SEPTEMBER 2008

Red Line Corridor Transit Study

Alternatives Analysis/Draft Environmental Impact Statement

RED LINE
Corridor Transit Study

Governor Martin O'Malley

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

MTA Maryland

Maryland Department of Transportation

Secretary John D. Porcari

RED LINE CORRIDOR TRANSIT STUDY
BALTIMORE, MARYLAND

ALTERNATIVES ANALYSIS/ DRAFT ENVIRONMENTAL IMPACT STATEMENT

PREPARED PURSUANT TO:

National Environmental Policy Act of 1969, §102 (42 U.S.C. §4332); and Federal Transit Laws (49 U.S.C. §5301(e), §5323(b) and §5324(b)); 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); Executive Order 12898 (Environmental Justice)

by the

FEDERAL TRANSIT ADMINISTRATION
U.S. DEPARTMENT OF TRANSPORTATION

and the

MARYLAND TRANSIT ADMINISTRATION

Letitia A. Thompson
Regional Administrator, Region III
Federal Transit Administration

09/02/08
Date of Approval

Paul J. Wiedefeld
Administrator
Maryland Transit Administration

9/03/08
Date of Approval

ABSTRACT

This Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) for the Red Line Corridor Transit Study describes and summarizes the transportation and environmental impacts related to the implementation of a new east-west transit alignment through Baltimore, Maryland. The Red Line Corridor Transit Study is proposed to improve east-west movement through the corridor; enhance transit connections; support community revitalization and economic development opportunities; and help address regional congestion and traffic-related air quality issues. The corridor limits for the study extend from western Baltimore County at the Centers for Medicare and Medicaid Services through the downtown business district to the Johns Hopkins Medical Center in eastern Baltimore City. The corridor is approximately 14 miles in length.

This AA/DEIS includes a description of the alternatives and options considered, as well as a comparative evaluation of the alternatives including the costs, benefits, and impacts. The alternatives considered included: No-Build, Transportation System Management (TSM), Bus Rapid Transit (BRT), and Light Rail Transit (LRT). A Locally Preferred Alternative (LPA) has not yet been identified; public and agency comments on the DEIS will be factored before the LPA is selected. The alternatives were analyzed for impacts to the following resources: neighborhoods, community facilities and services; environmental justice; displacements and relocations; economic activity; land use; parks, recreation, and open space; visual quality; air quality; noise and vibration; energy; contaminated sites; utilities; cultural 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; construction activities; safety and security; indirect and cumulative effects; irreversible and irretrievable resources; and short-term impacts and long-term benefits. Mitigation measures to reduce anticipated impacts are detailed in the document.

FOR ADDITIONAL INFORMATION CONCERNING THIS DOCUMENT, CONTACT:

Gail Mc Fadden-Roberts
Federal Transit Administration, Region III
1760 Market Street, Suite 500
Philadelphia, PA 19103
215-656-7100

Diane Ratcliff
Maryland Transit Administration
6 Saint Paul Street, 9th Floor
Baltimore, MD 21202
410-767-3787

A 90-day period has been established for comments on this document. Comments may be submitted in writing or may be made orally at the public hearings. Written comments should be submitted to Diane Ratcliff at the address above. Information on the public hearings can also be obtained from Lorenzo Bryant, Project Manager at the MTA. This document and information about the hearing(s) may be found on the project's web site at www.baltimoreredline.com

Fact Sheet

Red Line Corridor Transit Study Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS)

Project Description

The Red Line Corridor Transit Study supports the ongoing planned expansion of an interconnected regional transit system. The study examines alternative transportation investments in the 14-mile corridor from the Social Security area of Baltimore County on the west to the Johns Hopkins Hospital Bayview area of Baltimore City on the east.

The Red Line will increase transportation choices, improve efficiency of the current transit system, and help address the region's air quality concerns. The Red Line also will encourage economic development, community revitalization and transit-oriented development at planned locations along the corridor.

The Red Line Corridor Transit Study considers alternative transit modes including Bus Rapid Transit (BRT) and Light Rail Transit (LRT). The study also considers a No-Build alternative and a Transportation Systems Management (TSM) alternative. The study seeks to maximize benefits to corridor communities and the region, while minimizing adverse effects on the environment.

Lead Agencies

US Department of Transportation/
Federal Transit Administration (FTA), Region III

Maryland Department of Transportation/
Maryland Transit Administration (MTA)

Purpose of the AA/DEIS

The purpose of this Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) is to provide important information for selecting the mode and general alignment of the most suitable transit improvement for the Red Line Corridor. This document compares the potential transportation and environmental impacts, costs, and benefits of the alternatives under consideration.

Public Comment Period

The comment period for the Red Line Corridor Transit Study AA/DEIS ends on December 17, 2008. You can submit written comments through the project website at *http://www.baltimoreredline.com*. Or, you can submit your written comments to the Maryland Transit Administration. Please send comments to:

Ms. Diane Ratcliff
Director
Office of Planning
Maryland Transit Administration
6 Saint Paul Street, 9th Floor
Baltimore, MD 21202

Document Availability

The AA/DEIS and supporting Technical Reports are available online at: *http://www.baltimoreredline.com*

CDs of the AA/DEIS and a DVD of the supporting technical reports are available at no charge. Please contact the MTA at the address noted under "Public Comment Period."

Printed copies of the AA/DEIS and supporting Technical Reports are available for review at the following locations:

Maryland Transit Administration
6 Saint Paul Street, 9th Floor
Baltimore, MD 21202

Baltimore City Department of Planning
417 East Fayette Street; 8th Floor
Baltimore, MD 21202

Baltimore County Office of Planning
County Courts Building, Room 406
401 Bosley Ave
Towson, MD 21204

Baltimore Metropolitan Council
2700 Lighthouse Point East, Suite 310
Baltimore, MD 21224

The following libraries have a printed copy of the AA/DEIS and a DVD of the Technical Reports available for review:

Enoch Pratt Free Library

Broadway Branch
301 N. Broadway
Baltimore, MD 21231

Central Branch
400 Cathedral Street
Baltimore, MD 21201

Canton Branch
1030 S. Ellwood Avenue
Baltimore, MD 21224

Edmondson Avenue Branch
4330 Edmondson Avenue
Baltimore, MD 21229

Forest Park Branch
3023 Garrison Boulevard
Baltimore, MD 21216

Orleans Street Branch
1303 Orleans Street
Baltimore, MD 21231

Patterson Park Branch
158 N. Linwood Avenue
Baltimore, MD 21224

Pennsylvania Avenue Branch
1531 West North Avenue
Baltimore, MD 21217

Southeast Anchor Branch
3601 Eastern Avenue
Baltimore, MD 21224

Walbrook Branch
3203 West North Avenue
Baltimore, MD 21216

Washington Village Branch
856 Washington Boulevard
Baltimore, MD 21230

Baltimore County Public Library

Catonsville Branch
1100 Frederick Road
Catonsville, MD 21228

North Point Library
417 East Fayette Street; 8th Floor
Baltimore, MD 21202

Woodlawn Branch
1811 Woodlawn Drive
Woodlawn, MD 21207

Contact Information

Please direct questions, comments, and requests for information on the Red Line Corridor Transit Study to:

By Regular Mail:
Please mail to Diane Ratcliff (address noted under Public Comment Period.)

By Phone:
(410) 767-3754

By E-mail:
redline@mtamaryland.com

Public Hearings

The MTA will hold four public hearings to accept comments on the AA/DEIS. The public hearing dates are:

Thursday, November 6
4:00 PM - 9:00 PM
Lithuanian Hall
851 Hollins St
Baltimore, MD 21201

Served by Bus Routes: 10, 20, 35

Saturday, November 8
10:00 AM - 3:00 PM
Edmondson High School
501 N. Athol Ave.
Baltimore, MD 21229

Served by Bus Routes: 6, 23, 40

Wednesday, November 12, 2008
4:00 PM - 9:00 PM
United Auto Workers Hall (UAW)
1010 Oldham St.
Baltimore, MD 21224

Served by Bus Routes: 10, 22, 23, 40

Thursday, November 13
4:00 PM - 9:00 PM
Woodlawn High School
1801 Woodlawn Dr.
Baltimore MD 21207

Served by Bus Routes: M6, 44

Next Steps

This AA/DEIS will be circulated for review to interested and concerned parties, including private citizens, community groups, the business community, elected officials, and public agencies. A series of public hearings will be held to encourage citizen participation in the decision-making process.

The FTA and MTA will consider information contained in the AA/DEIS, agency and public comments received at the public hearings and during the AA/DEIS comment period, and available funding to select a "Locally Preferred Alternative" for transit improvements in the Red Line Corridor. The decision would then be documented in a "Locally Preferred Alternative Report." The MTA will then request approval from FTA to begin preliminary engineering and preparation of the Final Environmental Impact Statement (EIS). The Final EIS will evaluate the operational and construction effects of the preferred alternative.

The Record of Decision (ROD) is the final step in the EIS process. The ROD is a brief report that states FTA's determination that the project has completed the requirements of the National Environmental Policy Act (NEPA). It summarizes the basis for the decision, identifies potential alternatives, and summarizes mitigation measures to lessen potential effects. With a ROD and FTA-approved funding, the project may proceed into final design and construction.

Introduction

The Red Line Corridor has been identified as the highest priority corridor within the Baltimore Region for potential transit improvements. The Red Line was first identified and prioritized in the 2002 *Baltimore Region Rail System Plan*. This plan envisions a transit system with six lines and focuses on giving riders access to jobs, education, shopping, recreation, and medical care. In the words of the plan: "Imagine being able to go just about everywhere you really need to go…on the train. 21 colleges, 18 hospitals, 16 museums, 13 malls, 8 theatres, 8 parks, 2 stadiums, and one fabulous Inner Harbor. You name it, you can get there. Fast. Just imagine the possibilities of Red, Green, Blue, Yellow, Purple, and Orange – six lines, 109 miles, 122 stations. One great transit system." The Red Line is an integral part of the plan, with stations near major employment centers in downtown Baltimore, Inner Harbor East, the Social Security Administration complex, the University of Maryland, Baltimore professional schools, and the adjacent hospital complex. The Red Line would improve public transit for many Baltimore City and Baltimore County residential neighborhoods; provide connections to existing Metro, Light Rail and MARC stations; and proximity to leisure activity points of interest, such as Oriole Park at Camden Yards, M&T Bank Stadium and the Hippodrome Theater.

Baltimore Inner Harbor

Role of the Alternatives Analysis/ Draft Environmental Impact Statement (AA/DEIS)

The AA/DEIS has a dual role. The first critical role is to provide a comparative analysis of various transit alternatives under consideration for the Red Line corridor. This comparison will provide information for interested citizens, elected officials, government agencies, businesses, and other stakeholders to assess the benefits and impacts of all of the alternatives under consideration in this document. In that sense, this AA/DEIS is an important tool in reaching to a decision on selecting the No-Build Alternative or any of the build alternatives.

The second important role of this AA/DEIS is to develop project documentation in accordance with the National Environmental Policy Act of 1969 (NEPA). A major purpose of this AA/DEIS is to provide a full evaluation of the environmental issues surrounding a proposed action and to inform decision-makers and the public of reasonable alternatives that could avoid or minimize adverse impacts. The AA/DEIS:

- Identifies and explains the purpose and need for improvements in the corridor.
- Develops and describes the alternatives for the proposed action being considered.
- Identifies the environmental and community effects of each alternative and also identifies measures to avoid, minimize or mitigate adverse impacts of the proposed action.
- Describes agency and public coordination efforts.
- Serves as the basis for a decision.
- Allows opportunities for public and agency input.

There are a number of intended audiences for the Red Line Corridor Transit Study AA/DEIS. These include:

- Federal Environmental Resource Agencies.
- State and Local environmental resource, planning, and transportation agencies.
- Maryland General Assembly.
- Federal elected officials including Maryland members of Congress.
- Baltimore City elected officials – Mayor's office and City Council.
- Baltimore County elected officials - County Executive's office and County Council.
- Community associations in the corridor.
- Individual residents.
- Businesses in the corridor.
- Institutions in the corridor.

A more detailed list of the organizations and individuals receiving the AA/DEIS or notified of its availability is provided in the Appendix of this AA/DEIS.

The Need for a Red Line Corridor Transit Project

Overview of the Corridor

The Red Line Corridor extends 14 miles from the Centers for Medicare & Medicaid Services (CMS) on the west in Woodlawn (Baltimore County) to the Johns Hopkins Bayview Medical Campus (Bayview) on the east (Baltimore City). The majority of the corridor falls within Baltimore City, with development typical of cities originating in the 18th century. The downtown central business district has commercial and institutional land uses, with densely developed residential areas radiating out toward the city/county boundary. The four-mile

Social Security Administration Office

portion of the corridor in Baltimore County contains major employment centers, shopping, interstate highways and housing. One of the region's largest employment centers, Social Security Administration, is located in the Woodlawn area. Traveling east towards the city line, residential densities increase with the pattern of development resembling a grid. Leakin Park and Gwynns Falls Park, large city-owned resources, lie just within the city limits. Moving toward the downtown area, the corridor intersects with the West Baltimore MARC Station, schools, and shopping centers, all within residential neighborhoods. The central business district 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, governmental agencies, and many financial institutions. The central business district offers a number of opportunities to connect with MARC, Metro, Light Rail, and the MTA core bus system. Moving toward the eastern portion of the corridor, the Inner Harbor East, Fells Point and Canton areas are undergoing intense infill development, creating even greater residential density and numerous business opportunities. The easternmost edge of the corridor is comprised mostly of industrial and institutional uses. At the Johns Hopkins Bayview Medical Center complex, connections with the Red Line would create multimodal hubs with the adjacent MARC Penn Line and Interstate highways I-95 and I-895.

Johns Hopkins Bayview Medical Campus

In 2000, the total population of the Red Line Corridor was 205,535, with 170,243 in Baltimore City and 35,292 in Baltimore County. The corridor is diverse in ethnic composition, with 124,813 African-Americans, 69,070 white, and 170,243 Hispanic, Asian, or other. Also, 13 percent of the people in the corridor are considered elderly.

In 2000, over 192,000 jobs were held within the Red Line Corridor, with the largest portion in the service industry (46 percent) and other large sections in retail (23 percent), finance, insurance, and real estate (nine percent) and government services (eight percent).

Future Growth in the Corridor

The Red Line Corridor includes much of the most significant economic growth anticipated in the Baltimore Region. Approximately 20 million square feet of gross building area is under review or under construction in the corridor. Development could be as large as 29 million square feet if all proposed projects are constructed. Some of the largest growth is proposed as a part of the Westside Renaissance Initiative, Uplands, Inner Harbor East, and Bayview. Corridor employment and residential growth is also expected to result from Base Realignment and Closure (BRAC) activities. More detailed information on projected growth can be found in Chapters 1 and 4 of the AA/DEIS.

Inner Harbor East

Existing and Future Transportation Conditions and Need for Improvements

Anyone who travels in and around Baltimore knows the difficulty of navigating congested streets in rush hour or attempting to drive across town. There is no shortcut or expeditious route on city roads that gets you quickly from East Baltimore to West Baltimore or from Western Baltimore County to the downtown central business district. Buses become stuck in those traffic jams, too. A public rapid transit route such as the Red Line offers hope for swift, convenient and dependable east-west travel through the heart of Baltimore. The Texas Transportation Institute's (TTI) 2004 *Urban Mobility Report* illustrates Baltimore's commuting problem: Baltimore ranks as the ninth worst city in the nation for growing traffic delays. In 2002, car travelers spent an extra 48 hours a year sitting in traffic. This compares to just nine hours of annual traffic delays in 1982. According to the TTI, the 2002 delays mean that 59.7 million hours of travel time are wasted in gridlocked Baltimore traffic and 101 million gallons of fuel are needlessly consumed. The region's yearly "congestion cost" exceeds $1 billion; that equates to $395 per year shelled out by each Baltimore area resident due to congestion.

Peak-period congestion is present throughout the corridor. Beginning on the west side, a number of highways converge from the west as they head downtown. Cooks Lane is a two-lane road with on-street parking. During peak-periods, traffic from two major roads, I-70 and Security Boulevard, feeds into this two-lane road that connects to US 40, making Cooks Lane congested.

US 40 is congested with traffic from Cooks Lane joining Baltimore National Pike/US 40 traffic headed east. The road width and right-of-way along US 40 narrows as it enters an older part of Baltimore. This portion of the corridor, US 40 from Edmondson Village to Rosemont, is largely residential, with older rowhouses fronting the street. Narrow sidewalks, utility poles immediately adjacent to the street, front steps of residences located against the sidewalk in some areas, high pedestrian volumes, on-street parking during off-peak hours, and the presence of numerous cross streets, many of them signalized, all result in slow travel speeds and long travel times along this portion of US 40. The heavy traffic congestion and slow travel speeds discourage many west side commuters from using US 40. These drivers instead use I-695 and I-95 to access downtown via I-395, adding to the heavy traffic already clogging those highways.

Even with the widening of I-695 and the implementation of the other planned and programmed road improvement projects, the western half of the corridor would still have to support growing amounts of future traffic. Future traffic growth in the range of 15 percent by 2030 is projected for Cooks Lane and US 40, making them even more congested than they are now. Currently Cooks Lane carries 22,000 vehicles, with Edmondson Avenue carrying over 50,000. In 2030, Cooks Lane is expected to carry 25,000 vehicles, with Edmondson Avenue's daily traffic growing to over 60,000.

Traffic Congestion

Downtown Baltimore is congested due to the high traffic volumes and the demand for both north-south and east-west travel, causing slow speeds on all major streets. Large numbers of vehicles making turning movements in this densely developed part of the corridor also contribute to delay. By 2030, Lombard Street and Fayette Street are expected to carry about 25 percent more traffic than today, with Fayette Street projected to carry 28,000 vehicles per day, and Lombard Street to carry 33,000. These east-west routes through downtown also carry the highest traffic volumes.

On the east side of the corridor, relatively large numbers of vehicles traveling on low-capacity roads cause congestion. For example, both Eastern Avenue and Fleet Street carry between 12,000 to 22,000 vehicles per day. These are two-way roads with one lane in each direction. Both streets allow parking with peak-hour, peak direction restrictions on both sides of the street due to the lack of driveways and off-street parking available in the area.

The closely-spaced intersections, numerous traffic signals, narrow lanes, and only one-lane operating in each direction cause slow traffic speeds along Eastern Avenue and Fleet Street. Vehicles that need to make left turns or park cause slower speeds and increase delays, as there is no safe way to move past these vehicles. Vehicle speeds and travel times will be even slower in the future due to the residential and commercial development that is underway, and expected growth in travel to downtown. For example, Boston Street, which is already congested today, is expected to grow 33 percent over current vehicular traffic levels by 2030.

Transit services in the Red Line Corridor fare no better than automobile travelers since the buses are subject to the same traffic congestion and slow travel speeds. In addition, substandard lane widths and poor road conditions in the curb lane result in a bus ride quality that is poor. Express bus service from Howard County has been reduced in recent years in response to declining ridership, an indication that transit in the corridor is not meeting user needs for the long-distance traveler. Buses operating on US 40/Edmondson Avenue average less than 11 mph over the majority of their route due to frequent stops and traffic congestion. Automobile speeds on this road range from 10 to 30 mph depending on location. Buses, with their frequent stops, have longer travel times than other vehicles. Long travel times result in long commutes for transit passengers from the corridor headed downtown, as well as for reverse commuters to the Social Security Administration complex and area businesses. For example, local buses take 26 minutes to travel the four-and-a-half miles between Edmondson Village and Howard Street downtown. Express service shaves only four minutes from that time. Traveling the 13-mile reverse commute from Highlandtown to CMS would take over an hour. These slow bus travel speeds are not attractive to riders.

Enhancing the Region

A Red Line project would provide much more benefit to the region than simply transportation related improvements. It would offer the opportunities to help shape the future of the Baltimore region. The line offers the potential to enhance community revitalization, support economic development, and help address the region's sub-standard air quality. The corridor spans various communities, with diverse economic conditions. Improved transit connections and services could encourage new development around transit stations that would benefit neighborhoods. New development could revitalize surrounding neighborhoods and provide shops and other amenities that would benefit residents and commuters. Development at a transit station could provide many daily commuter needs and errands without using a car. Although market forces, and other variables that are not directly related to transit, strongly inf uence development patterns, there are currently unrealized opportunities for growth and redevelopment within existing communities along the corridor that improved transportation could enhance.

Transit-Orientated Development (TOD) includes new development around existing or planned transit stations. The objective is to make transit stations a focal point for community growth. This brings more riders to transit, too. Ideally, such developments would add residences or offices along with small-scale retail that doesn't require cars to haul purchased goods. Transit often adds value to properties and encourages new development. In many cases communities seize the opportunity presented by a new transit line to leverage the potential for planned growth that brings more services, jobs, and residences to neighborhoods within walking distance of transit stations. TOD is sometimes facilitated by government agencies that offer land they own to help stimulate development. In the case of the Red Line, the Maryland Department of Transportation has begun planning studies to help communities further their growth goals through Transit-Oriented Development. Examples of such win-win partnerships exist in Owings Mills and State Center in the Baltimore area and in Hyattsville, New Carrollton, Savage, and Odenton, Maryland. In summary, Transit-Oriented Development can be an important catalyst in communities where there is disinvestment (vacant houses, abandoned retail space, etc.) or where land around transit stations is underutilized or empty.

The region's air quality could also be positively affected by greater transit use. High smog levels are a major contributor to hospital emergency room visits and asthma attacks. Baltimore averaged 11 Code Red (dangerously high air pollution) days during the 1990s. The Red Line can reduce dirty air by drawing more people away from their cars. For example, rail transit emits, per person, 75 percent less nitrogen oxide than cars and virtually no carbon monoxide or hydrocarbons.

Fells Point

Greektown

Poppleton

Red Line Alternatives

The Red Line Corridor Transit Study AA/DEIS examines a full range of alternatives from the No-Build (the present committed level of transportation improvements), to lower-cost upgrades of bus service, to more modest investments in shared-use routes, to major investments in dedicated guideway, grade-separated where necessary. **Figure S-1** shows the alignments being considered for the Red Line Alternatives. All alternatives investigated for the Red Line Corridor follow a similar alignment, starting in the west at CMS (Centers for Medicaid and Medicare office complex) in Baltimore County and continuing in a general easterly direction passing by the Security Square Mall, the Social Security Administration, Edmondson Village, the West Baltimore MARC Station, along Martin Luther King, Jr. Boulevard, through the downtown central business district, Inner Harbor East, Fells Point and Canton, to Bayview.

This AA/DEIS will compare combinations of improvements that achieve the greatest gain, balanced with cost and potential impacts and benefits to communities and the environment. The AA/DEIS analyzes the alternatives for their general benefits, costs, social, economic, environmental, and operational effects within the corridor. Each of the alternatives may have several options (such as tunnel segments or different route locations) that serve the same market. These options are described in more detail in Chapter 2 and Volume II.

The build alternatives under consideration would enhance and expand existing transit service by providing a higher speed, higher capacity transit system served by a more extensive feeder bus service. Four overall alternatives are included in the Red Line Corridor Transit Study:

Alternative 1: No-Build

Alternative 2: Transportation System Management (TSM)

Alternative 3: Bus Rapid Transit (BRT)

Alternative 4: Light Rail Transit (LRT)

These alternatives range from low-cost bus alternatives to higher-cost alternatives featuring various lengths of dedicated guideway. The No-Build Alternative is required as an alternative to assess the impacts if no transit improvements are made in the corridor, beyond what are already programmed for improvement. The TSM Alternative represents the lower investment bus alternative. The BRT and LRT alternatives represent the higher investment bus and rail alternatives. For the No-Build and TSM, there is effectively one option for each alternative. For the BRT and LRT alternatives, there are a wide range of options. For BRT or LRT, various options have been combined to form a range of different BRT and LRT end-to-end alternatives as follows:

Alternative 3: Bus Rapid Transit

3A: BRT, dedicated surface

3B: BRT, downtown tunnel + dedicated surface

3C: BRT, downtown tunnel + Cooks Lane tunnel + dedicated surface

3D: BRT, maximum tunnel + dedicated surface

3E: BRT, dedicated surface with Johnnycake Road alignment

3F: BRT, shared and dedicated surface + downtown tunnel

Alternative 4: Light Rail Transit

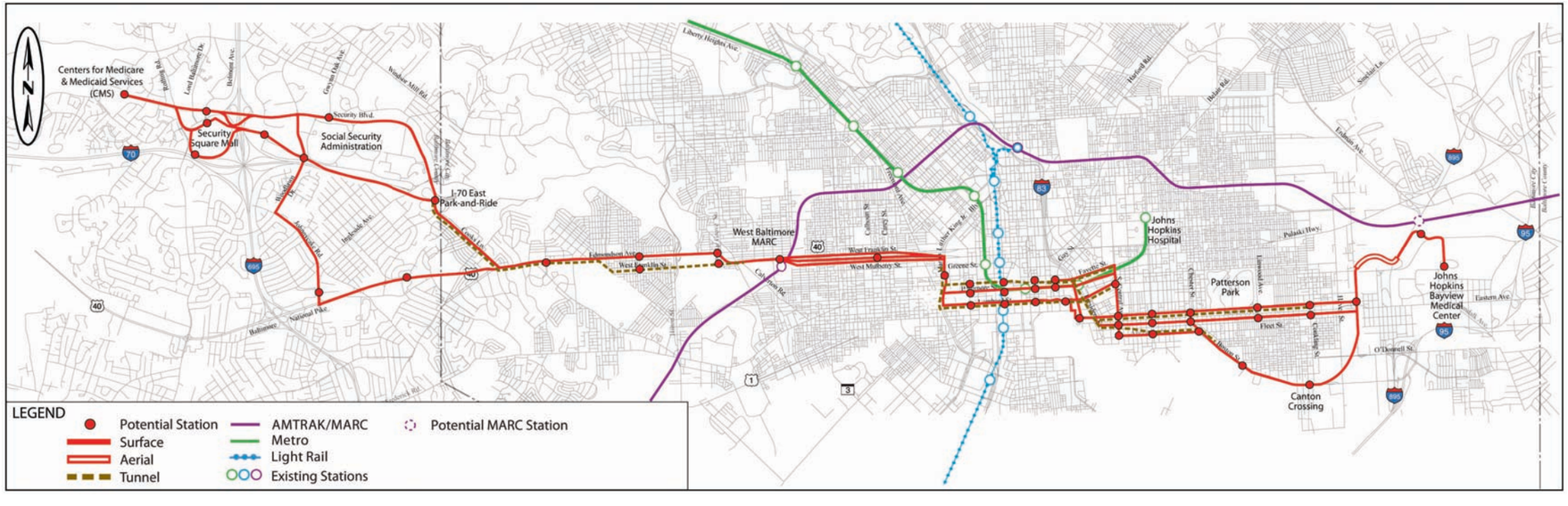
4A: LRT, dedicated surface

4B: LRT, downtown tunnel + dedicated surface

4C: LRT, downtown tunnel + Cooks Lane tunnel + dedicated surface

4D: LRT, maximum tunnel + dedicated surface

Figure S-1: Alignments Retained for Detailed Study



Performance of the Alternatives

There are ultimately two questions that need to be answered relative to the potential implementation of a Red Line transit alternative. The first question is whether a build alternative merits moving forward, or should the No-Build alternative be selected? This question is evaluated based on a number of factors indicating whether the build alternatives meet project purpose and need, availability of federal and state funding, whether FTA New Starts criteria are met, public input, and if a project can be implemented that meets all environmental regulatory requirements.

Certainly, building a fast public transit line bisecting Baltimore east and west holds enormous potential. Above all, the Red Line, stretching from Woodlawn in western Baltimore County through the downtown central business district to Bayview, and perhaps ultimately beyond, gives citizens of all ages enhanced mobility.

The Red Line ties suburban businesses in western Baltimore County – particularly large employers like the Social Security Administration and the Centers for Medicare and Medicaid Services (CMS) – to the City's large pool of job seekers and makes commuting fast and convenient for current workers. The same is true for suburban employees commuting from the west to downtown business offices.

The Red Line enhances access to the University of Maryland, Baltimore (UMB) downtown and to the City's major hospitals, including the University of Maryland Medical Center, Bayview Medical Center and the Veterans Administration Hospital. It makes trips to schools, churches, parks, and tourist attractions near proposed Red Line stations quick and reliable. Downtown sports and entertainment sites are a short walk away, too.

Transferring to other forms of MTA transit will be more convenient. The Red Line will connect directly to the Central Light Rail line and the Metro Subway, making combined east-west/north-south trips seamless. Multiple bus connections at Red Line stations mean seamless transfers. In short, public transit in Baltimore will be vastly improved.

If the answer to the first question is that a build alternative should move forward, then the second question becomes, which alternative should be selected? Much of this AA/DEIS provides information useful to that decision. Chapter 6 of the AA/DEIS is focused on comparing the No-Build, TSM, six BRT, and four LRT alternatives in detail. **Table S-1** compares major evaluation measures for each of the alternatives.

Comparison of Key Evaluation Measures

- Capital Costs - Costs range from $545 million to $2.4 billion for BRT, and $930 million to $2.5 billion for LRT. The incremental cost differences for the BRT and LRT alternatives results from the varying ratio of amount of surface operations versus tunnel operations.
- Travel Time - Travel time savings are achieved under any of the build options, with LRT generally providing more travel time savings than BRT. (LRT travel times are slightly shorter than BRT because 1) dwell times are shorter with LRT because multiple doors open while BRT will require passengers to board through the front door, 2) LRT assumes several intersections with minor cross street traffic volumes will have signal preemption, while BRT headways are too frequent to allow preemption, and 3) max speed for LRT in tunnel is 40 mph while BRT is limited to 30 mph for safety reasons given manually driven vehicles.)
- Average Weekday Ridership - For TSM, the year 2030 ridership is projected to be 17,600, for BRT 2030 ridership ranges from 29,300 to 41,500 and for LRT 2030 ridership ranges from 34,600 to 42,3000. LRT generally is projecting slightly more riders than BRT.
- FTA Cost-Effectiveness - FTA's standards to move a project into the next project phase typically require a cost-effectiveness index of $23.99 or lower. For the Red Line alternatives, both surface alternatives, 3A and 4A, meet the criteria. Alternatives 3E, 4B and 4C are in the range of $26.21 to $31.98. These three alternatives have the potential to be modified to meet the $23.99 index. Modifications include changes to the scope of the alternatives, or changes in the length of the alternative.
- Change in Parking Spaces - These numbers vary substantially among alternatives, based on amount of surface or tunnel, and specific options selected.
- Number of Residential Displacements - With all of the alternatives no residential displacements are needed.
- Environmental Effects - A more detailed analysis of environmental effects is included in Chapters 4 and 6 and also in Volume II. In general, there is not substantial difference among the alternatives with regard to impacts to natural resources, since most of the project area is in an urban, built environment. There are some differences among alternatives with regard to socioeconomic resources, physical, and cultural resources. These differences are described in Chapters 4 and 6 and Volume II of the AA/DEIS.

Table S-1: Evaluation of Alternatives Matrix

	Evaluation Measures													
	Red Line Capital Cost (2007$,Millions)	Red Line Corridor Incremental Annual Operating and Maintenance Cost (2007$, Millions)	Red Line Travel Time (end-to-end), minutes	Average Weekday Ridership: Red Line	New Riders per Day	Transit User Benefit (Hours/Day) vs. No-Build	FTA Cost-Effectiveness Index (Cost/User Benefit Hour)	Change in Number of Parking Spaces	Number of Transit-Dependent Households Served by Enhanced Transit	Number of Residences Displaced/ Relocated	Number of non-Residential Displacements/Relocations	Acres of ROW Required for Project	Acres of ROW Required for Maintenance Facility	Number of Historical & Archeological Properties Affected
Alternative 1 - No-Build (13.9 mi.)	N/A	N/A	80	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 2 - TSM (14.3 mi.)	$281	$5.01	76	17,600	3,850	3,530	N/A	-900	16,532	0	8	16.8	15.0	8
Alternative 3A - BRT, dedicated surface (13.8 mi.)	$545	$3.40	62	31,400	6,030	6,960	$18.10	-1,159	16,598	0	9	34.0	15.0	13
Alternative 3B - BRT, downtown tunnel + dedicated surface (14.9 mi.)	$1,019	$5.86	56	37,400	6,860	7,600	$44.74	-747	15,498	0	10	36.5	15.0	16
Alternative 3C - BRT, downtown tunnel + Cooks Lane tunnel + dedicated surface (14.7 mi.)	$1,151	$5.86	53	37,400	7,100	7,870	$49.06	-578	14,958	0	9	35.8	15.0	18
Alternative 3D - BRT, maximum tunnel + dedicated surface (13.7 mi.)	$2,404	$8.15	43	41,500	10,590	11,460	$63.93	-352	15,383	0	9	30.0	15.0	17
Alternative 3E - BRT, dedicated surface with Johnnycake Road alignment (14.8 mi.)	$571	$5.79	69	29,300	5,370	6,250	$26.21	-1,075	16,649	0	9	35.6	15.0	10
Alternative 3F - BRT, shared and dedicated surface + downtown tunnel (14.3 mi.)	$755	$6.09	65	34,300	5,910	6,620	$37.31	-644	16,532	0	9	17.0	15.0	13
Alternative 4A - LRT, dedicated surface (13.9 mi.)	$930	$3.63	55	34,600	9,860	10,900	$22.17	-1,272	16,598	0	9	33.3	12.6	11
Alternative 4B - LRT, downtown tunnel + dedicated surface (14.6 mi.)	$1,498	$3.13	43	41,100	12,330	13,130	$30.42	-361	14,148	0	9	36.2	12.6	14
Alternative 4C - LRT, downtown tunnel + Cooks Lane tunnel + dedicated surface (14.6 mi.)	$1,631	$3.12	41	42,100	12,720	13,580	$31.98	-254	14,148	0	9	35.5	12.6	13
Alternative 4D - LRT, maximum tunnel + dedicated surface (13.7 mi.)	$2,463	$7.37	36	42,300	13,260	14,200	$49.17	-250	15,383	0	9	29.6	12.6	15

Public Involvement/ Agency Coordination

Public Involvement

For the Red Line Corridor Transit Study, extensive public involvement activities have occurred throughout the study and will remain ongoing until the completion of the project. Activities to date include corridor-wide meetings, community meetings, and meetings for special interest groups. A wide variety of means, including non-traditional efforts, have been employed to reach individuals and distribute project information.

Over thirty corridor-wide public meetings, open houses, and workshops have been held to date in the study area. Approximately 300 people attended the Scoping Meetings held in May through June 2003. Nearly 200 comments were received. Open Houses were held in October and November 2004, June 2005, and November 2007. At the 2004 Open Houses, 288 people attended and 82 comments were received. At the 2005 Open House, 444 people attended and 162 comments were received. 350 attended Community Workshops held in November 2005 and 230 attended workshops in May 2006.

Public involvement has also been targeted toward communities and particular groups. Between November 2004 and May 2005, Community Working Groups (CWG) were formed and four rounds of meetings were held. The CWGs were formed as a way to develop valuable partnerships with organizations and individuals in communities in the project corridor. In 2006, the General Assembly established a Red Line Citizens' Advisory Council to advise MTA on project impacts, opportunities, and community concerns. The CAC has met monthly since September 2007.

Resource hubs at community facilities, information kiosks at rail stations and major employers, and frequent media releases allowed widespread distribution of public information materials. Elected officials and religious institutions also received regular project materials and updates. A "Speaker's Bureau" was established to meet with individual community associations in the project area. Separate initiatives included meetings with businesses and institutions, and outreach to environmental justice populations, with specific focus on the Hispanic population. Public information tools have included a project website, newsletters, fact sheets, and a comprehensive list of 126 frequently asked questions.

Red Line Public Workshop

Agency Coordination

The Red Line Project has been developed in accordance with the National Environmental Policy Act and the Maryland Streamlined Environmental and Regulatory Process, including coordination with Federal, State, and Local Regulatory Agencies. Outreach to these agencies has included the following methods: Interagency Review Meetings, field meetings, project correspondence, and a Technical Working Group, a multi-disciplinary group of state, regional, and local technical staff. Coordination with these agencies will continue throughout the development of the Red Line project.

Funding

The capital cost funding and annual operating cost subsidy for the Red Line may be funded from a package of federal, state, city, county and possible private sources. Additional detail on funding can be found in Chapter 5.

Federal Capital Funding Source

While some initial money has come from various federal transit formula funding programs, the vast majority of federal support for the Red Line will come from the FTA's Capital Investment Program for "New Starts." Funds are available for construction of new fixed-guideway systems or extensions to existing fixed-guideway systems. The New Starts program is a $1.5 billion discretionary fund for construction of new fixed-guideway systems. While the federal match can be as high as 80 percent, FTA generally only pays 50 percent or less of total project costs because of the competitive nature of this program. In order to become eligible for funding, projects must complete the major capital investment planning and development process, which looks at the results of an Alternatives Analysis, a set of established criteria, and the degree of local financial commitment.

Due to intense competition for federal transit funding, the federal share for transit New Starts projects has steadily declined over the past 10 years or so. Although the law allows an 80 percent federal share for New Starts projects, the trend has been to limit federal funds to around 50 percent. Funding for past transit projects in Maryland is an excellent example of this change in that the original Washington Metrorail system received 100 percent federal funding. When the Baltimore Metro was built, it received 90 percent federal funding. In the 1990s when the Baltimore Central Light Rail Line was built, it received 80 percent federal funding compared to the recently completed Largo extension of the Metrorail that received 60 percent federal funding. Because requests for this funding assistance far outstrip the available funds, projects from around the country compete against each other for funds. In recent fiscal years, the Congressional Appropriation Committee has been limiting the federal share to 50 percent and nearly all project requests for federal assistance are in this range.

State Capital and Operating Funding Source

The balance of capital and operating funds will have to come from the State's Transportation Trust Fund (TTF) and possible contributions from local governments and the private sector. Mass transit is one of many transportation modes competing for TTF dollars. The fund was created as a source of dedicated revenues to support the Maryland Department of Transportation (MDOT) – the MTA, State Highway Administration, the Maryland Port Administration, Motor Vehicle Administration, and the Maryland Aviation Administration. TTF revenue supports all of the Department's activities, including debt service, agency operations, and capital projects. TTF money comes from motor fuel taxes, motor vehicle titling taxes, motor vehicle fees, bond proceeds, and the Department's operating revenues including transit farebox receipts.

In late 2007, the General Assembly passed, and the Governor signed, a combination of revenue enhancements that will increase TTF revenues by more than $400 million a year. These funds would be available for distribution through the annual budgeting process.

Allocation of TTF funds is determined by the Maryland Secretary of Transportation and approved by the Governor and the General Assembly. Priorities and goals are set in the six-year Consolidated Transportation Program (CTP). As part of a continuing statewide

planning process, a Draft CTP is developed annually in concert with Maryland's 24 political subdivisions. This Draft CTP is presented to local elected officials and citizens for review and comment. The CTP is then revised and submitted for approval as part of the Governor's budget to the General Assembly in January.

Every year, priorities within the CTP are adjusted, based on local and regional needs and available revenue. If the Red Line gains federal approval, Maryland will have to revise priorities within the CTP or add additional funds to the TTF.

Demand for transportation projects in Maryland far outpaces available revenue. Maryland is considering a number of major transit capital investments in addition to the Red Line Corridor, including the Purple Line in Prince George's and Montgomery Counties and the Corridor Cities Transitway in Montgomery County, as well as a major MARC expansion (the commuter rail system in Maryland serving the Baltimore/Washington, D.C. region). In addition, high priority is being given to existing transit system preservation and rehabilitation. Along with transit needs, there are substantial funding needs for highways and other transportation systems supported by the TTF, which will require decisions regarding revenue increases for the TTF, other sources of revenue, and prioritization regarding the scale and timing of the projects for the transit corridors.

Given the State's growth plan for transit in Maryland, including consideration of implementation of three major capital investment projects (the Red Line, Purple Line, and the Corridor Cities Transitway), the MTA is developing a plan that combines the staggering and phasing of projects with a program to capture additional revenues from local governments. The intent is to have funds available to meet capital and operating costs of New Starts projects, as well as a range of additional system enhancements to improve system preservation and operations of the existing transit system and its general operating obligations.

This strategy is in the process of being developed by MDOT, along with a specific plan to implement it. Once the details of the revenue enhancements are available and decisions are made regarding the specific levels of investments in the various corridors, MTA would specify an exact plan for funding the Red Line through construction, ensuring the availability of funds for operating this new investment while maintaining the quality of operations and maintenance for the remainder of its transit systems.

Other Funding Sources

Beyond state and federal funds, the remainder of the funding would come from county, city, and possible private-sector sources. It is expected that the City of Baltimore and Baltimore County would provide capital funds for construction of the Red Line in addition to right-of-way contributions, easements, and ancillary roadway and trail facilities.

Future Actions

There are a number of steps that must be taken prior to a final decision on whether to proceed with a Red Line transit project. The first step will be after the Public Hearings on the AA/DEIS, which are currently scheduled for the Fall of 2008. At that point, local decision-makers will review technical data and public hearing testimony and determine if there is a project that merits further consideration. If the answer is yes, a "Locally Preferred Alternative" will be selected and submitted to the Federal Transit Administration (FTA). The MTA will also submit a New Starts application at this time. If FTA concurs that the Locally Preferred Alternative merits consideration, FTA will approve proceeding to the next step of Preliminary Engineering/Final Environmental Impact Statement (PE/FEIS). This normally requires two years and includes addressing all outstanding issues and developing the project in greater detail. The PE/FEIS stage includes significant public participation. After completion of the PE/FEIS, approval is sought from FTA to move into Final Design engineering.

Overview of the AA/DEIS

The documentation included as part of the Red Line Corridor Transit Study AA/DEIS is comprised of the main body of the AA/DEIS and a series of 19 Technical Reports.

The main body of the AA/DEIS consists of Volume I, Volume II, and an Appendix, all included as part of the hardcopy of the AA/DEIS document. The 19 Technical Reports are all contained on a DVD, which can be found at the back of the document.

Volume I

Volume I of the AA/DEIS provides corridor wide information on the Red Line Corridor Transit Project. Information in Volume I will be of particular interest to those whose interest focuses in the corridor as a whole, comparison of the full end-to-end alternatives, and the benefits and impacts of the potential alternatives. It is formatted in the typical format for a transit AA/DEIS, as described in FTA Guidelines.

There are seven chapters as follows:

- Chapter 1 – Purpose and Need
- Chapter 2 – Alternatives Considered
- Chapter 3 – Transportation Impacts
- Chapter 4 – Environmental Resources and Effects
- Chapter 5 – Costs and Funding
- Chapter 6 – Evaluation of Alternatives
- Chapter 7 – Public Involvement and Agency Coordination.

Volume II

Volume II focuses on the Red Line options, and associated transportation and environmental impacts, in specific Geographic Areas of the corridor. Information in Volume II will be of particular interest to those whose interest focuses on specific neighborhoods, on specific properties, or in specific Geographic Areas. Information is presented in nine Geographic Areas, and is presented from the west to the east. Some of the nine Geographic Areas are further divided into sub-areas for ease of presentation.

Appendix

An Appendix is included in the AA/DEIS following Volume II. The Appendix includes:

- References
- List of Preparers
- Distribution List
- List of Technical Reports
- Glossary
- Acronyms.

Technical Reports

In order to keep the AA/DEIS to a reasonable volume of content, more specific information is included in 19 Red Line Corridor Transit Study Technical Reports. These Technical Reports are listed below. They are all included on a DVD which can be found in a pocket located at the back of the AA/DEIS.

- Air Quality Technical Report
- Alternatives Technical Report
  - Appendix - Limits of Disturbance Drawings & Tunnel Plans and Profiles
- BRT Vehicle Storage & Maintenance Facility Technical Report
- Capital Cost Technical Report
- Cultural Resources Technical Report
- Economics Technical Report
- Travel Demand Forecasting Technical Report
- Final Definition of Alternatives
- Hazardous Materials Technical Report
- LRT Vehicle Maintenance & Storage Facility Technical Report
- Natural Resources Technical Report
- Neighborhood Effects Technical Report
- Noise & Vibration Technical Report
- Operating & Maintenance Cost Technical Report
- Public Involvement Technical Report
- Draft Section 4(f) Evaluation Technical Report
- Stations Technical Report
- Traffic, Parking & Transportation Technical Report
- Travel Demand Forecasting Technical Report

Chapter 4 – Environmental Resources and Effects

Chapter 6 – Evaluation of Alternatives

Chapter 7 – Public Input and Agency Coordination

Volume II – Option Descriptions by Geographic Area

Appendix

Tables:

Figures:

Volume I-Chapter 1

Purpose and Need

RED LINE Corridor Transit Study

WHAT IS THE PROJECT'S PURPOSE?

The Red Line Corridor Transit study is just one step in the ongoing development of an interconnected regional transit system that will improve the quality of transit service in the Baltimore Region. The purpose of the Red Line is to:

- More easily move people from one location to another in the corridor,
- Enhance transit connections,
- Support community revitalization and economic development opportunities, and
- Help the region address congestion and traffic-related air quality issues.

WHY DO WE NEED A RED LINE?

Anyone who travels in and around Baltimore knows the difficulty of navigating congested streets in rush hour or attempting to drive or take transit across town. There is no shortcut that gets you quickly from East Baltimore to West Baltimore or from Western Baltimore County to the downtown Central Business District. Buses become stuck in those traffic jams, too. A public rapid transit route such as the Red Line offers hope for swift, convenient and dependable east-west travel through the heart of Baltimore.

Purpose and Need

Introduction

The chapter on Purpose and Need tells the background story that led to the decision to study transportation improvements in the Red Line Corridor. This chapter discusses the issues and problems at hand and how this study plans to addresses them. In particular, this chapter will discuss the major job centers that could use more frequent transit service, the need to improve air quality, the opportunity to revitalize communities, the transit-dependent populations that could use transit service along the proposed Red Line Corridor, and how the Red Line would connect people to the rest of Baltimore, the rest of Maryland, and beyond. As the region grows with more people, jobs, and new development, the road and transit system of today will not accommodate the demands of tomorrow.

Corridor Overview

The Red Line Corridor extends 14 miles in an east-west direction from the Centers for Medicare & Medicaid Services (CMS) on the west in Woodlawn (Baltimore County) to the Johns Hopkins Bayview Medical Campus (Bayview) on the east (Baltimore City). See **Figure 1-1**. The majority of the corridor falls within Baltimore City, with development typical of cities originating in the 18th century. The downtown central business district has commercial and institutional land uses, with densely developed residential areas radiating out toward the city/county boundary.

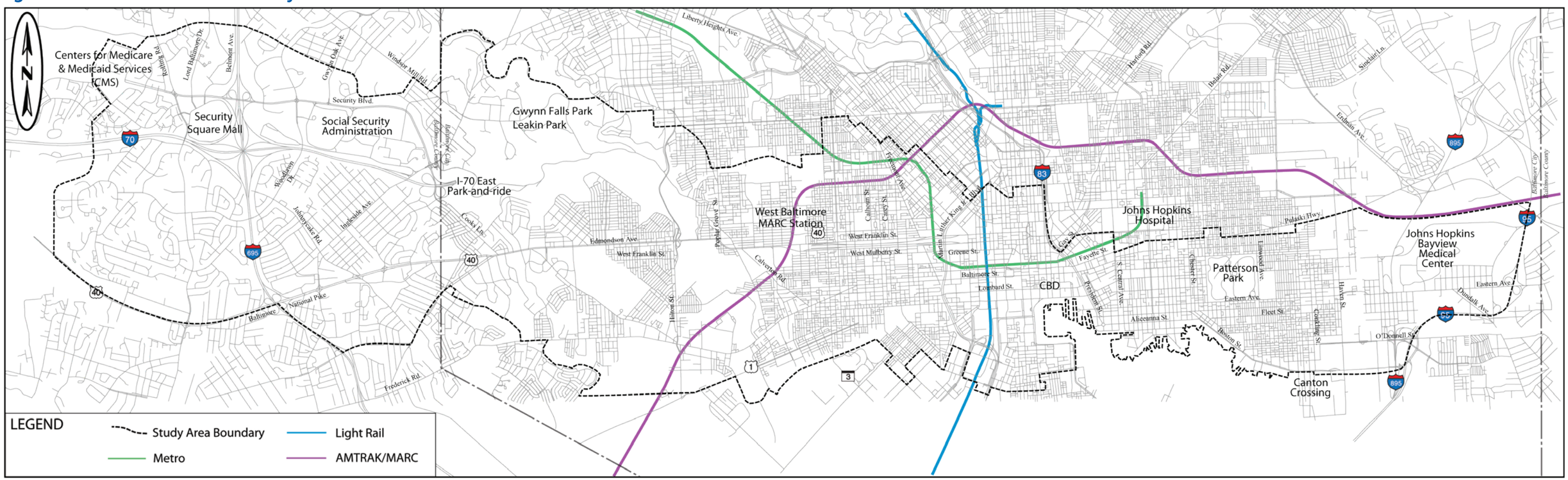
The four-mile portion of the corridor in Baltimore County contains major employment centers, shopping, interstate highways, and housing. The residential development in Baltimore County is somewhat less dense compared to that of the city. One of the region's largest employment centers, Social Security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

Traveling east towards 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 corridor. Moving toward the downtown area, the corridor intersects with the West Baltimore MARC Station, schools, and shopping centers, all within residential neighborhoods.

The central business district 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, governmental agencies, and many financial institutions. The central business district has recently also become a residential area and offers a number of opportunities to connect with MARC, Metro, Light Rail, and the MTA core bus system.

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

Figure 1-1: Red Line Corridor Study Area



Purpose of the Project

The Red Line Corridor Transit study is just one step in the ongoing development of an interconnected regional transit system that will improve the quality of transit service in the Baltimore Region. The purpose of the Red Line is to:

- More easily move people from one location to another in the corridor,
- Enhance transit connections,
- Support community revitalization and economic development opportunities, and
- Help the region address congestion and traffic-related air quality issues.

Project Needs

The Red Line would help address these needs:

- Offer an alternative to the private automobile and help meet statewide and corridor transportation goals for reducing congestion and travel times in the corridor.
- Help move larger numbers of existing and future travelers throughout the corridor. It would provide more convenient access to jobs, services, and activities in both downtown Baltimore and the suburbs.
- Connect the major employment centers in western Baltimore County and provide residents with travel options for accessing job opportunities and public services without using a car. It would also enhance connections between existing and future developments in downtown Baltimore, Fells Point and Canton, Baltimore County employment areas to the west, and the larger region.
- Serve as the key link in a logical, useful, multi-modal transit system. It would offer seamless connections between the existing Central Light Rail, Metro Subway, 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.
- Encourage commercial and residential growth around new transit stations. It would help revitalize existing communities and stimulate economic development within walking distance of new transit stations.
- Help the region fulfill federal and state goals for improving air quality by increasing transit use.

Alleviate Congestion and Improve Transit Travel Times

The Red Line Corridor currently faces traffic congestion, affecting both automobiles and buses. The main link in the 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 that contribute to the congestion and slow travel speeds on US 40, but most significantly are the numerous and closely spaced traffic signals along its length in the corridor. During peak travel periods, traffic speeds on US 40 range between 10-30 mph, even with posted speed limits of 40 mph. Currently, from the western end of the corridor to downtown, it can take as long as 30 minutes during the peak rush. This will worsen by 2030 with a projected increase in traffic of 20 percent.

Through the Central Business District 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 6-12 mph on streets posted at 25 mph. Delay is worsened by on-street parking and loading zones for businesses. Traffic through downtown and in eastern Baltimore City is projected to increase by 25-35 percent by 2030, thus worsening delays experienced today.

Buses in the corridor are subject to the same traffic congestion as automobiles but have longer travel times due to frequent stops. For example, for most bus routes, speeds during the busiest travel times average only about nine mph between Edmondson Village and downtown, for a total travel time of 26 minutes. Nonstop express bus service makes the trip in 22 minutes, saving only four minutes.

Provide Increased Mobility and Access to Employment and Major Activity Centers

Many people live, work, shop, and visit in the corridor, which leads to complex travel patterns and a large need for roads and transit services that work well. The number of trips between residential and employment areas located in the city and surrounding counties has increased in the region. Many major activity centers are located along the east-west corridor. To the east are the Bayview Medical Campus, Canton, Fells Point, and Inner Harbor East; to the west are University Center, the redevelopment at the West Baltimore MARC Station, and the Social Security Complex in Woodlawn.

Residents who drive generally use I-695, I-95, and other major highways to get to their destinations in suburban locations. Commuters driving to downtown from US 40 and I-70 west of Baltimore must chose between taking I-695 to reach downtown via I-95 and I-395, and using roads such as Cooks Lane and US 40/Edmondson Avenue to get to their destinations. All of the routes are currently congested.

Many residents rely on public transit to access jobs, services, and activities within the 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 get to 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.

Yet, despite long travel times and limited access to suburban locations, the demand for transit is high in the corridor. Nine bus routes provide east-west service in the corridor, carrying over 82,000 riders each weekday. The Red Line Corridor is an area with a proven demand for transit, despite the constraints to the service currently provided.

Provide Transportation Choices for East-West Commuting

Travel choices along the Red Line Corridor are currently limited to driving on congested roads, or taking a bus that travels along those same congested roads. For those who do not live within walking distance of transit, there is only one park-and-ride lot in the corridor. It is located on US 40/Edmondson Avenue east of Cook Lane, and it connects to local bus services, which provide no travel time savings over continuing to downtown by car.

Although bus routes operate throughout the corridor. A high-quality transportation alternative would give east-west travelers a choice of travel modes. More transportation choices would help those who depend on transit while offering an attractive transportation alternative for those who generally drive but take transit for some trips.

Improve 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 be provided that connects the highest density of origin-destinations without transfers, but also accommodates other origin-destinations with a minimum of transfers that are convenient (one at most is desirable).

There are connections which can be made today among some existing transit modes. These 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, and the Red Line project offers the opportunity for better connections between the MARC system, existing Central Light Rail, existing Metro, and existing bus service and a new Red Line.

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. That way, commuters can avoid the stress and expense of driving for their entire trip. In the case of rail services such as MARC and Metro, it also saves travel time, allowing travelers to avoid traffic congestion. Kiss-and-ride areas at stations make it safer and more convenient for drivers to drop off and pick up passengers at transit stations. This enables some households to reduce the number of cars needed, saving on travel expenses.

Safe and attractive pedestrian and bike paths can be important in getting transit riders from their homes and jobs to transit stops. 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.

Bus-to-bus transfers have to be easy in the corridor, and it is vital that there are convenient connections to Metro, Central Light Rail Line, and the MARC Camden and Penn Line stations. Within the Red Line Corridor, bus connections are currently available to all these lines: to the MARC Penn line at the West Baltimore MARC Station; to the Metro at the Charles Center and Shot Tower Stations; to Central Light Rail line at the Camden Yards and Lexington Market Stations; and to a number of local and commuter north-south bus routes.

Facilitate Community Revitalization and Economic Development

The 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. Development at a transit station can provide many daily commuter needs and errands without the use of a car. Although market forces, and other variables that are not directly related to transit strongly influence development patterns, there are currently unrealized opportunities for growth and redevelopment within existing communities along the corridor that improved transportation could enhance.

Specific communities within the Red Line corridor that would benefit from revitalization 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; Patterson Park; and Highlandtown. Areas within the Red Line corridor that would benefit from stimulus which would encourage redevelopment or support increased planned development include the Security Square Mall area, Edmondson Village, Downtown, Canton, and Bayview. In addition to providing stimulus, some areas may actually be restricted in terms of growth, due to a lack of transportation infrastructure. For example, the City of Baltimore states in its Southeast Baltimore Transportation Action Plan that the continued growth in the southeast part of the city (including Canton) cannot be accommodated without a major transportation capacity increase such as the Red Line.

Improve Air Quality

Currently, the Baltimore Region is not meeting the federal standards for 8-hour ground-level ozone, such as smog and fine particulate matter like fine soot. 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 State's environmental agency, cars, trucks, buses, and other mobile sources cause 41 percent of the nitrogen oxides in the state and 32 percent of the volatile organic compounds. These two pollutants contribute to ground-level ozone formation. Vehicle emissions and traffic congestion contribute to the amount of fine particulate matter. Transit can help reduce vehicle emissions because buses and trains, especially electric, can carry passengers using much less fuel and producing fewer emissions per traveler than cars. In addition, the MTA beginning in 2007, is replacing its core bus fleet with hybrid diesel-electric buses.

Project Goals and Objectives

The needs for the study are translated into goals and objectives, to develop and evaluate the alternative for transit improvements. **Table 1-1** outlines the goals and objectives established for the Red Line Project. These goals and objectives reflect the long-standing commitment to improve transportation opportunities in the corridor. The goals for the Red Line Corridor Project are consistent with the Baltimore Region Rail System Plan and planning decisions for Baltimore City and County. The evaluation of the alternatives to these goals and objectives can be found in Chapter 6.

Table 1-1: Red Line Corridor Transit Project Goals and Objectives

Goal	Objectives
Increase Transit Efficiency	Reduce transit travel times in the corridor Provide safe and attractive transit service
Improve Transit Mobility and Accessibility	Better accommodate existing and future east-west travel demands Improve transit access to jobs in the region Provide transit access to schools, shopping, events, healthcare and other services and cultural attractions in the corridor
Provide Transportation Choices for East-West Commuting	Encourage transit ridership Improve transit opportunities in the east-west corridor Improve transit service for the transit-dependent user as well as those individuals within the corridor who chose to use transit as an option
Improve Transit Connections	Develop connections between existing transit routes Provide transit connections to existing and planned economic development areas
Support Community Revitalization and Economic Development	Support ongoing community revitalization and economic development initiatives Provide transit stations compatible with local community character
Address Air Quality Issues and Environmental Stewardship	Provide a quality alternative to automobile travel Minimize impacts to the natural and human environment Support local, regional, and state policies and adopted Master Plans Support energy conservation

Corridor Demographics

Population, Households, and Employment

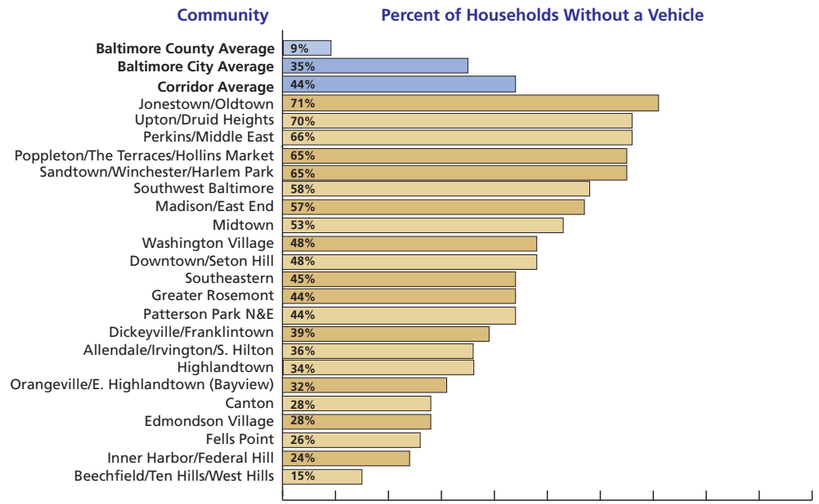
The Red Line Corridor extends across Baltimore City and into Baltimore County. The study area population according to the 2000 Census is 210,341 persons.

Many of the residents in the Red Line Corridor use transit as their sole means of transportation. **Figures 1-2** and **1-3** show the percentage of households, by community, without a vehicle. The Jonestown/Oldtown community has the highest percentage of no-car households at 71 percent.

Downtown Baltimore is a major employment center for government, office and healthcare workers, and the retail and service workers who support them. Its residential population has been growing. The Baltimore central business district has also been experiencing steady growth, adding jobs, businesses and residents. The Downtown Partnership in its *State of Downtown Baltimore Report* (2005) estimated that the city has 20 percent of all places of employment in the state and its 13,850 businesses employ 287,400 workers. In 2005, employment downtown expanded 6.8 percent from the year before. In the last two years, over $1 billion worth of projects were completed and $722 million are currently under construction. In addition, there is over $2.3 billion worth of projects in planning stages for 2006 through 2008 completion. These projects represent a mix of uses including business, office, and an expanding residential market.

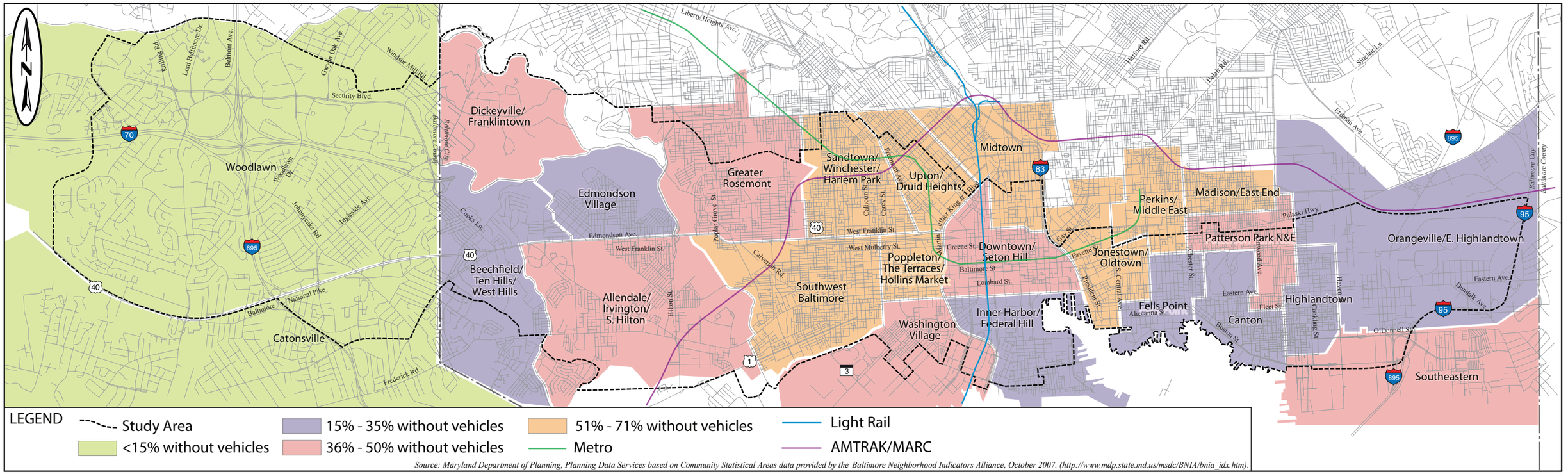
The western end of the corridor is also a major employment area. The Social Security Administration has over 15,000 employees and the Center for Medicare & Medicaid Services (CMS) employs over 3,500. The area is also a major retail center with the Security Square Mall and national retailers located along Security Boulevard.

Figure 1-2: Percentage of Households Without a Vehicle Within Study Area



Source: Maryland Department of Planning, Planning Data Services based on Community Statistical Areas by the Baltimore Neighborhood Indicators Alliance, October 2007.

Figure 1-3: Percentage of Households Without a Vehicle



Source: Maryland Department of Planning, Planning Data Services based on Community Statistical Areas data provided by the Baltimore Neighborhood Indicators Alliance, October 2007. (http://www.mdp.state.md.us/msdc/BNIA/bnia_idx.htm).

Table 1-2 and **Figure 1-4** identify the organizations in the corridor with over 1,000 employees.

Corridor Land Use

Existing Land Use

The local government, usually the Planning or Zoning Department, manages and oversees land use. Land use determines what general types of development (or non-development) occur in certain areas. Land use designations include residential, commercial, industrial, transportation and, park/open space. Designating an area for a certain land use guides development.

Today federal guidelines require an effort to develop coordination between land use and transportation, so they are supportive of each other.

Figure 1-5 shows the existing land use in the Red Line Corridor. Baltimore is like many other large cities with most business and commercial uses concentrated in the central business district. The portions of the corridor in western Baltimore County, western Baltimore City, and eastern Baltimore City are primarily residential. Other types of land uses including commercial, industrial, institutional, and parkland occur throughout the corridor.

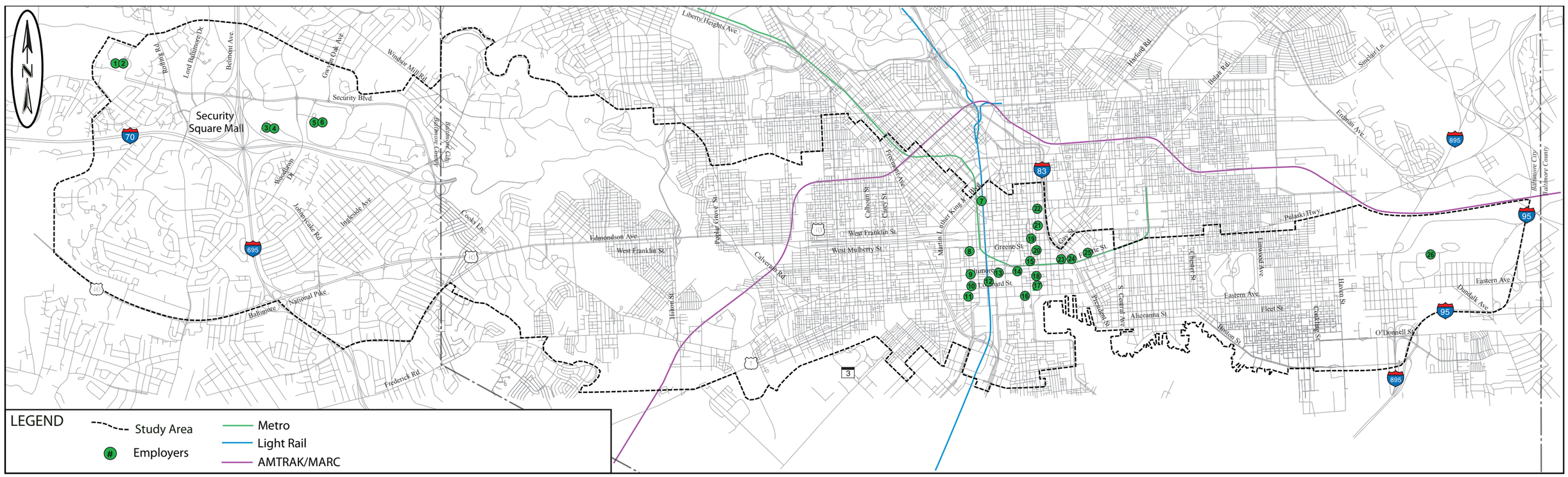
Land use throughout the corridor is largely residential with commercial and retail uses along the roads leading through the city (Baltimore Street, Franklin Street, Orleans Street, and Eastern Avenue are some examples). There are large clusters of development along these roads and at the east and west ends of Baltimore City and into Baltimore County. The Social Security area, Inner Harbor East, Fells Point, and Canton are examples of redevelopments which have continued to grow over the past 10 years.

Table 1-2: Organizations With Over 1,000 Employees Within Study Area

Map ID	Employer	Number of Employees
1	CMS	1,045
2	CMS	1,450
3	SSA - Woodlawn Cptr Bldg	1,086
4	SSA - Security West Bldg	4,005
5	SSA - Operations Bldg	6,663
6	SSA - Annex to Soc Sec	1,477
7	Maryland General Hospital	1,100
8	SSA - Metro West Bldg 1	2,114
9	Veterans Health Administration	1,200
10	University MD Med Sys Corp	4,800
11	UMAB School of Medicine/Law	1,604
12	US Army Corps of Engineers	1,700
13	State Dept of Education Hdqtrs	1,509
14	GSA leased to TD - IRS, TIGTA	1,803
15	CSX Corporation	1,200
16	Verizon Maryland Inc	1,200
17	Legg Mason Inc	1,000
18	Jos A Bank Clothiers Inc	1,174
19	Foodtemps Inc	1,000
20	Mercy Medical Center	1,324
21	Baltimore Sun Company Inc	1,650
22	Maryland Dept of Transportation	1,676
23	Police	1,155
24	City of Baltimore	1,155
25	United States Postal Service	2,085
26	Johns Hopkins Bayview Med Ctr	3,000

Source: Baltimore Metropolitan Council 2000 Master Establishment File

Figure 1-4: Organizations With Over 1,000 Employees



Along the corridor within Baltimore County, land use is predominantly medium-density residential. Several major commercial centers, such as Security Square Mall and Westview Shopping Center also exist in the area. The major commercial land uses are located near the I-695/I-70 interchange or along major thoroughfares such as US 40. There are many institutional land uses scattered throughout this portion of the corridor including cemeteries, police stations, fire stations, and medical facilities, as well as numerous schools and places of worship.

Land use in western Baltimore City is predominantly residential. The density of the residential development increases from the county/city line to downtown. This portion of the corridor contains the largest amount of parkland: Gwynns Falls/Leakin Park and Greenway and Gwynns Falls Trail. The Gwynns Falls Greenway contains over 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. Other large park systems in western Baltimore City include Carroll Park, Druid Hill Park, and Harlem Park. There are also numerous smaller parks located just west of the downtown area.

The corridor includes several large cemeteries such as New Cathedral, Loudon Park, and Mt. Olivet Cemeteries. Institutional land uses include the CMS, Social Security Administration, education facilities, and places of worship. There are several large areas classified for industrial uses located just west of the central business district, such as 500-acre Carroll Camden Industrial Area. A major commercial area is the Edmonson Village Shopping Center, located east of the Baltimore City/Baltimore County line. Other areas of commercial land uses, such as Lexington Market, along US 40 and downtown, are located throughout the corridor.

As is typical of a large city, land use in the central business district is mostly commercial. There are also institutional uses, including educational facilities, health care facilities, and places of worship scattered throughout. High-density residential land use has recently been added to downtown districts such as City Center, Inner Harbor, West Side, and Harbor East.

East of the Inner Harbor are the neighborhoods of Little Italy, Fells Point, Patterson Park, Highlandtown, and Canton. Although the majority of these areas are residential, there are several commercial areas. Examples include Broadway in Fells Point, which is home to restaurants, shops, and bars; Boston Street in the Canton neighborhood; and Eastern Avenue in the Highlandtown neighborhood. Housing in these neighborhoods is largely row houses.

The Bayview area consists mainly of industrial and institutional land uses, with surrounding residential land uses. The Johns Hopkins Bayview Medical Center complex is located on 130-acres in southeast Baltimore at the east end of the corridor. It includes the Bayview Medical Center and three National Institutes of Health research centers, operating on a campus with 2.8 million square feet of patient, research and support facilities.

Planned and Proposed Development

It is important that the Red Line connect areas where people live and work to areas where people want to go. Planned or proposed large-scale developments are new destinations and would benefit from the high-quality transit the Red Line would offer. There is an opportunity during the planning stages for the Red Line to consider the location of these planned or proposed facilities when considering alignments and station locations.

Figure 1-5: Existing Land Use

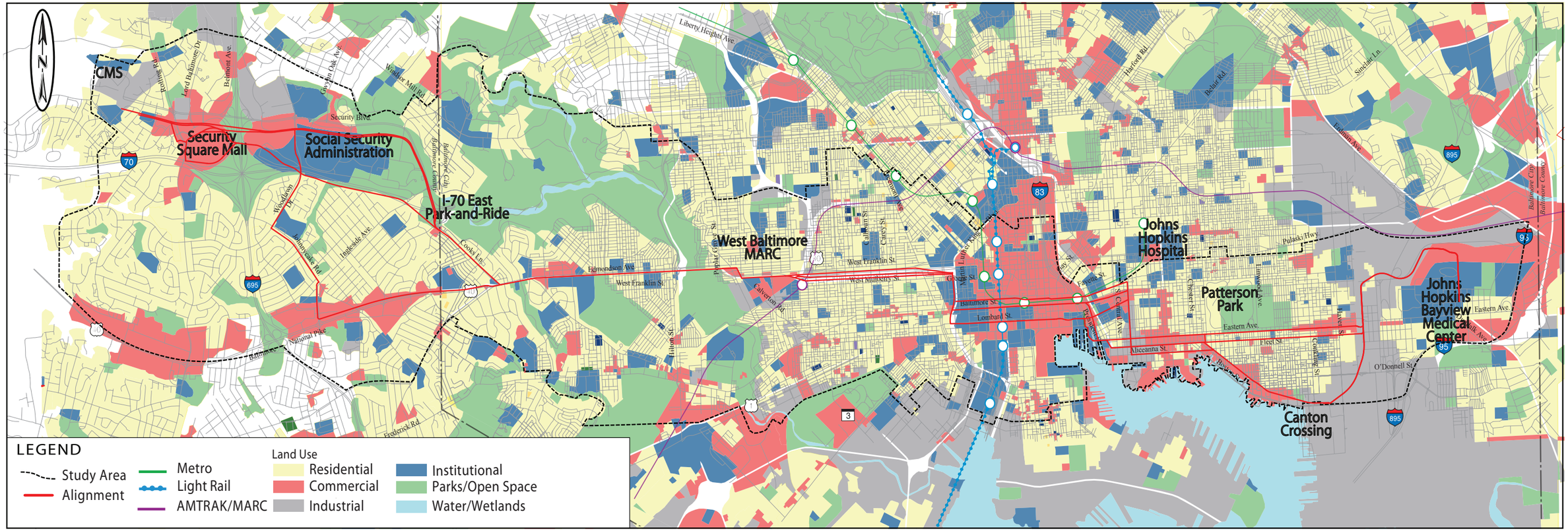


Table 1-3 and **Figure 1-6** show planned and proposed development in the Red Line Corridor.

The Westside Renaissance Initiative is a 100-block, 450-acre area that proposes 1,800 residential units and 400,000 square feet of office space and includes a number of projects shown in **Figure 1-6** and listed in **Table 1-3**. It will have 250,000 square feet of retail and entertainment uses, and a 300,000 square foot expansion of the University of Maryland - Baltimore and the University of Maryland Medical System campuses. In addition, it includes renovation of the Hippodrome Performing Arts Center (completed in 2004) and a new 850-room convention hotel. State, city, and private developers are investing over $1 billion in this area.

The newly completed *Uplands Master Plan* includes the redevelopment of a Baltimore City-owned vacant and former apartment complex into 1,100 new, affordable homes located south of Edmondson Avenue.

Expanding the transit network in the Red Line Corridor will improve connections between these developments and Baltimore's central business district, including developing areas such as Inner Harbor East, Fells Point, Canton, Baltimore County employment areas to the west; and the larger Baltimore region accessed by connections with MARC, Central Light Rail, Metro, and the MTA core bus system.

The Harbor East, Fells Point, and Canton areas that are currently experiencing new development will benefit from additional transit access.

Areas that currently have limited developer interest might be stimulated with job creation and business development opportunities because of additional transit access and investment. These include Empowerment Zones, Enterprise Zones and Focus Areas. Large areas in the Red Line Corridor contain State of Maryland Enterprise Zones and Federal Empowerment Zones that encourage sustained economic opportunity and promote community revitalization through employment tax credits, job training, and loan programs.

Baltimore City's Focus Area enables businesses to take advantage of Personal Property Tax Credits, in addition to the tax credits available with the Enterprise and Empowerment Zones. The personal property tax credit is a 10-year credit against personal property taxes, and is an actual reduction in the amount of taxes that would have been due on personal property. There is one Focus Area in the Red Line Corridor; the Carroll-Camden area is shown on **Figure 1-6**.

The Bayview Medical Center plans to build up to 5 million additional square feet and grow from 6,300 employees today to over 12,000 by 2030. This future growth will increase the travel market at this end of the Red Line Corridor. The immediate vicinity of Bayview is designated as one of the city's Biotech/University/Hospital Districts where zoning would be more flexible to allow mixed-use development in the surrounding neighborhoods to support the facility.

Based on demographic trends, and with increased interest in lifestyle and health benefits, there is an increasing demand across the US for walkable communities close to transit. The State of Maryland Transit-Oriented Development Task Force defines transit-oriented development, as: "A place of relatively higher density that includes a mixture of residential, employment, shopping, and civic uses and types, located within an easy walk of a bus or transit center." Transit-oriented development is generally located within a 10-minute walk of a transit station (up to a half-mile away). This type of development can increase transit ridership by creating destinations close to stations. It also offers residents a convenient commute to jobs, shopping, and entertainment in the region.

The Transit-Oriented Development Task Force envisions surrounding transit stations with vibrant neighborhoods

Figure 1-6: Planned and Proposed Development

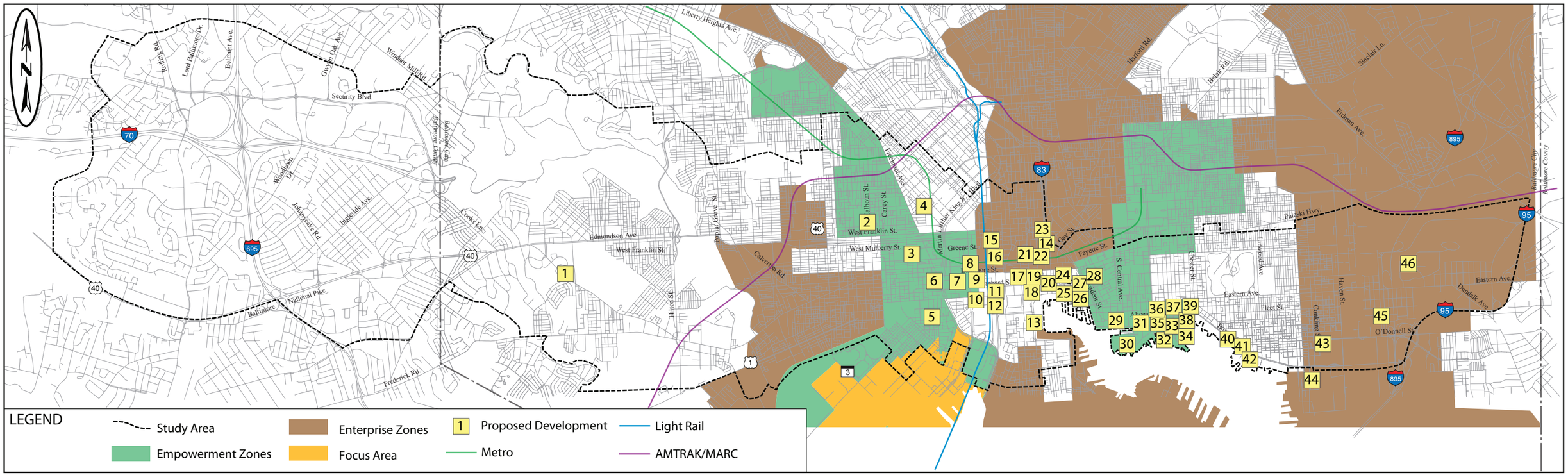


Table 1-3: Planned and Proposed Development

ID	Proposed Development	Total Gross Building Area (in thousands of sq. ft.)	Type of Development				
			Residential	Commercial	Institutional	Hotel	Retail
1	Uplands	1,251	X				
2	Harlem Park	740	X				X
3	Poppleton Project	2,762	X				X
4	Upton West	443	X				
5	Camden Crossing	334	X				
6	UMB Biotech	1,130			X		
7	UMB Dental School	367			X		
8	UMMS Ambulatory Care Center	500			X		
9	UMMS Sonneborn Building Renovation	238			X		
10	The Zenith	191	X	X			
11	City Hotel	750				X	
12	Hilton Convention Center Hotel	462				X	X
13	Arc Wheeler Tower	445	X	X		X	X
14	Cityscape	324				X	
15	Super Block-Lex. Sq./Rainbow App.	395	X				X
16	39 W. Lexington (Old BGE Building)	196					X
17	Mechanic Theatre	245	X			X	X
18	One East Redwood	108	X				X
19	F&D Building	189	X				X
20	One Light St. Hotel	179				X	
21	Mercy Hospital Expansion	500		X			
22	Richard Nyang Project	384	X	X			X
23	Marriot Springhill Suites	59				X	
24	414 Water Street	212	X				
25	300 E. Pratt	1,000		X			X
26	Shot Tower Metro	315	X				X
27	Cordish Balloon Tower	238	X			X	
28	Arbermarle Square	458	X				X
29	Harbor East	2,884	X	X		X	X
30	Harbor Point	1,800	X	X		X	X
31	Fells Landing	64	X				
32	Crescent at Fells Point	277	X				
33	Henderson's Wharf	85	X				
34	Hanover Wharf	201	X				
35	Union Wharf	370	X				
36	Union Box	201	X				
37	Osiris Building	159	X				
38	Ann St. Project	231					X
39	Aliceanna Street Project	313	X				X
40	The Moorings	71	X				
41	Light House Point	176	X				
42	Icon Tower	212	X				
43	Canton Crossing	2,429	X	X			X
44	Brewers Hill (Struever Brothers)	737		X			X
45	Greektown	1,240	X				
46	Bayview	2,500			X		
TOTAL ALL PROJECT CATEGORIES		28,365					

Source: Downtown Partnership, Baltimore Development Corporation, Baltimore City Department of Planning, Owner/Developer communication, www.camdencrossing.com, and www.integral-online.comNotes:

1 - Includes UMB Biotech Building II, UMB BioPark (Maryland Forensic Medicine Center and the remainder of project [8 buildings]); and UMB BioPark Garage

2 - Includes Harbor E-Parcel C; Harbor E-Parcel H; Harbor E-EJ Codd; Harbor E-Spinnaker Bay; Harbor E-Parcel B; Harbor E-4 Season/Legg Mason

where people can live, work, shop, or eat out, all within a safe and pleasant walk to buses, Light Rail, Metro, and MARC trains. The State is promoting transit-oriented development to increase the number of riders and get a better return on its public investment. The State has policies which will support private investment in transit by attracting new homes and businesses to the station areas.

Examples of transit-oriented development are already under construction in the Baltimore region. For instance, the area around the Owings Mills Metro Station is being redeveloped into a Town Center, a type of transit-oriented development. Plans were announced last year for a large transit-oriented development surrounding the Light Rail stop at the State Center Government complex which, as part of the Westside Renaissance Initiative, is well underway. Recent development renovations at Hunt Valley have created strong connections to the Light Rail's northern terminus in Baltimore County.

Figure 1-7 shows locations of major transit-oriented development opportunities in the Red Line Corridor. An analysis of the proposed Red Line Corridor shows that large amounts of development are currently occurring or planned; most of which would qualify as transit-oriented development should the proposed transit line be put in place.

The Red Line Corridor contains about 29 million square feet of gross building area of planned and proposed development under review or under construction. This proposed development includes about 5,470 dwelling units, 1.7 million square feet of retail, and 1.2 million square feet of office space. However, development activities do not occur evenly throughout the corridor. Through transit-oriented development planning and community development initiatives in the corridor and the region, Baltimore City, MDOT and MTA are seeking to guide existing and planned transit facilities into areas currently seeing low levels of investment or development.

In the case of the Red Line, MDOT has begun planning studies to help communities further their growth goals through transit-oriented development. Baltimore City and Baltimore County governments, in cooperation with local communities, have made some initial suggestions for possible transit-oriented development. They include the area around the West Baltimore MARC Station (a community based planning effort began in October 2006) and areas in Baltimore County near Security Square Mall. In several other sections of the city, MTA is coordinating planned development to optimize alignments and station locations for the Red Line.

Corridor Transportation

Travel Patterns and Demand

For a Red Line Corridor Transit Project to be effective, it is important to consider where people are going, when they are traveling, how often they are traveling, and how transit will meet those needs. Red Line transit service should be structured to meet both current and future travel needs.

Historically, commuters traveled from their residences in the outlying suburbs to jobs in the central business district. Baltimore is no different and its central business district is still a major employment center. However, the Baltimore Metropolitan Council's *Transportation Outlook 2035 Plan* notes that home-to-work commuting has moved from "starting in the suburbs going into the city" to also include "a pattern of work trips going from one suburb to another suburb." A number of large employment centers in the corridor, such as the Social Security Administration and Bayview, are located outside of the central business district, creating a demand for suburb-to-suburb trips, as well as city-to-suburb work trips.

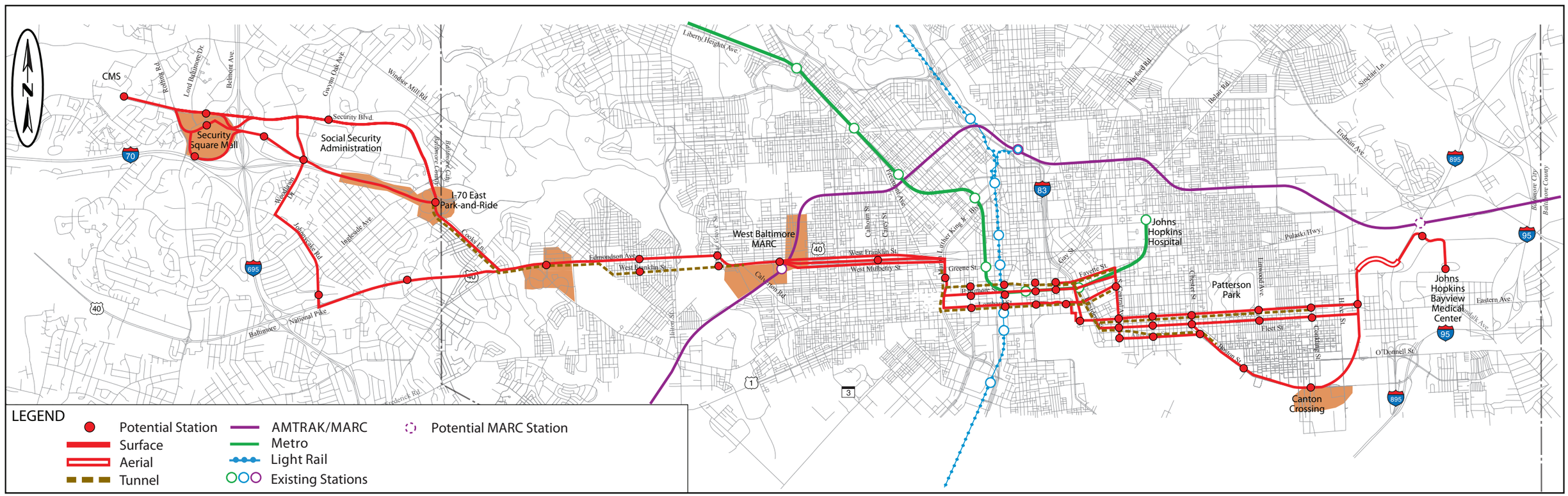
While work trips made during traditional peak hours cause much of the congestion and delay in the Red Line

Corridor, the roads and public transit system also serve a large number of other trips in the corridor. These include trips made for shopping, recreation, entertainment, family visits, education, medical care, cultural opportunities, and other purposes.

There are many major destinations located within the corridor, which create a demand for trips at all hours of the day. These include:

- Security Square Mall.
- Baltimore Convention Center which has 300 employees and hosts over half a million visitors annually.
- University of Maryland's Baltimore campus, which has 5,300 students and 6,600 faculty members and staff.
- Sojourner-Douglass College, which has 700 students and 120 faculty and staff.
- Health facilities including Johns Hopkins Hospital, Johns Hopkins Bayview Medical Center, Johns Hopkins University School of Medicine, Maryland General Hospital, the Veterans Administration Medical Center, Bon Secours Hospital, Mercy Medical Center, St. Agnes Health Care, and Kennedy Krieger Children's Hospital, with a combined total of over 38,000 employees and over 1.7 million patient visits annually.
- Churches, libraries, museums, theaters and other cultural institutions, including the National Aquarium, Maryland Science Center, and B&O Railroad Museum.
- Post offices, courts and other government offices.
- Sports arenas such as Camden Yards (48,900 seats), M&T Bank Stadium (71,000 seats), and 1st Mariner Arena (13,500 seats).
- Entertainment, tourist and recreation areas including the Inner Harbor area, numerous marinas along the Patapsco River, and parks both large and small located throughout the corridor.

Figure 1-7: Potential Major Transit-Oriented Development

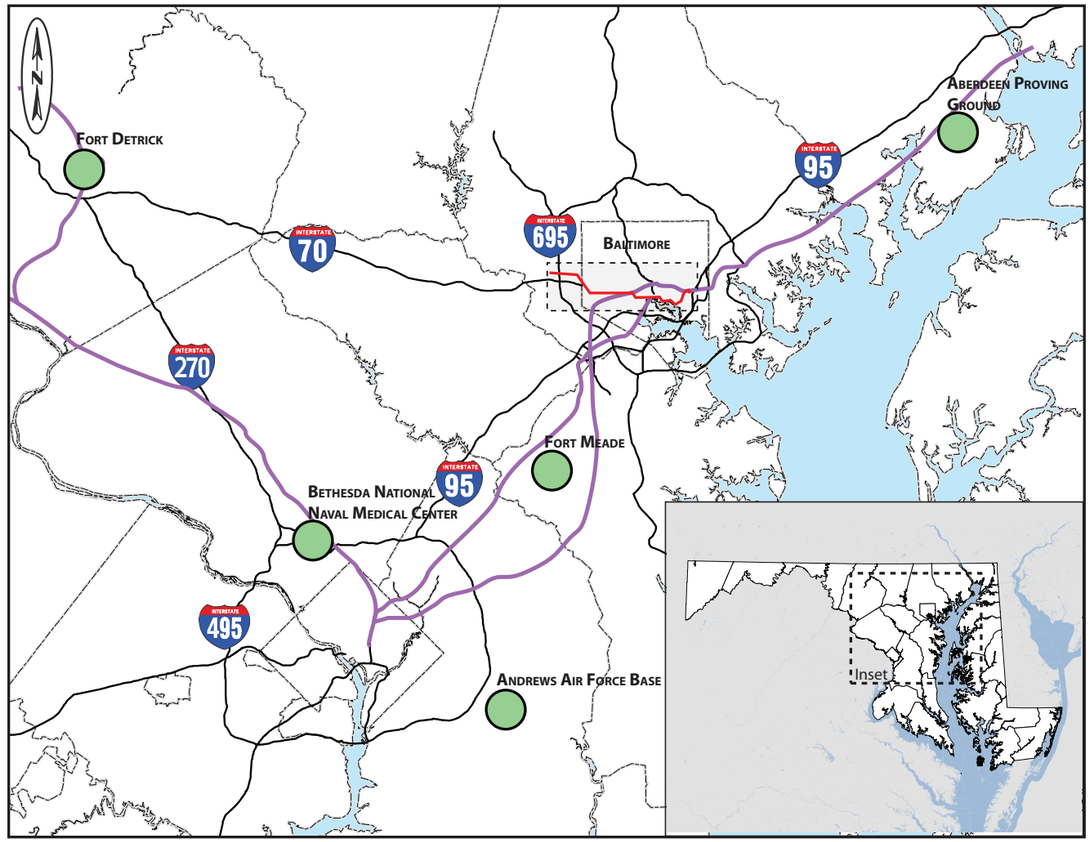


In addition, suburban areas can expect large population, job, and development growth. In November 2005, Congress authorized the US Department of Defense to begin its Base Realignment and Closure or "BRAC" process to more efficiently and effectively support the military. As a result of BRAC, bases in Maryland will gain additional military and civilian positions. **Figure 1-8** shows the locations of the five military bases in Maryland that will benefit from BRAC. Estimates of the total number of jobs due to BRAC are based on the number of on-base jobs plus the number of contractor and support-related jobs. By 2011, an estimated 40,000 to 60,000 total jobs are expected to come to Maryland. The two areas gaining the most BRAC jobs, and that are closest to the Red Line Corridor, are Aberdeen Proving Ground (8,200 on-base jobs plus 9,000 to 11,000 contractor and support jobs) and Fort Meade (5,700 on-base jobs plus 10,000 contractor and support jobs). Additional growth is expected through Enhanced Use Leasing (EUL) projects in which the US Department of Defense plans to lease out substantial portions of their land around the military bases for private developments. EUL projects at Aberdeen Proving Ground are estimated to have between 3,000 to 5,000 jobs, with 2 million square feet of office, hotel and conference center uses plus a law enforcement training facility on 1,300 acres. EUL projects at Fort Meade are estimated at 10,000 jobs, with 2 million square feet of office uses on 175 acres.

The Red Line corridor encompasses two stations on the MARC Penn Line – the West Baltimore Station, and the planned Bayview MARC Station. The Penn line has stations that serve both the Aberdeen Proving Ground (Aberdeen Station) and Fort Meade (Odenton Station). Major portions of Baltimore City fall within a 45-minute travel time of the Aberdeen Proving Ground and Fort Meade military bases. To meet workforce and housing needs, BRAC will require major improvements to the existing transportation system, services and facilities. One of the advantages for planning transportation improvements for BRAC is that the destination for the commuters is known – Maryland's military installations. Since the destination is known, the origin of these commuters moving to Maryland assists in focusing transit and highway improvements to ease their travel, and reduce the potential burden on the rest of Maryland residents and commuters.

The Red Line Corridor supports a variety of travel patterns. The current transit system faces the challenge of effectively and equitably serving trips into or within the corridor, as well as trips passing through the corridor.

Figure 1-8: Base Realignment and Closure (BRAC)



LEGEND

- Base Locations
- Red Line Corridor Transit Study Area
- Amtrak/MARC Train

BASE INFORMATION

Fort Detrick:
- 200 New BRAC Jobs
- 10,500 Non-BRAC Jobs

Bethesda National Naval Medical Center:
- 2,500 New BRAC Jobs

Andrews Air Force Base:
- 600 Non-BRAC Jobs

Fort Meade:
- 5,700 New BRAC Jobs
- 10,000 Contractor & Support Jobs

Aberdeen Proving Ground:
- 8,200 New BRAC Jobs
- 9-11,000 Contractor & Support Jobs

Source: MDOT, Base Realignment and Closure (BRAC) Department-Wide Briefing Book, 9/10/07.

Description of Existing Facilities and Services

This section describes the existing transportation network including public transit, roads, carpooling, park-and-rides, and bicycle and pedestrian facilities. By knowing the transportation facilities and services that already serve the Red Line Corridor, it is possible to identify the facilities and services needed in the future.

Public Transit in the Baltimore Region

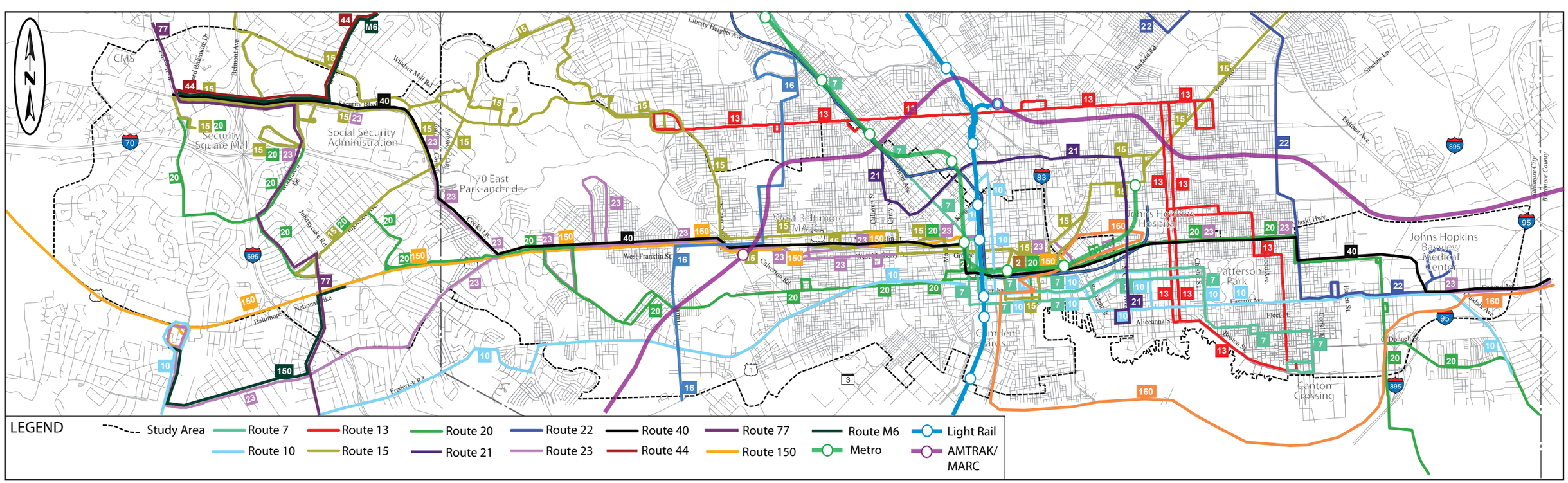
Baltimore's local and regional transit services include the Central Light Rail Line, Metro Subway (heavy rail), MARC (commuter rail), paratransit service for people with disabilities, and a comprehensive local and express bus network (see **Figure 1-9**).

- The MTA provides local and express bus service on over 55 routes that travel throughout the city of Baltimore, and Baltimore and Anne Arundel counties. MTA buses serve over 90 million passengers annually at more than 5,000 stop locations. These routes include major radial routes, cross-town routes, circumferential routes, as well as local circulator routes. Commuter bus services connect Baltimore City with Baltimore County, Anne Arundel County, and other regional locations.
- The 30-mile Central Light Rail Line (Light Rail) travels in a north-south direction from Hunt Valley in Baltimore County to Glen Burnie in Anne Arundel County. It has connections to both Penn Station and BWI Airport. The Light Rail crosses the Red Line Corridor as it travels along Howard Street. There are 32 stations along the Central Light Rail, many of which have parking available, or are designed to include access to connecting bus stops. The Light Rail carries over 8 million passengers each year.
- The 15½-mile Metro Subway (Metro) travels in a northwest to southeast direction from Owings Mills in Baltimore County to downtown Baltimore, continuing northeast from downtown to Johns Hopkins Medical Center in east Baltimore City. The Metro travels through the Red Line Corridor in a tunnel along Baltimore Street, with stations at Lexington Market, Charles Center, and the Shot Tower. The system provides service to over 15 million passengers a year. A one-way trip from end-to-end along all 14 stations takes half an hour. A Green Line Study is underway examining a possible extension of the Metro north of Johns Hopkins Station.
- The regional MARC system consists of three commuter rail lines that serve Baltimore City, eight counties in Maryland, Washington DC, and northern West Virginia. MARC carries in excess of 30,000 riders each day, most of whom are headed to Washington DC or to Baltimore City. MARC serves Baltimore with two lines, the Camden and Penn Lines. There are three MARC stations in Baltimore City: Camden Station, West Baltimore Station, and Pennsylvania Station at the northernmost limit of the central business district. Like most suburban MARC stations, these downtown MARC stations have park-and-ride lots. MARC ridership is growing, and plans are underway to increase the number of trains traveling on the Penn, Camden and Brunswick lines. A station at Bayview is also being studied for the Penn Line. This would result in two MARC stations located within the Red Line Corridor.
- For transit riders who have a disability that prevents them using the transit services described above, MTA provides a curb-to-curb accessible service. The MTA transports nearly 145,000 passengers each year in lift-equipped mobility vans, vans and taxis.

Public Transit in the Red Line Corridor

Eight bus routes (Routes #7, 10, 13, 15, 20, 23, 40, and 150) provide east-west service in the corridor and serve over 82,000 passengers per weekday. Three of these eight routes (15, 20 and 23) have the highest ridership in the MTA bus network. Route 23, which closely follows the route of the proposed Red Line, carries the largest number of passengers of the entire MTA bus network

Figure 1-9: Existing Transit Services



with an average weekday ridership of over 19,000.[1] Route 15, which serves the Social Security Administration and Westview Mall and runs to downtown Baltimore (with some service continuing on to Perry Hall and White Marsh), has the second highest ridership of any MTA bus route, with an average of over 16,000 riders every weekday. Route 20 travels the corridor between Security Square Mall and Dundalk along Baltimore and Fayette Streets, a few blocks south of Routes 23 and 15. Route 20 carries an estimated 10,800 riders each day.

MTA's Quickbus 40 is a new route that closely follows the Red Line corridor, providing frequent, limited-stop service from Security Square Mall through downtown to Bayview, continuing to the Essex Park-and-Ride lot and further east along Eastern Avenue. In 2006, this route carried an average of 6,300 passengers per day.

The Red Line Corridor has bus, Metro, Central Light Rail and MARC train service on north-south routes that generally do not serve east-west trips along the corridor. The one exception: Metro serves some east-west trips through downtown in its subway portion.

Connections between existing bus routes in the Red Line corridor and the MARC, Metro, and Central Light Rail services are generally good. Bus stops are located as close as possible to nearby rail stations.

The MTA is has begun to include other amenities to the Quickbus service in addition to being a faster, limited-stop service. These include improved bus stops with lighted shelters, larger signs with maps of the bus routes, and a system that will provide real-time information on when the next bus will arrive.

The Red Line Corridor does contain an extensive bus network serving east-west travel. However, while travelers in other parts of Baltimore have a choice between automobile travel and fast and reliable rail service, public transit for those traveling east-west along the Red Line Corridor is generally limited to buses that move slower than general traffic. Local and express buses in Baltimore travel on roads shared with other vehicles. Buses are subject to the same traffic signals and traffic congestion as the other vehicles. With time spent at bus stops, bus travel in the corridor is slower than travel by private automobile. The fact that ridership is so high in the Red Line Corridor, despite bus travel being slower than automobile travel, emphasizes the strong transit market in this corridor.

1 This ridership estimate predates the new Quickbus 40 bus line. It is likely that some of these 19,000 riders are currently riding on Quickbus 40 buses.

Roads

I-695 is a beltway around Baltimore. It bisects the Red Line Corridor on the west side.

The major east-west roads in the corridor are:

- I-70 is a major interstate which terminates at a park-and-pool lot about two miles east of I-695.
- US 40 enters the Red Line Corridor from the west as the Baltimore National Pike. It merges into Edmondson Avenue, and turns on Franklin Street before traveling along a section of road that was originally constructed to be part of an extended I-70. Through downtown, US 40 splits into two one-way roads, Franklin Street and Mulberry Street, before combining back into Orleans Street. US 40 becomes Pulaski Highway as it heads northeast out of the corridor.
- MD 122 (Security Boulevard) parallels I-70 to the north to serve the large CMS and Social Security Administration areas on both sides of I-695, as well as providing access to Security Square Mall.

The major north-south roads in the corridor are:

- I-895 travels through Baltimore in a northeast-southwest direction, bisecting the Red Line Corridor near the Bayview Medical Center on the east side. I-895 crosses under the Patapsco River through the Harbor Tunnel.
- I-395 branches off I-95 to provide direct access to downtown Baltimore.
- I-83 is an interstate roadway from the north that terminates at the Baltimore central business district on President Street.
- US 1 is a major road from the northeast to southwest that traverses the corridor west of the Baltimore central business district. US 1 has a one-way pair of lanes through the corridor, traveling on Fulton Avenue and Monroe Street, both of which are two lane roads.

Major downtown thoroughfares include:

- President Street is a four to six lane road and the terminus of I-83. It is a two-way street, which runs in a north-south direction and provides a connection to Eastern Avenue and Fleet Street.
- Charles Street is a two to four lane street that runs in a north-south direction through the heart of the central business district, then continues north of downtown. It is one-way northbound through the corridor.
- Central Avenue is a two-lane, two-way street that runs in a north-south direction.
- Broadway is a multi-lane, two-way street that runs in a north-south direction.
- Baltimore Street is a three to four-lane street that runs one-way in the eastbound direction. It has restricted parking in the curb lanes between Martin Luther King, Jr. Boulevard and President Street and two lanes traveling in both directions east of President Street.
- Lombard Street has two to six lanes that travel one-way in a westbound direction.
- Fayette Street is a two to four lane street that mainly travels one-way in a westbound direction.
- Pratt Street has two to six lanes that travel one-way in an eastbound direction.

Other important roadways in the corridor include:

- Cooks Lane is a two-lane, two-way residential street with on-street parking. It is critical to traffic movement in the corridor, serving as a key link between I-70 and US 40/Edmondson Avenue.
- Rolling Road is a four-lane north-south roadway located near the far western side of the Red Line Corridor. This roadway provides a parallel route to I-695 on the west side.
- Martin Luther King, Jr. Boulevard: I-395 exits onto this six-lane, north-south road on the west side of the central business district.
- Eastern Avenue is an east-west road that travels from the Inner Harbor to the eastern end of Baltimore County. It is MD 150 along much of its length. I-95, I-895 and I-695 (east) each have exits on Eastern Avenue, providing important links to downtown. Within the corridor, two of Eastern Avenue's four lanes are used for parking.
- Fleet Street is a two-way road that travels east-west from the Inner Harbor to Bayview. It is not continuous due to the rail tracks paralleling I-95. Parking is allowed on two of the street's four lanes because of the lack of available off-street parking in this older section of Baltimore.
- Boston Street is a four-lane two-way road that serves as a key entryway to the Canton area.

The current transportation network in the western portion of the corridor does not adequately address the existing demand for travel between I-70 and downtown Baltimore. The presence of high-density residential neighborhoods and sensitive resources (such as large parks and cemeteries) make it difficult to provide an efficient transportation network in the corridor. The original interstate highway plan for Baltimore included the continuation of I-70, the major connecting freeway from the west, into downtown. In anticipation of the extension, a 10-block section of western downtown Baltimore was razed, displacing hundreds of residents. In its place, a six-lane freeway was planned to connect with the future I-70. A short segment of highway was constructed but the planned extension was abandoned partly because it would have traveled through Leakin Park and Gwynns Falls Park, both of which are considered prime parkland. Since the highway also would have traveled through established residential neighborhoods, the connecting link between I-70 and downtown was never completed. Today, I-70 ends approximately two miles east of I-695 and about five miles from the central business district.

Without a major connecting link between I-70 and the central business district, motorists are forced to use US 40 from the west. US 40 is generally a six-lane divided road, with narrow lanes and a posted speed of 30 mph. Four roads and their corresponding traffic merge onto US 40 west of Edmondson Village; traffic from Security Boulevard and I-70 via Cooks Lane; traffic from US 40 west from western Baltimore and Howard County; and traffic from Edmondson Avenue, serving northern Catonsville.

Where these four road networks meet, current traffic is 56,000 vehicles per day, leading to reduced speeds and delays during morning and afternoon rush hours. It is projected that daily traffic on Edmondson Avenue/US 40 will rise to 63,000 vehicles per day in 2030, leading to increased congestion and delay.

As US 40 moves into downtown Baltimore, the road network becomes a one-way grid pattern with numerous traffic signals between short blocks. Traffic volumes are high, leading to slow travel speeds. Vehicles trying to move through road intersections are hindered by the high demand along both north-south and east-west travel routes.

East of downtown Baltimore, I-95 skirts south of the central business district. Motorists from the heavily residential northeast suburbs accessing I-95 must decide between using congested US 40 or lesser arterial and city streets, including Eastern Avenue and Fleet Street, both of which are two-way streets with one-lane operating in each direction or substantially increasing their travel distance by going through one of the tunnels. Eastern Avenue, which becomes MD 150, provides a direct link to downtown from I-95, I-895, and I-695. Both Eastern Avenue and Fleet Street carry about 1,000 vehicle trips during the peak hours. Even with only one lane operating in each direction, Eastern Avenue and Fleet Street each carry about 14,000 vehicles per day.

Other streets on the east side, such as Boston Street, are experiencing traffic growth both due to the redevelopment of the Canton area and more trips into the growing downtown area. This creates congested traffic conditions that result in an increased cost of doing business along the respective routes and, for residents, a diminished quality of life due to longer travel times.

The Bayview Hospital area is served by Lombard Street. Additional interchange movements have recently been provided from I-895 to Lombard Street to increase access to the area. Motorists from the central business district must use many of the local streets to access the Bayview area.

Carpooling and Park-and-Ride

There is one park-and-ride facility in the corridor for commuters. The Westside Skill Center Park-and-Ride lot, located on Edmondson Avenue at N. Athol Avenue, has 247 spaces. Four bus routes (20, 23, 40, and 150) serve riders who use the park-and-ride. There is also a park-and-pool lot located at the end of I-70 near Cooks Lane. Residents use this lot for carpool trips but MTA buses do not serve it.

Five bus routes serve travelers entering the corridor from the east who use the Essex Park-and-Ride lot on Eastern Street near Virginia Avenue. Three of these bus routes head to downtown including Route 23, Quickbus 40, and Route 160. Route 160 runs express buses via I-95, bringing riders to downtown through the Fort McHenry Tunnel.

The MARC Penn Line and Route 160 to downtown serve a park-and-ride lot at Martin State Airport, for commuters traveling from further east.

Bicycle and Pedestrian Facilities

Figure 1-10 shows the bicycle and pedestrian facilities in the corridor. As of 2006, there are 4.7 miles of on-street bike lanes, 13.8 miles of off-street bike paths, and 2.3 miles of signed bike lanes in the City of Baltimore. The Gwynns Falls and Jones Falls trails are two of the facilities that make up the greater bicycle network. The Gwynns Falls Trail is complete while only one mile is complete of the eight-mile long Jones Falls Trail.

There is a signed bike route between the Inner Harbor and Fort McHenry, and bike lanes exist along Bayard, Bush, Ridgely, Ostend and Warner connecting to the Gwynns Falls Trail. MTA accommodates bicycles on the Light Rail and Metro, and folding bikes are allowed on MARC. Most MTA rail stations have bike parking and/or bike lockers. The Bicycle Master Plan proposes a 450-mile on-street and off-street network to be rolled out in several phases. The first phase has an implementation date of between 2006 and 2010.

Pedestrians and bicyclists share these multi-use trails. For example, the Gwynns Falls and Jones Falls trails have multi-use hiker-biker trails.

Description of Other Transportation Improvements

The projects included in the Baltimore Regional Transportation Board's. Constrained Long Range Plan (CLRP) are listed in Table 2-2 in Chaper 2. These projects on the CLRP are included in the regional travel demand model and are part of the definition of the Red Line No-Build Alternative.

The Red Line Corridor Transit Study must consider other transportation improvements occurring in the corridor. **Table 1-4** and **Figure 1-11** highlight the programmed and planned transportation projects in the corridor. The programmed projects are currently funded in Baltimore City's capital plan, or are included in Baltimore County's

Figure 1-10: Bicycle and Pedestrian Facilities

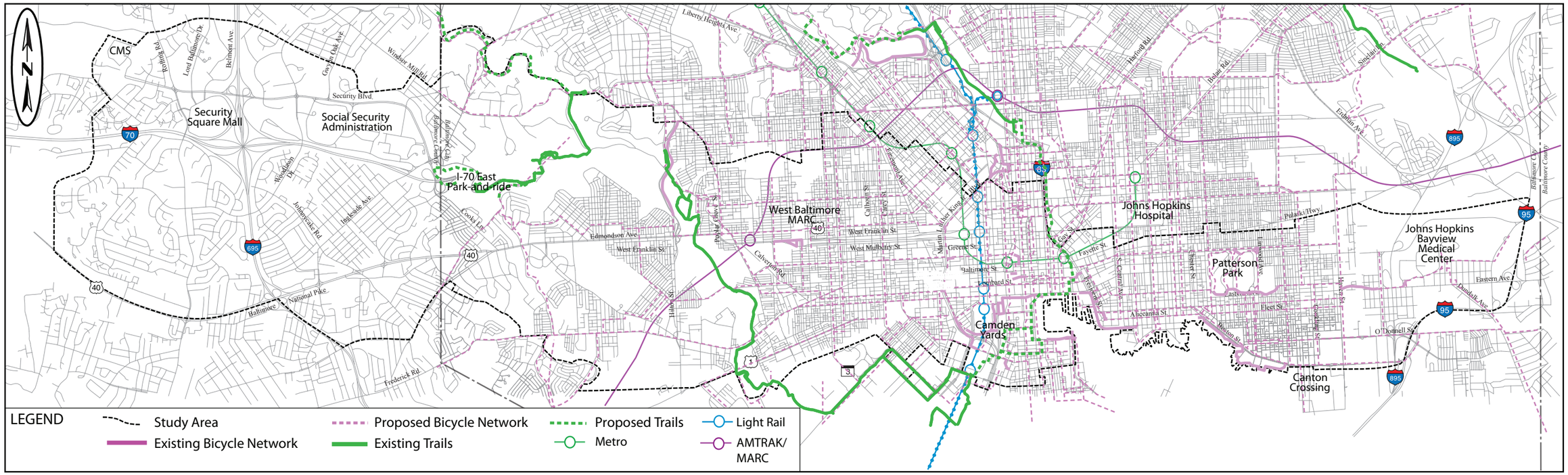


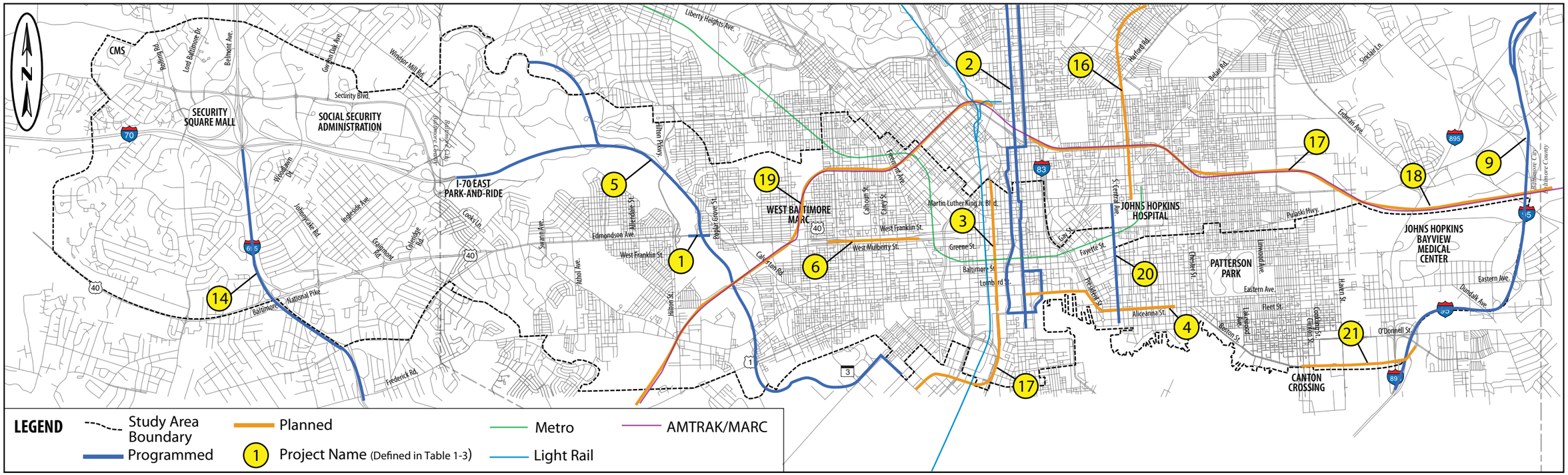
Table 1-4: Planned and Programmed Transportation Projects

#	Project Name	Project Description
1	Edmondson Avenue Bridge Reconstruction	Replace and widen bridge over Gwynns Falls
2	Charles Street Trolley	Study to construct trolley line between Federal Hill and Johns Hopkins University in Charles Village
3	Light Rail Signal Improvements	Signal improvements along the Central Light Rail Line corridor
4	Downtown Shuttle System	Study of shuttle buses to serve downtown Baltimore and Harbor East/Fells Point Area
5	Gwynns Falls Trail Phase II/ III	Bike/Pedestrian trail from West Baltimore to the Inner Harbor
6	US 40	Pedestrian path and landscaping from Monroe to Poppleton Streets
7	*Baltimore Harbor Tunnel Thruway (I-895)	Canton Viaduct Bridge replacement
8	*I-95, I-895 and I-695 Harbor Crossings	Traffic Management Study
9	Fort McHenry Tunnel (I-95)	Bridge, Roadway and Signage Rehabilitation on I-95 North of Tunnel
10	*Carroll Camden Access Study	Study to improve access to the Carroll Camden development area and improve safety and operations along I-95 between Washington Boulevard and I-395
11	*Fort McHenry Tunnel (I-95)	Bridge, Roadway and Signage Rehabilitation on I-95 South of Tunnel
12	*Fort McHenry Tunnel (I-95)	Higher Speed Toll Plaza Modifications
13	*Express Toll Lane Initiative	Feasibility study to add high-speed toll lanes on Baltimore Beltway (I-695) from I-895 to US 40
14	Baltimore Beltway (I-695)	Study to upgrade to 8-lane freeway from I-95 South to Security Boulevard
15	*Baltimore Beltway (I-695)	Widen to 8 lanes from I-83 North to I-95 North
16	Green Line Study	Study from Johns Hopkins Metro Station to Morgan State University
17	MARC System Improvements	Upgrade service, capacity, and facilities
18	Bayview MARC Station	New station
19	West Baltimore MARC Station	Relocation of station, parking facilities, transit-oriented development at station area
20	Central Avenue Reconstruction	Reconstruct Central Avenue between Lancaster Street and Monument Street
21	Boston Street Alignment Study	Study additional capacity from I-95 to Boston Street

**Regionally important projects located outside of the corridor map boundary.*

Sources: Maryland Department of Transportation Consolidated Transportation Program 2007-12.
Baltimore City website www.ci.baltimore.md.us/government/dpw/transportation.htm,
www.baltimorecity.gov/government/planning/cip.php#reportsmaps
Baltimore County Master Plan 2010.
Transportation Outlook 2035 Draft Long - Range Transportation Plan.
Baltimore Metropolitan Council.

Figure 1-11: Planned & Programmed Transportation Projects



Capital Improvement Program (CIP) or the Maryland Department of Transportation's six-year Consolidated Transportation Program (CTP). The CTP includes projects from MDOT and its agencies (including MTA and SHA), as well as Maryland's 24 political subdivisions, including Baltimore City and Baltimore County. Other projects are planned, but are not currently funded in any of these capital programs.

Of all the improvements listed in **Table 1-4**, the widening of I-695 and the improvements to I-95 would have the largest impact on automobile travel in the Red Line Corridor. The impact of these improvements is that it will be easier for motorists to reach the boundaries of the City and will assist in reducing the growth in the number of commuters who use I-70, Cooks Lane and US 40 to reach downtown from the west. These improvements would make it easier for drivers from the west to enter downtown via I-695, I-95 and I-395, avoiding the congestion from limited capacity on the I-70/Cooks Lane/US 40 route.

The Green Line Study proposes extending high-quality transit service from Johns Hopkins Metro Station northeast to Morgan State University. This would have little impact on the east-west travel in the Red Line Corridor. The ongoing improvements to the Central Light Rail Line, as well as the Charles Street Trolley project currently being studied by the Charles Street Development Corporation, also would be improvements in north-south travel.

The MARC improvements would improve transit service, and, with the addition of a station in the Bayview area, would provide a new transit option for residents, visitors, and workers along Red Line Corridor.

Bicycle and pedestrian path improvement projects could increase the use of existing or future transit in the corridor by making it easier, faster, and/or safer for nearby residents to get to transit stops.

Overall, however, these improvements would not provide a reduction in travel times along much of the Red Line Corridor in 2030. This is due partly because there are no capacity improvements scheduled for the major east-west roads in the corridor (such as US 40 and Eastern Avenue). In addition, travel demand is expected to outstrip the ability of these roadway improvements to accommodate the new traffic.

Current and Future Transit Performance

Existing transit services in the Red Line Corridor fare no better than automobile travelers as the buses are subject to the same traffic congestion and slow travel speeds. In addition, substandard lane widths and poor road conditions in the curb lane result in poor bus ride quality. Express bus service from Howard County has been reduced in recent years in response to declining ridership – an indication that transit in the corridor is not meeting user needs for the long-distance traveler. **Table 1-5** shows Quickbus 40 travel times between selected locations in the corridor.

Buses operating on US 40/Edmondson Avenue average less than 11 mph over the majority of their route due to frequent stops and traffic congestion. Automobile speeds on this road range from 10 to 30 mph depending on location. Buses, with their frequent stops, have longer travel times than other vehicles. This results in long commutes for transit passengers from the corridor headed downtown as well as for reverse commuters to the Social Security Administration complex and area businesses. For example, local buses take 26 minutes to travel the four-and-a-half miles between Edmondson Village and Howard Street downtown. Express service shaves only four minutes from that time. Traveling the 13-mile reverse commute from Highlandtown to CMS would take over an hour. These slow bus travel speeds are not attractive to riders.

Reductions in express bus service from Howard County is due to declining ridership partly caused by long transit travel times. Commuters from the I-70 corridor and from the I-695 service areas to the north and south of I-70 do not have any transit options other than the bus service on existing congested streets, which have long travel times.

The reasons for choosing automobile travel over transit are personal and vary from household to household. These reasons can include: decreased speed or service levels on transit, increased incomes (making automobile ownership and travel more affordable), and travel destinations that are not easily accessible by transit.

Table 1-5: Current MTA Quickbus 40 Travel Times

From	To	Distance	Travel Time	Average Speed
Security Square Mall	Downtown (Charles Street)	10 miles	42 min	14 mph
Edmondson Village	Howard Street	5 miles	22 min	14 mph
Rosemont	Howard Street	3 miles	13 min	13 mph
Patterson Park	University Center	3 miles	25 min	7 mph
Chester Street & Eastern Avenue	Howard Street & Baltimore Street	2 miles	19 min	7 mph
Poppleton	Social Security Administration	7 miles	27 min	15 mph
West Baltimore MARC Station	CMS	8 miles	32 min	14 mph

Note: Local bus service in the corridor has longer travel times

If no improvements are made to east-west transit service in the Red Line Corridor, future transit service levels would likely be similar to today's, with travel times likely longer because of the projected increase in traffic. Proposed improvements such as the QuickBus program would improve ride quality and passenger service, and could slightly reduce travel times by reducing the number of local stops on some routes.

Current and Future Highway Performance

Peak-period congestion is present throughout the corridor. Beginning on the west side, a number of highways converge from the west as they head downtown. Cooks Lane is a two-lane road with on-street parking. During peak-periods, traffic from two major roads, I-70 and Security Boulevard, feeds into this two-lane road that connects to US 40, making Cooks Lane congested.

US 40 is congested with traffic from Cooks Lane joining Baltimore National Pike/US 40 traffic headed east. The road width and right-of-way along US 40 itself narrows as it enters an older part of Baltimore. This portion of the corridor, US 40 from Edmondson Village to Rosemont, is largely residential, with older rowhouses fronting the street. Narrow sidewalks, utility poles immediately adjacent to the street, front steps of residences located against the sidewalk in some areas, high pedestrian volumes, on-street parking during off-peak hours, and the presence of numerous cross streets, many of them signalized, all result in slow travel speeds and long travel times along this portion of US 40.

The heavy traffic congestion and slow travel speeds discourage many west-side commuters from using US 40. These drivers instead use I-695 and I-95 to access downtown via I-395, adding to the heavy traffic already clogging those highways.

Even with the widening of I-695 and the implementation of the other planned and programmed road improvement projects, the western half of the corridor would still have to support growing amounts of future traffic. Future traffic growth in the range of 15 percent by 2030 is projected for Cooks Lane and US 40, making them even more congested than they are now. Currently Cooks Lane carries 22,000 vehicles, with Edmondson Avenue carrying over 50,000. In 2030, Cooks Lane is expected to carry 25,000 vehicles, with Edmondson Avenue's daily traffic growing to over 60,000.

Downtown Baltimore is congested due to the high traffic volumes and the demand for both north-south and east-west travel, causing slow speeds on all major streets. Large numbers of vehicles making turning movements in this densely developed part of the corridor also contribute to delay. By 2030, Lombard Street and Fayette Street are expected to carry about 25 percent more traffic than today, with Fayette Street projected to carry 28,000 vehicles per day, and Lombard Street to carry 33,000. These east-west routes through downtown also carry the highest traffic volumes.

On the east side of the corridor, relatively large numbers of vehicles traveling on low-capacity roads cause congestion. For example, both Eastern Avenue and Fleet Street carry between 12,000 to 22,000 vehicles per day. These are two-way roads with one lane in each direction. Both streets allow parking with peak-hour, peak direction restrictions on both sides of the street due to the lack of driveways and off-street parking available in the area.

The closely-spaced intersections, numerous traffic signals, narrow lanes, and only one lane operating in each direction causes slow traffic speeds along Eastern Avenue and Fleet Street. Vehicles that need to make left turns or park cause slower speeds and increase delays, as there is no safe way to move past these vehicles. Vehicle speeds and travel times will be even slower in the future than today, not only due to the residential and commercial development that is underway, but also from the expected growth in travel to downtown. For example, Boston Street, already congested today, is expected to grow 33 percent over current vehicular traffic levels by 2030.

Level of service (LOS) measurements rate how well traffic operates on a given street or at an intersection. LOS is a measure of expected travel delay, driver discomfort, and congestion. An analysis of LOS determined how well traffic operates in the Red Line Corridor. A rating scale, using the letters A through F, describes the amount of delay or congestion that drivers experience. Like the grading scales used in schools, A is the best grade and F is the worst. The letter A represents free flowing traffic conditions through the letter F, which represents stop-and-go traffic conditions. **Table 1-6** shows the locations of congestion that occur during the PM peak period at a number of intersections in the corridor. This table presents a sample of corridor intersections, showing that congestion will worsen as 2030 approaches, due to the growing traffic levels.

Potential Transit Markets

The Red Line would serve people who want to travel east to west within the Corridor. However, as part of a larger network, the Red Line also can serve many more people living or working outside of the corridor. This section describes the places that would benefit from the Red Line, both inside and outside of the Corridor.

Four distinct travel markets would directly benefit from transportation improvements within the Red Line Corridor:

1. **Residents** of the corridor traveling to downtown as their final destination, or transferring from the transit services that link to regional destinations such as BWI Airport, Aberdeen Proving Grounds, and Washington DC.
2. **Commuters** headed into the Red Line Corridor from the east or west. West of the corridor, this includes commuters from the I-70 corridor, including northern Howard County and southern Carroll County, and those areas served by the Baltimore Beltway (I-695), including the Liberty Road and Rolling Road corridors and the Catonsville area. Commuters headed downtown from eastern Baltimore County and Harford County enter the corridor via I-95, I-895, Eastern Avenue, Pulaski Highway/US 40, and Dundalk Avenue.
3. **Reverse commuters** to the large Social Security Administration complex in Woodlawn, the CMS (Medicare) processing center, Security Square Mall, and surrounding businesses coming from residential areas in Baltimore City.
4. **Commuters, patients and visitors** headed to the many hospitals and other medical centers in the Red Line Corridor.

Other travel markets would benefit as well, as the Red Line would connect with two MARC stations (West Baltimore and proposed Bayview), the Central Light Rail (which runs along Howard Street downtown), and at least two downtown Metro stations (Charles Center and Shot Tower), providing new transit connections between destinations throughout the region, including BWI Airport, Aberdeen Proving Grounds, and Washington, DC. BRAC-related growth on and near the Aberdeen Proving Grounds may create a greater ridership, in a reverse commute direction, for those who choose to live in Baltimore and work at the military base.

Residents Traveling to Downtown

Downtown contains a wide variety of attractions, which draw in travelers from near and far in every direction. These attractions include jobs, government offices, museums, libraries, colleges, hospitals, restaurants, shopping, theaters, sports arenas, the convention center, and the Inner Harbor entertainment district. Travelers also head downtown to transfer to MARC, the Baltimore Metro, Amtrak, the Central Light Rail line, and local or long-distance bus services. The Red Line would also serve the tourists and special events in downtown.

Although the Baltimore Metropolitan Council found that the percentage of person trips using transit into the central business district has remained relatively steady over the last six years, there is a need to reduce the number of trips by vehicles with only one person inside, also known as single occupancy vehicles. The number of trips made by single occupancy vehicles into the central business district leads to congestion that affects buses and other vehicles that must travel along the same roads. As the on-going downtown revitalization spreads east to Fells Point, Canton, and west to the University of Maryland area, the downtown population and workforce will continue to expand and require enhanced mobility in the Red Line Corridor.

Commuters from Surrounding Areas

Travel demand to suburban residential and employment locations has increased in the region. These outlying locations make it increasingly difficult for the existing transit service to serve these dispersed outlying locations.

The Brookings Institute's report, *Baltimore in Focus: A Profile from Census 2000* indicated that suburban population in the region grew by 35 percent between 1980 and 2000 and 89 percent of new international immigrants in the Baltimore region settled in the suburbs. The Baltimore Metropolitan Council's population estimates anticipate employment in suburban jurisdictions of the Baltimore Region to increase by 25 percent between 2000 and 2030. Baltimore City employment shows an almost 10 percent increase. The Brookings Institute reports that, in 2000, 51 percent of commuter trips in the Baltimore region began and ended in the suburbs, and 55 percent of all regional commuters are driving alone.

I-70 west of I-695 carries nearly 92,000 vehicles per day. This volume drops off rapidly at the I-695 interchange with less than 25,000 motorists continuing along I-70 to the east. I-70 motorists have numerous destinations along I-695, including employment centers along I-695 as well as interstate commuting. A large number

Table 1-6: Sample of Traffic Levels of Service During PM Peak Hours

Intersection	Level of Service (2006)	Level of Service (2030)
Edmondson Avenue at Swann Avenue	B	C
Edmondson Avenue at Franklintown Road	C	C
Security Blvd (MD 122) at Rolling Road	E	E
Security Blvd (MD 122) at Woodlawn Drive	D	E
Security Blvd (MD 122) at Ingleside Avenue	E	E
President Street at Lombard Street	D	F
I-83/President Street at Fayette Street	F	F
Boston Street at Aliceanna Street	D	F
Martin Luther King, Jr. Blvd and Saratoga St.	F	F
Martin Luther King, Jr. Blvd and Baltimore St.	F	F
Martin Luther King, Jr. Blvd and Lombard St.	F	F

Source: Red Line Corridor Transit Study, Traffic, Parking & Transportation Technical Report, 2007

WHAT DOES CONGESTION COST?

The Texas Transportation Institute's (TTI) 2005 Urban Mobility Report illustrates Baltimore's commuting problem: Baltimore ranks as the 17th worst city in the nation for growing traffic delays. In 2003, car travelers spent an extra 50 hours a year sitting in traffic. This is in comparison with all other areas, which see an average of 47 hours. This also compares to just nine hours of annual traffic delays in 1982.

According to the TTI, the 2003 delays mean that 59.7 million hours of travel time are wasted in gridlocked traffic in Baltimore and 40 million gallons of fuel are needlessly consumed when considering an average of nearly 27 million gallons. The region's yearly "congestion cost" exceeds $1 billion versus the $742 million average. The region's "congestion cost" equates to $395 per year that is paid by each Baltimore area resident due to congestion.

of commuters use I-695 to reach downtown Baltimore via I-95 due to the congestion on the I-70/Cooks Lane/US 40 route. East of the corridor, thousands of travelers enter the corridor daily from I-895, I-95, Eastern Avenue, Pulaski Highway/US 40, and Dundalk Avenue. I-895 alone carries 72,000 vehicles per day along the Harbor Tunnel, dropping off to 54,000 north of the corridor.

Residents of areas along the I-70 and I-695 corridors on the west, as well as commuters from the east, would be able to take advantage of improved Red Line transit to travel downtown. The availability of transit service that could travel faster than regular traffic would allow drivers to park at park-and-ride lots near stations on the western or eastern end of the corridor, and take a fast transit trip to downtown, instead of wasting time and fuel traveling along existing highway routes to downtown.

Reverse Commuters to SSA, CMS, Security Square Mall, and Surrounding Businesses

Travel demand to suburban residential and employment locations has increased in the region. The Baltimore Metropolitan Council estimates that employment in suburban jurisdictions of the Baltimore Region will continue to grow by 25 percent between 2000 and 2030. Currently, transit does not effectively serve major suburban employment centers in the Baltimore region, making access to jobs difficult without an automobile.

Total employment along Security Boulevard is over 32,000 today. This is expected to grow to over 40,000 jobs by the year 2030. Transit improvements in the Red Line Corridor would connect to the Social Security Administration and other employment centers in western Baltimore County providing Baltimore City residents with travel options for accessing jobs and public services in this area without using a car.

Medical Facilities

Transit improvements would benefit the many hospitals and health care facilities in the corridor by providing faster travel times during commuter peak periods, as well as in other ways. Many hospitals have limited parking, or set aside too much land and other resources for parking facilities. Increasing the number of visitors, patients and staff who arrive by transit would free up these resources for use in health care. In addition, patients who cannot drive after a medical procedure may need transit. Transit can also be a vital connection for transit dependent patients and visitors.

Medical facilities operate around the clock, and generate a large number of trips each day. As an example, the Bayview Medical Center campus, which includes the hospital, research facilities, and doctor's offices, has about 6,300 employees who serve 500,000 patients each year. Add visitors and deliveries, this becomes a destination for thousands of trips each day. Trips will increase in the future, as total campus employment is expected to reach 12,000 by 2030.

Agency Transportation Goals

The Red Line Corridor Transit Study is the result of state, regional, and local government agencies working together. All of these agencies have goals for the Red Line Corridor and most of them overlap. This section outlines the goals of these agencies and how they can be considered together.

Agencies Involved in Transportation Planning

There are a number of local, state and regional agencies involved with the transportation planning process in the Baltimore region. The agencies involved in the process include:

- Maryland Department of Transportation (MDOT)
- Maryland Transit Administration (MTA)
- Maryland Transportation Authority (MDTA)
- State Highway Administration (SHA)
- Baltimore Regional Transportation Board
- Baltimore City Department of Transportation
- Baltimore City Planning
- Balimore County Office of Planning

Metropolitan Planning

Metropolitan Planning Organizations (MPOs) perform regional or metropolitan transportation planning tasks in urbanized areas with a population over 50,000. The MPO for the Baltimore Region, which encompasses the Red Line Corridor, is known as the Baltimore Regional Transportation Board. MPOs are responsible for developing long-range transportation plans and a four-year Transportation Improvement Program (TIP) for the area. The TIP is expected to be consistent with long-range plans and include all projects in the metropolitan area that are proposed for funding with federal revenue. The Red Line project is in the TIP as a current planning project, with construction estimated in 2010 if federal funding can be secured.

Statewide Planning

Each state is responsible for the statewide transportation planning process within its jurisdiction. MDOT is the agency that develops transportation policy for the state. Under MDOT are several administrations including the MTA, which oversees transit facilities and services, and the SHA which oversees state highway facilities and services. MDOT, with assistance from its administrations, produces the 20-year Statewide Transportation Plan and the four-year Statewide Transportation Improvement Program (STIP). Projects which will be implemented in the next four years with federal funding are listed in the STIPs.

Statewide Goals

MDOT has outlined the following four statewide goals in their 2006 *Annual Attainment Report on Transportation System Performance*:

Goal 1: Efficiency

This goal aims to extend the useful life of existing facilities and equipment as well as maximize the operational performance and capacity of existing systems.

Goal 2: Mobility

This goal aims to address congestion by adding key links in the transportation system and addressing system needs with cost-effective options.

Goal 3: Safety and Security

This goal aims to reduce the number of injuries, fatalities and risks and ensure the security of the public.

Goal 4: Productivity and Quality

This goal aims to reduce the time required for project implementation, to incorporate environmental stewardship into all projects and activities, and to contain costs and leverage resources using business-like organization and innovative approaches to funding and service delivery.

Regional Goals

The *Baltimore Regional Rail System Plan* has three main objectives for all planned and proposed transit lines within the region, including the Red Line. Those objectives are:

- To establish, over the next 40 years, a true system of rail lines that provides fast and reliable rail service between major activity centers in the region.
- To serve areas with the greatest concentration of population and employment.
- To make the most of [Baltimore's] prior transportation investments.

Of the six corridors discussed in the *Baltimore Regional Rail System Plan*, the Red Line is one of two corridors recommended highest priority for further study. There are 10 guiding principles of the Plan to achieve the overall objectives including "serve corridors with high concentrations of population" and "attract new riders to transit". These guiding principles are consistent with the City of Baltimore's *Transportation Strategic Plan*, discussed later in the chapter.

The *Baltimore Regional Rail System Plan* calls for the Red Line and the rest of the rail system to be as competitive with the automobile as much as possible with regard to speed and reliability. The Plan also calls for the system to attract new riders to transit and contribute to Maryland's goal of doubling transit ridership. The system must "serve major employment centers" as well as "major activity centers, universities, shopping centers, tourist attractions and entertainment centers".

The Plan requires rail lines to support existing land use and major targeted growth areas. It also calls for seamless movement throughout the system. The Plan requests the MTA and the private sector to establish an advocacy group to monitor the implementation of the Plan.

The implementation of the *Baltimore Regional Rail System Plan* also depends on funding. The Plan recommends that the MTA make "a compelling case for 'New Starts' funding," looking for new funding strategies, "working within the consolidated, multimodal structure of the Maryland Transportation Trust," and teaming with the private sector.

Baltimore County Goals

Baltimore County's *Master Plan 2010* recognizes the Woodlawn Security area, located north of I-70 as an Employment Center. As such, the County government will continue "to attract major new investment" to areas like Woodlawn Security. The same area is also within the County's larger Southwest Revitalization Area. In addition, the Master Plan calls for transit, as well as pedestrian and bicycle transportation. Interconnectivity is the key, according to the document: "Intermodal connections are important when providing transit service - if the links are not continuous, it becomes inconvenient and impractical for people to use."

Baltimore City Goals

The City of Baltimore Comprehensive Master Plan (Adopted June 15, 2006) highlights goals for the city over the next six years. The Plan organizes its discussion into four topics that are important to a high quality of life in the city: "Live", "Earn", "Play", and "Learn". Transportation is an integral part of the Master Plan including Goal 3 of the Learn section "Improve Transportation Access and Choice for City Residents". This goal identifies the need to create a citywide pedestrian plan, and intermodal transit hubs. It also calls for support of the *Baltimore Regional Rail System Plan* (and its Red Line and Green Line priority routes). Goal 3 for the Earn section is "Improve Access to Jobs and Transportation Linkages Between Businesses," which calls for Transit-Oriented Development incentives for transit focal points such as the West Baltimore MARC Station.

Goal 3 of the Learn section, "Improve Transportation Access and Choice for City Residents", Goal 3 of the Earn section "Improve Access to Jobs and Transportation Linkages Between Business", and Goal 4 of the Learn section, "Ensure Safe and Convenient Transportation to and from Education Facilities" all support the need for the Red Line project.

Finally, the Master Plan identifies the neighborhoods of Poppleton and Franklin Square as "Growth Promotion Areas" where additional capital and resources are required in order "to capture a substantial part of future State growth".

The Baltimore Department of Transportation has outlined the following eight goals in their 2003 *Transportation Strategic Plan*, the most current strategic plan that is available to the public.

Goal 1:

Develop a world-class transit system capable of connecting the communities of Baltimore to one another and to the region.

Objectives:

- Provide an optimized transit system.
- Increase usage of the local transit system to alleviate the need for additional road and parking capacity.
- Improve the capacity of the transportation network without detracting from the communities and corridors that they serve.

The Red Line is part of a larger rail plan, the *Baltimore Regional Rail System Plan,* connecting major activity centers in the area and allows seamless connectivity. The Red Line, as the region's first east-west transit corridor, would establish a connection integral for a region-wide transportation network.

Goal 2:

Modernize the transportation system to meet the future needs of Baltimore. Travel demand for east-west commuting is strong, and forecasts indicate that the demand will only get stronger.

Objectives:

- Improve the condition of the infrastructure.
- Reduce direct and indirect costs associated with maintenance backlog.
- Incorporate modern technologies throughout the existing system.

The Red Line would accommodate the growing demand and divert more commuters from the automobile to transit.

Goal 3:

Provide access and mobility for people and goods throughout Baltimore and its surroundings.

Objectives:

- Provide better mobility and accessibility for walking and bicycling.
- Reduce the need for automobile travel and improve the integration of the transportation system.
- Provide better regional access to neighborhoods and activity centers in Baltimore.
- Reduce travel times and travel costs for city residents, employers, visitors, and goods.

The Red Line would be a high-quality transit system with exclusive or semi-exclusive lanes to ensure faster travel times.

Goal 4:

Ensure optimum safety and security throughout the entire transportation system.

Objectives:

- Improve public perception of the security of transportation in Baltimore.
- Reduce the number of transportation-related crimes and incidents.
- Shorten the response times of emergency services.

The Red Line would explore safety measures including new and/or improved technologies and communications equipment.

Goal 5:

Support the economic development of Baltimore as an employment center and as a desirable place to live.

Objectives:

- Increase the attractiveness of transportation corridors.
- Improve access to businesses.
- Provide better transportation options for all ages.
- Reduce travel time for shopping/delivery of goods.
- Improve visitor and tourist access to attractions.

By connecting major employment centers and major destinations, the Red Line would serve as an incentive to employers to establish their businesses along the corridor and within the metropolitan Baltimore area.

Goal 6:

Support the sustainable development of the region and the preservation of Baltimore's cultural, social and natural resources.

Objectives:

- Balance transportation and land use.
- Reduce transportation impacts on natural, cultural and social resources.
- Improve the appearance and cleanliness of transportation systems.
- Improve air quality.

The Red Line would support existing land use and major targeted growth areas. The seamless movement of the Red Line would attract more automobile drivers to public transit. In turn, this could lead to fewer automobiles on the roads, reducing wear and wear on roads, reducing air pollution, among other things.

Goal 7:

Improve the quality and quantity of information communicated among all regional transportation stakeholders. Public involvement is not only encouraged, but the National Environmental Policy Act requires it. The same goes for government agencies, private sector companies, and private citizens.

Objectives:

- Provide informed transportation users, operators and providers.
- Provide open communication between all parties.
- Provide targeted information to the intended audience.

Goal 8:

Establish a sound and adequate funding base for transportation operations, maintenance and investment. A transit network is only as good as the funding it receives.

Objectives:

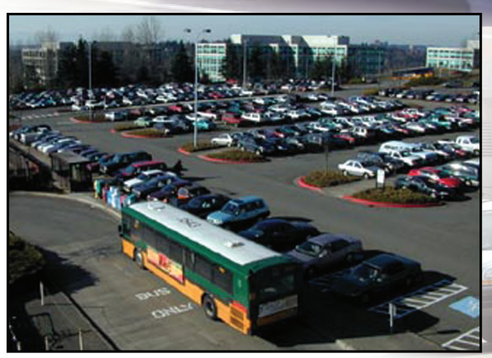
- Obtain sufficient funds to meet the needs on a timely basis.
- Allow for shared costs of providing transportation distributed among transportation users and providers.
- Maintain stable funds for ongoing maintenance, rehabilitation and replacement needs.

The Red Line would seek the appropriate funding programs to complete the project as efficiently as possible.

Volume I-Chapter 2

Alternatives Considered

RED LINE
Corridor Transit Study



Alternatives Development Process

Regional Context

There have been transportation system planning studies in the Baltimore Region, dating back as far as the 1960s, which have included enhanced public transit. **Figure 2-1** shows the most recent of these studies, the *Baltimore Region Rail System Plan,* which was developed in 2001-2002. This plan envisioned a transit system that enhanced access to jobs, education, shopping, recreation and medical care. The Rail System Plan connected the region's highest employment centers, 21 colleges, 18 hospitals, 16 museums, 13 malls, 8 theatres, 8 parks, 2 stadiums, and the Inner Harbor. The physical element of the Rail System Plan included six transit lines, 109 miles, and 122 stations. The Red Line was an integral part of this plan, with stations near major employment centers in downtown Baltimore, Inner Harbor East, the Social Security Administration complex, the University of Maryland professional schools, and the adjacent hospital complex; improved public transit for many Baltimore City and Baltimore County residential neighborhoods; connections to existing Metro, Light Rail and MARC stations; and proximity to recreational activity points of interest, such as Oriole Park at Camden Yards, M&T Bank Stadium and the Hippodrome Theater.

Figure 2-1: Baltimore Regional Rail Plan

The *Baltimore Region Rail System Plan* set the vision for a high-quality, regional transit system. This plan recommended that the Red Line be given high priority for project planning, which the MTA initiated with the Red Line Corridor Transit Study.

It is within this current planning phase that more detailed modes and alignments are being studied. In addition to the 2002 *Baltimore Region Rail System Plan*, the Red Line Corridor has long been a part of the *Baltimore Regional Transportation Board Constrained Long Range Plan*. This long range plan, mandated by the Federal government, is the official blueprint for transportation improvements in the region for the next 20 years. The plan is approved by the Baltimore Regional Transportation Board (BRTB), which is the official Metropolitan Planning Organization (MPO) for the Baltimore Region. The BRTB is comprised of lead elected officials from all of the local jurisdictions in the Baltimore region.

Red Line Corridor

Previous system planning studies for the Red Line Corridor did not recommend a specific mode for implementation (bus, Metro, light rail, or commuter rail), or a specific horizontal alignment (along a particular street, railroad or utility corridor), or a specific vertical alignment (at-grade, aerial structure, or tunnel). An alignment is the horizontal or vertical location of the transit route. Therefore, 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.

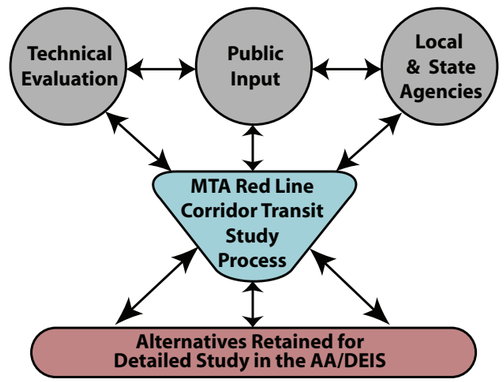
Figure 2-2 shows the general process for developing, refining and screening the alternatives for the Red Line Corridor Transit Study.

The development of alternatives has been an innovative process involving technical evaluation lead by the MTA study team, with input from the public, and from a wide range of local and state agencies. Public input and interaction has occurred through a variety of sources, including periodic corridor-wide workshops, meetings with individual community associations, as well as written and website correspondence. Chapter 7 in the AA/DEIS, provides a summary of public involvement activities and the Public Involvement Technical Report provides greater detail on the entire public involvement program.

In addition to public input, significant coordination was held with government agencies in the alternatives development process. Agency coordination is summarized in Chapter 7 of the AA/DEIS. The most significant coordination occurred in the alternatives development process through a Technical Working Group, which included representation from the Maryland State Highway Administration, Maryland State Planning, Baltimore City Department of Transportation, Baltimore City Department of Planning, Baltimore City Department of Public Works, Baltimore County Department of Planning, Baltimore Development Corporation, Maryland Department of Transportation, Baltimore County Office of Community Conservation, Baltimore County Department of Public Works, and the Maryland Transit Administration. This Technical Working Group met frequently (often every two weeks) throughout the alternative development process and helped to create, evaluate, and develop alternatives.

In terms of mode, the AA/DEIS focuses on bus and light rail. A more detailed description of bus and light rail modes is provided later in this chapter of the AA/DEIS.

Figure 2-2: Alternatives Development Process



Bus modes included in the study are Transportation System Management (TSM) and Bus Rapid Transit (BRT). Neither commuter rail nor Metro are included as modes in the AA/DEIS. Commuter rail is primarily applicable to longer distance travel from suburban or rural areas into higher density employment areas. The Red Line Corridor does not incorporate the distances appropriate to commuter rail. Metro was not included as a mode alternative due to its high capital cost and need for total grade separation. A prudent and feasible Metro right-of-way does not exist for an east-west Red Line alignment.

In terms of horizontal alignments, a wide range of alignments has been studied for BRT and Light Rail Transit (LRT). Many of these have been eliminated from further consideration. These eliminated alignments are shown on **Figure 2-6**. More detailed information on the rationale for their elimination can be found in the *Alternatives Technical Report*. The horizontal alignments which remain are presented in detail later in this chapter. The alignments are presented within nine geographic areas from the western limits of the project to the eastern limits. The alignments are separated into nine geographic areas for two main reasons. First, if the reader of the AA/DEIS has a primary interest in a specific area, they can focus on that area. Second, the reader can compare options within a geographic area (for example, Cooks Lane tunnel vs. Cooks Lane surface options, or Franklin Street surface option vs. US 40 lower level option).

In terms of vertical alignment, it is important to assess the costs and benefits of a full range of alignments, including at-grade, tunnel and aerial. Various vertical alignments are maintained in the study and are described in Volume II, organized by geographic areas.

Overall Alternatives

The Red Line Corridor Transit Study AA/DEIS examines a full range of alternatives from the No-Build (the present committed level of transportation improvements), to lower-cost upgrades of bus service, to more modest investments in shared-use routes, to major investments in dedicated guideway, grade-separated where necessary. This study will compare combinations of improvements that achieve the greatest gain, balanced with cost and potential impacts and benefits to communities and the environment.

The AA/DEIS analyzes the alternatives for their general benefits, costs, social, economic, environmental, and operational effects within the corridor. Each of the alternatives may have several options (such as tunnel segments or different route locations) that serve the same market. These options are described in more detail at the end of this chapter and in Volume II of the AA/DEIS.

All alternatives investigated for the Red Line Corridor follow a similar alignment, starting in the west at CMS (Centers for Medicaid and Medicare office complex) in Baltimore County and continuing in a general easterly direction passing by the Security Square Mall, the Social Security Administration, Edmondson Village, the West Baltimore MARC Station, along Martin Luther King, Jr. Boulevard, through the downtown Central Business District, Inner Harbor East, Fells Point and Canton, to Bayview.

The build alternatives under consideration would enhance and expand existing transit service by providing a higher speed, higher capacity transit system served by a more extensive feeder bus service.

Based on the system plans referenced above, as well as the discussion included on modes, alignments, and general concepts, four **overall** alternatives are included in the Red Line Corridor Transit Study.

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

These alternatives range from low-cost bus alternatives to higher-cost alternatives featuring various lengths of dedicated guideway. The No-Build alternative is required as an alternative to assess the impacts if no transit improvements are made in the corridor, beyond what are already programmed for improvement. The TSM/Enhanced Bus Alternative represents the lower investment bus alternative. The BRT and LRT alternatives represent the higher investment bus and rail alternatives. For the No-Build and TSM, there is effectively one option for each alternative. For the BRT and LRT alternatives, there are a wide range of options. These options are explained in greater detail in Volume II.

Modes Considered and Project Elements

Modes Considered for Build Alternatives

The densely developed nature of the Red Line Corridor requires transit to be flexible in how it operates and how it fits into the existing street network. Two transit modes are being considered for the build alternative of the Red Line Corridor: Bus and LRT. Two bus alternatives are included, TSM/Enhanced Bus and BRT. BRT and LRT vehicles provide flexibility since they can be used in exclusive rights-of-way, which reduces travel time and, if necessary, in mixed traffic, which reduces costs and impacts.

TSM/Enhanced Bus

Transportation System Management (TSM) involves relatively low-cost improvements to existing bus services on existing roads. Bus travel is made faster by dedicating one or more lanes for transit use along part or all of the corridor. Traffic signals can be upgraded to give buses priority over regular traffic at intersections. Stations are improved to enhance the transit experience, including shelters, park-and-ride lots, and some improvements to adjacent sidewalks.

Operationally, TSM adds new buses to increase service frequencies, and usually involves diverting some existing bus routes to simplify service or take advantage of proposed bus-only lanes. Improvements to feeder bus routes (buses that bring passengers to the corridor) are also included to strengthen the local transit network, extend the service area, and provide benefits to users outside the study corridor.

BRT

Bus Rapid Transit (BRT) is a versatile, rubber-tired transit mode that can be designed to operate like rail transit. BRT offers more flexibility than fixed rail transit because of the vehicle's ability to get on and off the guideway and serve other areas, such as residential neighborhoods. BRT vehicles can also drive around obstacles such as stopped buses or other vehicles. When buses operate in a combination of dedicated right-of-way, dedicated lanes, or protected right-of-way, with on-line stops, the service is similar to rail rapid transit.

BRT is basically a faster and more efficient version of traditional bus service. BRT buses will include diesel hybrid electric buses. This vehicle will be larger, allowing for more passengers and a more comfortable ride, as well as providing additional doors for faster boarding and alighting. Diesel hybrid electric buses produce fewer emissions, use less fuel, and operate more quietly than traditional diesel buses.

Existing BRT - Ruane, France

LRT

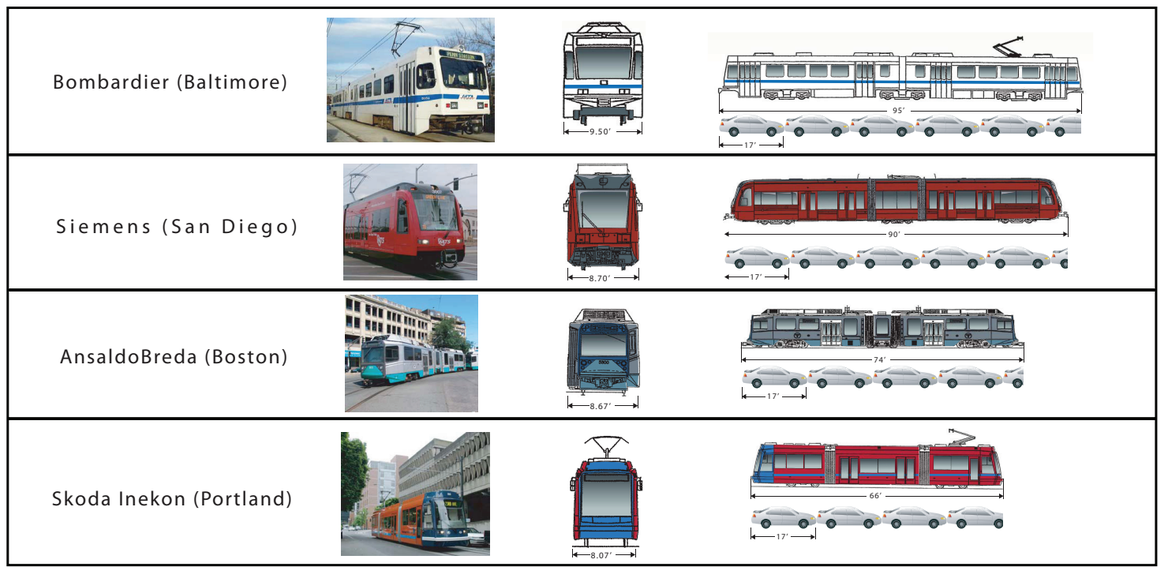
Light Rail Transit (LRT) is a mode of transportation that relies on trains operating on a fixed track. It differs from heavy rail (such as Metro) in that, rather than drawing its power from an electrified third rail, LRT is powered by overhead wires. This allows it to run above ground in mixed traffic, although it can have a dedicated right-of-way and run either in tunnel or on bridges.

LRT vehicles are typically larger than BRT vehicles and can operate in trains; therefore, fewer vehicles are needed to provide the same capacity.

Red Line Vehicles

The vehicles selected for the Red Line would be recognizable as different from any vehicle currently used by MTA. If BRT, it would be designed with a special theme or logo to stand out from other MTA buses. The "look and feel" of BRT buses can also be different than typical buses. The BRT vehicles would carry 90 passengers (versus 60 on regular buses). If LRT, the vehicles would be narrower and potentially shorter than the existing MTA light rail vehicle, allowing it to fit more naturally into local neighborhoods and existing streets. The LRT vehicles would carry 150 passengers.

Existing LRT - Portland, Oregon



Light Rail Vehicles in use in North Ameria

Project Elements

The Red Line Corridor Transit Study includes physical and operational elements which can apply to both BRT and LRT. Physical elements include a specific location for a horizontal alignment in a separate lane or along a curb lane, or within the second lane from the curb lane, or a specific vertical alignment (tunnel or aerial). Physical elements will also include park-and-rides, stations, storage and maintenance facilities, and traction power substations.

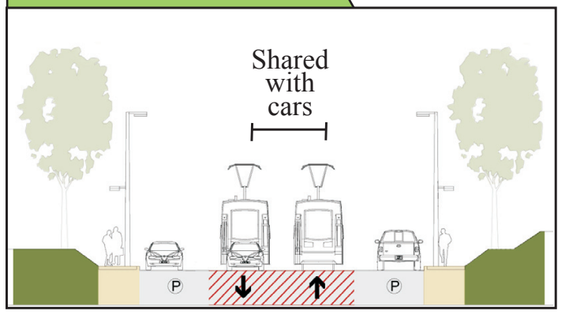
Operational elements include improvements to how the system will operate. These items include signal priority, queue-jumper lanes, "NextBus" real-time informational displays, frequency of service, hours of operation, and automated fare collections.

Physical Elements

At-Grade

The Red Line Corridor Transit Study is considering different at-grade scenarios to best fit transit into the existing road network. The following options represent the basic design concepts under consideration.

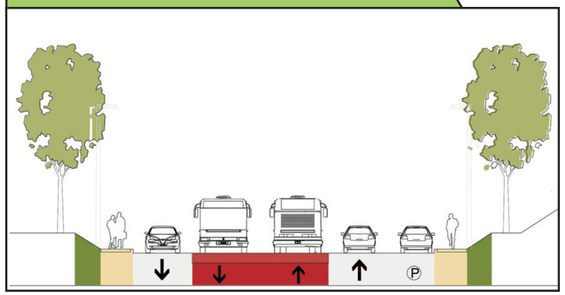
SHARED TRANSIT LANE



Shared Lanes. With this option, the transit vehicle would operate in the same lane as other vehicles.

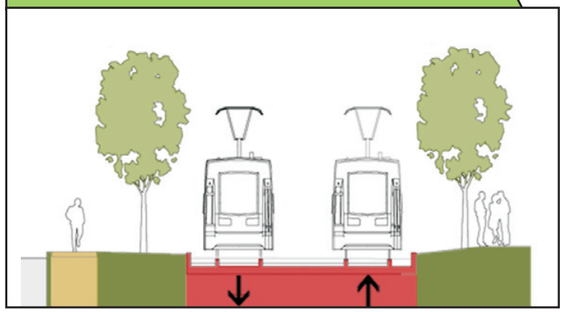
Legend
- Ⓟ -Parking
- - Shared Lane
- - Dedicated Lane
- ↑↓ - Direction of Transit/Traffic Lane

DEDICATED TRANSIT IN MEDIAN



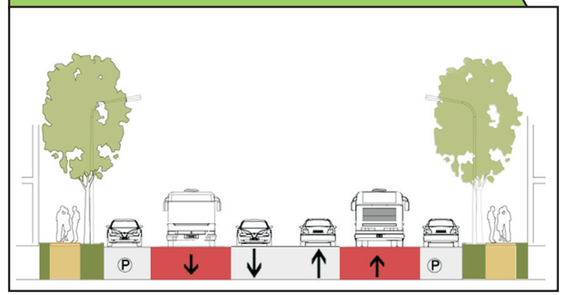
Dedicated Transit in the Median. These options typically include two-way transit lanes located in the median of the street. Pavement markings or some sort of crossable barrier would be used to identify the transit lanes.

TRANSIT ON NEW DEDICATED RIGHT-OF-WAY



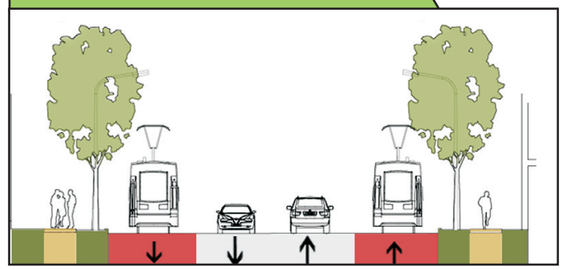
Transit Operating on a New Dedicated Right-of-way. This option includes two-way transit in separate lanes. With this option, the transit vehicles would be physically separated from the rest of traffic so that other vehicles cannot enter.

DEDICATED TRANSIT IN SECOND LANE OUT



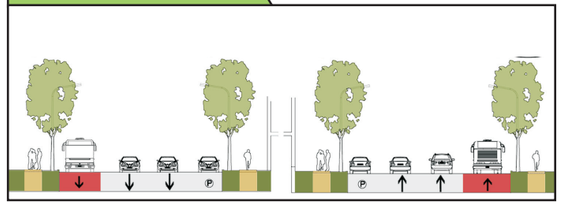
Transit Operating in the Second Lane Out (Dedicated Lane). This option leaves the curb lane open for parking and/or right-turning vehicles while putting transit vehicles in the adjacent lane to the left of the curb lane.

DEDICATED TRANSIT IN CURB LANE



Transit Operating in the Curb Lane. With this option, transit vehicles would operate within the right curb lane with portions of shared use for right turning vehicles. However, no parking for vehicles is provided in this scenario.

TRANSIT COUPLET

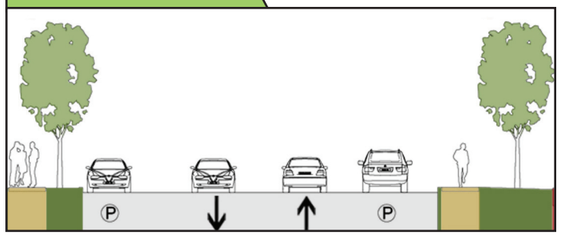


Transit Couplets. With this option, eastbound transit vehicles would travel on one street and westbound transit vehicles would travel on the other street, in a pair.

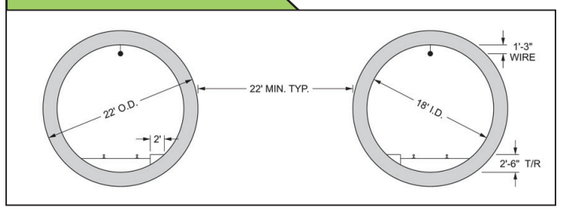
Tunnels

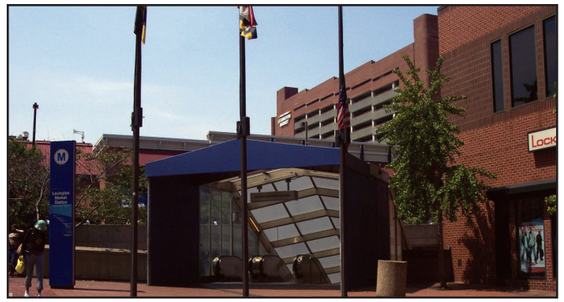
A tunnel would allow BRT or LRT to operate underground and avoid traffic congestion on surface streets. Tunnels can reduce travel time on transit and because they are "out of the way" and avoid impacts on the surface. Tunnels include vehicle portals and pedestrian headhouses. Portals are simply the entrance and exit points where the transit transitions from surface to tunnel. Transit vehicles use portals to enter or exit a tunnel. Transit passengers use headhouses to enter or exit the tunnel stations. An example of a portal is located just west of the Mondawmin Station along the existing Metro line.

TRANSIT TUNNEL



BRT OR LRT TUNNEL





Headhouse at Lexington Market Metro Station

Aerial Structures

An aerial structure will allow the BRT and LRT options to pass over obstacles. Aerial structures are, like tunnels, "out of the way" and avoid impacts on the street. Aerial structures are held up by concrete piers. These piers are supported by piles which are located below the ground surface.

Park-and-Rides

Park-and-ride facilities allow people to leave their personal vehicles and transfer to either bus or rail for the rest of their trip until they return.

Existing Baltimore Light Rail on Aerial Structure

While there is bus service throughout the corridor today, there is only one small park-and-ride lot at Westside Skill Center on US 40 at Swann Avenue. People **from** Howard County and western Baltimore County, as well as people from east of I-895 in Baltimore County, are a potentially large market for new transit passengers. All Red Line alternatives include at least two large park-and-ride lots to serve people: at the eastern end of I-70 at Security Boulevard and near Johns Hopkins Bayview campus.

Other stations that may provide parking include Security Square Mall, Westview, Edmondson Village, and the West Baltimore MARC Station on the west side of the Red Line Corridor, and the Canton Crossing Station on the east side. Travel demand estimates will help determine the potential size of the parking facilities.

Stations

Stations are where the transit vehicle stops to pick up and drop off passengers. There are numerous factors considered

Existing park-and-ride — King County, Washington

when selecting locations for stations. Proximity to major activity centers and potential ridership, accessibility, community access, nearby land uses, integration with the surrounding neighborhood, and effect on overall trip time are some of the factors considered. A number of areas are being considered for stations within the Red Line Corridor to serve the residents and businesses along the line. **Table 2-1** and **Figure 2-3** show the potential station areas and connecting transit services. Stations are listed from west to east along the corridor. Within each area, specific sites can vary slightly in location. A finalized station location would occur during the next phase of project development.

Stations intended to serve commuters driving to the station will include parking. Stations serving patrons and activity centers within a ¼ to ½ mile walk of the station, such as downtown and within dense neighborhoods, may not include parking. Specific stations will also provide connections to other transit service, such as the West Baltimore MARC Station on US 40, various bus lines, and will include appropriate facilities for these connections. As the designs of bus or rail further evolve, small, neighborhood-serving park-and-ride lots may be identified. These would be identified as a result of further design and public input.

Existing Baltimore Light Rail - Cromwell Station

Station facilities include the following:

- Platforms
- Shelters/Canopies
- Seating
- Ticket machines
- Transit and local information
- Real-time information on transit vehicle arrivals

Tunnel stations also include the following:

- Underground platform and mezzanine
- Elevators
- Escalators
- Stairs connecting the station with the surface

Vehicle Access to Stations

Unless otherwise noted, access to stations would be the same for all alternatives.

Large Park-and-Ride Stations

Social Security Administration Station

For Alternative 3E along Woodlawn Drive, a multi-level parking garage is proposed just east of Woodlawn Drive between Parallel Drive and I-70. This facility is projected to accommodate 1,500 - 2,000 vehicles under build-out conditions and this facility would not affect the existing access to the Social Security Administration parking facilities. Access to the proposed parking garage is provided along Parallel Drive and a 'right turn only' exit is provided on the top level of the garage onto I-70 about 1,000 feet east of Woodlawn Drive. An elevated pedestrian walkway would provide access to the transit station on the west side of Woodlawn Drive.

I-70 East Park-and-Ride

A surface parking lot is proposed in the northwest quadrant of the I-70 and Security Boulevard interchange to facilitate transit use. Two-way access to the facility is proposed along Security Boulevard, Ingleside Avenue and I-70. The access at Security Boulevard is located in the southeast corner, whereas the Ingleside Avenue access is located on the northwest corner of the parking lot. The access to I-70 is located on the southwest corner of the facility. The signalized intersection at Security Boulevard and parking lot entrance would provide control to both vehicular and transit traffic.

Table 2-1: Potential Station Areas (west to east)

Center for Medicare and Medicaid Services (CMS)	Charles Center
Security Square Mall-200 spaces Ⓟ	Government Center/Inner Harbor
Security West	Pier 5
SSA Main Campus	Central Avenue Station
I-70 East-800 spaces Ⓟ	Inner Harbor East
Westview Plaza-50 spaces Ⓟ	Fells Point
Coleridge	Chester Street
Edmondson Village-40 spaces Ⓟ	Patterson Park
Allendale	Eastern Avenue
Rosemont	Canton
West Baltimore MARC	Canton Crossing-100 spaces Ⓟ
Harlem Park	Highlandtown
Poppleton	Bayview-MARC-500 spaces Ⓟ
University Center	Bayview Campus
Howard Street	

Ⓟ Park-and-ride *Note: A portion of the spaces planed for Bayview-MARC are part of the planned MARC station.*

Bayview MARC Station

A surface parking lot is proposed in the vicinity of the proposed Bayview MARC Station. This parking lot would have vehicular access from Lombard Street. The number of access points has not been determined yet, however it is anticipated that there could be one to three two-way access points to this facility.

Medium/Small Park-and-Ride Lots

Security Square Mall

Existing parking spaces will be allotted for a MTA Red Line park-and-ride just south of the Mall Loop Road. Parking spaces would require pavement markings to be changed in this area. Access to the park-and-ride lot would be via the existing mall access.

Westview Shopping Center

For Alternative 3E, about 50 parking spaces are proposed to be leased and dedicated to the Red Line park-and-ride within the existing Westview Shopping Center. Transit stations are proposed along Ingleside Avenue and this alternative would use existing access to the shopping center along US 40 and Ingleside Avenue.

Edmondson Village Shopping Center

The transit station is proposed parallel to Edmondson Avenue and would use the existing shopping center access.

West Baltimore MARC

A separate park-and-ride facility is not being proposed for the Red Line.

Canton Crossing

A 100 space parking lot is proposed in a vacant parcel located east of Conkling Street and bounded by the perimeter of Boston Street on the south, Haven Street on the east and O'Donnell Street on the north of this facility. Access is proposed to be located along Boston Street or Haven Street.

Other Stations Without Parking

Throughout the MTA Red Line corridor, local buses are assumed to use the concrete pads provided for the MTA Red Line transit vehicles. Sidewalks and ramps would be improved to be ADA compliant within a ¼ mile to ½ mile radius around a proposed station location.

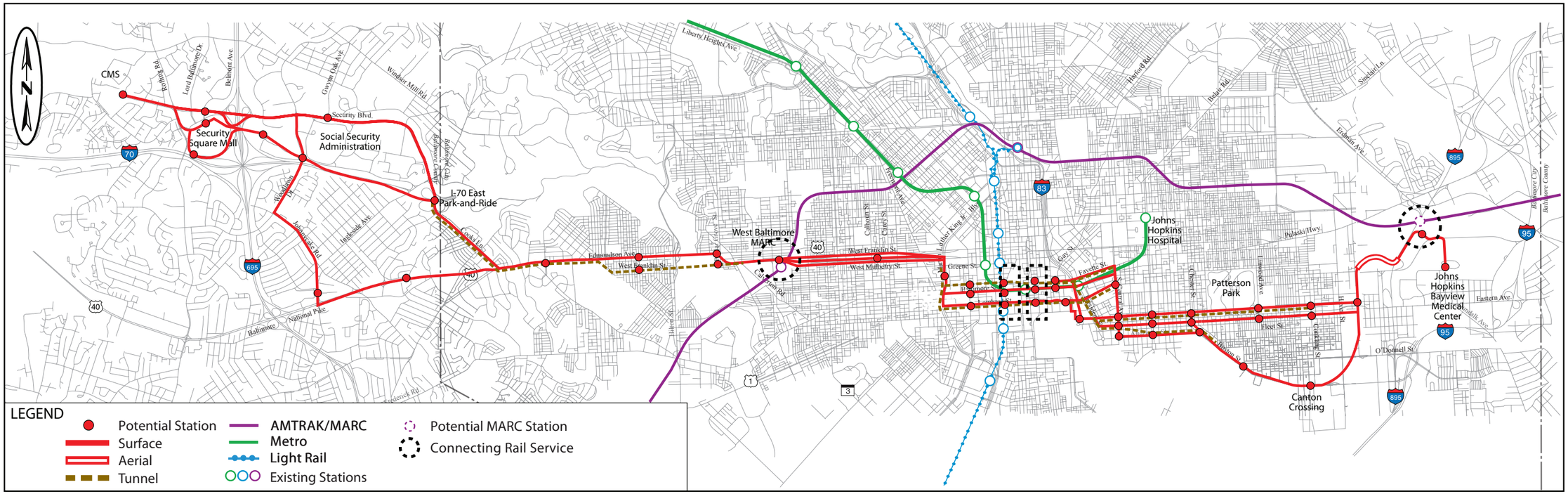
For more information, refer to the *Stations Technical Report* on the DVD attached at the back of this document for a full description of the station locations.

Vehicle Storage & Maintenance Facilities

For either the BRT or LRT alternative, a new vehicle storage and maintenance facility will be needed within the Red Line Corridor to support efficient and reliable operation. Existing MTA storage and maintenance facilities for bus and light rail vehicles are located adjacent to the Red Line service area. The closest MTA bus maintenance facilities (near Washington Boulevard and Monroe Street, west of downtown and near Ponca Street, and Eastern Avenue east of downtown) do not have sufficient capacity available to accommodate Red Line buses or light rail vehicles nor is there space available to expand these facilities.

North Avenue LRT Facility

Figure 2-3: Potential Station Locations and Connecting Rail Transit Service



Northwest Bus Facility

The Red Line Corridor Transit Study identified five candidate locations for a Red Line storage and maintenance facility for either BRT or LRT (**Figure 2-4)**.

- I-70 Central – on the north side of I-70, midway between the Beltway and the Baltimore City Line.
- I-70 – on land now used as the I-70/Security Boulevard Interchange.
- Calverton Road – would occupy part of the property bounded by Franklintown Road, Franklin Street and the AMTRAK railroad tracks.
- US 40 Lower Level – in the freeway section of US 40 between Franklin and Mulberry Streets (north/south boundaries) and between Pulaski Street and Martin Luther King, Jr. Boulevard (west/east boundaries).
- Canton Crossing – south of Boston Street along the west side of Haven Street.

The size of the storage and maintenance facility will be dependent primarily upon the required capacities of the shop building and vehicle storage areas. These capacities will be determined by the number of vehicles required to meet the Red Line service requirements, which will be different for BRT and LRT. It also will be dependent on several factors such as: the end-to-end length of the project, the frequency of service in peak usage periods, the vehicle operating speeds, travel times through congested sections of the system, and station dwell times (the time a vehicle is stopped at a station to pick up and drop off passengers).

For more information, refer to the *Storage and Maintenance Facility Technical Report* on the DVD attached at the back of this document.

Traction Power Substation (TPSS)

Traction Power Substations (TPSS) provide the electric current required for the light rail trains to operate. TPSS are generally located every mile and include a 10 foot x 20 foot structure that sits on a concrete pad. For underground stations, the TPSS will occupy a space above platform level, but within the station limits. The location of the TPSS will not be determined until the next phase of the project, should light rail be selected.

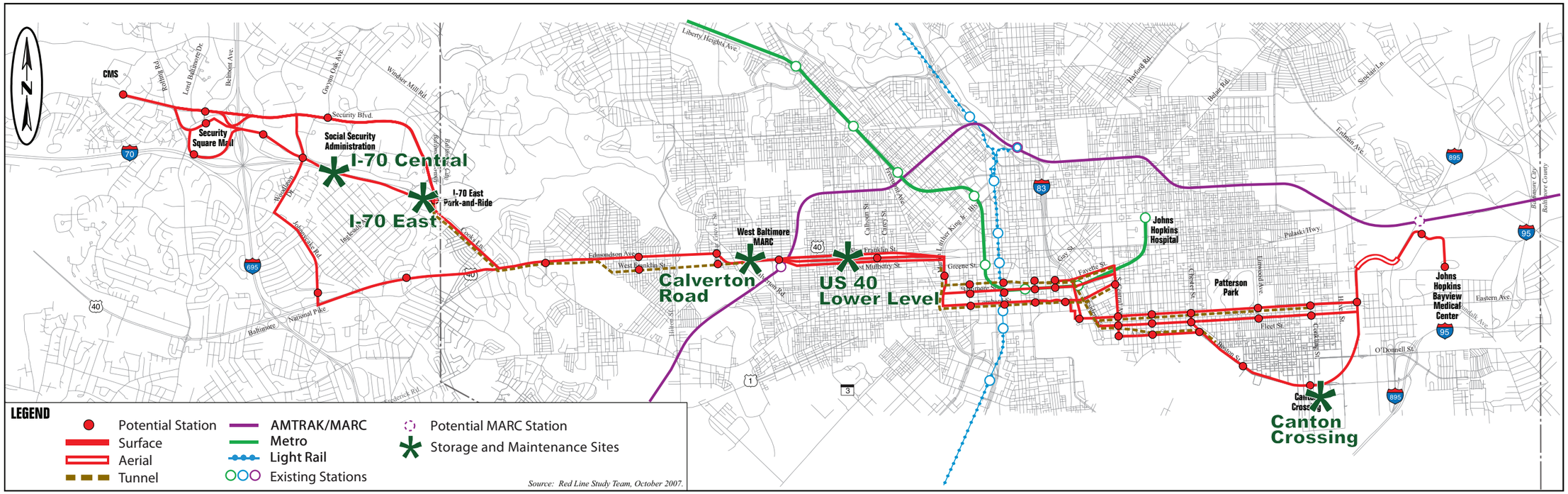
Transit-Oriented Development

Transit-Oriented Development (TOD) includes residential or commercial areas designed to maximize access to public transportation. They are generally located within a 10-minute walk of a transit station (up to a half-mile away) which can increase transit ridership by creating origins and destinations close to stations. The goals of these developments are to accommodate the market demand for proximity to walkable and transit-oriented communities and to surround stations with vibrant neighborhoods where people can live, work, and shop or eat out, all within a safe walk to Light Rail, Metro, MARC, and buses.

Common features frequently found at TOD sites include:

- Pedestrian Friendly Areas – including wide sidewalks, well marked crosswalks, good lighting and narrow streets to slow vehicle traffic.
- Dense Development – buildings located in clusters immediately around the station, with density of development tapering off moving farther out.
- Parking – including a limited number of parking spaces

Figure 2-4: Candidate Locations for Storage and Maintenance Facilities



to encourage shared parking between different land uses that need it at different times during the day or week.

- High-Quality Transit Service – including, wherever possible, access to buses and rail. For example, the Mondawmin Station on the Baltimore Metro connects with many local bus routes.

Figure 2-5 shows the locations of potential TOD opportunities in the Red Line Corridor.

Operational Elements

The following operational elements are proposed as part of the Red Line Corridor Transit Study.

Signal Priority

For shared-lane and dedicated-lane operations, Intelligent Transportation System (ITS) measures may be used to speed the movement of buses or rail vehicles by giving transit priority over other vehicles. Traffic lights can be programmed to detect the approach of a bus or LRT vehicle, and alter the green phase to favor transit.

Queue-Jump Lanes

Queue-jump lanes are created at intersections by setting aside a portion of the right-hand lane for buses (or for buses plus right-turning vehicles). They are typically created by removing a few parking spaces or using existing right-turn lanes. While regular traffic stops and lines up in general traffic lanes at a red light, buses move to the right-hand queue-jump lane. When the light turns, the queue-jump lane gets a green signal a few seconds before the general traffic lanes, allowing buses to jump ahead of the vehicles waiting at the light.

Real-Time Information Displays

This element includes displays at each station location to inform passengers when the next bus will be arriving. The system involves the use of electronic monitoring of transit vehicles. This greatly enhances the ride for individuals who are trying to decide if they have enough time to get coffee or a newspaper before the next bus arrives, and also to assure riders who are unfamiliar with the operating schedule.

In tunnel stations, this information would also assist passengers to position themselves in the portion of the station platform closest to where their bus will stop before the bus arrives.

Each LRT station could also include real-time information displays indicating when the next train is due to arrive. This information enhances ride quality by decreasing the passenger's uncertainty.

Similar to the NextBus system that is being installed at selected bus stops in Baltimore, the LRT Next Vehicle Arrival displays will rely on information provided from transponders that are on each train. The transponders send information on each train's current location to a centralized operations center that calculates predicted arrival times for each station. This information is then transmitted electronically to variable electronic message signs that will be located at the stations for all passengers to see.

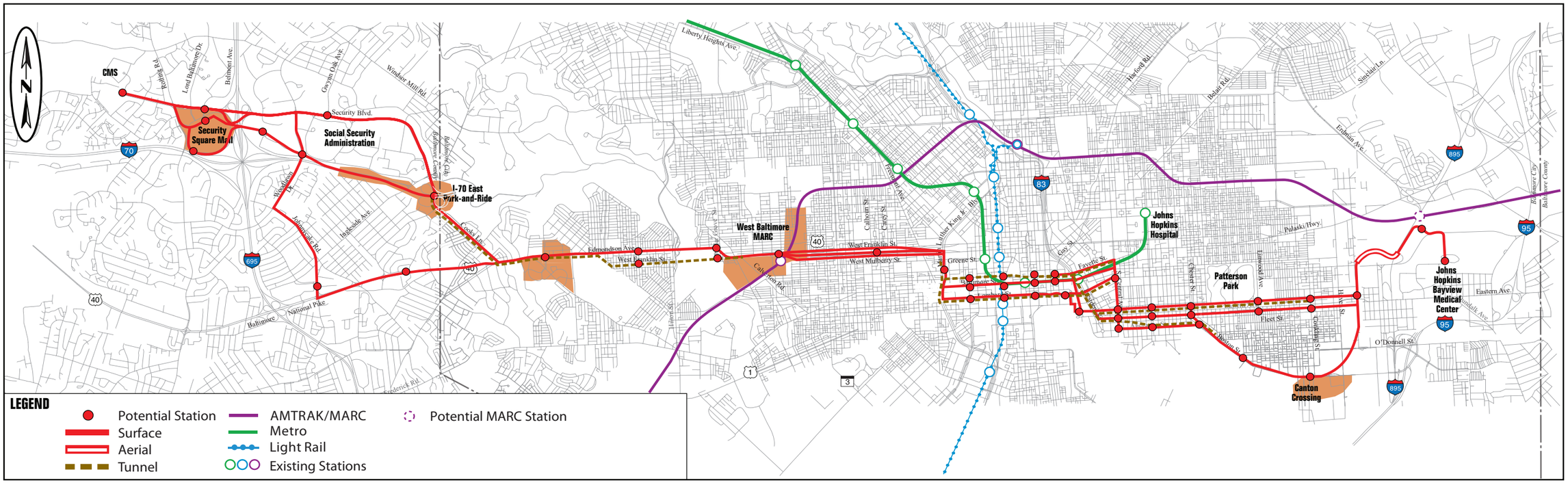
Automated Fare Collections

To reduce transit travel times, it is important to minimize the amount of time that buses or rail vehicles spend at stops, loading and unloading passengers. To an extent, this can be accomplished by reducing the number of stops, as will be done for the Red Line alternatives. However, fewer stations means more passengers boarding at each station, which can lead to passengers lining up at stops.

For both LRT and BRT mainline service, a payment system will be used to eliminate the need for a transaction at the time of boarding. Tickets are purchased in advance of the bus or train arrival. The system also allows all doors to be opened for passengers to board and exit the vehicle. Fare inspection and enforcement are typically done by roving teams of inspectors; the vehicle operator is not involved in that function.

Transactions can be made at automated fare collection machines located at stations. Fare cards and passes will also be available for purchase online, and from neighborhood stores. This system is already in use on Baltimore's Light Rail.

Figure 2-5: Potential Transit-Oriented Development



Alignments Considered and Eliminated from Further Study

The scoping process for the Red Line Corridor Transit Study was held in spring 2003. During the scoping process, a very wide range of alignment concepts was presented to the general public and regulatory agencies for input. **Figure 2-6** shows the many alignments that were initially considered in the Red Line Corridor. This figure also shows the alignments that were later eliminated from further study in this AA/DEIS, as well as those retained.

After receiving public and agency feedback, the study team screened the alignments to reduce the number for detailed analyses. The various preliminary alignments were evaluated and compared to determine the advantages and disadvantages of each, based on the following general factors:

- Ability to address Project Purpose & Need
- 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
- Public Input

The study team performed further analyses on the alignments following this preliminary screening process. Some of these alignments were eliminated based on the results of the additional analyses and public comments received after the November 2005 workshops.

The alignments eliminated during the preliminary screening phase or upon more detailed analysis are as follows:

- US 40 between I-695 to Ingleside Drive

Longer, more circuitous route to Social Security Administration; higher estimated construction costs

- Rolling Road between Rolling Bend Road to US 40

Longer, more circuitous route which would not serve Social Security Administration, a major employment center

- Crosby Road between Rolling Road to Johnnycake Road

Longer alignment with longer travel time which would not directly serve Social Security Administration

- I-695 between Security Boulevard to US 40

High construction cost associated with modifying interchanges at Security Boulevard, I-70, and US 40

- Old Frederick Road Alternative

Longer, more circuitous alignment; higher cost associated with conflicts with Amtrak/MARC alignment; narrow existing roadway along Old Frederick Road

- Quarry Alternative from Edmondson Avenue via Hilton to West Baltimore MARC Station

Impacts to Gwynns Falls Park and forested areas; longer, more circuitous alignment; higher cost associated with conflicts with Amtrak/MARC alignment

- Baltimore/Fayette One-Way Pair between West Baltimore MARC to Martin Luther King, Jr. Boulevard

High number of at-grade intersections; higher construction costs due to one-way pair; no connection with existing West Baltimore MARC

- Lombard/Pratt One-Way Pair between West Baltimore MARC to Martin Luther King, Jr. Boulevard

High number of at-grade intersections; longer, more circuitous alignment; higher cost because of new Gwynns Falls crossing and one-way pair

- Lombard/Pratt One-Way Pair between Martin Luther King, Jr. Boulevard and Central Avenue

Less centrally located within Central Business District; less accessible to other transit modes including Baltimore Metro

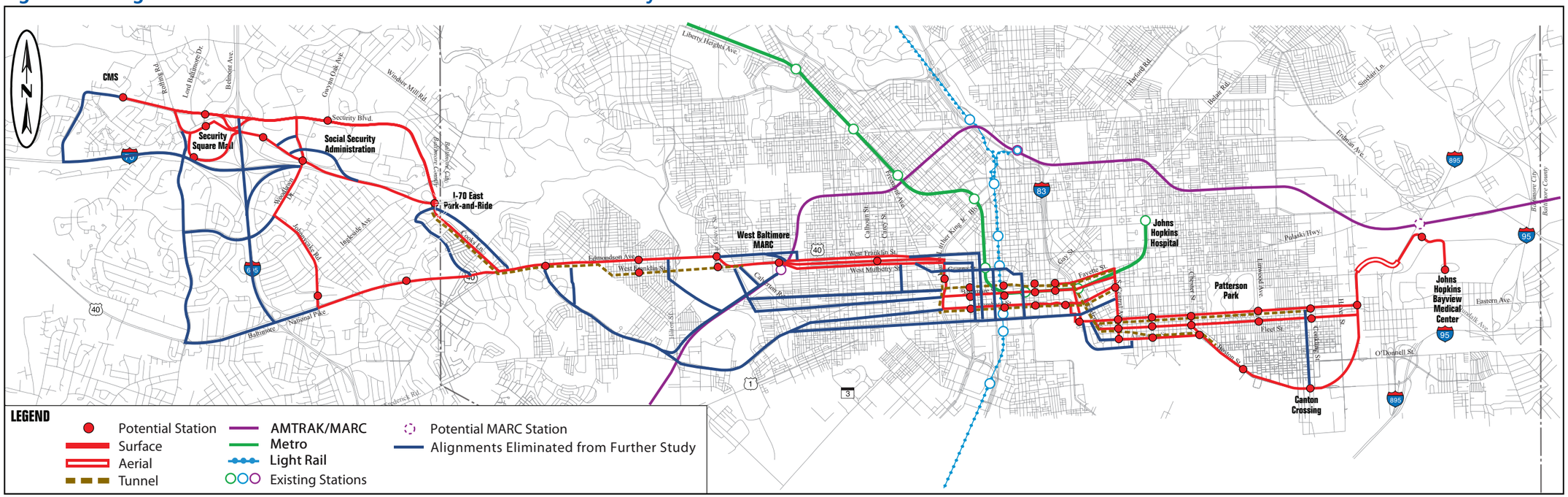
- West Franklin/West Mulberry East of Martin Luther King, Jr. Boulevard

Does not directly serve University of Maryland campus and its future development

- Saratoga Street (surface)

Does not directly serve University of Maryland campus and its future development; steep grades

Figure 2-6: Alignments Considered and Eliminated from Further Study



- Saratoga Street (tunnel)
Does not directly serve University of Maryland campus and its future development
- Pratt Street (tunnel)
Less centrally located within Central Business District; less accessible to Baltimore Metro
- Lancaster Street
Less desirable operational scenario due to number of abrupt turns
- Oldstone Road
Longer travel times for commuters parking at an I-70 West park-and-ride using Oldstone Road and Security Boulevard than from a park-and-ride east of I-695; also inconsistent with approved land use for the Oldstone Road/Security Boulevard area
- I-70 West of I-695
Longer travel time for park-and-ride commuters versus using the I-70 East Station; need for costly multi-level commuter parking garage because of insufficient space for surface parking; anticipated environmental impacts to stream, wetlands, and forested areas; and I-70 West station area inconsistent with Baltimore County's land use goals
- Central Social Security Administration Options
Steep grades; impacts to Dead Run; within future secure area of the Social Security Administration campus; and impacts to campus day care center
- Stamford Road Alignment
Local street which carries very low traffic volumes; limited existing right-of-way; limited operating speeds due to steep grades and sharp road curvature
- Brookwood Road Tunnel
Impacts to Leakin Park
- Franklintown Road or Calverton Road
Indirect alignment with longer travel times and higher costs; costs and impacts to MARC/Amtrak alignment; possible impact to Bentalou Elementary School
- Edmondson Avenue Tunnel or Franklin Bridge Options through Gwynns Falls Park
Residential, Gwynns Falls Park, and stream impacts; construction costs
- Edmondson Avenue between Longwood Street to Pulaski Street
Requires relocation of West Baltimore MARC station
- Schroeder Street and Fayette Street to Martin Luther King, Jr. Boulevard
Narrow local residential streets with low traffic volumes
- Fremont Avenue (surface)
Narrow local residential streets with low traffic volumes; connection from US 40 to Fremont Avenue problematic
- Paca Street/Eutaw Street Transit couplet
Very slow transit speeds
- Baltimore Street/Fayette Street Transit couplet
Less central to downtown activity zones; narrow cross section for Fayette Street
- President Street (surface)
Reduced roadway capacity in a congested area with high traffic volumes; limited available right-of-way for widening
- Eastern Avenue (2-way transit)
Would require total elimination of parking; limited available right-of-way for widening
- Canton Loop
Longer travel times and delays; circuitous transit trips
- Conkling Street (surface)
Unnecessary with extension of corridor to Bayview

For more information, refer to the *Alternatives Technical Report* on the DVD attached at the back of this document, for a full description of the alignments considered and eliminated from further study.

Heavy Rail Alternative

Heavy rail was also considered for the Red Line corridor. See the accompanying text box.

Due to continued public interest, two alternatives which incorporate heavy rail were studied.

The MTA analyzed a heavy rail alternative (not shown on Figure 2-6) which would extend from the Social Security Administration in Woodlawn to East Baltimore at Greektown. The alternative would leave the Social Security Administration, would run at-grade along I-70 to the I-70 East Park-and-Ride, would proceed in tunnel to the Edmondson Village Shopping Center and would continue in tunnel southeast to the intersection of Old Frederick Road and Hilton Street. It would then follow the Amtrak/MARC Penn Line to the West Baltimore MARC station and US 40 lower level. It would then proceed in tunnel to the existing Metro tunnel from Lexington Market to Johns Hopkins, would continue in tunnel to the Amtrak/MARC Penn Line, and would run on aerial structure to Greektown in East Baltimore.

Daily ridership in 2030 for this alternative was estimated at 43,100. Capital costs were estimated at $2.38 billion. The FTA New Starts cost-effectiveness was estimated at $56.71 per user benefit hour which, according to FTA guidelines, equates to a Low rating for this measure. Therefore, this alternative was not added to the alternatives retained for detailed study because of the high cost and low cost-effectiveness.

Another alternative that was suggested by the public (not shown on Figure 2-6) includes heavy rail and would be comprised of three transit modes: light rail, heavy rail (as a Metro extension), and streetcar. The light rail component of the alternative would follow a Red Line light rail alignment from CMS to Martin Luther King, Jr. Boulevard and would continue south along Martin Luther King, Jr. Boulevard. At Fayette Street, the alternative would split into one-way pairs, with the eastbound direction on Baltimore Street and the westbound direction on Fayette Street. At Greene and Paca Streets, the alternative would travel south to Camden Yards. At Camden Yards, light rail would enter a tunnel under Conway Street then would turn north, intersecting Metro at the Charles Street Station.

A second component of this alternative would be a streetcar. From Camden Yards, it would extend along Pratt Street to Inner Harbor East, Fells Point, Canton, and Canton Crossing before turning north following Haven Street to the Amtrak/MARC Penn Line, turning northwest to a proposed station at Edison Highway. A third component of this alternative would be Metro, extended from Johns Hopkins Hospital to the Amtrak/MARC Penn Line to Johns Hopkins Bayview Medical Center.

Daily ridership in 2030 on all components was estimated to be approximately 33,600. Capital costs were estimated at $1.8 billion. The FTA New Starts cost-effectiveness was estimated at $41.21 per user benefit hour which, according to FTA guidelines, equates to a Low rating for this measure. Therefore, this alternative was not added to the alternatives retained for detailed study because of the high cost and low cost-effectiveness.

For more information, refer to the *Alternatives Technical Report* on the DVD attached at the back of this document, for a full description of the alignments considered and eliminated from further study.

WHY ISN'T METRO BEING STUDIED FOR THE RED LINE?

Metro, or 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, Metro 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 U.S. 40, east of the West Baltimore MARC Station.

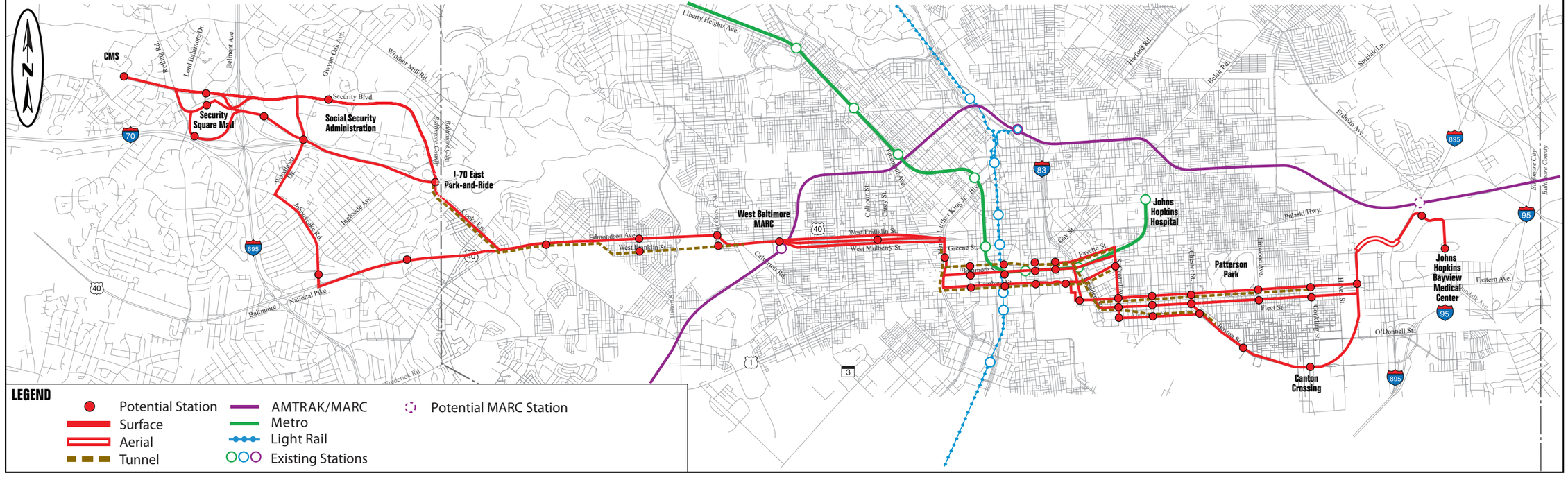
A Metro alternative from CMS to Patterson Park for the Red Line is estimated to cost between $2.2 billion and $2.6 billion, including construction of the alignment, stations, vehicles,maintenance and storage yard and other associated costs. To be competitive nationally for federal funding, a project of this magnitude would generally need to have 130,000 to150,000 trips per day. Currently Metro from Owings Mills to Johns Hopkins Hospital carries about 45,000 trips per day. Even if the project received federal funds, historically most projects have been capped at $500 million in appropriations to optimize the number of eligible projects funded. Given this restriction, the State of Maryland would not be able to afford the $1.7 billion to $2.1 billion local share. A more expansive discussion of the justification for not studying Metro for the Red Line can be found on the project website: http://www.baltimoreredline.com/pages/images/finalmetrofactsheet.pdf.

Alignments and Options Retained for Detailed Study

There are four overall alternatives and 12 specific alternatives carried forward in this DEIS. The succeeding pages provide a list of alignments and options by Geographic Area, which when combined comprise specific alternatives. **Figure 2-7** illustrates the alignments retained for detailed analysis.

- No-Build – consists of the existing highway and transit network as well as planned and programmed (committed) improvements for year 2030.
- TSM – Buses would operate in the corridor with minimal dedicated lanes or exclusive rights-of-way. TSM represents the best that can be done for mobility in the corridor without constructing a new transit guideway, but still includes investment in new buses, TSM stations, and some infrastructure improvements such as queue jump lanes and operational improvements using advanced technology.
- BRT – consists of medium investment options, including shared and dedicated lanes operating in the corridor within some dedicated and exclusive rights-of-way, and high investment options including mostly dedicated bus lanes and exclusive rights-of-way. The high investment options, include above ground structures and/or tunnels for faster operations.
- LRT – consists of medium investment options, including shared and dedicated lanes operating in the corridor within some dedicated and exclusive rights-of-way, and high investment options including mostly dedicated light rail lanes and exclusive rights-of-way. The high investment options include above ground structures and/or tunnels for faster operation.

Figure 2-7: Alignments Retained for Detailed Study



Alternative 1: No-Build

The No-Build alternative examines what conditions will be like in the year 2030 if the Red Line is not built. This alternative provides a baseline by which all environmental impacts of the build alternatives are compared.

The No-Build alternative consists of the transit service levels, highway networks and traffic volumes, and forecasted demographics for year 2030 that are assumed in the Baltimore Regional Transportation Board's Constrained Long Range Plan (CLRP). The CLRP consists of the existing highway and transit network, as well as planned and programmed (committed) improvements. The Regional transit and highway projects and the local projects in the Study Corridor in the CLRP are summarized in **Table 2-2**.

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

FACILITY	LOCATION	DESCRIPTION
Transit Projects		
LRT/BRT	Fells Point to Security	Red Line
MARC	Camden and Penn lines	Add bi-level coaches
MARC	Perryville to DC	Penn Line improvements
MARC	Baltimore to DC	Camden Line capacity improvements
MARC	East Baltimore	New station
Regional Highway Projects		
I-95	Washington Blvd to Martin Luther King Blvd	Access improvements on city streets, modified interchanges @ I-95, Washington Bvld, Russell Street
I-95	I-95/I-895 (N) Split to north of MD 43 (Section 100)	Widen from 8 to 12 lanes, modify interchanges @ I-895, I-695, MD 43
I-95	North of MD 43 to north of MD 22 (Section 200)	Widen from 8 to 12 lanes, modify interchanges @ MD 152, MD 24, MD 543, MD 22
I-95	North of MD 22 to Susquehanna River (Section 300)	Widen from 6 to 8 lanes, modify interchanges @ MD 155
I-695	I-95 (S) to MD 122	Widen from 6 to 8 lanes
Local Project in the Red Line Study Area		
Greenmount Connector	North Avenue to Biddle Street	Widen from 4 to 6 landes, add ramp to connect Greenmount to I-83 & Fallsway
I-83	@ Saratoga Street	New ramps and directional changes on Saratoga and Lexington
I-83	@ Madison Avenue	New ramp
Dundalk Avenue Bypass	Keith Avenue at Broening Highway	Partial to full interchange, new access to Broening from Holabird Business Park
I-83	@ Howard Street	New partial interchange with ramp from MLK Blvd @ Howard Street

Alternative 2: Transportation System Management (TSM)

TSM represents the best that can be done for mobility in the 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. TSM falls between the No-Build Alternative and the build alternatives in terms of both costs and impacts.

Examples of features that could be included in the TSM Alternative are:

- Expanded routing and availability of MTA buses.
- Improved quality of transit service with increased frequency and traffic signal priority.
- Better transit coordination, support facilities and marketing.
- New MTA buses.
- Improved accessibility with complimentary modes such as bicycles and walking.
- More parking and bus lanes.
- New bus stops that would have shelters and amenities comparable to those proposed for the build alternatives, plus some improvements to adjacent sidewalks for access and compliance with the Americans with Disabilities Act (ADA).
- Signal priority and/or queue jump lanes at major intersections, where practical, if the analysis demonstrates that such priority provides substantial time savings.

For the Red Line Corridor Transit Study, TSM is identified as Alternative 2. Alternative 2 would generally provide bus operations along existing roadways in dedicated curb lanes marked for buses and right-turning traffic only. In some places where right-of-way is constrained, the buses would operate in shared lanes with vehicular traffic. The alignment and operations of Alternative 2 are shown in **Figure 2-8** below and presented in **Table 2-3**. This table briefly describes TSM by geographic area.

Figure 2-8: Alternative 2: Transportation System Management

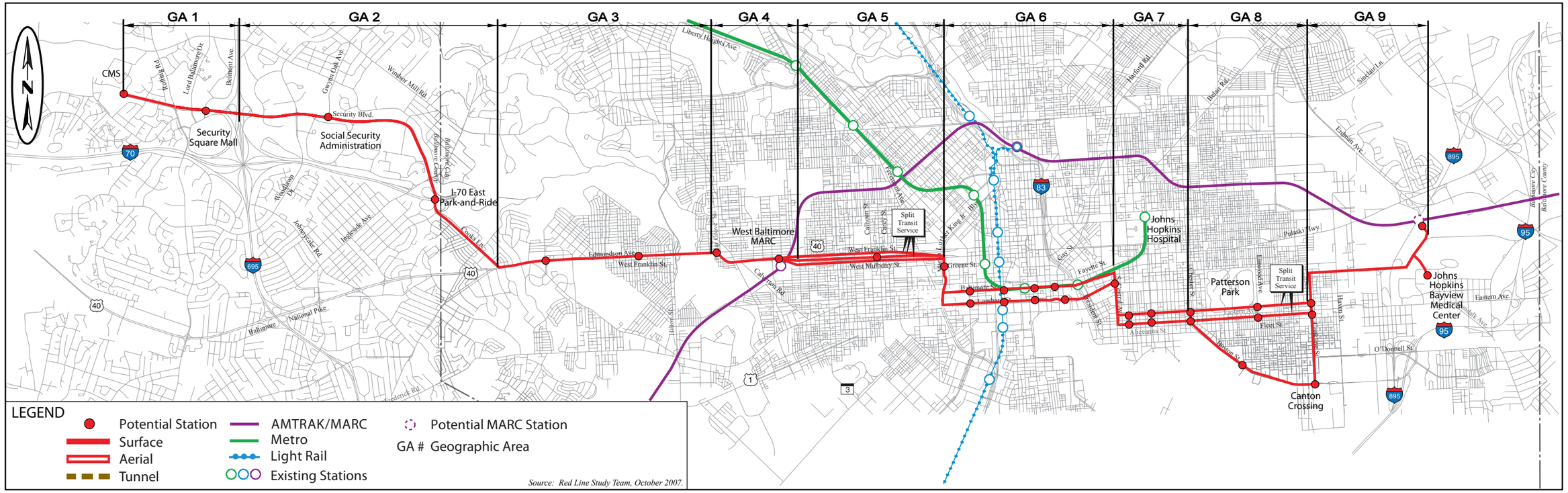


Table 2-3: Alternative 2: TSM

GEOGRAPHIC AREA 1		
Segment	**Surface or Tunnel**	**Description**
Security Blvd. from CMS to Rolling Road	Surface	Shared transit lane curbside inbound and shared transit median lane outbound
Security Sq. Mall Area from Rolling Road to I-695	Surface	Shared transit/traffic lanes in each direction on Security Blvd.

GEOGRAPHIC AREA 2		
Segment	**Surface or Tunnel**	**Description**
I-695 Area from I-695 to Woodlawn Drive	Surface	Shared transit/traffic lanes in each direction on Security Blvd.
Social Security Administration Area from Woodlawn Dr. to I-70	Surface	Dedicated curbside transit lane in each direction on Security Blvd., 2 traffic lanes in each direction
I-70 park-and-ride	Surface	Three options for surface parking lot
Cooks Ln. from I-70 park-and-ride to US 40	Surface	Shared transit/traffic lanes in each direction, full time parking on each side

GEOGRAPHIC AREA 3		
Segment	**Surface or Tunnel**	**Description**
US 40 from Cooks Ln. to Longwood St.	Surface	Dedicated transit curbside, 2 traffic lanes, no parking, peak period, peak direction; shared transit/traffic, 2 traffic lanes, curbside parking all other times.

GEOGRAPHIC AREA 4		
Segment	**Surface or Tunnel**	**Description**
US 40 from Longwood St. to W Baltimore MARC	Surface	Dedicated transit curbside, 2 traffic lanes, no parking, peak period, peak direction; shared transit/traffic, 2 traffic lanes, curbside parking all other times.

GEOGRAPHIC AREA 5		
Segment	**Surface or Tunnel**	**Description**
Franklin/ US 40/Mulberry from W. Baltimore MARC to Martin Luther King, Jr. Blvd.	Surface	Shared transit/traffic lanes with split service on Franklin, US 40, and Mulberry.
Martin Luther King, Jr. Blvd. from US 40 to Lombard St.	Surface	Shared transit/traffic lanes on Martin Luther King, Jr. Blvd.

GEOGRAPHIC AREA 6		
	Surface or Tunnel	**Description**
Fayette/Baltimore/ Lombard from Martin Luther King Jr. Blvd to Market Pl.	Surface	Dedicated transit curbside on Baltimore St-Lombard St couplet. On Baltimore, 2 eastbound traffic lanes, 1 parking lane left curb full time. On Lombard, 3-5 westbound traffic lanes, no parking on either curb.
Baltimore/Lombard/Central/Pier 5/6 from Market Pl. to Central Ave. at Aliceanna St.	Surface	Dedicated transit on Baltimore St-Lombard St couplet. On Baltimore, eastbound transit curbside, 2 eastbound traffic lanes, 1 parking lane left curb full time. On Lombard, westbound transit second lane out, 1-3 westbound traffic lanes, no parking on left curb. On Central Ave., dedicated transit second lane out, 1 traffic lane in each direction with center left turn lane, 1 parking lane on each right curb full time.

GEOGRAPHIC AREA 7		
Segment	**Surface or Tunnel**	**Description**
Eastern/Fleet/Aliceanna Sts. from Central Ave. to Chester St.	Surface	Dedicated transit curbside on Eastern-Fleet couplet peak period only, shared transit off-peak. One traffic lane per direction on both Eastern and Fleet. Full-time parking eastbound curb lane on Eastern, westbound curb lane on Fleet. Off-peak parking westbound curb lane on Eastern, eastbound curb lane on Fleet.

GEOGRAPHIC AREA 8		
Segment	**Surface or Tunnel**	**Description**
Eastern/Fleet/Boston Sts. from Chester St. to Conkling St.	Surface	Split transit service among Eastern-Fleet and Boston Street: Dedicated transit curbside on Eastern-Fleet couplet peak period only, shared transit off-peak. One traffic lane per direction on both Eastern and Fleet. Full-time parking eastbound curb lane on Eastern, westbound curb lane on Fleet. Off-peak parking westbound curb lane on Eastern, eastbound curb lane on Fleet. Shared transit/traffic lanes on Chester and Boston Streets.

GEOGRAPHIC AREA 9		
Segment	**Surface or Tunnel**	**Description**
Conkling Street to Bayview	Surface	Shared lanes on Conkling and Lombard Streets to North Bayview Station. Shared lanes on Bayview Boulevard to Bayview Station.

Alternative 3: Bus Rapid Transit

Three components define Alternative 3: the mode, alignments and options. The mode for Alternative 3 is bus. There are different routes under consideration that the BRT could operate along horizontally and vertically. The horizontal alignments extend west to east from CMS and Security Square Mall to Bayview. The vertical alignments include surface, varying lengths of tunnel, and aerial structures. These alignments are shown in **Figure 2-9** and listed below by geographic area.

Geographic Area 1

Along Security Boulevard and then to Rolling Road and the north side or south side of the mall, or continuing along Security Boulevard.

Geographic Area 2

Continuing along Security Boulevard or along the central alignment to the I-70 East Park-and-Ride and Cooks Lane at US 40. Also, a BRT alignment that is unique to Alternative 3 is along Security Boulevard, along Woodlawn Drive, Johnnycake Road, Ingleside Avenue and US 40.

Geographic Areas 3 & 4

The alignments continue along US 40 at the surface or in a tunnel.

Geographic Area 5

There are three surface alignments under consideration in this geographic area: along US 40 in the lower level, Franklin Street or Mulberry Street. It would then continue along Martin Luther King, Jr. Boulevard on surface or in a tunnel. There is one tunnel alignment (with several portal locations) under consideration in this area: adjacent to the west side of Martin Luther King, Jr. Boulevard.

Geographic Area 6

The alignments in this geographic area continue from Martin Luther King, Jr. Boulevard through downtown on surface alignments along Baltimore and/or Lombard Streets. The alignments proceed to either Central Avenue or alignments along Pier 5/6, to alignments on Eastern Avenue and Fleet Street. There are tunnel alignments also under consideration through downtown under Lombard or Fayette Streets to Central Avenue or the tunnel could continue to the south and east under Eastern Avenue.

Geographic Area 7

Along Central Avenue, there are surface alignments to Eastern/Fleet or Fleet/Aliceanna couplets. The alignments then continue along either of these surface couplets, or in a tunnel alignment under Eastern Avenue.

Geographic Area 8

At Chester Street, the surface alignments would either continue along the Eastern/Fleet couplet or along Boston Street. The tunnel alignment under Eastern Avenue continues through this geographic area.

Geographic Area 9

From Conkling Street to just east of Haven Street, the surface alignments continue from either Boston Street or Eastern Avenue. The Eastern Avenue tunnel alignment would end in a portal near Haven Street.

There is only one surface alignment in this area terminating at Bayview. The surface alignment would be on new right-of-way following this general alignment: along the Norfolk Southern railroad to an aerial structure over active freight rail lines. The alignment transitions back to grade along the west side of I-895, under I-895 to an alignment on new right-of-way to Bayview Medical Center.

Along all the alignments under consideration, there are different options to how the BRT would operate. Options under consideration include whether the transit would operate in a shared or dedicated lane with vehicular traffic, or whether introducing transit onto a street would result in the removal of a parking lane. The location and operational details of the options for Alternative 3 (BRT) are presented in **Table 2-4**. This table briefly describes the options by geographic area. The options are presented in greater detail in Volume II of this AA/DEIS.

Figure 2-9: Alternative 3: Bus Rapid Transit

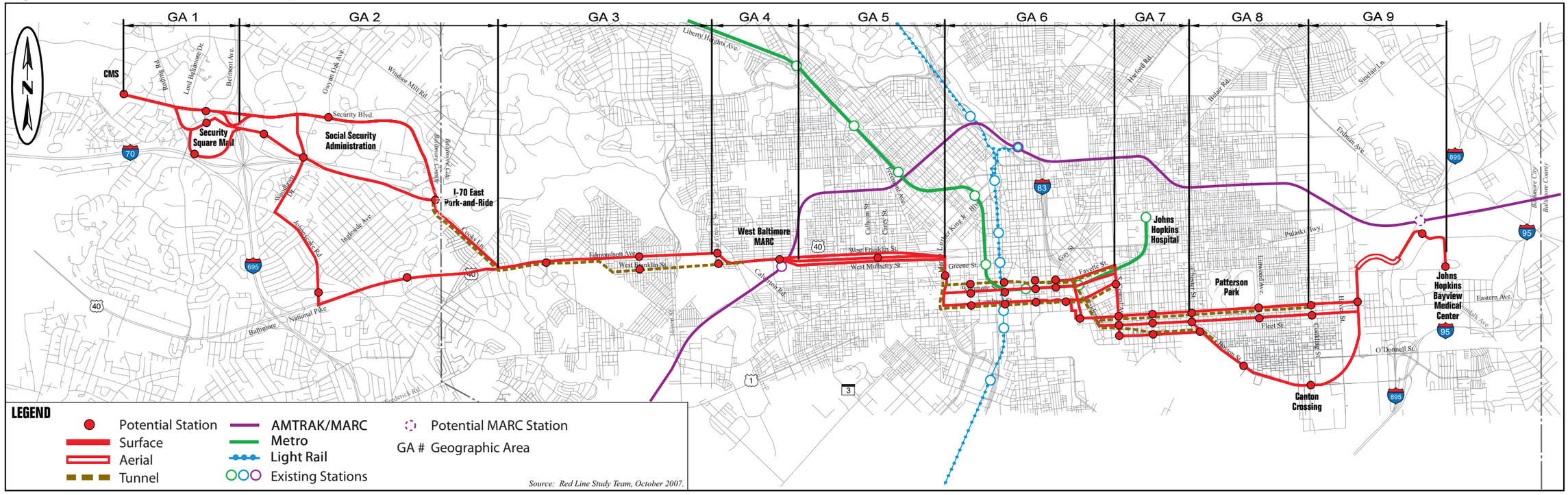


Table 2-4: Alternative 3: Bus Rapid Transit Options

GEOGRAPHIC AREA 1		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Security Blvd. from CMS to Rolling Road	Surface	Shared transit lane curbside inbound and shared transit median lane outbound
Security Sq. Mall Area from Rolling Road to I-695	Surface	Dedicated transit on south side of Security Boulevard
	Surface	Shared transit/traffic lanes in each direction on Rolling Road, dedicated transit on north side of mall
	Surface	Shared transit/traffic lanes in each direction on Rolling Road, dedicated transit on south side of mall

GEOGRAPHIC AREA 2		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
I-695 Area from I-695 to Woodlawn Drive	Surface	Dedicated transit on south side of Security Boulevard
	Surface	Dedicated transit on central alignment between I-70 and Security Blvd.
Social Security Administration Area from Woodlawn Dr. to I-70	Surface	Dedicated transit on south side of Security Boulevard, 2 traffic lanes eastbound, 3 traffic lanes westbound
	Surface	Dedicated transit on north side of I-70
	Surface	Dedicated transit in median of I-70
Woodlawn/Johnnycake/Ingleside from Woodlawn Dr. at Security Blvd. to US 40 at Cooks Ln.	Surface	Dedicated curbside transit lanes on Woodlawn, 1 traffic lane in each direction, no parking. Shared transit/traffic lanes on Johnnycake and Ingleside in each direction, full-time parking in curb lanes.
	Surface	Dedicated transit in median of US 40, 3 traffic lanes in each direction, no parking.
	Surface	Dedicated transit in existing left most lanes of US 40, 2 traffic lanes in each direction, no parking.
I-70 Park-and-Ride	Surface	Multiple options for location of surface parking lot including with and without maintenance facility; representative option includes alignment along I-70, parking lot in the northwest quadrant
Cooks Ln. from I-70 Park-and-Ride to US 40	Surface	Dedicated transit in median, one traffic lane in each direction, full-time parking on west side
	Surface	Dedicated transit inbound, one traffic lane inbound, shared transit/traffic outbound, full-time parking on west side
	Surface	Shared transit/traffic lanes in each direction, full-time parking on west side
	Tunnel	Cooks Lane tunnel

GEOGRAPHIC AREA 3		
Segment	**Surface or Tunnel**	**Option Description**
US 40 from Cooks Ln. to Longwood St.	Surface	Dedicated transit in median, 3 traffic lanes peak period, peak direction, no parking; 2 traffic lanes peak period, off-peak direction, one lane of parking
	Surface	Dedicated transit in median, 2 traffic lanes in each direction, full-time parking in curb lane
	Tunnel	US 40 and West Franklin Street Tunnel to Calverton Rd.

GEOGRAPHIC AREA 4		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
US 40 from Longwood St. to W Baltimore MARC	Surface	Dedicated transit on north side and/or in median of Franklin St., 3 traffic lanes peak period, peak direction, no parking; 2 traffic lanes peak period, off-peak direction, one lane of parking. Outbound traffic is diverted from Franklin St. to Franklintown Rd. and Edmondson Ave.
	Surface	Dedicated transit on north side of Franklin St., 3 traffic lanes inbound, 1 traffic lane outbound, full time parking in outbound curb lane. On Edmondson Ave., 3 traffic lanes outbound peak period, peak direction, no parking; 2 traffic lanes outbound peak period, off-peak direction, one lane of parking; 1 traffic lane inbound, full time parking in inbound curb lane
	Surface	Dedicated transit in median, 2 traffic lanes in each direction, full-time parking in curb lane
	Tunnel	US 40 and West Franklin Street Tunnel to Calverton Road (Portal C)

GEOGRAPHIC AREA 5		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Franklin/US 40/Mulberry from W. Baltimore MARC to Martin Luther King, Jr. Blvd.	Surface	Dedicated transit in existing left-most lanes of US 40 lower level, 2 traffic lanes in each direction
	Surface	Dedicated transit on south side of Franklin St.
	Surface	Dedicated transit on north side of Mulberry St.
Martin Luther King, Jr. Blvd. from US 40 to Lombard St.	Surface	Dedicated transit on west side of MLK Jr. Blvd.
	Tunnel	MLK tunnel – portal on Fremont Avenue (Portal G) to Lombard Street Tunnel
	Tunnel	MLK tunnel – various tunnel portals along MLK Blvd to a tunnel under Fayette or Lombard Streets

GEOGRAPHIC AREA 6		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Fayette/Baltimore/Lombard from Martin Luther King Jr. Blvd to Market Pl.	Surface	Dedicated transit in second lane out on Baltimore St-Lombard St couplet. On Baltimore, 2 eastbound traffic lanes, 1 parking lane right curb full time. On Lombard, 3-5 westbound traffic lanes, 1 parking lane right curb full time.
	Surface	Dedicated transit curbside on Baltimore St-Lombard St couplet. On Baltimore, 2 eastbound traffic lanes, 1 parking lane left curb full time. On Lombard, 3-5 westbound traffic lanes, no parking on either curb.
	Surface	Dedicated transit (two-way) on north side of Baltimore St., 1 traffic lane eastbound, intermittent parking in right curb lane
	Tunnel	Fayette Street tunnel
	Tunnel	Lombard Street tunnel

Table 2-4: Alternative 3: Bus Rapid Transit Options (continued)

GEOGRAPHIC AREA 6 (Continued)		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Baltimore/Lombard/Central/Pier 5/6 from Market Pl. to Central Ave. at Aliceanna St.	Surface	Dedicated transit in second lane out on Baltimore St-Lombard St couplet to Central Ave. On Baltimore, 2 eastbound traffic lanes, 1 parking lane right curb full time. On Lombard, 1-3 westbound traffic lanes, 1 parking lane right curb full time.
	Surface	Dedicated transit on Baltimore St-Lombard St couplet to Central Ave. On Baltimore, eastbound transit curbside, 2 eastbound traffic lanes, 1 parking lane left curb full time. On Lombard, westbound transit second lane out, 1-3 westbound traffic lanes, no parking on left curb.
	Surface	Dedicated transit (two-way) on north side of Baltimore St. to Central Ave., 1 traffic lane eastbound, intermittent parking in right curb lane
	Tunnel	Fayette Street tunnel to a portal on Fayette St. at Central Ave. (Portal I)
	Tunnel	Lombard Street tunnel to Central Ave. with various portal locations
	Tunnel	Fayette St. tunnel continuing to Eastern Ave. tunnel
	Tunnel	Lombard St. tunnel continuing to Eastern Ave. tunnel
	Surface	From Market Pl. to President St., dedicated transit curbside W Falls Ave-Harbor Magic Way Couplet to Eastern-Fleet couplet.
	Surface	Dedicated transit second lane out on Central Ave., 1 traffic lane in each direction with center left turn lane, 1 parking lane on each curb full time.
	Surface	Dedicated transit second lane out Eastern-Fleet couplet, one-way traffic on Eastern-Fleet, 2 traffic lanes peak direction, right curb parking full-time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, one-way traffic on Eastern-Fleet, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, two-way traffic on Eastern-Fleet, 1 lane in each direction, full-time parking right curb only

GEOGRAPHIC AREA 7		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Eastern/Fleet/Aliceanna Sts. from Central Ave. to Chester St.	Surface	Dedicated transit second lane out Eastern-Fleet couplet, one-way traffic on Eastern-Fleet, 2 traffic lanes peak direction, right curb parking full-time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, one-way traffic on Eastern-Fleet, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, two-way traffic on Eastern-Fleet, 1 lane in each direction, full-time parking right curb only
	Surface	Dedicated transit second lane out Fleet-Aliceanna couplet, one-way traffic on Fleet-Aliceanna, 2 traffic lanes peak direction, right curb parking full-time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Fleet-Aliceanna Couplet, one-way traffic on Fleet-Aliceanna, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Fleet-Aliceanna Couplet, two-way traffic on Fleet-Aliceanna, 1 lane in each direction, full-time parking right curb only
	Tunnel	Eastern Ave. tunnel

GEOGRAPHIC AREA 8		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Eastern/Fleet/Boston Sts. from Chester St. to Conkling St.	Surface	Dedicated transit second lane out Eastern-Fleet couplet, one-way traffic on Eastern-Fleet, 2 traffic lanes peak direction, right curb parking full-time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, one-way traffic on Eastern-Fleet, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, two-way traffic on Eastern-Fleet, 1 lane in each direction, full-time parking right curb only
	Surface	Dedicated transit in median of Boston St., 2 traffic lanes in each direction, full time parking westbound right curb
	Surface	Dedicated transit on south side of Boston St., 1 traffic lane in each direction with continuous left turn lane, full-time parking westbound right curb
	Tunnel	Eastern Ave. tunnel

GEOGRAPHIC AREA 9		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Conkling Street to Norfolk Southern Canton Railroad	Surface	Dedicated transit second lane out Eastern-Fleet couplet, one-way traffic on Eastern-Fleet, 2 traffic lanes peak direction, right curb parking full time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, one-way traffic on Eastern-Fleet, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, two-way traffic on Eastern-Fleet, 1 lane in each direction, full-time parking right curb only
	Tunnel	Eastern Ave. tunnel - Portal O
	Surface	From Boston St. and Conkling Street on abandoned Norfolk Southern railroad right-of-way
Norfolk Southern/Canton Railroad to Bayview MARC Station	Aerial & Surface	Kresson B Alignment - at-grade in inactive Norfolk Southern railroad right-of-way; aerial structure over active Norfolk Southern railroad to dedicated surface alignment north of Lombard Street on west side of I-895, under I-895
Bayview MARC Station to Bayview Medical Center	Surface	Alignment on new right-of-way to Mason Lord Drive, dedicated transit on east side of Mason Lord Drive

Alternative 4: Light Rail Transit

Three components define Alternative 4, the mode, alignments and options. The mode for Alternative 4 is LRT. There are different routes under consideration that the LRT could operate along horizontally and vertically. The horizontal alignments extend west to east from CMS and Security Square Mall to Bayview. The vertical alignments include surface, varying lengths of tunnel and aerial structures. These alignments are shown in **Figure 2-10** and listed below by geographic area.

Geographic Area 1

Along Security Boulevard and then to Rolling Road and the north side or south side of the mall, or continuing along Security Boulevard.

Geographic Area 2

Continuing along Security Boulevard or along the central alignment to the I-70 East Park-and-Ride and Cooks Lane at US 40.

Figure 2-10: Alternative 4: Light Rail Transit

Geographic Area 3 & 4

The alignments continue along US 40 at the surface or in a tunnel.

Geographic Area 5

There are three surface alignments under consideration in this geographic area: along US 40 in the lower level, Franklin Street or Mulberry Street. It would then continue along Martin Luther King, Jr. Boulevard on surface or in a tunnel. There are two tunnel alignments (with several portal locations) under consideration in this area: under Fremont Avenue or adjacent to the west side of Martin Luther King, Jr. Boulevard.

Geographic Area 6

The alignments in this geographic area continue from Martin Luther King, Jr. Boulevard through downtown on surface alignments along Baltimore and Lombard Streets. The alignments proceed to either Central Avenue or along Pier 5/6 to alignments on Eastern Avenue and Fleet Street. There are tunnel alignments under consideration through downtown under Lombard and Fayette Streets to Central Avenue, or the tunnel could continue to the south and east under Eastern Avenue/ Fleet Street/Aliceanna Street.

Geographic Area 7

Along Central Avenue there are surface alignments to Eastern/Fleet or Fleet/Aliceanna couplets. The alignments then continue along either of these surface couplets, or in a tunnel alignment under Eastern Avenue/Fleet Street/ Aliceanna Street.

Geographic Area 8

At Chester Street, the surface alignments would either continue along the Eastern/Fleet couplet or continue along Boston Street. There are two tunnel alignments in this geographic area. One tunnel alignment is under Eastern Avenue. The other tunnel alignment continues from Fleet Street to Aliceanna Street.

Geographic Area 9

From Conkling Street to just east of Haven Street, the surface alignments continue from either Boston Street or Eastern Avenue. The Eastern Avenue tunnel alignment would end in a portal near Haven Street. There is only one surface alignment in this area terminating at Bayview. The surface alignment would be on new right-of-way following this general alignment: along the Norfolk Southern railroad to an aerial structure over active freight rail lines. The alignment transitions back to the surface along the west side of I-895, continuing under I-895 to an alignment on new right-of-way to Bayview Medical Center.

Along all the alignments under consideration, there are different options for how the LRT would operate. Options under consideration include whether the transit would operate in a shared or dedicated lane with vehicular traffic, or whether introducing transit onto a street would result in the removal of a parking lane. The location and operational details for the options for Alternative 4: LRT are presented in **Table 2-5**. This table briefly describes the options by geographic area. The options are presented in greater detail in Volume II of this AA/DEIS.

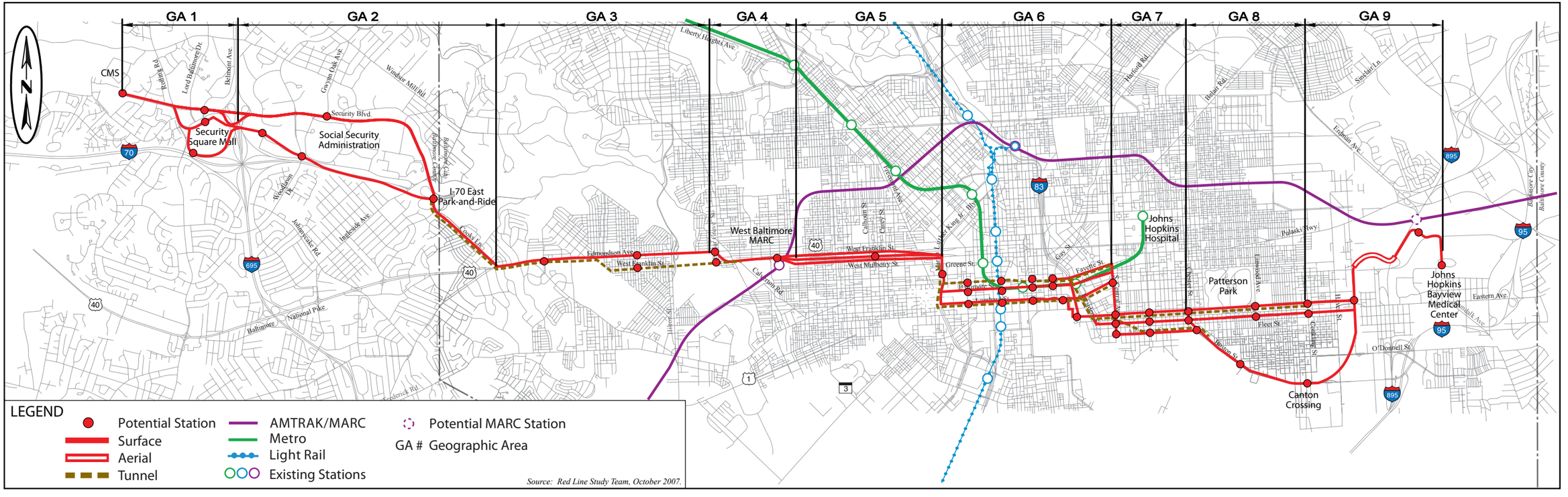


Table 2-5: Alternative 4: Light Rail Transit Options

GEOGRAPHIC AREA 1		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Security Blvd. from CMS to Rolling Road	Surface	Dedicated transit on south side of Security Boulevard
Security Sq. Mall Area from Rolling Road to I-695	Surface	Dedicated transit on south side of Security Boulevard
	Surface	Dedicated transit on west side of Rolling Road, dedicated transit on north side of mall
	Surface	Dedicated transit on west side of Rolling Road, dedicated transit on south side of mall

GEOGRAPHIC AREA 2		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
I-695 Area from I-695 to Woodlawn Drive	Surface	Dedicated transit on south side of Security Boulevard
	Surface	Dedicated transit on central alignment between I-70 and Security Blvd.
Social Security Administration Area from Woodlawn Dr. to I-70 Park-and-Ride	Surface	Dedicated transit on south side of Security Boulevard, 2 traffic lanes eastbound, 3 traffic lanes westbound.
	Surface	Dedicated transit on north side of I-70
I-70 Park-and-Ride	Surface	Multiple options for location of surface parking lot including with and without maintenance facility; representative option includes alignment along I-70, parking lot in the northwest quadrant and no maintenance facility
Cooks Ln. from I-70 Park-and-Ride to US 40	Surface	Dedicated transit in median, one lane of traffic in each direction, full time parking on west side
	Surface	Dedicated transit inbound, one traffic lane inbound, shared transit/traffic outbound, full time parking on west side
	Surface	Shared transit/traffic lanes in each direction, full time parking on west side
	Tunnel	Cooks Lane tunnel

GEOGRAPHIC AREA 3		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
US 40 from Cooks Ln. to Longwood St.	Surface	Dedicated transit in median, 3 traffic lanes peak period, peak direction, no parking; 2 traffic lanes peak period, off-peak direction, one lane of parking
	Surface	Dedicated transit in median, 2 traffic lanes in each direction, full time parking in curb lane
	Tunnel	US 40 and West Franklin Street Tunnel to Calverton Road

GEOGRAPHIC AREA 4		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
US 40 from Longwood St. to W. Baltimore MARC	Surface	Dedicated transit on north side and/or in median of Franklin St., 3 traffic lanes peak period, peak direction, no parking; 2 traffic lanes peak period, off-peak direction, one lane of parking. Outbound traffic is diverted from Franklin St. to Franklintown Rd. and Edmondson Ave.
	Surface	Dedicated transit on north side of Franklin St., 3 traffic lanes inbound, 1 traffic lane outbound, full time parking in outbound curb lane. On Edmondson Ave., 3 traffic lanes outbound peak period, peak direction, no parking; 2 traffic lanes outbound peak period, off-peak direction, one lane of parking; 1 traffic lane inbound, full time parking in inbound curb lane.
	Surface	Dedicated transit in median, 2 traffic lanes in each direction, full-time parking in curb lane
	Tunnel	US 40 and West Franklin Street Tunnel to Calverton Road (Portal C)

GEOGRAPHIC AREA 5		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Franklin/US 40/Mulberry from W. Baltimore MARC to Martin Luther King, Jr. Blvd.	Surface	Dedicated transit in median of US 40, 2 traffic lanes in each direction
	Surface	Dedicated transit on south side of Franklin St.
	Surface	Dedicated transit on north side of Mulberry St.
Martin Luther King, Jr. Blvd. from US 40 to Lombard St.	Surface	Dedicated transit on west side of MLK Jr. Blvd.
	Tunnel	Fremont Avenue tunnel
	Tunnel	MLK Jr. Blvd. tunnel – portal between W. Lexington Ave. and W. Fayette St. (Portal F)

GEOGRAPHIC AREA 6		
	Surface/ Tunnel/ Aerial	**Option Description**
Fayette/Baltimore/ Lombard from Martin Luther King Jr. Blvd to Market Pl.	Surface	Dedicated transit in second lane out on Baltimore St-Lombard St couplet. On Baltimore, 2 eastbound traffic lanes, 1 parking lane right curb full time. On Lombard, 3-5 westbound traffic lanes, 1 parking lane right curb full time.
	Surface	Dedicated transit curbside on Baltimore St-Lombard St couplet. On Baltimore, 2 eastbound traffic lanes, 1 parking lane left curb full time. On Lombard, 3-5 westbound traffic lanes, no parking on either curb.
	Surface	Dedicated transit (two-way) on north side of Baltimore St., 1 traffic lane eastbound, intermittent parking in right curb lane
	Tunnel	Fayette Street tunnel
	Tunnel	Lombard Street tunnel

Table 2-5: Alternative 4: Light Rail Transit Options (continued)

GEOGRAPHIC AREA 6 (Continued)		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Baltimore/ Lombard/ Central/ Pier 5/6 from Market Pl. to Central Ave. at Aliceanna St.	Surface	Dedicated transit in second lane out on Baltimore St-Lombard St couplet to Central Ave. On Baltimore, 2 eastbound traffic lanes, 1 parking lane right curb full time. On Lombard, 1-3 westbound traffic lanes, 1 parking lane right curb full time.
	Surface	Dedicated transit on Baltimore St-Lombard St couplet to Central Ave. On Baltimore, eastbound transit curbside, 2 eastbound traffic lanes, 1 parking lane left curb full time. On Lombard, westbound transit second lane out, 1-3 westbound traffic lanes, no parking on left curb.
	Surface	Dedicated transit (two-way) on north side of Baltimore St. to Central Ave., 1 traffic lane eastbound, intermittent parking in right curb lane
	Tunnel	Fayette Street tunnel to Central Ave. with various portal locations
	Tunnel	Lombard Street tunnel to Central Ave. with various portal locations
	Tunnel	Fayette St. tunnel continuing to Eastern Ave. tunnel
	Tunnel	Lombard St. tunnel continuing to Eastern Ave. tunnel
	Surface	From Market Pl. to President St., dedicated transit curbside W Falls Ave-Harbor Magic Way Couplet to Eastern-Fleet couplet.
	Surface	Dedicated transit second lane out on Central Ave., 1 traffic lane in each direction with center left turn lane, 1 parking lane on each curb full time.
	Surface	Dedicated transit in median on Central Ave., 1 traffic lane in each direction, 1 parking lane on each curb full time.
	Surface	Dedicated transit second lane out Eastern-Fleet couplet, one-way traffic on Eastern-Fleet, 2 traffic lanes peak direction, right curb parking full-time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, one-way traffic on Eastern-Fleet, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, two-way traffic on Eastern-Fleet,1 lane in each direction, full-time parking right curb only

GEOGRAPHIC AREA 7		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Eastern/Fleet/ Aliceanna Sts. from Central Ave. to Chester St.	Surface	Dedicated transit second lane out Eastern-Fleet couplet, one-way traffic on Eastern-Fleet, 2 traffic lanes peak direction, right curb parking full-time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, one-way traffic on Eastern-Fleet, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, two-way traffic on Eastern-Fleet, 1 lane in each direction, full-time parking right curb only
	Surface	Dedicated transit second lane out Fleet-Aliceanna couplet, one-way traffic on Fleet-Aliceanna, 2 traffic lanes peak direction, right curb parking full time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Fleet-Aliceanna Couplet, one-way traffic on Fleet-Aliceanna, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Fleet-Aliceanna Couplet, two-way traffic on Fleet-Aliceanna, 1 lane in each direction, full-time parking right curb only
	Tunnel	Eastern Ave. Tunnel
	Tunnel	Fleet/Aliceanna Tunnel

GEOGRAPHIC AREA 8		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Eastern/Fleet/Boston Sts. from Chester St. to Conkling St.	Surface	Dedicated transit second lane out Eastern-Fleet couplet, one-way traffic on Eastern-Fleet, 2 traffic lanes peak direction, right curb parking full-time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, one-way traffic on Eastern-Fleet, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, two-way traffic on Eastern-Fleet, 1 lane in each direction, full-time parking right curb only
	Surface	Dedicated transit in median of Boston St., 2 traffic lanes in each direction, full time parking westbound right curb
	Surface	Dedicated transit on south side of Boston St., 1 traffic lane in each direction with continuous left turn lane, full-time parking westbound right curb
	Tunnel	Fleet/Aliceanna tunnel to a portal on Aliceanna Street (Portal M)
	Tunnel	Fleet/Aliceanna tunnel to a portal on Boston Street (Portal N)
	Tunnel	Eastern Ave. Tunnel

GEOGRAPHIC AREA 9		
Segment	**Surface/ Tunnel/ Aerial**	**Option Description**
Conkling Street to Norfolk Southern Canton Railroad	Surface	Dedicated transit second lane out Eastern-Fleet couplet, one-way traffic on Eastern-Fleet, 2 traffic lanes peak direction, right curb parking full-time; 1 traffic lane off-peak direction, parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, one-way traffic on Eastern-Fleet, 1 traffic lane, full-time parking both curbs
	Surface	Dedicated transit second lane out Eastern-Fleet Couplet, two-way traffic on Eastern-Fleet, 1 lane in each direction, full time parking right curb only
	Tunnel	Eastern Ave. tunnel to Portal O
	Surface	From Boston St. at Conkling Street on abandoned N-S railroad right-of-way
Norfolk Southern/Canton Railroad to Bayview MARC Station	Aerial & Surface	Kresson B Alignment - at-grade in inactive Norfolk Southern railroad right-of-way; aerial structure over active Norfolk Southern railroad to dedicated surface alignment north of Lombard Street on west side of I-895, under I-895
Bayview MARC Station to Bayview Medical Campus	Surface	Alignment on new right-of-way to Mason Lord Drive, dedicated transit on east side of Mason Lord Drive

Forming End-to-End Alternative

It is necessary to combine BRT or LRT options from geographic areas to form complete end-to-end BRT or LRT alternatives. These **specific** alternatives are:

- Alternative 1: No-Build
- Alternative 2: TSM/Enhanced Bus
- Alternative 3: Bus Rapid Transit
  - 3A: BRT, dedicated surface
  - 3B: BRT, downtown tunnel + dedicated surface
  - 3C: BRT, downtown tunnel + Cooks Lane tunnel + dedicated surface
  - 3D: BRT, maximum tunnel + dedicated surface
  - 3E: BRT, dedicated surface with Johnnycake Road alignment
  - 3F: BRT, shared and dedicated surface + downtown tunnel
- Alternative 4: Light Rail Transit
  - 4A: LRT, dedicated surface
  - 4B: LRT, downtown tunnel + dedicated surface
  - 4C: LRT, downtown tunnel + Cooks Lane tunnel + dedicated surface
  - 4D: LRT, maximum tunnel + dedicated surface

These end-to-end alternatives are presented in Chapter 6 of the AA/DEIS where comparisons are made between full end-to-end alternatives.

THE AA/DEIS ANALYZES 12 ALTERNATIVES, BUT WHAT WOULD HAPPEN IF A VARIATION OF ONE OF THE ALTERNATIVES IS CHOSEN?

Ultimately, the MTA, with input from stakeholders, will decide which alternative (No-Build or one of the build alternatives) is the "preferred alternative," for the Red Line Corridor. If a build alternative is chosen, options can be mixed and matched within the preferred alternative depending on which option(s) best serve the corridor and have the least impacts. MTA's decision will rely heavily on technical information and community feedback.

Volume I-Chapter 3

Transportation System and Consequences

RED LINE Corridor Transit Study

Transportation System and Consequences

Introduction

This chapter presents the analysis of impacts on the transportation system, comparing the Red Line alternatives and options with the transportation goals and objectives of the project. As identified in Chapter 1, the transportation related goals and objective are:

- Increase transit efficiency by reducing travel times in the corridor and provide a safe and attractive transit service.
- Increase transit mobility and accessibility by better accommodating existing and future east-west travel, improve transit access to jobs, schools, shopping, and other services.
- Provide transportation choices by encouraging transit ridership, improve transit opportunities in the east-west corridor, improve transit service for transit-dependent users and others in the corridor.
- Improve transit connections by developing the connections between the existing and proposed transit services and existing and proposed development areas.

The transportation analysis is presented at both the corridor-wide level and in greater detail by geographic area and option (in Volume II). Some transportation criteria are described at a corridor-wide level, such as end-to-end transit travel times. Other criteria which have a very localized effect, such as parking spaces gained or lost, are described generally by alternative, but specifically analyzed by option within a geographic area.

The corridor-wide level of analysis is organized by: transit; roadway; connections to passenger and freight service; and bicycle and pedestrian access. The transit analysis at the corridor-wide level includes a description of the existing transit service in the corridor under the No-Build Alternative, a description of how Alternatives 2, 3, and 4 would operate if implemented, and the ridership and travel times projected for each of the build alternatives. Roadway issues discussed at a corridor level include congestion, travel times, access to stations, and impacts to neighborhood parking and access. Interaction between existing passenger and freight rail systems and the Red Line alternatives is also discussed. Lastly, the bicycle and pedestrian access to stations is described.

Volume II presents the detailed analysis of localized effects for each option within a geographic area. The transportation criteria for this analysis includes:

- Peak-period traffic lanes affected (Yes/No)
- Number of parking spaces (gained or lost)
- Vehicular access affected (Yes/No)
- 2030 transit travel times (minutes)
- 2030 roadway PM peak-period direction travel times (minutes)
- Number of intersections below LOS D

There are a few transportation terms that warrant defining in order to understand the transportation analysis that is presented.

Peak-hour – The hour during which the maximum amount of travel occurs. For the Red Line Study the PM peak hour is 5 PM to 6 PM.

Peak-period – The period during which the maximum amount of travel occurs in the AM or PM peak. For this study the AM peak-period is 6:30 AM to 9:30 AM. The PM peak-period is 3:30 PM to 6:30 PM.

Guideway or Transitway – A fixed facility for the operation of transit vehicles.

Trunkline – Mainline service operating along a guideway.

Feeder Bus – Local bus service that moves passengers to stations and connects with faster mainline bus or rail service.

Alighting – Exiting from a transit vehicle.

Corridor-wide Transportation

Transit

Existing Transit Service

The effectiveness of transit service is dependent upon several factors including geographic coverage, hours of operation and frequency of service, door-to-door travel times, travel time reliability, number and convenience of transfers, ride comfort, and safety.

Currently, the MTA provides transit service throughout much of Baltimore City and Baltimore County, with commuter bus service extending into Howard and Harford counties.

A number of local bus routes currently serve east-west travel markets in the corridor, as shown in **Figure 3-1**. The Quickbus 40 provides limited-stop (express) service from CMS along Security Boulevard, Cooks Lane, US 40, through downtown along Baltimore Street (eastbound) and Fayette Street (westbound), to Bayview Medical Center, and then along Eastern Avenue out of the corridor to Essex. Several other bus routes serve similar east-west trip patterns, including routes 10, 15, 20, 23, 150, and portions of Route 7.

Proposed Transit Service

The Red Line would provide improved east-west travel within MTA's transit service area.

Under the No-Build Alternative, east-west transit service would continue to be provided by local buses traveling in mixed traffic. Peak-hour travel times would be slower than today in many areas due to the projected growth in traffic volumes and congestion on major roads.

The TSM and build alternatives, described in Chapter 2, propose to improve service in the corridor in a number of ways, including:

- Increased frequency of service
- Faster service
- Improved reliability and ride quality
- Better station and stop amenities, including real-time transit information

Hours of Service

The Red Line would likely operate during the same time periods as other MTA services, which presently operate as shown in **Table 3-1**.

As demand warrants, service for any or all these lines can be extended to 24 hours, seven days a week. Some bus routes currently operate 24 hours, while other routes do not offer weekend service. Express buses typically operate only during weekday peak-periods.

Table 3-1 Existing MTA Hours of Service

Rail Service	Weekday		Saturday	Sunday
	Starts	Ends		
Metro	5:00 a.m.	12:30 a.m.	6:00 a.m.-12:30 a.m.	6:00 a.m.-12:30 a.m.
Light Rail	6:00 a.m.	11:00 p.m.	6:00 a.m.-11:00 p.m.	11:00 a.m.-7:00 p.m.
MARC	4:30 a.m.	10:30 p.m.	No service	No service
Local Bus	4:30 a.m.	2:00 a.m.	5:30 a.m.-2:00 a.m.	5:30 a.m.-1:00 a.m

Reliability

Reliability and dependability of transit service is a critical factor in attracting ridership. Individuals need to be able to plan on a transit trip taking a certain amount of time in order to be able to arrive at work, school, or appointments on time.

Current local bus service using existing roads is routinely delayed by traffic congestion and accidents. The existing on-time performance of MTA bus routes is approximately 65 percent, which is close to the national average for buses operating in mixed traffic. Under the No-Build Alternative, this situation would continue, with delays increasing due to the expected growth in traffic volumes by 2030.

In Alternatives 2, 3 and 4, transit-only lanes would provide a way for buses or LRT vehicles to travel not only faster, but also more reliably. Options with transit-only tunnels provide the greatest travel time reliability. Transit-only lanes on surface streets are relatively less reliable because they can be held up by traffic at cross-streets or by interference from pedestrians.

Those alternatives and options that have the greatest exposure to traffic can therefore be assumed to have the lowest reliability, as they would have greater exposure to congestion and unpredictable traffic events. The No-Build alternative, with buses traveling in mixed traffic, would therefore be the least reliable. Alternative 2: TSM, that has both dedicated and shared lanes with right-turning traffic, would be more reliable than the No-Build Alternative. Alternatives 3 and 4 would be more reliable than TSM and No-Build, as they have dedicated lanes along most of the Red Line Corridor.

Ride Quality

Comfort is another factor in attracting additional riders from their cars. Narrow lanes and poor road conditions in the curb lane, including the presence of storm drains, make for a poor-quality bus ride, occasionally literally lifting passengers out of their seats.

Vehicle Improvements

Comfort on the Red Line would be enhanced by providing new vehicles as proposed in Alternatives 2, 3, and 4.

In the TSM and BRT alternatives, the vehicles used for trunkline service would likely be articulated 60-foot buses. These buses will provide a higher capacity than the standard buses (90 passengers/bus vs. 60 for regular buses), and should enhance the quality of the ride by providing faster exiting, more comfortable seating, and a smoother ride.

In the LRT alternatives, trunkline service would be provided by new light rail vehicles, which will also provide more comfortable seating, a smoother ride, and faster exiting from multiple doors.

Travelway Improvements

Another way to improve ride quality is by improving the surface of the transitway on which the buses or LRT vehicles travel. Improvements to portions of existing curb lanes are included in Alternative 2. The existing road surface will be resurfaced or reconstructed for the transitway in Alternatives 3 and 4, which would enhance the ride quality.

Transit Access Improvements

The quality of a transit trip would also be enhanced by improving service reducing wait times and by making station facilities more comfortable. Alternatives 2, 3, and 4, as shown in **Table 3-2,** propose a transit service with increased frequencies. New stations with enhanced amenities, such as shelters, seating, and real time information displays, are also proposed. These stations are being designed with improvements in pedestrian access, park-and-ride lots, and car drop-off access to make the trip to the transit station more accessible. Additional details on station locations and amenities are available in the *Red Line Stations Technical Report*. Station-area amenities and impacts are briefly described later in this chapter.

Trunkline Service

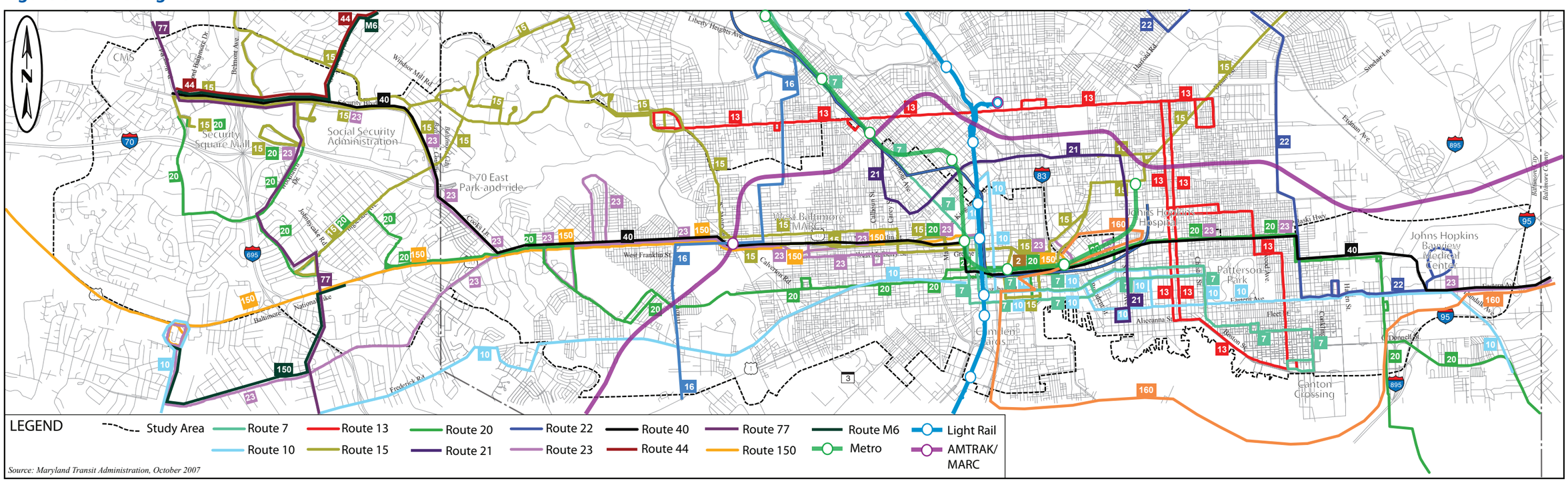
A number of local bus routes currently serve east-west travel markets in the corridor, as shown in **Figure 3-1**. The Quickbus 40 route serves the entire corridor, providing limited-stop (express) service from CMA along Security Boulevard, Cooks Lane, and US 40, through downtown along Baltimore Street (eastbound) and Fayette Street (westbound), to Bayview Medical Center, and then along Eastern Avenue out of the corridor to Essex. Several other bus routes serve similar east-west trip patterns, including Routes 10, 15, 20, 23, 150, and portions of Route 7.

With Alternative 2 and the build alternatives, new trunkline or mainline service is proposed along the corridor, provided with either articulated (60-foot-long) buses (Alternative 3) or with Light Rail trains (Alternative 4). This service would replace the Quickbus 40 route, and nearly double the service and capacity in the corridor, improving ride quality and reliability.

With Alternative 2 and Alternative 3, the new trunkline routes would extend from the western terminus at CMS to the eastern terminus at Bayview. Additional trunkline service would extend east and west to serve park-and-ride lots in Baltimore and Howard counties.

With Alternative 4, the light rail guideway would follow the same alignments as those proposed in most of the BRT alternatives. Light rail trains would operate between the two terminal stations at CMS and Bayview, replacing the Quickbus 40 route and portions of other routes.

Figure 3-1: Existing MTA Transit Service



Feeder Bus Service

To extend the reach of the trunkline service into surrounding neighborhoods, Alternatives 2, 3, and 4 each propose modifications to existing east-west bus routes to bring passengers to the higher-speed trunkline service.

In the LRT alternative, several existing bus routes (MTA Routes 10, 15, 20, 23, and 150) will be re-routed to terminate at an LRT station, allowing passengers to easily transfer from bus to LRT. Some local bus service would continue to operate along streets in which the light rail guideway is located to serve local bus stops.

In the TSM and BRT alternatives, these feeder routes will run on portions of the guideway rather than terminate at a station. This will allow residents of neighborhoods served by the feeder bus routes to be picked up at their local stops and then travel express along the high-speed guideway. Allowing feeder buses to run on the TSM and BRT would lead to improved service levels for local passengers as well. As in the LRT alternative, some local bus service would continue to operate in the curb lane parallel to the mainline, providing connections to Red Line stations, and serving local bus stops in neighborhoods along the guideway.

Under the TSM alternative and most of the BRT alternatives, feeder buses would be able to easily get on and off of the guideway. Where long tunnel segments are involved (Alternative 3D, described in Chapter 6), it may not be practical to have feeder buses make the long diversions required to reach the tunnel portals. In this situation, feeder service would run in mixed traffic on surface streets and serve local stops, with most passengers transferring to trunkline service for a faster trip.

Fares

The MTA fare structure uses a single, flat fare for all trips on local busses, metro, and Central Light Rail. The TSM, BRT, and LRT Alternatives will all use the same flat fare as existing local buses and Central Light Rail.

Other Transit Service

Other bus lines, MARC, Metro, and the Central Light Rail Lines are generally assumed to operate the same in all four alternatives. Minor changes may be made to make transfers easier. For example, transit schedules may be modified, or local bus stops may be added to drop passengers off closer to the new Red Line stations.

In addition, some local buses could be re-routed to operate in the downtown BRT tunnel that is part of Alternatives 3B, 3C and 3F, if doing so improves the travel time and reliability for those routes.

Frequency of Service

Under Alternatives 2, 3 and 4, service frequencies on the majority of existing bus routes in the corridor will remain similar to the future No-Build, with the addition of new trunkline service along the corridor. The trunkline service between CMS and Bayview Medical Center could operate as shown in **Table 3-2**.

Table 3-2: Transit Service Frequency

Alternative	# Buses or Trains/Hour in Peak-Periods	# Buses or Trains/Hour Off-Peak-Periods
No-Build – 1 (QuickBus 40 route)	5	4
2: TSM	12	7-8
3A: BRT	15	7-8
3B: BRT	15	7-8
3C: BRT	15	7-8
3D: BRT	15	7-8
3E: BRT	15	7-8
3F: BRT	12	7-8
4A: LRT	6	6
4B: LRT	6-7	6-7
4C: LRT	6-7	6-7
4D: LRT	7-8	7-8

Note: BRT service is more frequent than LRT service to compensate for the greater capacity of the LRT vehicle.

Central Light Rail at North Avenue rail yard

HOW WILL THE RED LINE AFFECT EXISTING BUS SERVICE?

Similar to the Light Rail and the Metro, the Red Line is viewed as a "trunkline" or mainline service, providing a faster, more frequent and higher quality ride than buses on city streets. An important component of this trunkline service, however, is connecting to the rest of the transit system, including local bus routes within the corridor. Therefore, the MTA is examining existing bus routes to determine if they should be modified to serve one or more Red Line stations.

Changes to existing bus service could differ, depending on the mode chosen for the Red Line, either Bus Rapid Transit or Light Rail Transit. The primary goal with any service change is to enhance accessibility and reliability of the transit system.

If Light Rail Transit is selected, portions of the bus routes operating within the corridor parallel to the Light Rail Transit guideway (e.g., portions of bus Routes 10, 15, 20, 23 and 40) would likely be modified to serve transit stations. Those bus lines would become "feeder" routes, operating locally through neighborhoods and along major streets, terminating at a transit station so passengers can transfer to the faster and better ride via the Red Line. This is how the "M" routes and other bus routes operate today to Metro and Light Rail stations. The rationale is that once the investment is made in a Red Line rapid transit line, the MTA should reduce redundant bus routes that parallel or duplicate service provided by the Red Line. Some local bus service would continue running along streets adjacent to the guideway to serve local bus stops.

If Bus Rapid Transit is selected for the Red Line, the majority of existing bus routes within the corridor likely will be routed onto the guideway or dedicated bus lane and serve the Red Line stops through downtown. In addition, existing buses would operate locally through neighborhoods and then join the dedicated guideway at an appropriate location and continue through town as express buses. In this way, the passenger won't have to transfer from the local bus to the express route and the passenger's total transit trip would be faster than it is today. Some local buses would continue to run along streets adjacent to the guideway to serve local bus stops.

Regardless of the mode selected for the Red Line, bus routes outside of the corridor and those crossing the corridor (such as Routes 13, 16 and 77) would only be modified, if appropriate, to serve an adjacent Red Line station and allow transfers between those routes and Red Line service.

Travel Times

Each alternative provides specific improvements to reduce east-west transit travel times along the Red Line corridor, including varying lengths of tunnels and dedicated guideway, traffic signal priority, and improved boarding times. The end-to-end travel times by alternative are shown in the **Table 3-3**.

In general, the greater the length of tunnel, the shorter the alternative's travel time would be. Route length varies between alternatives, and must be taken into account when comparing the travel times by alternative.

The Woodlawn/Johnnycake/Ingleside alignment in Alternative 3E is a mile longer than the alignments along Security Boulevard and I-70 via Cooks Lane to US 40 in the BRT alternatives. Similarly, the distance from downtown to Bayview via Boston Street is about 6,000 feet longer than the distance via Eastern Avenue.

Table 3-4 presents a sample of station-to-station travel times for each of the alternatives.

Transit Ridership

Growth in transit ridership is an important measure of success for transit projects. The more riders an alternative can attract, the better the mobility.

Travel demand modeling provides a number of ways to look at the ridership impacts of a change in transit service. The following discussion on ridership will summarize:

- Daily ridership on the guideway **(Table 3-5)**
- New transit trips **(Table 3-5)**
- Transit boardings at Red Line stations (projected morning peak-period and daily transit boardings by station are summarized in **Tables 3-6** through **3-8**.)
- Transit user benefits (travel time savings - **Table 3-10**)

Daily Ridership

Guideway boardings are the total number of passengers boarding or getting off of any train or bus at a guideway station. New transit trips show the number of new transit riders compared to the No-Build Alternative. Some riders of the improved Red Line service would be people who would take existing bus transit under the No-Build, others are individuals who might not have made a trip, or who would have used their car instead. Calculating new transit riders is especially important for measuring how well an alternative can achieve the air quality goals outlined in Chapter 1: Purpose and Need. **Table 3-5** summarizes the 2030 daily guideway boardings as well as daily and annual new transit trips.

Transit Demand by Station

While all stations receive walkup and feeder bus patrons, the greatest morning boarding volumes would typically be those stations providing major park-and-ride facilities and feeder bus service – such as I-70 East station, Bayview MARC station, and Canton Crossing station – and stations where major transfers occur, such as the Howard Street and Charles Center stations. Transit patrons would generally walk to a rail station when the distance does not exceed 1/4 to 1/2 of a mile. Beyond that, most patrons would access a station by either automobile or feeder bus.

Projected morning peak-period and daily transit boardings by station are summarized in **Tables 3-6** through **3-8**.

Table 3-3: CMS-to-Bayview Distance, Travel Time, and Speed

Alternative	Guideway Distance	CMS-to-Bayview Travel Time[1]	Travel Time Savings[1]	Average Speed[2]
No-Build	13.9 miles	80 min	---	10 mph
2: TSM	14.3 miles	76 min	4 min	11 mph
3A: BRT	13.8 miles	62 min	18 min	13 mph
3B: BRT	14.9 miles	56 min	24 min	16 mph
3C: BRT	14.7 miles	53 min	27 min	17 mph
3D: BRT	13.7 miles	43 min	37 min	19 mph
3E: BRT	14.8 miles	69 min	11 min	13 mph
3F: BRT	14.3 miles	65 min	15 min	13 mph
4A: LRT	13.9 miles	55 min	25 min	15 mph
4B: LRT	14.6 miles	43 min	37 min	21 mph
4C: LRT	14.6 miles	41 min	39 min	22 mph
4D: LRT	13.7 miles	36 min	44 min	23 mph

Note: 1: Travel times are rounded to the nearest 1 minute.
2: Average speeds are rounded to the nearest 1 mph.

Table 3-4: Sample Station-Station Travel Times in 2030

Alternative	Security Sq Mall to Charles Center	Edmondson Village to Charles Center	Howard Street to Social Security Admin	Bayview to Charles Center	Fells Point to W. Baltimore MARC
No-Build	45 min	22 min	39 min	31 min	28 min
2: TSM	41 min	23 min	35 min	32 min	27 min
3A: BRT	32 min	20 min	28 min	25 min	23 min
3B: BRT	29 min	18 min	26 min	21 min	16 min
3C: BRT	27 min	18 min	24 min	21 min	17 min
3D: BRT	25 min	15 min	22 min	13 min	14 min
3E: BRT	38 min	20 min	26 min	25 min	24 min
3F: BRT	36 min	20 min	32 min	26 min	18 min
4A: LRT	28 min	17 min	24 min	23 min	22 min
4B: LRT	25 min	15 min	22 min	14 min	12 min
4C: LRT	23 min	15 min	20 min	14 min	12 min
4D: LRT	21 min	13 min	18 min	11 min	12 min

Table 3-5: Guideway Trips and New Transit Trips

Alternative	Total Daily Guideway Boardings	Annual Guideway Boardings	Daily New Transit Trips vs. No-Build	Annual New Transit Trips
No-Build	---	---	---	---
2: TSM	17,600	5,280,000	3,850	1,155,000
3A: BRT	31,400	9,420,000	6,030	1,809,000
3B: BRT	37,400	11,220,000	6,860	2,058,000
3C: BRT	37,400	11,220,000	7,100	2,130,000
3D: BRT	41,500	12,450,000	10,590	3,177,000
3E: BRT	29,300	8,790,000	5,370	1,611,000
3F: BRT	34,300	10,290,000	5,910	1,773,000
4A: LRT	34,600	10,380,000	9,860	2,958,000
4B: LRT	41,100	12,330,000	12,330	3,699,000
4C: LRT	42,100	12,660,000	12,720	3,816,000
4D: LRT	42,300	12,690,000	13,260	3,978,000

Note: Daily Guideway Boardings and New Transit Trips include all trip purposes.

HOW IS RIDERSHIP PROJECTED FOR FUTURE YEARS?

Ridership estimates for any transit project typically are calculated through a travel demand model developed by the local Metropolitan Planning Organization (MPO), the local transit agency or a similar organization. Transit projects in Baltimore use the travel demand model developed by the Baltimore Regional Transportation Board (BRTB), the region's local MPO.

Similar to the majority of models in use across the country, the BRTB travel demand model estimates ridership in a four-step process:

1. Trip Generation: Estimating how many people will travel to and from small geographic areas within the metropolitan area.
2. Trip Distribution: Estimating how many people will travel between each geographic area. For example, if the first step estimated that 200 people will travel to the Inner Harbor, this step might estimate 40 of those 200 people will come from Towson, and 35 people will come from Woodlawn.
3. Mode Choice: Estimating how many people will take transit versus automobile.
4. Assignment: Designating auto trips to the highway network and transit trips to the transit network, specific buses and rail services.

Other steps in the model process include accounting for truck traffic and how people taking transit actually get to the transit stop or station.

Developing travel demand models is data-intensive and time-consuming. It is an ongoing process involving constant data updates to reflect changing conditions and new land use projections. Also part of a travel demand model are population and employment estimates; highway and transit networks and speeds, access links to connect the geographic zones to the highway and transit networks, transit routes, frequencies, number of stops and stations, station parking and bus access, and fares and other costs. After the data is obtained all of it is calibrated to actual, observed counts to ensure the model reflects reality. This work is performed for the Baltimore area by the Baltimore Regional Transportation Board.

After the future No-Build conditions are finalized, the specific improvements proposed with an alternative are added to the model, including, the guideway and any bus or rail service changes that are part of a proposed alternative. Each alternative includes the guideway, stations, station facilities (park-and-ride), travel speeds, frequencies (number of trains or buses per hour) and fares. The model is then run through a computer (a 10-hour process) and results are checked for reasonableness.

One of the important results from the travel demand model computer runs is the number of new transit passengers, those who choose to take transit rather than use their automobile for some portion of their daily trips. This measure indicates the attractiveness of the new service relative to highway travel times and costs. Another important result of the travel demand run is an output known as "user benefits" or "user benefit hours" – the measure of time savings not only for those who switch from the automobile to transit, but the time savings for those who already take transit but now experience shorter travel times after implementation of new service. The measure expresses the benefits for all transit users, not only those who stopped using their automobile for their travel.

Table 3-6: Morning Peak-Period Boardings in 2030

Station Name	Alt 2	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 3F	Alt 4A	Alt 4B	Alt 4C	Alt 4D
CMS	10	20	20	20	20	20	0	40	30	30	30
Security Square	20	340	280	330	380	140	80	640	660	700	730
Security West	n/a	10	20	10	20	10	n/a	60	70	90	100
SSA	10	120	110	170	190	410	20	260	290	340	370
I-70 East	190	940	890	1,140	930	n/a	850	840	850	920	1,070
Westview	n/a	n/a	n/a	n/a	n/a	440	n/a	n/a	n/a	n/a	n/a
Coleridge	n/a	n/a	n/a	n/a	n/a	220	n/a	n/a	n/a	n/a	n/a
Edmondson Village	300	630	600	630	520	590	570	940	940	950	990
Allendale	380	530	500	520	310	510	530	540	550	550	560
Rosemont	460	720	710	690	190	640	700	560	680	670	680
W. Balt. MARC	790	1,130	1,060	1,050	810	980	1,180	700	690	690	700
Harlem Park	340	450	360	340	370	320	370	300	300	300	310
Poppleton	70	160	130	100	180	140	80	90	90	90	90
University Center	610	560	250	230	220	500	850	490	90	90	90
Howard Street	310	480	780	1,930	1,010	440	840	470	540	550	560
Charles Center	380	550	1,900	550	1,840	490	1,560	340	1,420	1,440	1,350
Government Center/Inner Harbor	520	880	540	700	590	810	560	700	370	380	360
Central Ave	130	210	110	300	190	190	0	140	n/a	n/a	n/a
Inner Harbor East	20	20	70	20	100	50	20	90	270	270	120
Fells Point	160	160	210	200	500	200	200	200	210	210	190
Chester Street	0	70	50	50	150	90	60	120	n/a	n/a	140
Patterson Park	0	100	n/a	n/a	520	120	90	390	n/a	n/a	270
Canton	n/a	n/a	190	190	n/a	n/a	n/a	n/a	320	320	n/a
Canton Crossing	n/a	n/a	790	430	n/a	n/a	n/a	n/a	1,660	1,690	n/a
Highlandtown	0	90	220	230	1,970	140	160	680	540	590	1,320
Bayview MARC	320	760	700	500	570	850	810	1,760	1,630	1,660	2,530
Bayview Campus	0	30	50	50	40	20	0	80	150	160	170
Total	**5,020**	**8,960**	**10,540**	**10,380**	**11,620**	**8,320**	**9,530**	**10,430**	**12,350**	**12,690**	**12,730**

Note: Estimates shown include all boardings, including transfers from feeder bus and those passengers who arrive by walking, are dropped off, or drove to the station (where parking is provided).

Table 3-7: Morning Peak-Period Alightings in 2030

Station Name	Alt 2	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 3F	Alt 4A	Alt 4B	Alt 4C	Alt 4D
CMS	0	130	60	60	80	60	0	170	150	150	160
Security Square	50	160	170	190	210	130	160	330	340	360	380
Security West	n/a	130	120	130	150	160	10	230	230	250	270
SSA	60	220	210	230	240	150	170	420	450	490	520
I-70 East	10	30	30	30	30	n/a	20	60	40	50	50
Westview	n/a	n/a	n/a	n/a	n/a	150	n/a	n/a	n/a	n/a	n/a
Coleridge	n/a	n/a	n/a	n/a	n/a	100	n/a	n/a	n/a	n/a	n/a
Edmondson Village	100	260	240	260	220	230	210	380	390	410	440
Allendale	120	190	170	180	120	170	190	170	170	170	170
Rosemont	160	270	320	310	110	250	310	290	340	330	350
W. Balt. MARC	520	560	700	780	750	520	700	460	550	550	580
Harlem Park	50	80	90	90	90	70	80	80	60	60	60
Poppleton	320	520	270	260	310	450	320	420	180	190	200
University Center	1,100	1,580	550	670	560	1,390	1,000	910	370	380	390
Howard Street	960	1,390	2,370	3,000	2,740	1,280	2,400	1,440	1,950	2,010	2,120
Charles Center	1,030	1,500	2,750	1,840	2,900	1,390	2,370	1,280	2,030	2,080	2,070
Government Center/ Inner Harbor	460	600	1,420	1,440	1,460	560	1,500	560	1,070	1,080	1,140
Central Ave	120	210	110	260	140	210	0	130	n/a	n/a	n/a
Inner Harbor East	30	430	360	350	590	380	380	510	530	540	490
Fells Point	30	230	170	160	440	200	170	190	250	250	270
Chester Street	0	50	50	40	60	50	30	60	n/a	n/a	80
Patterson Park	10	120	n/a	n/a	260	100	50	130	n/a	n/a	160
Canton	n/a	n/a	160	160	n/a	n/a	n/a	n/a	230	230	n/a
Canton Crossing	n/a	n/a	90	100	n/a	n/a	n/a	n/a	700	730	n/a
Highlandtown	40	200	170	160	380	220	150	730	530	590	970
Bayview MARC	0	20	30	30	40	20	30	40	60	60	50
Bayview Campus	40	450	550	560	590	430	100	630	880	860	880
Total	**5,210**	**9,330**	**11,160**	**11,290**	**12,470**	**8,670**	**10,350**	**9,620**	**11,500**	**11,820**	**11,800**

Note: Estimates shown include all alightings, including transfers from feeder bus and those passengers who arrive by walking, are dropped off, or drove to the station (where parking is provided).

Table 3-8: Daily Guideway Station Boardings

Station Name	Alt 2	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 3F	Alt 4A	Alt 4B	Alt 4C	Alt 4D
CMS	10	260	130	140	170	140	0	370	310	310	330
Security Square	100	870	780	890	1,020	460	400	1,670	1,710	1,820	1,920
Security West	n/a	240	240	240	290	290	10	510	520	580	640
SSA	130	580	550	680	740	970	330	1,160	1,280	1,430	1,540
I-70 East	330	1,670	1,580	2,030	1,670	n/a	1,500	1,560	1,540	1,660	1,920
Westview	n/a	n/a	n/a	n/a	n/a	1,000	n/a	n/a	n/a	n/a	n/a
Coleridge	n/a	n/a	n/a	n/a	n/a	550	n/a	n/a	n/a	n/a	n/a
Edmondson Village	690	1,520	1,460	1,530	1,270	1,400	1,360	2,280	2,300	2,330	2,460
Allendale	860	1,230	1,160	1,200	730	1,180	1,240	1,230	1,240	1,250	1,260
Rosemont	1,070	1,700	1,790	1,730	520	1,530	1,750	1,470	1,750	1,720	1,780
W. Balt. MARC	2,260	2,900	3,030	3,150	2,700	2,590	3,250	2,010	2,140	2,140	2,200
Harlem Park	670	900	770	750	790	680	770	660	610	610	640
Poppleton	680	1,170	700	630	840	1,020	690	880	460	470	490
University Center	2,950	3,680	1,380	1,550	1,350	3,260	3,190	2,410	800	820	830
Howard Street	2,200	3,220	5,440	8,490	6,460	2,970	5,590	3,290	4,290	4,410	4,610
Charles Center	2,420	3,530	8,010	4,120	8,170	3,240	6,780	2,790	5,940	6,070	5,900
Government Center/ Inner Harbor	1,690	2,550	3,370	3,690	3,530	2,360	3,550	2,160	2,480	2,520	2,590
Central Ave	420	720	380	960	570	680	0	460	n/a	n/a	n/a
Inner Harbor East	100	770	740	640	1,180	740	690	1,030	1,380	1,390	1,050
Fells Point	320	670	650	630	1,610	700	640	670	790	790	800
Chester Street	0	200	160	150	370	240	170	300	n/a	n/a	380
Patterson Park	10	370	n/a	n/a	1,350	380	240	910	n/a	n/a	750
Canton	n/a	n/a	610	600	n/a	n/a	n/a	n/a	950	940	n/a
Canton Crossing	n/a	n/a	1,520	910	n/a	n/a	n/a	n/a	4,070	4,180	n/a
Highlandtown	70	490	670	670	4,040	620	540	2,440	1,840	2,010	3,960
Bayview MARC	550	1,350	1,260	930	1,060	1,510	1,440	3,100	2,910	2,970	4,450
Bayview Campus	70	830	1,030	1,050	1,090	780	180	1,220	1,770	1,770	1,800
Total	**17,600**	**31,420**	**37,410**	**37,360**	**41,520**	**29,290**	**34,310**	**34,580**	**41,080**	**42,190**	**42,300**

Note: Estimates shown include all boardings, including transfers from feeder bus and those passengers who arrive by walking, are dropped off, or drove to the station (where parking is provided).

Special Generator Trips

In addition to transit trips for work, shopping, and other purposes included in the ridership estimates in **Table 3-5**, transit passenger trips to and from sports games at the two downtown stadiums and other large events are expected. These include Orioles and Ravens games, Artscape, July 4th and New Years fireworks displays, and other events where transit ridership has been traditionally high. The existing Central Light Rail Line carried approximately 600,000 passengers in 2007 to and from special events. This equates to about 2,000 trips on an average weekday, or 7.5 percent of the 27,000 average weekday boardings on the Central Light Rail.

It is estimated that, between 480,000 and 690,000 passengers would be expected to take the Red Line to special events in 2030, as shown in **Table 3-9**.

Local bus operating on Baltimore Street

Transit User Benefits

User benefit hours is a measure of the time saved by all transit passengers. These include existing passengers who experience a faster trip, as well as those patrons who have switched from the automobile to transit. The FTA requires an estimate of user benefit hours, and has a specific formula for calculating it. User benefit hours are used in the calculation of cost effectiveness, described later in Chapter 6.

The alternatives with the longest tunnels and faster travel times (Alternatives 3D, 4B, 4C, and 4D) provide the highest level of user benefits.

Table 3-10 summarizes the user benefit hours compared to the No-Build and TSM alternatives.

Table 3-9: Special Generator Guideway Trips

Alternative	Annual Special Generator Guideway Boardings
No-Build	270,000
2: TSM	510,000
3A: BRT	600,000
3B: BRT	600,000
3C: BRT	660,000
3D: BRT	480,000
3E: BRT	540,000
3F: BRT	570,000
4A: LRT	660,000
4B: LRT	690,000
4C: LRT	690,000

Table 3-10: Daily and Annual User Benefit Hours

Alternative	Total Daily User Benefit Hours Vs. No-Build	Total Daily User Benefit Hours Vs. TSM	Annual User Benefit Hours Vs. TSM
No-Build	---	---	---
2: TSM	3,530	---	---
3A: BRT	6,960	3,430	1,029,000
3B: BRT	7,610	4,080	1,224,000
3C: BRT	7,870	4,340	1,302,000
3D: BRT	11,460	7,930	2,379,000
3E: BRT	6,250	2,720	816,000
3F: BRT	6,620	3,090	927,000
4A: LRT	10,900	7,370	2,211,000
4B: LRT	13,130	9,600	2,880,000
4C: LRT	13,580	10,050	3,015,000
4D: LRT	14,190	10,660	3,198,000

Market Analysis

This section describes how well the alternatives serve the intended markets. The Purpose and Need identified three primary markets:

1. Residents of the corridor traveling downtown as their final destination, or as a transfer to other transit services that link to regional destinations such as BWI Airport, Aberdeen Proving Grounds, Washington, DC, and New York City.
2. Commuters from the I-70 corridor, including northern Howard County and southern Carroll County, those areas served by the Baltimore Beltway (I-695), including the Liberty Road and Rolling Road corridors and the Catonsville area, and from I-859 and I-95 on the east side of the corridor.
3. Reverse commuters to the large Social Security Administration complex in Woodlawn, the CMS (Medicare) processing center, Security Square Mall, and surrounding businesses coming from residential areas in Baltimore City.

Table 3-11 summarizes the number of additional home-based-work passenger trips in each alternative relative to each market. As shown, residents within the corridor and reverse commuters show the largest increases in transit trips, with an increase of between five and 14 percent for residents and between 18 and 31 percent increase in reverse commute transit trips.

The largest gain in transit trips for residents in the Red Line corridor is from the Security Square (12-49 percent), Edmondson Village (7-31 percent), and Canton areas (2-20 percent) to the CBD and nearly the same amounts from those three districts to all other areas in the region.

Reverse commuters are well served, with increases in transit trips between 44 and 67 percent to the SSA/ Security Square area and between 11 and 29 percent to Woodlawn, Catonsville, and Dundalk areas. In all cases, the faster travel times of the alternatives with the longer lengths of tunnel show the greatest gains in ridership.

Commuters from outside the area are also well served with the alternatives, especially to downtown Baltimore. Howard County shows an increase in transit trips of between five and 26 percent to the CBD, with Essex and Dundalk showing an increase of between 6 and 29 percent each. Increases from other areas outside of the corridor range from four to ten percent generally, with Dundalk showing larger increases to areas outside of the CBD.

User benefits for low income riders make up a high proportion of the overall benefits within several key markets. Work related user benefits attributable to low income residents range from 11 percent to the CBD to 24 percent for trips to the Bayview Medical Complex and other locations within the corridor. Forty-seven percent of shopping trips into the social security area are attributable to low income residents, as are nearly 40 percent of trips other than work and shopping to Bayview Medical Complex area. Thirty-eight percent of all non-work and non-shopping trips with the Red Line corridor are attributable to low income residents.

Table 3-11: Home-Based-Work Transit Trips verses the No-Build Alternative

MARKETS		NO-BUILD			INCREASE IN TRANSIT TRIPS VS. NO-BUILD										
Origin	Destination	Person Trips	Transit Trips	Transit Share	2 TSM	3A BRT	3B BRT	3C BRT	3D BRT	3E BRT	3F BRT	4A LRT	4B LRT	4C LRT	4D LRT
Residents of Red Line Corridor															
Security Area	CBD	2,783	516	19%	29	60	101	84	142	39	36	198	215	230	251
Edmondson Village	CBD	3,550	846	24%	53	57	100	76	139	55	67	227	247	247	261
Rosemont	CBD	3,063	1,044	34%	44	48	73	65	53	47	60	118	108	109	107
Catonsville	CBD	3,438	705	21%	13	4	23	12	25	15	8	68	74	74	84
Poppleton	CBD	7,327	2,829	39%	20	25	25	18	19	11	24	63	38	38	39
Canton	CBD	4,867	1,140	23%	-13	20	74	40	190	10	70	134	187	192	228
Security Area	All Other Areas	29,739	1,322	4%	147	271	330	320	384	220	183	453	489	525	569
Edmondson Village	All Other Areas	18,829	2,043	11%	171	289	334	305	416	264	276	546	577	588	624
Rosemont	All Other Areas	14,487	2,225	15%	87	137	184	156	200	130	149	191	209	213	221
Catonsville	All Other Areas	49,336	2,808	6%	148	158	186	166	202	199	166	216	225	230	257
Poppleton	All Other Areas	29,731	5,958	20%	46	131	135	118	196	103	124	198	230	238	253
Canton	All Other Areas	26,856	3,174	12%	46	114	253	178	578	93	184	233	400	411	518
Total		**194,006**	**24,610**	**13%**	**791**	**1,314**	**1,818**	**1,538**	**2,544**	**1,186**	**1,347**	**2,645**	**2,999**	**3,095**	**3,412**
Commuters from Outside Corridor															
Randallstown/ Woodlawn	CBD	9,511	2,663	28%	-1	14	0	52	77	8	3	41	39	47	58
Howard County	CBD	8,072	1,011	13%	44	22	9	202	267	-69	-54	140	162	180	213
White Marsh	CBD	3,834	559	15%	12	2	-6	-3	6	2	15	8	31	31	43
Essex	CBD	5,570	1,193	21%	60	67	82	131	171	52	102	122	191	190	236
Dundalk	CBD	4,106	785	19%	-1	27	105	70	175	23	107	98	228	228	219
Randallstown/ Woodlawn	All Other Areas	82,279	4,675	6%	97	128	143	136	218	104	108	186	232	247	257
Howard County	All Other Areas	233,247	4,864	2%	97	196	222	235	269	167	115	206	248	260	282
White Marsh	All Other Areas	51,273	2,004	4%	51	86	101	88	127	80	72	118	146	149	145
Essex	All Other Areas	64,102	2,779	4%	85	114	132	118	183	103	102	160	186	190	190
Dundalk	All Other Areas	59,739	3,715	6%	99	245	374	269	655	222	341	386	748	755	661
Total		**521,733**	**24,248**	**5%**	**543**	**901**	**1,162**	**1,298**	**2,148**	**692**	**911**	**1,465**	**2,211**	**2,277**	**2,304**
Reverse Commuters															
All Areas	SSA/Security Area	47,270	2,294	5%	456	998	1,006	977	1,104	922	655	1,383	1,389	1,460	1,546
All Areas	Woodlawn	38,820	1,615	4%	164	172	189	188	218	169	172	226	240	251	268
All Areas	Catonsville	44,425	2,994	7%	457	406	428	415	479	446	419	551	520	532	558
All Areas	Dundalk	84,003	5,403	6%	199	669	960	740	1,324	633	589	934	1,547	1,566	1,347
Total		**214,518**	**12,306**	**6%**	**1,276**	**2,245**	**2,583**	**2,320**	**3,125**	**2,170**	**1,835**	**3,094**	**3,696**	**3,809**	**3,719**
Grand Total		**930,257**	**61,164**	**7%**	**2,610**	**4,460**	**5,563**	**5,156**	**7,817**	**4,048**	**4,093**	**7,204**	**8,906**	**9,181**	**9,435**

MARKETS		NO-BUILD			PERCENT INCREASE IN TRANSIT TRIPS VS. NO-BUILD										
Origin	Destination	Person Trips	Transit Trips	Transit Share	2 TSM	3A BRT	3B BRT	3C BRT	3D BRT	3E BRT	3F BRT	4A LRT	4B LRT	4C LRT	4D LRT
Residents of Red Line Corridor															
Security Area	CBD	2,783	516	19%	6%	12%	20%	16%	28%	8%	7%	38%	42%	45%	49%
Edmondson Village	CBD	3,550	846	24%	6%	7%	12%	9%	16%	7%	8%	27%	29%	29%	31%
Rosemont	CBD	3,063	1,044	34%	4%	5%	7%	6%	5%	5%	6%	11%	10%	10%	10%
Catonsville	CBD	3,438	705	21%	2%	1%	3%	2%	4%	2%	1%	10%	10%	10%	12%
Poppleton	CBD	7,327	2,829	39%	1%	1%	1%	1%	1%	0%	1%	2%	1%	1%	1%
Canton	CBD	4,867	1,140	23%	-1%	2%	6%	4%	17%	1%	6%	12%	16%	17%	20%
Security Area	All Other Areas	29,739	1,322	4%	11%	20%	25%	24%	29%	17%	14%	34%	37%	40%	43%
Edmondson Village	All Other Areas	18,829	2,043	11%	8%	14%	16%	15%	20%	13%	14%	27%	28%	29%	31%
Rosemont	All Other Areas	14,487	2,225	15%	4%	6%	8%	7%	9%	6%	7%	9%	9%	10%	10%
Catonsville	All Other Areas	49,336	2,808	6%	5%	6%	7%	6%	7%	7%	6%	8%	8%	8%	9%
Poppleton	All Other Areas	29,731	5,958	20%	1%	2%	2%	2%	3%	2%	2%	3%	4%	4%	4%
Canton	All Other Areas	26,856	3,174	12%	1%	4%	8%	6%	18%	3%	6%	7%	13%	13%	16%
Total		**194,006**	**24,610**	**13%**	**3%**	**5%**	**7%**	**6%**	**10%**	**5%**	**5%**	**11%**	**12%**	**13%**	**14%**
Commuters from Outside Corridor															
Randallstown/ Woodlawn	CBD	9,511	2,663	28%	0%	1%	0%	2%	3%	0%	0%	2%	1%	2%	2%
Howard County	CBD	8,072	1,011	13%	4%	2%	1%	20%	26%	-7%	-5%	14%	16%	18%	21%
White Marsh	CBD	3,834	559	15%	2%	0%	-1%	-1%	1%	0%	3%	1%	6%	6%	8%
Essex	CBD	5,570	1,193	21%	5%	6%	7%	11%	14%	4%	9%	10%	16%	16%	20%
Dundalk	CBD	4,106	785	19%	0%	3%	13%	9%	22%	3%	14%	12%	29%	29%	28%
Randallstown/ Woodlawn	All Other Areas	82,279	4,675	6%	2%	3%	3%	3%	5%	2%	2%	4%	5%	5%	5%
Howard County	All Other Areas	233,247	4,864	2%	2%	4%	5%	5%	6%	3%	2%	4%	5%	5%	6%
White Marsh	All Other Areas	51,273	2,004	4%	3%	4%	5%	4%	6%	4%	4%	6%	7%	7%	7%
Essex	All Other Areas	64,102	2,779	4%	3%	4%	5%	4%	7%	4%	4%	6%	7%	7%	7%
Dundalk	All Other Areas	59,739	3,715	6%	3%	7%	10%	7%	18%	6%	9%	10%	20%	20%	18%
Total		**521,733**	**24,248**	**5%**	**2%**	**4%**	**5%**	**5%**	**9%**	**3%**	**4%**	**6%**	**9%**	**9%**	**10%**
Reverse Commuters															
All Areas	SSA/Security Area	47,270	2,294	5%	20%	44%	44%	43%	48%	40%	29%	60%	61%	64%	67%
All Areas	Woodlawn	38,820	1,615	4%	10%	11%	12%	12%	13%	10%	11%	14%	15%	16%	17%
All Areas	Catonsville	44,425	2,994	7%	15%	14%	14%	14%	16%	15%	14%	18%	17%	18%	19%
All Areas	Dundalk	84,003	5,403	6%	4%	12%	18%	14%	25%	12%	11%	17%	29%	29%	25%
Total		**214,518**	**12,306**	**6%**	**10%**	**18%**	**21%**	**19%**	**25%**	**18%**	**15%**	**25%**	**30%**	**31%**	**30%**
Grand Total		**930,257**	**61,164**	**7%**	**2,610**	**4,460**	**5,563**	**5,156**	**7,817**	**4,048**	**4,093**	**7,204**	**8,906**	**9,181**	**9,435**

Roadway

Congestion

Roadway Travel Times

The various alternatives would have an impact on motorists and their ability to traverse a section of roadway. Several options require that lanes be reallocated for use by transit vehicles. This reallocation of the pavement would provide the needed guideway for transit vehicles to operate in, but would result in a reduction in vehicular lanes available for automobiles. In some cases, motorists would move to other parallel alternate streets. In other instances, like Security Boulevard between Woodlawn Drive and Ingleside Avenue, there is enough capacity on the existing roadway so that the reduction of a lane has little impact on travel times.

The roadway travel times for Alternatives 3 and 4 are fairly similar. A more significant difference occurs between the various options. The major differences in travel time for the options are in the following locations. All roadway travel times are projected for the Year 2030 in the PM peak hour (5 PM – 6 PM).

Geographical Area 3: US 40 at Cooks Lane to Longwood Street

The two-lane BRT and LRT options along Edmonson Avenue would increase the travel time by four minutes along westbound US 40 compared to the No-Build alternative.

Geographical Area 4: Longwood Street to West Baltimore MARC

The two-lane BRT and LRT options along Franklin Street would add five minutes of travel time along this section of roadway.

Geographical Area 6: Martin Luther King Boulevard at Lombard Street to Central Avenue and Aliceanna Street

On the Baltimore/Lombard Street couplet travel time along Fayette Street would increase by approximately six minutes.

The two-way BRT and LRT option on Baltimore Street would significantly increase travel time compared to the No-Build alternative.

Geographical Area 7: Central Avenue at Aliceanna Street to Chester Street

The Eastern-Fleet couplet option with one-way traffic and one lane would add five minutes to Aliceanna Street travel times and 12 minutes to Fleet Street travel times.

The Fleet-Aliceanna couplet option with one-way traffic and one lane would add five minutes of travel time for Aliceanna Street and 10 minutes of travel time for Eastern Avenue.

Geographical Area 8: Chester Street to Conkling Street

The dedicated transit option for Boston Street will add approximately six to eight minutes of travel time for eastbound motorists.

Intersections

The level of service (LOS) is a measure of the ability of the road network to accommodate traffic flow. The LOS at an intersection is another method of comparing the various alternatives and design options. LOS ranges from A being the best (less than a 10 second delay) to F being the worst with a greater than 80-second delay. Intersections that operate at LOS E or F are identified as unacceptable. The levels of service are calculated using the Synchro software program with the Highway Capacity Manual results. The Level of Service is calculated for all signalized intersections for all the options.

The results of the capacity analysis of the options showed little difference between the results of the BRT alternative compared to the LRT alternative. This result is due to the similar vehicular volume between those alternatives.

The various options do have an impact on how acceptably they operate. The following locations would experience significant intersection delays.

Geographical Area 3: US 40 at Cooks Lane to Longwood Street

The two-lane Edmondson Avenue option would cause three to four intersections to operate below LOS D versus none in the No-Build.

Geographical Area 4: Longwood Street to West Baltimore MARC

Two to three additional intersections would operate below LOS D for the two-lane options along Franklin Street.

Geographical Area 6: Martin Luther King, Jr. Boulevard at Lombard Street to Central Avenue and Aliceanna Street

The Baltimore Street two-way transit dedicated option would increase the number of unacceptably operating intersections from four to eleven.

Geographical Area 7: Central Avenue at Aliceanna Street to Chester Street

The Eastern/Fleet couplet option with one-lane, one-way traffic would increase the number of intersections operating unacceptably from two to ten.

The Fleet/Aliceanna couplet with one lane per direction would increase the number of intersections operating below LOS D by five.

Geographical Area 8: Chester Street to Conkling Street

Either of the Boston Street options would cause three to four additional intersections to operate below LOS D.

Lanes Affected

Several options of the three build alternatives would require that changes be made to the number of roadway lanes. This would allow for transit to operate in exclusive lanes and thereby provide a time advantage for transit vehicles. Besides reducing the number of lanes, street patterns could be modified under various options. This would mean changing two-way to one-way on the east side of downtown, such as in Fells Point.

Alternative 2 provides for exclusive lanes for bus service in several areas. This means that one travel lane would be converted to a bus-only lane. This would occur at the following locations:

- Security Blvd. between Woodlawn Avenue and I-70
- Edmondson Avenue between Cooks Lane and West Franklin Street
- West Franklin Street between Edmondson Avenue and Pulaski Street
- Baltimore Street between Martin Luther King, Jr. Boulevard and Market Place
- Lombard Street between Martin Luther King, Jr. Blvd. and Market Place

The roadways that would experience a reduction in the number of peak-period lanes, depending on the option (for both Alternatives 3 and 4) include:

- Security Boulevard
- I-70
- Edmondson Avenue
- West Franklin Street
- US 40 “lower level”
- Baltimore Street
- Lombard Street

Three streets would experience a change in the direction of flow from a two-way street to a one-way street for some of the options. The streets that would experience such a change include:

- Eastern Avenue
- Fleet Street
- Aliceanna Street

These three streets could experience a reduction in the total number of combined lanes over the entire section.

On-street parking on Baltimore Street

Impacts to Neighborhood Parking & Access

Parking

One of the key aspects associated with the impacts along the Red Line Corridor is related to parking spaces. Residents and business owners desire to have parking spaces as close to home or commercial establishments as possible. This allows easy access to their site.

There are many different types of restrictions associated with parking. This could range from peak-period parking restrictions, to truck-loading zones, to handicapped spaces, to permit-only spaces. These types of spaces each provide a specific need for the residents or business located in that area.

The three build alternatives were analyzed to determine the impacts on parking. Alternative 2 would have the least impact on parking. The elimination of parking spaces under this alternative would occur in areas where dedicated transit lanes would be provided. This includes in front of the Social Security Administration along Security Boulevard, along Baltimore and Lombard Streets through the downtown area, and along Central Avenue due to the conversion of angle parking to parallel parking.

The parking elimination associated with Alternative 3 and Alternative 4 varies greatly with each option. Most options would require that no parking be removed or that parking would be removed only during construction activities.

Other options would cause a major displacement of parking spaces. The locations where parking displacement would be the greatest under certain options are:

- Social Security Mall
- Cooks Lane
- Edmondson Avenue from Franklin Street to Pulaski Street
- Baltimore Street from Martin Luther King, Jr. Boulevard to Market Place
- Eastern Avenue
- Fleet Street
- Aliceanna Street
- Boston Street

The effects on parking as a result of different options are described in Volume II of the AA/DEIS.

The number of parking spaces eliminated would have varying impacts to the residents and businesses in the study area. This was determined by the proximity of the remaining spaces on any given street in the area. For example, along the east side of Cooks Lane approximately 107 spaces would be eliminated under the options. Normally less than 10 vehicles are parked on that side of the roadway. There are many available parking spaces on the west side of Cooks Lane that could be used by motorists who presently park their vehicles on the east side. On the other hand, there is no additional parking in front of the SSA along Security Boulevard.

Vehicular Access

The various alternatives for the Red Line would influence vehicular access to certain roadways or businesses, and motorists may need to utilize different routes to access these locations.

There are two types of access-point modifications. The first is when the alternative influences the ability to access certain roadways or driveways. The major sections for changes in this type of access modification would occur along US 40 from Ingleside Avenue to Franklin Street, Franklin Street from Edmondson Avenue to Warwick Street, and along Boston Street. These adjustments or modifications are made to ensure safety. Left-turning motorists would be required to make turns at signalized locations in order for light rail trains or bus rapid transit vehicles traveling in the same direction to stop when the turning movement takes place. For example, today a motorist has the ability to make a left turn from US 40/Edmondson Avenue eastbound to Augusta Avenue. If the median LRT or BRT option is selected, this movement would be prohibited for safety reasons. Motorists traveling eastbound on Edmondson Avenue that wanted to access Augusta Avenue would need to make a u-turn at a signalized intersection, (e.g., for Augusta Avenue using Wildwood Parkway) or access the roadway from a parallel street.

The second type of access modification is change in the street patterns. For example, if today a street is two-way and needs to be converted to one-way for one of the build alternative options, this changes the ability of motorists to access that street from one direction. The following roadways would be considered for access modifications due to the changes in street pattern operations from a two-way to a one-way system:

- Eastern Avenue from President Street to Haven Street Alternative 3 and 4; several options
- Fleet Street from President Street to Haven Street Alternative 3 and 4; several options
- Aliceanna Street from President Street to Boston Street Alternative 3 and 4; several options.

The No-Build and the TSM Alternatives would have no impact to access points. The impacts to access points by the alternatives will be dependent upon which option is selected. **Table 3-12** shows the range of access points that may be modified by an alternative, depending upon the option.

Table 3-12: Range of Access Point Modification

Alternative	Range Of Access Point Modification
1	0
2	0
3*	5-52
4*	6-49

**Note: Does not include street pattern changes*

Pedestrian Movements

The construction of the Red Line would require modifications to pedestrian access at various locations so that people can access the same points as before. Pedestrian access can be impacted in several ways. These include the removal of medians that provide a refuge for pedestrians, increasing and decreasing the distance that pedestrians need to cross the roadway, or installing or removing traffic signals that would increase or decrease the distance to a signalized intersection. The changing of street patterns from one-way to two-way would require that pedestrians change the way they observe traffic to cross the roadway.

The major change to pedestrian access would occur along Edmondson Avenue, Franklin Street, and Boston Street with the median transit options. With some options, all three of these roadways would see the elimination of the median. This, in turn, changes the number of signals, since left turns would be required at signalized intersections to prevent collisions with transit vehicles. Also along these roadways, signals have been added or taken away. New signals would be added at the follwing locations: Boston Street at Kenwood Avenue, Boston Street with South Potomac Street, and Lombard Street with West Falls Road. Signals are proposed to be removed at the following locations: Edmondson Avenue at Glen Allen Drive and Edmondson Avenue at West Side Skill Center.

Red Line Connections to Passenger and Freight Service

Red Line Connections with Metro/ Light Rail/MARC

The Red Line alignments and station locations seek to optimize connections at existing MTA transit stations and key ridership generators like the Social Security Administration, University of Maryland-Baltimore, downtown offices, Baltimore City government buildings, and Bayview.

Proposed station locations vary slightly by mode and alignment. Four key sites for the Red Line stations in the Central Business District are as follows.

- University Center Station - in the vicinity of Greene Street and the University of Maryland, Baltimore campus.
- Howard Street Station – in the vicinity of Howard Street providing a direct connection to the Light Rail at the University Center/Baltimore Street Station.
- Charles Center Station – in the vicinity of Charles Street/Light Street, which would provide a transfer point to the Charles Center Metro Station.
- Government Center/Inner Harbor Station – in the vicinity of Gay and Market Streets, which would provide a transfer point with the Shot Tower/Market Place Metro Station.

The stations at Howard Street, Charles Center, and Government Center/Inner Harbor would provide connections to the existing Central Light Rail Line and Metro.

The Central Light Rail and Metro lines operate on frequent headways providing optimal transfer connections between the Red Line and the other rail lines. The Central Light Rail operates every 20 minutes and the Metro rail line operates every 15 minutes.

MARC

The Red Line alignments would provide a direct transfer connection to the MARC commuter rail at the West Baltimore MARC station. Connections also could be made to a new Bayview MARC station if that station is constructed. The MARC Camden Line would be within walking distance from the Red Line Howard Street station area. Passengers could transfer to the Central Light Rail along the Howard Street Station area for connections to Amtrak service at the Penn Station.

Freight rail corridor in East Baltimore

Red Line and Freight Railroads

There are four main active freight rail lines that run through the Red Line Corridor in a north-south direction. The first corridor is the Amtrak main line referred to as the Northeast Corridor. Norfolk-Southern also uses this rail alignment for freight shipping. Because of the multiple uses for this railroad alignment (for Amtrak, MARC and Norfolk Southern) the options for the Red Line were designed to avoid impacts to the Northeast Corridor bridges.

The second corridor is called the CSX Transportation, Inc. (CSXT) Howard Street Tunnel alignment. This north-south tunnel carries CSXT's main line through Baltimore City at varying depths directly below the surface of Howard Street. This tunnel is relatively shallow and thereby poses an obstruction to any east-west transit tunnel alignment. A Red Line tunnel in this case would have to go deeper to cross under the Howard Street Tunnel.

The other two freight rail corridors are located in the east end of the Red Line Corridor. One freight corridor is a north-south corridor located between Haven Street and Oldham Street. It consists of three to five tracks owned by the Canton Railroad Company (CTN) and the Norfolk Southern Corporation (NS) and one to two tracks owned by the CSXT, which vary depending on location. The CTN tracks end between O'Donnell Street and Eastern Avenue, while the NS tracks continue, angle northeasterly and cross under the CSXT track north of Eastern Avenue.

The fourth freight corridor is occupied by a single CTN track, which runs north-south west of Ponca Street from Boston Street to O'Donnell Street, then turns generally eastward north of O'Donnell Street after crossing the roadway at-grade. Both corridors connect the traditionally industrial Canton waterfront area, the Dundalk and Seagirt Marine Terminals, and the former Mittal (Bethlehem) Steel plant at Sparrows Point with CSXT and NS freight yards and Amtrak's Northeast Corridor north of the Johns Hopkins Bayview Medical Center Campus.

In addition to the active rail corridors there are two abandoned rights-of-way and one inactive right-of-way. The first abandoned right-of-way is located between Conkling Street and CTN/NS rail corridor from Boston Street to a point north of O'Donnell Street. The second abandoned right-of-way is located north of Lombard Street between Haven Street and the CSXT right-of-way. These inactive rail corridors were utilized in designing alignments for the Red Line. The inactive right-of-way is owned by NS and is located one-half block east of Haven Street between approximately Foster Street and Pulaski Highway.

Bicycle and Pedestrian Access

Making the Red Line accessible to all transportation modes will help increase the service area, provide more choices to riders, and thus help improve ridership. All stations would not have automobile access; however, all stations would be accessible to pedestrians and bicyclists. Therefore, the safety of bicyclists and pedestrians will be a guiding factor in the design of stations.

Bicycle Access

Improved bicycle facilities connecting to stations on the Red Line Transit corridor would provide mobility choices to the riders and may translate into increased ridership for the Red Line. Some of these opportunities exist in the following locations:

- US 40/Edmondson Avenue: (Station @ Allendale Street) at Hilton Parkway (Bike Lane) and Allendale Street (Bike Lane).
- US 40/Edmondson Avenue: (Station @ Edmondson Village Shopping Center) at Winans Way/Upland Parkway (Bike Lane).
- US 40/Edmondson Avenue: (Station @ Allendale Street) at Gwynns Falls Park (Bike Trail).

In addition, the East Baltimore Rail Trail (from East of Haven Street, Monument Street to Boston Street) and Franklin and Mulberry Trails (from Fremont Avenue to Fulton Avenue) are proposed in the same area as the Red Line. These trails would provide additional opportunities for bicycle riders and trail users to connect to transit.

In the downtown area, the location of several Red Line stations, such as the stations on Martin Luther King, Jr. Boulevard, Charles Center and on Central Avenue, coincides with the bicycle improvements proposed in the City of Baltimore Bicycle Master Plan. In the eastern part of the Red Line Corridor, most stations are on proposed bike routes, such as along Fleet Street, Aliceanna Street, Boston Street, and at Bayview Campus.

Even without special bicycle accommodations at stations such as bicycle racks or lockers, bicyclists would be able to bring their bicycles on board the Red Line. This will expand the service areas of Red Line stations beyond the ¼ to ½ mile walking range of stations without parking facilities.

Pedestrian Access

A key component of a transit system is the ability of its riders to access stations or stops. This means that pedestrians must be able to easily and safely get to their desired location. If pedestrians are forced to walk in inconvenient areas where either no sidewalks exist or it is difficult to cross the street, they are less likely to utilize the transit service. Therefore, it is important to take into account pedestrian operations in order to improve pedestrian access to the transit stops or stations.

The majority of the Red Line study area has sidewalks located along the roadways. The sidewalks vary in width from four feet to greater than ten feet. The wider sidewalk widths are in the central business district. The following locations do not have sidewalks:

- Security Blvd from Keenan Drive to Mount Vernon Drive.
- Security Blvd/ Cooks Lane through the I-70 interchange area.
- Portions of the alignments on new right-of-way adjacent to freight rail lines in the eastern end of the corridor.

Existing pedestrian access would be maintained or improved with all build alternatives and options. A few minor changes in pedestrian access include intersections where signalization, and consequently, pedestrian signals, have been removed. Pedestrians would need to walk to the next adjacent signalized intersection to cross any major roadway.

For options where the transit would be located in the median, pedestrian refuges in the median have been maintained. Areas, especially along Security Boulevard, include sidewalks outside the dedicated transitway for the BRT or LRT alternatives. There would be buffers between the dedicated transitway and the roadway and the transitway and the sidewalk.

The construction of any of the build alternatives would need to take into account pedestrian access. This would mainly be at the station locations. For example, along Edmondson Avenue, several options propose stations in the median of the roadway. This means pedestrians must cross one vehicular lane to reach the median area next to traffic to access the station. In order to improve pedestrian

access, the following items would be considered during the design phase:

- Provide pedestrian-accessible signals at all locations where the route would traverse. The timing of these signals would be coordinated with the bus rapid transit or light rail trains.
- Pedestrians should be discouraged from crossing the tracks except at signalized intersections.
- At station locations, pedestrians must be directed to appropriate locations where they can cross the street. At the same time pedestrians should be discouraged from crossing mid-block to access the station.
- Provide marked crosswalks to define the legs of the intersection that pedestrians would need to utilize to cross the street.
- Meet ADA requirements for sidewalks.
- Ensure enough space is provided to pedestrians at crosswalk locations. This would ensure that pedestrians are not set back so far from the intersection that it takes additional time to reach the crosswalk.
- Provide sidewalks along Cooks Lane/ Security Boulevard to tie into the proposed park-and-ride lot at the termination of I-70.

Pedestrian crossing Baltimore Street at Charles Center Metro Station

Volume I-Chapter 4

Environmental Resources and Effects

RED LINE Corridor Transit Study

Environmental Resources and Effects

Introduction

The purpose of this chapter is to provide information about the existing environmental resources and the potential environmental effects, both positive and negative, that would be expected to occur with construction, implementation and operation of Alternative 2: TSM and the build alternatives (Alternative 3: BRT and Alternative 4: LRT) as detailed in Chapter 2 - Alternatives Considered. Chapter 3 - Transportation System and Effects describes the transportation impacts of those alternatives. The general format of this chapter is very similar to that of Chapter 3. And, as noted in Chapter 3, there are technical reports and other detailed information available that provide a greater level of detail than the information presented in this chapter.

It is important to inform the public, agencies and decision-makers about the environmental effects and benefits of the various alternatives and options. This chapter presents the results of the environmental analyses to support the decision-making process towards selection of a Locally Preferred Alternative (LPA). Other decision-making factors include capital cost, operating costs, potential ridership, and input from the public and review agencies. These and other considerations are the focus of Chapter 6 - Comparison of Alternatives, where end-to-end alternatives are compared against each other for their overall potential for accomplishing the study goals. Chapter 6 will summarize the key environmental differentiators (across alternatives and options) and/or major environmental issues (for end-to-end alternatives or in a specific location or option) from Chapter 4 to form the environmental part of the overall alternatives comparison.

Chapter 4 presents the corridor wide analysis of the environmental features. The environmental features analyzed include the following:

- Neighborhoods, Community Facilities and Services
- Environmental Justice
- Displacements and Relocations
- Economic Activity
- Land Use
- Parks, Recreation and Open Space
- Visual Quality
- Air Quality
- Noise and Vibration
- Energy
- Contaminated Sites
- Utilities
- Cultural Resources
  - Historic Structures
  - Archaeological Resources
- Section 4(f) Resources
- Habitat and Species
- Rare, Threatened and Endangered Species
- Surface and Groundwater Resources
- Waters of the United States including Wetlands
- Floodplains
- Critical Area
- Other Natural Features
- Construction Activities
- Safety and Security
- Indirect and Cumulative Effects
- Irreversible and Irretrievable Resources
- Short-Term Impacts & Long-Term Benefits

The discussion of the above resources at the corridor level includes:

- Summary: A review of the resource, results of the analysis by alterative, and any mitigation or follow-up that is required.
- Overview: Presents an overview of the resource discussed and references any relevant regulations and laws that the review was in accordance with.
- Existing Conditions: A summary of the environmental resource as it currently exists in the Red Line Corridor, and the methodology used to analyze impacts to that resource.
- Potential Impacts: Presents the analysis results, by resource, for the various alternatives at a corridor wide level.
- Mitigation Measures: A discussion of potential mitigation measures for those impacts that are unavoidable.

The impact analyses by option at a Geographic Area level are presented in Volume II of this AA/DEIS.

Neighborhoods Community Facilities and Services

SUMMARY

Of the 84 total neighborhoods in the corridor, 47 are in the vicinity of a Red Line alignment. The impacts to neighborhoods were assessed by residential property acquisition, neighborhood cohesion and isolation, neighborhood character and visual environment, and community facilities and services. The No-Build Alternative includes planned and programmed transit and highway projects and no new construction from the Red Line it is anticipated that there would be no property acquisition, no changes in access to neighborhoods, no impacts to parking, would not affect the neighborhood character or visual environment, nor impact community facilities and services.

Residential displacements (a total property take) are not required for any of the Red Line build alternatives. Small amounts or narrow strips of residential property may be required depending on the specific options selected. None of the alternatives are expected to affect neighborhood cohesion or isolation. Visual impacts could occur in neighborhoods near a tunnel headhouse or portal, or near a storage and maintenance facility.

Depending on the option configuration for the selected alternative, any of the build alternatives would result in effects to community facilities and services. These effects could be property impacts, changes in access or parking, visual impacts, and/or noise and vibration impacts.

This discussion presented here in Chapter 4 describes the effects on neighborhoods, community facilities, and services by alternative at a corridor wide level. For specific effects by option refer to Volume II of this AA/DEIS, or by neighborhood in the *Neighborhood Effects Technical Report.*

Overview

The Red Line alternatives were evaluated to assess the potential impacts and benefits each would have on residential neighborhoods in the corridor. Eighty-four individual neighborhoods were identified within the initial corridor boundaries. As the study progressed, some of the conceptual alignments that were used to define the initial corridor were dropped from consideration. As a result, many of the neighborhoods identified within the corridor are no longer located near the Red Line build alternatives and would not be directly affected. Of the 84 total neighborhoods, 47 are located in the vicinity of the build alternatives and potentially would be affected. These 47 neighborhoods are discussed in this section.

The assessment of potential impacts and benefits of each build alternative to the Red Line neighborhoods considered: property acquisition, neighborhood cohesion, neighborhood character, visual environment, and community facilities. Where particular types of impacts to neighborhoods have been discussed elsewhere in the DEIS, those sections have been referenced.

To facilitate the evaluation, the corridor was divided into nine Geographic Areas and the 47 potentially affected neighborhoods were grouped into those Geographic Areas (see **Table 4-1**). The Geographic Areas are listed in order from west to east. For more information, please refer to the *Neighborhood Effects Technical Report* on the DVD attached to this document.

Existing Conditions

The environment within the Red Line Corridor has population and housing characteristics consistent with its urban setting.

Population

In 2000, the total population of the Red Line Corridor was 210,341. Of the total population of the corridor, 37,393 people resided in Baltimore County and 172,948 people resided in Baltimore City.

While many ethnicities are represented within the corridor the majority of the population, in 2000, was African-American with 108,408 individuals (63 percent) falling into this category. Over 53,445 individuals (31 percent) were classified as White. The remaining population was classified as American Indian/ Alaskan Native, Asian/ Pacific Islander, Other, or Two or More Races. Hispanic individuals, who can be of any race, totaled 4,515 (3 percent).

Table 4-1: Potentially Affected Neighborhoods

Geographic Area 1	
Chadwick	Rolling Road Farms
Geographic Area 2	
Westview Park	Westview
Westowne	Catonsville Manor
Ridgeway	Little Creek Drive
Colonial Park	Edmonson Heights
West Hills Park	Western Star
Westgate	West Hills
Geographic Area 3	
Ten Hills	Hunting Ridge
Rognel Heights	Uplands
Edmondson Village	Allendale
Carroll-South Hilton	Franklintown Road
Geographic Area 4	
Mosher	Penrose/Fayette Street Outreach
Rosemont Homeowners/Tenants	
Geographic Area 5	
Midtown-Edmondson	Harlem Park
Franklin Square	Poppleton
Heritage Crossing	Hollins Market
Geographic Area 6	
Seton Hill	Washington Hill
University of Maryland	Inner Harbor
Downtown	Jonestown
Pleasant View Gardens	Little Italy
Geographic Area 7	
Fell's Point	Upper Fells Point
Geographic Area 8	
Canton	Highlandtown
Brewers Hill	
Geographic Area 9	
Kresson	Greektown
Hopkins Bayview	

Transit Dependent Populations

In 2000, 13 percent of the people residing in the Red Line Corridor were considered elderly. The elderly population is distributed somewhat evenly throughout the corridor, with no major concentrations of elderly population occurring.

The location of persons residing in the Red Line Corridor that reported having a disability or disabilities are distributed evenly throughout the corridor with no major concentrations. However, disabilities were reported higher in Baltimore City than in Baltimore County portions of the corridor.

There was considerable disparity in the number of low-income families between the Baltimore County and Baltimore City portions of the corridor. Only six percent of the families in the Baltimore County portion of the corridor were considered low-income, as compared to 35 percent of the Baltimore City families.

Housing

The Red Line Corridor is diverse in terms of the type, condition, and age of housing units it contains. Various types of housing including row homes, single-family homes, apartments, and condominiums exist in the corridor.

In 2000, most housing units in the corridor were occupied; however, approximately 15 percent were vacant. The majority of the vacant units were located within the Baltimore City portion of the corridor.

Potential Impacts

As the effects of Alternative 1: No-Build are similar in each Geographical Area, Alternative 1 is discussed separately. Following that, impacts are described for each resource category by alternative and neighborhood.

Alternative 1: No-Build

The Alternative 1: No-Build is the baseline against which the build alternatives (Alternatives 2, 3, and 4) are compared. The No-Build Alternative would provide the transit service levels and highway networks that are assumed in the Baltimore Metropolitan Council's Constrained Long Range Plan (CLRP), which consists of previously planned and programmed improvements as of December 2004.

As this alternative proposes no transportation improvements beyond those already planned and programmed in the CLRP, it would not result in the reduction of vehicular capacity on corridor roadways (i.e., no implementation of dedicated lanes). However, this alternative would not provide any additional transportation options, nor would it provide any means for improving transit travel

times through the project corridor. Furthermore, it is likely that the existing need for improved transit mobility in the project corridor, as well as the need for improved transportation choices and improved efficiency of the transit system, will continue to heighten if left unaddressed.

Alternative 1: No-Build would not involve any project-related construction. Therefore, it is anticipated that the No-Build Alternative would result in no property acquisition, no changes to the existing transit and roadway systems, no alteration to traffic patterns, and no changes in access to existing neighborhoods. It is anticipated that the No-Build Alternative would not impact parking, would not affect neighborhood character or the visual environment, would not affect community facilities and services, and therefore, would have no effect on neighborhood cohesion. Additionally, there would be no adverse noise impacts and since there would be no construction involved with the No-Build Alternative, there would be no construction related effects on local neighborhoods. Though the No-Build Alternative would not adversely affect corridor neighborhoods, it would also provide no mobility benefits and would not address the purpose and need for the project.

Residential Property Acquisition

Effects on residential property are assessed by determining the amount of land, outside of existing public right-of-way, that would be acquired by the proposed alternatives and the effect of the acquisition on any structures located on the property.

The Red Line alternatives are predominantly located within public right-of-way. However, some options would require the acquisition of small amounts of residential property in certain neighborhoods. In most cases, the property that would be acquired is a narrow strip of land along the edge of residences within the neighborhoods. Residential displacements (a total property take) are not required for any of the Red Line alternatives.

Alternative 2: TSM

No residential right-of-way is anticipated for Alternative 2: TSM.

Alternative 3: BRT

Alternative 3: BRT would result in residential right-of-way acquisitions within 12 neighborhoods. These impacts would vary depending on specific option configurations. Additional information on right-of-way impacts is provided in Volume II of the DEIS.

- Westview Park
- Colonial Park
- West Hills Park
- West Hills
- Hunting Ridge
- Uplands
- Edmondson Village
- Allendale
- Franklintown Road
- Rosemont Homeowners/Tenants
- Penrose/Fayette Street Outreach
- Canton

Alternative 4 : LRT

Alternative 4: LRT would result in residential right-of-way acquisitions within 10 neighborhoods. These impacts would vary depending on specific option configurations. Additional information on right-of-way impacts is provided in Volume II of the DEIS.

- Chadwick
- Colonial Park
- West Hills
- Hunting Ridge
- Edmondson Village
- Allendale
- Franklintown Road
- Rosemont Homeowners/Tenants
- Penrose/Fayette Street Outreach
- Canton

Neighborhood Cohesion and Isolation

Effects on neighborhood cohesion were assessed by evaluating the relationship between the proposed alternatives and the neighborhood. This evaluation determined if the proposed alternatives would bisect neighborhoods or isolate one or more portions of a neighborhood from others. It also determined if the construction of the proposed alternatives would create a barrier that would isolate one neighborhood from another.

None of the alternatives are expected to affect neighborhood cohesion and isolation because the proposed transit service would operate almost entirely on existing roadways between neighborhoods.

Neighborhood Character and Visual Environment

Alternative 3: BRT and Alternative 4: LRT

For options that utilize tunnels, headhouses, entrances into underground stations and tunnel portals, there would be new visual elements present.

The following neighborhoods could potentially have headhouses or portals and associated visual impacts:

- Hunting Ridge, Rognel Heights, Uplands, Edmondson Village, Allendale, Franklintown Road
- Penrose/Fayette Street Outreach, Rosemont Homeowners
- Midtown Edmondson
- Inner Harbor, Downtown, Jonestown, Pleasant View Gardens, Little Italy
- Fell's Point, Upper Fell's Point
- Canton, Brewers Hill, Highlandtown

A storage and maintenance facility at the I-70 East location would require removal of existing vegetation and pavement, as well as grading that could result in changes to the views from the Colonial Park neighborhood.

A storage and maintenance facility at the US 40 Lower Level location would be visible to homes along Franklin and Mulberry Streets and lighting from the facility could be visible to adjacent houses along those same streets in the Harlem Park, Franklin Square and Poppleton neighborhoods.

Alternative 4: LRT

All of the potentially affected neighborhoods (with the exception of Westview Park, Westview, Catonsville Manor, Ridgeway, Westowne, and Western Star) have the potential for changes to the visual environment as a result of overhead centenary system and in-ground rails associated with Alternative 4: LRT.

Community Facilities and Services

Effects on community facilities and services were assessed by determining if there are property impacts, changes in access or parking, visual impacts, and/or noise and vibration impacts that affect community facilities in each neighborhood. Unless otherwise noted, acquisitions for community facilities would be strip acquisitions.

As previously stated, additional information on right-of-way impacts is provided in Volume II of the DEIS and the *Neighborhood Effects Technical Report*. Additional information on impacts to access and parking is provided in Chapter 3, with detailed information provided in Volume II of the DEIS and in the *Traffic, Parking, and Transportation Technical Report*. Noise and vibration impacts are discussed in detail in the *Noise and Vibration Technical Report*. These technical reports are included on the DVD attached to this document.

Note: Increased transit access for various community facilities are not included in the effects below.

Alternative 2: TSM

Alternative 2: TSM would affect the following neighborhood community facilities and services:

- Rognel Heights

Edmondson Village Shopping Center parking

- Midtown Edmondson

West Baltimore MARC Station parking

- Upper Fells Point

The Holy Rosary School peak-parking on Eastern Ave.

Alternative 3: BRT and Alternative 4: LRT

Alternative 3: BRT and Alternative 4: LRT would affect the following neighborhood community facilities and services:

- Chadwick

Christ the King Church property strip acquisition along Security Boulevard (Alternative 4: LRT only)

- Westview Park

Southwest Academy property strip acquisition along Johnnycake Road, adjacent to the school's athletic fields (Alternative 3: BRT option along Johnnycake only)

- Colonial Park

Holy Korean Martyrs Catholic Church right-of-way acquisition of narrow strip that currently provides open space between the facility and Security Boulevard (option on south side of Security Boulevard only)

- West Hills

St. William of York Roman Catholic Church and School property strip acquisition and short-term parking (Cooks Lane surface options only)

- Hunting Ridge

Hunting Ridge Presbyterian Church vehicular access modification (all options except tunnel under Cooks Lane continuing under US 40 and West Franklin Street)

- Rognel Heights

Gospel Spreading Church of God vehicular access modification (surface options only)

Edmondson Village Shopping Center access modification (surface options only)

- Uplands

Westside Skill Center vehicular access modification and property strip acquisition (surface options only)

- Edmondson Village

Mt. Olive Holy Evangelistic Church property strip acquisition (3-lane surface option only) and vehicular access modification (2-lane surface option only)

St. Bernadine Roman Catholic Church property strip acquisition (3-lane surface option only) and vehicular access modification (surface options only)

Edmondson United Methodist Church property strip acquisition (3-lane surface option only)

- Allendale

Edmondson High School property strip acquisition (Alternative 3: BRT 3-lane surface option only)

Traveler's Best Bible Church property strip acquisition (Alternative 4: LRT 3-lane surface option only)

Mary E. Rodman Elementary School Recreation Center temporary impacts from construction of underground station (tunnel option only)

Vaughn Greene Funeral Home property strip acquisition (surface options only)

Baltimore City Department of Social Services total property acquisition and displacement (Alternative 4: LRT 3-lane surface option only)

Olivet Fellowship Free Hall property strip acquisition (Alternative 4: LRT 3-lane surface option only)

- Carroll-South Hilton

Western Cemetery right-of-way acquisition of narrow strip along the south side of US 40 (surface options only)

- Penrose/Fayette Street Outreach

Western Cemetery property strip acquisition and vehicular access modification (surface options only)

Maryland Department of Corrections Pre-Release Facility property strip acquisition (all transitway options), total property acquisition and displacement (Calverton Vehicle Storage and Maintenance Facility Site)

Maryland Department of Public Works Water/Wastewater Facility property strip acquisition (all transitway options), total property acquisition and displacement (Calverton Vehicle Storage and Maintenance Facility Site)

- Midtown Edmondson

West Baltimore MARC Station parking and vehicular access modification

- Poppleton

Carter Memorial Church of God In Christ property strip acquisition (all options except Alternative 4: LRT Fremont Tunnel option)

- University of Maryland

University of Maryland Medical System facilities, Westminster Church, and St. Paul's Cemetery loss of on-street parking (surface options only)

- Little Italy

Baltimore International College property strip acquisition (Lombard Street tunnel option with various portals to Central Avenue only)

- Upper Fells Point

The Holy Rosary School parking on Eastern Avenue (Eastern-Fleet surface and Eastern Avenue tunnel options only)

- Hopkins Bayview

Johns Hopkins Bayview Medical Center property strip acquisition

Mitigation Measures

Mitigation measures for property acquisition are discussed in Displacements and Relocations. Mitigation measures for noise and vibration are discussed in Noise and Vibration. Mitigation measures for the neighborhood visual environment are discussed in Visual Quality.

Environmental Justice

SUMMARY

In accordance with Executive Order 12898, environmental justice (EJ) communities, or minority and low-income communities, were identified in the Red Line Study corridor to ensure that these communities would not be disproportionately or adversely affected by the project, and that these communities are provided opportunities for input during the NEPA process. Census 2000 block group data was the primary source for identifying these communities. Two hundred and twenty-three block groups cover the Red Line Study Corridor, of which 87 are adjacent to an alignment and meet the EJ thresholds for minority or low-income populations or both. The total population in 2000 in the study corridor was 210,341, of which 49,043 (23.3%) were low-income persons and 140,974 (67%) were minority persons.

No effects to EJ communities are anticipated with the No-Build Alternative with the project. Each of the build alternatives would potentially affect environmental justice communities in varying ways. Generally, the surface alignments would affect access, mobility, and parking at different levels throughout the corridor. The Alternative 3: BRT surface alignments would have more substantial effects associated with station noise than the LRT alignments. The Alternative 4: LRT surface alignments would have more effects to neighborhood character and aesthetics than Alternative 3: BRT because LRT would require fixed tracks and catenary lines. Both Alternative 3: BRT and Alternative 4: LRT would have more overall effects than Alternative 2: TSM. Generally, the tunnel segments of the alignments would have fewer operational effects.

Although the majority of the affected block groups were found to be environmental justice areas and the majority of the effects would be in environmental justice population areas, the effects associated with the build alternatives are similar throughout the corridor. No individual area would experience appreciably more severe or greater effects than other areas, environmental justice or otherwise.

Outreach to EJ communities and community leaders will be maintained throughout the planning and potential construction of the Locally Preferred Alternative to help pinpoint potential problems before they become impacts, thus helping to facilitate ways to avoid or minimize impacts all together.

Overview

Issued by President Clinton on February 11, 1994, Executive Order 12898 – *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations* (EO 12898) directs federal agencies to "promote nondiscrimination in Federal programs substantially affecting human health and the environment, and provide minority and low-income communities access to public information on, and an opportunity for public participation in, matters relating to human health or the environment." The Order directs agencies to utilize existing law to ensure that when they act:

- They do not discriminate on the basis of race, color, or national origin.
- They identify and address disproportionately high and adverse human health or environmental effects of their actions on minority and low-income communities.
- They provide opportunities for community input in the National Environmental Policy Act (NEPA) process, including input on potential effects and mitigation measures.

The principles of environmental justice are rooted in Title VI of the Civil Rights Act of 1964, which prohibits discrimination on the basis of race, color, and national origin in programs and activities receiving federal financial assistance. Following the direction of EO 12898, federal agencies developed their own strategies to implement environmental justice.

This analysis was developed under the US Department of Transportation's (USDOT) *Order to Address Environmental Justice in Minority Populations and Low-Income Populations* (DOT Order 5610.2), the Federal Highway/Transit Administration's (FHWA/FTA) *Actions to Address Environmental Justice in Minority Populations and Low-income Populations* (FHWA 6640.23), and the Council on

Environmental Quality's (CEQ) *Environmental Justice – Guidance Under the National Environmental Policy Act.*

DOT Order 5610.2 is an internal directive that is based on the framework of the NEPA, Title VI of the 1964 Civil Rights Act, Uniform Relocation Assistance and Real Property Acquisition of 1970, and the Intermodal Surface Transportation Efficiency Act of 1991. The DOT Order 5610.2 and FHWA 6640.23 define the fundamental principles of environmental justice as:

- Avoiding, minimizing, or mitigating disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations;
- Ensuring full and fair participation by all potentially affected communities in the transportation decision-making process; and
- Preventing the denial of, reduction in or significant delay in the receipt of benefits by minority and low-income populations (USDOT, 1997).

This environmental justice analysis identifies disproportionately high and adverse human health and environmental effects to minority and low-income communities that would result from the Red Line Corridor Transit Study. For more information, please refer to the *Environmental Justice Technical Report* on the DVD attached to this document.

Study Area Boundary

The Red Line study area boundary was defined during the initial conceptual alignment studies. The study area contains portions of both Baltimore City and Baltimore County. Within the study area, 225 US Census 2000 block groups were defined; 202 in Baltimore City and 23 in Baltimore County. US Census 2000 indicates no inhabitants in two of the block groups, both located in Baltimore City. They have not been counted in the statistical analysis bringing the total block groups in the study area to 223.

Existing Conditions

Methodology for Identifying Environmental Justice Populations

FHWA/FTA Order 6640.23 guidelines emphasize that each project should be analyzed in context. Definitions of terms used in this analysis include:

- Low-Income – a person whose household income is at or below the Department of Health and Human Services poverty guidelines.
- Minority – a person who is Black, Hispanic, Asian American, American Indian, or Alaskan Native.
- Low-Income Population – any readily identifiable group of low-income persons who live in geographic proximity.
- Minority Population – any readily identifiable group of minority persons who live in geographic proximity:

Council on Environmental Quality (CEQ) guidance defines the minority population threshold as being either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

Characteristics of potential environmental justice populations were identified within the study area. The US Census 2000 block group data provided the basis for establishing the location of environmental justice populations in the study area. Following the CEQ guidance, block groups that exceeded 50 percent low-income would be considered low-income populations. To be more inclusive of low-income populations and in accordance with the CEQ guideline's concept of "meaningfully greater," block groups that exceeded 23 percent, which is the percentage of persons living below the poverty level for the study area, are also considered low-income populations for this study.

Supplemental sources were consulted regarding low-income and minority populations within the study area to verify the findings of the research and to support future public outreach activities. The supplemental sources included: National Center for Education Statistics, Government Assisted Housing Programs, City and County Officials, and field visits.

Environmental Justice Populations

The total population in the study area is 210,341 persons (based on Census Block Groups), with 140,974 of these persons (67 percent) identifying themselves as minorities and 49,043 persons (23 percent) meeting the definition of low-income. **Figure 4-1** shows the EJ areas within the Red Line Corridor. **Table 4-2** shows that the study area percentages for minority and low-income persons are similar to that of Baltimore City, but are much greater than Baltimore County. A further breakdown of the Census information shows that for the study area block groups within Baltimore County, the percentage of minority persons of 57 percent is greater than the County as a whole. For study area block groups located in Baltimore City, the minority percentage was similar (69 percent) but the percentage of low-income persons was greater (28 percent).

The environmental justice threshold for low-income and minority populations was set following the previously described methodology based upon CEQ guidelines. One hundred seventy-five out of 223 block groups (78 percent) meet the EJ threshold(s) for a minority population, a low-income population, or both, and are considered environmental justice populations.

Issues of Past Concern

1950's and 1960's same period, the prevailing national concept of urban renewal focused on a vision of providing improved modern housing and a speedy and efficient transportation system to revitalize US cities. In Baltimore, the vision was translated into a series of public works projects that included an extensive network of interstate freeways, public housing projects, and modern downtown offices. The concept of an interstate highway system through Baltimore City was formally proposed in 1960 and was partially executed. Among the proposals was an "East-West Highway" that would connect the downtown business district with I-95 and I-70. Only sections of this highway plan were built. In 1968, I-70 was extended from the Baltimore Beltway in an easterly direction towards downtown Baltimore terminating at Leakin Park. In 1975, construction began to connect downtown Baltimore to I-70 by going through West Baltimore, Leakin Park and Gwynn Falls Park. For many years, efforts were made to continue the I-70 project, but opposition from neighborhoods in West Baltimore, environmental groups, and preservationists brought the interstate project and the hope of connecting I-70 to the central business district to an end. Today I-70 terminates at the Security Boulevard Park-and-ride. However, before construction ceased, a 1.4 mile segment from Greene Street west to North Pulaski Street was constructed. This segment of road is known as The Highway to Nowhere.

Table 4-2: Population Statistics

Population Statistics						
	Maryland	Baltimore City	Baltimore County	Study Area	Baltimore City Portion of the Study Area	Baltimore County Portion of the Study Area
Total Population	5,296,486	651,154	754,292	210,341	172,948	37,393
Low-income Persons[1]	438,676 (8.2 %)	143,514 (22.0 %)	47,603 (6.3 %)	49,043 (23.3 %)	46,658 (27.5%)	2,385 (6.4%)
White	3,287,071 (62.1 %)	201,881 (31.0 %)	554,287 (73.5 %)	75,826 (36.0 %)	53,445 (30.9%)	15,922 (42.6%)
African-American/Black	1,457,336 (27.5 %)	415,725 (63.8 %)	148,774 (19.7 %)	127,405 (60.5 %)	108,408 (62.7%)	17,146 (45.9%)
Asian	208,618 (3.9 %)	10,087 (1.5 %)	23,607 (3.1 %)	5,582 (2.6 %)	3,023 (1.7%)	2,338 (6.3%)
Other[2]	24,747 (0.5 %)	3,480 (0.5 %)	3,000 (0.4 %)	1,303 (0.6 %)	1,018 (0.6%)	281 (0.8%)
Two or More Races	103,587 (1.9 %)	8,880 (1.4 %)	11,046 (1.5 %)	3,363 (1.6 %)	2,539 (1.5%)	741 (2.0%)
Hispanic[3]	227,105 (4.3 %)	11,101 (1.7 %)	13,578 (1.8 %)	5,480 (2.6 %)	4,515 (2.6%)	965 (2.6%)
Minority Persons	2,009,415 (37.9 %)	449,273 (69 %)	200,005 (26.5 %)	140,974 (67.0 %)	119,503 (69.1%)	21,471 (57.4%)

Source: US Census 2000 Summary File 3 (SF-3)

[1] 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 FactFinder, factfinder.census.gov).

[2] Other includes American Indian/Alaskan Native, Native Hawaiian and Other Pacific Islander, and some other race.

[3] Hispanic can be of any race.

According to US Census 1960, the neighborhoods impacted by the Highway to Nowhere included Poppleton, Seton Hill, Harlem Park, Franklin Square, and Heritage Crossing. They were predominately African-American and generally lower in income. These neighborhoods contained many blocks of row homes.

Some portions of these neighborhoods were removed as early as 1959 to accommodate HUD-funded public housing projects. In all, about 971 residences occupied by 2,800 people, 62 businesses and a school were removed to accommodate the 1.4 mile section of road (Baltimore Sun, March 17, 1997). The displaced residents were relocated throughout Baltimore City from 1966-1969 and received compensation for their houses. However, residents recall that the compensation was not sufficient for a replacement house.

Many longtime residents of the study area were either involved with or remember past development activities that disproportionally affected minority and low-income populations. Continued outreach with community leaders and residents of this area throughout the Red Line Corridor Transit Study process will continue.

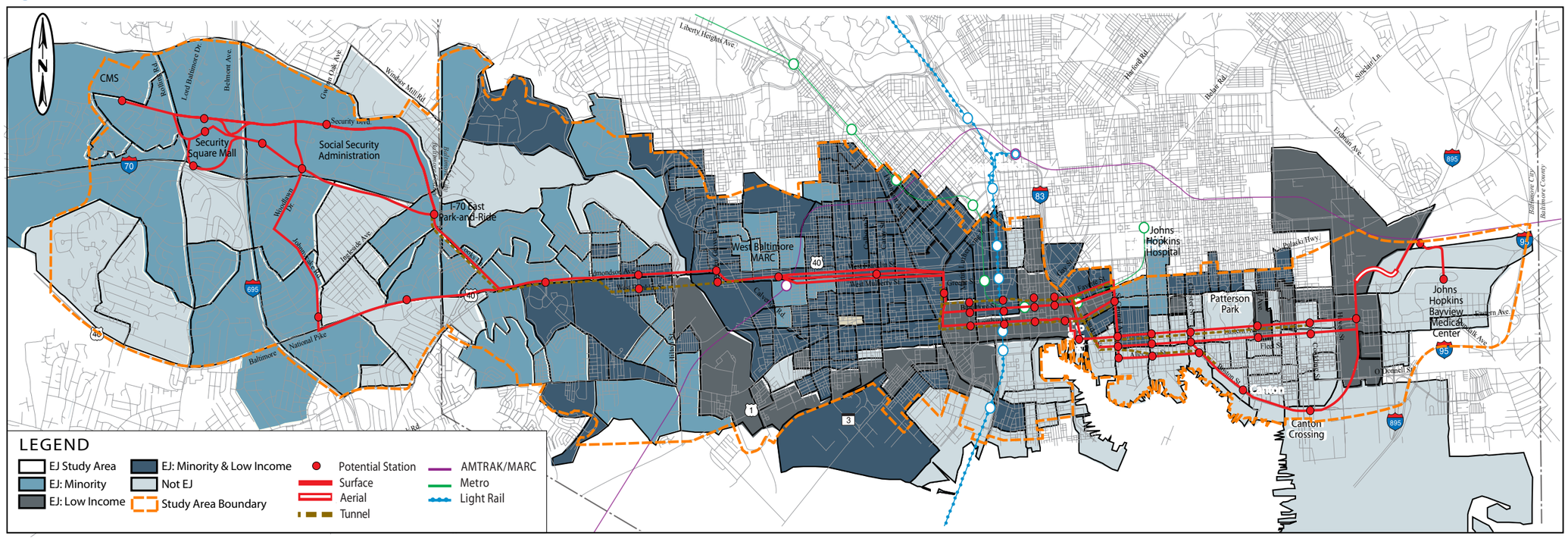
Potential Impacts

Environmental Justice Impact Analysis

The ultimate purposes of the environmental justice analysis are to identify any disproportionately high and adverse effects on environmental justice populations, ensure that environmental justice populations are not denied benefits, and to ensure that environmental justice populations have received full and fair access to study related public involvement.

All of the Red Line alternatives and options were considered, and all of the potential impacts that would directly affect the study area were gathered. The location and severity of anticipated impacts associated with the various options were used to determine if environmental justice populations would be disproportionately impacted.

Figure 4-1: Environmental Justice Areas



Affected Area

Table 4-3 also shows the potentially affected neighborhoods and their corresponding block groups. Out of the 223 block groups that make up the study area, 87 abut one or more of the build alternatives. Because of their proximity to proposed alternative alignments, these block groups have the potential to be directly affected by the Red Line. Sixty-five of the 87 block groups (75 percent) are considered environmental justice populations.

Red Line impacts were determined for each of the neighborhoods in the study area, as identified in the Neighborhoods, Community Services, and Facilities portion of this DEIS. The Baltimore City neighborhood boundaries are based upon neighborhoods previously defined by the City as Neighborhood Statistical Areas (NSAs). The neighborhoods located in Baltimore County consist of groups of census blocks or block groups that collectively represent a community, as determined by the Baltimore County Department of Planning.

Type of Impacts

The construction and operation of the Red Line would have the potential to create a variety of impacts. For each Red Line option, the following potential impacts were assessed in the following manner.

- Residential Property – Determine the amount of land outside of existing public right-of-way that would be acquired as part of each proposed option and the effect of the acquisition on the use of that land or any displacement of structures located on the property.
- Neighborhood Cohesion and Isolation – Determine disruption in the interaction among persons and groups within a community.
- Access – Determine where the options would result in changes to the existing pattern of vehicular or pedestrian/bicycle traffic or the restriction of access at locations where access currently exists.
- Mobility – Determine the decreases in transportation options and efficiency of travel.

Table 4-3: Red Line Study Area Block Groups that Meet or Exceed One or Both Environmental Justice Thresholds

Potentially Affected Neighborhoods	Population	White	African American or Black	Asian and Pacific Islander	Other	Two or more races	Hispanic	Minority	Low-Income	Block Group
Allendale	815	0%	94%	0%	0%	0%	6%	100%	37%	2007.01 1
Allendale	887	1%	96%	0%	0%	2%	1%	99%	20%	2007.01 3
Allendale	1,225	0%	99%	0%	1%	0%	0%	100%	23%	2007.01 4
Carroll – South Hilton	1,105	54%	36%	6%	1%	0%	2%	46%	25%	2006.00 1
Chadwick	1,714	28%	50%	13%	2%	2%	4%	72%	15%	4015.01 2
Chadwick	4,538	25%	58%	8%	2%	2%	5%	75%	7%	4015.01 4
Downtown	1,331	36%	48%	14%	0%	2%	0%	64%	44%	401.00 2
Edmondson Heights	1,878	26%	71%	0%	0%	2%	0%	74%	6%	4013.01 1
Edmondson Village	895	0%	100%	0%	0%	0%	0%	100%	12%	1608.01 4
Edmondson Village	1,072	0%	100%	0%	0%	0%	0%	100%	34%	1608.02 2
Franklin Square	857	5%	93%	0%	0%	2%	0%	95%	43%	1901.00 2
Franklin Square	786	1%	98%	0%	0%	0%	1%	99%	38%	1901.00 4
Franklin Square	438	0%	98%	0%	2%	0%	0%	100%	37%	2001.00 2
Franklintown Road	861	2%	97%	0%	1%	0%	0%	98%	46%	1606.00 4
Franklintown Road	616	0%	96%	0%	2%	0%	2%	100%	24%	1606.00 5
Franklintown Road	1,560	0%	100%	0%	0%	0%	0%	100%	23%	1607.00 4
Greektown	1,090	66%	9%	0%	8%	3%	15%	34%	30%	2607.00 2
Harlem Park	1,264	0%	100%	0%	0%	0%	0%	100%	38%	1601.00 3
Harlem Park	904	0%	98%	0%	0%	0%	2%	100%	32%	1601.00 4
Harlem Park	492	3%	94%	0%	3%	0%	0%	97%	39%	1602.00 3
Harlem Park	380	0%	100%	0%	0%	0%	0%	100%	58%	1603.00 3
Harlem Park, Franklin Square	570	6%	92%	0%	0%	0%	2%	94%	42%	1901.00 1
Heritage Crossing	412	0%	98%	0%	0%	0%	2%	100%	40%	1703.00 2
Heritage Crossing, Poppleton	472	0%	100%	0%	0%	0%	0%	100%	46%	1801.00 1
Highlandtown	1,288	73%	18%	4%	1%	3%	0%	27%	43%	2608.00 1
Hollins Market	744	28%	58%	6%	1%	4%	4%	72%	31%	1803.00 1
Hollins Market	654	57%	39%	0%	0%	2%	2%	43%	37%	2101.00 1
Hunting Ridge, Rognel Heights	630	26%	72%	0%	0%	0%	2%	74%	2%	2804.01 2
Inner Harbor	1,117	66%	20%	9%	0%	1%	4%	34%	32%	2201.00 1
Inner Harbor, Downtown	327	63%	15%	16%	0%	6%	0%	37%	29%	401.00 1
Jonestown	286	53%	42%	0%	0%	3%	2%	47%	52%	302.00 1
Jonestown, Pleasant View Gardens,	698	1%	96%	0%	0%	2%	1%	99%	51%	501.00 1
Kresson	618	76%	12%	0%	3%	7%	2%	24%	47%	2604.04 2
Kresson, Greektown	917	75%	6%	1%	2%	13%	2%	25%	36%	2607.00 1
Little Creek Drive, Colonial Park	909	23%	67%	6%	1%	0%	3%	77%	3%	4011.02 1
Little Italy	171	50%	40%	10%	0%	0%	0%	50%	50%	302.00 2
Midtown-Edmondson	545	0%	99%	0%	0%	1%	0%	100%	42%	1604.00 4
Mosher	826	0%	99%	1%	0%	0%	0%	100%	33%	1606.00 3
Penrose, Fayette Street Outreach	551	0%	90%	8%	0%	2%	0%	100%	23%	2001.00 4
Penrose, Fayette Street Outreach	806	3%	97%	0%	0%	0%	0%	97%	28%	2002.00 5
Penrose, Fayette Street Outreach, Midtown Edmondson	529	2%	93%	0%	0%	2%	4%	98%	22%	2001.00 1
Penrose, Fayette Street Outreach, Midtown Edmondson	667	2%	97%	0%	0%	1%	0%	98%	11%	2002.00 1
Pleasant View Gardens	729	0%	97%	0%	0%	0%	3%	100%	56%	501.00 3
Poppleton	1,573	1%	96%	2%	1%	0%	0%	99%	53%	1801.00 2
Poppleton, Harlem Park	698	4%	95%	0%	1%	0%	0%	96%	35%	1802.00 1
Rognel Heights	568	17%	83%	0%	0%	0%	0%	83%	9%	2804.02 1
Rolling Road Farms	972	24%	72%	0%	0%	0%	4%	76%	8%	4015.01 1
Rosemont	750	0%	100%	0%	0%	0%	0%	100%	17%	1605.00 2
Rosemont	919	1%	99%	0%	0%	0%	0%	99%	13%	1605.00 4
Rosemont, Midtown Edmondson	879	0%	99%	0%	0%	1%	0%	100%	32%	1605.00 3
Seton Hill	330	16%	84%	0%	0%	0%	0%	84%	48%	402.00 1
Seton Hill, University of MD, Inner Harbor	990	55%	33%	9%	0%	2%	2%	45%	44%	402.00 2
Ten Hills	777	35%	49%	6%	4%	7%	0%	65%	9%	2804.03 5
Uplands	1,877	1%	97%	0%	0%	2%	0%	99%	47%	2804.04 2
Washington Hill	207	41%	59%	0%	0%	0%	0%	59%	20%	301.00 1
Washington Hill	245	7%	44%	7%	0%	0%	43%	93%	11%	301.00 2
Washington Hill, Fells Point	1,975	14%	83%	0%	0%	0%	3%	86%	62%	301.00 3

Note: These Block Groups meet or exceed one or both Environmental Justice Thresholds
Minority – 50% or over
Low-Income – 23% or over

- Parking – Determine where the options would result in permanent changes in parking availability.
- Neighborhood Character and Aesthetics – Determine where the options would result in the addition of new elements to, or removal of existing features from, the visual environment and where the options would result in significant changes to the existing visual character.
- Community Facilities – Determine if there are property impacts or changes in access or parking that would affect community facilities.
- Operational Noise – Determine increases in noise generated by the options that would exceed federal noise abatement criteria. This assessment of impacts considers general noise generated by transit vehicles as well as other noise such as "wheel squeal" and transit vehicle horns.
- Station Noise – Determine increases in noise generated at Red Line stations that would exceed federal noise abatement criteria. This assessment of impacts considers the cumulative noise exposure from station activity.
- Vibration – Determine the area that would experience vibration exceeding the FTA's vibration impact criteria. This assessment of impacts considers vibration generated by transit vehicles on the surface and in tunnels.

For each type of impact, a ranking system was developed to classify the severity of the impact. The following is a summary of those tables, by type of potential impact.

- Residential Property – Alternative 3: BRT and Alternative 4: LRT could require right-of-way acquisition from block groups in up to 10 or 13 neighborhoods, respectively. Except for the Canton neighborhood, all the potentially affected block groups are considered environmental justice populations. Individual parcel impacts would range from one square foot to 47,198 square feet (±1.1 acre).
- Neighborhood Cohesion and Isolation – Only one of the 87 block groups has the potential to experience cohesion impacts. For this block group, which is considered an environmental justice population, one of the three BRT or LRT options that pass through it would likely result in minor impacts.
- Access – Depending on the alternative and option selected, up to 55 of the 87 block groups could experience some level of access related impact. Of these, 38 (69%) are considered environmental justice populations.
- Mobility – No substantial adverse impacts to mobility are anticipated. Up to 56 of the 87 block groups could, however, experience some level of impact. Of these, 41 (73%) are considered environmental justice populations.
- Parking – Up to 35 of the 87 block groups could experience some level of impact. Of these, 18 (51%) are considered environmental justice populations.
- Neighborhood Character and Aesthetics – Up to 68 of the 87 block groups could experience some level of impact. Of these, 51 (75%) are considered environmental justice populations.
- Community Facilities – Up to 27 of the 87 block groups could experience some level of impact from access or parking alteration or minor right-of-way acquisition. Of these, 26 (96%) are considered environmental justice populations. For two of the block groups the impact would be considered substantial for one of the three possible LRT options, due to displacement of a building from the City Social Services facility.
- Operational or Station Noise – Up to 67 of the 87 block groups could experience some level of noise impact. Of these, 46 (69%) are considered environmental justice populations.
- Vibration – Up to 54 of the 87 block groups could experience some level of impact. Of these, 37 (69%) are considered environmental justice populations.

In addition to these identified impact areas, two additional elements were analyzed to determine the potential impacts to environmental justice populations in the study area: (1) park-and-ride lots and (2) storage and maintenance facilities. These elements are discussed below.

Park-and-Ride Lots

Seven potential park-and-ride lot locations are being considered. Five of these locations are in or in close proximity to environmental justice populations. They are:

- CMS Station Area: Dedicated South Side Transitway – located in the Chadwick Neighborhood and the end of Security Boulevard. The potential parking area would have less than 50 parking spaces. The parking area is within 100 feet of houses and Chadwick Elementary School
- I-70 East (NW Quadrant) – located just southeast of the Colonial Park Neighborhood.
- I-70 East (SW Quadrant) – abuts the Edmondson Heights and West Hills Park Neighborhoods.
- I-70 East (SE Quadrant) – abuts the northern portion of the West Hills Neighborhood. Houses are further than 100 feet away.
- Edmondson Village Station – located in the Edmondson Village Shopping Center parking lot within the Rognel Heights Neighborhood. Edmondson Village and Allendale Neighborhoods are in close proximity to the shopping center.

While park-and-ride lots can offer regional benefits, those living in close proximity to them may experience adverse effects such as traffic congestion, noise impacts, and neighborhood character and aesthetic impacts.

Three of the park-and-ride lots under consideration (at I-70 East) would abut I-70 and would be physically separated from any residential neighborhoods. Another option is to alter, but not expand, an existing parking lot (Edmondson Village).

Storage and Maintenance Facility

At least one storage and maintenance facility would be needed to store and service the Red Line transit vehicles. Activities associated with the facilities would include washing, detailing, fueling, repairing, and parking of vehicles when they are not in use. Five sites were studied as possible locations for the maintenance and storage facilities. Three of the sites are located in or within close proximity to environmental justice population areas and are described below. Potential effects for neighborhoods within close proximity to the maintenance facilities include noise, vibration, air quality, neighborhood character and aesthetics, and mobility.

- I-70 East – straddles the border of Baltimore County and Baltimore City at the terminus of I-70. The area is currently a Park-and-ride lot. Access to and from I-70 and portions of Security Boulevard would need to be altered. Three neighborhoods (Colonial Park, Edmondson Heights, and West Hills Park) containing environmental justice populations are located within 100 feet of the site.
- Calverton Road Site – located in a mixed use area off of Franklintown Road and West Franklin Street. The area currently contains retail, private, non-profit, and Baltimore City owned properties. Two neighborhoods (Penorose/Fayette Street Outreach and Rosemont Homeowners/Tenets) containing environmental justice populations are located within 100 feet of the site.
- US 40 Lower Level Site – located along the portion of US 40 referred to as The Highway to Nowhere. Vehicular traffic to and from Downtown as well as the Red Line alignment would be shifted to West Franklin Street and/or West Mulberry Street. Six neighborhoods (Midtown-Edmondson, Penrose/Fayette Street Outreach, Harlem Park, Franklin Square, Poppleton, and Heritage Crossing) containing environmental justice populations are located within 50 feet of the sight.

Out of the five sites considered, the US 40 Lower Level Site would be the closest to residential areas; therefore impacts to the neighborhoods in the area are anticipated to be the most substantial. Details on all the potential sites and impacts can be found in the *Storage and maintenance Facility Technical Report* on the DVD attached to this document.

Environmental Justice Disproportionately Analysis

A disproportionately high and adverse effect is defined as an effect that is predominately borne by, or would be suffered by, an environmental justice population and that is appreciably more severe and greater in magnitude than adverse effects suffered by a non-environmental justice population. In general, the determination of disproportionately impacted environmental justice populations is determined by analyzing the pattern of impacts in relation to low-income or minority population areas.

The study team prepared several tables that identify the severity of each type of impact on each affected block group for all of the Red Line options. These detailed tables can be found in the *Environmental Justice Technical Report*. The tables also distinguish between environmental justice populations and non-environmental justice populations.

No effects are anticipated with the No-Build Alternative with the project. Each of the build alternatives would

affect environmental justice communities in varying ways. Generally, the surface alignments would affect access, mobility, and parking at different levels throughout the corridor. Alternative 3: BRT surface alignments would have more substantial effects associated with station noise. Alternative 4: LRT surface alignments would have more effects to neighborhood character and aesthetics than Alternative 3: BRT because LRT would require fixed tracks and catenary lines. Both Alternative 3: BRT and Alternative 4: LRT would have more overall effects than Alternative 2: TSM. Generally, the tunnel segments of the alignments would have fewer operational effects.

Each alternative has varying options throughout the corridor that could be used to create an end-to-end alternative. Each option would have different effects on the neighborhood and block groups.

Although the majority of the affected block groups were found to be environmental justice areas and the majority of the effects would be in environmental justice population areas, the effects associated with the build alternatives are similar throughout the corridor. No individual area would experience appreciably more severe or greater effects than other areas, environmental justice or otherwise.

The location of a storage and maintenance facility in the US 40 Lower Level has the potential to disproportionately affect environmental justice populations surrounding the site. The disproportionate affects would not be from an impact stand point due to acquisition of property, disruption to neighborhood cohesion or isolation, change in access, or decreased transportation options because the storage and maintenance facility would be in the lower level roadway right-of-way below the surrounding communities. Rather, the potential for affects to environmental justice populations around this site would be due to the history of the construction of the US 40 Lower Level. When the roadway was constructed in the 1970's, approximately 700 homes were purchased and removed, primarily relocating environmental justice populations. These memories still remain with communities adjacent to the Lower Level.

Additional information will be gathered as the Red Line Corridor Transit Study process continues. In the event that the US 40 Lower Level site is selected, mitigation and minimization strategies would need to be coordinated throughout the design and construction process.

Denial of Benefits

The potential that environmental justice populations would be denied the benefits of the proposed transit system was analyzed. As described below, the main benefits are improved mobility and faster travel times to locations along the corridor.

Station Location

Station locations associated with transit projects are generally seen as the primary benefit to nearby neighborhoods. Access to another mode of travel increases transportation options for accessing work, shopping, school, or entertainment. Additionally, the urban planning practice of Transit-Oriented Development (TOD) is based on maximizing access to transit by developing residential and commercial properties in an orderly manner around or near station locations.

Generally stations would be located in the same vicinity for each alternative. Detailed designs and station locations can be found in the *Stations Technical Report* on the DVD attached to this document.

Environmental justice populations would not be denied the benefit of access to a station. The vast majority of the neighborhoods in the study area, most of which contain environmental justice populations, are within a half mile of a proposed Red Line station.

Other Benefits

Throughout the study area, additional enhancements to sidewalks and crosswalks at various locations are associated with many options. In most neighborhoods, pedestrian accessibility is being enhanced. Also, it is anticipated that the new transit system would provide an alternative to cars.

Mitigation Measures

Numerous design options are being considered for the final design of the Red Line. Generally, options with tunnels will minimize many of the surface effects to noise levels, mobility, and visual character.

Disproportionate effects to environmental justice communities would only be carried out if: a) there is a substantial need for the project based on the overall public interest; and b) the alternatives would have less adverse effects on protected populations (or would have other adverse impacts that are more severe), or would involve increased costs of extraordinary magnitude.

In order to avoid, minimize, and mitigate any impacts, discussions and outreach to community leaders and service providers will be maintained. Continued outreach would help pinpoint potential problems before they become impacts, thus helping to facilitate ways to avoid or minimize impacts all together.

Displacements and Relocations

SUMMARY

There are no proposed residential displacements with any of the Red Line Alternatives. Up to 15 business/institution displacements would be permanently acquired depending on the options selected. Many of these displacements would be acquired for the storage and maintenance facility site.

Overview

Within the Red Line Corridor, there are no proposed residential displacements with any of the alternative options. Up to 15 business/institutional uses would be permanently acquired for Alternatives 3 or 4 based upon the options chosen. These businesses/institutions are located primarily within the west side of the corridor, with eight located within one of the storage and maintenance facility sites. For more information, please refer to the *Neighborhood Effects Technical Report* and the *Environmental Justice Technical Report* on the DVD attached to this document.

Potential Impacts

Alternative 1: No-Build would not involve any project-related construction or right-of-way acquisitions. Therefore, displacements and right-of-way acquisitions are not anticipated with the No-Build Alternative. With Alternative 2: TSM, the acquisition of up to 14.9 acres of right-of-way are anticipated for a storage and maintenance facility depending on the location chosen. Up to 51.4 acres of right-of-way, 14.9 acres of which would be required for a storage and maintenance facility, are anticipated with Alternative 3: BRT. For Alternative 4: LRT, 51 total acres of right-of-way (up to 12.6 acres for a storage and maintenance facility) are anticipated. Volume II of this DEIS presents the anticipated right-of-way impacts by geographic area and option.

Mitigation Measures

Affected property owners will receive assistance in accordance with federal and/or state requirements depending on the funding source. *The Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970* 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 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 all property owners as compensation for land acquisition. A displaced small business owner may be eligible for re-establishment expenses.

Economic Activity

SUMMARY

Education, health and social services are the most prevalent employment industries in the corridor. Alternatives 2, 3, and 4 would not have a major impact on the distribution of industries and businesses located within the corridor. Regionally, the Red Line would provide economic benefits by improving transit access and mobility for the work force and consumers within the corridor. The Red Line would create permanent jobs to operate and maintain the system. A large number of temporary jobs would also be created for the build alternatives for several years during construction.

Overview

The Red Line Corridor is located in a highly developed urban area that spans Baltimore County, Baltimore City and the Central Business District. The economic characteristics of these areas are analyzed in the following sections.

Table 4-4: Industry and Occupational Employment (by percentage of total)

Industries Employing Residents	Maryland	Baltimore County	Baltimore City	Red Line Corridor
Education, Health and Social Services	21%	23%	27%	24%
Professional, Scientific, Management, Administrative, and Waste Management Services	12%	10%	10%	11%
Public Administration	10%	8%	9%	9%
Retail Trade	10%	11%	9%	10%
Manufacturing	7%	9%	8%	8%
Finance, Insurance, Real Estate, and Rental and Leasing	7%	10%	7%	7%
Construction	7%	6%	5%	5%
Arts, Entertainment, Recreation, Accommodation and Food Services	7%	6%	8%	9%
Other	19%	17%	17%	17%
Total	100%	100%	100%	100%
Occupations of Residents	**Maryland**	**Baltimore County**	**Baltimore City**	**Red Line Corridor**
Management, Professional, and Related Occupations	41%	40%	33%	33%
Sales and Office Occupations	26%	29%	27%	27%
Service Occupations	14%	13%	20%	19%
Production, Transportation, and Material Moving Occupations	10%	10%	13%	14%
Other	9%	8%	7%	7%
Total	100%	100%	100%	100%

Table 4-5: Income and Unemployment

Characteristics	Maryland	Baltimore County	Baltimore City	Red Line Corridor
Median Household Income	$52,868	$50,667	$30,078	$31,532
Labor Force	2,769,525	396,897	287,159	115,078
Percent Unemployment	4.7%	4.2%	10.7%	10.3%

Sources: US Census 2000; Baltimore Metropolitan Council Community Profile

Existing Conditions

The corridor spans developed urban areas with a variety of businesses and industries. Education, health and social services are the most prevalent employment industries in the corridor. **Table 4-4** shows the distribution of industry and occupational employment and occupations that are comparable among the state, county, city, and corridor.

The primary occupations of civilian residents for the state, county, city, and corridor are management, professional, and related occupations. Sales and office occupations represent the second highest category.

A number of large businesses (1,000+ employees) are located in the corridor. Some of the large businesses in the corridor include:

- US Department of Health and Human Services/Social Security Administration
- Johns Hopkins Medical Institutions
- University of Maryland Medical System
- Maryland Transit Administration
- US Postal Service
- US Army Corps of Engineers

Figure 4-2 shows the locations of the largest employers in the corridor.

Table 4-5 shows the median household income and unemployment data for Maryland, Baltimore County, Baltimore City, and the Red Line Corridor. Median household income is considerably higher in Maryland and Baltimore County than in the Baltimore City or the Red Line Corridor. Similarly, the trends in unemployment rates throughout the geographical areas tend to mirror the trends in income. Unemployment rates in Baltimore County are comparable to the statewide average whereas unemployment in Baltimore City and the corridor are considerably higher.

Within the Red Line Corridor, approximately 7,500 businesses employed more than 192,000 people in 2000. The largest proportion (46 percent) of businesses was in the service industry, with the remaining largest portions in retail (23 percent); finance, insurance, and real estate (9 percent); and government services (8 percent). Most businesses (84 percent) had 20 or fewer employees. Medium-sized businesses (21 to 99 employees) accounted for 11 percent of the total businesses in the corridor, while large businesses with more than 100 employees accounted for 4 percent. In terms of total corridor employment, the largest proportion (64 percent) of employees work at large businesses.

Real property taxes represent the largest source of operating revenue for both Baltimore City and Baltimore County. In fiscal year 2007, real property taxes for Baltimore City were 29.4 percent of $2.016 billion.[1] A similar proportion of Baltimore County's operating budget is funded with real property tax revenue at 30 percent of a total of $1.956 billion in 2005.[2] A much smaller portion of the state's fiscal year 2007 operating revenue is funded by property taxes: approximately two percent of total operating revenue of $27.8 billion.[3] More detailed information on the economic analysis of the Red Line Corridor can be found in the *Economics Technical Report* on the DVD attached to this document.

Potential Impacts

Alternative 1: No Build includes already planned and programmed transit and highway projects. These projects could result in economic benefits or impacts. The economic benefits or impacts from the build Alternatives 2, 3, or 4 would be in addition to any benefit or impact from Alternative 1: No Build.

The Red Line build Alternatives 2, 3, and 4 would not have a major impact on the distribution of industries and businesses located within the corridor. Some property tax revenues would be lost due to direct property acquisitions; however, these property effects will be avoided and minimized to the greatest extent possible. Therefore, the build alternatives are expected to have a negligible effect on property tax revenues (less than a one percent reduction) on both the state and local level. In the Construction Activities section later in this chapter, temporary impacts during construction are described. These activities would affect business operations near the alignment of the respective alternative options.

[1] *City of Baltimore Fiscal Year 2007 Summary of Adopted Budget. Available at: http://www.ci.baltimore.md.us/government/finance/Fiscal2007SummaryAdoptedBudget.pdf*

[2] *Baltimore County Fiscal Year 2005 Adopted Budget. Available at: http://www.co.ba.md.us/Agencies/budfin/budget/05budget_adopted.html*

[3] *State of Maryland Estimated Revenues for the Fiscal Year Ending June 30, 2007. Available at: http://dbm.maryland.gov/dbm_publishing/public_content/dbm_search/budget/toc_fy2007_fiscal_digest/fisdig07exb.pdf*

WHAT JOB OPPORTUNITIES MIGHT BE AFFORDED TO LOCAL RESIDENTS IF THE RED LINE PROJECT IS IMPLEMENTED?

If the Red Line is built, job opportunities will fall into two categories: new jobs and better access to existing jobs.

In public works construction projects of this magnitude contractors rely heavily on the local labor pool to help build it. Both skilled and unskilled labor will be necessary. Once the Red Line is built and open for service, MTA will have numerous new positions in operations and maintenance. This can include a wide range of jobs such as drivers, security personnel, and mechanics. New jobs also could result from re-development or new development near Red Line stations, particularly from Transit Oriented Development.

Better access to existing jobs within the Red Line corridor also would occur. Major employers such as the Centers for Medicare and Medicaid Services, Social Security Administration and companies located downtown and at Inner 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 they can reach by connecting to MARC, Central Light Rail and Metro. This would potentially allow employers to draw upon a larger worker pool within the region.

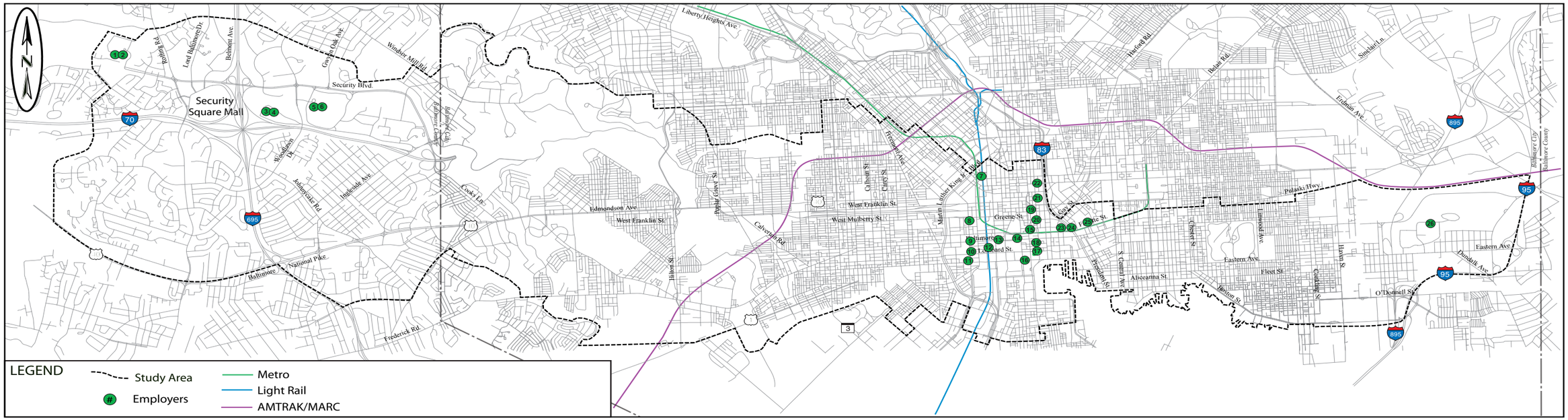
Figure 4-2 Map Key: Organizations with Over 1,000 Employees

Map ID	Employer	Number of Employees
1	CMS	1,045
2	CMS	1,450
3	SSA - Woodlawn Cptr Bldg	1,086
4	SSA - Security West Bldg	4,005
5	SSA - Operations Bldg	6,663
6	SSA - Annex to Soc Sec	1,477
7	Maryland General Hospital	1,100
8	SSA - Metro West Bldg 1	2,114
9	Veterans Health Administration	1,200
10	University MD Med Sys Corp	4,800
11	UMAB School of Medicine/Law	1,604
12	US Army Corps of Engineers	1,700
13	State Dept of Education Hdqtrs	1,509
14	GSA leased to TD - IRS, TIGTA	1,803

Map ID	Employer	Number of Employees
15	CSX Corporation	1,200
16	Verizon Maryland Inc	1,200
17	Legg Mason Inc	1,000
18	Jos A Bank Clothiers Inc	1,174
19	Foodtemps Inc	1,000
20	Mercy Medical Center	1,324
21	Baltimore Sun Company Inc	1,650
22	Maryland Dept of Transportation	1,676
23	Police	1,155
24	City of Baltimore	1,155
25	United States Postal Service	2,085
26	Johns Hopkins Bayview Med Ctr	3,000

Source: Baltimore Metropolitan Council 2000 Master Establishment File

Figure 4-2: Organizations with Over 1,000 Employees



Regionally, the Red Line would provide economic benefits by improving transit access and mobility for the work force and consumers within the corridor. The Red Line would create permanent jobs to operate and maintain the system. A large number of temporary jobs would also be created for the build alternatives for several years during construction. This would vary by alternative but would mostly be proportional to the construction cost of the respective alternative. An estimate of the permanent and temporary construction jobs anticipated as a result of the Locally Preferred Alternative may be provided in the Final EIS.

Mitigation Measures

Impacts to the economic structure of the community within the Red Line Corridor will continue to be minimized through careful planning and design. Nomajor adverse impacts to the economic structure of the corridor are anticipated with any of the alternatives.

Throughout the planning, design and construction phases the MTA will continue to coordinate with businesses in the corridor and especially those adjacent to the preferred alignment, when selected, to prevent or minimize short-term or long-term disruptions to parking, access or delivery. Similar to initiatives in other cities, the MTA may enter into written agreements with the business community on programs to assist impacted businesses.

Land Use

SUMMARY

The Red Line project is in accordance with State, Baltimore County, and Baltimore City land use policies and planning goals. No effects to land use are anticipated with the No-Build Alternative. Alternative 2:TSM would require some new right-of-way from residential and commercial land uses. The amount of right-of-way required for Alternative 3: BRT or Alternative 4: LRT would vary depending on the option configuration. The surface options proposed under Alternatives 3 and 4 would result in greater conversion of residential and commercial land uses to transportation uses than the tunnel alignments. The Red Line also has the potential to induce new development or spur redevelopment throughout the corridor, thus affecting land use. The land uses around the stations would have the most potential to support new development or redevelopment.

Overview

The purpose of this section is to identify the existing and planned future land uses within the Red Line Corridor; describe the state and local land use policies that are in place; and analyze the potential effects of the proposed alternatives on land use. Potential effects of the proposed Red Line alternatives on land use are indicated by direct or indirect changes in land use resulting from the proposed alternatives or from induced development. The assessment of these effects is conducted through a two-step process that involves first establishing baseline land use characteristics, and second, evaluating the direct and indirect changes.

Establishing the baseline characteristics involves identifying existing and anticipated future land uses in the corridor and comparing them to determine development trends. After establishing the baseline land use characteristics, the proposed Red Line alternatives were evaluated to assess the potential each would have for causing direct or indirect changes in land use.

Numerous state, county and city policies that affect the manner in which development in the corridor can occur are currently in place. The scale on which these policies affect land use ranges from local to regional. **Figure 4-3** shows selected land use designations relevant to the Red Line Corridor. The following sections describe the relevant land use policies.

State of Maryland Land Use Policies

Smart Growth, Priority Funding Areas, and Rural Legacy

The 1997 Smart Growth Priority Funding Areas Act designated certain areas as Smart Growth areas. These areas, now called Priority Funding Areas (PFAs), include Baltimore City and the area inside the Baltimore Beltway (I-695).

In response to the state's initiatives, Baltimore County designated its PFAs essentially as those areas located within the County's Urban Rural Demarcation Line (URDL). By targeting funding to the PFAs, the County and State have jointly enhanced opportunities for economic growth and community conservation. The Baltimore County portion of the corridor is located entirely within the PFA.

Baltimore County utilizes the Rural Legacy Program to ensure that areas rich in agricultural, historic, scenic, and cultural resources are preserved, as well as to acquire parkland. According to Maryland Department of Planning (MDP), there are no approved Rural Legacy Programs within the Baltimore County or City portions of the corridor.

Priority Places

The Priority Places Initiative provides assistance to the most compelling projects and plans within PFAs. Priority Places are not tied to a single state agency. Instead, they draw from the coordinated efforts and resources of every department that has a growth related role. The Priority Places Initiative has the potential to affect land use in the corridor by further focusing the use of State funds to areas in need of heightened assistance and attention.

There is one Priority Place located within the Baltimore City portion of the corridor: the neighborhood of Poppleton. The City aims to transform Poppleton into a mixed-income neighborhood, attracting middle-income homebuyers and improving quality of life for current residents.

Critical Area Program

The Critical Area Program is a state-mandated program to assist in pollution reduction and to enhance the quality of the Chesapeake Bay. This program has the potential to affect land use and development because it places limitations and special requirements on development within the Critical Area. Please refer to the *Natural Resources Technical Report* for additional information regarding Critical Area.

Baltimore County Land Use Policies

Planning Strategy

The Urban Rural Demarcation Line (URDL), identifies the areas of the County that have or would receive public water and sewer infrastructure and, therefore, determines the amount of development within rural protected areas. The portion of the Red Line Corridor located within Baltimore County is entirely within the URDL.

Baltimore County Greenways

Baltimore County has adopted an aggressive stream valley protection program that will ensure greenway protection along designated streams.

There is one proposed greenway located within the portion of the corridor located in Baltimore County. The Gwynns Falls Greenway is a proposed 1.75-mile stream valley greenway. This project is part of a larger effort to establish a greenway corridor along the length of the Gwynns Falls, linking Baltimore City and Baltimore County.

Zoning

Currently, Baltimore County has 36 zoning classifications. These classifications help to control the nature of the land use in the County by detailing the uses that are permitted, the maximum intensity of the use allowed, building height limits, and building setbacks from roads and other property lines.

Baltimore City Land Use Policies

Empowerment Zones

Empowerment Zones affect local land use by encouraging business development within designated areas. Federal grants and tax incentives are offered for businesses locating in and hiring residents of a designated zone. Three Empowerment Zones are located within Baltimore City (referred to as Zones 1, 2, and 3). The Red Line Corridor is located within Zones 1 and 2.

Enterprise Zones

Enterprise Zones are specific geographic areas targeted for economic revitalization. Enterprise Zones encourage economic right-of-way and investment in distressed areas by offering tax advantages and incentives to businesses locating within the zone boundaries.

There is one designated Enterprise Zone located within Baltimore City – the Carroll/Camden Industrial Park. This area encompasses properties in and around the communities of Westport, Washington Village, Morrell Park, and Saint Paul.

Zoning

According to the Baltimore City Department of Planning, the City's current zoning code is no longer an effective tool for guiding the City's growth, in part because of the many changes in economic and social trends which have occurred in the 30 years since the last comprehensive rezoning in 1971. Currently, Baltimore City is re-developing its entire zoning process. Current zoning data for Baltimore City was not available for inclusion in this report.

Local Land Use Planning Goals

Local land use plans help direct and guide the type of land use and the intensity of development permitted. Changes in land use patterns that result from new development can affect the character of an area and result in physical impacts to the environment. Therefore, proposing development that is consistent with the local land use plans helps to minimize the effects of that development on the environment.

Baltimore County

The Baltimore County Master Plan, entitled *Master Plan 2010*, includes specific policies to enhance existing development and to provide for orderly and appropriate new development of the county through the year 2010. Each element contains goals, policies, and implementation measures that are pertinent to the Red Line Corridor Transit Study.

Baltimore City

The City of Baltimore's Comprehensive Master Plan: 2007 – 2012 implements a six-year strategy that encourages infill and redevelopment that is transit-oriented, brings back vacant areas into productive use, located in Growth Promotion Areas (GPA), and the central business district (CBD), yet preserves and respects the City's historic character. Different from the conventional comprehensive plans of the past, the Baltimore City's Master Plan merges a comprehensive business plan and urban development plan into one holistic document. The Plan acts as a "blueprint" for master planning in Baltimore City, and discusses the following elements:

- Live: Housing stock and aesthetic built environment, social and human services, and urban amenities and attractions.
- Earn: Economic opportunity, sustainable employment, training opportunities, and job accessibility.
- Play: Cultural, natural, and entertainment entities.
- Learn: Education for residents and other potential consumers.

Existing Conditions

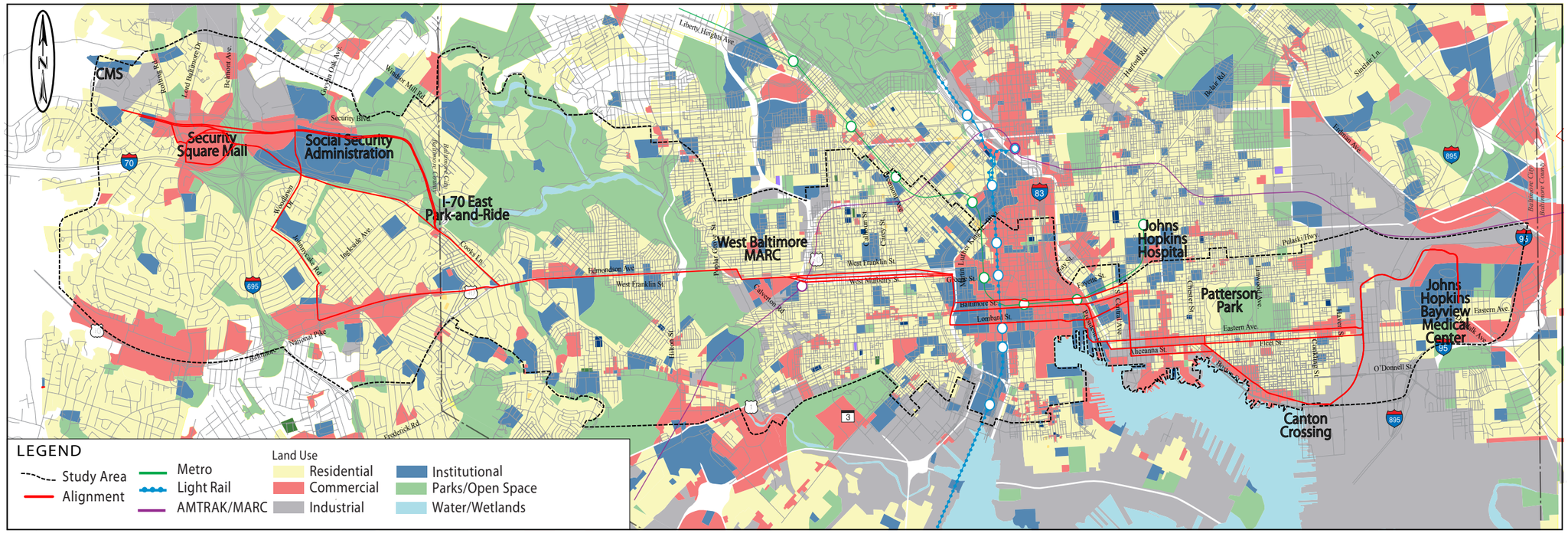
Existing land uses in the Red Line Corridor were identified through the use of GIS data, which were provided by Baltimore County and Baltimore City. The accuracy of the data for existing land uses in close proximity to the proposed Red Line alternatives was confirmed through field data collection.

Land use within the Baltimore County portion of the corridor is predominantly medium-density residential. There are several major commercial centers that exist in this portion of the corridor. These include the Social Security Administration, Security Square Mall and Westview Shopping Center. Baltimore County has classified areas identified by these commercial centers as "Employment Centers." This designation refers to areas consisting of large commercial clusters supporting the economic growth of the region. There are also various institutional land uses scattered throughout this portion of the corridor including cemeteries, police stations, fire stations, medical facilities, numerous schools, and places of worship.

Land use within the western segment of Baltimore City in the corridor is predominantly residential. Higher density residential development is located closer to the downtown CBD; while medium density residential development is located near the city/county line. This portion of the corridor contains the largest amount of parkland in the corridor. The only major commercial land use area near the city/county line is the Edmondson Village Shopping Center. Other contributing elements to land use in this area include cemeteries, education facilities, and places of worship.

Land use in the CBD is primarily commercial. There are also institutional uses, including educational facilities, health care facilities, and places of worship. High-density residential land use is also characteristic of the CBD.

Figure 4-3: Existing Land Use



Land use within the eastern segment of Baltimore City in the corridor is predominantly residential. There is one large parcel of parkland (Patterson Park) located in the center of this area and Canton Waterfront Park; a smaller parkland area is located in the southeast portion of this area. The eastern portion of this area is also characterized with linear sections of commercial land uses and isolated industrial land uses.

The eastern most limits of the Red Line Corridor are characterized with industrial land uses and the Johns Hopkins Bayview Medical Center. Commercial land uses are concentrated along Eastern Avenue and Lombard Street, north of the Johns Hopkins Bayview Medical Center. Residential lane uses consist of rowhomes in the Greektown area and along Eastern Avenue.

Future Land Use

Future land uses were identified by reviewing local land use plans and identifying reasonably foreseeable future development. This information was then coordinated with the local planning agencies who provided input regarding the accuracy of the information as well as any supplemental information. The discussion of future land use describes the areas of the corridor that are expected to experience changes in land use designation.

Figure 4-4 and **Table 4-6** show the proposed development in the corridor. Several new development projects are proposed in Baltimore County in the Woodlawn, Fairbrook, and Catonsville communities. By localizing new development in these targeted areas, the county will be consistent with Smart Growth initiatives. The largest anticipated change in land use in the Baltimore County portion of the corridor is expected to occur in the Fairbrook area. Land in the Fairbrook community that is currently undeveloped is expected to be used for a multi-family townhome development. Baltimore County has also concentrated its future planning efforts on infill development and revitalization of Community Conservation Areas adjacent to the city boundary. The county also anticipates an increase in commercial development to occur within the I-70 / I-695 interchange over the next twenty years that will meet the needs of residents and regional shoppers.

In contrast, land use in the corridor that is in Baltimore City, is anticipated to change very little over the next 20 years. The predominant land uses will still be residential and commercial. It is the City's goal to meet the commercial and business needs of its residents through infill development and the adaptive re-use of existing buildings. Baltimore City Officials plan to focus most future redevelopment in the Inner Harbor area and capitalize on the desire to live in a dense urban setting that is served by shopping and entertainment activities. Successful reinvestment has also been targeted in waterfront neighborhoods of Canton and Fells Point. The large mixed-use redevelopment projects associated with Canton Crossing, Harbor East and Brewer's Hill have utilized brownfield and adaptive reuse concepts to convert vacant industrial property into vibrant urban communities.

While there are many areas of Baltimore City that have naturally strong markets, there are other areas that need substantially more resources to effect lasting change and encourage new growth. As a result, Baltimore City identified Growth Promotion Areas (GPA) to strategically attract additional resources. GPA's within the corridor include the Booth-Boyd, Poppleton, and Franklin Square neighborhoods.

Potential Impacts

The proposed Red Line alternatives could affect existing and future land use in several ways. These include directly converting land from its existing use to transportation use; limiting or precluding planned future developments from occurring; and indirectly inducing unplanned development as well as supporting and enhancing planned development. This section summarizes the effects that the proposed alternatives would have on existing and future land use in the Red Line Corridor.

Direct Conversion of Land Use

Alternative 1: No-Build

Alternative 1: No-Build includes already planned and programmed transit and highway projects in the Baltimore Region. These projects could result in changes to land uses. However, because there are no construction-related activities with the Red Line No-Build Alternative, impacts to land uses are not anticipated with this project.

Alternative 2: TSM

Alternative 2: TSM would operate on the surface, almost entirely within the current rights-of-way of existing streets. Small amounts of new right-of-way would be required along US 40/Franklin Street and Edmondson Avenue to accommodate roadway improvements and stations proposed under this alternative. This right-of-way is mainly comprised of residential lane uses. In addition, right-of-way would be required for proposed park-and ride facilities and for the proposed storage and maintenance facilities. The right-of-way associated with the proposed location for these facilities is mainly commercial land uses. Since only small amounts of new right-of-way would be required, Alternative 2: TSM would result in very little direct conversion of land to transportation use.

Alternative 3: BRT

Alternative 3: BRT proposes new BRT service on the surface of many existing streets within dedicated transitways. In many locations, right-of-way would be acquired to accommodate a dedicated transitway and proposed stations. These locations include: businesses along Security Boulevard, businesses along Rolling Road, the I-695/I-70 interchange vicinity, Edmondson Shopping Center, and US 40/Pulaski Street vicinity. The land that would be converted to transportation use at these locations is currently classified as commercial, institutional and some residential. In addition, Alternative 3: BRT includes options that would place a dedicated transitway on a new alignment. These options are located in Baltimore County in the vicinity of Security Square Mall and the Social Security Administration. The direct conversion of land use is more substantial in these locations because the entire new transitway would be converted from its current use to transportation. In addition, new right-of-way would be required for proposed park-and-ride facilities and for certain proposed storage and maintenance facilities.

Alternative 4: LRT

Alternative 4: LRT proposes new LRT service on the surface of many existing streets within dedicated transitways. Alternative 4: LRT would result in similar direct conversions of land to transportation use as Alternative 3: BRT because the proposed alignments, station locations, and parking facilities would be the same for both alternatives. However, the stations for the LRT service proposed under Alternative 4: LRT would typically include longer platforms. Therefore, some additional right-of-way could be needed in the vicinity of proposed stations. In addition, the configuration of storage and maintenance facilities for LRT vehicles differs from BRT vehicles.

Since Alternative 4A is located entirely on the surface and includes options to construct dedicated transitways on new alignment, it is expected that this alternative would result in the greatest amount of direct land use conversion of any of the proposed LRT alternatives. Alternative 4: LRT tunnel options would require very little conversion of land to transportation use.

Induced Development/ Redevelopment

The Red Line has the potential to induce new development or spur redevelopment in various locations throughout the corridor, thus affecting land use. The Red Line has the potential to support high-density development around proposed station locations. The areas around stations would become more attractive places for commuters to live. Increased population density would make the areas around stations more attractive places for businesses to be located and businesses would potentially open near stations. This, in turn, would create jobs near the stations, which would potentially further increase population density. Through this continuous cycle of increasing population density and increasing business activity, the transit station areas would potentially become vibrant activity centers.

While the Red Line alternatives may contribute to this cyclical pattern of redevelopment, they are not the only factor that must be considered is this analysis. There are existing policies in place that encourage the re-use or redevelopment of land within the Red Line Corridor. In addition, local land use plans support the redevelopment of various locations within the corridor. These policies and plans, in conjunction with the improved transit access and improved transit access and improved mobility that would be provided by the Red Line build alternatives increases the potential for redevelopment to occur, especially in the vicinity of proposed transit.

Consistency with Local Land Use Plans

The purpose of this section is to determine the consistency of the Red Line alternatives with adopted Master Plans.

Baltimore County

The proposed alternatives were compared with objectives identified in the Baltimore County's *Master Plan 2010.* The goal of *Master Plan 2010* is to foster the county's economic growth to be consistent with the guidelines regulating the Urban Rural Demarcation Line (URDL). The alternatives may increase the potential for development around the proposed transit stations and along the transit corridor. Associated development would be consistent with Baltimore County's URDL and would be supported by the Woodlawn-Security Employment Center and consistent with the objectives identified in Baltimore County's *Master Plan* 2010.

Baltimore City

The proposed alternatives were compared with objectives identified in *The City of Baltimore's Comprehensive Master Plan: 2007 – 2012*. The goals and objectives identified in the master plan aim to improve and increase the housing stock in Baltimore City, draw more residents and visitors to Baltimore's expanding entertainment venues and historical resources, expand the availability of jobs for the city and improve the city's educational services and resources.

The Red Line Corridor Transit Study is consistent with Baltimore City's planning efforts as it is specifically identified in Baltimore City's Master Plan as being part of their overall transportation goals. In general, the Red Line alternatives are consistent with all four elements (i.e., Live, Earn, Play, and Learn) of the master plan.

Mitigation Measures

Close coordination between Baltimore County, Baltimore City, state agencies, and effected property owners will be required to ensure that land use conversions are consistent with local land use policies and plans. Any land use conversions that are inconsistent with land use policies will require appropriate mitigation measures.

Table 4-6: Proposed Development

ID	Proposed Development	Total Gross Building Area (in thousands of sq. ft.)	Type of Development				
			Residential	Commercial	Institutional	Hotel	Retail
1	Uplands	1,251	X				
2	Harlem Park	740	X				X
3	Poppleton Project	2,762	X				X
4	Upton West	443	X				
5	Camden Crossing	334	X				
6	UMB Biotech	1,130			X		
7	UMB Dental School	367			X		
8	UMMS Ambulatory Care Center	500			X		
9	UMMS Sonneborn Building	238			X		
10	The Zenith	191	X	X			
11	City Hotel	750				X	
12	Hilton Convention Center Hotel	462				X	X
13	Arc Wheeler Tower	445	X	X		X	X
14	Cityscape	324				X	
15	Super Block-Lex. Sq./Rainbow App.	395	X				X
16	39 W. Lexington (Old BGE Building)	196					X

Figure 4-4: Proposed Development

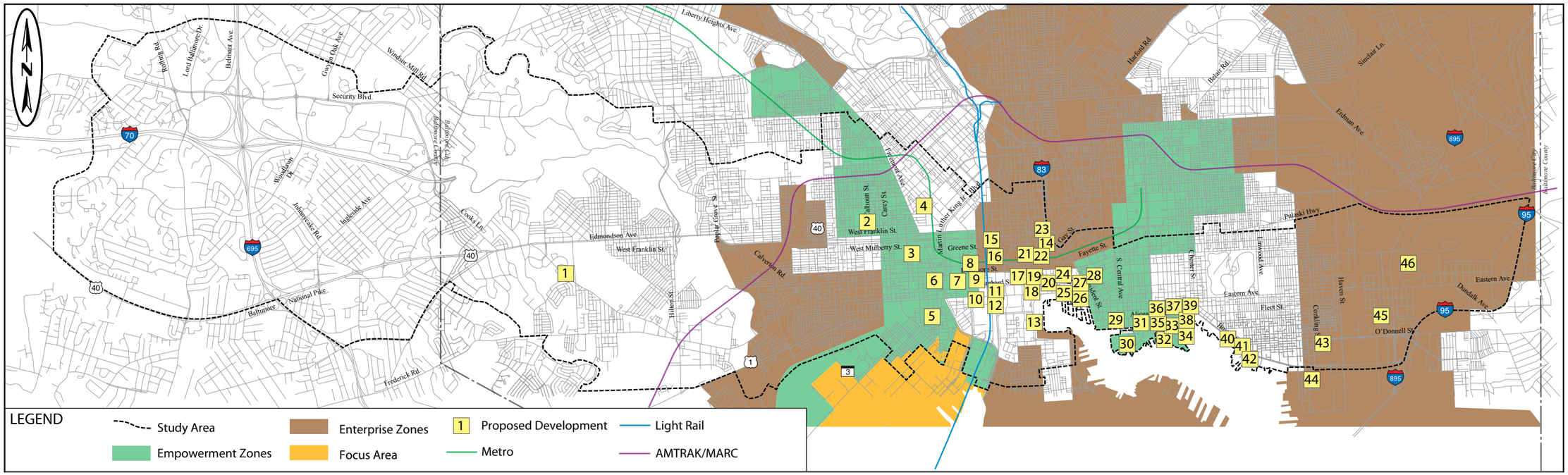


Table 4-6: Proposed Development, continued

ID	Proposed Development	Total Gross Building Area (in thousands of sq. ft.)	Type of Development				
			Residential	Commercial	Institutional	Hotel	Retail
17	Mechanic Theatre	245	X			X	X
18	One East Redwood	108	X				X
19	F&D Building	189	X				X
20	One Light St. Hotel	179				X	
21	Mercy Hospital Expansion	500		X			
22	Richard Nyang Project	384	X	X			X
23	Marriot Springhill Suites	59				X	
24	414 Water Street	212	X				
25	300 E. Pratt	1,000		X			X
26	Shot Tower Metro	315	X				X
27	Cordish Balloon Tower	238	X			X	
28	Arbermarle Square	458	X				X
29	Harbor East	2,884	X	X		X	X
30	Harbor Point	1,800	X	X		X	X
31	Fells Landing	64	X				
32	Crescent at Fells Point	277	X				
33	Henderson's Wharf	85	X				
34	Hanover Wharf	201	X				
35	Union Wharf	370	X				
36	Union Box	201	X				
37	Osiris Building	159	X				
38	Ann St. Project	231					X
39	Aliceanna Street Project	313	X				X
40	The Moorings	71	X				
41	Light House Point	176	X				
42	Icon Tower	212	X				
43	Canton Crossing	2,429	X	X			X
44	Brewers Hill (Struever Brothers)	737		X			X
45	Greektown	1,240	X				
46	Bayview	2,500			X		
TOTAL ALL PROJECT CATEGORIES		28,365					

Source: Downtown Partnership, Baltimore Development Corporation, Baltimore City Department of Planning, Owner/Developer communication, www.camdencrossing.com, and www.integral-online.comNotes:

1 - Includes UMB Biotech Building II, UMB BioPark (Maryland Forensic Medicine Center and the remainder of project [8 buildings]); and UMB BioPark Garage

2 - Includes Harbor E-Parcel C; Harbor E-Parcel H; Harbor E-EJ Codd; Harbor E-Spinnaker Bay; Harbor E-Parcel B; Harbor E-4 Season/Legg Mason

Parks, Recreation Land and Open Space

SUMMARY

Eighty-three public parks and recreational areas were identified in project corridor, but only four of these facilities would be impacted by the proposed alternatives. It is anticipated that Alternatives 2, 3, and 4 would impact the following parks or recreational facilities:

- A small portion of Leakin Park/Parcel 7900F that is adjacent to Cooks Lane and the proposed I-70 park-and-ride lot.
- A proposed surface or underground station next to the main entrance to Patterson Park at Eastern and Linwood Avenues.
- A surface station proposed with the Fayette Street alignment has the potential to affect the War Memorial Plaza.
- A proposed surface station along the University Plaza has the potential to be effected.

If a build alternative is chosen as the Locally Preferred Alternative, further avoidance and minimization efforts will be considered, and the project team will continue to coordinate with city and county representatives regarding potential effects to park and recreational lands.

Overview

Part of the land use survey described in the previous section included the identification of parks, recreation land, and open space within the Red Line Corridor. The following section describes the parkland identified, potential impacts, and migation. Detailed analysis of the parkland impacts can be found in Volume II of the DEIS.

Section 4(f) of the US Department of Transportation Act (DOT) of 1966 (23 USC. 138 and 49 USC. 303), requires that the proposed use of land from a publicly-owned public park, recreation area, wildlife and/or waterfowl refuge, or any significant historic or archaeological site, as part of a federally funded or approved transportation project, is permissible only if there is no feasible and prudent alternative to the use. Refer to the Section 4(f) section of this chapter for the 4(f) Evaluation for this project.

Section 6(f) of the Land and Water Conservation Fund Act (16 USC 460) requires that the Secretary of the US Department of the Interior (DOI) approve any conversion of lands purchased or developed with assistance under this act to a use other then public, outdoor recreation use.

Program Open Space was created for the purpose of expediting the acquisition of outdoor recreation and open space areas and providing recreation facilities before land is devoted to other purposes. The Annotated Code of Maryland provides that. "Land acquired or developed under a State grant from Program Open Space may not be converted (from outdoor public recreation or open space use to any other use) without written approval of the Secretary of the Department of Natural Resources, the Secretary of the Department of Budget and Management and the Secretary of the Department of Planning. Any conversion in land use may be approved only after the local governing body replaces the land with land of at least equivalent area and of equal recreation or open space value, and for any conversion of land acquired or developed under a State grant from Program Open Space ...the appraised monetary value of the land proposed for acquisition shall be equal to or greater than the appraised monetary value of the land to be converted, under the proposed new use of the converted land." [Natural Resources Article §5-906(e)(7) and (8)].

Existing Conditions

Figure 4-5 identifies the public parks and recreation areas located within the Red Line Corridor. Major parks in the corridor include Dead Run Stream Valley Park in Baltimore County and Leakin Park in Baltimore City.

The initial level of inventory identified parks, recreational areas, and open space for the entire Red Line Corridor using tax parcel files. This resulted in the identification of over 83 properties within the corridor and included both public parks, as well as open spaces that are owned by public agencies that could be used for recreation. Of the 83 publicly-owned parcels initially inventoried within the corridor, 11 parcels are located in Baltimore County and 72 parcels within Baltimore City. The Baltimore City parcels are comprised of regional parks, city play lots,

passive parks, tot lots, and traffic islands, as named in the city's tax parcel inventory file. Most, but not all of the 83 inventoried parks, play lots, open space, recreation areas owned by the Baltimore City and Baltimore County were located and verified by field observations. However, it became apparent that about a dozen of the city-owned tax parcels did not have any park-like appearance, functions or use as public parks and that several parkland-like parcels were not inventoried as city-owned parkland.

In 2004, the Baltimore City Recreation and Parks Department staff was contacted, the agency advised that the City's Department of Planning was in the process of updating the city parcel inventory. At the recommendation of the Baltimore City Recreation and Parks Department, a useful tool to map city-owned parks was provided by the Parks and People Foundation. With support from the city, and building on the city's rich heritage of parks, the Parks and People Foundation's One Park Program is planned to unite the city in an integrated system of parks, street trees, community gardens, landscaped boulevards and paths, squares, schoolyards, college campuses, recreation areas, and other public open spaces.

A comparison of the initially identified 83 parks and recreational areas within the Red Line Corridor with the locations of the proposed alternatives indicated that 79 of the 83 public parks and recreational areas would not be impacted by the proposed alternatives. The impact evaluation focused on these four remaining parks and recreational areas. For additional information, please refer to the separate *Section 4(f) Evaluation Technical Report* for further descriptions, impact analysis, and coordination for Section 4(f) resources.

None of these public parks inventoried were purchased using Land and Water Conservation Act funds or through Program Open Space; thus Section 6(f) and Program Open Space land replacement approvals will not be requested.

Potential Impacts

Whenever possible, parks, recreation land, and open space have been avoided by the proposed alternatives.

Impacts to parks, recreational land or open space are not anticipated with the No-Build Alternative. Alternative 2: TSM, Alternative 3: BRT and Alternative 4: LRT would impact a small portion of Leakin Park/Parcel 7900F located along Cooks Lane just south of I-70. The portion of Leakin Park/Parcel 7900F that would be impacted is a maintained area between two service roads. Any impact is not expected to alter the use or function of the park.

Alternatives 2, 3, and 4 include a proposed surface or underground station next to the main entrance of Patterson Park at the northwest corner of the Eastern Avenue and Linwood Avenue. The location of either the surface or underground station would not impede access to the park and will benefit park users by providing direct access to the park.

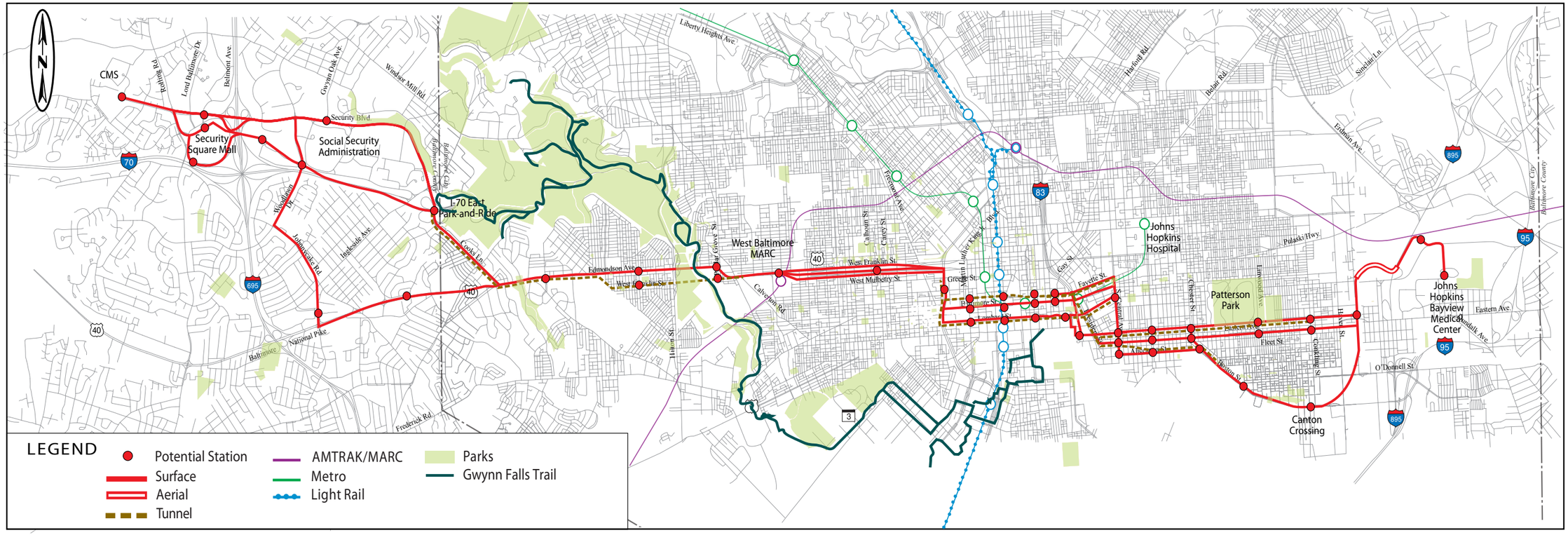
The surface station associated with the Fayette Street alignment with Alternatives 2, 3, and 4 has potential to impact the War Memorial Plaza which is located between North Holiday Street and North Gay Street and bound to the north and south respectively by East Lexington Street and East Fayette Street. The location of the surface station would not impede access to the park and will benefit park users by providing direct access to the park.

Alternatives 2, 3, and 4 include a proposed surface station along the northwest perimeter of University Plaza along West Baltimore Street, east of South Greene Street. The location of the surface station would not impede access to the park and would benefit park users by providing direct access to the park.

Mitigation Measures

Mitigation measures to potential parks, recreation land, and open space could include:

Figure 4-5: Parks



- Replacement land of equal or greater natural resource and economic value could be provided in a manner to be agreed upon by the park owner and the Maryland Transit Administration.
- Erosion and sediment control measures would be provided and strictly enforced to minimize water quality impacts.
- Additional appropriate mitigation measures, such as landscaping (where applicable with respect to the resource), would be developed through coordination with the park owner.

The project team has met with the city and county representatives at various times for purposes of confirming research/inventory data, reviewing the alternatives and options under consideration, and discussing potential impacts and mitigation measures. Additional discussions are anticipated to occur regarding the project's potential impacts to parks, recreation areas, and open space, and mitigation measures that could lessen potential impacts.

Visual Quality

SUMMARY

NEPA requires the consideration of visual effects or aesthetics from a transportation project. Because no specific design decisions regarding construction materials, design, or location have been made, the discussion focuses on typical system components that will be seen with a Red Line project. These components included alignments, stations, vehicles, and storage and maintenance facilities. Either BRT or LRT would require stations or tunnel headhouses and a storage and maintenance facility. Visual aspects of an LRT Alternative that would differ from a BRT alternative are that LRT requires traction power substations and overhead catenary wires to supply the operating power. As the project moves into design, minimization principles will be considered to reduce the potential visual effects associated with the transit facilities and alignments.

Overview

The National Environmental Policy Act (NEPA) requires that consideration be given to the effects that proposed federal actions or projects are likely to have on the quality of the human environment. NEPA identifies visual effects, or aesthetics, as one of the environmental factors which must be considered. This section addresses the visual effects of the following components of the Red Line Corridor Transit Study:

- Transitway Alignments
- Stations
- Vehicles
- Storage and Maintenance Facilities

Existing Conditions

Visual Setting in Corridor

The visual setting of the Red Line Corridor can mostly be associated with existing roadways in urban and suburban settings. This analysis describes the existing visual environment along the corridor. Views can be defined as those from an outside observer seeing the transit system and all its components. Effects would be described as changes that result from the construction of the transit system as a whole or from any of its components, and that would change the perception of an outside observer in a substantial way. The change can be positive or negative. Typically areas which are traversed by the proposed transit system are analyzed for their sensitivity relative to visual impacts. Sensitive areas are usually defined as areas which have one or several of the following components:

- Protected Views - Those that are well known and relevant to the community and have found recognition in planning documents usually through the definition of a viewshed. No officially protected viewsheds are known from planning documents of Baltimore City and County.
- Parks and Natural Areas - These areas are usually sensitive to any manmade structure placed in or near them. Visual impacts would be assessed differently from other environmental effects, such as effects to watersheds or habitats.
- Historic Districts - Baltimore City differentiates between local historic districts and National Register Districts. Typically the local districts have higher sensitivity and have been established because of a high number of structures qualifying as historically significant. The addition of new construction could represent negative effects if views of significant structures would be obstructed or the new transit elements would not be context-sensitive, i.e. clash with existing styles, scale or massing.
- Historic Landmarks - Sensitivity as described before, however limited to one building or a group of related buildings.
- Conversely, areas of low sensitivity could be upgraded by the construction of a transit system either by the system investment itself or by accompanying streetscape or landscape work.

Interpretation of the existing visual character and land uses is based on field visits, data collection and responses of the public. Field visits occurred during alignment planning in 2003-2007. In addition to field visits, information was gathered from local planning agencies to obtain historic information and information about planning objectives for certain areas. Public workshops and informational meetings provided additional data.

Visual Character Typology

To get a general sense of the visual sensitivity of the corridor potentially affected by the transit system, ten visual character types were identified within the corridor. Because the transit system is proposed to follow public rights-of-way (i.e., mostly streets) over almost the entire length of the corridor, the experience of the rider on the transit system would be very similar to the experience of a person using the street or viewing the transit from the edge of the street. There are only two segments in which the transit user would traverse currently private right-of-way (Social Security campus and the former industrial areas and rail yards at the eastern end of the corridor.) No part of the corridor would be such that the visual effect on the transit rider would be considered negative.

Potential Impacts

No specific design decisions regarding construction materials, design of structures such as shelters, colors or brand of vehicles etc. have been made yet. The visual impact discussion is focused on the typical system components of either of the proposed modes (BRT and LRT) and specific geographic areas of the corridor.

BRT and LRT have the following transit system components with potential effects on the visual environment:

- Transitway - Surface alignments, bus guideways or trackways, and underground tunnel alignments.
- Stations - Surface stations or underground tunnel stations.
- Overhead catenary wire system (LRT only) - The powerline system receives electric power from traction power substations which are shipping container sized units placed near the transitway.
- Structures - overpasses, retaining walls (BRT and LRT).
- Vehicles - BRT: Standard 40-foot low floor or articulated buses are being considered; LRT: standard 8 feet-6 inches wide articulated low floor vehicles are being considered. These are 60-90 feet long.
- Storage and Maintenance Facility (BRT and LRT) - The facility includes storage areas and repair shops for the vehicles in the fleet (BRT possible use by other bus lines to accomplish optimal fleet size).

The alternatives have been developed with consideration of the following potential impacts.

Surface Alignments

Transitways for buses are paved similar to roadways and placed outside or adjacent to existing roadways. They would have additional visual effects similar to a roadway widening. LRT transitways in existing roadways include embedded track, usually constructed with girder-rail (grooved rail). Although transitways have no or little visual impact in themselves, they are often defined visually through different paving materials or striping to keep motor vehicles from using the transit.

Surface Stations

Stations consist of the following elements to be constructed: platforms, shelters, signs, ticket vending machines, benches, and trash receptacles. The most visible element would be the shelters which can be designed to be more prominent or in such a way that they blend in. Some stations have related functions like bus stops or bus transfer points, drop off areas or parking lots (park-and-rides).

Tunnel Portal, Boston Green Line

Tunnel Alignments

Moving the transitways underground does not entirely remove the transit system from view. Tunnels would need occasional ventilation shafts and would be most visible at the portals where the transitway transitions from surface to subsurface grade.

Tunnel Stations

Tunnel stations would be visible on the surface by "headhouses" which protect the stairways, elevators and escalators connecting the surface area to the below grade platforms. Depending on the station layout (with or without mezzanine level) there would be at least two headhouses per station.

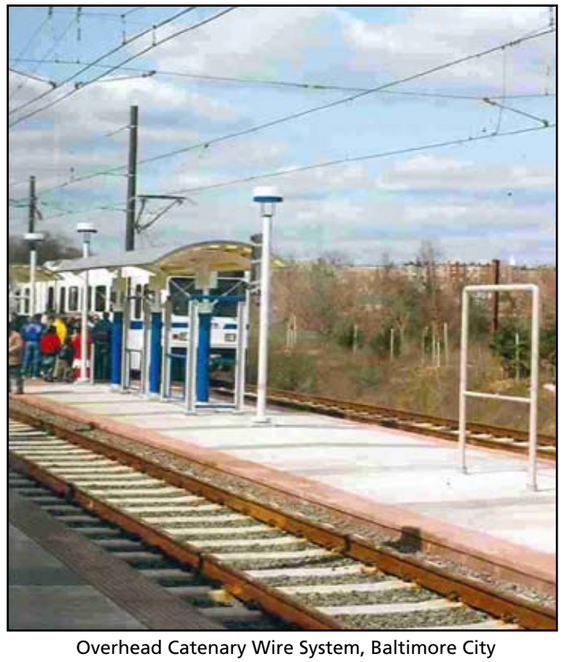
Station Headhouse, Chicago Red Line

Traction Power System/ Overhead Catenary Wire System

Traction power substations and overhead catenary wires supply the power for the LRT to operate. The proposed BRT system would not use overhead wire. No decisions have been made regarding the details of the traction power system or the catenary wire system.

Elements of the traction power system are as follows:

- Power poles - side or center location to support one or several wires. Pairs of poles can be connected by spanwires from which the power wire is suspended. Power poles can be steel or concrete and would be around 20-25 feet high. Power substations feed power to the transit line. They are trailer size, prefabricated or constructed in place along the alignement about every two miles. They are similar to utility switchgear stations and can have varying architectural enclosures.



Overhead Catenary Wire System, Baltimore City

Vehicles

Neither bus, BRT, or LRT vehicles would have visual impacts that exceed the impacts of trucks or other larger vehicles typically encountered on roadways.

The vehicles selected for the Red Line would be recognizably different from any vehicle currently used by the MTA. If BRT, it would be designed with a special theme or logo to stand out from other MTA buses. The "look and feel" of BRT buses can also be different than typical buses. If LRT, the vehicles would be narrower than the existing MTA light rail vehicle, allowing it to fit more naturally into local neighborhoods and existing streets.

Structures

The impacts from transit structures include:

- The large structures needed to support the transitways could potentially have visual impacts. Such structures could include retaining walls, bridges, abutments, underpasses, etc.
- The use of structures, such as retaining walls, bridges and overpasses, has been minimized. Depending on the selected alternative, only two new overpasses, would be constructed west of the Bayview area and at the Beltway in Woodlawn. One alignment requires an underpass at the West Baltimore MARC Station and the Franklin Street alignment requires an overpass across US 40 at Martin Luther King, Jr. Boulevard. The overpass would swing from the northside of US 40 across the expressway lanes to the southside of the expressway lanes near where the expressway lanes become elevated above Martin Luther King, Jr. Boulevard. For the Bayview area of the proposed alignment, a larger elevated portion of alignment is proposed to cross a freight railyard. There is little visual sensitivity in this area.
- Small retaining walls (typically less than 5 feet high) might occur in several places along Cooks Lane or Edmondson Avenue.

Storage and Maintenance Facility

The design and location of storage and maintenance facilities varies depending on the selected alternative and mode. Visual impacts cannot be discussed in detail at this time because only concept layouts have been developed. (See the BRT and LRT *Storage and Maintenance Technical Reports*). The total area needed for a complete storage and maintenance facility is 10-15 acres. The following uses pertain to the storage and maintenance facility:

- Storage building for 30-40 trains or buses (no number has been determined).
- Repair shop, a building 20-30 feet high allowing for repair and maintenance, cleaning, painting etc.
- Access roads and employee parking.

Mitigation Measures

The following minimization principles will be considered to reduce the potential visual effects associated with transit facilities and alignments.

Surface Alignments

- Transitways have been placed in existing public roadway rights-of-way wherever possible.
- Smallest feasible footprints for both transitways and stations were used.
- Transitways for LRT could be ballasted track or grass track design (where soil is placed allowing grass to grow alongside and in between the rails), further reducing visible effects. Grass track has been successfully applied in various climates in Europe (Paris, France and Stuttgart, Germany) but has only been used in the United States in Kenosha, Wisconsin.

Surface Stations

- Stations would be designed with near minimal dimensions to fit, in most cases, into existing rights-of-way and be placed where they would not be visually intrusive.
- Stations could use existing sidewalk areas as platforms except where placed in median or on the side of street behind existing curb.
- Most stations are envisioned to have small modular shelters as typically used for bus stops that would fit on existing sidewalks or relatively narrow median platforms and will not block views to and from buildings.

Tunnel Stations

- Exits and related structures could be small and placed on sidewalks.
- Exist could be placed in or under buildings and become mostly invisible.

Traction Power System/ Overhead Wire System

- Single wire "trolley wire" would have less visual impact than catenary systems in which the live wire is suspended from a catenary cable allowing for larger spacing of poles.

- More extreme mitigation measures would be for the traction power system to be submerged below ground power system like in Bordeaux (France), or battery power. It is not known if any system in the United States uses either mitigation strategy.
- Traction power equipment could be placed in underground vaults or in buildings or designed with architecturally appealing enclosures.

Transit Vehicles

- Smaller type transit vehicles have been proposed for reduced width of needed transitway and tighter turning radi, which allow turns within the existing intersections. It was assumed that the transit vehicles would be approximately the width of standard buses (8 feet, 6 inches) which can navigate existing traffic lanes. The mitigative result of the smaller vehicle is less its diminished visual impact in the street and more the reduction in construction needs.
- Vehicles that fit existing travel lanes require less or no widening. Vehicles that can turn on existing intersections require less or no property acquisition or demolition.

Transit Structures

- Use of structures and grade-separation have been minimized.
- Various opportunities exist to make retaining walls, bridges and abutments esthetically pleasing. They could include landscaping, use of landscape dry stack systems (retaining walls), use of masonry veneer etc.

Storage and Maintenance Facilities

- Minimized size of a storage and maintenance facility is proposed with capacity limited to fleet needed for the Red Line.
- Separation of storage and maintenance facility functions are considered to reduce spatial needs in one location.
- Some storage and maintenance facility locations have been selected inside existing rights-of-way (at I-70 East and at US 40 east of West Baltimore MARC).
- The I-70 East location, although within an existing highway right-of-way is located in a visually sensitive area due to its proximity to Leakin Park. Opportunities exist to mitigate impacts through grading, landscaping and options which combine parking, station, and storage and maintenance facilities into a mixed use complex.
- Due to the size of the site available in the lower level of US 40, not all elements of the storage and maintenance facility would be concealed from view. The visibility of such industrial use elements in an area of residential use would have visual effects. Mitigation measures could include landscaping or development of additional uses on the upper level adjacent to the expressway.
- Locations for storage and maintenance facilities outside existing road rights-of-way have been selected for areas with existing industrial uses where no or small visual impacts would be expected:
    - LRT facility at Franklintown Road (mostly city property, some private property). This is currently an industrially used area adjacent to the Amtrak rail corridor.
    - An LRT facility within the Canton Crossing redevelopment area. The facility would be part of a larger redevelopment plan of this formerly industrial area and visual effects would have to be mitigated for.

Air Quality

Overview

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, damaging property, reducing the productivity or vigor of crops or natural vegetation, or harming human or animal health.

Criteria Pollutants

As required by the Clean Air Act (CAA), the US Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards for six major air pollutants. **Table 4-7** identifies these pollutants, known as criteria pollutants: carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead. The "primary" standards have been established to protect the public health. The "secondary" standards, intended to protect the nation's welfare, account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare.

SUMMARY

The EPA regulates air quality under the Clean Air Act. Since the Red Line may alter travel patterns within the corridor, pollutants traced to motor vehicle are relevant to the evaluation of the Red Line's impacts. The pollutants included in the Red Line air quality analysis are: CO2, VOC, NO2, PM10, MSAT, and greenhouse gases.

A regional analysis determines a project's overall impact 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. The build alternatives are predicted to decrease regional pollutant burdens by approximately 0.02% to 0.15%. The Red line is not predicted to measurably increase MSAT levels.

The results of the local analysis show that the Red Line is not predicted to cause or worsen a violation of the National Ambient Air Quality Standards. The Red Line is also not expected to cause a violation of the PM2.5 standard.

Construction-related effects of the Red Line would be limited to short-term increased fugitive dust and mobile-source emissions during construction. State and local regulations regarding dust control and other air quality emission reduction controls would be followed.

Mobile Source Air Toxics (MSAT's)

The EPA also regulates air toxics which are those pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human made sources, including on road mobile sources, non road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

Greenhouse Gases

Gases that trap heat in the atmosphere are often referred to as greenhouse gases. These gases are necessary to life as we know it, since they keep the planet's surface warmer than it otherwise would be. As concentrations of greenhouse gases increase, however, the Earth's temperature rises. Effects of these rising temperatures include climate change and rising sea levels. The principal greenhouse gases that enter the atmosphere because of human activities are Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O) and Fluorinated Gases. For more information, please refer to the *Air Quality Technical Report* on the DVD attached to this document.

Existing Conditions

Attainment Status/Regional Air Quality Conformity

The Red Line 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 moderate nonattainment areas for O_3. The area must come into attainment for $PM_{2.5}$ and O_3 by April 2010 and June 2010, respectively. EPA has recently (September 21, 2006) revoked the annual PM_{10} standard and revised the $PM_{2.5}$ 24-hour standard from 65 to 35 ug/m^3. Attainment status for this revision will be based on monitored data collected in 2007-2009 and area designations will be issued in 2010. Based upon the new designations, the EPA may revise the attainment dates for $PM_{2.5}$.

Local Meteorology

The nature of the surrounding atmosphere is an important element in assessing the ambient air quality of an area. Located on the Mid-Atlantic coast, Baltimore sits at the mouth of the Patapsco River, which empties directly into the Chesapeake Bay. The city is protected from harsh weather variations year-round by the Chesapeake Bay and Atlantic Ocean to the east and the Appalachian Mountains due west.

Table 4-7: National Ambient Air Quality Standards

Pollutant	Averaging Period	National and State Standards	
		Primary	Secondary
Carbon Monoxide (CO)	8-Hours[1]	9 ppm (10 mg/m_3)	No Secondary Standard
	1-Hour[1]	35 ppm (40 mg/m_3)	No Secondary Standard
Lead (Pb)	Maximum Quarterly Average	1.5 µg/m_3	Same as Primary Standard
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.053 ppm (100 µg/m_3)	Same as Primary Standard
Particulate Matter (PM_{10})	Annual Arithmetic Mean[2]	50 µg/m3 / Revoked [2]	–
	24-Hour[3]	150 µg/m_3	–
Fine Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean[4]	15 µg/m_3	Same as Primary Standard
	98th Percentile 24-Hour[5]	65 µg/m_3/ 35 µg/m_3	Same as Primary Standard
Ozone (O3)	Fourth Highest 8-Hour Daily Maximum[6]	0.08 ppm	Same as Primary Standard
	Maximum Daily 1-Hour Average[7] (Applies only in limited areas)	0.12 ppm (235 µg/m_3)	Same as Primary Standard
Sulfur Dioxide (SO2)	Annual Arithmetic Mean	80 µg/m3 (0.03 ppm)	–
	24-Hours[1]	365 µg/m3 (0.14 ppm)	–
	3-Hours[1]	–	1,300 ug/m3 / (0.5 ppm)

Notes: ppm = parts per million, µg/m3 = micrograms per cubic meter.

[1] Not to be exceeded more than once per year.

[2] Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).

[3] Not to be exceeded more than once per year on average over three years.

[4] 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/m3.

[5] 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 35µg/m3 (effective December 17, 2006).

[6] 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.

[7] (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is <1, as determined by Appendix H of 40 CFR 50 – National Primary and Secondary Ambient Air Quality Standards http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title40/40cfr50_main_02.tpl .

(b) As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the 14 eight-hour ozone nonattainment Early Action Compact (EAC) Areas. The Red Line is not located in one of these areas.

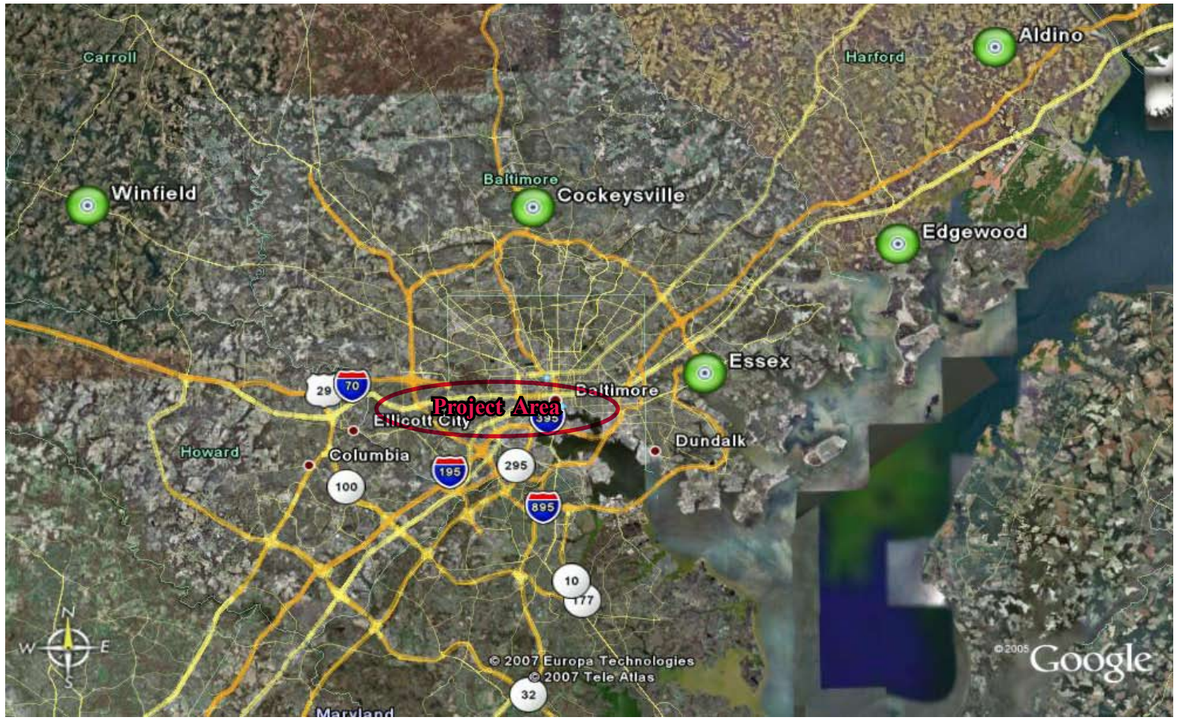
Source: EPA, "National Primary and Secondary Ambient Air Quality

Since the region is near the average path of the low pressure systems which move across the country, changes in wind direction are frequent and contribute to the changeable character of the weather. The annual prevailing wind direction is from the west, with winter and spring months having the highest average wind speed. The proximity of large water areas and the inflow of southerly winds contribute to high relative humidity during much of the year. Rainfall distribution throughout the year is rather uniform; however, the greatest intensities are confined to the summer and early fall months, the season for hurricanes and thunderstorm activity. Precipitation averages at 41 inches annually (NOAA, 1998).

Monitored Air Quality

The Air and Radiation Management Administration (ARMA), within the Maryland Department of the Environment (MDE), is responsible for implementing and enforcing regulations to ensure that the air Maryland citizens breathe is clean and healthful. This mission is accomplished through several methods, including air pollution monitoring. **Figure 4-6** shows the location of the monitors within the metropolitan area relative to the corridor. **Figure 4-7** shows the maximum measured air pollutant concentrations at these monitors for the years 2004-2006.

Figure 4-6: Air Quality Monitoring Locations



Potential Impacts

Since the Red Line may alter travel patterns within the corridor, pollutants that can be traced principally to motor vehicles are relevant to the evaluation of the Red Line's impacts. These pollutants include CO_2, VOC, NO_x, PM_{10}, $PM_{2.5}$, MSAT and greenhouse gases. Carbon dioxide (CO_2) is the most abundant of the greenhouse gases, therefore, CO_2 levels are quantified and represent the Red Line's impact on greenhouse gas emissions. Due to the nature of the pollutants, CO and $PM_{2.5}$ are analyzed on a regional and local level. As the area is in attainment for PM_{10}, it will only be analyzed on a regional level. VOCs and NO_x levels are of a concern due to their role in helping to form ozone on a regional level, therefore, they are analyzed on a regional level. MSAT is analyzed on a regional level.

Regional Impacts

A regional analysis determines a project's overall impact on regional air quality levels. This analysis uses regional Vehicles Miles Traveled (VMT) and Vehicle Hours Traveled (VHT) within the region with and without the project to determine daily "pollutant burden" levels.

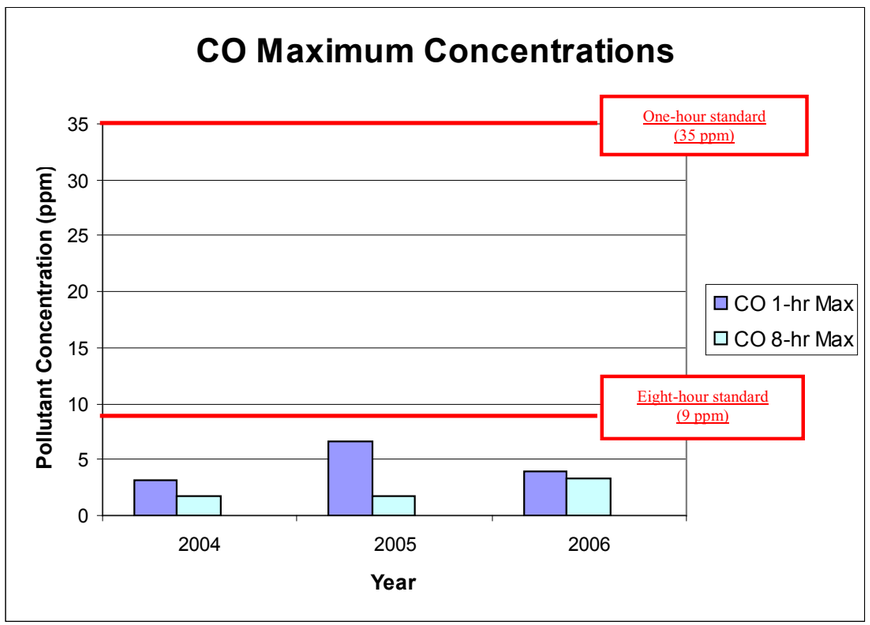
The various build alternatives are predicted to decrease regional pollutant burdens by approximately 0.02% to 0.15%. Alternatives 3D is predicted to demonstrate the largest (0.15%) reduction, while Alternative 2: TSM is predicted to demonstrate the smallest (0.02%) reduction.

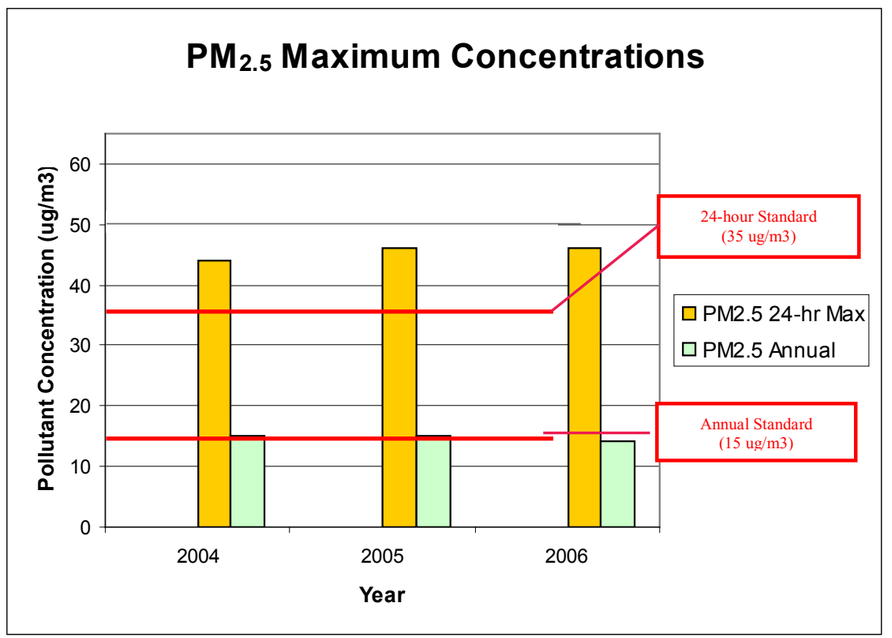
Local CO Impacts

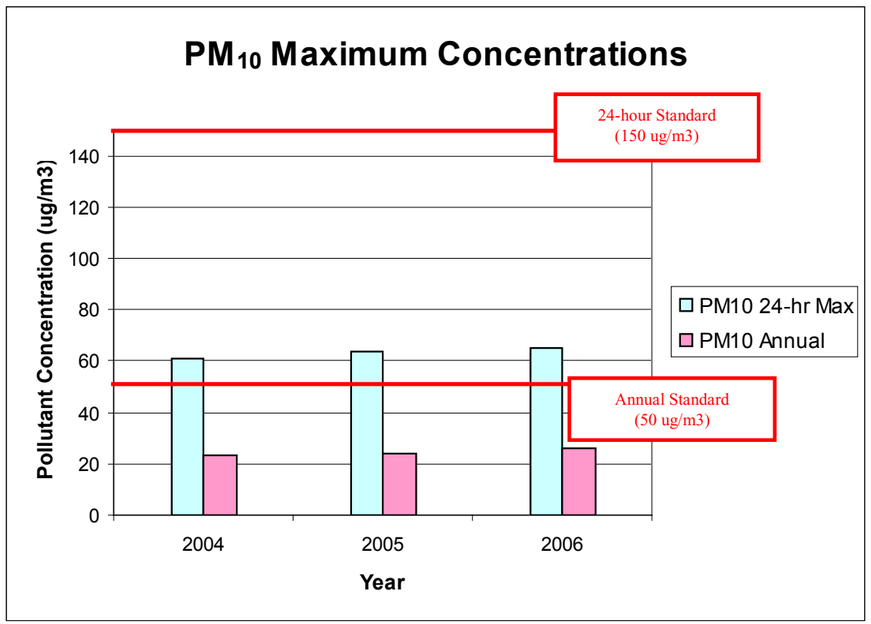
Microscale CO air quality modeling was performed using the most recent version of the EPA mobile source emission factor model (MOBILE6.2) and the CAL3QHC (Version 2.0) air quality dispersion model to estimate future No-Build (without the proposed project) and future Build (with the proposed project) CO levels at selected locations in the corridor.

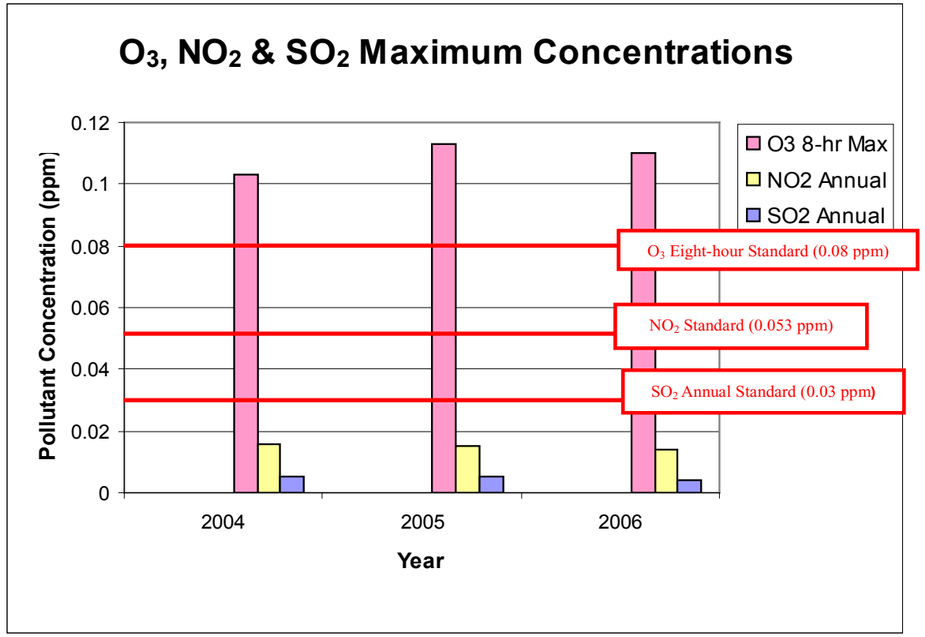
A screening evaluation was performed to identify which intersections in the corridor are most congested and most affected by the build alternatives. Two

Figure 4-7: Maximum Measured Pollutant Concentrations









hundred-fifty locations were screened based on changes in intersection volumes, delay, and levels-of-service (LOS) from Alternative 1: No-Build to the build alternatives. Sites fail the screening evaluation if the LOS decreases below "D" in one of the build alternatives as compared to Alternative 1: No-Build, or if the traffic delay and/or volume increases from Alternative 1: No-Build to the build scenario along with a LOS below D.

Fifty-five of the 250 locations failed the screening analysis. **Table 4-8** identifies the 11 intersections that were selected for detailed analysis. These 11 sites were selected from the 55 sites that failed the screening because they have either the highest traffic volumes, highest delays, or they are near a sensitive receptor. Each geographic area contains at least one analysis site.

Table 4-8: CO_2 Microscale Analysis Locations

Site #	Description
1	MD122 (Security Boulevard) & Belmont Avenue
2	Baltimore National Pike & Winters Lane
3	MD122 & Woodlawn Drive
4	US40 (Edmonson Avenue) & Winans Way
5	US40 (Franklin Avenue) & Warwick Avenue
6	West Fayette Street & Martin Luther King Boulevard
7	West Pratt Street & South Calvert Street
8	Fleet Street & South Central Avenue
9	Eastern Avenue & South Luzerne Avenue
10	Odonnell Street & South Conklin Street
11	East Lombard Street & I-895

The analysis at the 11 receptor sites revealed that the predicted maximum 1-hour CO concentrations for all build alternatives were each less than 10 ppm, well below the EPA standard of 35 ppm. The predicted maximum 8-hour CO concentrations for all build alternatives were each less than 6 ppm, well below the EPA standard of 9 ppm. The values include a background CO value which accounts for the CO from other sources upwind of the receptors. Based on these results, the Red Line is not predicted to cause or worsen a violation of the CO National Ambient Air Quality Standards under any alternative.

$PM_{2.5}$ Impacts

Following the guidelines in *EPA's Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance* Areas (March 29, 2006, referred to as "*PM_{10} Guidance*"), a $PM_{2.5}$ qualitative hot-spot analysis should be conducted only if the project is an air quality concern, defined in 40 CFR 93.123(b)(1) as follows:

i. New or expanded highway projects that have a large number or increase in diesel vehicles;

ii. Projects affecting intersections that are at LOS D, E, or F with a large number of diesel vehicles, or those that will change to LOS D, E, or F because of increased traffic volumes from a large number of diesel vehicles;

iii. New bus and rail terminals and transfer points that have a large number of diesel vehicles congregating at a single location;

iv. Expanded bus and rail terminals and transfer points that greatly increase the number of diesel vehicles congregating at a single location; and

v. 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.

Examples of projects of air quality concern that would be covered by 40 CFR 93.123(b)(1) include the following:

- A project on a new highway or expressway that serves a large volume of diesel truck traffic, such as facilities with greater than 125,000 annual average daily traffic where eight percent or more of such average-annual daily traffic (AADT) is diesel truck traffic;
- A major new bus or intermodal terminal that is considered to be a "regionally significant project" under 40 CFR 93.101; and
- An existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increases by 50 percent or more, as measured by bus arrivals.

Alternative 3: BRT proposes to use hybrid buses. It is currently assumed that these vehicles would be diesel hybrids. Since it has not been firmly established which particular vehicles would be purchased, the analysis used traditional diesel vehicles to estimate pollutant emissions for Alternative 3: BRT.

Alternative 3: BRT does not affect roadways with more than 125,000 annual average daily traffic and 8 percent trucks. The major roadways that Alternative 3: BRT would affect are Security Boulevard, US 40 (Edmondson Avenue and Franklin Street) and Eastern Avenue -- all of which have an annual average daily traffic well below 125,000 vehicles.

Based on current operation projections, Alternative 3: BRT and Alternative 4: LRT are expected to reduce overall bus operations by replacing some existing bus routes with either BRT or LRT services between CMS and Bayview. BRT trunkline service would supplement existing bus service, with several existing bus routes operating on the proposed guideway. Alternative 4: LRT would replace portions of several existing bus routes and end other routes at a LRT station. Alternative 3: BRT and Alternative 4: LRT would not increase bus arrivals by 50 percent at any location within the corridor. Therefore, the Red Line is not a project of air quality concern regarding $PM_{2.5}$ emissions, based on the guidance set forth in 40 CFR 93.123(b)(1)(iv). Alternative 4: LRT proposes to use electric vehicles. Therefore, Alternative 4: LRT is not predicted to affect $PM_{2.5}$ levels in the corridor.

Mobile Source Air Toxics (MSATs) Impacts

Alternative 4: LRT proposes to use electric vehicles, therefore, this alternative is not predicted to affect MSAT levels in the corridor. Alternative 3: BRT proposes to use hybrid buses. It is currently assumed that these vehicles would be diesel hybrids. Since it has not been firmly established which particular vehicles would be purchased, the analysis used traditional diesel buses to estimate pollutant emissions for Alternative 3: BRT. Hybrid buses would likely have lower MSAT emissions than traditional diesel buses.

It is possible to qualitatively assess the levels of future MSAT emissions. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can identify and compare the potential differences in MSAT emissions, if any, from the alternatives. The qualitative assessment 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.*

Based on the recommended tiering approach detailed in the FHWA methodology, the Red Line falls within the Tier 2 approach. The amount of MSATs emitted would be proportional to the VMT, assuming the vehicle mix does not change. The predicted regional VMT estimates indicate that all build alternatives would reduce regional VMT within the 0.02 percent to 0.15 percent range. These changes are so small that they are not considered measurable. Therefore, the Red Line is predicted to generally produce no meaningful regional MSAT effects.

The reconfigured travel lanes proposed for Alternative 3: BRT and Alternative 4: LRT would move some traffic closer to nearby homes, schools, and businesses. Therefore, there may be localized areas where ambient concentrations of MSATs could be higher under Alternative 3: BRT and Alternative 4: LRT than under Alternative 1: No-Build. However, as discussed previously, the magnitude and duration of these potential increases compared to Alternative 1: No-Build cannot be accurately quantified because of the inherent deficiencies of current models. In sum, when new travel lanes are constructed, the localized level of MSAT emissions for the build alternatives, particularly Alternative 3: BRT, could be higher relative to Alternative 1: No-Build. However, this could be offset due to increases in localized speeds and reductions in congestion (which are associated with lower MSAT emissions). MSATs would be lower in other locations where traffic shifts away from nearby homes, schools, and businesses. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will cause region-wide MSAT levels to be substantially lower than today in almost all cases.

Greenhouse Gas Impacts

CO_2 emission estimates are based on the amount of direct energy required for each alternative. 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 also include the energy required to fuel Alternative 3: BRT vehicles and power Alternative 4: LRT trains. CO_2 emission coefficient factors are then applied to the energy estimates to determine the amount of CO_2 generated. All coefficient factors were obtained from the Department of Energy's, Energy Information Administration.

The CO_2 emission burdens by alternative are shown in **Table 4-9**. CO_2 emission burdens under Alternative 3: BRT and Alternative 4: LRT are predicted to demonstrate almost no change (less than 0.15 percent) as compared to Alternative 1: No-Build. Alternative 3: BRT is predicted to produce slightly lower CO_2 emission burdens compared with Alternative 1: No-Build. Alternative 4: LRT is predicted to produce slightly higher CO_2 emission burdens. Considering the very small scale of these numbers and the resulting predicted changes, the difference in the predicted CO_2 emission burdens for the alternatives can be considered insignificant and not measurably different from Alternative 1: No-Build.

Mitigation Measures

The Red Line is not predicted to cause or worsen a violation of the National Ambient Air Quality Standards. The Red Line is not expected to measurably increase regional emission burdens or MSAT levels. The Red Line also is not expected to cause a violation of the $PM_{2.5}$ standard. Therefore, mitigation measures are not required.

Table 4-9: CO2 Emission Burdens

Alternative	Daily Direct Energy (million BTUs)	Total CO2 (kg)	Percent Change from No Build
No-Build Alternative	892,835	63,349,486	-
Alternative 2	892,829	63,349,563	0.00 %
Alternative 3A	892,235	63,307,426	-0.07 %
Alternative 3B	892,131	63,300,114	-0.08%
Alternative 3C	891,887	63,282,763	-0.11%
Alternative 3D	891,689	63,268,711	-0.13%
Alternative 3E	892,435	63,321,643	-0.04%
Alternative 3F	892,104	63,298,074	-0.08%
Alternative 4A	892,704	63,390,149	0.06%
Alternative 4B	892,787	63,404,467	0.09%
Alternative 4C	892,754	63,402,168	0.08%
Alternative 4D	892,581	63,393,074	0.07%

Construction-related effects of the Red Line would be limited to short-term increased fugitive dust and mobile-source emissions during construction. State and local regulations regarding dust control and other air quality emission reduction controls would be followed. Once a Locally Preferred Alternative is selected, a quantitative construction analysis would be conducted if it is determined that the construction would last longer than five years.

Noise and Vibration

SUMMARY

The construction and operation of the Red Line has the potential to increase noise and vibration levels in adjacent sensitive land uses in the corridor. FTA Noise and Vibration Criteria were used to assess noise and vibration impacts.

No severe noise impacts are expected from Alternative 4:LRT during operation. Alternative 2: TSM and Alternative 3: BRT are predicted to have severe noise impacts during operation. Noise impacts associated with station activities is also predicted to be greater for Alternative 3: BRT than Alternative 4: LRT. Depending on the storage and maintenance site selected, an LRT facility could have more impacts than a BRT facility. An additional noise impact associated with only the LRT alternative is wheel squeal, which occurs when trains negotiate tight curves on tracks. Potential, severe impacts from wheel squeal were identified in 23 locations in the corridor.

Vibration impacts are anticipated only with Alternative 4: LRT along Fleet Street generally between Central Avenue and Haven Street. Vibration impacts are not anticipated with the No-Build Alternative, Alternative 2, or Alternative 3.

If a build alternative is chosen as the Locally Preferred Alternative, mitigation measures to reduce potential noise and vibration impacts will be assessed.

Overview

Noise is measured in decibels. To account for human sensitivity to noise, decibels are measured on the "A-scale", abbreviated dBA. The noise assessment focused on average conditions over a 24-hour period. Noise that occurs at night (between 10:00 p.m. and 7:00 a.m.) is given a major 10 dBA penalty. This is known as a Day-Night Equivalent Level (Ldn). For example, a rural area with no major roads nearby would average around 50 dBA (Ldn) compared with a noisy residential area located close to a major road that would average around 70 dBA. **Figure 4-8** compares typical indoor and outdoor noise levels.

Ground-borne vibration is a small but rapidly fluctuating motion transmitted through the ground. Ground-borne vibration diminishes (or "attenuates") over distance. Some soil types transmit vibration easily, while others do not. The response of humans, buildings, and sensitive equipment to vibration is described in terms of root-mean square (RMS) velocity level in decibel units (VdB). As a reference point, the average person can just barely perceive vibration velocity levels below 70 VdB. **Figure 4-9** compares typical vibration levels.

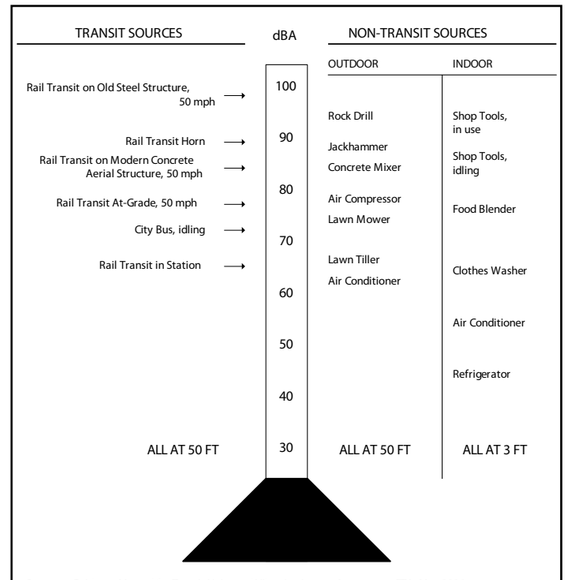
The construction and operation of the Red Line has the potential to increase noise and vibration levels in adjacent sensitive land uses. Such increases potentially can cause undesirable effects on people, animals, and/or structures. The principal source of existing noise in the corridor is vehicular traffic – from automobiles, trucks, and buses. As an existing transportation corridor, most adjacent land uses are exposed to at least moderate noise levels. Whether an increase in noise from proposed construction and operation of the Red Line is objectionable depends on the project-generated noise level relative to existing community noise.

FTA Noise Criteria

FTA uses noise criteria to measure potential noise impacts. The goals of the noise criteria are to minimize the adverse noise impacts on the community and to provide feasible and reasonable noise control where necessary and appropriate.

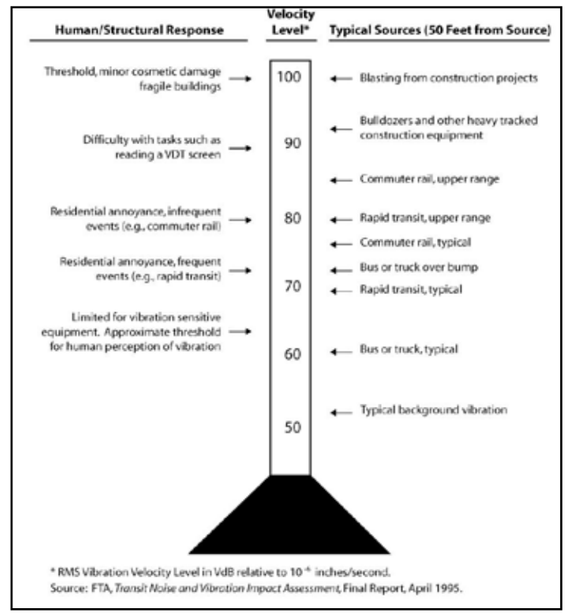
For this study, the FTA noise impact criteria were used to assess impacts at sensitive sites near the proposed transit facilities. The FTA defines noise and vibration criteria in its guidance manual *Transit Noise and Vibration Impact*

Figure 4-8: Typical Indoor and Outdoor Noise Levels



Source: Guidance Manual for Transit Noise and Vibration Impact Assessment, FTA, May 2006

Figure 4-9: Vibration Sources and Levels



* RMS Vibration Velocity Level in VdB relative to 10^{-6} inches/second.
Source: FTA, *Transit Noise and Vibration Impact Assessment*, Final Report, April 1995.

Table 4-10: FTA Noise Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq}(h)$*	Tract of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land used as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq}(h)$*	Institutional land uses with primary daytime and evening use. This category includes schools, libraries, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material.

Assessment (FTA-VA-90-1003-06 May 2006). **Table 4-10** provides FTA's noise criteria for different land uses.

FTA guidelines assess noise impacts for various land use categories using different noise metrics (L_{eq} or L_{dn}). For land uses involving daytime and evening uses and affected by road traffic noise, the noise descriptor is L_{eq} (h), which is defined as the L_{eq} for the nosiest hour of transit-related activity during which human activities occur at noise sensitive locations.

FTA Vibration Criteria

FTA uses vibration criteria to measure potential vibration impacts generated by a transit project. FTA guidelines apply to transit vehicles operating on the transit corridor, near stations and near other supporting transit facilities. FTA published its vibration impact criteria in the FTA Manual Transit Noise and Vibration Impact Assessment to assess vibration impacts from transit operations. The criteria are based on the maximum vibration levels in decibels (vibration decibels or VdB) for three land use categories generated by a single pass-by event. **Table 4-11** provides FTA's ground-borne vibration criteria for different land uses. For more information, please refer to the *Noise & Vibration Technical Report* on the DVD attached to this document.

Table 4-11: FTA Ground-Borne Vibration Criteria

Existing Noise Exposure* $L_{eq}(h)$ or L_{dn} (dBA)	Project Noise Impact Exposure, * Leq(h) or Ldn (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Moderate Impact	Severe Impact	No Impact	Moderate Impact	Severe Impact
51	<54	54-60	>60	<59	59-65	>65
52	<55	55-60	>60	<60	60-65	>65
53	<55	55-60	>60	<60	60-65	>65
54	<55	55-61	>61	<60	60-66	>66
55	<56	56-61	>61	<61	61-66	>66
56	<56	56-62	>62	<61	61-67	>67
57	<57	57-62	>62	<62	62-67	>67
58	<57	57-62	>62	<62	62-67	>67
59	<58	58-63	>63	<63	63-68	>68
60	<58	58-63	>63	<63	63-68	>68
61	<59	59-64	>64	<64	64-69	>69
62	<59	59-64	>64	<64	64-69	>69
63	<60	60-65	>65	<65	65-70	>70
64	<61	61-65	>65	<66	66-70	>70
65	<61	61-66	>66	<66	66-71	>71
66	<62	62-67	>67	<67	67-72	>72
67	<63	63-67	>67	<68	68-72	>72
68	<63	63-68	>68	<68	68-73	>73
69	<64	64-69	>69	<69	69-74	>74
70	<65	65-69	>69	<70	70-74	>74
71	<66	66-70	>70	<71	71-75	>75
72	<66	66-71	>71	<71	71-76	>76
73	<66	66-71	>71	<71	71-76	>76
74	<66	66-72	>72	<71	71-77	>77
75	<66	66-73	>73	<71	71-78	>78
76	<66	66-74	>74	<71	71-79	>79
77	<66	66-74	>74	<71	71-79	>79
>77	<66	66-75	>75	<71	71-80	>80

*Note: * L_{eq} is used for land use where nighttime sensitivity is a factor; L_{eq} during the hour of maximum transit noise exposure is used for land use involving only daytime activities.*

Existing Conditions

This section discusses existing noise and vibration levels in the corridor.

Existing Noise Levels

Noise measurements were conducted to determine existing noise levels at noise sensitive sites. Noise levels were measured between February and May 2006 at 29 sites. The noise measurement sites were selected as a sample that represented various residential areas that could experience noise impacts from the Red Line transit alternatives. These noise measurement sites were converted into analysis neighborhoods which provided a representative measure of day-night noise levels (L_{dn} dBA) for a given neighborhood. The analysis neighborhoods were defined generally as noise-sensitive areas where Red Line operating characteristics, land use, and background ambient noise were assumed to be largely consistent.

The analysis neighborhoods were chosen based on an extensive review of the proposed transit alignments and the location of associated transit facilities. The criteria for selecting the noise sensitive sites within the analysis neighborhoods included land use, existing ambient noise, number of sensitive receivers in the area, and the site's potential sensitivity to changes in noise levels.

The existing noise levels in the analysis neighborhoods were determined from the 2006 community noise survey measurements and calculations based upon the latest-available 2005 traffic conditions. The existing day-night noise level (L_{dn} dBA) for the analysis neighborhoods ranged from a low of 55 to 78 (L_{dn} dBA).

Existing Vibration Levels

The FTA impact assessment procedures do not require the measurement of baseline vibration levels to assess potential impacts from project generated vibration and therefore no existing vibration measurements were recorded. The Red Line Corridor currently is exposed to vibrations generated predominately from trucks and buses traveling on existing roadways. Typical vibration levels generated from road traffic movements are generally in the 50 to 60 VdB range which are below the FTA vibration impact thresholds.

Potential Impacts

This section discusses the potential noise and vibration impacts from the construction and operation of the transit alternatives, storage and maintenance facilities, and stations.

Analysis Procedures and Assumptions

Noise impacts were assessed following the FTA criteria. Project construction noise and vibration and the potential for impacts from wheel squeal, generated by rail vehicles in tight curves and from ground-borne vibration, are discussed qualitatively. The analysis predicted vehicle noise emissions and measured the reduction of sound as it travels from the vehicle to noise-sensitive receptor locations along the right-of-way. The assumptions used in the analysis are conservative and reflect the worse-case scenario.

Every noise analysis must characterize three elements: the noise source, the sound path, and the affected noise receptor. Some land use activities are more sensitive to noise than others (for example: residences, parks, and churches are more noise sensitive than commercial and industrial areas).

The proposed Red Line could use diesel buses with either conventional or hybrid-electric drive systems or light rail vehicles which are similar to, but most likely smaller than, the existing MTA light rail vehicles. For a given type of vehicle, noise emissions depend upon the operating conditions. Operating conditions are characterized for buses by vehicle speed and rate of acceleration and for rail cars by speed and track type (such as tie-and-ballast

Table 4-12: Summary of Noise Impacts from Red Line Operations

Alignment	Alt 2	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 3F	Alt 4A	Alt 4B	Alt 4C	Alt 4D
Along Security Blvd. west of Rolling Road	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Along Cooks Lane west of US 40	Moderate	Moderate	Moderate	---	---	---	Moderate	Moderate	Moderate	---	---
Along Woodlawn Drive	---	---	---	---	---	Moderate	---	---	---	---	---
Along Johnnycake Road	---	---	---	---	---	Moderate	---	---	---	---	---
Along US 40 between Longwood Street and the West Baltimore MARC	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	---	---	---	---
Along Baltimore Street east of Martin Luther King Jr. Blvd.	---	Moderate	---	---	---	Moderate	---	---	---	---	---
Along Central Avenue north of Eastern Avenue	Moderate	Moderate	Moderate	Moderate	---	Moderate	Moderate	Moderate	---	---	---
Along Fleet Street west of Chester Street	---	---	---	---	---	Moderate	---	---	---	---	---
Along Boston Street	Moderate	---	Moderate	Moderate	---		Moderate	---	---	---	---
Along the Norfolk Southern ROW near O'Donnell Street	---	---	Moderate	Moderate	---	---	---	---	---	---	---
Along Fleet Street west of Haven Street	Severe	Severe	Severe	Severe	Severe	Severe	Severe	---	---	---	---
Along the Norfolk Southern ROW near Lombard Street	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	---	---	---	---

or embedded in the roadway pavement). Noise exposures from stationary trains in stations and trains at very low speeds are due to the auxiliary mechanical equipment mounted on the roof of the car. Noise from buses at stations will primarily be the result of the idling diesel engine, along with the air conditioning system.

Future Noise Levels: Transit Operations

Table 4-12 shows the estimated future noise impacts from transit operations. The results of the noise analysis for transit operations indicate that, in general, noise impacts associated with unmitigated transit operations under Alternative 3: BRT would be greater than those under Alternative 4: LRT.

Throughout most of the corridor, residential development is characterized by single-family attached, row-house construction paralleling the alignment right-of-way. Consequently, noise exposures are essentially limited to the front tier of dwellings since subsequent rights-of-way of noise-sensitive sites would be shielded by the fronting structures (except at crossing streets). However, in seven neighborhoods in the western portion of the corridor, lower-density, single-family detached or duplex housing exists and Red Line noise exposures can spread further from the right-of-way.

No severe noise impacts are expected from Alternatives 4: LRT, 4A, 4B, 4C, and 4D. Severe impacts are predicted to occur under Alternative 2: TSM and Alternative 3: BRT, 3A, 3B, 3C, 3D, and 3E.

Future Noise Levels: Stations

Noise from station area activities was estimated by following the FTA Guidance Manual that referenced values for idling vehicle sound levels at 50 feet (LA = 70 dBA for rail vehicles and 75 dBA for buses). Since station positions have not been finalized, worst-case locations were considered generally any mid-block location within any analysis neighborhood.

Station activities are expected to have widespread "severe" impacts if stations are placed in residential areas. Buses would have more noise impacts than LRT vehicles. In general, noise impacts associated with station activities resulted in a greater number of impacts under Alternative 3: BRT than Alternative 4: LRT.

Future Noise Levels: Storage and Maintenance Facilities

Given the preliminary nature of the locations and operational conditions under which the proposed storage and maintenance facilities would function over each 24-hour weekday time period, established prediction procedures were used in determining noise levels at representative residential properties near each facility. Of the six storage and maintenance facility sites, estimated future noise levels were calculated at residential properties in four analysis neighborhoods. The neighborhoods are located near I-70 Central, I-70 East, Calverton Road, and US 40. No quantitative assessments were made at the remaining two sites, Exxon and Calverton Crossing, since they are located in predominantly commercial/industrial areas with no nearby noise sensitive properties.

LRT Storage and Maintenance Facilities

In accordance with the FTA's noise assessment screening procedures for LRT storage and maintenance facilities, only noise sensitive sites that are less than 125 feet from parking facilities and 1,000 feet from storage and maintenance facilities were analyzed for potential noise impacts. Reference levels of 118 dBA for storage and maintenance facility sites and 92 dBA for parking areas were used for these two sources. At each representative site evaluated, the contribution from each noise source was estimated and the total noise level was determined. Future day-night noise levels (L_{dn}) generated from LRT storage and maintenance facility operations are estimated to range from 52 to 69 L_{dn}. Proposed storage and maintenance facility activities are not expected to have widespread impacts on adjacent residential areas. However, moderate impacts are projected to occur near residential properties near the proposed US 40 Lower Level storage and maintenance facility site.

BRT Storage and Maintenance Facilities

In accordance with the FTA's noise assessment screening procedures, only noise sensitive sites that are located at less than 125 feet from parking facilities and 350 feet from bus storage and maintenance facilities need to be analyzed for noise impacts. For BRT operations, noise emanated from three major sources - bus storage, maintenance facility, and automobile parking lots - were considered at each facility.

Future day-night noise levels (L_{dn}) generated from BRT storage and maintenance facility operations are estimated to range from 54 to 60 L_{dn}. Projected noise levels at these sites indicate that noise associated from BRT storage and maintenance facility operations are below the FTA impact thresholds and, therefore, no impacts are expected.

Future Noise Levels: Wheel Squeal

When trains negotiate tight curves on train tracks the fixed wheel axle does not follow the track curvature and the wheels are forced to follow the track. This causes the wheel flange to rub tightly against the rail head as the axle (and the train) negotiate the curved track. These rubbing forces often generate high vibration levels of the wheel flange (and the wheel) depending on the track curvature. The tighter the curvature (ie. smaller the radius of curvature of the track) the greater the generated forces resulting in vibration and high pitched noise.

A track with a curve radius greater than 750 feet and near residential or commercial land uses has the potential for wheel squeal. Potential impacts from wheel squeal were identified at 32 locations (including all alignments and options) with the following 23 locations having potentially severe noise impacts:

- Security Boulevard at Rolling Road
- Rolling Road at Rolling Bend Road
- (south) Security Square Mall at east Rolling Road
- (north) Security Square Mall
- (north) Security Square Mall at Belmont Avenue
- Cooks Lane at Edmondson Avenue
- Edmondson Avenue at Franklin Street
- US 40 at Martin Luther King Jr. Boulevard
- Baltimore Street at Martin Luther King Jr. Boulevard
- Lombard Street at Martin Luther King Jr. Boulevard
- Baltimore Street at President Street
- (west) President Street at Pratt Street

IF THE RED LINE IS BUILT, HOW WILL I BE PROTECTED FROM ANY DAMAGE TO MY PROPERTY OR LOSS OF USE OF MY PROPERTY DUE TO VIBRATION DURING CONSTRUCTION OR OPERATION?

There are strict codes, which will be enforced, governing emissions of noise and vibration during construction. In addition to properties directly adjacent to a construction site, haul routes to and from the site will be monitored. It is also an MTA requirement that properties in close proximity to a site that could potentially be damaged by vibrations must be surveyed before construction so conditions existing at the property prior to construction can be recorded. Thus, if damages do occur the property owner can be properly compensated or can make repairs that are paid by the MTA.

Vibrations resulting from construction activities generally can be mitigated by design and by a combination of monitoring and enforcement. As an example, the Johns Hopkins Metro Station, a major underground construction project, was built within 50 yards of Hopkins' Wilmer Eye Clinic – a very vibration-sensitive facility where micro-surgery is performed on human eyes. The hours of construction were limited to non-critical times of the day; a rubber-lined loading hopper and an enclosed loading shed were used along with rubberized conveyor belts; truck back-up alarms were disabled, and many other precautions were implemented. The vibration limitations were exceedingly restrictive. Vibrations were monitored by attaching geophones to the building structure in the basement under the eye clinic as well as in the lawn area between the construction zone and the building. Vibrations from construction were mitigated so well that the only movements recorded were ambient vibrations already within the building from elevators, copying machines and doors slamming.

Vibrations caused by transit operations can be mitigated by design. With a modern rail system, vibrations are virtually eliminated by using continuously welded rail (no joints), resilient wheels, elastomeric fasteners that absorb vibrations and good track and wheel maintenance. Track switches, where two tracks meet (such as at crossovers), are the most problematic. By their nature, joints exist. Where they must be placed in vibration sensitive areas, mitigation by design may include such features as placing special trackwork on floating slabs, use of flange-bearing frogs or even movable point frogs. ("Frogs" refer to the crossing point of two rails that ensure train wheels can cross to the other rail.)

If Bus Rapid Transit (BRT) is the selected mode, vibrations will be no greater than along existing bus routes. Both ride quality and noise/vibration emissions will be improved over existing bus operations by having a dedicated busway and using a new smooth, rigid pavement structure.

- President Street at Fleet Street
- Lombard Street at Central Avenue
- Eastern Avenue at Central Avenue
- Eastern Avenue at (west) President Street
- Eastern Avenue at Chester Street
- Eastern Avenue at Conkling Street
- Fleet Street at Central Avenue
- Fleet Street at Boston Street
- Fleet Street at Conkling Street
- Aliceanna Street at Central Avenue
- Aliceanna Street at Boston Street

Vibration Impacts: Potential LRT and BRT Operations

Generally, pneumatic tire vehicles which would be operating under Alternative 3: BRT do not generate vibration complaints when compared to Alternative 4: LRT. When complaints are experienced with BRT vehicles, they are typically the result of airborne noise from the vehicles rattling windows or items hung on the walls, or of ground-borne vibration caused by potholes, pavement joints, other road surface irregularities, or close proximity to the traffic lane.

The possibility of vibration impacts exists throughout much of the Red Line Corridor for both Alternative 3: BRT and Alternative 4: LRT. The results of the vibration analysis indicated that Alternative 4: LRT would have a greater number of impacts compared to Alternative 3: BRT.

Table 4-13: Transit Noise Mitigation Measures

Application	Mitigation Measure		Effectiveness
Source	Stringent Vehicle & Equipment Noise Specifications		Varied
	Operational Restrictions		Varied
	Resilient or Damped Wheels*	For Rolling Noise on Tangent Track:	2 dB
		For Wheel Squeal on Curved Track:	10-20 dB
	Vehicle Skirts		* 6-10 dB
	Undercar Absorption*		5 dB
	Spin-slide control (prevents flats)*		**
	Wheel Truing (eliminates wheel flats)*		**
	Rail Grinding (eliminates corrugations)*		**
	Turn Radii greater than 1,000 feet*		(Avoids Squeal)
	Rail Lubrication on Sharp Curves*		(Reduces Squeal)
	Movable-Point Frogs (reduce rail gaps at crossovers)*		(Reduces Impact Noise)
	Engine Compartment Treatments (Buses)		6-10 dB
Path	Sound Barriers close to Vehicles		6-15 dB
	Sound Barriers at Right-of-way Line		3-10 dB
	Alteration of Horizontal & Vertical Alignments		Varied
	Acquisition of Buffer Zones		Varied
	Ballast on At-Grade Guideway*		3 dB
	Ballast on Aerial Guideway*		5 dB
	Resilient Track Support on Aerial Guideway		Varied
Receiver	Acquisition of Property Rights for Construction of Sound Barriers		5-10 dB
	Building Noise Insulation		5-20 dB

Source: Transit Noise and Vibration Impact Assessment, FTA, May 2006.

*Notes: * Applies to rail projects only*

*** These mitigation measures work to maintain a rail system in its as-new condition. Without incorporating them into the system, noise levels could increase up to 10 dB.*

The results of the vibration analysis indicate that vibration impacts are possible in two locations in the corridor for Alternative 4: LRT, 4A, 4B, 4C, and 4D:

- Along Fleet Street east of Central Avenue
- Along Fleet Street west of Haven Street.

No impacts are anticipated for the No Build Alternative, Alternative 2: TSM, or Alternative 3: BRT, 3A, 3B, 3C, 3D, 3E, and 3F.

Mitigation Measures

No mitigation measures to reduce potential noise and vibration impacts have been assessed at this stage of the study. The appropriateness of noise and vibration mitigation would be assessed during the design phase of the study, if a build alternative is chosen later as the Locally Preferred Alternative.

Among the most effective noise mitigation treatments is noise control at the outset, during the specification and design of the transit vehicle. Such source treatments apply to all transit modes. By developing and enforcing stringent but achievable noise specifications, the transit property takes a major step in controlling noise everywhere on the system. It is important to ensure that the noise levels quoted in the specifications are achievable with the application of the best available technology during the development of the vehicle and reasonable in light of the noise reduction benefits and costs. **Table 4-13** presents other general mitigation measures that may be considered.

Energy

SUMMARY

Overall, direct energy consumption is predicted to decrease slightly (by less than 0.15%) under all alternatives. The slight reductions in roadway vehicle energy are offset by increases in energy usage by the proposed BRT and LRT. The indirect energy consumption, or that needed to construct the project is predicted to be higher with Alternative 4: LRT due to the estimated higher energy requirements for constructing one track mile versus one roadway mile.

Overview

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.

Existing Conditions

Energy Consumption

Transportation is the second largest source of energy consumption in the United States. In Maryland, the transportation sector is the largest source of energy consumption. On a per capita basis, Maryland's transportation energy consumption is 75.3 million Btus, which is below the United States per capita average of 93.1 million Btus (USDOT, 1993).

Direct vs. Indirect Energy

Transportation energy is generally discussed in terms of direct and indirect energy. 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 thermal value of the fuel being used. Indirect energy consumption involves the non-recoverable, one-time energy expenditure involved in constructing the physical infrastructure associated with a project.

Potential Impacts

Direct Energy Consumption

The Red Line is predicted to have little or no effect on overall energy consumption in the corridor. Roadway energy is predicted to decrease very slightly (less than 0.2 percent for all alternatives). The slight reductions in roadway vehicle energy are offset by increases in energy usage by the proposed BRT and LRT. Overall energy consumption is predicted to decrease slightly (by less than 0.15%) under all alternatives.

Energy in terms of energy per passenger mile also shows a slight decrease under all the build alternatives, as compared to the Alternative 1: No-Build. Energy per overall passenger mile in the project area decreases in the range of 0.02 to 0.15% under the various build alternatives. This decrease is due to the fact that Btu per passenger mile varies by mode. The Btu per passenger miles are based on general load factors from the U.S. Department of Energy's report titled Transportation Energy Data Book, Edition 26, dated 2007.

Indirect Energy Consumption

Indirect energy is the energy needed to construct a project. Accurate indirect energy costs are extremely difficult to estimate given the uncertainty of field variables at this point in the analysis. The indirect energy values calculated should be considered as an indicator between alternatives, rather than absolute values. Construction energy factors estimate the amount of energy necessary to extract raw materials, manufacture and fabricate construction materials, transport materials to the work site, and complete construction activities.

The analysis is based on the number of lane miles (or track miles) to be constructed for each alternative. Estimates of construction energy reflect at-grade, elevated and below-grade construction. Indirect energy expenditures are predicted to be highest for the Alternative 4: LRT. This is due to the higher energy requirements estimated for constructing one track mile as compared to one roadway mile. The Indirect Energy Consumption Alternatives 3 and 4 are shown in **Table 4-14.**

Table 4-14: Indirect Construction Energy Consumption for Alternatives 3 and 4

Alternative	Number of Track or Lane Miles	Btus Consumed (millions)
Alternative 3A	26.2	170,467
Alternative 3B	31.9	212,130
Alternative 3C	29.4	217,860
Alternative 3D	30.0	233,068
Alternative 3E	27.6	289,980
Alternative 3F	29.0	187,267
Alternative 4A	26.2	471,018
Alternative 4B	26.2	448,150
Alternative 4C	29.6	580,888
Alternative 4D	27.4	664,989

Mitigation Measures

The Red Line is predicted to have little or no effect on overall energy consumption in the corridor. Conservation of energy could be achieved in facility planning, construction, operation, and maintenance. Conservation could also be applied to recycling pavements, hardware items (guardrails, signals, tires, right-of-way, etc.), using indigenous plants for landscaping, and applying Best Management Practices in roadway maintenance. Other measures that could be applied include using high pressure sodium vapor lamps for light, solar powered lighting, promoting carpools, vanpools, buses and bicycle projects. Measures to mitigate the larger indirect energy usage during construction may include limiting idling of machinery and optimizing construction methods to lower fuel use.

Contaminated Sites

SUMMARY

The Maryland Department of the Environment regulates contaminated sites through the Solid Waste, Hazardous Waste, Oil Control and Voluntary Cleanup Programs. No effects to contaminated sites are anticipated with the No-Build Alternative or Alternative 2: TSM. Alternative 3: BRT and Alternative 4: LRT are expected to encounter contaminated soil and groundwater during construction activities. Typically, alignments with limited near surface construction will involve less excavation and correspondingly have reduced management of contaminated materials. Likewise, tunnel sections and deep utility relocations near contaminated sites would involve more effort to remove, handle, and dispose of contaminated materials.

Overview

The historical industrial development within the corridor has yielded various environmental conditions of concern to the project. Industrial activities such as chemical storage and use, oil refining, metal casting and plating, etc. were in operation across a significant portion of the corridor during the 1800's and 1900's. During this period, environmental statutes which regulated the manufacture, storage, use, and/or disposal of hazardous substances and petroleum products and provided for the protection of natural resources did not exist or were in their infancy.

With the inception of more stringent environmental regulations in the early 1970's, the federal and state governments formed regulatory agencies that focused their attention on releases from manufacturing processes and waste disposal in these industrial operations.

Maryland Department of the Environment (MDE) bears the primary regulatory authority under Title 26 of the Code of Maryland (COMAR). MDE regulatory actions for contaminated sites are typically administered under the Solid Waste, Hazardous Waste, Oil Control, and Voluntary Cleanup Programs.

Case histories of several former industrial sites have revealed evidence of subsurface contamination to the soil and groundwater as the result of unregulated work practices and waste management. A database review of publicly available regulatory files was conducted to identify properties within the study area with on-site use, storage, and/or release of hazardous materials or regulated wastes. This review relies on regulatory compliance records to determine which sites have potential for environmental concerned during construction. The database search included regulatory files from the Environmental Protection Agency (EPA) and the MDE, totaling in 11 databases under the following programs:

- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- Resource Conservation and Recovery Act (RCRA)
- RCRA Corrective Actions (CORRACTS)
- State Equivalent Priority List (SPL)
- State Equivalent CERCLIS List (SCL)
- National Priority List (NPL)
- Toxic Substances Control Act (TSCA)
- State Hazardous Waste System (SHWS)
- Leaking Underground Storage Tank (LUST)
- Registered Underground Storage Tanks (UST)
- Registered Aboveground Storage Tanks (AST)

The database search identified 347 sites within the corridor of these 158 currently have some level of environmental concern.

Refer to the *Preliminary Hazardous Materials Screening Assessment Report* on the DVD attached to this document for more detail on contaminated sites along the corridor and their impact on the proposed construction. Discussion of existing conditions and potential impacts follows.

Existing Conditions

The environmental conditions of concern which arise from commercial properties mainly involve the maintenance and use of underground storage tanks (UST's). In most cases, subsurface contamination on these properties is the result of a leaking underground storage tank (LUST). Commercial properties such as gasoline stations and auto repair facilities are a few examples of sites which may have environmental concerns as the result of LUST's. Dry cleaning operations are examples of sites which are generally considered to represent a potential risk of subsurface contamination as the result of the use of chemicals used in the dry cleaning process. While the extent of potential subsurface contamination from a commercial site may not present as significant a risk as those from a larger industrial site, localized sections of the corridor may contain significant levels of contamination.

Plans for redevelopment of many of these contaminated sites were made upon completion of site remediation activities that reduced contamination concentrations to acceptable residual levels. Regulatory actions under the Voluntary Cleanup Program (VCP) often include deed restrictions on future land use and prohibitions on specific activities, such as excavation or groundwater use in contaminated areas. MDE typically issues a decision of no further action required when contaminants are present at modest concentrations and are not migrating off site such that they do not present a risk to the public health. MDE issues a Certificate of Completion upon completion of cleanup activities that are sufficient to protect the public and the environment. Project activities near remediated sites may still encounter residual subsurface contamination that remains following the regulatory actions.

Residential properties provide the least potential risk of conditions which could be an environmental concern. Typically petroleum products in storage or in use at residential homes are kept in relatively small quantities in UST's or aboveground storage tanks (AST's). Releases or spills from these units are normally minor in nature. Chemicals which are used in the home in most cases are limited to small containers and do not present an elevated environmental concern unless improperly stored or used in large quantities.

Railroad activities are another potential source of environmental concern within the corridor. Railroad operations have been known to be a major source of surface and subsurface contamination on properties adjacent to railroad lines. Contamination has resulted from hazardous cargo spills as well as incremental releases of fuel and lubricants from equipment. A total of six major railroad lines are located within the corridor. The MARC Camden and Penn Lines serve downtown and east Baltimore. CSX and Norfolk Southern maintain active rights-of-way which cross the corridor in southeast Baltimore. Inactive rights-of-way owned by the Norfolk Southern and Canton Railroads parallel Haven Street in southeast Baltimore and are under consideration for the Red Line. Canton Railroad operates a variety of active connectors and spurs in southeast Baltimore, but they do not cross current Red Line alternatives. Another AMTRAK line is located along the Gwynns Falls in the center of the corridor. Project activities along or near these rail lines may encounter some degree of undocumented contamination from railroad operations.

Potential Impacts

Alternative 1: No-Build

Alternative 1: No-Build would not involve any project-related construction that could encounter contaminated sites; therefore no efects are anticipated.

Alternative 2: TSM

Alternative 2: TSM consists of low-cost improvements that do not include major construction activities that would be expected to encounter contaminated sites.

Alternative 3: BRT and Alternative 4: LRT

Alternative 3: BRT and Alternative 4: LRT are both expected to encounter contaminated soil and groundwater during construction activities near contaminated sites. Typically, alignment sections that are limited to near-surface construction (at-grade sections) involve less excavation and correspondingly reduced management of contaminated materials. Likewise, tunnel sections and deep utility relocations near contaminated sites would require much more effort to remove, handle, and dispose of contaminated materials.

MDE case files were used to identify sites where subsurface contamination was documented or suspected. The sites are ranked as presenting a slight, moderate, or severe risk of contamination within the proposed construction. The risk ranking was 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 MTA route alternative.

Pertinent information was evaluated to rank the site according to the risk presented to the nearest proposed route alternative.

- Slight Risk Sites – These sites contain suspected contamination or documented contamination that is limited within the property boundary and is not expected to extend into the project right-of-way. Adverse impacts to the project from these sites are considered unlikely.
- Moderate Risk Sites – These sites contain documented contamination releases that may extend beyond the property boundary. Contamination may be present in the construction zone at concentrations that require special management and disposal.
- 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 will probably encounter some degree of contamination. Adverse impacts to construction will depend on type of contaminant, migration pathways, depth of excavation, and dewatering conditions.

For detailed impacts by option refer to Volume II of the DEIS.

Mitigation Measures

Mitigation measures will only be needed in areas where construction encounters contaminated soil or groundwater. Even where the alignment is located near or over part of a known contaminated site, the construction may not involve excavation to a depth that exposes contaminated soil.

Most of the contaminated soil that is encountered during construction will be impacted by modest levels of petroleum contamination originating from nearby leaking tank sites. The required mitigation will be appropriate handling and disposal of contaminated soils at MDE-permitted petroleum-contaminated soils treatment facilities.

Where other contaminants, such as arsenic, chromium, lead, or other toxic metals are present in high concentrations, the excavated soils must be disposed of at

a permitted facility. To prevent soil contaminants from migrating off the construction alignment with airborne dust, strict dust control measures will be required, such as water-spraying exposed soil surfaces and covering soil stockpiles.

The tunnel excavations are expected to encounter localized areas of groundwater that is contaminated with petroleum from nearby leaking tank sites. Typical mitigation for contaminated groundwater would be on-site filtration to reduce contaminant concentrations to acceptable levels before discharging the treated water into the storm drain system in accordance with an appropriate MDE permit.

Utilities

SUMMARY

To date, only the major utilities in the Red Line Corridor were identified. One of the major tasks of preliminary engineering and final design will be a thorough utility search to identify underground utilities and to develop strategies for maintaining, protecting or relocating utilities that could be affected during construction.

Utility impacts from the Red Line No-Build Alternative are not anticipated. With the surface alignments for Alternatives 3 and 4, little or no impact on deep utilities is anticipated. Overhead utilities would be adjusted as necessary to clear catenary or construction equipment. With the tunnel alignments it may be necessary to replace or reinforce older utilities pipes.

Stormwater Management Best Management Practices (SWM/BMPs) will be required for any of the Red Line build alternatives. At this stage of the study, a conceptual level of design approach has been taken to estimate the amount of increase impervious surface. The Red Line has 184 acres of transit alignment area and will require the treatment of approximately 32 acres of impervious surface to meet stormwater management requirements.

Overview

Existing utilities located within the study's proposed construction limits include electrical distribution and service lines, telephone, water, and sanitary sewer. When the Locally Preferred Alternative is identified, one of the major tasks of preliminary engineering and final design will be a thorough utility search, including test pits as necessary, to identify size, age and location of underground utilities, and to develop strategies for maintaining, protecting or relocating utilities that could be influenced by construction.

Existing Conditions

The corridor contains electrical distribution and service lines, telephone, water, and sanitary sewer lines, the locations of which will be determined during preliminary engineering. To date, only the locations of the major utilities have been identified. The stormwater conduit under Central Avenue is an aging brick arch structure of questionable structural integrity. Traffic over the conduit has recently been restricted by construction of a median in the street. The Jones Falls conduit, a three-cell box culvert, lies under a major downtown portion of the Jones Falls Expressway as far south as Baltimore Street.

In addition to the Central Avenue and Jones Falls stormwater conduits mentioned above, a number of large utilities appear in utility company records. For the tunnel option under Eastern Avenue, the following major utilities have been identified:

- 72x33 inch storm drain under Eden Street at Eastern Avenue
- 48-inch storm drain under Broadway at Eastern Avenue
- Two 42-inch sanitary lines under Eastern Avenue between President and Bond Streets.

There is also a sanitary line under Glover Street at Eastern, and storm drains under Lakewood at Eastern and Linwood at Eastern which are not identified dimensionally.

Potential Impacts

Utility impacts from the Red Line No-Build Alternative are not anticipated. Except as noted, the construction of the transitway in a street section will have little or no impact on deep utilities. Handholes, valve boxes, manhole entrances and signal loop detectors can be expected to be in conflict with a surface alignment and would require relocation or restoration on a case-by-case basis. Manholes can frequently be modified by reorienting the stack to eliminate a conflict with a rail or other fixed feature of the guideway. Overhead utilities such as power and cable lines, traffic signals and signage would be adjusted, as necessary, to clear catenary or construction equipment. Foundations for catenary poles, even though back of the curb line, may necessitate relocating shallow, or even deep utilities.

It may be necessary to replace or reinforce older utility pipes occurring over bored tunnels and subject to potential surface settlement. Older cast iron pipes with lead joints, frequently used in the past for Baltimore's water and gas distribution systems, can withstand very little joint rotation and are vulnerable to damage caused by surface settlement. During past tunnel construction, the MTA has replaced these older, vulnerable pipes prior to constructing tunnels beneath them. In these cases, the procedure has been to identify the vulnerable areas with the utility owner and enter into agreements to have the utility relocated either by the owner or by MTA's contractor(s), preferably prior to the tunnel's approach.

It is expected that some reinforcing would be required for the stormwater conduit under Central Avenue whether the Red Line passes over or tunnels under the structure. The City's final design for reconstruction of the conduit is to begin in 2010 and will be coordinated with any Red Line construction.

The long tunnel option under Fayette Street would require soil modification to assure continuous support of the pile foundations supporting the Jones Falls conduit, while the tunnel may pass approximately ten feet below the estimated pile tip elevations.

In general, given the age and condition of the City's water, wastewater, and conduit infrastructure, any relocations made as a result of the Red Line are considered an overall benefit to the City's utilities and to water quality.

Stormwater Management

Stormwater Management Best Management Practices (SWM/BMP) will be required for any Red Line build alternatives. At this stage of the study, a concept-level design approach has been taken to estimate the extent of the increase in impervious areas at each outfall, compute the volume of water quality requirements, identify potential locations for SWM/BMPs, and develop respective estimated required footprint sizes. Based on the alignments that would have the most impacts relative to stormwater management needs, the Red Line has 184 acres of transit alignment area and generates a total of about 26 acres of new impervious area; 40.5 acres of redeveloped pavement area; 69 acres of pavement maintenance area; and causes a permanent removal of about 2.5 acres of existing pavement.

Based on current MDE SWM Guidelines, an estimated 32 acres of impervious surface will need to be treated to meet stormwater management requirements. A total of 45 SWM/BMP facilities have been identified and located at various outfall locations. Total combined footprint of these facilities, if a surface alignment is selected, is about 6.4 acres. Details for type of facilities would be decided at the preliminary engineering/ Final EIS stage and could range from Low Impact Development (LID) techniques such as, rain gardens, bioretentions, water quality inlets vegetative buffers and manufactured BMPs, to other structural BMPs such as underground detention vaults, sand filters, and aboveground extended detention basins.

The estimated cost for construction of these facilities will depend on the selected type of facility (surface versus tunnel) and site constraints at the future design stage. Construction costs for SWM could range from $10 million to $15 million (not including the right-of-way cost).

Based on this concept-level analysis for the "worst-case scenario", use of underground BMPs in certain areas, potential coordination with other state/local agencies for "shared" or institutional management facilities, stormwater management requirements can be met for any alignment option and will have a minor importance in the final selection of an alternative.

Mitigation Measures

Temporary service disruptions can be expected during any required utility relocations. Construction activities would be planned and scheduled to minimize utility service outages to the greatest extent possible. All work involving the relocation and protection of utilities will be coordinated with and approved by the utility owner. Planned outages will require notification of the affected utility users.

Cultural Resources

SUMMARY

In accordance with Section 106 of the National Historic Preservation Act, project impacts to historic sites including, architectural structures, archeological resources, and parkland resources listed on or eligible for listing on the National Register of Historic Places, was assessed for the Red Line Study.

Historic sites were identified in the Area of Potential Effects (APE), which was determined to be 500 feet on either side of the center line of an alignment in densely developed areas, and a 1,000-foot buffer was used in less dense areas. Thirty-five historic sites were identified, through the literature search and field reconnaissance, to be potentially adversely effected by the project's alignments. If a build alternative is chosen as the Locally Preferred Alternative, specific measures to avoid, minimize and mitigate for these potential adverse effects to historic sites will be assessed.

Archeological resources were identified within an APE of a 200-foot wide buffer around the proposed alignments. Thirty-six previously documented archeological resources were identified in the APE. If a build alternative is chosen as the Locally Preferred Alternative, a more detailed evaluation of the potential effects to archeological resources will be developed, as well as archeological sensitivity modeling to identify locations within the APE that may warrant additional field investigation.

Overview

This section discusses historic properties potentially affected by the proposed alignment options for the Red Line. The text below describes the regulatory framework governing cultural resources. Statistics regarding the presence of listed, eligible, or potentially eligible resources within the Area of Potential Effects (APE) are provided, as are preliminary assessments of the Red Line's potential to create adverse effects on these historic properties. A corresponding Eligibility/Effects Table and accompanying map identifying resources within the APE that are more than 50 years old are also included.

Regulatory Framework

Section 106 of the National Historic Preservation Act of 1966 (NHPA)

Section 106 of the National Historic Preservation Act (NHPA) of 1966 (as amended) requires federal agencies to consider the impacts of their project undertakings on historic architectural, archaeological, and parkland resources that are either listed in the National Register of Historic Places (NRHP) or eligible for listing (36 C.F.R. 800). If projects are federally permitted, licensed, funded, or partially funded, the project must comply with Section 106. Under Section 106, federal agencies are required to provide the public with information about a proposed project and its effect on historic properties and to seek public comment and input, except where confidentiality is considered necessary. Agency officials should plan consultations that are appropriate to the scale and nature of the undertaking.

In addition to the NHPA, the Red Line Corridor cultural resources studies where conducted in compliance with the:

- *Section 101(b)(4) of the National Environmental Policy Act (NEPA) of 1969;*
- *Section 1(3) and 2(b) of Executive Order 11593;*
- *Section 4(f) of the US Department of Transportation Act of 1966.*
- *Advisory Council on Historic Preservation Implementing Regulations 36 CFR Part 800 - Historic Properties (as amended)*
- *Maryland Environmental Policy Act of 1973 (as amended), and the*
- *Maryland Historical Trust Act of 1985, as amended, State Finance and Procurement Article §§ 5A-325 and 5A-326 (formerly Article 83B) of the Annotated Code of Maryland.*

Historic Structures

This section presents the survey methodology for conducting architectural surveys, evaluating resources for eligibility for listing in the NRHP, and applying the Criteria of Adverse Effect to NRHP listed, eligible, and potentially eligible historic resources within the APE. Effects resulting from the Red Line alignment options on historic and cultural properties are discussed below in detail. When the Locally Preferred Alternative is selected and preliminary engineering is initiated, additional consultation with the State Historic Reservation Officer (SHPO) will be undertaken to formalize any remaining determinations of eligibility, determine effects, and to develop appropriate mitigation measures, if required.

Historic Structures Survey Methodology

In 2004, the Maryland Transit Administration (MTA) The cultural resources team began its work in summer 2004 with a literature search to determine the extent of previous documentation of historic properties in the Area of Potential Effects (APE). The APE was determined to be 500 feet on either side of the center line in densely developed areas, and a 1,000-foot buffer was used in less dense areas. This literature search found that while many resources had previously been listed on the National Register or had been determined eligible, a large number of resources had been inventoried but not assessed for NR eligibility. The documentation also revealed areas that had not been surveyed, and clearly many new resources would be identified in further investigation. Historical and Geographical Information System (GIS) data about the previously identified resources was obtained and assembled from multiple repositories by the cultural resources team. The primary information sources were the Maryland Historical Trust (MHT), Baltimore City's Commission for Historical and Architectural Preservation (CHAP) and the NRHP.

Given the large size of the corridor and the 50+ age of the building stock in most areas, the team was asked to make a reconnaissance survey of the study area, in order to provide both the team and client with a sense of the number and types of new resources present in the corridor. The reconnaissance consisted of photographing resources, entering them into a matrix, and delineating their locations in GIS on team maps. For both the previously documented resources and the newly identified resources, the team made preliminary recommendations of level of documentation believed to be necessary (i.e. DOE forms or short forms). This work culminated with the preparation of The Red Line Corridor Transit Study: Cultural Resources – Reconnaissance Survey document, which was submitted to the MHT in April of 2005. Review comments were received in August 2005.

Following review of the Red Line reconnaissance survey by MHT and a request for intensive-level documentation, the team conducted an intensive-level field survey of the entire corridor from west to east. Maryland Determination of Eligibility (DOE) forms were prepared for all previously recorded resources in the APE which lacked DOE determinations. Resources newly identified by the team during the reconnaissance survey were documented with both DOE forms and short forms, as appropriate. Both individual resources and districts were identified in this process. Black-and-white documentary photography and mapping of all resources on USGS quad maps for the SHPO were part of the documentation. Concurrently, GIS mapping of all historic resources in the APE was completed and refined by the project team. This document, The Red Line Corridor Transit Study – Historic Resources, was submitted to MHT in February 2006 and review comments were received March 19, 2007. The team proceeded to revise the submitted DOE forms, and these revised documents were submitted to MHT in December 2007. Approximately 385 resources were found to lie within the APE.

In 2007, the cultural resources team was asked to conduct a reconnaissance survey of the Bayview Extension APE. Prior documentation on the project area was reviewed at CHAP and MHT. The research found that the Bayview Extension APE contains two brewery sites listed on the National Register of Historic Places, but the area was otherwise largely un-surveyed. The APE was subsequently surveyed at the reconnaissance level by the project team. The reconnaissance consisted of photographing resources, entering them into a matrix, and delineating their locations in GIS on team maps. As with the earlier Red Line Reconnaissance Survey, the team made preliminary recommendations of level of MHT documentation believed to be necessary. Documentation at the intensive level would consist of either short forms for resources believed to be clearly not eligible, or DOE forms for all districts and resources believed to be potentially eligible. This survey was completed in fall 2007 and identified 19 new resources. The Reconnaissance Survey for the Bayview Extension of the Red Line was submitted to MHT in early 2008, and is currently under review.

As of January 2008, identification of historic resources within the original Red Line APE and the Bayview Extension was completed. A total of 385 resources were

identified as falling within the original APE following both reconnaissance and intensive surveys, and an additional 21 resources were identified in the reconnaissance survey for the Bayview Extension. Summary Information on these resources is discussed in **Table 4-15. Figure 4-10** shows the historic districts within the Red Line Corridor. Detailed mapping and a discussion of eligibility and effects is included in the Red Line Transit Corridor Study – Section 106 Effects Evaluation technical memorandum.

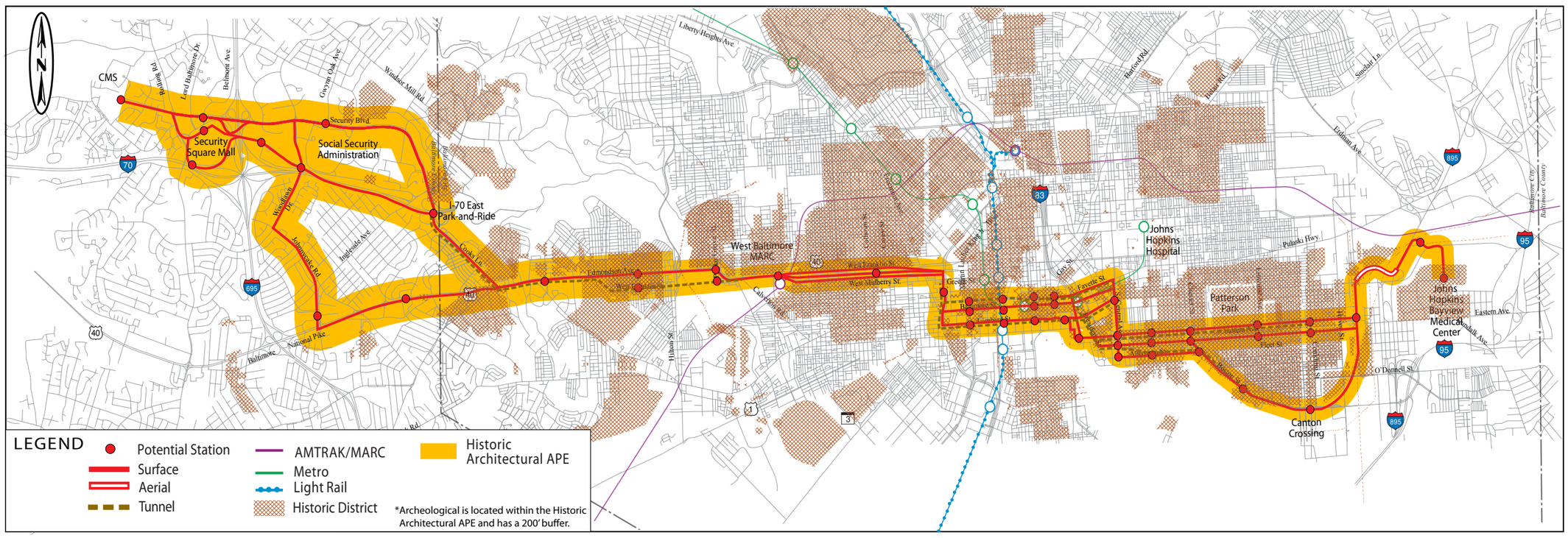
With the recent completion of the historic resource identification process, the cultural resources investigation shifted to an analysis of the potential effects of the proposed alternatives and options on those resources determined to be eligible for the NRHP. Working with project engineers and GIS specialists, the cultural resources team analyzed the most recent plans for the transit system and identified areas where effects to historic resources were likely. The team also suggested means of avoiding or mitigating adverse effects through sympathetic design,

Table 4-15: General Effects on Historic Resources by Build Alternative

Surface Options		
TSM Alignment	Bus in the Street	NPA
TSM Station	Station within Historic District	AE*
	Station adjacent to Historic District	NAE
	Station adjacent to individual resource (character altered)	AE*
	Station adjacent to individual resource (character unaltered)	NAE
BRT Alignment	Bus in the street (within/adjacent to historic district)	NPA
	Bus on elevated section (within/adjacent to historic resource -character altered)	AE*
BRT Stations	Station within Historic District	AE*
	Station adjacent to Historic District	NAE
	Station adjacent to individual resource (character altered)	AE*
	Station adjacent to individual resource (character unaltered)	NAE
LRT Alignment	Train in street (character of district unaltered)	NPA
	Train on elevated section (within/adjacent to historic district-character altered)	AE*
	Station within Historic District	AE*
	Station adjacent to Historic District (character unaltered)	NAE
	Station adjacent to individual resource (character altered)	AE*
	Station adjacent to individual resource (character altered)	NAE

Tunnel Options		
BRT Alignment	Bus in the tunnel	NPA
BRT Stations	Cut/Cover Station/Track Section directly adjacent to historic district/individual property	AE**
	Portal/Headhouse within Historic District	AE*
	Portal/Headhouse adjacent to individual resource (character altered)	AE*
	Portal/Headhouse adjacent to individual resource (character unaltered)	NAE
LRT Alignment	Train in street (character of district altered)	NPA
	Train on elevated section (within/adjacent to historic resource -character altered)	NPA
LRT Stations	Cut/Cover Station/Track Section directly adjacent to historic district/individual property	AE**
	Portal/Headhouse within Historic District	AE*
	Portal/Headhouse adjacent to Historic District	NAE
	Portal/Headhouse adjacent to individual resource (character altered)	AE*
	Portal/Headhouse adjacent to individual resource (character unaltered)	NAE
Treatment Notes	* *Potential Adverse Effects to be avoided/minimized by relocation or context sensitive design* ** *Potential Adverse Effects from cut/cover excavation adjacent to historic structures to be avoided/ minimized through engineering measures to avoid soil subsidence and construction vibration impacts*	

Figure 4-10: Historic Districts and Historic Architectural APE



alterations to headhouse locations, or other means. The potential effects to cultural resources by option and Geographic Area are presented in Volume II of the AA/DEIS. Most recently, in May and June 2008, the survey team presented representatives of the Maryland Historical Trust and CHAP with a review of the latest project area mapping and preliminary assessment of potential effects

Potential Adverse Effects to Historic Resources

A summary matrix of the potential Adverse Effects for the historic resources, is shown in **Table 4-16** details which project elements have been identified as potential Adverse Effects. Historic properties are defined as those that are listed in or eligible for listing in the NRHP. For more information on the potential Adverse Effect properties refer to Volume II of the AA/DEIS.

Treatment of Potential Adverse Effects

A more detailed discussion of specific measures to avoid, minimize, or mitigate potential Adverse Effects on specific historic properties will be addressed during preliminary engineering. However, a general discussion of the appropriate treatment for certain categories of effects can be outlined at this point in the project phase. Potential impacts to historic districts from the proposed construction surface stations, tunnel headhouses, and portals can be effectively avoided or minimized by relocating these structures outside of a historic district or into a location that would not have a direct impact on the architectural character of adjacent historic resources.

Should relocation be determined to be infeasible, the potential Adverse Effect from these proposed new structures could be mitigated through the development of context-sensitive designs that represent compatible additions to the surrounding historic built environment. As noted above, excavation of cut-and-cover section and stations directly adjacent to historic properties has the potential to result in impacts related to construction vibration and structural damage resulting from soil subsidence. In these cases, special care will need to be taken to employ construction techniques that will avoid or minimize these potential impacts. In addition, it may be necessary to carefully monitor the condition of the structure before, during, and after construction to identify and address any structural changes related to construction impacts.

The current options include tunnel sections that would pass beneath a number of historic cemeteries. While all of these tunnel sections would be bored a minimum of 20.0 feet below the surface level, special geotechnical evaluation and construction techniques may be necessary to avoid or minimize construction to subsurface burials or surface monuments or any other associated contributing structural features. As one of the locations under consideration for a park-and-ride is in the vicinity of a historic district, the layout and design of this facility would need to include consideration for potential noise and light impacts to nearby historic properties. Relocation of the relatively high potential noise generating operations (i.e. transit vehicle parking areas), may help to minimize noise impacts, while the location and design of the lot lighting fixtures can help to minimize light impacts.

Although the current analysis has identified a range of potential Adverse Effects to the historic properties within project APE, in most cases, it is possible to identify appropriate treatment options that could avoid or minimize these impacts. Preliminary coordination with the project engineers has allowed for the identification of treatment options for a majority of these potentially affected historic properties (Identified by asterisk in **Table 4-16**). As a result, although these impacts are identified as potential Adverse Effects in the AA/DEIS, through continued design refinement, it is anticipated that many of these effects can be reduced to the level of No Adverse Effects in the Final EIS.

Archeological Resources

Overview

At the time of the Red Line *Phase IA Archeological Survey*, several Red Line alignments and alternatives were under consideration. Given their cumulative linear extent and the stage of the study at the time of the survey, it was deemed prudent to conduct a systematic archeological assessment study in order to acquire a comprehensive understanding of the archeological sensitivity of the Red Line Corridor. This survey was also performed with the intent to provide the MTA with information that could assist with project planning activities. The primary purposes of the Phase IA Archeological Survey were:

- To develop a comprehensive overview of the archeological context and sensitivity of the Red Line Corridor that can be applied toward project planning activities.

Table 4-16: Potential Effects on Historic Resources in the Corridor

Historic Resource	Surface Station In/ Adjacent to Historic District	Station Adjacent to Individual Resource	Head House in Historic District	Head House Adjacent to Individual Resource	Portal In/ Adjacent to Historic District	Portal Adjacent to Individual Resource	Elevated Station Within/ Adjacent to Resource	Potential Noise & Vibration Impacts	Property Takes from Resource	Tunnel Beneath Historic Cemetery	Park-and-ride (Noise & Light)
Franklintown HD *											x
Galloway-Dickey House *									x		
Hunting Ridge H.D. *									x		
St. Bartholomew's						x		x			
St. William of York *									x		
Allendale/West Mulberry H.D. *	x		x						x		
Edmondson Historic District *	x										
Edmondson Village Shopping Center *	x		x								
New Cathedral Cemetery *										x	
American Ice Company *							x		x		
Old West Baltimore *		x									
Franklin Square Historic District *	x										
Fayette Street/ M. E. Church *		x							x		
Old West Baltimore H.D. *	x										
Old Saint Paul's Cemetery *										x	
Carroll Museum *								x			
Shot Tower *				x							
U.of M.Medical Hospital HD *	x		x								
Market Center Historic District *	x		x								
Business and Government H.D. *	x		x		x						
Jonestown Historic District *	x		x			x					
Old Town Friend's Meetinghouse *								x			
U of MD School of Social Work *				x							
Baltimore City Hall				x							
War Memorial *				x							
Faust Brothers Building *		x									
South Central Avenue H.D. (GA-6) *	x		x		x						
Fells Point H.D.*	x		x								
Polish Home *				x							
South Central Avenue H.D.(GA-7) *	x		x								
Patterson Park H.D. *	x		x								
Canton Historic District *	x		x								
Edward Renneburg and Sons *		x									
Patterson Park/Highlandtown H.D.*	x										
Brewer's Hill *	x										

- To construct an archeological foundation for any additional archeological studies that may be warranted upon selection of the Locally Preferred Alternative.

The Phase IA Survey was performed in accordance with the protocols as established by:

- *MHT's Standards and Guidelines for Architectural and Historical Investigations in Maryland (2000).*
- *MHT's Standards and Guidelines for Archeological Investigations in Maryland (Shaffer and Cole 1994).*
- *Archeology and Historic Preservation: The Secretary of the Interior's Standards and Guidelines (FR 48:44716-44742) (Sept. 1983).*

Area of Potential Effects (APE)

Using relevant project materials and observations made during inspection of the Red Line Corridor, an archeological APE that encompasses an area, where effects related to the project could reasonable be expected to occur, was established in consultation with the MTA and MHT.

For archeological resources, the APE was determined to consist of lands where the proposed project would result in the disturbance of existing lands surfaces. Based on reviews of preliminary design schemes, an APE encompassing lands within 100 feet on both sides of the centerline of the proposed alignments was established. Therefore, a 200-foot wide buffer was established for the purposes of the Phase IA Archeological Survey. An APE for historic standing structures was established separately.

This APE was recommended with the understanding that upon the selection of a Locally Preferred Alternative, the APE would be revised accordingly in consultation with the MTA and the MHT to address the specific conditions of the Locally Preferred Alternative.

Archeological Resources Documentation

Following MHT recommendations, the archeological evaluation during the development of the AA/DEIS limited the archeological documentation to a detailed summary of all previously recorded archeological sites in the APE, including information on the nature of the completed investigations, the character of the identified sites and their current condition. The above noted efforts are presented in a Phase IA Archeological Survey Report that was submitted to the MHT in June 2006 and review comments were received on March 19, 2007. A revised version of this technical report was submitted to MHT on April 4, 2008 (and CHAP) and a copy of this report is included in the Cultural Resources Technical Report on the DVD attached included with the AA/DEIS. The definition of the APE for archeological resources and the proposed methodology for the collection of preliminary archeological data had been included in the Preliminary Section 106 Submission to the MHT (September 2004).

Phase IA Archeological Survey

The APE extends through Baltimore City and into Baltimore County on both the east and west ends of the Red Line Corridor. From a research perspective, the Red Line Corridor Transit Study provides a unique opportunity to examine the historic growth and development of Baltimore City and its surroundings. In accordance with the study goals, the Phase IA Survey examined the effect of social and cultural change upon the landscape and evaluated these factors in assessing the archeological sensitivity of the Red Line Corridor.

It was anticipated that a thorough review of documentary materials would easily allow researchers to conduct exercises in landscape reconstruction, historic sequencing, and spatial modeling. The results of the survey were then used to help understand the archeological context of the APE from a regional perspective. In turn, the efforts provided a strong foundation for developing predictive models that could assist in delineating archeological sensitivity areas within the APE.

Survey Methods

Several measures were undertaken to achieve the survey goals and archeological research objectives of the Phase IA Archeological Survey, which included documentary research, a field inspection of the APE, and generation of an inventory of previously documented archeological sites. Identified resources were plotted on study base mapping (refer to the *Phase IA Technical Report*). Data collected by these efforts were then applied to develop predictive models and to assess the archeological sensitivity of the APE.

Previously Documented Archeological Resources within the Project APE

The vast majority of the previously identified archeological resources are clustered in the eastern portion of the APE. This distribution pattern undoubtedly has more to do with the higher level of previous development-driven investigations of the downtown areas of Baltimore City than the actual distribution of archeological resources. In fact, the western portion of the APE, particularly in Baltimore County, has a greater number of less intensively developed areas and greater areas of green space, suggesting that these areas my have higher potential to yield important and more intact archeological sites. A short discussion of archeological potential is included below, although a more intensive evaluation of existing areas of elevated archeological potential will not be undertaken until the selection of the Locally Preferred Alternative is complete.

Within the eastern portion of the APE, the majority of the identified sites in the downtown area between Martin Luther King Jr. Boulevard and Central Avenue. Twenty-seven of 36 archeological sites fall within this area, while eight sites fall east of downtown.

The historic development of Baltimore City, did not gain momentum until after the Revolutionary War, explaining the relative scarcity of early-18th century archeological resources. Only one of the sites included in the APE appears to contain a historic component dating to this time period. Sites with mid-to-late eighteenth- century material are more plentiful, with 18 of the total 37 sites including such components. Not surprisingly, these sites are clustered around the Inner Harbor, Jonestown, and Fells Point sections of the city, as these three areas represented the earliest cores of historic development. Although there are a number of sites which have been determined to be eligible for the NRHP, the majority of sites have been determined to be ineligible or have not yet had formal determinations. Formal determination of eligibility for all the sites that fall within the APE would be undertaken during subsequent stages of project development.

Areas of Archeological Potential

The APE falls within an urban/suburban setting that has undergone extensive landscape alteration since the early eighteenth century. Construction and demolition, as well as land filling, have been extensive. The transition from Coastal Plain to the Piedmont is apparent in the topography of the APE. In the east, the APE crosses various low-lying areas with very little relief to gently rolling uplands. Most of the land crossed by the APE consists of a mix of assorted urban/suburban commercial, residential, and industrial properties along existing roadways. Although most of the roadside edges of the properties within the APE are paved, occasional stretches of unpaved ground surface can also be also found throughout the project APE. Within the Baltimore City limits, undeveloped areas include isolated vacant lots, city parklands, and well-maintained landscaped patches. Beyond the city limits, unpaved surfaces within the APE include front yard areas of residential properties and the peripheries of undeveloped woodlots that abut the roadways. These less intensively disturbed areas of project areas have the potential to include more intact and therefore more significant archeological resources.

During the early stages of the project planning, the development of the list of potentially affected archeological resources was based on the previously identified sites that fell within the 200-foot wide buffer (100 feet on each side of the alignment centerline). With the completion of more detailed project plans and preliminary engineering, it was possible to refine this analysis by assessing which sites had the potential of being effected by the proposed alternatives. This determination was based on the spatial relation of the site boundaries to the detailed Limits of Disturbance (LOD) of the various alignments and options. The determination also took into account eligibility status (ineligible sites were not considered) as well as evidence on the current condition of the site. These potentially affected sites are identified in **Table 4-17** and are addressed in a general discussion below.

With a limited number of exceptions, most notably specific tunnel sections, the vast majority of project LOD impacts are within the right-of-way of exiting roadways. In most cases, it is reasonable to assume that that the construction and continual upgrading and maintenance of the roadway right-of-way and in-road utilities would have substantially disturbed most of the archeological sites that extend into the roadbed. As a result, it is anticipated that the portion of the sites that lie within an existing roadway right-of-way will not retain sufficient integrity to be considered eligible for the NRHP. Portions of these sites that extend outside the ROW, have a somewhat higher potential to remain intact; however, the disturbance from the construction of adjacent structures, sidewalks and utilities are likely to have produced significant disturbance to these sites.

Table 4-17: Summary of Previously Documented Archeological Resources Within Project APE

Site #	Site Name	Site associated w/extant buildings (MIHP#)	MD/National Register Status (as currently recorded with the MHT)	Current Landuse of Site	Extent of Site Disturbance	Probably Effects
18BC159	UMAB G-1	No	Not eligible (DOE 3/10/2004)	Medical research park	Major	No
18BC1	Thomas Morgan Pottery	No	Not determined	Commercial standing structure	Destroyed	No
18BC6	Carroll/ Caton House Courtyard	Yes - Carroll/Caton House (MIHP# B-2)	MHT DOE (5/25/1995) and MHT Easement	Standing structure, public courtyard, rental space	Minor	No
18BC14	9 North Front Street	Yes - 9 North Front Street (MIHP# B3716) and MHT Easement	Eligible MHT DOE (1988)	Recreational, standing structure, educational	Minor	No
18BC19	St. Paul's Cemetery	Yes -St. Pauls Cemetery (NR Listed - MIHP# B-3696)	Eligible	Transportation, sepulchre	Minor	Yes
18BC20	Mauldin Perine Pottery	No	Not determined	Transportation	Destroyed	No
18BC21	John Feast Botanical Garden	No	Not determined	Transportation	Unknown	Yes
18BC33	Block 1370	No	Not determined	Standing structure, commercial	Destroyed	No
18BC38	Clagget Brewery	No	Not determined	Recreational, transportation, commercial, educational	Moderate	No
18BC48	Albemarle Row House I	No	Not determined	Unknown	Destroyed	No
18BC49	Albemarle Row House II	No	Not determined	Unknown	Destroyed	No
18BC50	Albemarle Row House II	Yes- 50 Albemarle Street	Not determined	Possible bed & breakfast	major	No
18BC55	Cheapside Wharf	No	Not determined	Commercial	Destroyed	No
18BC62	Harrison's at Pier 5	No	Not eligible	Recreational, Commercial	Major	No
18BC63	Harrison's at Pier 6	No	Not eligible	Recreational, standing structure commercial education	Unknown	No
18BC65	Jones Falls Metro Station (E)	No	Not determined	Construction site, transportation	Major	No
18BC66	Jones Falls Metro Station (W)	No	MHT DOE (2/14/1989), contributing resources to Business & Government HD	Construction site, transportation	Major	No
18BC67	Columbus Plaza	No	Eligible	Residential, standing structure, commercial	Partially destroyed	No
18BC69	Jones Falls Metro Station (N)	No	Ineligible	Transportation	Major	No
18BC75	Bernstein Building	No	Not eligible	Recreational, standing structure, commercial	Unknown	No
18BC106	Old Town Meeting House	Yes -Society of Friends Meeting House (MIHP #B-9)	B-9 listed 1993	Recreational	Moderate	No
18BC107	McKim's School	Yes - McKim School House (MIHP #B-19)	MHT preservaton easement, B-19 listed 1974	Recreational, standing structure, educational	Moderate	No
18BC112	Baltimore Infirmary	No	Determined ineligible by MHT (11/16/1995)	Educational, landscaped urban open space	Major	Yes
18BC114	42 Albemarle Street Outside of APE but associated w/ 18BC48, 18BC49, and 18BC50)	No	Not determined	Standing structure, warehouse	Minor	No
18BC124	President Street Station	Yes - President Street Station (MIHP# B-3741)	B-3741 listed 1992	Educational, museum	Minor	No
18BC143	Lloyd Street Synagogue	Yes - Lloyd Street Synagogue (MIHP# B-20)	MHT preservation Easement, B-20 listed 1978, Eligible	Museum	Moderate	No
18BC144	Westminster Presbyterian Church	Yes - Westminster Presbyterian Church (MIHP# B-54) and Cemetery (MIHP# B-101)	MHT preservation Easement, B-54, and B-101 listed 1974, Eligible	Recreation, rental hall, cemetery	Minor	No
18BC148	Walinchus	Yes -Star-Spangled Banner House (MIHP# B-0015)	Not determined	Museum	Destroyed	No
18BC28	Eden Street Kiln	No	Not determined	Unknown	Unknown	Yes
18BC32	H & S Bakery	No	MHT DOE (9/10/1999)	Standing structure, commercial	Possibly destroyed	No
18BC46	Old School 6	No	Not determined	Educational, recreational	Unknown	No
18BC138	Fells Point Synagogue	Yes - 1534 Fleet Street	Not determined	Commercial, standing structure	Minor	No
18BC145	Caroline & Fleet	No	Not determined	Vacant lot	Moderate	Yes
18BC146	Tutti Frutti	No	Not determined	Vacant lot	Moderate	No
18BC56	The American Can Company	No	Not determined	Commercial	Unknown	No
18BC108	Baier Brewery	No	Not determined	Commercial, standing structure	Minor	No

Conclusions and Recommendations

The MHT requested a preliminary identification survey effort for the Red Line project, and that a more intensive survey effort be deferred, until a Locally Preferred Alternative is selected. In order to fulfill these documentation requirements, the *Red Line Corridor Transit Study: Cultural Resources Reconnaissance Survey* dated May 2005 and the current the *Phase IA Archeological Assessment Technical Report dated June 2006* were submitted to the MHT.

As requested by the MHT, the current archeological study represents a detailed summary of all previously recorded archeological sites in the project APE, including information on the nature of the completed investigations, the character of the identified sites, and their current condition. Upon the selection of the Locally Preferred Alternative, a more detailed evaluation of the potential impacts of the Locally Preferred Alternative to both Historic Architectural and Archeological Resources will be developed and included in a Section 106 Effects Determination document, which will be coordinated with the MHT and other consulting parties. In addition to effects analysis on the archeological resources within the APE for the Locally Preferred Alternative, this document will also include archeological sensitivity modeling to identify locations within the APE that may warrant additional investigation or field evaluation.

Red Line Transit Study – Section 106 Public Involvement and Agency Coordination

The MTA developed a Section 106 Public Involvement Plan as part of the overall Red Line Corridor Transit Study Public Involvement Program. Refer to Chapter 7 of the DEIS for more information on the public involvement and agency coordination activities for the project.

The MTA has carried out formal consultation pursuant to Section 106 of the National Historic Preservation Act (36 CRF 800). This consultation has included representatives of the State Historic Preservation Officer (SHPO) at the MHT, as well as the local county and municipal authorities (including CHAP and Baltimore County Planning Department-Preservation Services). These three agencies have been identified as Section 106 consulting parties and formal consultation and inter-agency coordination will continue throughout the project planning process. At the time of this report, no other parties have formally requested to be considered formal consulting parties.

The MTA has continued the process to identify potential interested and consulting parties by gathering information about local groups who expressed interest in historic resources and historic preservation and placing them on the mailing list for the NEPA public program. In addition to continued consultation with the MHT, as well as local county and municipal authorities (including CHAP and Baltimore County Planning Department-Preservation Services), the MTA has identified a number of other public groups with an interest in historic resources and preservation programming within the Red Line Transit Corridor. The current potential interested parties list includes thirty-one agencies and organizations, list of the consulting parties, and interested parties.

After considering input from the consulting parties and the public, MTA will prepare a report that applies the Criteria of Adverse Effect to listed or eligible properties, which will be submitted to the MHT and all other consulting parties for review and comment. If adverse effects are identified, MTA will draft a Memorandum of Agreement (MOA) that includes the identification of adversely affected resources and measures to minimize or mitigate project impacts to such resources. If needed, the MOA will also contain a plan for additional archaeological studies. The SHPO and other consulting parties will be provided the opportunity to review the draft MOA and provide comments. Once the SHPO has provided comments, a final MOA will be prepared. The SHPO, the FTA, MTA, and any parties that assume responsibility under the MOA will be signatories to the MOA. The FTA may invite all consulting parties to concur with the MOA. The FTA may also invite additional parties to be signatories. However, pursuant to 36 CFR 800, "the refusal of any party invited to concur in the memorandum of agreement does not invalidate the Memorandum of Agreement."

Section 4(f) Evaluation

SUMMARY

In accordance with Section 4(f) of the US DOT Act of 1966, the Red Line Study included a Section 4(f) Evaluation. Section 4(f) requires that the use of publicly-owned parks, recreation areas, wildlife and/or waterfowl refuge, or any significant historic sites, as part of a federally funded or approved transportation project, is permissible for use only if is there is no feasible and prudent alternative to the use.

As part of the alternatives development process, the MTA has undertaken a substantial effort to avoid and minimize impacts to Section 4(f) resources. Section 4(f) resources that could potentially be affected by the build alternatives include Leakin Park, Patterson Park, War Memorial Plaza, and University Plaza, as well as numerous historic sites. It is anticipated that these potential impacts would be *de minimis* impacts, or that there would be no adverse effect on the protected resource. All of the potential *de minimis* impacts to parks and historic sites are associated with minor impacts to the properties from slight widening of the road or the placement of surface stations or head houses. A *de minimis* impact recommendation would be made to the FTA following further design if a build alternative is chosen as the Locally Preferred Alternative.

Overview

Section 4(f) of the US Department of Transportation Act of 1966 (23 U.S.C. 138 and 49 U.S.C. 303), requires that the use of land from a publicly-owned public park, recreation area, wildlife and/or waterfowl refuge, or any significant historic or archaeological site, as part of a federally funded or approved transportation project, is permissible for use only if there is no feasible and prudent alternative to the use. Final action requiring the taking of such land must also document and demonstrate that the proposed action includes all possible planning to minimize harm to the property resulting from such use. Section 4(f) is one of numerous social, economic, and environmental issues that must be considered under the "umbrella" of the environmental review process.

A Section 4(f) "use" occurs when: 1- land from a Section 4(f) resource has been permanently incorporated into a transportation facility (which occurs when land is acquired or a permanent easement obtained from a resource protected under Section 4(f)); 2- when there is a temporary occupancy of land that is adverse in terms of the Section 4(f) statute's preservationist purposes (such as a temporary constructive easement); or 3- when there is a constructive use of land. Constructive use is a type of indirect use in which a transportation project's proximity impacts (as opposed to direct impacts) are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired. The *Draft Section 4(f) Evaluation* contains the overall project findings in accordance with the requirements of Section 4(f) of the Department of Transportation Act of 1966, as amended.

Section 4(f) legislation was most recently amended in March 2008 in 23 CFR 774 in response to Section 6009(a) of the Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU). These revisions were made in an effort to simplify the process and approval of projects that have only *de minimis* impacts on lands impacted by Section 4(f) (23 CFR 774. 3(b)). Section 6009(a) states that an analysis of avoidance alternatives is not required and the Section 4(f) evaluation process is complete once the US DOT (in this case the Federal Transit Administration) determines that a use of Section 4(f) property results in a *de minimis* impact (as defined in 23 CFR 774.17). This determination occurs after consideration of impact avoidance, minimization, and mitigation or enhancement measures.

De minimis impacts to Section 4(f) resources are impacts that would have no adverse effect on the protected resource. The requirements for *de minimis* determinations are different for parks and historic sites. 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 – in this case the Baltimore County Department of Recreation and Parks, or the Baltimore City Department of Recreation and Parks – must concur that the project will not adversely affect the resource. For historic properties, a *de minimis* impact finding may be made if a "no adverse effect" or "no historic properties

affected" determination is made through the Section 106 process (refer to the Cultural Resources section of this DEIS) and concurred upon by the Maryland Historical Trust (MHT). A *de minimis* finding cannot be made if there is a "constructive" Section 4(f) use (i.e., the use results from indirect impacts).

Impacts to Section 4(f) Resources

The No-Build Alternative would not involve any project-related construction and impacts to Section 4(f) resources are not anticipated. Section 4(f) resources that could be affected by transportation use from this project include two publicly owned public parks (Leakin Park and Patterson Park) as well as numerous historic sites. As part of the alternatives development process, the MTA has undertaken substantial effort to avoid and minimize impacts to Section 4(f) resources. Through the development of early Section 4(f) resource inventories and engineering intended to avoid and minimize impacts whenever reasonable, most of the small neighborhood parks and historic sites have been avoided by the proposed build alternatives.

It is anticipated that there would be no potential constructive uses incurred by the build alternatives to any of the historic sites within the Red Line Corridor. The build alternatives would introduce new surface stations and/or tunnel head houses and portals to the urban environment within the Red Line Corridor. The Red Line Corridor already contains high-density urban residential and business development, roadways containing high traffic volumes, and current LRT alignments already in use. It is not anticipated that the potential noise and visual impacts from the proposed structures will substantially diminish the protected activities, features, or attributes of the historic sites covered under Section 4(f).

Furthermore, following consideration of impact avoidance and minimization, as described in the *Draft Section 4(f) Evaluation*, it is anticipated at this time that all potential impacts to parks and historic sites would likely be considered to have a potential no adverse effect on the resources. Therefore, MTA intends to pursue a finding of *de minimis* impact for each of the potential Section 4(f) uses identified.

All of the potential *de minimis* impacts to the parks and historic sites are associated with minor impacts to the properties from slight widening of the road or the placement of surface stations or head houses. The MTA anticipates that as this project moves further into planning and the Locally Preferred Alternative is chosen, additional avoidance and/or minimization techniques will be implemented to either reduce the number of impacts or completely avoid impacts. *De minimis* findings are dependent upon concurrence from the officials with jurisdiction (for parks) and/or the Maryland Historical Trust (for historic properties) that there will not be an adverse impact from the project. This determination will occur following the identification of the Locally Preferred Alternative. **Figure 4-11** shows the potential Section 4(f) resources in the corridor.

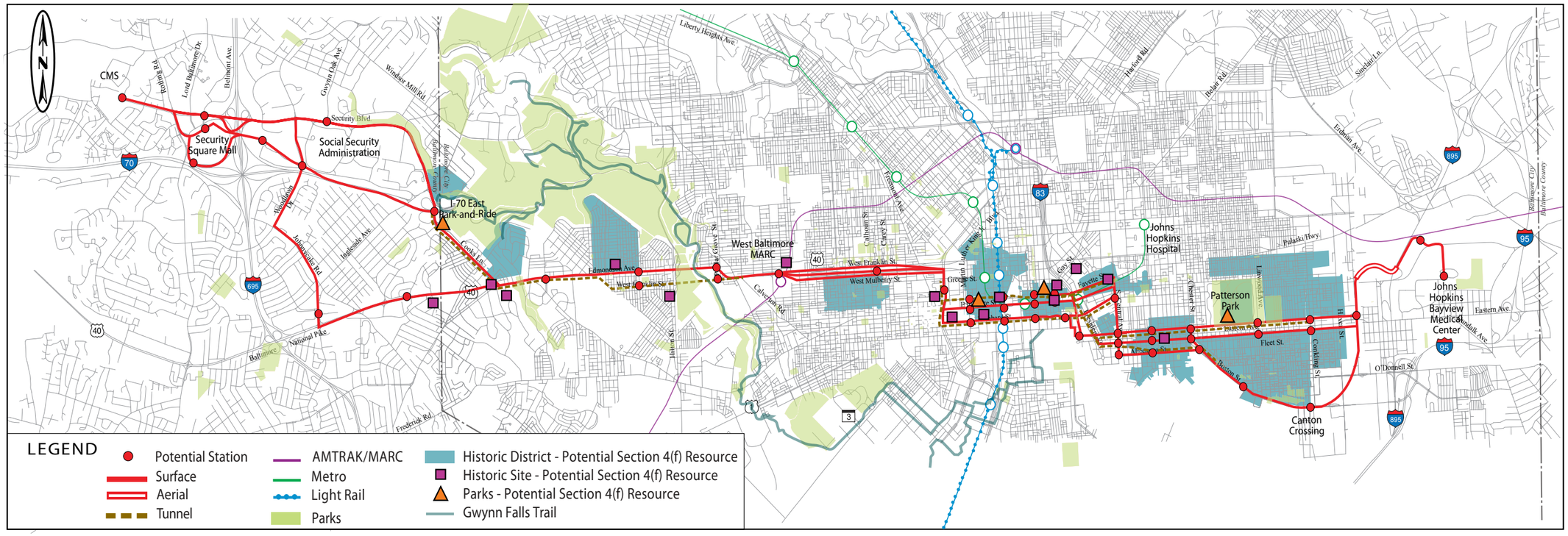
The following is a general summary of the potential 4(f) impacts by build alternative. The specific impacts associated with the options are presented in Volume II of this DEIS.

Parks

Alternatives 2, 3 and 4 would impact a small portion of Leakin Park/Parcel 7900F located along Cooks Lane just south of I-70. The portion of Leakin Park/Parcel 7900F that would be impacted is a maintained area between two service roads. The impact is not expected to alter the use or function of the park. Also, Leakin Park would benefit from the Red Line. There is a proposed station adjacent to the park that includes parking and access to the park's hiker/biker trail system.

The surface station and tunnel head house locations associated with Alternatives 2, 3, and 4 have potential impacts to Patterson Park property. The proposed locations for the surface station or tunnel head house for each of the build alternatives are just inside the park boundary

Figure 4-11: Section 4(f) Resources



by the entrance of Patterson Park at the northeast corner of the South Patterson Park Avenue and Eastern Avenue intersection. The location of either the surface station or tunnel head house would not impede access to the park or affect the overall function of the park. It would benefit park users by providing direct access to the park.

A surface station or tunnel head house associated with Alternatives 2, 3, and 4 has a potential impact to the War Memorial Plaza. The War Memorial Plaza is located between North Holliday Street and North Gay Street and bound to the north and south respectively by East Lexington Street and East Fayette Street. The proposed location of the surface station or tunnel head house would be along the boundary of the park but would not impede access to the park. The station would benefit park users by providing direct access to the park.

The surface station or tunnel head house locations associated with Alternatives 2, 3, and 4 have potential physical impacts to University Plaza. The proposed location for the surface station or tunnel head house would be along the northwest boundary of University Plaza along West Baltimore Street, east of South Greene Street. The location of the surface or tunnel head house would not impede access to the park and would benefit park users by providing direct access to the park.

Historic Sites

Historic sites include any prehistoric or historic district, site, building, structure, or object listed in, or eligible for listing in, the National Register of Historic Places. The term "historic sites" includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that are listed in, or are eligible for listing in, the National Register. The cultural resources survey identified 404 historic sites within the Red Line Area of Potential Effect (APE). Of the 404 historic sites, 34 historic sites may experience a potential adverse effect. The MTA is currently coordinating with the Maryland Historic Trust (MHT) on the potential adverse effects determination. For additional information on historic sites that may be affected by the project, please refer to the Cultural Resources section of the DEIS as well as the *Draft Section 4(f) Evaluation Technical Report* included on the DVD with the DEIS for further descriptions, impact analysis, and coordination for Section 4(f) resources.

For cultural resources, a *de minimis* impact finding may be made if a "no adverse effect" or "no historic properties affected" determination is made through the Section 106 process (refer to the Cultural Resources section of this DEIS) and concurred upon by the MHT. The draft Section 4(f) evaluation identified potential *de minimis* impacts to some historic sites within the Red Line Corridor. The proposed locations of the surface stations, tunnel head houses, and/or portals could potentially impact some parcels containing historic sites. (These are identified in the Cultural Resources section of the DEIS.) The MTA anticipates that the potential impacts would not adversely affect the character or use of the historic sites and therefore could be considered *de minimis* impacts. Also, the MTA anticipates that as this project moves further into planning and the Locally Preferred Alternative is chosen, the implementation of a Memorandum of Agreement (MOA) as well as additional avoidance and/or minimization techniques for the LPA will either reduce the number of *de minimis* impacts to historic sites or completely avoid *de minimis* impacts to historic sites.

Upon completion of a more detailed evaluation of the potential impacts to archeological resources from the Locally Preferred Alternative, a Section 4(f) evaluation would be completed, if required. The archeological evaluation would include the identification of archeological sites that are eligible for listing on the National Register of Historic Places through detailed archeological investigation, as established through a MOA.

Natural Resources

Habitat and Species

SUMMARY

The Red Line corridor is highly urbanized with the majority of the remaining natural areas concentrated in the western portion of the corridor from I-695 to the Gwynns Falls. The primary habitats in the corridor include forests and other vegetated, non-forested areas, including the stream valleys of Dead Run and Gwynns Falls and new growth areas along I-895 and the inactive Norfolk Southern right-of-way. In general, the aquatic habitat and biological communities in the corridor surface waters reflect the high degree of urbanization in their associated watersheds.

Project-related environmental effects from the No-Build Alternative are not anticipated. The build alternatives would all result in impacts to forested habitat, primarily in the habitat along Security Boulevard between Woodlawn Drive and I-70, with the greatest impacts at the proposed I-70 park-and-ride.

Approval from the Maryland Department of Natural Resources, Forestry Division will be required if a build alternative is selected and more detailed design has been completed. Potential effects to aquatic habitat and water quality would be minimized by strict adherence to sediment and erosion controls and stormwater management plans.

Overview

The Red Line Corridor is a highly urbanized area where most natural resources have been altered during years of landscape manipulation for development. Despite the many years of disturbance that has diminished the extent and quality of the natural habitat within the corridor, the corridor contains a number of natural resources that enhance the area **(Figure 4-12)**. The majority of the remaining natural areas are concentrated in the western portion of the corridor from I-695 to the Gwynns Falls.

Forests in Maryland are regulated under the Forest Conservation Act, Natural Resources Article, Section 5-1609, Annotated Code of Maryland. For more information, please refer to the *Natural Resources Technical Report* on the DVD attached to this document. It contains more detail on terrestrial and aquatic habitat, and specific species that have been documented or would be expected to be present within the Red Line Corridor.

Existing Conditions

Terrestrial Habitat and Wildlife

The western portion of the corridor contains many communities with large street trees that provide important natural and aesthetic benefits. The far western portion of the corridor, beyond the Baltimore Beltway, and the central portion just west of downtown, contain no notable natural habitat areas near the alignment options. The eastern portion of the corridor contains mostly highly manipulated natural settings like Patterson Park, or abandoned industrial areas were natural vegetation has recolonized on previously developed parcels.

Primary habitat types in the corridor include forests and other areas that are vegetated, but non-forested. Forested habitat within the corridor occurs primarily within the stream valleys of Dead Run and Gwynns Falls, with additional new-growth forested areas along I-895 and the inactive Norfolk-Southern right-of-way. Non-forested habitat is associated primarily with the I-70/I-695, I-695/Security Boulevard, and I-70/Security Boulevard interchanges and portions of Patterson Park and the inactive Norfolk-Southern-Canton rail line. The interchanges and abandoned rail line are comprised of disturbance-tolerant tree, sapling, shrub, vine, and herbaceous species including numerous non-native varieties. Terrestrial portions of Patterson Park are comprised primarily of lawn grasses with scattered larger trees. Throughout the remainder of the corridor, isolated street trees and small patches of lawn grasses provide additional non-forested habitat areas.

One hundred and thirty-seven (137) significant trees, greater than 30-inches in diameter at breast height (DBH), were identified within the corridor. The majority of the significant trees occur naturally within the riparian and adjacent forested uplands associated with Dead Run and Gwynns Falls. There are also many large street trees along Security Boulevard and the intersection of Cooks Lane and US 40. The significant trees are represented by 21 different species ranging in size from 30 to 65.7 inches DBH.

The presence of terrestrial wildlife within the corridor is a function of available habitats. Because of the urban and built-up land uses present within the corridor, native wildlife species would be expected to be mostly restricted to the less developed areas such as the stream valleys of Dead Run and Gwynns Falls. These forested stream valleys also provide habitat for more sensitive wildlife

such as forest interior dwelling bird species (FIDS) that require large, mature forested areas to successfully reproduce. More open, early successional habitats, such as those found within the interchanges at the western end of the corridor and the inactive rail line at the eastern end of the study, provide habitat for disturbance-tolerant species and species adapted to woodland/field edges.

Aquatic Habitat and Species

In general, the aquatic habitat and biological communities in corridor surface waters reflect the high degree of urbanization in their associated watersheds. While the Maryland Biological Stream Survey (MBSS) sampled a few stream sites that resulted in a fair or good rating for fish or aquatic habitat, most aquatic communities sampled were found to be in the poor and very poor range. These results are in keeping with the high degree of paved surfaces in the corridor watersheds, which contribute pollutants and limit the quality of aquatic habitat in corridor streams.

Potential Impacts

Alternative 1: No-Build, would not involve any project-related construction or changes to the natural environment. As a result, project-related environmental effects from Alternative 1: No-Build are not anticipated.

The impacts from the build alternatives are described as follows.

Terrestrial Habitat and Wildlife

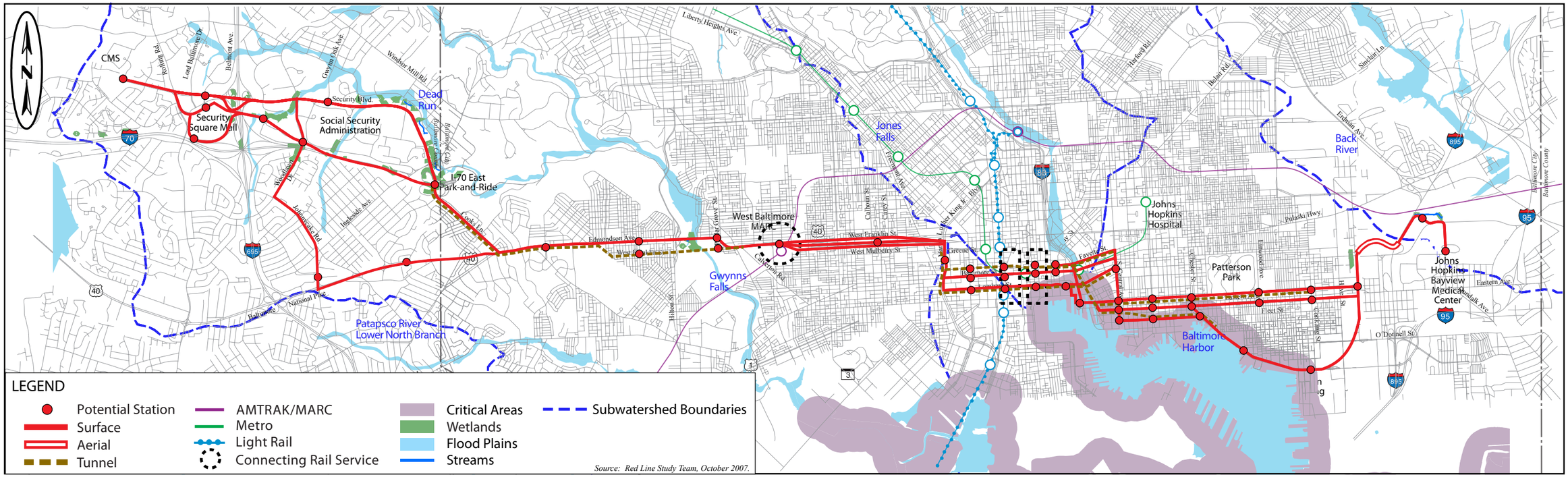
Forested habitat impacts would result from all potential build alternatives and their component options. All of these impacts would occur between I-695 to Gwynns Falls and between Conkling Street and the Bayview Medical Campus. Forest impacts from the project would occur primarily to upland, deciduous forest habitat that occurs along Security Boulevard between Woodlawn Drive and I-70. The greatest impacts in this area are associated with potential parking lots and maintenance facility options in the I-70 Park-and-ride. Very minor impacts would also occur to the stream valley forest habitat at the transitway crossing of Gwynns Falls along US 40/Edmondson Avenue. The least amount of forest impact would occur under Alternative 2: TSM (16.29 acres), while the most would occur under Alternative 3: BRT and Alternative 4: LRT when these alternatives include dedicated transit on the south side of Security Boulevard and in the median of I-70. The need for surface parking lots at the I-70 Park-and-Ride would result in similar impacts of around 17 acres of forest loss for Alternative 3: BRT and Alternative 4: LRT.

All of the build alternatives would impact at least one significant tree, although none of the build alternatives would impact the majority of the significant trees identified along the corridor. Alternative 3: BRT would impact as little as one significant tree, depending on which transit option is selected. All of the other build alternatives would result in the loss of a number of large trees in the area between Woodlawn Drive and Edmondson Avenue (US 40) where mature street trees exist along Security Boulevard and Cooks Lane. The cut-and-cover construction of the Cooks Lane tunnel portal (BRT and LRT options) would lead to the greatest impact. Options with a curbside transit lane along US 40 would have no impact to significant trees, while the options along US 40 with a dedicated transit lane in the median would have the greatest impact in this area (nine trees).

Aquatic Habitat and Species

All of the build alternatives would reduce aquatic habitat within the corridor to a small degree. Extension of culverts could lead to direct loss of fish and macroinvertebrates within the construction zone and would permanently alter the available habitat in the impact area. However, the species expected to be impacted are adapted to disturbed settings and would be likely to colonize the area again. During operation of the build alternatives, the BRT and LRT would have similar potential to increase water quality degradation from stormwater runoff because greater impervious (paved) surfaces from either mode could affect water quality. However, the small incremental impervious impacts that could be expected from the project are unlikely to affect aquatic habitat or the makeup of biological communities to an appreciable degree.

Figure 4-12: Natural Resources



Mitigation Measures

Terrestrial Habitat and Wildlife

Before a sediment and erosion control permit is issued for a project, the Maryland Forest Conservation Act requires that a Forest Stand Delineation (FSD) and a Forest Conservation Plan (FCP) must be submitted and approved by the Maryland Department of Natural Resources (MDNR), Forestry Division. A more detailed forest assessment, including preparation of a FSD and FCP, would need to be completed for the project once an alternative has been selected and more detailed design has been completed. All forest impacts would be addressed and mitigated for in compliance with the Act, which requires the minimization of clearing and cutting of forests and mitigation in compliance with the Forest Conservation Act.

Aquatic Habitat and Species

Potential effects to aquatic habitat and water quality would be minimized by strict adherence to sediment and erosion control and stormwater management plans, which would be developed in accordance with state regulations to provide long-term mitigation of potential effects from stormwater. In addition, in-stream construction would not be performed during the period of fish spawning and early development from March 1 to June 15 in accordance with Maryland's Use I time-of-year restrictions.

Rare, Threatened and Endangered Species

SUMMARY

There are no known rare, threatened, or endangered species within the corridor, and therefore no impacts are anticipated with any of the Red Line alternatives.

Overview

The US Fish and Wildlife Service and the National Marine Fisheries Service regulate and protect federally-listed endangered and threatened species under the Endangered Species Act of 1973. In Maryland, state and federal rare, threatened, and endangered species are regulated by the Maryland Department of Natural Resources (MDNR), Wildlife and Heritage Service.

Existing Conditions

There are no known rare, threatened, or endangered species within the corridor, as documented in the letter (dated May 2, 2006) from the MDNR, Wildlife and Heritage Service.

Potential Impacts

No impacts to rare, threatened or endangered species are anticipated in the corridor.

Mitigation Measures

No mitigation measures are required.

Surface and Groundwater Resources

SUMMARY

Maryland Department of the Environment manages Maryland's surface and groundwater resources. All of the surface waters in the corridor have high amounts of trash, channelization and chemical water quality problems. Project-related effects to surface and groundwater are not anticipated with the No-Build Alternative. All of the build alternatives have the potential to increase levels of certain contaminants within affected surface waters. Sediment and erosion control plans and stormwater best management practices implemented during the construction will minimize changes in corridor water quality. The construction of a surface or tunnel alignment is anticipated to have minor affects on groundwater in the corridor. Prior to construction, MDE approval will be required.

Overview

The Maryland Department of the Environment (MDE) manages Maryland's surface and groundwater resources to maintain safe reliable drinking water supplies and restore Maryland's water and wetlands. For more information, please, refer to the *Natural Resources Technical Report* on the DVD attached to this document.

Existing Conditions

Surface Water

The entire corridor is contained within the Patapsco River watershed. Two main subwatersheds, Gwynns Falls and Jones Falls, comprise most of the corridor. Dead Run, a tributary to Gwynns Falls, parallels a substantial portion of the western corridor, from I-695 to I-70. In addition, a small portion of the Lower North Branch of the Patapsco River is located in the far western portion of the corridor, and the Back River subwatershed is located in the far eastern portion of the corridor. With the exception of Back River, all of these subwatersheds drain into the Baltimore Harbor, located at the southern edge of the corridor.

The Gwynns Falls and Jones Falls subwatersheds are characterized by high amounts of impervious (paved) surfaces and low amounts of forested land uses. Over 50 percent of the stream miles within Baltimore City have little or no vegetated riparian buffers. All of the corridor surface waters have high amounts of trash, channelization, and chemical water quality problems such as elevated levels of fecal coliform from sewage overflows, and low dissolved oxygen are common. The Back River subwatershed is one of the most densely populated watersheds within the Chesapeake Bay drainage basin (MDE 2007). Residential and commercial land uses make up 91 percent of the watershed and high amounts of refuse and channelization impact the system. Herring Run, a primary tributary to Back River, is located just north of the corridor and receives drainage from the project area, although it is not directly crossed by the corridor.

Groundwater

Based on information gathered from the US Geological Survey (USGS), Maryland Groundwater Survey, and the MDE, the corridor includes two different types of aquifers–one in the Coastal Plain and one in the Piedmont. An aquifer is a geologic formation such as fractured rock or coarse sand, which possesses the porosity required to store and transmit water in usable quantities. The portion of the corridor west of Gwynns Falls is underlain by the relatively low-yielding Crystalline-Rock aquifers of the Piedmont while the eastern portion is underlain by the more productive Potomac Aquifer of the Coastal Plain.

The corridor is entirely located in the Greater Baltimore area that relies on surface water withdrawals to provide drinking water. Groundwater withdrawals that do occur in the corridor occur primarily for industrial uses.

Potential Impacts

Alternative 1: No-Build would not involve any project-related construction or changes to the natural environment. As a result, project-related environmental effects from Alternative 1: No-Build are not anticipated. The impacts from the build alternatives are described below.

Surface Waters

All of the build alternatives and options have the potential to increase levels of certain contaminants within the affected surface waters. These increases would be expected to be minimized with the use of approved sediment and erosion control during construction and implementation of stormwater best management practices, as required by MDE. However, the build alternatives could still affect water quality to some degree, exacerbating problems within subwatersheds where contaminant levels are already elevated.

Potential impacts during construction include physical disturbances or alterations, accidental spills, and sediment releases that can affect aquatic life. During construction, wind and rain could severely erode large areas of soil that would be exposed following the removal of vegetation and naturally-occurring soil stabilizers. Erosion of these exposed soils can considerably increase the sediment load to receiving waters (Barrett 1995). While all of the build alternatives have the potential to affect existing surface water to some degree, the relatively small amount of new impervious surfaces and related pollutants that the project would add to the highly urbanized setting of the corridor would be expected to cause only minimal changes, if any, in corridor water quality.

After construction, impacts associated with the use of the transitway, would be mainly based on the potential for contamination of surface waters by run-off from new impervious surfaces. These runoff constituents can be grouped as heavy metals, salt, organic molecules, and nutrients (Trombulak 1999).

Groundwater

Alternatives constructed completely on the surface are anticipated to have minor affects to groundwater in the corridor. Only small changes in the movements of the shallow groundwater table are likely to occur during grading and construction of the project facilities. In addition, the urbanized nature of the corridor and soils make it unlikely that runoff from the transitway, after

construction, would reach the groundwater table. Instead, any runoff would be treated in accordance with MDE guidelines for stormwater management and released to surface waters.

The Martin Luther King, Jr. Boulevard and Fayette/ Lombard Street tunnels would be relatively shallow, and likely to only affect the shallow groundwater table rather than the much deeper and important groundwater aquifers of the Coastal Plain. Where tunnels are planned in the Piedmont (Cooks Lane tunnel and US 40 and West Franklin Street tunnel), tunnel boring would likely intercept the rock fracture aquifers that are typical of this physiographic province, potentially causing a minor change in localized groundwater paths. These minor changes, however, would not be expected to affect overall groundwater flows or quantities.

Mitigation Measures

Surface Waters

During construction, the potential for water quality impacts 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.

Groundwater

Construction of any of the tunnels is likely to involve temporary lowering of the local groundwater level, as water would need to be pumped out to allow for tunnel construction activities. During the geotechnical investigations that would occur in later phases of the project, a groundwater testing program would be undertaken to identify any potential groundwater or soil contaminants that could be encountered during tunnel construction. 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.

Waters of the United States Including Wetlands

SUMMARY

Waters of the US including wetlands are regulated by the Army Corp of Engineers (ACOE) and the Maryland Department of Environment (MDE). All Waters of the US including wetlands within 100 feet of the Red Line alternatives and station areas were surveyed. Project-related effects to Waters of the US including wetlands are not anticipated with the No-Build Alternative. Alternative 2: TSM would not affect any wetlands, but would potentially affect 12 linear feet of streams. Corridor wide, Alternative 3: BRT and Alternative 4: LRT would potentially affect 0.16 acres of wetlands, except for Alternative 3E which would impact 0.15 acres of wetlands and Alternative 3F would have no impacts to wetlands. Corridor wide the effects to Waters of the US for Alternative 4: LRT would be 446 linear feet and for Alternative 3: BRT would be 456 linear feet, except for Alternative 3E (187 linear feet) and Alternative 3F (12 linear feet). Coordination with ACOE and MDE will be required in later phases of the project to make a final determination on the appropriate mitigation and permits needed for the Locally Preferred Alternative.

Overview

Waters of the United States, including wetlands, are regulated under Section 401 and 404 of the Clean Water Act, the Maryland Tidal Wetlands Act, and the State of Maryland Nontidal Wetlands Protection Act. There are no tidal wetlands identified along the project alternatives. However, effects to nontidal resources may require a Maryland Nontidal Wetlands Permit, a Section 401 Water Quality Certificate, and a Waterway Construction Permit from the MDE, as well as a Section 404 permit from the US Army Corps of Engineers (ACOE) for the discharge of dredged or fill material into Waters of the United States, including wetlands.

All Waters of the United States, including wetlands, within 100 feet of the alternatives and station areas were identified and flagged in accordance with the 1987 Corps of Engineers Wetland Delineation Manual (ACOE, 1987). At the time of the delineation, the ACOE considered ephemeral channels within their jurisdiction. During wet-weather conditions, ephemeral channels carry excess water run-off to regulated wetlands and streams. In mid-2006, the US Supreme Court in Rapanos v. US and Carabell v. US Army Corps of Engineers, 126 S.Ct 2208 ruled that the ACOE would be unlikely to have jurisdiction over these areas. A jurisdictional determination would need to be obtained in later phases of the project once a Locally Preferred Alternative is identified.

Under recently released guidance from the ACOE, the identified ephemeral channels would need to be evaluated in more detail to determine if they are jurisdictional under the new ruling. Based on technical information in the guidance, it is unlikely that most of the identified ephemeral channels would be considered jurisdictional or subject to permitting requirements. However, ephemeral channels potentially affected by the project would remain a consideration until later phases of the project when a jurisdictional determination is obtained.

For more information, refer to the *Natural Environment Technical Report* on the DVD attached to this document.

Existing Conditions

Field investigations identified Waters of the United States, including wetlands, in the corridor. Fourteen of these areas were vegetated palustrine wetlands, some of which also included perennial or intermittent stream channels. Seventeen of the systems were perennial or intermittent stream channels (Waters of the United States) with no adjacent vegetated wetlands. In addition, 11 ephemeral channels that carry wet weather flows to other Waters of the United States were identified and flagged.

All of the Waters of the United States, including wetlands, have been influenced to some degree by the intense development in the 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 wildlife habitat and sediment trapping. The least impacted and highest functioning wetlands in the corridor are those vegetated systems located in the forested floodplains of streams such as Dead Run and Gwynns Falls. These wetlands would be expected to provide groundwater discharge/recharge, flood absorption, terrestrial and aquatic wildlife habitat, and water quality benefits such as nutrient uptake and sediment trapping.

Potential Impacts

Alternative 1: No-Build

Alternative 1: No-Build would not involve any project-related construction or changes to the natural environment. As a result, project-related environmental effects from Alternative 1: No-Build are not anticipated.

Alternative 2: TSM

Alternative 2: TSM would not impact any vegetated wetlands. Alternative 2: TSM would affect 12 linear feet of stream channel.

Alternative 3: BRT and Alternative 4: LRT

In accordance with Section 404 of the Clean Water Act and the Maryland Nontidal Wetlands Protection Act, efforts have been made to reduce the potential for impacts to Waters of the United States, including wetlands, wherever possible. As a result, potential effects to these resources from Alternatives 3 and 4 are minimal.

The greatest effect to stream channels would occur under those build alternatives with dedicated transit on the north side of I-70 which would result in 446 linear feet of impact.

The build alternatives would affect Waters of the United States, including wetlands, located on the western side of the corridor, just inside the Baltimore Beltway and on the eastern end of the corridor within the abandoned Norfolk-Southern railroad right-of-way. Effects in the western portion of the corridor would occur because the existing roads that would be reconfigured or expanded to accommodate the transit alignments would cross or closely parallel Dead Run and its tributary drainages, making complete avoidance of impacts to the system difficult.

In the eastern portion, impacts would occur in the abandoned rail right-of-way to wetlands that have formed from unmaintained drainage structures. In other areas, there are either no identified Waters of the United States, or the resources identified would not be impacted by any of the proposed options. Impacts to vegetated wetlands from the build alternatives and their component options are generally small and similar between alternatives,

with impacts. So corridor-wide, Alternative 3: BRT and Alternative 4: LRT would potentially affect 0.16 acres of wetlands, except for Alternative 3E which would impact 0.15 acres of wetlands and Alternative 3F would have no impacts to wetlands. Corridor-wide the effects to Waters of the US for Alternative 4: LRT would be 446 linear feet and for Alternative 3: BRT would be 456 linear feet, except for Alternative 3E (187 linear feet) and Alternative 3F (12 linear feet).

Effects to streams or vegetated wetlands from any of the build alternatives may require a Maryland Nontidal Wetlands Permit, a Section 401 Water Quality Certificate, and a Waterway Construction Permit from the MDE, as well as a Section 404 permit from the ACOE for the discharge of dredged or fill material into Waters of the United States, including wetlands. Because impacts to Waters of the United States, including wetlands, under any of the build alternatives would be expected to total less than an acre, based on preliminary designs, the project is anticipated to qualify for a Maryland State Programmatic General Permit (MDSPGP-3).

Mitigation Measures

Appropriate mitigation measures for stream and wetland impacts will be identified for any of the build alternatives during final design. Coordination with the ACOE and MDE would be required in later phases of the project to make a final determination of the need for permits and determine mitigation requirements for the Locally Preferred Alternative.

Floodplains

SUMMARY

Floodplains in the corridor are located along the Gwynns Falls, Dead Run, Maiden's Choice, the Jones Falls, and the Patapsco River. No effects to floodplains are anticipated with the No-Build Alternative. The build alternatives have the potential to have a minor affect the Dead Run floodplain and the Patapsco River floodplain. Techniques will be investigated to further minimize or avoid impacts in floodplain areas and the Locally Preferred Alternative will be design in accordance with FEMA approved local floodplain construction requirements. Any construction within the 100-year floodplain would also require a permit from the Maryland Department of Environment.

Overview

Several federal regulations govern fill and construction in floodplains to ensure that proper consideration is given to the avoidance and mitigation of adverse floodplain effects. These regulations include Executive Order 11988, US Department of Transportation Order 5650.2, entitled "Floodplain Management and Protection", and the National Flood Insurance Act of 1968.

The approximate locations of 100-year floodplain limits in the corridor are based on data from the Federal Emergency Management Agency (FEMA). The 100-year floodplain refers to the areas along or adjacent to a stream or body of water that area capable of storing or conveying floodwaters during a 100-year storm. The approximate locations of the 100-year floodplains in the corridor are shown on Figure 4-12. For more information, refer to the Natural Environment Technical Report on the DVD attached to this document.

Existing Conditions

Floodplains are located along the Gwynns Falls and two of its major tributaries, Dead Run and Maiden's Choice Run, in the western half of the corridor, as well as along the Jones Falls and the tidal Patapsco River in the eastern half of the corridor.

Potential Impacts

The significance of floodplain encroachment was evaluated with respect to the criteria in Executive Order 11988 (Floodplain Management) and US DOT Order 5650.2. The majority of the floodplain encroachments from the proposed alternatives would be from traverse crossings of floodplains not from longitudinal encroachments which were avoided. Longitudinal crossings have been avoided because they would result in more floodplain fill, reducing conveyance and floodplain storage. A summary of the potential encroachments into FEMA-designated 100-year floodplains for each alternative follows.

Alternative 1: No-Build

Alternative 1: No-Build would not involve any project-related construction or changes to the natural environment. As a result, project-related environmental effects from Alternative 1: No-Build are not anticipated.

Alternative 2: TSM, Alternative 3: BRT, and Alternative 4: LRT

The build alternatives have the potential to affect the nontidal floodplains of Dead Run and its tributaries as well as the tidal floodplain of the Patapsco River/ Baltimore Harbor. Otherwise, no floodplain impacts are anticipated.

The potential for floodplain impacts from the build alternatives occur in non-tidal floodplain areas found between Rolling Road and the I-70 Park-and-Ride. In these areas, culvert extensions for crossings of Dead Run or its tributaries or widening of an existing road berm would require that fill be placed in the 100-year floodplain to accommodate the transitway.

In the tidal Patapsco River floodplain, placement of substantial amounts of fill is not anticipated, and existing grades would remain largely unchanged. Project-related activities in the tidal floodplains in the downtown area related to any of the alternatives are not expected to have a negative effect on flood levels or alter floodplain boundaries.

Individual impacts to any one floodplain area are relatively small. Efforts to avoid and minimize impacts to 100-year floodplain will continue as the project moves into preliminary engineering and final design. Hydraulic and hydrologic studies would be performed to determine if any floodplain encroachments would have negative effects on storage areas for floodwaters or alter flooding characteristics. Techniques that will be investigated to further minimize or avoid impacts may include alignment shifts to ensure the narrowest possible crossing and bridging of floodwaters to further reduce encroachment and allow for unrestricted passage of floodwaters.

Mitigation Measures

All construction occurring within the FEMA designated 100-year floodplain must comply with FEMA approved local floodplain construction requirements. These requirements consider structural evaluations, fill levels, and grading elevations. 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 shall 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.

Construction within the 100-year floodplain would also require a Waterway Construction Permit from the MDE. All transit facilities located within the floodplain would be designed to comply with Maryland floodplain regulations.

Critical Area

SUMMARY

Maryland's Critical Area Act protects the land that falls within 1,000 feet of tidal waters of the Chesapeake Bay and its tributaries. The portion of the Red Line corridor within the Critical Area extends from approximately Charles Street to Conkling Street in Canton. No effects to the Critical Area are anticipated with the Red Line No-Build Alternative. All of the surface alignments with the build alternatives have the potential to effect land within the Critical Area. The surface alignments with Alternative 4: LRT would have higher effects on areas in the Critical Area over Alternatives 2 and 3. The greatest effect to land in the Critical Area occurs with the options along Boston Street. Review of the project by the Critical Area Commission will be required if a build alternative is chosen as the Locally Preferred Alternative and land within the Critical Area will be affected.

Overview

Maryland's Critical Area Act gives special protection to areas that fall within 1,000 feet of tidal waters of the Chesapeake Bay and its tributaries. For more information, please refer to the *Natural Environment Technical Report* on the DVD attached to this document.

Existing Conditions

A portion of the corridor, surrounding the Baltimore Harbor, is located within the Critical Area extending from approximately Charles Street to Conkling Street in Canton. This portion of the Critical Area is designated as an area of Intense Development and development within the Critical Area subject to review by the Critical Area Commission.

Potential Impacts

Alternative 1: No-Build

Alternative 1: No-Build would not involve any project-related construction or changes to the natural environment. As a result, project-related environmental effects from Alternative 1 are not anticipated.

Alternative 2: TSM, Alternative 3: BRT and Alternative 4: LRT

With the exception of build alternatives in tunnel throughout the harbor area, all of the build alternatives cross portions of the Critical Area associated with the Baltimore Harbor between downtown and Canton. In general, Alternative 4: LRT surface alternatives would convert more unpaved area to impervious surfaces than Alternative 3: BRT, though this could vary, somewhat, depending on which options are selected. The option with the greatest disturbance of unpaved areas within the Critical Area is in the downtown area (2.82 acres) under Alternative 4: LRT with any of the Eastern-Fleet couplet options. The surface options under Alternative 4: LRT also have notably higher effects to the Critical Area, compared to the surface options under Alternative 3: BRT, with the greatest effect in this area (5.64 acres) occurring with the LRT options along Boston Street.

Mitigation Measures

Development within the Critical Area buffer is subject to review by the Critical Area Commission (CAC). As part of their review, the CAC would require the Red Line 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. As a result, alternatives that would result in the greatest conversion of pervious areas to impervious areas would require the greatest pollution reductions. Pollution reduction requirements may be accomplished on-site either by installing adequate stormwater management. The CAC will also require mitigation for impacts to land within the Critical Area. This mitigation will be in the form of plantings.

Other Natural Features

SUMMARY

A preliminary review of the soils, geology and topography in the corridor was conducted to reveal any subsurface conditions that could lead to problems during construction. No long-term effects to soils, geology, or topography are anticipated with any of the alternatives in the corridor.

Overview

The Red Line Corridor has been preliminarily evaluated with respect to the soils, geology, and topography. The investigation was conducted to reveal any adverse subsurface conditions that could lead to construction difficulties, excessive maintenance, or possible failure of the structures.

Existing Conditions

Geology and Topography

Maryland has various physiographic provinces which have different landscapes that are influenced by the underlying geology. A physiographic province is an area that is outlined according to similar terrain that has been shaped by a common geologic history.

The Red Line alignments cross from the Piedmont province in the western part of the corridor from approximately the Security Square Mall area to the West Baltimore MARC Station area, into the Coastal Plain province in the eastern part of the corridor from approximately the West Baltimore MARC Station area to the Bayview Hospital area.

The Coastal Plain province has layers of sediments that were deposited by water. Sediments are defined as soil fragments that are carried and deposited by wind, water or ice. The Coastal Plain sediments form a wedge which is thinnest at the boundary with the Piedmont bedrock. The wedge of sediments thickens toward the southeast. The boundary area between the Piedmont province and the Coastal Plain province is called the Fall Zone. The rock types that exist in the Piedmont area include amphibolite, serpentinite, gneiss, pegmatite, and schist. In the Coastal Plain province, sediments of various grain sizes are present, including gravel, sand, silt and clay.

The Red Line Corridor extends through low rolling hills for its entire length.

Soils

The typical soil profile for the Piedmont region is made up of residual soils, weathered rock, and bedrock. The depth to bedrock along the western section of the alignment typically ranges from 0 to 50 feet. The residual soils are a product of the in-situ weathering of the underlying bedrock material. The soils in this area generally consist of sandy and silty clay, silt, and silty sand. The residual soil transitions into weathered rock. The bedrock encountered along the western portion of the alignment consists of gneiss and amphibolite.

The Coastal Plain region is made up of sedimentary soil. The formations that were encountered during the investigation are interchanging layers of sand and clay. From the Fall Zone, the Coastal Plain soils increase in depth from west to east.

Design and Construction Considerations

The main soils and geology consideration for the design and construction of the Red Line Corridor is the tunnel installation. Soft ground and hard rock tunneling will be encountered during construction. The proposed tunnel alignments may encounter mixed face conditions and groundwater.

The method of excavating bored tunnels depends heavily upon the nature of the subsurface materials. Soft ground and hard rock tunneling will require different excavating procedures and will involve different types of monitoring of displacements to existing structures. In soft ground tunneling, dewatering methods become a critical aspect of the excavation. It is possible to pump too rapidly causing piping or underground erosion. The distribution of stresses due to lowering the ground water level can also cause ground settlements that can damage existing structures if not carefully monitored.

Mixed face conditions are areas where the tunnel face encounters a soil to rock interface during construction. The construction equipment must be able to handle the soil and rock at the same time. Also, the groundwater tends to concentrate at the interface of soil and rock. Dewatering the soil is difficult because the top surface of the rock forms a low permeability base that limits drawdown of ground water.

Potential Impacts

No long-term impacts to soils, geology, or topography are anticipated as a result of any of the alternatives along the corridor.

Mitigation Measures

No mitigation measures are required.

Construction Activities, Impacts, and Mitigation Measures

SUMMARY

There would be no construction activities with the No-Build Alternatives; therefore no impacts are anticipated or mitigation required. Alternative 2: TSM would have a minor amount of construction along the Red Line Corridor for spot pavement repairs, utility adjustments, station construction, and sidewalk repairs near stations. The construction effects with Alternative 2 would be localized and minor, such as noise and vibration from construction equipment temporary interruptions to vehicular and pedestrian traffic.

Alternatives 3 or 4 would result in construction impacts; however, the impacts vary depending on the alignment and options selected. Surface options for either BRT or LRT would involve construction along existing roadways and possibly new right-of-way. The impacts associated with the construction of a surface option could include: emissions and dust from construction vehicles, noise, temporary interruptions to vehicular and pedestrian traffic, and temporary loss of on-street parking. The construction of a tunnel alignment for Alternatives 3 or 4 would result in localized impacts at the mucking shaft and portal cut-and-cover locations. The most noticeable impacts associated with the construction of a tunnel would be transportation to and from the mucking shafts and cut-and-cover locations.

Construction impacts will vary throughout the corridor depending on street characteristics, frontage along that street, and the type of transit operation proposed. If a build alternative is chosen as the Locally Preferred Alternative, construction-related impacts could be avoided or minimized.

Alternative 1: No-Build and Alternative 2: TSM would not involve construction activities.

Alternative 3: BRT and Alternative 4: LRT consist of a combination of the transit options discussed below. Construction activities would vary depending on the build alternative.

Surface Options

- Shared Lanes (BRT only) - The addition of BRT to shared traffic lanes involves minimal construction and therefore the lowest level of impacts. Construction could include spot pavement repairs to smooth the riding surface, pothole repairs, and inlet and manhole cover adjustments.
- Dedicated LRT or BRT Transitway in Street Lanes or Medians - This configuration could involve two parallel streets with one track or bus lane on each street (couplet options), one street with two tracks or two bus lanes (dedicated right-of-way), or two tracks or bus lanes within a street median. Construction activities would be similar for all three options. The BRT alignment would involve full-depth concrete pavement replacement and could require utility adjustments or relocations. There could be advantages to running BRT along the interior lanes or medians on streets previously occupied by streetcars, such as Edmondson Avenue, as those lanes are likely to be relatively free of older utilities.

  Modern LRT embedded track construction typically involves continuously welded rail (CWR) embedded in either cast-in-place or precast concrete. Track assembly and concrete work would be completed one segment at a time.
- Dedicated LRT or BRT Transitway on Private Rights-of-Way - Construction for this type of transit operation will typically involve the creation of a completely new busway (BRT) or trackbed (LRT), typically resulting in minimal infrastructure disruption but requiring the taking of private property.

  Additional construction may include: transit stations and parking; storm drainage and utility relocations; construction of grade crossings for intersecting streets and driveways; installation of the overhead wire system (known as the catenary) and transformers for LRT; and other support systems.

Tunnel and Related Underground Options

The Red Line Corridor Transit Study has identified sections along the alternatives that could be constructed as tunnels.

Bored Tunnels

Preliminary profiles through the central business district, along Lombard and Fayette Streets, locate the tunnels above rock line but below groundwater level. Tunnel options along Cooks Lane would likely be constructed through rock, but above groundwater level. The deeper tunnels could be twin bored circular tunnels constructed using a tunnel boring machine. Due to expected high groundwater conditions, notably the east-west alignment options through the central business district, it is expected that an earth pressure balance machine or a slurry face machine would be used, which eliminates the need for compressed air and its associated safety risks and high labor costs.

The tunnels are typically constructed from one portal location, known as the "mucking shaft", through to the far portal. The mucking shaft is the scene of most of the visible tunnel activity, as it is the passageway through which the excavated material (muck) is removed and the tunnel lining segments and construction materials enter. The mucking shaft will require approximately two acres for a laydown and staging area and a ventilation plant; this would also be a source of the noise, air pollution and dust. Due to the laydown area required for the mucking operation, the tunnels through the central business district would need to be driven from west to east, from the portal locations on the west side of Martin Luther King, Jr. Boulevard.

As the tunnels rise to the surface and join with approaching portals, and in other areas where shallow tunnels are necessary, construction of bored tunnels would end and be replaced by cut-and-cover construction.

Stations, Shafts, Cut-and-Cover Tunnels and Portals

Stations, shafts, cut-and-cover tunnels, and portals require very similar construction techniques. All require top-down construction with large excavations in public streets, major utility relocations, and temporary diversions of traffic. "Top-down" construction is a method of installing an excavation system by first constructing vertical supports, known as soldier piles, in bored holes, and then installing lagging (insulation used to prevent heat diffusion) between soldier piles as the excavation progresses downward. As the excavation reaches each predetermined level, a system of internal bracing or tie backs is installed. The first level of bracing, just below the street surface, also serves as framing to carry temporary decking upon which traffic can operate as work goes on below. Upon completion of the excavation, the permanent structure is constructed from the bottom up and each level of bracing is removed as the loads are transferred to the previously completed structure.

Stations typically require excavations to depths of 50 to 70 feet, and an excavated length of 450 to 650 feet. The width of the station excavations in the central business district may be limited to as little as 66 feet, which is the space between building faces on opposite sides of the street.

Tunnel portals are constructed similarly, except that they may lie outside of streets, not requiring decking over and maintenance of traffic, and that one end of the structure "daylights" and requires minimal excavation support.

LRT or BRT Storage and Maintenance Facilities

Construction of storage and maintenance facilities will begin with the establishment of appropriate entrances and access roads into and through the job site. Once site access has been established, erosion and sediment control measures within and around the perimeter of the site would be installed, a construction staging area set up, and clearing and removal of existing structures and grading would begin. Subsurface utilities would be installed during the same time as the initial grading operations. Once the grade has been attained, sub-ballast for LRT or sub-base for BRT can be placed.

For LRT, the ballast would be placed, yard tracks would be laid, and switch machines, yard lighting and the catenary system would be installed. While the maintenance building is constructed, work in the storage yard would also progress. As the project approaches completion, parking lots would be paved and striped, sidewalks poured and planting areas landscaped.

Construction Impacts and Mitigation Measures

Any build alternative would have construction impacts. These impacts are discussed in general terms in this section by the types of impacts, such as to neighborhoods, traffic, natural resources, and cultural resources.

Specific impacts of construction, and associated mitigation measures, will be addressed in the next project phase, Preliminary Engineering/Final EIS for any selected alternative.

Construction impacts will vary throughout the Red Line Corridor due to differences in street characteristics, street frontage along the route, and the type of transit operation proposed. A general discussion of the level and type of impacts for each alternative follows.

Alternative 1: No-Build

There would be no construction activities with Alternative 1: No-Build; therefore, no impacts are anticipated or mitigation required.

Alternative 2: TSM

Alternative 2: TSM would involve a minor amount of new construction along the Red Line Corridor including spot pavement repairs, utility adjustments, station construction, and sidewalk repairs near stations. The construction effects would be localized and minor, typically consisting of noise and vibration from construction equipment, and temporary interruptions of vehicular and pedestrian traffic. The MTA would work with communities to minimize potential effects. Mitigation could include route detours, signage, and other methods to inform residents of upcoming construction activities.

Alternative 3: BRT and Alternative 4: LRT

Surface options for Alternative 3: BRT and Alternative 4: LRT would involve a substantial amount of construction along existing roadways and potentially along new rights-of-way. As a result, potential impacts include emissions, fugitive dust, noise and vibration from construction equipment, temporary interruptions to vehicular and pedestrian traffic, temporary loss of on-street parking, and temporary loss of utility services.

Construction-related effects associated with the various tunnel options for Alternative 3: BRT and Alternative 4: LRT would be more substantial than the surface options. Tunnels typically take longer to construct than surface streets or transitways. While the general public would not see most of the tunnel construction, localized environmental impacts would be expected. The more noticeable impacts would result in the hauling of excavated materials from the muck shafts and the shipping of liner segments, concrete and other materials to the shafts. For a typical tunneling operation, assuming a single bore at a time, and a production rate of 60 feet per day, approximately 85 ten-yard truckloads of excavated materials will be removed per day.

With proper planning and implementation, construction-related impacts to neighborhoods and natural resources could be avoided or minimized. The following sections

describe the short-term effects for Alternative 3: BRT and Alternative 4: LRT in more detail.

Air Quality During Construction

Temporary air quality impacts would be associated with equipment exhausts and dust generated by excavation and hauling activities. Air polluting emissions from construction equipment can be minimized by proper engine maintenance and code enforcement.

Fugitive dust is generated as construction vehicles travel on temporary haul roads and from handling of excavated materials and debris. Dust is also generated by wind erosion of unprotected or non-stabilized earth surfaces and stockpiles. Dust control measures may include: application of water and calcium chloride to haul roads; providing and using truck wheel wash stands where vehicles enter public/paved streets; enforcing the Maryland law requiring covered trucks; minimization of exposed, erosion prone areas to the greatest extent possible; stabilization of exposed earth with grass, geotextile fabric (a man-made fabric used in the control of soil erosion), ground cover, paving, or other finished surface as early as possible; and covering or shielding stockpiled materials from the wind.

Construction Impacts on Noise and Vibration from Construction

Impacts from construction noise are determined by the distance of construction activities to sensitive land uses, and the timing and duration of the noise generating activity. Typically, the various phases of a construction project will generate different levels and quality of noises based on the mix of equipment in use at that time. The dominant sources of construction noise are the diesel engine, impact pile driving, pavement breaking, blasting, and back-up alarms activities.

Measures that can be used to lessen construction noise fall into two general categories: 1) design considerations; and 2) construction staging and/or sequencing of operations. Design considerations would include: erecting temporary walls or earth berms between the noise source and the sensitive receptor, the identification of haul routes that avoid sensitive receptors to the maximum extent possible; and locating stationary noise generating equipment at a distance from sensitive receptors.

Support in the form of excavation systems using soldier piles placed in pre-augered holes, rather than driven piles, could assist in reducing noise during the construction of underground stations, shafts and portals. The goal would be to avoid blasting but, if the need is encountered, local codes and restrictions would prevail. The major noise generators related to the tunnel and station construction would be associated with the mucking operation and the tunnel ventilation plant during excavation. Properly installed and maintained mufflers on diesel equipment and air compressors would substantially reduce noise impacts.

Construction activities should be planned to avoid prolonged noise generating activities and to minimize construction activities during the most sensitive time of day or night.

Construction activities can result in varying degrees of ground vibration that diminish in strength with distance. Construction activities that typically generate the most severe vibrations are impact pile driving and blasting. Smaller, less perceptible vibrations will also occur in tunneling, primarily with each "shove", or advancement, by the hydraulic jacks.

Mitigation measures may include restricted activities near vibration sensitive receptors. Construction staging considerations could include limited hours of loading and hauling operations, stockpiling excavated materials in the station excavation during non-haul hours, the use of rubber-tired excavation equipment instead of tracked equipment, and disabling backup alarms on trucks operating in sensitive areas.

Construction Impacts to Water Quality, Wetlands and Floodplains

Earthwork would be required during the construction of the project, and exposed soils could result in site erosion and sedimentation impacts to nearby water resources. The construction of tunnels and underground stations, and possibly other system elements, will require dewatering of excavation sites. The dewatering water may contain suspended sediments and contaminants that could affect receiving waters.

A Stormwater Pollution Prevention Plan (SWPPP) would be prepared and implemented. The SWPPP would, as a minimum, identify appropriate Best Management Practices (BMPs) and include a detailed monitoring program.

Construction Impacts on Contaminated Soils and Hazardous Materials

Excavations for a new LRT track or a BRT lane would be no deeper than the existing pavement section, and would not be expected to encounter soil contaminants or hazardous materials. In deeper excavations, such as for utility relocations, contaminants could be encountered.

In tunnels, much of the profile would be below the groundwater level at which many petroleum products, from spills or leaking tanks, remain suspended and could be exposed. Some volatile organic compounds may be expected and, as a precautionary measure, the specifications would require blast-proofing all tunneling equipment, including the boring machine and all incidental equipment that would operate in the tunnel environment. An appropriate ventilation plan would be established in the event of an unexpected encounter with a volatile material.

Public Safety During Construction

Particular attention will be given to maintaining public safety during the construction period. Public access to construction areas will be limited to the greatest extent possible. This can be accomplished with temporary fencing, warning signs and other safety precautions.

Construction Impacts on Historic Structures

BRT and LRT tunnel segments would require excavation using a cut-and-cover process to transition from the surface to a bored-tunnel portion of the tunnel segment. Where these excavations occur directly adjacent to an individual historic structure, the effects that potential construction vibrations and soil subsidence may have on these adjacent structures will be evaluated. During the AA/DEIS process, a preliminary subsurface investigation program was conducted along the proposed alignment. The purpose of this program was to provide a conceptual idea of what design options are available, to provide an indication of the locations of any areas along the alignment that may need special consideration and to provide preliminary information for tunneling considerations. The construction of tunnels produce changes in the soil and ground water that have the potential to cause settlement at the ground surface or at overlying structures. Settlement can be caused by the lowering of the ground water table due to external dewatering or by lost ground caused by soil movement at the tunnel boring machine.

Prior to final design, a more detailed subsurface investigation will be implemented and mitigation plans will be developed to prevent damage to overlying structures, particularly historic structures. The following mitigation measures are some of the methods that will be considered to prevent or reduce loss of ground that can cause settlement:

- Establish and install an extensive monitoring program in advance of construction
- Require the use of tunneling equipment and methods that reduce loss of ground
- Ground freezing
- Grouting between tunnel and foundations
- Slurry walls
- Chemical grouting
- Underpinning

These methods have been successfully utilized in numerous tunneling projects located in urban areas, including construction of the Baltimore Metro, Section C segment from Charles Center to John Hopkins Hospital.

In addition to trying to prevent settlement due to loss of ground, an instrumentation program will be considered to constantly measure any ground movement that is occurring. Instrumentation can also be placed on critical structures to measure any potential impacts on the structure during tunneling.

Construction Impacts to Archaeological Resources

Archaeologically significant areas and mitigation measures will be further defined in final design. It is expected that investigations and archiving of artifacts would take place prior to construction, and that the construction effort would be focused on minimizing further disturbance to archaeological resources. Any archaeological finds would be cataloged and protected.

Maintenance of Traffic During Construction

Construction activities would result in temporary interruptions to both vehicular and pedestrian traffic patterns. During various stages of construction, additional traffic would be generated by hauling of construction debris, excavation spoils and building materials. Maintenance of traffic and construction staging would be planned and

scheduled to minimize traffic delays and interruptions to the maximum extent possible. Coordination with and approval by the involved jurisdictions would be required. Appropriate signing, the project website and other notices will be used to notify motorists of road closures and detours, and pedestrians of sidewalk closures and detours. Access to residences and businesses would be maintained to the maximum extent possible, and access for fire and emergency vehicles would be maintained at all times.

Construction Impacts on Neighborhoods

The construction of any of the Red Line build alternatives would result in construction-related effects on neighborhoods within the study area. The nature and severity of the effects would differ between the alternatives. The MTA will work with communities to minimize potential effects. Appropriate signing, the project website and other notices will be used to notify motorists of road closures and detours, and pedestrians of sidewalk closures and detours.

Safety and Security

SUMMARY

SAFETEA-LU requires the evaluation of safety and security during transportation project planning. MTA has developed a System Safety Program Plan and a System Security Program Plan (SSPP) which incorporates safety and security into all MTA operations and services. It is anticipated that under the No Build and TSM Alternatives, safety and security would remain at current levels or follow current trends. Alternatives 3 and 4 would be consistent with MTA's SSPP because existing bus and light rail vehicles are incorporated into the current system safety and security program plans. If a build alternative is chosen as the Locally Preferred Alternative, the MTA will consider safety and security measures during design, construction, and operation of the Red Line. These measures could include a safety and security board, fencing, emergency standards, and video surveillance.

Overview

This section discusses how the overall design and operation of the Red Line could affect safety and security. Potential issues include safety and security of: passengers using the system, transit stations, facilities, vehicles, and employees.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) requires the evaluation of safety and security during transportation project planning. SAFETEA-LU requires each State to consider and implement projects, strategies, and services that increase the safety of the transportation system, safeguard the personal security of all motorized and non-motorized users, and support homeland security. FTA has undertaken a nationwide security program to strengthen security and emergency preparedness plans and coordination with local fire, police, and emergency responders. On June 21, 2007, FTA issued its final version of the circular, Safety and Security Management Guidance for Major Capital Projects. This circular identifies specific safety and security activities that a transit agency must perform and document in a Safety and Security Management Plan.

Other relevant regulations and guidelines include:

- Occupational Safety and Health Administration (OSHA) requirements.
- National Fire Protection Association (NFPA) 130, Standard for Fixed Guideways.
- Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)
- All codes and regulations of Baltimore City and Baltimore County.

Existing Conditions

MTA's priority is to provide a safe and secure transit environment. As part of the continuous effort to secure its transit services and facilities, MTA has developed a System Safety Program Plan and a System Security Program Plan (SSPP). The SSPP, which fulfills FTA's requirement for a Safety and Security Management Plan, incorporates safety and security into all MTA operations and services. The SSPP helps to minimize threats against MTA facilities, passengers, and employees by incorporating security features into the design of the transit facilities. The following sections describe how, through the use of the SSPP and other programs and policies, the MTA promotes an optimal level of safety and security throughout its operations. The Red Line prioject will be designed, constructed and operable to MTA's current SSPP.

Passengers

The SSPP gives all MTA employees and departments the responsibility of upholding the highest level of safety for passengers. Some of these programs and policies include employee rulebooks, operations manuals, and training programs. The MTA also promotes safety and security through passenger and public awareness programs. The goals of the passenger and public awareness programs are to heighten awareness regarding safety, to reduce the occurrence of passenger injuries, and demonstrate a commitment to safety. These awareness programs provide information to the public through a variety of methods including media advertisements, variable message systems, information hotlines, and presentations to area schools and businesses.

Stations and Facilities

The SSPP provides the framework for ensuring passenger and employee safety at all 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, MTA performs frequent inspections of its facilities, tracks, systems, and station areas to provide transit service in the most safe and reliable manner possible.

Vehicles

MTA transit vehicles are equipped with physical safety and security measures to support the overall operation of the transportation system. For example, Metro trains cars are equipped with CCTV that record on 50-hour loops. All buses and mobility vehicles have Automatic Vehicle Locaters (AVL) using global positioning system (GPS) units to locate any operating vehicle at anytime. In addition, buses, light rail and Metro vehicles are regularly inspected for any unsafe or unhealthy condition.

Employees and Contractors

MTA's Employee Safety Program includes 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. Many of these programs have been developed in accordance with federal, state, and local regulatory requirements.

Emergency Preparedness Plan

As described in the SSPP, 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. The MTA has written comprehensive emergency preparedness plans (EPPs) for each of its transit divisions (Metro, Light Rail, MARC, Bus, and Mobility). These plans establish the roles and responsibilities that will be carried out not only by MTA personnel, but also by various emergency response agencies during an emergency.

Security and Police Operations

MTA's System Security Program Plan maximizes the level of security experienced by all passengers, employees, and other users of the system. The plan aims to reduce the cost associated with security breaches and to maximize protection of MTA property and facilities. MTA Police provide two types of safety and security reviews for stations and other MTA facilities. The first is a review of proposed plans using a Crime Prevention through Environmental Design (CPTED) analysis. For example, MTA Police review plans for new stations or maintenance facilities for elements that may compromise or improve the safety and security of riders. MTA Police also perform Vulnerability Risk Assessment (VRA) of existing facilities. They recently completed VRAs for all four bus divisions. A VRA assesses vulnerabilities and determines if they are mechanical, employee-related or criminal in nature. State, County, and local law enforcement agencies support the MTA Police in protecting the existing transit system.

Pedestrian and Motorist Safety

MTA makes every effort to reduce or eliminate pedestrian and motorist conflicts with transit vehicles at all 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.

Potential Impacts

Alternative 1: No-Build

Alternative 1: No-Build, assumes that transit service levels, highway networks, traffic volumes, and demographic forecasts will remain constant. Safety and security would remain at current levels or follow current trends. Therefore, Alternative 1: No-Build would have minor impacts to safety or security.

Alternative 2: TSM

Alternative 2: TSM includes operational and small capital improvements plus selected upgrades to intersections, minor roadway widening, and technology based transit improvements. Safety and security would remain at current levels or follow current trends. Therefore, Alternative 2: TSM would not have major benefits or adverse impacts on the safety and security of the transportation system.

Alternative 3: BRT and Alternative 4: LRT

Alternative 3: BRT and Alternative 4: LRT would be consistent with MTA's SSPP because existing bus and light rail vehicles are incorporated into the current system safety and security program plans. Elements of the SSPP may require revision or expansion to include the new Red Line operations; however, most revisions are expected to be minor.

A BRT or LRT tunnel would be a new element in the MTA system. However, the tunnel and underground station construction introduce no substantially new components that are not shared by either existing rail tunnels (such as the Metro) or existing highway tunnels that convey buses (such as the existing I-95 Harbor Tunnel).

A potential impact may result if a build alternative were to reduce roadway capacity and increase congestion, it could slow local emergency fire and safety response times. However, if allowed, the BRT options and the LRT options that include embedded tracks present beneficial shared use opportunities for emergency response vehicles by allowing the emergency response vehicles to bypass traffic congestion. This also occurs on Howard Street with the existing Central Light Rail Line.

Other issues include:

- Pedestrian Safety: The types of access controls that exist today are familiar to drivers and pedestrians in the corridor and are similar to what would exist under any of the BRT or LRT alternatives. Throughout the corridor, passengers would access curbside stations via sidewalks as they do with bus stops today. Access to center platform BRT and LRT stations would occur with signal-protected crosswalks at intersections or special crossing locations that would be signed and signaled appropriately. MTA also promotes safety in its community outreach efforts. Pedestrian safety awareness training programs at schools within one-half mile of transit routes have been well received by the public.
- Traffic Safety: In general vehicular traffic would typically remain the same as in the future No-Build on the street over which the transit alternatives would operate. Little if any diversion of traffic onto adjoining neighborhood streets is expected as these streets do not typically offer attractive parallel routes. The exception to this is the diversion of traffic to Edmondson Avenue near the West Baltimore MARC station under two options.

  Drivers and pedestrians are familiar with transit vehicles operating along the curb lanes that would occur under some of the build options as this is where local buses operate. Alternative 3: BRT and Alternative 4: LRT with two lanes of tracks in the center of the street would introduce a new type of transit condition under some options, but one that exists in some locations such as Howard Street. The types of traffic controls, turning restrictions, and other techniques that would be used throughout the corridor would be comparable to what exists today in the corridor. At some locations, such as where the BRT or LRT alignment transitions from the ditch to surface streets special traffic signal phases and signage would allow transit vehicles to make the necessary maneuvers. Special traffic signal phases and signage also would be used where options transition from the median/center of the street to the curb lane.
- At-grade Railroad Crossings: There is a potential for increased at-grade accidents with the addition of the transit alignment crossings along the Red Line alignment. Safety measures would be incorporated at these crossing locations during planning and design activities to reduce the likelihood of conflicts.
- Crime: Some citizens have expressed concern about safety on vehicles and in their neighborhoods if Alternative 3: BRT or Alternative 4: LRT is selected and implemented. Properly designed and maintained stations combined with technology and procedures would be used to dissuade criminals from operating in such areas. MTA will continue to meet with concerned citizens and business owners throughout the project development process to develop mitigation strategies to address perceptions about crime and safety of the transit system.
- High Security and/or Potential High Risk Locations: Alternative 3: BRT and Alternative 4: LRT in the western portion of the alignment could increase traffic around Centers for Medicare and Medicaid Services (CMS) and the Social Security Administration (SSA). Close coordination would continue between MTA, SSA, CMS, the Maryland Emergency Management Agency, Baltimore County's Office of Emergency Management, and other affected stakeholders (including nearby elementary schools) to minimize any potential impacts.

  Locations such as tourist areas, major institutions, stadiums, and other sensitive areas will be handled on a case-by-case basis in association with the owners/operators of those facilities so that their concerns are understood and a mutually agreed upon safety plan is developed. Likewise, in residential neighborhoods throughout the corridor, MTA will work with community groups and local emergency responders to understand and address specific issues such as home to school walking routes, religious events, visibility, emergency response routes, and other activities to minimize potential interruptions in current pedestrian and vehicular flows.
- Construction Activities: Alternative 3: BRT and Alternative 4: LRT would involve very similar construction activities as those used to construct the existing light rail and Metro surface and tunnel sections. It would not involve any unusual or particularly dangerous construction types, procedures, or locations that would pose any major safety or security impacts. Standard construction safety practices as established by government regulations and codes, as well as MTA specifications, would minimize the potential for accidents and other safety problems.

Mitigation Measures

The Red Line would be planned and built in compliance with all federal, state, and local safety and security guidelines. The MTA would work with police, fire, and other agencies during project design to ensure reliable emergency access is maintained and develop alternative plans or routes to avoid delays in emergency response times.

If a build alternative is selected as the Locally Preferred Alternative, a safety and security board could be created to include MTA police, local area law enforcement, and emergency personnel from the communities directly affected by the Red Line alignment. This board would conduct a comprehensive review of MTA's existing SSPP and emergency response plans to identify and address any potential conflicts between the SSPP and local emergency response plans. New or modified procedures could be developed to accommodate the specific needs of the Red Line prior to its implementation. The MTA will continue its proactive efforts to improve safety through passenger and public awareness programs.

The Red Line could use the following mitigation measures to reduce potential risks to public safety and security:

- Fencing and Barriers: Fencing and/or barriers could be provided along the transit alignment and surrounding station areas, as needed. The fencing and barriers would be designed to prevent unauthorized persons and vehicles, and debris from entering transit right-of-way and station areas, and to increase safety along the alignment.
- Emergency Standards: The Red Line would meet National Fire Protection Association (NFPA) 130 requirements. NFPA 130 identifies fire protection standards for transit systems including the number and location of entry/exit points, the timing for station evacuation in emergencies, and other safety considerations.
- Technology: The Red Line would use video surveillance, emergency telephones, and other current technology. The video surveillance system would be capable of transmitting real-time video to MTA via a fiber optic or other suitable transmission network. Emergency telephones will be consistent with existing units and meet performance requirements of MTA's existing emergency telephone network.
- Crime Prevention through Environmental Design: The Red Line will incorporate CPTED strategies during design to maximize safety and security for facilities and passengers. Typical CPTED strategies include: adequate lighting to increase visibility of people, parking and building access areas, landscape plantings that maintain visibility; decorative fencing; and perimeter control.

Indirect and Cumulative Effects

SUMMARY

An Indirect and Cumulative Effects (ICE) analysis was prepared for the study in accordance NEPA and CEQ regulations. The resources evaluated for indirect and cumulative effects include socioeconomic, cultural, and natural resources. Using readily available data from State and local sources, the resources were mapped using GIS and analyzed to determine the nature and extent of the indirect and cumulative effects created by the project.

Minor indirect and cumulative effects to socioeconomic resources are anticipated as a result of the Red Line project and other development projects in the study corridor. The indirect and cumulative effects would be minor due to the existing high level of development in the corridor and existing Smart Growth laws, land use plans, and zoning regulations in place for Baltimore City and Baltimore County. The Red Line build alternatives could affect the growth rates in the corridor through infill development and revitalization and improved access and mobility in the corridor. No future development projects are dependent on the completion of the Red Line.

It is anticipated that the Red Line No-Build and build alternatives would have no indirect effects on cultural resources in the ICE boundary. Cumulative effects to historic sites and structures are expected to be minimal due to established laws and regulations designed to protect cultural resources.

It is anticipated that the Red Line would have minimal indirect and cumulative effects on natural resources within the ICE boundary. Indirect and cumulative effects to waters of the US including wetlands, surface water, and ground water resources will be minimized through stormwater management requirements controlling runoff from developments. Sediment and erosion control requirements controlling the runoff from new development would limit sediment reaching waterways.

Overview

An Indirect and Cumulative Effects (ICE) analysis has been prepared for this study. The ICE was developed in compliance with the National Environmental Policy Act (NEPA), and the Council on Environmental Quality (CEQ) regulation 40 CFR 1508.25(c). The resources evaluated for indirect and cumulative effects include socioeconomic, cultural, and natural resources.

Temporal and geographic boundaries were developed to encompass all resources that may be affected. The temporal boundary extends from 1970 to 2030. The temporal boundary was developed based upon information availability, population trends, and key events in the corridor over the past 55 years. The year 1970 was selected as the past timeframe limit based upon past events, population changes, and a limited availability of natural and socioeconomic resource information prior to the passage of NEPA in 1970. The future timeframe was determined from the study's design year of 2030.

Using the environmental resources (socioeconomic, natural, and cultural) that would be affected by direct and indirect impacts of the alternatives as a guide, multiple resource boundaries were reviewed to determine the appropriate geographic sub-boundaries that would create the ICE boundary. The sub-boundaries included census tract boundaries, Traffic Analysis Zone (TAZ) boundaries, and watershed boundaries. Based on readily available data from State and County sources, the resources were mapped using GIS mapping techniques and analyzed to determine the nature and extent of indirect and cumulative effects created by the Red Line Corridor Transit Study.

ICE on Socioeconomic Resources

Indirect and cumulative effects to the socio-economic resources within the ICE boundary are anticipated as a result of the Red Line Corridor Transit Study and other development projects within the area. Indirect and cumulative effects are anticipated to be minor due to the existing high level of development in the corridor and the existing Smart Growth laws and land use plans and zoning regulations of Baltimore County and Baltimore City.

Much of the ICE boundary has been "built-out"; therefore, most of the indirect effects from the alternatives are expected to be minor. Although the Red Line alternatives would not cause any changes in the pattern of the land use, they would have indirect effects on the growth rates of commercial and residential development revitalization. The Red Line build alternatives would improve access and mobility throughout the ICE boundary, thereby improving the ease and availability of existing community services to the residents who use them. Improved access would likely stimulate growth, thus boosting employment opportunities, resulting in an overall benefit to the economic environment within the corridor.

As the demand for new business and residential properties increases, the resulting development pressures on remaining parcels of undeveloped land would also increase. However, this development pressure will be limited through the existing zoning regulations in place by Baltimore County and Baltimore City, which will look to accommodate these demands through infill development and redevelopment of existing developed areas, rather than new development within previously undisturbed areas. Both the Baltimore County and Baltimore City Master Plans have the identified goal of conserving and enhancing the character of existing communities and neighborhoods, and all new developments must demonstrate compliance with this goal before being approved.

Alternative 1: No-Build would not have any indirect effects, but any of the proposed build alternates would have the same effect on the growth rates within the ICE boundary. The cumulative effects will be limited through the existing Smart Growth laws and zoning regulations in place by Baltimore County and Baltimore City. No future development projects are dependent on the completion of the Red Line.

ICE on Cultural Resources

It is anticipated that the Red Line would have no indirect effects on cultural resources within the ICE boundary.

A majority of the ICE boundary has been built-out, meaning that few undeveloped areas remain. Therefore, cultural resources within these areas have a greater potential of being already disturbed. Cumulative effects to historic sites and structures are expected to be minimal due to established laws and regulations designed to protect cultural resources. They include the following:

- The National Historic Preservation Act 1966, as amended; 36 CFR Part 800 – Protection of Historic Properties; Executive Order 11593
- The Maryland Historic Trust Act of 1990 (Article 83B, §§ 5-607, 5-617, to 5-619, and 5-623 of the Annotated Code of Maryland)
- Section 4(f) of the Department of Transportation Act of 1966

ICE on Natural Resources

It is anticipated that the Red Line would have minimal indirect and cumulative effects on natural resources within the ICE boundary. Federal, state, and local requirements and regulations are currently in place to offset indirect and cumulative effects from the Red Line project, as well as all publicly and privately funded projects. Indirect and cumulative effects to Waters of the US including wetlands, surface water, and groundwater would be minimized through stormwater management requirements controlling the runoff from new development. Sediment and erosion control requirements in place would limit the sediment reaching waterways.

Because most of the area within the ICE boundary is already built-out, there are no indirect or cumulative effects anticipated on forested land, habitat, or wildlife.

Irreversible & Irretrievable Resources

NEPA requires that the environmental analysis 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.

Alternative 1: No-Build would not require an irreversible and irretrievable commitment of resources.

The build alternatives would require a similar commitment of natural, human, and monetary resources. Natural resources include the land on which the project would be constructed, water resources, and habitat. Since the build alternatives would be generally constructed

in existing rights-of-way, potential effects on natural resources are minimal. Other natural resources consist of the fossil fuels, energy, and materials such as cement, aggregate and bituminous material (for example, asphalt) that would be used in construction.

The build alternatives would change energy consumption by less than 0.15 percent, which is predicted to have little or no effect on overall energy consumption. However, the use of this energy is considered an irretrievable commitment of resources because it is unlikely that the energy used during construction can be used, again, for some other purpose.

For the same reason, the commitment of human resources during construction activities is considered irretrievable. The project would require the use of human resources in the fabrication and preparation of construction materials and in the physical effort associated with building the project. However, the project would not have a long-term effect on the continued availability of human resources (workers).

Construction of the build alternatives would require a one-time expenditure of federal, state, and local funds, which are irretrievable in the sense that these funds would not be available for other projects.

Short-term Impacts/Long-term Benefits

NEPA requires that the environmental analysis 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 build alternatives) with the long-term benefits of the alternatives. For this document, short-term refers to the period of construction – the time when the largest number of temporary environmental impacts is most likely to occur. Long-term refers to the period following the completion of construction activities.

Alternative 1: No-Build would not require short-term uses of the environment.

Construction activities associated with the build alternatives would have temporary effects by disrupting traffic flow and travel routes in the Red Line Corridor. However, the inconveniences to residents, motorists, and transit patrons would be offset by the improved transit system once construction is completed. The build alternatives would help reduce traffic congestion in the Red Line Corridor by providing a transit system that enhances connections with other transit services, and improves east-west travel, mobility and access in the corridor.

The build alternatives would require a short-term use of monetary, construction material, and energy resources. The commitment of monetary resources during the construction period would have the economic benefit of creating employment opportunities in the construction industry. The commitment of monetary, construction material, and energy resources would benefit the Baltimore Region and the Red Line Corridor by:

- Improving mobility and accessibility
- Reducing travel times
- Supporting economic development opportunities.

Volume I-Chapter 5

Costs and Funding

RED LINE Corridor Transit Study

Introduction

This chapter presents the one-time capital cost for design and construction for the Red Line BRT and LRT alternatives, as well as the annual change in operating and maintenance (O&M) costs and farebox revenues for the transit systems in the corridor. This chapter also discusses the financial setting for the evaluation of the improvements, including a discussion of MTA funding mechanisms and future financial outlook, and the strategy for funding the capital cost and operating and maintenance cost needs of the alternatives.

Capital Costs

Capital Cost Methodology

The capital costing methodology provides professionally accepted guidelines for accurately and consistently estimating the costs of the capital components of the alignment(s) under consideration in the Red Line Transit Corridor. It provides a framework for using the cost estimates by defining the basis for the estimates and the associated level of confidence for the estimated costs for the various components. Capital cost estimates also contribute to the assessment of effectiveness and efficiency.

The methodology used in generating capital cost estimates has been developed in general accordance with FTA guidelines for estimating capital costs. Part of the FTA guidelines call for cost estimates to be prepared and reported using the latest revision of the FTA's Standard Cost Categories (SCC).

Comparative capital cost estimates will be required in progressive levels of detail as the project development process passes through the various stages of the alternative analysis, preliminary engineering, and final design process.

General Approach

Conceptual engineering drawings, typical sections, station locations and/or written descriptions were prepared for each of the alternatives. These planning documents formed the basis to define major cost components and to identify the various facility elements needed for capital cost estimates. These facility elements can be classified into one of two broad groups, either "typical" or "non-typical" facilities.

Typical facility costs were developed for elements that can be defined by a typical cross-section and applied over a given length of alignment. The typical facility composite unit cost is developed by combining the costs for all of the individual construction elements applicable to a given typical section or facility and creating a representative composite unit cost. Typical sections or facilities have been developed for each of the alternatives.

Non-typical facility costs were developed based on conceptual engineering and design related to the unique facility under consideration. For those non-typical facilities elements that are necessary for overall system operation, but whose costs cannot be allocated to a specific geographic segment of the system (e.g., vehicles, storage and maintenance facility, etc.), these costs were included at the summary level.

Capital Cost Categories

In accordance with the latest version of the FTA's Standard Cost Categories, the capital cost components of the various alternatives have been classified into the following cost categories.

10 Guideway and Track Elements

20 Stations, Stops, Terminals, Intermodal Facilities

30 Support Facilities: Yards, Shops, Administration Buildings

40 Sitework and Special Conditions

50 Systems

60 Right-of-way, Land, Existing Improvements

70 Vehicles

80 Professional Services

90 Unallocated Contingency

Details on each of these cost categories is provided in the *Capital Cost Technical Report*, one of the technical reports attached to the AA/DEIS document.

Cost Data

Cost data was developed using several sources and was compared to those seen in the Baltimore region for similar types of construction. The first task in developing the cost data was to prepare a list of work items that are typical, based on the scope of work for transit technology. Unit costs for these work items were then estimated using various cost references and historical cost data, and were compiled into a database format to form a Unit Cost Library (UCL). The key elements of the UCL are an Item Code, Item Description, Unit of Measure, and Unit Cost. This UCL summary includes those items typically found in a project of this scope. All unit costs include contractor's direct construction costs plus all taxes, general expenses, overhead, and profit. The unit costs do not include items such as engineering, construction management, owner's administrative costs, and allowances for contingencies. These costs were included as percentage add-ons to the cost estimate under other cost categories.

Unit costs included in the estimates were derived from multiple resources. Unit costs associated with civil and structural construction elements that are generally common to both transit and highway construction projects used cost data found in the Maryland Department of Transportation, State Highway Administration (SHA) Item Average Unit Costs. For those unit costs associated with trackwork, stations and systems construction elements that are principally found on transit construction projects, cost data from recent construction bids from other transit systems throughout the United States were compared and adjusted to specific project needs. Unit cost data was obtained from a historical cost estimating database of completed projects and their respective historical bid information. All cost resources were adjusted to reflect current local Baltimore rates and conditions. Adjustments for differences in geographic locations used a factor calculated from the current city cost index for the source location and Baltimore, as published by *RS Means*. Adjustments for differences between the published date of any historical cost data and the current base year of the cost estimates used an escalation factor calculated using the Construction Cost Index (CCI) value published by *Engineering News-Record* (ENR) for each of the periods in question.

Contingency is typically included in an estimate as an allowance for the conceptual nature of the engineering design completed, or to address imperfections in estimating methods that are associated with a project's development stage. Contingency, in the statistical sense, is the estimated percentage by which a calculated value may differ from its true or final value. The contingency allowance is used to account for those items of work (and their corresponding costs) which may not be readily apparent or cannot be quantified at the current level of design, such as unknown project scope items, or a potential project change resulting from public/political issues or environmental or technical requirements. For the purposes of this estimating program, contingency, was assigned to two major categories – "allocated" and "unallocated".

Allocated contingency was used based on the level of design information available for individual items of work, as well as the relative difficulty in establishing unit prices for these items. The allocated contingency allowance (in the range of 10 percent to 35 percent) was allocated according to the FTA construction or procurement cost categories. The exact percentage selected for each cost category was based on professional judgment and experience related to the cost variability typically seen for items of work within a particular cost category.

Unallocated contingency is similar in nature to allocated contingency in that it is primarily applied as an allowance for unknowns and uncertainties due to the level of project development completed. The major difference is that allocated contingencies are intended to address uncertainties in the estimated construction, right-of-way, and vehicle costs that typically occur as the amount of engineering and design information advances, while unallocated contingencies are typically much broader in nature and often address changes in the project scope and schedule. Unallocated contingency was calculated as five percent of the total of cost categories 10 to 50 and then two percent of cost categories 60 to 80.

Capital Cost Estimates for the Red Line Alternatives

Table 5-1 indicates the total capital costs, in 2007 dollars, for each of the eleven build alternatives.

Due to the large number of options under consideration for the Red Line, and the impracticality of showing hundreds of permutations and combinations of options, "representative options" were selected to form the basis of comparison among the alternatives. The representative options used for the alternatives are described in Chapter 6.

Table 5-1: Total Capital Costs by Alternative

Alternative	Total Capital Costs ($ millions)
No Build	N/A
2: TSM	$281
3A: BRT	$545
3B: BRT	$1,019
3C: BRT	$1,151
3D: BRT	$2,404
3E: BRT	$571
3F: BRT	$755
4A: LRT	$930
4B: LRT	$1,498
4C: LRT	$1,631
4D: LRT	$2,463

Capital Cost Comparisons Between Options

Although representative options have been used to compare end-to-end alternatives, there are a number of comparisons between options where within a particular segment there are substantive enough differences in capital costs worth noting. The following cost comparisons are presented for BRT and then LRT for surface options and tunnel options.

BRT Surface Options

- *From Security Square Mall Station to I-70 Park-and-Ride*
  - North side of I-70 = $61.8 million
  - South side of Security Boulevard = $75.8 million
- *From I-70 Park-and-Ride to US 40 at Swann Avenue*
  - Cooks Lane Dedicated = $17.8 million
  - Cooks Lane Dedicated Inbound / Shared Outbound = $15.1 million
  - Cooks Lane Shared = $12.9 million
  - Cooks Lane Tunnel = $180.8 million
- *From US 40 at Cooks Lane to West Baltimore MARC*
  - US 40 Two-lane Service = $80.5 million
  - US 40 Three-lane Service = $87.8 million
- *From Longwood Street to West Baltimore MARC*
  - US 40 Three-lane Service, vehicular traffic diverted to Franklintown Road = $22.7 million
  - US 40 Three-lane Service, vehicular traffic diverted near Pulaski Street = $31.5 million
- *From West Baltimore MARC to MLK Boulevard*
  - US 40 Two-Lane Service = $14.8 million
  - Mulberry Street or Franklin Street = $18.0 million
- *From MLK Boulevard to Central Avenue*
  - Baltimore Street/Lombard Street Couplet = $50.5 million
  - Baltimore Street Two-way = $ 34.1 million
- *From Chester Street to Railroad Right-of-Way*
  - Eastern Avenue/Fleet Street Couplet = $39.5 million
  - Boston Street = $26.0 million

BRT Tunnel Options

- *From I-70 Park-and-Ride to West Baltimore MARC*
  - Cooks Lane Tunnel to US 40 at Swann Avenue and Two-lane Surface from Swann Avenue to West Baltimore MARC = $267.4 million
  - Cooks Lane/US 40 Tunnel to Calverton Road and Two-lane Surface from Calverton Road to West Baltimore MARC = $890.8 million
- *From MLK Boulevard to Central Avenue*
  - Lombard Tunnel Portal north of Fayette Street to Central Avenue south of Lombard Street = $505.2 million
  - Fayette Tunnel Portal north of Lexington Street to Central Avenue south of Lombard Street = $466.3 million
  - Fayette Tunnel to Gay Street and Surface from Gay Street to Central Avenue = $365.5 million
- *From MLK Boulevard to Railroad Right-of-way*
  - Lombard Tunnel to Railroad Right-of-way = $1,133.3 million
  - Lombard Tunnel to Central Avenue and Surface from Central Avenue to Railroad Right-of-way = $575.6 million

LRT Surface Options

- *From Security Square Mall Station to I-70 Park-and-Ride*
  - North side of I-70 = $88.5 million
  - South side of Security Boulevard = $100.1 million
- *From I-70 Park-and-Ride to US 40 at Swann Avenue*
  - Cooks Lane Dedicated = $39.6 million
  - Cooks Lane Dedicated Inbound/Shared Outbound = $36.8 million
  - Cooks Lane Shared = $34.6 million
  - Cooks Lane Tunnel = $173.7 million
- *From US 40 at Cooks Lane to West Baltimore MARC*
  - US 40 Two-lane Service = $133.9 million
  - US 40 Three-lane Service = $136.9 million
- *From Longwood Street to West Baltimore MARC*
  - US 40 Three-lane Service, vehicular traffic diverted to Franklintown Road = $38.7 million
  - US 40 Three-lane Service, vehicular traffic diverted near Pulaski Street = $48.9 million
- *From West Baltimore MARC to MLK Boulevard*
  - US 40 Two-lane Service = $26.9 million
  - Mulberry Street or Franklin Street = $28.5 million
- *From MLK Boulevard to Central Avenue*
  - Baltimore Street/Lombard Street Couplet = $89.3 million
  - Baltimore Street Two-way = $60.0 million
- *From Chester Street to Railroad Right-of-way*
  - Eastern Avenue/Fleet Street Couplet = $70.7 million
  - Boston Street = $58.8 million

LRT Tunnel Options

- *From I-70 Park-and-Ride to West Baltimore MARC*
  - Cooks Lane Tunnel to US 40 at Swann Avenue and Two-lane Surface from Swann Avenue to West Baltimore MARC = $305.9 million
  - Cooks Lane/US 40 Tunnel to Calverton Road and Two-lane Surface from Calverton Road to West Baltimore MARC = $827.7 million
- *From US 40 to Lombard Street at MLK Boulevard*
  - Fremont Tunnel = $130.6 million
  - MLK Boulevard West Side Surface to Lombard Street Tunnel = $93.9 million
- *From MLK Boulevard to Chester Street*
  - Lombard Tunnel to a Portal on Aliceanna Street at Chester Street = $763.2 million
  - Lombard Tunnel to Central Avenue and Surface from Central Avenue to Chester Street = $588.6 million
  - Fayette Tunnel to Central Avenue and Surface from Central Ave to Chester Street = $566.2 million
- *From MLK Boulevard to Railroad Right-of-way*
  - Lombard/Eastern Tunnel to Railroad Right-of-way = $1,100.3 million
  - Lombard Tunnel to Central Avenue and Surface from Central Avenue to Railroad Right-of-way = $649.6 million

Operating & Maintenance Costs

Operating and maintenance (O&M) costs cover the labor and material costs to operate the transit service (such as bus and light rail operators and supervisors) and to maintain the system (such as vehicle maintainers, track and signal maintainers, station and vehicle cleaners, and transit police). Operating and maintenance costs fluctuate by the amount of transit service provided:

Table 5-2: Annual Change in Operating Characteristics for the BRT Alternatives

Bus Rapid Transit						Background (Other) Bus Services		
Alternative	Daily Peak Vehicles	Annual Vehicle Revenue Miles	Annual Vehicle Revenue Hours	Guideway Lane Miles	Tunnel Stations	Daily Peak Vehicles	Annual Vehicle Revenue Miles	Annual Vehicle Revenue Hours
2	37	1,489,500	127,400	N/A	N/A	-29	-1,111,900	-116,500
3A	40	1,640,300	126,900	28	N/A	-42	-1,523,500	-157,000
3B	37	1,718,100	112,700	30	4	-44	-1,362,300	-154,300
3C	37	1,718,100	112,700	30	4	-44	-1,370,300	-153,400
3D	31	1,641,900	96,200	27	12	-46	-1,427,300	-156,100
3E	44	1,753,800	139,800	30	N/A	-41	-1,535,000	-146,800
3F	37	1,489,500	127,400	4	4	-38	-1,190,500	-128,400

Table 5-3: Annual Change in Operating Characteristics for the LRT Alternatives

Light Rail						Background (Other Bus Services)		
Alternative	Daily Peak Vehicles	Annual Vehicle Revenue Miles	Annual Vehicle Revenue Hours	Guideway Track Miles	Tunnel Stations	Daily Peak Vehicles	Annual Vehicle Revenue Miles	Annual Vehicle Revenue Hours
4A	28	1,571,500	132,200	28	N/A	-66	-2,123,100	-180,100
4B	24	1,837,700	113,100	30	6	-77	-2,388,300	-199,100
4C	24	1,837,700	113,100	30	6	-77	-2,388,500	-199,100
4D	24	1,939,500	113,300	27	12	-74	-2,337,400	-194,200

Table 5-4: Net O&M Costs by Alternative

Alt	Red Line Facility O&M Cost	Background Bus	Net O&M Cost Increase to MTA Transit System
2	$ 17,582,000	$ (12,573,000)	$ 5,010,000
3A	$ 20,626,000	$ (17,226,000)	$ 3,400,000
3B	$ 22,518,000	$ (16,655,000)	$ 5,862,000
3C	$ 22,487,000	$ (16,627,000)	$ 5,860,000
3D	$ 25,266,000	$ (17,115,000)	$ 8,150,000
3E	$ 22,389,000	$ (16,604,000)	$ 5,785,000
3F	$ 20,237,000	$ (14,149,000)	$ 6,089,000
4A	$ 25,872,000	$ (22,247,000)	$ 3,625,000
4B	$ 28,138,000	$ (25,011,000)	$ 3,126,000
4C	$ 28,138,000	$ (25,013,000)	$ 3,124,000
4D	$ 31,713,000	$ (24,343,000)	$ 7,369,000

frequency of service and the number of vehicles necessary to operate that service. O&M cost models were used to test the effects of system changes, and help differentiate the proposed alternatives.

A general description of the operating plans and service hours can be found in Chapter 3. Detailed operating plans for each alternative can be found in the *Final Definition of Alternatives*, provided on the accompanying DVD of Technical Reports.

Operating & Maintenace Cost Methodology

The O&M cost models developed for this study conform to the Federal Transit Administration's (FTA's) most recently issued technical guidelines for transit alternatives analysis. Estimating operating and maintenance costs for an alternatives analysis involves two primary steps: 1) development of operating plans and estimation of operating statistics for each transit mode included in each alternative, and 2) development of O&M cost models and their application to the operating statistics obtained in step 1 to estimate the O&M costs for the new service. The operating statistics (vehicle hours, vehicle miles, etc.) were derived from the final operating plan for each service alternative. A detailed explanation of the O&M models and their validation can be found in the *Operating and Maintenance Cost Technical Report* on the DVD attached to this document.

Operating Costs for the Red Line Alternatives

Tables 5-2 and 5-3 summarize the net change in operating characteristics for each of the alternatives compared to the No-Build. Each alternative involves a reduction of existing bus service, replaced by either BRT or LRT services between CMS and Bayview. As described in the operating plans in Chapter 3, BRT trunkline service augments existing bus service, with several existing routes operating on the proposed guideway. The guideway in the LRT alternatives replaces sections of several bus routes, with those buses terminating at a LRT station, and consequently shows a larger reduction in background bus operations.

Total estimated operating and maintenance costs for the alternatives are shown in **Table 5-4**. The costs are derived from the number of peak vehicles, vehicle miles and hours, and length of guideway. For each mode, BRT and LRT, the operating costs increase as more service is operated to meet the higher passenger demand attracted to the faster service provided by longer lengths of tunnel.

WHO WILL PAY FOR THIS PROJECT?

It will take a combination of financing – from the Federal Government through the Federal Transit Administration (FTA), from the State of Maryland through the Department of Transportation's Consolidated Transportation Trust Fund, and possibly from local governments and the private sector. While some initial money has come from various federal transit formula funding programs, the vast majority of federal support for the Red Line will come from the FTA's Capital Investment Program for "New Starts." Funds are available for construction of new fixed guideway systems or extensions to existing fixed guideway systems. In order to become eligible for funding, projects must complete the major capital investment planning and development process, which looks at the results of an

Alternatives Analysis, a set of established criteria and the degree of local financial commitment.

The New Starts program is a $1.5 billion discretionary fund for construction of new fixed guideway systems. While the federal match can be as high as 80 percent, FTA generally only pays only 50 percent or less of total project costs because of the competitive nature of this program.

The balance of funds will have to come from the state's Transportation Trust Fund (TTF) and possible contributions from local governments and the private sector. Mass transit is one of many transportation modes competing for TTF dollars. The fund was created in 1971 as a source of dedicated revenues to support the Maryland Department of Transportation – the MTA, State Highway Administration, the Maryland Port Administration, Motor Vehicle Administration and the Maryland Aviation Administration. TTF revenue supports all of the department's activities, including debt service, agency operations and capital projects. TTF money comes from motor fuel taxes, motor vehicle titling taxes, motor vehicle fees, bond proceeds and the department's operating revenues, including transit farebox receipts.

Funding Strategy

This section summarizes the current strategy for funding and financing a project that may emerge from this alternatives analysis. It provides background information regarding transportation revenue and expenditures in Maryland and places the project in the context of the state's transportation budgeting and capital planning process.

The State Transportation Improvement Program/ Consolidated Transportation Improvement Plan (STIP/ CTP) includes funding for ongoing planning through 2010 for the Red Line Corridor Transit Study.

Transit Funding In Maryland

Most transit agencies fund their operating and capital costs through local and regional funding sources, with some federal funding assistance. The MTA is unusual as a transit agency in that it is part of a State Department of Transportation. As such, the non-federal share of transit expenditures, both capital and operating, is funded by the State. Transit is one of several modes that are funded using the Maryland Transportation Trust Fund (TTF). The TTF was created in 1971 to provide a dedicated source of revenues to support state transportation.The fund supports all of the department's activities, including debt service, modal agency operations, and capital projects.

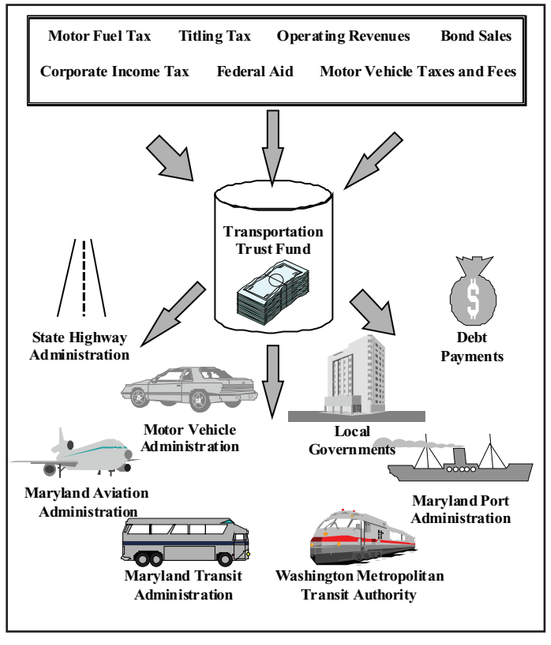
All state revenues for transportation are collected through the TTF, including taxes, users' fees and charges, bond proceeds, federal aid, and operating receipts. Highway toll revenues are collected by the Maryland Transportation Authority.

Several sources of revenue make up the TTF. They include the following:

- Motor vehicle fuel tax of 23.5 cents per gallon of gasoline, 24.25 cents per gallon of diesel fuel, and seven cents per gallon of aviation fuel.
- Motor vehicle registration and other fees.
- Motor vehicle title tax of five percent of the fair market value of new and used vehicle sales and those of new residents.
- Corporate income tax – 21 percent of the State's seven percent corporate income sales tax.
- Operating revenues from transit fare boxes, Maryland.
- Beginning in 2009, 6.5 percent of the six percent state sales and use tax will be dedicated to the TTF and is estimated to be $1.6 billion over the six-year period covered by the MDOT capital program.
- Maryland Port Administration terminal operations, Maryland Aviation Administration flight activities, fees, parking, and concessions.
- Federal funds – authorized by the US Congress. The SAFETEA-LU legislation authorized $720 million in annual funds to the department; $580 million in highway programs and $140 million in transit funds.

The TTF is predominantly comprised of motor vehicle and other user fees. These offer a stable source of revenue for the Department of Transportation, a source that consistently grows at a modest rate each year. However, because the motor vehicle fuel tax is a flat fee, rather than charged as a percentage of retail prices, revenues from that source do not grow with inflation. **Figure 5-1** shows how the TTF works.

Figure 5-1: How the Trust Fund Works

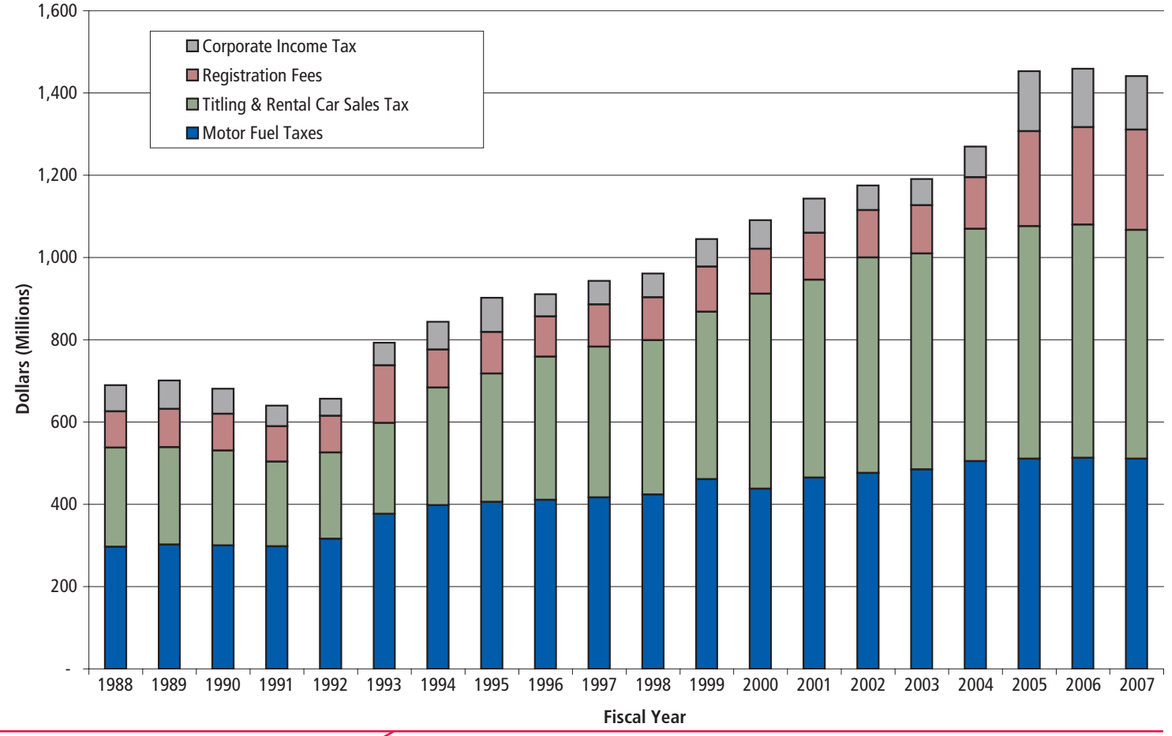


Allocation of TTF funds is determined by the Maryland Secretary of Transportation and approved by the Governor and the General Assembly. A target fund balance of $100 million is maintained to provide for MDOT's working cash flow requirements.

Maryland is considering a number of major transit capital investments in addition to the Red Line Corridor, including the Purple Line in Prince George's and Montgomery Counties and the Corridor Cities Transitway in Montgomery County, as well as a major MARC expansion (the commuter rail system in Maryland serving the Baltimore/Washington, D.C. region). In addition, high priority is being given to existing transit system preservation and rehabilitation. Along with transit needs, there are substantial funding needs for highways and other transportation systems supported by the TTF, which will require decisions regarding revenue increases for the TTF, other sources of revenue, and prioritization regarding the scale and timing of the projects for the transit corridors.

The last time the 23.5 cent-per-gallon gas tax was raised in Maryland was 1992. Estimates made in 2007 indicated a potential $1.5 billion transportation funding shortfall for 2008 and a $40 billion shortfall over the next 20 years. To address this transportation funding situation as well as a shortfall in the State's general fund, the Governor called a Special Session of the Maryland General Assembly in Fall 2007. Specific to the TTF, the Governor proposed several different mechanisms that should increase fund revenues. These included indexing the gasoline tax to the rate of inflation, increasing auto titling fees, and increasing corporate income tax rates. In late 2007, the General Assembly passed, and the Governor signed, a combination of revenue enhancements that increased Trust Fund revenues by more than $400 million a year. These funds were available for distribution through the annual budgeting process that occurred during the typical 90-day session of the General Assembly, which began in January 2008. **Figure 5-2** illustrates the TFF revenue increase from 1988 to 2007.

Figure 5-2: Transportation Trust Fund Revenue Increase Strategy



Historically, transit has received approximately 35 percent of the Transportation Trust Fund over a given six-year capital program. In FY 2007, transit accounted for 25.3 percent of the Transportation Trust Fund expenditures, with 18.6 percent allocated to MTA and 6.7 percent allocated to the Washington Metropolitan Area Transit Authority.

Given the State's growth plan for transit in Maryland, including consideration of implementation of three major capital investment projects (the Red Line, Purple Line, and the Corridor Cities Transitway), the MTA is developing a plan that combines the staging and phasing of projects with a program to capture additional revenues from local governments. The intent is to have funds available to meet capital and operating costs of New Starts projects, as well as a range of additional system enhancements to improve system preservation and operations of the existing transit system and its general operating obligations.

This strategy is in the process of being developed by MDOT, along with a specific plan to implement it. Once the details of the revenue enhancements are available and decisions are made regarding the specific levels of investments in the various corridors, the MTA will develop a strategy for funding this project through construction, ensuring the availability of funds for operating this new investment while maintaining the quality of operations and maintenance for the remainder of its transit systems.

Beyond state funds, the remainder of the funding would come from federal, county, and possible private-sector sources. It is expected that the City of Baltimore and Baltimore County would provide capital funds for construction of the Red Line in addition to right-of-way contributions, easements, and ancillary roadway and trail facilities.

Baltimore County Funding

Baltimore County's involvement in project funding will be determined with the selection of the final alignments and associated right-of-way needs. The County has implemented programs in the past to support transit at existing Metro Stations – most notably at the Owings Mills Station.

Baltimore City Funding

The City of Baltimore has become involved in implementing the infrastructure necessary to support the development of the Red Line. The City recently submitted an application to the MTA to have the US 40/Edmondson Avenue Bridge over Gwynns Falls considered as a local match. The bridge is being designed with sufficient right-of-way width and structural capicity to accommodate the future Red Line. Futher local match opportunities will be explored as other infrastructure projects move forward.

Potential Private-Sector Funding

Private sector funding contributions would most likely come from development projects adjacent to certain Red Line stations. Contibutions are typically targeted toward stations, enhancements, and mitigations along the alignment.

Federal Aid

New Starts

The Federal Transit Administration's discretionary New Starts program is the federal government's primary financial resource for supporting locally planned, implemented, and operated major transit capital investments. The New Starts program funds new, and extensions to existing, fixed guideway systems, including commuter rail, light rail, heavy rail, BRT, trolleys, and ferries. For the five-year period FY 2005 - FY 2009, the New Starts program is authorized at $7.4 billion ($1.5 billion per year average). The New Starts program is funded at about 16 percent of the total federal transit funding for FY 2005 - FY 2009 ($45.3 billion). To qualify for federal funding, transit New Starts projects must be authorized by the US Congress in the Surface Transportation Authorization Act, which occurs every five or six years. The current authorization act (SAFETEA-LU) is in effect through FY 2009. The allocation of federal funds for specific transit New Starts projects occurs in the annual Transportation Appropriations Act. Congress earmarks transit New Starts discretionary funds to various projects throughout the country. The bulk of projects that obtain federal transit discretionary funding earmarks are those projects that are in FTA's Full Funding Grant Agreement (FFGA) process. In fact, FTA's FY 2007 budget request to Congress includes $1.228 billion (92 percent of the total request) for New Starts projects in the FFGA pipeline and $102 million for other projects (eight percent).

Due to intense competition for federal transit funding, the federal share for transit New Starts projects has steadily declined over the past 10 years or so. Although the law allows an 80 percent federal share for New Starts projects, the trend has been to limit federal funds to around 50 percent. Funding for transit projects in Maryland is an excellent example of this trend in that the original Washington Metrorail system received 100 percent federal funding. When the Baltimore Metro was built, it received 90 percent federal funding. In the 1990s when the Baltimore Central Light Rail Line was built, it received 80 percent federal funding compared to the recently completed Largo extension of the Metrorail that received 60 percent federal funding. Because requests for this funding assistance far outstrip the available funds, projects from around the country compete against each other for funds. In recent fiscal years, the Congressional Appropriation Committee has been limiting the federal share to 50 percent and nearly all project requests for federal assistance are in this range.

For transit projects seeking federal funds, the agency sponsoring a locally selected transit project submits a "New Starts Criteria" package to FTA to get the project into the "funding pipeline." This package is first developed after the Alternatives Analysis is completed and a Locally Preferred Alternative (LPA) is selected, prior to the request to enter the Preliminary Engineering (PE) phase. The package provides information describing the proposed project and information about a number of criteria used to rate the project against other projects from around the country competing for the limited pool of Section 53-09 New Starts funds. These criteria include the following:

- Mobility improvements (travel time savings, low income households served).
- Environmental benefits.
- Operating efficiencies (operating cost-per-mile).
- Cost-effectiveness (transportation system user benefits).
- Transit-supportive land use patterns, policies, and programs.
- Local financial commitment.

Under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU, August 2005), a five level scale of "High," "Medium-High," "Medium," "Medium-Low," and "Low" is established for overall project rating, as well as for individual criteria. Only those projects rated "Medium" or higher, overall, may be advanced through the New Starts project development process or be recommended for funding. A "Medium" overall rating requires a rating of at least "Medium" for both project justification and local financial commitment, and if a project receives a "Low" rating for either project justification or local financial commitment, it will receive a "Low" overall rating. FTA further notes that it will not generally recommend for funding any project which does not achieve a rating of at least "Medium" for cost effectiveness. A project must receive an overall rating of at least "Medium" to be admitted into preliminary engineering or final design, or to receive a funding recommendation.

Another key variable is the local financial commitment, which focuses on the availability and reliability of local funding sources for capital construction and operating and maintenance costs, as well as the overall amount and share of project cost being requested from the federal Section 53-09 program. Maryland has historically rated very well in these areas.

A project emerging out of an Alternative Analysis phase with a selected Locally Preferred Alternative (LPA) that is in the state's Constrained Long Range Transportation Plan (CLRP) and receives at least a "Medium" rating is eligible to submit a "Request to Initiate Preliminary Engineering." During the PE phase, the project will complete detailed planning and conduct preliminary engineering, complete the federal and state environmental review processes (environmental impact statement), and prepare project management and financial plans. At the completion of the PE phase, the New Starts Criteria for the project is updated and submitted for rating and recommendation. After completing the PE phase and receiving a New Starts rating from FTA, the project would submit a "Request to Initiate Final Design." In this phase, final construction plans are developed, and property acquisition and construction and equipment procurement occur that eventually lead to the start of operations. A key element of this phase is negotiating a

"Full Funding Grant Agreement" (FFGA) between the sponsoring agency and FTA regarding the amount and payout schedule for the federal share of funds.

The Red Line Corridor Transit Study, and the Purple Line and the Corridor Cities Transitway in Montgomery County are potential New Starts projects. None of these projects have selected an LPA, and therefore have not submitted a "New Starts Criteria" package to FTA for rating. Since these projects have not been rated, they are not officially in the New Starts pipeline and have yet to submit "Request to Initiate Preliminary Engineering." The Red Line Corridor Transit Study and the Purple Line project are in the Alternatives Analysis phase, and the Corridor Cities Transitway project is at the stage of updating its environmental documentation and, subsequently, selecting the LPA for the transit component of the project. All have entered the federal environmental process, NEPA.

The current SAFETEA-LU authorizating legislation expires in FY2009 at which time it is excepted that a successor authorizing legislation would be passed by Congress and signed into law. The candidate Maryland New Starts projects, including the Red Line Corridor, would be seeking capital funding authorized in this successor legislation.

Capital Cost Funding Strategy

A number of decisions will affect the amount and timing of the funding required for building and operating the Red Line Corridor transit improvement. First is the decision on the LPA which will establish the overall level of capital funding needed. It is possible that the LPA may be a modification of an alternative considered in this DEIS in terms of location of the terminal stations, the number and location of stations and other components of the project definition. The other decision is the timing of the construction and start of operations, including initiation and phasing/staging of construction. Major influences on the timing will be the availability of funding, especially the state's funding, and the state priorities relative to the other New Starts projects.

MDOT will seek federal Section 53-09 New Starts funding for the LPA. While up to 80 percent of the project costs can be covered by the New Starts program, it is expected that MDOT will be seeking between 50 and 60 percent. The majority of the non-New Starts funding is expected to come from the Maryland Transportation Trust Fund. Capital fund contributions, above right-of-way, and related property and easement contributions are expected from Baltimore City and Baltimore County. Non-New Starts federal funding will be sought for various enhancements, such as trails, and roadway, railroad and transit-oriented development improvements, where eligible.

The MTA will aggressively pursue private sources of funding. At a number of station areas, there may be the potential for developer contributions for stations in the adjoining area.

In the Fall 2007, a Special Session of the Maryland Legislature enabled a number of revenue enhancements that include a $400 million-per-year increase in revenue to the Transportation Trust Fund. In January 2008, the Governor announced that $100 million was committed to the Red Line.

The FY 2008-2013 MDOT Consolidated Transportation Program (CTP) has a total of $100,785,000 in state funds for the Red Line Corridor Transit Project. The CTP shows funds by both category of expense and years of anticipated expenditure through the year 2013. The CTP is updated every year for all projects within the program. The FY 2008-2013 CTP shows funds for planning/NEPA/preliminary engineering through FY 2011, Final Design funds and from FY 2011 through FY 2013, right-of-way funds from FY 2011 through FY 2013, and construction funds beginning in 2013. Since a Locally Preferred Alternative has not been selected, these funds are essentially being held in place, pending selection of an alternative. Should No-build be selected, any unspent funds revert back to the Transportation Trust Fund. Should a Build alternative be selected, the funds by category of expenditure and year of expenditure will be adjusted annually to reflect the scope and cost of the project, federal funds anticipated, and project schedule. The state funds allocated to the Red Line are based on six-year revenue projections for the entire Transportation Trust Fund, calculated by MDOT, for the purpose of assigning funds to the entire MDOT Capital Program.

It is expected that a further funding revenue increase will be pursued over the next several years to fund the priority transit projects in Maryland, including system preservation, MARC improvements, and the selected New Starts projects. While one possible scenario is to increase revenue to the Maryland Transportation Trust Fund, other jurisdictional or institutional revenue and funding mechanisms are possible, such as special transit improvement districts, or local option funding. It is expected that funding for the Red Line Corridor LPA and other priority New Starts Projects will be in place by 2011.

O&M Cost Funding Strategy

The MTA will operate the Red Line transit service. As is the case for existing MTA services, that portion of the annual operating and maintenance and associated costs not covered by fare revenues, i.e., the operating subsidy, would be funded by the Transportation Trust Fund. As part of the State-level revenue enhancement for capital funding, other sources and mechanisms for providing the operating subsidy may be considered, including possible county contributions.

Conclusions

The capital cost funding and annual operating cost subsidy for the Red Line would be funded from a package of federal, state, county/city and possible private sources. It is expected that 50-60% of the capital funding will be sought from the federal New Starts funding. While other federal, county and private sources will contribute to the remainder of the capital funding needs, the State of Maryland would be the principle source. Recent revenue increase and programmatic commitments will cover the funding need for design and initial capital costs. It is expected that further revenue increases and funding mechanisms will be in place by 2011 to fund the implementation and operations of the Red Line LPA.

Volume I-Chapter 6

Evaluation of Alternatives

RED LINE
Corridor Transit Study

Evaluation of Alternatives

Introduction

This chapter presents the evaluation of alternatives and impacts analysis for the Red Line Corridor Transit Study. The purpose of the evaluation process is to bring together qualitative and quantitative information for each alternative so that the alternatives' benefits, costs, and transportation and environmental consequences can be evaluated against the stated purpose and need for the project. The study goals and objectives from Chapter 1 are presented, and a set of 22 study evaluation measures that address the goals and objectives are introduced. An evaluation matrix is then presented, providing information for the alternatives relative to the study evaluation measures. The performance of the alternatives with regard to each of the evaluation measures is discussed, including equity considerations, covering the extent to which the alternatives improve transit service throughout the corridor, and distribute costs and reduce environmental effects across neighborhoods/populations. The final section provides a summary of major trade-offs, in which the alternatives' costs, benefits and impacts are compared and contrasted. This chapter also discusses how FTA's New Starts Criteria are incorporated into the evaluation.

Alternatives Evaluated in This Chapter

The No-Build alternative (Alternative 1) is required as an alternative to assess the impacts if no transit improvements are made in the corridor, beyond what are already programmed for improvement. The TSM Alternative (Alternative 2) represents the lower investment bus alternative. The BRT and LRT alternatives represent the higher investment bus and rail alternatives. For the No-Build and TSM, there is effectively one option for each alternative. For the BRT and LRT alternatives, there are a wide range of options. These options were summarized in **Tables 2-3** and **2-4**, and explained in greater detail later in Volume II.

Due to the wide range of options (both horizontal and vertical alignments) for BRT and LRT, it is not possible to evaluate all possible combinations of options. It is therefore necessary to combine BRT or LRT options from geographic areas to form complete end-to-end BRT or LRT alternatives, in order to allow a reasonable assessment of alternatives. The following end-to-end alternatives and the representative options which comprise the alternatives, have been developed to represent a full range of BRT and LRT alternatives for comparison.

Alternative 1: No-Build

Alternative 2: TSM bus service as follows:

- Shared lanes on Security Boulevard to Woodlawn Drive,
- Two dedicated curb lanes on Security Boulevard,
- I-70 Park-and-Ride lot,
- Shared transit/traffic lanes on Cooks Lane,
- Curb lanes of US 40 to the West Baltimore MARC station,
- Shared transit/traffic lanes with bus service on Franklin Street, US 40 lower level, and Mulberry Street,
- Shared transit/traffic lanes on Martin Luther King, Jr. Boulevard,
- Dedicated lanes in a Baltimore Street/Lombard Street Couplet,
- Dedicated transit on Central Avenue,
- Dedicated transit curbside on Eastern Avenue/ Fleet Street Couplet, shared transit in the off-peak period, to Chester Street,
- Bus service on both Eastern Avenue/Fleet Street and Boston Street with dedicated transit curbside on Eastern Avenue/Fleet Street Couplet and shared transit/traffic lanes on Boston Street,
- Shared lanes on Conkling Street from Boston Street to Eastern Avenue,
- Lombard Street to the proposed Bayview MARC Station, and
- Shared lanes on Bayview Boulevard to the Bayview station.

Figure 6-1: Alternative 2: TSM

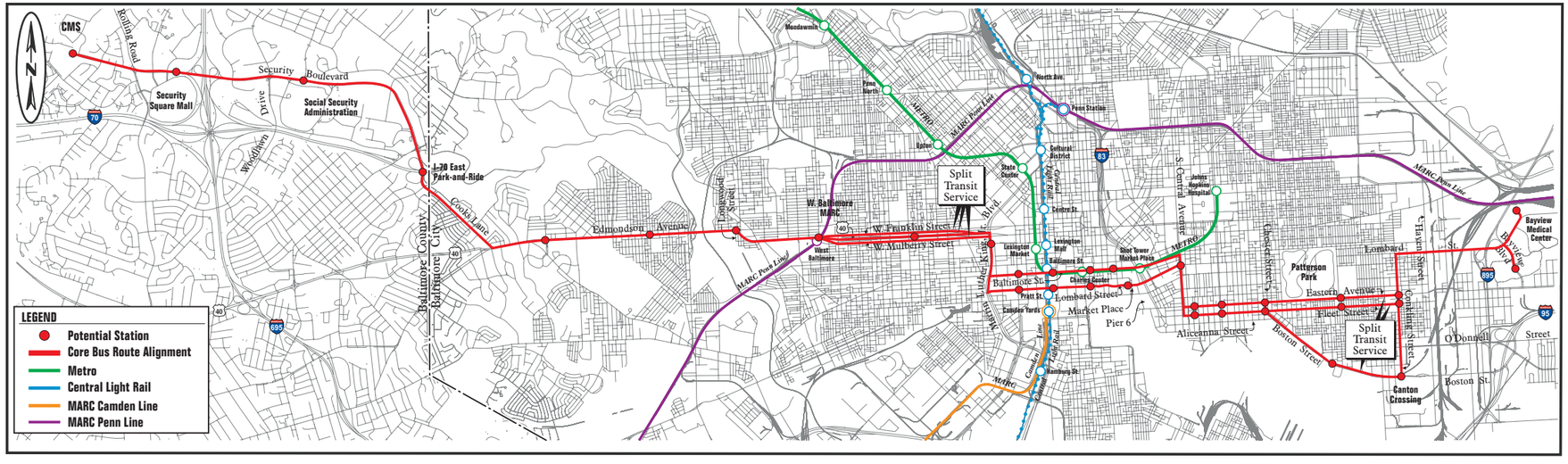
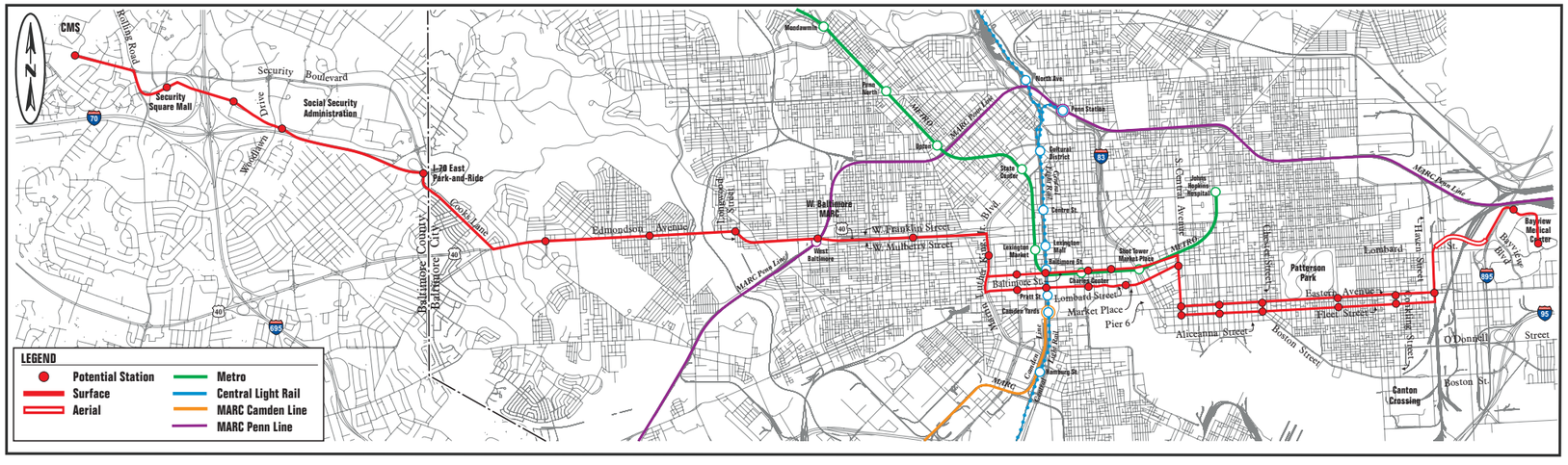


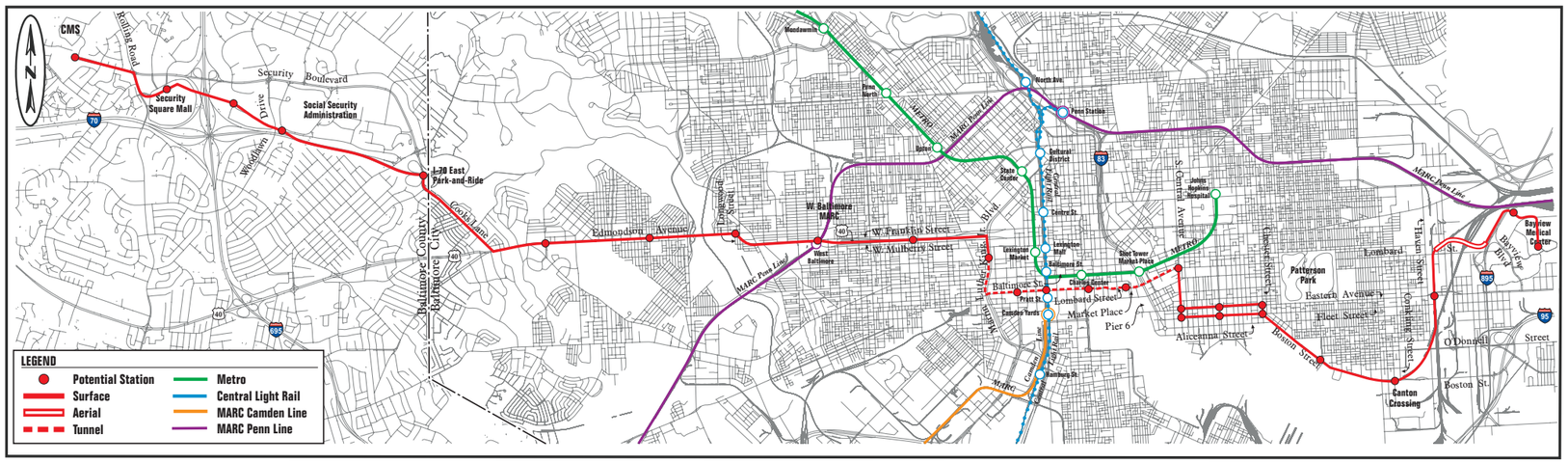
Figure 6-2: Alternative 3A: BRT, Dedicated Surface



Alternative 3A: BRT as follows:

- Shared lanes on Security Boulevard,
- Shared lanes on Rolling Road,
- North side of the Security Square Mall,
- Central alignment and the north side of I-70,
- I-70 Park-and-Ride lot,
- Two dedicated lanes on Cooks Lane,
- Median of US 40 with two vehicular lanes,
- Lower level of US 40,
- West side of Martin Luther King, Jr. Boulevard,
- Baltimore Street/Lombard Street Couplet dedicated transit in 2nd lane out on both Baltimore and Lombard Streets,
- Central Avenue 2nd lane out,
- Eastern Avenue/Fleet Street Couplet dedicated transit 2nd lane out, no parking in left curb lane peak period,
- Norfolk-Southern-Canton Railroad right-of-way, and
- New alignment to Mason Lord Drive on the Bayview Medical Campus.

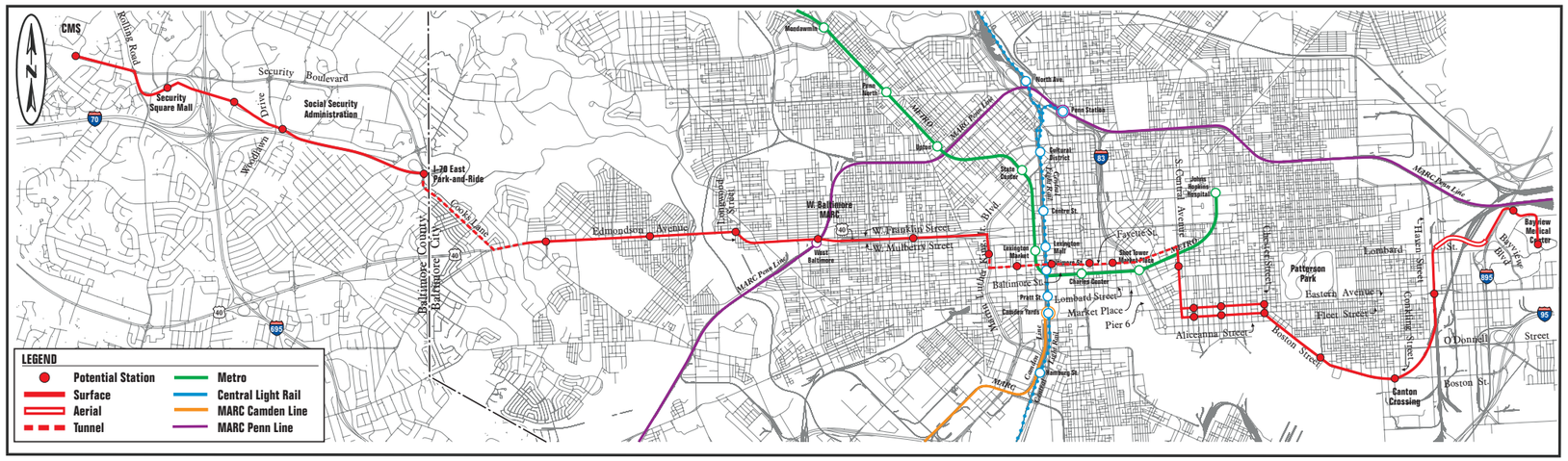
Figure 6-3: Alternative 3B: BRT, Downtown Tunnel and Dedicated Surface



Alternative 3B: BRT as follows:

- Shared lanes on Security Boulevard,
- Shared lanes on Rolling Road,
- North side of the Security Square Mall,
- Central alignment and the north side of I-70,
- I-70 Park-and-Ride lot,
- Two dedicated lanes on Cooks Lane,
- Median of US 40 with two vehicular lanes,
- Lower level of US 40,
- West side of Martin Luther King, Jr. Boulevard,
- Lombard Street Tunnel from Martin Luther King, Jr. Boulevard continuing to a portal on Central Avenue,
- Central Avenue 2nd lane out,
- Eastern Avenue/Fleet Street Couplet dedicated transit 2nd lane out, no parking in left curb lane peak period,
- Median of Boston Street,
- Norfolk-Southern-Canton Railroad right-of-way, and
- New alignment to Mason Lord Drive on the Bayview Medical Campus.

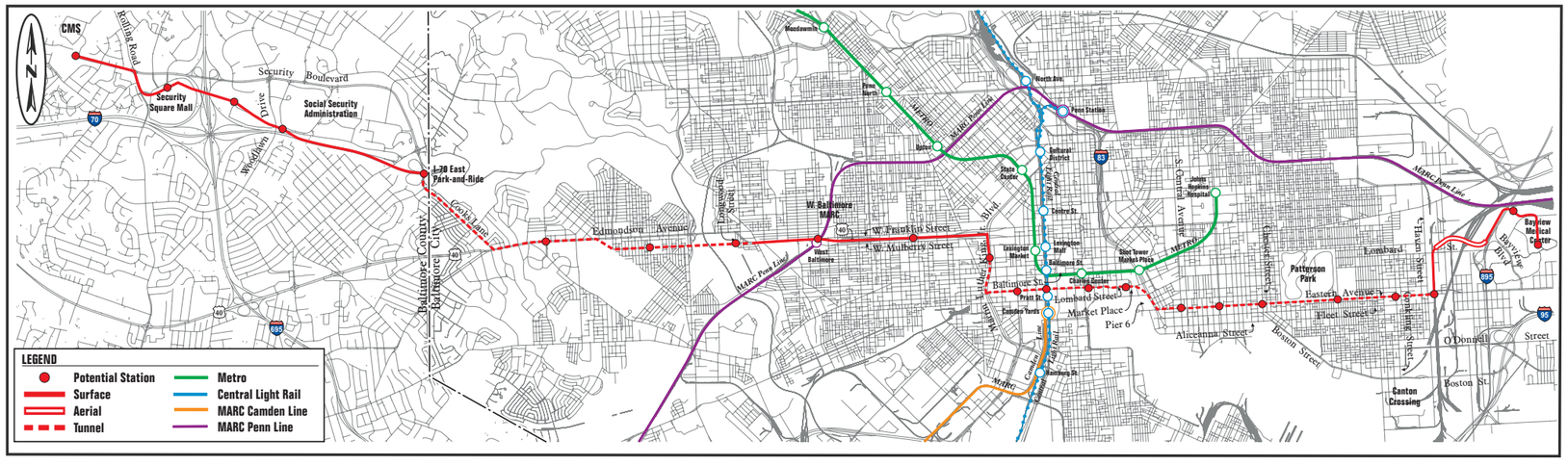
Figure 6-4: Alternative 3C: BRT, Downtown Tunnel and Cooks Lane Tunnel and Dedicated Surface



Alternative 3C: BRT as follows:

- Shared lanes on Security Boulevard,
- Shared lanes on Rolling Road,
- North side of the Security Square Mall,
- Central alignment and the north side of I-70,
- I-70 Park-and-Ride lot,
- Tunnel under Cooks Lane,
- Median of US 40 with two vehicular lanes,
- Lower level of US 40,
- West side of Martin Luther King, Jr. Boulevard,
- Fayette Street Tunnel from Martin Luther King, Jr. Boulevard continuing to Central Avenue,
- Central Avenue 2nd lane out,
- Eastern Avenue/Fleet Street Couplet dedicated transit 2nd lane out, no parking in left curb lane peak period,
- Median of Boston Street
- Norfolk-Southern-Canton Railroad right-of-way, and
- New alignment to Mason Lord Drive on the Bayview Medical Campus.

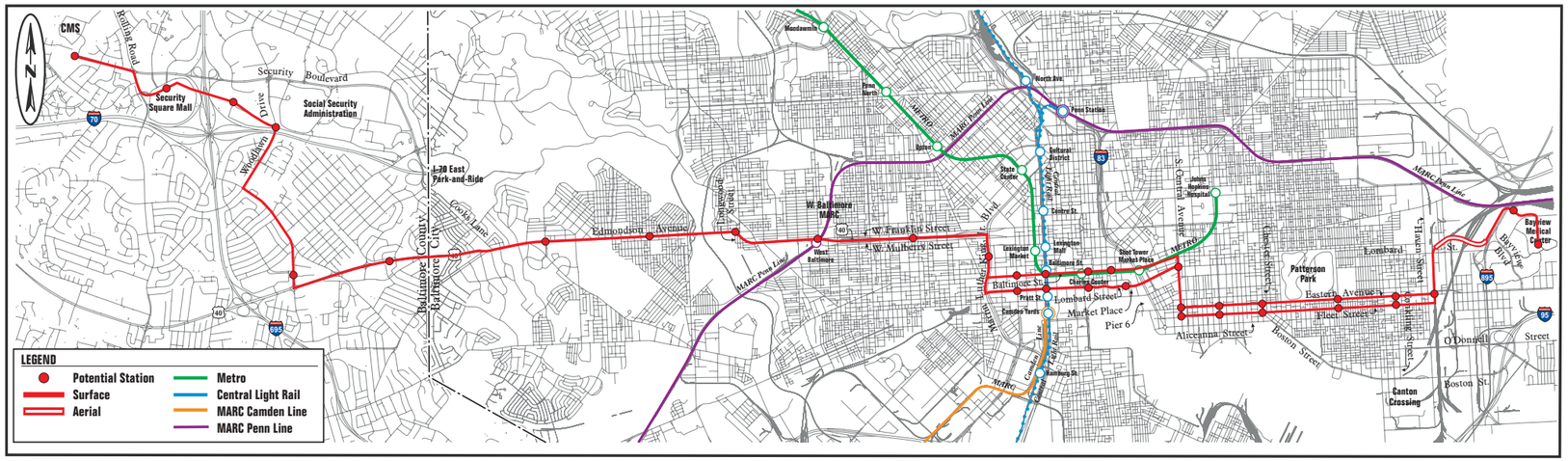
Figure 6-5: Alternative 3D: BRT, Maximum Tunnel and Dedicated Surface



Alternative 3D: BRT as follows:

- Shared lanes on Security Boulevard,
- Shared lanes on Rolling Road,
- North side of the Security Square Mall,
- Central alignment and the north side of I-70,
- I-70 Park-and-Ride lot,
- Tunnel under Cooks Lane,
- Tunnel under US 40 and West Franklin Street to Calverton Road,
- Median of US 40 with two vehicular lanes,
- Lower level of US 40,
- West side of Martin Luther King, Jr. Boulevard,
- Lombard Street Tunnel continuing under Eastern Avenue to a portal in Norfolk-Southern-Canton Railroad right-of-way
- Continuing in Norfolk-Southern right-of-way, and
- New alignment to Mason Lord Drive on the Bayview Medical Campus.

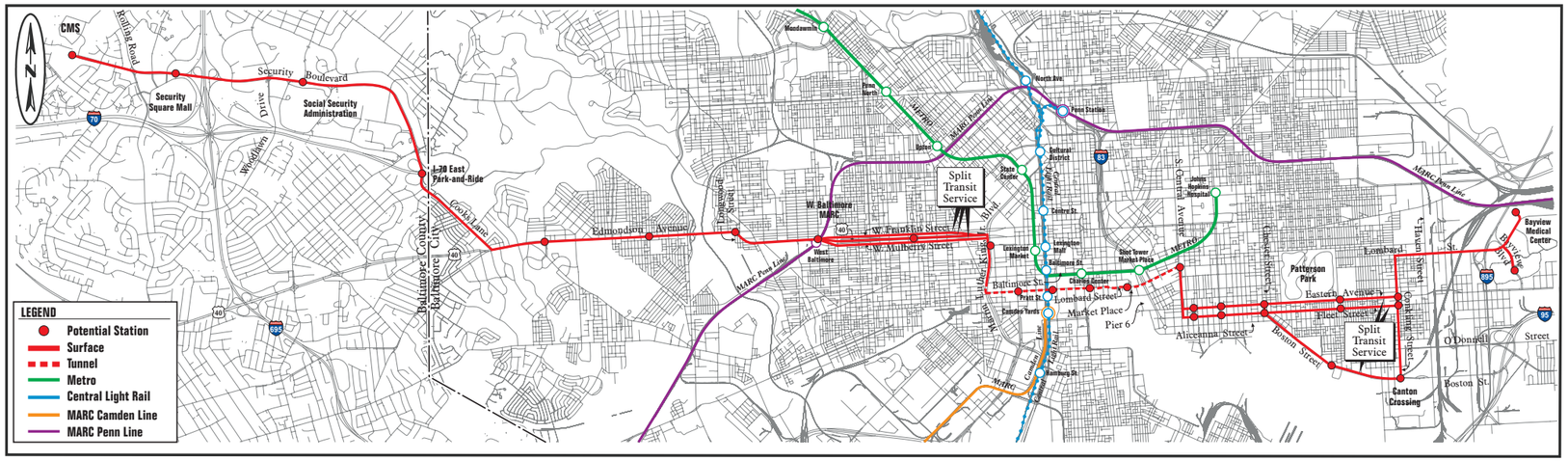
Figure 6-6: Alternative 3E: BRT, Dedicated Surface with Johnnycake Road Alignment



Alternative 3E: BRT as follows:

- Shared lanes on Security Boulevard,
- Shared lanes on Rolling Road,
- North side of the Security Square Mall,
- Central alignment to Woodlawn Drive,
- Two dedicated curb lanes on Woodlawn Drive,
- Shared transit/traffic lanes on Johnnycake Road and Ingleside Avenue,
- Dedicated transit lanes, two vehicular lanes on US 40 to Cooks Lane,
- Median of US 40 with two vehicular lanes,
- Lower level of US 40,
- West side of Martin Luther King Jr. Boulevard,
- Baltimore Street/Lombard Street couplet dedicated transit in 2nd lane out on both Baltimore and Lombard Streets,
- Central Avenue 2nd lane out,
- Eastern Avenue/Fleet Street Couplet dedicated transit 2nd lane out, no parking in left curb lane peak period,
- Norfolk-Southern-Canton Railroad right-of-way, and
- New alignment to Mason Lord Drive on the Bayview Medical Campus.

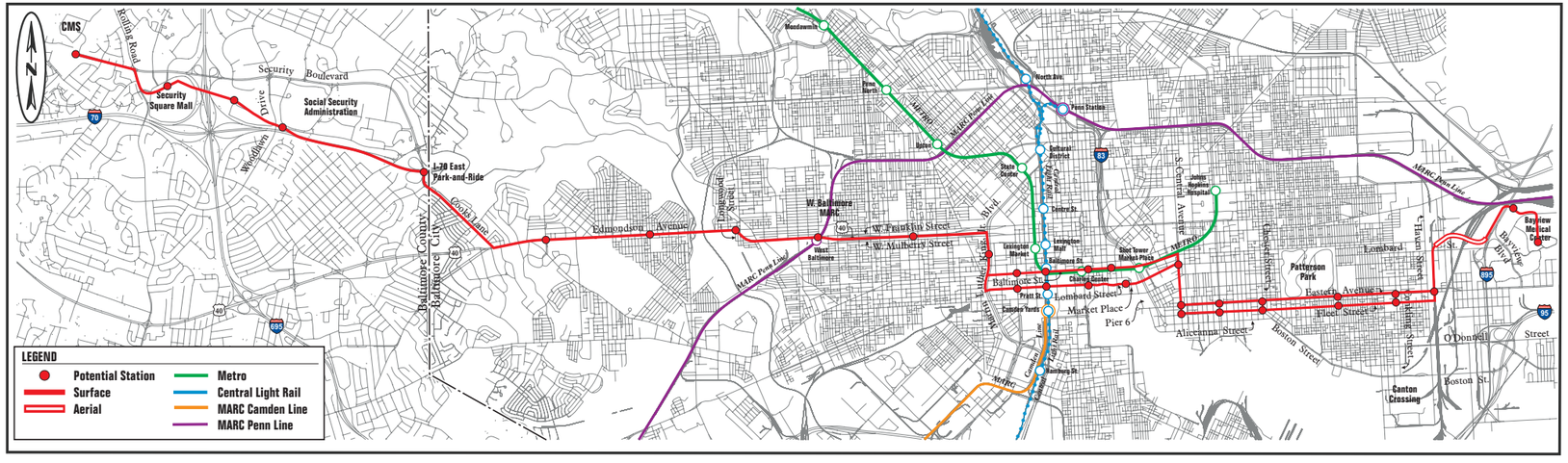
Figure 6-7: Alternative 3F: BRT, Shared and Dedicated Surface and Downtown Tunnel



Alternative 3F: BRT as follows:

- Shared lanes on Security Boulevard to Woodlawn Drive,
- Two dedicated curb lanes on Security Boulevard,
- I-70 Park-and-Ride lot,
- Shared transit/traffic lanes on Cooks Lane,
- Curb lanes of US 40 to the West Baltimore MARC station,
- Shared transit/traffic lanes with bus service on Franklin Street, US 40 lower level, and Mulberry Street,
- Shared transit/traffic lanes on Martin Luther King, Jr. Boulevard,
- Portal on Fremont Avenue to the Lombard Street tunnel to a portal on Central Avenue,
- Dedicated transit on Central Avenue,
- Dedicated transit curbside on Eastern Avenue/Fleet Street Couplet, shared transit in the off-peak period, to Chester Street,
- Bus service on both Eastern Avenue/Fleet Street and Boston Street with dedicated transit curbside on Eastern Avenue/Fleet Street couplet and shared transit/traffic lanes on Boston Street,
- Shared lanes on Conkling Street from Boston Street to Eastern Avenue,
- Lombard Street to the proposed Bayview MARC Station, and
- Shared lanes on Bayview Boulevard to the Bayview station.

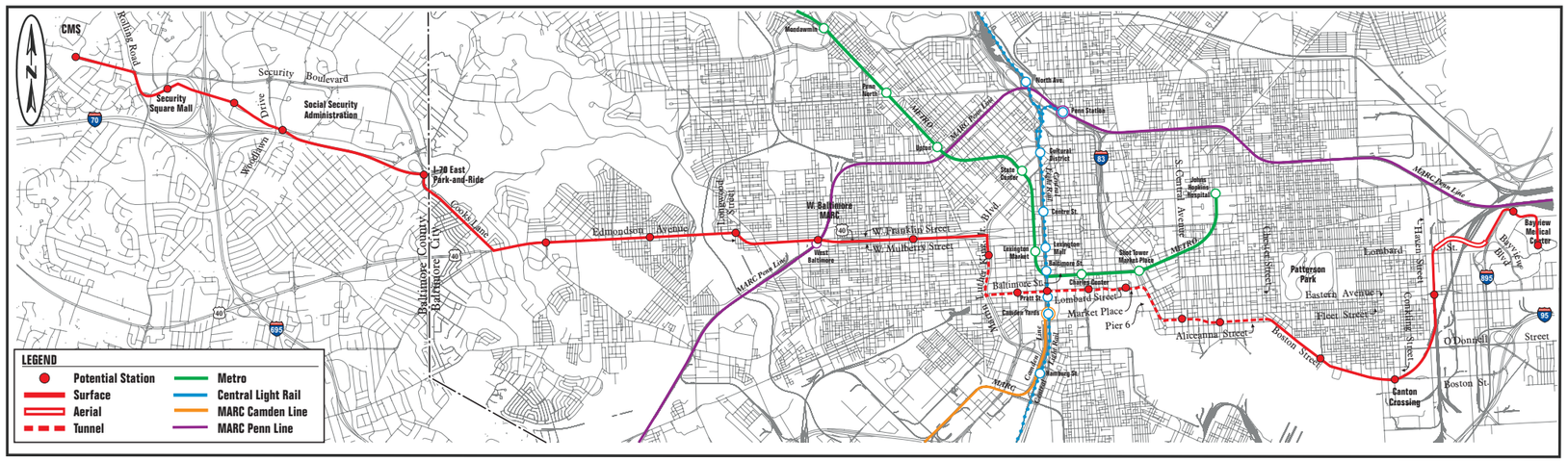
Figure 6-8: Alternative 4A: LRT, Dedicated Surface



Alternative 4A: LRT as follows:

- South side of Security Boulevard,
- West side of Rolling Road,
- North side of the Security Square Mall,
- Central alignment and the north side of I-70,
- I-70 Park-and-Ride lot,
- Two dedicated lanes on Cooks Lane,
- Median of US 40 with two vehicular lanes,
- Lower level of US 40,
- West side of Martin Luther King, Jr. Boulevard,
- Baltimore Street/Lombard Street couplet with dedicated transit in 2nd lane out on both Baltimore and Lombard Streets,
- Central Avenue 2nd lane out,
- Eastern Avenue/Fleet Street Couplet with dedicated transit in 2nd lane, no parking in left curb lane in peak-period,
- Norfolk-Southern-Canton Railroad right-of-way, and
- New alignment to Mason Lord Drive on the Bayview Medical Campus.

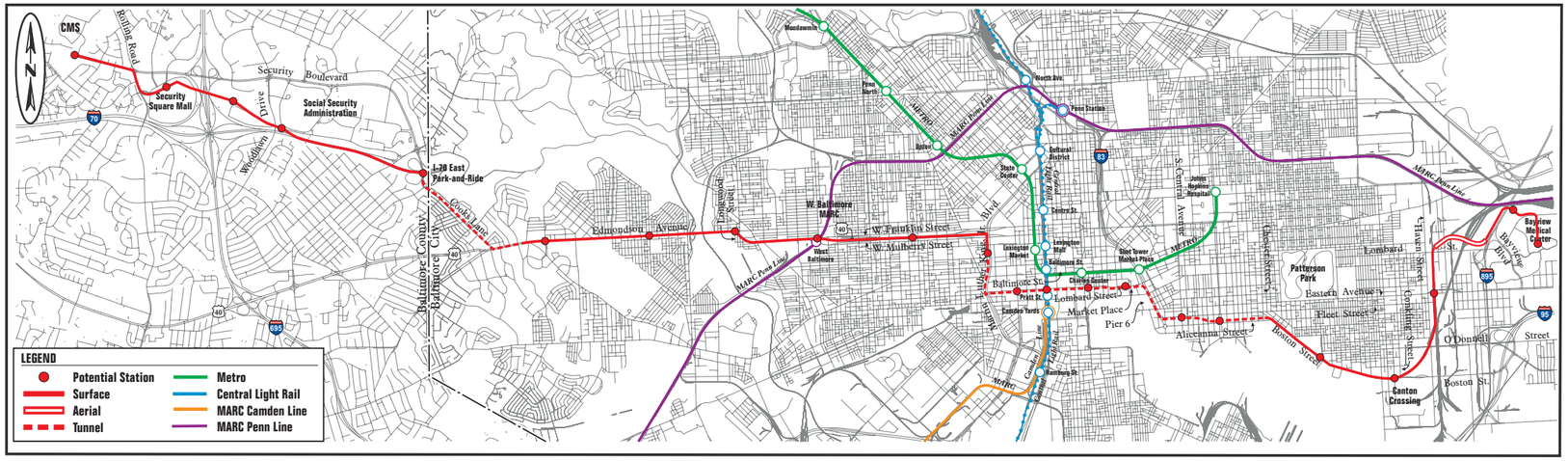
Figure 6-9: Alternative 4B: LRT, Downtown Tunnel and Dedicated Surface



Alternative 4B: LRT as follows:

- South side of Security Boulevard,
- West side of Rolling Road,
- North side of Security Square Mall,
- Central alignment and the north side of I-70,
- I-70 Park-and-Ride lot,
- Two dedicated lanes on Cooks Lane,
- Median of US 40 with two vehicular lanes,
- Lower level of US 40,
- West side of Martin Luther King, Jr. Boulevard,
- Lombard Street tunnel continuing under Eastern Avenue to a portal on Aliceanna Street at Boston Street,
- Median of Boston Street to Conkling Street
- Continuing in Norfolk-Southern-Canton Railroad right-of-way, and
- New alignment to Mason Lord Drive on the Bayview Medical Campus.

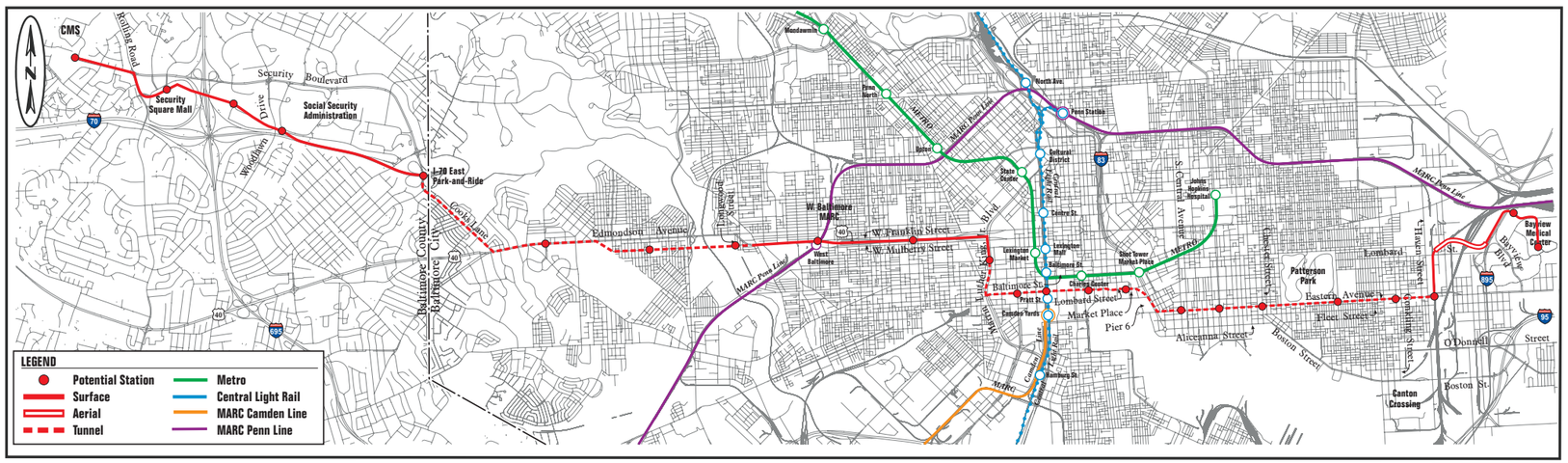
Figure 6-10: Alternative 4C: LRT, Downtown Tunnel and Cooks Lane Tunnel and Dedicated Surface



Alternative 4C: LRT as follows:

- South side of Security Boulevard,
- West side of Rolling Road,
- North side of Security Square Mall,
- Central alignment and the north side of I-70,
- I-70 Park-and-Ride lot,
- Tunnel under Cooks Lane,
- Median of US 40 with two vehicular lanes,
- Lower level of US 40,
- West side of Martin Luther King, Jr. Boulevard,
- Lombard Street tunnel continuing under Eastern Avenue to a portal on Aliceanna Street at Boston Street,
- Median of Boston Street to Conkling Street
- Continuing in Norfolk-Southern-Canton Railroad right-of-way, and
- New alignment to Mason Lord Drive on the Bayview Medical Campus.

Figure 6-11: Alternative 4D: LRT, Maximum Tunnel and Dedicated Surface



Alternative 4D: LRT as follows:

- South side of Security Boulevard,
- West side of Rolling Road,
- North side of Security Square Mall,
- Central alignment and the north side of I-70,
- I-70 Park-and-Ride lot,
- Tunnel under Cooks Lane,
- Tunnel under US 40 and West Franklin Street to Calverton Road,
- Median of US 40 with two vehicular lanes,
- Lower level of US 40,
- West side of Martin Luther King, Jr. Boulevard,
- Lombard Street tunnel continuing under Eastern Avenue to a portal in Norfolk-Southern-Canton Railroad right-of-way
- Continuing in Norfolk-Southern-Canton Railroad right-of-way, and
- New alignment to Mason Lord Drive on the Bayview Medical Campus.

It is noted that in going from Alternatives 3A to 3D, and 4A to 4D, the alternatives will be more costly to construct, using longer lengths of dedicated guideway. This allows a comparison of different levels of investment, from all surface alignments in BRT Alternative 3A and LRT Alternative 4A (providing a traffic-free lane or lanes for transit), a downtown tunnel in Alternatives 3B and 4B, to major lengths of tunnel in Alternatives 3D and 4D. Alternative 3E is the only alternative to use the Johnnycake Road alignment. Alternative 3F includes a shared and dedicated surface alignment for its length except that it is in tunnel in the downtown Baltimore area.

In this chapter, these 12 alternatives will be evaluated against a set of 22 study evaluation measures that are proposed herein. First, however, the environmental information that was presented for the options in Chapter 4 is presented for the 12 end-to-end alternatives.

Environmental Information for End-to-End Alternatives

Chapters 3 and 4 included quantitative information on transportation and environmental impacts for the options in the geographic areas. In this section, environmental information from Chapter 4 is presented for the end-to-end alternatives. This information is contained in **Table 6-1**.

Table 6-1 (next page) presents environmental information in ten categories: Displacements; Right-of-Way Required; Parks, Recreation and Open Space; Historic, Archeological, and other Cultural Resources; Streams; Wetlands and Waters of the US; Floodplains; Critical Area; Forests and Significant Trees; and Contaminated Materials and Sites.

Displacements, Relocations, and Right-of-Way Required

No residences would be displaced in order to build the Red Line; however, depending on the alternative, up to three business relocations and up to seven institution relocations, would be required. **Table 6-1** also shows the number of acres of right-of-way required for the alternatives. Generally, only sliver acquisitions, or portions of properties, would be needed for the project. The following alternatives would affect fewer than 90 properties: TSM, 3D and 3F; the remaining alternatives would require right-of-way between 108 and 242 properties.

Recreation and Open Space

The alternatives do not have significant park impacts.

Historic, Archeological, and other Cultural Resources

Table 6-1 expresses impacts in this category in terms of number of properties and districts adversely affected. The range of impacts for the build alternatives is 8 to 18.

Streams

Stream impacts are expressed in terms of linear feet affected. The TSM Alternative and Alternative 3F each affect 12 linear feet. Eight of the other 10 build alternatives fall into the range of 446 to 456 feet. Alternative 3E affects 187 linear feet.

Wetlands and Waters of the US

TSM affects zero acres, as does Alternative 3F. The other build alternatives affect 0.15 to 0.16 acres.

Floodplains

Alternative 3E affects 0.24 acres of floodplains. Alternatives 4A, 4B and 4C affect between 1.21 and 2.13 acres. TSM and the remaining alternatives affect between 0.65 and 0.72 acres.

Critical Area

Alternatives 3D and 4D impact no Critical Area. Alternatives 4A, 4B and 4C impact 4.46 acres or more of Critical Area. TSM and the remaining build alternatives impact less than one acre.

Forests and Significant Trees

Alternative 3E impacts 4.86 forest acres. TSM impacts 16.31 forest acres. The remaining alternatives impact 26.27 to 26.31 acres of forest.

TSM affects one significant tree. The other build alternatives impact between 5 and 17 significant trees, with Alternatives 3D, 3E, 3F and 4D in the low end of the range, and the other alternatives in the upper end of the range.

Contaminated Materials and Sites

Alternative 3F affects 14 such sites; TSM affects 17 sites. Alternative 4D affects 42 sites, and the remaining build alternatives affect between 43 and 61 sites.

Table 6-1 (next page) also provides information on the number of affected sites for each alternative that would be classified as high, moderate or slight severity of contamination.

Attainment of Goals and Objectives, and Addressing Project Need

Chapter 1 set the stage for the Draft Environmental Impact Statement by establishing the Purpose and Need for transportation improvements in the Red Line Corridor. It did so by identifying problems and opportunities for transportation as well as economic and community development in the corridor.

Chapter 1 also established goals and objectives for the study. These are shown in **Table 6-2**.

Study Evaluation Measures

Twenty-two evaluation measures were created to address the goals and objectives. The No-Build, TSM, and the ten other build alternatives will be evaluated against these evaluation measures. The 22 study evaluation measures are described in **Table 6-3**. In addition, the goal(s) that are addressed by each of the evaluation measures are identified.

Role of FTA's New Starts Criteria

The Section 53-09 "New Starts" program is the Federal government's primary program for providing financial support to locally-planned, implemented, and operated fixed guideway transit major capital investments. The federal transportation legislation, SAFETEA-LU, requires that proposed New Starts projects be justified based on several project justification criteria, including: Mobility Improvements; Environmental Benefits; Operating Efficiencies; Cost Effectiveness; and Transit Supportive Land Use Policies and Future Patterns. Another factor also cited in the legislation is that FTA must also consider the local financial commitment for a proposed project.

In a relatively new requirement, SAFETEA-LU further requires that FTA consider in its review the economic development effects of New Starts projects. FTA is evolving guidance on evaluating projects in regard to economic development impacts. This future guidance will also take

Table 6-2: Red Line Corridor Transit Study Goals and Objectives

Goals	Objectives
1. Increase Transit Efficiency	• Reduce transit travel times in the corridor • Provide safe and attractive transit service
2. Increase Transit Mobility and Accessibility	• Better accommodate existing and future east-west travel demands • Improve transit access to jobs in the region • Provide transit access to schools, shopping, events, healthcare and other services and cultural attractions in the corridor
3. Provide Transportation Choices for East-West Commuting	• Encourage transit ridership • Improve transit opportunities in the east-west corridor • Improve transit service for the transit-dependent user as well as those individuals within the corridor who choose to use transit as an option
4. Improve Transit Connections	• Develop connections between existing transit routes • Provide transit connections to existing and planned economic development areas
5. Support Community Revitalization and Economic Development	• Support ongoing community revitalization and economic development initiatives • Provide transit stations compatible with local community character
6. Address Air Quality Issues and Environmental Stewardship	• Provide a quality alternative to automobile travel • Minimize impacts to the natural and human environment • Support local, regional, and state policies and adopted Master Plans • Support energy conservation

Table 6-1: Environmental Information for Red Line Alternatives

ALTERNATIVE	Displacements			ROW Required		Parks, Recreation and Open Space				Historic, Archeological, and other Cultural Resources	Streams	Wetlands and Waters of the US	Floodplains	Critical Area	Forest		Contaminated Materials and Sites	
	# of Residences	# of Businesses	# of Institutions	# of Properties Affected	Quantity (Acre)	# of Takes	Quantity (Acre)	Significance of Severity of Use	# of Properties in Proximity	# of Properties and Districts Adversely Affected	Linear Feet Affected	Acres Affected	Acres Affected	Acres Affected	Acres Affected	Number of Significant Trees Affected	# of Sites Affected	Severity of Contaminated Site	
No-Build	0	0	0	0	0	0	0	None	0	0	0	0	0.00	0	0	0	0	0	High
																		0	Moderate
																		0	Slight
2: TSM	0	1	7	22	16.78	0	0	None	21	8	12	0	0.72	0.12	16.31	1	17	3	High
																		3	Moderate
																		11	Slight
3A: BRT	0	2	7	231	33.97	1	0.01	Minimal	15	13	456	0.16	0.65	0.1	26.27	14	53	10	High
																		14	Moderate
																		29	Slight
3B: BRT	0	3	7	242	36.54	1	0.01	Minimal	17	16	456	0.16	0.69	0.56	26.28	14	55	16	High
																		17	Moderate
																		22	Slight
3C:BRT	0	2	7	137	35.75	3	0.10	Minimal	16	18	456	0.16	0.69	0.43	26.28	17	61	16	High
																		18	Moderate
																		27	Slight
3D: BRT	0	2	7	88	30.04	1	0.04	Minor	12	17	456	0.16	0.65	0	26.27	8	43	8	High
																		12	Moderate
																		23	Slight
3E: BRT	0	2	7	144	35.55	0	0	None	14	10	187	0.15	0.24	0.1	4.86	9	57	10	High
																		17	Moderate
																		30	Slight
3F: BRT	0	2	7	22	16.98	0	0	None	20	13	12	0	0.72	0.25	16.31	5	14	3	High
																		3	Moderate
																		8	Slight
4A: LRT	0	3	6	213	33.26	1	0.01	Minimal	15	11	446	0.16	2.13	4.46	26.30	14	56	10	High
																		14	Moderate
																		32	Slight
4B: LRT	0	3	6	225	36.15	1	0.01	Minimal	16	14	446	0.16	1.21	6.81	26.31	14	52	14	High
																		17	Moderate
																		21	Slight
4C: LRT	0	3	6	131	35.51	0	0	None	16	13	446	0.16	1.21	6.81	26.31	17	52	14	High
																		17	Moderate
																		21	Slight
4D: LRT	0	3	6	108	29.61	1	0.04	Minor	12	15	446	0.16	0.65	0	26.28	8	42	8	High
																		11	Moderate
																		23	Slight

Table 6-3: Study Evaluation Measures and Goals Addressed

Evaluation Measure	Goal(s) Addressed
Red Line Capital Cost – Capital cost of the Red Line, in 2007 dollars	1
Red Line Corridor Incremental Annual Operating and Maintenance Costs – Annual operating cost of transit in the Red Line Corridor, accounting for reductions in parallel bus service that could take place as riders shift to using the Red Line, in 2007 dollars	1
Red Line Travel Time – Travel time on Red Line in minutes, measured during the peak period, from one end of the corridor to the other	1, 2, 3 and 4
Average Weekday Ridership: Red Line – Ridership on an average weekday estimated for year 2030, on the Red Line for TSM and the Build Alternatives	1, 2, 3 and 6
New Riders per Day – Number of daily riders that would use transit instead of driving as a result of implementation of an alternative, thereby providing air quality improvements, energy savings and benefits; number is derived from the travel demand models used in the study	1, 3 and 6
Transit User Benefit – Number of hours of user benefits per day for an alternative compared with TSM alternative [and generally equivalent to travel time savings calculated for all transit riders]. It is used as input to the calculation of the FTA Cost-Effectiveness Index.	1, 2, 3 and 4
FTA Cost-Effectiveness Index – Calculated by dividing annualized capital and operating and maintenance costs for a build alternative compared to a baseline alternative, by the number of hours of user benefits expressed in terms of travel time, to yield the "cost per hour of user benefits". Because this measure divides cost by a calculation of effectiveness, it is identified by FTA as a cost-effectiveness measure. Typically, the TSM alternative is designated as the baseline alternative	1 and 2
Intersections below Level of Service D – Number of intersections below peak hour Level of Service (LOS) D in the Red Line Corridor for that particular end-to-end alternative; LOS D is generally considered the minimum acceptable in an urban area	1, 2 and 6
Change in Number of Parking Spaces – Number of parking spaces gained or lost in order to implement the alternative, not counting number of spaces added in major park-and-ride lots	1, 2 and 6
Red Line Travel Time between Security Square Mall (SSM) and Charles Center – Peak period transit travel time in minutes between SSM and Charles Center	1, 2, 3 and 4
Red Line Travel Time between Edmondson Village and Charles Center – Peak period transit travel time in minutes between Edmondson Village and Charles Center	1, 2, 3 and 4
Red Line Travel Time between West Baltimore MARC Station and Fells Point – Peak period transit travel time in minutes between West Baltimore MARC station and Fells Point	1, 2, 3 and 4
Red Line Travel Time between Charles Center and Bayview Medical Center – Peak period transit travel time in minutes between Charles Center and Bayview Medical Center	1, 2, 3 and 4
Number of Transit-Dependent Households Served by Enhanced Transit– Number of households that do not own a car in adjacent communities/neighborhoods	1, 3 and 4
Number of Residences Displaced/Relocated – Number of residences that would be relocated due to construction of an alternative	5
Number of Non-Residential Displacements/Relocations – Number of non-residential displacements and relocations (e.g., businesses, commercial establishments, etc.) due to construction of an alternative	5
Acres of Right-of-Way Required for the Project – Acres of right-of-way or property that would need to be acquired due to construction of an alternative and the Maintenance Facility	5
Acres of Right-of-Way Required for the Maintenance Facility – Portion of overall acres of right-of-way or property needed for the maintenance facility required for an alternative and the maintenance facility.	5
Number of Historic Properties Affected – Number of historic properties that would be affected by an alternative, either directly or by proximity, due to the presence of the Red Line	6
Number of Potential TOD Locations Provided by Enhanced Transit – Number of potential Transit Oriented Development (TOD) locations identified in Chapters 1 and 2 that would be served by improved transit as a result of implementing an alternative	5
Daily Auto VMT Change from No-Build – Change in daily automobile Vehicle Miles of Travel (VMT) in the region, comparing an alternative with No-Build; results in improved air quality from increased transit riding by transit riders, and by persons riding transit who had been traveling by car	6
Daily Air Emissions Change – Change in carbon monoxide emissions per day emitted by the transportation sector, in kilograms of carbon monoxide, resulting from reduced use of the automobile mode	6

into account that there is overlap between two of the criteria, land use and economic development impacts.

In total, the New Starts Criteria are intended to measure the overall merits of a project and the sponsor's ability to build and operate it. Projects undergo the formal New Starts review process when designation of a Locally Preferred Alternative is under consideration at the end of AA/DEIS. Since the Red Line is not yet at this stage of development, a New Starts evaluation is not yet required; however, an evaluation against some New Starts criteria is useful and is generally performed in alternatives analyses.

The following indicates how the New Starts Criteria are incorporated into the set of measures to be used to evaluate Red Line Corridor alternatives:

Mobility Improvements – Considered in the evaluation measures involving travel time as well as the equity considerations section of this chapter.

Environmental Benefits – Incorporated in various evaluation measures: displacements, relocations, right-of-way required, historic and archeological impacts, air quality.

Operating Efficiencies – Cost and travel time measures are among the measures used.

Cost Effectiveness – FTA cost effectiveness calculation is included as an evaluation measure, as are costs and ridership that are components of the cost effectiveness calculation; in addition, the summary of major trade-offs covered later in this chapter compares an alternative's costs with its various benefits and environmental impacts, thereby providing a cost-effectiveness comparison.

Transit-Supportive Land Use Policies and Future Patterns/Economic Development Potential – Considered in the evaluation measure regarding Transit-Oriented Development.

Local Financial Commitment – Covered in the financial analysis included in Chapter 5.

Evaluation of Alternatives Against Study Evaluation Measures

Table 6-4 presents the evaluation data prepared for all of the end-to-end alternatives. In the table, the No-Build, TSM and ten other build alternatives are shown along the left, and the 22 evaluation measures are shown across the top

The following discusses the 22 evaluation measures, covering the information included in **Table 6-4**. For presentation purposes, the 22 measures are organized into three categories: Costs and Effectiveness; Transportation and Connectivity, and Equity, Economic and Environmental.

Costs/Effectiveness Measures

Red Line Capital Cost

Capital cost is $281 million for TSM; it ranges between $545 million and $2,404 million for the BRT alternatives; and it ranges between $930 million and $2,463 million for the LRT alternatives. Comparing with Average Weekday Ridership on the Red Line, it is seen that the higher capital cost alternatives also have higher estimated ridership. As capital cost increases, representing increasing amount of grade separation, this can lead to ridership increases due to the improved transit service.

Capital cost of BRT alternatives appears to be in three groupings: Alternatives 3A, 3E, and 3F cost in the range of $545 million to $755 million; 3B and 3C between $1.02 billion and $1.15 billion; and 3D over $2.4 billion. In going from BRT Alternative 3A to 3C, there appears to be ridership benefits to having increased grade separation, although the capital cost also increases. However, in then seeing how Alternative 3D compares with 3C, there is a very large increase in cost for a moderate increase in ridership. Similarly, for LRT alternatives, as capital cost increases, ridership increases, although Alternative 4D has a relatively modest increase in ridership for the large cost increase over 4C. Therefore, although grade separation causes service to improve and ridership to increase, the impact of grade separation on capital cost is an important consideration.

Table 6-4: Evaluation of Alternatives Matrix

	Evaluation Measures																				
	Costs and Effectiveness							Transportation and Connectivity						Equity, Economic and Environmental							
	Red Line Capital Cost (2007$,Millions)	Red Line Corridor Incremental Annual Operating and Maintenance Cost (2007$, Millions)	Red Line Travel Time (end-to-end), minutes	Average Weekday Ridership: Red Line	New Riders per Day	Transit User Benefit (Hours/Day) vs. No-Build	FTA Cost-Effectiveness Index (Cost/User Benefit Hour)	Intersections below Level of Service D	Change in Number of Parking Spaces	Red Line Travel Time (minutes) Security Square Mall (SSM)-Charles Center	Red Line Travel Time (minutes) Edmondson Village-Charles Center	Red Line Travel Time (minutes) W. Baltimore MARC Station-Fells Point	Red Line Travel Time (minutes) Charles Center-Bayview	Number of Transit-Dependent Households Served by Enhanced Transit	Number of Residences Displaced/ Relocated	Number of non-Residential Displacements/Relocations	Acres of ROW Required for Project	Acres of ROW Required for Maintenance Facility	Number of Historical & Archeological Properties Affected	Number of Potential TOD Locations Provided by Enhanced Transit	Daily Auto VMT Change from No-Build	Air Emissions (Daily Kilograms Change from No-Build)
Alternative 1 - No-Build (13.9 mi.)	N/A	N/A	80	N/A	0	N/A	N/A	24	N/A	45	24	28	31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 2 - TSM (14.3 mi.)	$281	$5.01	76	17,600	3,850	3,530	N/A	27	-900	41	23	27	32	16,532	0	8	16.8	15.0	8	5	-19,000	-163
Alternative 3A - BRT, dedicated surface (13.8 mi.)	$545	$3.40	62	31,400	6,030	6,960	$18.10	32	-1,159	32	20	23	25	16,598	0	9	34.0	15.0	13	4	-73,000	-622
Alternative 3B - BRT, downtown tunnel + dedicated surface (14.9 mi.)	$1,019	$5.86	56	37,400	6,860	7,600	$44.74	37	-747	29	18	16	21	15,498	0	10	36.5	15.0	16	5	-83,000	-707
Alternative 3C - BRT, downtown tunnel + Cooks Lane tunnel + dedicated surface (14.7 mi.)	$1,151	$5.86	53	37,400	7,100	7,870	$49.06	37	-578	27	18	17	21	14,958	0	9	35.8	15.0	18	5	-84,000	-716
Alternative 3D - BRT, maximum tunnel + dedicated surface (13.7 mi.)	$2,404	$8.15	43	41,500	10,590	11,460	$63.93	29	-352	25	15	14	13	15,383	0	9	30.0	15.0	17	4	-121,000	-1,027
Alternative 3E - BRT, dedicated surface with Johnnycake Road alignment (14.8 mi.)	$571	$5.79	69	29,300	5,370	6,250	$26.21	36	-1,075	38	20	24	25	16,649	0	9	35.6	15.0	10	3	-57,000	-484
Alternative 3F - BRT, shared and dedicated surface + downtown tunnel (14.3 mi.)	$755	$6.09	65	34,300	5,910	6,620	$37.31	32	-644	36	20	18	26	16,532	0	9	17.0	15.0	13	5	-83,000	-700
Alternative 4A - LRT, dedicated surface (13.9 mi.)	$930	$3.63	55	34,600	9,860	10,900	$22.17	32	-1,272	28	17	22	23	16,598	0	9	33.3	12.6	11	4	-51,000	-431
Alternative 4B - LRT, downtown tunnel + dedicated surface (14.6 mi.)	$1,498	$3.13	43	41,100	12,330	13,130	$30.42	36	-361	25	15	12	14	14,148	0	9	36.2	12.6	14	5	-65,000	-549
Alternative 4C - LRT, downtown tunnel + Cooks Lane tunnel + dedicated surface (14.6 mi.)	$1,631	$3.12	41	42,100	12,720	13,580	$31.98	36	-254	23	15	12	14	14,148	0	9	35.5	12.6	13	5	-67,000	-566
Alternative 4D - LRT, maximum tunnel + dedicated surface (13.7 mi.)	$2,463	$7.37	36	42,300	13,260	14,200	$49.17	26	-250	21	13	12	11	15,383	0	9	29.6	12.6	15	4	-71,000	-601

In summary, capital costs are lower for BRT than for LRT and lower with less tunnel. When comparing Alternatives 3A and 3E, capital costs are lower for the Cooks Lane surface alignment versus the Johnnycake Road surface alignment.

Red Line Corridor Incremental Operating and Maintenance Cost

Annual O&M cost, expressed as the increase in cost over the No-Build Alternative, is $5.01 million for TSM; it ranges between $3.40 million and $8.15 million for the BRT Alternatives; and it ranges between $3.12 million and $7.37 million for the LRT alternatives. Comparing with the evaluation measure, Average Weekday Ridership on the Red Line, it is seen that TSM would carry significantly fewer riders than the other build alternatives, even though operating costs are the same order of magnitude as the other build alternatives. Thus the other build alternatives are more effective than TSM from the standpoint of ridership compared with what it would cost to serve those riders.

Among BRT alternatives, there are three alternatives with Average Weekday Ridership above 35,000: 3B, 3C, and 3D. Of these, Alternative 3D costs significantly more to operate. Alternative 3F is relatively close at slightly below 35,000 riders; it would cost about the same to operate as Alternatives 3B and 3C.

Comparing LRT alternatives, 4A and 4C are relatively close in their operating and maintenance costs yet 4C carries 7,500 more daily riders. Alternatives 4B and 4C serve similar number of riders and have similar operating and maintenance costs.

In summary, it appears that for surface alternatives, BRT has slightly less operating and maintenance costs than LRT. The reverse is true for the alternatives with the most tunnel: LRT is less than BRT. Generally, lower operating and maintenance costs occur with less tunnel for a given mode. Also, lower operating and maintenance costs occur with the Cooks Lane surface alignment (Alternative 3A) versus the Johnnycake Road surface alignment (Alternative 3E).

Red Line Travel Time (end-to-end)

Travel time (end-to-end) ranges between 43 and 69 minutes for the BRT alternatives and 36 to 55 minutes for the LRT alternatives, compared to 80 minutes for No-Build and 76 minutes for TSM. The BRT and LRT alternatives are much more effective from this standpoint; and TSM is marginally better than No-Build. Alternatives 3D and 4D are the fastest BRT and LRT alternatives, respectively, in keeping with their greater length of operation in tunnels. Furthermore, in going from 3A to 3D, and from 4A to 4D, travel time improves with the extent of grade separation (i.e., separation from regular traffic).

BRT Alternatives 3E and 3F have longer travel times than the other BRT alternatives, although 3F is relatively close to 3A.

Comparing LRT alternatives with similar BRT alternatives, (i.e., comparing alternative 4A with 3A, 4B with 3B, etc.), it is seen that the LRT alternatives are more effective from a travel time perspective. (LRT travel times are slightly shorter than BRT because: 1) dwell times are shorter with LRT because multiple doors open while BRT will require passengers to board through the front door, 2) LRT assumes several intersections with minor cross street traffic volumes will have signal preemption, while BRT headways are too frequent to allow preemption, and 3) max speed for LRT in tunnel is 40 mph while BRT is limited to 30 mph for safety reasons given manually driven vehicles.)

Shorter travel time results from the Cooks Lane surface alignment (Alternative 3A) versus the Johnnycake Road surface alignment (Alternative 3E).

Average Weekday Ridership: Red Line

Red Line Average Weekday Ridership is 17,600 for the TSM Alternative, and ranges between 29,300 and 41,500 for the BRT alternatives and between 34,600 and 42,300 for the LRT alternatives.

Comparing LRT alternatives with similar BRT alternatives, i.e., comparing alternative 4A with 3A, 4B with 3B, etc., it is seen that the LRT alternatives are more effective, in that their projected ridership is higher.

BRT Alternatives 3E and 3F generally have lower projected ridership than the other BRT alternatives.

The most expensive LRT alternative (4D) carries only marginally more riders than Alternatives 4B and 4C, whereas the most expensive BRT alternative (3D) transports more than 10% more riders than the next highest BRT alternatives (3B and 3C). This is because the length of tunnel for Alternative 3D is significantly more than for Alternatives 3B and 3C.

Weekday ridership for the Cooks Lane surface alignment (Alternative 3A) is higher than for the Johnnycake Road surface alignment (Alternative 3E).

New Riders per Day

This measure of new riders per day attracted from cars is indicative of the attractiveness of the service that would be offered by the Red Line compared with the lower cost alternatives. It is expressed as the number of person trips taken by transit for TSM compared with the No-Build alternative. Attracting trips out of cars is significant as a specific evaluation measure, and also because attracting persons out of cars contributes to lowering traffic congestion, as well as a reduction in the amount of air pollutants emitted by vehicles.

As shown in **Table 6-4**, the number of person trips per day attracted to transit is nearly 4,000 for TSM, ranges from 5,910 to 10,590 for BRT alternatives, and from 9,860 to 13,260 for LRT alternatives. The number of such trips is less than 3,300 per day greater than TSM for five of the BRT alternatives.

BRT Alternative 3D attracts the largest number of trips out of automobiles among the BRT alternatives, 10,590, or 6,740 more than TSM attracts. BRT Alternatives 3E and 3F attract fewer trips out of cars than the other BRT alternatives, though 3F is close to 3A. LRT Alternative 4A attracts 9,860 automobile person-trips to transit, and the other three LRT alternatives range from 12,330 (4B) to 13,260 (4D). In summary, LRT attracts more new transit riders than BRT. As the degree of grade separation increases, the number of new riders attracted to transit also goes up. The Cooks Lane surface alignment (Alternative 3A) generates more new transit riders than would the Johnnycake Road surface alignment (Alternative 3E).

User Benefit Hours per Day compared with TSM

This evaluation measure looks at the number of hours of user benefits per day for an alternative compared with a TSM alternative. Generally equivalent to travel time savings calculated for all transit riders, it is used as input to the calculation of the FTA Cost-Effectiveness Index.

Daily user benefit hours for the BRT and LRT alternatives ranges from 2,720 to 10,660. More specifically, daily user benefit hours are 2,720 or less for Alternatives 3A, 3B, 3C, 3E, and 3F; whereas the range for Alternatives 3D, 4A, 4B, 4C, and 4D is from more than 7,000 hours per day to greater than 10,000 hours per day.

In summary, LRT yields higher user benefit hours than BRT. More tunneling also yields higher user benefit hours. Lastly, the Cooks Lane surface alignment (Alternative 3A) yields higher user benefit hours than the Johnnycake Road surface alignment (Alternative 3E).

FTA Cost Effectiveness Index

FTA Cost Effectiveness Index, expressed in dollars, is the ratio of an alternative's cost divided by the number of hours of user benefits for that alternative. Per FTA requirements, the calculation is performed in comparison with the TSM alternative, i.e., costs and user benefits are the net change compared with TSM. Because it is expressed in dollars per hour of benefit, a lower number is considered better cost effectiveness. Current FTA guidance indicates that with a Cost-Effectiveness Index of under $24, an alternative is potentially eligible for federal New Starts funding. This is a decision that is made after preliminary engineering is complete and all environmental requirements have been fulfilled.

Table 6-5: Cost-Effectiveness Calculations Compared to the Alternative 2: TSM

	Capital Costs	Equivalent Annual Capital Costs	Equivalent Annual Capital Costs Above TSM	Net Change in Operating Costs	Net Change in Operating Costs Above TSM	Daily User Benefit Hours[1]	Daily User Benefit Hours Above TSM	Annual Benefit Hrs	C/E
TSM	$280,750,000	$24,050,000	---	$5,010,000	---	3,530	---	---	---
Alt3A	$544,660,000	$44,288,000	$20,238,000	$3,400,000	-$1,610,000	6,960	3,430	1,029,000	$18.10
Alt3B	$1,018,560,000	$77,828,000	$53,778,000	$5,862,000	$852,000	7,600	4,070	1,221,000	$44.74
Alt3C	$1,150,580,000	$87,075,000	$63,025,000	$5,860,000	$850,000	7,870	4,340	1,302,000	$49.06
Alt3D	$2,403,770,000	$173,010,000	$148,960,000	$8,150,000	$3,140,000	11,460	7,930	2,379,000	$63.93
Alt3E	$571,210,000	$44,661,000	$20,611,000	$5,785,000	$775,000	6,250	2,720	816,000	$26.21
Alt3F	$755,010,000	$57,450,000	$33,400,000	$6,089,000	$1,079,000	6,610	3,080	924,000	$37.31
Alt4A	$929,510,000	$74,463,000	$50,413,000	$3,625,000	-$1,385,000	10,900	7,370	2,211,000	$22.17
Alt4B	$1,497,820,000	$113,533,000	$89,483,000	$3,126,000	-$1,884,000	13,130	9,600	2,880,000	$30.42
Alt4C	$1,630,800,000	$122,360,000	$98,310,000	$3,124,000	-$1,886,000	13,580	10,050	3,015,000	$31.98
Alt4D	$2,463,250,000	$179,079,000	$155,029,000	$7,369,000	$2,359,000	14,200	10,670	3,201,000	$49.17

Table 6-5 shows the Cost-Effectiveness Calculations with capital costs, operating costs and user benefit compared to the TSM Alternative. In **Table 6-5**, cost effectiveness ranges from $18.10 to $63.93 for the BRT alternatives and from $22.17 to $49.17 for LRT alternatives. Generally, the lower cost (capital cost as well as operating and maintenance cost) alternatives have lower (better) cost effectiveness. This is true regardless of mode (the formula doesn't include mode in the calculation).

The better performing alternatives by FTA's cost effectiveness measure are 3A, 4A and 3E, followed by 4B and 4C. Comparing LRT alternatives with similar BRT alternatives, i.e., comparing alternatives 4A with 3A, 4B with 3B, etc., it is seen that cost effectiveness is better for 3A vs. 4A, but 4B, 4C and 4D are more cost effective than 3B, 3C and 3D. Thus, as the amount of grade separation increases and the alternatives become more expensive, the advantage goes increasingly toward LRT, because of the ability of LRT to attract more riders and achieve greater travel time savings compared with BRT. Lastly, the cost effectiveness of the Cooks Lane surface alignment (Alternative 3A) is better than the Johnnycake Road surface alignment (Alternative 3E).

Transportation and Connectivity Measures

Intersections below Level of Service D

In **Table 6-4**, the number of intersections with less than desirable level of service is 24 for No-Build, 27 for TSM, and 26 to 37 for the other build alternatives. The range of 26 to 37 in the number of intersections that have lower than desired level of service is not a large number of such intersections, considering this is a relatively dense urban corridor, and the calculation takes into account the estimated traffic volumes in year 2030. In addition, the increment of the build alternatives over No-Build, which ranges from plus 3 to plus 13, is not a large incremental impact.

In general, LRT yields fewer intersections at undesirable levels of service than does BRT. As well, increased tunneling seems to have some traffic benefit although somewhat inconsistently. Lastly, the Cooks Lane surface alignment (Alternative 3A) yields fewer intersections and undesirable levels of service than would the Johnnycake Road surface alignment (Alternative 3E).

Change in Number of Parking Spaces

The range is a loss of 900 spaces for TSM; from a loss of 352 spaces to a loss of 1,159 spaces for BRT alternatives; and from a loss of 250 spaces to a loss of 1,272 spaces for LRT alternatives. This measure points out an additional benefit of increased use of tunneling to construct the Red Line: fewer parking spaces would be lost. With the most tunnel, LRT results in fewer parking spaces lost. The Johnnycake Road surface alignment (Alternative 3E) results in slightly fewer parking spaces lost than the Cooks Lane surface alignment (Alternative 3A).

Red Line Travel Times between Selected Stations

The four evaluation measures were developed in order to look at how well various connections could be made, by looking at sample travel times on the Red Line for: the far western section of the corridor to Downtown (between Security Square Mall and Charles Center); the central west portion of the corridor to Downtown (between Edmondson Village and Charles Center); the western end of the Central Business District to the CBD's eastern end (between West Baltimore MARC Station and Fells Point); and from Downtown to the eastern terminus of the corridor (between Charles Center and Bayview). In effect, these links allow a comparison of travel time from two different locations in the west of the corridor to downtown, one comparison that traverses Downtown, and a fourth link from Downtown to the east end of the corridor.

Transit travel time for traveling these links shows patterns similar to the end-to-end travel time:

- BRT and LRT alternatives are faster than No-Build or TSM. The two links which show the greatest improvement in travel time compared with No-Build and TSM are West Baltimore MARC Station-Fells Point, and Charles-Bayview (as much as 50-60 percent improvement).
- LRT travel time is generally lower than BRT (which means that LRT has higher average operating speed).
- Travel time decreases in going from Alternatives A to D, regardless of mode and comparing Alternatives 2 and 3F. This indicates with increased tunneling, travel time improves. Again, this trend is most pronounced for West Baltimore MARC Station-Fells Point, and Charles Center-Bayview (as much as 50 percent improvement).
- Alternatives 3E and 3F have higher travel times than the other BRT alternatives. This trend is most pronounced for Security Square Mall-Charles Center. This link also shows that the Cooks Lane surface alignment (Alternative 3A) has lower travel time than the Johnnycake Road surface alignment (Alternative 3E).

Equity, Economic and Environmental Measures

Number of Transit-Dependent Households Served

As shown in **Table 6-4**, there are 14,148 to 16,649 households along Alternatives 2 through 4D which do not own a vehicle. Unlike other measures, this evaluation measure is not dependent on mode or the amount of tunneling but is entirely dependent on the location of the specific alignment, the number of stations, and the location of stations. The number and the location of stations have the most effect on reaching the most households without a car. Furthermore, alternatives which use the Eastern Avenue alignment reach more zero-car households than on Boston Street. Of Alternatives 3B, 3C, and 3E, which all are assumed to have the most stations (24), Alternative 3E (Johnnycake Road alignment) which uses Eastern Avenue reaches more zero-car households than either alternatives 3B or 3C which use Boston Street.

Number of Residences Displaced/Relocated

No residential displacements or relocations are required in order to implement any of the alternatives. This is unusual

for a major transportation project, and is a benefit of having the project follow existing transportation corridors.

Number of Non-Residential Displacements/ Relocations

The number of business/institutional units displaced is 8 for TSM, ranges from 9 to 10 for BRT alternatives, and is 9 for LRT alternatives. Furthermore, 8 of the units would be needed in order to implement one element of the project: the maintenance facility. The use of existing transportation corridors contributes to the relatively low number of displacements for any of the alternatives.

Acres of Right-of-Way or Property Required for the Project

Right-of-way required to implement the Red Line improvements consists of 16.8 acres for the TSM alternative, and ranges from 17.0 acres to 35.6 acres for the other build alternatives. This is a relatively small range in acres comparing one build alternative with another. Furthermore, there is relatively little difference in comparing acres required for BRT as compared with LRT.

Acres of Right-of-Way or Property Required for Maintenance Facility

Right-of-way required to implement the maintenance facility consists of 15.0 acres for TSM and the BRT alternatives, and is 12.6 acres for the LRT alternatives. A smaller facility is needed for LRT because there are fewer light rail vehicles needed to operate the Red Line due to the large size of those vehicles, and therefore the maintenance facility can be smaller. The fact that nearly all of the acres needed for the project are for the maintenance facility reinforces the importance of the process that will be used to develop the maintenance facility within the context of the overall project.

Number of Historic and Archeological Properties Affected

This evaluation measure in **Table 6-4** expresses impacts in terms of number of historic properties and districts affected either directly or by proximity, either directly or by proximity. The range of historic impacts for the build alternatives is 8 to 18. In general, it appears that LRT affects fewer historic properties. Surface alignments also seem to affect fewer properties. The Johnnycake Road surface alignment (Alternative 3E) affects fewer historic properties than the Cooks Lane surface alignment (Alternative 3A). In preliminary engineering, more information will be available about the extent of impacts on historic properties and districts, and the mitigation that would be required.

Number of Potential TOD Locations Provided Enhanced Transit

Five potential TOD locations were identified in the corridor: Social Security Mall, I-70 East Park-and-Ride, Edmondson Village, West Baltimore MARC station area, and Canton Crossing. Of these five locations, from three to five would be served by Alternatives 2 through 4D. Alternative 3E is the only alternative which would not serve the I-70 East Park-and-Ride. It also does not serve the Canton Crossing since it follows the Eastern Avenue corridor. For the same reason Alternatives 3A, 3D, 4A, and 4D would not serve Canton Crossing. All other alternatives serve all five potential TOD locations.

Daily Auto VMT Change from No-Build

TSM and the build alternatives reduce automobile vehicle miles of travel compared with No-Build. The reduction for TSM is 19,000 per day; it ranges from 57,000 per day to 126,000 for BRT and from 36,000 to 71,000 for LRT. The two alternatives with the greatest reduction in automobile VMT are BRT Alternatives 3C and 3D. In general, BRT yields a greater reduction in automobile VMT than does LRT. Tunneling reduces VMT more than for surface alignments. The Cooks Lane surface alignment (Alternative 3A) reduces VMT more than the Johnnycake Road surface alignment (Alternative 3E).

Air Emissions

The trend in reductions in air emissions is similar from alternative to alternative as for the previous evaluation measure (Change in VMT).

Equity Considerations

As is pointed out in this chapter and in the Environmental Justice section of Chapter 4, the Red Line Corridor contains large populations of minorities, low-income households, and zero-car owning households. Accordingly, transit service improvements and other benefits that would be provided by the Red Line would accrue for these population groups. Conversely, any negative impacts associated with the project may also impact the identified groups.

The detailed analysis of Chapter 4 indicated that there is not a disproportionate impact on minority and low-income populations as a result of the Red Line; that all the alternatives would have relatively similar impacts; and that the transit service and economic benefits of access to Red Line stations would be available to environmental justice population groups.

In Chapter 6, the alternatives evaluation matrix **(Table 6-4)** contains an evaluation measure quantifying the number of transit-dependent households (defined as households that do not own a car) served by each of the alternatives. It was found that the number of such households in the corridor that would be served by TSM and the other build alternatives ranges between 14,100 and 16,600. Expressed in terms of percentage of households served, this represents 34-36% of households served by the alternatives are zero-car households. Accordingly, it can be said that TSM and the other build alternatives effectively serve transit-dependent households.

In **Table 6-4**, the end-to-end travel time data indicates that the Red Line would represent a significant transportation improvement in the corridor. The table provides further insight into the evaluation measures, which quantify travel time on the Red Line for four different segments of the corridor. These four evaluation measures allow a comparison of travel time from two different locations in the west of the corridor to downtown, one comparison that traverses Downtown, and a fourth link from Downtown to the east end of the corridor. As shown in **Table 6-4**, travel time for all of the BRT and LRT alternatives improves over No-Build and TSM. Accordingly, as measured by travel time on these four links, all sections of the corridor would accrue benefits of improved transit service as a result of the Red Line.

Summary of Major Trade-Offs

This discussion focuses on the evaluation measures that vary most among the alternatives, thus providing the most insight into how the alternatives compare. These measures are end-to-end travel time, capital cost, net operating and maintenance cost, Red Line ridership, right-of-way required, reduction in automobile vehicle miles of travel, reduction in air pollutants, and the FTA cost effectiveness measure.

TSM

- The TSM Alternative provides only a small reduction in travel time from No-Build.
- Net operating and maintenance costs are higher for TSM than a number of other build alternatives, and less than most alternatives, yet ridership on TSM is significantly lower than the other build alternatives.
- TSM requires about half of the amount of right-of-way required for the other build alternatives (except Alternative 3F).
- The amount of improvement in reducing automobile vehicle miles of travel, or reducing air pollutants, for the TSM Alternative is much smaller than the other build alternatives.
- Because some build alternatives are less than $24 per hour of user benefits, the cost-effectiveness of those build alternatives is such that the project appears to be capable of qualifying to obtain approval from FTA to initiate preliminary engineering. In that phase of study, the build alternatives that will be included therein are to be compared with TSM, per FTA requirements, so TSM is automatically carried forward into preliminary engineering.

BRT Alternatives

- Based upon the financial analysis that is predicated upon achievable levels of funding, both federal as well as non-federal, it would be very difficult to finance an alternative costing more than $2 billion. Thus BRT Alternative 3D may not be financially achievable.
- The three BRT alternatives with the least capital cost among the build alternatives are 3A, 3E and 3F.
  - Alternative 3E costs more to build than Alternative 3A, costs more to operate, and carries fewer riders and takes longer than Alternative 3A, so is less cost effective.
  - Alternative 3F costs 39 percent more to build than Alternative 3A and 79 percent more to operate. Alternative 3F is also more expensive than 3E. The ridership of Alternative 3F is significantly higher than 3A or 3E. However, because 3F is significantly more expensive than 3A or 3E, its cost effectiveness is not as good as those two alternatives.
  - Although its ridership is nine percent higher overall than 3A, Alternative 3F attracts slightly fewer drivers out of their cars. However, it has somewhat greater traffic congestion benefits as measured by reduction in automobile vehicle miles of travel, and more air quality benefits in terms of reduction in air emissions compared to the No-Build Alternative.
  - Perhaps the largest difference among these three alternatives is in terms of net Operating and Maintenance cost, in which Alternative 3A improves by more than 40 percent over Alternative 3E and by 44 percent compared with Alternative 3F.
  - Compared with No-Build, improvement in end-to-end travel time for Alternatives 3A, 3E and 3F ranges from 14 percent (3E) to 30 percent (3A). This significant improvement results in good levels of projected ridership as well as substantial environmental benefits.
- Alternatives 3B and 3C are more expensive to build than 3A, 3E or 3F.
  - The travel time improvements over No-Build for Alternatives 3B and 3C are 24 and 27 minutes, respectively, or 30-34 percent, at about twice the capital cost of the least expensive BRT alternative (Alternative 3A).
- The performance of Alternatives 3B and 3C according to **Table 6-4** is similar in some regards; for example, in terms of net Operating and Maintenance cost and average weekday ridership. However, there are some differences: Alternative 3C is somewhat more expensive to build compared with 3B and has lower cost effectiveness, but attracts somewhat more persons out of cars, and has more benefits in terms of VMT reduction and air quality improvements.
- Net operating and maintenance costs are substantially lower for 3A than for 3B or 3C. If BRT is carried into preliminary engineering, it would be beneficial to see the extent to which increased grade separation, which achieves benefits for Alternatives 3B and 3C albeit at substantial cost, could be incorporated into 3A in order to obtain additional travel time improvements and ridership.

LRT Alternatives

- LRT Alternative 4D may not be financially feasible for the same reason as Alternative 3D.
- In the discussion of specific evaluation measures, it was found that LRT generally serves more riders than BRT and in some cases has significantly lower net operating and maintenance costs. The operating and maintenance cost advantage of LRT over BRT is most apparent for Alternatives 4B and 4C compared with 3B and 3C. These four alternatives utilize a downtown tunnel. LRT is able to take advantage of operation in this tunnel to achieve lower comparable operating and maintenance costs.
- Capital costs are significantly higher for LRT compared with BRT. The capital cost increment of LRT over BRT is two percent for 4D vs. 3D; more than 40 percent for 4B and 4C compared with 3B and 3C, and 71 percent in the case of 4A vs. 3A.
- The number of persons attracted out of cars and onto transit is 25 percent to 64 percent greater on LRT than BRT for similar lengths of tunneling.
- LRT alternatives have lower travel times than their BRT counterparts. Travel time improvement is a direct benefit to transit riders, and is a contributing factor to the attractiveness of the LRT alternatives to automobile users. The substantial travel time improvement also contributes to the relative cost effectiveness of LRT in the face of high capital costs.
- Alternatives 4A, 4B and 4C are relatively cost effective compared with Alternative 4D.

Cost Effectiveness

- The better performing alternatives by FTA's cost effectiveness measure are 3A, 4A and 3E, followed by 4B and 4C.
- Comparing LRT alternatives with similar BRT alternatives, i.e., comparing Alternatives 4A with 3A, 4B with 3B, etc., it is seen that cost effectiveness is better for 3A vs. 4A, but 4B, 4C and 4D are more cost effective than 3B, 3C and 3D. Thus, as the amount of grade separation increases and the alternatives become more expensive, the advantage goes increasingly toward LRT because of the ability of LRT to attract more riders and have greater incremental travel time improvement compared with BRT.

Volume I- Chapter 7

Public Input and Agency Coordination

Public Input and Agency Coordination

Public Involvement Overview

The Red Line Corridor Transit Study team has conducted a comprehensive public involvement program beginning early in the project development process. Public involvement is an integral part of all projects requiring compliance with the National Environmental Policy Act (NEPA). The public involvement program began in the Spring of 2003 with project scoping meetings. Extensive public involvement activities have occurred to date and will remain ongoing until the completion of the project. Activities to date include Community Workshops, Open Houses, and Community Working Group (CWG) Meetings (**Table 7-1**). Also included in the public involvement program are individual meetings with communities and other organizations, the distribution of various project publications, and other non-traditional targeted outreach efforts. Outreach to the public is vital to the success of, and subsequent completion of, the Red Line Corridor Transit Study.

Additional information on the public involvement process may be found in the *Public Involvement Technical Report*, included on the DVD provided with this AA/DEIS.

Corridor-Wide Public Meetings

Over thirty corridor-wide public meetings, open houses, and workshops have been held to date in the study area. The public meetings are summarized in the following sections.

Scoping Meetings

Five public scoping meetings took place in May and June of 2003. These meetings served as an opportunity for the public to meet with the study team, share visions for future transit in their communities, and provide comments. The public scoping meetings were used to initiate the public involvement process and to educate the community on the possibility of BRT and LRT technology connecting Baltimore County and Baltimore City. These scoping meetings also provided an opportunity for the community to comment on the proposed alternatives for transit modes in their communities. Approximately 300 people attended the meetings and nearly 200 comments were received via comment cards, e-mail, and letters.

Scoping Meetings	
May 21, 2003	War Memorial Building
May 29, 2003	Hampstead Hill Elementary School
June 5, 2003	Rosemont Tower Senior Apartments
June 5, 2003	Woodlawn Community Center
June 18, 2003	St. William of York

Fall 2004 Public Open Houses

Seven open houses took place in October and November of 2004. The purpose of the open houses was to introduce the public to the Red Line Corridor Transit Study process, the NEPA process, the proposed public involvement process, and information on proposed alternatives for the project. The open house format offered attendees the opportunity to ask questions about the study and receive responses directly from the study team. Two-hundred and eighty-eight people attended the open houses. Eighty-two comments were received during the three week comment period. The major comment themes were: effects of the project on neighborhoods, BRT, LRT, existing bus system, and consideration of heavy rail.

Fall 2004 Public Open Houses	
October 26, 2004	War Memorial Building
October 27, 2004	Woodlawn Community Center
October 28, 2004	St. Patrick's Church
November 3, 2004	Hampstead Hill Elementary School
November 4, 2004	Harlem Park Middle School
November 6, 2004	Alexander Hamilton Elementary School
November 9, 2004	Hunting Ridge Presbyterian Church

Summer 2005 Public Open Houses

Five open houses took place in June 2005. The purpose of the Summer 2005 Open Houses was to provide the public with an opportunity to review and discuss the various alignments under study, possible station locations, information on environmental and community issues, and the project schedule. Attendees also received maps of the alignments and options retained for further study, issue papers on environmental justice, noise/vibration, and tunneling, a technical evaluation information sheet, comment form, and a list of the Red Line Resource Hubs. Four hundred and forty-four people attended the five open houses and 162 comments were received. The major comment themes were: effects of the project on neighborhoods, property values, local traffic impacts, and LRT.

Summer 2005 Public Open Houses	
June 6, 2005	St. James Episcopal Church
June 7, 2005	MTA Charles Center Metro Station Mezzanine
June 7, 2005	Woodlawn Community Center
June 8, 2005	Edmonson High School
June 9, 2005	Holy Rosary Church Hall

Fall 2005 Community Workshops

In November 2005, five Community Workshops were held with the purpose of providing an open forum for public comment on the proposed alignments and stations. The workshop set-up provided attendees with the option to choose which segment of the corridor they were most interested in learning about and commenting on that segment. A volunteer facilitator and note taker were located at each of the tables, which displayed detailed alignment and station mapping. The facilitators reviewed the mapping with the participants, while the note takers recorded ideas, questions, and concerns provided by members of the public. The November 2005 workshops focused on obtaining community-level feedback regarding alignments and segments under consideration as a means of elimination and reduction of options by the study team. The workshops were also used as educational forums to discuss the potential benefits of transit and how transit projects have enhanced and transformed communities.

Following the workshops, a summary packet was sent to each workshop attendee who provided their contact information. Approximately 350 community members received the packets specific to the workshop they attended. The packets included a summary of the exact comments made at the workshop, information on how all attendees evaluated the workshops, and copies of the typical section diagrams that were shared at the workshop. All materials presented at the workshops, as well as the summary packets mailed to the community members, were posted on the project website and included in the *Public Involvement Technical Report* included on the DVD provided with the AA/DEIS.

Fall 2005 Community Workshops	
November 5, 2005	Edmonson High School
November 8, 2005	World Trade Center
November 10, 2005	Bentalou Elementary School
November 15, 2005	Holy Rosary Church Hall
November 19, 2005	Woodlawn Community Center

Table 7-1: Major Corridor-Wide Public Involvement Activities

Meeting Timeframe	Type of Public Meeting	Topics Presented
Spring 2003	Project Scoping Meetings	Formal public initiation of the project
Fall 2004	Open House Meetings	Initial corridor concepts
Fall 2004 – Spring 2005	Community Working Group Meetings	Five Community Working Groups formed to focus on the project at the community level
Spring 2005	Public Meetings	Preliminary recommendations on alignments
November 2005	Public Workshops	Reduced set of alternatives
May 2006	Public Workshops	End-to-end Alternatives and potential station locations
November 2007	Public Workshops	Animations of the Alternatives, technical details on the alignment options

Spring 2006 Community Workshops

Five Community Workshops were held in May of 2006 throughout the study area. These workshops provided the MTA with an opportunity to gather feedback on possible station locations, inform the public of the Red Line Corridor Transit Study's overall status and goals, and present new material on the various alignments. Following the workshops, approximately 230 community members received summary packets, which were specific to the workshop they attended. The packets included a summary of the exact comments made at the workshop, information on how all attendees evaluated the workshops, and copies of the mapping that was handed out at the workshop. All materials presented at the workshops, as well as the summary packets mailed to the community, members were posted on the project website and included in the *Public Involvement Technical Repor*t included on the DVD provided with the AA/DEIS.

Spring 2006 Community Workshops	
May 11, 2006	Lexington Market
May 13, 2006	Holy Rosary Church Hall
May 18, 2006	Edmonson High School
May 20, 2006	Lockerman Bundy Elementary School
May 31, 2006	Woodlawn High School

Fall 2007 Public Open Houses

In November 2007, five Open Houses were held throughout the study area, which had now been expanded to include the Johns Hopkins Bayview Campus. At these Open Houses, the MTA had six display areas to present a wide range of project information. The six display areas were called: Focus on the Future, the Alternatives, Stations in Your Community, VISSIM Display Area, Realizing the Vision, and Detailed Technical Information. Following the Open Houses, all community members who submitted a question and their contact information received a response. All materials presented at the workshops, as well as the summary packets mailed to the community members were posted on the project website and included in the *Public Involvement Technical Report* included on the DVD provided with the AA/DEIS.

Fall 2007 Public Open Houses	
November 7, 2007	Woodlawn High School
November 8, 2007	Edmonson High School
November 13, 2007	Holy Rosary Church Hall
November 14, 2007	Carter Memorial Church
November 15, 2007	Our Lady of Fatima Church

Community Working Group Meetings

MTA formed Community Working Groups (CWG) following the Fall 2004 Open Houses. Community and business organizations, major institutions, and Baltimore City and County agencies were asked to appoint a representative to serve on the Working Group. The representatives worked directly with the study team and brainstormed about possible alignments and station locations and also provided reactions and comments. The CWGs served as filters of information with the goal of developing groups of individuals with an understanding of the project who could serve as information disseminators. The CWGs were formed as a way to develop valuable partnerships with organizations and individuals in communities affected by the project. Between November 2004 and May 2005, four rounds of CWG meetings were held. The CWG meetings are summarized in **Table 7-2**.

Table 7-2: CWG Objectives and Presentations

Round 1 November 15-19, 2004	Review of the purpose and expectations of the Community Working Group process
	Introduction to the Red Line Corridor Transit Study
	Presentation of the proposed alignments and potential station locations
Round 2 January 31- February 23, 2005	Review of potential station locations and process for determining station locations
	Presentation of identified environmental resources in the study area
	Presentation and review of and CWG comment on Community Facility mapping
Round 3 March 30-April 12, 2005	Presentation of the NEPA, process including the environmental resource analysis
	Presentation of the process and evaluation measures for determining the alignments to be retained for detailed study
	Review of the public involvement schedule and outreach activities
Round 4 May 2-11, 2005	Presentation of the alignments recommended for further study
	Review of the evaluation for determining the alignments and stations recommended for further study
	Announcement of the upcoming June 2005 Public Open Houses

During the four rounds of CWG meetings, CWG members asked questions and provided insight into the visions and goals that they saw for the Red Line Corridor Transit Study and for their communities. The study team and the CWG members also discussed the concerns that the CWG members voiced regarding how the proposed Red Line could affect them. Comments were recorded and documented in order to gain a better understanding of community and project development issues.

Targeted Outreach Plan

The targeted outreach plan for the Red Line Corridor Transit Study consists of seven major categories, which include: resource hubs and community stops, elected officials, religious institutions, community organizations, business/special interest groups; environmental justice populations, and media outreach. Each component is summarized below.

Resource Hubs and Community Stops

The Public Involvement Team has identified 34 locations within the study area to place up-to-date public information materials. These Resource Hubs are easily accessible by the public and have been set up to provide project information including: fact sheets, meeting fliers, newsletters, public meeting announcements, mailing list sign-up cards, and various other project publications. Resource Hubs are in area libraries, community and recreation centers, schools, and shopping centers throughout the Red Line study area. Additional information kiosks have been placed at Lexington Market and Charles Center metro stations, Social Security Administration, Security Square Mall, Johns Hopkins University, Bon Secours Hospital, University of Maryland Downtown Campus and Hospital, and St. Agnes Hospital.

Elected Officials

Fifty-one elected officials are on the study mailing list and receive project briefings. A list of the elected officials may be found in the Appendix of the DEIS.

Religious Institutions

The Red Line Public Involvement Team was involved in a concentrated effort to raise awareness of the project through focused outreach at religious institutions. The team recognized that a number of citizens in the study corridor worship at institutions and also meet for various activities. Working with church leadership, Red Line information was placed in church bulletins and also included at available church information centers. The project was also presented at a Greater Baltimore Bus Initiative (GBBI) Interdenominational Clergy breakfast held July 28, 2005. Religious institutions remain a part of the project's overall mailing list and outreach strategy.

Speaker's Bureau

The Red Line "Speaker's Bureau" was created to establish and maintain open communications with residents within the study area and give communities the opportunity to discuss how their community may be affected by the proposed Red Line. Meetings with community associations were held in an informal, one-on-one setting. Eighty-nine Speaker's Bureau meetings were held throughout the Red Line study area between September 2005 and December 2007. These meetings are continuing in 2008.

Businesses and Institutions

Meetings with major business organizations and institutions have been held in order to inform and receive comments from these groups about the study and encourage their participation in planning. In order to fulfill one of the key purposes of the Red Line Study (to provide economic revitalization along the corridor), it is imperative that the project team seek out and receive

feedback from area businesses regarding their ideas and concerns regarding the project.

Specific businesses and institutions met with during the Red Line Corridor Transit Study include:

- US Department of Health and Human Services
- Centers for Medical and Medicaid Services (CMS)
- Merchants of Security Square Mall
- Social Security Administration (SSA) in conjunction with the General Services Administration (GSA)
- University of Maryland Medical Center (UMMC)
- Hale Properties L.L.C.
- Johns Hopkins Bayview Medical Center

Environmental Justice Populations

As part of the Red Line Corridor Transit Study, the MTA is committed to involving all stakeholders in the project development process. Therefore, representation from minority populations and low-income populations is an essential and important part of this study. NEPA requires that all agencies identify and address any disproportionately high adverse effects to minority and low-income populations also known as environmental justice populations, to ensure equal representation and equal protection to all persons within the study area. The Public Involvement Team has reached these population groups by distributing project information and receiving feedback from the public at targeted locations with minority and low-income populations.

The MTA has launched a public involvement plan especially targeted for outreach to the Hispanic population. Press releases and public notices have been printed and published in Spanish, and a Spanish link is available on the project website. To further the Hispanic outreach efforts, Speaker's Bureau meetings have been scheduled along with other outreach events throughout the study area, and a Spanish-speaking MTA staff person is available at all public meetings in the Fells Point area, which is the area with the highest percentage of Spanish-speaking population. The team also conducted "grocery store outreach" in shopping centers along proposed Red Line alignments, which included distribution of translated meeting notifications to "Resource Hubs" in Spanish-speaking communities prior to public workshops.

Media Outreach

A variety of media outlets have been utilized to inform the public about the Red Line Corridor Transit Study. Advertisements were placed in a total of 14 local English and Spanish language newspapers and other publications. Advertisements, at different times in the study, announced the 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.

Citizens' Advisory Council

In 2006 the General Assembly passed a bill creating the Red Line Citizens' Advisory Council (CAC). The CAC is responsible for advising the MTA on impacts, opportunities, and community concerns about the Red Line. The CAC is comprised of five members appointed by the President of the Senate, five members appointed by the Speaker of the House, two members appointed by the Governor, two members appointed by the Mayor of Baltimore, and one member appointed by the Baltimore County Executive.

Red Line CAC Meetings have been held on the following dates and will continue throughout the Red Line project in 2008 and beyond:

- September 27, 2007
- October 11, 2007
- November 15, 2007
- December 13, 2007
- January 10, 2008
- February 21, 2008
- April 10, 2008

For more information on the CAC, please visit the project website: *http://www.baltimoreredline.com/pages/citizens_advisory_council.htm*

Public Information

Website

The Red Line project website, *www.baltimoreredline.com*, provides visitors with a project overview, Red Line Study details, public involvement materials and announcements, a place to submit comments, and a kids corner. The website is intended to serve as a place where information on the study is easily accessible and up-to-date. Additionally, the website is a resource for the public to view materials from past public meetings, get notices about upcoming public meetings, and to submit comments to the study team. The website, which has received more than 1,800 hits, contains information about past and future open houses and community meetings, presentations, displays, photo simulations, large-scale and detailed maps, general project information, project documents, PowerPoint presentations, and comment forms presented at meetings for those individuals and organizations unable to attend.

A link on the project website was developed for the Limited English Proficiency (LEP) population. The Spanish page provides translation of project information including workshop announcements and a project overview.

Newsletters & Fact Sheets

The Public Involvement Team uses newsletters to provide information about the Red Line Study. The newsletters include information on project schedules, mode alternatives, upcoming open houses and public meetings, and the study process. Fact sheets are used as informational handouts at public meetings and other outreach events.

Frequently Asked Questions

One hundred and twenty-six frequently asked questions on the project were developed to address questions the public was raising at Red Line public outreach events. These questions and answered were prepared in Fall 2007 and distributed at the November 2007 workshops, as well as available on the project website.

Agency Coordination

The Red Line Project has been developed in accordance with the National Environmental Policy Act and the Maryland Streamlined Environmental and Regulatory Process, including coordination with Federal, State, and Local Regulatory Agencies. Outreach to these agencies has included the following methods: Interagency Review Meetings, field meetings, project correspondence, and the Technical Working Group. Coordination with these agencies will continue throughout the development of the Red Line project.

Interagency Review Meetings

Interagency coordination began early in the project planning process with the agency scoping meeting held in May 2003. The resource agencies who attended the Interagency Review meetings 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

The agencies were given a field tour of the Red Line study area in March 2004. In addition, study team members provided presentations at two Interagency Review Meetings on April 20, 2005 (topics included: a project overview, discussion of the proposed alternatives and routes, environmental considerations and project coordination) and April 19, 2006 (topics included a project overview, pubic involvement update and discussion of the team's strategy to address Environmental Justice).

SHPO Coordination

There has been coordination with the Maryland Historic Trust (MHT) and it will continue throughout the development of the Red Line project. A summary of Section 106 Coordination can be found in the Cultural Resources section of this Chapter, and more detail can be found in the *Cultural Resources Technical Report* on the DVD attached to this AA/DEIS.

Through project coordination with the MHT and other consulting parties, it was determined that the MHT would defer the determination of Adverse Effects until after the selection of a Locally Preferred Alternative. In order to provide an effective consultation method with the MHT, MTA has suggested the implementation of a Section 106 Memorandum of Agreement or a Programmatic Agreement. This agreement would allow the parties to work together to develop a series of agreed design treatments to allow for the avoidance and minimization of potential Adverse Effects.

Resource Agency Correspondence

The following correspondence was received from the resource agencies regarding the Red Line Corridor Transit Study. Copies of these letters can be found in the *National Resources Technical Report* on the DVD attached to this AA/DEIS.

- US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Habitat Conservation Service, May 2, 2006
- Maryland Department of Natural Resources, Wildlife and Heritage Service, May 2, 2006.

Technical Working Group

The Technical Working Group is a multi-disciplinary group of state, regional, and local staff convened to discuss various technical issues from preliminary alternative screening to the development of various options.

The Agencies Include:

- Maryland Department of Transportation
- Maryland Transit Administration
- Maryland State Highway Administration
- Maryland Department of Planning
- Baltimore City Department of Planning
- Baltimore City Department of Transportation
- Baltimore County Office of Community Conservation
- Baltimore County Department of Public Works
- Baltimore County Department of Planning
- Baltimore Development Corporation
- Baltimore Regional Transportation Board

The Technical Working Group met on the following dates:

- October 7, 2004
- December 2, 2004
- January 6, 2005
- February 3, 2005
- March 10, 2005
- July 13, 2005
- July 27, 2005
- August 10, 2005
- August 24, 2005
- September 7, 2005
- September 21, 2005
- October 5, 2005
- October 19, 2005
- November 29, 2005
- February 15, 2006
- March 29, 2006
- April 26, 2006
- June 21, 2006