1.0%	9	0.4%	72.0%	2,504	99.2%	Yes	20.5%	28.3%	No	Baltimore City
1605.00	4,245	21	0.5%	4,113	96.9%	5	0.2%	15	0.4%	57	1.3%	34	0.8%	72.0%	4,224	99.5%	Yes	20.5%	34.5%	Yes	Baltimore City
1606.00	3,509	23	0.7%	3,388	96.6%	11	0.4%	8	0.2%	27	0.8%	52	1.5%	72.0%	3,486	99.3%	Yes	20.5%	21.5%	No	Baltimore City
1607.00	5,615	32	0.6%	5,433	96.8%	4	0.1%	16	0.3%	84	1.5%	46	0.8%	72.0%	5,583	99.4%	Yes	20.5%	42.4%	Yes	Baltimore City
1608.01	3,281	25	0.8%	3,169	96.6%	2	0.1%	3	0.1%	56	1.7%	26	0.8%	72.0%	3,256	99.2%	Yes	20.5%	14.9%	No	Baltimore City
1608.02	3,045	21	0.7%	2,955	97.0%	1	0.0%	22	0.7%	24	0.8%	22	0.7%	72.0%	3,024	99.3%	Yes	20.5%	22.8%	No	Baltimore City
1701.00	1,602	309	19.3%	1,180	73.7%	30	1.0%	7	0.4%	34	2.1%	42	2.6%	72.0%	1,293	80.7%	Yes	20.5%	39.4%	Yes	Baltimore City
1703.00	2,011	17	0.8%	1,909	94.9%	18	0.6%	9	0.4%	27	1.3%	31	1.5%	72.0%	1,994	99.2%	Yes	20.5%	45.6%	Yes	Baltimore City
1801.00	2,200	18	0.8%	2,127	96.7%	2	0.1%	6	0.3%	23	1.0%	24	1.1%	72.0%	2,182	99.2%	Yes	20.5%	38.4%	Yes	Baltimore City
1802.00	977	55	5.6%	903	92.4%	2	0.1%	3	0.3%	8	0.8%	6	0.6%	72.0%	922	94.4%	Yes	20.5%	40.0%	Yes	Baltimore City
1803.00	1,909	574	30.1%	1,184	62.0%	45	1.5%	13	0.7%	38	2.0%	55	2.9%	72.0%	1,335	69.9%	Yes	20.5%	30.4%	No	Baltimore City
1901.00	1,895	30	1.6%	1,747	92.2%	2	0.1%	15	0.8%	24	1.3%	77	4.1%	72.0%	1,865	98.4%	Yes	20.5%	39.9%	Yes	Baltimore City
2001.00	1,846	32	1.7%	1,745	94.5%	2	0.1%	7	0.4%	30	1.6%	30	1.6%	72.0%	1,814	98.3%	Yes	20.5%	23.4%	No	Baltimore City
2002.00	2,969	36	1.2%	2,876	96.9%	6	0.2%	13	0.4%	26	0.9%	12	0.4%	72.0%	2,933	98.8%	Yes	20.5%	31.1%	Yes	Baltimore City
2004.00	1,691	44	2.6%	1,611	95.3%	4	0.1%	4	0.2%	20	1.2%	8	0.5%	72.0%	1,647	97.4%	Yes	20.5%	48.1%	Yes	Baltimore City
2006.00	2,713	706	26.0%	1,879	69.3%	19	0.6%	8	0.3%	39	1.4%	62	2.3%	72.0%	2,007	74.0%	Yes	20.5%	26.4%	No	Baltimore City

Table 5-5: Project Study Corridor Census Tracts that Meet Environmental Justice Category Definitions

Census Tract	Total	White	% White	Black or African American	% Black or African American	Asian	% Asian	Other	% Other	Two or More Races	% Two or More Races	Hispanic	% Hispanic	Jurisdiction Total Minority %	Total Minority	Total Minority %	EJ Category: Minority	Jurisdiction Total Low-Income %	Census Tract Low-Income%	EJ Category: Low Income	Jurisdiction
2007.01	4,619	22	0.5%	4,517	97.8%	6	0.2%	10	0.2%	34	0.7%	30	0.6%	72.0%	4,597	99.5%	Yes	20.5%	13.1%	No	Baltimore City
2101.00	2,130	818	38.4%	1,108	52.0%	66	2.2%	18	0.8%	54	2.5%	66	3.1%	72.0%	1,312	61.6%	Yes	20.5%	34.8%	Yes	Baltimore City
2102.00	3,373	1,331	39.5%	1,590	47.1%	226	7.5%	20	0.6%	83	2.5%	123	3.6%	72.0%	2,042	60.5%	Yes	20.5%	19.8%	No	Baltimore City
2604.04	1,996	534	26.8%	576	28.9%	78	2.6%	29	1.5%	42	2.1%	737	36.9%	72.0%	1,462	73.2%	Yes	20.5%	17.2%	No	Baltimore City
2608.00	2,647	1,053	39.8%	456	17.2%	44	1.5%	30	1.1%	58	2.2%	1,006	38.0%	72.0%	1,594	60.2%	Yes	20.5%	36.8%	Yes	Baltimore City
2803.01	4,101	335	8.2%	3,601	87.8%	19	0.6%	26	0.6%	43	1.0%	77	1.9%	72.0%	3,766	91.8%	Yes	20.5%	20.0%	No	Baltimore City
2804.01	3,565	491	13.8%	2,956	82.9%	22	0.7%	9	0.3%	45	1.3%	42	1.2%	72.0%	3,074	86.2%	Yes	20.5%	12.7%	No	Baltimore City
2804.02	1,574	14	0.9%	1,515	96.3%	3	0.1%	4	0.3%	15	1.0%	23	1.5%	72.0%	1,560	99.1%	Yes	20.5%	6.9%	No	Baltimore City
2804.03	5,073	1,273	25.1%	3,551	70.0%	52	1.7%	31	0.6%	92	1.8%	74	1.5%	72.0%	3,800	74.9%	Yes	20.5%	8.4%	No	Baltimore City
2804.04	2,267	112	4.9%	2,100	92.6%	7	0.2%	10	0.4%	19	0.8%	19	0.8%	72.0%	2,155	95.1%	Yes	20.5%	21.4%	No	Baltimore City
2805.00	3,549	245	6.9%	3,041	85.7%	111	3.7%	15	0.4%	40	1.1%	97	2.7%	72.0%	3,304	93.1%	Yes	20.5%	53.9%	Yes	Baltimore City
4011.01	6,487	1,343	20.7%	4,203	64.8%	315	10.4%	28	0.4%	142	2.2%	456	7.0%	37.3%	5,144	79.3%	Yes	7.9%	4.1%	No	Baltimore County
4011.02	962	147	15.3%	671	69.8%	78	2.6%	4	0.4%	22	2.3%	40	4.2%	37.3%	815	84.7%	Yes	7.9%	9.6%	No	Baltimore County
4012.00	3,270	721	22.0%	2,276	69.6%	35	1.2%	12	0.4%	87	2.7%	139	4.3%	37.3%	2,549	78.0%	Yes	7.9%	7.0%	No	Baltimore County
4013.01	3,891	777	20.0%	2,751	70.7%	98	3.2%	19	0.5%	55	1.4%	191	4.9%	37.3%	3,114	80.0%	Yes	7.9%	7.0%	No	Baltimore County
4013.02	2,650	365	13.8%	2,136	80.6%	25	0.8%	17	0.6%	36	1.4%	71	2.7%	37.3%	2,285	86.2%	Yes	7.9%	8.8%	No	Baltimore County
4015.05	4,039	1,292	32.0%	1,802	44.6%	490	16.2%	37	0.9%	105	2.6%	313	7.7%	37.3%	2,747	68.0%	Yes	7.9%	7.5%	No	Baltimore County
4015.06	4,523	569	12.6%	3,193	70.6%	385	12.7%	21	0.5%	145	3.2%	210	4.6%	37.3%	3,954	87.4%	Yes	7.9%	4.0%	No	Baltimore County
4015.07	5,129	629	12.3%	2,936	57.2%	914	30.2%	36	0.7%	152	3.0%	462	9.0%	37.3%	4,500	87.7%	Yes	7.9%	20.3%	Yes	Baltimore County

Source: US Census 2010

The project would require permanent subsurface easements for the Cooks Lane and downtown tunnel sections of the alignment. These subsurface easements include 75 properties located in the West Hills, Hunting Ridge, Poppleton, and downtown neighborhoods, which are located in Census Tracts 2804.01, and 1801.00, 1802.00 and 1401.00, respectively.

During the acquisition process impacts to minority business owners and residents would be determined and addressed throughout the corridor. As stated above, 97 of the 102 residential partial acquisitions required for the Preferred Alternative are located in EJ areas. Although entrances and steps would be re-constructed at these locations, land parcels purchased would become part of the public right-of-way for transportation use.

Property acquisition activities will be performed in accordance with the USDOT Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) as amended and FTA Circular 5010.1D, Grants Management Requirements and all applicable Maryland State laws that establish the process through which MTA may acquire real property through a negotiated purchase or through condemnation.

b. Long-Term Effects on Neighborhood Cohesion and Isolation

The Preferred Alternative would improve accessibility and, in turn, encourage more pedestrian and bicycle travel. The stations are strategically located along existing thoroughfares and would create an activity node within the community, not a means of isolation. In addition, the Red Line stations have been planned to encourage redevelopment around station areas in an effort to create a sense of place in local neighborhoods.

Normal surface operation of the Preferred Alternative would not impact neighborhood cohesion. In areas where fencing and guardrails are required for safety reasons around the guideway and as part of the station design, pedestrian crossing areas would be included. These increased mobility options are a benefit to EJ neighborhoods and will help to promote cohesion and reduce isolation.

c. Long-Term Effects on the Roadway Network

To construct the Preferred Alternative with minimal property impacts, the number of traffic lanes must be reduced along 13 roadway pairs or segments. This reduction would allow for transit to operate in exclusive lanes. Lane closures traversing 19 EJ areas along 12 of these roadway pairs or segments on Security Boulevard, I-70, Edmondson Avenue, West Franklin Street, Franklintown Road, and the US 40 “lower level segment” generally result in the net loss of one travel lane in the east or westbound direction. Travel lanes (ranging from one to three lanes in each direction) would be maintained after the reduction of the above noted travel lanes in these areas. These impacts serve to improve transit operations through the provision of a dedicated travel lane and provide a travel time advantage to transit vehicles.

d. Long-Term Effects on Traffic Volumes and Travel Time

Travel demand forecasts were developed for roadways in the project study corridor. In general, traffic volumes on roadways are projected to be lower under the Preferred Alternative than under the No Action Alternative in 2035. The Preferred Alternative would decrease traffic volumes on most roadways because some trips would shift from automobile to the Red Line, and because the reduction in the number of lanes with the Preferred Alternative may cause some automobile trips to shift to other roadways. However, the Preferred Alternative would increase average daily traffic volumes in four of the 19 locations analyzed in the project study corridor. Three of those four locations are in EJ areas. **Table 5-6** presents the three roadway segments where there would be net increases in average daily traffic volumes in EJ areas.

While increases in roadway traffic are projected in three EJ areas under the Preferred Alternative, the amount of the projected increase is small (3 to 4 percent) in two of those areas; in the third, the amount is larger (30 percent), but that increase occurs on an Interstate (I-70), not a residential street. Additionally, the No-Build would increase traffic volumes in 12 EJ areas, an even greater number than would be affected under the Preferred Alternative.

Table 5-6: Average Daily Traffic under the Existing, 2035 No-Build, and the Preferred Alternative

Location	Existing (2011) (1)	No-Build (2035) (2)	Percent Growth (1) vs. (2)	Preferred Alternative (3)	Percent Growth (2) vs. (3)
I-70, East of I-695 (Gwynn Oak neighborhood, Census Tract 4011.02)	25,000	34,500	+38%	45,000	+30%
Frederick Avenue west of Hilton Drive (Edmondson Village neighborhood, Census Tract 1608.01)	15,000	17,000	+13%	17,500	+3%
President Street, north of Lombard Street (Downtown neighborhood, Census Tract 0401.00)	35,000	34,500	-1%	36,000	+4%

Decreases in auto travel time by 50 percent or more are anticipated to occur at nine of the 11 locations analyzed in AM peak hour. Decreases in the AM peak hour occur in the following EJ areas:

- Martin Luther King, Jr. Boulevard between US 40 and Lombard Street (-61 percent in eastbound direction); Poppleton neighborhood (Census Tracts 402.00, 1803.00 and 1801.00)
- President Street between Pratt Street and Fleet Street (-50 percent in northbound direction); Little Italy neighborhood (Census Tract 301.00)

An increase in auto travel time by 50 percent or more is expected to occur during the AM peak hour at only one location, which is in the EJ Area listed below:

- President Street between Pratt Street and Fleet Street (+175 percent in southbound direction); Little Italy neighborhood (Census Tract 301.00)

There are no predicted decreases in auto travel time by in the PM peak hour. However, increases in auto travel time by 50 percent or more in the PM peak hour are anticipated to occur at three locations within the project study corridor. All of these locations are in EJ areas as follows:

- Parallel Drive from Woodlawn Drive to Ingleside Avenue (+143 percent in westbound direction); Gwynn Oak neighborhood (Census Tract 4011.02). This may be a result of the change in travel patterns along Parallel Drive, because of the relocation of the I-70 Park-and-Ride and the implementation of the Preferred Alternative.
- Franklin Street between Edmondson Avenue and Pulaski Street (+58 percent in westbound direction); Penrose/Fayette Street Outreach, Rosemont Homeowners/Tenants and Mosher neighborhoods (Census Tracts 2001.00, 2002.00, 1605.00, 1606.00)
- President Street between Pratt Street to Fleet Street (+55 percent in westbound direction); Little Italy neighborhood (Census Tract 301.00)

While impacts to traffic volumes and travel time are experienced in six locations in EJ areas, these impacts would be experienced by all travelers who pass through those areas and not just by residents of the EJ areas. These impacts are also the result of providing dedicated travel lanes for the light rail vehicles; the light rail service provides a benefit to residents of the EJ areas.

e. Long-Term Effects on Levels-of-Service

Overall, of the 156 signalized and unsignalized intersections identified under the build condition, the Preferred Alternative would reduce the total number of failing intersections compared with the No-Build Alternative. A total of 16 intersections in the AM peak and 17 intersections in the PM peak periods would decrease in LOS in comparison to No-Build condition. However, 31 intersections in the AM peak and 20 intersections in the PM peak would improve in the build condition when compared to the No-Build condition. All but 10 of these improved intersections are located in EJ areas; three locations in the AM peak and seven locations in the PM peak hour. Congestion at unsignalized intersections would decrease under the Preferred Alternative, with the exception of the Parallel Drive access point to the Social Security Administration (SSA) parking lot. LOS is generally improved over existing conditions throughout the project study corridor.

f. Long-Term Effects on Parking

The Preferred Alternative would not affect parking associated with truck loading zones or passenger loading zones in EJ areas. The project would result in an increase in parking spaces in many EJ areas. An additional 1,134 parking spaces would be located at the Security Square Mall, I-70 and Brewers Hill/Canton Crossing park-and-ride lots, which would be constructed as part of the Preferred Alternative. In addition, the planned expansion of park-and-ride lots at the West Baltimore and the Bayview MARC stations are currently programmed and would add another 985 parking spaces. A total 741 parking spaces would be eliminated as part of the Preferred Alternative. Of those 741 spaces, 361 could be accommodated by offsetting parking in adjacent areas.

A total of 551 parking spaces would be eliminated in EJ areas, however 150 of these are located at the SSA West parking lot (30 parking spaces) and a City-owned parking garage at the First

Mariner Arena on Lombard Street (120 parking spaces). Of the 401 remaining parking spaces that are located in commercial, industrial or residential areas, 191 parking spaces located in EJ areas cannot be accommodated by nearby parking locations. The areas where the highest number of permanent parking impacts occur are located along US 40/Edmondson Avenue (Rognel Heights, Edmondson Village, Allendale and the Franklintown Road neighborhoods; Census Tracts 2804.02, 1608.01 and 1608.02, 2007.01, 2006.00, 1606.00) where 58 spaces would be lost and along Calverton Road near the OMF site (Penrose/Fayette Street Outreach (2002.00) where 105 spaces would be lost. The total number of spaces that cannot be accommodated by nearby parking spaces in EJ areas is 221 parking spaces.

The Boston Street corridor was reviewed to determine specific impacts to EJ populations and none were identified. Along Boston Street 72 parking spaces would be permanently eliminated, and another 54 spaces would be eliminated at local businesses and a City owned parking lot.

g. Long-Term Effects on Public Transit

The project study corridor contains 23 bus routes that either cross or operate parallel to the Preferred Alternative. All of the bus routes traverse EJ areas and serve EJ populations. Four of the top ten bus routes (based on the number of daily riders) in the Baltimore region operate within the project study corridor. Because of the large number of existing bus routes, the majority of the routes in the feeder bus network required to serve the Red Line are already in place.

Overall improved transit connectivity is a significant benefit to EJ populations throughout the project study corridor who tend to be more transit dependent as compared to the general population. The headways in the peak period for transit trips from Centers for Medicare & Medicaid Services (CMS) to the Bayview MARC station via the existing transit network would decrease from 10 minutes to 7 minutes and off peak headways would decrease from 20 to 30 minutes to 10 minutes in year 2035. The public transit improvements are a benefit to EJ populations.

h. Long-Term Effects on Neighborhood Character and Aesthetics

Impacts on neighborhood character and aesthetics are assessed by determining where the Preferred Alternative would add new elements to or remove existing features from the visual environment and where the options would result in substantial changes to the existing character. The Preferred Alternative contains the following elements that would alter the visual environment: at-grade and aerial transitway alignments; tunnel portals and tunnel ventilation facilities, light rail vehicles; stations; traction power substation (TPSS) locations; the OMF; and parking lots. The potential effect on the visual quality of the surrounding environment was rated to determine the range of effect and a summary is presented in **Table 5-7**. An impact rating of “low,” “medium,” or “high” was assigned to each location based on the following criteria:

- Low impact: does not obstruct the existing viewshed from residential, commercial or institutional properties; not adjacent to primary pedestrian route, public space or platform;

- Medium impact: visible from some residential, commercial or institutional properties but is either not on a primary roadway/pedestrian route or is in an area of already compromised visual impact; not adjacent to public space; and
- High impact: adjacent to residential, commercial, or institutional properties; highly visible from primary roadway, retail locations, public space, or residences; highly visible from station platform or primary pedestrian route.

Table 5-7: Summary of Visual Effects in EJ Areas

Census Tract	Neighborhood	Overall Visual Impact Rating	Summary of Contributing Visual Elements
4015.07	Windsor Mill	Low to Medium	Central Instrument house (CIH) (medium), Overhead catenary system (OCS) Poles, street fixtures, TPSS-1 (medium), Security Mall Station
4011.01	Gwynn Oak	Medium to High	OCS Poles, Social Security Station, ramps and stairs to station, TPSS-3, CIH, aerial structure over I-695
4013.01	Gwynn Oak	High	Cooks Lane Portal-west, I-70 reconfiguration , park-and-ride lot, TPSS-4, CIH
2804.01	West Hills and Hunting Ridge	Low	Underground tunnel section
2804.01	Hunting Ridge	Low to High	TPSS-5 (high), CIH (high), Cooks Lane Portal-east, OCS Poles, Street fixtures, guideway, Edmondson Avenue Station
2007.01	Allendale	Low	TPSS-6, OCS Poles, Street fixtures, guideway
2002.00	Penrose/Fayette Street Outreach	Medium to High	OMF Facility, OCS Poles, guideway
1603.00 and 1601.00, 0402.00	Harlem Park	Medium to High	TPSS-9 and 10 (high), station platform and entrance structures, guideway, CIH
1801.00, 1803.00, 0401.00	Poppleton, Hollins Market, downtown	Medium	Station entrances (canopies, escalators and stairs), ancillary structures (ventilation shafts, slurry plants, service rooms etc.)

i. Long-Term Effects on Community Facilities and Services

The Preferred Alternative would not displace any community facilities. All major routes providing access to these community services would remain open after the completion of the project.

j. Long-Term Effects on Air Quality

Potential air quality impacts as a result of the construction of the Preferred Alternative were analyzed at the regional, local, and spot level for the project. The air quality analysis was completed to conform to the requirements of the Clean Air Act of 1990 and the Federal Transportation Conformity Rule along with various Maryland Department of the Environment (MDE) standards. Volatile organic compounds (VOC) and nitrogen oxides (NO_x) were evaluated at the regional level; carbon monoxide (CO), ozone (O_3), particulate matter ($PM_{10}$and $PM_{2.5}$) and mobile source air toxins (MSAT) were analyzed a the regional and local level.

Regional emissions under the Preferred Alternative are expected to be reduced 1.5 to 1.9 percent in comparison to the No-Build condition for CO, NO_x, VOC, $PM_{10,}$ and $PM_{2.5}$. In addition, CO concentrations under the Preferred Alternative would not violate the National Ambient Air Quality Standards. For $PM_{2.5}$, hot-spot analysis was conducted however; the use of electric powered light rail vehicles would reduce the overall bus trips by 1 percent thus resulting in no CO impacts within the project study corridor and the region at this time. The potential for MSAT effects were analyzed and determined to be lower under the Preferred Alternative in comparison to the No-Build Alternative because of the implementation of existing emissions control measures and offsets under the build scenario.

An analysis was competed for the OMF (Census Tract 2002.00, Penrose/Fayette Outreach neighborhood). The analysis included the potential air quality effects because of emissions from facility via on-site operations and maintenance; no significant impacts were identified.

k. Long-Term Effects on Noise and Vibration

The operational impacts of the Red Line were evaluated using the guidelines set forth by the FTA's *Transit Noise and Vibration Assessment* and the Federal Highway Administration's (FHWA) *Noise Abatement Criteria* and State Highway Administration guidelines were applied to assessment of noise impacts because of the I-70 realignment and all potential mitigation measures.

Operational Noise

Three noise-and vibration-sensitive land use categories were evaluated for this project and included historic land marks (FTA Category 1), residential (FTA Category 2) and institutional facilities (FTA Category 3). The loudness, or magnitude, of noise determines its intensity and is measured in decibels (dB) that can range from below 40 dB (the rustling of leaves) to over 100 dB (a rock concert). To determine the existing background noise levels at sensitive receptors in the vicinity of the proposed transit rail corridor, noise-monitoring was conducted at 28 representative locations throughout the corridor. The measured day-night noise levels along the project study corridor range from 54 dBA to 79 dBA. Measured peak-hour noise levels at institutional receptors along the project study corridor range from 58 dBA to 69 dBA. Future noise levels under the No-Build Alternative are anticipated to be similar to those under existing conditions. Of the 28 sites analyzed three locations resulted in a *moderate* impact as summarized in **Table 5-8**.

Table 5-8: Summary of Noise Impacts

Receptor		Land Use		Noise	Existing	Preferred Alt	FTA Criteria[1]		Total
ID	Description	Type[3]	FTA	Metric	Noise	Noise[2]	"Moderate"	"Severe"	Noise
M14	W. Franklin St at Franklintown Rd	RES	2	L_{dn}	77	**66**	65	75	77
M15	W. Mulberry St at Smallwood St	RES	2	L_{dn}	73	**65**	65	72	74
M26	Boston St at Conklin St	RES	2	L_{dn}	67	**63**	62	68	69

Notes: [1] FTA criteria include *moderate* and *severe* impact categories
[2] *Moderate* impacts under the Preferred Alternative are bold and shaded for clarity.
[3] Land use types include single- or multi-family residences (RES), schools (SCH), churches (CHU), medical facilities (MED), and motels (MTL).

Source: Noise & Vibration Technical Report, 2012

Noise impacts at the 28 noise monitoring locations were used to characterize noise impacts from the Preferred Alternative at over 1,500 receptors along the Preferred Alternative. As a result of this evaluation, corridor-wide project noise exposure levels along the Preferred Alternative are predicted to exceed the FTA *moderate* impact criteria at 96 residences because of light rail transit (LRT) warning bells and grade crossing bells. Several exceedances were the result of LRT pass-bys. Ninety-one of the 96 predicted *moderate* exceedances occur in EJ areas and are primarily located on Edmondson Avenue at 23 residences in the Edmondson Village neighborhood and 20 residences in the Allendale neighborhood.

On West Franklin Street in the Mosher neighborhood, 29 residences located across the street from the OMF site are predicted to have *moderate* noise impact because of the combined effects from general maintenance activities and the switches. Noise generated by the OMF site is not expected to result in and *severe* impacts at any of the closest receptors in the vicinity of the site because any significant activities (such as wheel truing) would occur indoors.

An FTA *severe* impact criteria rating was identified at one residence on Boston Street in the Canton neighborhood, which is not an EJ area. None of the project noise exposure levels are predicted to exceed the FTA *moderate* or *severe* impact criteria at parks, schools, or medical buildings along the Preferred Alternative. In addition, no exceedances of the FTA noise impact criteria because of the TPSS facilities are predicted at any receptors along the Preferred Alternative. Additionally, it is anticipated fan plant operations in the future condition would not exceed FTA noise impact criteria. However, impacts from the operation of fan plants would be further analyzed and evaluated during Final Design.

Vibration

The FTA vibration criteria for evaluating ground-borne vibration impacts from train pass-bys at nearby sensitive receptors was used to determine potential impacts. FTA criteria use three designations to distinguish the intensity of vibration impacts for projects. *Frequent* events category is defined as more than 70 events per day. Similarly, the *occasional* events category is defined as between 30 and 70 events per day while the *infrequent* events category is defined as less than 30 events per day. To describe the human response to vibration, the average vibration amplitude (called the root mean square, or RMS, amplitude) is used to assess impacts. The RMS velocity level is expressed in inches per second or VdB. In general, the vibration threshold of human perceptibility is approximately 65 VdB.

Vibration-monitoring was conducted at 14 representative locations including two medical laboratories throughout the project study corridor. Vibration measurements documented existing vehicular traffic along local streets and arterials in the vicinity the identified receptors. Average vibration levels from existing transportation sources at all sites ranged from 0.01 inches per second (ips) for car pass-bys to 0.05 ips for truck pass-bys. Future vibration levels under the No-Build condition are expected to be similar to those currently experienced under existing conditions. One exceedance was assessed because of LRT pass-by at the location of a hotel adjacent to Security Boulevard.

None of the project noise exposure levels at parks, schools are predicted to exceed the FTA *frequent* impact criteria along the Preferred Alternative. Corridor-wide vibration levels are predicted to exceed the FTA *frequent* criterion of 72 VdB at 45 residences. Many of these impacts are because of the proximity of residences to proposed switches. Twenty-seven of the 45 predicted exceedances occur along West Franklin Street (Census Tract 2002.00 Penrose/Fayette Street Outreach neighborhood) across from the OMF site. Ground-borne noise levels are also predicted to exceed the FTA *frequent* criterion of 35 dBA at 29 residences of the 45 total ground-borne noise exceedance locations in the same area.

Overall, operational noise and vibration impacts would not result in a *severe* impact in EJ areas under FTA criteria. During Final Design, the MTA will evaluate proposed mitigation measure to determine their effectiveness in reducing noise and vibration impacts.

5.4.5 Short-Term Construction Effects and Mitigation

This section identifies short-term construction effects during construction of the Preferred Alternative on EJ populations for a total of about 4 to 5 years.

a. Short-Term Effects on Neighborhoods

One source of impacts on the physical footprint in neighborhoods during construction is the location of proposed construction staging areas, which are identified and described in **Chapter 3** of this FEIS. Construction staging areas, also referred to as “laydown areas,” are sites that are used for the storage of materials and equipment, and other construction-related activities, such as assembly of concrete forms and reinforcing steel cages. Field offices for contractors and construction managers would be situated in temporary job site trailers at staging areas or existing office space near the construction areas.

Staging areas are typically fenced and are often lit for security. Staging areas of adequate size and proximity to the alignment are essential to minimize construction traffic through the project study corridor and to provide adequate space and access for construction activities. Because of the dense urban environment of Baltimore, very few vacant parcels are available within close proximity to the proposed alignment that could be used for staging areas.

Staging areas in EJ areas include the following locations: staging areas 1-1, 1-4, and 1-6 (Windsor Mill and Gwynn Oak neighborhoods) encompass portions of the West segment, and would be located within 20 to 200 feet of several residential homes including single family homes, multi-family residential units, and townhouses. Three construction staging areas: 3-1, 3-2 and 3-3 would be located along the US 40 segment (Uplands, Penrose/Fayette Street Outreach and Harlem Park neighborhoods) including locations adjacent to residential areas, but are located within the existing roadway. Construction staging areas 3-2 and 3-3 would be below grade, and are further buffered by retaining walls and a swath of grass on either side.

Construction staging area 4-1 would be located in the Harlem Park neighborhood and adjacent to existing rowhouses, multi-family residences, and an apartment building. Construction stagging areas 4-3, 4-4, 4-5, 4-6 and 4-7 are proposed within Census Tract 0401.00 (Inner Harbor) and are surrounded by commercial, retail, and office uses. One residential apartment building is located approximately 50 feet southeast of staging area 4-7. Construction staging areas 4-8, 4-9 and 4-10 are not in EJ areas but were analyzed to identify specific impacts to EJ populations; no specific EJ populations were located around construction staging areas 4-3 to 4-10. Construction staging areas are proposed to be located in the public right-of-way or on property purchased for the project through easements or permanent acquisition.

Construction of the downtown tunnel would require the use of a temporary Slurry Plant that would be located within the median of US 40 below Franklin and Mulberry Streets. Although the majority of this facility and related operations would be below grade, some portions of the Slurry Plant would project above street level of Mulberry Street and potentially be visible from Heritage Crossing.

The proposed Poppleton Station would also require the use of a temporary Slurry Plant as part of the station construction activities. It is anticipated that this facility would be located adjacent to the proposed station and that temporary construction barriers would be installed to visually screen the facility from nearby land uses.

In the Fell's Point neighborhood (Census Tracts 0201.00 and 0203.00), several commercial properties would be displaced in addition to the temporary relocation (for a period of approximately 12 months) of any occupants of several commercial properties along Fleet Street just east of the Broadway intersection. The upper floors of those buildings include apartments that appear to be occupied as residences. It is unknown if those residents constitute an EJ population. However, there is an emerging Hispanic population within the Broadway corridor. Therefore, it is assumed for purposes of this analysis that the temporary relocations at this location may affect one or more EJ households.

Property acquisition activities, including relocations, will be performed in accordance with the USDOT Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) as amended and FTA Circular 5010.1D, Grants Management Requirements and all applicable Maryland State laws that establish the process through which MTA may acquire real property through a negotiated purchase or through condemnation.

b. Short-Term Effects on Traffic Operations

Construction of the Preferred Alternative would result in temporary short-term impacts to local and regional transportation operations including lane closures, temporary signals, temporary roadway closures, detours, and disruption of traffic during peak and nonpeak times.

Lane and Intersection Closures and Turning Movement Restrictions during Construction

Lane closures and turning movement restrictions are anticipated throughout the project study corridor during construction. In addition, the Preferred Alternative would require that minor intersections be closed for approximately 2 weeks for grade crossing construction. These closures would restrict turning movements from the mainline and turning and through movements on the side streets. Major intersections would not be closed during grade crossing construction because of the potential for major traffic disruption and/or lack of sufficient alternate routes.

For the erection or removal of bridge girders; temporary closures of I-695, Security Boulevard, Janney Street, Kresson Street, CSX, Norfolk-Southern, Oldham Street, Ponca Street, and I-895 would be required. It is anticipated these closures would be short duration and occur overnight.

Roadway Closures during Construction

Maintenance of traffic options would be limited in areas where open-cut and cut-and-cover activities are undertaken. Cut-and-cover activities would occur at the tunnel portal, station, and ventilation facility areas. Because of limited right-of-way and space requirements for equipment and storage, roadway closures are anticipated at several locations. Additionally, short duration, overnight roadway closures may be required for some construction activities, such as erecting girders.

There would be additional congestion and delays in areas of roadway closures, including adjacent parallel streets and cross-streets. Access to local businesses through existing or temporary driveways would be provided where possible; however, there may be some instances where access cannot be maintained. In these cases, other accommodations would be arranged with the property owner.

Levels-of-Service during Construction

To understand the impacts of the lane reductions and closures during construction, LOS at key intersections in the project study corridor were calculated for an assumed peak construction year of 2016. Fourteen of the 24 intersections with “failing” LOS along the project study corridor are located in EJ areas. **Table 5-9** presents the intersections with a LOS “E” or “F” under existing conditions or during the Construction Year in EJ areas.

Table 5-9: 2016 Construction Year Levels-of-Service

Census Tract	EJ Neighborhood	Signalized Intersections	Existing		Construction (2016) LOS	
			AM	PM	AM	PM
4015.07	Windsor Mill	MD 122 (Security Boulevard) at Woodlawn Drive	D	**E**	C	D
4013.01	Gwynn Oak	MD 122 (Security Boulevard) at Ingleside Avenue	**E**	**E**	D	**E**
4011.01	Gwynn Oak	US 40 at Ingleside Avenue	D	**E**	D	**E**
2804.04	Uplands	US 40 at Swann Avenue	B	B	A	C
2002.00	Penrose/Fayette Street Outreach	Mulberry Street at Pulaski Street	**E**	C	C	C
1801.00	Poppleton	West Mulberry Street at Gilmor Street	C	B	**E**	B
		West Mulberry Street at Carey Street	B	B	**E**	B
		West Mulberry Street at Arlington Street	A	B	**F**	A
		Mulberry Street at Martin Luther King, Jr. Boulevard	**F**	C	**F**	**F**
		Martin Luther King, Jr. Boulevard at Saratoga Street	**E**	D	**F**	**E**
		Martin Luther King, Jr. Boulevard at Baltimore Street	C	**E**	D	**F**
0402.00	University of Maryland	Lombard Street at Martin Luther King, Jr. Boulevard	C	**E**	C	**F**
		Lombard Street at Penn Street	B	**E**	B	D
		Lombard Street at Greene Street	C	C	C	**F**
0401.00	Inner Harbor / Downtown	Lombard Street at Howard Street	C	C	B	**F**
		Lombard Street at Hopkins Place	**F**	**F**	**F**	**F**
		Lombard Street at Hanover Street	B	**E**	B	D
		Lombard Street at Light Street	C	**F**	**F**	**F**
		Lombard Street at Calvert Street	C	C	C	**F**
Non-EJ Neighborhoods		Boston Street at Aliceanna Street	B	**E**	C	D
		Boston Street at East Street	A[1]	B[1]	B	**E**
		Boston Street at Clinton Street	D	C	D	D
		Eastern Avenue at Patterson Park Avenue	C	C	**F**	**E**
		O'Donnell Street at Conkling Street	D	D	**F**	**E**
		Total – LOS E OR F	**5**	**10**	**9**	**14**

Note: [1] Unsignalized Intersection in worst approach LOS in the existing condition

Short-term effects to traffic operations during construction would be mitigated through the development of maintenance of traffic (MOT) plans during the Final Design and construction phases of the project. Access to major roadways would be maintained where possible. Closures in the cut-and-cover areas have the potential to impact business owners; however, the use of the MOT plans would provide access to most businesses. Traffic impacts would affect the entire project study corridor.

c. Short-Term Effects on Parking

During construction, approximately 2,960 on-street and off-street parking spaces would be temporarily eliminated. A total of 1,022 on-street parking spaces along the Preferred Alternative are required. On-street parking impacts in EJ areas occur on Edmondson Avenue, Franklintown Road, Franklin Street, and Mulberry Street. On-street parking in the proposed station and portal construction areas within the Downtown Tunnel segment (Census Tracts 1801.00, 0401.00, 0402.00) would also be temporarily lost during construction on Fremont Avenue, Light Street, Fleet Street, and Broadway.

A total of 1,938 off-street parking spaces would be removed during construction. Off-street parking zones in EJ areas would also be affected by construction activities. It is possible that some off-street parking spaces adjacent to Security Boulevard would be affected temporarily during construction. A total of 2,318 on-street and off-street parking spaces located in EJ areas would be impacted. Two off-street parking lots and a garage account for a total of 1,567 parking spaces that would be temporality eliminated at Security Square Mall (293), the Security West facility (386) and a City owned parking garage located at the First Mariner Arena (888). Locations where a large number of on-street and off-street parking spaces would be removed in commercial and residential areas of EJ neighborhoods include:

- Census Tract 4015.07 – Security Boulevard; Boulevard Place Shopping Center (67 parking spaces)
- Census Tracts 2804.01, 2804.02, 2804.03, 2804.04, 2007.01, 2006.00, 1608.01, 2002.00, 1606.00, 1607.00, 1608.02, 2803.01 – Edmondson Avenue from Cooks Lane to Franklintown Road (387 parking spaces)
- Census Tract 2002 (Penrose/Fayette Street Outreach) – Franklin Street from Franklintown Road to Warwick Avenue (50 parking spaces)
- Census Tract 1604 (Midtown-Edmondson) – Edmondson Avenue from Bentalou Street to Fulton Avenue (108 parking spaces)

d. Short-Term Effects on Transit Services

During construction, local area transit would be affected by lane closures and restrictions within the project study corridor. These disruptions would include: bus stop closures, provision of temporary bus stops to locations as near as possible to existing locations, schedule delays, and bus route detours. All service areas and stops would be maintained.

e. Short-Term Effects on Air Quality

An analysis for PM_{10}, $PM_{2.5}$, nitrogen dioxide (NO_2), sulfur dioxide (SO2) and CO was conducted to determine whether emissions generated by the construction of the Preferred Alternative would significantly impact adjacent land uses at construction sites throughout the project study corridor. Short-term emission estimates were based on peak period activity levels at construction sites throughout the corridor and were compared to short-term standards at 1-hour, 8-hour, and 24-hour intervals. It was assumed that there would be up to three 8-hour work shifts per day for 30.1 days per month, with emissions being produced every hour for a 24-hour period. Using mitigation techniques to control emissions, the analysis determined that two sites, the Cooks Lane Western Tunnel Portal and the Downtown Tunnel Western Portal would have the highest total emissions because of the duration of construction activities associated with the removal of excavated tunnel materials and transport by truck off site. Additional analyses were conducted to model conditions and to predict pollutant concentrations. No violations of the NAAQS are predicted at these analysis sites, therefore there are no violations during construction activity for the project.

f. Short-Term Effects on Noise and Vibration

Construction activities would include track-laying for aerial and at-grade sections, tunnel/station excavation and blasting, passenger stations, bridges, park-and-ride facilities, and an OMF. Typical distances at which an exceedance of MDE noise limits of 90 dBA at residence during the daytime, 55 dBA at residences during the nighttime and 62 dBA at non-residential receptors is predicted ranges from 177 feet to 3,155 feet to 1,409 feet, respectively. These distances to potential impact locations, reflect the loudest construction activities including blasting at downtown stations, pile driving and other impact categories associated with station excavation. As a result of these preliminary construction noise estimates, construction activities are predicted to exceed both the MDE daytime and nighttime noise limits. Exceedances of the MDE daytime and nighttime noise L_{max} noise limits are predicted at all 1,538 receptors identified within the project screening distance during daytime and nighttime periods.

Along the Preferred Alternative, construction activities would include the use of bulldozers, dump trucks, vibratory rollers, blasting, and tunnel boring machines (TBM). Blasting and the use of impact pile drivers would be avoided whenever possible to eliminate the potential for vibration impacts (such as minor cosmetic structural damage) at nearby sensitive receptors. The distances at which an exceedance of the FTA vibration damage criterion of 0.5 ips ranges from 8 feet for surface track laying to 30 feet for tunnel boring activities. Construction activities are predicted to exceed the FTA damage criteria at 36 residences from downtown tunneling construction activities. Similarly, above ground or at-grade construction vibration levels are also predicted to exceed the FTA *frequent* annoyance criteria at 577 receptors from tunneling activities and an additional 230 receptors from surface track laying activities. With mitigation, including the requirement that contractors use noise and vibration control measures, many of the noise and vibration impacts can be minimized.

5.4.6 Assessment of Potential for "Disproportionately High and Adverse Effects" on Minority and Low-Income Populations

a. Standards for Evaluating Effects

The US Department of Transportation has defined a "disproportionately high and adverse effect" on minority and low-income populations as an adverse effect that:

- "Is predominantly borne by a minority population and/or a low-income population; or
- "Will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non low-income population."

The identification of a disproportionately high and adverse effect on EJ populations does not preclude a project from moving forward. USDOT Order 5601.2a states that a project with disproportionately high and adverse effects on EJ populations may be carried out under the following conditions:

- Programs, policies, and activities that would have a disproportionately high and adverse effect on minority populations or low-income populations would only be carried out if further mitigation measures or alternatives that would avoid or reduce the disproportionately high and adverse effects are not practicable. In determining whether a mitigation measure or an alternative is "practicable," the social, economic (including costs) and environmental effects of avoiding or mitigating the adverse effects would be taken into account.
- Programs, policies or activities that would have a disproportionately high and adverse effect on populations protected by Title VI ("protected populations") would only be carried out if:
    (1) A substantial need for the program, policy or activity exists, based on the overall public interest; and

    (2) Alternatives that would have less adverse effects on protected populations (and still satisfy the need identified in subparagraph (1) above) have either:

        (a) adverse social, economic, environmental, or human health impacts that are more severe; or

        (b) would involve increased costs of an extraordinary magnitude.

Determinations of whether a project will have disproportionately high and adverse effects must take into consideration "mitigation and enhancements measures that will be taken and all offsetting benefits to the affected minority and low-income populations…" USDOT Order, Section 8.b. The FTA Circular explains how benefits are considered in making this determination:

> Determinations of disproportionately high and adverse effect include taking into consideration mitigation and enhancement measures that will be incorporated into the project. Additionally, your analysis also should include consideration of offsetting benefits to the affected minority and low-income populations. This is particularly important for public transit projects because they often involve both adverse effects (such as short-term construction impacts, increases in bus traffic, etc.) and positive benefits (such as increased transportation options, improved connectivity, or overall improvement in air quality). Your NEPA EJ analysis will include a review of the totality of the circumstances before you determine whether there will be disproportionately high and adverse effects on EJ populations. FTA Circular 4703.1, p. 46.

b. Evaluation of Effects

As described above, the Preferred Alternative has the potential to cause adverse effects on EJ populations, while also benefiting EJ populations. Potential adverse effects on EJ populations in the study corridor include:

- Business property acquisitions, including some business relocations
- Partial residential property acquisitions (no residential displacements)

- Parking impacts
- Noise and vibration impacts, during construction and operation

While these adverse effects would occur on EJ populations, the EJ populations in the corridor also benefit from the project. The Preferred Alternative would provide a much-needed improvement in transit service in Baltimore, creating much faster and more direct transit access from residential neighborhoods in EJ areas to employment and commercial centers in Baltimore City and in Baltimore County. This improvement would benefit low-income and minority areas throughout the project corridor, including transit-dependent residents of those areas. Some of the EJ areas that would be most directly affected, such as neighborhoods along Edmondson Avenue, would also be among the principal beneficiaries of the project; the Preferred Alternative would greatly improve access to residences and businesses along Edmondson Avenue, helping to promote economic growth.

In addition, while some adverse effects would be borne primarily by EJ populations, the effects of the project overall would be distributed among EJ and non-EJ areas. For example, the surface alignment of the Preferred Alternative along Edmondson Avenue has impacts in an EJ community. But the primarily surface alignment along Boston Street, which is in a non-EJ area, also would have impacts to adjacent development, would reduce the availability of on-street parking during construction and operations, and would reduce the number of traffic lanes on an existing street.

Taking all of these factors into account, MTA and FTA have concluded that the Preferred Alternative as a whole would not have “disproportionately high and adverse effects” on EJ populations. Nonetheless, MTA and FTA recognize that some of the specific impacts of the Preferred Alternative may adversely affect EJ populations. Therefore, where possible, the alignment options have been refined through the NEPA process to avoid sensitive areas and minimize impacts to both the human and natural environment. Environmental commitments and mitigation measures identified throughout **Chapters 3, 4,** and **5** of this FEIS will address impacts from LRT operations and construction activities that may affect EJ populations.

5.4.7 Full and Fair Access

Full and fair access to meaningful involvement by low-income and minority populations in project planning and development is an important aspect of environmental justice. History has shown that attempting to design major transportation projects without open communication and timely feedback from affected users and communities has caused serious mistakes and expensive delays in the past (Baltimore Regional Partnership, 1999). Meaningful involvement means the project team invites participation from those groups typically under-represented, throughout all the project stages. It is important to advise EJ populations of the project development steps and listen to their feedback. Residents are an important source for local history, special sites, and unusual traffic, pedestrian or employment patterns relevant to the project. This information is used in the design and evaluation of alternatives, to avoid negative impacts to valued sites, and to support the development of safe, practical, and attractive transportation options that are responsive to the environmental justice population’s concerns.

The full and fair participation by minority and low-income populations in the Red Line decision-making process was achieved by interviewing service providers, city and county agency staff, and community leaders regarding the community's characteristics and their preferred method for receiving information. The information obtained in these meetings provided insight as to how public outreach could be effective and appropriate for EJ populations. The MTA launched several new programs for involving communities, following the execution of the *2008 Baltimore City Red Line Community Compact*, including the Station Area Advisory Committee (SAAC) program and the hiring of Community Liaisons to facilitate dialogue with stakeholders at the grassroots level. In addition to these new programs, a range of tools and techniques has been utilized to engage minority and low-income populations in addition to the general public and they include the following:

- Limited English Proficient (LEP) Procedures
- Hispanic Outreach
- Small Group Meetings and Presentations

Red Line Citizens' Advisory Council (CAC), all of these tools and techniques were implemented to increase awareness of the project throughout the Baltimore region, to provide up-to-date project information, as well as create relationships, opportunities, and connections to sustain project outreach and feedback.

The Red Line public involvement activities during this phase have included: public hearings, open houses, community events, small group meetings, and the distribution of various project publications. In addition, non-traditional targeted outreach efforts which included grocery store outreach, door-to-door canvassing, ministerial outreach, transit center outreach, and social media campaigns were employed to provide a comprehensive program to reach stakeholders and more specifically traditionally underserved populations such as minority, low-income, elderly, and disabled populations. These events, meetings, and get-togethers provided MTA with a greater understanding of, and appreciation for, the neighborhoods that the Red Line would serve. Since the AA/DEIS Public Hearings, approximately 240 outreach events have been held with the stakeholders along the project study corridor.

Other outreach activities, many of which have taken place in environmental justice neighborhoods, have been on-going since Spring of 2003. These activities include:

- Project information distribution at Red Line Resource Hubs
- Coordination with Elected Officials
- Red Line Website
- Publications – including print advertisements, newsletters, fact sheets, fliers, and door hangers/information cards

Since the AA/DEIS was issued, the Red Line project has continued to conduct an intensive public involvement effort to address concerns and mitigate potential effects. Please refer to the *Public Involvement Technical Report* in **Appendix I**, which contains a description of public involvement activities that occurred between November 2008 and June 2012. In addition, agency coordination and outreach is discussed in **Section 8.3** of this FEIS while public involvement and CAC meetings are discussed in **Sections 8.4** and **8.5** of the FEIS.

The *2008 Red Line Public Involvement Technical Report* describes the outreach activities prior to November 2008.

5.5 Property Acquisitions and Displacements

5.5.1 Introduction and Methodology

This section summarizes the property acquisitions, easements, and displacements associated with the Preferred Alternative. The *Property Acquisitions and Displacements Technical Memorandum*, includes more detailed information (**Appendix D**). Property impacts were determined by comparing the construction limits of the Preferred Alternative to the available existing right-of-way. Construction limits extending outside the existing right-of-way were identified as needs for either additional right-of-way acquisition or easement. The right-of-way acquisition and easement needs were separated into individual properties to be identified as project impacts.

In order to develop accurate property maps to evaluate potential impacts to properties resulting from the Preferred Alternative, existing right-of-way and individual properties within the project study corridor were identified using Baltimore County and Baltimore City area tax maps. Available record documents (deeds, plats, etc.) associated with the identified parcels were gathered from public files. A mosaic map was created depicting the existing property lines, existing right-of-way, and existing known easements. The existing right-of-way limits were verified in the field to tie it to the existing topographic survey. A transitway design was developed based on a number of factors including the needs of project and geometric constraints. Based on the design needs, cut/fill limits were established for necessary slopes along the Preferred Alternative improvements. Along a majority of the project, a 10-foot setback was applied beyond the cut/fill line for sediment control and construction related activities.

The setback line represents the limit of disturbance required for the construction and operation of the Preferred Alternative. The limit of disturbance was overlaid with the right-of-way file. Areas where the limit of disturbance exceeded the existing public right-of-way were identified throughout the project study corridor, and are considered a property impact.

The Preferred Alternative will not require any acquisition of real property that would result in an involuntary residential displacement.

5.5.2 Existing Conditions

Property parcels within the project study corridor were established, researched, surveyed and verified. This extensive process, as described above, ensures that the property maps are accurate and up to date with the most current information available. Metes and Bound surveys will be undertaken as the project moves forward in Final Design to identify final property acquisition and easement needs.

5.5.3 Future No-Build Conditions

Under the No-Build Alternative, there would be no transportation improvements beyond those already planned and programmed. The No-Build Alternative would not involve any project-related construction; therefore, there would be no project-related impacts (permanent or temporary) to properties within the project study corridor. Additionally, no construction-related easements would be required.

5.5.4 Preferred Alternative

The Red Line Preferred Alternative is predominately located within the public right-of-way. However, portions of the Preferred Alternative limit of disturbance would extend beyond the existing right-of-way. These extended areas require the acquisition of private or institutional property. The property would either need to be acquired or granted an easement for construction and maintenance of the Preferred Alternative, bridge structures, roadway reconstruction, stations, traction power substation (TPSS) buildings, central instrument houses (CIH), ventilation buildings, and the Operations and Maintenance Facility (OMF).

a. Long-Term Operational Effects

The following section summarizes the permanent acquisitions and easements that would result from the Preferred Alternative. Detailed property and right-of-way impact descriptions and tables are available in the *Property Acquisitions and Displacements Technical Memorandum.*

Acquisition or Displacement for Permanent Project Elements

The majority of the property acquisitions would be "sliver takes," or narrow strips of property located directly adjacent to the proposed project. Many of the sliver takes would be partial acquisitions, meaning the majority of the property would remain with the current owner and, in most cases, the acquisition would not affect the use of the property.

Based on the current engineering drawings for the Preferred Alternative, a total of 192 properties would require either a partial or total right-of-way acquisition, totaling approximately 1,840,801 square feet (42 acres) of property. Of these properties, 169 would require partial property acquisition. The majority of these partial acquisitions would occur within the US 40 segment, where sliver takes, averaging approximately one to four feet from the current edge of pavement, from 97 residential properties would be required in order to accommodate the Red Line surface transitway and retain parking availability in the affected neighborhoods.

The remaining 23 properties would require total property acquisition and displacement (13 commercial, three industrial, one institutional, and six governmental). Any property that is not currently vacant and would be acquired in full, or a property where the access is permanently eliminated due to the Preferred Alternative, would be considered a displacement. Ten of the displacements are located within the proposed OMF site. The Preferred Alternative will not require any acquisition of real property that would result in an involuntary residential displacement (Md. Laws Chapter 569, 2009). The Preferred Alternative will not require any acquisition of real property that would result in an involuntary residential displacement. Engineering drawings and right-of-way needs are subject to change as the project enters Final Design.

A summary of the permanent right-of-way acquisitions is provided in **Table 5-10**. Detailed property and right-of-way impact descriptions and tables are available in the *Property Acquisitions and Displacements Technical Memorandum.* To review the location of proposed property acquisitions, refer to the **Volume 2 Environmental Plate Series, Plate Series 1** and **Appendix K** of this FEIS.

Table 5-10: Property Acquisitions Resulting from the Preferred Alternative

Type of Property	Partial Property Acquisitions (Number of Properties (Square Feet))	Total Property Acquisitions/ Displacements (Number of Properties (Square Feet))
West Segment		
Residential	0	0
Commercial	8 (211,470 SF)	1 (0 SF)[1]
Industrial	1 (45,524 SF)	0
Institutional	2 (24,067 SF)	0
Governmental	0	0
Cooks Lane Tunnel Segment		
Residential	0	0
Commercial	1 (4,968 SF)	0
Industrial	0	0
Institutional	0	0
Governmental	0	0
US 40 Segment		
Residential	97 (7,919 SF)	0
Commercial	10 (4,697 SF)	2 (8,870 SF)[2]
Industrial	0	0
Institutional	4 (2,576 SF)	0
Governmental	19 (26,228 SF)	0
Downtown Tunnel Segment		
Residential	0	0
Commercial	1 (2,205 SF)	6 (63,809 SF)
Industrial	0	0
Institutional	0	0
Governmental	1 (54,000 SF)	0
East Segment		
Residential	4 (1,173 SF)	0
Commercial	3 (69,483 SF)	0
Industrial	12 (233,817 SF)	2 (212,916 SF)
Institutional	0	0
Governmental	5 (4,525 SF)	1 (6,601 SF)
Operations and Maintenance Facility		
Residential	0	0
Commercial	0	4 (218,846 SF)
Industrial	0	1 (73,018 SF)
Institutional	1 (421 SF)	1 (102,247 SF)
Governmental	0	5 (461,421 SF)

Table 5-10: Property Acquisitions Resulting from the Preferred Alternative

Type of Property	Partial Property Acquisitions (Number of Properties (Square Feet))	Total Property Acquisitions/ Displacements (Number of Properties (Square Feet))
Total	**169 (693,073 SF)**	**23 (1,147,728 SF)**
Total Area	**1,840,801 SF (42 Acres)**	

Notes: [1] Commercial parcel reflects relocation of existing Bank of America ATM from private property being acquired as part of the Security Mall Park-and-Ride; the square footage for the ATM is included under the Partial Property Acquisition column.
[2] Commercial parcel reflects two businesses located on the same property.

Permanent Easements to Facilitate Permanent Project Elements

Easements are the use of private property without the transferring of ownership. Permanent easements for the Red Line project are categorized into four types:

1. Permanent surface easements are typically needed for project construction and allow for future right of access. Future right of access would be needed for maintenance purposes, etc.
2. Permanent utility easements are needed for project construction and allow for future right of access specifically for utilities.
3. Underground easements are needed at locations where underground work extends outside the public right-of way.
4. Additionally, aerial easements are needed at locations where bridges or other aerial structures extend beyond the public right-of-way.

Based on the current engineering drawings, a total of approximately 757,305 square feet (17 acres) of permanent surface/utility easements would be needed for the Preferred Alternative. Underground easements for the tunnels would be total approximately 81,502 square feet (2 acres). Aerial easements totaling approximately 44,918 square feet (1 acre) would be needed in the East segment for properties in the vicinity of the proposed bridge structure over I-895. The overall permanent easement requirements would impact 161 properties.

Table 5-11 summarizes permanent easements required to construct the Preferred Alternative. Detailed property and easement descriptions and tables are available in the *Property Acquisitions and Displacements Technical Memorandum.* To review the location of proposed permanent easements, refer to the **Volume 2 Environmental Plate Series, Plate Series 1** and **Appendix K** of this FEIS.

Table 5-11: Permanent Easements Resulting from the Preferred Alternative

Type of Property	Surface/Utility (Number of Properties (Square Feet))	Underground (Number of Properties (Square Feet))	Aerial (Number of Properties (Square Feet))
West Segment			
Residential	0	0	0
Commercial	7 (142,979 SF)	0	0
Industrial	1 (75,546 SF)	0	0
Institutional	1 (31,137 SF)	0	0
Governmental	6 (210,855 SF)	0	0
Cooks Lane Tunnel Segment			
Residential	0	27 (14,178 SF)	0
Commercial	0	0	0
Industrial	0	0	0
Institutional	0	0	0
Governmental	0	0	0
US 40 Segment			
Residential	0	0	0
Commercial	0	0	0
Industrial	0	0	0
Institutional	0	0	0
Governmental	0	0	0
Downtown Tunnel Segment			
Residential	0	50 (5,215 SF)	0
Commercial	0	35 (36,604 SF)	0
Industrial	0	1 (620 SF)	0
Institutional	0	7 (20,675 SF)	0
Governmental	0	4 (4,210 SF)	0
East Segment			
Residential	0	0	0
Commercial	2 (21,714 SF)	0	0
Industrial	11 (275,074 SF)	0	8 (39,827 SF)
Institutional	0	0	0
Governmental	0	0	1 (5,091 SF)
Operations and Maintenance Facility			
Residential	0	0	0
Commercial	0	0	0
Industrial	0	0	0
Institutional	0	0	0
Governmental	0	0	0
Totals	**28 (757,305 SF)**	**124 (81,502 SF)**	**9 (44,918 SF)**
	17 Acres	**2 Acres**	**1 Acre**

b. Short-Term Construction Effects

A temporary easement is the use of private property without the transferring of ownership. Temporary surface easements are necessary for project construction, and access is granted for a certain period of time (typically the time of construction activities). Specific activities requiring temporary surface easements may include grading, building formwork for concrete, structural erection, vehicular/equipment access, worker access, etc.

Based on the current engineering drawings, a total of approximately 538,568 square feet (12 acres) of temporary easements would be needed for the Preferred Alternative. The temporary easement requirements would impact 269 properties.

During construction, it would be necessary to limit or curtail vehicular and pedestrian access in certain areas to address public safety and to accommodate the variety of machinery, storage areas, and construction activities that would occur. Generally, the method of construction would determine the extent of access limitation that would occur along the various lengths of the alignment. It would be necessary at various locations to restrict access to buildings for periods ranging from several hours to up to 4 years. The Maryland Transit Administration (MTA) would coordinate with the occupants concerning the affected locations and relocation options.

For example, at the proposed Fell’s Point station, the properties located on the south side of Fleet Street between Bethel Street and Broadway would be prohibited access for approximately 9 to 12 months during station excavation and slurry wall construction. Therefore, the FEIS conservatively assumes that all of these building occupants would need to relocate temporarily during the construction period. While MTA would coordinate with the occupants concerning temporary relocation options, the building occupants could choose not to return to their former building locations.

In other locations, construction might need to occur in the basements of certain buildings. Though access to the ground and upper floors would generally be provided, access to some basements might be temporarily restricted. In such cases, it is not anticipated that MTA would need to acquire the buildings or permanently displace the residents and businesses from the buildings adjacent to the construction work.

Table 5-12 summarizes the temporary surface easements that would be required to construct the Preferred Alternative. Additional detail regarding construction staging, temporary easements, and construction easement durations is available in the *Property Acquisitions and Displacements Technical Memorandum*. To review the location of proposed temporary easements, refer to the **Volume 2 Environmental Plate Series, Plate Series 1**, as well as **Appendix K** of this FEIS.

Table 5-12: Temporary Easements Resulting from the Preferred Alternative

Type of Property	Number of Properties	Temporary Construction Easement (Square Feet)
West Segment		
Residential	12	9,322 SF
Commercial	11	42,086 SF
Industrial	1	90,205 SF
Institutional	1	11,628 SF
Governmental	0	0
Cooks Lane Segment		
Residential	0	0
Commercial	2	4,382 SF
Industrial	0	0
Institutional	1	4,020 SF
Governmental	1	4,370 SF
US 40 Segment		
Residential	175	24,657 SF
Commercial	9	10,260 SF
Industrial	0	0
Institutional	4	1,825 SF
Governmental	12	33,269 SF
Downtown Tunnel Segment		
Residential	2	33,720 SF
Commercial	0	0
Industrial	0	0
Institutional	0	0
Governmental	0	0
East Segment		
Residential	3	687 SF
Commercial	5	72,293 SF
Industrial	23	157,627 SF
Institutional	0	0
Governmental	5	12,941 SF
Operations and Maintenance Facility		
Residential	0	0
Commercial	0	0
Industrial	1	23,440 SF
Institutional	1	1,836 SF
Governmental	0	0
Total	**269**	**538,568 SF (12 Acres)**

c. Compensation and Relocation Assistance

Property acquisition activities, including relocations, would be performed in accordance with the US Department of Transportation (DOT) Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) as amended and Federal Transit Administration (FTA) Circular 5010.1D, Grants Management Requirements and all applicable Maryland State laws that empower MTA to acquire real property through a negotiated purchase or through condemnation.

The Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) requires that "*the project developer shall not proceed into any phase which will cause the relocation of any persons, or proceed with any construction project, until it has furnished assurances that all displaced persons will be satisfactorily relocated to a comparable decent, safe and sanitary housing within their financial means, or that such housing is in place and has been made available to the displaced person.*"

Payments for the cost of moving are also provided. The owner of a displaced business is entitled to receive payment for actual reasonable expenses incurred in moving the business or personal property; for actual direct losses of tangible personal property; and for actual reasonable expenses incurred in the search for a replacement site. Fair market value would be provided to property owners as compensation for land acquisition. A displaced small business owner may be eligible for reestablishment expenses.

The MTA is working with Baltimore City on a Memorandum of Understanding (MOU) for the Red Line project, which would allow the City to conduct acquisition activities for the Preferred Alternative. At the request of the MTA, the City may acquire property rights needed to widen the public right-of-way to accommodate the project. Prior to construction, the City shall convey rights to MTA in order for the MTA to own, operate, and maintain the Preferred Alternative within the dedicated public right-of-way.

d. Avoidance and Minimization

During planning and advanced conceptual design, opportunities to avoid and minimize effects to private properties were actively pursued. Overall project effects were reduced by locating segments of the Preferred Alternative in tunnel sections or within transportation right-of-way where possible to avoid property acquisitions. A large portion of the surface level segments of the Preferred Alternative are located within urbanized road right-of-way, which significantly limits additional opportunities for avoidance and minimization of effects to properties. In order to reduce construction-related impacts to properties, construction staging would help to reduce the duration of temporary easements required.

A variety of measures would be taken to minimize the effects of access restrictions on residential and commercial properties. For example, in each zone where heavy construction would occur (such as station locations, cut-and-cover tunnel construction areas, and portals), an analysis would be conducted prior to construction to consider the access needs of the affected properties and a plan would be prepared working with the affected property owners. At this stage in project design, it is not feasible to provide specific plans for each construction zone. Refer to **Chapter 3** of this FEIS for additional information.

e. Mitigation

- Property acquisition activities, including relocations, will be performed in accordance with the USDOT Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) as amended and Federal Transit Administration (FTA) Circular

5010.1D, Grants Management Requirements and all applicable Maryland State laws that establish the process through which Maryland Transit Administration (MTA) may acquire real property through a negotiated purchase or through condemnation.

- Additional mitigation measures for temporary easements to private property would entail the restoration of property easement areas to pre-construction conditions. Restoration would include re-grading disturbed areas, replanting vegetation and trees removed for construction, replacement of structures, utilities, and equipment, and re-establishment of property access, as applicable.

5.6 Economic Activity

5.6.1 Introduction and Methodology

This section summarizes the characteristics of the existing economy within the project study corridor and the likely effects associated with the Red Line project associated with the No-Build condition and the Preferred Alternative on the Baltimore County and Baltimore City economies. In addition to general economic impacts, this section discusses the fiscal impact of the project on local property taxes. For more detailed discussion, refer to the *Economic Activity Technical Memorandum* (**Appendix D**).

The *Economic and Job Impacts of the Construction of the Red Line Mass Transit System on Baltimore City* (Baltimore City study) was completed in November 2009 on behalf of Baltimore City. The findings of this report were a primary source of information for the employment effects of the Red Line project. Current and future employment projections described in this section were obtained from the Baltimore City study. Although a Baltimore City study, the portions of Baltimore County within the project study corridor were included in the analysis model inputs, and employment and economic analysis included both Baltimore County and Baltimore City (JFI, 2009). As the Preliminary Engineering phase has progressed, some of the projections in the Baltimore City study are different than current assumptions. These differences are as follows:

- The Baltimore City study assumed a construction timeframe of 4 years; the Maryland Transit Administration (MTA) assumes a 7-year construction estimate (2014-2021) in this Final Environmental Impact Statement (FEIS).
- The Baltimore City study assumed a planning and construction budget of $1.6 billion with design and planning phase expenditures of $217 million and construction phase expenditures of $1.4 billion; MTA assumes a cost estimate for the Preferred Alternative in 2012 dollars of $2.223 billion, including expenditures for planning and construction. MTA has developed based on the construction schedule, escalation, and inflation while the Red Line is being constructed. The cost estimate at the start of Red Line service in 2021 is $2.575 billion in year of expenditure dollars (refer to **Chapter 2, Section 6** for additional information).

An analysis of tax revenue changes as a result of Red Line construction was conducted for the FEIS. This analysis was based on the estimated right-of-way needs associated with construction of the Preferred Alternative. As the project moves into Final Design, construction duration and budget projections, as well as right-of-way requirements, will continue to be refined.

5.6.2 Existing Conditions

a. Employment within the Project Study Corridor

Based on the distribution of industry and occupational employment within the Red Line project study corridor as reported in the Baltimore City study, the communities within the project study corridor have a lower share of residents engaged in professional and management services when compared to County, City and State residents as a whole. A high number of residents in the project study corridor are employed in the health care and social services industries when compared with County, City, and State averages, particularly those residing in the Baltimore City segments of the project study corridor. Eleven percent of the residents in the project study corridor are employed in the construction or transportation and materials moving occupations, where the job opportunities created by the construction of the Red Line would be concentrated (JFI, 2009).

There are approximately 7,500 businesses located within the project study corridor, employing over 192,000 people (BMC, 2002). The largest proportion of businesses are in the service industry, with the remaining largest portions in retail; finance, insurance, and real estate; and government services. The majority of businesses are small, with 20 or fewer employees, to medium sized, with 21 to 99 employees. However, while large businesses with over 100 employees only make up a small number of overall employers within the project study corridor, over 120,000 employees work at large businesses. Multiple business centers and institutions within the project study corridor employ over 1,000 people, including:

- Centers for Medicare & Medicaid Services
- Social Security Administration
- University of Maryland
- Office centers in Downtown Baltimore and Harbor East
- Johns Hopkins Bayview Medical Center campus

Additionally, several clusters of medium and large sized businesses are located within a few blocks of the Preferred Alternative station locations.

b. Real Property Tax Revenue and Economic Development

Real property taxes represent the largest source of operating revenue for both Baltimore City and Baltimore County. According to Baltimore County’s fiscal year 2012 adopted budget, real property taxes represented 32 percent of revenue for the County’s $2.632 billion total operating budget (Baltimore County, 2011). A similar proportion of the Baltimore City’s operating budget is funded with real property tax revenue, totaling 33.9 percent of the $2.297 billion operating budget. Comparatively, over 2 percent of the State of Maryland’s fiscal year 2012 operating revenue is funded by property taxes (DBM, 2011).

Baltimore County, Baltimore City, and the State of Maryland's plans and policies support increased development in areas served by transit, including walkable, transit-accessible, mixed-use areas such as Security Square, Fell's Point, Canton, Harbor East, and Highlandtown. Several revitalization or expansion projects are in the planning or construction phases in the vicinities of the Red Line Preferred Alternative stations, representing millions of square feet of new mixed-use building space:

- Security Square Mall area
- Uplands Development
- Edmondson Village
- Poppleton area
- Harbor East
- Canton Crossing
- Brewers Hill
- Highlandtown/Greektown
- Johns Hopkins Bayview Medical Center campus

Recently completed developments at Woodberry Station, Penn Station, Cultural Center Station, and Lexington Market Station along the Central Light Rail Line, Owings Mills Metro Station, and Baltimore Metro are representative of successful projects supporting the transit oriented development (TOD) in the Baltimore region.

5.6.3 Future No-Build Conditions

The No-Build Alternative would include already planned and programmed transit and highway projects, and the Red Line would not be constructed. There would be no significant temporary or permanent growth in employment opportunities throughout the project study corridor, and access to current employers within and surrounding the corridor would remain unchanged. Local Red Line construction spending would not occur. There would not be improved transit accessibility in the Red Line station areas. Because no Red Line construction would occur under the No-Build Alternative; there would be no Red Line construction related effects, adverse or beneficial, on businesses and employers throughout the corridor. Construction expenditures within the local economy and construction jobs created would be limited to the already planned and programmed transit and highway projects.

5.6.4 Preferred Alternative

a. Long-Term Operational Effects

Employment within the Project Study Corridor

Once the Red Line is built and open for service, the MTA would result in new permanent positions in operations and maintenance. Regionally, the Red Line would provide economic benefits by improving transit access and mobility for the work force and consumers within the corridor. Job opportunities would fall into two categories; new jobs and better access to existing jobs.

The MTA has begun work on an initiative that would lead to future employment and training opportunities for local area residents as well as expanded opportunities for local disadvantaged businesses. The initiative will outline a policy and identify potential programs to "put Baltimore to work on the Red Line" as summarized in the *Baltimore City Red Line Community Compact*. The *Compact* is available on the project website. The MTA anticipates having a policy and program in place before construction contracts are advertised (*Economic Activity Technical Memorandum,* 2012).

Baltimore City created the Red Line Economic Empowerment Office to help residents find jobs and job training. The goals of the Red Line Economic Empowerment Office include working to create a pipeline for jobs, job training, contractors, and entrepreneurs to prepare them for work and opportunities on the Red Line project and along the Red Line's 14-mile corridor. Additionally, this office has applied these goals to prepare residents for work on the upcoming Uplands Redevelopment Project. Training for future job opportunities is ongoing through a variety of Baltimore City Workforce Development Programs.

Transit often encourages new development that brings more services, jobs and residences to neighborhoods within walking distance of transit stations. While the scope of the MTA would be limited to building the Red Line transit system itself, Baltimore City and Baltimore County governments, in cooperation with local communities, have made some initial suggestions for possible TOD opportunities, which could lead to more construction jobs and permanent jobs near Red Line stations (*Economic Activity Technical Memorandum,* 2012).

In the long-term, better access to existing jobs within the Red Line corridor would occur. Major employers such as the Centers for Medicare & Medicaid Services, Social Security Administration and companies located downtown and at Harbor East would benefit from higher quality transit access and service. Residents who live within the corridor not only would have better access to jobs within the corridor but to jobs that can be reached via new connections to MARC, Light Rail, and Metro. Implementation of the Preferred Alternative would provide access to employment to a greater number of people, and would potentially allow employers to draw upon a larger worker pool within the region.

Real Property Tax Revenue and Economic Activity

While effects to residential and business properties would be avoided and minimized to the extent possible, some direct property acquisitions would occur under the Preferred Alternative. The majority of the property acquisitions would be "sliver takes," or narrow strips of property located directly adjacent to the proposed project. Many of the sliver takes would be partial acquisitions, meaning the majority of the property would remain with the current owner and, in most cases, the acquisition would not affect the use of the property.

Any property that is acquired in full, or a property where the access is eliminated due to the Preferred Alternative, will be considered a displacement. Properties that would be acquired in full (displacements) that contain structures would likely be demolished in order to accommodate the Preferred Alternative. The Preferred Alternative will not require any acquisition of real property that would result in an involuntary residential displacement (2009 Md. Laws Chapter 569).

All acquired property would be transferred to MTA and become part of the public right-of-way, thus removing the property from the tax base. In total, sliver takes would be required from 172 properties, and 21 displacements would result from the Preferred Alternative (11 commercial, 3 industrial, 1 institutional, and 6 governmental). Ten of the displacements are located within the proposed Operations and Maintenance Facility (OMF) site. **Table 5-13** below summarizes the tax revenue impacts as a result of property acquisitions resulting from the Preferred Alternative.

By removing tax-paying properties from the tax base, and converting them to a non-tax-paying public use, some property tax revenues would be permanently lost. However, these acquisitions would result in a negligible loss of property tax revenue to the State, Baltimore County, and Baltimore City when compared to overall tax revenues, as described in **Section 5.6.2** above. Additional detail regarding property effects are contained in **Chapter 5, Section 5** of this FEIS, and in the *Property Acquisitions and Displacements Technical Memorandum* (**Appendix D**).

Table 5-13: Tax Revenue Impacts in Dollars

Property Type	Baltimore County			Baltimore City		
	No. of Parcels	Proportional State Tax Loss	Proportional City Tax Loss	No. of Parcels	Proportional State Tax Loss	Proportional City Tax Loss
West Segment						
Residential	0	$0	$0	0	$0	$0
Commercial	8	$3,621	$35,563	0	$0	$0
Industrial	1	$3,088	$30,329	0	$0	$0
Institutional	-	$0	$0	-	$0	$0
Governmental	-	$0	$0	-	$0	$0
Cooks Lane Segment						
Residential	0	$0	$0	0	$0	$0
Commercial	0	$0	$0	1	$135	$2,732
Industrial	0	$0	$0	0	$0	$0
Institutional	-	$0	$0	-	$0	$0
Governmental	-	$0	$0	-	$0	$0
US 40 Segment						
Residential	0	$0	$0	97	$423	$8,567
Commercial	0	$0	$0	12	$262	$5,299
Industrial	0	$0	$0	0	$0	$0
Institutional	-	$0	$0	-	$0	$0
Governmental	-	$0	$0	-	$0	$0
Downtown Tunnel Segment						
Residential	0	$0	$0	0	$0	$0

Table 5-13: Tax Revenue Impacts in Dollars

Property Type	Baltimore County			Baltimore City		
	No. of Parcels	Proportional State Tax Loss	Proportional City Tax Loss	No. of Parcels	Proportional State Tax Loss	Proportional City Tax Loss
Commercial	0	$0	$0	7	$3,201	$64,813
Industrial	0	$0	$0	0	$0	$0
Institutional	-	$0	$0	-	$0	$0
Governmental	-	$0	$0	-	$0	$0
East Segment						
Residential	0	$0	$0	5	$215	$4,363
Commercial	0	$0	$0	3	$72	$1,453
Industrial	0	$0	$0	14	$3,299	$66,809
Institutional	-	$0	$0	-	$0	$0
Governmental	-	$0	$0	-	$0	$0
OMF Segment						
Residential	0	$0	$0	0	$0	$0
Commercial	0	$0	$0	4	$1,470	$29,772
Industrial	0	$0	$0	1	$0	$0
Institutional	-	$0	$0	-	$0	$0
Governmental	-	$0	$0	-	$0	$0
Project Total	**9**	**$6,709**	**$65,892**	**144**	**$9,077**	**$183,808**

b. Short-Term Construction Effects

The Baltimore City study used the IMPLAN model, an economic impact assessment software system, to determine economic effects from the construction of the Red Line. The model is based on multipliers that describe the response of an economy to a change in demand or production to estimate the economic impacts of a project. Although a Baltimore City study, the portions of Baltimore County within the project study corridor were included in the model inputs (JFI, 2009). The IMPLAN analysis focused on three measures of economic activity or effects from the Red Line project: output (a figure similar to business sales activity), employment, and employee compensation.

Additionally, multiplier effects occur as the spending associated with an economic activity are earned and then re-spent by others in the local economy. For example, a person spends $100 in a local store. The storeowner then uses that $100 to pay his employees. The employees then re-circulate the money by spending it in the community. This effect produces three types of impacts:

- Direct Impacts: those economic impacts occurring in the impacted businesses and related industries as a direct result of the Red Line construction expenditures
- Indirect Impacts: those impacts likely to occur based on structural conditions of the economy, for example the purchase of goods and services to support the construction of the Red Line

- Induced Impacts: estimated impacts based on the resident spending associated with the increase in incomes attributable to the Red Line construction activities

The total effects are the combination of these direct, indirect, and induced effects, and are greater than the direct effects occurring as a result of the Red Line construction.

Employment within the Project Study Corridor

The Baltimore City study concluded that the construction of the Red Line would generate substantial economic benefits to Baltimore City and the portion of Baltimore County within the study corridor. Following is a summary of anticipated Red Line construction effects to local employment and economy as modeled using IMPLAN. Including direct, indirect, and induced effects, the construction of the Red Line would generate a total of just under $2.1 billion in economic activity over the 4-year construction period assumed in the Baltimore City study (MTA assumes a 7-year construction period in this FEIS):

- The construction of the Red Line would create or support approximately 9,800 direct construction and related jobs earning $539.7 million in salaries and wages over the construction period
- Including multiplier effects, the construction of the Red Line would create or support approximately 15,000 jobs earning $775.2 million in salaries and wages over the construction period
- The initial 3-year design and planning phase of the Red Line project would generate $273.4 million in economic activity in Baltimore City and create or support approximately 2,050 jobs earning $102.7 million in salaries and wages
- The construction phase of Red Line project would generate $1.8 billion in economic activity and create or support approximately 12,950 jobs earning $672.5 million in salaries and wages

Operation and maintenance of the Preferred Alternative would add approximately 200 additional MTA jobs. The construction phase of the Red Line would likely create job opportunities specifically for residents of the affected communities. As summarized in the *Baltimore City Red Line Community Compact*, the planned MTA Red Line employment initiative would lead to future employment and training opportunities for local area residents as well as expanded opportunities for local disadvantaged businesses.

In public works construction projects of this magnitude, contractors rely heavily on the local labor pool during construction to help build the project. Both skilled and unskilled labor would be necessary. The construction of the Red Line would likely create job opportunities specifically for residents of the affected communities. A slightly higher percentage of the project study corridor's employed residents are employed in construction-related occupations and in transportation and materials moving, occupations where the majority of the jobs associated with the construction of the Red Line would be concentrated.

Based on the workforce-related demographic information on the population along the Red Line route, construction of the Red Line may create employment opportunities for residents of the affected communities. The Red Line is expected to directly create over 15,000 new jobs in the community, 55 percent of which would be in construction and 17 percent of which would be professional, scientific, or technical services. The new jobs are anticipated to generate approximately $775 million in employee compensation (JFI, 2009).

The Baltimore City Red Line Economic Empowerment Office has also created incentives to encourage contractors to hire local residents for the Red Line construction. Contractors and subcontractors would be reimbursed a portion of the cost of training a new employee if the employee is referred by a Baltimore City Workforce Development Program (Baltimore City, 2012).

The Red Line Community Compact (September, 2008), signed by city and state officials, as well as 72 leaders of community organizations, describes how the Red Line would be built and operated for the benefit of Baltimore and its communities. The Community Compact emphasizes four main points:

- Put Baltimore to work on the Red Line: encourage and promote local and minority contract participation.
- Make the Red Line green: include green space and environmental improvements into the project.
- Community-centered station design, development and stewardship
- Reduce impact of construction on communities

Tax Revenue and Economic Activity
In the short-term, as a major construction project, disruptions to businesses adjacent to the construction site would occur. Temporary effects from construction would include:

- Decrease in roadway capacity that results in delays, congestion and detours
- Alterations to property access
- Loss of parking, especially short-term street parking
- Airborne dust
- Noise and vibrations from construction equipment and vehicles
- Loss of visibility of businesses to their customers

During construction, it would be necessary to limit or curtail vehicular and pedestrian access in certain areas to address public safety and to accommodate the variety of machinery, storage areas, and construction activities that would occur. Generally, the method of construction would determine the extent of access limitation that would occur along the various lengths of the alignment. It would be necessary at various locations to restrict access to buildings for periods ranging from several hours to up to 4 years. The MTA will coordinate with the occupants concerning the affected locations and relocation options.

For example, at the proposed Fell's Point station, the properties located on the south side of Fleet Street between Bethel Street and Broadway would be prohibited access for approximately 9 to 12 months during station excavation and slurry wall construction. Therefore, the FEIS conservatively assumes that all of these building occupants would need to relocate temporarily during the construction period. While MTA will coordinate with the occupants concerning temporary relocation options, the building occupants may choose not to return to their former building locations.

In other locations, construction might need to occur in the basements of certain buildings. Though access to the ground and upper floors would generally be provided, access to some basements might be temporarily restricted. In such cases, it is not anticipated that MTA would need to acquire the buildings or permanently displace the residents and businesses from the buildings adjacent to the construction work.

In the Baltimore City study, the total construction budget for the entire Red Line was divided into two time periods: 3 years of design and planning and 4 years of construction, with a projected total projected cost of $1.4 billion during this timeframe[2]. It is important to note that these figures were for the construction of the Red Line only and for the year of the report. They do not include any related TOD projects that could occur in the project study corridor with the initiation of the project. They also do not account for the anticipated increase in visitation, once the Red Line is operational, to area attractions and entertainment venues such as Oriole Park at Camden Yards; M&T Bank Stadium; 1st Mariner Arena; the Hippodrome Theater; Baltimore Convention Center; the Inner Harbor; and restaurants, shopping, and other venues located in neighborhoods along the Red Line corridor.

According to the Baltimore City study, construction of the Red Line would not have a major effect on the distribution of industries and businesses located within the corridor. However, including direct, indirect, and induced effects, it could generate over $2.078 billion in local economic activity, both in Baltimore County and Baltimore City, over the projected 4-year construction period (JFI, 2009).

c. Avoidance and Minimization

The MTA will continue to coordinate with businesses throughout the corridor, especially those adjacent to the Preferred Alternative alignment, to avoid or minimize temporary disruptions to parking, access, or delivery. Emissions of noise and vibration during construction will be minimized and mitigated through design, monitoring, and enforcement.

d. Mitigation

- Property acquisition activities, including relocations, will be performed in accordance with the USDOT Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) as amended and Federal Transit Administration (FTA) Circular 5010.1D, Grants Management Requirements, and all applicable Maryland State laws

[2] The 2009 *Economic and Job Impacts of the Construction of the Red Line Mass Transit System on Baltimore City* report was based on cost estimates that differ from current FEIS cost estimates.

that establish the process through which MTA may acquire real property through a negotiated purchase or through condemnation.

5.7 Visual and Aesthetic Resources

5.7.1 Introduction and Methodology

The approach for identifying and analyzing effects to visual and aesthetic resources for the Red Line project applies a modified version of the Federal Highway Administration (FHWA) Visual Impact Assessment for Highway Projects. The FHWA methodology provides seven main components, which are addressed as follows in this section. Additional details regarding methodology for assessment and potential effects are available in the *Visual and Aesthetic Resources Technical Report* (**Appendix D)**.

1. Define Project Viewshed/Setting: The "project viewshed" generally encompasses the existing natural and manmade physical features that are located within 200 feet adjacent to the Preferred Alternative and up to 3 miles where longer-range views are possible. Five visual districts have been identified within the project viewshed to facilitate the assessment of visual and aesthetic conditions that may be affected from the introduction of the Preferred Alternative.

2. Determine Viewer Groups: Each visual district/sub-district was reviewed to identify the major groups of viewers who would be affected by the new visual elements of the project. Such groups might include residents; workers who are employed by businesses in the district; visitors who come to the district to access entertainment, cultural, educational, or other commercial venues in the district; and, transit riders, pedestrians, cyclists or motorists who travel through the district to locations within or outside of the district.

3. Identify Key Viewpoints and Views and Assess Visual Quality: The FHWA methodology calls for identifying very specific key viewpoints and coming up with a numerical assessment of "visual quality" based on three factors: "vividness," "intactness," and "unity," resulting in a numerical qualification of the relative value of the identified landscape. Given the diverse nature of the areas and communities through which the Preferred Alternative passes, it was determined that making a numerical judgment as to the quality of a particular visual environment would be inconsistent with the *Community Compact*. An alternative methodology was therefore applied in which both general and key views were identified and a neutral determination of the "compatibility" of the project components with the identified context was assigned.

4. Analyze Changes in Existing Visual Resources and Viewer Response: Visual change is a function of the ease of visibility of the project component and/or the amount the project component effects on existing view. Viewer response is subjective, and thus is best analyzed by applying presumed sensitivity ratings for particular identified viewer groups. In general, it is assumed that there is a direct relationship between the amount of exposure to the district by the viewer group and that group's sensitivity to changes. Similarly, it is also assumed that a viewer group's sensitivity rises with the amount that group identifies, or feels invented in, the district. Thus residents are perceived as having a higher sensitivity than workers, even if they might have a similar amount of exposure to the district.

5. Depict Visual Appearance with the Project: The Final Environmental Impact Statement (FEIS) and associated technical memoranda provide verbal descriptions and image visualizations of a range of physical components that comprise the project. These components will continue to be defined through Final Engineering, but are described to the level known at this time.
6. Assess the Project's Visual Impacts: The visual effect of the Preferred Alternative is assessed by weighing four factors: 1) the nature of the project components, 2) the context in which those components are placed, 3) the changes to the visual landscape and 4) the viewer's response to those changes.
7. Propose Methods to Mitigate Adverse Visual Impacts: A high level of visual impact does not necessarily imply that the visual effect is negative. Instead, the adverse nature of a visual effect must be determined through input from affected viewer groups, with regard to the positive or negative perception of a visual impact. Potential adverse visual impacts can be avoided decreasing the visibility of a design component or, making the component similar to existing context. Further identification of visual effects and appropriate mitigation would be defined in conjunction with community involvement through the Final Design.

Based on the criteria described above, general visual effects were assigned a rating of low, medium, or high as dependent on these factors: the nature of a project component, contextual compatibility between the visual component and its surroundings, changes to the visual landscape as a result of the visual component, and viewer sensitivity. A more detailed discussion of how the general visual effects ratings were assigned follows.

a. Nature of the Project Component

The nature of the project component refers to the design, size, and type of the project element. **Table 5-14** summarizes the types of project components that comprise the Preferred Alternative. Also identified is the anticipated level of effect that would result from the introduction of the component into the project viewshed. The project components are more fully described in **Chapter 2, Section 2.4.2** of this FEIS. The level of general visual effect reflects the visibility of a component absent from context, location, or exposure to a specific viewing group. Therefore, the level is a reflection of the components design, size, and type.

Table 5-14: Red Line Project Components

Component	General Visual Effect
1. Overhead Catenary System (OCS)	Medium to High
2. LRT Tracks	
-Ballasted	Medium to High
-Direct Fixation	Medium
-Embedded	Low
-Green Track	Low
3. Transitway	
-Aerial	High
-At Grade	Medium
-Underground	Low

Table 5-14: Red Line Project Components

Component	General Visual Effect
4. Tunnel Portal	High
5. Stations	
-Grade Separated	High
-At Grade	Medium
-Underground	Low to High
6. TPSS/CIH	
-Basic Treatment	High
-Improved Treatment	Medium
-Custom Treatment	Low

b. Contextual Compatibility

Contextual compatibility refers to project components' compatibility with or deviation from existing elements in the project study corridor. **Table 5-15** summarizes the types of contextual compatibility and the anticipated level of effect that would result.

Table 5-15: Contextual Compatibility

Description	General Visual Effect
Introduction of new elements that are either the same or similar to existing elements in the project viewshed	Low
Introduction of new elements that while different from existing elements in the project viewshed, are of a scale, material and/or aesthetic value commensurate with existing elements	Medium
Introduction of new elements that are neither similar to nor of commensurate scale, material, and/or aesthetic value with existing elements	High

c. Changes to the Visual Landscape

Changes to or interruption of identified views or visual resources within the project viewshed were evaluated. **Table 5-16** provides the definitions of various types of visual change and the anticipated level of effect that would result.

Table 5-16: Visual Landscape Change

Description	General Visual Effect
Does not obstruct existing viewshed from residential, commercial or institutional properties; not adjacent to primary pedestrian route, public space or platform	Low
Visible, moderately obstructs view-shed from some residential, commercial or institutional properties but is either not on primary roadway/pedestrian route or is in an area of already compromised visual effect; not adjacent to public space	Medium
Adjacent to residential, commercial or institutional properties; highly visible from primary roadway, retail locations, public space, or residences; highly visible from station platform, or primary pedestrian route; obstructs existing viewshed	High

d. Viewer Sensitivity

Viewer sensitivity refers to the level of expected response to project components based on the frequency and duration of the exposure of the viewer to the project component. **Table 5-17** summarizes the descriptions and expected sensitivity rating for general viewer groups.

Table 5-17: Viewer Sensitivity

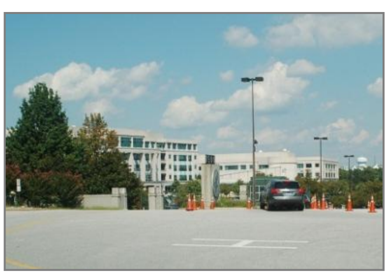
Viewer Group	Description	General Visual Sensitivity
Transitory	People who only are traveling through the project study corridor and to another location; may include drivers, cyclists, transit riders, or pedestrians	Low
Limited Exposure	People who may stay within the project study corridor for an extended period, but do not have a long-term interest in property in or adjoining the project study corridor; includes workers, shoppers, tourists, or other visitors	Medium
Permanent	People who hold a long-term interest in property in or adjoining the project study corridor; generally includes residents, business owners, and other property owners or renters	High

5.7.2 Existing Conditions

There are five visual districts identified in the project viewshed. The visual districts, and applicable sub-districts, are identified on **Figure 5-5**. The visual districts are coincident with the five segments of the Preferred Alternative described in **Chapter 2, Section 2.4.2**. Additional detail and visuals for each visual district are available in the *Visual and Aesthetic Resources Technical Report*.

a. West Segment Visual District

The West Segment Visual District is located in the Woodlawn area of Baltimore County, and includes proposed stations along the alignment at Centers for Medicare & Medicaid Services (CMS), Security Square Mall, Social Security Administration (SSA), and alongside I-70 (near the intersection of Ingleside Avenue and Parallel Drive). The viewer groups in the West Segment Visual District are pedestrians, drivers, transit riders, cyclists, and workers at CMS and the SSA. The accompanying photographs depict typical views within the visual district.



Entrance to CMS

Sidewalk on Security Boulevard

View east on Parallel Drive

The West Segment Visual District contains three visual sub-districts:

1. <u>West Segment Visual Sub-District 1: End of Security Boulevard to Rolling Road</u>: The project viewshed follows along Security Boulevard through a predominantly residential area lined by trees and bookended by commercial/office developments.

2. West Segment Visual Sub-District 2: Rolling Road to I-695 Overpass: The project viewshed continues along Security Boulevard through an area predominated by commercial/shopping structures, including Security Square Mall, and with low levels of landscaping.
3. West Segment Visual Sub-District 3: I-695 to End of I-70 at Parallel Drive: The project viewshed passes over I-695 and follows along I-70, a heavily used commuter route that runs through a relatively heavily wooded zone. The north side of the viewshed is lined by large office complexes while the south side contains low and medium density housing.

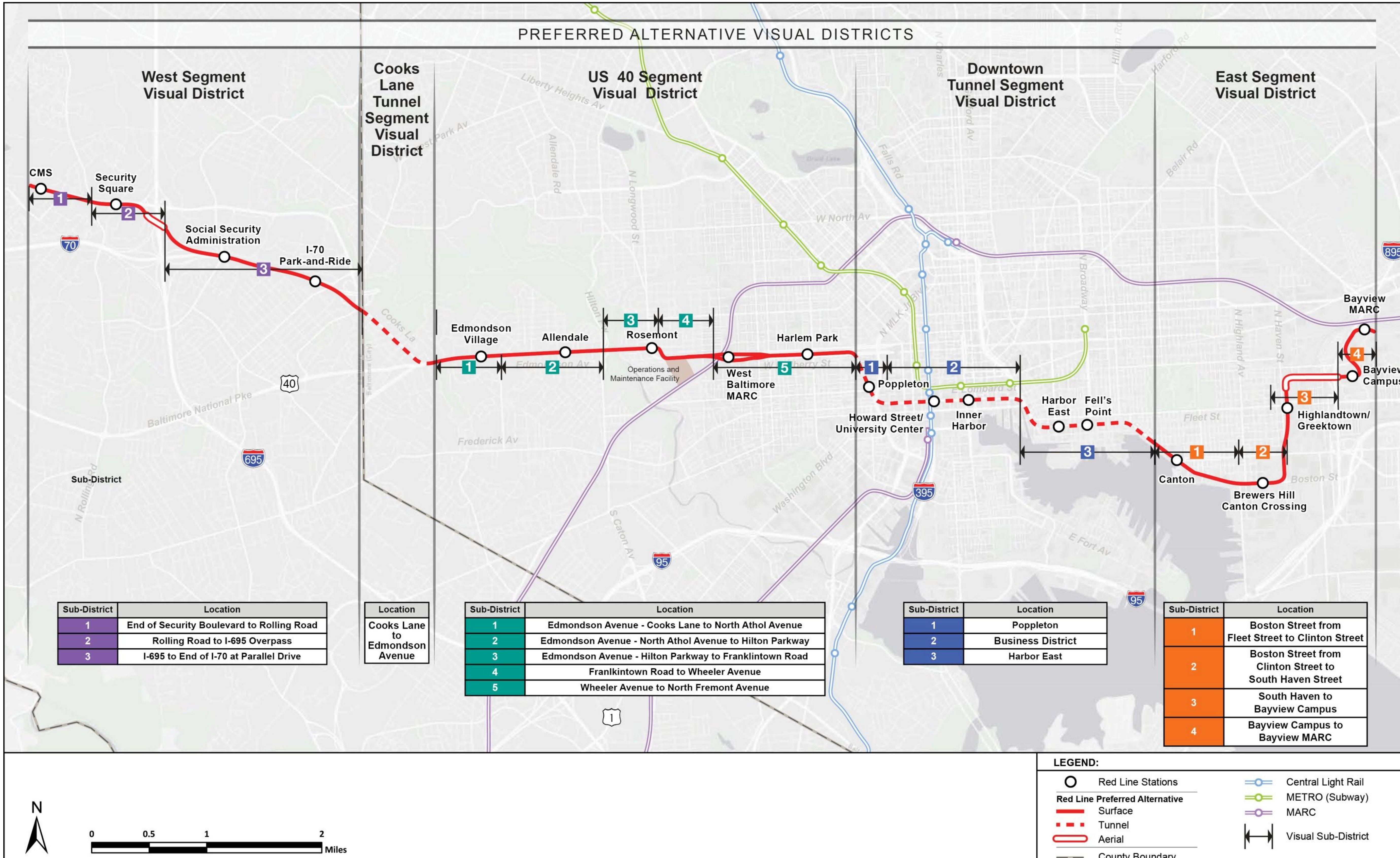
b. Cooks Lane Tunnel Segment Visual District

Cooks Lane is comprised of two lanes with on-street parking on both sides and falls in a relatively steep grade north from its intersection with Edmondson Avenue. Single-family rowhouses with small front yards and porches line the majority of Cooks Lane. At the northern end, the row homes on the west side are set above the roadway with multiple levels of landscaping between. Most have a series of steps from Cooks Lane up to front porches and some of the yards are fenced. Adjacent to the south end of Cooks Lane, multi-family apartments and a two-story brick school building line the west side, with small single-family homes and multi-family apartments on the east side (see photograph. St. William of York anchors the southwest corner of Cooks Lane and Edmondson Avenue. The church is a stone building with ornate detailing surrounded by a well-maintained yard and two statues. Cooks Lane terminates on the south end at US 40/Edmondson Avenue. The viewer groups in the Cooks Lane Tunnel Segment Visual District are pedestrians, drivers, and residents along Cooks Lane.

View south on Cooks Lane at Briarcliff Road

c. US 40 Segment Visual District

The US 40 Segment Visual District is located in the westernmost part of Baltimore City and encompasses five proposed stations on the Preferred Alternative alignment, which mainly runs in dedicated lanes in the median of Edmondson Avenue from just east of Cooks Lane (where the alignment ascends out of the Cooks Lane Tunnel) to just west of Fremont Avenue (where the alignment again descends into a tunnel which traverses below Downtown and Fell's Point neighborhoods). The accompanying photographs depict typical views within the visual district. The areas along the alignment include medium-density residential housing in the form of historic single-family dwellings, and semi-attached and attached row homes with limited amounts of commercial uses. These uses help to characterize the surrounding neighborhoods as having low- to medium-density development. The viewer groups in the US 40 Segment Visual District are pedestrians, drivers, transit riders and residents along the Edmondson Avenue corridor.



Sub-District	Location
1	End of Security Boulevard to Rolling Road
2	Rolling Road to I-695 Overpass
3	I-695 to End of I-70 at Parallel Drive

Location
Cooks Lane to Edmondson Avenue

Sub-District	Location
1	Edmondson Avenue - Cooks Lane to North Athol Avenue
2	Edmondson Avenue - North Athol Avenue to Hilton Parkway
3	Edmondson Avenue - Hilton Parkway to Franklintown Road
4	Franlkintown Road to Wheeler Avenue
5	Wheeler Avenue to North Fremont Avenue

Sub-District	Location
1	Poppleton
2	Business District
3	Harbor East

Sub-District	Location
1	Boston Street from Fleet Street to Clinton Street
2	Boston Street from Clinton Street to South Haven Street
3	South Haven to Bayview Campus
4	Bayview Campus to Bayview MARC

Figure 5-5: Preferred Alternative Visual Districts

View east on Edmondson Avenue

Rowhomes on south side of Edmondson Avenue

North side of Edmondson Avenue

The US 40 Segment Visual District contains five visual sub-districts:

1. US 40 Segment Visual Sub-District 1: Edmondson Avenue - Cooks Lane to North Athol Avenue: The project viewshed in this area is mainly low-density residential, but also contains the historic Edmondson Village Shopping Center and Edmondson-Westside High School.
2. US 40 Segment Visual Sub-District 2: Edmondson Avenue - North Athol Avenue to Hilton Parkway: The project viewshed passes through an area of medium density residential development with many rowhouses sited directly facing the street.
3. US 40 Segment Visual Sub-District 3: Edmondson Avenue - Hilton Parkway to Franklintown Road: The project viewshed transitions from an area that is mainly residential to an area that is a mix of residential and commercial.
4. US 40 Segment Visual Sub-District 4: US 40 between North Franklintown Road and Wheeler Avenue: The project viewshed then shifts to turn down Franklintown Road, between commercial and residential blocks, and then turns again onto West Franklin Street. This segment of the sub-district is bordered on the north by medium density rowhouses and on the south by light industrial/commercial structures.
5. US 40 Segment Visual Sub-District 5: Wheeler Avenue to North Fremont Avenue: The project viewshed grows wider in this sub-district to encompass both Mulberry Street and Franklin Street. The first part of the viewshed includes the West Baltimore MARC station and associated parking lots; then shifts into the lower level of US 40 where a split highway containing 3 lanes of traffic in each direction runs at a level below the prevailing city streets. At the regular street level, medium density rowhouses line the streets facing the suppressed highway.

d. Downtown Tunnel Segment Visual District

The Downtown Tunnel Segment Visual District has five proposed underground stations and ancillary buildings along the alignment. It is densely developed and consists mainly of medium to large scale buildings, with smaller scale residential and retail at the east and west ends of the segment. The accompanying photographs depict typical views within the visual district. The first station is between a developed residential neighborhood to the west and the University of Maryland Medical Campus to the east. The next two stations are in the downtown business district which is developed with medium to high density office, retail and institutional properties. The final two stations are in close proximity to the harbor on the east side of downtown, which is developed with a mix of medium to high density office, new and established residential and retail.


View of Poppleton Fire House


View south at President Street


View west at Broadway in Fell's Point

The viewer groups in the Downtown Tunnel Segment Visual District are pedestrians, drivers, transit riders, cyclists, students at the University of Maryland, tourists, and workers in the business district of downtown. The western and eastern portion of this visual district includes residential development, introducing an additional viewer group.

The Downtown Tunnel Segment Visual District contains three visual sub-districts:

1. <u>Downtown Tunnel Segment Visual Sub-District 1: Poppleton</u>: The project viewshed follows southeast along Fremont Avenue to its intersection with Martin Luther King, Jr. Boulevard. This area is predominantly medium density rowhouses, and also contains the University of Maryland BioPark.
2. <u>Downtown Tunnel Segment Visual Sub-District 2: Business District</u>: This portion of the viewshed contains the large scale business, university and commercial structures that predominate downtown Baltimore, and is centered on the east-west route of Lombard Street.
3. <u>Downtown Tunnel Segment Visual Sub-District 3: Harbor East</u>: After leaving the downtown business district, the project viewshed continues through a series of historic and redeveloped neighborhoods: historic Little Italy, typified by medium-to-high density housing, and numerous restaurants and bakeries; the recently constructed Harbor East area, containing a mixture of high-rise residential, commercial and office structures along the waterfront; and historic Fell's Point, a neighborhood of medium-to-high density housing with numerous restaurants and small scale commercial enterprises.

e. East Segment Visual District

The East Segment Visual District is located in the easternmost portion of Baltimore City with five proposed stations along the alignment. The first three stations are in the Canton and Highlandtown/Greektown neighborhoods, which are primarily developed with medium-density, attached row homes, moderate-density housing along the Canton waterfront, and commercial retail along Boston Street in Canton and Eastern Avenue near Haven Street in Highlandtown. The last two easternmost stations are located in and around the Johns Hopkins Bayview Medical Center campus, a campus setting with detached medium-scale buildings, landscaping and surface parking. The accompanying photographs depict typical views within the visual district. The viewer groups in the East Segment Visual District are pedestrians, drivers, transit riders, cyclists, tourists and employees and visitors in Canton and at Johns Hopkins Bayview Medical Center campus.


View west along Boston Street


View south to Harbor

View across Johns Hopkins Bayview Medical Center campus

East Segment Visual District contains four visual sub-districts:

1. East Segment Visual Sub-District 1: Boston Street - Fleet Street to Clinton Street: The project viewshed follows Boston Street and passes through the neighborhood of Canton, an area of medium to high density housing that also contains a variety of shopping, commercial and entertainment destinations, including several marinas.
2. East Segment Visual Sub-District 2: Boston Street - Clinton Street to South Haven Street: After Clinton Street, the project viewshed enters an area, generally known as Canton Crossing, where the predominantly residential character changes to more commercial development among the remnants of former industrial sites.
3. East Segment Visual Sub-District 3: South Haven Street to Bayview Campus: The viewshed continues through a zone of present and former industrial sites along Haven Street and then passes through a currently unused rail right-of-way bordered by active commercial/industrial sites. Although the immediate project viewshed is industrial, this area is closely bordered by medium density residential rowhouse neighborhoods. Leaving the rail right-of-way, the project viewshed passes east through an industrial zone north of the Greektown neighborhood and continues over I-895.
4. East Segment Visual Sub-District 4: Bayview Campus to Bayview MARC: The viewshed continues east through a part of the Johns Hopkins Bayview Medical Center campus known as Alpha Commons, and then turns north on Bayview Boulevard. Passing north of the campus, the viewshed proceeds behind a light industrial area and terminates along and above the rail lines that would contain the planned Bayview MARC station.

5.7.3 Future No-Build Conditions

The No-Build Alternative would have no direct long-term or short-term effects to the visual environment. However, there would be changes to the visual conditions within the project study corridor as a result of other projects described below.

These projects discussed below are major projects that would have a large enough effect so as to transform a significant part of the viewshed, but are not related to the construction of the Red Line Preferred Alternative.

- Extension of Security Boulevard west of CMS: While the extension of Security Boulevard is mostly outside of the project study corridor, it would affect viewsheds by replacing a large grove of trees that currently border the western edge of the project study corridor and replacing with a new street. Current projections estimate the completion of the extension of Security Boulevard prior to the completion of the project.

- Improvements at the West Baltimore MARC station: These improvements would include expanded surface parking lots, new 800-feet raised train platforms, and more and improved vertical and horizontal circulation connections to the new platforms.
- The Boston/O'Donnell Street connection between Boston Street west of South Conkling Street to the O'Donnell Street Overpass just west of South Haven Street: This project would add a four-lane aerial structure to the existing industrial landscape.
- Bayview MARC station: At the eastern end of the Red Line project study corridor a new MARC station would be constructed north of the Bayview Campus, with a large park-and-ride facility (by others) along Lombard Street.

There are other likely land development projects, such as new development or redevelopment of existing uses within the project study corridor not related to the Red Line that would affect existing visual conditions over time. Most development would have some visual effect on the project viewshed, but only those large projects that would provide a major visual change to a significant portion of the project viewshed are discussed below.

- Uplands: The Uplands residential development is located along the south side of Edmondson Avenue in the US 40 Segment Visual District. This development would add over 700 housing units on over 63 acres of now vacant land.
- Canton Crossing: This development is located on the south side of Boston Street in the East Segment Visual District. When complete, Canton Crossing would create a major shopping and restaurant destination on currently vacant, formerly industrial land.

5.7.4 Preferred Alternative

The following analysis of the visual effects of the Preferred Alternative uses four factors in assessing a level of visual effect on the affected visual district: nature of the project component; contextual compatibility; changes to the visual landscape; and viewer sensitivity. These factors may individually have high, medium, or low ratings, and would be considered in tandem to determine an overall high, medium or low visual effect rating.

a. Long-Term Operational Effects

The analysis of the visual impacts of the Preferred Alternative includes four factors in assessing visual impacts on the affected Visual District and sub-districts: the nature of the project component (design, size, etc.); contextual compatibility; changes to the visual landscape, and viewer sensitivity. These factors were individually assigned low, medium, or high ratings, and were used in tandem to determine an overall low, medium, or high visual effect rating. The effects of the Preferred Alternative on visual and aesthetic resources are based on the amount of change the introduction of the light rail transit components operation would have on existing visual conditions. A viewer's response to the introduced visual components is subjective, and the nature of the introduced component itself may be viewed positively or negatively. While a component that contrasts substantially from the existing context may be characterized as having a high visual impact, that impact might be considered a general positive by the community. **Table 5-18** summarizes the long-term visual effects of the Preferred Alternative. Of

16 visual districts or sub-districts identified throughout the project study corridor, the Preferred Alternative would have an overall visual effect of "high" on one sub-district, and an overall visual effect of "medium to high" on five sub-districts. A more detailed description of the introduced project components, analysis of the visual effect of the Preferred Alternative, and visual illustrations are provided in the *Visual and Aesthetic Resource Technical Report.*

Table 5-18: Summary of Effects to Aesthetics and Visual Resources

Visual District/Sub-District	Project Components	Contextual Compatibility Effect	Visual Change	Viewer Sensitivity	Overall Visual Effect
West Segment Visual District					
Sub-District 1: End of Security Boulevard to Rolling Road	• At-grade transitway with ballasted and embedded tracks • OCS • At-grade center platform station • Traction power substation (TPSS) • Central Instrument House (CIH)	Medium	Medium	Low to High	Low to Medium
Sub-District 2: Rolling Road to I-695 Overpass	• At-grade transitway with ballasted and embedded tracks • OCS • At-grade center platform station • Park-and-ride facility • TPSS	Low to Medium	Medium	Low to Medium	Low

Table 5-18: Summary of Effects to Aesthetics and Visual Resources

Visual District/Sub-District	Project Components	Contextual Compatibility Effect	Visual Change	Viewer Sensitivity	Overall Visual Effect
Sub-District 3: I-695 to End of I-70 at Parallel Drive	• Aerial and at-grade transitway segments • At-grade sections would include ballasted and embedded tracks • Two at-grade stations with center station platforms • Park-and-ride facility • TPSS • CIH • Portal to underground tunnel	Medium	High	Low to Medium	Medium to High
Cooks Lane Segment Visual District					
Cooks Lane to Edmondson Avenue	• Portal to underground tunnel in center of Edmondson Avenue	• Low (below grade) • High (at grade)	Low	Medium to High	Low
US 40 Segment Visual District					
Sub-District 1: Edmondson Avenue - Cooks Lane to North Athol Avenue	• Portal in center of Edmondson Avenue; portal walls topped with protective fencing • East of portal, at-grade transitway with green and embedded tracks • OCS • Two TPSS structures • CIH	Medium to High	Medium to High	High	Medium to High
Sub-District 2: Edmondson Avenue - North Athol Avenue to Hilton Parkway					
Sub-District 3: Edmondson Avenue - Hilton Parkway to Franklintown Road					

Table 5-18: Summary of Effects to Aesthetics and Visual Resources

Visual District/Sub-District	Project Components	Contextual Compatibility Effect	Visual Change	Viewer Sensitivity	Overall Visual Effect
Sub-District 4: North Franklintown Road to Wheeler Avenue	• At-grade transitway with embedded, direct fixation, and green tracks • OCS • TPSS • CIH • Red Line Operations and Maintenance Facility (OMF)	Medium	Medium to High	Low to High	Medium to High
Sub-District 5: Wheeler Avenue to North Fremont Avenue	• At-grade transitway with green or embedded tracks • OCS • Portal to underground tunnel • One at-grade split side-platform station • Adjacent surface parking lot • One underground station with station entrance structures • TPSS • CIH	Medium to High	Medium to High	Low and High	Medium to High
Downtown Tunnel Segment Visual District					
Sub-District 1: Poppleton	• Portal to underground tunnel • Underground transitway • Five underground stations with street-level station entrances and 60-foot high ancillary structures	Medium	High	Medium	Medium
Sub-District 2: Business District					

Table 5-18: Summary of Effects to Aesthetics and Visual Resources

Visual District/Sub-District	Project Components	Contextual Compatibility Effect	Visual Change	Viewer Sensitivity	Overall Visual Effect
Sub-District 3: Harbor East					
East Segment Visual District					
Sub-District 1: Boston Street from Fleet Street to Clinton Street	• Portal from underground segment to at-grade segment; portal would consist of concrete walls topped by protective fencing • At-grade segment would include green and embedded tracks • Roadway reconstruction to accommodate transitway, bike lanes, and street parking • OCS • TPSS • CIH	Medium to High	High	High	High
Sub-District 2: Boston Street from Clinton Street to South Haven Street	• At-grade transitway with green and embedded tracks • Roadway reconstruction to accommodate transitway, bike lanes, and street parking • OCS • TPSS • At-grade, center platform station • Park-and-ride lot	Low to Medium	Medium	Medium to High	Medium

Table 5-18: Summary of Effects to Aesthetics and Visual Resources

Visual District/Sub-District	Project Components	Contextual Compatibility Effect	Visual Change	Viewer Sensitivity	Overall Visual Effect
Sub-District 3: South Haven to Bayview Campus	• At-grade transitway with ballasted and direct fixation tracks • OCS • Aerial transitway on existing rail bridge • TPSS • CIH • Side platform at-grade station • Bridge structure over I-895	Low to medium	Low to High	Low	Low
Sub-District 4: Bayview Campus to Bayview MARC	• At-grade transitway with grass tracks • OTS • TPSS • CIH • At-grade center platform station with pedestrian bridge	Low to High	Medium to High	Medium	• Medium to High (Bayview Medical Campus) • Low (MARC Station area)

b. Short-Term Construction Effects

Introduction of construction equipment, trucks, fencing, or walls surrounding proposed construction staging and laydown areas, as well as fugitive dust, would create a temporary aesthetic/visual effect to neighborhoods surrounding or adjacent to where these activities would occur. See **Chapter 3** for a detailed discussion of construction methods and activities.

c. Avoidance and Minimization

Under the Preferred Alternative, effects to aesthetics and visual resources were avoided by placing segments of the alignment underground. During Final Design and construction, existing tree buffers would be preserved to the extent possible. Additionally, trees and landscaping would be included at park-and-ride facilities, and the lighting selected for stations and park-and-ride lots would not promote light pollution to the surrounding areas. In order to minimize their visual effects, TPSSs, CIHs, at-grade station platforms, and entrances to below-grade stations would be designed in a manner compatible with each of the respective visual districts in which they would be located.

d. Mitigation

Following is a summary of measures to mitigate effects to visual and aesthetic resources throughout the project study corridor. For more detailed information on mitigation measures by visual district and sub-district, refer to the *Visual and Aesthetic Resources Technical Report.*

Where impacts to street trees are unavoidable, trees would be replaced in accordance with Baltimore City tree replacement requirements. During Final Design, other mitigation measures will be explored including the potential use of structured screening (i.e., solid fencing) to screen residential properties from select system components; architectural and landscape treatments at tunnel portals to reduce effects to neighboring properties; pedestrian lighting; decorative paving materials at sidewalks; pedestrian crossing; and incorporation of public art.

5.8 Parks, Recreation Land and Open Space

5.8.1 Introduction and Methodology

Two federal laws that protect parks, recreation land and open space include Section 4(f) of the United States Department of Transportation (USDOT) Act of 1966 (Refer to **Chapter 6** for more detail) and Section 6(f) of the Land and Water Conservation Fund Act (LWCFA). Additionally, Maryland Program Open Space (POS) provides funding for Maryland's local and state parks and conservation areas. Coordination with agencies at the state and local levels is required for effective implementation and compliance with these laws and programs.

Section 4(f) requires that the proposed use of land from any publicly-owned public park, recreation area, wildlife and/or waterfowl refuge, or any significant historic site may not be approved as part of a federally-funded or federally-approved transportation project unless:

- There is no feasible and prudent avoidance alternative to the use of land from the property, and the action includes all possible planning to minimize harm to the property; or
- The use of Section 4(f) properties, including any measures to minimize harm, will have a de minimis effect on the property.

Section 6(f) of the LWCFA requires that federally assisted actions that propose effects to, or the permanent conversion of, outdoor recreation property that was acquired or developed with LWCFA grant assistance be approved by the Department of the Interior’s National Park Service.

In Maryland, LWCFA funds are administered through POS, which was developed by the Maryland Department of Natural Resources (DNR) to provide funding for Maryland's local and state parks and conservation areas. Local POS grants, referred to as “localside,” make funds available to local governments to assist with buying land and building park facilities to help meet local goals of land conservation and recreation for their citizens.

The following methods and tools were used to identify publicly-owned public parks and recreation areas, as well as publicly-owned open space with potential recreational value: review of GIS layers, review of the Baltimore CityView mapping tool, visual observation, and property record searches. Following the initial inventory the Baltimore County Department of Recreation and Parks, the Baltimore City Department of Recreation and Parks, and DNR were consulted with to identify significant publicly-owned public parks, recreational land, and open space resources; and to confirm the official with jurisdiction for each property.

5.8.2 Existing Conditions

Eleven significant parks, recreation lands, or open space areas are located within or adjacent to the project study corridor. Two properties in Baltimore City were purchased or improved, in part, with POS Localside grants administered by DNR (Canton Waterfront Park and Canton Park/Du Burns Arena). No LWCFA funds were used in the acquisition or improvements of any of the properties; therefore, the requirements of Section 6(f) do not apply. A summary of the park, recreation, and open space resources is presented in **Table 5-19**. These resources are identified on **Figure 5-6**.

Table 5-19: Parks, Recreation Land and Open Space along the Project Study Corridor

<table>
<tr><th>Resource</th><th>Area</th><th>Ownership</th><th>Description/Activities</th></tr>
<tr><td colspan="4">West Segment</td></tr>
<tr><td rowspan="2">Chadwick Elementary School

Located adjacent to the south of the western project terminus</td><td>13.4 acres</td><td>Baltimore County Board of Education</td><td>Parcel contains school buildings, recreational tennis courts and indoor recreational facilities available to the public outside of normal school hours</td></tr>
<tr><td>6.0 acres</td><td>Baltimore County Department of Recreation and Parks</td><td>Parcel contains playing fields used by youth leagues and nearby residents outside of normal school hours</td></tr>
<tr><td colspan="4">Cooks Lane Tunnel Segment</td></tr>
<tr><td colspan="4">No resources present.</td></tr>
<tr><td colspan="4">US 40 Segment</td></tr>
<tr><td>Gwynns Falls/ Leakin Park

Located in western Baltimore City</td><td>1,200 acres</td><td>Baltimore City Department of Recreation and Parks</td><td>Contiguous parkland from the western boundary of Baltimore City, following the Gwynns Falls from Windsor Mill Road to Wilkens Avenue; includes woodlands, recreational trails, picnic areas and miniature steam trains in use from April through October</td></tr>
<tr><td>Uplands Park

Located in the Uplands/Ten Hills neighborhoods of Baltimore City, on the south side of Edmondson Avenue between Nottingham Road and Uplands Parkway</td><td>33.6 acres</td><td>Baltimore City Department of Recreation and Parks</td><td>Wooded area located in the Upland/Ten Hills neighborhoods of Baltimore City, and bound by Edmondson Avenue to the north</td></tr>
</table>

Table 5-19: Parks, Recreation Land and Open Space along the Project Study Corridor

Resource	Area	Ownership	Description/Activities
Edmondson-Westfield High School Located on the south side of Edmondson Avenue in western Baltimore City	26.0 acres	Baltimore City Board of Education	High school with publicly-owned and accessible playing fields and tennis courts
Downtown Tunnel Segment			
Holocaust Memorial Park Located in the downtown area of Baltimore City, on the north side of East Lombard Street at South Gay Street	2.3 acres	Baltimore City Department of Recreation and Parks	Memorial to the Holocaust
Columbus Park Located in Baltimore City Inner Harbor area, at the northwest corner of Eastern Avenue and South President Street	0.7 acre	Baltimore City Department of Recreation and Parks	Columbus monument, pedestrian plaza and walking paths
East Segment			
Boston Street Pier Park Located in the Canton neighborhood of Baltimore City on the south side of Boston Street at South Lakewood Avenue	0.8 acre	Baltimore City Department of Recreation and Parks	Multi-use paths and a pedestrian bridge/fishing pier connecting to the Baltimore Waterfront Promenade
St. Casimir's Park Located in the Canton neighborhood of Baltimore City on the north side of Boston Street between South Lakewood and South Kenwood Avenues	1.4 acres	Baltimore City Department of Recreation and Parks	Includes open space, walking paths, and benches

Table 5-19: Parks, Recreation Land and Open Space along the Project Study Corridor

Resource	Area	Ownership	Description/Activities
Canton Waterfront Park [1] Located in the Canton neighborhood of Baltimore City on the south side of Boston Street between South Linwood Avenue and South Clinton Streets	7.0 acres	Baltimore City Department of Recreation and Parks	Korean War Memorial, water taxi landing, fishing and crabbing access, pedestrian and bicycle access, and a segment of the Baltimore Waterfront Promenade
Du Burns Arena (also known as Canton Park)[1] Located in the Canton neighborhood of Baltimore City on the north side of Boston Street at the intersection with Ellwood Avenue	2.5 acres	Baltimore City Department of Recreation and Parks	Home of the Baltimore Blast soccer team, also hosts club sports, and events such as roller derby and boxing matches
Canton Soccer Park Located in the Canton neighborhood of Baltimore City on the north side of Boston Street between South East Avenue and South Clinton Street	2.9 acres	Baltimore City Department of Recreation and Parks	Playing fields accessible to the public, and used by youth and club sports

Note: [1] These properties were acquired or improved with Program Open Space Localside Grant Funds

5.8.3 Future No-Build Conditions

Under the No-Build Alternative, the Red Line would not be constructed. There would be no effects to the publicly-owned parks, recreation land, or open space properties described above as a result of the Red Line project.

5.8.4 Preferred Alternative

Effects to parks, recreation lands and open space are described below. For additional information on effects to parks, recreation lands and open space refer to **Chapter 6** of this Final Environmental Impact Statement (FEIS).

a. Long-Term Operational Effects

Long-term effects to park, recreation and open space areas are summarized below. Under the Preferred Alternative, none of the project noise exposure levels at the parks are predicted to exceed the Federal Transit Administration (FTA) moderate or severe impact criteria.

West Segment

- Chadwick Elementary School: Impacts to the Chadwick Elementary school grounds would be limited to the parcel owned and maintained by the Baltimore County Board of Education, and no impacts to recreational facilities located on this parcel would occur. Of the 13.4-acre impacted parcel, a 0.7 acre area of the property would be required for construction of and access to a proposed traction power substation (TPSS). No impacts to the parcel owned and maintained by the Baltimore County Department of Recreation and Parks would occur.

US 40 Segment

- Gwynns Falls/Leakin Park: Effects to Gwynns Falls Park would be avoided under the Preferred Alternative.
- Uplands Park: Permanent effects to Uplands Park would be avoided under the Preferred Alternative.
- Edmondson-Westside High School: Of the 26.0-acre property, approximately 150 square feet of school property near the Edmondson Avenue and Athol Avenue intersection would be purchased in fee simple to accommodate intersection improvements and stormwater management. No effects to recreational facilities would occur.

Downtown Tunnel Segment

- Holocaust Memorial Park and Columbus Park: Effects to these parks would be avoided under the Preferred Alternative.

East Segment

- Boston Street Pier Park: Boston Street Pier Park would incur only minor effects from the Preferred Alternative. Of the 0.8-acre property, a fee-simple area of less than 0.1 acre would be required from this park to accommodate stormwater management for the Red Line project.
- St. Casimir's Park: St. Casimir's Park would incur only minor effects from the Preferred Alternative. Of the 1.4-acre property, a fee-simple area of less than 0.1 acre would be required to accommodate sidewalk reconstruction and stormwater management for the project.
- Canton Waterfront Park: There are no permanent effects to Canton Waterfront Park.
- Canton Park/Du Burns Arena: There are no permanent effects to Canton Park/Du Burns arena property.
- Canton Soccer Park: Effects to Canton Soccer Park would be avoided under the Preferred Alternative.

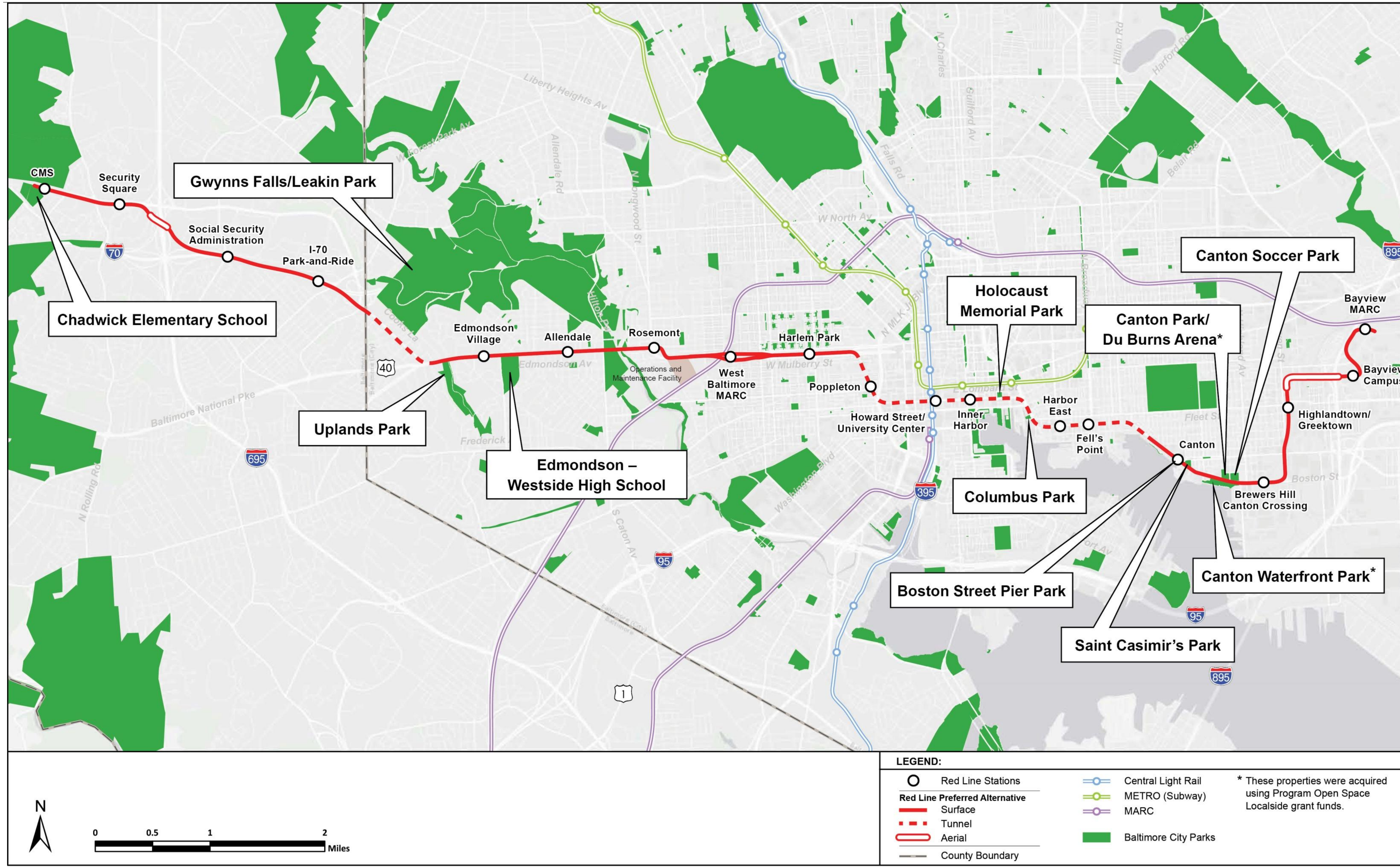


Figure 5-6: Existing Parks and Recreation Areas along the Preferred Alternative Project Study Corridor

b. Short-Term Construction Effect

Each affected park, recreation land, and open space described in the previous section would experience temporary impacts due to construction activities, which are more fully described in **Chapter 3** of this FEIS. This section describes temporary occupancies (easements) that would be required during construction of the Red Line project. The areas of temporary easement required from each resource would be in addition to applicable permanent impacts as described in the previous section.

US 40 Segment

- Uplands Park: Of the 33.6-acre property, a temporary easement of 0.1 acre would be required to accommodate two eastbound lanes of traffic on the south side of Edmondson Avenue during construction, as well as a temporary sidewalk to maintain pedestrian access during construction. Construction activities on the property would also include vegetation removal, temporary fill, and erosion and sediment control measures. The duration of the temporary easement would be approximately 30 months.
- Edmondson-Westside High School: During construction, a temporary easement of 0.1 acre along Edmondson Avenue would be required from the 26.0-acre school property for grading, and erosion and sediment control measures. Construction activities would not encroach upon or prohibit activities on school playing fields or recreational amenities. Construction along this portion of Edmondson Avenue is anticipated to last for approximately 2 years, during which time the temporary easement would be maintained.

East Segment

Under the Preferred Alternative, temporary easements to park resources along Boston Street would result from construction work such utility relocations, mill and overlay work, curb and sidewalk rehabilitation, stormwater management facilities, proposed track work, etc. All work along Boston Street would last approximately 6 to 12 months in duration, and impacts to individual parks would occur intermittently within that timeframe.

- Boston Street Pier Park: During construction, a temporary easement of less than 0.1 acre would be required from the 0.8-acre park property for grading, sidewalk reconstruction and erosion and sediment control along Boston Street.
- St. Casimir's Park: A temporary easement of less than 0.1 of would be required from the 1.4-acre park property for curb and sidewalk reconstruction and mill and overlay work on Boston Street.
- Canton Waterfront Park: During construction, a temporary easement of 0.1 acre would be needed from the 7.0-acre park property for curb and sidewalk reconstruction, and mill and overlay work on Boston Street.

  Canton Waterfront Park includes a parking lot with vehicle entrances at South Ellwood and South East Avenues. Intersection work proposed on Boston Street would temporarily affect left turns, which would also prohibit left turn movements to and from the parking lot entrances during construction. Right-in, right-out entrances to and from South Ellwood and South East Avenues would be maintained. Work at each intersection would last approximately 2 weeks, and would be staggered so that only one entrance is affected at a time and access is maintained. Boat trailer access to Canton Waterfront Park would be maintained during and after construction.

- Canton Park/Du Burns Arena: During construction, a temporary easement of less than 0.1 acre would be needed from the 2.5-acre property for sidewalk repairs and modifications.

c. Avoidance and Minimization

During planning and advanced conceptual design, opportunities to avoid and minimize effects to parks, recreation land and open space were actively pursued. Overall project effects were reduced by locating segments of the Preferred Alternative in tunnel sections or within transportation right-of-way where possible. A large portion of the surface level segments of the Preferred Alternative are located within urbanized road right-of-way, which significantly limits additional opportunities for avoidance and minimization of effects to specific park, recreation land or open space resources. However, in cases where effects to parks, recreation land and open space could not be avoided, opportunities to minimize effects included shifting the alignment and/or the limit of disturbance to reduce such effects to parks and recreational properties.

Forest Conservation Plans will be developed during the design stage of the project to provide tree protection devices and techniques for individual tree protection. Specific tree impact avoidance and minimization techniques will be outlined in the Forest Conservation Plans and further detailed in **Section 5.15** of the FEIS.

In order to avoid effects to park users, particularly along Boston Street, any anticipated roadway or sidewalk closures will be staged to maintain pedestrian and vehicular access, as applicable, to at least one park entrance at a time.

d. Mitigation

- Mitigation for removal of trees within parklands located in Baltimore County will be completed in accordance with Maryland Department of Natural Resources requirements. Trees removed on Baltimore City parkland will be replaced in coordination with the City. The selection of forest mitigation or individual street tree planting sites will be coordinated through DNR and the appropriate agencies with jurisdiction.
- Disturbance to park properties as a result of construction activities, including areas requiring grading, will be restored to acceptable conditions through coordination with the park owners.

5.9 Built Historic Properties

This section discusses additional work conducted for built historic properties since publication of the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS), and discusses effects to built historic properties in relation to the No-Build and Preferred Alternative. The work was conducted by architectural historians who meet the Secretary of the Interior's Professional Qualification Standards in accordance with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, and its implementing regulations at 36 CFR Part 800.

The following information is addressed in this section: the revised Area of Potential Effects (APE); additional properties evaluated for the National Register of Historic Places (NRHP); potential effects of the Preferred Alternative on built historic properties (i.e. those that are listed in or eligible for listing for the NRHP); and efforts to minimize potential adverse effects during operation of the Red Line. Consultation with the Maryland State Historic Preservation Officer (MD SHPO) at the Maryland Historical Trust (MHT) and Section 106 consulting parties is discussed. Proposed mitigation measures are addressed in the draft Programmatic Agreement included in **Appendix H**. Throughout the course of the project, multiple documents, including reconnaissance survey reports, determinations of eligibility, and a proposed assessment of effects have been prepared, and are summarized below. Additional details regarding built historic properties and proposed effects of the Preferred Alternative are available in the *Section 106 Assessment of Effects for Built Historic Properties,* located in **Appendix I**.

5.9.1 Introduction and Methodology

Architectural history investigations for the Red Line project span approximately 8 years and respond to various project changes, from early assessments of multiple alignments under consideration to the current limit of disturbance developed for the Preferred Alternative. The following discusses the methodology used for identification and evaluation of built historic properties for the Red Line project. The surveys meet the guidelines for architectural surveys established by the MHT. Section 106 consultation efforts are described below in **Section 5.9.5**.

a. APE and Reconnaissance-Level Survey

The Red Line project historic architectural study began in 2004. At that time, the Maryland Transit Administration (MTA) was considering and studying multiple alignment alternatives; these alternatives generally extended from the Woodlawn area in Baltimore County in the west to Canton in eastern Baltimore City. The initial historic architectural APE was determined to be 500 feet from each alignment's center line (i.e., a 1,000-foot buffer centered on each alignment) for areas west of Gwynns Falls Park, and 250 feet from each alignment's center line (i.e., a 500-foot buffer centered on each alignment) for areas east of the park.

The wider APE was applied to the suburban areas of Baltimore County and western Baltimore City, while the narrower APE was used for Baltimore City's densely built urban areas. Because of the potential for project changes as alignments were refined, all parties agreed that the APE would change over the course of the project, which is typical Section 106 practice.

A reconnaissance-level survey was conducted because of the many alternatives under consideration at that time and the numerous potential historic properties within the study areas. The survey results provided information about the number and types of potential historic properties near the proposed alignments as well as their NRHP eligibility or listing status.

The entire project area APE was surveyed and examined to identify buildings, structures, objects, sites, districts, and landscape features more than 45 years of age (the project standard at the time to allow for project planning completion) located within the APE that had not been previously listed or evaluated for the NRHP.

MTA submitted the resulting *Cultural Resources Technical Report: Volume 1 – Red Line Corridor Transit Study: Cultural Resources Reconnaissance Survey* to MHT in April 2005. MHT provided comments in correspondence dated August 25, 2005, and formally concurred with the APE delineation. No additional work was requested to revise the survey report. MHT provided additional guidance on proposed intensive-level survey treatments. The Baltimore City Commission on Historic and Architectural Preservation and the Baltimore County Department of Planning received copies of this documentation, but did not comment on its contents.

b. Intensive-Level Survey

During intensive-level survey, architectural historians that met the Secretary of the Interior's Professional Qualification Standards photographed properties, made visual assessments, took field notes, and documented historic settings.

Per MHT standards and guidelines, historians conducted archival research and prepared Determination of Eligibility (DOE) Forms for all previously identified resources in the APE that had not been evaluated for NRHP listing. Resources greater than 45 years of age and newly identified during the reconnaissance survey were documented with either DOE Forms or Short Forms for Ineligible Properties (Short Forms), as appropriate. This documentation included required accompanying documentation. MHT did not request updated documentation for previously evaluated properties unless their eligibility status had clearly changed.

MTA submitted the resulting three volume intensive-level survey *Historic Structures Survey Technical Report* to MHT in February 2006. Comments were received from MHT in correspondence dated March 19, 2007. MTA incorporated MHT's suggested changes and submitted revised DOE Forms to MHT in December 2007. The Baltimore City Commission on Historic and Architectural Preservation and the Baltimore County Department of Planning received copies of this documentation, but did not comment on its contents. For additional details, please refer to this report.

c. Bayview Extension APE and Reconnaissance-Level Survey

The Red Line project was extended to the east in 2007 to the Johns Hopkins Bayview Medical Center campus in eastern Baltimore City because MTA determined there was sufficient ridership potential. The APE guidelines previously established for the original survey were applied to the Bayview Extension. Therefore, the APE for this urban area was defined to be 250 feet on either side of the center line. Historians evaluated properties built before 1960 during this survey.

A similar documentation and evaluation methodology was applied to the expanded APE in this area. MTA submitted the resulting *Cultural Resources Technical Report: Volume 4 – Red Line Corridor Transit Study: Bayview Extension Cultural Resources Reconnaissance Survey* to MHT at an April 7, 2008, meeting that included the historians. Detailed discussions led to agreement on how to proceed with the intensive-level survey. The Baltimore City Commission on Historic and Architectural Preservation received copies of this documentation, but did not comment on its contents.

d. Bayview Extension Intensive-Level Survey

As with the Red Line's original intensive-level survey, historians prepared MHT DOE Forms for all previously identified but not NRHP-evaluated resources in the expanded APE, as well as newly identified properties more than 45 years of age.

MTA submitted the resulting *Red Line Corridor Transit Study – Bayview Extension; Historic Architectural Resources Survey* to MHT in February 2010. Comments were received from MHT in correspondence dated June 9, 2010, that included follow-up comments for the original intensive-level survey. MTA submitted revised DOE Forms based on MHT comments on May 2, 2012. The Baltimore City Commission on Historic and Architectural Preservation received copies of this documentation, but did not comment on its contents.

e. Refined APE and Additional Identification Based on the Locally Preferred Alternative

Officials selected the Red Line Locally Preferred Alternative (LPA) in August 2009. Although preliminary limit of disturbance remained unknown, historians refined the APE in July 2010 to only include the LPA and excised areas associated with alternatives no longer under consideration. Historians applied the same prior methodology to this revised APE, using either the 500-foot or 250-foot buffer from the centerline as appropriate. Additional properties were identified and evaluated as a result of these changes.

In January 2012, MHT asked that all properties that would become 50 years old prior to the completion of the project planning process be identified and evaluated; considering the project schedule, the Federal Transit Administration (FTA) and MTA decided that all properties built in or before 1963 would be evaluated. This revised year-built guideline would apply to the entire revised APE, requiring re-evaluations in previously surveyed areas.

f. Additional Identification and Evaluation Based on the Limit of Disturbance

The preliminary Red Line limit of disturbance was established in December 2011. Therefore, MTA refined the APE to consider the limit of disturbance, rather than the linear project information previously considered. Following prior precedent and MHT recommendations, the new APE was 500 feet on either side of the limit of disturbance's outer limits to the west (and inclusive) of Gwynns Falls Park, and 250 feet on either side of the limit of disturbance's outer limits to the east of the park.

Historians conducted field surveys and additional research between July 2011 and April 2012 to document and photograph any unevaluated properties built in 1963 or earlier. MTA submitted these final additional DOE and Short Forms to MHT in May and June 2012; MHT concurrence with these determinations was received in July 2012 and September 2012.

5.9.2 Existing Conditions

The survey work above documented the existing conditions within the APE. Seventy-eight historic properties were identified within the Red Line project's APE. These properties or districts that are listed in or eligible for the NRHP are described in order from west to east in the *Section 106 Assessment of Effects for Built Historic Properties.* The proposed Section 106 effects findings are located in **Appendix I**, and shown in **Volume 2 Environmental Plate Series**. MHT and the consulting parties have the opportunity to review and provide comments on the proposed effects findings concurrent with the Final Environmental Impact Statement (FEIS) comment period.

Only one historic property, the Franklintown Road over Dead Run Bridge (SHA #B0096), is located within Baltimore County. All other historic properties are located in Baltimore City. Two of the NRHP-listed properties, Davidge Hall and the Star-Spangled Banner Flag House, are National Historic Landmarks (NHL).

5.9.3 Future No-Build Conditions

Under a future No-Build Alternative, there would be no changes to the existing transportation services or facilities in the areas along the proposed Red Line corridor, beyond those projects already committed. Therefore, the No-Build Alternative would have no project related effects on built historic properties.

5.9.4 Preferred Alternative

This section summarizes the proposed Section 106 determination of effects on built historic properties, as defined in 36 CFR Part 800.5.

a. Long-Term Operational Effects

Effects to historic properties were discussed with consulting parties during meetings in September and October 2012. In accordance with Section 106, the Preferred Alternative would have the following proposed effects findings:

- *no effect* on 45 individual historic properties;
- *no adverse effect* on 28 individual historic properties; and an
- *adverse effect* on five individual historic properties

Therefore, an overall finding *of adverse effect* on historic properties has been proposed for the Preferred Alternative. The proposed effects findings have been submitted to the State Historic Preservation Office (SHPO) and consulting parties for review. The Advisory Council on Historic Preservation (ACHP) has been notified of this proposed finding of adverse effect on historic properties, and has been invited to participate in the consultation process. The historic properties that have proposed adverse effects by the Preferred Alternative are all located within Baltimore City and are presented in **Table 5-20**. The corresponding *Section 106 Built Historic Properties* plate series number associated with each historic property is referenced in the table, and available in **Volume 2 Environmental Plate Series, Plate Series 3** of this FEIS. Full documentation of the proposed Section 106 effects determinations is available **in Appendix I** of this FEIS.

Table 5-20: Summary of Potential Section 106 Adverse Effects to Built Historic Properties

Plate #	Historic Property	MHT#	Description	Build Date	NRHP Status	Reason for Adverse Effect Determination
8	***Poppleton Fire Station (Engine House No. 38)***	B-3693	• Two-story brick and limestone Tudor Revival firehouse with a central, Tudor archway	1910	Listed	Adverse effect is a result of project construction activities and cumulative visual changes to the historic setting
9/10	***Business and Government Historic District***	B-3935	• Commercial buildings range from small two- and three-story storefront buildings • Modern 25-story office towers • Major landscaping features are Monument Square, War Memorial Plaza, and the open space in front of the Fish Market	Primarily ca. 1900 to 1925; some earlier and later	Listed	Adverse effect is due to the proposed demolition of contributing buildings and visual adverse effects from project components including introduction of a ventilation building and project construction
10	***South Central Avenue Historic District***	B-5058	• Approximately eight blocks of light industrial precinct • Comprised of brick two- and three-story industrial and residential buildings • Several larger buildings include the Bagby Furniture Company and Strauss Malt House	ca. early 19th to mid-20th century	Listed	Adverse effect is a result of visual effects due to a change in setting from project components including introduction of a ventilation building and construction

Table 5-20: Summary of Potential Section 106 Adverse Effects to Built Historic Properties

Plate #	Historic Property	MHT#	Description	Build Date	NRHP Status	Reason for Adverse Effect Determination
10/ 11	***Fell's Point Historic District***	B-3714	• Harborside residential and light industrial community • Approximately 75 acres consisting of mainly small 2.5-story and also more elaborate 3.5-story houses • Large open market square on the water at the foot of Broadway	ca. 1760s to late 19th century	Listed	Adverse effect is a result of visual effects due to a change in setting from project components including a ventilation building and construction
10	***Public School No. 25 (Captain Henry Fleete School)***	B-3928	• T-shaped brick Late Victorian school; two stories high with a ground level basement and a central three-story Romanesque tower capped by a pyramidal roof	1892	Listed	Adverse Effect is a result of visual effects due to a change in setting from project components including a ventilation building

b. Short-Term Construction Effects

Short-term noise, vibration, visual, and traffic effects would occur during construction. Construction effects, which are not permanent, but would last for up to 7 years, would likely require monitoring. Proximate historic buildings may be monitored to avoid unanticipated adverse effects. Special attention would be paid to potential effects for historic properties that may require underpinning.

Initial studies indicate that noise and vibration effects may occur at select locations as a result of project construction and operations; some of the locations are within historic property boundaries. These impacts would be minimized by implementing established best practices and construction techniques that reduce these impacts substantially. At this time, noise and vibration experts and historians anticipate that these effects would be reduced to a point where they would not reach a threshold that would constitute an adverse effect based on distinct noise or vibration effects. Air quality studies conclude there would be no effects to air quality proximate to historic properties.

c. Avoidance, Minimization, and Mitigation

A Section 106 draft Programmatic Agreement has been developed to avoid, minimize, and mitigate adverse effects to historic properties through stipulations that must be implemented. The Programmatic Agreement includes a stipulation that provides for assessments and procedural plans for any unanticipated adverse effects, which could include unanticipated direct effects or indirect effects, such as noise and vibration. This stipulation acknowledges that project situations may require ongoing effects assessments and provides for consultation on any unanticipated adverse effects if warranted. The draft Programmatic Agreement is included in **Appendix H.** The final executed Programmatic Agreement will be included in the project Record of Decision (ROD).

5.9.5 Section 106 Consultation

a. MD SHPO Consultation

This section discusses consultation efforts with Section 106 consulting parties, including the MD SHPO. The purpose of consultation has been to share information on the Preferred Alternative and to discuss the following:

- methodology in developing the APE;
- identification of historic properties listed or determined eligible for listing in the National Register (Determinations of Eligibility);
- assessment of effects; and
- avoidance, minimization, or mitigation efforts that may be needed to offset any adverse effects on cultural resources.

FTA has consulted with the MD SHPO to delineate the built environment APE, identify historic properties, and evaluate properties not previously evaluated for NRHP eligibility. To date, the MD SHPO has reviewed and commented on the following:

- *Cultural Resources Technical Report: Volume 1 – Red Line Corridor Transit Study: Cultural Resources Reconnaissance Survey* and APE delineation (August 25, 2005 correspondence)
- Evaluations in the *Historic Structures Survey Technical Report* (March 19, 2007 correspondence)
- *Cultural Resources Technical Report: Volume 4 – Red Line Corridor Transit Study: Bayview Extension Cultural Resources Reconnaissance Survey* and APE delineation (April 7, 2008 meeting)
- Evaluations in the *Red Line Corridor Transit Study – Bayview Extension; Historic Architectural Resources Survey* (June 9, 2010 correspondence, included follow-up comments on the original evaluations)
- Refined APE and list of additional properties for evaluation (January 17, 2012 correspondence)
- DOE and Short Forms provided in May and June 2012 (concurrence received in July 2012 and September 2012)

b. Section 106 Consulting Parties

The Red Line public outreach process was initiated in 2003, and a series of public scoping meetings and open houses continued into 2004 and 2005. MTA sent public notification mailings in 2005; these mailings included approximately 5,000 individuals and 250 community organizations. A community newsletter sent in 2005 described the Section 106 process and invited interested and consulting parties to a series of public meetings in 2005.

In 2006, MTA developed a Section 106 Public Participation Program that has been followed throughout the course of the project. At that time, no individuals or community groups had requested consulting party status and only three public comments on the project related to historic properties concerns. Twenty-six community organizations and three government agencies were invited to become consulting parties. No community organizations responded to the invitation. MTA proceeded with consultation with MHT, the Baltimore City Commission on Historic and Architectural Preservation (CHAP) and the Baltimore County Planning Department's preservation services staff. Only MHT and CHAP chose to participate actively.

In 2009, MTA received correspondence from a group of community organizations expressing concerns about the project's effects on the Canton Historic District. These organizations included the Anchorage Homeowners Association, Baltimore Harbor Watershed Association, Canton Community Association, Canton Cove Association, Canton Square Homeowners Association, and Waterfront Coalition. The groups requested and were granted consulting parties status, and were provided with project documentation related to the project and Canton Historic District. As project work continued in 2010 and 2011, consultation continued with MHT staff and CHAP, as appropriate.

FTA has complied with 36 CFR Part 800.2, and identified and contacted nine federally-recognized Native American tribes in October 2012, including the Absentee-Shawnee Tribe of Oklahoma, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe, Oneida Indian Nation, Onondaga Nation, Saint Regis Mohawk Tribe, Shawnee Tribe, and Tuscarora Nation. In addition, FTA has identified and contacted state-recognized tribes with cultural ties to the project area, including the Piscataway Indian Nation, Inc., Piscataway Conoy Confederacy and Subtribes, Inc., and the Cedarville Band of Piscataway Indians. The Delaware Tribe of Indians wishes to be considered a consulting party, and notified and further consulted if human remains or objects of cultural patrimony are found during construction activities. The Shawnee Tribe wishes to be considered a consulting party, if unanticipated discoveries are found during construction activities.

A consulting party meeting was held on September 25, 2012 to share project information and listed/eligible historic properties within the APE identified. A second meeting was held on October 17, 2012 to provide an overview of potential effects, and to discuss potential avoidance, minimization, and mitigation measures. Additional consulting party meetings are being planned to continue discussions on the effects, potential avoidance, minimization and mitigation measures, and the Programmatic Agreement.

In a letter dated November 6, 2012, the FTA notified the ACHP of the proposed finding of adverse effect on historic properties, in accordance with 36 CFR Part 800.6. The FTA asked the

ACHP to review information attached to the letter, to determine if the agency wishes to join the consultation process.

Additional tasks are required to complete the Section 106 process. Comments on the proposed effects determinations in the *Section 106 Assessment of Effects for Built Historic Properties* from MHT, consulting parties, and the public will be incorporated into a final *Section 106 Assessment of Effects for Built Historic Properties.* Additional consulting parties meetings will be held in December and January, as appropriate, to discuss comments on the effects determinations and finalize the Programmatic Agreement (refer to **Appendix H** for a draft of the document). Following formal concurrence on the effects determination and Programmatic Agreement, the Programmatic Agreement will be circulated for signatures. The executed Programmatic Agreement will be completed prior to the ROD.

5.10 Archeological Resources

The archeological investigations undertaken in support of the Red Line project have been conducted in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470 et. Seq.); Archeology and Historic Preservation: The Secretary of the Interior's Standards and Guidelines (FR 48: 44716-44742), September 1983; Maryland Historical Trust's (MHT) Standards and Guidelines for Archeological Investigations in Maryland (1994); and MHT's Standards and Guidelines for Architectural and Historical Investigations in Maryland (2000).

5.10.1 Introduction and Methodology

A *Phase IA Archeological Assessment Technical Report* was prepared in 2007 by the Maryland Transit Administration (MTA) in support of the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS). The *Phase IA Archeological Survey* provided a comprehensive overview of the archeological context and sensitivity for prehistoric and historic archeological sites within the project study corridor. Prehistoric sites include resources associated with Native American activities prior to Euro-American occupation in the region. Historic sites represent activities post-dating Euro-American occupation in the region.

For the current study, a predictive model for the Preferred Alternative was developed which incorporated evidence of prior disturbance, current land use and previously recorded cultural resources to justify areas of high, medium, and low cultural resource sensitivity. The results of the Phase IA survey and supporting predictive models identified 22 areas of archeological sensitivity along the Preferred Alternative, five areas in Baltimore County and 17 areas in Baltimore City.

Concurrently, data regarding subsurface conditions is being gathered through the archeological monitoring of project geotechnical borings. Initiated in December 2009, archeologists, working in conjunction with the geotechnical staff, are recording the soils in geotechnical bores collected from areas of archeological sensitivity in the limit of disturbance. The bores provide a glimpse of the soil stratigraphy in the project setting, including modern and historic fill, as well as the natural subsoil development. The soils information and any archeological observations are shared with the project geomorphologist. This monitoring effort is allowing the archeological team to verify the anticipated subsurface conditions in potentially sensitive portions of the alignment, and help to highlight areas of elevated potential or subsurface integrity. For example, soil bores along Boston Street have confirmed significant historic infilling in the setting, but evidence of the potential for wharves, pilings and other wooden features associated with 19th and early 20th century maritime activities at the harbor.

In support of this Final Environmental Impact Statement (FEIS), each area of archeological sensitivity where the Preferred Alternative would cause ground disturbance has been reviewed and assessed with regard to the potential for encountering archeological resources during construction. The limit of disturbance was used to identify the known effects based on the Preferred Alternative. The limit of disturbance constitutes the archeological Area of Potential Effects (APE) for the project. Six archeological study zones were identified along the limit of disturbance. These study zones include:

- Archeological Study Zone 1: generally overlaps with the Preferred Alternative West segment
- Archeological Study Zone 2: generally overlaps with the Preferred Alternative Cooks Lane Tunnel segment
- Archeological Study Zone 3: generally overlaps with the Preferred Alternative US 40 segment
- Archeological Study Zone 4: generally overlaps with the Preferred Alternative Downtown Tunnel segment
- Archeological Study Zone 5: generally overlaps with a portion of the Preferred Alternative East segment from the eastern Downtown Tunnel portal on Boston Street to Johns Hopkins Bayview Medical Center campus
- Archeological Study Zone 6: generally overlaps with a portion of the East segment, and includes Johns Hopkins Bayview Medical Center campus

It was determined that a subsurface archeological investigation (Phase IB) was warranted in select areas where proposed near- or at-surface construction effects, such as stations and ventilation shafts, would affect potentially significant archeological resources. A draft Phase IB archeological work plan was prepared outlining the proposed methodology for the effort and submitted to the MHT on April 5, 2012. MHT concurred with the work plan on April 17, 2012. As part of the Phase IB identification effort, archival research, field survey, and analysis of the field survey results will be conducted by MTA. The results of the Phase IB effort will be used to assess the need for Phase II evaluation in order to determine the National Register of Historic Places significance of potentially eligible archeological sites.

The proposed archeological field effort will be undertaken in two stages:

- Stage 1, which is currently underway, includes testing of permeable, accessible surface alignment segments within areas of archeological sensitivity in the limit of disturbance (**Table 5-21**). Field surveys include hand-excavated shovel test pits (STPs) conducted at 15-meter intervals within each sensitivity area. It is anticipated that this effort, including archival research, STPs, and geomorphological investigations, would be completed prior to the issuance of the Record of Decision (ROD) based on access to properties.

- Stage 2 would be undertaken after the issuance of the ROD. It is anticipated that this effort would include Phase IB identification survey of below-ground alignment section, potential Phase II archeological evaluation studies of archeological sites identified within Stage 1, and Phase III archeological data recovery efforts for National Register-eligible sites that cannot be avoided by the effects of the Preferred Alternative. The draft *Section 106 Programmatic Agreement* outlines these work efforts (refer to **Appendix H**).

5.10.2 Existing Conditions

The archeological analysis completed to date has identified 22 areas of sensitivity within six archeological study zones in the limit of disturbances of the Preferred Alternative with the potential to contain archeological resources. These 22 areas are summarized in **Table 5-22**.The sensitivity areas with the archeological study zones are shown in **Volume 2 Environmental Plate Series, Plate Series 4**.

Table 5-21: Proposed Stage 1 Phase IB Archeological Excavations

Study Zone	Location	Area of Sensitivity	Testing Methods
1	West Segment	BA-1	40 STPs
		BA-2	20 STPs
		BA-3	15 STPs
		BA-4	45 STPs
2	Cooks Lane Tunnel Segment	BA-5	20 STPs
3	US 40 Segment	BC-1	10 STPs
		BC-3	10 STPs
		BC-4	50 STPs
		BC-5	8 STPs
		BC-6	10 STPs
4	Downtown Tunnel Segment	BC-7	Deferred to Stage 2 – exact impacts unknown
		BC-8	
		BC-9	
		BC-10	
		BC-11	
		BC-12	
		BC-13	
5	Downtown Portal to Johns Hopkins Bayview Medical Center campus	BC-14	10 STPs
		BC-15	Deferred to Stage 2 – exact impacts unknown
		BC-16	20 STPs
		BC-17	Deferred to Stage 2 – exact impacts unknown
6	Johns Hopkins Bayview Medical Center campus	BC-18	50 STPs

Table 5-22: Prehistoric and Historic Archeological Potential within Areas of Sensitivity

Sensitivity Area	Current Condition	Prehistoric Potential	Historic Potential	Possible Archeological Resources Encountered
BA-1	Security Boulevard right-of-way, residential, CMS offices	High	Low	Resource procurement sites
BA-2	Security Boulevard right-of-way, Security Square Mall parking lot, I-695 right-of-way	High	Low	Resource procurement sites
BA-3	I-70 right-of-way, Social Security Administration (SSA) offices	High	High	Resource procurement sites; late 19th to early 20th c. mill pond, race track and residence
BA-4	I-70 right-of-way, SSA offices	High	High	Resource procurement sites; mid- to late-19th century residences
BA-5	I-70/Security Blvd Interchange	High	High	Resource procurement sites; mid- to late-19th century residences
BC-1	Open courtyard in urban development	Low	High	Late 19th-early 20th century residences
BC-3	Open/grassy parcels adjacent to road	Moderate to High	Moderate to High	Resource procurement sites; Late 19th to early 20th century residences
BC-4	Commercial/industrial development	Moderate to High	Moderate to High	Resource procurement sites; Late 19th to early 20th century residences
BC-5	MARC parking lot	Moderate	Moderate to High	Resource procurement sites; Late 19th to early 20th century residences
BC-6	Grassy area along I-170	Moderate to High	Moderate to High	Resource procurement sites; Late 19thcentury Union Orphans Asylum
BC-7	Commercial/residential development	Low	Moderate to High	Late 18th to early 20th century residences
BC-8	Historic Cemetery	Low	High	Early 19th through 20th century
BC-9	Commercial/residential development	Low	Moderate to High	Late 18th through early 20th century residential/commercial
BC-10	Commercial/residential development	Low	Moderate to High	Late 18th through early 20th century residential/commercial
BC-11	Commercial/residential development	Low	Moderate to High	Late 18th through early 20th century residential/commercial
BC-12	Commercial/residential development	Low	Moderate to High	Late 18th through early 20th century residential/commercial
BC-13	Commercial/residential development	Low	High	19th century wharves, canning industry
BC-14	Commercial	Low	High	Possible location of Sterrett

Table 5-22: Prehistoric and Historic Archeological Potential within Areas of Sensitivity

Sensitivity Area	Current Condition	Prehistoric Potential	Historic Potential	Possible Archeological Resources Encountered
	development			Shipyard
BC-15	Industrial development; Boston Street right-of-way	Low to Moderate	High	Resource procurement sites; Late 19th century residences
BC-16	Wooded ground along Eastern Avenue	Low	High	Late 19th century development
BC-17	Commercial/industrial development	Low	Moderate	Late 19th century development
BC-18	Institutional/commercial development	Moderate	High	Resource procurement sites; 1866 Almshouse location, pauper cemetery

5.10.3 Future No-Build Conditions

The No-Build Alternative assumes the future conditions of transportation facilities and services in 2035 if the Red Line is not built. In the future, without the Preferred Alternative, archeological resources buried within the limit of disturbance would mostly likely remain in place, although disturbance could occur from future activities that would not be related to the Preferred Alternative.

5.10.4 Preferred Alternative

a. Long-Term Operational Effects

Any potential archeological resources that would be affected by the Preferred Alternative would be documented prior to construction. Once the Preferred Alternative is constructed and operational, it is anticipated that no further effects to archeological resources would occur.

b. Short-Term Construction Effects

The analysis conducted for the limit of disturbance identified those effects to archeological resources that could occur as a result of construction of the Preferred Alternative. Archeologically sensitive areas and the potential for construction effects within the limit of disturbance are shown on **Volume 2 Environmental Plate Series, Plate Series 4** and listed in **Table 5-23**. For each area of the limit of disturbance where the potential for archeological resources were identified, the table shows the potential archeological resource, proposed effect, and proposed depth of effect. A summary of the proposed construction activities within each area of archeological sensitivity is presented following **Table 5-23**. A discussion of the proposed construction effects by archeological study zones and areas of sensitivity is presented in the *Archeological Resources Technical Memorandum* (refer to **Appendix D**).

Table 5-23: Archeological Sensitivity Areas and Proposed Construction Effects

Study Zone	Area of Sensitivity	Potential Archeological Resource	Proposed Impact	Proposed Depth of Effect (feet below grade surface [ft. bgs])
Zone 1 (West Segment)	BA-1	Prehistoric	At-grade/ballasted track	6-7 ft. bgs at tailtrack, 1 ft. bgs/1 ft fill in general
	BA-2			1-2 ft. bgs in general, 8-10 ft of fill at bridge approach
	BA-3	Prehistoric; Historic - Possible mill pond, race track and residence	At-grade/ballasted track	30-50 ft of fill at bridge approach, 2-4 ft. bgs and 2-4 ft. of fill along I-70 right-of-way
	BA-4	Prehistoric; Historic – 19th century farmstead remains	Park-and-ride lot	10-15 ft. bgs
Zone 2 (Cooks Lane Tunnel Segment)	BA-5	Prehistoric; Historic – 19th century farmstead remains	Tunnel portal	50-60 ft. bgs
Zone 3 (US 40 Segment)	BC-1	Historic - Late 19th to early 20th century residences	Stormwater management facility	8-10 ft. bgs
	BC-3	Prehistoric; Historic - Late 19th to early 20th century residents	Possible stormwater management facility	6-8 ft. bgs
	BC-4		Calverton yards and shops	10-15 ft. bgs, 10-15 ft fill
	BC-5	Prehistoric; Historic - Late 19th to early 20th century residences	Improvements to West Baltimore MARC Station	4-5 ft. bgs
	BC-6	Prehistoric; Historic - late 19th to early 20th century residences, Union Orphans Asylum	Traction power substation	4-5 ft. bgs
Zone 4 (Downtown Tunnel Segment)	BC-7	Historic - late 18th to early 20th century residences	Poppleton Station	60-70 ft. bgs
	BC-8	Historic – early 19th through 20th century cemetery	St. Paul's Cemetery	50 ft. bgs

Table 5-23: Archeological Sensitivity Areas and Proposed Construction Effects

Study Zone	Area of Sensitivity	Potential Archeological Resource	Proposed Impact	Proposed Depth of Effect (feet below grade surface [ft. bgs])
Zone 4 (Downtown Tunnel Segment)	BC-9	Historic – late 18th through early 20th century residential/ commercial	Howard Street/ University Center Station	80-85 ft. bgs
	BC-10	Historic – late 18th through early 20th century residential/ commercial	Inner Harbor Station	65 ft. bgs
	BC-11	Historic – late 18th through early 20th century residential/ commercial	Harbor East Station	90 ft. bgs
	BC-12	Historic – late 18th through early 20th century residential/ commercial	Fell's Point Station	85 ft. bgs
	BC-13	Historic - 19th century wharves, canning industry	Tunnel portal	50 ft. bgs
Zone 5 (Downtown Portal to Johns Hopkins Bayview Medical Center campus)	BC-14	Historic - alleged location of 18th century Sterrett Shipyard	At-grade/ballasted track, stormwater retention features	6-8 ft. bgs
	BC-15	Prehistoric; Historic - late 19th century residences	At-grade/ballasted track	1-2 ft. bgs
	BC-16	Historic - late 19th century residences	At-grade/ballasted track, stormwater retention features	6-8 ft. bgs
	BC-17	Historic - late 19th century residences	Aerial track	20-60 ft. bgs in pier footprints
Zone 6 (Johns Hopkins Bayview Medical Center campus)	BC-18	Prehistoric; Historic - 1866 Almshouse location, pauper cemetery	At-grade/ballasted track, –and-ride lots, stormwater retention features	1-2 ft. bgs/1-2 ft fill on Johns Hopkins Bayview campus, 10-15 ft. bgs/5-10 ft fill along I-895 right-of-way and NS property, 6-8 ft. bgs in stormwater features

5.10.5 Section 106 Programmatic Agreement

MTA is continuing to consult with the Federal Transit Administration (FTA) and MHT regarding the appropriate effort to further identify archeological resources within the Preferred Alternative and the potential effects of the project on these resources. MTA has prepared a draft Programmatic Agreement that outlines the archeological tasks to be completed after issuance of the ROD if appropriate. The draft Programmatic Agreement stipulates additional Phase I investigations of properties not accessible prior to the ROD, as well as a Phase II evaluation study of the Ward Farmstead Site (18BA582), located in area BA-4, to determine the site's eligibility for inclusion on the National Register of Historic Places. The archeological effort will entail the appropriate field excavation strategy, including STPs and test units, as well as specialized studies of soils, artifacts, and ecofacts. If National Register-eligible archeological sites will be adversely affected, MTA will coordinate with the FTA and MHT to find ways to avoid effects to the sites or minimize effects. If effects cannot be avoided, the Programmatic Agreement ensures that appropriate measures, such as intensive excavations to recover significant data or alternative mitigation strategies, is coordinated with the FTA and MHT to mitigate the effects to archeological resources. The unanticipated discovery of archeological resources will be addressed using the same methodology applied to the overall project. The draft *Section 106 Programmatic Agreement* is included in **Appendix H** of this FEIS. The final executed Programmatic Agreement will be included in the ROD.

5.10.6 Section 106 Consultation

Project consultation was conducted pursuant to the assessment of effects to archeological resources under the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321-4347), Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 et. seq) and Section 4(f) of the Department of Transportation Act of 1996, as amended (49 U.S.C. Section 303).

During earlier phases of the project, invitations to participate in the Section 106 process were included in project newsletters and public meeting announcements, which were mailed to property owners in the project study corridor (refer to **Section 5.9.5** for a full discussion of the timeline). In order to solicit comments and participation from specific parties likely to be interested in historic, archeological, and cultural resources, the MTA developed a list of Section 106 interested parties and verified that they were included on the project mailing lists. Those parties who chose to participate include the MHT, Baltimore City Commission on Historic and Architectural Preservation (CHAP), Baltimore County Planning Department, Anchorage Homeowners Association, Baltimore Harbor Watershed Association, Canton Community Association, Canton Cove Association, Canton Square Homeowners Association, and the Waterfront Coalition.

FTA has complied with 36 CFR Part 800.2, and identified and contacted nine federally-recognized Native American tribes in October 2012, including the Absentee-Shawnee Tribe of Oklahoma, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe, Oneida Indian Nation, Onondaga Nation, Saint Regis Mohawk Tribe, Shawnee Tribe, and Tuscarora Nation. In addition, FTA has identified and contacted state-recognized tribes with cultural ties to the project area, including the Piscataway Indian Nation, Inc., Piscataway Conoy Confederacy and Subtribes, Inc., and the Cedarville Band of Piscataway Indians. The Delaware Tribe of Indians wishes to be considered a consulting party, and notified and further consulted if human remains or objects of cultural patrimony are found during construction activities. The Shawnee Tribe wishes to be considered a consulting party, if unanticipated discoveries are found during construction activities.

A consulting party meeting was held on September 25, 2012 to share project information and listed/eligible historic properties within the APE identified. A second meeting was held on October 17, 2012 to provide an overview of potential effects, and to discuss potential avoidance, minimization, and mitigation measures. Additional consulting party meetings are being planned to continue discussions on the effects, potential avoidance, minimization and mitigation measures, and the Programmatic Agreement.

In a letter dated November 6, 2012, the FTA asked the Advisory Council on Historic Preservation (ACHP) to review project information and, to determine if the agency wishes to join the consultation process.

Additional tasks are required to complete the Section 106 process. Additional consulting parties meetings will be held in December and January, as appropriate, to discuss comments on the effects determinations and finalize the Programmatic Agreement. Upon concurrence, the Programmatic Agreement will be circulated for signatures. The executed Programmatic Agreement is anticipated to be completed prior to the ROD. Following the stipulations in the Programmatic Agreement and the MHT-approved Phase IB Archeological Workplan, an archaeological Phase IB report will be submitted to MHT. Consulting parties will be provided an opportunity to review and comment on the Phase IB archeological report concurrent with MHT review. Any additional archeological efforts will be conducted following the stipulations presented in the Programmatic Agreement in order to fulfill the Section 106 process. The ACHP may choose to join the consultation process for these remaining tasks.

5.11 Air Quality

This section presents a summary of the air quality analyses prepared in support of the Preferred Alternative. Included within this section is a description of the pollutants of concern, applicable air quality standards, and existing air quality within the project study corridor. The section concludes with an explanation of the project's effect on air quality within the project study corridor during light rail transit (LRT) operations, as well as during construction activities. For more detailed information refer to the *Air Quality Technical Report* (**Appendix I**).

5.11.1 Introduction and Methodology

a. Air Quality Standards

Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants degrade the atmosphere by reducing visibility; they are responsible for damaging property, reducing the productivity or vigor of crops or natural vegetation, and harming human or animal health.

"The Clean Air Act (CAA) directs the US Environmental Protection Agency (EPA) to establish air quality standards — known as the National Ambient Air Quality Standards (NAAQS) — and to designate areas that are not in attainment of those standards. The CAA requires States who are in nonattainment of those standards to develop plans for coming into compliance, known as State Implementation Plans (SIPs).

To assist States in achieving compliance with the NAAQS, Section 176(c) of the CAA requires federal agencies to ensure that their actions "conform to" States' plans for achieving the NAAQS. This section of the CAA includes specific air quality conformity requirements for transportation plans, programs, and projects. The transportation conformity requirements are implemented by EPA through regulations at 40 CFR Part 93."

Section 176(c)1(A) of the CAA defines conformity as follows:
Conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards; and that such activities will not cause or contribute to any new violation of any NAAQS in any area; increase the frequency or severity of any existing violation of any NAAQS in any area; or delay timely attainment of any NAAQS or any required interim emission reductions or other milestones in any area.

As required by the CAA, NAAQS have been established for six major air pollutants. These pollutants, known as criteria pollutants, are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_2), particulate matter (PM), sulfur dioxide (SO_2), and lead (Pb). The federal standards are summarized in **Table 5-24**. The "primary" standards have been established to protect public health. The "secondary" standards are intended to protect the nation's welfare, and they account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of general welfare.

Table 5-24: National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour (1)	None	
	35 ppm (40 mg/m^3)	1-hour (1)		
Lead	0.15 µg/m^3 (2)	Rolling 3-Month Average	Same as Primary	
Nitrogen Dioxide	53 ppb (3)	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour (4)	None	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour (5)	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual (6) (Arithmetic Average)	Same as Primary	

Table 5-24: National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
	35 µg/m^3	24-hour (7)	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour (8)	Same as Primary	
	0.08 ppm (1997 std)	8-hour (9)	Same as Primary	
	0.12 ppm	1-hour (10)	Same as Primary	
Sulfur Dioxide	0.03 ppm (11) (1971 std)	Annual (Arithmetic Average)	0.5 ppm	3-hour (1)
	0.14 ppm (11) (1971 std)	24-hour (1)		
	75 ppb (12)	1-hour	None	

Notes: 1 Not to be exceeded more than once per year.

2 Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

3 The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

4 To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).

5 Not to be exceeded more than once per year on average over 3 years.

6 To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

7 To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

8 To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

9 (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
(c) EPA is in the process of reconsidering these standards (set in March 2008).

10 (a) EPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$ 1.

11 The 1971 sulfur dioxide standards remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

12 Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

Source: www.epa.gov/air/criteria.html

In accordance with 40 CFR 93.116 (updated on July 1, 2010), a Federal Highway Administration (FHWA)/Federal Transit Administration (FTA) project must not cause or contribute to any new localized CO, PM_{10}, and/or $PM_{2.5}$ violations, increase the frequency or severity of any existing CO, PM_{10}, and/or $PM_{2.5}$ violations, or delay timely attainment of any NAAQS or any required interim emission reductions or other milestones in CO, PM_{10}, and $PM_{2.5}$ nonattainment and maintenance areas.

The EPA classifies areas as being either in “attainment,” “maintenance,” or “non-attainment.” Refer to **Table 5-25**. An area that exceeds the NAAQS for one or more pollutants is said to be in "non-attainment" of the NAAQS enforced under the CAA; a previous non-attainment area that has demonstrate compliance with the NAAQS is considered a “maintenance” area. The EPA established primary and secondary NAAQS for six criteria pollutants. The designation of an area is determined on a pollutant-by-pollutant basis.

Table 5-25: Attainment Classifications and Definitions

Attainment	Unclassified	Maintenance	Nonattainment
Area is in compliance with the NAAQS.	Area has insufficient data to make a determination and is treated as being in attainment.	Area once classified as nonattainment but has since demonstrated attainment of the NAAQS.	Area is not in compliance with the NAAQS.

b. Pollutants for Analysis
Pollutants that can be traced principally to motor vehicles are relevant to the evaluation of the project’s effects. These pollutants include CO, hydrocarbons (HC), nitrogen oxides (NO_x), O_3, PM_{10}, $PM_{2.5}$ and mobile source air toxics (MSATs). The sources of these pollutants and their effects are provided in the *Air Quality Technical Report*. Transportation sources account for a small percentage of regional emissions of SO_x and Pb; thus, a detailed analysis of these pollutants is not required.

c. Regional Analysis Methodology
A regional or mesoscale analysis of a project determines a project's overall effect on regional air quality levels. This analysis uses regional Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT) within the region with and without the project, to determine daily “pollutant burden” levels. Emission factors were calculated using EPA’s MOBILE6.2 mobile source emission factor program.

d. Microscale Carbon Monoxide Analysis Methodology
Microscale CO air quality modeling was performed using the most recent version of the EPA mobile source emission factor model (MOBILE6.2) and the CAL3QHC (Version 2.0) air quality dispersion model to estimate future No-Build conditions (without the proposed project) and future Preferred Alternative (with the proposed project) CO levels at selected locations within the project study corridor.

e. Particulate Matter Analysis Methodology
A $PM_{2.5}$ conformity analysis has been conducted, following the guidelines in EPA’s *Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas (March 29, 2006, referred to as “PM2.5/10 Guidance”).*

f. Greenhouse Gas Analysis Methodology

A greenhouse gas analysis was conducted based on the amount of energy required to operate the roadways and rail.

5.11.2 Existing Conditions

a. Attainment Status/Regional Air Quality Conformity

The project study corridor encompasses both Baltimore City and Baltimore County. Baltimore City is classified as a maintenance area for CO, whereas Baltimore County is classified as attainment for CO. Both areas are classified as nonattainment areas for $PM_{2.5}$ and as serious nonattainment areas for O_3 (refer to **Table 5-25** for the classifications). The regulations applicable to a proposed project with respect to these designations, the applicable planning agency, and the current status of the area's planning documents, are provided in the *Air Quality Technical Report.*

5.11.3 Future No-Build Conditions

The No-Build Alternative would not result in a reduction in vehicle miles traveled as would occur with the Preferred Alternative as identified in **Table 5-26**. Therefore, the selection of the No-Build Alternative would require the *Long Range Transportation Plan* (LRTP) to be revised to reflect the removal of the Red Line project from the plan. In addition, the conformity analysis would need to be re-evaluated to account for the additional VMT in the region. The No-Build Alternative air quality conditions are compared with the Preferred Alternative in the following section.

5.11.4 Preferred Alternative

a. Long-Term Operational Effects and Mitigation

The results of the air quality analysis are presented by pollutant comparing the No-Build Alternative and the Preferred Alternative.

Results of Emission Burden Assessment

The emission burden analysis of a project determines a project's overall effect on regional air quality levels. As shown in **Table 5-26**, an emission burden analysis based on the project study corridor's 2035 VMT and VHT was conducted for the No-Build Alternative and Preferred Alternative. Emission factors were calculated using EPA's MOBILE6.2 mobile source emission factor program. EPA would require the use of MOVES2010 a for new quantitative CO hot-spot analyses for transportation conformity purposes as of March 2013. Since the air quality analysis was conducted before this date, emission factors from the MOBILE6.2 program were used. This approach was documented in the February 28, 2012 letter from FTA to EPA contained in **Appendix G** of this FEIS.

The Preferred Alternative is predicted to decrease regional pollutant burdens by approximately 1.5 to 1.9 percent.

Table 5-26: Regional Emission Burden Assessment (2035)

Alt	Daily VMT	Pollutant (Metric Tons per Day)					Percent Change from No-Build				
		CO	NO_x	VOC	PM_{10}	$PM_{2.5}$	CO	NO_x	VOC	PM_{10}	$PM_{2.5}$
No-Build	4,394,528	36.0	0.8	0.8	0.1	0.1	–	–	–	–	–
Preferred	4,319,653	35.5	0.8	0.7	0.1	0.1	-1.5%	-1.5%	-1.9%	-1.7%	-1.7%

Notes: CO=carbon monoxide; NO_x=nitrogen oxides; VOC=volatile organic compounds; PM_{10}=particulate matter (10 microns); $PM_{2.5}$=fine particulate matter (2.5 microns).

Results of Microscale Carbon Monoxide Assessment

Maximum 1-hour and 8-hour CO levels were predicted at 11 intersections along the proposed project study corridor. To determine the intersections to be modeled, a screening evaluation was performed to identify which intersections in the project study corridor are most congested and most affected by the Preferred Alternative. Approximately 150 intersections were screened based on changes in volumes, delay, and levels-of-service (LOS) from the No-Build to the Preferred Alternative. Sites were considered to have failed the screening evaluation if the LOS decreases below “D” in the Preferred Alternative, as compared to the No-Build Alternative, or if the delay and/or volume increases from the No-Build to the Preferred Alternative at an intersection where the LOS is D or worse.

Of those intersections screened, 11 were selected for detailed analysis. These 11 intersections, which are shown on **Figure 5-7** and identified in **Tables 5-27** and **5-28**, were selected because they failed the screening analysis, have the highest volumes, have the highest delays, have a large increase in volume from No-Build to Preferred Alternative conditions, or are near a sensitive receptor. Each segment along the project study corridor that is described in **Chapter 2** of this FEIS contains at least one analysis site.

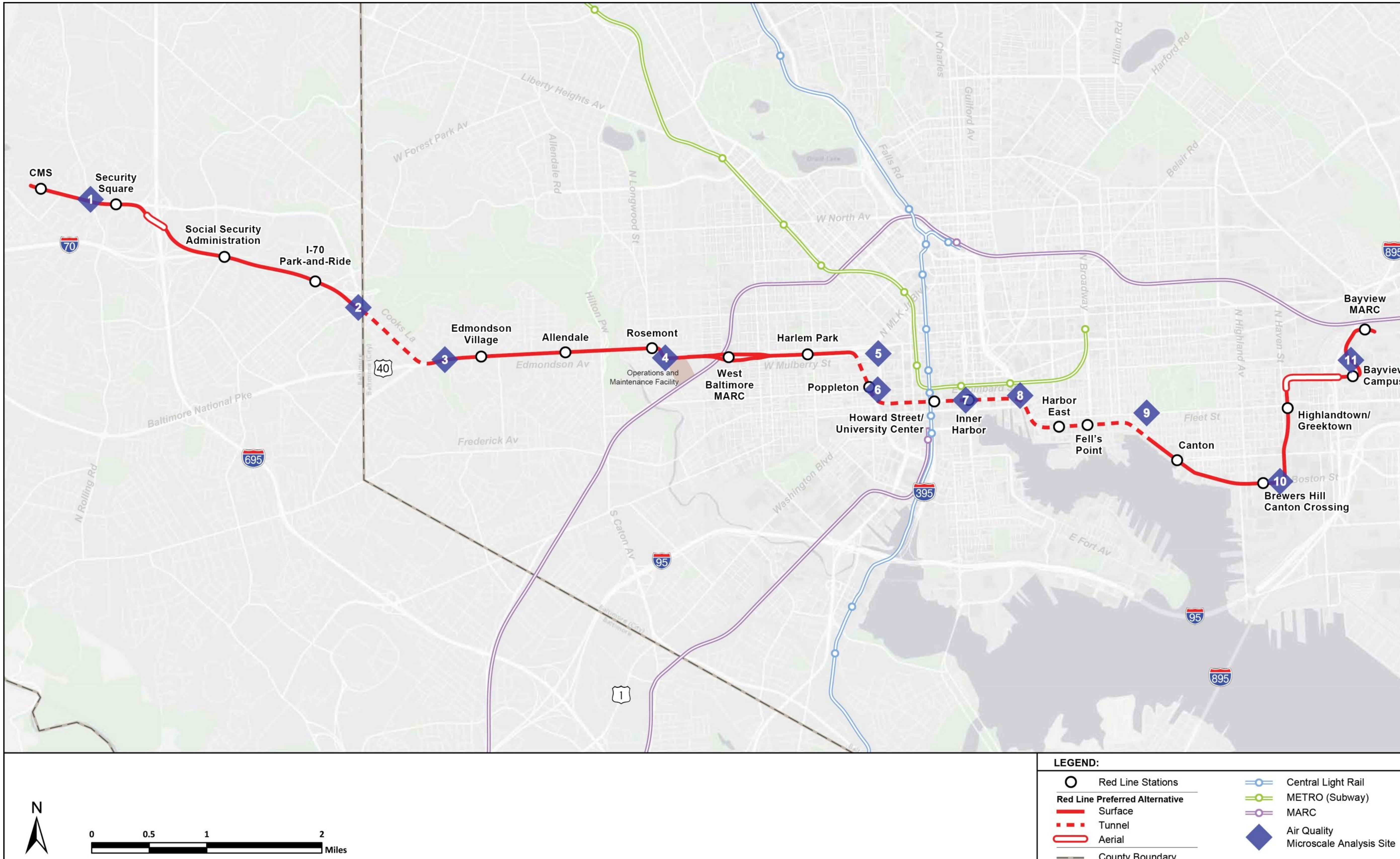


Figure 5-7: Air Quality Microscale Analysis Sites

Maximum 1-hour and 8-hour CO concentrations were estimated for each alternative as shown in **Tables 5-27** and **Table 5-28**, respectively. The MOBILE6.2 data used in the CO analysis and the CAL3QHC (Version 2) input and output information for each site are included in the *Air Quality Technical Report*. No violations of the NAAQS are predicted under either alternative as shown in **Tables 5-27 and 5-28**.

Table 5-27: Predicted Worst-Case One-Hour CO Concentrations (ppm)

Receptor Number (See Figure 5-7)	Site Description	Existing (2011)		No-Build				Preferred Alternative			
				2021 (Opening Year)		2035 (Design Year)		2021 (Opening Year)		2035 (Design Year)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	Security Blvd & Rolling Rd	4.8	4.4	4.1	4.1	4.1	4.0	3.7	4.0	3.8	4.0
2	Security Blvd & Forest Park Ave	3.5	3.7	3.3	3.4	3.4	3.4	3.6	4.0	3.9	4.0
3	US 40 & Winans Way	4.2	4.3	4.0	4.2	4.1	4.3	3.9	3.9	3.9	3.8
4	US 40 & Franklintown	4.5	3.9	4.1	3.9	4.0	3.9	3.9	3.8	3.6	4.0
5	MLK & Mulberry St	5.4	4.4	5.6	5.2	5.8	5.4	5.1	5.6	5.9	5.6
6	MLK & Baltimore St	5.1	4.2	5.0	5.3	5.1	6.3	4.5	5.2	5.4	6.4
7	Lombard St & Light St	4.7	4.8	4.4	4.7	4.5	4.6	4.3	4.2	4.4	4.4
8	Lombard St Pratt St & President St	4.9	4.8	4.6	4.6	4.5	4.5	4.4	4.2	4.4	4.4
9	Eastern Ave & Patterson Park Ave	3.4	3.5	3.1	3.3	3.5	3.3	3.4	3.4	3.7	3.3
10	Boston St & Conkling Old Boston St	N/A	N/A	3.0	3.2	3.7	3.4	3.3	3.3	3.5	3.3
11	Lombard St & I-895 Ramps	3.7	3.8	3.5	4.1	3.8	4.7	3.8	3.6	3.9	4.5

Notes: Concentrations include one-hour CO background = 2.3 ppm. One-hour CO Standard = 35 ppm
N/A = intersection does not currently exist

Table 5-28: Predicted Worst-Case Eight-Hour CO Concentrations (ppm)

Receptor Number (See Figure 5-7)	Site Description	Existing (2011)	No-Build		Preferred Alternative	
			2021 (Opening Year)	2035 (Design Year)	2021 (Opening Year)	2035 (Design Year)
1	Security Boulevard & Rolling Road	3.4	2.9	2.9	2.8	2.8
2	Security Boulevard & Forest Park Avenue	2.6	2.4	2.4	2.8	2.8
3	US 40 & Winans Way	3.0	2.9	3.0	2.7	2.7
4	US 40 & Franklintown	3.1	2.9	2.8	2.7	2.8
5	MLK & Mulberry Street	3.8	3.9	4.1	3.9	4.1
6	MLK & Baltimore Street	3.6	3.7	4.4	3.6	4.5
7	Lombard Street & Light Street	3.4	3.3	3.2	3.0	3.1
8	Pratt Lombard Street & President Street	3.4	3.2	3.1	3.1	3.1
9	Eastern Avenue & Patterson Park Avenue	2.4	2.3	2.4	2.4	2.6
10	Boston Street & Conkling Old Boston Street	N/A	2.2	2.6	2.3	2.4
11	Lombard Street & I-895 Ramps	2.7	2.9	3.3	2.7	3.1

Notes: Concentrations include eight-hour CO background = 1.6 ppm.
Eight-hour CO Standard = 9 ppm
N/A = intersection does not currently exist

Results of $PM_{2.5}$ Assessment

A $PM_{2.5}$ conformity analysis has been conducted, following the guidelines in EPA's *Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas (March 29, 2006, referred to as "PM2.5/10 Guidance").* Applying the $PM_{2.5/10}$ Guidance, a $PM_{2.5}$ hot-spot analysis should be conducted according to qualitative guidance only if the project is a project of air quality concern, as defined in 40 CFR 93.123(b)(1) as follows:

1. New or expanded highway projects that have a significant number of or significant increase in diesel vehicles;
2. Projects affecting intersections that are at level of service (LOS) D, E or F with a significant number of diesel vehicles, or those that would change to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles;
3. New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location;
4. Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and

5. Projects in or affecting locations, areas, or categories of sites which are identified in the $PM_{2.5}$ or PM_{10} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

Electrically-powered rail vehicles are proposed for the Preferred Alternative; therefore, the Preferred Alternative is not predicted to affect $PM_{2.5}$ levels in the project study corridor. Based on current operational projections, the Preferred Alternative is predicted to reduce overall bus trips by approximately 1 percent.

Following the guidance set forth in 40 CFR 93.123(b)(1)(iv), a series of meetings with the Interagency Consultation Group (ICG) for the project's study area, which includes the Baltimore Regional Transportation Board, the Maryland Department of the Environment and the Maryland Department of Transportation, were held to determine whether the project should be considered as a project of air quality concern regarding $PM_{2.5}$ emissions. The ICG issued a letter, dated November 26, 2012, classifying the project as not a project of air quality concern (**Appendix G**).

Results of the MSAT Assessment

FTA has not issued guidance on consideration of MSAT emissions, but follows FHWA's guidance when conducting NEPA analyses for projects with the potential to affect MSAT emissions. On February 3, 2006, the FHWA released *Interim Guidance on Air Toxic Analysis in NEPA Documents.* This guidance was superseded on September 30, 2009 by the FHWA's *Interim Guidance Update on Air Toxic Analysis in NEPA Documents.* The purpose of the FHWA's guidance is to advise on when and how to analyze MSATs in the NEPA process for highways. This is interim guidance because MSAT science is still evolving. As the science progresses, the FHWA would update the guidance.

Technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project. However, it is possible to assess qualitatively the levels of future MSAT emissions under the project, which can give a basis for identifying and comparing the potential differences in MSAT emissions, if any, from the alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA titled, *A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives*, found at: www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm.

Based on the recommended tiering approach detailed in the FHWA methodology, the project falls within the Category 2 as a project with low potential MSAT effects. For the Preferred Alternative, the amount of MSATs emitted would be proportional to the VMT, assuming that other variables, such as fleet mix, are the same.

As shown in **Table 5-28**, the VMT estimated for the Preferred Alternative is lower than the No-Build Alternative for the project study corridor. As such, the Preferred Alternative is predicted to reduce MSATs in the overall project study area in comparison to the No-Build Alternative. The emissions likely would be lower than present levels in the design year as a result of the EPA's national control programs that are projected to reduce annual MSAT emissions by 72 percent between 1999 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the project study area likely would be lower in the future in nearly all cases.

There may be localized areas where ambient concentrations of MSATs could be higher under the Preferred Alternative than under the No-Build Alternative. Dispersion studies have shown that the "roadway" air toxics start to drop off at about 100 meters (328 feet). By 500 meters (1,640 feet), most studies have found it very difficult to distinguish the roadway from background toxic concentrations in any given area. However, as discussed previously, the magnitude and duration of these potential increases compared to the No-Build Alternative cannot be accurately quantified because of the inherent deficiencies of current models. However, on a regional basis, the EPA's vehicle and fuel regulations coupled with fleet turnover would cause region-wide MSAT levels to be significantly lower than today in almost all cases.

Conformity Determination

The Transportation Conformity Rule, which was promulgated by USEPA under the CAAA, provides criteria and procedures for determining conformity of transportation plans, programs and projects funded or approved under Title 23 U.S.C. or the Federal Transit Act to SIPS. This project is located in Baltimore City and Baltimore County. As stated previously, the attainment status of this area is a follows:

- Baltimore City is classified as a maintenance area for CO;
- Baltimore County is classified as attainment for CO; and
- Both the City and County are classified as nonattainment areas for $PM_{2.5}$ and as serious nonattainment areas for O_3.

As such, a conformity determination with the following requirements is required:

- The Project must originate from a conforming transportation plan and program; and
- The project must eliminate or reduce the severity and number of violations of the NAAQS.

Transportation projects that originate from a conforming TIP are considered to conform to the rule. The Red Line Project is listed as Project 40-0602-69 on the 2012-2015 TIP, which was approved by the Baltimore Regional Transportation Board on November 14, 2011. The result of the project's CO analysis documents that the CO levels will be below the one-hour (35ppm) and the eight-hour (9 ppm) CO NAAQS, and the result of the regional analysis is that emissions of ozone precursors (nitrogen oxides and hydrocarbons) would decrease with the project. In addition, the ICG classified this project as not a project of air quality concern for localized $PM_{2.5}$ impacts, as documented in their letter to MTA on November 26, 2012. As such the project is not expected to create or worsen $PM_{2.5}$ violations of the NAAQS. Furthermore, MSAT emissions will likely be lower than present levels in the design year as a result of EPA's national control programs. Therefore, this project will comply with the conformity requirements established by the Clean Air Act.

Results of the Greenhouse Gas Assessment

CO_2 emission estimates are based on the amount of direct energy required. The direct energy values represent the energy required for vehicle propulsion. This energy is a function of traffic characteristics such as volume, speed, distance traveled, vehicle mix, and thermal value of the fuel being used. The direct energy calculations include the energy required to power the light rail under the Preferred Alternative.

As shown in **Table 5-29**, CO_2 emission burdens under the Preferred Alternative are predicted to increase by 0.2 percent, as compared to the No-Build Alternative. Considering the scale of these numbers and the very small predicted percent changes, the differences in the predicted CO_2 emission burdens for the Preferred Alternative can be considered insignificant and not measurably different from the No-Build Alternative.

Table 5-29: CO_2 Emission Burdens

Alternative	Daily Direct Energy (million BTUs)	Total CO_2 (kg)	Percent Change from No-Build
No-Build	27,337	1,956,849	–
Preferred Alternative	27,170	1,961,198	0.2%

Effects of Operations and Maintenance Facility Activities

The Operations and Maintenance Facility (OMF) would service and store rail cars and locomotives as described in **Chapter 2** of this FEIS. Emission sources from OMF activities include gas-fired roof-top heating units (on some of the on-site buildings) and spray booth operations that would paint the rail cars and other equipment or parts. Emissions from on-site diesel emissions would be minimal (and not considered in this analysis) because the locomotives at the facility would operate under electric power, and diesel locomotives would only operate under emergency conditions to move trains and/or equipment around the site.

Two detailed air quality analyses were conducted to estimate the potential air quality effects of OMF emissions on nearby sensitive land uses. The first analysis estimated potential effects of the criteria pollutants from heating system emissions. Three criteria pollutants from the gas-fired heating units were considered: NO_2, PM_{10}, and $PM_{2.5}$. The other criteria pollutants were not considered for analysis because their emissions from firing natural gas are very low. The second analysis was conducted to estimate the potential effects of the air toxic pollutants that have the potential to be released from spray booth operations. Both (long-term) carcinogenic and chronic non-carcinogenic and acute (short-term) health risks were considered.

The results of these analyses concluded are that the potential air quality effects associated with emissions of the criteria and toxic pollutants releases from the operations are as follows:

- Maximum estimated criteria pollutant concentrations at nearby sensitive land uses are within (i.e., would not exceed) the NAAQS and, as such, are not considered to be significant; and
- Maximum estimated cancer, noncancer, and acute risks associated with toxic pollutants releases from spray booth operation are all less than health-related guideline values

established by EPA for health-related assessments, and toxic pollutants effects, therefore, are not considered to be significant.

b. Short-Term Construction Effects

Results of On-Site Analysis of Criteria Pollutant Emissions

An analysis was conducted to determine whether emissions generated by the construction of the project would significantly impact (i.e., cause an exceedance of an applicable air quality standard at) nearby sensitive land uses. Dust generated from earth moving activities and gaseous emissions generated from diesel exhaust equipment were considered. The pollutants of concern are PM_{10} and $PM_{2.5}$, NO_2, SO_2, and CO.

Emission rates of each pollutant from all emission sources operated at the construction site were estimated, based on information from EPA's Nonroad, AP-42 and MOBILE6.2 model, for each type of construction activity. Short-term emission estimates were based on peak period activity levels at the site (defined as emissions per month or tons per day). These emission estimates were used to compare the modeling results to short-term standards (i.e. 1-hour, 8-hour, and 24-hour). Annual average activity levels were used to compare modeling results to annual standards.

Emission rates were estimated assuming up to three 8-hour shifts per day and 30.1 days per month. It was assumed that emissions would occur every hour over a 24-hour period. The following measures to minimize construction-phase emissions that were assumed for this analysis are provided in the *Air Quality Technical Report*.

The two construction sites with the highest total emissions – the Cooks Lane Tunnel Western Portal and the Downtown Tunnel Western Portal – were selected for analysis. The highest monthly emissions for the total duration of the construction period for each site (tons per month) were converted to daily emissions (tons per day) and then to grams per second. Emissions were then divided by the size of the construction area and input to the dispersion model.

A detailed air quality analysis was conducted to estimate pollutant concentrations, which were then compared to applicable NAAQS. Dispersion modeling was conducted using the EPA's AERMOD atmospheric dispersion model (latest version 12060) to simulate physical conditions and predict pollutant concentrations at nearby receptor locations. Regulatory default options and the urban dispersion algorithm of the AERMOD model were used in the analysis. Five consecutive years of meteorological data (2007-2011) from Baltimore-Washington International Airport, which is considered to be representative of land uses near the project site, were used.

The estimated maximum impact for each pollutant was added to the applicable background concentration for that pollutant, and the total estimated concentrations were compared with the applicable NAAQS. Receptors (i.e., locations where pollutant concentrations were estimated) considered in this analysis are ground-level sites located on a grid network surrounding each construction site boundary within approximately 1000-feet of the site boundary in all directions.

The result of the analysis is that no violations of the NAAQS are predicted during construction activities. Detailed modeling procedures and results of the dispersion modeling analyses are provided in the *Air Quality Technical Report*.

Results of the On-Site Air Toxics Analysis

Potential air toxics impacts from the project's construction activities are primarily a result of emissions from the diesel-fueled equipment. Toxic air pollutants can be grouped into two categories: carcinogenic air pollutants, and non-carcinogenic air pollutants. These include hundreds of pollutants, ranging from high to low toxicity. While no federal standards have been promulgated for toxic air pollutants, the EPA has issued guidelines that establish acceptable ambient levels for these pollutants based on human exposure criteria.

The procedures to estimate cancer risk and chronic non-cancer and acute hazard indexes of toxic pollutants that are outlined in the EPA Human Health Risk Assessment Protocol (HHRAP) were used. The HHRAP is a guideline that can be used to perform health risk assessment for individual compounds with known health effects to determine the level of health risk posed by an increased ambient concentration of that compound at a potentially sensitive receptor. The derived health risk values from the HHRAP are used in this analysis to determine the total risk posed by the release of multiple air toxic contaminants.

Emission rates of the toxic air pollutants from the diesel engines were estimated using Total Organic Compound (TOC) emission factors from EPA's *Compilation of Air Pollutant Emission Factors* (AP-42).

A dispersion modeling analysis of toxic pollutants was conducted using the same methodology that was used for criteria pollutants. The exposure concentrations produced from the AERMOD modeling analysis were then used to estimate cancer risk through inhalation and chronic non-cancer and acute hazard indexes for each pollutant utilizing guideline values.

The result of the air toxics analysis is that the overall incremental cancer risk from all pollutants combined is below the applicable significant threshold of one in-one million (1E-06), and both the total chronic non-cancer and acute health hazard risks are less than 1. As such, the potential cancer, chronic non-cancer, and acute health risks associated with the project's construction activities are well within acceptable ranges and thus not considered to be significant.

Results of the Off-Site Mobile Source Analysis

Potential air quality impacts associated with the operation of construction-phase vehicles (including trucks used for the transportation of rock and debris removal, transport of construction materials and cement, and construction workers' vehicles) on the roadway network were estimated.

One-hour and 8-hour CO levels were estimated near the intersections of Baltimore Street/Martin Luther King, Jr. Boulevard and Eastern Avenue/Patterson Park Avenue, which were selected for analysis because they are predicted to experience poor levels of service during construction, are part of the proposed truck hauling routes, and have sensitive receptors (residences and a park) nearby.

The result of the analysis is that no violations of the NAAQS are predicted to occur. Detailed results of the modeling analyses are provided in the *Air Quality Technical Report*.

c. Mitigation

The MTA will implement the following measures to minimize construction-phase emissions. Such measures could include:

Construction

- Minimizing land disturbance
- Implementing dust control measures in accordance with MDE requirements
- Covering trucks when transporting excavated or other loose materials
- Using emission control devices, such as diesel particulate filters, for up to 80 percent of applicable construction equipment
- Paving construction roads and parking areas to road grade where such roads and parking areas exit the construction site to prevent dirt from washing onto paved roadways
- Minimizing dirt track-out by washing or cleaning trucks before leaving the construction site
- Using ultra-low sulfur diesel fuel for diesel equipment
- Complying with EPA’s Tier 2 emission standards or better for construction equipment engines

Post-Construction

- Revegeting any disturbed land not used
- Removing unused material
- Removing dirt piles
- Revegeting vehicular paths created during construction to avoid future off-road vehicular activities

5.12 Energy

5.12.1 Introduction and Methodology

Transportation energy is the energy required to move people and goods from place to place, and is generally discussed in terms of operational and construction energy consumption.

Operational energy consumption, also known as “direct” energy, involves all energy consumed by vehicle propulsion. This energy is a function of traffic characteristics such as volume, speed, distance traveled, vehicle mix, and the thermal value of the fuel being used. Operational energy consumption also includes the energy required to maintain the transportation facilities, such as lighting and ventilation systems. Construction energy consumption, also known as “indirect” energy, involves the non-recoverable, one-time energy expenditure involved in constructing the physical infrastructure associated with a project.

Energy is commonly measured in terms of British thermal units, or Btus. A Btu is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. For transportation projects, energy usage is predominantly influenced by the amount of fuel used. The average Btu content of fuels is the heat value (or energy content) per quantity of fuel, as determined from tests of fuel samples.

Direct energy effects were calculated using emission factors from the *Transportation Energy Data Book, Edition 30* (US Department of Energy, 2011). Indirect energy effects for this project were calculated using the equipment inventory method, which takes into account each individual piece of construction equipment, as well as the dates of operation, utilization rates, equipment horsepower, and load factors.

5.12.2 Existing Conditions

Transportation accounts for a major portion of the energy consumed within the United States. For example transportation accounted for approximately 28 percent of energy consumption within the United States in 2010. The transportation sector is the second largest consumer of energy after the industrial sector, which accounted for 31 percent of energy consumption within the United States in 2010. The residential and commercial sectors accounted for 22 percent and 18 percent of energy consumption within the United States in 2010, respectively.

Within the State of Maryland, the transportation, residential, and commercial sectors each accounted for 30 percent of energy consumption in 2010. The industrial sector was the smallest consumer of energy in Maryland in 2010, at 10 percent. Petroleum (e.g., gasoline, diesel fuel, jet fuel) was the predominant source of transportation energy in Maryland in 2010, at 99 percent. Natural gas and electric vehicles accounted for the remaining 1 percent of transportation energy consumption.

Maryland ranks 24 out of 50 states in terms of transportation energy consumption, with 443 trillion Btus of transportation energy consumed in the year 2010 (US Energy Information Administration). In comparison, the state of California ranked number one with the consumption of 3,097 trillion Btus of transportation energy in 2010; and the state of Vermont ranked last, with 52 trillion Btus of transportation energy consumption in 2010.

On a per capita basis, Maryland ranks 25 out of the 50 states in terms of petroleum consumption, at approximately 525 trillion Btus consumed in 2010. In comparison, the state of Texas ranked first at 5,841 trillion Btus of petroleum consumption; and the state of Vermont ranked last, with 82 million Btus of petroleum consumption per capita in 2010.

Maryland currently relies on imported energy for most of its energy needs as the state lacks indigenous fossil fuel resources. All petroleum and natural gas products are transported to Maryland via pipeline or through other entry points, such as the Port of Baltimore or Maryland's liquefied natural gas (LNG) facility, Cove Point, on the Chesapeake Bay's western shore. Maryland imports approximately 30 percent of its electrical energy from surrounding states and imports coal to generate electricity in-state. Almost 60 percent of electricity in Maryland comes from coal-fired facilities, followed by approximately 30 percent from the two nuclear power plants at Calvert Cliffs (Maryland Energy Outlook, 2010).

According to the Maryland Energy Outlook (Maryland Energy Administration, 2010), several drivers currently affect the State's transportation fuel mix and demand picture:

- Energy security concerns in Maryland and at the national level
- Greenhouse gas emissions
- Fuel price volatility
- Federal and State legislative requirements, including Corporate Average Fuel Economy (CAFE), the *Maryland Clean Cars Act of 2007*, *Energy Independence and Security Act of 2007* (EISA) and the potential for a low carbon fuel standard
- Smart Growth/efficient land use policies that impact transportation planning and public services

Maryland currently has a number of policies and programs in place to reduce transportation energy demand and to promote alternative fuel vehicles and fuels, electrically-powered transportation and Smart Growth policies. As an electrically-powered public transit system, the Preferred Alternative is consistent with Maryland's policies to reduce transportation energy demand.

5.12.3 Future No-Build Conditions

The effects of the No-Build Alternative on transportation-related energy consumption in the project study corridor have been quantitatively assessed. For the No-Build Alternative, there would be no additional energy use associated with operation or maintenance of the light rail system, nor would there be any energy use for construction activities. Therefore, the No-Build Alternative only analyzes the energy use of the roadway network. A comparison of the No-Build Alternative and Preferred Alternative daily energy consumption in 2035 is summarized in **Table 5-30**.

5.12.4 Preferred Alternative

a. Long-Term Operational Effects

The effects of the Preferred Alternative on transportation-related energy consumption in the project study corridor have been quantitatively assessed. The results are presented in **Table 5-30** comparing the No-Build Alternative and the Preferred Alternative daily energy use for the year 2035.

Table 5-30: Daily Energy Consumption No-Build and Preferred Alternatives

Mode		2035 No-Build Alternative	2035 Preferred Alternative
Roadways			
Daily Project Corridor Vehicle Miles Traveled (VMT)		4,394,528	4,319,653
Average Speed (mph)		31.4	31.2
Energy Intensity (mBtus)	Auto	5,127	5,039
	Light Trucks	13,746	13,512
	Heavy Trucks	8,464	8,320
	Total Roadway	*27,337*	*26,871*
	% Change from No-Build	–	*-1.7%*
Total mBtus per Passenger Mile (assuming 1.2 passengers/vehicle)		22,781	22,393
Light Rail Transit (LRT)			
Daily VMT		–	3,536
Total LRT (mBtus)		–	299
Total mBtus per Passenger Mile (assuming 22.4 passengers/vehicle)		–	13.4
Total (Roadways and LRT)			
Daily Direct Energy Consumed (mBtus)		27,337	27,170
% Change from No-Build		–	-0.61%
Total (Roadways and LRT) in terms of Passenger Miles			
Daily Direct Energy Consumed (mBtus)		22,781	22,406
% Change from No-Build		–	-1.7%

Note: mBtus = millions of Btus

The table presents the daily roadway vehicle miles traveled (VMT) of the project corridor, as well as the average roadway speed for each alternative. The energy consumption of roadway vehicles is directly influenced by the average speed on the roadways. This can vary by vehicle type, though fuel economy generally improves with increasing speed until around 55 mph, when fuel economy begins to worsen with increasing speed. The table presents the energy intensity, or energy consumption, of each roadway vehicle category (auto, light, and heavy trucks) in terms of mBtus (millions of Btus). The table presents the total of all roadway energy consumption. Finally, it presents this total in terms of passenger miles, assuming 1.2 passengers per roadway vehicle; this is essentially the total roadway energy consumption divided by 1.2 passengers per vehicle. As shown in the table, total daily roadway energy consumed would decrease under the Preferred Alternative by 1.7 percent, as compared to the No-Build Alternative.

The table also presents the daily VMT of the additional light rail transit (LRT) under the Preferred Alternative. For the LRT system, 100 percent of the energy is assumed to come from electrical sources. The total energy consumption of the LRT is presented in terms of mBtus, and also in terms of mBtus per passenger mile. The latter assumes 22.4 passengers per vehicle and is essentially the total LRT energy consumption divided by 22.4 passengers per vehicle.

The bottom rows of the table present two totals – the total daily direct energy consumption, and the total daily direct energy consumption in terms of passenger miles. When factoring in the additional energy use of the light rail, total daily direct energy consumed would decrease under the Preferred Alternative by 0.6 percent, as compared to the No-Build Alternative. When comparing the direct energy use in terms of passenger miles, total daily direct energy would decrease under the Preferred Alternative by 1.7 percent, as compared to the No-Build Alternative. The greater decrease in energy use, when comparing in terms of passenger miles, is because of the fact that the LRT carries more passengers than a typical roadway vehicle.

b. Short-Term Construction Effects

The energy required for construction was estimated based on horsepower requirements, equipment use, equipment load factors, and the construction schedule for the Preferred Alternative. Total estimated energy use for the duration of construction operations would be approximately 472,000 mBtus.

c. Mitigation

There is no mitigation required.

5.13 Noise and Vibration

This section provides a summary of the noise and vibration analysis conducted for the Red Line project. It provides a summary discussion on the criteria and methods used to assess noise and vibration effects; identifies the location of noise and vibration monitoring sites; and discusses the predicted long-term operational and short-term construction effects to these monitoring sites. Also provided, are recommended measures to mitigate or reduce these noise and vibration effects on the surrounding community. Additional and detailed technical information may be found in the *Noise and Vibration Technical Report* (**Appendix I**).

5.13.1 Introduction and Methodology

A noise and vibration assessment was conducted in accordance with National Environmental Policy Act (NEPA) and the guidelines set forth by Federal Transit Administration (FTA). The operational effects were evaluated using the guidelines set forth by the FTA's *Transit Noise and Vibration Assessment.*[3] Traffic noise impacts associated with the proposed I-70 realignment were evaluated using the Maryland State Highway Administration's (SHA) *Highway Noise Policy*. Temporary construction effects were also predicted using both the FTA guidelines and the FHWA's *Roadway Construction Noise Model* (RCNM). The temporary effects of these construction activities were evaluated using the *Noise Control Policy* from the Maryland Department of the Environment (MDE).

Where exceedances of the project impact criteria were predicted, mitigation measures were developed and evaluated to determine whether they are both "feasible" (able to provide adequate noise reduction benefits) and "reasonable" (mitigation is cost-effective based on the benefit provided). The Maryland SHA *Highway Noise Policy* was used to evaluate the effectiveness of mitigation measures such as noise barriers. For example, to be feasible, a noise

[3] Federal Transit Administration, "Transit Noise and Vibration Impact Assessment," Washington, DC, May 2006

barrier must provide a minimum 5-decibel noise reduction for at least 50 percent of the impacted receptors. Similarly, the noise barrier system would be considered reasonable if the area of wall provided per benefited residence is equal to, or less than, 2,700 square feet.

a. Noise

Transit noise effects are assessed based on land use categories and sensitivity to noise from transit sources. These criteria do not generally apply to industrial or commercial areas since they are generally compatible with higher noise levels.

Noise effects resulting from a proposed transit project are determined by comparing the existing and future project-related outdoor noise levels. Based upon FTA guidelines, project impacts are categorized as "No Impact," "Moderate Impact," and "Severe Impact," as determined from the allowable project noise exposure for a given existing ambient noise level. As the existing level of ambient noise increases, the allowable level of project noise contribution also increases, but only up to a certain point. Beyond that point, no increase in project noise contribution is allowed. *Moderate* impact and *severe* impact criteria levels of predicted noise are determined from the existing 24-hour measured noise levels.

The average day-night noise level over a 24-hour period (or L_{dn}) is used to characterize noise exposure for residential areas (FTA Category 2). The L_{dn} descriptor describes a receiver's cumulative noise exposure from all events over a full 24 hours, with events between 10:00 PM and 7:00 AM increased by 10 decibels to account for greater nighttime sensitivity to noise. For other noise sensitive land uses, such as schools and libraries (FTA Category 3) and outdoor amphitheaters (FTA Category 1), the average hourly equivalent noise level [or $L_{eq}(h)$] is used to represent the facility's peak operating period. For disclosure purposes, the maximum noise level (L_{max}) that occurs during an event, such as a bus or train pass-by, is also reported since that is the actual level heard in the community.

Traffic forecasts for the I-70 realignment considered traffic conditions that generated the greatest amount of highway noise. These traffic conditions would compute the nosiest traffic hour for comparison with the SHA noise abatement criteria.

b. Vibration

The response of humans, buildings, and monitoring equipment to vibration from transit projects is assessed in terms of root mean square (RMS) velocity level, expressed in inches per second, or the velocity level in decibels (VdB).

The FTA guidelines contain vibration impact criteria for ground-borne vibration levels from transit projects. For residential receptors, the FTA vibration criteria are 72 VdB for *frequent* events (defined as more than 70 train vibration events per day), 75 VdB for *occasional* events (defined as between 30 and 70 train vibration events per day), and 80 VdB for *infrequent* events (defined as less than 30 train vibration events per day).

c. Construction Criteria

During the environmental analysis phase of a project, construction details are conceptual and would be further refined as the design of the project advances. Therefore, the FTA guidelines suggest evaluating prototypical construction scenarios against local ordinances if applicable criteria are available. Since neither the Baltimore County nor the City noise ordinances provide quantitative noise limits on construction activities, the noise policy from the MDE was used to assess temporary construction activities.

The potential for annoyance from the conceptual construction scenarios was evaluated at sensitive receptors along the project study corridor using FTA Vibration Criteria. These proposed construction scenarios include primarily surface-related activities and are, therefore, unlikely to cause even minor structural damage, such as small cracks in plaster walls. However, for tunneling activities, pile driving, and blasting activities, the FTA damage criteria were used to assess the potential for cosmetic damage.

5.13.2 Existing Conditions

a. Noise

To determine the existing background noise levels at sensitive receptors in the vicinity of the Preferred Alternative alignment, a noise monitoring program was conducted at 28 representative monitoring locations as shown on **Figure 5-8** and **Volume 2 Environmental Plate Series, Plate Series 5**.

Noise levels were measured at various periods of the day in accordance with the FTA guidelines to determine the average ambient conditions during a typical weekday. These measurements were started on December 12-16, 2011 and completed on February 6-10, 2012.

The noise measurements documented existing noise sources along the project study corridor, such as existing traffic along I-695, Edmondson Avenue, Lombard Street, Boston Street, and other major cross streets. The 24-hour day-night noise level (or L_{dn}) is used to describe existing noise at residences and other FTA Category 2 land-uses. Similarly, peak-hour equivalent noise levels (L_{eq}) are reported for non-residential or institutional receptors such as schools, libraries, or churches.

The peak-hour noise levels were collected during periods assumed to be representative of the noisiest hour of the day. All noise levels are reported in A-weighted noise levels (or dBA) for comparison with the FTA criteria. A detailed description of the noise monitoring program is included in the *Noise and Vibration Technical Report*. The monitoring site receptors are listed and described in **Table 5-31**. The existing noise monitoring results by receptor for peak-hour equivalent noise levels (L_{eq}) and 24-hour day-night noise levels (L_{dn}) are shown in the last two columns of the table.

As summarized in **Table 5-31**, the measured day-night noise levels along the project study corridor range from 54 dBA at Receptors M08 and M12 (residences along Kirkwood Road and Edmondson Avenue, respectively) to 79 dBA at Receptor M20 (mixed-use properties along Lombard Street in Downtown). In general, the lower noise levels represent suburban locations while the higher noise levels reflect heavy vehicular traffic along downtown urban streets.

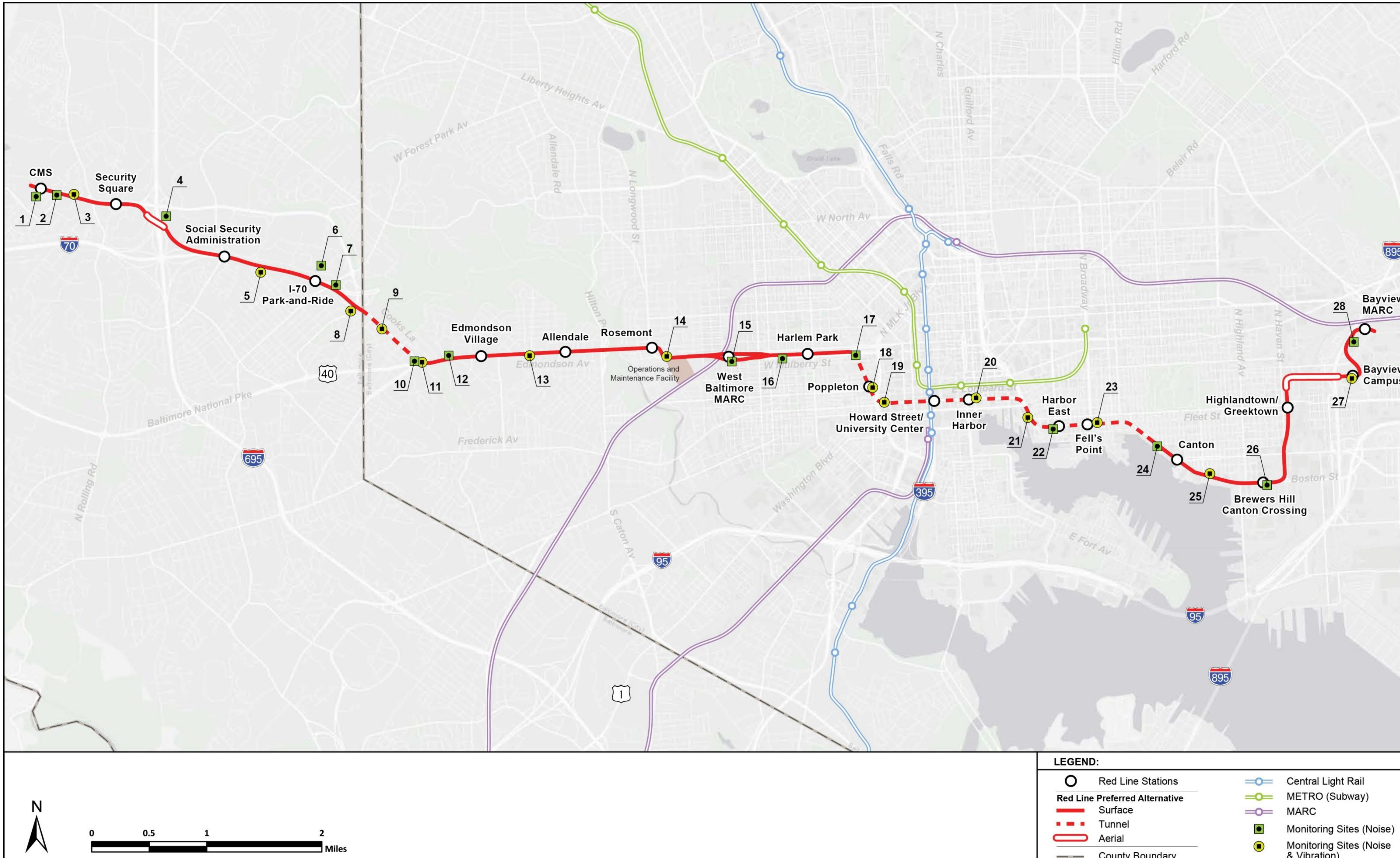


Figure 5-8: Noise and Vibration Monitoring Sites

Table 5-31: Existing Noise Monitoring Results

ID	Receptor Description	Neighborhood[1]	Land Use	FTA Land Use Category	Peak-Hour (L_{eq})	Day-Night (L_{dn})
West Segment						
M01	Chadwick Elementary, Winder Road	Windsor Mill	School	3	58	–
M02	Winder Road at Calais Court	Windsor Mill	Residence	2	58	58
M03	Security Boulevard	Windsor Mill	Residence	2	59	61
M04	Days Inn, Whitehead Court	Gwynn Oak	Motel	2	60	71
M05	Baltimore Street at I-70	Gwynn Oak	Residence	2	61	64
M06	Calvert Road	Gwynn Oak	Residence	2	58	59
M07	Ingleside Avenue at I-70	Gwynn Oak	Residence	2	69	70
Cooks Lane Tunnel Segment						
M08	Kirkwood Road at Forest Park Avenue	Gwynn Oak	Residence	2	50	54
M09	Cooks Lane	West Hills	Residence	2	72	69
M10	St. William of York Church/ School, Cooks Lane	West Hills	Church	3	69	–
M11	Edmondson Avenue at Cooks Lane	Hunting Ridge	Residence	2	71	74
M12	Edmondson Avenue at Glen Allen Drive	Hunting Ridge	Church	3	50	54
US 40 Segment						
M13	Edmondson Avenue at Cathedral Cemetery	Allendale	Funeral Home	3	73	69
M14	West Franklin Street at Franklintown Road	Rosemont Homeowners/ Tenants	Residence	2	72	77
M15	West Mulberry Street at Smallwood Street	Penrose/ Fayette Street Outreach	Residence	2	73	73
M16	West Mulberry Street at North Gilmore Street	Franklin Square	Residence	2	74	68
Downtown Tunnel Segment						
M17	West Mulberry Street at Fremont Avenue	Poppleton	Residence	2	63	65
M18	North Fremont Avenue at Baltimore Street	Poppleton	Residence	2	71	74
M19	University of Maryland Medical School, West Lombard Street	University of MD	School	3	69	–
M20	West Lombard Street at Calvert Street	Downtown	Residence	2	74	79

Table 5-31: Existing Noise Monitoring Results

ID	Receptor Description	Neighborhood[1]	Land Use	FTA Land Use Category	Peak-Hour (L_{eq})	Day-Night (L_{dn})
M21	President Street at Eastern Avenue	Inner Harbor	Residence	2	69	68
M22	Fleet Street at Central Avenue	Inner Harbor	Residence	2	65	66
M23	Fleet Street at Broadway	Fell's Point	Residence	2	69	72
M24	Boston Street at Montford Avenue	Canton	Residence	2	62	65
East Segment						
M25	Boston Street at Potomac Street	Canton	Residence	2	73	69
M26	Boston Street at Conkling Street	Canton Industrial Area	Residence	2	64	67
M27	Alpha Commons Drive	Hopkins Bayview	Residence	2	65	67
M28	East Lombard Street	Hopkins Bayview	Medical	3	66	71

Note: [1] The neighborhood data was provided by Baltimore City (2010) and Baltimore County (2012)

Similarly, measured peak-hour noise levels at institutional receptors along the project study corridor range from 58 dBA at Receptor M01 (Chadwick Elementary School on Winder Road in Chadwick Manor) to 69 dBA at Receptors M10 (St. William of York Church and School on Cooks Lane in Hunting Ridge) and M19 (University of Maryland Medical School on Lombard Street in Downtown). These levels are representative of active urban land uses.

In general, the project study corridor generally consists of dense residential and a mix of residential-commercial communities along highways and urban arterials (I-70, Edmondson Avenue, Mulberry Street, Lombard Street, etc). Based on the monitoring results, the high ambient noise conditions noted in **Table 5-31** reflect the proximity of residences to active transportation corridors.

b. Vibration

Similar to noise, a vibration monitoring program was conducted on February 6-10, 2012 at 14 representative locations shown in **Volume 2 Environmental Plate Series, Plate Series 5** including Sites M03, M05, M08, M09, M11, M13, M14, M18-21, M23, M25 and M27. Unlike noise, however, vibration is event-based rather than a cumulative exposure over a period of time. Therefore, existing vibration measurements documented existing vehicular traffic along local streets and arterials in the vicinity the identified receptors. Average vibration levels from existing transportation sources at all sites ranged from 0.01 ips for car pass-bys to 0.05 ips for truck pass-bys.

Additionally, vibration measurements were also conducted at the National Institute of Health (NIH) facility at the Johns Hopkins Bayview Medical Center campus on May 7-9, 2012. These detailed measurements are intended to document the ground propagation characteristics between the proposed Red Line and the façade of the building. These measurements also document the seismic response of the building itself, as well as the sensitive laboratory equipment including electron microscopes and magnetic resonance imaging (MRI) machines. Because of the sensitivity of this equipment, a low vibration threshold of 300-400 micro-inches per second (μips) is proposed for the Red Line construction and operations.

5.13.3 Future No-Build Conditions

a. Noise

Future noise levels under the No-Build Alternative are anticipated to be similar to those under existing conditions. The project study corridor is characterized by urban communities that include major highways (such as I-70 and US 40 lower level) and arterials (such as Lombard Street and Edmondson Avenue). Regardless of other projects in the Long Range Transportation Plan, ambient noise under the No-Build condition is anticipated to be essentially the same as the Existing conditions without the Preferred Alternative. For example, it takes a doubling of the traffic volumes for the noise levels to increase by 3 dBA, the threshold where most listeners detect the change. However, increases in traffic levels of less than 40 percent in the project study corridor between now and 2035 are expected to result in higher congestion and lower average travel speeds. Therefore, no significant noise effects are expected under the No-Build Alternative.

b. Vibration

Future vibration levels under the No-Build Alternative are expected to be similar to those currently experienced under existing conditions. Traffic, including heavy trucks and buses, rarely creates perceptible ground-borne vibration unless vehicles are operating very close to buildings or there are irregularities in the road, such as potholes or expansion joints. The tires and suspension systems of automobiles, trucks, and buses eliminate most ground-borne vibration. Since no project elements are proposed under the No-Build condition, the alternative would not cause any vibration effects.

5.13.4 Preferred Alternative

a. Long-Term Operational Effects and Mitigation

The long-term noise and vibration effects from operating the Red Line are summarized in the following section. The long-term noise and vibration effects are presented in the following categories: operating light rail transit in the project study corridor; pass-bys from light rail vehicles; special trackwork, traction power substations; operations and maintenance facility; ventilation facilities; feeder bus operations; traffic noise effects from the re-alignment of I-70; historic properties; and parks, schools, and other institutional receptors.

Operational Noise

Potential noise impacts has been assessed for the Preferred Alternative using the FTA noise impact assessment methodology. The Preferred Alternative would introduce new noise sources into the environment which may cause impact to sensitive receptors. **Table 5-32** summarizes the predicted noise levels at representative receptors from the Preferred Alternative. At residences and other FTA Category 2 land uses such as motels and hospitals sensitive to nighttime activity, the L_{dn} metric was used to reflect the particularly heightened sensitivity to nighttime noise. The "Preferred Alternative Noise" levels, which represent the future project noise only under the Preferred Alternative, were used to assess the onset of impact from the project. The "Total Noise," which represents the cumulative or total future ambient noise with the project, is also reported for disclosure purposes. However, the determination of noise impact, according to FTA's guidance, is based on the noise level caused by the project alone (the "Preferred Alternative Noise" level) not the "Total Noise."

Table 5-32: Predicted Noise Levels at Representative Receptors from the Preferred Alternative (dBA)

Receptor		Land Use Category		Noise Metric	Existing Condition	Preferred Alternative	FTA Criteria[1]		Total Noise
ID	Description	Type[1]	FTA				"MOD"	"SEV"	
West Segment									
M01	Chadwick Elementary, Winder Road	School	3	L_{eq}	58	44	62	67	58
M02	Winder Road at Calais Court	Residence	2	L_{dn}	58	54	57	62	59
M03	Security Boulevard	Residence	2	L_{dn}	61	56	58	64	62
M04	Days Inn, Whitehead Court	Motel	2	L_{dn}	71	55	65	70	71
M05	Baltimore Street at I-70	Residence	2	L_{dn}	64	50	60	66	64
M06	Calvert Road	Residence	2	L_{dn}	59	44	57	63	59
M07	Ingleside Avenue at I-70	Residence	2	L_{dn}	70	53	64	70	70
Cooks Lane Tunnel Segment									
M08	Kirkwood Road at Forest Park Avenue	Residence	2	L_{dn}	54	31	55	61	54
M09	Cooks Lane	Residence	2	L_{dn}	69	25	64	69	69
M10	St. William of York Church/School, Cooks Lane	Church	3	L_{eq}	71	26	69	74	69
M11	Edmondson Avenue at Cooks Lane	Residence	2	L_{dn}	74	27	65	72	74
M12	Edmondson Avenue at Glen Allen Drive	Church	3	L_{eq}	50	32	58	65	50
US 40 Segment									
M13	Edmondson Avenue at Cathedral Cemetery	Funeral Home	3	L_{eq}	73	58	70	77	73
M14	West Franklin Street at Franklintown Road	Residence	2	L_{dn}	77	**66[2]**	65	75	77
M15	West Mulberry Street at	Residence	2	L_{dn}	73	**65**	65	72	74

Table 5-32: Predicted Noise Levels at Representative Receptors from the Preferred Alternative (dBA)

Receptor		Land Use Category		Noise Metric	Existing Condition	Preferred Alternative	FTA Criteria[1]		Total Noise
ID	Description	Type[1]	FTA				"MOD"	"SEV"	
	Smallwood Street								
M16	West Mulberry Street at North Gilmore Street	Residence	2	L_{dn}	68	56	63	68	68
Downtown Tunnel Segment									
M17	West Mulberry Street at Fremont Avenue	Residence	2	L_{dn}	65	41	61	66	65
M18	North Fremont Avenue at Baltimore Street	Residence	2	L_{dn}	71	43	70	75	71
M19	University of Maryland Medical School, West Lombard Street	School	3	L_{eq}	69	42	69	74	69
M20	West Lombard Street at Calvert Street	Residence	2	L_{dn}	79	37	65	75	79
M21	President Street at Eastern Avenue	Residence	2	L_{dn}	69	38	69	74	69
M22	Fleet Street at Central Avenue	Residence	2	L_{dn}	69	37	66	71	65
M23	Fleet Street at Broadway	Residence	2	L_{dn}	72	39	65	71	72
M24	Boston Street at Montford Avenue	Residence	2	L_{dn}	65	46	61	66	65
East Segment									
M25	Boston Street at Potomac Street	Residence	2	L_{dn}	69	62	64	69	70
M26	Boston Street at Conklin Street	Residence	2	L_{dn}	67	**63**	62	68	69
M27	Alpha Commons Drive	Residence	2	L_{dn}	67	59	62	68	68
M28	East Lombard Street	Medical	3	L_{eq}	66	51	67	72	66

Notes: [1] The FTA criteria include *moderate* (MOD) and *severe* (SEV) impact categories.
[2] FTA *moderate* effects are shown in bold font and shaded to better distinguish from no impact.

Noise effects at the selected noise monitoring locations listed in **Table 5-32** were used to characterize noise effects from the Preferred Alternative at almost 1,600 receptors along the project study corridor. As a result of this evaluation, corridor-wide project noise exposure levels along the Preferred Alternative are predicted to exceed the FTA *moderate* impact criteria at 96 residences and the FTA *severe* impact criteria at one residence (The Shipyard condominium building at the corner of Boston Street and Lakewood Avenue).

None of the project noise levels along the Preferred Alternative are predicted to exceed the FTA impact criteria at any FTA Category 3 receptors. The predicted corridor-wide noise effects are summarized in **Table 5-33** and shown graphically in the *Noise and Vibration Technical Report*.

Table 5-33: Corridor-wide Project Noise Effects under the Preferred Alternative

Location	Type Use[1]	Impact (Moderate or Severe)	Number of Residences Affected[2]	Major Source(s) Contributing to Impact[3]
FTA Land Use Category 2				
West Segment	RES	Severe Moderate Total	0 3 3	LRT pass-bys Warning bells
Cooks Lane Tunnel Segment	RES	Severe Moderate Total	0 1 1	LRT pass-bys Warning bells
US 40 Segment	RES	Severe Moderate Total	0 87 87	LRT pass-bys Warning bells Switches
Downtown Tunnel Segment	RES	Severe Moderate Total	0 0 0	None
East Segment	RES	Severe Moderate Total	1 5 6	LRT pass-bys Warning bells
Total – All Uses		**Severe** **Moderate** **Total**	**1** **96** **97**	

Notes: [1] RES includes both Single-Family Residences (SFR) and Multi-Family Residences (MFR).
[2] The number of affected residences is shown for the Preferred Alternative.
[3] Major sources include LRT pass-bys, LRT warning bells, and switches or special trackwork. The operations and maintenance facility and TPSS are not expected to be a primary source for effects in any noise-sensitive locations.

Because of the federal regulation to provide safety warnings at all 53 at-grade crossings proposed along the project corridor, noise levels from onboard warning bells and stationary crossing bells are predicted to contribute to exceedances of the FTA *moderate* impact criteria under the Preferred Alternative. For example, maximum noise levels from light rail transit (LRT) warning bells are predicted to range from 54 dBA at Site M1 (Chadwick Elementary School) to 74 dBA at Site M26 (residences along West Mulberry Street). Similarly, maximum noise levels from stationary grade crossing bells (such as the low-profile Invensys devices) are predicted to range from 36 dBA at Site M1 (Chadwick Elementary School) to 69 dBA at Site M15 (residences along West Mulberry Street). Overall, predicted noise levels from warning bells (LRT bells at-grade crossings and stations) and stationary crossing bells are predicted to contribute to over 50 percent of the FTA *moderate* impacts under the Preferred Alternative.

Other noise impacts predicted under the Preferred Alternative are because of required track switches, which provide access for trains accessing and egressing the facility at the proposed operations and maintenance facility (OMF).

Operational Vibration

Unlike noise, which is assessed using cumulative noise levels over a 1-hour or 24-hour period, transit vibration effects are assessed based on individual events, such as a train pass-by. To reduce transit vibration effects at residences and other sensitive receptors along the Preferred Alternative, the entire rail corridor would be constructed with continuously welded rail track with ballast along at-grade sections and direct fixation along aerial or tunnel sections. These measures are expected to reduce vibration levels that are caused by steel wheels rolling over steel rails at rail joints. Along aerial sections, the sheer mass of the elevated structures and the additional separation between the train source and the ground-level receptors result in greater attenuation compared to at-grade track. At-grade crossings, embedded track at cross streets is not expected to result in any vibration effects, because of the short section limited to the width of the cross street. All predicted vibration levels were compared with the FTA *frequent* impact criteria to assess the onset and severity of impact.

In addition to residences, schools, and churches, two other highly vibration-sensitive receptors were identified along the Preferred Alternative: the University of Maryland's Proton Building proposed at Fremont Avenue and Baltimore Street in Downtown, and the NIH facility at the Johns Hopkins Bayview Medical Center campus. Both of these facilities include sensitive imaging equipment such as electron microscopes and MRI machines.

To show the variation along the Preferred Alternative alignment in vibration levels, transit vibration levels were predicted at the same receptor locations as for the noise analysis and are summarized in **Table 5-34**. Maximum vibration levels from LRT vehicle pass-bys are predicted to range from below detection at Site M6 (residences along Calvert Road) to 67 VdB at Site M15 (residences along West Mulberry Street) to 71 VdB at Site M28 (hospital building at Johns Hopkins Bayview). The predicted corridor wide vibration effects with the Preferred Alternative are summarized in **Table 5-35**. Corridor wide vibration levels are predicted to exceed the FTA *frequent* criterion of 72 VdB at 45 residences. Many of these effects are because of the proximity of residences to proposed switches. Ground-borne noise levels are also predicted to exceed the FTA *frequent* criterion of 35 dBA at 49 residences.

Table 5-34: Summary of Vibration Levels at Representative Receptors

Receptor		Land Use		Vibration (VdB)[1]		Ground-borne Noise (dBA)[2]	
ID	Description	Type	FTA	Preferred Alternative	Criteria	Preferred Alternative	Criteria
West Segment							
M01	Chadwick Elementary, Winder Road	School	3	52	75	17	40
M02	Winder Road at Calais Court	Residence	2	60	72	25	35
M03	Security Boulevard	Residence	2	61	72	26	35

Table 5-34: Summary of Vibration Levels at Representative Receptors

Receptor		Land Use		Vibration (VdB)[1]		Ground-borne Noise (dBA)[2]	
ID	Description	Type	FTA	Preferred Alternative	Criteria	Preferred Alternative	Criteria
M04	Days Inn, Whitehead Court	Motel	2	74	72	39	35
M05	Baltimore Street at I-70	Residence	2	56	72	21	35
M06	Calvert Road	Residence	2	< ambient	72	< ambient	35
M07	Ingleside Avenue at I-70	Residence	2	59	72	24	35
Cooks Lane Tunnel Segment							
M08	Kirkwood Road at Forest Park Avenue	Residence	2	47	72	12	35
M09	Cooks Lane	Residence	2	55	72	20	35
M10	St. William of York Church/School, Cooks Lane	Church	3	52	75	17	40
M11	Edmondson Avenue at Cooks Lane	Residence	2	53	72	18	35
M12	Edmondson Avenue at Glen Allen Drive	Church	3	51	75	16	40
US 40 Segment							
M13	Edmondson Avenue at Cathedral Cemetery	Funeral Home	3	64	75	29	40
M14	West Franklin Street at Franklintown Road	Residence	2	66	72	31	35
M15	West Mulberry Street at Smallwood Street	Residence	2	67	72	32	35
M16	West Mulberry Street at North Gilmore Street	Residence	2	62	72	27	35
Downtown Tunnel Segment							
M17	West Mulberry Street at Fremont Avenue	Residence	2	52	72	17	35
M18	North Fremont Avenue at Baltimore Street	Residence	2	59	75	24	40
M19	University of Maryland Medical School, West Lombard Street	School	3	54	65	19	30
M20	West Lombard Street at Calvert Street	Residence	2	60	72	25	35
M21	President Street at Eastern Avenue	Residence	2	52	75	17	40
M22	Fleet Street at Central Avenue	Residence	2	57	72	22	35
M23	Fleet Street at Broadway	Residence	2	53	72	18	35
M24	Boston Street at Montford Avenue	Residence	2	51	72	16	35
East Segment							
M25	Boston Street at Potomac Street	Residence	2	64	72	29	35
M26	Boston Street at Conklin Street	Residence	2	68	72	33	35
M27	Alpha Commons Drive	Residence	2	63	72	28	40

Table 5-34: Summary of Vibration Levels at Representative Receptors

Receptor		Land Use		Vibration (VdB)[1]		Ground-borne Noise (dBA)[2]	
ID	Description	Type	FTA	Preferred Alternative	Criteria	Preferred Alternative	Criteria
M28	East Lombard Street	Medical	3	71	75	36	40

Notes: [1] Maximum vibration velocity levels (in VdB) are reported for all receptor sites.
[2] Ground-borne noise because of vibration are reported in A-weighted decibels (dBA).

Table 5-35: Corridor-wide Project Vibration Effects under the Preferred Alternative

Location	Type Use[1]	Impact (Frequent)	No. Residences Affected		Major Source(s) Contributing to Impact[2]
			GB-VIB	GB-NZ	
FTA Category 1					
Downtown Tunnel Segment #4	MED	*frequent*	1	0	Pass-bys
FTA Category 2					
West Segment #1	RES	*frequent*	1	2	Switches
Cooks Lane Tunnel Segment #2	RES	*frequent*	0	0	None
US 40 Segment #3	RES	*frequent*	44	47	Pass-bys & Switches
Downtown Tunnel Segment #4	RES	*frequent*	0	0	None
East Segment #5	RES	*frequent*	0	0	None
Total FTA Category 2		*frequent*	**45**	**49**	
FTA Category 3					
			0	0	
Total – All Uses		**Total**	**46**	**49**	

Notes: [1] Residence includes Single-Family Residence; and Multi-Family Residence
[2] Major sources include LRT pass-bys, LRT warning bells, and switches or special trackwork. The operations and maintenance facility and TPSS are not expected to be a major source for effects in any noise-sensitive locations.

Because of rail discontinuities at switches, vibration levels from LRT vehicle pass-bys over switches are predicted to range from below background to 60 VdB at Site M2 (residences along Winder Road) to 66 VdB at Site M14 (residences along West Franklin Street) to 71 VdB at Site M28 (medical building at the Johns Hopkins Bayview).

However, vibration because of in-service train operations over switches used to access the OMF would contribute to exceedances of the FTA Category 2 *frequent* criterion of 72 VdB at 27 residences along West Franklin Street. Similarly, ground-borne noise because of these switches would also contribute to exceedances of the FTA Category 2 *frequent* criterion of 35 dBA at 29 residences. No FTA Category 3 land-uses were identified in the vicinity of the OMF.

At highly sensitive buildings such as the University of Maryland's Proton Building at the BioPark, ground-borne vibration levels from future Red Line operations of 46 VdB are predicted to exceed the building-specific criterion of 40 VdB (or 100 μips). However, at the NIH building at Johns Hopkins Bayview Medical Center, ground-borne vibration levels from future Red Line operations of 46 VdB are not predicted to exceed the building-specific criterion of 50 VdB (or

300 μips). Based on the modeling analysis, project vibration levels are not predicted to exceed the FTA *frequent* impact criteria at any non-residential land-uses (Category 1 or 3) except the proposed Proton Building under the Preferred Alternative.

Noise and Vibration Mitigation

Since noise and vibration effects are predicted for the Preferred Alternative, mitigation measures were investigated to determine their effectiveness in reducing *moderate* and *severe* noise effects from LRT operations. The following mitigation measures were evaluated for their potential to eliminate both *moderate* and *severe* noise and vibration effects along the project corridor:

- Median barriers or other supplemental safety measures at at-grade crossings to eliminate the need to sound warning horns, particularly at night;
- Relocating switches away from sensitive receptors;
- Utilizing approved control technologies (such as spring frogs) to eliminate rail gaps at switches; or,
- Track-side noise barriers or parapets to shield residents from wayside train pass-bys.

Implementing approved control measures at affected grade crossings, such as median barriers, four quadrant gates or other supplemental safety measures promulgated by MTA and the Federal Railroad Administration (FRA), would eliminate the need for LRT warning bells and stationary crossing bells particularly during the nighttime period. However, during Final Design, the feasibility of eliminating or minimizing use of the LRT warning and crossing bells will be investigated to comply with the current and future MTA policy on all new LRT corridors (such as the Purple Line).

Noise and vibration impacts were also predicted at residences along West Franklin Street because of the rail discontinuities associated with the switches used to access the proposed OMF. To mitigate these predicted impacts, approved control measures will be considered during Final Design, including, for example, spring frogs (to eliminate the gap in the switch) or low-profile noise barriers to shield nearby residences from the clickety-clack of revenue service trains over these switches.

b. Short-Term Construction Effects and Mitigation

Noise and vibration effects are expected during construction of the Red Line at residences and other sensitive receptors along the Preferred Alternative. The anticipated construction methods and activities that are anticipated during the construction of the Preferred Alternative (as described in **Chapter 3** of this FEIS) were used as input to this construction noise and vibration analysis.

In order to gauge the level of potential impact from construction activities, a detailed noise and vibration assessment was developed in accordance with FTA guidelines based upon preliminary construction scenarios. More detailed information regarding this analysis is contained in the *Noise and Vibration Technical Report*.

The analysis made conservative assumptions regarding construction noise and vibration to ensure that potential maximum adverse effects through the project study corridor were analyzed and disclosed consistent with NEPA requirements. However, during Final Design, when more detailed construction plans are available, this analysis, including mitigation, would be refined. Noise and vibration levels from construction activities along the Preferred Alternative, although temporary, could be a nuisance at nearby sensitive receptors such as residences and schools. Noise and vibration levels during construction are difficult to predict and vary depending on the types of construction activity and the types of equipment used for each stage of work. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns and is not usually at one location very long.

Within the project study corridor, construction activities would include track-laying for aerial and at-grade sections, tunnel and underground station excavation, construction of passenger stations, bridges, park-and-ride facilities, and an OMF. Typical distances at which an exceedance of the MDE noise limit of 90 dBA at residences during the daytime, 55 dBA at residences during the nighttime and 62 dBA at non-residential receptors is predicted, ranges from 177 feet to 3,155 feet to 1,409 feet, respectively. These distances to predicted impact reflect the loudest construction activities including blasting at downtown stations, pile driving and other impact categories associated with station excavation. For example, maximum construction noise levels are predicted to range from 83 dBA at Site M8 (residences along Stamford Road) because of excavation activities for the Cooks Lane Eastern Tunnel Portal to 94 dBA at Site M18 (residences along North Fremont Avenue) because of Poppleton station excavation activities.

Similarly for vibration, construction activities would include the use of bulldozers, dump trucks, vibratory rollers, blasting, and tunnel boring machines (TBM). The distances at which an exceedance of the FTA vibration damage criterion of 0.5 ips would occur (for typical timber and masonry residences) ranges from 8 feet for surface track laying to 30 feet for tunnel boring activities. However, for highly sensitive buildings, such as the proposed University of Maryland's Proton Building, tunnel boring activities are predicted to exceed the 100 μips threshold limit within 1,875 feet of the alignment. Similarly, these distances to predicted impact reflect the construction activities with maximum ground impact including blasting at downtown stations, pile driving and ground-breaking activities associated with subsurface construction. For example, maximum construction vibration levels because of tunnel boring activities are predicted to range from 0.03 ips PPV at the proposed Proton Building along North Fremont Avenue to 0.93 ips PPV at Site M17 (residences along Fremont Street).

Construction activities are predicted to exceed both the MDE daytime and nighttime noise limits at almost every residence and commercial property within the project study corridor. The total number of exceedances of the MDE L_{max} noise criteria is summarized in **Table 5-36** for both daytime and nighttime construction activities. Because of the large impact distances based on the MDE criteria, exceedances of the MDE daytime and nighttime noise L_{max} noise limits are predicted at all 1,538 receptors identified within the project screening distance. For this analysis, the construction activities were applied to both daytime and nighttime periods.

Table 5-36: Summary of Receptor Impacts for the Construction Noise and Vibration Assessment within the Project Study Corridor

Construction Activity		Noise, L_{max}		Vibration[1]	
	Type	Daytime	Nighttime	PPV, ips	RMS, VdB
Alignment	Surface	632	903	2	230
Alignment	Tunnel	504	965	38	577
Station Excavation	Tunnel	6	880	1	13
Portal Excavation	Tunnel	23	1,440	1	57
Operations and Maintenance Facility	Surface	0	889	0	0

Note: [1] Vibration is reported in inches per second (ips) to assess the onset of damage (peak particle velocity or PPV) and in vibration decibels (VdB) to assess the onset of annoyance (root mean square or RMS).

Noise and Vibration Mitigation

Since the overall project construction period is expected to last approximately seven years, significant noise effects are expected, particularly on those receptors adjacent to the alignment without adequate noise control measures. As such, MTA is committed to providing noise and vibration control measures during construction whenever feasible and reasonable in accordance with its own construction specifications to mitigate impacts and to achieve consistency with the local and MDE noise ordinances as part of the Preferred Alternative. To reduce temporary construction noise and vibration impacts that are expected along the Preferred Alternative, several "good housekeeping" practices are recommended. For example, the following noise and vibration control measures could be incorporated into the construction process:

- Use construction methods that avoid pile-driving at locations containing noise- and vibration-sensitive receptors, such as residences, schools, and hospitals. Whenever possible, MTA's contractor would consider using cast in place drilled hole (CIDH) or drilled piles rather than impact pile drivers to reduce excessive noise and vibration.
- Conduct a survey of the closest receptors (particularly fragile historic properties) to determine the baseline structural integrity and condition of walls and joints. These surveys could include the installation of strain gauges or a photographic documentation of the interior walls and exterior façade as a basis for comparison after construction is completed. Depending on the baseline conditions of the nearby buildings, an appropriate construction and monitoring plan would be developed to minimize potential damage to susceptible structures.
- Where practical, erect temporary noise barriers between noisy activities and noise-sensitive receptors.
- Locate construction equipment and material staging areas away from sensitive receptors. Route construction traffic and haul routes along roads in non-noise-sensitive areas where possible.
- Require contractors to use best available control technologies to limit excessive noise and vibration when working near residences (e.g., CIDH piles).

- Adequately notify the public of construction operations and schedules. Methods such as construction-alert publications or a Noise Complaint Hotline could be used to handle complaints quickly.
- Where possible, consideration should be given to early construction of permanent barriers to shield receptors from some construction generated noise.

All mitigation measures would be confirmed during the Final Design phase of the project when the details of the project components and the construction scenarios have been finalized.

5.14 Ecological Resources

5.14.1 Introduction and Methodology

The project study corridor is located primarily within urban and suburban areas of Baltimore City and adjacent Baltimore County. The segment limits used for the natural resources technical studies generally match the Preferred Alternative segment limits, with the exception of the transition areas between tunnel and surface construction areas at the segment boundaries. The following segments were used during field inventory efforts: West; Cooks Lane Tunnel; US 40; Downtown Tunnel; and East. The project segment limits for the natural resource inventory efforts were similar to the segment limits presented in **Chapter 2** with only slight limit modifications. The Cooks Lane Tunnel segment eastern limit for the natural resources inventory extended slightly further east to capture the tunnel portal areas. Other than this segment limit modification, all other segments limits are the same as presented in **Chapter 2**.

The area assessed for the natural resources technical studies includes a study area of the limit of disturbance plus 50 feet beyond in order to capture contiguous wetlands and water features and critical root zones of adjacent trees, in accordance with Maryland Department of Natural Resources (DNR) requirements. According to the *State Forest Conservation Technical Manual*, a critical root zone is a circular region measured outward from a tree trunk that represents the area of roots that must be maintained or protected for the tree's survival. The critical root zone equals 1-foot of radial distance for every inch of tree diameter measured at 4.5 feet above the ground (diameter at breast height — see Forests **Section 5.15**). For specimen trees, the critical root zone is 1.5 feet for every inch of tree diameter.

Very few areas within the project study corridor support natural habitats. The portions of the project study corridor supporting larger tracts of natural habitat occur primarily within the I-70 corridor and the Gwynns Falls stream valley. The remainder of the project study corridor contains smaller patches of mostly disturbed vegetation that occur in small community parks, along small tributary streams, or in the cloverleaves of major interchanges (refer to **Volume 2 Environmental Plate Series, Plate Series 2**).

a. Terrestrial Habitat

Terrestrial habitats are defined as areas of land that are able to provide food and shelter required for the survival of various terrestrial plants and animals. Terrestrial habitats within the project study corridor include forests, individual trees, and non-forested, vegetated areas (e.g., lawns, parkland). Terrestrial habitat within the project study corridor was assessed through aerial mapping and field reconnaissance conducted in Spring 2012.

b. Terrestrial Wildlife

The presence and diversity of terrestrial wildlife, including birds, mammals, reptiles, and amphibians, in the project study corridor is largely dependent on the quality and availability of terrestrial habitats. Because of the urban nature of the project study corridor, terrestrial habitats are limited, thereby reducing the diversity of wildlife. Information on wildlife within the project study corridor was obtained from observations noted during fieldwork for other natural resources and from published or unpublished data collected from outside sources.

Forest Interior Dwelling Bird Species (FIDS) depend on large, contiguous forest stands to successfully breed and produce sustainable populations, and optimally require forests of at least 100 acres or riparian forest at least 300 feet wide to maintain viable breeding populations. However, forests as small as 50 acres in size can also provide important FIDS habitat if interior habitat (defined as at least 300 feet from any edge) within the overall acreage is 10 acres or greater, and trees are generally at least 5 inches in diameter or greater, or provide a closed canopy. FIDS species recorded within the project study corridor have been identified through the use of the online Breeding Bird Atlas Explorer (*USGS Patuxent Wildlife Research Center & National Biological Information Infrastructure*) with data from the Maryland and District of Columbia Breeding Bird Atlas Project for the Baltimore West and Baltimore East United States Geological Survey (USGS) Quadrangle Maps.

c. Aquatic Habitat and Species

Aquatic habitat within the project study corridor is primarily comprised of nontidal streams associated with the Patapsco River watershed. Major tributary streams and their subwatersheds that cross or receive drainage from the project study corridor include the Gwynns Falls and its tributary, Dead Run, the Jones Falls, and Back River (refer to **Figure 5-9**). The mainstems of these streams that fall within the project study corridor have retained some of their natural characteristics and forested floodplains. However, past and present disturbances from adjacent developments and infrastructure have greatly affected the aquatic habitat of these waterways. In particular, the smaller, first and second order tributaries are typically piped for much of their length or confined in concrete channels.

The overall biological condition of the streams within the project study corridor can be determined by analyzing the fish and benthic macroinvertebrate communities within those streams, as well as the physical habitat quality of the stream. Existing data from DNR Maryland Biological Stream Survey (MBSS), Baltimore County Department of Environmental Protection (BCDEP), and Baltimore City Department of Public Works (BCDPW) were reviewed and compiled to determine the biological conditions within the project study corridor based on Index of Biotic Integrity (IBI) scores. **Table 5-37** summarizes how the fish and benthic macroinvertebrate IBI scores are translated into narrative rankings and reference stream conditions (Roth et al., 1997).

Figure 5-9: Watersheds, Biological/Water Quality Monitoring Stations, and Floodplains

The aquatic habitat methods are based on the Environmental Protection Agency's (EPA) Rapid Bioassessment Protocol (RBP) and have been modified for use in Maryland streams. This protocol assigns a Physical Habitat Index (PHI) value based on eight parameters: instream habitat, epifaunal substrate, number of root wads and woody debris, remoteness, shading, bank erosion, riffle-run quality, and embeddedness. Ranked scores as translated as follows: Minimally Degraded, Partially Degraded, Degraded, or Severely Degraded.

Table 5-37: MBSS IBI Scores and Rankings

IBI Score	Narrative Ranking	Characteristics
4.0 – 5.0	Good	Comparable to reference streams considered minimally affected, biological metrics fall within the upper 50 percent of reference site conditions.
3.0 – 3.9	Fair	Comparable to reference conditions, but some aspects of biological integrity may not resemble the qualities of minimally affected streams.
2.0 – 2.9	Poor	Significant deviation from reference conditions, indicating some degradation. On average, biological metrics fall below the 10^{th} percentile of reference site values.
1.0 - 1.9	Very Poor	Strong deviation from reference conditions, with most aspects of biological integrity not resembling the qualities of minimally affected streams, indicating severe degradation. On average, most or all metrics fall below the 10^{th} percentile of reference site values.

Source: Roth et al., 1997

d. Endangered and Threatened Species

Regulatory agencies that protect special status species include the US Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and DNR Wildlife and Heritage Service. USFWS and NMFS regulate and protect federally-listed endangered and threatened species under the Endangered Species Act of 1973, and federally managed fish species under the Magnuson-Stevens Fishery Conservation & Management Act. State and federally-listed rare, threatened and endangered species are regulated in Maryland through DNR Wildlife and Heritage Service. Effects to endangered and threatened species were assessed qualitatively based on queries to regulatory agencies. NMFS, USFWS and DNR were contacted in January 2006 as part of the preparation of the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) to determine the potential presence of endangered or threatened species within the project study corridor. Follow-up letters were submitted to these same agencies in December 2009 and December 2011, and the USFWS on-line certification database was queried in November 2011 to obtain current species information, as part of the preparation of the Final Environmental Impact Statement (FEIS). Refer to **Section 5.14.2.d** and **Appendix G** for agency responses.

5.14.2 Existing Conditions

a. Terrestrial Habitat

The entire project study corridor is broadly classified as urban or developed land (Anderson et al. 1976) that includes sub-classes of residential, commercial, industrial, and other urban or developed land. The Anderson classification system is a macro-scale assessment and assigns classifications related to the most common, or majority, land use in an area. Consequently, this land use also includes areas of non-developed lands such as the forested stream valley of Gwynns Falls that bisects the US 40 segment of the project study corridor.

Primary terrestrial habitat types in the project study corridor include woodlands (refer to **Section 5.15**) and other areas that are vegetated, but non-forested, such as narrow hedgerows or mowed lawns and landscaping. These forested and non-forested habitat types include both upland and wetland vegetative communities. Of these types, the forested upland and wetland areas provide the highest value terrestrial habitat. Non-forested habitat is associated primarily with the I-70/I-695, I-695/Security Boulevard, and I-70/Security Boulevard interchanges, parkland in Canton, and portions of the inactive Norfolk Southern rail line. The interchanges and inactive rail line are comprised of disturbance-tolerant tree, sapling, shrub, vine, and herbaceous species including numerous non-native varieties. The remainder of the terrestrial habitat occurs throughout the project study corridor in small patches of maintained lawn grasses with scattered larger trees within residential communities and landscaped commercial properties.

b. Terrestrial Wildlife

The presence of terrestrial wildlife within the project study corridor is a function of available habitats. Because of the urban nature of the project study corridor, terrestrial habitats are limited, thereby reducing the diversity of wildlife. Most wildlife resources expected to occur within the project study corridor would likely be found within the larger, less developed riparian corridors of Dead Run and Gwynns Falls. More open, early successional habitats, such as those found within the interchanges at the western end of the project study corridor and the inactive rail line at the eastern end of the project study corridor, provide habitat for disturbance-tolerant species and species adapted to woodland/field edges. Wildlife use of these areas would be expected to be limited because of their relatively small size, limited cover, and isolation from larger vegetated corridors. Common species found in these types of habitats as transients or residents are detailed in the *Natural Resources Technical Report* in **Appendix I**.

The forest habitat within the Dead Run and Gwynns Falls watershed portions of the project study corridor provide habitat to many forest and forest edge species of wildlife such as, white-tailed deer (*Odocoileus virginianus)*, red fox (*Vulpes vulpes)*, gray squirrel, southern flying squirrel (*Glaucomys volans)*, eastern chipmunk (*Tamias striatus)*, raccoon, Virginia opossum, striped skunk (*Mephitis mephitis)*, white-footed mouse (*Peromyscus leucopus)*, eastern box turtle (*Terrapene carolina)*, black rat snake (*Elaphe obsoleta)*, and American toad (*Anaxyrus americanus)*. According to the *2002-2006 Maryland-DC Breeding Bird Atlas Project*, 78 species of birds were reported as at least possibly breeding within these riparian and adjacent developed areas

These larger forest patches also serve as habitat for FIDS, which depend upon large, contiguous forest stands in order to successfully breed and produce sustainable populations. Refer to the *Natural Resources Technical Report* for a list of FIDS recorded during the *2002-2006 Maryland-DC Breeding Bird Atlas Project* as possibly breeding within the larger forest tracts of the project study corridor.

c. Aquatic Habitat and Species

The *Code of Maryland Regulations* (COMAR) 26.08.02.01-.02 provides designated use classes for all Maryland waterways. With the exception of Dead Run, all stream segments located within the project study corridor are classified as Use I, which are protected for water contact recreation and aquatic life. Dead Run is classified as a Use IV waterbody which is protected for water contact recreation, aquatic life, and recreational trout waters (Maryland Department of the Environment, 2012).

Numerous MBSS, BCDEP, and BCDPW biological/water quality monitoring stations within close proximity to the project study corridor are located along the Gwynns Falls, Jones Falls, and Back River subwatersheds and their tributaries (**Figure 5-9**). Because the streams in the Baltimore Harbor subwatershed are piped in closed sections beneath the urban street grid, no biological data were available in the Baltimore Harbor subwatershed. Although a small portion of the Lower North Branch of the Patapsco River subwatershed is located near the far southwestern corner of the project study corridor, no portion of the project limit of disturbance drains to this subwatershed; this subwatershed is not included in any further discussions that follow.

In general, the biological communities in project study corridor streams reflect the high degree of urbanization in their associated watersheds. All three of the project study corridor subwatersheds have impervious percentages greater than 34 percent (ACOE 2006 and DNR 1998). Most IBI scores were in the Poor and Very Poor range, reflecting the high level of imperviousness in the project study corridor.

Fish

Overall, 24 species of fish were identified within the project study corridor (refer to the *Natural Resources Technical Report* for more detail and list). Of these 24 species, only two, American eel (*Anguilla rostrata*) and striped bass (*Morone saxatilis*), are considered migratory fish. With its proximity to tidal waters, the project study corridor would be expected to support more migratory species; however, with the high level of stream piping and overall urbanization, it is likely that downstream blockages and impaired water quality limit the use of many project study corridor streams by migratory species. However, the NMFS Chesapeake Bay Program Office reports that the Gwynns Falls is probably spawning and nursery ground for some migratory perch species (NMFS letter December 30, 2011, **Appendix G**). Four species of game fish, rainbow trout (*Oncorhynchus mykiss*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), and striped bass, were identified within the project study corridor. Dead Run, as a Use IV, Recreation Trout Waters, has been occasionally stocked with trout for recreational fishing. **Table 5-38** summarizes Fish Index of Biotic Integrity (FIBI) scores from MBSS sampling conducted within the project study corridor.

Table 5-38: Summary of Fish Index of Biotic Integrity within the Red Line Project Study Corridor

Agency	Subwatershed	FIBI Score Range	FIBI Narrative	Average FIBI Score
MBSS	Gwynns Falls	1.00 - 3.67	Very Poor – Fair	2.53
MBSS	Jones Falls	1.00 - 3.67	Very Poor – Fair	1.89
MBSS	Back River	2.67	Poor	2.67

Source: MBSS website (www.dnr.state.md.us/streams/mbss)

Benthic Macroinvertebrates

Benthic macroinvertebrate Index of Biotic Integrity (BIBI) scores ranged from Very Poor to Poor within the Gwynns Falls and Jones Falls subwatersheds, to Very Poor in the Back River subwatershed. Generally, all groups of macroinvertebrates found within all three subwatersheds are considered tolerant to urbanization, reflecting the affected nature of the aquatic community.

Physical Habitat

The MBSS Physical Habitat Index (PHI) rated the sites within the Gwynns Falls subwatershed from Severely Degraded to Partially Degraded while the Jones Falls subwatershed was rated as Severely Degraded. Overall, sites located within the Gwynns Falls subwatershed had a moderate amount of shading with low bank erosion because of bank armoring, including concrete lining and gabion baskets. Instream habitat, riffle/run quality, and epifaunal substrate usually scored in the suboptimal range for the individual metrics. The low amounts of instream woody debris and root wads negatively affect the aquatic habitat availability in the Gwynns Falls subwatershed. All of the MBSS-sampled sites in the Jones Falls subwatershed suffered from either extensive concrete channelization or severe bank erosion. Very low amounts of instream root wads and woody debris were present, and embeddedness was very high. These factors greatly reduce the potential for colonization by sensitive macro-invertebrate communities, though the large pools and good instream habitat would allow for a relatively diverse fish population. PHI values were not available for the one site sampled by MBSS in the portion of the Back River subwatershed within the project study corridor; however, the "Poor" and "Very Poor" respective fish and macroinvertebrate IBI scores may indicate that the physical habitat is also degraded.

d. Endangered and Threatened Species

No known rare, threatened, or endangered species were identified by federal or state agencies within the project study corridor. According to November 15, 2011 USFWS correspondence, except for occasional transient individuals, no federally proposed or listed threatened or endangered species are known to exist within the project study corridor **(Appendix G)**. Therefore, no Biological Assessment or further Section 7 consultation with the USFWS is required. According to December 30, 2011 NMFS correspondence, resource impact concerns are limited to the proposed crossing of the Gwynns Falls near US 40, as probable spawning and nursery ground for species that are important prey for mobile, federally managed predators within the Chesapeake Bay **(Appendix G)**. In a letter dated July 6, 2010, DNR indicated that there is an American Peregrine Falcon nest site occurring within the project study corridor. The documented species in need of conservation and important prey species known to occur within the vicinity of the project study corridor, as identified by NMFS and DNR (refer to **Appendix G**) are listed in **Table 5-39** with their current status. Species considered "In Need of Conservation" are those species whose existence as part of the State's natural resources is in jeopardy. "Important Prey" species are those species that serve as prey for federally-managed or endangered predators.

Table 5-39: Listed Species and Species of Interest Identified by DNR and NMFS as Occurring in the Vicinity of the Project Study Corridor

Common Name	Scientific Name	State (S)/Federal (F) Status
American Peregrine Falcon	*Falco peregrinus anatum*	In Need of Conservation (S)
White Perch	*Morone Americana*	Important Prey (F)
Yellow Perch	*Perca flavescens*	Important Prey (F)

Sources: Maryland Department of Natural Resources letters dated July 6, 2010, and January 2012. National Marine Fisheries Service letter dated December 30, 2011.

Peregrine falcons have bred on the 33rd floor of the former Legg Mason Building (formerly known as the US Fidelity and Guaranty Building) at the corner of Pratt Street and Light Street since the early 1980s. Nesting again took place in 2006, and the DNR Wildlife and Heritage Service database (DNR, July 6, 2010) indicates that the peregrines currently maintain a nest site on a window ledge of the building.

The Gwynns Falls provides "probable nursing and spawning ground" for white perch and yellow perch that migrate from the Chesapeake Bay into the watershed. These species are important prey for the federally-managed Bluefish (*Pomatomus saltatrix*) and other federally-managed predators in the Bay. Migratory perch can travel from the Bay into the Gwynns Falls passing through the project study corridor upstream to the confluence with Dead Run (NMFS, December 30, 2011, **Appendix G**).

5.14.3 Future No-Build Conditions

The No-Build Alternative would not result in changes to the natural environment and no short and long-term effects are anticipated. A discussion of the effects from the Preferred Alternative follows.

5.14.4 Preferred Alternative

This section describes the long- and short-term effects, avoidance and minimization measures, and mitigation to ecological resources, including terrestrial habitat, terrestrial wildlife, aquatic habitat and species, and endangered and threatened species. The effects are described by the five segments of the project study corridor. Effects to forests are detailed in **Section 5.15.**

a. Terrestrial Habitat

Long-Term Operational Effects

Long-term forest and hedgerow effects would occur within the West and Cooks Lane Tunnel segments at the west end of Security Boulevard at the proposed CMS Station, the Security Square Mall loop adjacent to I-695, Social Security Administration property adjacent to the I-70 off-ramp to I-695, the new Parallel Drive/I-70 intersection, I-70 Park-and-Ride, and Cooks Lane western tunnel portal where siting of facilities would permanently remove forest in those locations. Although considered permanent removal, this minor effect (i.e., only small sections of forest to be removed) would not significantly affect the terrestrial habitat available to local wildlife since adjacent forested areas would remain intact. The forested areas to be affected do not provide valuable terrestrial wildlife because forest is adjacent to roadways, is small in area, and are fragmented contiguous forest. Further detail on forest/hedgerow effects are described in the **Section 5.15** of this chapter.

Long-term forest effects at the US 40/Gwynns Fall crossing would be minor since Baltimore City would be widening the US 40/Edmondson Avenue bridge crossing at that location, removing forest during their work. The Red Line project would not remove any additional forest at the US 40/Edmondson Avenue bridge crossing, since rail line construction would be conducted entirely within the footprint of the Baltimore City bridge reconstruction project limit of disturbance. No long-term impacts to forest or hedgerow resources would occur within the Downtown Tunnel segment. Non-forested areas, primarily lawn and isolated trees that provide minimal terrestrial habitat value, would also realize long-term effects through displacement from siting of facilities in the US 40 and Downtown Tunnel segments.

Long-term forest and hedgerow effects within the East segment would involve clearing of low quality forest/hedgerow resources located within the in-active Norfolk Southern rail line. In addition, long-term impacts to previously disturbed forest/hedgerow resources would occur for construction of the rail line within the MDTA right-of-way (I-895), and Bayview MARC station adjacent to Johns Hopkins Bayview Medical Center, PiCorp, Norfolk Southern, and industrial properties near the eastern terminus of the project study corridor.

Short-Term Construction Effects

Short-term forest/hedgerow effects throughout the project study corridor would be limited because temporary staging and stockpile areas during construction would primarily be sited in non-forested areas (such as parking lots, and lawns), or within forest to be permanently affected. Non-forested areas would also realize short-term effects during construction, and these temporary effects would be limited to staging and stockpile areas.

Avoidance and Minimization

The Preferred Alternative alignment has been designed to minimize the effect on the higher value terrestrial habitat that forested areas provide. For example, forest effects within the project study corridor in the West segment near I-70 and the Social Security Administration, would be minimized to the extent possible by transitioning the track alignment from the wooded strip between Parallel Drive and I-70, onto the westbound lanes of I-70 resulting in reduced forest effects on the north side of I-70.

Mitigation

Unavoidable effects to forest would be mitigated in accordance with state requirements as described in **Section 5.15.**

b. Terrestrial Wildlife

Most wildlife resources expected to occur within the project study corridor would likely be found within the larger, less developed riparian corridors of Dead Run and Gwynns Falls.

Long-Term Operational Effects

Long-term effects to wildlife resources are unlikely because the Preferred Alternative would follow existing roadway alignments, and wildlife corridors, such as along Gwynns Falls, would remain intact.

Short-Term Construction Effects

Construction may temporarily displace mobile species such as birds and mammals (which would likely move to existing adjacent habitat), but they typically quickly relocate back to their former habitat post-construction. In some cases mobile species may permanently relocate to the nearest similar habitat. In either case, this would be considered a minor effect. FIDS habitat would be affected by minor encroachment since only slight widening of existing roadways would be necessary to accommodate the Preferred Alternative.

Avoidance and Minimization

Forest and non-forested habitat (and the wildlife species occurring within that habitat) have been avoided or effects minimized to the greatest extent practicable throughout the project study corridor through careful design. Contiguous riparian corridors (such as at Gwynns Falls and Dead Run) and large forest tracts, in particular, have been avoided to reduce the potential for effects to FIDS habitat. The minor encroachments on the edges of FIDS habitat minimize the extent of effect to forest interiors that would otherwise result if the transitway were to bisect FIDS habitat.

Mitigation

Mitigation would not be required since long-term effects would be avoided.

c. Aquatic Habitat and Species

Effects to aquatic habitats and species are related to direct loss of habitat from project infrastructure such as culvert extensions that would occur and water quality degradation that could potentially occur from construction and operation of the Preferred Alternative. However, because of the limited aquatic resources directly within the project study corridor, and water quality protection measures that would be employed throughout construction and operation of the Preferred Alternative, overall effects to aquatic habitat and species from the Preferred Alternative are expected to be minimal.

Long-Term Operational Effects

The Preferred Alternative would result in the permanent or temporary loss of approximately 1,941 linear feet of aquatic stream habitat within the project corridor, largely as a result of proposed culvert extensions. Extension of culverts could lead to direct loss of fish and macroinvertebrates within the construction zone and would permanently alter the available habitat. However, the species expected to be affected are acclimated to disturbed settings and would likely recolonize to temporarily disturbed areas, though the communities are unlikely to be identical to those present prior to construction.

During operation, the Preferred Alternative would have the potential to increase water quality degradation from stormwater runoff because greater impervious surfaces created by the Preferred Alternative could affect water quality. However, overall net increases in impervious surfaces are expected to be minimal, amounting to an approximately 7-acre increase in impervious area for the approximately 340 total acres of the Preferred Alternative. Because all of the affected watersheds have already exceeded impervious thresholds for aquatic degradation, the small incremental impervious effects that could be expected from the Preferred Alternative are unlikely to affect overall aquatic habitat or the makeup of biological communities to an appreciable degree. Refer to **Section 5.19** for additional details on water quality in the project study corridor.

Short-Term Construction Effects

Potential effects during construction include physical disturbances or alterations, accidental spills, and sediment releases that can affect aquatic life. Earth-moving activities could expose unstabilized soils that can be delivered to waterways during storm events. Increased sediment loads can destroy or damage fish spawning areas and macroinvertebrate habitat. An accidental sediment release in a stream can clog the respiratory organs of fish, macroinvertebrates, and the other members of their food web (Barrett 1998). Additional suspended sediment loads have also been shown to cause stream warming (CWP 2003). Barrett (1995) found that the initial response to increased sedimentation because of construction was a reduction in numbers and species of fish and macroinvertebrates. This reduction in fish numbers in areas of siltation was generally reversed within 12 months of the cessation of construction activity.

Avoidance and Minimization

During the planning process, direct effects to stream channels have been substantially reduced by locating the Preferred Alternative within tunnels where appropriate and within existing impervious or developed areas for a majority of its length. Additional opportunities to decrease stream effects through the use of retaining walls and other techniques to reduce the Preferred Alternative limit of disturbance are currently being explored and would continue as more detailed project designs are developed.

Potential effects to aquatic habitat and water quality during construction would be minimized by strict adherence to MDE-approved sediment and erosion control plans. Long-term water quality effects would be minimized through the use of stormwater management plans developed in accordance with state regulations requiring the use of environmental site design to provide long-term mitigation of potential effects from stormwater.

In-stream construction would not be performed in Use I streams during the period of fish spawning and early development from March 1 to June 15 in accordance with the State's Use I time of year restrictions. In Dead Run and its tributaries, in-stream construction would be restricted from March 1 through May 31 in accordance with the State's Use IV time of year restrictions.

Mitigation
Unavoidable direct effects to stream channels would be mitigated in accordance with state and federal requirements as described in **Section 5.18.4.c.** Mitigation of stream effects generally focuses on water quality and stream stability improvements and, as such, would also be expected to provide mitigation of affected aquatic habitat.

d. Endangered and Threatened Species

Long-Term Operational Effects
Long-term effects would not be anticipated since rare, threatened or endangered species are not known to occur within the project study corridor per DNR, USFWS and NMFS.

Short-Term Construction Effects
Short-term effects would not be anticipated since rare, threatened or endangered species are not known to occur within the project study corridor. Short-term effects may occur to species of interest during construction including peregrine falcon and certain fishes. Construction effects could include noise, and sedimentation into waterways from stormwater runoff of disturbed soil. The proximity of nesting peregrine falcons at Light Street and Lombard Street may result in temporary effects to the species during construction of the Inner Harbor Station and associated roadway work in the vicinity. Further consultation with DNR would be required as design proceeds to provide for their review of project details and the need for any mitigation (DNR, July 6, 2010).

Avoidance and Minimization
Proposed tunneling under the Jones Falls, and use of the existing US 40 crossing over Gwynns Falls would avoid effects to downstream fisheries resources and their habitat. Application of required erosion and sediment control BMPs would minimize the potential effects to fish by limiting sedimentation into streams during rain events. Construction work would be scheduled to avoid noise effects to the falcon during nesting season.

Mitigation
Mitigation would not be required since long-term effects would be avoided.

5.15 Forests

5.15.1 Introduction and Methodology

The Maryland Department of Natural Resources (DNR) defines forest as "a biological community dominated by trees and other woody plants covering a land area of 10,000 square feet or larger and at least 35 feet wide. Forest includes areas that have at least 100 trees per acre with at least 50 percent of those having a 2-inch or greater diameter at breast height (dbh), and forest areas that have been cut but not cleared. Forest does not include orchards." Specimen trees are defined by DNR as "trees having a dbh of 30-inch or more, or trees having 75 percent or more dbh of the current State champion of that species." Areas dominated by trees and/or brush that did not meet the stem-density or width requirements of a forest, as defined by DNR, were classified as hedgerow.

A Forest Stand Delineation (FSD) is an inventory of existing forest/trees and other environmental site features, and it provides a basis for determination of the most suitable forest and resource protection areas during the early stages of site development planning. A full FSD would not be required for this project and no plot points were recorded, based on guidance from DNR. The investigation included a walk-through level FSD that characterized the forests within the limit of disturbance plus the 50-foot study area beyond, including common and dominant species, invasive species, overall forest condition, history, and successional stage. Specimen trees within the forest study area boundary were inventoried.

A Forest Conservation Plan, or similar would be prepared during the latter stages of design and would detail the limits of disturbance; amount of forest that would be retained, removed, reforested, and afforested during site development; locations of specimen trees for retention and removal; types and locations of tree/forest protection devices and supplemental tree care; maintenance and monitoring parameters; and long-term protection measures.

5.15.2 Existing Conditions

This discussion summarizes the identified forest stands, hedgerows, and specimen trees by segment. Refer to **Volume 2 Environmental Plate Series, Plate Series 2** and to the *Natural Resources Technical Report*, Table III-1, (**Appendix I**) for a summary table of all forest stands and hedgerows identified within the project study corridor, including the forest stand or hedgerow site identification number, acreage, forest association, dominant vegetation, canopy size, condition, and invasive cover.

The majority of forest stands and hedgerows throughout the project study corridor are located adjacent to existing roadways and contain invasive species, predominantly along previously disturbed edges. Common forest stand associations, or cover-types, include tulip poplar (*Liriodendron tulipifera*) and oak (*Quercus sp.*) associations, in accordance with Society of American Foresters designations. The more urbanized segments of the project study corridor contain hedgerows and small forest stands dominated by disturbance tolerant and invasive species.

A total of 46 forest stands, 47 hedgerows, and 163 specimen trees were identified within the limit of disturbance and 50-foot buffer. **Table 5-40** below provides a breakdown of inventoried forest stands, hedgerows, and specimen trees by segment. All forest stands, hedgerows and specimen trees are depicted on **Volume 2 Environmental Plate Series, Plate Series 2**.

Table 5-40: Inventoried Forest Stands, Hedgerows, and Specimen Trees ($\geq$30 inches dbh)

Segment	West	Cooks Lane Tunnel	US 40	Downtown Tunnel	East	Total
Forest Stands	26	12	4	0	4	46
Hedgerows	18	2	12	2	13	47
Specimen Trees	79	70	13	0	1	163

The majority of forest stands and hedgerows within the West segment are located along the I-70 corridor. In general, forest stands within this segment contain more mature trees and provide a higher quality habitat in comparison to the other segments within the project study corridor based on species composition and stand age. Invasive and pioneer species (those species that colonize a site following disturbance) dominate the previously disturbed forest stand edges. A total of 26 forest stands, 18 hedgerows, and 79 specimen trees occur within this segment.

The majority of forest stands and hedgerows within the Cooks Lane Tunnel segment are located along I-70. In general, forest stands and hedgerows within this segment are early-successional and dominated by disturbance tolerant and invasive species. A total of 12 forest stands, two hedgerows, and 70 specimen trees occur within this segment.

The majority of forest stands and hedgerows within the US 40 segment are located along the Edmondson Avenue corridor and Gwynns Falls stream valley. In general, forest stands and hedgerows within this segment are early-successional and dominated by pioneer species and invasives. A total of four forest stands, 12 hedgerows, and 13 specimen trees occur within this segment.

The Downtown Tunnel segment is located in a highly urbanized area dominated primarily by street/individual trees, as described in **Section 5.16**. Two hedgerows are located along the US 40 corridor and are of low quality with high levels of invasives. No specimen trees occur within this segment.

The majority of forest stands and hedgerows within the East segment are located along inactive rail lines and the I-895 corridor near Lombard Street. In general, forest stands and hedgerows within this segment are early-successional, dominated primarily by pioneer and invasive species. Four forest stands, 13 hedgerows, and one specimen tree occur in this segment.

5.15.3 Future No-Build Conditions

The No-Build Alternative would not result in changes to the natural environment and no short and long-term effects are anticipated. A discussion of the effects from the Preferred Alternative follows.

5.15.4 Preferred Alternative

a. Long-Term Operational Effects

Long-term forest/hedgerow effects because of construction of the Preferred Alternative would result from physical removal/disturbance during clearing and grubbing operations. Forest/hedgerow effects may result from critical root zone (CRZ) disturbance, tree canopy/limb damage, soil compaction, and changes in soil moisture regimes because of grading operations and other construction related activities directly adjacent to retained forest/hedgerow areas. Additional forest/hedgerow effects could result from sunscald and windthrow of individual trees growing along the recently exposed edges of retained forest/hedgerow areas.

The Preferred Alternative would result in 34.8 acres of forest effect and the removal of 39 specimen trees (refer to **Table 5-41**). The majority of the long-term forest effects would occur within the West and Cooks Lane Tunnel segments (28.5 acres) in the western reaches of the project study corridor, where most of the resources exist. The majority of these resources were previously disturbed to some degree during past construction of roadways and/or surrounding development. Forested areas would be cleared at the west end of Security Boulevard for construction of the CMS Station and tail track section, and adjacent to Greengage Road for potential installation of the traction power substation (TPSS). The I-695 Bridge and adjacent track construction at the Security Square Mall loop would affect mainly early successional forest resources within the Security Boulevard/I-695 interchange. The largest area of vegetation effects would occur on (SSA) property and the I-70 right-of-way for construction of the new Parallel Drive/I-70 interchange, I-70 park-and-ride, and the Cooks Lane Tunnel portal.

Minor forest effects are proposed within the US 40 segment at the Allendale senior housing facility on Franklin Street to accommodate a TPSS. Long-term forest effects at the Gwynns Falls crossing would be minor under the Preferred Alternative because Baltimore City would be clearing this forested area as part of the US 40/Edmondson Avenue bridge improvements project that would be constructed prior to the construction of the Preferred Alternative; therefore these effects are not be calculated for the Preferred Alternative. Scattered areas of hedgerow dominated by invasive species would be removed for construction of the Operations and Maintenance Facility at North Calverton Road and North Franklintown Road, as well as adjacent to the Amtrak bridges on West Franklin Street and West Mulberry Street.

The low quality forest/hedgerow resources located within the in-active Norfolk Southern rail corridor would be cleared for construction of the Preferred Alternative within the East segment. The Maryland Transportation Authority (MDTA) right-of-way (I-895) in the East segment contains previously disturbed forest/hedgerow resources that would be cleared for construction of the rail line and Bayview MARC station adjacent to Johns Hopkins Bayview Medical Center, PiCorp, Norfolk Southern, and industrial property near the eastern terminus of the project study corridor.

Total specimen tree (≥30 inches dbh) effects are summarized by segment in **Table 5-41**.

Table 5-41: Forest Effects by Segment

Segment	Effects (square feet)	Effects (acres)	Specimen Tree Effects (≥ 30 inches dbh)
West Segment	903,673.01	20.73	29
Cooks Lane Tunnel Segment	337,385.17	7.77	7
US 40 Segment	8,059.8	0.19	3
Downtown Tunnel Segment	0	0	0
East Segment	265,348.30	6.09	0
Total Combined Forest Effects in All Segments	**34.8 Acres**		**39**

b. Short-Term Construction Effects

Short-term forest/hedgerow effects should be limited since temporary staging and stockpile areas during construction would be sited primarily in non-forested areas, or within forests to be permanently affected. Staging and stockpiling areas located within forests would be replanted whenever possible following construction. For example, portions of the forest cleared within the cloverleaf area near Forest Park Avenue and I-70 to accommodate staging and stockpiling associated with tunnel boring operations and rail construction would be replanted, where possible.

c. Avoidance and Minimization

Avoidance and minimization of forest and specimen tree effects would continue throughout the design and construction of the Preferred Alternative. During planning and advanced conceptual design, forest effects were reduced by moving the Preferred Alternative into tunnel sections or within existing impervious surfaces and developed areas, where possible. For example, forest effects were reduced within the I-70 corridor near the SSA complex by shifting the proposed track alignment from the forested strip between I-70 and Parallel Drive to the existing travel lanes of I-70 westbound. Forest/hedgerow effects were minimized at the far western extent of the project study corridor by shifting the track alignment further north into existing Security Boulevard and away from the vegetated buffer and private residences along the southern border of the Preferred Alternative.

Forest Conservation Plans, or similar will be prepared during the design phase of the project and would detail additional impact avoidance and minimization techniques to be applied during construction, as outlined in the *State Forest Conservation Technical Manual*, Third Edition, 1997. Avoidance and minimization measures may include: 1) tree protection fencing installed along the outside edge of the limit of disturbance to prevent access by construction equipment and staging and stockpiling of materials within forest retention areas; 2) root pruning along the edge of the limit of disturbance, where excavation is required to cleanly cut the roots of retained forest and/or specimen trees to reduce stress by promoting fibrous root growth and to prevent tearing of the roots beyond the limit of disturbance; 3) branch pruning to adjacent trees to reduce construction stress, provide equipment clearance, and correct any construction related limb damage; and 4) supplemental watering, fertilization, and mulching may be required to reduce tree stress and promote tree health. Additional construction techniques may be warranted to avoid and minimize forest/specimen tree effects including tree wells, retaining walls, air spading, root aeration matting, and tunneling for utility installation.

d. Mitigation

Mitigation for forest impacts will be required to meet state regulations. The final forest planting obligation for the project will be negotiated between MTA and DNR, during the design development stage. Hedgerow and specimen tree effects are not usually mitigated separately from the forest planting obligation, since these resources are included within the limit of disturbance used by the state to meet mitigation requirements. However, Baltimore City will require mitigation for removal of all trees located on parkland or City property including street trees and specimen as described in **Section 5.16**. Trees planted in Baltimore City to meet the City requirement will be applied to the project-wide forest planting obligation. A variance that requires justification for specimen tree removal within the Preferred Alternative will be submitted to DNR for approval as part of the forest conservation review process.

DNR requires that forest mitigation planting sites be chosen based on a site selection hierarchy as follows:

- on-site
- same watershed/county as the effect area
- forest conservation banks/fee-in-lieu

The selection of forest mitigation planting sites will be coordinated through DNR and Baltimore City. The Park Master Plans for Baltimore City and the Tree Baltimore Program may assist in the identification of potential planting sites within City limits. In addition, the City has partnering relationships with watershed groups and non-profits such as Blue Water Baltimore, which may provide planting opportunities. The removal of existing I-70 roadway pavement within the project study corridor may also provide an opportunity to plant trees on-site.

5.16 Street Trees/Individual Trees

5.16.1 Introduction and Methodology

A roadside tree is defined as "any tree that grows all or in part within a public road right-of-way." The Maryland Department of Natural Resources (DNR), Baltimore City Planning and Baltimore City Recreation and Parks staff provided guidance regarding inventory of roadside trees and Baltimore City street trees. A separate Roadside Tree Permit for the Baltimore County portion of the Red Line project would not be required since effects to roadside trees in Baltimore County would be covered under project-wide state forest compliance. Baltimore City administers its own roadside/street tree regulations in lieu of DNR enforcement of the Roadside Tree Law.

Baltimore City defines specimen trees as $\geq$20-inch diameter at breast height (dbh) and street trees as those trees located within the public right-of-way. As mentioned in the forests section, DNR defines specimen trees as "trees having a dbh of 30-inch or more, or trees having 75 percent or more dbh of the current State champion of that species." All specimen trees within the forest study area boundary in Baltimore City were inventoried and located on plans using hand-held GPS survey, see the *Natural Resources Technical Report*, located in **Appendix I**. All street trees in Baltimore City were inventoried and located, regardless of size. Individual trees within a study area of the limit of disturbance plus 50 feet beyond that may be affected by the project were also inventoried, regardless of size. The tree inventory included recording dbh, species and health status of each tree. Refer to **Volume 2 Environmental Plate Series, Plate Series 2**.

5.16.2 Existing Conditions

A total of 2,671 trees were inventoried within the forest study area boundary. Refer to the *Natural Resources Technical Report* for more detailed tree inventory data. The total number of trees inventoried within each segment is included on **Table 5-42.** The majority of trees inventoried within the project study corridor are generally in good health.

Table 5-42: Existing Street/Individual Trees

Location	Segment					Total
	West	Cooks Lane Tunnel	US 40	Downtown Tunnel	East	
Right-of-Way	177	127	199	168	335	**1,006**
Private	546	160	334	157	313	**1,510**
Park	0	55	0	0	100	**155**
Total Street/Individual Trees	**723**	**342**	**533**	**325**	**748**	**2,671**

Within the West segment, the majority of individuals are planted landscape and/or street trees located in commercial areas in and around the Security Square Mall and Social Security Administration (SSA) property. A total of 79 specimen trees (≥30" dbh according to DNR requirements) were inventoried, mostly within forested settings surrounding the I-70 corridor.

Of the 342 trees inventoried in the Cooks Lane Tunnel segment, most are located on private property and right-of-way, in residential areas. A total of 69 trees were identified within Gwynns Falls/Leakin Park and 21 trees were identified within Uplands Park. A total of 70 specimen trees (≥30" dbh) were inventoried within this segment, and the majority of these were located within forested settings adjacent to Gwynns Falls Park or within residential communities in the western section of Edmondson Avenue near Cooks Lane.

Within the US 40 segment, individual trees were identified primarily within residential areas on private properties and right-of-way. A total of 533 trees were inventoried within this segment, 13 of which are specimens. Within the Downtown Tunnel segment, a total of 325 trees were inventoried, most within the right-of-way in commercial/business districts of downtown Baltimore. No specimen trees (≥30" dbh) were identified within this segment.

The East segment includes 748 trees, with a single specimen tree (≥30" dbh). A few trees were located within Canton Park, Boston Street Park, and St. Casmir's Park properties; however, the majority of individuals were located within right-of way or private properties in the Canton area.

5.16.3 Future No-Build Conditions

The No-Build Alternative would not result in any changes to the natural environment and no short and long-term effects are anticipated. A discussion of the effects from the Preferred Alternative follows.

5.16.4 Preferred Alternative

a. Long-Term Operational Effects

Long-term street/individual tree effects would result from permanent design elements such as traction power substations, park-and-ride lots, permanent roadway improvements, sidewalks and surface construction of ancillary buildings for underground stations. Because any tree removal would require mitigation, regardless of long-term or short-term effect, all tree effects have been quantified under the long-term effects section only.

The Preferred Alternative may affect (long-term and short-term) 315 trees within Baltimore County and 948 in Baltimore City (**Tables 5-43**). Street trees and individual trees would be affected along Security Boulevard and adjacent private and commercial properties within the West segment to accommodate roadway reconfiguration and sidewalk improvements associated with track installation within the existing road right-of-way between Centers for Medicare & Medicaid Services (CMS) and the I-695/Security Boulevard interchange. The Security Mall Station park-and-ride lot construction would affect individual trees along Security Boulevard and within mall parking lot islands. Landscape trees adjacent to SSA parking lots and buildings would affect individual trees within the I-70 portion of the project study corridor.

Individual long- and short-term tree effects within the Cooks Lane Tunnel segment would result from above ground roadway improvements and tunnel portal construction within the vicinity of the Cooks Lane and Edmondson Avenue intersection and would include street trees, park trees, and privately owned trees. Within the US 40 segment, street trees and individual trees on private property would be affected along Edmondson Avenue for construction of the track and associated facilities within the narrow urbanized corridor. Tree effects within the Downtown Tunnel segment would be minimal and would consist of street tree removal associated with above ground construction of tunnel portals, station boxes and ancillary facilities, utility relocations, sidewalk improvements, maintenance of traffic (MOT), and staging/stockpiling areas. Individual tree effects within the East segment would include street trees, private and City park trees primarily along Boston Street and the Johns Hopkins Bayview Medical Center campus.

Table 5-43: Individual/Street Tree Effects in Baltimore City and Baltimore County

Location	Trees Inventoried by Segment					Total # of Trees	Total DBH
	West	Cooks Lane Tunnel	US 40	Downtown Tunnel	East		
Baltimore City							
Right-of-Way/ Park/City	0	41	115	75	306	**537**	**4,316**
Private	0	21	165	119	106	**411**	**3,589**
Total Baltimore City	**0**	**62**	**280**	**194**	**412**	**948**	**7,905**
Baltimore County							
Right-of-Way	128	5	0	0	0	**133**	N/A
Private	180	2	0	0	0	**182**	N/A
Total Baltimore County	**308**	**7**	**0**	**0**	**0**	**315**	**N/A**

b. Short-Term Construction Effects

Short-term effects would result from removal and replacement of trees to accommodate MOT during construction, underground utility relocations, erosion and sediment control devices, and staging and stockpiling areas. Short-term effects have been quantified together with long-term effects section above.

Tree decline and/or mortality would result from significant critical root zone disturbance (CRZ), tree limb damage, soil compaction, placement of fill in the CRZ, and changes in soil moisture regimes because of grading operations and other construction-related activities conducted directly adjacent to retained street/individual trees.

c. Avoidance and Minimization

The Preferred Alternative alignment has been shifted and the limit of disturbance minimized where possible to avoid and minimize tree effects despite the limited opportunities within a large portion of the Preferred Alternative's urbanized right-of-way. During the planning process, street/individual tree effects were reduced by moving the Preferred Alternative into tunnel sections or shifting the alignment to avoid specimen trees, where reasonable. Potential effects to the cluster of specimen London plane (*Platanus x acerfolia*) street trees near the intersection of Cooks Lane and Edmondson Avenue (Cooks Lane Tunnel segment) were minimized as a result of proposed tunnel portal shift from the west to the east side of Winans Way. This shifted the temporary MOT lane further east, thereby reducing potential effects to this cluster's critical root zones. In addition, the proposed track alignment and roadway improvements in front of the Edmondson Village shopping center were shifted to the south to minimize effects to the London plane trees along the north side of Edmondson Avenue within the US 40 segment.

Specific tree impact avoidance and minimization techniques will be outlined in the Forest Conservation Plans developed in the Final Design phase. Tree protection fencing will be installed to prevent access by construction equipment and staging and stockpiling of materials within tree protection areas. Root pruning may be conducted along the edge of the limit of disturbance, where excavation is required to cleanly cut the roots of retained trees to reduce stress by promoting fibrous root growth and to prevent tearing of the roots beyond the limit of disturbance. Proper branch pruning may be required to reduce construction stress, provide equipment clearance, and correct any construction-related limb damage. Supplemental watering, fertilization, and mulching may be required to reduce tree stress and promote tree health.

d. Mitigation

Mitigation measures would be incorporated throughout the project to limit the effects to street trees. A list of mitigation efforts include:

- MTA will replace trees removed from parkland or City property including street trees and specimen trees to meet City and DNR requirements.
- Trees removed on private property will be mitigated where possible, as negotiated by MTA and the property owner.

5.17 Chesapeake Bay Critical Area

5.17.1 Introduction and Methodology

The Maryland Chesapeake Bay Critical Area Act gives special protection to areas that fall within 1,000 feet of tidal waters of the Chesapeake Bay and its tributaries. Critical Area requirements are managed to meet the requirements of the federal Coastal Zone Management Act (CZMA); however there is no direct connection between these state and federal requirements. Development by state agencies on state-owned land may be subject to review by the Chesapeake Bay Critical Area Commission. As part of their review, the commission will require projects in intensely developed areas to reduce stormwater pollutant loadings by 10 percent. This “10 Percent Rule” requires treatment of both existing impervious areas and new impervious areas added by the project to result in a net reduction of yearly phosphorous loading to 90 percent of pre-project conditions within the Critical Area. Phosphorous is recognized by the Commission as the keystone pollutant, whose reduction will equate to the reduction of a broad range of other pollutants commonly found in runoff. This 10 percent runoff pollution reduction requirement may be accomplished on-site, either by installing adequate stormwater management or tree planting. Off-site reduction may also be considered as a pollutant offset within the same drainage area or immediate vicinity of the project area, as approved by the commission. The commission will also require replacement of existing trees affected in the Critical Area.

Critical Area boundaries are identified by statewide mapping developed and maintained by the Maryland Department of Natural Resources (DNR) and Baltimore City. The mapping identified the 1,000-foot Critical Area and areas known as "100-foot buffer" – the land within 100 feet of tidal waters, tidal wetlands, and tributaries. The 100-foot buffer was identified based on the edge of water shown in the 2010 project aerial photographs. Vegetation within the Critical Area was characterized during the forest stand delineation (FSD) and street tree inventory efforts, as described in the Forests and Street Trees/Individual Trees sections (**Sections 5.15 and 5.16**), to meet the requirements of the Critical Area Project Application Checklist for State Agency Programs. Trees located inside the limit of disturbance within the boundaries of the 1,000-foot Critical Area and 100-foot buffer were identified.

5.17.2 Existing Conditions

A portion of the project study corridor surrounding the Baltimore Harbor is located within the Critical Area extending from approximately Charles Street to the eastern study limits in Canton, as shown in **Figure 5-10**. This portion of the Critical Area is designated as an Intensely Developed Area (IDA) and is primarily impervious surface (e.g., roadway, parking lots, sidewalk and buildings) with some landscape vegetation including small trees. A small portion of the project study corridor falls within the 100-foot buffer along Boston Street, near the Harris Creek Bridge in Canton. Trees identified within the Critical Area are listed by segment in **Table 5-44**.

5.17.3 Future No-Build Conditions

The No-Build Alternative would not result in changes to the natural environment and no short and long-term effects are anticipated. A discussion of the effects from the Preferred Alternative follows.

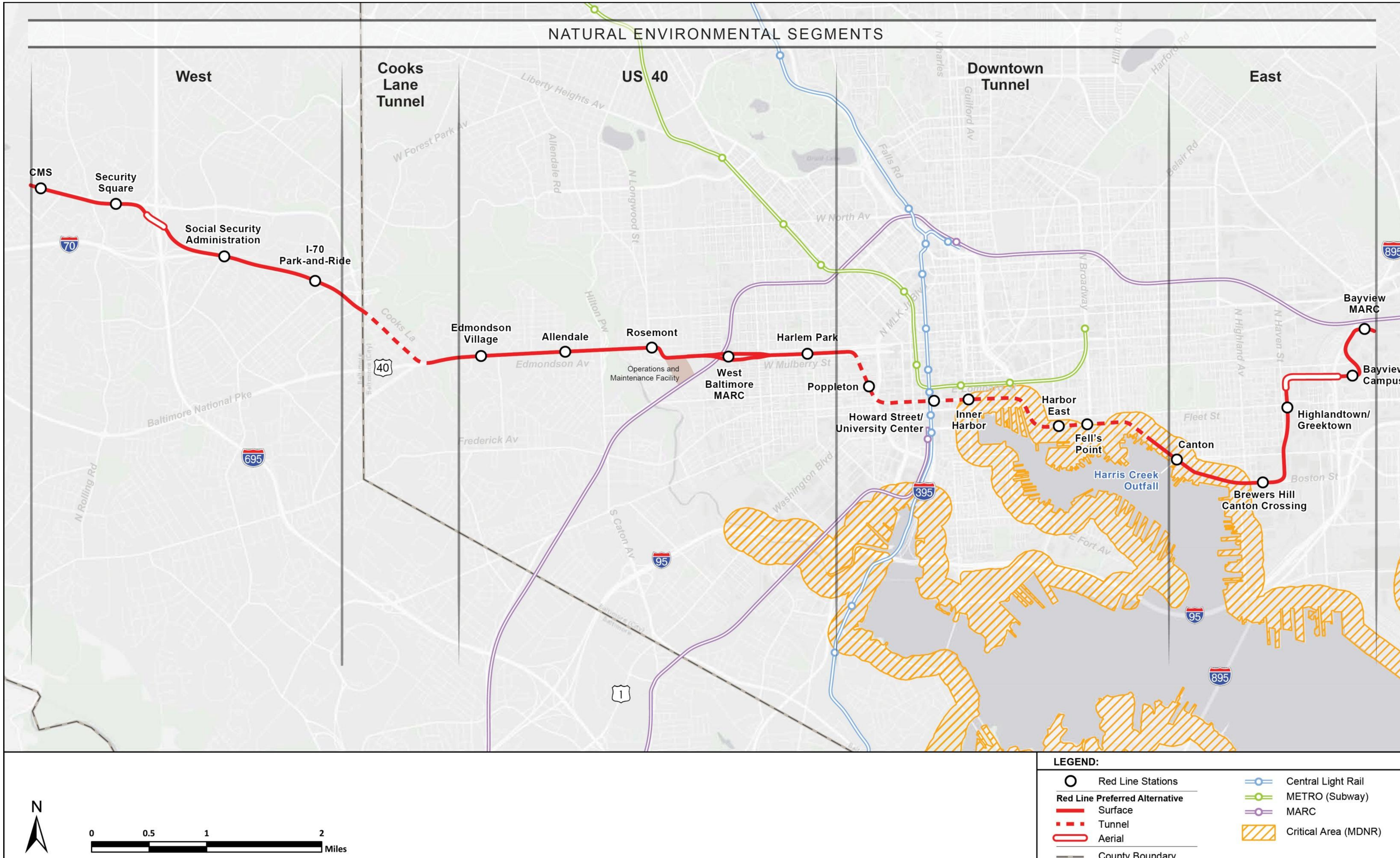


Figure 5-10: Chesapeake Bay Critical Area

Table 5-44: Trees within the Critical Area

Segment	Trees	
	100-Foot Boundary	1,000-Foot Boundary
West	0	0
Cooks Lane Tunnel	0	0
US 40	0	0
Downtown Tunnel	0	197
East	23	387
Total	**23**	**584**

5.17.4 Preferred Alternative

a. Long-Term Operational Effects

Long-term effects to Critical Area would occur in the Downtown Tunnel and East segments. The Preferred Alternative would not convert unpaved area to impervious surfaces in the Downtown Tunnel segment for construction of the Inner Harbor Station, Harbor East Station, and the tunnel portal on Boston Street. Conversion of 1.28 acres of unpaved area to impervious surfaces would occur in the East segment from the construction of the Canton Station and expansion of roadway to accommodate the track in the current median of Boston Street (including within the 100-foot buffer at Harris Creek). The impervious area within the Critical Area would increase from 56 percent cover (existing conditions) to approximately 61 percent cover under the Preferred Alternative. Long-term vegetation effects would occur to landscaping plants, street trees, and park trees within the Critical Area in both the Downtown Tunnel and East segments (refer to **Table 5-45**). The Downtown Tunnel segment tree effects would total 149. The East segment tree effects would total 232, with nine additional trees affected within the 100-foot buffer.

Table 5-45: Tree Effects within the Critical Area

Segment	Trees	
	100-Foot Boundary	1,000-Foot Boundary
West	0	0
Cooks Lane Tunnel	0	0
US 40	0	0
Downtown Tunnel	0	149
East	9	232
Total	**9**	**381**

b. Short-Term Construction Effects

Short-term effects related to increase in impervious area would occur in the Downtown and East segments from temporary construction activities such as staging areas, stockpiling and erosion/sediment controls. Short-term effects within these segments would also include street tree effects within the Critical Area during maintenance of traffic and for stockpile areas used temporarily during construction. Effects resulting from short-term construction activities all require the same mitigation, and therefore have been quantified together with long-term effects.

c. Avoidance and Minimization

Effects to the Critical Area would be minimized through placement of the track alignment in the current roadway and a portion underground. In addition, the impervious area on Boston Street has been minimized by reducing the current four-lanes to two-lanes plus a turn lane for the Preferred Alternative.

d. Mitigation

The Project will adhere to the 10 Percent Rule, to meet required pollutant load reductions, through installation of approved stormwater management facilities and implementation of best management practices. Because of the highly developed nature of the project study corridor and very limited available space within the right-of-way, stormwater management is anticipated primarily through linear micro-bioretention planter boxes. The micro-bioretention planter box facilities provide landscaped areas to temporarily store and filter impervious runoff through the planting media prior to introduction to the closed pipe storm drain network. The micro-bioretention planter boxes are proposed within the existing public right-of-way, and generally located between the back of sidewalk and right-of-way line.

Street tree replacement required by Baltimore City will be used to fulfill the replacement required by Critical Area, and buffer effects (near Harris Creek Bridge crossing) will be mitigated with tree planting within the buffer through coordination with DNR and Baltimore City during Final Design. Any trees affected at staging areas that are not designated for permanent facilities will be replaced on-site to mitigate for short-term construction effects at those locations.

5.18 Wetlands and Waters of the US

5.18.1 Introduction and Methodology

Waters of the US, including wetlands, are regulated under Section 401 and 404 of the Clean Water Act. Executive Order 11990 of the Federal Register (FR) (42 FR 26961E.O. 11990, May 1977), entitled *Protection of Wetlands*, was enacted to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands, to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative, and to ensure that proposed construction incorporates all possible measures to limit harm to the wetland. The State of Maryland also regulates these resources under the Maryland Tidal Wetlands Act and the Maryland Nontidal Wetlands Protection Act. Because of the length of time elapsed between the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) and the Final Environmental Impact Statement (FEIS) phases of the Red Line, and shifts in the Preferred Alternative alignment, waters of the US, including wetlands, were reevaluated for the FEIS phase of the project for the Preferred Alternative. With the exception of Edmondson Avenue where it crosses the Gwynns Falls stream valley, all areas within the limit of disturbance plus the 50 feet beyond were investigated. At Edmondson Avenue over the Gwynns Falls, the area of field study was limited to the bridge itself as the Preferred Alternative would be contained entirely within the limits of the new bridge to be built by Baltimore City prior to construction of the Preferred Alternative.

Wetlands and other waters of the US were identified and flagged in accordance with the Regional Supplement to the US Army Corps of Engineers (USACE) Wetland Delineation Manual:

Atlantic and Gulf Coastal Plain Region Version 2.0 (USACE, November 2010) and Eastern Mountains and Piedmont Region (USACE, July 2010). These manuals employ a three-parameter approach to wetland identification using hydrophytic vegetation, hydric soils, and hydrology. All three parameters must be present for an area to be considered a jurisdictional wetland under Section 404 of the Clean Water Act. Areas that do not meet all three of these parameters, but may still be regulated include palustrine open water (ponds), stream systems (waterways), and certain disturbed areas.

Agency field reviews were conducted with the USACE and the Maryland Department of the Environment (MDE) on May 9 and September 27, 2012 to gain agency jurisdictional determination concurrence on the waters of the US and wetland boundaries. Informal concurrence on the wetland and waterway boundaries was received in the field as reflected in meeting minutes, however, the preliminary jurisdictional determination letter formally documenting this concurrence is pending. The wetlands and waterways described below and shown on the mapping provided in the **Volume 2 Environmental Plate Series, Plate Series 2** reflect the results of these field reviews with the boundaries as shown. Minutes of the agency field reviews are provided in the *Natural Resources Technical Report* in **Appendix I** of this FEIS.

5.18.2 Existing Conditions

During the field investigation, 19 wetlands and 19 waterways were identified. All of the wetlands and waterways have been influenced to some degree by the intense development in the project study corridor, and the majority of the systems identified have been heavily manipulated through past ditching or filling. Despite the high degree of manipulation, these areas may still provide some limited functions such as groundwater discharge/recharge, wildlife habitat, and sediment trapping. The least affected and highest functioning wetlands in the project study corridor are those vegetated systems located in the forested floodplain of Dead Run and its tributaries along I-70 (W13, W18, and W21). These wetlands would be expected to provide groundwater discharge/recharge, flood desynchronization, terrestrial and aquatic wildlife habitat, and water quality benefits such as nutrient uptake and sediment trapping.

Each of the waters of the US, including wetlands, identified during the field investigation is described in detail in the *Natural Resources Technical Report.* The locations of waters of the US, including wetlands, are shown on detailed maps provided in **Volume 2 Environmental Plate Series, Plate Series 2**.

5.18.3 Future No-Build Conditions

The No-Build Alternative would not result in changes to the natural environment and no short and long-term effects are anticipated. A discussion of the effects from the Preferred Alternative follows.

5.18.4 Preferred Alternative

Effects to waters of the US, including wetlands, resulting from the Preferred Alternative, are shown in **Table 5-46**. At this stage of design, calculated effects are based on the anticipated limit of disturbance and include both long-term, permanent effects from project structures and facilities needed for operation of the transitway, and short-term, temporary effects from project construction. Both short- and long-term combined effects were calculated together, and were not differentiated at this phase of study. Temporary effects would be restored following completion of construction. As project design progresses, short- and long-term effects would likely be reduced further, as the project limits of disturbance are better defined, and temporary and permanent effects would be calculated separately.

a. Long-Term Operational Effects and Short-Term Construction Effects

Effects to waters of the US, including wetlands, from the Preferred Alternative, would only occur within the West segment, Cooks Lane Tunnel segment and East segment with most effects occurring within the East segment (**Table 5-46**). No wetland or waterway effects are proposed within the US 40 or Downtown Tunnel segments. Most effects resulting from the Preferred Alternative would not occur from construction of the rail line itself, as the track is primarily being constructed over existing road surfaces or placed within tunnels. Even where some rail effects to wetlands are currently shown (e.g., the Red Line crossing of the I-695 ramps and mainlines), more refined design would likely result in some reduction in these effects, as the rail alignment would be placed on an aerial structure over these wetland systems. The majority of the waterway effects would occur where existing roads would be reconfigured or expanded to accommodate the Preferred Alternative, particularly in the West segment where these roads would cross or closely parallel Dead Run and its tributary drainages. The majority of the wetland effects result from these same activities as well as the conversion of the inactive Norfolk Southern rail right-of-way in the East segment for active use as the Red Line corridor. There are no effects to tidal waterways, as the only tidal resource crossed by the project study corridor is the Jones Falls, and this would be crossed by the Downtown Tunnel segment, well below the stream bottom.

Total effects to wetlands and waterways from all project segments amount to 0.23 acre of palustrine forested wetlands, 0.99 acre palustrine emergent wetlands, 1,941 linear feet of perennial and intermittent streams, and 324 linear feet of ephemeral channel. Based on these impacts, the Maryland Transit Administration (MTA) intends to apply for an individual Section 404 Permit from the USACE, and an Individual Non-tidal Wetlands and Waterways Permit from the MDE. **Table 5-46** summarizes wetland and waterway effects by segment.

Table 5-46: Wetland and Waterway Effects Associated With the Preferred Alternative

Wetland or Waterway No.[1]	PFO[2] (Ac)	PEM[3] (Ac)	R3/R4[4] (Lf)	Ephemeral[1] (Lf)
West Segment				
1		0.01		
2	0.03	0.03		
3		0.21		
5		0.04		
9			282	
10		0.02		
11			111	74
12			3	
13	0.08			
14				250
15		0.03		

Table 5-46: Wetland and Waterway Effects Associated With the Preferred Alternative

Wetland or Waterway No.[1]	PFO[2] (Ac)	PEM[3] (Ac)	R3/R4[4] (Lf)	Ephemeral[1] (Lf)
16			8	
19		0.03		
20			805	
21	0.02			
22			350	
32			1	
Total	**0.13**	**0.37**	**1,560**	**324**
Cooks Lane Tunnel Segment				
27			167	
28		0.07		
29			55	
30		0.01		
Total		**0.08**	**222**	
East Segment				
33	0.07	0.01		
34	0.03	0.40		
36		0.01		
40		0.12		
41			159	
Total	**0.10**	**0.54**	**159**	**0**
Project Total	**0.23**	**0.99**	**1,941**	**324**

Notes: [1] No effects occur within the US 40 or Downtown Tunnel segments
[2] Palustrine Forested Wetland
[3] Palustrine Emergent Wetland
[4] R3 = Riverine Upper Perennial, R4 = Riverine Intermittent

b. Avoidance and Minimization

In accordance with the federal Clean Water Act (CWA), Executive order 11990, and state regulations, efforts were made during preliminary design of the Preferred Alternative to reduce the potential for effects to waters of the US, including wetlands, wherever possible; consequently, effects have been minimized to the extent possible. For example, the Preferred Alternative was placed on an existing roadway bridge over Gwynns Falls and within a tunnel under the Jones Falls. Effects are primarily related to stream or ephemeral channels that cross perpendicular to the project or are located in roadside ditches that would be affected by the parallel adjacent transitway. Additionally, unavoidable effects occur in the inactive Norfolk Southern corridor at the far eastern end of the project study corridor where drainage ditches have not been maintained and wetlands have formed. Specific avoidance and minimization efforts undertaken thus far include:

- Shifting the alignment to follow the I-70 ramp instead of extending through the Social Security Administration (SSA) West campus.
- Constructing retaining walls adjacent to the SSA West campus rather than large embankments.

- Relocating the alignment onto I-70 rather than extending the alignment through a wooded section between I-70 and Parallel Drive.
- Adjusting the track profile to minimize the limit of disturbance.
- Using ballast curb (retained ballast) rather than standard ballast slopes to minimize the limit of disturbance.

Wetlands and waterways that have been completely or partially avoided with the current project design as compared to earlier stages of the project include WL-6 (0.04 acre PFO), WUS-8 (70 linear feet R4), WUS-11 (65 linear feet Ephemeral, 180 linear feet R3), WUS-12 (57 linear feet R3), WL-13 (0.29 acre PFO), WUS-17 (28 linear feet R3), WUS-22 (73 linear feet R3), and WUS-24 (46 linear feet Ephemeral).This has resulted in a reduction of forested wetland effects of approximately 0.3 acre, perennial/intermittent stream effects of approximately 408 linear feet, and ephemeral channel effects of approximately 111 linear feet. Further impact avoidance and minimization efforts will continue to be investigated (including exclusion fencing at wetland, wetland buffer, and stream boundaries) through the Final Design phase which may result in additional reductions of effects.

c. Mitigation

All mitigation measures employed to compensate for unavoidable project effects to waters of the US, including wetlands, will follow applicable federal and state regulations and guidelines, as well as other recommendations from federal and state resource agencies. Mitigation may be required in the form of establishment/creation, enhancement, or preservation to replace the loss of wetland, stream, and/or other aquatic resource functions. Because of the general lack of approved wetland/stream mitigation banks and in-lieu fee sites in Maryland, this project would be required to seek permittee-responsible mitigation to compensate for unavoidable wetland and stream effects.

Traditionally, mitigation requirements under Section 404 are determined by the ratio of wetland acres replaced to wetland acres lost. Emergent wetlands are typically mitigated on a 1:1 replacement basis, while forested and scrub-shrub wetlands are mitigated on a 2:1 replacement basis. The decision to replace function, acreage, or both may be adjusted at the discretion of the USACE or MDE, depending on the practicability of the proposed mitigation. **Table 5-47** provides potential acreage requirements for wetland compensation for the Preferred Alternative based on the above referenced replacement ratios.

Table 5-47: Projected Wetland Compensation Ratios

Cowardin Wetland Class[1]	Wetland Acres Impacted	Potential Wetland Acres Compensation Required (Replacement Ratio)
PFO	0.23	0.46(2:1)
PEM	0.99	0.99 (1:1)
Total	1.22	1.45

Note:[1] PFO = Palustrine Forested; PEM = Palustrine Emergent

The regulatory agencies typically target compensatory stream mitigation projects to replace stream functions when feasible. In addition to stream channel improvements, mitigation measures for waterway effects consider the size, stream order, and location of the stream to determine appropriate stream mitigation. Other mitigation measures, such as removal of fish blockages, riparian buffer enhancements, and water quality improvements, may also be used at the agencies' discretion.

Development of the Red Line Preferred Alternative Compensatory Mitigation Package will occur in two phases:

- *Phase I - Conceptual Mitigation Plan*
- *Phase II – Final Mitigation Plan*

The *Phase I Conceptual Mitigation Plan* (**Appendix D**) is based on a comprehensive mitigation site search, and results in a list of proposed mitigation opportunities that, based on initial investigations, are preliminarily both technically feasible and able to provide functional replacement of impacted resources. The *Phase I Conceptual Mitigation Plan* contains an excess of potential sites to allow for viable replacement site options if detailed site investigations in Phase II result in a site being dropped from further consideration for any reason. Phase II will include detailed on-site technical investigations of the top-ranked sites. For wetlands, Phase II technical investigations may include groundwater monitoring, soil permeability investigations, delineation and monitoring of adjacent wetlands if present, among other investigations. For stream sites, technical investigations during Phase II may include conducting geomorphic assessments and hydraulic analyses. Property-owner negotiations, Phase I cultural resources screening, infrastructure conflict assessments and any other studies necessary to fully evaluate the technical and practical constructability of the proposed sites will be conducted during Phase II.

A complete compensatory mitigation package will be designed to fulfill the mitigation requirements. As the preliminary step, research and coordination was performed to determine the potential to contribute to an established wetland mitigation bank or in lieu program in accordance with the mitigation hierarchy outlined in applicable regulations. Based on coordination with US Environmental Protection Agency (EPA), USACE, Baltimore County Department of Environmental Protection and Sustainability (BCDEPS), Baltimore City Department of Public Works (BCDPW), and other mitigation banking organizations, it has been determined that there are no active mitigation banks located within or near the targeted watersheds for this project, and that a fee in lieu program for mitigation is not the preferred mitigation approach for this project.

Phase I Conceptual Mitigation Plan

The *Phase I Conceptual Mitigation Plan* has been completed as part of the FEIS phase of the Red Line project. The methods used in developing the package are summarized below, and are detailed in the *Natural Resources Technical Report*.

The development of the *Phase I Conceptual Mitigation Plan* occurred in two stages. Stage I consisted of a desktop review of existing published sources and focused on watershed improvement opportunities. Stage II consisted of detailed field surveys of the highest ranked sites to more fully evaluate each site's mitigation potential. The sites found to be most suitable during the Stage II field investigations were ranked and compiled into a draft *Phase I Conceptual Mitigation P*lan for review by the agencies. Agency field reviews were then conducted of the top-ranked sites to solicit preliminary agency comments on the overall suitability of the proposed mitigation sites. In a letter dated November 1, 2012, the USACE acknowledged their review of the *Phase I Conceptual Mitigation Plan*, and determined that it is acceptable for inclusion in and evaluation of this FEIS (**Appendix G**). Furthermore, the USACE acknowledged that the *Phase I Conceptual Mitigation Plan* documents acceptable sites and opportunities to adequately mitigate for anticipated Preferred Alternative impacts to waters of the US, including jurisdictional wetlands. Coordination with MDE will continue until concurrence on proposed mitigation is obtained. The following discussion summarizes the results of the Stages I and II.

Wetlands

The wetland mitigation site-selection process focused on locating non-forested areas with the highest potential for wetland creation or restoration with emphasis on "in-kind" replacement within the US Coast Guard designated watershed affected by the project study corridor. This designation is represented by Hydrologic Unit Code (HUC) 02060003 and corresponds with the Patapsco River watershed. Under the State of Maryland watershed designations, the project study corridor crosses the Gwynns Falls and Back River watersheds and the direct Baltimore Harbor drainage (including tidal portions of Jones Falls).

Based on the results of the Stage I Desktop Wetland Site Identification, 34 possible wetland mitigation sites located on both public and private lands were identified and retained for further study. An additional seven sites were identified during the Stage II field investigations and from agency recommendations. A total of 41 sites were evaluated during Stage II. From these 41 sites, 32 sites were dropped because they were not fully-suited for wetland mitigation, leaving a total of nine potential wetland mitigation sites that were carried forward in the *Phase I Conceptual Mitigation Plan* and presented to the regulatory agencies to obtain their input and feedback regarding site viability in providing suitable compensatory wetland mitigation for impacts anticipated from the Red Line Preferred Alternative. Details on the potential wetland mitigation sites are presented in the *Natural Resources Technical Report*.

Streams

The stream mitigation site-selection process focused on locating stream segments with the highest potential for restoration within the Patapsco River watershed. Preliminary investigations for potential stream mitigation sites focused on Dead Run within the Gwynns Falls subwatershed since a majority of the anticipated effects are located in this subwatershed.

Based on the results of the Stage I desktop stream site identification, 19 potential stream mitigation sites were identified and retained for further study in Stage II. An additional 15 stream and buffer sites were identified during the Stage II field investigations and further document review. From all of the sites identified, 16 sites were dropped because they were not viable for stream mitigation, leaving a total of 18 stream and buffer sites that were carried forward in the *Phase I Conceptual Mitigation Plan* and presented to the regulatory agencies to obtain their input and feedback regarding site viability in providing suitable compensatory stream mitigation for impacts anticipated from the Preferred Alternative. Details on the potential stream mitigation and riparian buffer reforestation sites are presented in the *Natural Resources Technical Report.*

Mitigation Package

After the completion of Stages I and II of the mitigation site search for potential wetland and stream mitigation projects, the most viable sites were presented to agency representatives. Field visits to 11 of the 14 highest ranked and most viable sites were completed on September 12, 27, and 28, 2012, and agency feedback was solicited. Based on the on-site investigations during Stage II, and the agency review comments during coordination efforts, preferred sites were selected for inclusion in the *Phase I Conceptual Mitigation Plan*. The potential mitigation sites presented in the *Phase I Conceptual Mitigation Plan* total 19.91 acres of potential wetland mitigation and 22,560 linear feet of potential stream mitigation. The linear feet of potential stream mitigation includes estimates on riparian buffer opportunities, but does not factor potential mitigation credit for stormwater management (SWM) Best Management Practices (BMP) opportunities associated with some sites. Detailed information and maps of each site identified in the *Phase I Conceptual Mitigation Plan* are presented in the *Natural Resources Technical Report.*

The *Phase II Final Mitigation Plan* will be initiated following the Record of Decision (ROD), and is required to be complete prior to issuance of the federal wetlands and waterways permit. The *Phase II Final Mitigation Plan* will be prepared and implemented during Final Design in consultation with the USACE and MDE.

5.19 Surface Waters: Water Quality, Scenic and Wild Rivers, Floodplains and Navigable Waterways

5.19.1 Introduction and Methodology

The location of streams and their associated watershed limits within the project study corridor were determined using the Maryland Department of Natural Resources (DNR) third order watershed GIS files. The entire project study corridor is contained within the Patapsco River third order watershed (**Section 5.14, Figure 5-9**). Two main subwatersheds, Gwynns Falls and Jones Falls, comprise most of the project study corridor. Dead Run, a tributary to Gwynns Falls, parallels a substantial portion of the West segment of the project, from I-695 to I-70. A small portion of the Back River watershed is located in the far eastern portion of the project study corridor in the vicinity of the Johns Hopkins Bayview Medical Center campus. In addition, a small portion of the Lower North Branch Patapsco River is located in the far western portion of the project study corridor. However, no portion of the actual project study corridor limit of disturbance crosses the Lower North Patapsco River watershed; consequently, this subwatershed is not discussed in any greater detail below. With the exception of Back River, all of these subwatersheds drain into the Baltimore Harbor, located at the southern edge of the project study corridor. Herring Run, a primary tributary to Back River, is located north of the project study corridor and receives drainage from the project study corridor, although it is not directly crossed by the Preferred Alternative.

a. Chemical Water Quality/Total Maximum Daily Loads

The *Code of Maryland Regulations* (COMAR) 26.08.02.01-.02 provides designated use classes for all Maryland waterways. The Maryland Department of the Environment (MDE) has established acceptable standards for several parameters for each designated Stream Use Classification (refer to COMAR 26.08.02.01-.03 *Water Quality* (MDE, 2007)). With the exception of Dead Run, all stream segments located within the project study corridor are classified as Use I, "Water Contact Recreation and the Protection of Aquatic Life." (MDE, 2007). Dead Run is classified as a Use IV waterbody which is protected for "Water Contact Recreation, Protection of Aquatic Life, and Recreational Trout Waters" (MDE, 2012).

Existing data determined to fall within the project study corridor were used to compile a summary of existing water quality conditions for the project study corridor. Water quality sampling locations are shown in **Section 5.14, Figure 5-9.**

Total maximum daily loads (TMDLs) are developed as part of state requirements under the Clean Water Act (CWA). A TMDL plan is developed to determine the maximum amount of a pollutant that a waterbody can receive and meet the ambient water quality standards set forth by Section 303 of the CWA and state requirements. Each state is required to prepare a biannual list of stream segments that are considered "impaired" and submit this list (303(d) list) to the Environmental Protection Agency. These segments are known as water quality limited segments (WQLs) and a TMDL must be developed for each. Coordination with MDE on preliminary stormwater management concepts has been initiated to ensure that all TMDL requirements would be met.

b. Scenic and Wild Rivers

The DNR Scenic and Wild Rivers program was developed to protect the scenic, recreational, and aquatic habitat values of the State's wild and scenic rivers under the National Wild and Scenic River Act (16 U.S.C §§ 1271-1287). The definition of a wild and scenic river, under this Act, is a river that possesses outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. The DNR program regulates present and future use and development of the scenic and wild rivers, tributaries, and adjacent land areas to protect their primitive qualities and characteristics, and to protect the water quality of the river. This Act does not serve the purpose of halting development and use of a river; instead the goal is to preserve the character of the river.

c. Floodplains

Executive Order 11988 of the Federal Register (42 FR 26951, 3 CFR, 1977), entitled *Floodplain Management* requires the avoidance, to the extent possible, of long- and short-term adverse impacts to floodplains and the direct and indirect support of floodplain development, wherever there is a practicable alternative. US Department of Transportation (DOT) Order 5650.2, entitled *Floodplain Management and Protection* prescribes policies and procedures for ensuring that proper consideration is given to the avoidance and mitigation of adverse floodplain effects. Data from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) was obtained to identify regulated floodplains within the project study corridor. Floodplains are regulated at the state level by the MDE. Any construction in nontidal floodplains would require a Waterway Construction Permit from the MDE. Floodplain fill in tidal floodplains is not an MDE permitted activity, though flood protection is a critical consideration for engineering design in tidal floodplains.

d. Navigable Waterways

The US Army Corps of Engineers (USACE) regulates structures that are located in, under or over navigable waters of the US under Section 10 of the Rivers and Harbors Act of 1899. "Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce" (33 C.F.R Part 329.4). Navigable waters within the project study corridor were identified in discussions with the USACE Baltimore District (Interagency Review Meeting, November 16, 2011).

5.19.2 Existing Conditions

Surface waters in the project study corridor generally reflect the high degree of urbanization in their watersheds. The Gwynns Falls and Jones Falls subwatersheds are characterized by high amounts of impervious surfaces and low amounts of forested land uses. The Back River subwatershed, at the eastern end of the project study corridor, is one of the most densely populated watersheds within the Chesapeake Bay drainage basin (MDE, 2012). Residential and commercial land use make up 91 percent of the subwatershed and high amounts of refuse and channelization affect the system.

In the West segment, the majority of the streams have been straightened and armored to some degree to allow for development, to prevent erosion and convey high storm flows. Substantial portions of the stream network have been piped for road culverts and residential and commercial development, but naturalized stream corridors still exist in areas that remain forested. In the Cooks Lane Tunnel, US 40, and Downtown Tunnel segments, the stream network is largely contained within a man-made underground storm drainage network, with the exception of the Gwynns Falls mainstem and the tidal portion of the Jones Falls. The majority of the East segment contains primarily piped water resources; however, the eastern-most portion includes an open stream channel.

a. Chemical Water Quality/Total Maximum Daily Loads

The majority of the development within the project study corridor occurred prior to the implementation of stormwater management regulations. Consequently, runoff generated by existing impervious areas is conveyed directly to project study corridor streams through the storm drain network with little or no quantity or quality treatment. These conditions and other urbanization related effects have lead to widespread chemical water quality impairments in project study corridor streams. The results of the chemical water quality sampling by state and local agencies between 2000 and 2012 are summarized in the *Natural Resources Technical Report* in **Appendix I** of the Final Environmental Impact Statement (FEIS). Several WQLs have been identified by MDE under Section 303 of the CWA within the project study corridor and the status and results of the TMDL process are summarized below in **Table 5-48**.

Table 5-48: Status of TMDLs within the Project Study Corridor

Watershed/Basin	Impairment	Status
Back River	Nutrients	Approved: June 29, 2005
	PCBs	Submitted: Sept. 30, 2011
Baltimore Harbor	Nutrients	Approved: Dec. 17, 2007
	Chlordane	Approved: March 23, 2001
	PCBs	Submitted: Sept. 30, 2011
Gwynns Falls	Non-tidal Bacteria	Approved: Dec. 4, 2007
	Sediments	Approved: March 10, 2010
Jones Falls	Non-tidal Bacteria	Approved: Feb. 21, 2008
	Sediments	Approved: Sept. 29, 2011

Source: MDE TMDL website (www.mde.state.md.us/Programs/WaterPrograms/TMDL)

b. Scenic and Wild Rivers

According to the DNR Scenic and Wild Rivers program website, no scenic and wild rivers are located within the project study corridor.

c. Floodplains

The 100-year non-tidal floodplains fall within the project study corridor along a tributary to Dead Run that flows through the I-695/I-70 Interchange and into the Social Security West property and along the Dead Run mainstem at the intersection of Security Boulevard and Ingleside Avenue. The Dead Run tributary floodplain is relatively confined because of the rolling topography and fill that were added to the landscape to accommodate highway ramps and parking areas. The Dead Run mainstem floodplain is somewhat broader; however, substantial floodplain encroachment has occurred for private development as well as city and county infrastructure, with numerous streets, sewer lines, and water mains crossing or paralleling designated floodplain areas. Despite these encroachments, the 100-year floodplains along Dead Run and its tributaries continue to provide floodplain values, including but not limited to moderation of flood flows, water quality benefits, and habitat for wildlife, though these values have been somewhat diminished by urbanization.

The 100-year non-tidal floodplain of the Gwynns Falls mainstem crosses beneath Edmondson Avenue and the project study corridor east of Hilton Parkway. However, in this area, the Preferred Alternative would be contained entirely within the limits of the new Edmondson Avenue Bridge to be built by the Baltimore City prior to construction of the Red Line, and the bridge-deck would be well above the limits of the 100-year floodplain. Consequently, the Gwynns Falls floodplain does not fall within the project study corridor and is not expected to be affected by the Preferred Alternative, and therefore would not be evaluated further in this document.

In addition to these non-tidal floodplains, the downtown portion of the Preferred Alternative would be located in the broader tidal floodplains of the Jones Falls and the tidal Patapsco River. The Jones Falls floodplain crosses the project study corridor east of President Street; however, this portion of the Jones Falls is tidal and is confined by the city street grid. All of the floodplain areas of the Jones Falls and tidal Patapsco River within the project study corridor are currently developed.

d. Navigable Waterways

Based on coordination with the USACE, the tidal portion of the Jones Falls crossed by the project study corridor between East Lombard and East Pratt Streets, west of South President Street, is a Navigable Waterway as defined in 33 C.F.R. Part 329. As such, the Preferred Alternative crossing of the Jones Falls would-be regulated by the USACE under Section 10 of the Rivers and Harbors Act of 1899.

5.19.3 Future No-Build Conditions

The No-Build Alternative would not result in changes to the natural environment and no short and long-term effects are anticipated. A discussion of the effects from the Preferred Alternative follows.

5.19.4 Preferred Alternative

This section describes the long- and short-term effects, avoidance and minimization measures, and mitigation to surface waters including discussions on water quality, scenic and wild rivers, floodplains and navigable waterways.

a. Chemical Water Quality/Total Maximum Daily Loads

The Preferred Alternative has the potential to increase levels of certain contaminants within the affected subwatersheds on both a long- and short-term basis. These increases would be expected to be greatly minimized with the use of approved sediment and erosion control during construction and implementation of stormwater Environmental Site Design (ESD) best management practices (BMPs) over the long-term as required by MDE. However, some degree of chemical water quality impairment could still occur.

Long-Term Operational Effects

Long-term water quality effects associated with the operation of the Preferred Alternative after construction are mainly based on the potential for contamination of surface waters by run-off from new impervious surfaces. Impervious surface runoff can include numerous individual chemicals, but can generally be grouped as heavy metals, salt, organic molecules, and nutrients (Trombulak, 1999).

The Preferred Alternative would result in approximately:

- 300 acres of transit alignment;
- 95.7 acres of undisturbed or maintained impervious area (e.g., roadway re-striping, mill and overlay, undisturbed impervious, etc.);
- 60.1 acres of reconstructed impervious area (e.g., full depth roadway replacement, or existing impervious area replaced with different proposed land use such as sidewalk to roadway, or roadway to transitway track bed);
- 23.1 acres of impervious area removal; and

- 30.5 acres of new impervious area, resulting in a net increase of 7.4 acres of impervious area throughout the project study corridor.

Because the Preferred Alternative would largely be located within currently paved areas along already existing roadways or in below-grade tunnels not subject to rainfall, the trackbed would not be expected to increase impervious surface-related contaminants to surface waters to an appreciable degree. However, other project elements such as station areas and operations and maintenance facility would, in some cases, add larger areas of new pavement in currently undeveloped areas or introduce additional potential contaminants used for track and vehicle maintenance. These areas would have the potential to negatively affect water quality as a result of increased contaminant runoff to surface waters. Current designs result in a net impervious increase of approximately 7 acres over the entire length of the project. Increased site imperviousness associated with the Preferred Alternative could result in increased site runoff volumes and downstream peak discharge rates.

Although the Preferred Alternative has the potential to increase levels of contaminants in the project study corridor watersheds, it is unlikely that they would affect TMDL management plans. Sources of sediment from the Preferred Alternative would be associated with imperviousness; however, existing and proposed stormwater management would likely be minimal and would be incorporated in the TMDL plan for urban stormwater sources. Although the potential for effects to TMDL management are minimal, any potential effects would be addressed through the MDE stormwater and sediment and erosion control permitting process as required under Maryland's Sediment and Erosion Control (COMAR 26.17.01) and Stormwater Management regulations (COMAR 26.17.02).

Short-Term Construction Effects

Potential short-term effects during construction include physical disturbances or alterations, accidental spills, and sediment releases that can affect aquatic life. During construction, large areas of exposed soil can be severely eroded by wind and rain when the vegetation and naturally occurring soil stabilizers are removed. Erosion of these exposed soils can considerably increase the sediment load to receiving waters (Barrett, 1995).

Avoidance and Minimization

During construction, the potential for water quality effects would be minimized through strict adherence to MDE approved sediment and erosion control plans, which would include best management practices such as super silt fence, straw bales, sediment basins, and other methods to capture potential sediment from exposed soils. In addition to treatment of sediment laden runoff resulting from surface construction activities, Portable Sediment Tanks (PSTs) or other acceptable filtration devices would be required to filter discharge pumped from subsurface activities such as tunnel boring and station construction. Additionally, increases in impervious area are being minimized through removal of existing pavement where practicable for proposed stormwater management features, grass medians, or landscaping amenities, as well as consideration of green track.

Long-term negative effects to water quality, including TMDLs, would be further reduced by implementation of ESD-based stormwater management maintained over the life of the Red

Line's operation. While detailed stormwater management planning and design typically occurs later in the project design process, MTA has initiated stormwater management planning and coordination during the FEIS phase of the Red Line project to ensure that project designs anticipate the right-of-way requirements, potential effects, and technical challenges of required stormwater management.

Mitigation

Potential effects will be addressed by MTA through the MDE stormwater and sediment and erosion control permitting process as required under Maryland's Erosion and Sediment Control (COMAR 26.17.01) and Stormwater Management regulations (COMAR 26.17.02). Further detailed information on stormwater requirements and the Red Line's approach can be found in the *Natural Resources Technical Report*. To determine stormwater management requirements throughout the project study corridor, a comprehensive impervious area inventory was performed to identify new impervious area, removed impervious area, maintained impervious area, and reconstructed impervious area. Stormwater management facilities will be required to address water quality and quantity requirements associated with new development and redevelopment activities consistent with ESD criteria to the maximum extent practicable established by the Stormwater Management Act of 2007. Additionally, increases to peak 100-year discharge rates resulting from increases in impervious areas associated with construction of the Preferred Alternative must be attenuated within the Jones Falls, Gwynns Falls, and Herring Run inter-jurisdictional waterways.

Examples of micro-bioretention planter boxes

Based on current MDE Stormwater Management (SWM) Guidelines, an estimated 63 acres of impervious surface would need to be treated to meet stormwater management requirements. Stormwater management would be required to intercept, filter, and attenuate runoff from project disturbances through a combination of linear bioretention and underground quantity management. Water quality treatment must be provided through ESD practices to provide temporary storage and filtration of the contaminants from surface runoff. Increases to peak discharge rates associated with high frequency storm events would be managed through implementation of ESD features as practicable to mimic pre-development hydrology.

A total of approximately 80 potential surface SWM/BMP facilities have been identified and located within the project right-of-way (refer to the **Volume 2 Environmental Plate Series, Plate Series 6**). The total combined footprint of these facilities is approximately 6.4 acres. Facilities would include ESD practices and low impact development (LID) techniques such as rain gardens, bioretention facilities, water quality inlets, vegetative buffers, and manufactured BMPs, as well as other structural BMPs such as underground detention vaults, sand filters, and surface extended detention basins. Because of the highly developed nature of the project study corridor and limited available space, surface water quality treatment is anticipated primarily through linear micro-bioretention planter boxes. The micro-bioretention facilities provide landscaped areas to temporarily store and filter impervious runoff through the planting media prior to introduction to the closed pipe storm drain network. Micro-bioretention planter boxes are generally proposed within the existing public right-of-way between the curb and sidewalk, or sidewalk and right-of-way. Examples of micro-bioretention planter boxes applied to a streetscape in the public right-of-way are provided in the photos on the previous page. Water quantity volume, as well as 100-year peak discharge attenuation not provided through ESD practices would be addressed through 35 proposed underground storage vaults within the project right-of-way (see photo).

Example of an underground storage vault within a road right-of-way

b. Scenic and Wild Rivers

There are no designated scenic and wild rivers within the Red Line project study corridor; therefore, no long- or short-term effects would occur.

c. Floodplains

Effects to floodplains resulting from the Preferred Alternative are shown in **Table 5-49**. At this stage of design, calculated effects are based on the anticipated limit of disturbance and include both long-term, permanent effects from project structures and facilities needed for operation of the transitway, and short-term, temporary effects from project construction. Both short and long-term combined effects were calculated together, and were not differentiated at this phase of study. Temporary effects would be restored following completion of construction. As project design progresses, short- and long-term effects would likely be reduced further as the project limit of disturbance are better defined. Temporary and permanent effects would be calculated separately during design, and temporary effects would be restored following completion of construction.

Long-Term Operational and Short-term Construction Effects

The acres of combined long- and short-term floodplain effects for each segment of the Preferred Alternative are shown in **Table 5-49**. Floodplain effects presented below represent the estimated footprint of temporary construction access and long-term fill areas associated with construction of the project. Effects required for access during construction (e.g., to install culvert extensions) would be short-term and have been accounted for within the extents of the limit of disturbance.

Actual analysis of potential project related changes to hydraulic function and elevation of the 100-year floodplain would be determined using hydraulic and hydrologic floodplain modeling as part of the engineering process for each structure in later phases of design. In general, the majority of the floodplain encroachments would be from traverse crossings of floodplains. Longitudinal crossings have been avoided.

Table 5-49: Summary of Short and Long-Term Floodplain Effects

Project Segment	Non-tidal 100-Year Floodplain (Acres)	Tidal 100-Year Floodplain (Acres)
West Segment	0.7	-
Downtown Tunnel Segment	-	0.8
East Segment	-	0.2
Total	**0.7**	**1.0**

Filling of the 100-year floodplain would occur within three project segments; West, Downtown Tunnel, and East. The West segment 0.7-acre floodplain effect would be associated with construction of the track across a tributary to Dead Run and proposed sidewalk improvements within the 100-year floodplain of the Dead Run mainstem at North Forest Park Avenue and Security Boulevard. Culvert extensions for the crossings of the Dead Run tributary would require fill be placed in the 100-year floodplain to accommodate the transitway. At the Dead Run mainstem, effects have been included in the impact figures for the current phase of engineering because the project limit of disturbance falls within the 100-year floodplain. However, the sidewalk improvements proposed in the floodplain are unlikely to result in any measurable effect to floodplain elevation or function.

In the tidal Patapsco River floodplain, placement of substantial amounts of fill is not anticipated, and existing grades would remain largely unchanged. However, within this Downtown Tunnel segment, two underground stations are proposed within the 100-year tidal floodplain: the Inner Harbor Station at the corner of Light and Lombard Streets and the Harbor East Station at South Central Avenue and Fleet Street. The entrances for these two underground stations would result in approximately 0.8 acre of 100-year floodplain impact, including the footprint of all construction activities and surface elements. The East segment floodplain effects would total 0.2 acre to this tidal floodplain from construction of the track along Boston Street where the Red Line emerges from the Downtown Tunnel segment.

Avoidance and Minimization

In accordance with Executive Order 11988 and USDOT Order 5650.2, the Preferred Alternative avoids the majority of the potential floodplain effects within the project study corridor. Longitudinal crossings are expressly discouraged pursuant to DOT Order 5650.2, and have been avoided because they would result in more floodplain fill, reducing conveyance, and floodplain storage. Within the tidal Patapsco Basin, much of the alignment lies within a tunnel segment, except for two entrances to underground stations and a number of vent shafts and tunnel portals. This portion of the floodplain is completely developed, with natural vegetation occurring only as street trees and areas of lawn. The crossing of the Gwynns Falls is on a high bridge, well outside the 100-year floodplain. Other minimization efforts include a perpendicular track crossing of a tributary to Dead Run, and only minimal sidewalk improvements proposed in the Dead Run mainstem floodplain.

Further tidal floodplain impact avoidance and minimization is difficult, as the few surface elements in the Downtown Tunnel segment are necessary for station access and operation of the tunnel and the alignment exits the Downtown Tunnel segment on Boston Street, paralleling the tidal Patapsco Basin.

Mitigation
Hydraulic and hydrologic studies will be performed if necessary to determine if any floodplain encroachments would have negative effects on storage areas for floodwaters or alter flooding characteristics during Final Design. If these studies determine that flood elevation changes would occur, floodplain storage mitigation may be required to meet regulatory compliance standards and would be determined at that time. All construction occurring within the FEMA designated 100-year floodplain must comply with FEMA approved local floodplain construction requirements. If, after compliance with the requirements of Executive Order 11988 and US DOT Order 5650.2, new construction of structures or facilities are to be located in a floodplain, accepted flood proofing and other flood protection measures would-be applied to new construction or rehabilitation. To achieve flood protection, wherever practicable, structures would be elevated above the base flood level rather than filling for culvert placement.

d. Navigable Waterways

Long-Term Operational and Short-Term Construction Effects
No short- or long-term effects to navigable waters are anticipated from the Preferred Alternative. The Jones Falls, the only designated navigable waterway within the project study corridor, is not anticipated to be affected. While no effects to the Jones Falls are anticipated because of the tunnel, the Red Line project will require authorization under Section 10 of the Rivers and Harbors Act, which states that authorization is required for any activities “in, upon, over, and/or under navigable waters of the US.” The Downtown Tunnel segment passes beneath this navigable water and is therefore subject to USACE (and potentially USCG) navigable waters permitting requirements. MTA will coordinate with USACE and US Coast Guard (USCG) to receive the appropriate approvals.

Avoidance and Minimization
Effects to the Jones Falls would be avoided by the Preferred Alternative through the construction of the Downtown Tunnel. The portion of the Downtown Tunnel that would pass beneath the Jones Falls would be constructed using a tunnel boring machine entirely below ground in this area. The top of the proposed tunnel would be located approximately 40 feet below the bottom of the Jones Falls, with approximately 10 to 15 feet of bedrock located immediately above the tunnel. In addition, there are no above ground project elements proposed in the immediate vicinity that would affect the Jones Falls, or its designation as a Navigable Waterway.

Mitigation
No mitigation would be required for navigable waterways.

5.20 Groundwater

5.20.1 Introduction and Methodology

Information on groundwater resources within the project study corridor was gathered from available published data sources, including the United States Geological Survey (USGS), Maryland Geological Survey (MGS), and Maryland Department of the Environment (MDE).

5.20.2 Existing Conditions

The availability of groundwater is largely controlled by the geology of an area. Based on published data sources, the project study corridor includes two different types of aquifers: one in the Coastal Plain, and one in the Piedmont. The portion of the project study corridor west of Gwynns Falls is underlain by the Crystalline-Rock aquifers of the Piedmont while the eastern portion is underlain by the Potomac Aquifer of the Coastal Plain. The Piedmont Physiographic Province, which characterizes the western portion of the project study corridor, is underlain by bedrock that is almost impermeable, but yields some water from secondary porosity and permeability provided by fractures. Three types of bedrock aquifers underlay the Piedmont as a whole, but the Crystalline-Rock Aquifer is the only one located within the project study corridor. Groundwater recharge is highly variable within the Piedmont and depends heavily on the local precipitation, runoff, and the capacity of the land surface to accept infiltrating water.

The Coastal Plain Province has six aquifers that consist mostly of semi-consolidated rocks. The project study corridor falls within only one of these; the Potomac Aquifer. The Potomac Aquifer consists mostly of permeable sands but has some confining layers of clay and sandy clay restricting the vertical flow of water in the aquifer.

The project study corridor is entirely located in the greater Baltimore area that relies on surface water withdrawals for drinking water. Groundwater withdrawals that do occur in the project study corridor occur primarily for industrial uses.

Wellhead protection programs have been implemented throughout the state to improve the quality of infiltrating water including regulating proper sewage disposal. There are no designated wellhead protection areas within the project study corridor. However, the fall zone, where the Piedmont meets the Coastal Plain, crosses the project study corridor in the vicinity of Gwynns Falls Park. Much of the recharge for Coastal Plain aquifers occurs in or near the fall zone, where the aquifers are nearer to the ground surface.

5.20.3 Future No-Build Conditions

The No-Build Alternative would not result in changes to the natural environment and no short and long-term effects are anticipated. A discussion of the effects from the Preferred Alternative follows.

5.20.4 Preferred Alternative

a. Long-Term Operational Effects

Where above ground, the Preferred Alternative would primarily occupy existing paved surfaces and other existing transportation rights-of-way. Long-term effects to groundwater resources are anticipated in these highly urbanized areas as runoff would be directed to surface waters through stormwater management or treated as it is being infiltrated into the local groundwater through Environmental Site Design (ESD) stormwater facilities. Refer to **Section 5.19.4** for more detail on location and examples of ESD facilities.

Where forest clearing and replacement with paved surfaces is proposed, small but permanent changes in local water tables may result, although significant changes in the quantity or quality of groundwater discharged to receiving streams are not expected. The Preferred Alternative would intercept groundwater resources where the Cooks Lane Tunnel and Downtown Tunnel are being constructed. These tunnels, which would reach a maximum depth of 80 feet below existing grade, could cause permanent but localized changes to groundwater flowpaths. The proposed Cooks Lane Tunnel lies in the Piedmont physiographic province, and is composed of overburden consisting of fill and residual soil, underlain by mafic or felsic rock. These materials generally transmit lower amounts of groundwater because of their inherently lower permeabilities; therefore effects associated with the Cooks Lane Tunnel would likely only affect local movements, and not the quantity or quality of groundwater resources.

The portion of the alignment within the Downtown Tunnel segment is topographically low, with elevations ranging from nearly at sea level to approximately 80 feet above sea level, consequently, shallow groundwater tables are near the surface over much of the designated tunnel zone. Where unconsolidated sediments predominate, significant yields of groundwater are typical since these areas serve as unconfined aquifers when located near tidal waters. Although the tunnel is likely to intercept and diffuse groundwater flows from these varied sources, significant effects to the quantity or quality of groundwater are not expected to occur.

b. Short-Term Construction Effects

Short-term construction effects to groundwater resources are not anticipated. During construction, runoff would be directed to surface waters through stormwater management or treated as it is being infiltrated into the local groundwater through ESD stormwater facilities. Temporary changes in local water tables may result during construction activities; however, significant changes in the quantity or quality of groundwater discharged to receiving streams are not expected. Stormwater runoff originating from these surfaces during construction would be managed in accordance with MDE guidelines.

c. Avoidance and Minimization

The Preferred Alternative would primarily occupy existing paved surfaces and other existing transportation rights-of-way, thereby minimizing effects to groundwater. Stormwater runoff originating from these surfaces will be managed in accordance with MDE guidelines. Though minor localized changes to groundwater flowpaths may occur, these changes would be minimized and are not expected to have significant implications.

d. Mitigation

No mitigation would be required for groundwater; however, construction of both tunnel segments may require some level of pumping of groundwater discharge during the boring process. Although inflow is expected to be low because of the use of an earth pressure balance system on the tunnel boring machine, a general permit from MDE would require that any contaminated groundwater collected from the tunnel be treated on-site prior to disposal into the city sewer system. A groundwater testing program using a series of wells has been initiated as part of the Preferred Alternative's hazardous materials studies to identify locations of potentially contaminated groundwater within the designated tunnel corridor. Final results of this study are pending. If contaminants are identified, tunnel designs and construction methods would incorporate environmental safeguards to both protect workers and provide for remediation of contaminants before any discharge of groundwater to surface waters.

5.21 Soils and Geology

5.21.1 Introduction and Methodology

This section presents an inventory and evaluation of soils and geological resources in the project study corridor with respect to their physical characteristics, distribution, and geotechnical capability to accommodate the Preferred Alternative. It describes the anticipated No-Build condition with respect to soils and geology, as well as assessments of potential long-term operational and short-term construction effects of the Preferred Alternative. It also presents qualitative descriptions of methods for mitigation of potential adverse effects.

The area considered extends approximately 200 feet from either side of the Preferred Alternative, except for the broad characterization of major soil and rock units and physiography, for which the area under consideration was regional. All elevations stated are referenced to the Red Line project vertical datum, NAVD88.

The methodology for this inventory and assessment was in general accordance with National Environmental Policy Act (NEPA) and Federal Transit Administration (FTA) guidelines, including sources of published and non-project-specific soils and geology data included:

- United States Geological Survey (USGS)
- Maryland Geological Survey (MGS)
- United States Department of Agriculture (USDA) Soil Surveys
- Geologic and subsurface information published in peer-reviewed technical journals
- Geologic and subsurface information from investigations and as-built records from completed construction projects in the project study corridor

Data collection also included site reconnaissance to observe surface geologic and man-made features that could either affect construction or be affected by the Preferred Alternative. Both field exploration and laboratory testing related to the Preferred Alternative were performed during several different project phases, and the following data reports were issued:

- 2004-2006: Red Line/Green Line Transit Alignment Study (Planning Phase)
- 2009-2010: Red Line Advanced Conceptual Design phase
- 2011-2012: Red Line Extended Conceptual Engineering phase and Phase 1 of Preliminary Engineering

Geotechnical properties of soils and geologic resources in the project study corridor were directly assessed during these investigations by means of borings, in-situ testing, and laboratory testing. Data collection methods, results, and interpretations are presented in the *Geotechnical Data Reports* and *Technical Memoranda* prepared for the tunnel segments and in the *Geotechnical Engineering Reports* prepared for the surface segments. More detailed information on methodology and existing conditions is available in the *Soils and Geology Technical Memorandum* (refer to **Appendix D**).

5.21.2 Existing Conditions

The following sections describe the regional geology, physiography, topography and drainage, site geology, geologic structures, seismicity, and groundwater conditions as relating to soils and geology of the project study corridor. A geologic map showing the location of the Preferred Alternative is presented in **Figure 5-11**.

a. Regional Geology

Geologic structure, lithology, and stratigraphy of rock and soils in the project study corridor are complex and reflect a complex sequence of tectonic, erosional, and depositional events. Refer to Crowley, 1976; Crowley and Reinhardt, 1979; Reinhardt and Crowley, 1979; Sinha et al., 1997; and Horton et al., 2010, for more detailed information.

Two general rock types underlie the Baltimore region: the Proterozoic- and Paleozoic-age crystalline rocks of the Piedmont Plateau and the wedge of Cretaceous-age and younger unconsolidated to semi-consolidated sediments overlying the east-sloping surface of crystalline rocks in the Coastal Plain. Beneath the Coastal Plain sediments, the bedrock surface slopes gently to the southeast at an average of about 85 feet per mile.

b. Physiography

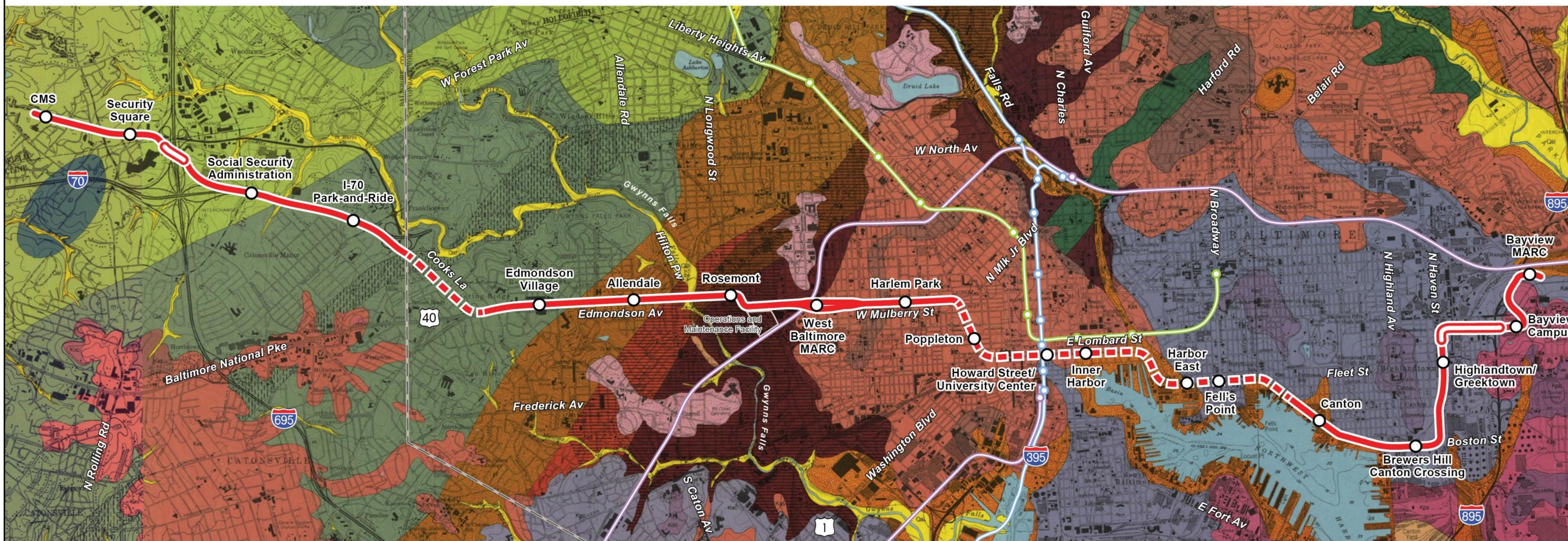
The Preferred Alternative alignment crosses two distinct physiographic provinces. The western portion of the Preferred Alternative alignment is located within the Piedmont Upland Region of the Piedmont Plateau physiographic province, a gently rolling upland of low relief to very rolling and hilly terrain, underlain by Proterozoic and Paleozoic igneous and metamorphic rocks.

The eastern portion of the Preferred Alternative alignment is located within the Western Shore Lowlands Region of the Coastal Plain Province, a flat to rolling upland surface underlain by fluvial and estuarine terraces, marshes, and drowned mouths of rivers draining into the Chesapeake Bay and Potomac estuary system.

The Piedmont and the Coastal Plain physiographic provinces are separated by the Fall Line, an imaginary line connecting locations on Piedmont rivers which marked the colonial limit of inland navigation. The Fall Line represents the boundary between areas underlain by Piedmont igneous and metamorphic rock and areas underlain by unconsolidated Coastal Plain sediments.

c. Topography and Drainage

Ground surface elevations in the project study corridor range from about sea level at the Baltimore Harbor up to about 450 feet near the western terminus.



LEGEND:

Red Line Stations

Red Line Preferred Alternative
- Surface
- Tunnel
- Aerial

- County Boundary
- Central Light Rail
- METRO (Subway)
- MARC

QUATERNARY
- Artificial Fill
- Alluvium
- Alluvial Terrace Gravel

UNCONSOLIDATED TO SEMI-CONSOLIDATED STRATA LOWER CRETACEOUS POTOMAC GROUP
- Patapsco Formation
  - Kpc *Clay facies*
  - Kps *Sand facies*
- Patuxent Formation
  - Kxs *Sand facies*
  - Kxc *Clay facies*
- Arundel Formation
  - Kac *Clay facies*
  - Kas *Sand facies*
- Potomac Group (?)

INTRUSIVE ROCKS CAMBRO-ORDOVICIAN (?)
- *Overprint:* Pegmatite Injection Complex
- *Overprint:* Cold Spring Gneiss Injection Complex

CAMBRIAN (?)
- Jones Falls Schist
- James Run Formation
  - jr *Relay Gneiss Member*
  - jc *Carroll Gneiss Member*
  - jd *Druid Hill Amphibolite Member*

CAMBRIAN (?) BALTIMORE MAFIC COMPLEX
- Mount Washington Amphibolite
  - s *Serpentinite*
  - ac *Actinolite*
  - b *Biotite schist*
- Hollofield Layered Ultramafite
- Raspeburg Amphibolite

References: Crowley, William P. and Juergen Reinhardt, 1979. *Geologic Map of the Baltimore West Quadrangle*, Maryland Department of Natural Resources, Maryland Geological Survey, Scale 1:24,000.

Reinhardt, Juergen and William P. Crowley, 1979. *Geologic Map of the Baltimore East Quadrangle*, Maryland Department of Natural Resources, Maryland Geological Survey, Scale 1:24,000.

Crowley, William P. and Juergen Reinhardt, 1980. *Geologic Map of the Ellicott City Quadrangle*, Maryland Department of Natural Resources, Maryland Geological Survey, Scale: 1:24,000.

0 0.5 1 2 Miles

N

Figure 5-11: Geology

Major streams in the region include the Susquehanna, Gunpowder, Patapsco, and Patuxent Rivers, all of which flow from the Piedmont Plateau across the Coastal Plain to empty into the Chesapeake Bay. The Preferred Alternative is located entirely within the watershed of the Patapsco River, the lower portion of which is the tidal estuary inlet of Baltimore Harbor, which comprises the Northwest Branch and the Middle Branch of the Patapsco River.

d. Site Geology

Overburden is defined as all loose nonlithified material lying above weathered rock. In the project study corridor it is comprised of fill, Cretaceous- and post-Cretaceous-age deposits, and residual soil. Thicknesses of overburden in the project study corridor range from less than a few feet, in areas of rock outcrops near Cooks Lane and the Gwynns Falls, to greater than 150 feet at the eastern end of the Preferred Alternative.

Owing to the close association between the Preferred Alternative and existing transportation features and/or urban development, the soils along the project study corridor are generally mapped by the USDA as urban land or highway udorthents typical of the classification associated with disturbed land.

Descriptions of geologic and geotechnical soil groups are presented in the following sections obtained primarily from Crowley and Reinhardt, 1979; Reinhardt and Crowley, 1979; Otton et al., 1964; and Bennett and Meyer, 1952.

Post-Cretaceous Deposits

Post-Cretaceous deposits in the project study corridor include Quaternary Period deposits of Pleistocene and Holocene (Recent) age. They consist of the following:

- Fill: Artificial fill in the project study corridor consists of a heterogeneous mix of soil, rock, brick, construction stone, and timber. Areas defined as fill may also include buried shoreline structures. Major areas of filled ground are adjacent to the Inner Harbor and Fell's Point.
- Alluvium: Quaternary alluvium consisting of interbedded gravel, sand, silt, and clay occurs in floodplains of perennial streams, upland drainage areas, marshes adjacent testuaries, and reclaimed land. Alluvium is likely to be present in many areas of the project study corridor, although commonly overlain by artificial fill. Maximum reported thickness of Quaternary alluvium in the Baltimore area is 15 feet.
- Pleistocene Marine and Terrace Deposits: Pleistocene deposits reflect the variations in climate, sea level, and drainage resulting from repeated glacial episodes in areas to the north, which alternately caused channel erosion or terrace deposition. Upland terrace deposits in the western portion of the project study corridor generally consist of quartz gravel in a silt and sand matrix (Crowley and Reinhardt, 1979). The upland deposits reportedly occur chiefly as a thin cap, commonly less than 10 to 15 feet thick, on high ridges or hills. They have been mapped west of the Gwynns Falls. Lowland terrace deposits in the eastern portion of the project study corridor, generally mapped as the Talbot Formation, include two identified facies: a silt-clay facies and an interlayered sand facies (Reinhardt and Crowley, 1979). The lowland deposits occur chiefly below elevation 50 feet. Where not mapped, they may be present locally beneath other materials.

Cretaceous Sediments

The oldest deposited sediments in the project study corridor are stratigraphically within the Lower Cretaceous Potomac Group. The three formations present in the project study corridor are the Patuxent Formation, the Arundel Clay, and the Patapsco Formation. They are listed as follows from oldest to youngest, as they crop out from west to east:

- Patuxent Formation: The Patuxent Formation consists of highly variable, intercalated sand, gravel, sandy clay, and clay. Maximum total thickness is reported to be 300 feet.
- Arundel Clay: The Arundel Clay was deposited on an eroded surface developed on the Patuxent Formation. Maximum reported thickness in the Baltimore area is 200 feet.
- Patapsco Formation: Similar to the Patuxent Formation, the Patapsco Formation generally consists chiefly of sand, gravel, and clay in beds that are commonly lenticular or irregular. Maximum thickness is believed to be about 300 feet.

Residual Soils

Residual soils derived from in-situ weathering of the underlying rock locally underlie Cretaceous or post-Cretaceous sediments in the project study corridor. Their thickness and nature reflect the composition of the underlying parent rock and the local erosional history.

Overburden - Rock Transition Zone

As elsewhere in the Piedmont Upland and adjacent Coastal Plain, a transition zone of highly weathered to completely weathered rock is present between rock and overburden in the project study corridor. Weathered rock in the Baltimore region generally reflects the character of the parent rock.

Transition zone thickness is variable, with variations in thickness directly related to variations in underlying lithology and erosional history. The original rock mass structure is largely intact, with visible crystalline texture. Completely weathered rock is typically soil-like, with all rock material decomposed and disintegrated to soil. It occurs directly beneath residual soil or other overburden if residual soil is absent. Highly weathered rock is typically rock-like. It occurs below completely weathered rock and grades downward into rock.

e. Bedrock Geology

The project study corridor is underlain by two major rock groups: the Baltimore Mafic Complex and the Chopawamsic Terrane (Crowley and Reinhardt, 1979; Reinhardt and Crowley, 1979; Crowley, 1976; Sinha et al., 1997; and Horton et al., 2010).

- Baltimore Mafic Complex: The western portion of the Preferred Alternative is underlain by the Baltimore Mafic Complex. Published descriptions describe it as intimately mixed metagabbro, serpentinite, metapyroxenite, and various kinds of talc-, actinolite-, and epidote-bearing schists. In the project study corridor, the Baltimore Mafic Complex includes the Hollofield Formation and the Mount Washington Formation (Crowley, 1976).
- Chopawamsic Terrane: The project study corridor is underlain by the Chopawamsic Terrane along US 40 (US 40 segment), through the Downtown area (Downtown Tunnel segment), along the East segment and at the Operations and Maintenance Facility. The

Chopawamsic Terrane is an assemblage of metamorphic and igneous rocks for which an Ordovician age has been determined. In the project study corridor, the Chopawamsic Terrane includes the James Run Formation, the Jones Falls Schist, and the Raspeburg Amphibolite.

f. Geologic Structures

The project study corridor crosses the inferred fold axes of the Hollofield Anticiline near Security Square and the Jones Falls Syncline along US 40, west of the Gwynns Falls. The corridor does not cross any mapped faults, although unmapped faults have been encountered in Red Line geotechnical investigations for both tunnel segments. These faults are anticipated to have relatively minor displacements and to generally strike north to northeast, consistent with the regional structural trend and mostly across or oblique to the tunnel alignments. Additional minor faults are also likely to be present.

g. Seismicity

The Central Appalachian region, in which Baltimore is located, is generally characterized by a moderate amount of low-level earthquake activity (Bollinger, 1969). Although seismic energy release within Maryland is relatively low, the Federal Emergency Management Agency (FEMA) reclassified Maryland from having a low earthquake hazard to a medium earthquake hazard because of increased number of seismic activity since 1990 (Reger, 1999). Soils in the project study corridor have been screened for liquefaction potential in response to a potential seismic event. Results indicate that the majority of soils within the project study corridor present a very low potential for liquefaction. Localized zones of potentially susceptible soft, organic deposits located between the Jones Falls waterway and Brewers Hill/Canton Crossing would be further investigated and evaluated.

h. Mineral Resources

Gold, copper, chromite, bog iron, dimension stone, and aggregate were formerly mined in the region, but mining operations were shut down in the nineteenth and early twentieth centuries because of depletion and/or decreasing commercial viability. There are no active mining operations within five miles of the Preferred Alternative.

5.21.3 Future No-Build Conditions

Maintenance and development activities for existing and proposed facilities, such as site excavation, site clearing, landscaping, and harbor dredging within and surrounding the project study corridor would be expected to continue under No-Build conditions. These activities would create changes in the built environment, but would not adversely impact soils and geologic conditions within which the Preferred Alternative would be constructed. Normal geologic processes, such as erosion and sedimentation, would also continue. No specific effects with respect to soils or geology would be anticipated.

5.21.4 Preferred Alternative

a. Long-Term Operational Effects

Soil and rock affected by the Preferred Alternative would be excavated and disturbed during construction. Once the Preferred Alternative is operational, no further potential long-term effects to the underlying soils and rock would be anticipated as a result of either Preferred Alignment tunnel or surface alignment design elements. No long-term changes would be expected to geologic structures or faults, to rock or soil stability, to seismicity, or to the rock and soil units surrounding the excavation and underlying and supporting the surface structures.

Potential effects of a seismic event could include liquefaction of susceptible soils or amplified ground motions in poorly consolidated overburden. However, the Preferred Alternative would not induce or amplify these earthquake effects.

b. Short-Term Construction Effects

Potential effects of construction would include the effects of dewatering; the effects of excavation on the stability of slopes and/or walls supporting existing buildings, infrastructure, and historic resources; and the indirect effects of construction associated with the loss of arable land, or mineral resources. Additional potential effects of construction would include such effects as soil erosion; vibrations from the excavation process; dust hazards; and inhalation hazards because of disturbance of rock with naturally occurring asbestos. Additional data to be collected in future investigations would enhance understanding of the properties and anticipated behavior of soil and rock materials.

West Segment

Proposed above ground structures and track affecting subsurface materials would include bridges, embankments, platforms, rail beds, retaining structures, rail infrastructure foundations, and utilities. Construction would occur on existing fill or residual soil throughout the area of proposed track construction. Construction is not expected to affect compressible soils, nor are there expected to be any stability effects from slopes or unsupported excavations. In general, excavations are not expected to encounter groundwater or involve bedrock removal; however, erodible soils could be impacted by removal of protective cover. Normal construction vibrations would likely include pile driving and grading equipment, but these would generally occur at distances from existing development whereby the potential effects can be controlled by normal construction procedures. Risks of seismic damage because of liquefiable granular soils are considered nil, and the inertial effects of potential seismic activity on walls, bridges, and other surface structures is also expected to be low based upon the USGS identification of seismic risk in proximity to the Preferred Alternative.

Cooks Lane Tunnel Segment

Potential construction impacts for the Cooks Lane Tunnel segment can be generally summarized as being related to weak, erodible, or unstable materials; dust; settlement/subsidence; vibration and seismicity; and secondary effects of impacts to groundwater. Construction impacts related to soil and geology are described below.

- <u>Weak, Erodible, or Unstable Materials</u>
    - Soil erosion: The residual soil is highly erodible and would be removed by surface runoff if it is exposed during construction.
    - Slope stability: Stress relief at valley locations, one of which is near the west portal, may have produced exceptionally open joints which could reduce stability during

portal construction. Temporary slopes could also become unstable over the construction period.

- Unstable materials: Transition zone materials are prone to sudden collapse and can be expected to exhibit raveling to flowing behavior during excavation. They are considered unstable below the groundwater table. They are also susceptible to erosion and would erode relatively rapidly if not protected.
- Slaking rock: Weak rock types are susceptible to raveling and slaking upon exposure to the elements. They would deteriorate rapidly, within weeks, soon after exposure to air and water if not protected.
- Fault zones: Three fault zones have been identified along the Cooks Lane Tunnel segment. Available boring information indicates that rock in the fault zones is poor quality, closely fractured, and more weathered and permeable than surrounding rock. These zones would require special care in design and construction.

- <u>Dust</u>
  - Dust: Dust and rock flour would be generated during excavation, processing, and transport of excavated materials.
  - Asbestos minerals: A portion of the amphibolite rock and overlying soil encountered in Cooks Lane Tunnel excavations may contain amphibole asbestos, which is a potential inhalation hazard. Additional laboratory testing would be performed. Should asbestos minerals be present, additional measures for material handling and disposal, monitoring, and protection of workers would be implemented.
- <u>Settlement/Subsidence</u>
  - Settlement or heave could occur because of implementation of stability mitigation measures such as chemical grouting or jet grouting.
  - Ground surface subsidence could occur because of tunneling-induced alteration of the in-ground stress regime. Dewatering effects could also induce localized settlements.
- <u>Vibration and Seismicity</u>
  - Blast-induced vibrations: Proposed retained cuts at the west and east ends of the proposed Cooks Lane Tunnel alignment would be largely in transition zone materials, with some rock and overburden. Because weathering is uneven, excavation properties in the open excavations may be variable and unpredictable. At the west retained cut, a knob of rock in the open cut area is surrounded by Transition Zone. Localized blasting or ripping may be needed in addition to common excavation, with associated vibrations.
  - Seismicity: Potential seismic events could induce displacement of below grade construction.

- Secondary Effects of Impacts to Groundwater
  - Tunnel groundwater inflows: Ground loss and fall out could occur in association with high tunnel groundwater inflows, particularly at fault zones.

US 40 Segment and Operations and Maintenance Facility
Proposed above ground structures and track construction affecting subsurface materials would include platforms, rail beds, rail infrastructure foundations, and utilities. Construction would occur on existing fill or residual soil throughout the area of proposed track improvements. Construction is not expected to impact compressible soils, nor are there expected to be any stability effects from slopes or unsupported excavations. In general, excavations are not expected to encounter groundwater or involve bedrock removal; however, erodible soils could be affected by removal of protective cover. Normal construction vibrations would likely include pile driving and grading equipment, but these would generally occur at distances from existing development whereby the potential effects can be controlled by normal construction procedures. Risks of seismic damage because of liquefiable granular soils are considered nil, and the inertial effects of potential seismic activity on walls, bridges, and other surface structures is also expected to be low based upon the USGS identification of seismic risk in proximity to the Preferred Alternative.

Downtown Tunnel Segment
Like the Cooks Lane Tunnel segment, potential construction impacts related to soils and geology for the Downtown Tunnel segment can be generally summarized as being related to weak, erodible, or unstable materials; dust; settlement/subsidence; vibration and seismicity; and secondary effects of impacts to groundwater. Impacts for the Downtown Tunnel would generally be the same as those noted for the Cooks Lane Tunnel with the following exceptions:

- Weak, Erodible, or Unstable Materials
  - Same impacts noted for Cooks Lane with the exception of Slope Stability, which is not a concern for this tunnel, and different fault zone impacts as noted below.
  - Fault zones: Four fault zones have been identified along the Downtown Tunnel alignment. Available boring information indicates that rock in these fault zones is poor quality, closely fractured, and more weathered and permeable than surrounding rock. Loosening, fallout, and high groundwater inflows are likely in these areas.
- Dust
  - Same impacts noted for Cooks Lane with different asbestos minerals impacts as noted below.
  - Asbestos minerals: Same as for Cooks Lane, however, initial laboratory testing to determine asbestos mineral content indicated the presence of non-asbestiform actinolite amphibole, a potential skin irritant but not an inhalation hazard. Additional laboratory testing would be performed for confirmation.

- Settlement/Subsidence

  This subcategory is not the same as noted for Cooks Lane. The following settlement/subsidence impacts apply only to the Downtown Tunnel segment:

  - Compressible soils: Compressible soils are known to be present along the eastern portion of the proposed Downtown Tunnel alignment. If groundwater drawdown were not controlled and limited to minimize drops in pre-construction pore pressures in these materials, potential damaging ground displacements could be induced.
  - Excavation impacts to adjacent structures: If existing structures are not supported, excavations for stations or other structures may undermine or otherwise destabilize or induce movements in existing structures adjacent to the excavations.

- Vibration and Seismicity

  - Unlike Cooks Lane Tunnel segment, the blast-induced vibration impacts would not apply for the Downtown Tunnel segment.
  - Mixed excavation at stations: Transition zone materials are expected to be encountered in excavations for all five proposed stations. Some rock is expected in excavations for the three westernmost proposed stations, Poppleton Station, Howard Street/University Center Station, and Inner Harbor Station. Because weathering is uneven, excavation properties may be variable and unpredictable. Localized blasting or ripping, with associated vibrations, may be needed in addition to common excavation at the three proposed stations where rock is anticipated.

- Secondary Effects of Impacts to Groundwater

  - Groundwater inflows: The somewhat irregular distribution of highly permeable sands and gravels could cause sudden inflows of high volumes of groundwater during construction and affect stability, possibly resulting in instability or surface settlements.

East Segment

Proposed above ground structures and track construction affecting subsurface materials would include bridges, platforms, rail beds, retaining structures, rail infrastructure foundations, and utilities. Construction would occur on existing fill or sedimentary deposits throughout the area of proposed track improvements. Construction, particularly dewatering and/or fill placement, may have an impact upon compressible soils in the vicinity of Canton Station, where the former channel of Harris Creek was in-filled. Stability of existing slopes north of the Eastern Avenue overpass may be affected by fill wall construction or related excavations. In general, excavations are not expected to encounter groundwater or involve bedrock removal; however, erodible soils could be affected by removal of protective cover. Normal construction vibrations would likely include pile driving and grading equipment, generally at distances from existing development whereby the potential effects can be controlled by normal construction procedures. Risks of seismic damage because of liquefiable granular soils are considered nil, but the inertial effects of bedrock acceleration, albeit low within the seismic risk setting of

Baltimore, could be amplified by the presence of soft sediments in the buried former channel of Harris Creek at the western end of the design segment.

c. Avoidance and Minimization

Elements of the Preferred Alternative, including excavation support and slopes, will be engineered and built in accordance with applicable local, state and federal design codes and construction standards. Best Management Practices (BMPs) would be implemented to minimize effects to groundwater hydrology and surface water runoff.

Seismic design considerations would be incorporated in proposed surface and subsurface structures. Structures will be designed in accordance with project seismic design criteria to resist an appropriate level of shaking, including a maximum design earthquake load.

d. Mitigation

No mitigation of long-term operational effects is proposed or warranted. Geotechnical investigations and analysis will continue in Final Design and Construction so that appropriate mitigation for significant short-term construction effects can be developed as necessary. If liquefaction impact analyses indicate potential unacceptable performance of structures, appropriate mitigation measures will be incorporated into the Final Design. The effect of soil overburden on ground motions will also be considered.

5.22 Hazardous Materials

5.22.1 Introduction and Methodology

The Maryland Department of the Environment (MDE) bears the primary regulatory authority under Title 26 of the Code of Maryland (COMAR). MDE regulates hazardous materials and contaminated sites through the Solid Waste, Hazardous Waste, Oil Control, and Voluntary Cleanup Programs. In order to understand the potential environmental sites of concern within the project study corridor, the analysis focused on properties located within a 400-foot radius of the Preferred Alternative.

The first step in the analysis was to conduct a database review of publicly available regulatory files concerning properties with on-site use, storage, and/or release of hazardous materials or regulated wastes. Sanborn Fire Insurance Maps and historical aerial photographs were also reviewed to identify historical development trends of industrial, commercial, and residential properties across the project study corridor for approximately the last 100 years. The results of the database search reports were prioritized to create a list of sites which were considered potential sites of concern. The level of concern at these sites was based on the nature and extent of previously documented hazardous material issues identified during the regulatory file and document review. Public Information Act (PIA) requests were submitted to MDE and Environmental Protection Agency (EPA) for access to the case files.

A field reconnaissance of the sites of concern was performed to confirm their location and evaluate local conditions. A non-intrusive field reconnaissance was conducted through the completion of a windshield survey of each property to identify current site conditions. Detailed site investigations of specific properties that would be required for the project would be performed where a significant risk of contamination is anticipated. These investigations are anticipated to begin following the issuance of the Record of Decision (ROD) as part of the Phase II investigations.

As part of the technical studies and ongoing preliminary engineering work, geotechnical borings were performed along the proposed Preferred Alternative alignment. To take advantage of the geotechnical drilling activities, the environmental soil sampling was performed at the same time. During preliminary investigation activities performed in 2009-2010, a total of 27 soil samples were collected from boring locations and submitted for laboratory analysis. An additional 78 soil samples were collected from boring locations in 2011-2012, and were submitted for laboratory analysis.

In order to provide representative groundwater quality data, environmental groundwater sampling was performed at 38 observation wells installed as part of the geotechnical investigations during 2009 through 2012. A representative groundwater sample was collected from 35 of the 38 observation wells.

5.22.2 Existing Conditions

Properties currently located within the project study corridor consist of a combination of residential, commercial, and industrial sites. Initial identification of properties located within the project study corridor range from those in parts of Baltimore City which had first been developed in the late 1700s/early 1800s to those along the I-695/I-70 Corridor, which were developed in the 1960s and 1970s. Throughout a large portion of the project study corridor, land has been redeveloped numerous times with various commercial and industrial uses. Refer to **Section 5.2** for additional information on the land uses throughout the project study corridor.

Subsurface contamination of soil and groundwater has been documented at various sites, originating from historic industrial processes and unregulated onsite waste disposal. The enactment and enforcement of environmental regulations in recent decades resulted in the investigation and detection of contamination at many sites. Some degree of investigation or cleanup effort has been initiated at most of these sites, but some subsurface contamination is expected to remain.

Based on review of information collected from environmental databases, historical records, the site reconnaissance, and a review of regulatory files, several areas in the project study corridor have been identified where subsurface contamination, most likely consisting of contaminated groundwater, could have migrated into the alignment from contaminated properties located near the alignment. Potential contamination sources typically include commercial and industrial properties that adjoin the alignment, which have documented subsurface contamination of the soil and/or groundwater from leaking underground storage tanks, or improper chemical use and waste disposal procedures that may have migrated into the alignment. The most common subsurface contaminant is petroleum hydrocarbons. Other contaminants include heavy metals, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and asbestos.

a. Sites of Concern for Contamination – Corridor Level

Following review of database searches, the MTA submitted PIA requests for access to the MDE case files for 347 sites. Based on the file reviews, 81 sites were identified as presenting some level of environmental concern to the Preferred Alternative. It was determined that the remaining 266 sites would not present significant environmental concern because of sites no longer being located along the Preferred Alternative or for which the MDE case file was closed. Closure of the MDE case file indicates that site investigation and cleanup has been completed to the satisfaction of MDE, and contamination of neighboring properties is not expected.

Based on the review of federal and state case files, the MTA created an inventory of sites where evidence of subsurface contamination was documented in regulatory files. Summary sheets were created for each site in which the property, land use, and suspected or confirmed contamination release are described. The sites were prioritized as presenting a slight, moderate, or high risk of encountering contamination during construction based on the following factors:

- Confirmation of the presence of subsurface contamination by site investigation results
- The type and extent of soil and/or groundwater contamination
- Migration direction and depth of groundwater contamination
- Proximity, direction, and relative elevation of the Preferred Alternative

Pertinent information was evaluated to rank the site according to the risk presented to the Preferred Alternative as follows:

- 30 Slight Risk Sites: Contain suspected contamination or documented contamination that is limited within the property boundary and is not expected to extend into the alignment. Adverse effects to the project from these sites are considered unlikely.
- 36 Moderate Risk Sites: Contain documented contamination releases that may extend beyond the property boundary. Contamination may be present in the alignment at concentrations that require special management and disposal.
- 15 High Risk Sites: Properties or clusters of properties, with widespread contamination and/or previous or on-going remediation efforts. Contaminated soil and/or groundwater likely extend beyond property boundaries. Project excavation and dewatering efforts would probably encounter some degree of contamination.

Refer to **Volume 2 Environmental Plate Series, Plate Series 5** for the location of these sites.

b. Sites of Primary Concern

The list of sites of concern was further categorized into the sites with the most significant risk that contamination would migrate into the Preferred Alternative based on the type of contamination and the source location relative to the alignment. The 23 sites selected are summarized in **Table 5-50** and include all 15 high risk sites of concern and eight moderate risk sites that are in locations that would make contaminant migration into the alignment more likely than migration from the other moderate risk sites. The purpose of designating the 23 sites of primary concern is to focus the ongoing and future field investigations to determine if the suspected contamination is actually present in the Preferred Alternative. Any adverse effects to construction of the Preferred Alternative would depend on site-specific characteristics (such as type of contaminant, migration pathways, depth of excavation, and dewatering conditions).

c. Soil Sampling Results

Because of the type of suspected contamination, the majority of the soil samples were analyzed only for petroleum hydrocarbons, specifically diesel range organics (DRO) and gasoline range organics (GRO); as well as RCRA Metals. Additional samples were also submitted for VOCs, SVOCs, and polychlorinated biphenyls (PCBs). Soil sampling locations are presented in the **Volume 2 Environmental Plate Series, Plate Series 5**. The soil analytical results were compared to the MDE *Non-Residential Cleanup Standards for Soil and Groundwater, Update 2.1*, June 2008. Analytical results from the soil sampling are summarized as provided in the *Preliminary Hazardous Materials Screening Assessment Report* (refer to **Appendix D**) in the project record.

Table 5-50: Moderate and High Risk Sites of Primary Concern for Contamination

Site of Concern	Site ID # (Plate #)	Type of Contamination	Contaminant of Concern	Potential Construction Impact
West Segment				
No primary sites of concern located.				
Cooks Lane Tunnel Segment				
Fishers Arco 1699 Forest Park Avenue	2-01 (Plate 7)	Soil and groundwater	Petroleum hydrocarbons	Deep Excavation/ Dewatering
US 40 Segment				
Merit Station 510 Franklintown Road	3-09 (Plate 12)	Soil and groundwater	Petroleum hydrocarbons	Shallow Utility Excavation and Dewatering
Downtown Tunnel Segment				
Howard Street Tunnel at Lombard Street	4-04 (Plate 18)	Soil and groundwater	Tripropylene	Tunnel Dewatering
Fleet Eden Garage (Bohager) 1400 Block Eastern Avenue/Fleet Street	4-07 (Plate 20)	Soil and groundwater	Petroleum hydrocarbons/ Metals/VOCs/SVOCs	Tunnel Dewatering
Loading Dock Liquors William Bonnett Property 2051 and 2101 Fleet Street	4-14 4-15 (Plate 21)	Soil and groundwater	Petroleum hydrocarbons	Tunnel Dewatering
East Segment				
Baltimore Marina Center 2701 Boston Street	5-03 (Plate 22)	Soil and groundwater	Metals	Shallow Excavation and Dewatering
Exxon Company/Terminal 3801 Boston Street	5-09 (Plate 23)	Soil and groundwater	Petroleum hydrocarbons/ Metals	Shallow Excavation and Dewatering

Table 5-50: Moderate and High Risk Sites of Primary Concern for Contamination

Site of Concern	Site ID # (Plate #)	Type of Contamination	Contaminant of Concern	Potential Construction Impact
Gunther Brewery parking area 1301-B South Conkling Street	5-10 (Plate 23)	Soil and groundwater	Petroleum hydrocarbons/ SVOCs/VOCs/ Metals	Shallow Excavation and Dewatering
Gunther Brewery 1211 South Conkling Street	5-11 (Plate 23)	Soil and groundwater	Petroleum hydrocarbons/ SVOCs/VOCs/ Metals	Shallow Excavation and Dewatering
Gunther Brewery 3701 O'Donnell Street	5-12 (Plate 24)	Soil	Metals/SVOCs	Shallow Excavation and Dewatering
Cambridge Iron & Metal Co. 910 South Kresson Street	5-14 (Plate 24)	Soil and groundwater	Petroleum hydrocarbons/ PCBs/VOCs/ Metals	Shallow Excavation and Dewatering
A2Z Environmental Group, LLC 311 South Haven Street	5-23 (Plate 26)	Soil and groundwater	Petroleum hydrocarbons/ VOCs/Metals	Shallow Excavation and Dewatering
The Chesapeake Machine Company 210 South Janney Street	5-27 (Plate 26)	Soil and groundwater	Petroleum hydrocarbons/ PCBs/SVOCs/ VOCs/Metals	Shallow Excavation and Dewatering
Petroleum Services, Inc. 4200 East Lombard Street	5-30 (Plate 26)	Soil and groundwater	Petroleum hydrocarbons	Shallow Excavation and Dewatering
The United Oil Co., Inc. 4405 East Baltimore Street	5-31 (N/A)[1]	Soil and groundwater	Petroleum hydrocarbons	Shallow Excavation and Dewatering
F. Bowie Smith & Son, Inc. 4500 East Lombard Street	5-33 (N/A)[1]	Soil and groundwater	Petroleum hydrocarbons/ Wood-Treatment Chemicals	Shallow Excavation and Dewatering
Lonza Baltimore, Inc. 5901/6001 East Lombard Street	5-38 (Plate 28)	Soil	Metals/PAHs	Shallow Excavation and Dewatering
Norfolk Southern 6000 East Lombard Street	5-39 (Plate 28)	Soil and groundwater	Petroleum hydrocarbons	Shallow Excavation and Dewatering

Table 5-50: Moderate and High Risk Sites of Primary Concern for Contamination

Site of Concern	Site ID # (Plate #)	Type of Contamination	Contaminant of Concern	Potential Construction Impact
Operations and Maintenance Facility (noted as Segment 6 for the purposes of this analysis and Volume 2)				
Supervisor of Elections Warehouse 301 North Franklintown Road	6-06 (Plate 12)	Soil and groundwater	Petroleum hydrocarbons	Shallow Excavation and Dewatering
Maryland Food Bank 241 North Franklintown Road	6-07 (Plate 12)	Soil and groundwater	Petroleum hydrocarbons	Shallow Excavation and Dewatering
L & J Processing Facility 222 North Calverton Road	6-08 (Plate 13)	Soil and groundwater	Petroleum hydrocarbons/ PCBs/VOCs/ Metals	Shallow Excavation and Dewatering
City of Baltimore – Western Substation #5 239 North Calverton Road	6-09 (Plate 12)	Soil and groundwater	Petroleum hydrocarbons	Shallow Excavation and Dewatering

Note: [1] Site is north of the limit of disturbance for the Preferred Alternative and not shown in Plate Series

d. Groundwater Sampling Results

Groundwater samples were collected from 35 observation wells located along the Preferred Alternative alignment. Groundwater sampling locations are presented in the **Volume 2 Environmental Plate Series, Plate Series**. The groundwater analytical results have been compared to the MDE Cleanup Standard for Type I and Type II Aquifers. The analytical results from the groundwater sampling are provided in the *Preliminary Hazardous Materials Screening Assessment Report.*

e. Sites of Concern by Station

There are a total of 19 stations proposed along the Preferred Alternative. (Refer to **Chapter 2** for additional information on the stations.) The proposed stations with sites of concern for contamination and hazardous materials are summarized in **Table 5-51**.

Table 5-51: Sites of Concern by Station

Proposed Station	Sites of Concern	Suspected Contaminants of Concern
Edmondson Village	3-01 3-02 & 3-03	Petroleum Dry Cleaning Solvents
Allendale	3-04	Petroleum
Rosemont	3-05, 3-06, 3-07, & 3-08	Petroleum
Harlem Park	3-14	Petroleum & Dry Cleaning Solvents
Poppleton	4-01	Petroleum
Howard Street/University Center	4-04	Petroleum & VOCs
Harbor East	4-07 & 4-08	Petroleum & Solvents
Fell's Point	4-12	Petroleum

Table 5-51: Sites of Concern by Station

Proposed Station	Sites of Concern	Suspected Contaminants of Concern
Canton	5-03	Metals (Chromium)
Brewers Hill/Canton Crossing	5-09 & 5-10	Petroleum & Metals
Highlandtown/Greektown	5-17, 5-20 & 5-21	Petroleum
Bayview Campus	None	None
Bayview MARC	5-37 & 5-39	VOCs, SVOCs, PAHs, & Metals

f. Sites of Concern by Proposed Traction Power Substation Location

There are 17 traction power substations (TPSS) proposed along the Preferred Alternative. (Refer to **Chapter 2** for additional information on the TPSS.) The proposed TPSS with adjacent sites of concern for contamination and hazardous materials are summarized in **Table 5-52**.

Table 5-52: Sites of Concern by Traction Power Substation

Proposed TPSSs	Sites of Concern	Suspected Contaminants of Concern
TPSS-4	2-01	Petroleum
TPSS-5	3-01	Petroleum
TPSS-6	3-04	Petroleum
TPSS-7	3-10 & 6-09	Petroleum
TPSS-11 is part of the Howard Street/University Center Underground Station – See **Table 5-51**		
TPSS-12 is a part of the Harbor East Underground Station – See **Table 5-51**		
TPSS-13	5-03	Metals
TPSS-14	5-05, 5-06 & 5-09	Petroleum & PAHs
TPSS-15	5-09	Petroleum
TPSS-17	5-38 & 5-39	Metals & Petroleum

5.22.3 Future No-Build Conditions

The No-Build Alternative would not involve any property acquisitions or project-related construction that could encounter hazardous materials; therefore, no effects are anticipated.

5.22.4 Preferred Alternative

Given the historic and current land uses in the alignment, the information obtained during the records review, and the observations made during the site inspections, there is a potential for the presence of hazardous materials to be encountered along the Preferred Alternative.

a. Long-Term Operational Effects

Although there are several contaminants of concern within various environmental media, the installation of new pavement, new ballast, and new cast-in-place structures during the proposed construction of the Preferred Alternative would help to prevent exposures to the potentially contaminated soils and groundwater along the alignment during the post-construction phase.

Potential Effects to Stormwater Management Facilities

Numerous stormwater management (SWM) facilities have been proposed for the Preferred Alternative. The proposed structures consist of either environmental site design features (ESD) or underground vaults (UG) structures. (Refer to **Section 5.19** for additional information on the

SWM proposed with the Preferred Alternative.) The ESD features involve surface treatments; while the UG structures involve excavation activities. Where a risk of subsurface contamination is probable, the most likely adverse effect, if any, would be limitations on reuse of excavated materials.

Typical stormwater facilities would be constructed to depths of three to six feet where significant interaction with potentially contaminated groundwater is not anticipated. The most common soil contaminants that were detected near these depths at concentrations exceeding MDE cleanup levels are arsenic and chromium, which are not anticipated to be sufficiently leachable to adversely affect stormwater. Future soil sample analyses would include testing of toxic metal leachability using the Resource Conservation Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) to provide additional data concerning this issue.

Because of the shallow excavation required during the installation of these structures, the most significant effects to the proposed SWM structures would be related to contamination within 5 feet of ground surfaces. Any proposed SWM ponds that would require more extensive excavation and grading activities would be affected by both surface and sub-surface residual contamination (defined as remaining after the conclusion of regulatory actions).

Post-Construction Dewatering

If persistent groundwater contamination is encountered that results in contaminated groundwater inflow after the completion of construction (for example, during sump pump operations in tunnels and stations), then discharges from project sump and underdrain systems may need long-term permitting. The long-term National Pollutant Discharge Elimination System (NPDES) permit would require periodic sampling and analysis to determine compliance with effluent limits. If the contaminant concentrations exceed the effluent limitations, then treatment would likely be required before discharge of the effluent.

b. Short-Term Construction Effects

Preferred Alternative construction through contaminated areas would be subject to regulatory requirements for appropriate management and disposal of contaminated materials to protect workers and the public. The greatest potential effects are expected in areas of deep excavation, such as tunnel sections, where dewatering would be required and greater volumes of contaminated soil may be encountered.

Asbestos was not detected in multiple bedrock samples from the two tunnel sections. However, asbestos minerals are known in similar bedrock types elsewhere in Maryland; therefore, asbestos analysis would be performed on future rock core samples along the tunnel sections to provide additional confirmation.

Construction-related effects are also expected during shallow utility excavation and surface construction dewatering. These activities would not encounter contamination similar to deep excavation activities since the soils would not be in direct contact with groundwater. However, near-surface construction would need to include the management of effects related to residual petroleum, metal, and solvent contamination, which are expected to occur within 5 feet of ground surface in some areas, as well as the dust created during construction.

Excavated Soils

Excavated materials that contain contaminant concentrations exceeding the applicable MDE regulatory level would be considered as regulated waste materials for the purposes of off-site disposal, unless onsite reuse is authorized by MDE. MDE defines soils that contain more than 10 milligrams per kilogram (mg/kg) of petroleum hydrocarbons as oil-contaminated soil, which must be disposed of at an approved oil-contaminated soil treatment facility, unless on-site reuse is authorized by MDE.

Soils that contain non-petroleum contaminants would require disposal in an approved landfill facility or off-site treatment facility. If the contaminants are present in very high concentrations, off-site remediation, chemical stabilization, or recycling of the materials may be appropriate. Typically, soils with obvious contamination would need to be characterized for the disposal facility by performing analyses for hazardous waste characteristics such as corrosivity, ignitability, presence of PCBs, and TCLP.

Tunnel Muck

Tunneling activities may encounter potential contamination within the excavated soils or tunnel muck because of the presence of residual soil contamination and contaminated groundwater. Muck is described as a combination of excavated soil, rock, groundwater, and any conditioning additives that were required for the excavation and/or muck removal process.

During excavation activities, the tunnel muck would be stockpiled for loading and disposal. Dewatering of the tunnel muck would be performed as part of the separation process, and affected water generated would be handled in the same manner as described in the following paragraphs. Depending on the contaminant levels present in the muck, disposal of these materials may include re-use as borrow material or disposal at an approved landfill. Prior to reuse or disposal, representative samples of the muck stockpiles would be collected and submitted for laboratory analysis to properly characterize the waste. Based on the analytical results, it can be determined if the materials are suitable for reuse, or that the materials meet the analytical requirements specified by the approved landfill. Typically, such requirements include analysis of representative samples for RCRA waste characteristics, including TCLP analysis for common waste parameters. The quantity of samples and laboratory analysis required would be dictated by the specific requirements of the operating permit for the disposal facility.

Dewatering

Dewatering activities near contaminated zones may result in the collection and discharge of contaminated groundwater. Where this occurs, treatment of the dewatering effluent may be necessary before discharge. In most cases, the contamination would likely consist of petroleum hydrocarbons, and treatment with an oil/water separator and carbon filtration system would reduce the petroleum concentrations sufficient for discharge to the stormwater system. Dewatering treatment would be performed under MDE's General NPDES permit for the discharge of treated groundwater from oil-contaminated groundwater sources.

The permit sets numerical limits on the effluent concentration of oil product contamination following treatment of the contaminated groundwater. The limits are based on what has been demonstrated to be technologically achievable. Self-monitoring is required to verify compliance. The permit also requires testing to verify that the effluent is not toxic to aquatic life. This is a requirement of the Clean Water Act. All discharges would comply with the effluent limitations and monitoring requirements as described in the general permit conditions.

Potential Effects to Construction Staging Areas

The proposed construction staging areas identified in **Chapter 3** of this FEIS have been reviewed for potential contamination as part of the Preferred Alternative. These staging areas could be impacted by residual contamination associated with previous and current land uses, within the first 5 feet of the ground surface. Additional analysis would be conducted as part of the Phase II investigation on these staging areas.

Demolition Debris

Where existing buildings would be acquired for right-of-way purposes, pre-demolition surveys would be required to determine the appropriate demolition and debris disposal methods. For the purposes of characterizing the waste and selecting the appropriate disposal method or location, a representative sample of the waste would be submitted for laboratory analysis and analyzed according to the TCLP analysis for lead.

Health and Safety Plan

Construction workers would be more likely than the general public or local residents to have complete exposure pathways for soil and groundwater contaminants. MTA would provide the hazardous materials reports and the results of supplemental investigations with the contract documents for the proposed construction. Construction contractors would be required to develop and implement a site-specific health and safety plan (HASP) that identifies the potential risks and details the appropriate personal protective equipment (PPE) required to protect the onsite workers, in accordance with 29 CFR 1910.120 and 29 CFR 1926.65. The HASP would address the anticipated contamination including: equipment and procedures to protect the workers and general public, monitoring of contaminant exposures, and identifying the contractor's chain of command for health and safety.

c. Mitigation

Mitigation measures would be incorporated throughout the project to limit the effects from hazardous materials. A list of mitigation efforts include:

- During Final Design and construction, if contaminated soils are identified and encountered, off-site remediation, chemical stabilization, or other treatments and disposal options will be evaluated.
- For existing buildings acquired for right-of-way purposes, pre-demolition surveys will be prepared to determine the appropriate demolition and debris disposal methods.
- Construction contractors will be required to develop and implement a site-specific health and safety plan. The plan will address the anticipated contamination including: equipment and procedures to protect the workers and general public, monitoring of contaminant exposures, and identifying the contractor's chain of command for health and safety.

5.23 Utilities

5.23.1 Introduction and Methodology

This section of the Final Environmental Impact Statement (FEIS) describes the existing utilities and service providers within the project study corridor, as well as the potential effects of the Preferred Alternative to these existing utilities during construction and operations.

Proper planning and implementation of mitigation techniques will be essential to address and limit the utility effects associated with the Preferred Alternative. Utility disruptions have the potential to affect residents and commercial businesses throughout the project study corridor and beyond.

The process of gathering existing utility data has advanced through the following tasks:

- Obtaining utility records from utility service providers,
- Coordinating with various utility agencies and owners,
- Conducting field surveys,
- Developing composite utility mapping; and
- Verifying potentially affected utilities through specific test pits, vacuum test holes, and manhole/vault surveys.

Potential utility effects were determined based on the criteria outlined in the Maryland Transit Administration (MTA) *Red Line and Purple Line Design Criteria Manual* (April, 2012). The minimum preferred horizontal distance from underground utilities is 10 feet from the centerline of the adjacent track for ballasted track sections and 7 feet from centerline of the adjacent track for embedded track sections. The minimum preferred vertical clearance from the top of rail for both ballasted and embedded track sections to the top of the utility passing beneath the track is 5.5 feet. These criteria provide a general guide for evaluating potential utility effects and designing proposed relocations during the construction of the transitway. This section documents potential effects to utilities because of construction of the transitway. Effects associated with the Preferred Alternative related to traction power stations, underground stations, platforms, road improvements, overhead catenary systems, and supporting infrastructure will be further investigated as the project moves into Final Design. Detailed mitigation will also be identified as the project moves into Final Design.

Early coordination meetings with various utility owners throughout the project study corridor have occurred, and are essential in determining exceptions to the design criteria based on specific utility related issues including age, construction materials, and ongoing maintenance and repair issues.

Utility effects may generally be classified by three categories as follows:

1. Permanent relocation of an existing utility that is physically in conflict with the Preferred Alternative including proposed transitway, associated structures, excavation, or grading.
2. Temporary relocation of an existing utility that is physically in conflict with construction activity and would be permanently relocated after completion of the respective construction activity. In some instances the permanent location for the relocated utility

may be the original location. Temporary relocations would predominately be associated with the construction of the tunnel portals and underground stations.

3. An existing utility that is not physically affected and may remain in place, but requires structural protection to support the utility during construction activities or to reinforce the utility to protect against the additional loads associated with the transitway.

Outages may be required to complete connections of relocated utilities to existing utilities. These outages would require advance notice to, and coordination with, the utility owner in order to minimize potential effects to customers. It may also be necessary in some instances for the contractor to notify impacted customers. To the extent possible, outages would be scheduled to occur during non-peak periods in order to minimize potential effects to the utility owners and customers.

5.23.2 Existing Conditions

Typical utilities within the project study corridor include water, sewer, gas, steam, chilled water, electric, high voltage power, telephone, cable television, petroleum, and fiber optics. Some utilities such as electric power, telephone and communications may be located overhead on utility poles rather than in underground conduits or ductbanks. The Johns Hopkins Bayview Medical Center on the east side and Social Security Administration on the west side each maintain a private network of campus-related utilities.

In addition to the utility relocations, there are storm drain effects throughout the Preferred Alternative alignment. The storm drainage systems within the project study corridor would be designed in accordance with Maryland State Highway Administration, Baltimore County and Baltimore City criteria, and generally would maintain current drainage patterns. The proposed storm drain system would be designed to utilize existing storm drain infrastructure as feasible, and new proposed storm drain features would be located to minimize utility conflicts, thus reducing potential utility relocations.

In the *Utilities Technical Memorandum (*refer to **Appendix D**) major utilities are identified based on size and complexity to relocate or protect. Such utilities include electric transmission lines, water mains greater than 16 inches in diameter, sewers greater than 15 inches in diameter, gas mains greater than 8 inches in diameter, steam mains, chilled water mains, and fiber optic lines. Utilities identified and discussed in the technical report include:

- Electric distribution and high voltage transmission
- Water supply system
- Sewer system
- Natural gas service
- Steam and chilled water
- Communications
- Petroleum and fuel oil lines

5.23.3 Future No-Build Conditions

Utility modifications including relocations and upgrades are anticipated under the No-Build Alternative. Planned roadway and development projects throughout the project study corridor include the Uplands Development, reconstruction of the Edmondson Avenue Bridge over Gwynns Falls Park, West Baltimore MARC Station Park-and-Ride expansion, Bayview MARC Station, Canton Crossing Development, Boh'Donnell Connector roadway project, and Cassell Drive relocation as part of Hopkins Bayview Master Plan. Effects to major utilities associated with these projects would be addressed as part of their respective designs and construction.

Baltimore City and Baltimore County have each entered into a Consent Decree with the United States Environmental Protection Agency (EPA), the State of Maryland Department of the Environment (MDE), and the United States Department of Justice (DOJ). As part of the Consent Decree, Baltimore City and Baltimore County are responsible for various upgrades and new construction throughout the existing sewer collection and conveyance systems. This work is required regardless of the final disposition of the Preferred Alternative.

The water transmission mains along Edmondson Avenue, Franklin Street and Lombard Street are approximately 100 years old and in need of rehabilitation or replacement. This work is required regardless of the final disposition of the Red Line project. Baltimore City has in fact delayed the rehabilitation or replacement of these transmission mains to allow for coordination with the Red Line project.

Baltimore Gas and Electric (BGE) has planned upgrades to the 24- and 26-inch diameter Granite gas transmission mains that are located in Baltimore County. Relocation of the portion along Security Boulevard was initiated in summer of 2012. The other portion from the proposed I-70 Park-and-Ride to Cooks Lane is currently under design and is planned for construction in summer 2013. This work and the associated construction and disruptions in service are planned regardless of the proposed Red Line project. The Edmondson Avenue, Franklintown Road, and Franklin Street 12-inch diameter and larger gas mains are approximately 100 years old and may require rehabilitation or replacement regardless of the proposed Red Line project.

5.23.4 Preferred Alternative

Extensive utility effects related to the Preferred Alternative are anticipated because of the significant number of utilities located within the project study corridor. Utilities that would be affected by construction of the Preferred Alternative include water, sewer, gas, electric conduits and ductbanks, telephone conduits and ductbanks, steam, chilled water, cable television, and fiber optics. Composite utility plans have been developed based upon records received from the various utility companies. The composite utility plans would be used to create the plan and profile drawings for proposed utility impact mitigation. Preliminary utility effect mitigation drawings, items, and quantities have been prepared for the purpose of developing an order of magnitude construction effort for relocation, encasement, or support of utilities. During the Final Design phase of the project, concrete encasement of telephone, electric, fiber optics, and cable television facilities in lieu of relocation would be investigated. To the extent possible, utilities needed for operation of the Preferred Alternative would be designed within the existing right-of-way of dedicated roadways or in utility easements.

a. Long-Term Operational Effects

Utilities in direct conflict with the proposed transitway, associated structures or grading required as part of the Preferred Alternative construction would be relocated in accordance with the utility owner's standards and the *MTA Red Line and Purple Line Design Criteria Manual*. Where a conflict exists between the owner's standards and the *MTA Design Criteria Manual*, the owner's design standards shall govern. To the extent possible, utilities affected by the transit system construction should be supported and protected in place in accordance with the utility company's standards rather than relocated. Supporting and protecting utilities in place helps reduce outages and potentially reduces the limit of disturbance. The utility and storm drain effects along the five corridor segments of the Preferred Alternative, as well as the operations and maintenance facility (OMF), are summarized in **Table 5-53**. Refer to **Section 2.4.2** of this FEIS for a description and map of the five segments in the project study corridor.

Table 5-53: Major Utilities Affected by Segment

Affected Utility	Location	Owner(s)	Impacts
West Segment			
Two 16-inch water mains	Intersection of Security Boulevard and Rolling Road	Baltimore City	• Potential relocation, reinforcement, or protection because of additional loads associated with proposed transitway crossing
115kv underground electric transmission line	Along Security Boulevard and the Security Square Mall parking lot	BGE	• Crosses Preferred Alternative alignment; test hole proposed to determine potential effects • Potential relocation, reinforcement, or protection because of additional loads associated with proposed transitway crossing
Fiber optic cable	Along Security Boulevard	Verizon Business	• Relocation required because of longitudinal conflict with proposed transitway alignment
Various sanitary sewers	Transverse crossings of the Preferred Alternative alignment	Baltimore County	• Baltimore County is in the process of upgrading antiquated sanitary sewers, potential conflicts to be determined • Potential relocation, reinforcement, or protection because of additional loads associated with proposed transitway crossing

Table 5-53: Major Utilities Affected by Segment

Affected Utility	Location	Owner(s)	Impacts
Underground electric and fiber optics	Along south side of Parallel Drive	Social Security Administration	• Potential relocation, reinforcement, or protection because of impacts associated with proposed roadway improvements
Fiber optic cable	Along Rolling Road crossing Security Boulevard	ICBN	• Relocation, reinforcement, or protection because of additional loads associated with proposed transitway crossing
Cooks Lane Tunnel Segment			
84-inch corrugated metal pipe storm drain	Within and adjacent to Cooks Lane Tunnel west portal	Baltimore County	• Relocation because of direct conflict with tunnel boring operation
48-inch water main; currently inactive		Baltimore City	• May be abandoned and/or removed if impacted by transit tunnel construction, impacts to be determined
48-inch water main		Baltimore City	• May be replaced with 36-inch main if affected by transit tunnel construction, impacts to be determined
Overhead electric		BGE	• Relocation required because of proposed road realignment
8-inch gas		BGE	• Relocation required because of relocation of 84-inch storm drain
12-inch sewer		Baltimore County	• Relocation required because of proposed road realignment
20- and 24-inch water mains		Baltimore City	• Relocation because of direct conflict with tunnel boring operation
12- and 16-inch water mains	Within and adjacent to Cooks Lane Tunnel east portal along Edmondson Avenue	Baltimore City	• Relocation because of cut and cover construction associated with the east portal construction
33-inch diameter storm drain		Baltimore City	
Fiber optic cable		AT&T	

Table 5-53: Major Utilities Affected by Segment

Affected Utility	Location	Owner(s)	Impacts
US 40 Segment			
16- and 20-inch water mains	Along Edmondson Avenue, Franklintown Road, Franklin Street and Mulberry Street	Baltimore City	• Potential conflicts may be avoided through coordination with Baltimore City for rehabilitation/ replacement in advance of Red Line construction • Potential relocation, reinforcement, or protection because of longitudinal conflicts with proposed transitway alignment or loads associated with transitway crossing
20-inch gas mains	Along Edmondson Avenue, Franklintown Road and Franklin Street	BGE	• Potential relocation, reinforcement, or protection because of longitudinal conflicts with proposed transitway alignment or loads associated with transitway crossing
Ductbanks	Edmondson Avenue	Verizon	• Where feasible, ductbanks would be lowered or concrete encased and supported in place rather than relocated to reduce costs and potential outages associated with construction
Transverse utility crossings: water, sewer, gas, electric, telecommunications	Every intersection along Edmondson Avenue, Franklintown Road, Franklin Street, and Mulberry Street	Multiple Owners	• Relocation, reinforcement, or protection of these utilities may be necessary because of insufficient depth below the proposed Red Line profile and additional loads associated with the transitway

Table 5-53: Major Utilities Affected by Segment

<table>
<tr><th>Affected Utility</th><th>Location</th><th>Owner(s)</th><th>Impacts</th></tr>
<tr><td colspan="4">Downtown Tunnel Segment</td></tr>
<tr><td>48-inch prestressed concrete cylinder pipe (PCCP) water transmission main</td><td>Near the western limit of the Downtown Tunnel Segment</td><td>Baltimore City</td><td>• PCCP has been historically susceptible to catastrophic failure; relocation or rehabilitation may be warranted regardless of vertical clearance</td></tr>
<tr><td>54-inch storm drain</td><td rowspan="4">Intersection of West Mulberry Street and Fremont Avenue within the cut and cover area of the west portal</td><td>Baltimore City</td><td rowspan="4">• Anticipated utility and storm drain relocations associated with cut and cover construction of portals and underground stations</td></tr>
<tr><td>16- and 20-inch water mains</td><td>Baltimore City</td></tr>
<tr><td>20-inch gas main</td><td>BGE</td></tr>
<tr><td>15-inch diameter sanitary sewer</td><td>Baltimore City</td></tr>
<tr><td>60-inch storm drain</td><td rowspan="3">Fremont Avenue within the Poppleton Station footprint</td><td>Baltimore City</td><td rowspan="15">• Construction of slurry walls for support of excavation would require severing of utilities and storm drains; utilities and storm drains may have to be temporarily relocated multiple times to maintain services and flows during slurry wall construction
• Temporary roadway decking structures would be required at each station; relocated utilities and storm drains would be supported from the underside of the decking structure
• As design advances, coordination with affected utility owners would be required to phase the shutdown of specific utilities. In some instances where services can be maintained through temporary facilities, a utility may be removed during construction and permanently replaced once backfill of the excavation begins</td></tr>
<tr><td>16- and 20-inch gas mains</td><td>BGE</td></tr>
<tr><td>16-inch water main</td><td>Baltimore City</td></tr>
<tr><td>40- and 42-inch water mains</td><td rowspan="3">Lombard Street within the Howard Street/University Center Station footprint</td><td>Baltimore City</td></tr>
<tr><td>12-inch steam main</td><td>Veolia Energy</td></tr>
<tr><td>60-inch storm drain</td><td>Baltimore City</td></tr>
<tr><td>81-way City ductbank</td><td rowspan="4">Lombard Street within the Inner Harbor Station footprint</td><td>Baltimore City</td></tr>
<tr><td>40-inch water main</td><td>Baltimore City</td></tr>
<tr><td>20-inch gas main</td><td>BGE</td></tr>
<tr><td>12-inch steam main</td><td>Veolia Energy</td></tr>
<tr><td>36-inch gas main and regulator station</td><td>Within the Light Street connector tunnel between the Red Line and the Charles Center Metro Station</td><td>BGE</td></tr>
<tr><td>16-inch water main</td><td rowspan="2">Eden Street and Fleet Street within the Harbor East Station footprint</td><td>Baltimore City</td></tr>
<tr><td>6-foot by 3.5-foot storm drain box culvert</td><td>Baltimore City</td></tr>
<tr><td>16-inch water main</td><td rowspan="2">Fleet Street with in Fell's Point Station footprint</td><td>Baltimore City</td></tr>
<tr><td>8-inch gas main</td><td>BGE</td></tr>
</table>

Table 5-53: Major Utilities Affected by Segment

Affected Utility	Location	Owner(s)	Impacts
27- and 36-inch interceptor sewer	Along Boston Street within the cut and cover area of the east portal	Baltimore City	• Anticipated utility and storm drain relocations associated with cut and cover construction of portals and underground stations
10-inch water		Baltimore City	
20-inch gas		BGE	
18-, 24, and 30-inch storm drain		Baltimore City	
East Segment			
12- and 20-inch gas mains	Along Boston Street	BGE	• As design progresses, relocation, reinforcement, or protection of these utilities may be necessary because of: longitudinal conflicts with the proposed alignment, insufficient depth below the proposed track profile, and/or additional loads associated with the transitway
16-inch water main		Baltimore City	
12-inch gas main	Along South Haven Street	BGE	
20-inch gas main	Along O'Donnell Street	BGE	
16-inch gas main	Along the old Eastern Avenue roadbed	BGE	
16-inch water main		Baltimore City	
24-inch diameter sanitary sewer	Along the Norfolk Southern Railroad right-of-way and Bank Street	Baltimore City	
Fiber optic cable	Along Lombard Street at the intersection of Bayview Boulevard	Verizon	
16-inch water main		Baltimore City	
11-foot by 12-foot Back River Outfall Sewer	North of East Lombard Street near proposed Bayview MARC station	Baltimore City	• Structural analysis may be required to determine if proposed grading and additional loads may affect outfall sewer
Water, sewer, and gas mains less than 8 inches in diameter; conduit ductbanks	Johns Hopkins Bayview Medical Center campus	Privately owned by Johns Hopkins Bayview Medical Center	• As design progresses, relocation, reinforcement, or protection of these utilities may be necessary because of: longitudinal conflicts with the proposed alignment, insufficient depth below the proposed track profile, and/or additional loads associated with the transitway
Operations and Maintenance Facility			
20-inch water main	Franklin Street and North Calverton Street	Baltimore City	• Existing utilities along North Calverton Street would be terminated and
27-inch sanitary sewer		Baltimore City	
8-inch gas main		BGE	

Table 5-53: Major Utilities Affected by Segment

Affected Utility	Location	Owner(s)	Impacts
Overhead and underground electric transmission lines		BGE	removed to allow for redevelopment of the site as part of the OMF
24-inch diameter storm drain		Baltimore City	

b. Short-Term Construction Effects

During construction of the Preferred Alternative (including park-and-ride areas, traction power substations, and road improvements), work that involves excavation within or adjacent to roadways could affect buried utilities. Utilities would be relocated in accordance with the Civil, Traffic, Utilities chapter of the *MTA Red Line and Purple Line Design Criteria Manual* and in accordance with the design guidelines and standards of the various utility owners. Some private utility owners would handle design and construction of their required utility relocations. In these instances, coordination with the utility owners regarding design and construction of the utility relocation work would be performed to avoid conflicts with other proposed utility relocation construction and the Red Line construction schedule.

Other than the open excavation areas associated with the tunnel portal areas and underground stations, the Downtown and Cooks Lane tunnel sections are deep and should pass below the existing utilities without effect. There may be areas where small ground movements could occur as a result of the tunnel construction. If these areas exist, sensitive utilities may need to be replaced or protected prior to tunneling. Sensitive utilities may include cast iron gas and cast iron and prestressed concrete cylinder water mains, particularly those with a history of problems. Any construction activities that could disturb utilities would require special measures to protect them during construction to prevent damage to the mains or lines as well as associated outages to service. These measures could include supporting, replacing or relocating utilities where necessary to avoid service disruptions to utility customers.

Excavation of the downtown underground stations would require temporary and permanent utility relocations. While the excavation is open during construction, utilities that do not conflict with the final station construction would be supported in place to the extent possible to reduce the amount of utility relocation work and associated costs and disruptions. This would typically be accomplished by suspending the utility line from the street deck beams that would be installed as part of the slurry wall construction.

The approval of the utility relocation drawings and maintenance of service connections throughout the project corridor during the construction process would need to be addressed prior to construction of the Preferred Alternative. The design of the utility relocations and subsequent approval by the various utility owners could take up to two years depending on the complexity and extent of the utility relocations. In order to initiate this effort, meetings have already been held with representatives of the different utility owners whose facilities may be affected by the Red Line project. Any unknown abandoned utilities that are encountered during construction would be removed, or otherwise appropriately addressed at the time they are encountered. Temporary and permanent relocation plans, as well as the responsibility for, and coordination of, the relocation work would be developed with each utility company or private or government agency.

Utility services would be maintained throughout construction with no significant effects to overall service. Every effort would be made to limit temporary outages as may be required. Scheduled outages would be coordinated with residents and businesses that may be affected through community outreach.

c. Avoidance and Minimization

Preliminary discussions with BGE have indicated that several gas transmission mains crossing the Preferred Alternative are approximately 60 years old or older, and in need of renewal or replacement. BGE has provided preliminary renewal/replacement plans to the MTA for review and coordination. It is anticipated that some of the antiquated BGE mains would be rehabilitated or replaced prior to construction of the Red Line. MTA will continue to coordinate with BGE to develop utility alignments that would avoid potential conflicts with the Preferred Alternative.

Multiple transverse sanitary sewer crossings of the transit alignment occur throughout sections of the Preferred Alternative alignment in Baltimore County. The County is currently completing structural pipe lining rehabilitation of its antiquated collection sewers. There may be opportunities for the sewers to be rehabilitated by Baltimore County well in advance of Red Line construction; therefore, reducing the costs and effects associated with Red Line construction.

In Baltimore City, areas of the water mains transecting the Preferred Alternative alignment are approximately 100 years old and in need of rehabilitation or replacement regardless of the proposed Red Line construction. There may also be opportunities to coordinate the rehabilitation or replacement of these utilities with the Preferred Alternative construction to reduce effects and in a manner that completes the utility work well in advance of Red Line construction. Refer to the *Utilities Technical Memorandum* for additional details on specific locations of current utilities projects and Red Line coordination with the utility owners.

d. Mitigation

All utility-related effects will be addressed in advance of, or in conjunction with, the proposed Red Line construction. Therefore, there is no required long term mitigation associated with the anticipated utility effects resulting from the proposed Red Line construction activities. As is typical for any utility infrastructure, there would be ongoing system preservation efforts which include periodic maintenance and construction that may impact distribution and service. However, these efforts are independent of the proposed construction and operation of the Red Line project. The replacement or relocation of some of the aging utilities to current engineering standards should help reduce the probability and frequency of failures and other problems in providing service.

5.24 Indirect and Cumulative Effects

5.24.1 Introduction and Methodology

In addition to the direct effects detailed in previous sections, the Preferred Alternative would result in indirect and cumulative effects to resources in the project study corridor and beyond. An indirect and cumulative effects analysis was completed to assess the potential indirect (secondary) and cumulative (incremental) effects of the Preferred Alternative when combined with other past, present, and reasonably foreseeable future actions in the vicinity of the project study corridor.

The Council on Environmental Quality (CEQ) regulations set forth in 40 CFR § 1500 et. Seq., require federal agencies to also consider the potential for indirect and cumulative effects from a proposed project. The CEQ regulations define the impacts and effects that must be addressed and considered to meet the National Environmental Policy Act (NEPA) requirements, as follows:

- Direct effects are caused by the action and occur at the same time and place (40 CFR § 1508.8(a))
- Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR § 1508.8(b)).
- Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7).

The terms “effects” and “impacts” are considered synonymous, as used in the CEQ regulations. The resources evaluated for indirect and cumulative effects resulting from the Preferred Alternative include those socioeconomic, cultural, and natural resources directly affected by the project.

A combination of analysis methodologies were employed to assess indirect and cumulative effects. The analyses were based on readily available information and data including:

- Trend Analysis: historic data were collected to understand past events and patterns, as well as the rates at which effects occurred.
- Map Overlays: mapping layers were compiled to create a reasonable and foreseeable future land use scenario.

The indirect and cumulative effects analysis included the identification of resources of interest and establishment of the geographic boundary and temporal boundary (time frame) for which the analysis was conducted. Analysis included determination of past, present, and reasonably-foreseeable future projects and analysis of indirect and cumulative effects to resources of interest within the defined temporal and geographic boundaries.

a. Resources of Interest

Any resource or component of the physical, natural, or social environment that is directly affected by the Preferred Alternative is included in the indirect and cumulative effects analysis. **Table 5-54** lists the resources evaluated for this indirect and cumulative effects analysis, along with the boundary within which they will be analyzed.

Table 5-54: Indirect and Cumulative Effects Analysis Resources and Geographic Boundaries

Resource	Representative Sub-Boundary
Land Use	Subwatersheds
Transit Oriented Development	Subwatersheds
Air Quality, Greenhouse Gases, and Climate Change	Subwatersheds
Floodplains	Subwatersheds
Forests	Subwatersheds
Community Facilities and Services	Station Area
Demographics and Environmental Justice	Station Area / US Census Tracts
Economic Conditions	Station Area / US Census Tracts
Public Parks and Recreational Facilities	Station Area
Cultural Resources (Built Historic Properties and Archeological Sites)	Station Area
Noise and Vibration	Station Area
Street Trees	Station Area
Hazardous Materials	Station Area
Utilities	Station Area

As part of the indirect and cumulative effects analysis, all direct effects of the Preferred Alternative are evaluated. Potential indirect and cumulative effects will be assessed within the overall indirect and cumulative effects analysis boundary by either the subwatershed area in which they are located or by the station area they are located closest to. Station areas were chosen as representative areas where development could occur. The subwatersheds were chosen to represent the environment within which the natural resources could be potentially affected by the project.

b. Geographic Boundary

The indirect and cumulative effects analysis geographic boundary was developed using the boundaries of environmental resources, traffic analysis zones and socioeconomic units that would be directly and indirectly affected by the Preferred Alternative. Those areas traversed by the Preferred Alternative were synthesized to create the overall indirect and cumulative effects analysis geographic boundary (see **Figure 5-12**).

The indirect and cumulative effects analysis boundary encompasses approximately 64 percent of Baltimore City, as well as a small portion of eastern Baltimore County (between US 40 and MD 150), a portion of Western Baltimore County surrounding both sides of I-695 between I-795 and US 40) and a very small portion of northern Anne Arundel County.

c. Temporal Boundary

The indirect effects analysis assesses the effect the proposed project would have on resources directly affected by the action during the present and into the foreseeable future (2012-2035). The cumulative effects analysis assesses the effects the proposed project would have when combined with other past, present, and reasonably foreseeable future actions. The time frame established for this assessment is from 1950 to 2035.

The past time-frame was selected based upon available Census data, historic events, development trends, and population changes. The future time-frame was chosen because it encompasses the period of time that the proposed action's effects will persist beyond the project life. The year 2035 was selected as the horizon year because existing regional plans and projections have been forecasted up to that point in time. Actions intended for a time beyond 2035 are not considered reasonably foreseeable.

Baltimore City and Baltimore County are both expected to experience a steady increase in population growth between 2012 and 2035. However, the trends indicate that much of the growth within the indirect and cumulative effects analysis boundary will occur in the form of redevelopment, as opposed to new construction requiring changes in land use. Therefore, significant changes in land use caused by development are not anticipated within the project study corridor. Details on the geographic and temporal boundaries are provided in the *Indirect and Cumulative Effects Analysis Technical Memorandum* in **Appendix I**.

d. Past Projects

Several significant historic events shaped the development of Baltimore between the 1950s and today. After World War II suburbanization began to spread and residents migrated from the City into the surrounding counties. By the 1950s between 7,000 and 8,000 houses a year were being constructed in the counties and as population migrated out of the City, retail and industry followed. In the 1950s and 1960s many residential areas in the City were demolished to make way for new expressways, schools, and public housing projects. During this time, the City as a whole and in particular the Edmondson Village area, experienced a notable shift in the composition of home owners as white residents were replaced by African-Americans. During this period home values decreased.

Another significant development that was completed in 1962 was One Charles Center. As the first modern office tower to be constructed in Baltimore, it was considered a success and a catalyst for continued office, hotel, residential and retail developments in the area. The success of Charles Center enabled continued investment in the renovation of downtown Baltimore. Using Federal Urban Renewal Funds the City constructed new infrastructure of piers, bulkheads, roads, utilities, and parks along the waterfront. In the 1980s and 1990s development continued with Harborplace, the National Aquarium, Power Plant, the Gallery, the Maryland Science Center, and the new Baltimore Visitors Center.

Significant transportation projects that were completed during the several decades prior to the initiation of the Red Line are listed below. These projects are considered significant because they, in part, have laid the foundation for the need to develop an east-west transit line in the Red Line project study corridor.

Highway Projects

- 1955-1962: Opened segments of the I-695 beltway around Baltimore City
- 1969: Easternmost segment of I-70 opened
- 1971: I-95 between the Baltimore Beltway and the Washington DC Capital Beltway completed

Transit Projects

- 1965: Baltimore Area Mass Transportation Plan, framed future rail transit system
- 1983: "Section A" of Metro line opened, from Charles Center to Reisterstown Plaza
- 1987: "Section B" of Metro Line opened, from Reisterstown Plaza to Owings Mills
- 1992: North-South Light Rail Line opened for service connecting Timonium to Glen Burnie
- 1994: "Section C" of Metro Line opened, from Charles Center to Johns Hopkins Hospital
- 1997: Light Rail extended to Hunt Valley, BWI Airport and Penn Station
- 2002: Baltimore Region Rail System Plan adopted, identified Red Line as one of three priority corridors

e. Present Projects

Presently Funded Transportation Improvement Projects

Funded transportation improvement projects listed in the *Baltimore Region Transportation Improvement Program* (2012-2015) (including transit, regional highway, local, and bicycle/pedestrian improvements) are currently underway within Baltimore City and Baltimore County portions of the indirect and cumulative effects analysis boundary area. The present transportation improvement projects are shown on **Figure 5-13**. A complete list of these projects is included in the *Indirect and Cumulative Effects Analysis Technical Report*.

Development Projects

Major development projects that are currently planned or underway within the project study corridor are summarized below by segment.

<u>US 40 Segment</u>

The US 40 segment contains one significant development project which is currently under construction. When complete, the Uplands residential development will occupy 100 acres and contain 1,100 mixed income dwelling units.

<u>Downtown Tunnel Segment</u>

The Downtown Tunnel segment contains several development projects. Beginning in the west, near the Poppleton Station, there are two development projects: one 22,000-square foot residential complex and a 200,000-square foot University of Maryland cancer treatment center. Farther east there are plans to construct a multi-use development with 1,800 dwelling units and 100,000 square feet of retail space. Plans to construct a 203,000-square foot commercial lab and office building for the University of Maryland have been submitted for approval.

In downtown Baltimore, near the Inner Harbor station, there are five approved projects that are currently on hold: three hotel projects (ranging from 150 rooms to 300 rooms); one 100 unit hotel/residential project; and a mixed-use redevelopment of the former Mechanic Theater containing a 120,000-square foot hotel, 100,000 square feet of retail, and a 250,000-square foot residential component. In the Harbor East Station area, an approved 1.8-million square foot office and retail complex will be proceeding in phases. In the Fell's Point Station area near the Broadway Market there is an approved 155-dwelling-unit project approved. Approved, but on hold, is a 92,700-square foot, 130-room Aloft Hotel, a 725-dwelling-unit residential project, and a mixed-use 284-dwelling-unit and 13,000-square foot retail project.

West Segment

Development plans within the West segment include the subdivision of four small residential lots, resulting in nine additional dwelling units and new construction of a warehouse, hotel/motel, 16-unit apartment building, two 121,000-square foot office buildings and three office buildings ranging from 18,000 to 36,000 square feet.

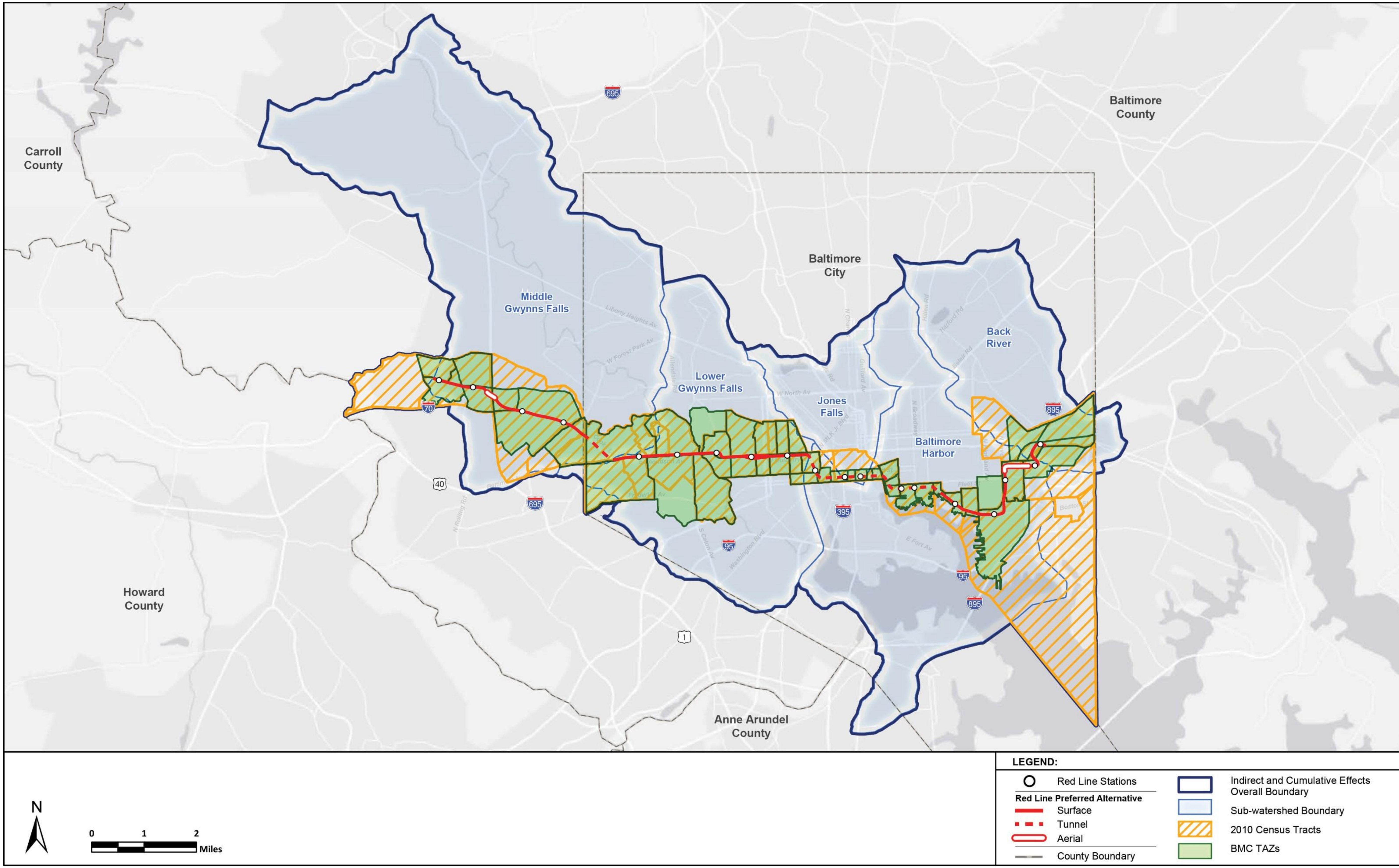


Figure 5-12: Indirect and Cumulative Effects Boundary

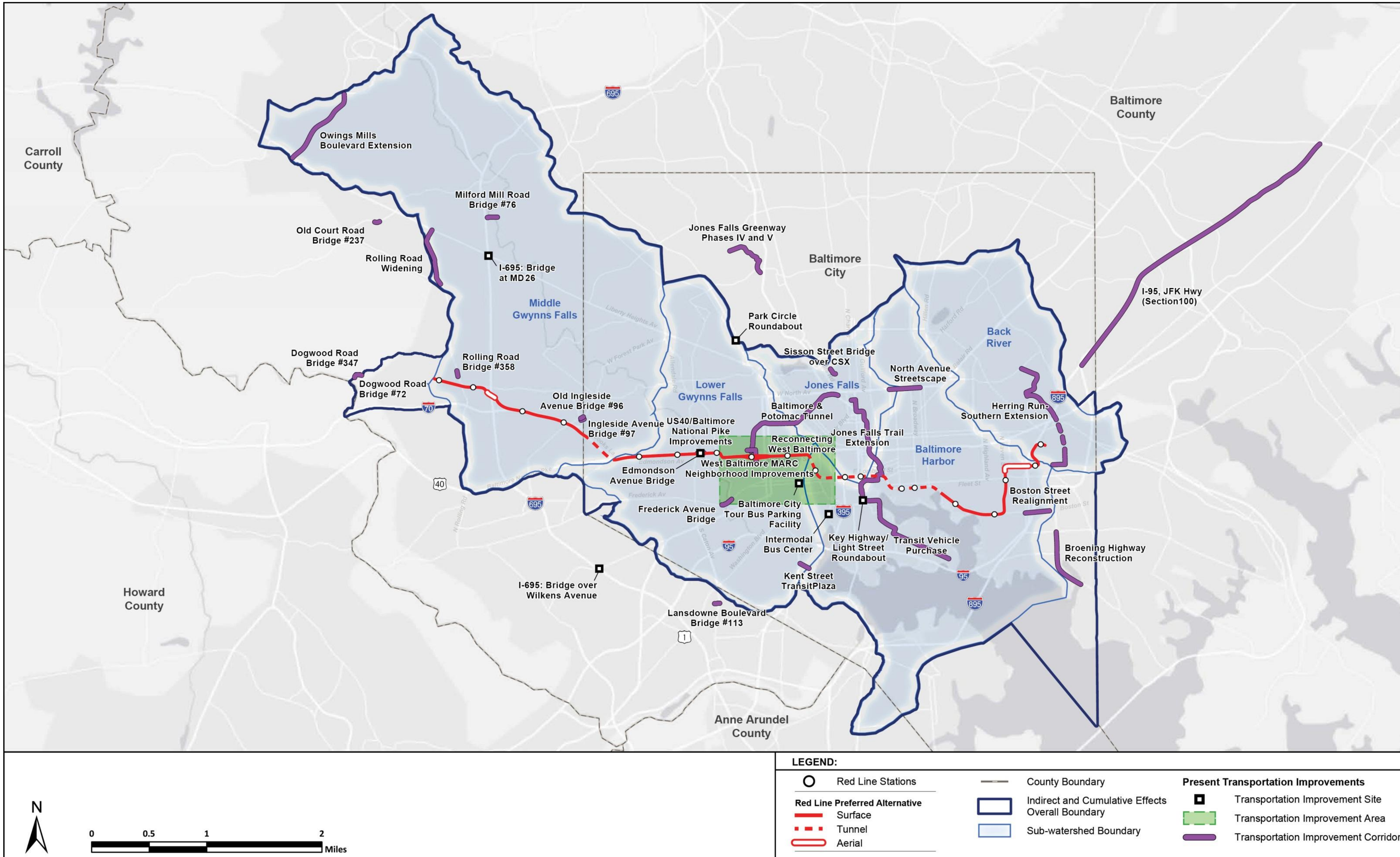


Figure 5-13: Present Transportation Projects

Cooks Lane Tunnel Segment

There are no development projects under construction, approved, or planned within the Cooks Lane Tunnel segment.

Also near the Fell's Point station, the Union Wharf residential complex is under construction. The development contains 280 dwelling units and is expected to be completed by 2014. Also near the Fell's Point Station, there is a 100-unit apartment project planned.

East Segment

Within the East segment there are several proposed development projects. Adjacent to the Brewers Hill/Canton Crossing Station, there is a large mixed-use development project that is ongoing. The Brewers Hill project is expected to be a total of 1.9 million square feet and include 430 dwelling units, 600,000 square feet of retail space, and 650,000 square feet of office space. Also near the Brewers Hill/Canton Crossing Station there are three approved projects. One project will have between 220 and 440 apartments and between 5,000 and 19,000 square feet of retail space. Another is a 480,000-square foot mixed-use shopping center, and the third project is a 700-space parking garage.

East of the Highlandtown/Greektown Station is a 17.9 acre residential development site. Approximately 4.5 acres of the site are partially built. Near the Bayview Station, the National Institute of Health is constructing 5 million square feet of new office space.

f. Reasonably Foreseeable Future Projects

Reasonably foreseeable future transportation projects within the indirect and cumulative effects analysis boundary have been gathered from the long range planning document, *Plan It 2035*, adopted by the Baltimore Regional Transportation Board in November 2011. *Plan It 2035* was developed with local, state, and federal transportation agencies, area business leaders, community advocates, and other stakeholders. The projects within the indirect and cumulative effects analysis boundary are summarized in **Table 5-55** and shown on **Figure 5-14**.

Table 5-55: Reasonably Foreseeable Future Projects

Transit Projects	Regional Highway Projects	Local Projects	Bicycle/Pedestrian Projects
• Bayview MARC and Intermodal Station • MARC Camden Line • MTA Green Line • MARC Growth and Investment (2016-2025 and 2016-2035) • MTA Bus • MTA Bus and Rail Improvements • MTA Transit • Red Line	• I-695 (MD 122 to I-95)	• Canton Truck Bypass • Security Boulevard Extension • North Ave/Harford Road Roundabout • I-695 Bridge over Milford Mill Road	• Haven Street Trail (Red Line Rail with Trail) • Martin Luther King, Jr. Side Path • Red Line Trail • Herring Run – Southern Extension • Bicycle/Pedestrian Access to Rail Stations

Sources: Baltimore Region Transportation Improvement Program 2012-2015, Baltimore Regional Transportation Board "Plan It 2035"

5.24.2 Existing Conditions

Existing conditions are described by the subwatershed or station area within which they are located (as shown in **Table 5-54**). Summary descriptions of the subwatersheds and station areas within the overall indirect and cumulative effects analysis boundary are provided below.

a. Subwatersheds

There are five subwatersheds included in the indirect and cumulative effects analysis boundary (see **Figure 5-12**). The Back River subwatershed is located in the north and eastern part of Baltimore City and covers portions of south central Baltimore County. Land use within the subwatershed is predominantly high- and medium-density residential and industrial.

The Jones Falls subwatershed is located in northern and central Baltimore City and in a portion of central Baltimore County. Land use in this subwatershed is predominantly high-density residential and commercial.

The Baltimore Harbor subwatershed is located in central and southeastern Baltimore City and has a small portion within northern Anne Arundel County. Land use in this subwatershed is predominantly high-density residential and industrial. Land use in this subwatershed is predominantly high-density residential and industrial.

The Middle Gwynns Falls subwatershed is located in southwestern Baltimore County and western Baltimore City. The predominate land uses in this subwatershed are residential and forest.

The Lower Gwynns Falls subwatershed is located almost entirely within the west side of Baltimore City. Land use in this subwatershed is predominantly residential and industrial.

b. Station Areas

The Preferred Alternative would traverse a physically and demographically diverse area in Baltimore County and Baltimore City. The Preferred Alternative would run through suburban areas with low-density development in Baltimore County, to moderately dense neighborhoods of West Baltimore, and through the densely developed downtown central business district to the moderately dense neighborhoods of East Baltimore. While the area around each station is unique, more details on the station areas are provided in the *Indirect and Cumulative Effects Analysis Technical Memorandum*.

5.24.3 Future No-Build Conditions

The No-Build Alternative would not directly or indirectly affect any of the factors within the indirect and cumulative effects analysis boundary as the Red Line would not be constructed under the No-Build Alternative. Though the No-Build Alternative would not involve any project-related construction, there would be changes to the environment and land use as a result of other unrelated projects.

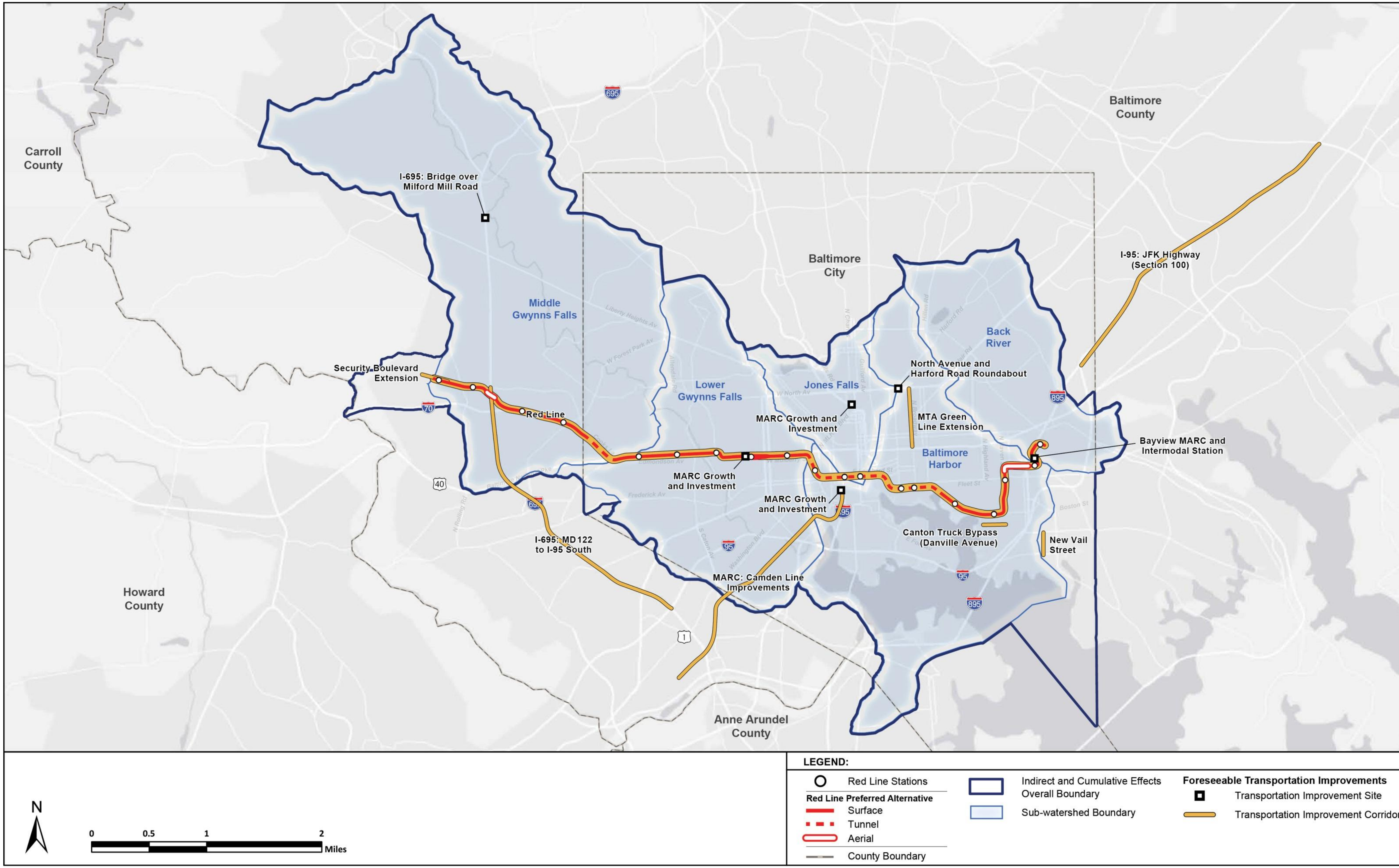


Figure 5-14: Foreseeable Future Transportation Projects

5.24.4 Preferred Alternative

This section discusses the potential indirect and cumulative effects to environmental resources within the overall indirect and cumulative effects analysis boundary and associated with the Red Line Preferred Alternative. As part of the indirect and cumulative effects analysis, all direct effects of the Preferred Alternative were evaluated. Potential indirect and cumulative effects were assessed within the overall indirect and cumulative effects analysis boundary by either the subwatershed area in which they are located or by the station area they are located closest to.

a. Subwatershed Area

Effects to the following resources were assessed within the subwatershed sub-boundary: land use, air quality, floodplains, and forested areas.

Land Use

Operation of the Preferred Alternative would result in minimal changes in land use as most of the Preferred Alternative would be located within existing transportation right-of-way. In addition, the Preferred Alternative would support planned growth in the project study corridor in a manner consistent with Baltimore County and City's plans, policies, and zoning.

The Preferred Alternative could indirectly increase the rate of development within the framework of the existing land use patterns. Any changes in development caused by the Preferred Alternative later in time would be consistent with Baltimore City's plans, policies, and zoning for the area. The potential for growth and land use changes in the region as a result of the proposed project is low, with the exception of redevelopment of vacant parcels and undeveloped areas, particularly near the planned Red Line stations. If this occurs, it could cause gentrification of neighborhoods and potentially spur the loss of some affordable housing. The majority of the land within indirect and cumulative effects analysis boundary is developed; therefore, a large influx in private development is unlikely. The extent, pace, and location of development within the indirect and cumulative effects analysis boundary will primarily be influenced by State, County, and local land use regulations. Therefore, the Red Line would not indirectly induce development from other projects, land use changes, or zoning changes, but may induce indirect effects caused by increases in the rate of development.

There could be an increase in other future transportation improvement projects as a result of the Red Line. This potential indirect effect would be a positive result of the project.

Cumulative effects to the land uses within the indirect and cumulative effects analysis boundary are anticipated to be minimal. The Red Line could cause changes to the rate of development in the area. Thus, when added to the potential increase in rate of development spurred by other unrelated development projects, this could result in the stimulation of development rates within designated growth areas. Although growth would be occurring in designated areas, the increased rate of development may result in faster conversion of land to a different use. This effect would be minimal due the developed nature of the land within the indirect and cumulative effects analysis boundary. Further, both Baltimore City and Baltimore County have made accommodations in their respective long-range plans to account for the possible existence of the Red Line. These factors would result in little to no cumulative effects on land use within the indirect and cumulative effects analysis boundary.

Existing land use regulations, such as Smart Growth, limit the amount and location of development prior to the completion of any project. Zoning regulations are in place to guide development to designated areas, thus managing potential adverse and unwanted effects to surrounding land use.

Transit Oriented Development

Transit oriented development (TOD) refers to development areas that include relatively higher density than the immediate surroundings that may include a mixture of residential, business, shopping, and civic uses and types, located within walking distance of a transit center. TOD can effectively create amenities for existing transit riders, generate new ridership through housing and destinations, reduce auto-dependency, and attract new investments to the area.

The Baltimore City Department of Planning has developed transit-supportive land use strategies to create compact, pedestrian-friendly activity zones near transit stations. In planning for future transit station areas they have partnered with the Maryland Department of Transportation (MDOT), MTA, and Baltimore County to investigate land use policies that support transit as part of the Red Line project.

The station area planning process has included in-depth community outreach and land use, and zoning analysis to help extend and integrate Baltimore's transit system and to leverage transit investments towards achieving community goals.

The potential for growth and land use changes as a result of the proposed project is low as most of the area within the project study corridor contains neighborhoods in an urban or suburban setting. Overall, the proposed project is not likely to cause a substantial change in type or intensity of land use.

Indirect effects from TOD within the project study corridor would be generally positive particularly in western and downtown Baltimore City, where vacancy rates are high. It is anticipated that overall cumulative effects would be beneficial from a corridor system perspective as the Preferred Alternative would provide a benefit to the traveling public with new and expanded transit service. Improved connectivity and accessibility; reduced dependency on auto use; and reduced roadway congestion, and associated air pollution emissions and energy consumption are some of the benefits.

Air Quality, Greenhouse Gases, and Climate Change

One of the primary greenhouses gases is carbon dioxide (CO_2). Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Greenhouse gas emissions trapped in the Earth's atmosphere are a contributing factor to raising temperatures and climate change.

CO_2 emission burdens were estimated for both the No-Build and the Preferred Alternatives. Both of these scenarios include past, present and reasonably foreseeable future actions, as detailed in local area plans, and are therefore representative of the project's cumulative impact. These estimates indicated a slight increase in CO_2 emissions of 0.2 percent from the No-

Build to the Preferred Alternative. Considering the scale of these numbers and the very small predicted percent changes, differences in the predicted CO_2 emission burdens for the Preferred Alternative can be considered insignificant and not measurably different from the No-Build Alternative. As such the project is not predicted to have significant cumulative effects on CO_2 emissions.

Both the No-Build and the Preferred Alternatives would result in indirect greenhouse gas emissions. Greenhouse gases would be emitted during the production and disposal of materials used for project-related construction. For example, emissions would be released during the production of the concrete used in construction or the manufacture of the equipment used during construction. Indirect emissions are also known as embodied and lifecycle emissions. At this time, there is no consistent and standardized method for calculating the embodied and lifecycle emissions for transportation projects. There are no tools currently available for clearly and meaningfully discerning which emissions are attributable to a specific project and which emissions would have occurred without the project. However, as with all environmental disciplines, vendors that produce equipment and materials used in project construction are subject to regulation at their facilities.

Sea level rise is also an expected result of climate change. Both the No-Build and Preferred Alternatives may be subject to effects due to climate change over the next few decades given the proximity of Baltimore to the Inner Harbor in terms of flooding, storm frequency and intensity. Although difficult to predict, it is recognized that the project study corridor is located near water in generally low elevation areas and that appropriate measures to mitigate possible effects can be taken during Final Design. MTA will coordinate with appropriate review agencies and Baltimore City to continue to incorporate best practices into design of the Preferred Alternative, including the stations and ancillary facilities, as more information and better predictive methods become available.

As such, the project is not expected to cause or contribute to a cumulative or indirect impact with regards to climate change.

Floodplains

The floodplains that would be directly affected fall within the Western, Downtown Tunnel, and Eastern segments of the Red Line. The Red Line would impact 0.7 acre of non-tidal 100-year floodplains and 1.0 acre of tidal 100-year floodplains.

Planned development and transportation projects within the indirect and cumulative effects analysis boundary were assessed by comparing planned projects with floodplain boundaries to evaluate potential indirect and cumulative impacts. The majority of the floodplains within the indirect and cumulative effects analysis boundary are within areas that are developed or are within protected parkland areas. The Preferred Alternative is not expected to change land use patterns, but could induce an increase in the rate of development within planned growth areas, which could result in indirect effects to floodplains. Most floodplain areas are protected from development through land use and zoning regulations.

Cumulative effects to floodplains from the Red Line when combined with other planned projects are possible. Disturbance to floodplain vegetation and landscapes may cause loss of hydraulic function. This loss could cause increased flooding, erosion and sedimentation, thus affecting downstream channel morphology. Future development would have minimal effect to 100-year floodplains due to existing regulations and the requirement for approval from the Maryland Department of the Environment (MDE). Permits requiring avoidance, minimization, and mitigation would offset most floodplain disturbances caused by cumulative effects.

Forested Areas

The Preferred Alternative would affect 34.8 acres of forested area and 39 specimen trees in Baltimore County and Baltimore City.

Present and future development projects and transportation projects were compared with the land use plans to determine the potential indirect and cumulative effects to forested areas. Most of the large, contiguous parcels of woodlands are located in protected parkland areas and along streams within the indirect and cumulative effects analysis boundary and are subject to protection from development.

Indirect effects to forested areas could occur as a result of the Preferred Alternative. The Preferred Alternative is not expected to change land use patterns, but could cause an increase in the rate of development which would cause a faster conversion of forested areas to developed areas where growth is designated. A change in the rate of development could adversely affect woodland species and degrade habitat areas. However, woodland conversion would not be inconsistent with historical trends of land use change in the state of Maryland which shows that over the last 50 years, Maryland has lost an average of 7,200 acres of forested woodland each year (Maryland Department of Natural Resources (DNR), 2003).

Cumulative effects to forested areas could occur when the Preferred Alternative is combined with other future transportation and development projects. Cumulative effects are most likely to occur in areas designated for development. Wildlife species would be affected from continued loss of habitat or habitat fragmentation. Indirect and cumulative effects to forested areas will be minimized and mitigated by the state and local laws and regulations.

b. Station Areas

Effects to the following resources were assessed within the station area sub-boundary: community facilities and services, demographics and environmental justice, economic conditions, public parks and recreational facilities, cultural resources, noise and vibration, street trees, hazardous materials, and utilities.

Community Facilities and Services

The Preferred Alternative would affect several properties owned or used by community facilities throughout the corridor. Affected facilities include schools, places of worship, cemeteries, and medical facilities. Portions of the properties of community resources may be acquired permanently, used under a permanent easement, or used during construction through temporary easements. The proposed effects either consist of property sliver takes (or narrow strips of property located directly adjacent to the proposed project) or effects to ancillary facilities such as parking areas or driveways. None of the properties would be fully acquired or displaced and no buildings housing community facilities or services would require permanent relocation.

Direct effects to bus service include: modifications to existing bus routes operating within the project study corridor; new feeder bus service to directly serve Red Line stations and other rail mode stations allowing passengers to transfer to light rail, heavy rail or commuter rail service. Increased access and reduced congestion resulting from the Red Line project are anticipated to improve emergency response times overall within the project study corridor. However, delays from gated crossings could increase response times along those routes.

Also, the elimination of some available on-street parking spaces may result in indirect effects to the surrounding communities, particularly near proposed stations. With fewer spaces available along the Preferred Alternative alignment (particularly along Edmondson Avenue and Boston Street), there could be more parked vehicles on surrounding side streets and a shortage of available spots in these areas. However, current parking restrictions would be eliminated along portions of Edmondson Avenue under the proposed parking configuration. The MTA is committed to working with Baltimore City to identify opportunities to offset the loss of parking during construction and in the long-term.

Cumulative effects to community facilities and services are anticipated to be minor. Future transportation development could incrementally affect community resources by putting added strain on the resources. However, the Preferred Alternative would not alter the pattern of development already affecting the communities surrounding the station areas.

Demographics and Environmental Justice

There are 30 communities throughout the project study corridor that have census tracts that meet environmental justice thresholds. A detailed list can be found in **Section 5.4**. The Preferred Alternative is anticipated to have minor direct effects on the environmental justice communities along the alignment. There would be partial property acquisitions associated with the Preferred Alternative, but these would be small sliver takes of property directly adjacent to the alignment and would not affect the function or use of most properties. The Preferred Alternative is expected to result in positive effects for the local communities by improving accessibility and mobility, reducing travel times and improving efficiency.

The Preferred Alternative is not expected to change land use patterns, but could cause an increase in the rate of development within planned growth areas, which could result in indirect effects to environmental justice populations. Potential indirect effects to environmental justice populations include the reduction in available affordable housing which could result from redevelopment of vacant or under-utilized areas surrounding proposed stations.

Cumulative effects to environmental justice populations could occur as a result of future development within the indirect and cumulative effects analysis boundary, specifically surrounding the stations that would convert affordable housing to areas where the existing population could not afford to live. Cumulative effects are most likely to occur in areas designated for residential development. Given the current land use and pattern of land use development, the areas that are most likely to incur changes in housing affordability are in potential TOD locations.

Economic Conditions

The Preferred Alternative would result in direct effects to businesses both permanently (displacements) and temporarily (during construction). As a result there may be permanent loss of some businesses that are directly affected and do not choose to relocate within the project study corridor. Within the station areas, indirect effects such as changes to the greater community structure (community interaction and the location of some businesses) would occur near the areas of direct effect. Twenty-one properties throughout the corridor would be permanently acquired. Specific details regarding these are summarized in **Section 5.5** and the *Property Acquisitions and Displacements Technical Memorandum* in **Appendix D***.*

Indirect effects of the Preferred Alternative include long-term benefits for the communities it traverses. The Red Line would further goals and policies for revitalization and investment within the indirect and cumulative effects analysis boundary. The fiscal benefits of Red Line operation would have a long-term, positive effect for the surrounding communities. Indirect effects to area businesses may include changes to the intensity of development or the timing of proposed development, due to modifications in access and traffic patterns that would occur with the construction of the Preferred Alternative particularly surrounding stations.

The Preferred Alternative is expected to have positive cumulative effects to the economy within the project study corridor. Cumulative effects to businesses and the economic environment could include additional businesses migrating to the station areas to serve the users of the Red Line. Cumulative effects on local employment would also be beneficial. Future development could create more jobs for local residents, increase available housing in the area, and improve mobility and accessibility for commuters.

Public Parks and Recreational Facilities

Under the Preferred Alternative, permanent direct effects are anticipated to affect two park and recreation areas. Less than 0.1 acre would be permanently acquired from each resource as part of the Red Line project. The access to and use of the facilities would not be affected.

The Preferred Alternative is not expected to change land use patterns, but may cause indirect effects to parkland as a result of changes in the rate of development. This is anticipated to be minor due to the existing land use and developed nature of the station areas.

Cumulative effects to public parks and recreational facilities could occur within areas designated for growth where there is potential for development. The Red Line project study corridor does not contain many vacant or unused properties in the vicinity of the station areas. Cumulative effects to parkland resulting from Federally-funded transportation projects would be regulated through existing laws, including Section 4(f) of the US Department of Transportation Act of 1966, which prohibits the use of park and recreational facilities for transportation uses unless there is no feasible and prudent alternative, or the use is determined to de minimus impact.

Cultural Resources (Built Historic Properties and Archaeological Sites)

Built historic properties in the project study corridor have been evaluated for direct effects. The Preferred Alternative would have an adverse effect on five architectural historic properties: Poppleton Fire Station No. 38, Business and Government Historic District, South Central Avenue Historic District, Fell's Point Historic District, and Public School No. 25 (Captain Henry Fleete School).

Indirect effects to cultural resources could occur by increasing the rate at which potential areas are redeveloped, particularly at vacant sites adjacent to station areas. Although it is not anticipated that adverse cumulative effects to cultural resources would result from the proposed project, other planned and programmed projects could cause cumulative effects to some historic and archeological resources in the project study corridor. Any potential effects resulting from proposed federal actions would be addressed through either the Section 4(f) of the 1966 Department of Transportation Act or Section 106 of the National Historic Preservation Act.

Noise and Vibration

The Red Line would introduce new noise sources into the environment which may cause impact to sensitive receptors primarily because of pass-bys from light rail vehicles. Corridor-wide vibration levels are predicated to increase under the Preferred Alternative, particularly near pass-bys and switches.

Minor indirect noise effects from changes in land use are anticipated only in areas where redevelopment may occur. However, small-scale redevelopment on vacant properties, particularly near station areas, would typically not create a permanent increase in noise or vibration within the area communities. Only temporary increases in noise and vibration would be anticipated during construction.

Cumulative effects to noise and vibration could occur with the construction and operation of future transportation developments within the indirect and cumulative effects analysis boundary. Any cumulative noise effects would be controlled by the local noise ordinances in place and, depending on the project type, could be regulated by the Maryland Department of the Environment, Federal Highway Administration (FHWA) or Federal Transit Administration (FTA).

Street Trees

The Preferred Alternative would result in the removal of 315 street trees in Baltimore County and 948 street trees in Baltimore City.

All street tree effects would be confined to the limit of disturbance for the Preferred Alternative and based on the required mitigation, the anticipated indirect effects to street trees would result in no net loss of trees. During construction accidental spills and sediment and/or concrete washout releases into forest/hedgerow retention areas could affect the health and vigor of edge street trees. After construction is complete, the residual effects from removal of select street trees could negatively affect the health of some remaining street trees due to sun scorch, adjacent changes in grading or slope, or changes to soil moisture etc.

Cumulative effects to street trees could occur when the Preferred Alternative is combined with other future transportation and development projects. Cumulative effects are most likely to occur in areas designated for development or redevelopment, particularly surrounding stations. In these areas, wildlife species could be affected from continued loss of habitat or habitat fragmentation.

Indirect and cumulative effects to street trees will be minimized and mitigated by Baltimore City through the administration of its own roadside/street tree regulations (in lieu of DNR enforcement of the Roadside Tree Law).

Hazardous Materials

The Preferred Alternative has a number of potential direct effects throughout the corridor, specifically the potential areas for contamination include former and current industrial sites and they vary within each segment. **Table 5-56** lists the type of risk for each segment.

Table 5-56: Hazardous Material Contamination Risk

Segment	Impact Risk Type		
	Slight	Moderate	High
West	Yes	No	No
Cooks Lane Tunnel	No	Yes	No
US 40	Yes	Yes	No
Downtown Tunnel	Yes	Yes	Yes
East	Yes	Yes	Yes

There are four station sites (Social Security Administration, Edmondson Village, Harlem Park, and Brewers Hill/Canton Crossing) along the alignment where there are concerns for contamination including petroleum, metals, chromium, and dry cleaning solvents. Potential effects from the Preferred Alternative would be managed by employing a number of mitigation techniques during the construction of the alignment including the implementation of a health and safety plan, segregating contaminated materials, and exercising proper treatment and disposal of contaminated materials.

The Preferred Alternative is not expected to have indirect effects resulting from changes in land use are anticipated. Increases in the rate of development could ultimately create the opportunity for greater discovery of hazardous material deposits and associated remediation of those areas. The increased potential for discovery and remediation would be a positive indirect effect of the project.

Based on the analyses conducted by the project team, there are a number of potential indirect hazardous material impacts along the alignment and near the station areas. These affects include the possibility of elevated chromium, VOC, and arsenic levels in soil samples around four station areas, moderate hazardous risk levels at stations in the Cooks Lane Tunnel, US 40, Downtown Tunnel and East segments and high hazardous risk levels at stations in the US 40, Downtown Tunnel and East segments.

Any new development or redevelopment activities in the area are not expected to release contaminants because of the strict regulations in place regarding hazardous materials. Redevelopment of previously contaminated properties offers the potential to further remediate residual contaminated soils and groundwater that may not have been treated before the current regulatory laws were established. This potential cumulative effect would be an overall benefit to the environment.

Any hazardous materials encountered by construction of a development or transportation project unrelated to the Red Line is required to be properly treated and disposed of as per MDE regulations.

Utilities

The Preferred Alternative would have extensive direct utility effects because of the significant number of utilities located within the project study corridor. Utilities in direct conflict would be relocated in accordance with the utility owner's standards and the Project Design Criteria manual.

Indirect effects to utilities are not anticipated because the project would not require the construction of new utility infrastructure for developments that are not related to the operation of the Red Line. After construction of the Preferred Alternative is complete, construction of any utility that requires replacement or relocation as a result of effects associated with the Red Line project would be in place. Separate planned transportation improvement and development projects throughout the Red Line project study area, and their respective effects to major utilities, would be addressed as part of their respective designs and construction.

The Red Line project, in combination with other future development, could result in cumulative effects to utilities within the indirect and cumulative effects analysis boundary and surrounding the station areas in the form of increased strain on the existing utilities. As is typical for any utility infrastructure, there would be ongoing system preservation efforts which include periodic maintenance and construction that would affect distribution and service.

c. Avoidance and Minimization

Potential indirect negative effects resulting from the project have been and would continue to be minimized through the alignment design and station area planning process, which will continue to include public outreach to residents and communities surrounding station locations.

d. Mitigation

The Council on Environmental Quality (CEQ) regulations, which implement NEPA, requires that Environmental Impact Statements include the consideration and discussion of possible mitigation for project impacts. Measures that would be appropriate to offset most indirect and cumulative effects will be beyond the control and funding capability of the MTA and FTA. The pace and extent of future development within the indirect and cumulative effects analysis boundary will be influenced and controlled by the state, county and city land use plans and policies. MTA will encourage state and local planning agencies that can influence development patterns and promote the benefits of controls that incorporate environmental protection into all planned development.

Possible mitigation strategies for indirect and cumulative effects could be considered by the responsible parties, including state and local planning agencies. These strategies may include low-impact development measures, land use management through planning regulations and zoning, and public education on the benefits of environmental conservation and smart growth.

Possible mitigation measures include specific zoning recommendations to minimize effects on notable features and area neighborhoods, and discourage development within adjacent neighborhoods located outside of the station areas or other areas where development is slated to occur.

Specific mitigation commitments for direct effects from the Preferred Alternative are identified throughout **Chapter 5** in each of the technical sections, when applicable, and summarized in **Section 5.27**.

5.25 Commitment of Resources

5.25.1 Irreversible and Irretrievable Commitment of Resources

The National Environmental Policy Act (NEPA) requires that environmental analyses include identification of “any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.” An irreversible or irretrievable commitment of resources results in the permanent loss of a resource for future uses (or alternative purposes) as they cannot be replaced or recovered.

The No-Build Alternative would not require an irreversible and irretrievable commitment of resources.

Construction of the Preferred Alternative would require the commitment of natural, human, and monetary resources. While some of these resources could be recovered within a relatively short period of time, other resources would be committed irreversibly and irretrievably. Since the Preferred Alternative would be generally constructed within existing roadway rights-of-way, potential effects on resources would be minimal. Natural resources include the land on which the Preferred Alternative would be constructed, water resources, and habitat, and these resources would realize primarily temporary effects during construction. Construction materials such as steel, fossil fuels, energy, cement, aggregate, and bituminous material would be irretrievably expended during grading, tunneling, and track and station construction.

For Design Year 2035, the Preferred Alternative would result in a -1.7 percent change in energy consumption over the No-Build Alternative. The use of this energy is considered an irretrievable commitment of resources because the energy used during construction cannot be used again for some other purpose.

Construction of the Preferred Alternative would require a one-time expenditure of federal, state, and local funds, which are irretrievable because these funds would not be available for other projects.

Employment during the construction period for the Preferred Alternative would create or support 9,800 jobs and with the multiplier effects could create or support 15,000 jobs (refer to **Section 5.6**). Operation and maintenance of the Preferred Alternative could create an additional 200 Maryland Transit Administration (MTA) jobs.

The commitment of these resources is based on the recognition that residents in the area, region and state would benefit from the improved quality of the transportation system. These benefits would consist of improved accessibility and mobility, savings in time and greater availability of quality services that are anticipated to outweigh the commitment of these resources.

5.25.2 Short-Term Effects/Long-Term Benefits

NEPA requires that environmental analyses include identification of "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity." This section compares the short-term uses of the environment (effects of the Preferred Alternative) with the long-term benefits of the Preferred Alternative. For this document, short-term refers to the period of construction – the time when the largest number of temporary environmental effects is most likely to occur. Long-term refers to the period following the completion of construction activities.

The No-Build Alternative would not involve any project-related construction; therefore, short- and long-term project-related effects from the No-Build Alternative are not anticipated.

Construction activities associated with the Preferred Alternative would have short-term effects by disrupting traffic flow and travel routes and reducing parking in the project study corridor. However, the inconveniences to residents, motorists, and transit patrons would be offset by the improved transit system once construction is completed. Any short-term uses of human, physical, socioeconomic, cultural, and natural resources would contribute to the long-term benefits of improved access to employment centers, improvements in both transit accessibility and availability in the project study corridor, and improved air quality in the region. There would also be long-term benefits of implementing transit supportive land use policies and supporting economic development opportunities.

5.26 Anticipated Permits and Approvals

Numerous federal, state, and local permits and approvals would be required during the design and construction phases for various aspects of the project. Permits and approvals are typically obtained as the project design and limits of disturbance are further refined. This includes implementing avoidance and minimization design measures and finalizing construction staging and access areas. Permits include, through interagency coordination, approvals for all media including water, air, land, cultural resources, threatened and endangered species, and waste management/hazardous materials transportation, among others, as applicable to the Preferred Alternative.

Agency coordination has been ongoing since the initiation of project planning, as summarized within the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS), and also summarized in **Chapter 8** of this Final Environmental Impact Statement (FEIS). Coordination with relevant regulatory and resource agencies would continue throughout the Final Design and construction. In regularly-scheduled interagency review meetings held throughout the project planning phase, the Maryland Transit Administration (MTA) has coordinated with the following resource/regulatory agencies:

- US Army Corps of Engineers (USACE)
- US Fish and Wildlife Service (USFWS)
- National Marine Fisheries Service (NMFS)
- US Environmental Protection Agency (EPA)
- Maryland Department of the Environment (MDE): Water Management Administration – Nontidal Wetlands and Waterways Division, Tidal Wetlands Division, Compliance Program, Sediment, Stormwater & Dam Safety Program, Land Management Administration – Oil Control Program
- Maryland Department of Natural Resources (DNR)
- Maryland Historical Trust (MHT)
- Critical Area Commission for the Chesapeake Bay (CAC)
- Federal Highway Administration (FHWA)

Interagency meetings have been held throughout planning and Preliminary Engineering and will continue to occur through the Record of Decision (ROD) and Final Design. The purpose of these meetings has been to keep the agencies well-informed of the project and to obtain any potential issues or concerns of the agencies early in the process and prior to the permitting phase. This coordination assists MTA in addressing agency comments and input early and throughout the design and permitting phases.

Additional agency coordination meetings have been held during the FEIS phase as follows:

- Wetland/Waterway Mitigation Meetings/Field Reviews, attended by MDE and USACE: June 8, September 12, September 27-28, 2012
- Jurisdictional Delineation (JD) Field Reviews, attended by USACE, MDE, USFWS, and NMFS: May 9 and September 27, 2012
- Coordination Meeting to discuss forest impacts and mitigation in Baltimore City, attended by Baltimore City Department of Recreation and Parks – Forestry Division: June 22, 2012
- Preferred Alternative Forest and Tree Field Tour, attended by DNR, Baltimore City Department of Planning, and Baltimore City Department of Recreation and Parks – Forestry Division: May 1, 2012

In addition to federal permits and approvals, the State of Maryland, Baltimore City and Baltimore County also require permits and approvals for certain activities. The Red Line project contractor(s) would obtain the necessary permits from Norfolk Southern, CSX, and Amtrak for railroad access. **Table 5-57** presents a summary of anticipated permit authorizations and approvals that would be required for the Preferred Alternative. Additional permits and approvals will continue to be identified throughout the Final Design and construction phases of the project.

Table 5-57: Anticipated Permits and Approvals Required for the Preferred Alternative

Impacts	Agency	Permit Authorization
Natural Resources		
Disturbance within 1,000-foot tidal Chesapeake Bay Critical Area including 100-foot tidal waters buffer	DNR, CAC	CAC approval
Nontidal waters of the US, Nontidal wetlands, 25-foot nontidal wetland buffer, and 100-year floodplain	USACE	Individual permit
	MDE Nontidal Wetlands & Waterways Division	Nontidal wetlands and waterways permit, water quality certification, construction within a floodplain, coastal zone consistency
Tunnel beneath a navigable waterway	USACE	Authorization under Section 10 of the Rivers and Harbors Act
Forest	DNR, in coordination with Baltimore City Department of Planning	Forest Conservation Act approval
Street trees	Baltimore City Department of Recreation and Parks, Forestry Division	Tree removal permit
Federal and State Rare, Threatened or Endangered Species (RTEs)	USFWS, NMFS, DNR	MD Forest Conservation Act compliance; Endangered Species Act requirements have been satisfied; no further consultation or approvals are required
Dewatering and groundwater withdrawal for contractor dewatering operations associated with tunneling or deep excavations	MDE, Baltimore City, Baltimore County	MDE Water Appropriations Permit, well construction permit delegated to localities and issued by Baltimore City or Baltimore County
Cultural Resources		
Archeological and	MHT	Section 106 compliance

Table 5-57: Anticipated Permits and Approvals Required for the Preferred Alternative

Impacts	Agency	Permit Authorization
historical resources	May need local concurrence from Baltimore Commission for Historical and Architectural Preservation (CHAP) under certain conditions	Section 106 compliance
Public parks/lands and historic sites	Federal Transit Administration (FTA) (local concurrence may be needed to satisfy procedural requirements)	Section 4(f) compliance
Water Resources		
Stormwater management	MDE, Sediment, Stormwater & Dam Safety Program	Stormwater management approval, COMAR 26.17.01 and 26.17.02, Waterway construction permits for new ponds or dams or alterations to existing impoundments
Erosion and Sediment Control (E&SC)	MDE, Sediment, Stormwater & Dam Safety Program	Erosion and sediment control approval, COMAR 26.17.01 and 26.17.02
Petroleum-contaminated groundwater	MDE, Oil Control Program	General permit for the discharge of treated ground water from oil contaminated ground water sources
Point source water pollution	MDE, Compliance Division	National Pollutant Discharge Elimination System (NPDES) general or individual permit to discharge stormwater associated with construction activities, Notice of Intent (NOI)
10% pollutant load reduction when impacts within Intensely Developed Area (IDA) overlay of 1,000’ Chesapeake Bay Critical Area or 100’ tidal buffer	DNR, CAC	CAC approval
Building Permits		
New facilities – Baltimore City	Baltimore City Department of General Services – one-stop permit center	Construction permit, includes approval of architectural, electrical, mechanical, structural, plumbing, stormwater, E&SC (>5000 square feet of earth disturbance), environmental, demolition
Affecting Baltimore City rights-of-way	Baltimore City Department of Public Works	Right-of-entry permit, easements, curb cuts, utility permits, Street Closure permit

Table 5-57: Anticipated Permits and Approvals Required for the Preferred Alternative

Impacts	Agency	Permit Authorization
New facilities – Baltimore County	Baltimore County Department of Permits and Development	Building permit, grading, razing, mechanical, electrical, plumbing, stormwater management, retaining walls, signs, floodplains, E&SC (>5000 square feet or 100 cubic yards of earth disturbance), utilities
Maintenance of Traffic (MOT)	Baltimore City or Baltimore County	MOT phasing to be submitted for approval, contractor variances from approved MOT must be approved
Blasting	Baltimore City or Baltimore County	Obtained by contractor, vibration monitoring program description to be included
Noise variance	Baltimore City or Baltimore County	Contractor application to noise restrictions, especially for nighttime operations
Railroad access permits	Norfolk Southern, CSX, or Amtrak	Required in conjunction with Railroad agreements, obtained by contractor, stipulates insurance requirements, provides mechanism for contractor to request railroad flaggers and other coordination, railroads to invoice MTA directly for protection services

Notes: [1] Permit authorizations may be required to conduct geotechnical drilling if the work is within protected jurisdictions described above.
[2] Assumes that no work would significantly affect a navigable waterway and therefore US Coast Guard coordination is not required.
[3] NEPA requirements are assumed complete, and table lists only permits or approvals that are likely to be required.

5.27 Environmental Commitments and Mitigation Measures

This section identifies commitments and mitigations measures for long-term operation and short-term construction-related impacts to environmental resources identified within this chapter. Specific commitment and mitigations measures related to construction methods and transportation are identified within **Chapters 3** and **4.**

5.27.1 Property Acquisition and Displacements

- Property acquisition activities, including relocations, will be performed in accordance with the USDOT Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) as amended and Federal Transit Administration (FTA) Circular 5010.1D, Grants Management Requirements and all applicable Maryland State laws that establish the process through which Maryland Transit Administration (MTA) may acquire real property through a negotiated purchase or through condemnation.

5.27.2 Neighborhoods/Visual and Aesthetic Resources

- MTA will develop and present to the adjacent communities alternative aesthetic treatments for the operations and maintenance facility that address visual impacts and shall consider the comments of those communities when determining the Final Design.
- MTA will seek community input regarding the aesthetic treatments of ancillary facilities and tunnel portals along the project alignment to address visual impacts.
- MTA will seek input from community organizations and businesses regarding methods to maintain access to neighborhoods, community facilities, and businesses during construction.
- MTA will develop a Tree Protection Plan to protect existing tree buffers and street trees where disturbance is not required for construction.
- MTA will prepare a Landscape Plan for all facilities, including park-and-ride facilities.
- MTA will design lighting to minimize light pollution to the surrounding areas.

5.27.3 Parks, Recreation Land and Open Space

- Mitigation for removal of trees within parklands located in Baltimore County will be completed in accordance with Maryland Department of Natural Resources (DNR) requirements. Trees removed on Baltimore City parkland will be replaced in coordination with the City. The selection of forest mitigation or individual street tree planting sites will be coordinated through DNR and the appropriate agencies with jurisdiction.
- Disturbance to park properties as a result of construction activities, including areas requiring grading, will be restored to acceptable conditions through coordination with the park owners.
- Roadway or sidewalk closures will be staged to maintain pedestrian and vehicular access to parks.

5.27.4 Cultural Resources (Built Historic Properties and Archeological Resources)

- A Programmatic Agreement is being prepared that outlines commitments and mitigations concerning cultural resources. A draft of the Programmatic Agreement is contained in **Appendix H** of the FEIS.

5.27.5 Air Quality

- MTA will implement measures to minimize construction-phase air quality emissions. Such measures could include the following:
  - Minimizing land disturbance;
  - Implementing dust control measures in accordance with Maryland Department of the Environment (MDE) requirements;

- Using emission control devices, such as diesel particulate filters, for up to 80 percent of applicable construction equipment;
- Covering trucks when transporting excavated materials or other loose materials;
- Using ultra-low sulfur diesel fuel for diesel equipment; and
- Complying with EPA's Tier 2 emission standards or better for all construction equipment engines.

5.27.6 Noise and Vibration

- For areas identified with moderate or severe impacts for noise during light rail transit (LRT) operations, MTA will identify mitigation measures where practicable and reasonable during Final Design.
- For areas identified with the potential for vibration impacts during LRT operations, MTA will identify mitigation measures that are both feasible and reasonable during Final Design.
- MTA will provide noise and vibration control measures during construction whenever feasible and reasonable in accordance with applicable local and MDE noise ordinances. Such measures could include the following:
  - Construction methods that avoid pile-driving at locations containing noise- and vibration-sensitive receptors, such as residences, schools, and hospitals. Whenever possible, cast in place drilled hole (CIDH) or drilled piles rather than impact pile drivers will be used to reduce excessive noise and vibration.
  - Development and implementation of a vibration monitoring program to during construction.
  - Where practical, erect temporary noise barriers between noisy construction activities and noise-sensitive receptors.
  - Locate construction equipment and material staging areas away from sensitive receptors, where applicable.
  - Use best available control technologies to limit excessive noise and vibration when working near residences.
  - Notify the public of construction operations and schedules. Methods such as construction-alert publications or a Noise Complaint Hotline could be used to handle complaints quickly.

5.27.7 Forests/Street Trees/Ecological Resources

- MTA will comply with DNR requirements for reforestation.
- Forest Conservation Plans, or similar will be prepared during the design phase of the project and would detail additional impact avoidance and minimization techniques to be applied during construction.

- MTA will identify forest mitigation sites in cooperation with DNR and Baltimore City. The *Park Master Plans* for Baltimore City and the Tree Baltimore Program may assist in the identification of potential planting sites within City limits. In addition, the City has partnering relationships with watershed groups and non-profits such as Blue Water Baltimore that may provide planting opportunities.
- Tree protection fencing will be installed along the outside edge of the limit of disturbance where necessary to prevent access by construction equipment and staging and stockpiling of materials within forest retention areas.
- MTA will replace trees removed from parkland or City property including street trees and specimen trees to meet City and DNR requirements**.**
- Trees removed on private property will be mitigated where possible, as negotiated by MTA and the property owner.

5.27.8 Chesapeake Bay Critical Area

- MTA will adhere to the 10-Percent Rule, to meet required pollutant load reductions, through installation of approved stormwater management facilities and implementation of best management practices.
- Street tree replacement required by Baltimore City will be used to fulfill the replacement required by Critical Area, and buffer effects (near Harris Creek Bridge crossing) will be mitigated with tree planting within the buffer through coordination with DNR and Baltimore City during Final Design. Any trees affected at staging areas that are not designated for permanent facilities will be replaced on-site to mitigate for short-term construction effects at those locations.

5.27.9 Wetlands and Waters of the US

- Mitigation measures employed to compensate for unavoidable project effects to waters of the US, including wetlands, will follow federal and state mitigation regulations and guidelines, as well as other recommendations from federal and state resource agencies.
- MTA will comply with mitigation requirements under the Clean Water Act Section 404, to determine the ratio of wetland acres replaced to wetland acres lost. Emergent wetlands are typically mitigated on a 1:1 replacement basis, while forested and scrub-shrub wetlands are mitigated on a 2:1 replacement basis.
- MTA will mitigate for impacts to perennial and intermittent streams at a 1:1 ratio.
- A *Phase I Conceptual Mitigation Plan* has been designed and was approved by the USACE. *A Phase II Final Mitigation Plan* will be prepared and implemented during Final Design in consultation with the USACE and MDE.
- MTA will prepare a Joint Federal/State permit application for wetlands and waters of the US during Final Design.
- Wetland protection fencing will be installed to protect wetlands and wetland buffers during construction.

5.27.10 Water Quality

- Potential effects will be addressed by MTA through the MDE stormwater and sediment and erosion control permitting process as required under Maryland's Erosion and Sediment Control (E&SC) (COMAR 26.17.01) and Stormwater Management regulations (COMAR 26.17.02).
- MTA will design stormwater management facilities required to address water quality and quantity requirements consistent with environmental site design (ESD) criteria to the maximum extent practicable.
- All construction occurring within the Federal Emergency Management Agency (FEMA) designated 100-year floodplain will comply with FEMA approved local floodplain construction requirements.

5.27.11 Navigable Waterways

- MTA will work with the United States Army Corps of Engineers (USACE) concerning the authorization required under Section 10 of the Rivers and Harbors Act. The Downtown Tunnel segment passes beneath Jones Fall Waterway and is therefore subject to the USACE's navigable waters permitting requirements. MTA will coordinate with the USACE and United States Coast Guard to obtain all necessary permits and approvals.

5.27.12 Groundwater

- MTA will obtain a general permit from MDE for treatment of contaminated groundwater collected on-site prior to approved disposal into the city sewer system.

5.27.13 Hazardous Materials

- During Final Design and construction, if contaminated soils are identified and encountered, off-site remediation, chemical stabilization, or other treatments and disposal options will be evaluated.
- Existing buildings acquired for right-of-way purposes, a pre-demolition survey will be prepared to determine the appropriate demolition and debris disposal methods.
- Construction contractors will be required to develop and implement a site-specific health and safety plan. The plan will address the anticipated contamination including: equipment and procedures to protect the workers and general public, monitoring of contaminant exposures, and identifying the contractor's chain of command for health and safety.

6. Draft Section 4(f) Evaluation

6.1 Introduction

The Maryland Transit Administration (MTA), in coordination with the Federal Transit Administration (FTA), is proposing the Red Line light rail transit (LRT) line, which would extend from western Baltimore County to the eastern edge of Baltimore City. The proposed 14.1 mile east-west LRT line would connect the areas of Woodlawn, Edmondson Village, West Baltimore, downtown Baltimore, Inner Harbor East, Fell's Point, Canton, and the Johns Hopkins Bayview Medical Center campus. The Red Line project is intended to improve system connectivity, transportation choices, and mobility in the project study corridor, support economic development efforts, and help improve regional air quality.

As part of the Red Line Corridor Transit Study Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) published in September 2008, public parks, recreation land or open space, and land owned by public agencies were initially identified within the Red Line project study corridor. No Program Open Space properties were identified. Based on reconnaissance surveys and intensive field surveys, historic resources were also initially identified within the original Area of Potential Effects (APE) for the AA/DEIS. MTA undertook a substantial effort to avoid and minimize impacts to Section 4(f) resources as part of the alternatives development process. However, because detailed limits of disturbance were not available at the time, specific impacts to resources protected by Section 4(f) of the US Department of Transportation Act (refer to **Section 6.2**) were not known or fully evaluated in the AA/DEIS. It was anticipated that any impacts to Section 4(f) resources as a result of the Red Line project would be de minimis, and would not require a Section 4(f) avoidance alternatives and least overall harm analysis. Therefore, a concurrent Draft Section 4(f) Evaluation was not prepared. Since the issuance of the AA/DEIS, the project has advanced into Preliminary Engineering, and more detailed design has occurred in the development of the Preferred Alternative. Subsequent to the announcement of the Locally Preferred Alternative (LPA) in August 2009, MTA has continued to refine the LPA. The refinements were made based on: public and stakeholder input, station planning, and additional engineering (including ridership, transit operations and constructability), which resulted in reduced environmental impacts, reduced project costs, and improved safety. These refinements have been incorporated in the Preferred Alternative. The Preferred Alternative is being documented and analyzed as part of the project's Final Environmental Impact Statement (FEIS) and is also described in **Section 6.3**.

This Draft Section 4(f) Evaluation has been prepared to assess the likely effects of the Red Line project's Preferred Alternative upon Section 4(f) resources located within the project study corridor, and to evaluate alternatives that avoid or minimize impacts caused by the Red Line project to those resources. This Draft Section 4(f) Evaluation is being circulated with the project's FEIS. Upon receipt of comments received on the Draft Section 4(f) Evaluation, a Final Section 4(f) Evaluation will be circulated as part of the Red Line project's Record of Decision (ROD). The Final Section 4(f) Evaluation will provide a final determination by the FTA and the US Department of Interior (DOI) as to whether feasible and prudent avoidance alternatives to the project's use of Section 4(f) resources exist, whether all possible planning to minimize harm to the resources has been performed, and recommended mitigation for unavoidable impacts.

This Draft Section 4(f) Evaluation provides notification of FTA's intent to pursue de minimis impact findings for park and recreation properties and historic sites that would be affected by the construction and operation of the Red Line project. The proposed de minimis findings are based on preliminary coordination with the officials with jurisdiction. Final de minimis impact determinations would be made following continued coordination with the officials with jurisdiction over the resource(s). Pursuant to 23 CFR 774.5(b)(2), all potential de minimis impacts are being presented for public review and comment with the FEIS, in conjunction with the requirements of National Environmental Policy Act (NEPA). The 45-day comment period for the FEIS also applies to comments on the proposed de minimis impact findings.

Section 4(f) resources were identified along the Preferred Alternative, including 78 historic sites and 11 publicly-owned public parks and recreational facilities. A complete list of resources that are protected under Section 4(f) within the project study corridor is included in **Appendix J, Attachment 1**.

Based upon the Preliminary Engineering undertaken for the Red Line project, it is anticipated that the Preferred Alternative would result in:

- Temporary occupancy (not a use) of three parklands and one historic property;
- De minimis impacts to two parklands and nine historic sites (individual properties and historic districts); and
- Section 4(f) use within the Business and Government Historic District because of the demolition of two contributing properties under the Preferred Alternative Proposed Inner Harbor Station, requiring both avoidance and least overall harm analyses.

There would be no constructive use of Section 4(f) resources as a result of the construction and operation of the Red Line project. **Figure 6-1** presents the Preferred Alternative alignment and identifies the Section 4(f) resources that would be affected by the Red Line.

6.2 Regulatory Framework and Applicability to the Red Line Project

This Draft Section 4(f) Evaluation has been prepared pursuant to Section 4(f) of the US Department of Transportation Act, 49 U.S.C. 303(c), and with the FTA's Section 4(f) regulations in 23 CFR Part 774.

6.2.1 Applicability

Section 4(f) of the US Department of Transportation Act of 1966, 49 USC 303(c) requires that the proposed use of land from any significant publicly-owned public park, recreation area, wildlife and/or waterfowl refuge, or any significant historic site may not be approved as part of a federally-funded or approved transportation project unless:

- FTA determines that there is no feasible and prudent avoidance alternative to the use of land from the property, and the action includes all possible planning to minimize harm to the property resulting from such use (23 CFR 774.3(a)); or
- FTA determines that the use of the Section 4(f) properties, including any measures to minimize harm (such as avoidance, minimization, mitigation, or enhancements measures) committed to by the applicant, would have a de minimis impact on the property (23 CFR 774.3(b)).

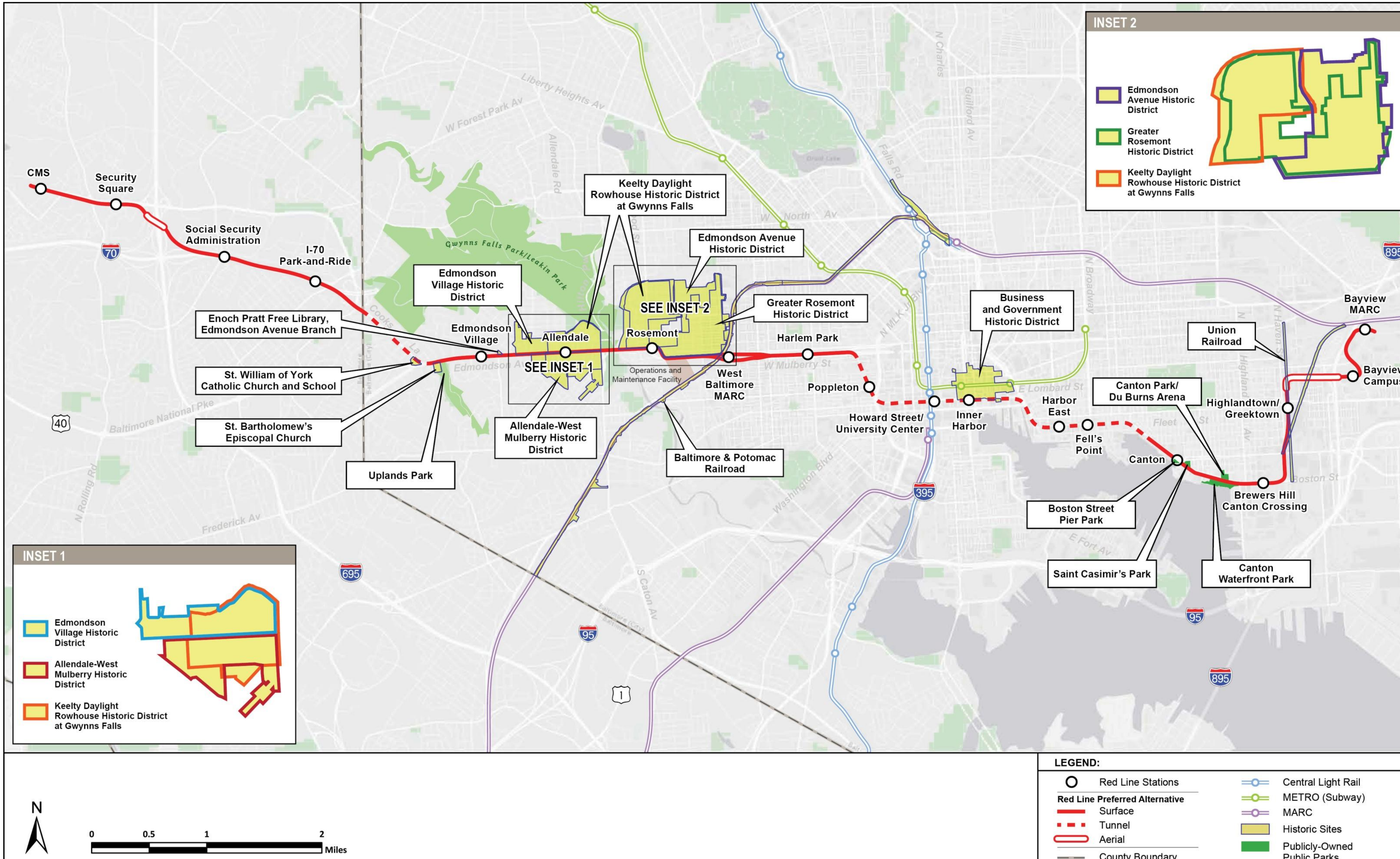


Figure 6-1: Section 4(f) Resources Affected by the Red Line Preferred Alternative

6.2.2 Use

Pursuant to 23 CFR 774.17, a "use" of Section 4(f) property occurs:

- When land is ***permanently incorporated*** into a transportation facility;
- When there is a ***temporary occupancy*** of land that is adverse in terms of the statute's preservation purpose as defined in 23 CFR 774.13(d); that is, when one of the following criteria for temporary occupancy are not met:
    - The duration of the occupancy must be less than the time needed for the construction of the project, and no change of ownership occurs.
    - Both the nature and magnitude of the changes to the Section 4(f) land are minimal.
    - No permanent adverse physical changes, nor interference with activities or purposes of the resources on a temporary or permanent basis, are anticipated.
    - The land must be returned to a condition that is at least as good as existed prior to the project.
    - There is documented agreement with the appropriate Federal, State, or local officials having jurisdiction over the land that the above conditions have been met.
- When there is a ***constructive use*** of a Section 4(f) property. As defined in 23 CFR 774.15, a constructive use occurs when the transportation project does not incorporate land from a Section 4(f) property, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired.

6.2.3 Feasible and Prudent Avoidance Alternative

A feasible and prudent avoidance alternative avoids using Section 4(f) property and does not cause other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) property. In assessing the importance of protecting the Section 4(f) property, it is appropriate to consider the relative value of the resource to the preservation purpose of the statute. The preservation purpose of Section 4(f) is described in 49 U.S.C. 303(a), which states: "It is the policy of the United States Government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites."

An alternative is not ***feasible*** if it cannot be built as a matter of sound engineering judgment.

An alternative is not ***prudent*** if:

- It compromises the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need;
- It results in unacceptable safety or operational problems;
- It causes severe social, economic, or environmental impacts even after reasonable mitigation; severe disruption to established communities; severe disproportionate

impacts to minority or low income populations; or severe impacts to environmental resources protected under other Federal statutes;

- It results in additional construction, maintenance, or operational costs of an extraordinary magnitude;
- It causes other unique problems or unusual factors; or
- It involves multiple factors above that while individually minor, cumulatively cause unique problems, or impacts of extraordinary magnitude.

6.2.4 All Possible Planning

All possible planning means that all reasonable measures identified in the Section 4(f) evaluation to minimize harm or mitigate for adverse impacts and effects must be included in the project.

For public parks, recreation areas and wildlife and waterfowl refuges, the measures may include (but are not limited to): design modifications or design goals; replacement of land or facilities of comparable value and function; or monetary compensation to enhance the remaining property or to mitigate the adverse impacts of the project in other ways.

For historic sites, the measures normally serve to preserve the historic activities, features, or attributes of the site as agreed by the FTA and the official(s) with jurisdiction over the Section 4(f) resource in accordance with the consultation process under 36 CFR Part 800.

In evaluating the reasonableness of measures to minimize harm, the FTA would consider the preservation purpose of the statute and:

- The views of the official(s) with jurisdiction over the Section 4(f) property;
- Whether the cost of the measures is a reasonable public expenditure in light of the adverse impacts of the project on the Section 4(f) property and the benefits of the measure to the property; and
- Any impacts or benefits of the measures to communities or environmental resources outside of the Section 4(f) property.

6.2.5 De Minimis Impacts

De minimis impacts to Section 4(f) resources are those impacts that would have no adverse effect on the protected resource.

For parks, de minimis impacts are defined as those that do not adversely affect the activities, features, and attributes of the resource. The official with jurisdiction over the park or property must concur in writing that the project would not adversely affect the resource.

For historic properties, a de minimis impact finding may be made if a “no historic properties affected” or “no adverse effect” determination is made through the Section 106 process and concurred upon by the Maryland Historical Trust (MHT), the State Historic Preservation Officer

(SHPO). For historic districts, the de minimis finding would be made for individual properties rather than the historic property as a whole.

After consideration of impact avoidance, minimization, and mitigation or enhancement measures, the FTA may determine that use of a Section 4(f) property results in a de minimis impact. In such cases, an analysis of avoidance alternatives is not required.

If the official with jurisdiction does not agree with a de minimis impact finding, an analysis of avoidance alternatives must be conducted. If the analysis concludes that there is no feasible and prudent alternative to use of the Section 4(f) resource, FTA may only approve the alternative that causes the least overall harm. A least overall harm analysis would be conducted to determine which alternative may proceed.

A de minimis finding cannot be made if there is a “constructive” use of a Section 4(f) property.

6.3 Proposed Action

6.3.1 Purpose of the Project

The Red Line project is just one step in the ongoing development of an interconnected regional transit system that would improve the quality of transit service in the Baltimore Region. The purpose of the Red Line project is to provide the following improvements in the project study corridor, which extends from the Centers for Medicare & Medicaid Services (CMS) in Baltimore County to the Johns Hopkins Bayview Medical Center campus in Baltimore City:

- Improve transit efficiency by reducing travel times for transit trips in the corridor
- Increase transit accessibility in the corridor by providing improved transit access to major employment and activity centers
- Provide transportation choices for east-west commuters in the corridor by making transit a more attractive option
- Enhance connections among existing transit routes in the corridor
- Support community revitalization and economic development opportunities in the corridor
- Help the region improve air quality by increasing transit use and promoting environmental stewardship

6.3.2 Project Need

The needs that exist in the project study corridor are:

- Roadway congestion contributes to slow travel times for automobiles and buses in the corridor
- Lack of convenient transit access to existing and future activity centers in the corridor, including downtown Baltimore, Fell’s Point, and Canton, as well as employment areas in Baltimore County to the west of Baltimore
- Lack of viable transit options for east-west commuters in the corridor

- Lack of connections from existing transit routes (including Central Light Rail, Metro, MARC, and bus network) to the I-70 travel market on the west side of the corridor, and to the I-95 and East Baltimore travel markets on the east
- Need for economic development and community revitalization in communities along the corridor, both in Baltimore County and in Baltimore City
- Need to support the regional goal of improving air quality by providing alternatives to automobile usage

6.4 Preferred Alternative

The Red Line is a proposed 14.1-mile east-west light rail transit line that would connect the CMS in Woodlawn (Baltimore County), and Edmondson Village, West Baltimore, downtown Baltimore, Inner Harbor East, Fell's Point, Canton and the Johns Hopkins Bayview Medical Center campus (Baltimore City). The majority of the project study corridor, approximately 11 miles, falls within Baltimore City. As shown on **Figure 6-2**, the transitway includes a combination of surface, tunnel and aerial segments.

6.4.1 Alignment

For presentation purposes, the project study corridor has been divided into five design segments consisting of three at-grade/aerial segments and two tunnel segments totaling approximately 14.1 miles. From west to east, these segments are: West; Cooks Lane Tunnel; US 40; Downtown Tunnel; and East. **Figure 6-2** identifies these five design segments in relation to the Preferred Alternative.

a. West Segment (2.9 miles)

The west segment would begin in Baltimore County at the CMS Station, a center platform station, located west of Rolling Road on the south side of Security Boulevard. At the western end of the Preferred Alternative, 380 feet of tail track would be provided beyond the station for the purpose of operation flexibility. The Preferred Alternative would traverse east in an exclusive right-of-way adjacent to the south side of Security Boulevard. The Preferred Alternative would then extend east with at-grade crossings at Greengage Road, Brookdale Road, Boulevard Place Shopping center entrance, and Rolling Road. From Rolling Road, the Preferred Alternative would run adjacent and parallel to the south side of Security Boulevard and along the northern boundary of Security Square Mall crossing Lord Baltimore Drive at grade. The Preferred Alternative would continue to the center platform Security Square Station located immediately west of Belmont Avenue. A park-and-ride lot is proposed at this station and at full development would have between 325-375 parking spaces.

The Preferred Alternative would extend east across Belmont Avenue at grade to the west side of I-695 (Baltimore Beltway), continuing southeast, and crossing the interchange diagonally on an aerial structure over I-695. The Preferred Alternative would continue adjacent to the existing parking lots at the Social Security Administration (SSA) west campus and along the north side of the I-70 ramp to I-695. The Preferred Alternative would continue east transitioning onto the existing excess pavement of westbound I-70, just west of Woodlawn Drive, to the center platform SSA Station on the existing bridge over Woodlawn Drive.

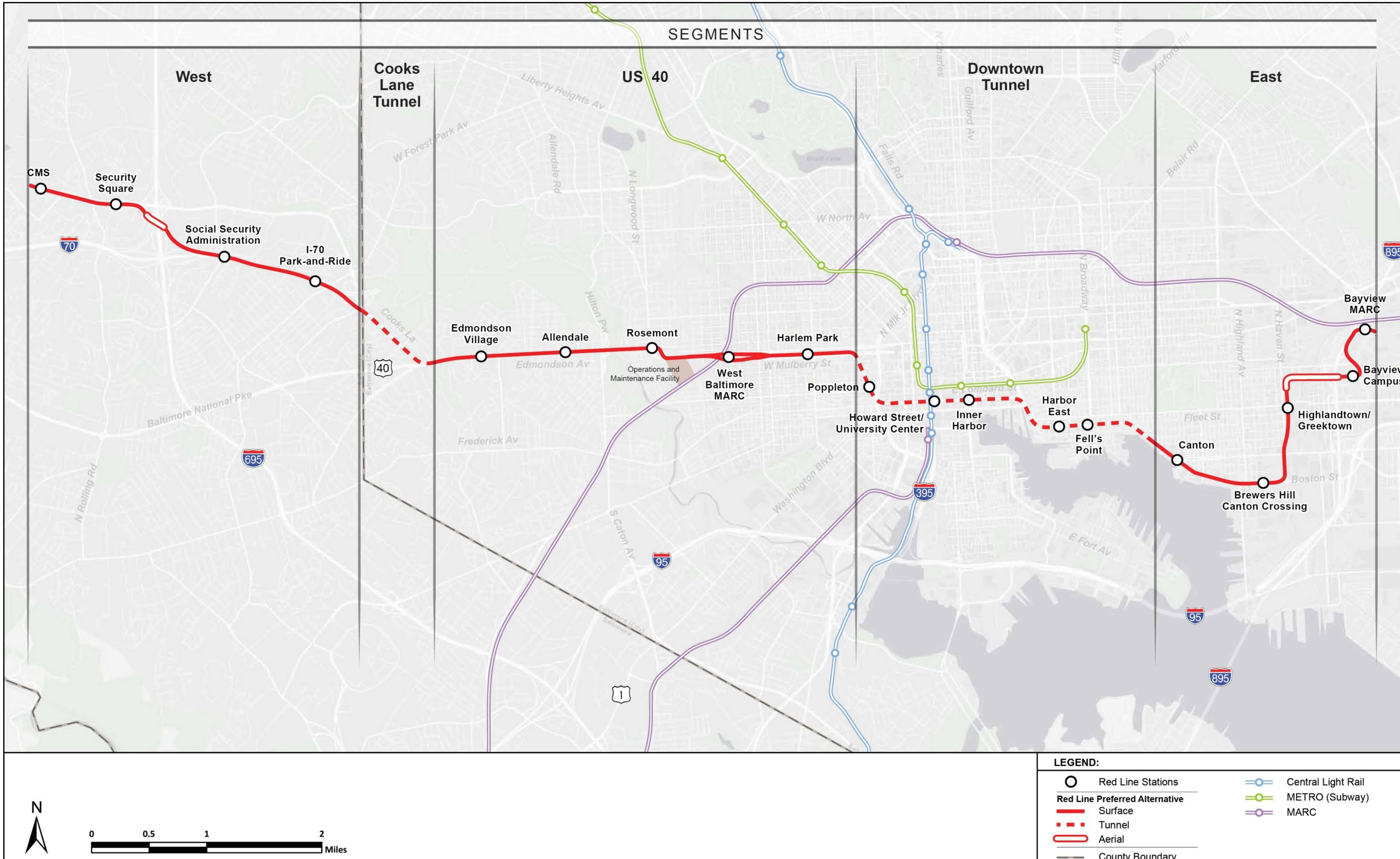


Figure 6-2: Preferred Alternative

Continuing east, the Preferred Alternative would cross at grade with a roadway connection from I-70 to Parallel Drive and continue on the former roadway pavement to the I-70 Park-and-Ride Station. The station and park-and-ride facility are located west of Ingleside Avenue occupying the former on-ramps to the former westbound I-70. Initially, the I-70 Park-and-Ride lot would have between 650 and 700 parking spaces with the opportunity for expansion, and could be expanded in the future.

Continuing east of the I-70 Park-and-Ride Station, the Preferred Alternative would cross over Ingleside Avenue on an existing bridge and curves in a southeast direction to the tunnel portal for the Cooks Lane Tunnel segment described below.

b. Cooks Lane Tunnel (1.3 miles)

The Preferred Alternative surface alignment would transition to a retained cut section in the southwest quadrant of the existing cloverleaf interchange at the end of I-70. This existing interchange loop ramp would be removed as part of the project. This tunnel section would begin through the portal on the northwest side of the intersection of Cooks Lane/Forest Park Avenue/Security Boulevard. The tunnel alignment would continue southeast under the intersection in a twin-bore tunnel beneath Cooks Lane crossing into Baltimore City. The tunnel would continue southeast centered under Cooks Lane to north of Coleherne Road; then curve left towards Edmondson Avenue and continue east following the centerline of Edmondson Avenue. The tunnel would continue along the centerline of Edmondson Avenue ascending through a portal section to meet grade approximately 400 feet west of Swann Avenue (**Figure 6-3**).

c. US 40 Segment (3.3 miles)

The US 40 segment would begin after the tunnel portal, continuing east in an exclusive right-of-way along the median of Edmondson Avenue crossing Swann Avenue at grade to the Edmondson Village Station. This center-platform station is located mid-block between Swann Avenue and North Athol Avenue.

The Preferred Alternative would continue east in the median of US 40 with at-grade crossings at traffic signal-controlled intersections at North Athol Avenue, Wildwood Parkway, and North Louden Avenue to the Allendale Station at the intersection of US 40 and Allendale Street. The Allendale Station would have a split platform with the westbound platform located on the west side of the Allendale Street and the eastbound platform located on the east side to the intersection. The Preferred Alternative would continue east at grade across Denison Street and Hilton Street. The Preferred Alternative would cross over the Hilton Parkway and Gwynns Falls in the center of an existing aerial structure. Baltimore City is currently developing plans to replace the existing Edmondson Avenue Bridge designed to include accommodations for the Red Line.

The Preferred Alternative would continue east at grade through the Edmondson Avenue (US 40)/Franklin Street intersection and Poplar Grove Street. The Rosemont Station platform would be located in the center of Edmondson Avenue east of Poplar Grove Street. East of the Rosemont Station, the Preferred Alternative would turn right and traverse south along the center of Franklintown Road. At the intersection of Franklintown Road and Franklin Street, the alignment would turn left and continue east along the median of US 40/Franklin Street. This is also the proposed location for the operations and maintenance facility site (OMF) on the south side of Franklin Street.

Figure 6-3: Rendering of the Proposed Tunnel Portal on Edmondson Avenue

Following the existing roadway, the Preferred Alternative would split near Wheeler Avenue and continue east diverging to cross under the Amtrak Northeast Corridor. The Preferred Alternative would maintain the existing structures over West Franklin Street and West Mulberry Street with minor modifications to the bridge structures, roadway, and utilities to protect the structures. The eastbound track would be adjacent to the north side of Mulberry Street, crossing under the existing Amtrak Bridge to the West Baltimore MARC Station eastbound platform located at the northwest corner of Smallwood Street and Mulberry Street. The West Baltimore MARC Station westbound platform is located at the southwest corner of Smallwood Street and Franklin Street. The westbound track is adjacent to the south side of Franklin Street. The split tracks would continue east along the edge of the West Baltimore MARC parking lots with separate at-grade crossings of Pulaski Street and Payson Street. The separate tracks converge from Franklin and Mulberry Streets just west of the North Fulton Avenue Bridge.

The Preferred Alternative would continue east in the median of the existing US 40 lower level roadway corridor. The tracks would split east of the Stricker Street pedestrian bridge onto the eastbound left lane of the US 40 corridor. The Harlem Park Station, a center-platform station, would be located between Calhoun Street and Carey Street. East of Carey Street the tracks would merge back to double-track before passing under the existing pedestrian bridge at Carrollton Avenue. The Preferred Alternative would continue under the Arlington Avenue Bridge to the portal for the Downtown Tunnel.

d. Downtown Tunnel (3.4 miles)

The tunnel would begin in the median of US 40 immediately west of the North Schroeder Street Bridge and would continue east descending into the tunnel portal within the median of US 40. The tunnel would then curve underneath Mulberry Street and continue south, beneath Fremont Avenue to the proposed underground Poppleton Station located immediately north of Baltimore Street. The entrance to the underground Poppleton Station would be located at the northeast corner of the intersection of Fremont Avenue and Baltimore Street.

The tunnel alignment would continue south and curve east crossing underneath Martin Luther King, Jr. Boulevard to the center of Lombard Street. The tunnel would continue east beneath Lombard Street to the underground Howard Street/University Center Station, located immediately east of Howard Street. The entrance to the underground station would be located at the northeast corner of Howard and Lombard Streets. The Preferred Alternative would cross under the existing CSX railroad tunnel beneath Howard Street just west of the proposed station.

The tunnel alignment would continue east to the underground Inner Harbor Station located underneath Lombard Street between Light and Calvert Streets. The entrance to the station would be located at the northeast corner of Lombard and Light Streets and along the north side of Lombard Street west of Calvert Street. From this station there would also be a pedestrian tunnel underneath Light Street to provide a direct connection to the Charles Street Metro Station located underneath Baltimore Street.

The Downtown Tunnel alignment would continue underneath Lombard Street until Market Place where the alignment curves south centered underneath President Street to Fleet Street. The tunnel alignment would then turns east, underneath Fleet Street to the underground Harbor East Station located east of Central Avenue.

The alignment would continue east centered underneath Fleet Street to the underground Fell's Point Station on the west side of Broadway. The entrance to the underground station would be located in the median of Broadway north of Fleet Street.

The tunnel alignment would continue east underneath Fleet Street to Washington Street and would turn southeast under Chester Street to Boston Street. The tunnel would continue southeast underneath Boston Street to a tunnel portal east of the intersection with Montford Avenue/Hudson Street ascending through a portal section to the median of Boston Street at surface (**Figure 6-4**).

e. East Segment (3.2 miles)

The Preferred Alternative would continue southeast at grade in the median of Boston Street to the Canton Station. The Canton Station would be a center platform station located west of the signalized intersection at South Lakewood Avenue.

Boston Street would be developed as one-lane in each direction full-time from Montford Avenue to Conkling Street. The Preferred Alternative would continue along the center of Boston Street with at-grade crossings at the signalized intersections of South Lakewood

Avenue, South Kenwood Street, Potomac Street (pedestrians only), South East Street, South Clinton Street, and South Conkling Street to the Brewers Hill/Canton Crossing Station. This center-platform station would be located between South Conkling and South Eaton Streets and would include a park-and-ride lot with approximately 500-600 parking spaces.

Figure 6-4: Rendering of Proposed Tunnel Portal on Boston Street

The Preferred Alternative would continue east at grade across Eaton Street and would transition diagonally on new right-of-way turning north on the west side of Haven Street. The Preferred Alternative would continue north adjacent to the west side of Haven Street crossing under the O'Donnell Street Bridge into the Canton Railroad right-of-way. The Preferred Alternative would then turn northeast crossing South Haven Street at grade into the Norfolk Southern (NS) right-of-way. The Preferred Alternative would continue north within the NS right-of-way to the Greektown/Highlandtown Station, a side platform station, which would be located south of Old Eastern Avenue. The Preferred Alternative would occupy the western portion of the NS right-of-way, a currently inactive railroad right-of-way referred to as Bear Creek Branch.

The Preferred Alternative would continue north over Eastern Avenue on an existing freight railroad bridge ascending and turning east onto a new aerial structure, passing overhead of the proposed NS freight track. The structure would cross above Janney Street, Kresson Street, CSX railroad, NS railroad, Oldham Street, Ponca Street, and I-895 to a proposed future Cassell Drive adjacent to the Johns Hopkins Bayview Medical Center property. The Preferred Alternative would continue east at grade along the alignment of Alpha Commons Drive to the Bayview Campus Station. This center platform station would be located immediately west of Bayview Boulevard. The Preferred Alternative would turn north at grade on the east side of Bayview

Boulevard continuing north adjacent to Bayview Boulevard with at-grade crossings of Nathan Shock Drive, a National Institutes of Health (NIH) driveway, and Lombard Street. The Preferred Alternative would continue north turning northeast along the eastside of I-895 to the proposed Bayview MARC Station, the eastern terminus of the Preferred Alternative. A park-and-ride lot with approximately 600 parking spaces is proposed as part of a new Bayview MARC Station, which is a separate project to be implemented by the MTA and Baltimore City. At the eastern end of the alignment, 380 feet of tail track would be provided beyond the station for the purpose of operation flexibility.

6.4.2 Stations

The Preferred Alternative would include 19 stations (14 surface and 5 underground). The proposed station locations have been identified based upon compatibility with surrounding site conditions, intended passenger catchment areas, site circulation, site services and amenities, transit oriented development opportunities, public space availability, future urban plan visioning, and community input through the Station Area Advisory Committees (SAACs). The proposed stations are identified in **Table 6-1.**

Stations along the alignment would have one of three types of platforms: center, side, and split. All surface station platforms would be approximately 194 feet long regardless of the type of platform. Examples of typical surface station platforms are presented in **Figure 6-5**.

Two surface stations would be grade separated: SSA which would be located on an existing bridge embankment and Harlem Park which would be located in the lower level of US 40. Therefore, these stations would include vertical circulation access elements such as stairs and ramps, or elevators for access to the platform. The stations would be designed in accordance with the Americans with Disabilities Act (ADA) to be fully accessible, barrier-free and user-friendly access for transit customers and personnel.

For the underground stations, there are two-level and three-level station designs currently being advanced (refer to **Figure 6-6**). The depth of the tunnel and station vary with the unique site conditions at each of the proposed five underground stations. Three-level stations are proposed in areas where the tunnel alignment is deep because of street utilities, vertical tunnel profile, and/or structural/geotechnical requirements. Patrons would enter from street-level entrances and descend to the public mezzanine level by elevator, escalator, or stairs; pay their fare; and then descend another level to the station platform (refer to **Figure 6-7**).

Table 6-1: Proposed Red Line Project LRT Stations

Station Name[1]	Station Type	Platform Type
CMS	At grade	Center
Security Square	At grade with park-and-ride	Center
Social Security Administration	At grade	Center
1-70 Park & Ride	At grade with park-and-ride	Center
Edmondson Village	At grade	Center
Allendale	At grade	Split Side

Table 6-1: Proposed Red Line Project LRT Stations

Station Name[1]	Station Type	Platform Type
Rosemont	At grade	Center
West Baltimore MARC	At grade with park-and-ride	Side
Harlem Park	Grade separated	Center
Poppleton	Underground; 2-level	Center
Howard Street/University Center	Underground; 3-level	Center
Inner Harbor	Underground; 2-level	Center
Harbor East	Underground; 3-level	Center
Fell's Point	Underground; 3-level	Center
Canton	At grade	Center
Brewers Hill/Canton Crossing	At grade with park-and-ride	Center
Highlandtown/Greektown	At grade	Side
Bayview Campus	At grade	Center
Bayview MARC	At grade with park-and-ride	Center

Note: [1]The station names are not final and would be determined with input from the communities as the design process continues.

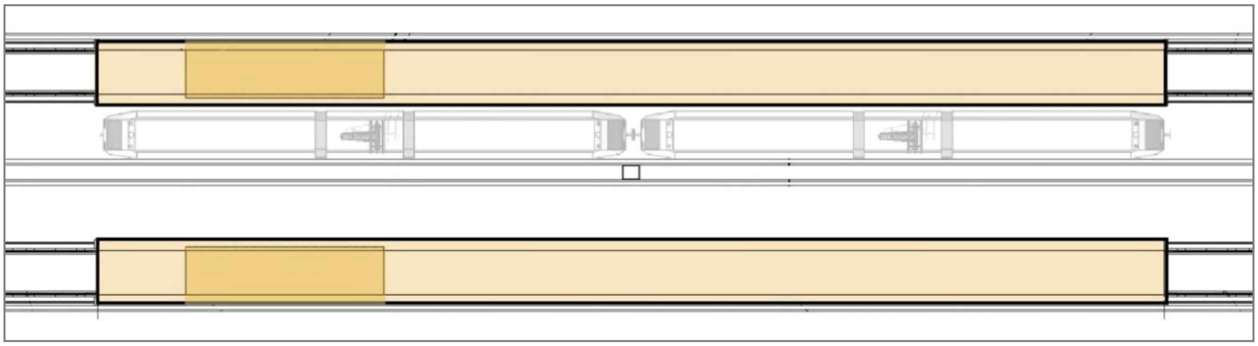
Each underground station would also have an accompanying ancillary building, which would house mechanical equipment, traction power substations, and ventilation shafts (refer to **Figure 6-8**). To meet the ventilation objectives, each underground station facility would contain two independent ventilation shafts, each containing two fans. Each shaft would connect to the tunnels at opposite ends of the station. In order to remove train-generated heat during operations, each shaft would include a fan system by-pass to allow the exchange of tunnel air with outside air. The fans would be reversible to either supply air to the tunnels, or exhaust from the tunnels.

These ancillary buildings would be up to 60-feet high, depending on the station and the ventilation requirements. The buildings for the two-level stations would be larger than those for the three-level stations. Each building would be designed to be compatible with surrounding structures and would contain the following internal components: transformers for power supply, staircases for access/egress, four fans, a battery room, and a series of silencers above the fans to attenuate their noise.

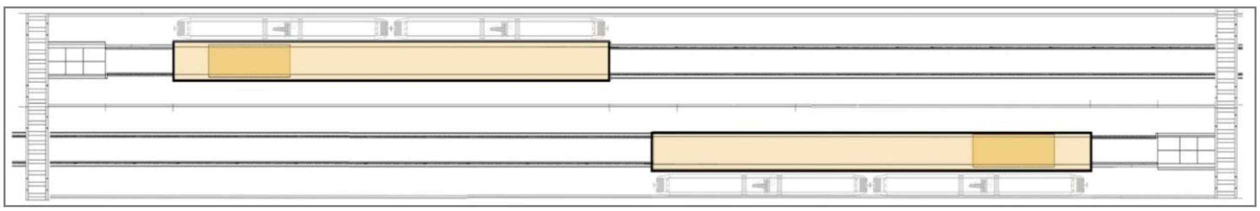
Two stations would provide connections to the existing MARC system: the West Baltimore MARC Station and the Bayview MARC Station. The Howard Street/University Center Station would provide a connection to the existing Central Light Rail Line. The Inner Harbor Station would provide a connection to the existing Charles Center Metro Station.

Figure 6-5: Examples of Typical Surface Station Platforms

Typical Side Platform Layout – Surface Station



Typical Split Platform Layout – Surface Station



Typical Center Platform- Surface Station

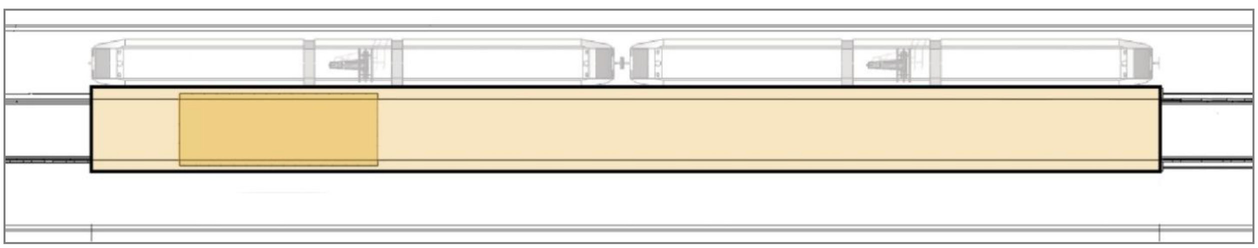


Figure 6-6: Underground Station Cross Sections

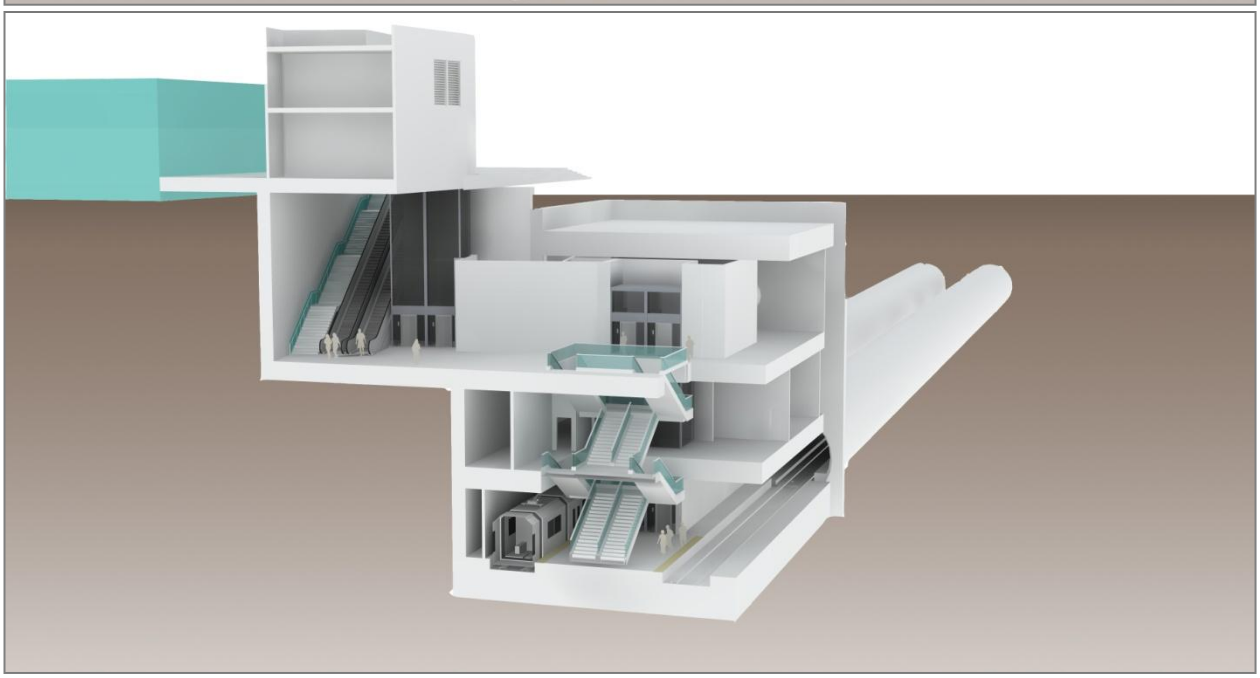


Figure 6-7: Typical Underground Station Entrance

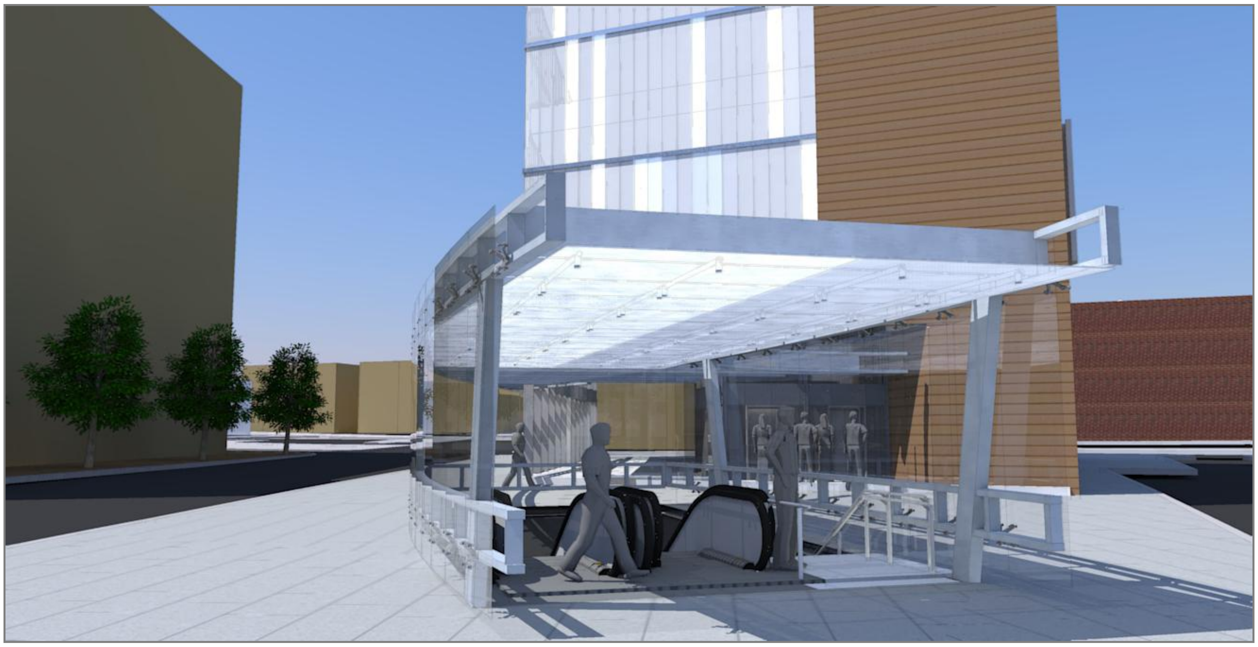
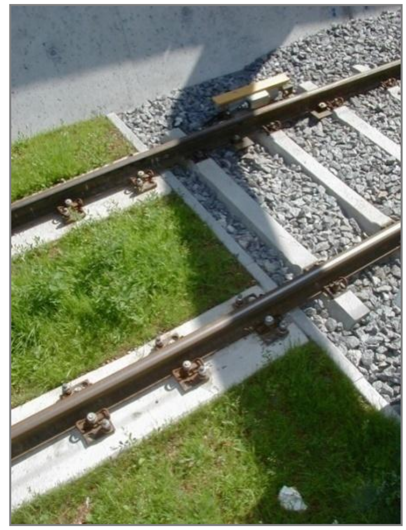


Figure 6-8: Rendering of a Typical Ventilation Structure

6.4.3 Track Types

The following four types of track are being considered for this project:



Green track transitioning to ballasted track

- *Ballasted track* – consist of rail, fasteners, crossties, and the ballast/sub ballast bed and would be used in areas in the corridor such as on the I-70 right-of-way and along the NS freight tracks on the east side of the corridor;
- *Embedded track* – is completely covered/embedded, except for the top of the rail and would be used at roadway grade crossings such as intersections;
- *Direct fixation* – is a track construction method in which the rails are directly affixed to a concrete deck or base slab, and would be used for tracks on aerial structures and in tunnels; and,
- *Green track* – is defined as a transitway designed for plant material to grow alongside and in between the rails. Green track, as shown in the photo above, is being considered in the portions of the corridor through residential communities such as along US 40/Edmondson Avenue and Canton.

6.4.4 Proposed Systems' Elements

In order to achieve effective, efficient operation, the Preferred Alternative would include traction power substations, communications, video surveillance, signaling, overhead catenary system, and fare collection.

a. Traction Power Substations

To provide electricity along the line for the light rail vehicles, 17 traction power substations (TPSS) are proposed and would be located along the alignment. The TPSS require approximately 45-foot by 85-foot sites plus access roads or driveways. A typical TPSS would be constructed of steel housing and depending on the location, could be surrounded by fencing, a brick wall, landscaping, or other forms of aesthetic barriers. Examples of existing TPSS for other light rail projects in the US are shown below.



The TPSS would be spaced along the alignment, approximately one mile apart. Two TPSS locations would be within underground stations and one location would be within the proposed operations and maintenance facility. Preliminary locations for TPSS sites have been identified for analysis and are shown on **Figure 6-9**. Final substation locations would be determined during Final Design for the project.

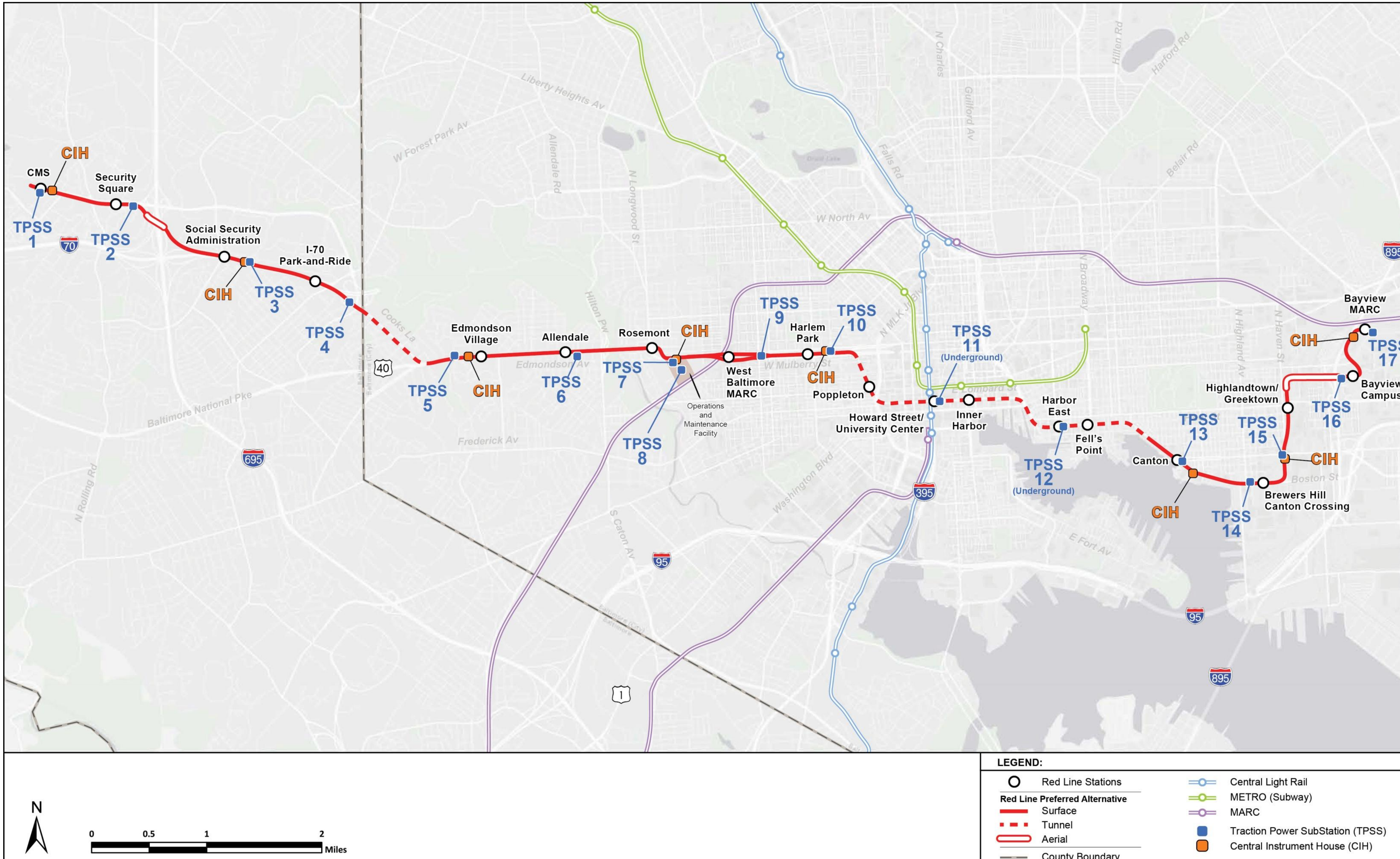


Figure 6-9: Proposed Locations for Traction Power Substations and Central Instrument Houses along the Red Line Project Study Corridor

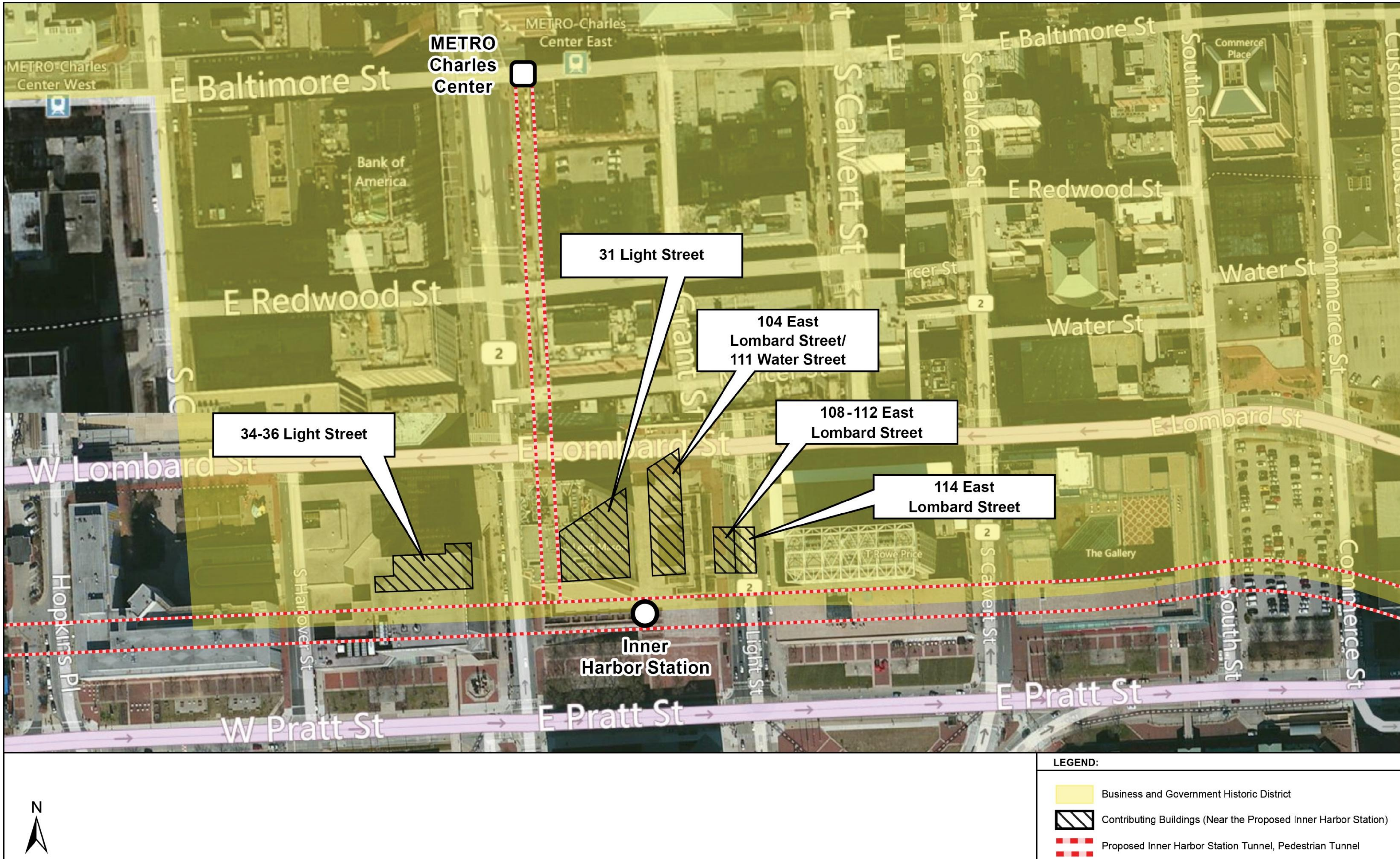


Figure 6-10: Location of Proposed Inner Harbor Station

b. Signal Central Instrument Houses

The signal CIH would contain elements of the signaling control system, circuits, and equipment required for safe vehicle operation. Currently, eight CIHs are planned along the alignment. The distances between the signal houses vary and are based on the locations of the crossover tracks where light rail vehicles can switch tracks. The CIH structures are prefabricated steel structures approximately 10 feet by 40 feet and 10 feet high. Preliminary locations for the CIH have been identified for analysis in the FEIS document and are shown on **Figure 6-9**.

6.4.5 Preferred Alternative Proposed Inner Harbor Station Location

The proposed Inner Harbor Station would be located at the southern boundary of the Business and Government Historic District (refer to **Figure 6-10** on previous page). Under the Preferred Alternative, the Inner Harbor Station would consist of a two-level underground station. The station structure would be approximately 300 feet long, located beneath East Lombard Street between Light and Calvert Streets. The Inner Harbor Station entrance would be located at the northeast corner of East Lombard and Light Streets. This location would best accommodate a pedestrian tunnel underneath the east sidewalk of Light Street to allow a direct connection to the Charles Center Metro Station, located approximately two blocks to the north beneath Baltimore Street. Emergency exits would be constructed in the sidewalk on the south side of Lombard Street.

The underground station structure and the pedestrian tunnel would be constructed using the cut-and-cover excavation method. In this method, construction of the station structure and pedestrian tunnel would involve excavation of soil and/or rock from the surface, extending to the depth of a finished trench. Retaining walls would be constructed to prevent the sides of the excavation from collapsing. In typical urban settings, one side of the street is excavated to a sufficient depth to allow for the trench to be decked, and then excavation begins on the other side of the street. The concept developed for the Red Line project involves excavating trenches perpendicular to the street. Steel support beams are placed in the trenches and supported by the retaining walls constructed to support the sides of the excavation. Removable concrete planks are placed on top of the steel support beams to create a working platform for construction and a roadway surface for vehicles. Excavation then proceeds below the temporary decking structure. Following construction of the underground components, the roadway and surrounding areas would be restored.

The Inner Harbor Station would be located within the National Register listed Business and Government Historic District. As with the other underground stations within the project study corridor, the Inner Harbor Station structures would house ventilation, smoke control, and equipment rooms located, in part, at the surface level. At the Inner Harbor Station, the structures proposed would be located at the site of two vacant buildings located at 108-12 and 114 East Lombard Street.

These two vacant buildings, as well as several others in the vicinity, are contributing buildings to the historic district. A detailed description of the impacts and cost of the Preferred Alternative proposed Inner Harbor Station are presented in **Section 6.9** and **Section 6.1**0.

6.5 Section 4(f) Properties

6.5.1 Publicly-Owned Public Parks and Recreation Areas

A park or recreation area is afforded federal protection under Section 4(f) if:

- it is publicly-owned, meaning the property is owned and operated by a public entity, or the public entity has a proprietary interest in the property, such as an easement;
- it is open to the public for visitation for more than a select group of the public at any time during normal hours of operation;
- the primary purpose of the property is recreation, (lands used primarily for non-recreational purposes but that host recreational activities do not have recreation as a primary purpose); and
- it is significant as a park or recreation area, meaning that the resource plays an important role in meeting the park and recreational objectives of the community, as determined by the official with jurisdiction.

If a park, recreation land, or open space meets these criteria, the entire property – including parking, maintenance facilities, and recreational facilities – must be considered as part of the resource. The following methods and tools were used to identify publicly-owned public parks and recreation areas within the project study corridor identified in the FEIS: review of GIS layers; review of the Baltimore City View mapping tool; visual observation; property records search; and consultation with the Baltimore County Department of Recreation and Parks, the Baltimore City Department of Recreation and Parks, and the Maryland Department of Natural Resources (DNR). Correspondence with these agencies is presented in **Appendix J**, **Attachment 2**.

Of the 11 parks and recreational areas within the project study corridor identified in **Appendix J**, **Attachment 1**, a total of five would be impacted by the Preferred Alternative. A brief description of each park that would be impacted by the Preferred Alternative is presented in **Table 6-2**.

Table 6-2: Parks and Recreational Areas within the Project Study Corridor that would be used by the Red Line Project

Resource (See Figure 6-1)	Park Area	Ownership	Description/Activities	Type of use by the Red Line Project
Uplands Park Located in the Uplands/Ten Hills neighborhoods of Baltimore City, on the south side of Edmondson Avenue between Nottingham Road and Uplands Parkway	33.62 acres	Baltimore City Department of Recreation and Parks	Forested area, passive recreation	0.1 acre temporary occupancy for to maintain traffic along Edmondson Avenue during construction for a duration of approximately 30 months

Table 6-2: Parks and Recreational Areas within the Project Study Corridor that would be used by the Red Line Project

Resource (See Figure 6-1)	Park Area	Ownership	Description/Activities	Type of use by the Red Line Project
Boston Street Pier Park Located in the Canton neighborhood of Baltimore City on the south side of Boston Street at South Lakewood Avenue	0.75 acre	Baltimore City Department of Recreation and Parks	Multi-use paths and a pedestrian bridge/fishing pier connecting to the Baltimore Waterfront Promenade	0.06 acre construction easement during construction along Boston Street for 6-12 months; 0.06 acre permanent use to accommodate plant cells for stormwater management
St. Casimir's Park Located in the Canton neighborhood of Baltimore City on the north side of Boston Street between South Lakewood and South Kenwood Avenues	1.4 acres	Baltimore City Department of Recreation and Parks	Open space, walking paths, and benches	0.09 acre construction easement during construction along Boston Street for 6-12 months; 0.07 acre permanent use to relocate a storm drain and to accommodate sidewalk shift along Boston Street
Canton Waterfront Park Located in the Canton neighborhood of Baltimore City on the south side of Boston Street between South Linwood Avenue and South Clinton Streets	7.0 acres	Baltimore City Department of Recreation and Parks	Korean War Memorial, water taxi landing, fishing and crabbing access, pedestrian and bicycle access, and a segment of the Baltimore Waterfront Promenade	0.1 acre temporary occupancy during civil work on Boston Street; work would be intermittent during a 6-12 month period
Du Burns Arena (also known as Canton Park) Located in the Canton neighborhood of Baltimore City on the north side of Boston Street at the intersection with Ellwood Avenue	2.5 acres	Baltimore City Department of Recreation and Parks	Hosts the Baltimore Blast soccer team, club sports, and sporting events such as roller derby and boxing matches	0.02 acre temporary occupancy during civil work on Boston Street; work would be intermittent during a 6-12 month period

Gwynns Falls/Leakin Park is a 1,200 acre publicly-owned public park operated by Baltimore City Department of Recreation and Parks. It includes contiguous parkland and woodlands from the western boundary of Baltimore City, following the Gwynns Falls from Windsor Mill Road to Wilkens Avenue. Activities include recreational trails, picnic areas, and miniature steam trains in use from April through October.

Under the Preferred Alternative, the Red Line would cross the Edmondson Avenue Bridge over Gwynns Falls/Leakin Park (**Figure 6-1**). Baltimore City is currently undertaking a project to improve and widen the Edmondson Avenue Bridge. The impacts to Gwynns Falls/Leakin Park as a result of these bridge improvements and/or widening are being evaluated by Baltimore City as part of the Edmondson Avenue Bridge project. Construction of the Edmondson Avenue Bridge improvements would be completed prior to the construction of the Red Line. No impacts to the park are anticipated as a result of the Preferred Alternative. Therefore, because construction of the Preferred Alternative would not result in direct impacts to Gwynns Falls/ Leakin Park, Section 4(f) would not apply.

6.5.2 Historic Sites

Historic sites were identified, in accordance with the Section 106 process of the National Historic Preservation Act, as amended (refer to FEIS **Chapter 5.9**). The applicability of Section 4(f) to historic sites is cited at 23 CFR Part 774.11(e), and the definition of a historic site is at 774.17. For the purposes of Section 4(f), a historic site is any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register, which is the equivalent of a historic property under Section 106.

Eligibility for the National Register is evaluated based on four criteria. It is customary to identify the applicable National Register criteria when describing a historic site in a Section 4(f) evaluation. Identifying these criteria provides a starting point for understanding the significant features, activities, or attributes of the site. The criteria are:

- *Criterion A:* association with events that have made a significant contribution to the broad patterns of our history;
- *Criterion B:* association with the lives of significant persons in our past;
- *Criterion C:* embodiment of the distinctive characteristics of a type, period, or method of construction, or representative of the work of a master, or that possess high artistic values, or representative of a significant and distinguishable entity whose components may lack individual distinction; and
- *Criterion D:* have yielded or may be likely to yield, information important in history or prehistory.

In addition to having significance, the property must also possess historic integrity, based on these seven aspects: location, design, setting, materials, workmanship, feeling, and association. They are used to assess the nature and degree of changes that may have occurred since the period of historic significance. To retain historic integrity, a property would always possess several, and usually most, of the aspects.

Certain kinds of properties are not usually considered for the National Register: religious properties, moved properties, birthplaces or graves, cemeteries, reconstructed properties, commemorative properties, and properties achieving significance within the past 50 years. These properties can be eligible for listing, however, if they meet special requirements called Criteria Considerations, in addition to meeting one or more of the criteria listed above, and possessing integrity. Criteria Consideration A applies to religious properties. A religious property is eligible if it derives its primary significance from architectural or artistic distinction or historical importance.

Properties and districts not previously listed in or determined eligible for the National Register, and that would be more than 50 years old at the end of the project planning process (built in and prior to 1963), were evaluated using MHT National Register evaluation forms. Determination of Eligibility (DOE) Forms included descriptions, historic contexts, evaluations applying the four National Register criteria (and Criteria Considerations, when applicable), and integrity assessments (for properties and districts with significance). For individual properties that were clearly ineligible for the National Register, a Short Form for Ineligible Properties was utilized. A total of 78 historic sites were identified for this project (**Appendix J, Attachment 1**).

When a project uses land from an individually National Register-listed or eligible property, and/or a property that is a contributing element to a listed or eligible historic district, Section 4(f) is applicable. There are 11 historic sites with land that would be used by this project. A brief description of each of these historic sites is presented in **Table 6-3**.

Table 6-3: Historic Sites within the Project Study Corridor that would be used by the Red Line Project

Resource (See Figure 6-1)	Maryland Inventory of Historic Properties Number	National Register of Historic Places Status	Eligibility Criteria	Type of Use by the Red Line Project
St. William of York Catholic Church and School (built in: church 1914; school and smaller wing of school ca. late 1940s; rest of school 1951) 600 Cooks Lane	B-5100	Eligible	C, Criteria Consideration A	Minor property acquisition
St. Bartholomew's Episcopal Church (built in: church 1931-32; parish hall earlier) 4711 Edmondson Avenue	B-5105	Eligible	C, Criteria Consideration A	Temporary easement with approximately 30 month duration
Enoch Pratt Free Library, Edmondson Avenue Branch (built in 1952) 4330 Edmondson Avenue	B-1384	Eligible	A, C	Minor property acquisition
[1] **Edmondson Village Historic District: Contributing Buildings** (built between ca. 1911 to 1938) Edmondson Avenue to south, Walnut Avenue and North Woodington Road to west, North Hilton Street to east, and on north by Gelston Drive	B-5109	Eligible	A, C	Sliver takes from multiple properties facing Edmondson Avenue

Table 6-3: Historic Sites within the Project Study Corridor that would be used by the Red Line Project

Resource (See Figure 6-1)	Maryland Inventory of Historic Properties Number	National Register of Historic Places Status	Eligibility Criteria	Type of Use by the Red Line Project
[1] **Allendale-West Mulberry Historic District: Contributing Buildings** (built between 1910s to mid-1930s) Bounded by Edmondson Avenue, Wildwood Parkway, New Cathedral Cemetery, West Mulberry Street, Gwynn Avenue, North Monastery Avenue, West Caton Avenue, North Culver Street, and North Hilton Street	B-5111	Eligible	A, C	Sliver takes from multiple properties facing Edmondson Avenue
[1] **Keelty Daylight Rowhouse Historic District at Gwynns Falls: Contributing Buildings** (built between 1910s to 1930s) Two sections located on west and east sides of Gwynns Falls Park: (1) west section bordered by Normandy Avenue, Lyndhurst Street, Gelston Drive, North Hilton Street, West Mulberry Street, Edgewood Street, West Lexington Street, North Grantley Street, West Saratoga Street, and Allendale Street and (2) east section bordered by Gwynns Falls Trail, Ellicott Driveway, Braddish Avenue, West Lafayette Avenue, Poplar Grove Street, and Edmondson Avenue	B-1378	Eligible	A, C	Sliver takes from multiple properties facing Edmondson Avenue
[1]**Greater Rosemont Historic District** (built between ca. 1890 to 1950s) Bounded by West Franklin Street, North Franklintown Road, Poplar Grove Street, Edmondson Avenue, Gwynns Falls Park, North Rosedale Street, Ellicott Driveway, Ashburn Street, Prospect Street, Braddish Avenue, West Lafayette Avenue, West Lanvale Street, North Dukeland Street, Rayner Avenue, Whitmore Avenue, Winchester Street, North Bentalou Street, CSX tracks, Riggs Avenue, and the Amtrak Northeast Corridor (historically the Baltimore & Potomac Railroad)	B-5112	Eligible	A, C	Sliver takes from multiple properties facing Edmondson Avenue and West Franklin Street

Table 6-3: Historic Sites within the Project Study Corridor that would be used by the Red Line Project

Resource (See Figure 6-1)	Maryland Inventory of Historic Properties Number	National Register of Historic Places Status	Eligibility Criteria	Type of Use by the Red Line Project
[1]**Edmondson Avenue Historic District** (built between early to mid-twentieth century) Bounded by West Franklin Street, North Franklintown Road, Edmondson Avenue, Evergreen Street, Rayner Avenue, Braddish Avenue, St. Peters Cemetery, North Bentalou Street, CSX tracks, Riggs Avenue, West Lafayette Avenue, and Spedden Street	B-5187	Listed	A, C	Sliver takes from multiple properties facing West Franklin Street
[2] **Baltimore & Potomac Railroad (Philadelphia, Baltimore & Washington Railroad): Contributing Railroad Bridges (west segment)** (established 1872; tunnel [1872]; most other structures and buildings from early part of twentieth century) Between Baltimore City/Baltimore County line (in community of Violetville) at southwest to Baltimore's Pennsylvania Station at northeast (excluding station itself)	B-5164	Eligible	A,C	Catenaries attached to undersides of two contributing railroad bridges
Business and Government Historic District: Contributing Buildings (built primarily ca. 1900 to 1925; some earlier and later) Bounded by South and North Charles Street, East Lexington Street, East Saratoga Street, North and South Gay Street, North Frederick Street, East Baltimore Street, West Falls Avenue, Water Street, and East Lombard Street	B-3935	Listed	A, C	Two district contributing buildings to be demolished

Table 6-3: Historic Sites within the Project Study Corridor that would be used by the Red Line Project

Resource (See Figure 6-1)	Maryland Inventory of Historic Properties Number	National Register of Historic Places Status	Eligibility Criteria	Type of Use by the Red Line Project
Union Railroad: Contributing Bridge over Eastern Avenue Underpass (railroad established ca. 1873; bridge overpasses date to post-1930) The entire length of the line in Baltimore City from the northern portal of the Baltimore & Potomac Tunnel under the Northern Avenue Bridge to the southern terminus at Boston Street in Canton	B-5163	Eligible	A	Repair work on a contributing railroad bridge

Notes: [1] The boundaries for the five historic districts overlap, as illustrated in **Figure 6-1**.
[2] This historic site also consists of a separate contributing east segment running northeast from O'Donnell Street (near South Haven Street) to the Bayview Railyard. However, this portion has no Section 4(f) use.

6.6 Temporary Occupancy

6.6.1 Temporary Occupancy of Publicly-Owned Public Parks and Recreational Areas

Three publicly-owned public parks and recreational areas would incur temporary impacts from the construction of the Preferred Alternative: Upland Park, Canton Waterfront Park, and Du Burns Arena. For these properties, FTA intends to make a determination that the temporary occupancy meets the criteria in 23 CFR 774.13(d), and therefore, the temporary occupancy does not constitute a temporary use.

As per Section 4(f) regulations, an evaluation of avoidance alternatives and an analysis of least overall harm are not required for these properties, and therefore have not been developed in this Draft Section 4(f) Evaluation. If concurrence is obtained from the official with jurisdiction over these resources, a final determination will be made by FTA in the Final Section 4(f) determination.

a. Uplands Park

Uplands Park is located on the south side of Edmondson Avenue between Nottingham Road and Uplands Parkway, directly east of the proposed Cooks Lane tunnel portal as the Preferred Alternative transitions from the tunnel segment to the surface in the median of Edmondson Avenue (**Figure 6-11**). The tunnel portal would be constructed within the roadway median from east of Brookwood Road to east of Glen Allen Drive, including the subsurface to above ground transition area. The completed above ground portion of the portal, including walls and fencing, would begin east of Winans Way/Uplands Parkway and continue to east of Glen Allen Drive.

Construction of the tunnel portal would require maintenance and protection of traffic and pedestrian access within the area. As such, a temporary easement of 0.09 acre would be required from Uplands Park to accommodate two eastbound lanes of traffic on the south side of Edmondson Avenue, as well as a temporary sidewalk to provide pedestrian access during construction of the tunnel portal (**Figure 6-11**). The temporary pedestrian sidewalk would be located along the perimeter of the park facing Edmondson Avenue. Construction activities would also include vegetation removal, temporary fill, and temporary erosion and sediment control measures within the easement footprint. The duration of construction would be approximately 30 months. Following construction, the temporary pedestrian sidewalk, fill, and erosion and sediment control measures would be removed. The site would be restored to original grade, vegetation would be replanted, and trees would be replaced at a 1:1 diameter at breast height (DBH) ratio.

b. Canton Waterfront Park

Canton Waterfront Park is located on the south side of Boston Street between South Linwood Avenue and South Clinton Streets. During construction of the Preferred Alternative's alignment along Boston Street, a temporary easement of 0.1 acre would be needed from this park property for curb and sidewalk reconstruction and mill and overlay work (**Figure 6-12**). Construction activities would occur within the approximate 6 to 12 month duration of all civil work that would be conducted on Boston Street.

Canton Waterfront Park includes a parking lot with vehicle entrances at South Ellwood and South East Avenues. Intersection work proposed on Boston Street would create temporary impacts, prohibiting left turn movements to and from the parking lot entrances during construction. Work at each intersection would last approximately 2 weeks, and would be staggered so that only one entrance is impacted at a time. Vehicle entrances would maintain right-in, right-out access during the closure of left movements. Boat trailer access to Canton Waterfront Park would be maintained during and after construction.

c. Du Burns Arena

Du Burns Arena (also known as Canton Park) is on the north side of Boston Street at the intersection with Ellwood Avenue. During construction of the Preferred Alternative, a temporary easement of 0.02 acre would be needed from this property to construct tie-ins to existing sidewalks (**Figure 6-12**). Construction activities would occur within the 6 to 12 month duration of all construction work that would be conducted on Boston Street.

6.6.2 Temporary Occupancy of Historic Sites

One historic site, St. Bartholomew's Episcopal Church, would incur a temporary impact from the construction of the Preferred Alternative. For this property, FTA intends to make a determination that the temporary occupancy meets the criteria in 23 CFR 774.13(d), and therefore, the temporary occupancy does not constitute a temporary use. If concurrence is obtained from the official with jurisdiction over these resources, a final determination will be made by FTA in the Final Section 4(f) Evaluation.

As per Section 4(f) regulations, an evaluation of avoidance alternatives and an analysis of least overall harm are not required for this property, and therefore have not been developed in this Draft Section 4(f) Evaluation.

a. St. Bartholomew's Episcopal Church

St. Bartholomew's Episcopal Church is an ecclesiastical historic site on the south side of Edmondson Avenue between Nottingham Road and Uplands Parkway (**Figure 6-11**). Under the Preferred Alternative, the nearby section of the transitway would be located to the north of the historic site, below the center of Edmondson Avenue. A tunnel portal transition of the tracks from underground to the surface would begin in front of the church. The portal would be constructed within the roadway median from east of Brookwood Road to east of Glen Allen Drive, including the subsurface to above ground transition area. The completed above ground portion of the portal, including walls and fencing, would begin east of Winans Way/Uplands Parkway and continue to east of Glen Allen Drive.

A temporary easement of 0.09 acre would be required from the 2.58 acre church property to accommodate two eastbound lanes of traffic on the south side of Edmondson Avenue and a temporary sidewalk to maintain pedestrian access during construction of the tunnel portal (**Figure 6-11**). The duration of construction would be approximately 30 months. Following construction, the area of impact would be restored to pre-construction conditions.

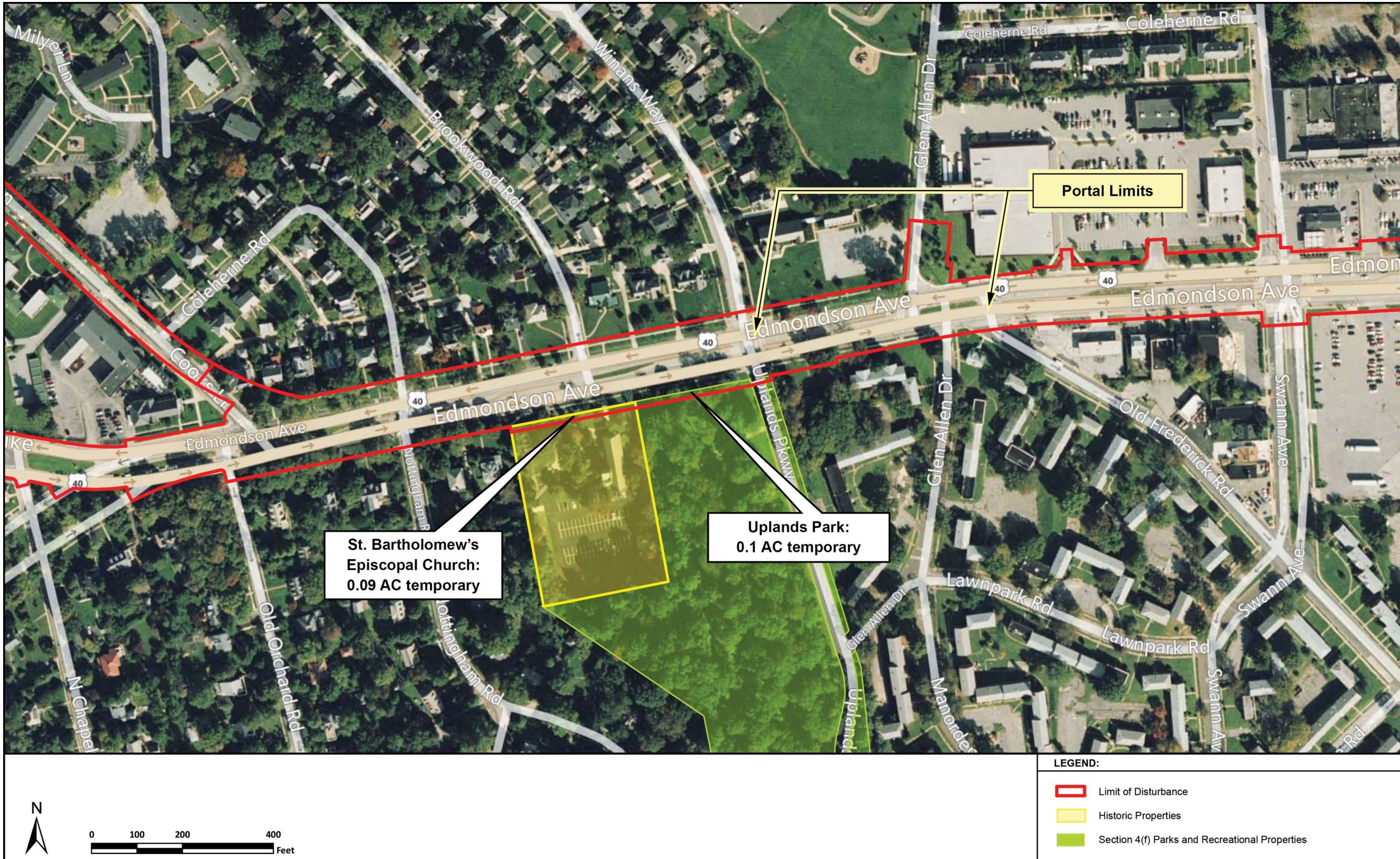


Figure 6-11: Uplands Park and St. Bartholomew's Episcopal Church

Figure 6-12: Canton Waterfront Park and Du Burns Arena

6.7 Use of Section 4(f) Resources

6.7.1 Documentation of De Minimis Impacts to Publicly-Owned Public Parks and Recreational Areas

Two publicly-owned public parks and recreational areas would incur only minor impacts from the Preferred Alternative: Boston Street Pier Park and St. Casmir's Park.

Following the FEIS/Draft Section 4(f) Evaluation public and agency comment period, the FTA intends to make a de minimis impact finding. As such, FTA and MTA have notified the official with jurisdiction, Baltimore City Recreation and Parks that they intend to seek written concurrence, pursuant to 23 CFR 774.3(b), that the impacts would not adversely affect the activities, features, or attributes that make the property eligible for Section 4(f) protection. Should the official with jurisdiction concur, the FTA would then issue a finding of de minimis impact on an individual property basis, which would be presented in the Final Section 4(f) Evaluation. If the official with jurisdiction does not concur, a revised Draft Section 4(f) Evaluation would be prepared and would include an evaluation of avoidance alternatives and an analysis of least overall harm.

a. Boston Street Pier Park

Boston Street Pier Park is located on the south side of Boston Street at South Lakewood Avenue (**Figure 6-13**). Under the Preferred Alternative, the transitway would operate in the roadway median on Boston Street. During construction, a temporary easement of 0.06 acre would be needed from the park property for grading, sidewalk reconstruction, and erosion and sediment control along Boston Street. Civil work on Boston Street, such as utility relocation and sidewalk work, would last approximately 6 to 12 months, and temporary impacts to park properties would be intermittent throughout that anticipated timeframe.

In addition to temporary construction easements, a fee simple area of 0.06 acre would be required from this park to accommodate stormwater management for the Red Line project. In order to avoid additional grading and minimize disturbance to the park, planter cells would be used to treat stormwater. Each planter cell (shown below) would be approximately 5 feet in width, and cells would be placed behind the sidewalk along the perimeter of the park along Boston Street. An example of a similar type stormwater management planter cell is presented below. Refer to **Figure 6-13** for the limits of impacts within Boston Street Pier Park.

Example of a Stormwater Management Planter Cell

b. St. Casimir's Park

St. Casimir's Park is on the north side of Boston Street between South Lakewood and South Kenwood Avenues (**Figure 6-13**). During construction of the Preferred Alternative, a temporary easement of 0.09 acre would be required from this park property for curb and sidewalk reconstruction, and mill and overlay work. Civil work on Boston Street, such as utility relocation and sidewalk work, would last approximately 6 to 12 months, and temporary impacts to park properties would be intermittent throughout that anticipated timeframe.

A fee simple area of 0.07 acre along the perimeter of the park facing Boston Street would be required to permanently relocate and maintain a storm drain near the median of Boston Street where the Preferred Alternative transitway would be located. Additionally, the fee simple area would accommodate a portion of the sidewalk, which would also be shifted, to accommodate the transitway (refer to **Figure 6-13**).

6.7.2 Documentation of De Minimis Impacts to Historic Sites

Nine historic sites with Section 4(f) uses evaluated in this Draft Section 4(f) Evaluation would incur minor impacts from the Preferred Alternative.

Following the FEIS/Draft Section 4(f) Evaluation public and agency comment period and review of the Section 106 Assessment of Effects for Built Historic Properties, the FTA intends to make a de minimis impact finding. As such, FTA and MTA have notified the official with jurisdiction, MHT, that they intend to seek written concurrence, pursuant to 23 CFR 774.3(b), and would not incur an "adverse effect" pursuant to 36 CFR Part 800.5(b). Should the official with jurisdiction concur, the FTA would then issue a finding of de minimis impact on an individual property basis, which would be presented in the Final Section 4(f) Evaluation. If the official with jurisdiction does not concur, a revised Draft Section 4(f) Evaluation would be prepared and would include an evaluation of avoidance alternatives and an analysis of least overall harm.

a. St. William of York Catholic Church and School

St. William of York Catholic Church and School is an ecclesiastical historic site located at the northwest corner of Edmondson Avenue and Cooks Lane (**Figure 6-14**). Under the Preferred Alternative, the nearby alignment would be underground, northeast of the historic site's boundary, following Cooks Lane and turning east to follow Edmondson Avenue. A tunnel portal would transition the tracks from underground to the surface further east along Edmondson Avenue. The portal would be constructed within the roadway median from east of Brookwood Road to east of Glen Allen Drive, including the subsurface to above ground transition area. The completed above ground portion of the portal, including walls and fencing, would begin east of Winans Way/Uplands Parkway and continue to east of Glen Allen Drive.

The project would result in a Section 4(f) use of this church and school because of sidewalk replacements required for the Preferred Alternative along the property's southeastern historic site boundary. The work would extend up to 20 feet into the property, which is approximately 0.2 acre of its 1.95 acres (**Figure 6-14**).

b. Enoch Pratt Free Library, Edmondson Avenue Branch

The Enoch Pratt Free Library, Edmondson Avenue Branch is a library and historic site located at the northeast corner of Edmondson Avenue and North Athol Avenue (**Figure 6-15**). Under the Preferred Alternative, the nearby section of the transitway would have two sets of tracks on Edmondson Avenue, running about 40 feet directly south of the library's boundary.

The project would result in a Section 4(f) use of this property because a small corner of the library's historic site boundary is within the project's limits of disturbance. Sidewalk replacements are anticipated for this approximately 261 square feet (0.006 acre) area within the 0.28 acre library boundary (**Figure 6-15**).

c. Edmondson Village Historic District

The Edmondson Village Historic District is a primarily residential rowhouse district between Edmondson Avenue to the south, Walnut Avenue and North Woodington Road to the west, North Hilton Street to the east, and on the north by Gelston Drive (**Figure 6-16**). A total of 60 contributing properties would be impacted within the Edmondson Village Historic District. Of those, 48 properties are also contributing properties to the overlapping Keelty Daylight Rowhouse Historic District at Gwynns Falls (refer to **Section 6.7.2.e** below).

Under the Preferred Alternative, the transitway near the district would have two sets of tracks on Edmondson Avenue, about 25 feet directly south of the district's boundary; the westbound and eastbound Allendale Station platforms would be on Edmondson Avenue at Allendale Street.

The project would result in a Section 4(f) use of 60 properties on the north side of Edmondson Avenue because land from the following National Register-eligible historic district contributing properties would be required: (a) four rowhouse properties and eight duplex properties between Wildwood Parkway and North Loudon Avenue; (b) 28 rowhouse properties and one church property between Mount Holly and Linnard Streets; and (c) 19 rowhouse properties between Edgewood and Denison Streets. These properties are on five of the 11 ½ blocks of the historic district that face south onto Edmondson Avenue.

The acquisitions are in the property front yards, involving contributing features such as terraces; lawns; concrete pavement, steps linking to the sidewalks, walkways, and curbs bordering the yards; and low rubble stone walls. Individual property acquisitions range from about 2 feet to 8 feet of the front yards. Called sliver takes, these partial acquisitions are narrow strips of the properties located directly adjacent to the proposed project; most of each property would remain with the current owner and the acquisitions would not affect the use of the properties. Refer to the photo for an example of proposed right-of-way within Edmondson Village Historic District. In all instances, the majority of the existing yards, including terraces, would be retained. In addition, the total property acquisitions of about 0.01 acre are a small part of the 89 acres of the historic district, representing about 0.01 percent of its size (**Figure 6-16**).

No buildings would be altered or demolished, and the character of the district would be maintained.

Example of proposed right-of-way within Edmondson Village Historic District

d. Allendale-West Mulberry Historic District

The Allendale-West Mulberry Historic District is a primarily residential rowhouse district and historic site bounded by Edmondson Avenue, Wildwood Parkway, New Cathedral Cemetery, West Mulberry Street, Gwynn Avenue, North Monastery Avenue, West Caton Avenue, North Culver Street, and North Hilton Street (**Figure 6-17**). A total of 102 contributing properties would be impacted within the Allendale-West Mulberry Historic District. Of those, 79 properties are also contributing properties to the overlapping Keelty Daylight Rowhouse Historic District at Gwynns Falls (refer to **Section 6.7.2.e**).

Under the Preferred Alternative, the transitway near the district would consist of two sets of tracks along Edmondson Avenue, about 20 feet directly north of the district's boundary; the westbound and eastbound Allendale Station platforms would be on Edmondson Avenue at Allendale Street.

The project would result in a Section 4(f) use of 102 properties on the south side of Edmondson Avenue because land from the following National Register-eligible historic district contributing properties would be required: (a) 88 rowhouse properties and one office property between Wildwood Parkway and Edgewood Street and (b) 13 rowhouse properties between Denison and North Hilton Streets. These properties are on eight of the nine blocks of the historic district that face north onto Edmondson Avenue.

The acquisitions are in the property front yards (with the exception of one side yard), involving contributing features such as terraces; lawns; concrete pavement, steps linking to the sidewalks, walkways, and curbs bordering the yards; and low rubble stone walls. Individual property acquisitions range from about 1 foot to 9 feet of the front yards within these sliver takes. In all instances, the majority of the existing yards, including terraces, would be retained. In addition, the total property acquisitions of about 0.3 acre are a small part of the 79 acres of the historic district, representing about 0.38 percent of its size (refer to **Figure 6-17**). Refer to the photo for an example of proposed right-of-way within Allendale-West Mulberry Historic District/Keelty Daylight Rowhouse Historic District at Gwynns Falls.

No buildings would be altered or demolished, and the character of this district would be maintained.

Example of proposed right-of-way within Allendale-West Mulberry Historic District/Keelty Daylight Rowhouse Historic District at Gwynns Falls

e. Keelty Daylight Rowhouse Historic District at Gwynns Falls

The Keelty Daylight Rowhouse Historic District at Gwynns Falls is a residential rowhouse district and historic site, located on the west and east sides of Gwynns Falls Park. The west section is bordered by Normandy Avenue, Lyndhurst Street, Gelston Drive, North Hilton Street, West Mulberry Street, Edgewood Street, West Lexington Street, North Grantley Street, West Saratoga Street, and Allendale Street and the east section is bordered by Gwynns Falls Trail, Ellicott Driveway, Braddish Avenue, West Lafayette Avenue, Poplar Grove Street, and Edmondson Avenue (**Figure 6-18**). A total of 152 contributing properties would be impacted within the Keelty Daylight Rowhouse Historic District at Gwynns Falls. Of the total, 48 properties are also contributing properties to the overlapping Edmondson Village Historic District (refer to **Section 6.7.2.c**), 79 are also contributing properties to the Allendale-West Mulberry Historic District (refer to **Section 6.7.2.d**), and 25 are also contributing properties to the Greater Rosemont Historic District (refer to **Section 6.7.2.f**).

Under the Preferred Alternative, the transitway in the west section of the district would consist of two sets of tracks along Edmondson Avenue within the district; in the east section the tracks would run along Edmondson Avenue, about 25 feet south of the district's boundary. The westbound and eastbound Allendale Station platforms would be on Edmondson Avenue at Allendale Street.

The project would result in a Section 4(f) use of 152 properties on the north and south sides of Edmondson Avenue because land from the following National Register-eligible historic district contributing properties would be required:

- North Side: (a) 28 rowhouse properties and one church property between Mount Holly and Linnard Streets; (b) 19 rowhouse properties between Edgewood and Denison Streets; and (c) 25 rowhouse properties between North Rosedale and North Longwood Streets.
- South Side: (a) 65 rowhouse properties and one office property between Normandy Avenue and Edgewood Street and (b) 13 rowhouse properties between Denison and North Hilton Streets.

These properties are on 11 of the 16 blocks of the historic district that face onto Edmondson Avenue.

The land acquisitions are in the property front yards (with the exception of one side yard), involving contributing features such as terraces; lawns; concrete pavement, steps linking to the sidewalks, walkways, curbs bordering the yards, and driveway; and low rubble stone walls. Individual property acquisitions range from about 1 foot to 9 feet of the front yards within these sliver takes. In all instances, the majority of the existing yards, including terraces, would be retained. In addition, the total property acquisitions of about 0.33 acre are a small part of the 235 acres of the historic district, representing about 0.14 percent of its size (**Figure 6-18**).

No buildings would be altered or demolished, and the character of the district would be maintained.

f. Greater Rosemont Historic District

The Greater Rosemont Historic District is a primarily residential rowhouse district and historic site bounded by West Franklin Street, North Franklintown Road, Poplar Grove Street, Edmondson Avenue, Gwynns Falls Park, North Rosedale Street, Ellicott Driveway, Ashburn Street, Prospect Street, Braddish Avenue, West Lafayette Avenue, West Lanvale Street, North Dukeland Street, Rayner Avenue, Whitmore Avenue, Winchester Street, North Bentalou Street, CSX tracks, Riggs Avenue, and the Amtrak Northeast Corridor (historically the Baltimore & Potomac Railroad) (**Figure 6-19**). A total of 40 contributing properties would be impacted within the Greater Rosemont Historic District. Of those, 25 properties are also contributing properties to the overlapping Keelty Daylight Rowhouse Historic District at Gwynns Falls (refer to **Section 6.7.2.e**), and 15 properties are also contributing properties to the overlapping Edmondson Avenue Historic District (refer to **Section 6.7.2.g**).

Under the Preferred Alternative, the transitway near the district would consist of two sets of tracks along Edmondson Avenue, and continue east along North Franklintown Road and West Franklin Street. The alignment would be about 30 to 60 feet south of the district's boundary; the Rosemont Station platforms would be on Edmondson Avenue, between Poplar Grove Street and North Franklintown Road, before the alignment turns onto North Franklintown Road. At the eastern end of the historic district, the alignment splits into two, with the west bound trains along West Franklin Street, and the east bound trains along West Mulberry Street; the two station platforms for each are east of the existing Amtrak Northeast Corridor alignment.

The project would result in a Section 4(f) use of 40 properties on the north side of Edmondson Avenue and Franklin Street because land from the following National Register-eligible historic district contributing properties would be required: a) 25 rowhouse properties between North Rosedale and North Longwood Streets and b) 15 rowhouse properties between Whitmore and North Warwick Avenues. These properties are located on two out of the thirteen blocks of the historic district that face south onto Edmondson Avenue, North Franklintown Road, and West Franklin Street.

The acquisitions are in the property front yards (with the exception of one side yard), involving contributing features such as terraces; lawns; and concrete steps linking to the sidewalks, curbs bordering the yards, and driveway. Individual property acquisitions range from about 0.5 foot to 1 foot of the front yards within these sliver takes. In all instances, the majority of the existing yards, including terraces, would be retained. In addition, the total property acquisitions of about 0.01 acre are a small part of the 270 acres of the historic district, representing about 0.004 percent of its size (**Figure 6-19**).

No buildings would be altered or demolished, and the character of this district would be maintained.

g. Edmondson Avenue Historic District

The Edmondson Avenue Historic District is a primarily residential rowhouse district and historic site bounded by West Franklin Street, North Franklintown Road, Edmondson Avenue, Evergreen Street, Rayner Avenue, Braddish Avenue, St. Peters Cemetery, North Bentalou Street, CSX tracks, Riggs Avenue, West Lafayette Avenue, and Spedden Street (**Figure 6-20**).

A total of 15 contributing properties would be impacted within the Edmondson Avenue Historic District. Of those, all are also contributing properties to the overlapping Greater Rosemont Historic District (refer to **Section 6.7.2.f**).

Under the Preferred Alternative, the transitway near the district would consist of two sets of tracks along North Franklintown Road, continuing east along West Franklin Street. The alignment would be about 30 to 60 feet south of the district’s boundary; the Rosemont Station platforms would be located on Edmondson Avenue, between Poplar Grove Street and North Franklintown Road, west of the western end of the historic district. At the eastern end of the historic district, the alignment splits into two, with the west bound trains along West Franklin Street, and the east bound trains along West Mulberry Street; the two station platforms for each are east of the existing Amtrak Northeast Corridor alignment.

The project would result in a Section 4(f) use of 15 properties because land from these National Register-eligible historic district contributing properties would be required on the north side of Franklin Street between Whitmore and North Warwick Avenues. These properties are on one of the seven blocks of the historic district that face south onto North Franklintown Road and West Franklin Street.

The acquisitions are in the property front yards and involve contributing features such as concrete steps linking to the sidewalks and concrete curbs bordering the yards. Individual property acquisitions average 0.5 foot of the front yards within these sliver takes. In all instances, the majority of the existing yards would be retained. In addition, the total property acquisitions of about 70 square feet are a very small part of the 167 acres of the historic district, representing about 0.001 percent of its size (**Figure 6-20**).

No buildings would be altered or demolished, and the character of this district would be maintained.

h. Baltimore & Potomac Railroad (Philadelphia, Baltimore & Washington Railroad)

The Baltimore & Potomac Railroad (Philadelphia, Baltimore & Washington Railroad) is a railroad corridor and historic site. It is between the Baltimore City/Baltimore County line at the southwest (in the community of Violetville) to Baltimore's Pennsylvania Station at the northeast (excluding the station itself) (**Figure 6-21**). Today, the alignment is part of Amtrak's Northeast Corridor; the MARC commuter trains and Norfolk Southern (NS) freight trains also use this railroad corridor.

Under the Preferred Alternative, the transitway's eastbound and westbound tracks would diverge and follow West Franklin and West Mulberry streets at grade. The elevated Baltimore & Potomac Railroad, including the West Baltimore MARC Station, is carried above these streets by two railroad bridges that are contributing elements of the historic alignment. The project would result in a Section 4(f) use of the bridges because overhead catenary lines would be attached to their undersides (**Figure 6-21**).

i. Union Railroad

The Union Railroad is a railroad alignment and historic site. It consists of the entire length of the line in Baltimore City that extends from the northern portal of the Baltimore & Potomac Tunnel under the Northern Avenue Bridge to the southern terminus at Boston Street in Canton (**Figure 6-22**). The portion of the railroad corridor with Section 4(f) use has been inactive since the 1980s, and is owned by NS.

The Preferred Alternative would run on rail lines from approximately Fait Avenue to East Platt Street. All existing rail line features such as the tracks, ties, and ballast along this section of railroad would be replaced. The new topography would be built-up and the new dual track alignment shifted as compared to the existing rail lines. The proposed Greektown/Highlandtown Station would consist of two platforms, each approximately 195 feet long and 10 feet wide with a partial canopy. They would flank the new Red Line tracks on either side, and be located between Fleet Street and Eastern Avenue. Construction staging areas would encompass portions of the railroad's alignment (**Figure 6-22**). At least some of the existing rails have 1920s date stamps, and could have been installed at their current location at that time. However, the integrity of the rail line features is impacted significantly by longtime inactivity and the growth of dense vegetation. The results of disuse include deteriorated railroad ties and ballast, and removed or covered over tracks.

Under the Preferred Alternative, the project would result in a Section 4(f) use of the Union Railroad because the alignment would travel across a railroad bridge (over Eastern Avenue) that is a contributing element of the historic railroad. The bridge's steel plates would be spot repaired, involving grinding off rusted areas and welding on new plates. The current concrete deck would be replaced in kind, although this would not be visible, except from underneath the bridge. The bridge would be painted. It would maintain its current historic appearance.

6.8 Documentation of Permanent Use of a Historic District Requiring Avoidance Alternatives and Least Overall Harm Analysis

The proposed Inner Harbor Station has the potential to result in a permanent, non-de minimis use of land within the Business and Government Historic District, as a result of the proposed demolition of two historic resources that would be required for the construction of the station ancillary building. The proposed Inner Harbor Station and ancillary building was discussed in **Section 6.4.5** of this Draft Section 4(f) Evaluation.

The Business and Government Historic District is a commercial and government district, and historic site bounded by South and North Charles Street, East Lexington Street, East Saratoga Street, North and South Gay Street, North Frederick Street, East Baltimore Street, West Falls Avenue, Water Street, and East Lombard Street **(Figure 6-23)**.

Within the historic district is 108-12 East Lombard Street, a three-story brick building constructed in the Colonial Revival style in 1904 that is vacant. The building played a role in Baltimore City's economic, commercial, and physical growth during the period of significance. It is one of the many early twentieth century low-scale buildings with classical details built during the years after Baltimore's Great Fire of 1904. The building retains enough integrity to be a contributing resource to the district. It retains its original location. Although a good number of the surrounding buildings have been replaced with larger scale commercial buildings, nearby buildings are still those from the historic district's period of significance. In addition, the area is still Baltimore City's active business and government district. The doors are boarded and the window sashes are either replaced or boarded, but otherwise the building retains most of its character-defining features, including Colonial Revival design details such as a wood cornice with a corbel table and egg-and-dart details, wood shutters flanking the windows, wood fanlight above a second floor window, and a wood round-arched primary entrance with keystone, topped by a broken pediment supported by Doric columns.

Adjacent to the 108-112 three-story brick building, is 114 East Lombard Street, a four-story brick building constructed in the Italianate style in 1906 that is also vacant (see photo). The property's association with the Business and Government Historic District's significance is identical to 108-12 East Lombard Street. This building retains enough integrity to be a contributing resource to the district. It retains its original location. Although a good number of the surrounding buildings have been replaced with larger-scale commercial buildings, nearby buildings are still those from the historic district's period of significance. In addition, the area is still Baltimore's active business and government district. The doors are boarded and the window sashes are either replaced or boarded, but otherwise it retains its character-defining features such as a prominent wood cornice with brackets and dentils, and rusticated rock-faced stone sills and string courses.

The Preferred Alternative proposes a configuration for the Inner Harbor Station that would result in a Section 4(f) use of both 108-12 and 114 East Lombard Street because these buildings would be acquired and demolished to accommodate the station ancillary building that would contain ventilation, smoke control and equipment rooms.

In accordance with Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations at 36 CFR Part 800, the undertaking would result in an “adverse effect“ to the Business and Government Historic District, so a finding of de minimis impact cannot be made. Therefore, an avoidance alternative evaluation and least overall harm analysis for the properties were conducted and are included in **Sections 6.9** and **6.10**, respectively, of this Draft Section 4(f) Evaluation.

108-12 and 114 East Lombard Streets

Figure 6-13: Boston Street Pier Park and St. Casimir's Park

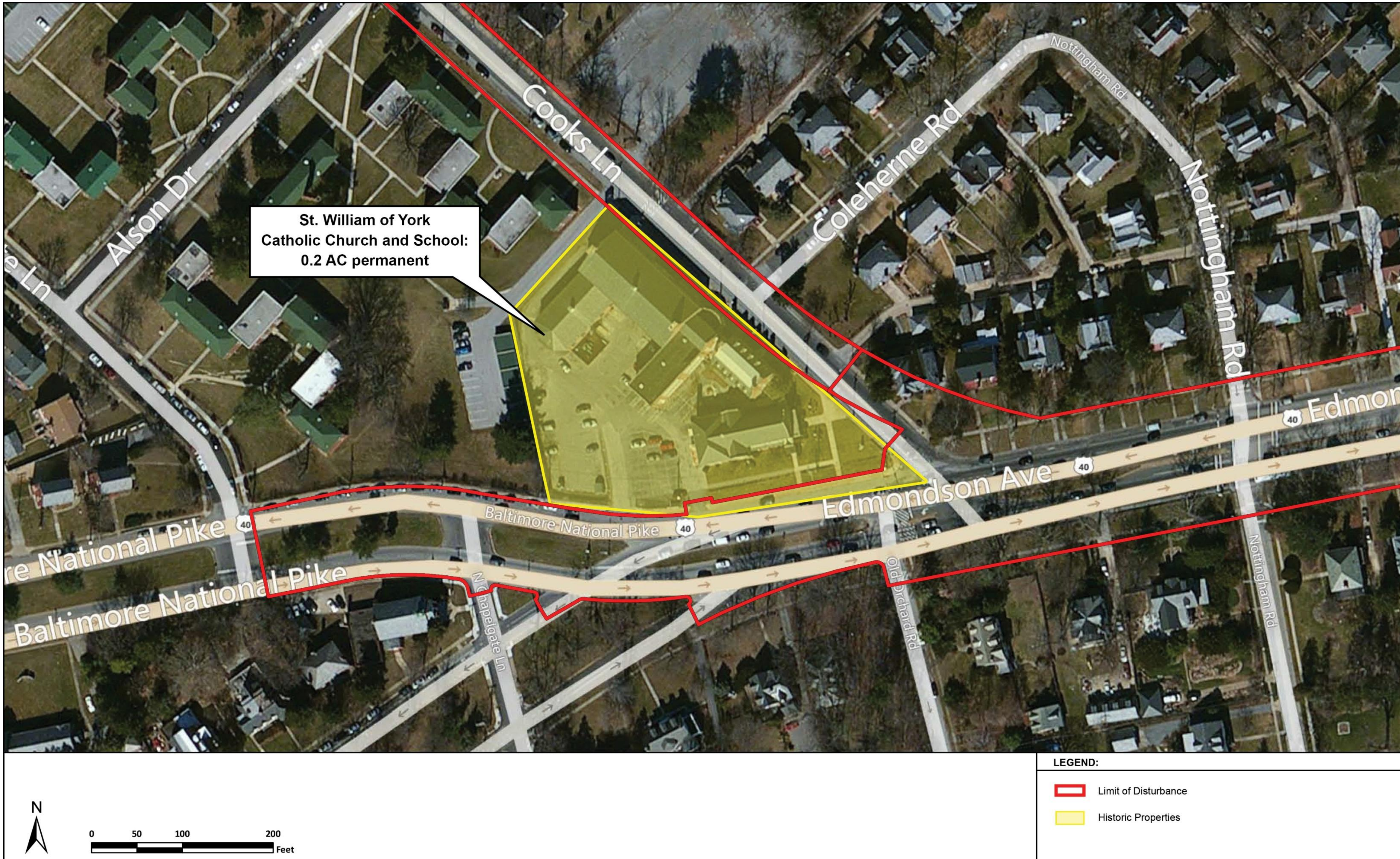


Figure 6-14: St. Williams of York Catholic Church and School

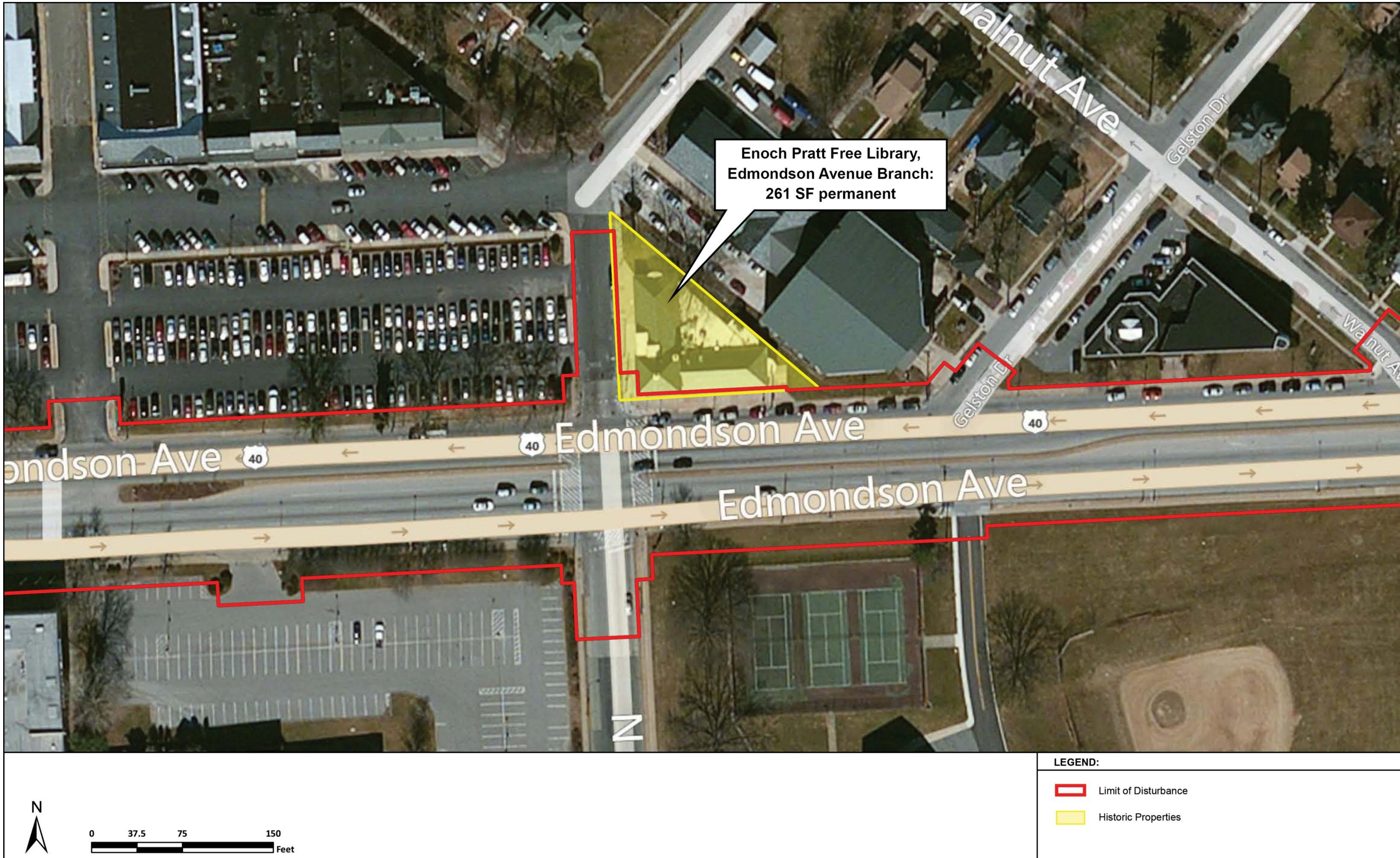


Figure 6-15: Enoch Pratt Free Library, Edmondson Avenue Branch

Figure 6-16: Edmondson Village Historic District

Figure 6-17: Allendale-West Mulberry Historic District

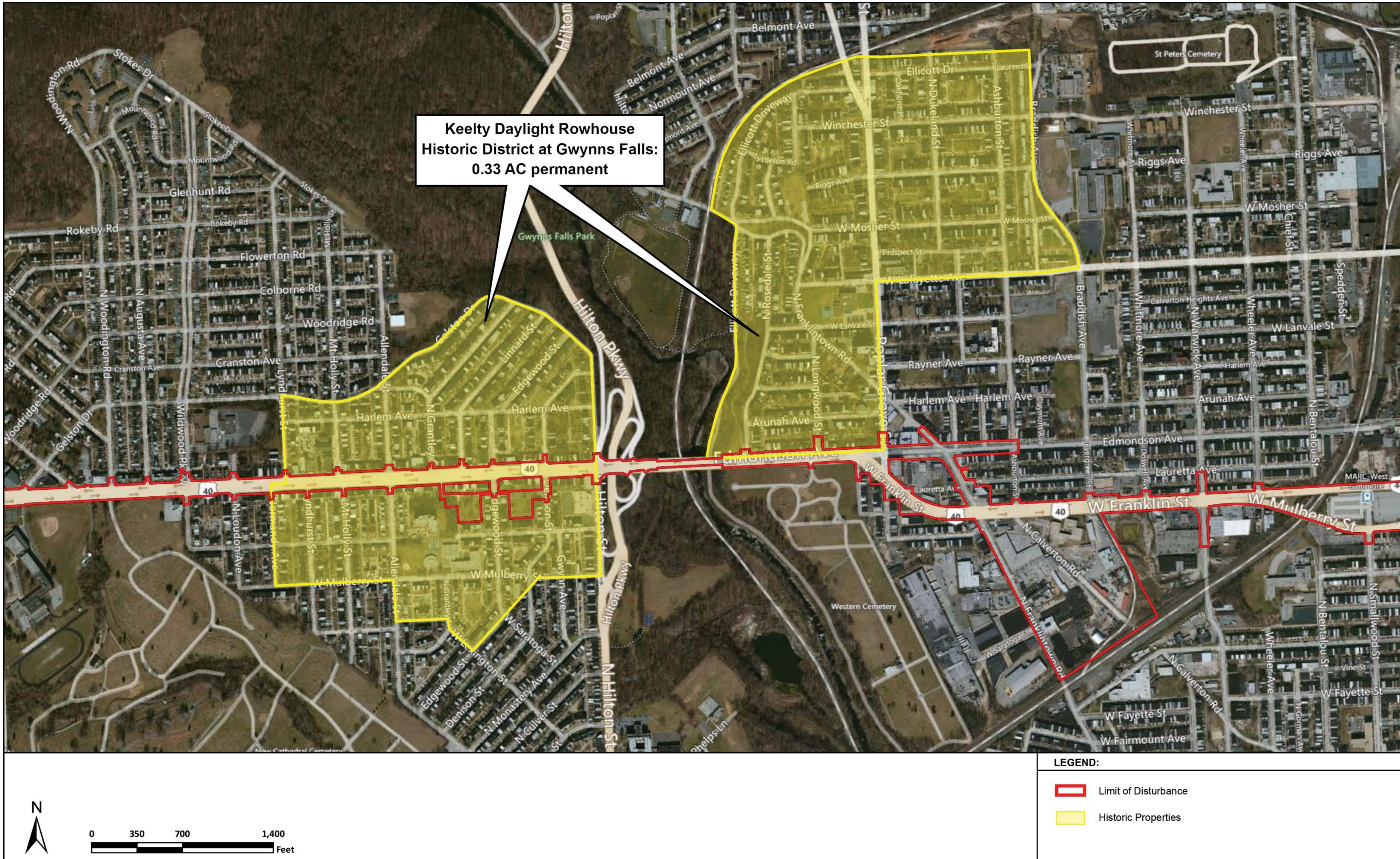


Figure 6-18: Keelty Daylight Rowhouse District at Gwynns Falls

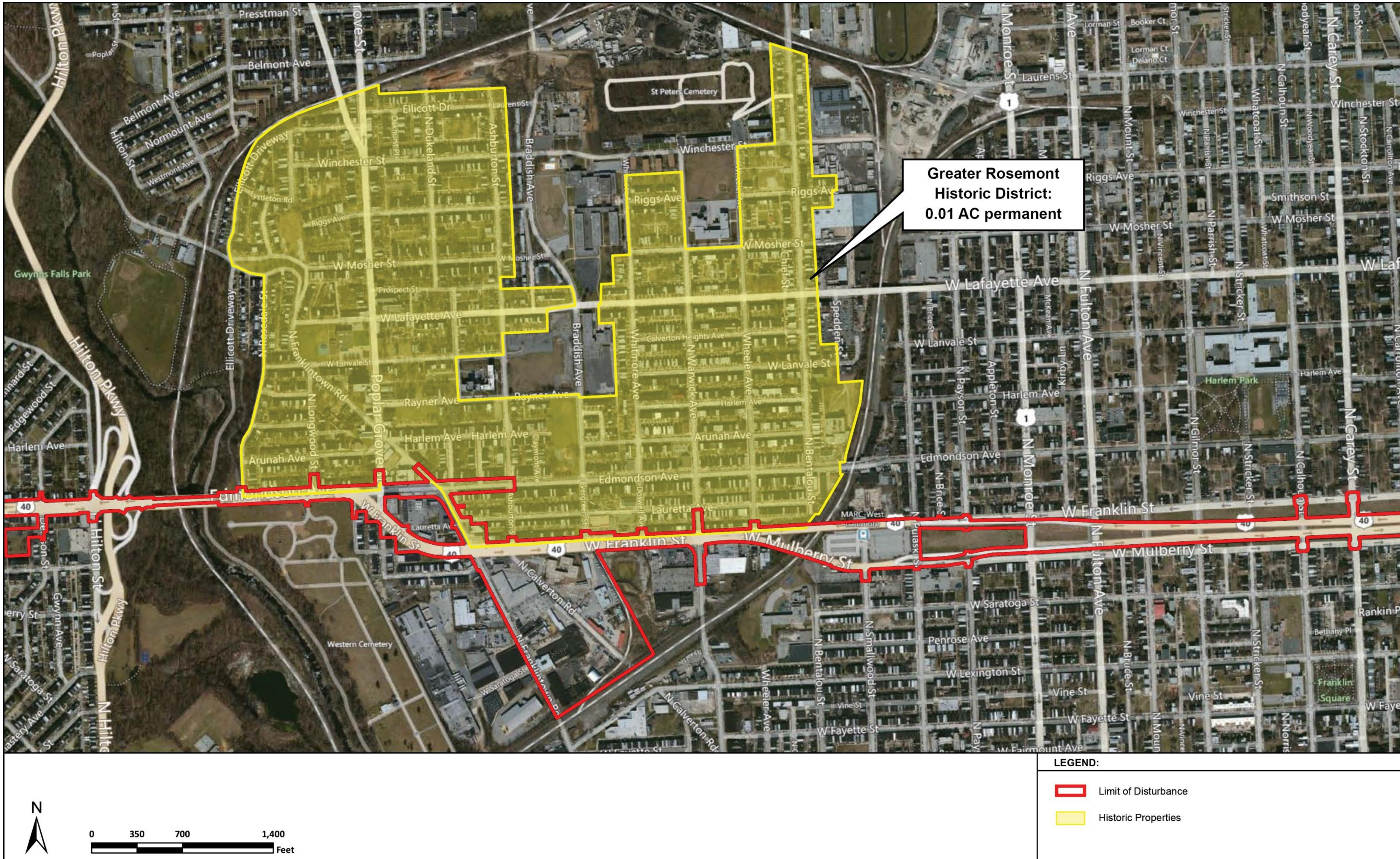


Figure 6-19: Greater Rosemont Historic District

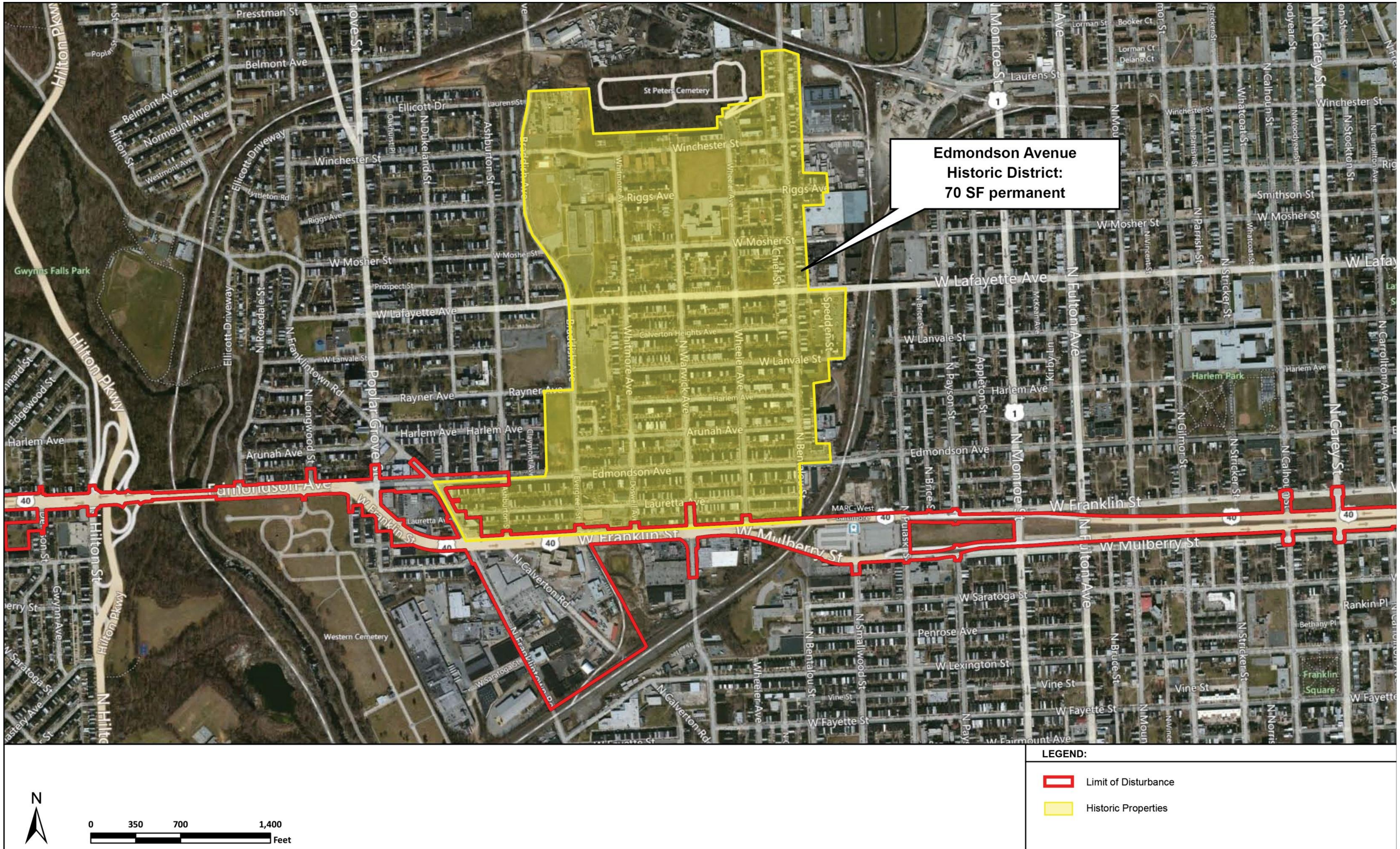


Figure 6-20: Edmondson Avenue Historic District

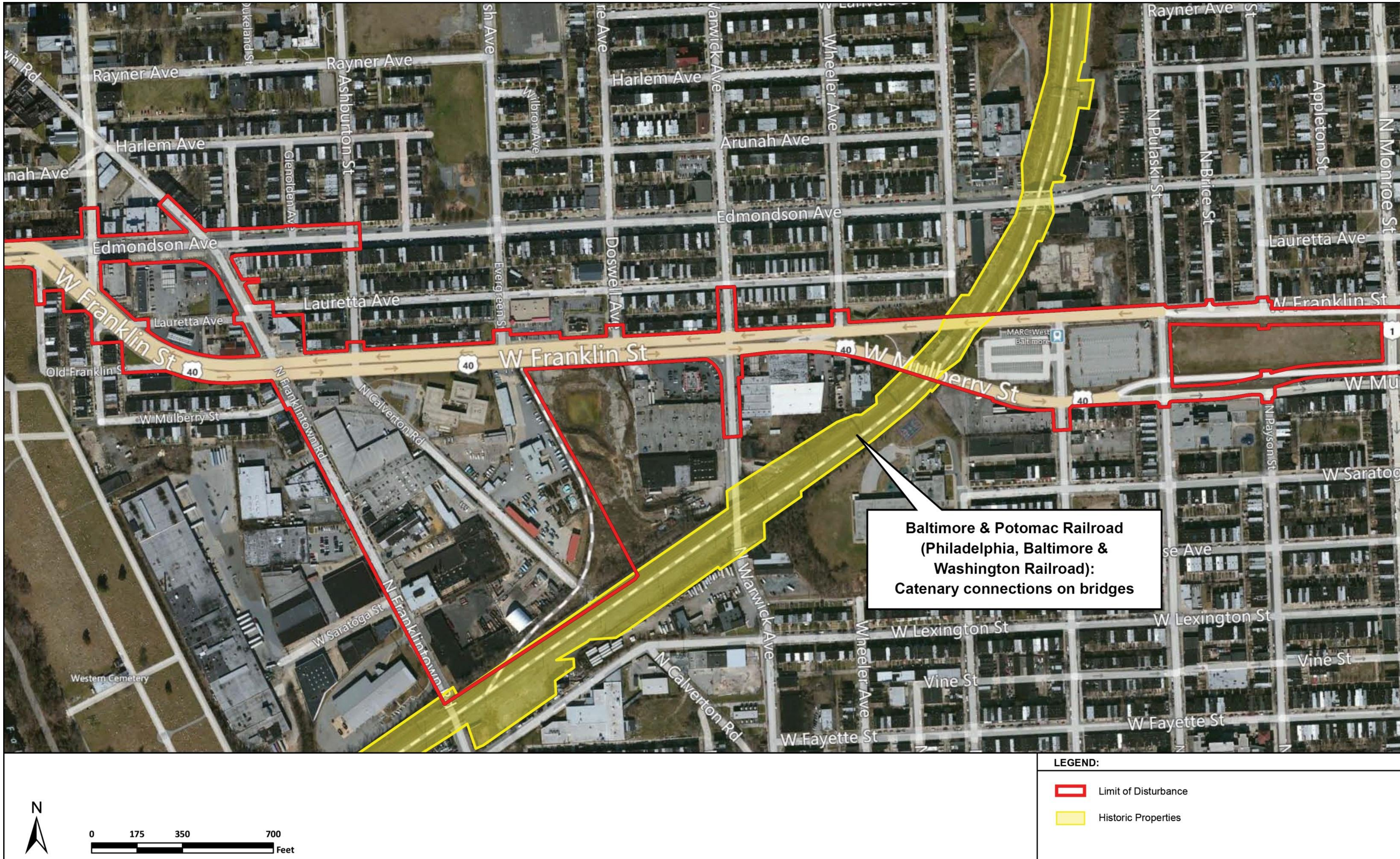


Figure 6-21: Baltimore & Potomac Railroad (Philadelphia, Baltimore & Washington Railroad)

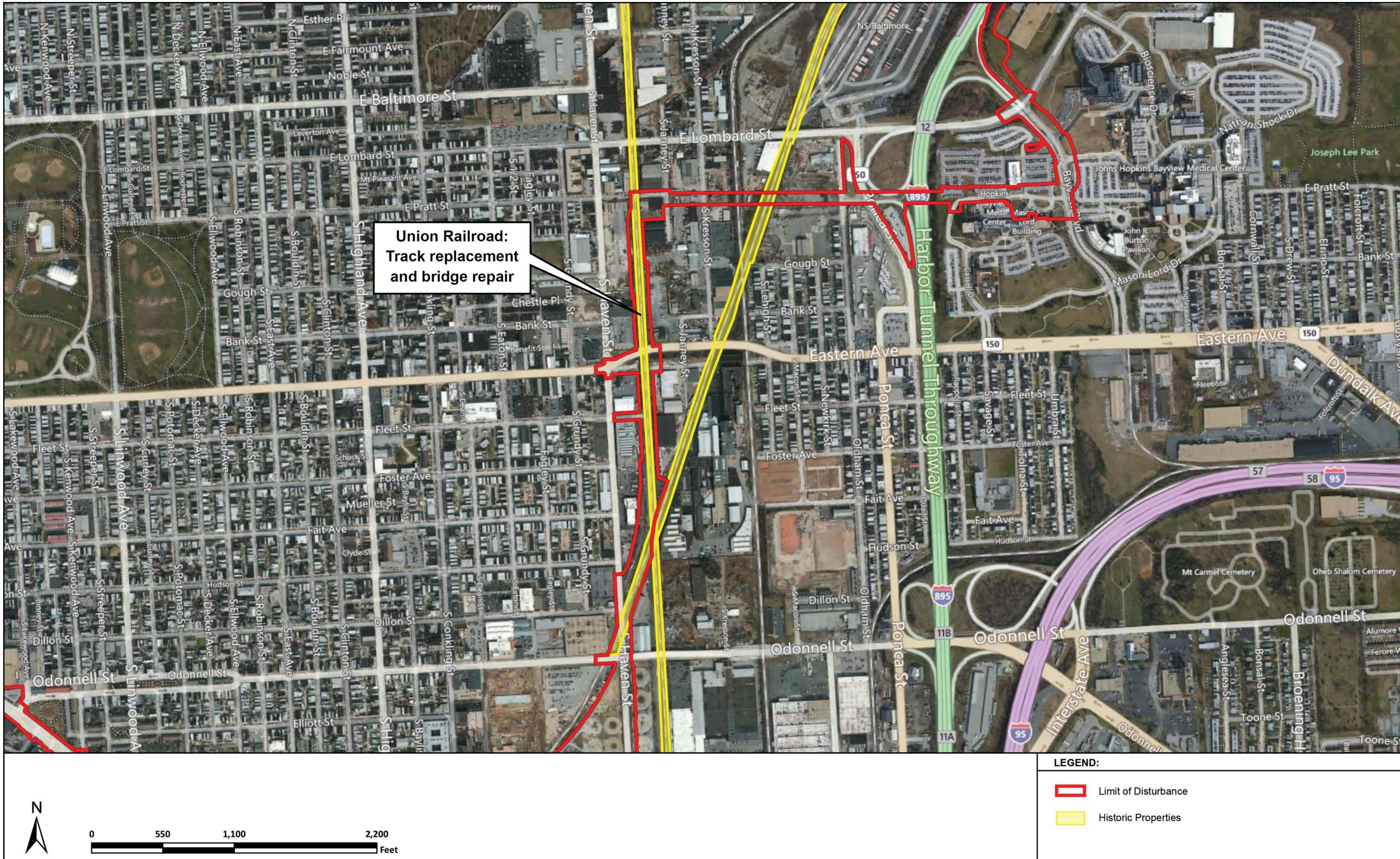


Figure 6-22: Union Railroad

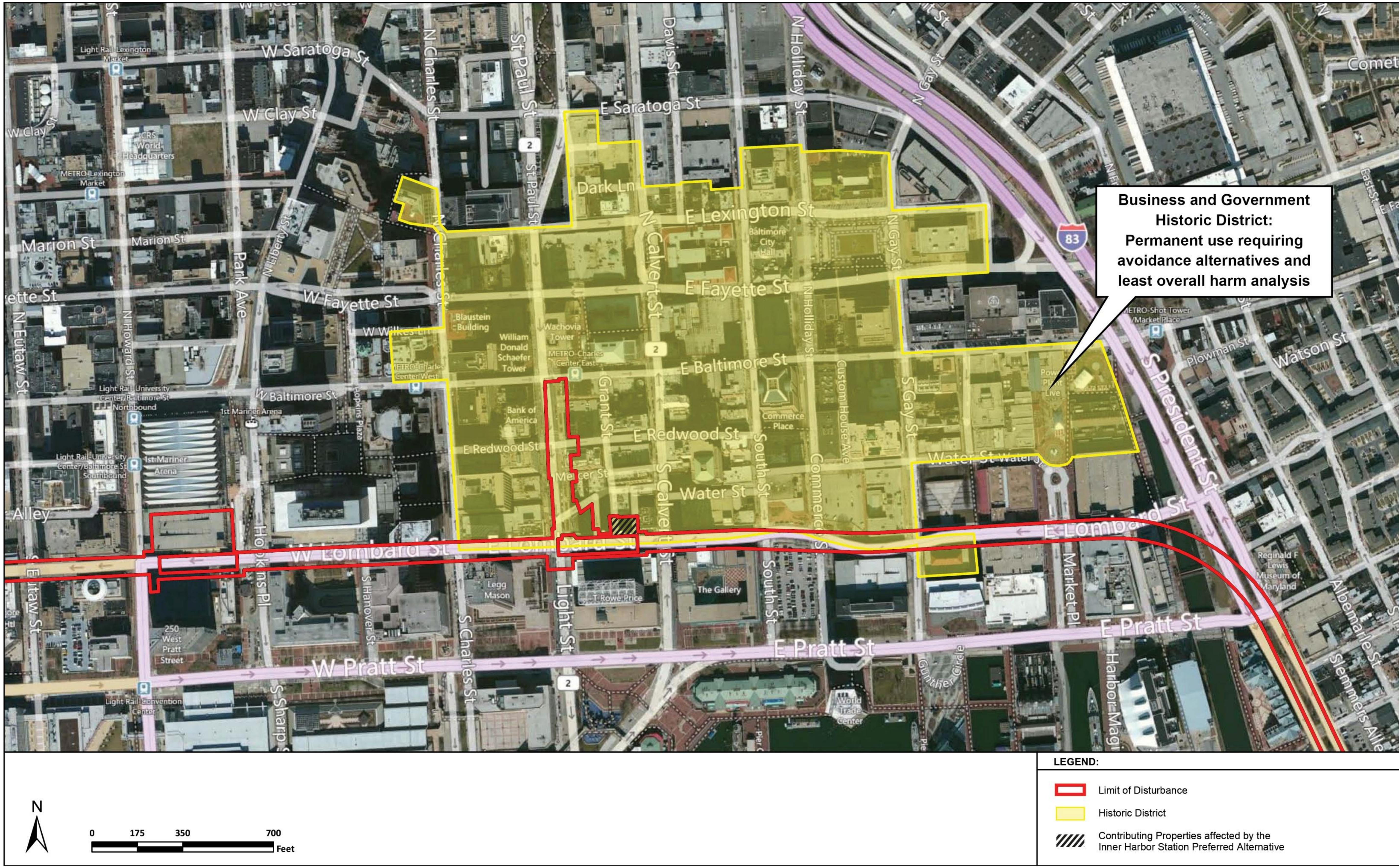


Figure 6-23: Business and Government Historic District

6.9 Alternatives to the Use of the Section 4(f) Resource

6.9.1 Inner Harbor Station Avoidance Alternatives

The area served by the proposed Inner Harbor Station includes the core of the downtown central business district (CBD), characterized by a dense concentration of office development, financial institutions, and Baltimore City government offices. The station would allow convenient transit access to the recreation activities, museums, entertainment, shops, restaurants, and other attractions concentrated at the Inner Harbor. Thus, the Inner Harbor Station location would support the project need of increased transit accessibility in the corridor, by providing improved transit access to major employment and activity centers within and around the CBD and Inner Harbor areas from other locations along the project study corridor.

The Inner Harbor Station location was also selected to enhance connections to existing transit routes. A station entrance at the northeast corner of East Lombard and Light Streets would best accommodate a pedestrian tunnel underneath the east sidewalk of Light Street and allow a direct connection to the Charles Center Metro Station, located underneath East Baltimore Street approximately two blocks to the north. The station would be within the area of MTA core bus service in the CBD. Fifty-six bus lines serve the CBD including nine lines operating north-south routes via North Charles and St. Paul Streets.

It is projected that the Inner Harbor Station would experience the highest volume of passenger use on the Red Line. In 2035, the design year for the project, there would be an average of 55,000 daily trips on the Red Line. The number of daily boardings and alightings at the Inner Harbor Station would each be in excess of 13,000. Of those daily trips, approximately 6,300 passengers would be transferring to the Charles Center Metro Station, and 6,300 would be transferring from the Charles Center Metro Station.

East Lombard Street, the location of the Preferred Alternative Inner Harbor Station, comprises the southern boundary of the Business and Government Historic District. In addition to the vacant buildings at 108-12 and 114 East Lombard Streets, there are multiple Section 4(f) properties within the Inner Harbor Station area. Each of the properties contains contributing buildings to the Business and Government Historic District, and includes:

- 34-36 Light Street
- 31 Light Street
- 104 East Lombard Street /111 Water Street

Alternatives that avoid all Section 4(f) properties at this location have been evaluated, as well as alternatives that would avoid individual Section 4(f) properties. Three total avoidance alternatives, in addition to the No-Build Alternative, have been developed and are discussed below and identified in **Figure 6-24**. Each avoidance alternative is described from west to east, and analyzed in accordance with the definition of *feasible and prudent avoidance alternative* found in 23 CFR 774.17.

6.9.2 Inner Harbor Station No-Build

Under the Inner Harbor Station No-Build Alternative, the Red Line would be constructed, but a passenger station would not be included at the Inner Harbor location. The Inner Harbor No-Build would avoid all Section 4(f) use associated with the Inner Harbor Station; however, the Inner Harbor Station No-Build Alternative does not meet the project purpose and need because it:

- would not increase transit accessibility in the corridor by providing improved transit access to major employment and activity centers; eliminating the Inner Harbor Station would likely result in decreased ridership because it would not service passengers working in the downtown area; and
- would not enhance connections among existing transit routes in the corridor because it would not serve passengers transferring to and from the Charles Center Metro Station.

Although the Inner Harbor Station No-Build Alternative would result in no impacts to Section 4(f) properties, it is not prudent because it would be unreasonable to proceed with the Inner Harbor Station No-Build Alternative in light of the project's stated purpose and need, specifically the needs for increased transit accessibility in the corridor by providing improved transit access to major employment and activity centers, and enhanced connections to existing transit routes. The Inner Harbor Station No-Build Alternative, while feasible, is not and prudent and it is being eliminated because it causes severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

6.9.3 Inner Harbor Station Avoidance Alternative 1 (Transamerica Plaza)

Under Inner Harbor Station Avoidance Alternative 1, the station entrance would be constructed at the southwest corner of East Lombard and Light Streets in the plaza outside the Transamerica Tower located at 100 Light Street**.** A three-level underground station would be required to minimize ancillary equipment space requirements on the surface level. However, ventilation exhaust structure ancillary building would need to be constructed at the surface level within the plaza. The underground station structure would be constructed beneath East Lombard Street between Light Street and South Charles Streets, with emergency exits in the sidewalk on the north side of East Lombard Street at both ends of the station structure.

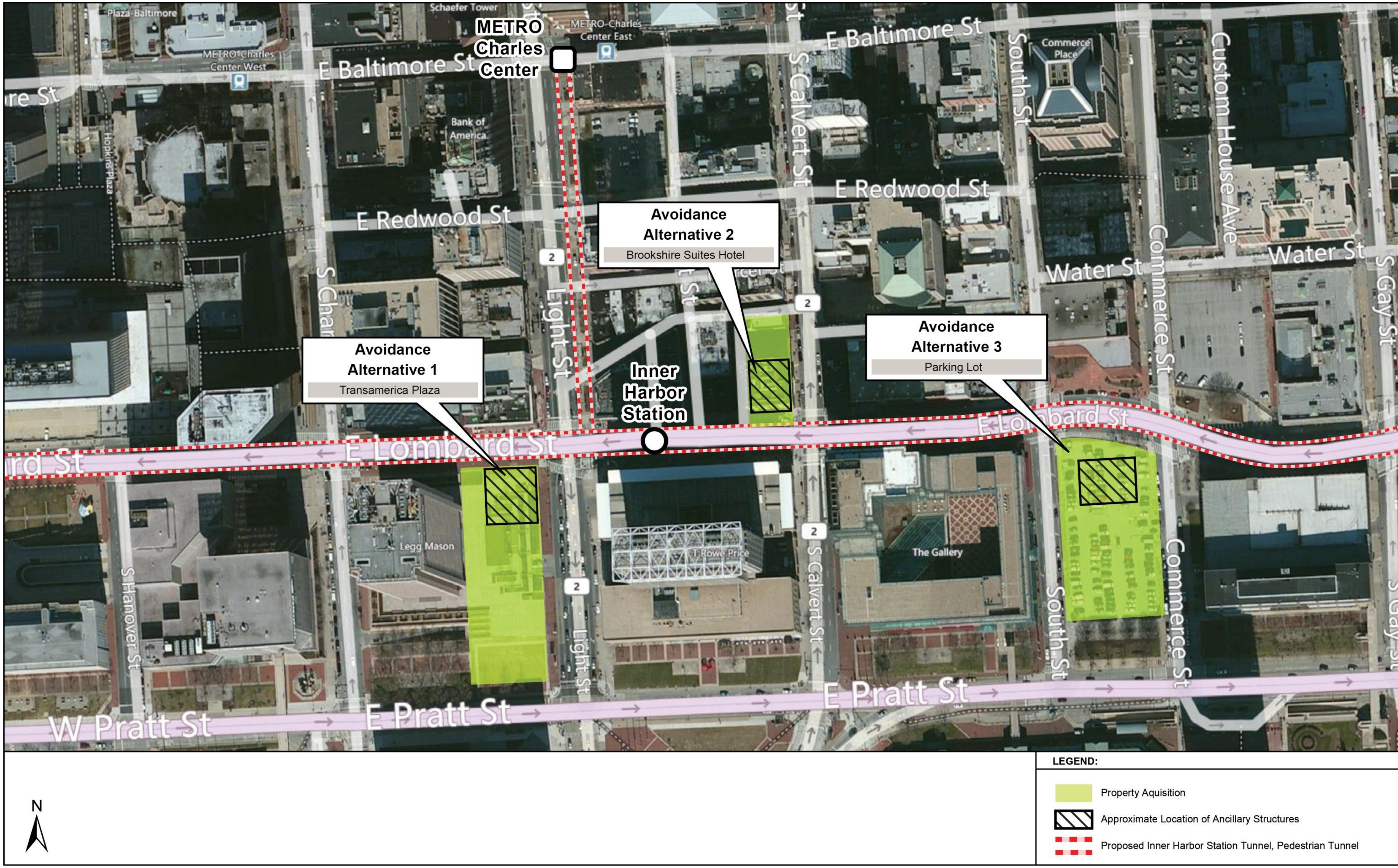


Figure 6-24: Location of Avoidance Alternatives

As shown in the photo, the Transamerica Tower is a 37-story skyscraper that was constructed in 1973. It occupies one square block between East Lombard and East Pratt Streets, and Light and South Charles Streets. A courtyard plaza surrounds the building. The tower includes a three-level underground parking garage comprised of 269 parking spaces and mechanical equipment rooms that extend under the plaza. The building leases Class A office space to multiple tenants and is currently at 95 percent occupancy.

Transamerica Plaza and Tower

Since the footprint of the Transamerica underground parking garage extends under the plaza surrounding the building, structural underpinning of the building foundation, as well as the foundation columns of the garage at 30 Light Street, would be required to place the underground station structure and entrance at this location. Structural underpinning is the process of physically strengthening and stabilizing the foundation of an existing building or other structure, and is accomplished by extending the building's foundation in depth or in breadth so it either rests on a more supportive soil stratum or distributes its load across a greater area. A variety of construction methods may be used, and the process is generally elaborate and expensive. Because of its configuration, parking in all 269 parking spaces in the Transamerica Tower garage would likely be permanently prohibited because of disruption of traffic circulation patterns from the required structural underpinning, and relocation of the mechanical rooms. Retrofitting the underground structures would be significantly complex and costly.

With the station entrance at the southwest corner of the intersection, an extension of the pedestrian tunnel across Light Street would be required. Extending the underground connection to Charles Center Metro Station across Light Street would result in a complex sequencing of construction and maintenance of traffic across Lombard Street. In addition to the staged lane closures on East Lombard Street for the cut-and-cover construction of the station structure, closure of the East Lombard and Light Streets intersection would be required, and traffic rerouted, for a period of approximately 6 to 12 months.

The estimated cost of Inner Harbor Avoidance Alternative 1, including right-of-way acquisition, garage reconfiguration, construction of the three-level station structure, and additional pedestrian tunnel segment, would be approximately $171.1 million.

Inner Harbor Station Avoidance Alternative 1, while feasible, is not prudent because it 1) would cause severe disruption to established communities because of traffic impacts during construction requiring closure of the intersection of Light and East Lombard Streets, in addition to the required lane closures on East Lombard Street for the cut-and-cover construction of the underground station structure; 2) results in additional construction costs of an extraordinary magnitude; 3) causes other unique problems or unusual factors, specifically the difficulty of retrofitting the below grade structures and elimination of the 269-space parking garage beneath the Transamerica tower and plaza; and 4) involves multiple factors, such as increased traffic disruptions, a business displacement, and high construction costs, that while individually minor, cumulatively cause unique problems or impacts of extraordinary magnitude.

Avoidance Alternative 1, while feasible, is not prudent and it is being eliminated because it causes severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

6.9.4 Inner Harbor Station Avoidance Alternative 2 (Brookshire Suites Hotel)

Under Inner Harbor Station Avoidance Alternative 2, the station entrance and the ancillary facility building would be constructed on the northwest corner of East Lombard and Calvert Streets, on the site occupied by the Brookshire Suites Hotel. Complete demolition of the Brookshire Suites Hotel building would be required, and the business would be relocated. The underground station structure would be constructed along East Lombard Street between Light and South Calvert Streets. Emergency exits at both ends of the station structure would be constructed in the sidewalk on the south side of East Lombard Street.

Brookshire Suites Hotel

The Brookshire Suites Hotel is a 12 story building, constructed in 1958, occupying the parcel at 120 East Lombard Street (see photo). It contains 97 guest rooms and suites, a business center, fitness room, a convenience store marketplace, and catered meeting and event space.

The first row of columns of the 100 East Pratt Street parking garage would require structural underpinning for stabilization of the foundation during construction. The potential for temporary access restrictions of building occupants during construction activities would be determined during Final Design. The underground pedestrian connection to Charles Center Metro Station would require an additional tunnel segment to be constructed underneath East Lombard Street between the station structure and Light Street. This would be constructed using a cut-and-cover method, causing additional disruptions to East Lombard Street beyond those required for construction of the underground station structure. Furthermore, riders transferring to and from the Charles Center Metro Station would be required to walk an additional block between stations via the underground pedestrian tunnel.

The estimated cost of Inner Harbor Station Avoidance Alternative 2, including purchase and demolition of the Brookshire Suites Hotel building, relocation of the business, stabilization of the 100 East Pratt Street garage foundation, and construction of the two-level station structure, would be approximately $146.1 million.

Inner Harbor Station Avoidance Alternative 2, while feasible, is not prudent because it 1) results in additional construction costs of an extraordinary magnitude and 2) causes other unique problems or unusual factors, specifically the need to construct a pedestrian tunnel an additional block under East Lombard Street, resulting in additional construction impacts and lane closures on East Lombard Street and an increased distance for riders to travel between the Charles Center Metro and Red Line Inner Harbor Stations.

Inner Harbor Station Avoidance Alternative 2, while feasible, is not prudent and it is being eliminated because it causes severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

6.9.5 Inner Harbor Station Avoidance Alternative 3 (Parking Lot)

Under Inner Harbor Station Avoidance Alternative 3, the station entrance would be constructed on the southeast corner of East Lombard and South Street on the site of an active parking lot (see photo) comprised of approximately 130 parking spaces, and the ancillary facility building would be built on the same property. The parking lot would be acquired and the business relocated. A three-level underground station structure would be constructed to the east of North Calvert Street. A three-level station would be required because of the depth needed to tunnel underneath and avoid impacts to the United States Custom House, a National Register-listed building on the northeast corner of East Lombard and North Gay Streets to the east. Emergency exits would be constructed in the plaza on the north side of Lombard Street and another in the sidewalk on this block of East Lombard Street. The Approximate cost of this avoidance alternative, including land acquisition, business relocation, and construction of the three-level station structure would be approximately $131.8 million.

A direct underground connection to Charles Center Metro Station would not be feasible from this location. Passengers wishing to connect to and from the Charles Center Metro Station would be required to leave the system by ascending approximately 70 feet from the station platform to the entrance/exit, traveling approximately four city blocks between stations, and descending another 70 feet to the platform at the other station. A passenger’s willingness to make a transit connection diminishes sharply when the length of the walk is greater and a transfer would require leaving the transit system. Therefore, without a direct connection between systems, projected ridership could be impacted. This alternative would not meet the project’s stated need to enhance connections among existing transit routes in the corridor.

Parking Lot at East Lombard between South and Commerce Streets

Inner Harbor Station Avoidance Alternative 3 is not prudent because it compromises the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need, specifically the lack of a direct connection to the Charles Center Metro Station.

Inner Harbor Station Avoidance Alternative 3, while feasible, is not prudent and it is being eliminated because it causes severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

6.9.6 Avoidance Analysis Conclusion

Based on the evaluation presented in this section, there is no feasible and prudent avoidance alternative to the use of land from a Section 4(f) property.

6.10 Evaluation of the Alternative Causing the Least Overall Harm

6.10.1 Design Change Avoidance Alternatives for Individual Section 4(f) Properties

Pursuant to 23 CFR 774.3(c), if the avoidance analysis determines that there is no feasible and prudent avoidance alternative, only the alternative that causes the least overall harm to Section 4(f) property may be approved. Since the previous discussion demonstrates that there is no feasible and prudent avoidance alternative, all of the other alternatives were evaluated to determine which alternative would cause the least overall harm to Section 4(f) property. This section evaluates those alternatives, including alternatives that would eliminate or reduce the use of individual Section 4(f) properties.

There are seven factors to be considered in identifying the alternative that would cause the least overall harm. These factors are: the ability to mitigate adverse impacts to each Section 4(f) property including any measures that result in benefits to the property; the relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection; the relative significance of each Section 4(f) property; the views of the official(s) with jurisdiction over each Section 4(f) property; the degree to which each alternative meets the purpose and need for the project; after reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f); and substantial differences in costs among the alternatives (see 23 CFR 774.3(c)(1)).

The location of the least harm alternatives are presented in **Figure 6-25**.

6.10.2 Inner Harbor Station Alternative 4 (34-36 Light Street)

The four-story brick former warehouse building at 34-36 Light Street was constructed with stylized and austere classical details in 1905 (see photo). Royal Farms, a convenience store, occupies most of the first floor and office space is available on the three floors above. The building has been recently retrofitted and rehabilitated. Most building sections behind the North Bay facing Light Street and the west bay facing East Lombard Street are incorporated into the garage that flanks the former warehouse building.

34-36 Light Street

The building played a role in Baltimore City's economic, commercial, and physical growth during the Business and Government Historic District's period of significance. One of the many early twentieth century low-scale buildings with classical details built during the years after Baltimore's Great Fire of 1904. The building retains enough integrity to be a contributing resource to the district. It retains its original location. Although a number of the surrounding buildings have been replaced with larger scale commercial buildings, such as the ten-story garage that flanks it, there are still other nearby buildings from the historic district's period of significance. In addition, the area is still Baltimore's active business and government district. The building was originally constructed as eight connected warehouses; construction of the adjacent garage demolished five of these warehouses, and portions of the remaining building have been incorporated into the garage, although the façades have been retained. In addition, the first floor window sashes and doors are recent replacements. However, the building still reads as a product of its time and retains most of its original character-defining features including stylized classical details such as brackets with guttae and keystones below the cornice, and brick pilasters.

Under Inner Harbor Station Alternative 4, the station entrance would be constructed at the northwest corner of East Lombard and Light Streets at the site of the 34-36 Light Street building. The contributing historic building would be demolished, and the Royal Farms and office tenants on the upper floors would be relocated. The underground station would require three levels to minimize surface ancillary facility building space requirements and fit within the existing footprint. The station structure would be beneath East Lombard Street between Light Street and South Charles Streets. Emergency exits at both ends of the station structure would be constructed in the sidewalk on the south side of East Lombard Street. The foundation of the parking garage at 30 Light Street and the first row of foundations of the parking garage under the Transamerica building would require structural underpinning for stability. The extent of business disruptions, if any, would be further identified during Final Design of the project.

As with Inner Harbor Station Avoidance Alternatives 1, locating the station entrance on the west side of Light Street would require an extension of the pedestrian tunnel across Light Street. This would result in a more complex sequencing and maintenance of traffic because of the need to closure of the intersection of East Lombard and Light Streets for a period of 6 to 12 months. In addition, lane closures would be required on East Lombard Street for the cut-and-cover construction of the underground station structure.

The estimated cost of Inner Harbor Station Alternative 4, including right-of-way acquisition, business relocation, building demolition, and construction of the three-level station structure and pedestrian tunnel extension would be approximately $131.3 million.

6.10.3 Inner Harbor Station Alternative 5 (30 Light Street Parking Garage)

Under Inner Harbor Station Alternative 5, the station entrance would be at the northwest corner of East Lombard and Light Streets on the site of an active parking garage at 30 Light Street, and the building would be demolished. The ancillary facility building would be on the same property. The two-level underground station structure would be beneath East Lombard Street between Light Street and South Charles Streets. Emergency exits, located at both ends of the station structure, would be constructed in the sidewalk on the south side of East Lombard Street.

Thirty Light Street is a 10-story tall parking garage facility on the north side of Lombard Street between Light and South Charles Streets (see photo). It was constructed in 2009 of reinforced concrete. The garage partially envelopes 34-36 Light Street, a contributing building to the Business and Government Historic District which houses a Royal Farms convenience store and upper floor office space. The garage includes pedestrian and vehicle entrances on both Light and East Lombard Streets, and contains 520 parking spaces, as well as two active retail spaces on the first floor. A Subway restaurant occupies one of the retail spaces, while the others are vacant.

30 Light Street Parking Garage (flanking 34-36 Light Street)

Figure 6-25: Location of Inner Harbor Station Alternatives Considered in Least Overall Harm Analysis

Because of the existing building configuration and circulation pattern inside the parking garage, partial demolition of the structure and reuse as a parking garage and retail space would not be feasible; the building would have to be demolished and the businesses relocated. Demolition would be difficult and costly because of the size and construction materials of the structure, as well as its location in relation to the Section 4(f) property that the structure partially envelopes.

Structural underpinning of the contributing historic building housing the Royal Farms and upper floor office space would be required for foundation stabilization during construction. With the station entrance at the northwest corner of the intersection, an extension of the pedestrian tunnel across Light Street would also be required.

As with the other alternatives to the west of Light Street, extending the underground connection to Charles Center Metro Station across Light Street would result in a more complex sequencing of construction and maintenance of traffic. In addition to the required closure of a block of East Lombard Street for the cut-and-cover construction of the station structure, extension of the pedestrian tunnel beneath Light Street would require closure of the East Lombard and Light Streets intersection and rerouting of traffic, for a period of approximately 6 to 12 months.

The estimated cost of Inner Harbor Station Alternative 5, including right-of-way acquisition, business relocations, demolition, and construction of the two-level station structure and pedestrian tunnel extension, would be approximately $154.1 million.

6.10.4 Inner Harbor Station Alternative 6 (31 Light Street)

Thirty-one Light Street is a five-story concrete building, constructed with stylized and austere classical details in 1904-05 (see photo). CVS Pharmacy currently occupies the first floor and office space is available on the floors above.

31 Light Street

The building played a role in Baltimore City's economic, commercial, and physical growth during the period of significance. It is one of the many early twentieth century low scale buildings with classical details built during the years after Baltimore's Great Fire of 1904. The building retains enough integrity to be a contributing resource to the district. It retains its original location. Although a good number of the surrounding buildings have been replaced with larger scale commercial buildings, nearby buildings are still those from the historic district's period of significance. In addition, the area is still Baltimore's active business and government district. The window sashes and doors are recent replacements. In addition, original protruding classical details were removed during a 1970s remodel that applied a flat metal skin; eliminated projecting elements included at least one string course and much of the cornice. However, during removal of the skin in the 1990s, these features were replaced in a design similar to the original, and recessed architectural elements, such as the pilasters and concrete panels between the windows (with their diamond shaped details), have been revealed. The building is still representative of that period of architecture.

Under Inner Harbor Station Alternative 6, the historic 31 Light Street building would be demolished and the station entrance and ancillary facility structures would be constructed on the site. The CVS Pharmacy and upper floor office tenants would need to be relocated. The two-level station structure would be underneath East Lombard Street to the east of Light Street. Emergency exits would be constructed in the sidewalk on the south side of East Lombard Street. Because the underground station structure would be adjacent to the proposed underground connection to the Charles Center Metro Station underneath the east sidewalk of Light Street, no additional extensions to the underground pedestrian connector would be required. While lane closures would occur on East Lombard Street during the cut-and-cover construction of the station structure, the intersection of East Lombard and Light Streets could remain open throughout construction activities.

With this alternative, the first row of columns of the 100 East Pratt Street parking garage would require structural underpinning for stabilization of the foundation during construction. The potential and duration for temporary access restrictions and need for relocation of building occupants during construction activities would be determined during Final Design.

The estimated cost of Inner Harbor Station Alternative 6, including real estate acquisition, business relocation, building demolition, and construction of the two-level station structure would be approximately $130.0 million.

6.10.5 Inner Harbor Station Alternative 7 (100 East Pratt Street Parking Garage)

The station entrance for Inner Harbor Station Alternative 7 would be constructed at the site of a parking garage building at 100 East Pratt Street**.** The station entrance would be housed within existing retail space on the first floor of the building, with an entrance on the southeast corner of East Lombard and Light Streets. A three-level station structure would be required to minimize ancillary equipment needs at the surface level and minimize impacts to the parking garage business. The underground station structure would be beneath East Lombard Street between Light and Calvert Streets. Emergency exits would be constructed in the sidewalk on the north side of East Lombard Street at both ends of the station structure.

Ventilation equipment would be housed inside the station structure, and ventilation exhaust would be routed through the parking garage. Because the underground station structure would be located adjacent to the proposed underground connection to the Charles Center Metro Station, underneath the east sidewalk of Light Street, no additional extensions to the underground pedestrian connector would be required. While lane closures would occur on East Lombard Street during the cut-and-cover construction of the station structure, the intersection of East Lombard and Light Streets could remain open throughout construction activities.


100 East Pratt Street Garage

The 100 East Pratt Street building is an 8-story parking garage facility comprised of 940 parking spaces, which was constructed in two phases in the 1970s (see photo). The building has frontage on East Lombard Street between Light and South Calvert Streets. There are vehicle entrances/exits on Light and South Calvert Street, and a vehicle exit on East Lombard Street. The building includes two first floor retail spaces with pedestrian entrances at the East Lombard Street and Light/South Calvert Street intersections. The first floor retail space in the 100 East Pratt Street garage would need to be reconfigured to accommodate the Inner Harbor Station entrance, and extensive reconstruction of the first column bay double-T girders of the parking garage would be required to facilitate routing ventilation ducting (exhaust chimneys) through the garage building. Six parking spaces on each floor of the garage, 48 parking spaces total, would be permanently displaced within the footprint of the vertical ducts under this alternative. Additionally, all 940 parking spaces of the garage operation would likely be out of service for the duration of the extensive structural modifications, which would take approximately 18 to 24 months. Both existing first floor retail spaces would need to be permanently acquired and relocated to accommodate the ancillary equipment and vent shafts. Structural underpinning of the contributing historic building foundation housing CVS Pharmacy and upper floor office space would be required.

The estimated cost of Inner Harbor Station Alternative 7, including partial acquisition of the garage, stabilization of building foundations, reconfiguration of the garage and retail units, and construction of the three-level station structure would be $153.5 million.

6.10.6 Inner Harbor Station Alternative 8 (100 East Pratt Street Parking Garage)

Under Inner Harbor Station Alternative 8, the station entrance would be constructed in the sidewalk on the northeast corner of East Lombard and Light Streets, adjacent to the property at 31 Light Street currently housing the CVS Pharmacy. Emergency exits would be in the sidewalk on the south side of East Lombard Street. No additional extensions to the pedestrian connector between the Red Line Inner Harbor and Charles Center Metro Stations would be required because the underground station structure would be constructed adjacent to the proposed tunnel. While closures would occur on East Lombard Street during cut-and-cover construction activities, the intersection at Light and East Lombard Streets would remain open to traffic during construction.

A three-level station structure would be required to house the passenger station and the ventilation equipment to minimize the need for surface structures. The station structure would be beneath East Lombard Street between Light and Calvert Streets. Vertical ventilation ducts would be in the inset corners of the 100 East Pratt Street parking garage located on the south side of East Lombard Street. In addition to structural underpinning of the first row of columns extensive reconfiguration of the garage building would be required because the non-emergency station ventilation would need to be routed through the garage. This would result in closure of all 940 parking spaces within the garage for a period of approximately 24 months, and the permanent loss of approximately 24 parking spaces. To accommodate all needed ancillary equipment, acquisition and displacement of both first floor retail spaces of the garage building and relocation of the tenants would be required.

There would be access restrictions to the CVS Pharmacy entrance during station entrance construction for a period of approximately 1 to 2 months until temporary pathways could be established. Foundation underpinning of the contributing historic building at 31 Light Street would be required for stabilization. It is not anticipated that structural underpinning of the foundation would harm the rest of the building. The potential for and duration of temporary access restrictions of building occupants would be determined during Final Design.

The estimated cost of Avoidance Alternative 8, permanent acquisition of 24 parking spaces from the garage at 100 East Pratt Street, acquisition and displacement of both retail spaces and relocation of the tenants, stabilization of the garage foundation, and construction of the three-level station structure would be $150.9 million.

6.10.7 Inner Harbor Station Alternative 9 (104 East Lombard Street/111 Water Street)

The 104 East Lombard Street/111 Water Street building is a four-story brick building constructed with stylized and austere classical details in 1906 (see photo). It has two commercial storefronts on Lombard Street and a restaurant on the Water Street entrance, with office space on the upper floors.

104 East Lombard Street/111 Water Street

The building played a role in Baltimore City's economic, commercial, and physical growth during the period of significance. It is also one of the many early twentieth century low scale buildings with classical details built during the years after Baltimore's Great Fire of 1904. The building retains enough integrity to be a contributing resource to the district. It retains its original location. Although a good number of the surrounding buildings have been replaced with larger scale commercial buildings, nearby buildings are still those from the historic district's period of significance. In addition, the area is still Baltimore's active business and government district. The doors and window sashes are replacements, but otherwise the building retains most of its original character-defining features including austere classical details such as stylized pilasters and panels.

Under Inner Harbor Station Alternative 9, the historic building at 104 East Lombard Street/111 Water Street would be demolished and the station entrance and ancillary facility building would be constructed on the site. A three-level station structure would be underneath East Lombard Street to the east of Light Street. The three-level structure would be required because of the narrow width of the lot at this property, and some of the ancillary structures would need to be housed in the station structure rather than above ground.

Emergency exits would be constructed in the sidewalk on the south side of Lombard Street. No additional extensions to the pedestrian connector between the Red Line Inner Harbor and Charles Center Metro Stations would be required because the underground station structure would be constructed adjacent to the proposed tunnel. While closures would occur on East Lombard Street during cut-and-cover construction activities, the intersection at Light and East Lombard Streets would remain open to traffic during construction.

The first row of the 100 East Pratt Street parking garage would require underpinning. The potential for and duration of, temporary access restrictions of building occupants would be determined during Final Design. All businesses and tenants of 104 East Lombard Street/111 Water Street would need to be relocated.

The estimated cost of Inner Harbor Station Alternative 9, including real estate acquisition, business relocation, building demolition, and construction of the three-level station structure would be approximately $132.3 million.

6.10.8 Least Overall Harm Analysis Summary

The Preferred Alternative proposed Inner Harbor Station would require a Section 4(f) use because of demolition of two contributing historic buildings to the Business and Government Historic District, located at 108-112 and 114 East Lombard Street. Each alternative was weighed against the seven criteria for evaluating least overall harm per 23 CFR 774.3(c)(1).

1. <u>The ability to mitigate adverse impacts to each Section 4(f) property including any measures that result in benefits to the property</u>: For those alternatives that include demolition of contributing buildings to the Business and Government Historic District (Preferred Alternative proposed Inner Harbor Station and Alternatives 4, 6, and 9), mitigation of adverse impacts would be the same or similar, and would be outlined in the Programmatic Agreement (PA) with the SHPO and consulting parties. Under each of these alternatives, impacts to additional contributing buildings because of structural underpinning would be avoided. Mitigation for the minor impacts because of structural underpinning of contributing buildings under Inner Harbor Station Alternatives 5, 7, and 8 would be mitigated through the terms identified in the PA.
2. <u>The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection</u>: There would be “no adverse effect” to the Business and Government Historic District as a result of structural underpinning to contributing buildings under Inner Harbor Station Alternatives 5, 7, and 8. Of the alternatives that would require demolition of contributing buildings, several factors were considered. The Business and Government Historic District includes over 200 contributing buildings. Approximately 15 buildings within the district are individually listed or eligible for listing in the National Register, such as Baltimore City Hall and the Old Post Office and Court House. The buildings in the vicinity of the Inner Harbor Station are not individually listed in the National Register.

However, because of their prominent locations with frontages on multiple streets, the remaining harm to the Business and Government Historic District would be greater under Inner Harbor Station Alternatives 4, 6, and 9 than under the Preferred Alternative. The contributing buildings at 108-112 and 114 East Lombard Street are in the middle of a block with frontage on Lombard Street only, making them less prominent within the district than the other buildings being considered for demolition.

3. The relative significance of each Section 4(f) property: The contributing buildings in the vicinity of the Inner Harbor Station are considered to be of equal significance within the historic district. However, the historic buildings at the intersection at 31 Light Street and 34-36 Light Street are large and visually prominent from several vantage points. The mid-block building at 104 East Lombard Street (111 Water Street) has frontage on two streets within the district and occupies a larger footprint than those buildings at 108-112 and 114 East Lombard Street. Additionally, Water Street retains much of its historic character, and demolition of 104 East Lombard Street (111 Water Street) would affect the character of two blocks within the historic district.
4. The views of the official(s) with jurisdiction over each Section 4(f) property: At a consultation meeting on July 17, 2012 with the MTA and FTA, the MHT (official with jurisdiction) expressed informal support for the Preferred Alternative proposed Inner Harbor Station. This occurred in context of a discussion regarding projected ridership and connections at the Inner Harbor Station in relation to Purpose and Need, constraints within the vicinity including historic buildings and active businesses, and avoidance and minimization measures and consideration undertaken by the Red Line team. MHT would have an opportunity to review and comment on this Draft Section 4(f) Evaluation, and their views would be detailed in the Final Section 4(f) Evaluation.
5. The degree to which each alternative meets the purpose and need for the project: Each alternative meets the Purpose and Need; however, Inner Harbor Station Alternative 5 would require an additional connection to the proposed pedestrian tunnel leading to the Charles Center Metro Station.
6. After reasonable mitigation the magnitude of any adverse impacts to properties not protected by Section 4(f): only the Preferred Alternative proposed Inner Harbor Station would not directly impact or displace any current or foreseeable business operations within the downtown central business district. Each of the other alternatives evaluated in this least overall harm analysis would require permanent impacts or relocations to active businesses. This factor weighed heavily in the initial selection of a site for the Inner Harbor Station ancillary buildings, and in this draft least overall harm analysis.
7. Substantial differences in costs among the alternatives: The Preferred Alternative proposed Inner Harbor Station would cost less than all other alternatives under consideration, and includes real estate costs, business relocations required under each of the other Inner Harbor Station alternatives, and construction costs.

Table 6-4 presents a comparison of the alternatives by each of the seven factors discussed above. Based on the draft evaluation presented in this section and in **Table 6-4**, several factors outweigh the importance of protecting the Section 4(f) properties at 108-112 and 114 East Lombard Street. A final analysis and conclusion would be included in the Final Section 4(f)

Evaluation, based on the views of the official with jurisdiction, Section 106 consulting parties, and comments on this Draft Section 4(f) Evaluation.

6.10.9 All Possible Planning to Minimize Harm

"All possible planning," as defined in 23 CFR 774.17, includes all reasonable measures to minimize harm and mitigate for adverse impacts and effects. Pursuant to 23 CFR 774.17, a de minimis impact determination inherently includes the requirement for all possible planning to minimize harm because impacts have already been reduced to a de minimis level. Therefore, additional planning to minimize harm is not required for those properties where a de minimis impact determination is made.

Overall, the Preferred Alternative minimizes harm to Section 4(f) resources by incorporating measures into the project that diminish impacts on and the use of the resources. Such measures have comprised, but are not limited to: the inclusion of underground segments and stations to minimize surface level impacts to protected resources; alignment shifts along the corridor as feasible; elimination of street-level parking along the surface level transitway segments where resources are present; and selecting stormwater management options that reduce or eliminate the need for extensive grading.

For Section 4(f) uses that cannot be avoided or further minimized, mitigation is being considered. The level of mitigation being considered is commensurate with the severity of the impact on the Section 4(f) property. Such mitigation would be determined through consultation with the officials having jurisdiction over each resource and presented in the Final Section 4(f) Evaluation.

A draft Programmatic Agreement (PA) has been developed in accordance with the provisions of Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations at 36CFR Part 800. Potential mitigation measures for impacts to historic resources have been developed in coordination with the MHT and the consulting parties. The PA is expected to be signed prior to the Record of Decision. The determinations of eligibility, Red Line project effects on historic sites, and the PA will be submitted to the Advisory Council on Historic Preservation (ACHP).

All minimization and mitigation measures will be documented in the Final Section 4(f) Evaluation. FTA will make a final determination of whether all possible planning has occurred based on the Final Section 4(f) Evaluation, after consideration of comments on the Draft Section 4(f) Evaluation.

Table 6-4: Seven Factors for the Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)

Inner Harbor Station Alternatives (refer to Figure 6-25)	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the official(s) with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)	vii. Substantial differences in costs among the alternatives
Preferred Alternative Proposed Inner Harbor Station **(108-12 and 114 East Lombard Street)**	Impacts would be mitigated as proposed in the Programmatic Agreement.	Harm to Business and Government District because of demolition of two contributing buildings. Mid-block buildings less visually prominent than those located at the intersection; mainly visible from East Lombard Street with no frontage on Water Street.	Smaller 3 and 4 story brick buildings at 108-112 and 114 East Lombard Street are less visually prominent in height and in their mid-block locations; they extend less than half a block to Water Street, but significant in that there are two separate parcels/buildings.	MHT verbally expressed support for the Preferred Alternative proposed Inner Harbor Station at a meeting on July 17, 2012 with the MTA and FTA. Comments made reflected support in light of the importance of the Inner Harbor Station to the Red Line project, and the constraints of the area. MHT would have an opportunity to review and comment on this Draft Section 4(f) Evaluation.	Meets the project purpose and need, particularly because of location of station entrance and potential to enhance connectivity to the Metro via an underground pedestrian tunnel.	Access restrictions to entrance to CVS Pharmacy at 31 Light Street for approximately 1 to 2 months until temporary pathways could be established. Minor impacts to 100 East Pratt Street parking garage during structural underpinning work; no loss of parking to garage and no business relocations required under this alternative.	Alternative would cost approximately $128.7 million.

Table 6-4: Seven Factors for the Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)

Inner Harbor Station Alternatives (refer to Figure 6-25)	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the official(s) with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)	vii. Substantial differences in costs among the alternatives
Inner Harbor Station Alternative 4 **(34-36 Light Street)**	Similar to the Preferred Alternative proposed Inner Harbor Station, impacts would be mitigated as proposed in the Programmatic Agreement.	Demolition of historic building at 34-36 Light Street with two prominent facades visible from Light and East Lombard Streets would cause slightly greater harm to Business and Government District than Preferred Alternative proposed Inner Harbor Station.	Former warehouse building housing the Royal Farms is a visually prominent 4-story building because of its location on a corner within the Historic District.	MHT has not provided views regarding this alternative; MHT would have an opportunity to review and comment on this Draft Section 4(f) Evaluation.	Meets the project purpose and need, but would require extension of pedestrian tunnel across Light Street.	Construction impacts to the intersection of East Lombard and Light Streets; requires relocation of Royal Farms business and office space tenants.	Alternative would cost approximately $131.3 million, slightly more than the Preferred Alternative proposed Inner Harbor Station.
Inner Harbor Station Alternative 5 **(30 Light Street Parking Garage)**	Minimal impacts to contributing building at 34-36 Light Street building, impacts would be mitigated as proposed in the Programmatic Agreement.	Minimal harm to Business and Government Historic District; only structural underpinning of the historic 34-36 Light Street property would occur, with no character defining features compromised.	Former warehouse building housing the Royal Farms is a visually prominent 4-story building because of its location on a corner within the Historic District.	MHT has not provided views regarding this alternative; MHT would have an opportunity to review and comment on this Draft Section 4(f) Evaluation.	Meets the project purpose and need, but would require extension of pedestrian tunnel across Light Street.	Construction impacts to the intersection of East Lombard and Light Streets; requires demolition of 30 Light Street Parking garage and relocation of garage business and retail tenants.	Alternative would cost approximately $154.1 million, substantially more than the Preferred Alternative.

Table 6-4: Seven Factors for the Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)

Inner Harbor Station Alternatives (refer to Figure 6-25)	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the official(s) with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)	vii. Substantial differences in costs among the alternatives
Inner Harbor Station Alternative 6 **(31 Light Street)**	Similar to the Preferred Alternative proposed Inner Harbor Station, impacts would be mitigated as proposed in the Programmatic Agreement.	Demolition of historic building at 31 Light Street with three prominent facades visible from Light, East Lombard, and Water Streets; would cause slightly greater harm to Business and Government District than the Preferred Alternative proposed Inner Harbor Station.	31 Light Street building housing the CVS Pharmacy is a visually prominent 5-story building because of its location on a corner within the Historic District.	MHT has not provided views regarding this alternative; MHT would have an opportunity to review and comment on this Draft Section 4(f) Evaluation.	Meets the project purpose and need, particularly because of location of station entrance and potential to enhance connectivity to the Metro via an underground pedestrian tunnel.	Minor impacts to 100 East Pratt Street parking garage during structural underpinning work; requires permanent relocation of CVS Pharmacy business and office space tenants.	Alternative would cost approximately $130.0 million, slightly more than the Preferred Alternative proposed Inner Harbor Station.

Table 6-4: Seven Factors for the Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)

Inner Harbor Station Alternatives (refer to Figure 6-25)	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the official(s) with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)	vii. Substantial differences in costs among the alternatives
Inner Harbor Station Alternative 7 **(100 East Pratt Street Parking Garage)**	Minimal impacts to contributing building at 31 Light Street, impacts would be mitigated as proposed in the Programmatic Agreement.	Minimal harm to Business and Government Historic District; only structural underpinning of the 31 Light Street property would occur, with no character defining features compromised.	31 Light Street building housing the CVS Pharmacy is a visually prominent 5-story building because of its location on a corner within the Historic District.	MHT has not provided views regarding this alternative; MHT would have an opportunity to review and comment on this Draft Section 4(f) Evaluation.	Meets the project purpose and need, particularly because of location of station entrance and potential to enhance connectivity to the Metro via an underground pedestrian tunnel.	Impacts to 100 East Pratt Street parking garage building: temporary closure of all 940 parking spaces for approximately 24 months, business would permanently lose 48 parking spaces, and both first floor retail spaces would be acquired and tenants relocated.	Alternative would cost approximately $153.5 million, substantially more than the Preferred Alternative.

Table 6-4: Seven Factors for the Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)

Inner Harbor Station Alternatives (refer to Figure 6-25)	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the official(s) with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)	vii. Substantial differences in costs among the alternatives
Inner Harbor Station Alternative 8 **(100 East Pratt Street Parking Garage)**	Minimal impacts to contributing building at 31 Light Street, impacts would be mitigated as proposed in the Programmatic Agreement.	Minimal harm to Business and Government Historic District; only structural underpinning of the 31 Light Street property would occur, with no character defining features compromised.	31 Light Street building housing the CVS Pharmacy is a visually prominent 5-story building because of its location on a corner within the Historic District.	MHT has not provided views regarding this alternative; MHT would have an opportunity to review and comment on this Draft Section 4(f) Evaluation.	Meets the project purpose and need, particularly because of location of station entrance and potential to enhance connectivity to the Metro via an underground pedestrian tunnel.	Impacts to 100 East Pratt Street parking garage building: closure of all 940 parking spaces for approximately 24 months, business would permanently lose approximately 24 parking spaces, and both first floor retail spaces would be acquired and tenants relocated.	Alternative would cost approximately $150.9 million, substantially more than the Preferred Alternative.

Table 6-4: Seven Factors for the Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)

Inner Harbor Station Alternatives (refer to Figure 6-25)	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the official(s) with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)	vii. Substantial differences in costs among the alternatives
Inner Harbor Station Alternative 9 **(104 East Lombard Street/111 Water Street)**	Similar to the Preferred Alternative proposed Inner Harbor Station, impacts would be mitigated as proposed in the Programmatic Agreement.	Demolition of historic mid-block building at 104-106 East Lombard Street visible from East Lombard and Water Streets would cause slightly greater harm to Business and Government District than the Preferred Alternative proposed Inner Harbor Station.	104 East Lombard Street/111 Water Street)historic 4-story brick building is visually less prominent in the Business and Government Historic District because obits mid-block location on East Lombard Street, but has a large footprint extending to Water Street, which retains several historic buildings, and would impact the historic character of that block as well.	MHT has not provided views regarding this alternative; MHT would have an opportunity to review and comment on this Draft Section 4(f) Evaluation.	Meets the project purpose and need, particularly because of location of station entrance and potential to enhance connectivity to the Metro via an underground pedestrian tunnel.	Minor impacts to 100 East Pratt Street parking garage during structural underpinning work; current restaurant, retail, and office tenants at 104 East Lombard Street/111 Water Street would need to be permanently relocated.	Alternative would cost approximately $132.3 million, slightly more than the Preferred Alternative proposed Inner Harbor Station.

Table 6-4: Seven Factors for the Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)

Inner Harbor Station Alternatives (refer to Figure 6-25)	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the official(s) with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)	vii. Substantial differences in costs among the alternatives
ANALYSIS RESULTS	The demolition of historic buildings contributing to the Business and Government Historic District would be mitigated as proposed in the Programmatic Agreement under the Inner Harbor Preferred Alternative and Alternatives 4, 6, and 9. Inner Harbor Station Alternatives 5, 7, and 8 would cause minor impacts to the historic district, which would also be mitigated under the terms of the Programmatic Agreement.	Minimal harm to historic buildings in the Business and Government Historic District under Inner Harbor Station Alternatives 5, 7, and 8. Of the Inner Harbor Station Alternatives requiring demolition of historic buildings, Inner Harbor Station Alternatives 4, 6, and 9 would cause slightly greater harm than the Preferred Alternative.	The historic buildings located on the intersection at 31 Light Street and 34-36 Light Street are large and visually prominent within the Business and Government Historic District. The mid-block building at 104 East Lombard Street (111 Water Street) is more visually prominent and occupies a larger footprint than those buildings at 108-112 and 114 East Lombard Street.	MHT verbally expressed support for the Preferred Alternative proposed Inner Harbor Station, and would have an opportunity to review and comment on this Draft Section 4(f) Evaluation.	Each alternative meets the purpose and need. However the Preferred Alternative proposed Inner Harbor Station and Alternatives 6, 7, 8 and 9 better meet the need to connect to existing transit by allowing a shorter connection to underground pedestrian tunnel leading to the Charles Center Metro Station.	Inner Harbor Station Alternatives 4, 5, 6, 7, 8, and 9 would require business relocations. Preferred Alternative proposed Inner Harbor Station would not require business relocations. Inner Harbor Station Alternatives 4 and 5 would cause additional construction impacts to the intersection of East Lombard and Light Streets.	The Preferred Alternative proposed Inner Harbor Station would cost slightly less than Inner Harbor Station Alternatives 4,6, and 9, and substantially less than Inner Harbor Station Alternatives 5, 7, and 8.

6.11 Coordination

- Department of Interior (DOI): This Draft Section 4(f) Evaluation is being provided to the DOI for review.
- Officials with Jurisdiction: coordination activities with the officials with jurisdiction over parks and historic properties in the study area has occurred as follows:
    - Baltimore County Department of Recreation and Parks: Initially contacted via letter in February 2012 requesting assistance in the identification of significant public parks within the study area. Based on subsequent coordination, it was determined that no Section 4(f) resources in Baltimore County would be affected by the Preferred Alternative.
    - Baltimore City Department of Recreation and Parks: Initially contacted via letter in February 2012 requesting assistance in the identification of significant public parks within the study area. A letter expressing Maryland Transit Administration's (MTA) intent to seek temporary occupancy exceptions and de minimis impact findings to parks and recreation areas in Baltimore City is being sent upon circulation of this Draft Section 4(f) Evaluation.
    - Maryland Historical Trust (MHT): Federal Transit Administration (FTA) has consulted with the MHT to delineate the built historic properties Area of Potential Effects, identify historic properties, and evaluate properties not previously evaluated for National Register eligibility. To date, the MHT has reviewed and commented on the following documents (followed by the MHT correspondence date): (1) *Cultural Resources Technical Report: Volume 1 – Red Line Corridor Transit Study: Cultural Resources Reconnaissance Survey* and Area of Potential Effects (APE) delineation (August 25, 2005 letter); (2) evaluations in the *Historic Structures Survey Technical Report* (March 19, 2007 letter); (3) *Cultural Resources Technical Report: Volume 4 – Red Line Corridor Transit Study: Bayview Extension Cultural Resources Reconnaissance Survey* and APE delineation (April 7,2008 meeting); (4) evaluations in the *Red Line Corridor Transit Study – Bayview Extension; Historic Architectural Resources Survey* (June 9, 2010 letter, also included follow-up comments on original evaluations); (5) refined APE and list of additional properties for evaluation (January 17, 2012 letter); and (6) Determination of Eligibility (DOE) Forms, Short Forms for Ineligible Properties, Addendums (for demolished properties), and DOE Form revisions (July 26, 2012 letter), DOE forms (September 13, 2012 letter). A letter expressing MTA's intent to seek concurrence on an adverse effect finding for historic sites is being sent to the MHT with circulation of this Draft Section 4(f) Evaluation.
- Section 106 Consulting Parties: A summary of coordination with Section 106 consulting parties follows.
    - Designated consulting parties during the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) phase in 2006 included the MHT, Baltimore City Commission for Historical & Architectural Preservation (CHAP), and Baltimore County Office of Planning (BCOP). Meetings were held with the

MHT (April 7, 2008) and CHAP (May 4, 2008) to provide a detailed overview of the project alignments, the cultural resources within the APE, and proposed additional investigations; BCOP chose not to participate. The MHT, CHAP, and BCOP were provided copies of submitted technical reports and invited to agency briefings.

- Additional consulting parties were identified in June 2009 (following the AA/DEIS) and also in September 2012 (as part of Final Environmental Impact Statement (FEIS) preparations): Baltimore Heritage, The Society for the Preservation of Federal Hill and Fell's Point, Anchorage Homeowners Association, Baltimore Harbor Watershed Association, Canton Community Association, Canton Cove Association, Canton Square Homeowners Association, Waterfront Coalition, US General Services Administration, Delaware Tribe of Indians, and Shawnee Tribe. A consulting party meeting was held on September 25, 2012 to share project information and listed/eligible historic properties within the APE identified. A second meeting was held on October 17, 2012 to provide an overview of potential effects, and to discuss potential avoidance, minimization and mitigation measures. Additional consulting party meetings are being planned to continue discussions on the effects, potential avoidance, minimization and mitigation measures, and the PA.
- Advisory Council on Historic Preservation: In a letter dated November 6, 2012, the FTA notified the ACHP of the finding of adverse effect on historic properties, in accordance with 36 CFR Part 800.6. The FTA also asked the ACHP to review information attached to the letter, to determine if the agency wishes to join the consultation process.

- Public: The public has an opportunity to review and comment on the Draft Section 4(f) Evaluation concurrently with the Red Line FEIS. Comments from the public related to the Section 4(f) analysis will be responded to in the Final Section 4(f) Evaluation, which will be included in the Record of Decision (ROD).

7. Evaluation of Alternatives

7.1 Introduction

The purpose of this chapter is to present a comparison of the Red Line Preferred Alternative to the No-Build Alternative. The effectiveness of the Preferred Alternative and No-Build Alternative in meeting the established purpose and needs for the project, as presented in **Chapter 1** of this Final Environmental Impact Statement (FEIS), is evaluated and summarized in a discussion on equity and trade-offs between the two alternatives. This chapter provides the basis for decision-makers and the public to assess the benefits and consequences of implementing the Red Line against the stated purpose and need for the project.

Updates to this Chapter since the AA/DEIS

This chapter has been updated to reflect the identification of the Preferred Alternative. The information presented in this chapter includes the updated and additional analysis presented in other chapters in this FEIS.

7.2 Project Purpose and Need

As presented in **Chapter 1** of this FEIS, the purpose and corresponding need for the project are summarized in **Table 7-1**.

Table 7-1: Project Purpose and Need

Purpose of the Project	Project Need
Improve transit efficiency by reducing travel times for transit trips in the project study corridor	Roadway congestion contributes to slow travel times for automobiles and buses in the project study corridor
Increase transit accessibility in the corridor by providing improved transit access to major employment and activity centers	Lack of convenient transit access to existing and future activity centers in the project study corridor, including downtown Baltimore, Fell's Point, and Canton, as well as employment areas in Baltimore County to the west of Baltimore
Provide transportation choices for east-west commuters in the project study corridor, by making transit a more attractive option	Lack of viable transit options for east-west commuters in the project study corridor
Enhance connections among existing transit routes in the project study corridor	Lack of connections from existing transit routes (including Central Light Rail, Metro, MARC, and bus network) to the I-70 travel market on the west side of the project study corridor, and to the I-95 and East Baltimore travel markets on the east
Support community revitalization and economic development opportunities in the project study corridor	Need for economic development and community revitalization in communities along the project study corridor, both in Baltimore County and in Baltimore City
Help the region improve air quality by increasing transit use, and promote environmental stewardship	Need to support the regional goal of improving air quality by providing alternatives to automobile usage

7.3 Effectiveness in Meeting the Project Purpose and Need

The effectiveness of the proposed project is the extent to which an alternative meets the purpose and needs that the proposed project is intended to address. The following section evaluates the effectiveness of the No-Build Alternative and the Preferred Alternative in meeting the identified purpose and need for the project.

7.3.1 Improve Transit Efficiency in the Corridor, by Reducing Travel Times for Transit Trips in the Corridor

The projected No-Build Alternative end-to-end transit travel time is 79 minutes. The Preferred Alternative would operate with an end-to-end transit travel time of 45 minutes, which would provide faster service than the No-Build Alternative. For example, current transit travel times during the peak-period on the US 40 Quick Bus between Edmondson Village and Baltimore Street and Charles Street intersection downtown is approximately 20 minutes. The same trip in 2035, according to the regional model, would take approximately 39 minutes under the No-Build Alternative, as a result of increased traffic congestion. With the Preferred Alternative, the transit travel time between Edmondson Village and the Inner Harbor Station at Charles and Lombard Streets would be 19 minutes.

The travel time savings of the Preferred Alternative over the No-Build Alternative would be achieved because the Preferred Alternative would operate in dedicated right-of-way, free from traffic congestion. As a result of increased reliability and convenience, the total transit trips would be greater for the Preferred Alternative (244,390 person-trips) than for the No-Build Alternative (225,980 person-trips), and dependency on congested roadways would be reduced. Refer to **Chapter 4, Table 4-3** for additional details.

7.3.2 Increase Transit Accessibility in the Corridor, by Providing Improved Transit Access to Major Employment and Activity Centers

The project study corridor is a major employment, entertainment, and educational destination from across the region, anchored by the Centers for Medicare & Medicaid Services (CMS) and the Social Security Administration on the west end, the University of Maryland, professional sports venues, Inner Harbor, and the central business district in the middle, and Johns Hopkins Bayview Medical Center campus on the east end of the corridor. There are approximately 7,500 businesses located within the project study corridor, employing over 192,000 people (BMC, 2002). The majority of businesses are small, with 20 or fewer employees, to medium sized, with 21 to 99 employees. However, while large businesses with over 100 employees only make up a small number of overall employers within the project study corridor, over 120,000 employees work at large businesses.

Under the No-Build Alternative, access to employment and activity centers would continue to be served by the bus network, with some planned and programmed transit improvements. Traffic congestion and slower travel speeds would result in longer commutes for transit passengers. The Preferred Alternative would improve access to jobs throughout the project study corridor and region by providing a more convenient and reliable transit service to employment centers, educational facilities, and activity centers, and by providing direct connections to the existing Central Light Rail, Metro, and MARC systems. (Refer to **Figure 7-1**.)

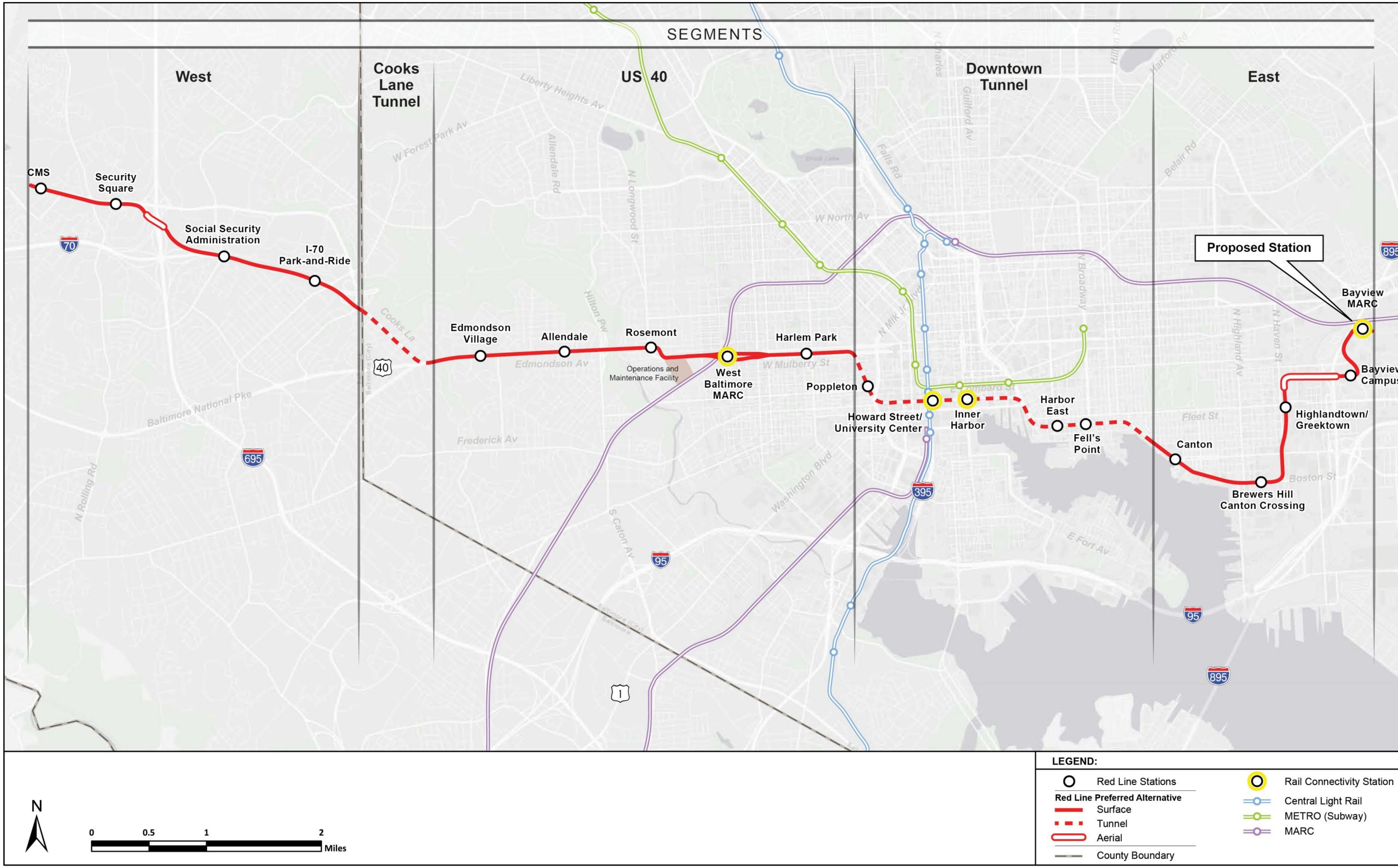


Figure 7-1: Preferred Alternative with Rail Connections

The Preferred Alternative would improve mobility and reduce commuting times in areas with the highest levels of employment in the Baltimore region. For example, current transit travel times during the peak-period on the Route 11 Local Bus between Canton Crossing and Charles Street and Redwood Street intersection downtown is approximately 21 minutes. The same trip in 2035, according to the regional model, would take approximately 36 minutes under the No-Build Alternative, as a result of increased traffic congestion. With the Preferred Alternative, the transit travel time between Canton Crossing and downtown at Charles and Lombard Streets would be 9 minutes.

In 2010, approximately 28 percent of the people residing in the project study corridor had no vehicle available or were transit-dependent. For these households, having reliable, fast transit service travel to and from jobs or other purpose could improve their quality of life. The Preferred Alternative would improve mobility and transit access to jobs and activity centers for these transit-dependent residents in the project study corridor.

7.3.3 Provide Transportation Choices for East-West Commuters in the Corridor, by Making Transit a More Attractive Option

The Preferred Alternative would provide faster transit service in the project study corridor over the No-Build Alternative. Under the No-Build Alternative, existing and future populations within the project study corridor would continue to be served by the local bus system, with some planned and programmed transit improvements.

The Preferred Alternative would improve the quality of east-west transit service in the project study corridor. A fixed transitway with dedicated right-of-way and separated from traffic would provide faster and more reliable service than bus service. Throughout the corridor, congestion on the roadways and highways affects the reliability of travel by automobile and bus. Light rail traveling in a dedicated right-of-way would not be subject to congested roadway conditions, resulting in dependable on-time service. The Preferred Alternative would operate with 7 minute headways during peak periods. The Preferred Alternative would also include stations, park-and-ride lots, pedestrian and bicycle improvements, and feeder bus service. These system elements would also contribute to enhancing the transit service and experience, thus expanding the ridership market with access to rail transit service.

The Preferred Alternative is expected to increase rail transit ridership. Compared to the No-Build Alternative, the regional travel demand model shows that the addition of the Preferred Alternative would increase transit rail ridership by over 28,900 trips per day. It is estimated that 18,170 person-trips would shift mode from auto to transit once the Preferred Alternative is operational, resulting in a reduction in highway trips in the region. Refer to **Chapter 4**, **Table 4-4**.

7.3.4 Enhance Connections Among Existing Transit Routes in the Corridor

Under the No-Build Alternative, enhancements to connections to existing transit routes in the project study corridor and throughout the region would be limited to the existing local bus system; therefore not meeting the project purpose and need. The Preferred Alternative would provide a critical “missing link” that connects the Metro, Central Light Rail, and MARC commuter trains with an east-west route. (Refer to **Figure 7-1**.) Riders on the Red Line would have two access connections to MARC: direct and improved access at the West Baltimore MARC Station and a direct connection to the proposed Bayview MARC Station. The connection with MARC would allow easy access to Washington DC and growing job opportunities at Fort Meade and Aberdeen. The Red Line Howard Street/University Center Station would provide a direct connection to the existing Central Light Rail at Lombard and Howard Streets. Riders of the Red Line would have a direct underground connection to the Metro at the Charles Center Metro Station, and the Inner Harbor Red Line Station would be within walking distance of the Shot Tower/Market Place Metro Station. Also, the Preferred Alternative would enhance flexibility and increase mobility for bicyclists or pedestrians beyond the operating transit network and improve safety concerns of non-motorized travelers at signalized intersections. Refer to **Chapter 4, Section 4.1** for additional details on the public transportation system.

7.3.5 Support Community Revitalization and Economic Development Opportunities in the Corridor

Development is expected to occur in the project study corridor regardless of whether or not the Red Line is constructed. The No-Build Alternative would be inconsistent with adopted land use plans. Baltimore City and Baltimore County have been anticipating the Red Line and have structured area land use plans so that the benefits of the Red Line project would be maximized. In addition, the proposed development and growth anticipated in this corridor would likely continue to grow and place increased burden on the transportation network. Under the No-Build Alternative traffic congestion in the corridor is anticipated to increase.

Because of the predominantly urban environment in which the Preferred Alternative would be located, much of the corridor is developed and the type of land use is not expected to substantially change as a result of the Preferred Alternative. However, the intensity of the land use could change as a result of development occurring around the proposed stations. This redevelopment would be consistent with local plans, policies, and zoning, which were developed with the assumption that a major transit improvement would be made along the Red Line corridor. Both Baltimore County and Baltimore City support the proposed Red Line project and their plans indicate that the project is expected to (and would be encouraged to) attract new development at station areas. As an example, many of the station areas have been designated as transit-oriented development (TOD) on the draft zoning map, reflecting Baltimore City's interest in TOD at the Red Line stations. Refer to **Chapter 5, Section 5.2** for additional details.

The Preferred Alternative would support the vision of the *Baltimore City's Red Line Community Compact* and Baltimore County's land use and zoning plans of increasing access to transit; encouraging and accommodating growth in mixed-use, transit and pedestrian-oriented development; and developing and redeveloping vacant or underutilized parcels. The Preferred Alternative would be consistent with land use and related development goals identified in Baltimore City's 2006 *LIVE, EARN, PLAY, LEARN* Comprehensive Master Plan, which focuses on implementing policies and zoning changes that permit and reward development near existing and proposed transit stations. The City recognizes the Preferred Alternative as an important component of its land use and development strategy. Baltimore County's Master Plan, *Master Plan 2020*, also emphasizes sustainability and encourages development near transit stations. The Preferred Alternative would support redevelopment opportunities around the 19 stations by enhancing access for residents and supplying a daily influx of transit riders and potential customers for businesses.

The Preferred Alternative could result in approximately 15,000 jobs during the construction of the Red Line. Regionally, the Preferred Alternative would provide economic benefits by improving transit access and mobility for the work force and consumers within the corridor. Job opportunities would fall into two categories: new jobs and better access to existing jobs. In public works construction projects of this magnitude, contractors may rely on the local labor pool to help build the project. Both skilled and unskilled labor would be necessary.

The construction of the Red Line would likely create job opportunities specifically for residents of the affected communities, as well as benefit local small or disadvantaged businesses. As summarized in the Red Line Community Compact, the planned Maryland Transit Administration (MTA) initiative to "put Baltimore to work on the Red Line" could lead to future employment and training opportunities for local area residents, as well as expanded opportunities for local disadvantaged businesses. Refer to **Chapter 5, Section 5.6** for additional details.

7.3.6 Help the Region Improve Air Quality by Increasing Transit Use and Promote Environmental Stewardship

The project study corridor encompasses both Baltimore City and Baltimore County. Baltimore City is classified as a maintenance area for carbon monoxide (CO), whereas Baltimore County is classified as attainment for CO. Both areas are classified as nonattainment areas for particulate matter ($PM_{2.5}$) and as serious nonattainment areas for Ozone (O_3). Ozone is a gas formed by the combination of nitrogen oxides, volatile organic compounds, and sunlight.

The Preferred Alternative would result in a decrease of vehicle miles traveled (VMTs), therefore resulting in fewer auto emissions, which would benefit the region's air quality. Refer to **Chapter 4, Table 4-18**. The Preferred Alternative is predicted to decrease regional pollutant burdens by approximately 1.5 to 1.9 percent. Refer to **Chapter 5, Table 5-26** for additional details. The Preferred Alternative would result in a daily reduction of 15,000 VMT in the project study corridor compared to the No-Build Alternative.

Overall, the No-Build Alternative would result in fewer impacts to transportation and environmental resources. However, the No-Build Alternative would not achieve the benefits of implementing the Red Line project in that it would not create jobs or encourage economic development and investment into the project study corridor. Also, the No-Build Alternative would result in an increase of approximately 77,000 daily vehicle miles traveled (VMT) in the region more than the Preferred Alternative, causing increased emissions, and therefore affecting the regional air quality conformity.

As shown in **Chapter 4**, the Preferred Alternative would benefit the regional transportation network as a whole by reducing delay and commuting times regardless of the mode. Under the Preferred Alternative, the type and quality of transit service in the project study corridor would be improved by adding a new light rail transit (LRT) line. A fixed transitway with dedicated right-of-way would provide faster and more reliable service than current bus service, which runs in mixed traffic. The Preferred Alternative would also provide park-and-ride facilities and bus service that would expand the ridership market by providing access to the proposed Preferred Alternative service.

Building the Preferred Alternative would require changes to be made to a number of roadways along the proposed LRT alignment. This would allow for LRT to operate in an exclusive guideway and thereby provide a time advantage to transit vehicles. Besides reducing the number of traffic lanes, street patterns would be modified in a number of other ways, including: regulating new turn restrictions, closing some accesses, and removing or installing new traffic signals at several intersections along the alignment where the LRT crosses high-volume side streets.

Despite this reduction in capacity, it is anticipated that the total number of failing intersections (Level of Service [LOS] E or F) in 2035 under the Preferred Alternative are less than the 2035 No-Build conditions. This reduction would occur because of a number of factors:

- The reduction in traffic volumes along the Red Line corridor caused by diversions of auto trips to Red Line transit;
- Some failing unsignalized intersections in the No-Build condition would be converted to signalized intersection that would improve the overall LOS; and
- Some corridors would experience improved progression along the mainline because with the transit priority and preemption treatments provided for the rail line.

Additionally, several mitigation measures were proposed at various intersections that improved operations of the Preferred Alternative when compared with No-Build conditions. Some intersections were relocated, while a few were removed because of the at-grade crossing of the Red Line transit. Signal timing optimization for Red Line transit provided progression preference to the main line with heavy vehicular traffic when compared to lighter side street vehicular traffic and improved the overall intersection LOS.

Permanent, long-term impacts from the Preferred Alternative include: non-residential acquisitions and displacements, modified viewsheds, impacted park lands, adverse effects to historic resources, increased noise, forest and street tree impacts, effects to natural resources (including waters of the US, wetlands, critical area, floodplain, and groundwater), potential for hazardous materials, utility relocation, and others as detailed in **Chapter 5** and summarized in the **Table 7-2**.

During planning and preliminary design, opportunities to avoid and minimize effects to environmental resources were actively pursued. Overall, the project effects were reduced by locating segments of the Preferred Alternative within tunnel sections or within transportation right-of-way. As the project continues into Final Design, additional avoidance and minimization measures would be pursued for impacts identified in this document. Any unavoidable effects would be mitigated for in accordance with the regulations governing that resource and commitments in this document. A summary of the commitments and mitigation is included in the last section of **Chapters 4** and **5** of the FEIS.

Table 7-2: Summary of Preferred Alternative Long-Term Effects

Summary of Preferred Alternative Long-Term Effects
Land Use
• Minimal because the current land use plans and zoning for Baltimore County and Baltimore City have been developed to anticipate the Red Line project, and to maximize the potential benefits from the project.
Neighborhoods and Community Facilities
• No displacement of community facilities such as schools, libraries, places of worship, emergency services, or park and recreation areas. • Neighborhood cohesion effects are not anticipated because the proposed transit service would operate almost entirely on existing roadways and thoroughfares. • Greater pedestrian activity and would provide improved accessibility for pedestrians and bicyclists.
Parking
• Permanent elimination of 741 parking spaces, and would provide 1,134 new parking spaces at park-and-ride facilities. • 380 spaces that would be permanently displaced by the project and that could not be accommodated nearby.
Environmental Justice
• No disproportionately high and adverse impact on environmental justice (EJ) populations.
Property Acquisitions and Displacements
• No acquisition of real property that would result in an involuntary residential displacement • An estimated 192 properties would require either a partial (169 of 192) or total (23 of 192) right-of-way acquisition totaling approximately 42 acres. The majority of the partial acquisitions are within the US 40 segment, where sliver takes from 97 residential properties would be required. • The 23 total takes include 13 commercial, three industrial, one institutional, and six governmental properties, primarily at the operations and maintenance facility (OMF).
Economic Activity
• Regional economic benefits by improving transit access and mobility for the work force and consumers within the project study corridor. • Better access to existing jobs. • Creation of approximately 200 permanent MTA jobs.
Visual and Aesthetic Resources
• New visual features introduced; of 16 visual districts or sub-districts identified throughout the project study corridor, an overall visual effect of "high" on one sub-district, and an overall visual effect of "medium to high" on five sub-districts

Table 7-2: Summary of Preferred Alternative Long-Term Effects

Summary of Preferred Alternative Long-Term Effects
Parks, Recreation and Open Space
• Long-term effects to park, recreation and open space areas are limited and include: ○ Chadwick Elementary School – 0.7 acre of the property would be required for construction of and access to a proposed traction power substation (TPSS); ○ Edmondson-Westside High School – approximately 150 square feet of school property near the Edmondson Avenue and Athol Avenue intersection would be purchased in fee simple to accommodate intersection improvements and stormwater management; ○ Boston Street Pier Park – a fee-simple area of less than 0.1 acre would be required from this park to accommodate stormwater management; ○ St. Casimir's Park – a fee-simple area of less than 0.1 acre would be required to accommodate stormwater management.
Historic Properties
• Proposed effects findings include: ○ no effect on 45 individual historic properties; ○ no adverse effect on 28 individual historic properties; and ○ an adverse effect on five individual historic properties, all located in Baltimore City: Poppleton Fire Station (Engine House No. 38), Business and Government Historic District, South Central Avenue Historic District, Fell's Point Historic District, and Public School No. 25 (Captain Henry Fleete School). • An overall finding of adverse effect on historic properties has been proposed.
Archeological Resources
• The archeological analysis completed to date has identified 22 areas of sensitivity. Any potential archeological resources that would be affected would be documented prior to construction and once operational, no further effects to archeological resources are anticipated.
Air Quality
• Predicted to decrease regional pollutant burdens by approximately 1.5 to 1.9 percent. • No violations of the NAAQS are predicted • Not considered a project of air quality concern regarding $PM_{2.5}$ emissions.
Noise and Vibration
• Corridor-wide project noise exposure levels are predicted to exceed the FTA moderate impact criteria at 96 residences and the FTA severe impact criteria at one residence (The Shipyard condominium building at the corner of Boston Street and Lakewood Avenue). • Vibration levels are predicted to exceed the FTA frequent criterion of 72 VdB at 45 residences. Ground-borne noise levels are predicted to exceed the FTA frequent criterion of 35 dBA at 49 residences. • Vibration levels are not predicted to exceed the FTA frequent impact criteria at non-residential land-uses (Category 1 or 3) except the proposed University of Maryland Proton Building.

Table 7-2: Summary of Preferred Alternative Long-Term Effects

Summary of Preferred Alternative Long-Term Effects
Ecological Resources (terrestrial habitat, terrestrial wildlife, aquatic habitat/species, and rare, threatened and endangered species)
• Impacts to 34.8 acres of forests with minimal effects to higher value terrestrial habitat. • Long-term effects to terrestrial wildlife resources are unlikely because on existing roadway alignments, and wildlife corridors, such as along Gwynns Falls, would remain intact. • FIDS habitat would be affected by minor encroachment since only slight widening of existing roadways would be necessary. • Permanent or temporary loss of approximately 1,941 linear feet of aquatic stream habitat, largely as a result of proposed culvert extensions. • Greater impervious surfaces could affect water quality. However, overall net increases in impervious surfaces are expected to be minimal, amounting to an approximately 7-acre increase in impervious area. Incremental impervious effects that could be expected are unlikely to affect overall aquatic habitat or the makeup of biological communities to an appreciable degree. • Long-term effects to rare, threatened, and endangered species would not be anticipated since none are known to occur within the project study corridor.
Forests
• Impacts to 34.8 acres of forest and removal of 39 specimen trees. • The majority of the long-term forest effects would occur within the West and Cooks Lane Tunnel segments (28.5 acres) in the western reaches of the project study corridor, where most of the resources exist.
Street Trees/ Individual Trees
• Impacts to 315 street trees within Baltimore County and 948 in Baltimore City.
Chesapeake Bay Critical Area
• Conversion of 1.28 acres of unpaved area to impervious surfaces would occur in the East segment from the construction of the Canton Station and expansion of roadway to accommodate the track in the current median of Boston Street (including within the 100-foot buffer at Harris Creek). • The impervious area within the Critical Area would increase from 56 percent cover (existing conditions) to approximately 61 percent cover. • Long-term vegetation effects would occur to landscaping plants, street trees, and park trees within the Critical Area in both the Downtown Tunnel and East segments. The Downtown Tunnel segment tree effects would total 149. The East segment tree effects would total 232, with nine additional trees affected within the 100-foot buffer.

Table 7-2: Summary of Preferred Alternative Long-Term Effects

Summary of Preferred Alternative Long-Term Effects
Wetlands and Waters of the United States
• Total effects to wetlands and waterways: o 0.23 acre of palustrine forested wetlands o 0.99 acre palustrine emergent wetlands o 1,941 linear feet of perennial and intermittent streams o 324 linear feet of ephemeral channel. • MTA intends to apply for a Section 404 Individual Permit from the US Army Corps of Engineers (USACE) and an Individual Non-tidal Wetlands and Waterways Permit from the MDE.
Surface Waters: Water Quality, Scenic and Wild Rivers, Floodplains and Navigable Waterways
• Net impervious increase of approximately 7 acres. • No designated scenic and wild rivers within the project study corridor; therefore, no long- or short-term effects would occur. • 0.7 acre of nontidal and 1.0 acre of tidal floodplain effects (combined long- and short-term). In general, the majority of the floodplain encroachments would be from traverse crossings of floodplains. • No long- or short-term effects to navigable waters are anticipated. While no effects to the Jones Falls are anticipated because of the tunnel, would require authorization under Section 10 of the Rivers and Harbors Act. The Downtown Tunnel segment passes beneath this navigable water and is therefore subject to USACE (and potentially USCG) navigable waters permitting requirements.
Groundwater
• Runoff would be directed to surface waters through stormwater management or treated as it is being infiltrated into the local groundwater through ESD stormwater facilities.
Soils and Geology
• Once operational, no long-term effects to the underlying soils and rock would be anticipated.
Hazardous Materials
• There is a potential for the presence of hazardous materials to be encountered
Utilities
• Utility-related effects would be addressed in advance of, or in conjunction with construction.
Draft Section 4(f) Evaluation
• The temporary occupancy of three parklands and one historic property during construction; • De minimis impacts to two parklands and nine historic properties; and • The permanent use of two contributing properties within the Business and Government Historic District under the proposed Inner Harbor Station.

It is anticipated that numerous federal, state, and local permits and approvals would be required during the design and construction phases of the project. Permits and approvals are typically obtained as the project design and limit of disturbance are further refined, including implementing avoidance and minimization design measures and finalizing the construction staging and access areas. A list of the anticipated permits and approval assumed for the Preferred Alternative are discussed in **Chapter 5**, **Section 5.26**.

7.4 Equity

Equity is the extent to which each alternative provides fair distribution of benefits, costs, and impacts across communities in the project study corridor. The benefits of land use, access, mobility, job creation, and environmental mitigation would be realized by residents throughout the project study corridor, while some adverse impacts would occur to those same communities. The Preferred Alternative would improve access and mobility within the project study corridor, thereby improving access to jobs, educational facilities, and cultural/entertainment venues. The project would be funded by a combination of federal, state, and local funds. Because a broad range of funding sources would be used, it is expected that the financial burden of the proposed project would be widely shared.

Overall, the Red Line would improve accessibility for all communities including low-income, minority, and transit-dependent populations. While some impacts would occur within these communities, these impacts would be minimal compared to the project's benefits to the larger environmental justice populations, and would be no different than impacts to the overall population in the corridor, including accessibility and a faster, more reliable mode of transit.

8. Public Participation and Agency Outreach

8.1 Public Involvement Overview

The Red Line project's comprehensive public involvement program, which began in Spring 2003, has been integral to the overall project efforts and has continued throughout the planning and design phases of the project. The initial public involvement plan has evolved and the implementation of the plan has continued to inform and engage area residents, communities, businesses, and other organizations. It is updated as appropriate as the Maryland Transit Administration (MTA) continues to develop the project and respond to comments on the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS). Many of the early programs are still in place while new programs and techniques have been added to expand the reach of outreach and engagement activities. Outreach to the public is vital to the successful implementation of the Red Line and is a necessary component of some federal regulations.

The MTA launched several new programs for involving communities, following the execution of the *2008 Baltimore City Red Line Community Compact*[1], including the Station Area Advisory Committee (SAAC) program and the hiring of Community Liaisons to facilitate dialogue with stakeholders at the grassroots level. These new programs are in addition to the continuation of various other public involvement activities, described below.

This chapter provides an overview of activities that have occurred since the AA/DEIS was published in 2008. Red Line public involvement activities during this phase have included: public hearings, open houses, Citizens' Advisory Council (CAC) and SAAC meetings, community events, small group meetings, and the distribution of various project publications. In addition, non-traditional targeted outreach efforts which included grocery store outreach, door-to-door canvassing, ministerial outreach, transit center outreach, and social media campaigns were employed to provide a comprehensive program to reach stakeholders and more specifically traditionally underserved populations such as minority, low-income, elderly, and disabled populations. For more information, please refer to the *Public Involvement Technical Report* (**Appendix I**).

Changes to this Chapter since the AA/DEIS

As noted above, a wide range of public outreach and involvement activities continue to be carried out since the publication of the AA/DEIS. This chapter of the Final Environmental Impact Statement (FEIS) focuses on the activities since the AA/DEIS. For information on public involvement activities carried out prior to the AA/DEIS, please refer to the AA/DEIS document (**Appendix D**).

8.2 Outreach Plan

The MTA participates in various public outreach activities to increase awareness of the project throughout the Baltimore region, provide up-to-date project information, as well as create relationships, opportunities, and connections to sustain project outreach and feedback. These

[1] The Compact, signed in September 2008, is an agreement among the communities along the project study corridor, Baltimore City, the MTA, and other project stakeholders to make the Red Line a catalyst for economic and environmental benefits in the project's neighborhoods.

events, meetings, and get-togethers were also held to develop a greater understanding of, and appreciation for, the neighborhoods that the Red Line would serve. Since the AA/DEIS Public Hearings, approximately 240 outreach events have been held with the stakeholders along the project study corridor.

The sections below describe outreach activities targeted to neighborhoods, as well as to the project study corridor and the larger region. Agency coordination and outreach is discussed in **Section 8.3** while public involvement and CAC meetings are discussed separately in **Sections 8.4** and **8.5**.

8.2.1 Project Publications

Since the AA/DEIS, MTA developed three newsletter publications, dated Fall 2009, Summer 2011, and Spring 2012. The Fall 2009 issue focused on Governor Martin O'Malley's announcement of the Locally Preferred Alternative (LPA), while the Summer 2011 issue discussed the project's entry into the Preliminary Engineering phase. The Spring 2012 issue announced the June 2012 Open House meetings and refinements to the LPA.

Regular (monthly/bi-monthly) e-newsletters continue to be distributed to subscribers to the project's email registry. The e-news provides more frequent updates on the project and notifies the community regarding upcoming events.

8.2.2 Resource Hubs

MTA identified 36 locations throughout the project study corridor for the placement of Red Line information. These locations include community recreation centers, libraries, schools, senior centers, and state buildings. These facilities are easily accessible by the public and were established to provide project information including fact sheets (Red Line general information and SAAC updates), meeting fliers, newsletters, public meeting announcements, mailing list sign-up cards, and other publications specific to the community. Where appropriate, information is provided in both English and Spanish.

8.2.3 Media Outreach

A variety of media outlets have been utilized to inform stakeholders. Advertisements were placed in a total of 14 local English and Spanish language newspapers and other publications announcing corridor-wide public meetings. Local television and radio stations were also utilized as a way to keep the public informed about upcoming Red Line meetings and other events.

8.2.4 Station Area Advisory Committees

In Fall 2010, MTA initiated the SAACs, a community-based design initiative to provide design input on the Red Line project development. The SAACs were formed to fulfill a commitment for community-centered station design, development, and stewardship that had been set forth in the *2008 Baltimore City Red Line Community Compact*.

Seventeen SAACs were formed to provide input into the planning and design of the nineteen proposed light rail stations along the project study corridor. Over the course of approximately 18 months, the SAACs met with facilitation teams and local government representatives to discuss and summarize ideas and concepts pertaining to the Red Line and the stations within their communities.

During the first phase of this process, the SAACs developed Vision Plans for their station areas focusing on areas broader than the project scope which would be influenced by, and would influence, the Red Line project and the stations. This information was presented at the May 2011 Open House meetings.

In the second phase, the SAAC members were asked to give input into three "focus areas" associated with their stations:

1) The station
2) Areas around the station
3) The transit corridor (between stations)

The results of this effort were the development of Design Concepts by the SAACs for each station that provided input on landscape, lighting, furnishings, artwork, sustainability, and station design (typical shelter design and entrances). This input was presented at the Summer 2012 Open House meetings.

The SAACs were helpful in providing valuable information about their communities and on how each proposed station would function in the community. The SAACs' work products are available on the project website (www.baltimoreredline.com), and were used to relay public comments to the project designers.

8.2.5 Community Liaisons

Designated by MTA to work with the communities, the Red Line Community Liaisons play a key role in MTA's efforts to enhance awareness of the project and engage the surrounding neighborhoods. The Community Liaisons work closely with residents, businesses, community organizations, and other stakeholders, and serve as liaisons between the MTA and communities. They work with diverse communities to ensure concerns are documented and submitted to the MTA for consideration into the project. Integrating the Community Liaisons into the Red Line project fulfills one of the goals outlined in the *2008 Baltimore City Red Line Community Compact*. Outreach efforts for this project have extended to numerous communities including minority, low-income, elderly and disabled throughout the project study corridor. Some examples of the outreach efforts include:

- Developed project materials for a Limited English Proficiency (LEP) audience;
- Some printed project materials were translated into Spanish;
- The text on the project website can be translated into more than 60 various languages; and
- One of the Resource Hubs (described in **Section 8.2.2** above) is located at Baltimore City's mixed population [nearly elderly (50+), elderly (62+) or disabled] residential facility, Rosemont Tower.

The five Community Liaisons, listed in **Table 8-1** have organized presentations, community events, business outreach, and other outreach efforts throughout the project study corridor.

8.2.6 Business and Stakeholder Meetings and Outreach

The MTA meets with businesses, special interest groups, and governmental agencies in an effort to provide project updates, as well as solicit comments. As new project details and updates become available, meetings are scheduled with these entities and coordinated through the Community Liaison staff.

Table 8-1: Community Liaisons

Name	Liaison Coverage Area	Station Areas Represented
Keisha Trent	West Segment	• Centers for Medicare & Medicaid Services (CMS) • Security Square • Social Security Administration • I-70 Park-and-Ride
Charisse Lue	Cooks Lane Segment	• Edmondson Village • Allendale • Rosemont • West Baltimore MARC
Lisa Akchin	US 40 Segment	• Harlem Park • Poppleton • Howard Street/University Center • Inner Harbor
Rachel Myrowitz	Downtown Tunnel Segment	• Harbor East • Fell's Point • Canton
John Enny	East Segment	• Brewers Hill/Canton Crossing • Highlandtown/Greektown • Bayview Campus • Bayview MARC

Source: Public Involvement Technical Report, 2012

8.2.7 Speaker's Bureau/Community Liaison Presentations

The Red Line "Speaker's Bureau" was created prior to the AA/DEIS to establish and maintain open communication with residents within the study area, and to give communities the opportunity to discuss how their community would be affected by the proposed Red Line project. Since the launch of the Community Liaisons program, these presentations to community associations are now referred to as Community Liaison presentations. They are typically held in an informal, small-group setting to encourage interaction. More than 80 presentations have been made since the AA/DEIS was published.

8.2.8 Festival and Event Outreach

During 2011, MTA attended 28 festivals and other summer events, and dedicated 415 hours to outreach and related preparation. The 2011 summer events ranged from small, community-based festivals, farmers' markets, and neighborhood block parties such as the St. Anthony's Festival and the Baltimore International College Block Party, to large regional events such as Artscape and the Maryland State Fair.

Many of the summer festival events are well established and well attended. Close to 3,660 people visited a Red Line booth or table, and more than 2,300 people added their names to the project mailing list. The summer events proved to be an effective way to connect with people who reside both inside and outside of the Red Line project study corridor. Participants discussed the project timeline, the LPA, cost estimates, economic development opportunities in the project area, and other project topics.

In 2012, MTA outreach efforts continued by participating in 26 canvassing/literature distribution events; 115 community events/festivals including displays at various farmer's markets, LatinoFest, Earth Day, Charm City Music Festival, National Night Out, Artscape and the Islamic Society of Baltimore Summerfest; 37 networking events; 57 community presentations with various community and business associations and 31 single stakeholder meetings. The audience for these groups ranged from single stakeholder to larger regional events.

8.2.9 Project Website

The Red Line project website (www.baltimoreredline.com) provides up-to-date information on the project and announces any upcoming meetings and events. The website includes downloadable materials, including a map and simulation of the Preferred Alternative, photos, fliers, e-newsletters, news articles, brochures, and various archived materials. Four project videos are also available on the website and include: the Red Line promotional video, produced in 2007; "Ride the Red Line," produced in 2009, depicting the downtown segment of the project; "Red Line West Side Story," produced in 2010; and the "East Side" video, produced in 2011, and the Red Line 2012 Preferred Alternative end-to-end video. Community members can also submit questions or comments through the website. The site also includes links to Twitter, Facebook and YouTube.

LEP considerations were also made in developing the project website. To reach various populations, website text can be translated into more than 60 languages. Also available on the website are topic-specific materials for further clarification, which include flyers and information sheets that have been translated to reach LEP stakeholders. The flyers and fact sheets are available in both English and Spanish to provide community members an overview of the project and include a comment card to fill out and signup for the project mailing list.

8.2.10 Hispanic Outreach

Focused outreach to Spanish speaking populations has been included as part of many of the outreach strategies and tools discussed above. The MTA has continued its relationship with advocacy organizations such as Education Based Latino Outreach Center (EBLO) and the Latino Providers Network to reach and engage the Hispanic community; as such Community Liaison presentations were also given during the development of the FEIS to provide up-to-date information and to receive feedback. In addition, the Community Liaisons also canvassed businesses and residential dwellings in the "Spanishtown" area of the Upper Fell's Point neighborhood (along Broadway, Eastern Avenue, Fleet Street) and in the Highlandtown neighborhood (along Eastern Avenue) to provide stakeholders with Red Line project fact sheets, newsletters and event invitations/announcements in both English and Spanish.

The Red Line project materials were also translated into Spanish and provided to the community at EBLO, Esperanza Center and the Southeast Anchor Pratt Library. In addition the FEIS **Executive Summary** was translated into Spanish as well as e-newsletter editions, frequently asked questions document, various fact sheets, and other pertinent project materials as needed.

The Community Liaisons also attended ethnic festivals and events known to reach Hispanic populations which included Latino Fest, Cinco de Mayo, Fell's Point Fun Festival, Highlandtown Farmer's Market, and the Hispanic Heritage Celebration.

8.2.11 Social Media

Social media tools including Facebook, Twitter and YouTube were established for the Red Line project and have played an integral role in quickly disseminating information to the public about the project. Since the creation of a Red Line themed fan page in 2011, the Baltimore Red Line Community Liaisons Facebook Fan Page (www.facebook.com/redlineliaisons) has earned 181 "Likes." The Community Liaisons regularly provide posts that emphasize project updates, outreach opportunities, and news relevant to the communities along the corridor. The Red Line Facebook page also occasionally highlights news from the transit and transportation industry. The Red Line project also maintains a Twitter account (@redlineliaisons) with approximately 60 followers. The Twitter account is linked to the Red Line Facebook page and, as such, typically contains similar content.

In addition to the Facebook and Twitter accounts, the Red Line project also maintains a YouTube page (www.youtube.com/redlineliaisons). Twelve videos about the project and events have been posted since its creation. There are many YouTube subscribers that follow Red Line updates and over 4,400 views of project-related videos have occurred.

All of the social media outlets can be found on each of their respective platforms as well as on the Red Line website (www.baltimoreredline.com). The project website has been optimized for mobile viewing on handheld devices.

8.2.12 High School Internship Program

The MTA created a high school internship program in 2009 with its first class of six students; since then the MTA has expanded its partnership to include three of the high schools located along the project study corridor: Woodlawn High School, Edmondson-Westside High School, and Patterson High School.

Each year up to 18 new high school students are selected by the MTA to work at three firms for 6 weeks in the summer. The program exposes the interns to the Red Line project, the MTA staff and facilities, as well as to careers in transportation and planning. Additionally, three college students from Morgan State University are selected each year to serve as college assistants to the program as they help to facilitate the daily activities of the program and serve as mentors to the high school interns. As mentors, the college assistants provide guidance to the interns in planning for future goals such as college and careers.

8.3 Agency Coordination

The Red Line project is being developed in accordance with the National Environmental Policy Act (NEPA) and the Maryland Streamlined Environmental and Regulatory Process, including coordination with federal, state, and local regulatory agencies. Outreach to these agencies has primarily been through regular, Interagency Review Meetings and correspondence, and coordination will continue (**Appendix G**).

The resource agencies that attend the Interagency Review Meetings typically include:

- Federal Highway Administration
- Federal Transit Administration
- US Army Corps of Engineers
- US Environmental Protection Agency
- US Fish and Wildlife Service
- National Park Service
- Maryland State Highway Administration
- Maryland Transit Administration
- Maryland Department of the Environment
- Maryland Historical Trust/Maryland State Historic Preservation Office
- Maryland Department of Planning
- Maryland Department of Natural Resources
- Baltimore Regional Transportation Board, the Metropolitan Planning Organization (MPO) for the region

Table 8-2 provides the dates and themes of the nine Interagency Review Meetings that have been held since the AA/DEIS.

Table 8-2: Interagency Coordination Meetings

Meeting Date	Topic of Discussion
November 18, 2009	Presented results of the AA/DEIS
December 15, 2010	Presented the Locally Preferred Alternative and schedule
November 16, 2011	Presented the Preferred Alternative and path forward for the FEIS
December 14, 2011	General project update and introduction of technical studies
March 21, 2012	Tunnel overview and Phase 1B archeology
April 18, 2012	Natural resource studies – approach, methodology, and status
May 16, 2012	Noise Studies – approach, methodology, and status
September 19, 2012	Natural resource studies – conceptual mitigation and; Air Quality
October 17, 2012	Cultural and Historic Resources

Source: Public Involvement Technical Report, 2012

The FTA and MTA have conducted numerous cultural resource studies along the project study corridor pursuant to the assessment of impacts to historic architectural, archaeological, and cultural resources required under NEPA, as amended (42 United States Code [USC] 4321-4347), Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470 et Seq.), and Section 4(f) of the Department of Transportation Act of 1996, as amended (49 USC Section 303). These studies were performed in consultation with the staff of the Maryland Historical Trust, representing the Maryland State Historic Preservation Officer and other appropriate consulting parties.

In August 2011, the President issued a memorandum entitled *Speeding Infrastructure Development Through More Efficient and Effective Permitting and Environmental Reviews*, which required federal agencies to identify and expedite a set of priority projects. In October 2011, the Red Line project was selected as one of 14 infrastructure projects around the country for an expedited permitting and environmental review process.

To encourage transparency during the project development process, the Federal Infrastructure Projects Dashboard allows the public to track the progress of each priority project. The dashboard, which is part of the government's performance.gov website, highlights best practices and successful coordination efforts that result in an efficient federal permitting process and review decisions which can benefit all projects. The performance.gov website informs the public of actions that require cooperation between federal agencies for the Red Line project. It summarizes the substantial public involvement and outreach activities to refine and improve the project.

8.4 Public Involvement Meetings

Numerous public meetings and workshops have been held since the publication of the AA/DEIS, including public hearings, open houses, SAAC meetings, and CAC meetings. These public meetings are summarized in the following sections.

8.4.1 Corridor-Wide Public Meetings

a. Public Hearings

Four public hearings were held in November 2008. These meetings served as a formal opportunity for the public to provide comments on the AA/DEIS, in accordance with NEPA and Section 106 of the National Historic Preservation Act. The AA/DEIS presented the project's purpose and need, an alternatives analysis, the affected natural and human environments, possible impacts, and potential mitigation for the build alternatives. Approximately 500 people attended the four meetings listed in **Table 8-3,** with 159 citizens providing testimony either during the hearing or privately with a court reporter. Written comments were also accepted at these hearings. Overall, more than 500 comments and several petitions received during the comment period.

Table 8-3: Fall 2008 Public Hearing Dates and Locations

Date	Meeting Location	Project Area Location
November 6, 2008	Lithuanian Hall	Downtown
November 8, 2008	Edmondson High School	West Baltimore
November 12, 2008	United Autoworkers Hall	East Baltimore
November 13, 2008	Woodlawn High School	Baltimore County

Source: Public Involvement Technical Report, 2012

b. Spring 2011 Public Open House Meetings

As noted in **Table 8-4**, four open house meetings occurred in May 2011. The purpose of the 2011 open house meetings was to highlight the work of the SAACs. The SAACs were comprised of community stakeholders and met regularly to provide input on how stations along the proposed Red Line could be designed to best serve their communities. At each of the open house meetings, SAAC members shared their work with the public and received input on the development of Vision Plans and other work products. More than 400 neighborhood residents attended to gather information, ask questions, and offer their input on the station design concepts presented by the SAACs.

Table 8-4: Spring 2011 Public Open House Meetings

Date	Location	Project Area Location
May 7, 2011	Edmondson High School	West Baltimore
May 11, 2011	Woodlawn High School	Baltimore County
May 14, 2011	Hampstead Hill Academy	East Baltimore
May 17, 2011	University of Maryland-Baltimore	Downtown

Source: Public Involvement Technical Report, 2012

c. Summer 2012 Public Open House Meetings

The purpose of the Summer 2012 open house meetings was to present the latest information on the project including the refinements that were made to the LPA as a result of further preliminary design and comments made on the AA/DEIS, as well as an update on the efforts of the SAACs. Approximately 380 people attended these four meetings held in June 2012 to learn about the project. To date, 65 comment cards have been received. Additionally, information on related area-specific projects, such as the West Baltimore MARC and Bayview MARC projects, and the Edmondson Avenue Bridge Project, were available at the Open House held in those specific areas of the project study corridor. The specific meeting locations are listed in **Table 8-5**.

Table 8-5: Summer 2012 Public Open House Meetings

Date	Location	Project Area Location
June 6, 2012	University of Maryland-Baltimore	Downtown
June 9, 2012	Hampstead Hill Academy	East Baltimore
June 12, 2012	Woodlawn High School	Baltimore County
June 16, 2012	Lockerman Bundy Elementary School	West Baltimore

Source: Public Involvement Technical Report, 2012

8.4.2 SAAC Meetings

As noted above, the SAAC meetings revolved around two phases: developing a Vision Plan for their respective station area(s), and providing specific design input. At the end of each phase of the SAAC efforts, Open Houses were held to provide an opportunity for the public to submit feedback on the Vision Plans, station locations, and focus areas. Information on SAAC meetings and events are described below.

a. SAAC Meetings

The SAAC members held regular meetings every 6 to 8 weeks from January 2011 through June 2012, when the formal 18-month program concluded. However, it is anticipated that coordination with SAAC members will continue until the end of the station planning process with a less rigorous meeting schedule.

b. SAAC Events

In an effort to provide information to the SAAC members on various topics, four special events were held:

1) New Links-Baltimore Seminar – that was designed to foster collaboration and provide station-area planning assistance.
2) Columbia Heights Walking Tour – that provided examples of development and enhancements that can be achieved in communities undergoing transit investment.
3) The RailVolution Conference – attendance at this event enabled participants to see examples of case studies from across the country in topics ranging from Transit Oriented Development (TOD) to bike sharing.
4) Philadelphia Light Rail Tour – that provided examples of TOD around surface and underground stations similar to what is proposed at the Howard Street/University Center station.
5) SAAC Celebration – was an event to honor the contributions of its members for the completion of the Red Line station planning process.

In addition, two special SAAC meetings were held to discuss critical design elements with the public:

- The I-70 SAAC Meeting – held to discuss existing conditions in the I-70 area, proposed concepts for the Red Line alignment and I-70 Park-and-Ride Station (including potential roadway modifications), and to solicit comments from the community.
- Operations and Maintenance Facility (OMF) Meeting – held to provide information regarding the planned Calverton light rail operations and maintenance facility to be located south of US 40 (West Franklin Street) at North Franklintown Road. This meeting was also advertised to the surrounding residences and communities near the OMF.

8.5 Citizens' Advisory Council

In 2006, the Maryland General Assembly passed a bill creating the Red Line CAC. The bill established the membership of the CAC and its role in the Red Line planning process. The CAC is responsible for advising the MTA on impacts, opportunities, and community concerns regarding the Red Line. The CAC's functions include:

- Advising the MTA on potential neighborhood impacts resulting from the Red Line project
- Providing input to the MTA as the project advances through the planning, engineering, right-of-way acquisition, and construction phases
- Reviewing economic development opportunities associated with the project

The CAC continued to meet monthly through 2012 to review numerous topics of importance to the planning and development of the Red Line. All of the CAC meetings have been open to the general public. The CAC will continue to work with MTA as the project moves towards implementation.

A brief overview of the topics discussed at the CAC meetings held between 2009 and September 2012 are listed in **Table 8-6**. For more detailed information regarding the CAC Retreats and other information related to the CAC, please review the Appendices of the *Public Involvement Technical Report*.

Table 8-6: CAC Meetings and Topics

Meeting Date	Major Topics
January 8, 2009	• Review of public comments • CAC role and strategies for working with community leaders • Economic scan
February 12, 2009	• Update on State Center Transit Project and Neighborhood Alliance • Federal economic recovery plan; implications for Red Line • CAC role and strategies for working with community leaders
March 12, 2009	• Analysis of CAC modifications to Alternative 4C • Update on Southeast Baltimore alignment options • Update on Red Line project milestones/schedule • Where Do We Go From Here; subcommittee report
April 2, 2009	• Analysis of CAC modifications to Alternative 4C (West Side) • Summary of DEIS comments • Subcommittee report
May 14, 2009	• Baltimore City land bank • Summary of DEIS comments • Selection of LPA • Subcommittee report
June 11, 2009	• Edmondson Avenue traffic capacity • West Baltimore MARC station update • CAC annual report • R. Keith downtown alternative • CAC bus tour

Table 8-6: CAC Meetings and Topics

Meeting Date	Major Topics
July 9, 2009	• R. Keith downtown alternative • Discussion of council vote on Alternative 4C • Proposed Red Line stations • CAC annual report
September 10, 2009	• Selected LPA • CAC annual report • Bylaw amendments
October 8, 2009	• Bylaw amendments • CAC annual report • Project schedule • Community compact
November 12, 2009	• CAC annual report • By-law amendments • Comparison of Alternative 4C LPA
January 14, 2010	• Implications of proposed changes to the FTA New Starts program • Planning for safety and security
March 11, 2010	• Red Line economic impact study • Transit safety and accident data • Station area planning process • Minimum operating segments
May 13, 2010	• Motion to honor R. Keith • Motion on frequency of CAC meetings • Light Rail and Metro collision data • Station Area Advisory Committee process • Ridership and capacity • Presentation of video simulation of West Side
July 8, 2010	• Ridership and capacity • Redevelopment opportunities • State Budget and Legislative Report • Crossover in Lombard Street Tunnel
September 9, 2010	• Response to capacity analysis • Annual report planning • Station area planning process
November 4, 2010	• Joint follow-up response to capacity analysis • Annual report • Station area planning process
January 13, 2011	• Follow-up response to capacity analysis • Introduction of Community Liaisons • Status of FTA New Starts process • Design options for Edmondson Avenue segment
March 10, 2011	• Final follow-up response to capacity analysis • Design options for Boston Street segment • Update on SAACs • Map documentation of project impacts

Table 8-6: CAC Meetings and Topics

Meeting Date	Major Topics
May 12, 2011	• CAC vacancies • Update on project outreach activities • Status of FTA New Starts process • Map documentation of project impacts • Design options for Edmondson Avenue segment • CAC committees
July 14, 2011	• Safety and security • Proposal for CAC committees • Proposed modifications to LPA • Project expenditures to date • Framework for special Edmondson Avenue meeting
September 8, 2011	• Adoption of annual report • Format for special meetings for Edmondson Avenue residents • What happens during Preliminary Engineering phase • SAAC reactions to proposed modifications to LPA • Project expenditures to date
January 12, 2012	• Bylaws amendment • Neighborhood community development • Economic empowerment • Construction and operation impacts & mitigation • Funding status • Design status • Meetings for I-70 communities • SAAC progress
February 9, 2012	• Presentation: Update of SAAC – Subcommittee Informational Session
March 8, 2012	• Public participation guidelines • Neighborhood community development • Economic empowerment • Construction and operation impacts & mitigation • Funding status • I-70 public meeting summary
May 10, 2012	• Neighborhood community development • Economic empowerment • Construction and operation impacts & mitigation • MTA employment opportunities • Surface station architectural concepts • Public meetings • Funding status • Legislative session summary
July 12, 2012	• Annual Report • Screening of updated project video • Funding status • Open House summary

Table 8-6: CAC Meetings and Topics

Meeting Date	Major Topics
September 13, 2012	• Annual Report • Construction and operation impacts & mitigation • Economic empowerment • Neighborhood community development • FEIS timetable • Summer outreach summary • Architectural concepts for underground stations

Source: Public Involvement Technical Report, 2012

9. AA/DEIS Public Comments Summary

9.1 Introduction

The Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) for the Red Line Corridor Transit Study was approved on September 2, 2008. Subsequently, the document was made available to the public and appropriate federal, state, and local agencies for review and comment. (Refer to the Distribution List in the Appendix of the AA/DEIS, pages A-6 and A-7.) The formal Notice of Availability was published in the Federal Register on October 3, 2008 initiating the 90-day public review and comment period (October 3, 2008 through January 5, 2009). Comments received during this period were in the form of written correspondence (which included letters, emails, and comment forms) and verbal testimony at one of four public hearings held for the project. For additional information about the public involvement associated with the AA/DEIS, refer to **Chapter 8** of this Final Environmental Impact Statement (FEIS).

Changes to this Chapter since the AA/DEIS

This is a new chapter for the FEIS. This chapter summarizes the comments received during the 90-day public comment period and provides the context for **Appendix A** of this FEIS where the official response to each of the 729 comments including six petitions received is provided. Issues raised in the comments have also been addressed throughout this FEIS where appropriate.

9.2 Summary of Comments Received

Of the total comments received, 164 comments were from elected officials, agencies, or organizations, 559 from individuals, and six petitions. During the 90-day public review and comment period there were multiple ways comments could be submitted to the Maryland Transit Administration (MTA): email or online comment form through the project website, oral testimony at four public hearing meetings, letters addressed to the MTA or Federal Transit Administration (FTA), or hard copy comment forms available at the public hearings or locations where the document was available for public review. A summary of the comments received by method is listed below. Please note that some organizations and individuals commented using more than one method or submitted multiple emails, letters, comment forms, or testimonies. Each individual comment has been counted once, regardless of who submitted the comment.

9.3 Response to Common Themes in Comments Received

The comments received included many common themes or issues raised. The following is a summary of the most common themes and issues raised in the AA/DEIS comments received and a response is shown in *italics.*

9.3.1 Support for Red Line Project

Comments were received which did not specify support for a specific alternative, as presented in the AA/DEIS, but supported the Red Line project in general and emphasized the need for transit improvements in the Baltimore Region.

The Preferred Alternative presented in the FEIS improves transit in the Baltimore Region, as your comment recommends. The Preferred Alternative is a light rail transit line, with tunnels under *downtown Baltimore and Cooks Lane, primarily surface in other portions of the corridor, and a limited amount of aerial structure. Since 2009, refinements and enhancements to the 2009 Locally Preferred Alternative have been made based upon further environmental analysis, engineering, cost estimating, geotechnical investigation, input from stakeholders, and the public involvement program. Some of these refinements include new alignment along Security Boulevard as opposed to through the Security Square Mall property, alignment along I-70 and the highway ramp from I-70 westbound to I-695 northbound, slight extension of the Cooks Lane tunnel, new alignment along Franklintown Road, tunnel under Fremont Avenue, new aerial from Norfolk Southern right-of-way over I-895 to Johns Hopkins Bayview Medical Center, and new alignment on the Bayview Campus. These refinements, along with the decrease from 20 stations to 19 stations, have resulted in the Preferred Alternative presented in the FEIS. A description of the Preferred Alternative can be found in Chapter 2 of the FEIS. An evaluation of the Alternatives which led to the Preferred Alternative can be found in Chapter 7 of the FEIS. The Preferred Alternative meets the project purpose and need and also is consistent with your comments on the need for the Red Line Build Alternative.*

9.3.2 Requesting the No-Build Alternative

Comments were received requesting selection of the No-Build Alternative, rather than support the Red Line project. While some comments provided no justification for this request, others suggested that the project is not needed, the resultant impacts to residences would not justify the need, or MTA should focus on improving existing services.

The No-Build Alternative represents the future conditions of transportation facilities and services in 2035 if the Red Line is not built. The No-Build Alternative integrates forecasted transit service levels, highway networks and traffic volumes, and demographics for the year 2035 for projects identified in the 2011 Baltimore Regional Transportation Board's Constrained Long Range Plan (CLRP), Plan It 2035. The CLRP consists of the existing highway and transit network as well as planned and programmed (committed) transportation improvements. The No-Build Alternative represents a continued investment in regional and local transportation projects, but does not address the purpose and need of reducing travel times, increasing transit accessibility, providing transportation choices for east-west commuting, or supporting community revitalization and economic development opportunities.

Under the No-Build Alternative, existing and future populations along the study corridor would continue to be served by the local bus system, with only planned and programmed transit improvements. Congestion on the roadways and highways would continue to negatively impact the reliability of travel by automobile and bus. The No-Build Alternative end-to-end transit travel time in 2035 is projected to be 79 minutes, whereas The Preferred Alternative would operate with an end-to-end transit travel time of 45 minutes, nearly half the travel time of the No-Build Alternative.

The Preferred Alternative would improve the quality of east-west transit service along the project study corridor by providing frequent and reliable service. Light rail traveling in a dedicated right-of-way would not be subject to congested roadway conditions, resulting in dependable, on-time service. The Preferred Alternative would provide park-and-ride facilities and feeder bus service to enhance access to the rail transit service and expanding the ridership *market. The Preferred Alternative will not require any acquisition of real property that would result in an involuntary residential displacement.*

Chapter 7 of the FEIS compares the No-Build Alternative with the Preferred Alternative while providing detailed information on transit efficiency and accessibility, transportation choices, system wide transit connections, and community revitalization and economic development.

9.3.3 Support for Alternative 4C

Several comments were received expressing support of Alternative 4C as presented in the AA/DEIS. Other comments noted support for Alternative 4C with various modifications.

The Locally Preferred Alternative selected in 2009 by the State of Maryland, with input from local governments, most closely resembles Alternative 4C in the AA/DEIS. Alternative 4C in the AA/DEIS was light rail in mode, with tunnels under downtown Baltimore and Cooks Lane, primarily surface in other portions of the corridor, and a limited amount of aerial structure. Since 2009, refinements and enhancements to the 2009 Locally Preferred Alternative have been made based upon further environmental analysis, engineering, cost estimating, geotechnical investigation, input from stakeholders, and the public involvement program. Some of these refinements include new alignment along Security Boulevard as opposed to through the Security Square Mall property, alignment along I-70 and the highway ramp from I-70 westbound to I-695 northbound, slight extension of the Cooks Lane tunnel, new alignment along Franklintown Road, tunnel under Fremont Avenue, new aerial from Norfolk Southern right-of-way over I-895 to Johns Hopkins Bayview Medical Center, and new alignment on the Bayview Campus. These refinements along with the decrease from 20 stations to 19 stations, have resulted in the Preferred Alternative presented in the FEIS. A description of the Preferred Alternative can be found in Chapter 2 of the FEIS.

9.3.4 Support for a Heavy Rail Alternative

Comments were received stating that a heavy rail alternative should be studied in the AA/DEIS.

Two alternatives which incorporated Heavy Rail were considered in the AA/DEIS for the Red Line. They were described in Chapter 2, page 29 of the AA/DEIS. Each of these alternatives was proposed by members of the public.

The first of the two alternatives was a full Heavy Rail Alternative from Social Security Administration to Greektown, 14.3 miles. This alternative was estimated to cost $2.383 Billion in 2007 dollars. The alternative was not carried forward through full analysis in the AA/DEIS due to its high capital cost as compared to Light Rail and Bus Rapid Transit Alternatives being studied. The Preferred Alternative for the Red Line in the FEIS has a cost of $2.575 Billion in year-of-expenditure dollars. The year-of-expenditure dollars are based on a schedule that has the Red Line opening in 2021 and escalation occurring at a rate of +3.1 percent per year. Escalating the previously studied Heavy Rail Alternative capital cost at the same rate that is being used for the Preferred Alternative, with a project opening in 2021 and a mid-point of construction in the year 2018, yields a year-of-expenditure capital cost of $3.334 Billion. This cost estimate for Heavy Rail is $759 Million higher than the Preferred Alternative. This 30 percent cost differential still renders the Heavy Rail Alternative as too costly when compared with the Preferred Alternative.

In addition, there are other aspects of this proposed Heavy Rail Alternative that could bring into question its feasibility, could lead to higher capital costs, and/or create environmental impacts that would need to be addressed. These include constructing adjacent to the Amtrak Northeast corridor and within Amtrak right-of-way; constructing connections with the existing Baltimore Metro and the need to shut down Metro service while that construction occurred, likely six to nine months at a minimum; additional property takes along Amtrak right-of-way; visual impacts of an aerial alignment from Orangeville to Greektown; potential 4(f) impacts from being in a tunnel under Leakin Park due to associated ventilation or emergency egress that may be required; and viability of an at-grade alignment along I-70.

The second of the two alternatives was not a full Heavy Rail Alternative, but a combination of three modes – Heavy Rail, Light Rail, and Streetcar. The Heavy Rail component extended the existing Metro from Johns Hopkins Hospital to the Johns Hopkins Bayview Medical Center. From Centers for Medicare & Medicaid Services (CMS) to the western portion of downtown, the Alternative would be light rail similar to the Preferred Alternative. Upon entering downtown, the light rail would be surface to Camden Yards, and then would be in tunnel to the existing Charles Center Metro Station. The third component would be a streetcar from Camden Yards, with surface operations along Pratt Street and through Harbor East, Fell's Point, Canton, Canton Crossing, and Haven Street to the Amtrak right-of-way, ending at Edison Highway. The streetcar alternative would run in mixed traffic along the surface. This Alternative was estimated to have a capital cost of $1.8 Billion in 2007 dollars. Escalated at 3.1 percent per year yields a cost of $2.518 Billion in year-of-expenditure dollars. This cost is comparable to the Preferred Alternative, just as it was similar to the costs of the light rail and bus rapid transit alternatives in the AA/DEIS. The reasons this alternative were not studied further in the AA/DEIS are:

- *Many east-west trips through the corridor would require transfers due to the multiple modes, increasing transit travel time and decreasing ridership.*
- *The entire streetcar component requires sharing lanes with traffic, which degrades both vehicular traffic movements, as well as transit travel times, and would reduce ridership.*
- *Introducing a new mode, streetcar, requires an additional new maintenance facility for streetcars and introduces a new mode of transit to Baltimore, which does not improve transit efficiency.*

Refer to Section 2.4.2 in the Alternatives Technical Report – 2012 Update for additional information, located in Appendix I.

9.3.5 Economic Development/Employment

Many comments were received from organizations and individuals citing the benefit of the Red Line in improving the job market. The reasons cited included: improved access to jobs and the creation of permanent and construction jobs.

The MTA and Baltimore City are working on workforce development programs that are intended to lead to future employment and training opportunities for local area residents, as well as expanded opportunities for local small (disadvantaged) businesses. The intent is for the area economy to benefit from the job creation and economic development the Red Line project can *generate. The MTA anticipates having a policy and program in place before construction contracts are advertised for the Red Line project.*

9.3.6 Home/Property Loss

The AA/DEIS stated several times that there would be no residential displacements with any of the Red Line Alternatives, including the Preferred Alternative. However, many comments were received from residents on the west side of the project study corridor concerned about the loss of their home or property from the Red Line.

The Preferred Alternative will not require any acquisition of real property that would result in an involuntary residential displacement. The majority of the Red Line would be constructed within the public right-of-way; however, there are areas where the Red Line would require additional property. There will be the need to acquire "sliver takes" or narrow strips of property from some residential properties adjacent to and along the Red Line. Just compensation will be paid for all land that is acquired. These partial property acquisitions will leave the majority of land in the ownership of the current proprietor. A listing of property acquisitions is included in Appendix K of the FEIS.

9.3.7 Protection of Homes During Construction

Several comments were received asking how the MTA would ensure building foundations are not compromised during the construction of the Red Line.

It would be necessary to use protective measures to support building foundations as part of tunnel or station excavation, where unavoidable. These measures are often utilized to reduce potential for damage caused by construction-induced movement.

Both the Cooks Lane Tunnel and Downtown Tunnel alignments and stations have been planned to avoid construction beneath existing buildings and other structures wherever possible. However, there are a few areas where this cannot be avoided. In addition, in some other areas, existing structures would be very close to excavation sites or the tunnel's alignment. In both of these cases, a variety of measures, including underpinning, grouting, and building external support frames or bracing structures would be used to protect nearby structures during and following construction. Types of protective measures for the Red Line include ground improvements, bracing structures, and underpinning nearby structures. Prior to construction, pre-construction conditions would be documented through baseline surveys and visual inspections for buildings that are directly adjacent to the alignment. These conditions can then be compared with any changes after construction and may be used as the basis for compensation.

9.3.8 Project Disproportionately Affects Minority and Low-income Communities

Eight organizations or individuals submitted comments stating the opinion that the project violates environmental justice legislation or Title VI of the Civil Rights Act. These comments were from organizations or individuals on the west side of the project study corridor who felt their comments were not being heard or addressed. They felt their communities were being impacted by a surface alignment when other communities had tunnel alignments, and that their communities would not benefit from the Red Line.

The FTA Office of Civil Rights has reviewed the environmental justice and Title VI complaints and either dismissed or found them insufficient. The FTA has not found any violation of Title VI of the Civil Rights Act, or the Community Right to Know Act.

In addition, Section 5.4 of the FEIS sets forth the detailed analysis performed to evaluate whether the Red Line would have a disproportionately high and adverse human health and environmental effects to minority and low-income communities that would result from the construction and operation of the Preferred Alternative. Since the AA/DEIS was published, the MTA has continued extensive public outreach with communities throughout the corridor, updated the environmental justice analysis with the 2010 US Census data, and continued coordinating with the FTA Office of Civil Rights. Refer to FEIS Chapters 5 and 8.

Overall, the Red Line would improve accessibility for all communities including low-income and minority populations. While some impacts would occur within these communities, the impacts of the project on minority and low-income communities are not disproportionately high and adverse, and the project benefits these same communities by providing improved accessibility and faster, more reliable transit.

9.3.9 Inadequate Public Outreach

Comments were received stating that citizens were not notified of the project or the public hearings.

The Baltimore Red Line planning study included a comprehensive public involvement program that was integral to the overall study effort. Public involvement activities began in Spring 2003 with the distribution of direct mail and e-mails announcing scoping meetings to approximately 84,280 homeowners and businesses, 214 associations and community groups, and over 1,450 individual e-mail addresses. Between 2004 and 2007, the MTA held five sets of open houses. From November 2004 to May 2005, four rounds of Community Workings Groups were held. Letters and project fact sheets were mailed to 249 religious institutions March 2005. Seventy-eight community meetings were held between September 2005 and March 2008. In 2006, the Maryland General Assembly passed a bill creating the Red Line Citizens' Advisory Council (CAC). The CAC advised the MTA on impacts, opportunities and community concerns about the Baltimore Red Line through the duration of the planning study. From 2010 to 2012 seventeen Station Area Advisory Committees (SAACs) were formed to provide input on the Red Line project development. Each of the SAACs met approximately ten times during that time frame.

Between project initiation and the 2008 public hearing, MTA developed 9 separate project newsletters distributed to the Red Line mailing list. Additionally, regular (monthly/bi-monthly) e-newsletters have been distributed to subscribers to the project's e-mail registry. Throughout planning, project information was made available at 34 resource hubs throughout the project area. MTA also made available a Red Line project website (www.baltimoreredline.com). Downloadable materials included a map and simulation of the Preferred Alternative, photos, *fliers, e-newsletters, news articles, brochures, videos. Refer to Chapter 8 of the FEIS for additional information.*

9.3.10 Rodent Control During Construction

Several comments were received expressing concern of rodent infestations in homes during construction of the Red Line.

Construction contractors will be required to implement rodent (mouse and rat) control programs.

9.3.11 Red Line and Bikes

Several comments were received regarding the Red Line accommodating bicycles, incorporating trail-to-rail in the design, and accommodating bicycles on the street.

Accommodate cyclists on transit line: The Red Line will allow bicycles on trains and will have accommodations for bicycles at Red Line stations.

Maximize trail by rail: Trails adjacent or parallel to the Red Line were considered during the development of the Preferred Alternative for the FEIS, but were not included in the definition of the Preferred Alternative due to additional capital cost and/or right-of-way impacts.

Share the road: The majority of the Preferred Alternative is not surface light rail within a roadway. However, in one location where light rail will be located in the median, the road will be revised to include a seven foot wide bike lane. That location is along Boston Street between Hudson Street/Montford Avenue to Eaton Street.

9.3.12 Concerns of Increased Crime

A common reason given in comments for not supporting the project was that the Red Line would result in increased crime in their community.

The Red Line is being designed with safety and security measures. Vehicles, station platforms, and parking lots will include closed circuit video cameras for observation and enforcement. The project design will also incorporate features to optimize sight lines for enhanced security. The MTA police force will patrol light rail vehicles, stations, and other project infrastructure.

9.3.13 Pedestrian Safety along Edmondson Avenue and Boston Street

A common theme in the comments received was that the Red Line in the median of Edmondson Avenue or Boston Street would make it unsafe for pedestrians.

The Red Line project would include designated pedestrian crossings along Edmondson Avenue and Boston Street. The Americans with Disabilities Act (ADA)-compliant crosswalks will have traffic signals with indications for safe pedestrian movements. The traffic signals will provide adequate time for pedestrians to walk across the entire width of Edmondson Avenue and Boston Street. Pedestrian refuge medians would be provided in the center of Edmondson Avenue and Boston Street for increased safety.

9.3.14 Requesting a Tunnel under Edmondson Avenue and Cooks Lane

Generally, these comments requested that if the Red Line is built it be placed underground as opposed to on the surface through Cooks Lane and/or along Edmondson Avenue.

The Preferred Alternative is located on the surface (at grade), generally within the median of Edmondson Avenue between the Cooks Lane Tunnel portal and the West Baltimore MARC station. There is adequate right-of-way available to construct light rail in the median without the need to purchase or relocate any residential homes. As such, an underground alternative is not needed to preserve adjacent land use. Also, the impact assessments for resources along Edmondson Avenue indicate that a surface alternative is feasible in this area of the project (see the FEIS, Chapter 2 and the Alternatives Technical Report – 2012 Update for more detail). In the AA/DEIS, tunnel alignments were studied under Edmondson Avenue/Franklin Street between Cooks Lane and Calverton Road. The major reason that a tunnel alignment was not pursued was cost. In order to design and construct that portion of the project underground, the cost of the project would increase by $525 million in year of expenditure dollars. Refer to Chapter 2 of the FEIS for additional information.

9.3.15 Effects on Traffic on Edmondson Avenue with the Red Line

Several comments noted that a surface alignment on US 40/Edmondson Avenue would result in traffic problems in their community. Traffic analysis for the Preferred Alternative has been updated in support of the FEIS. This analysis for US 40/Edmondson Avenue is summarized in the response below. Refer to **Chapter 4** of the FEIS and the *Traffic and Parking Technical Report* in **Appendix I** for additional information.

Building the Red Line transit system would require that changes be made to a number of roadways along the Red Line project study corridor. Currently, on Edmondson Avenue, three lanes are provided during the peak hour in the peak direction. Under the Preferred Alternative the three available lanes would be reduced to two lanes in each direction to accommodate the Red Line in the median.

Street patterns may be modified in a number of other ways including: new turn restrictions, removing signals, closing some median openings, and installing new traffic signals at several intersections along the Red Line alignment where the light rail would cross the roadway. The plans and profiles provided in the Volume 2 of the FEIS provide greater detail on these roadway modifications.

Traffic volumes along Edmondson Avenue, without the Red Line, are projected to increase by approximately 18 percent by 2035. With the Red Line, traffic volumes are expected to remain relatively unchanged compared to current conditions, due to the reduction in lanes and capacity to accommodate the Red Line in the median.

Levels of Service (LOS) were evaluated at signalized intersections along Edmondson Avenue for both the 2035 No-Build and the 2035 Build Condition. The assessment indicates the following changes in LOS:

- *Edmondson Avenue at Winans Way – From (A) to (C) during (PM) peak hour*

- *Edmondson Avenue at Swann Avenue – From D (D) to C (E) during AM (PM) peak hour*
- *Edmondson Avenue at Edmondson Shopping Center – From A (A) to B (C) during AM (PM) peak hour (Converted from signalized to unsignalized intersection in Build conditions)*
- *Edmondson Avenue at Wildwood Parkway – From B (B) to D (D) during AM (PM) peak hour*
- *Edmondson Avenue at Allendale Street – From A to C during AM peak hour*
- *Edmondson Avenue at Hilton Street – From A to D during AM peak hour*

LOS was evaluated at unsignalized intersections along Edmondson Avenue. The assessment indicated the following change in LOS:

- *US 40 (Edmondson Avenue) at Denison Street – From F (F) to A (B) during AM (PM) peak hour as it is converted to signalized intersection in build year*

During construction, impacts to the public would be minimized through the implementation of Traffic and Transportation Management Plans. Access to local businesses would be provided where possible with existing or temporary driveways; however, there may be some instances where access cannot be maintained. In these cases, other accommodations would be arranged with the property owner. Specific mitigation would be developed during Final Design to determine the maximum number of lanes which may be closed during peak traffic hours, maintenance and removal of traffic control devices, efficient traffic detours, and construction schedule restrictions. A detailed outreach plan will be developed prior to construction.

9.3.16 Parking Impacts along US 40/Edmondson Avenue

One reason frequently expressed in opposition to the Red Line on US 40/Edmondson Avenue was the loss of on-street parking in their community.

The implementation of the Red Line will require the elimination of some parking spaces along the corridor. Under the Preferred Alternative 58 on-street parking spaces would be eliminated along Edmondson Avenue between Cooks Lane and Franklintown Road. For those parking spaces that remain along Edmondson Avenue, vehicles may be parked 24-hours a day. MTA will work with the contractor to develop a plan to minimize the temporary loss of parking during construction. Refer to the Traffic and Parking Technical Report in Appendix I for additional information.

9.3.17 Support for a Tunnel under Fleet Street over Aliceanna Street

Several comments were received from residents in the Fell's Point neighborhood supporting a tunnel through their community over a surface option. Some of these comments expressed support for a tunnel alignment beneath Fleet Street instead of Aliceanna Street.

The Preferred Alternative for the Red Line now includes a tunnel through Fell's Point under Fleet Street not Aliceanna Street with the Harbor East Station located at Fleet Street and Central Avenue and the Fell's Point Station at Fleet Street and Broadway. With the decision to have a portal at Boston Street and Hudson Street/Montford Avenue, a tunnel under Fleet Street *provided a better geographic transition. A tunnel from Fleet to Boston Streets only required one horizontal curve. A tunnel from Fleet to Aliceanna Streets would have required an additional curve which would have increased capital costs and increased travel time.*

9.3.18 Supports Red Line but not an Alignment on Boston Street (Canton)

Comments were received requesting that an alternative alignment be selected that would not include Boston Street. Some of these comments requested the Red Line alignment be shifted to Eastern Avenue and Fleet Street. Because of the existing street widths, sidewalk widths, and building face locations, Eastern Avenue and Fleet Street could not be widened for the inclusion of light rail. All of the surface options were deemed infeasible because of the impacts to parking or impacts to roadway capacity and local access.

In selecting the Preferred Alternative there were many critical considerations including quality of transit service, projected transit ridership, cost-effectiveness, land use/transportation integration, economic development potential, environmental impacts, impacts to communities, and public and stakeholder input. To meet the project's purpose and need, it was important to connect people with key activity centers such as the Social Security Administration, University of Maryland downtown, central business district, Harbor East, and Johns Hopkins Bayview Medical Center campus. Transit connections to MARC and existing Metro and Central Light Rail were also critical to meeting the purpose and need.

The Boston Street corridor was selected as part of the Preferred Alternative because it represented the option with the least parking and traffic impacts when compared to the other surface options along Eastern Avenue and Fleet Street. It was also $412 million less to construct than a tunnel under Eastern Avenue. Ridership projections for the option along Boston Street were also comparable to options in the Eastern Avenue/Fleet Street corridor. Refer to the Alternatives Technical Report – 2012 Update for additional information.

9.3.19 Supports an Alignment on Eastern Avenue not Boston Street

Several comments noted support for the AA/DEIS Alternative 4D, which included a tunnel under Eastern Avenue, or support for a surface alignment on Eastern Avenue or Fleet Street as an alternative to a Boston Street alignment. The AA/DEIS included analysis of the three surface alignments as Eastern-Fleet one-way couplets and a tunnel under Eastern Avenue.

Various alternatives were analyzed in the AA/DEIS to use the Eastern Avenue/Fleet Street corridors. These alternatives were not selected as part of the Preferred Alternative due to lack of feasibility or high capital costs. Key reasons that the Eastern/Fleet Alternatives were not selected are described below.

Tunnel Option: A tunnel alternative along Eastern Avenue from the downtown area to the Norfolk Southern right-of-way, north of Eastern Avenue, was considered. The costs of this alternative, due to both the tunnel and underground stations, would increase the cost of the Red Line by $412 million, in year of expenditure dollars.

Eastern-Fleet surface LRT Option: Three surface options were considered in the AA/DEIS. The first option maintained two-way traffic on Eastern Avenue and Fleet Street with elimination of all parking on one side of each street. Light rail tracks would be separated with one directional track along Eastern Avenue and the other directional track along Fleet Street. Each of the other two surface options created one-way streets on both Eastern Avenue and Fleet Street with one lane for traffic, one lane for light rail, and two lanes for parking. Due to the existing street widths, sidewalk widths, and building face locations, Eastern Avenue and Fleet Street could not be widened for the inclusion of light rail. All of the surface options were deemed infeasible because of the impacts to parking or impacts to roadway capacity and local access.

Refer to the Alternatives Technical Report- 2012 Update for additional information.

In a letter dated May 7, 2012, FTA and MTA received a report recommending additional consideration of light rail alternatives located on Eastern Avenue. Refer to b'more mobile, "The Case for Eastern Avenue on The Red Line" (May 2012) included in *Appendix H of the Alternatives Technical Report – 2012 Update,* included in **Appendix I** of the FEIS. The report claimed that an Eastern Avenue route would serve more local users overall, and that it would better serve transit users in minority and low-income neighborhoods and therefore was more consistent with principles of environmental justice. FTA responded in a letter dated May 25, 2012, noting that environmental justice issues were being analyzed and would be addressed in the FEIS. In addition, MTA responded in a letter dated October 1, 2012. The MTA responses addressed the specific issues raised in the report in more detail and reaffirmed MTA's preference for the Boston Street alignment. The MTA cited several reasons, including: (1) the Boston Street alignment is more consistent with the project's purpose and need because it provides a direct connection to the Canton area; (2) the proposed alignment along Boston Street is consistent with environmental justice requirements; and (3) the cost and impact of an Eastern Avenue route, whether surface or tunnel, would be substantially greater than estimated in the b'more mobile report. FTA has reviewed MTA's response to the b'more mobile report and concurs with MTA's response. Refer to the *Alternatives Technical Report – 2012 Update, Appendix H* for additional information and copies of the b'more report and response letter.

9.3.20 Extend the Tunnel Further East Under Boston Street

Some comments received stated support for extending the tunnel further to the east under Boston Street. The Preferred Alternative includes a tunnel under a portion of Boston Street from Aliceanna Street to Hudson Street, transitioning to the surface and continuing in the median of Boston Street to South Conkling Street.

There is adequate right-of-way available to construct light rail in the median without the need to purchase or relocate any residential homes or businesses. As such, an underground alternative is not needed to preserve adjacent land use. Also, the impact assessments for resources along Boston Street indicate that a surface alternative is feasible in this area of the project (see the FEIS, Chapter 2 and the Alternatives Technical Report – 2012 Update for more detail). The major reason that a tunnel alignment was not pursued along Boston Street was cost. In order to design and construct that portion of the project underground, the cost of the *project would increase by $210 million, in year of expenditure dollars. Refer to the Alternatives Technical Report – 2012 Update for additional information.*

9.3.21 Effects on Traffic on Boston Street with the Red Line

Several comments noted that traffic congestion on Boston Street is a current problem that would get worse with a Red Line surface alignment on Boston Street. Traffic analysis for the Preferred Alternative has been updated in support of the FEIS. This analysis for Boston Street is summarized in the response below.

Building the Red Line transit system would require that changes be made to a number of roadways along the Red Line alignment corridor. Currently, two travel lanes in each direction are provided during the peak hour in the peak direction along Boston Street between Hudson Street and South Lakewood Avenue. Between South Lakewood Avenue and Clinton Street there are currently two travel lanes in each direction at all times. Under the Preferred Alternative, there would be one travel lane in each direction at all times for the entire length of Boston Street.

Street patterns may be modified in a number of other ways, including: new turn restrictions and removing or installing new traffic signals at several intersections along the Red Line alignment where the light rail would cross high volume side streets. The detailed plans and profiles provided in the Volume 2 of the FEIS provide greater design detail. Refer to Chapter 4 of the FEIS and the Traffic and Parking Technical Report in for additional information.

Without the Red Line, traffic volumes along Boston Street, north of Montford Avenue, are projected to increase by approximately 33 percent by 2035 and volumes east of Conkling Street are projected to increase by 56 percent by 2035. With the Red Line by 2035, traffic volumes along Boston Street are projected to increase by 22 percent north of Montford Avenue and increase by 25 percent east of Conkling Street.

Levels of Service (LOS) were evaluated at signalized intersections along Boston Street for both the 2035 No-Build and the 2035 Build Condition. The assessment indicated the following changes in LOS:

- *Boston Street at Aliceanna Street – From (F) to (B) during (PM) peak hour*
- *Boston Street at Montford Ave – From E to D during AM peak hour*
- *Boston Street at Ellwood Ave – From (A) to (D) during (PM) peak hour (Converted from signalized to unsignalized in Build conditions)*
- *Boston Street at Clinton Street – From F to E during AM peak hour*
- *Boston Street at Old Boston Street – From D (C) to E (E) during AM (PM) peak hour*

LOS was evaluated at unsignalized intersections along Boston Street. The assessment indicated the following changes in LOS:

- *Boston Street at Leakin Street – From F to better F during AM peak hour*

- *Boston Street at Safeway – From (D) to (A) during (PM) peak hour as it is converted to a signalized intersection in the Build year*
- *Boston Street at Kenwood Ave – From F (F) to D (D) during AM (PM) peak hour as it is converted to a signalized intersection in the Build year*
- *Boston Street at East Ave – From F to C during AM peak hour as it is converted to a signalized intersection in the Build year*
- *Boston Street at Bayliss Street – From F to B during AM peak hour*

During construction, impacts to the public would be minimized through the implementation of Traffic and Transportation Management Plans. Access to local businesses through existing or temporary driveways would be provided where possible; however, there may be some instances where access cannot be maintained. In these cases, other accommodations would be arranged with the property owner. Specific mitigation would be developed during Final Design to determine maximum number of lanes closed during peak traffic hours, maintenance and removal of traffic control devices, efficient traffic rerouting measures, and scheduling of construction activities within the roadways for times other than peak traffic periods.

9.3.22 Parking Impacts on Boston Street

One reason expressed in several comments received in opposition to the Red Line on Boston Street was the loss of on-street parking in their community.

The implementation of the Red Line will require the elimination of parking spaces along the corridor. Currently, there are 239 total parking spaces, 161 full-time and 78 part-time parking spaces, along Boston Street between Hudson/Montford to Haven Street. Under the Preferred Alternative, 126 parking spaces (both on-street and off-street) would be displaced. For those parking spaces that remain along Boston Street, vehicles may be parked 24-hours a day. The proposed park-and-ride at the Brewers Hill/Canton Crossing Station could provide temporary parking spaces during construction. Refer to Chapter 4 of the FEIS and the Traffic and Parking Technical Report for additional information.

9.4 Reponses to Comments

A response has been prepared for each comment received during the AA/DEIS public review and comment period and is presented in **Appendix A** of the FEIS. For ease of finding a specific comment these have been categorized by Agency, Elected Official, Organization, and individuals alphabetized by the commenter's last name or agency/organization representing. An alphabetized index is also provided.

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