



**EAST-WEST CORRIDOR FEASIBILITY STUDY
FINAL REPORT
DECEMBER 2022**

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STUDY BACKGROUND

About This Study

Regional Transit Plan

Connecting Our Future: A Regional Transit Plan for Central Maryland (RTP), finalized in September 2020, is a plan for improving public transportation in the region over the next 25 years. The Plan approaches regional mobility comprehensively, recognizing that people travel throughout Central Maryland in their daily activities. The Central Maryland region includes Anne Arundel County, Baltimore City, Baltimore County, Harford County, and Howard County. The RTP was developed in collaboration with a regional commission that included representatives from each jurisdiction.

A central focus of the RTP is increasing transit access for the region's residents, particularly those in historically underserved communities. Providing transit that connects residents to economic opportunities ensures the region's strength and vitality. In 2020, 40 percent of the region's 2.55 million residents and 50 percent of the region's 1.21 million jobs were accessible by bus or rail.¹ By 2045, the region is forecast to grow by nearly 300,000 people and 440,000 jobs. The RTP recognizes that the majority of growth in Central Maryland is not planned in areas accessible to existing transit stops and stations and recommends long-term expansion and enhancement of transit service to serve growing job and population centers, as well as coordinating transportation and land-use goals and strategizing the fiscal sustainability of those decisions.

The RTP identifies 30 Regional Transit Corridors to plan and develop over the next 25 years. Areas identified as Regional Transit Corridors demonstrate transit demand that justifies infrastructure, services, and/or technology improvements. All selected corridors are regionally significant, providing crucial connectivity within and between jurisdictions.

The RTP does not define specific routes, service patterns, alignments, stations, or levels of service, nor does it identify specific stations or modes to serve those corridors. The 30 corridors defined in the Plan were meant to remain flexible to accommodate the results of future feasibility studies. This study, along with the North-South Corridor Feasibility Study, is one of the first corridor feasibility studies conducted on behalf of the RTP Implementation Team.

The RTP corridors included in this study are shown in Figure 1 and Figure 2, Johns Hopkins Bayview to West Baltimore (Corridor 17) and Convention Center to Ellicott City (Corridor 16). Corridors 16 and 17 have been merged into a single corridor approximately 15-20 miles in length from Bayview to Ellicott City via Downtown Baltimore. The two corridors were combined because of their shared alignment through West Baltimore and their potential to connect more origins and destinations when planned together.

¹ This study used data from before the COVID-19 pandemic.

Figure 1: Corridor 17 (Johns Hopkins Bayview to West Baltimore)

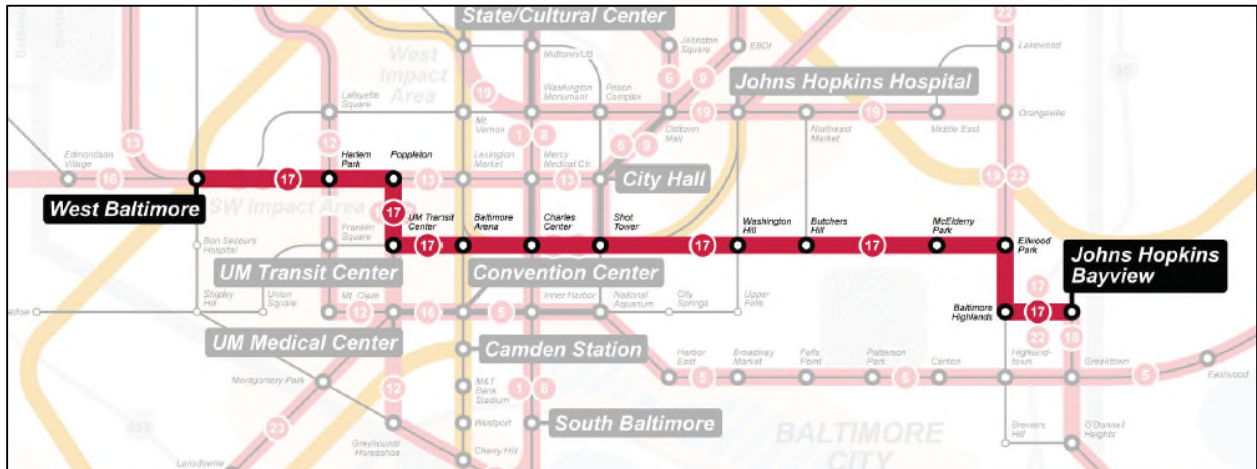
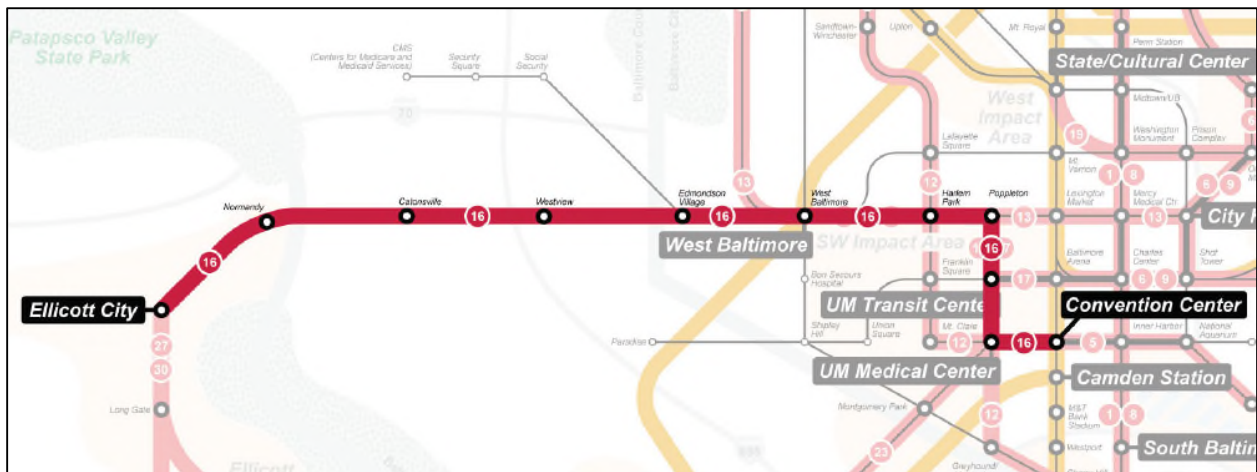


Figure 2: Corridor 16 (Convention Center to Ellicott City)



Purpose of this Feasibility Study

The East-West Corridor Feasibility Study seeks to both quantify and qualify potential benefits and impacts based on the following factors:

- Market Analysis – how productive could a potential transit investment be, in terms of its ridership?
- Transit Readiness – to what degree do the areas where the transit investment would occur have the activity, access, and design characteristics that best support transit use?
- Cost – how much would it cost to build and operate transit in this area?

To weigh the costs and benefits of various alternatives, RTP Implementation Team members, Maryland Department of Transportation Maryland Transit Administration (MDOT MTA), Baltimore City, Baltimore County, and Howard County collaborated to conduct this corridor feasibility study.

Together with input from the public, the project team developed seven preliminary alternatives that identify productive alignment segments, modes and station stop spacings that best balance access to stations and travel speeds, and major cost drivers. The information gained from testing the preliminary alternatives was used to guide the development of alternatives to study in more detail in the next phase, the East-West Corridor Alternatives Analysis.

Previous Studies and Plans

Studies and Plans Reviewed

The project team reviewed studies and plans produced between 1968 and 2020 to summarize the historical context for the East-West Corridor and contribute to the development of alternatives. Table 1 lists the previous studies and plans that were reviewed.

Table 1: Previous Studies and Plans Reviewed

PLAN TYPE	PLAN NAME (YEAR PUBLISHED)
Regional Transit Plans	Baltimore Region Rapid Transit Plan (1968) Baltimore Regional Rail System Plan (2002) Central Maryland Regional Transit Plan (2020)
Corridor Studies	East-West Transit Connector Study (2002) Baltimore Red Line Alternatives Technical Report (2008) Baltimore Red Line Heavy Rail Technical Memorandum (2008) QuickBus Service Analysis (2009) Baltimore Red Line Final Environmental Impact Statement (2012) Rethinking the Red Line Study Draft (2015) Premium Limited-Stop Bus Service Study (2020) Dedicated Bus Lane Study (2020)
Engagement & Vision Plans	Baltimore Red Line Community Impact (2008) Baltimore Red Line Station Area Advisory Committee Vision Plans (2011)
Locally Operated Transit System Plans	Baltimore County Transit Development Plan Draft (2020) Central Maryland Transit Development Plan (2018)
Other Transportation Studies	Baltimore City Separated Bike Lane Network Plan (2017) Maryland Bicycle and Pedestrian Master Plan (2019) Maryland Strategic Highway Safety Plan (2020)

Key Findings

Proposed high-capacity transit alignments in the East-West Corridor have shifted in location through the decades, but previous plans have consistently included connections to the following communities:

- Edmondson Village
- Midtown Edmondson
- Poppleton
- Westside
- Charles Center
- Highlandtown
- Bayview

Heavy rail, commuter rail, light rail, bus rapid transit, and enhanced/premium bus have all been studied as potential modes to serve the entire East-West Corridor. Automated guideway transit (people mover), modern streetcar, historic streetcar, personal rapid transit, and water taxi have been studied for segments of the corridor.

Heavy rail was the recommended mode for one study in 1968, when the federal government was funding the development of heavy rail lines in other regions. MDOT MTA studied heavy rail as recently as 2008 with the Baltimore Red Line Heavy Rail Technical Memorandum. Despite having been ruled out in 2008 because of its cost ineffectiveness, heavy rail has continued to have public support.

EXISTING CONDITIONS

The East-West Corridor has long been considered an important connection for opportunities across Baltimore City, Baltimore County, and Howard County. Community members and stakeholders have been involved in bringing high-capacity transit to this corridor for many years. The East-West Corridor comprises two of the 10 Early Opportunity corridors in the RTP.

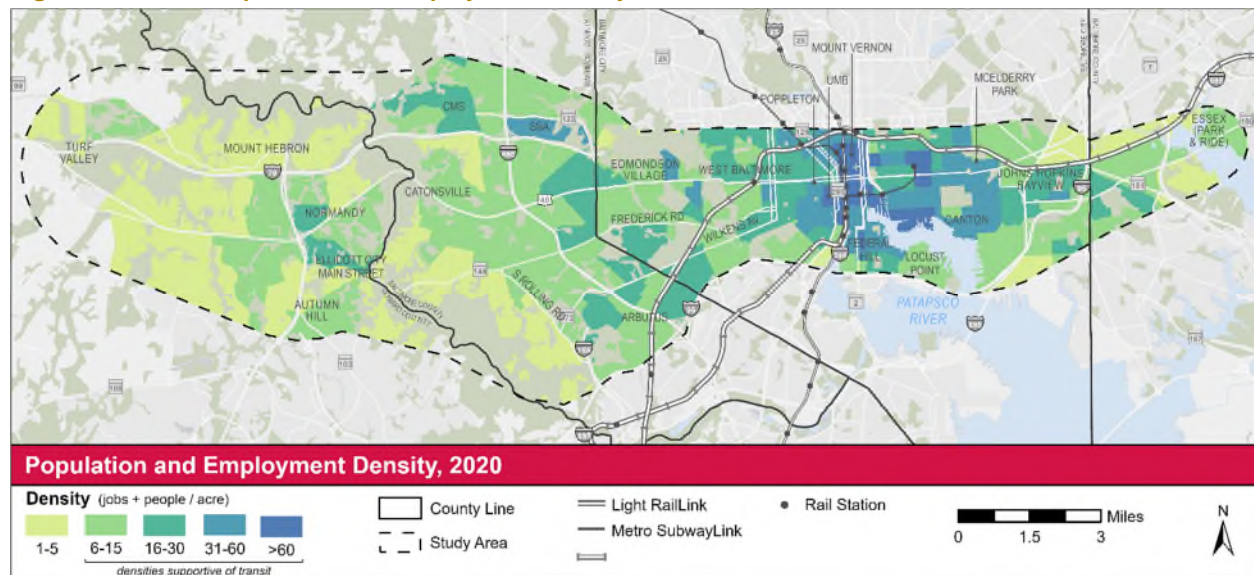
In the existing and future conditions analysis, the project team analyzed need and demand for transit, travel flows, and land use and development in the corridor. The main takeaways are described below. Detailed findings of these analyses can be found in the Existing and Future Conditions Technical Report (Appendix A).

Population and Employment Density

Within the East-West Corridor study area outlined in Figure 3, population and employment densities supportive of high-capacity transit are primarily located in Baltimore City, especially in Downtown, Midtown, and East Baltimore. North of Patterson Park in East Baltimore, Johns Hopkins Hospital and surrounding areas have high employment and population density. South of Patterson Park, Harbor East, Fells Point, and Canton Crossing have high combined population and employment density.

Beyond the limits of Baltimore City, pockets of high density are located in suburban areas that are anchored by major employers such as University of Maryland Baltimore County (UMBC) in Arbutus, Centers for Medicare & Medicaid Services (CMS), Social Security Administration (SSA), and Howard County government near Ellicott City Main Street.

Figure 3: Current Population and Employment Density



Source: Baltimore Metropolitan Council, Round 9A Cooperative Forecasts, updated July 2020.

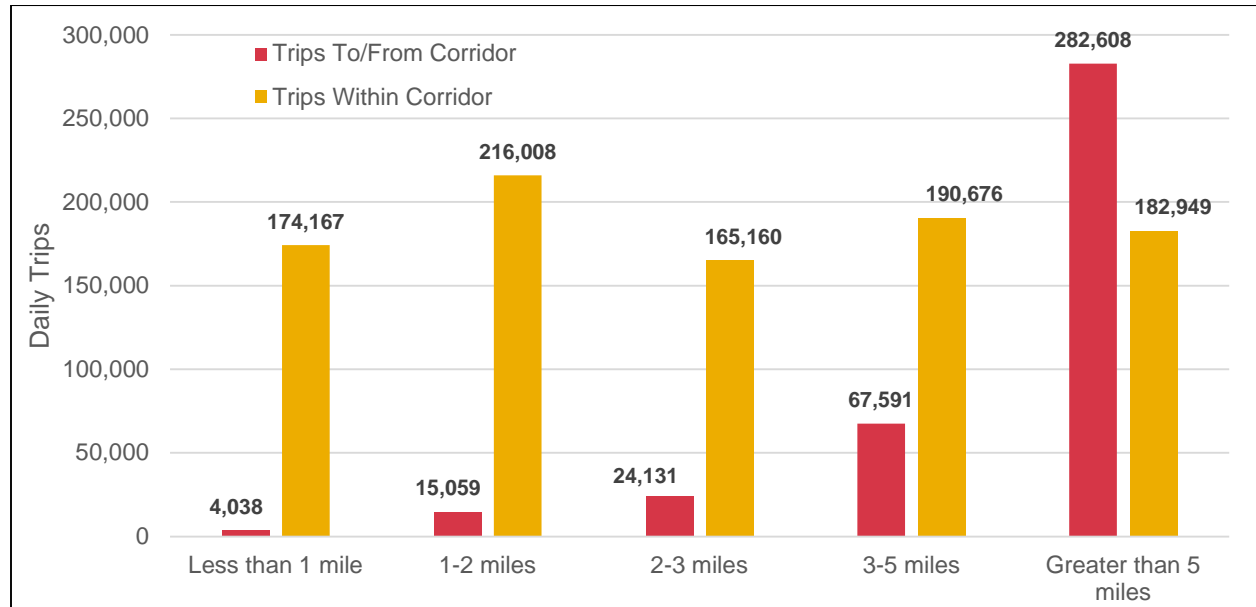
Regional Transit Connections

This study area is served by MDOT MTA Local, Express, and CityLink bus services, Regional Transportation Agency of Central Maryland (RTA) Route 405 local bus, and MARC commuter rail. Furthermore, the US 29 Flash BRT from Silver Spring in Montgomery County is planned to intersect this corridor and terminate in Mount Hebron. The RTP also includes high-capacity transit connections from Columbia and Howard County to Normandy, Ellicott City, and Catonsville as well as from Essex and Dundalk to Downtown, Bayview, and Johns Hopkins Hospital.

Trip Patterns

Trips within the corridor are mostly made across short distances with 80 percent of trips less than five miles in length and 42 percent of the trips less than two miles in length (Figure 4). Transit in the corridor should balance the access needs of shorter trips while also enabling regional mobility through faster travel on longer trips.

Figure 4: Daily Trip Volumes by Distance

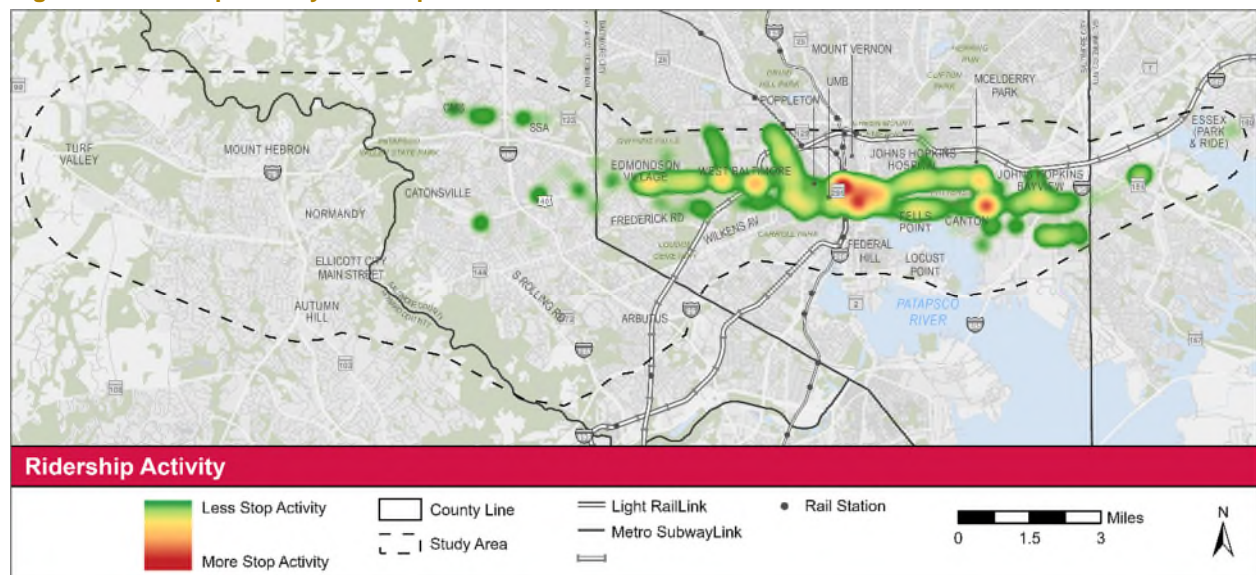


Source: Baltimore Metropolitan Council, Initiative to Simulate Individual Travel Events (InSITE) model, 2045 base year, run in 2019.

Transit Use

In addition to downtown Baltimore City areas, where transit usage is higher, some additional corridors stand out in terms of existing transit ridership (Figure 5). Edmondson Avenue in the western part of the corridor and Fayette Street and Eastern Avenue in the eastern part of the corridor are also highly traveled. These three corridors offer the greatest opportunities for attracting ridership.

Figure 5: Ridership Activity Heatmap



Source: MDOT MTA, Core Bus Automatic Passenger Counter counts, Fall 2019.

GOALS AND OBJECTIVES

The goals and objectives for this study were designed to capture stakeholder and community values, needs, and expectations, and provide a basis for measuring the performance of preliminary alternatives. In Spring 2021, the project team met with local government stakeholders and solicited input from the public through an online survey to understand priorities and weigh tradeoffs. The goals and objectives are listed in Table 2.

Table 2: Corridor Goals and Objectives

Goal 1: Improve the connectivity and operations of the existing transit network
1. Maximize connections to MARC
2. Improve connections between Metro Subway and Light Rail
3. Maximize connections to frequent bus service
4. Minimize time and cost to complete
5. Improve transit reliability and travel times
6. Choose infrastructure that can be shared by local bus service
Goal 2: Expand the reach and connectivity of the regional transit network
1. Facilitate regional travel between study area and southern Howard County and the Washington, DC suburbs
2. Facilitate travel to growing destinations on/past the east end of study area
3. Connect city residents to employment in Baltimore and Howard Counties in the western study area
4. Connect Baltimore and Howard County residents to City culture and entertainment
5. Connect Baltimore and Howard County residents to City employment, education, and health care
6. Connect important Baltimore County and Howard County destinations to each other
7. Strengthen connections to Locally Operated Transit Services (such as RTA of Central Maryland and Charm City Circulator)
8. Create a reliable east-west transit alternative to driving the Baltimore Beltway
Goal 3: Prioritize the needs of existing transit riders and transit-critical populations
1. Connect dense residential neighborhoods to major commercial centers (for jobs, goods, services)
2. Increase transit capacity in areas with high existing ridership
3. Decrease transit travel times serving areas with existing high ridership
4. Increase reliability and minimize transfers on long trips for existing riders
5. Match service hours of operation to the needs of transit reliant riders
6. Connect neighborhoods with low rates of employment or long commute times to job concentrations
7. Add rider amenities at important transfer and waiting locations to increase comfort and convenience
8. Invest in youth with improved reliability, reduced travel times, safer conditions for students, particularly for longer school and work trips

Goal 4: Maximize the economic and environmental benefit of a major transit investment

- | |
|---|
| 9. Maximize potential for Transit Oriented Development (TOD) and development/redevelopment opportunities |
| 10. Incentivize transit-collaborative policies and practices by serving institutions, job centers, and neighborhoods that have transit-oriented development plans and transportation demand management programs |
| 11. Connect higher education and health care institutions to enhance access to medical care, education, and related jobs |
| 12. Maximize potential to attract federal funding (e.g., FTA Capital Investment Grants Program) |
| 13. Maximize potential for private investment in transit |
| 14. Reduce the environmental and economic costs of new development (by reducing parking needs) |
| 15. Encourage the improvement of public spaces through placemaking on transit streets and around transit stations |
| 16. Support transformation of vacant and large redevelopment parcels into walkable, sustainable places (through transit-oriented development) |

ALTERNATIVES DEVELOPMENT

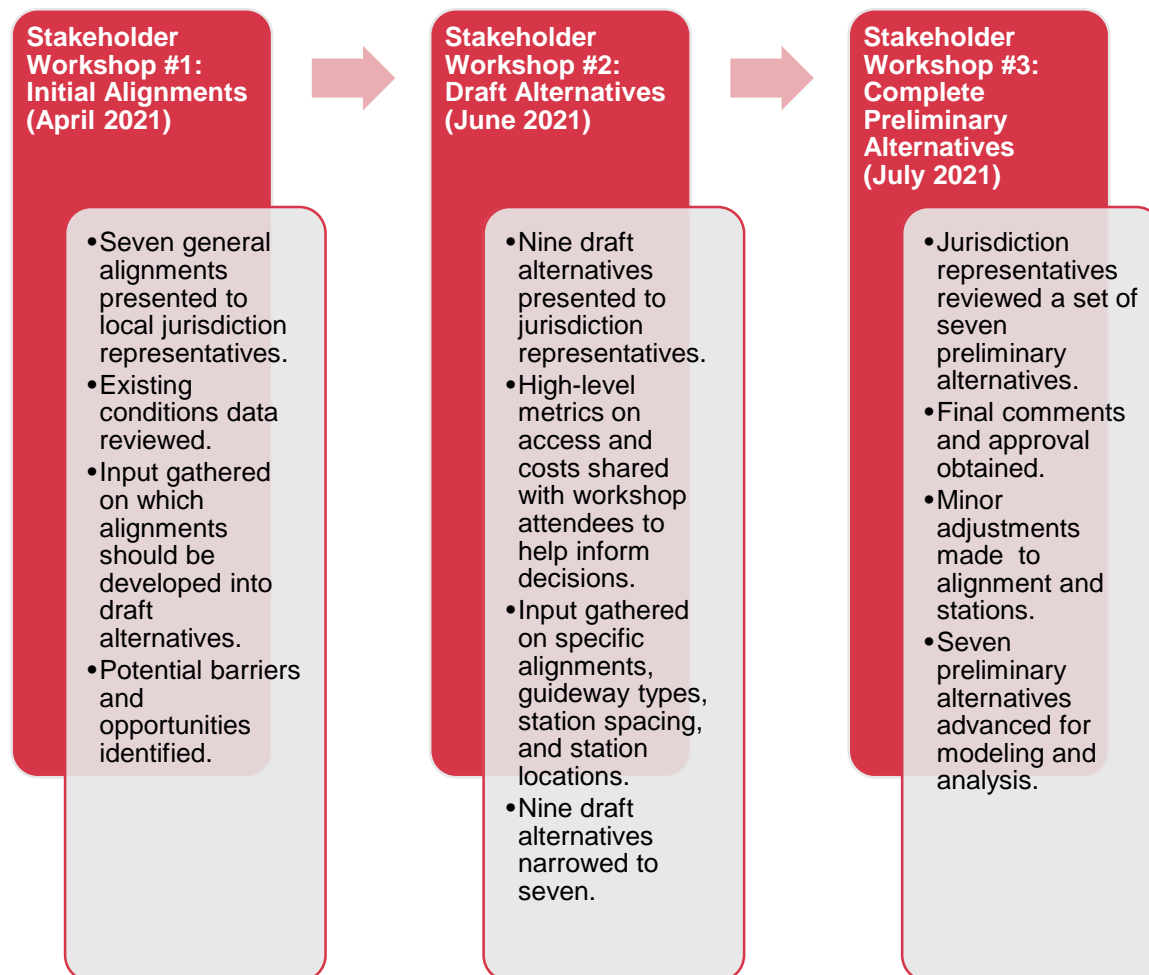
Development Process

The project team's multi-step process to develop preliminary alternatives for the East-West Corridor included the evaluation of existing conditions, development of project goals and objectives, exploration of potential alignments, and review of potential transit modes.

The overall development process, shown in Figure 6, included extensive collaboration with local jurisdictions across three rounds of stakeholder workshops that informed the development and refinement of the preliminary alternatives. Stakeholder workshops included staff from MDOT MTA, the Baltimore City Department of Transportation, the Baltimore County Transportation Planning Unit, and the Howard County Office of Transportation.

The alternatives developed from this process are preliminary. While station locations, guideway types, and assumed operating plans were developed for analysis, the preliminary alternatives will need refinement through community engagement and engineering and environmental evaluations in the Alternatives Analysis phase and subsequent planning and engineering phases.

Figure 6: Alternatives Development Stakeholder Workshop Process



Modes Considered

The project team examined the existing and future need and demand for transit, travel patterns, and land use in the corridor to select modes to include in the preliminary alternatives. Heavy Rail Transit (HRT), Light Rail Transit (LRT), and Bus Rapid Transit (BRT) were determined to be the most appropriate modes for consideration. All these modes are suitable for providing 20,000 or more trips per day in an urban and suburban corridor approximately 10-30 miles in length that serves regional and local trips.

LRT and BRT are the most common choices for new high-capacity transit lines in North America, and many LRT and BRT lines have been constructed in recent decades in similar regional corridors across the United States. These modes can provide 15,000 to 80,000 trips per day across major metropolitan regions, consistent with anticipated demand for the East-West Corridor. LRT and BRT stations are typically spaced one-half to two miles apart, consistent with objectives of improving transit travel times and aligning with existing travel patterns in the corridor.

New HRT lines are less common in North America than LRT and BRT. Newly constructed HRT lines are projected to provide 70,000 and 200,000 trips per day, which is greater than the corridor's expected ridership. However, the corridor contains an existing HRT segment (MDOT MTA Metro Subway), highway median suitable for HRT (US 40 in West Baltimore), and existing railroad right-of-way (Amtrak Northeast Corridor) that could be incorporated into a new HRT alignment. HRT's high speeds and long stop spacing make it suitable for a regional corridor, but its high costs hinder its ability to expand the reach and connectivity of the regional transit network on its own. Therefore, in this study HRT was paired with BRT, which could provide more cost-effective transit to Western Baltimore County and Howard County where population and employment densities are lower.

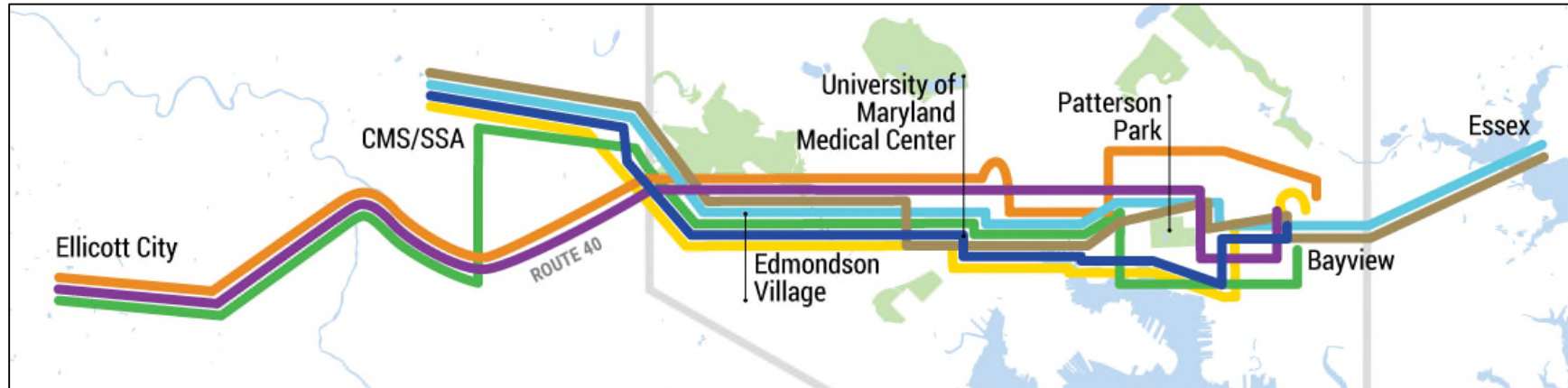
Streetcar was eliminated as a potential mode for the East-West Corridor. New streetcar lines are typically less than five miles in length, which is much shorter than the study corridor of 10-30 miles. Streetcars typically operate in mixed traffic and stop more frequently than LRT or BRT, resulting in slower travel speeds. These characteristics make streetcar an unsuitable mode to achieve the corridor's objectives to enable regional travel, shorten long commutes, and improve reliability and travel times.

Personal Rapid Transit (PRT) was also eliminated as a potential mode for the East-West Corridor. PRT systems circulate riders within a small geographic area using just a few stations. No PRT system has been constructed to serve trips more than a few miles in length, making it unsuited to a regional corridor 10-30 miles in length. PRT vehicles typically have a capacity of 2-8 people, making it unsuitable for meeting anticipated demand in the East-West Corridor.

Preliminary Alternatives

The project team developed seven preliminary alternatives to evaluate using measures of effectiveness (MOEs) aligned with the corridor goals and objectives. Figure 7 provides a summary of the alternatives' alignments.

Figure 7: Preliminary Alternatives

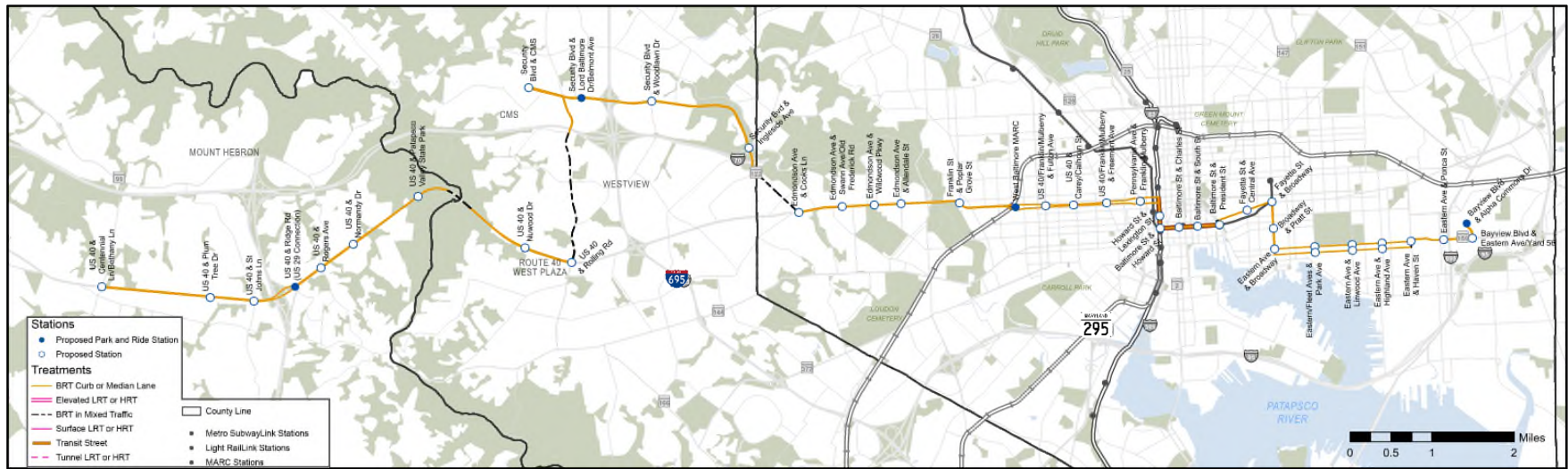


Preliminary Alternative 1	Preliminary Alternative 2	Preliminary Alternative 3	Preliminary Alternative 4	Preliminary Alternative 5	Preliminary Alternative 6	Preliminary Alternative 7
Bus Rapid Transit from Bayview to Ellicott City via Johns Hopkins Hospital and CMS/SSA	Bus Rapid Transit from Bayview to Ellicott City via Johns Hopkins Hospital and US 40	Heavy Rail Transit (Metro) from Bayview to Edmondson Village Bus Rapid Transit from Edmondson Village to Ellicott City	Light Rail Transit from Essex to CMS/SSA via Bayview and Johns Hopkins Hospital	Bus Rapid Transit from Essex to CMS/SSA via Bayview and Johns Hopkins Hospital	Light Rail Transit from Bayview to CMS/SSA via the Waterfront	Bus Rapid Transit from Bayview to CMS/SSA via the Waterfront

Preliminary Alternative 1: Bus Rapid Transit from Bayview to Ellicott City via Johns Hopkins Hospital and CMS/SSA

Preliminary Alternative 1 provides service between CMS/SSA and Bayview with BRT service along Eastern and Fleet Avenues, south of Patterson Park. It also provides a direct service to Johns Hopkins Hospital (JHH), satisfying the high volume of travel flows from the waterfront neighborhoods to JHH. Alternative 1 also tests how a transit street along Baltimore Street in the central business district (CBD) would affect MOE results. Furthermore, this alternative uniquely serves both Ellicott City and CMS/SSA. It meets the demand for travel between Howard County and CMS/SSA and provides a high-capacity connection for Howard County residents to other destinations in Baltimore County and Baltimore City.

Figure 8: Preliminary Alternative 1 (BRT) Alignment and Stations



PRELIMINARY ALTERNATIVE 1 (BRT) BAYVIEW-ELLICOTT CITY VIA CMS/SSA & JHH

Hours of Service		Bayview-CMS: Weekdays 5:00 AM – 2:00 AM, Saturday 5:00 AM – 1:00 AM, Sunday 6:00 AM – 12:00 AM CMS-Ellicott City: Weekday 5:00 AM – 11:00 PM, Saturday 6:00 AM – 11:00 PM, Sunday 6:00 AM – 10:00 PM
Frequency	Peak	BRT traveling between Bayview and CMS: 10 minutes BRT traveling between Bayview and Ellicott City: 10 minutes Combined BRT service between Bayview and CMS: 5 minutes
	Off Peak	BRT traveling between Bayview and CMS: 15 minutes BRT traveling between Bayview and Ellicott City: 15 minutes Combined BRT service between Bayview and CMS: 8 minutes
One-Way Travel Time		71 minutes
One-Way Length		22.7 miles
Stations		39

Preliminary Alternative 2: Bus Rapid Transit from Bayview to Ellicott City via Johns Hopkins Hospital and US 40

Preliminary Alternative 2 connects Howard County and Bayview with BRT service via a direct route using US 40. Remaining on US 40 through Baltimore City avoids traffic congestion in Downtown Baltimore, decreasing travel time between western and eastern Baltimore City. It would also provide high-capacity transit to redevelopment sites around Old Town (Gay St & Orleans St). Alternative 2 also tests how providing a connection between JHH and Bayview north of Patterson Park would affect MOE results.

Figure 9: Preliminary Alternative 2 (BRT) Alignment and Stations



PRELIMINARY ALTERNATIVE 2 (BRT) BAYVIEW-ELLICOTT CITY VIA US 40

Hours of Service	Bayview-Catonsville: Weekdays 5:00 AM – 2:00 AM, Saturday 5:00 AM – 1:00 AM, Sunday 6:00 AM – 12:00 AM Catonsville-Ellicott City: Weekday 5:00 AM – 11:00 PM, Saturday 6:00 AM – 11:00 PM, Sunday 6:00 AM – 10:00 PM	
Frequency	Peak	BRT traveling between Bayview and Catonsville: 10 minutes BRT traveling between Bayview and Ellicott City: 10 minutes Combined BRT service between Bayview and Catonsville: 5 minutes
	Off Peak	BRT traveling between Bayview and Catonsville: 15 minutes BRT traveling between Bayview and Ellicott City: 15 minutes Combined BRT service between Bayview and Catonsville: 8 minutes
One-Way Travel Time	60 minutes	
One-Way Length	18.4 miles	
Stations	36	

Preliminary Alternative 3: Heavy Rail (Metro) from Bayview to Edmondson Village and Bus Rapid Transit from Edmondson Village to Ellicott City

Preliminary Alternative 3 provides heavy rail service from Edmondson Village to Bayview using existing infrastructure. While the stop spacing necessary for heavy rail is sparser than LRT and BRT, Alternative 3 still serves major points of interest in Baltimore City, such as the CBD and JHH. Like Alternative 2, this alternative also does not serve CMS/SSA and instead tests how a direct route via US 40 through Eastern Baltimore County to Howard County would affect MOE results.

Figure 10: Preliminary Alternative 3 (HRT+BRT) Alignment and Stations



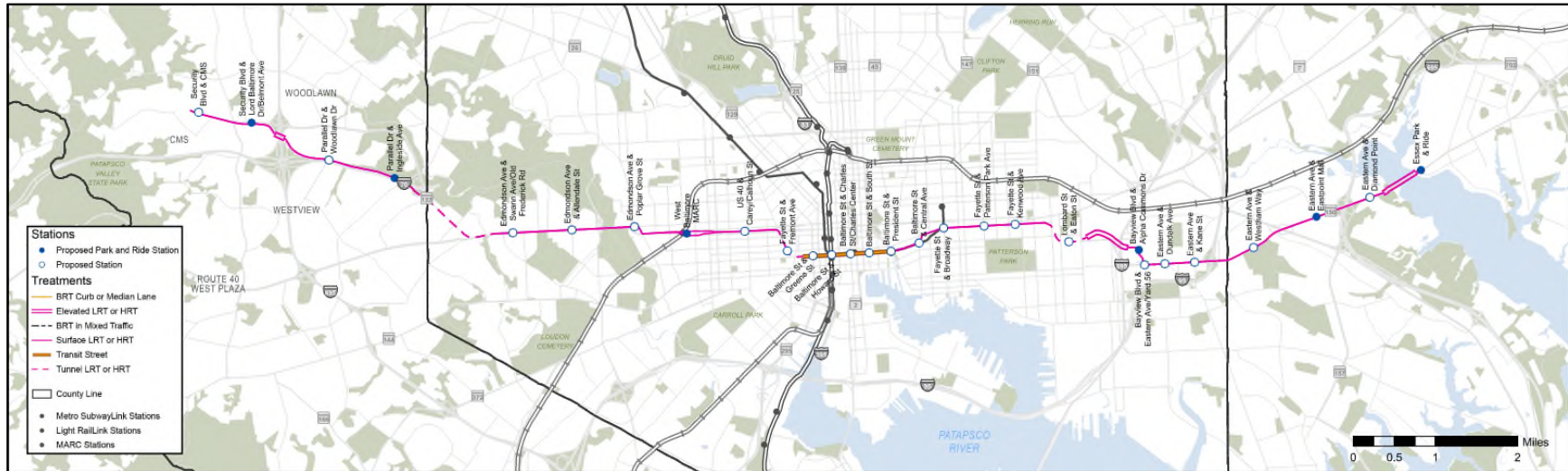
PRELIMINARY ALTERNATIVE 3 (HRT+BRT) BAYVIEW- ELLICOTT CITY

Hours of Service		HRT Bayview-Edmondson: Weekdays 5:00 AM – 2:00 AM, Saturday 5:00 AM – 1:00 AM, Sunday 6:00 AM – 12:00 AM BRT Edmondson-Ellicott City: Weekdays 5:00 AM – 11:00 PM, Saturday 6:00 AM – 11:00 PM, Sunday 6:00 AM – 10:00 PM
Frequency	Peak	HRT Bayview-Edmondson: 5 minutes BRT Edmondson-Ellicott City: 10 minutes
	Off Peak	HRT Bayview-Edmondson: 8 minutes BRT Edmondson-Ellicott City: 15 minutes
One-Way Travel Time		49 minutes
One-Way Length		19.1 miles
Stations		25 (one station is shared between BRT and HRT)

Preliminary Alternative 4: Light Rail from Essex to CMS/SSA via Bayview and Johns Hopkins Hospital

Preliminary Alternative 4 provides light rail service performs north of Patterson Park and between Bayview and Essex. From CMS/SSA to the CBD, it is similar to Alternative 6, which is similar to the previously studied Red Line Preferred Alternative. From the CBD, Alternative 4 uniquely serves Fayette Street and JHH with a mode and guideway type that could potentially provide placemaking opportunities. This alternative satisfies major travel flows that were seen from areas such as Dundalk and Middle River to and from Baltimore City by providing a connection at Essex.

Figure 11: Preliminary Alternative 4 (LRT) Alignment and Stations



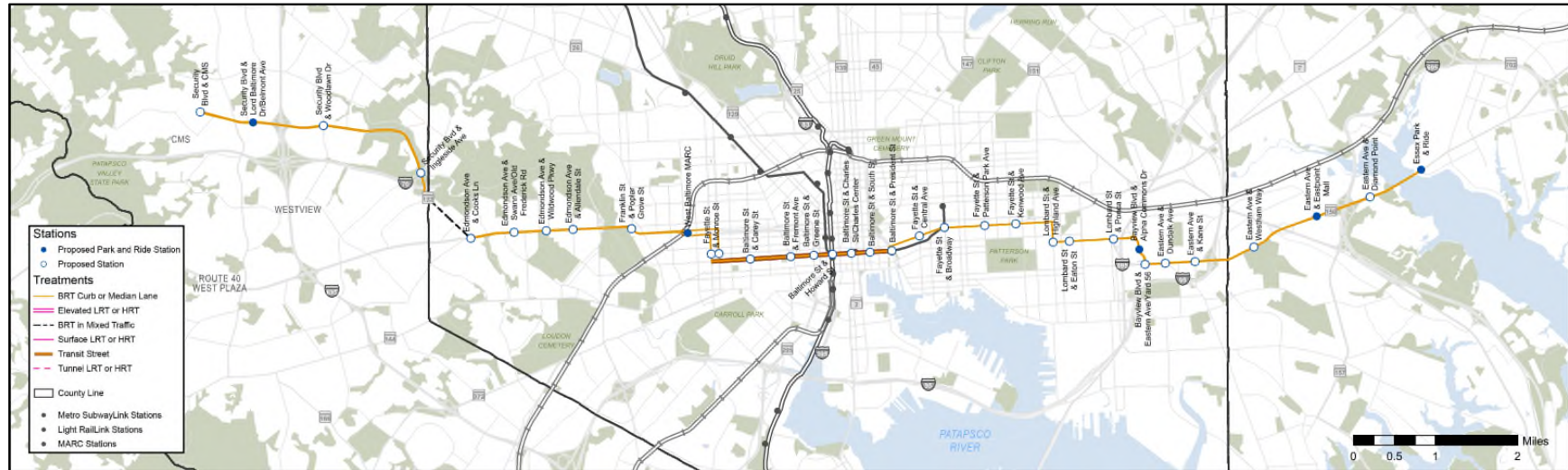
PRELIMINARY ALTERNATIVE 4 (LRT) CMS/SSA – ESSEX

Hours of Service	Weekdays 5:00 AM – 2:00 AM, Saturday 5:00 AM – 1:00 AM, Sunday 6:00 AM – 12:00 AM	
Frequency	Peak	7 minutes
	Off Peak	10 minutes
One-Way Travel Time	54 minutes	
One-Way Length	16.4 miles	
Stations	28	

Preliminary Alternative 5: Bus Rapid Transit from Essex to CMS/SSA via Bayview and Johns Hopkins Hospital

Preliminary Alternative 5 is similar to Preliminary Alternative 4 but tests how BRT, rather than LRT, would perform between CMS/SSA, Downtown Baltimore, JHH, and Bayview. It also tests a long transit street on Baltimore Street through Downtown and West Baltimore, which would provide a unique opportunity for placemaking and enhanced mobility in an area experiencing new investment. Alternative 5 also tests how BRT would perform on East Fayette Street through an area north of Patterson Park with high existing bus ridership.

Figure 12: Preliminary Alternative 5 (BRT) Alignment and Stations



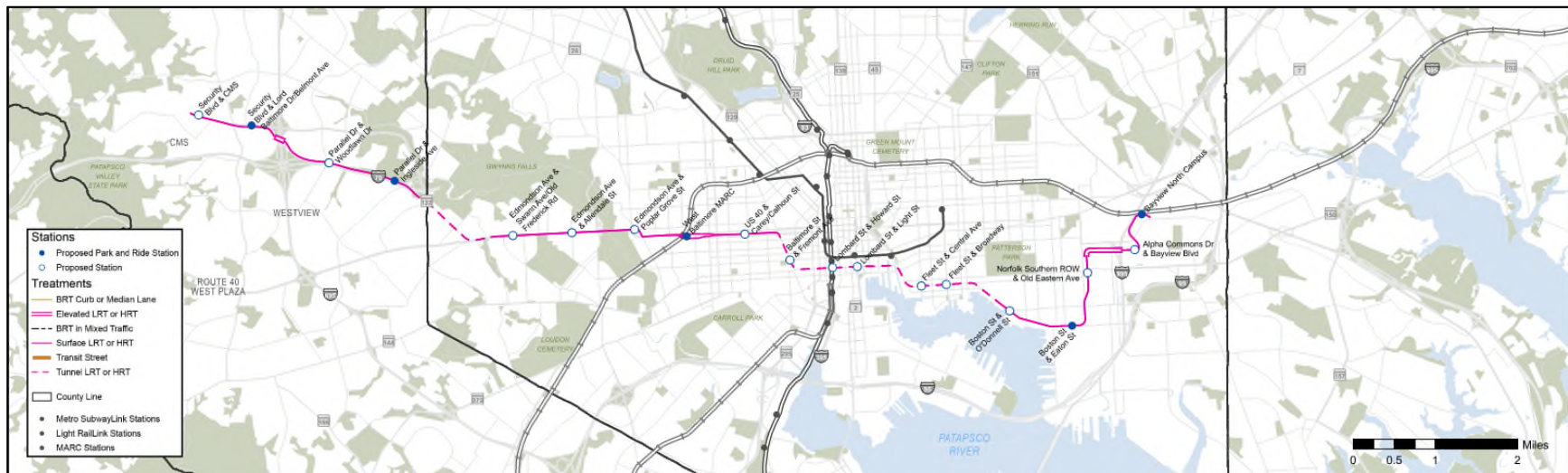
PRELIMINARY ALTERNATIVE 5 (BRT) CMS/SSA – ESSEX

Hours of Service	Weekdays 5:00 AM – 2:00 AM, Saturday 5:00 AM – 1:00 AM, Sunday 6:00 AM – 12:00 AM	
Frequency	Peak	7 minutes
	Off Peak	10 minutes
One-Way Travel Time	56 minutes	
One-Way Length	17.1 miles	
Stations	33	

Preliminary Alternative 6: Light Rail from Bayview to CMS/SSA via the Waterfront

Preliminary Alternative 6 follows the Red Line Preferred Alternative from the Final Environmental Impact Statement published in 2012. This iteration of the alternative provides light rail service from CMS/SSA to Bayview, passing through West Baltimore, Downtown, the Inner Harbor, waterfront neighborhoods, and new developments such as Canton Crossing (Boston St & Eaton St). To provide a baseline for comparison between this corridor feasibility study and the most recent major plan for this corridor, it was important to revisit the Red Line Preferred Alternative in this study with updated modeling and assumptions. Due to recent development, this alternative would require some modifications to its alignment in Southeast Baltimore.

Figure 13: Preliminary Alternative 6 (LRT) Alignment and Stations



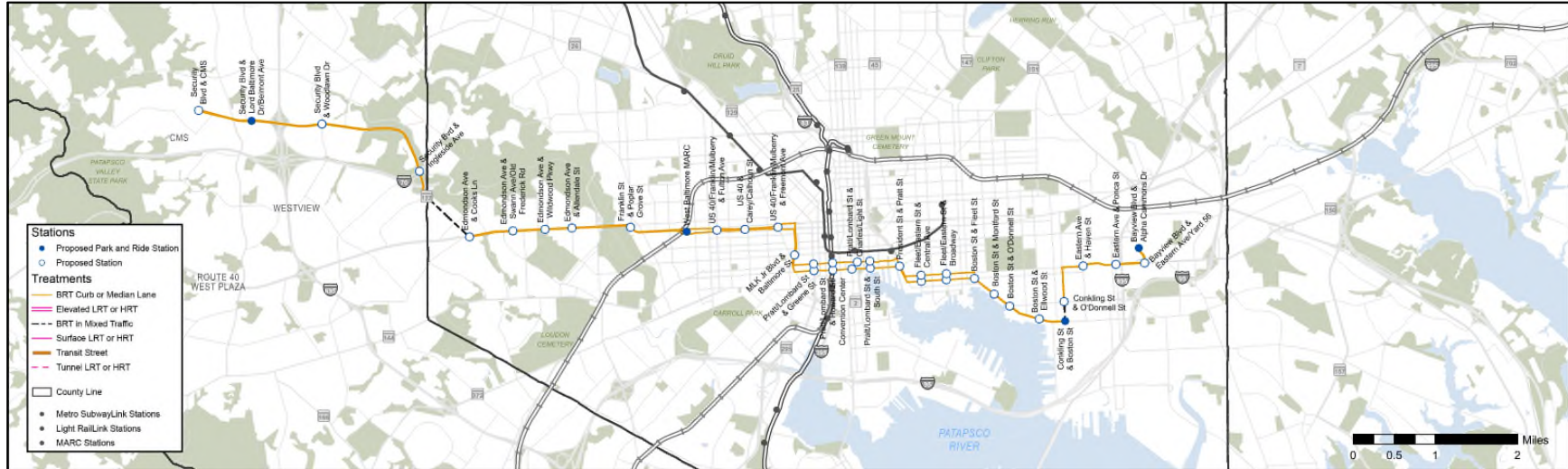
PRELIMINARY ALTERNATIVE 6 (LRT) CMS/SSA – BAYVIEW VIA THE WATERFRONT

Hours of Service	Weekdays 5:00 AM – 1:00 AM, Saturday 5:00 AM – 1:00 AM, and Sunday 10:00 AM – 10:00 PM	
Frequency	Peak	7 minutes
	Off Peak	10 minutes
One-Way Travel Time	43 minutes	
One-Way Length	14.1 miles	
Stations	19	

Preliminary Alternative 7: Bus Rapid Transit from Bayview to CMS/SSA via the Waterfront

Preliminary Alternative 7 follows the Preliminary Alternative 6 alignment with bus rapid transit rather than light rail. Its alignment uniquely uses Pratt Street and Lombard Street and Eastern Avenue and Fleet Street to serve the Inner Harbor and waterfront neighborhoods. It also provides service to Canton Crossing and Highlandtown/Canton neighborhoods via Conkling Street. Alternative 7 also tests the segment in West Baltimore by using the depressed segment of US 40 rather than Franklin and Mulberry streets.

Figure 14: Preliminary Alternative 7 (BRT) Alignment and Stations



PRELIMINARY ALTERNATIVE 7 (BRT) CMS/SSA – BAYVIEW

Hours of Service	Weekdays 5:00 AM – 2:00 AM, Saturday 5:00 AM – 1:00 AM, Sunday 6:00 AM – 12:00 AM	
Frequency	Peak	7 minutes
	Off Peak	10 minutes
One-Way Travel Time	53 minutes	
One-Way Length	14.2 miles	
Stations	31	

EVALUATION OF PRELIMINARY ALTERNATIVES

To evaluate the feasibility of the preliminary alternatives, the project team developed measures of effectiveness derived from the goals and objectives created for this project. These measures assess the potential impact of an alternative on existing and future conditions along the corridor. This section lists each measure, organized by the respective goal, outlines the methodology and data sources used for each, and presents how the preliminary alternatives performed. The results of these measures will help the RTP Implementation Team, other decision makers, and the public give informed feedback and recommendations for future implementation of quality transit along this corridor.

Measures of Effectiveness Results

A range of measures that align with the corridor goals were developed to evaluate how each Alternative performs. Additionally, the project team performed modeling to project the ridership and access each alternative would offer. Table 3 presents a qualitative summary of what was learned, with the results for most MOEs presented on a good to best scale. Table 4 presents the quantitative results for the MOEs.

Table 3: Measures of Effectiveness Results (Good to Best)

Goal	Theme	Alternative	1	2	3	4	5	6	7
		Mode	BRT	BRT	BRT+HRT	LRT	BRT	LRT	BRT
		Endpoints	Ellicott City - Bayview			CMS-Essex		CMS-Bayview	
		Length (miles)	22.7	18.4	19.1	16.4	17.1	14.1	14.2
		Number of Stations	39	36	25	28	33	19	31
		Average Station Spacing (miles)	0.6	0.5	0.8	0.6	0.5	0.7	0.5
		Measure							
Improve the connectivity and operations of the existing transit network	Reliability	Percent of dedicated or separated guideway	GOOD	BETTER	BETTER	BETTER	BETTER	BEST	BETTER
		Fixed or Flexible Guideway ²	FLEXIBLE	FLEXIBLE	FLEXIBLE/FIXED	FIXED	FLEXIBLE	FIXED	FLEXIBLE
	System Travel Savings	Average travel time savings for transit riders living in the corridor (minutes)	GOOD	GOOD	GOOD	BEST	BETTER	BEST	GOOD
	Travel Time	Transit travel time between West Baltimore and Hopkins Bayview (minutes)	GOOD	GOOD	BEST	BETTER	GOOD	BEST	GOOD

² Flexible guideway refers to alignment types that can enable transit vehicles to easily reroute due to roadway incidents or construction, such as dedicated bus lanes. Fixed guideway refers to alignment types that require transit vehicles to remain on a fixed guideway, such as rail tracks.

Goal	Theme	Alternative	1	2	3	4	5	6	7
		Mode	BRT	BRT	BRT+HRT	LRT	BRT	LRT	BRT
		Endpoints	Ellicott City - Bayview			CMS-Essex		CMS-Bayview	
		Length (miles)	22.7	18.4	19.1	16.4	17.1	14.1	14.2
		Number of Stations	39	36	25	28	33	19	31
		Average Station Spacing (miles)	0.6	0.5	0.8	0.6	0.5	0.7	0.5
		Measure							
Expand the reach and connectivity of the regional transit network	Ridership	Projected daily boardings in 2045 per mile	GOOD	GOOD	BETTER	BETTER	BETTER	BEST	BETTER
	Connections	Connections to rail stations, frequent bus routes and locally operated transit systems	BEST	GOOD	BETTER	BETTER	BETTER	BETTER	BETTER
	Access	To households within 1/2 mile of station, per mile	BETTER	BEST	GOOD	BETTER	BETTER	BEST	BEST
		To students within 1/2 mile of station per mile	GOOD	BEST	BETTER	BETTER	BETTER	GOOD	BETTER
		To future jobs within 1/2 mile of station, per mile	GOOD	GOOD	GOOD	BETTER	BETTER	BEST	BEST
Prioritize the needs of existing transit riders and transit-critical populations	Equity	Access to transit-critical populations ³	GOOD	BEST	GOOD	BETTER	BETTER	GOOD	BETTER
Maximize the economic and environmental benefit of a	Sustainability	Trips shifted to transit	BEST	BEST	GOOD	GOOD	BETTER	BETTER	BETTER
	Cost	Capital cost	\$	\$	\$\$\$\$	\$\$\$	\$	\$\$\$	\$

³ Transit-critical populations include low-income population, minority population, households without access to a vehicle, Limited English Proficiency population, adult population age 65 and older, and population with disabilities.

Goal	Theme	Alternative	1	2	3	4	5	6	7
		Mode	BRT	BRT	BRT+HRT	LRT	BRT	LRT	BRT
		Endpoints	Ellicott City - Bayview			CMS-Essex		CMS-Bayview	
		Length (miles)	22.7	18.4	19.1	16.4	17.1	14.1	14.2
		Number of Stations	39	36	25	28	33	19	31
		Average Station Spacing (miles)	0.6	0.5	0.8	0.6	0.5	0.7	0.5
		Measure							
major transit investment	Implementation	Implementation time	SHORTEST	SHORTEST	LONGEST	MIDDLE	SHORTEST	MIDDLE	SHORTEST
		Tunneling complexity	N/A	N/A	HIGH	MEDIUM	N/A	HIGH	N/A

Table 4: Measures of Effectiveness Results (Quantitative)

Goal	Theme	Alternative	1	2	3	4	5	6	7
		Mode	BRT	BRT	BRT+HRT	LRT	BRT	LRT	BRT
		Endpoints	Ellicott City - Bayview			CMS-Essex		CMS-Bayview	
		Length (miles)	22.7	18.4	19.1	16.4	17.1	14.1	14.2
		Number of Stations	39	36	25	28	33	19	31
		Average Station Spacing (miles)	0.6	0.5	0.8	0.6	0.5	0.7	0.5
		Measure							
Improve the connectivity and operations of the existing transit network	Reliability	Percent of dedicated or separated guideway	84%	95%	95%	92%	94%	100%	93%
		Fixed or Flexible Guideway	FLEXIBLE	FLEXIBLE	FLEXIBLE/FIXED	FIXED	FLEXIBLE	FIXED	FLEXIBLE
	System Travel Savings	Average travel time savings for transit riders living in the corridor (minutes)	2	2	2	4	2	3	2
	Travel Time	Transit travel time between West Baltimore and Hopkins Bayview (minutes)	54	52	39	47	51	44	57

Goal	Theme	Alternative	1	2	3	4	5	6	7
		Mode	BRT	BRT	BRT+HRT	LRT	BRT	LRT	BRT
		Endpoints	Ellicott City - Bayview			CMS-Essex		CMS-Bayview	
		Length (miles)	22.7	18.4	19.1	16.4	17.1	14.1	14.2
		Number of Stations	39	36	25	28	33	19	31
		Average Station Spacing (miles)	0.6	0.5	0.8	0.6	0.5	0.7	0.5
		Measure							
Expand the reach and connectivity of the regional transit network	Ridership	Projected daily boardings in 2045 per mile	1,100	1,100	1,400	1,400	1,400	1,900	1,500
	Connections	Connections to rail stations, frequent bus routes and locally operated transit systems	24	18	21	21	21	22	22
	Access	To households within 1/2 mile of station, per mile	2,600	3,100	2,300	2,700	2,700	3,000	3,200
		To students within 1/2 mile of station, per mile	800	1,200	1,000	1,000	1,000	900	1,000
		To future jobs within 1/2 mile of station, per mile	11,500	11,900	12,000	14,700	14,000	15,500	15,700
Prioritize the needs of existing transit riders and transit-critical populations	Equity	Low-income population within 1/2 mile of a station, per mile	1,700	2,400	1,900	2,500	2,400	2,100	2,300
		Minority population within 1/2 mile of a station, per mile	4,100	5,700	4,600	5,300	5,200	4,800	5,200

Goal	Theme	Alternative	1	2	3	4	5	6	7
		Mode	BRT	BRT	BRT+HRT	LRT	BRT	LRT	BRT
		Endpoints	Ellicott City - Bayview			CMS-Essex		CMS-Bayview	
		Length (miles)	22.7	18.4	19.1	16.4	17.1	14.1	14.2
		Number of Stations	39	36	25	28	33	19	31
		Average Station Spacing (miles)	0.6	0.5	0.8	0.6	0.5	0.7	0.5
		Measure							
		Zero-car households within 1/2 mile of a station, per mile	700	1,000	800	900	900	800	900
		Limited English proficiency population within 1/2 mile of a station, per mile	400	500	300	400	400	400	400
		Adult population over age 65 within 1/2 mile of a station, per mile	800	900	800	800	800	800	900
		Population with disabilities within 1/2 mile of a station, per mile	800	1,100	900	1,000	1,000	900	1,000
Maximize the economic and environmental benefit of a major transit investment	Sustainability	Trips shifted to transit	4,700	4,800	2,800	1,700	3,100	3,000	3,000
	Cost	Capital cost (\$ millions)	1,100	1,000	4,200	3,100	900	3,800	800
		Annual operating cost (\$ millions)	16	14	53	46	13	36	11

Goal	Theme	Alternative	1	2	3	4	5	6	7
		Mode	BRT	BRT	BRT+HRT	LRT	BRT	LRT	BRT
		Endpoints	Ellicott City - Bayview			CMS-Essex		CMS-Bayview	
		Length (miles)	22.7	18.4	19.1	16.4	17.1	14.1	14.2
		Number of Stations	39	36	25	28	33	19	31
		Average Station Spacing (miles)	0.6	0.5	0.8	0.6	0.5	0.7	0.5
	Measure								
Implementation	Implementation time (years)	6-8	6-8	10-12	8-10	6-8	7-9	5-7	
	Tunneling complexity	N/A	N/A	HIGH	MEDIUM	N/A	HIGH	N/A	

Measures of Effectiveness Takeaways

After analyzing the results of the measures of effectiveness, the project team concluded the following about the preliminary alternatives and specific geographic segments within the corridor:

Overall Takeaways

- All preliminary alternatives would attract enough ridership to support frequent transit service throughout the day.
- The preliminary alternatives are not equal in their ability to attract ridership. Specific alignment tests show greater ridership potential in some areas compared to others.
- All preliminary alternatives would improve travel times and reliability for transit riders through extensive new dedicated guideway.
- BRT preliminary alternatives have less travel time savings because their stations are spaced more closely, but more stations also increases access.
- Access to transit-critical populations varies based on station spacing and alignment differences through East Baltimore.
- Cost varies dramatically across preliminary alternatives and is driven by mode and length of tunneling. Costs to build and operate rail preliminary alternatives are 3 to 4 times higher than BRT.
- Implementation time is directly related to cost and risk across the preliminary alternatives. Rail preliminary alternatives will take longer to implement than BRT.

East Baltimore County

- Extending to Essex results in more than 4,000 additional riders along a 3.5-mile stretch.

East & Southeast Baltimore City

- North of Patterson Park provides more access to minority and low-incomes residents.
- Waterfront alignments provide more access to jobs.
- More stations provide more direct access but, slower travel times.

Downtown Baltimore

- Transit street ridership is similar, but slightly less, than alternatives with a downtown tunnel.
- Tunneling is the fastest way through Downtown, but reduces access and adds cost, complexity, and implementation time
- Serving downtown provides three to five times more riders than staying north on Franklin and Mulberry.

West Baltimore City

- Serving neighborhoods along Baltimore Street provides increased ridership.
- Closer station spacing provides more access for minority and low-income populations.
- More cost, environmental complexity, and implementation time with tunnel construction.

Far West Baltimore City

- Heavy rail transit attracts the most ridership in this segment.
- Light rail and bus rapid transit attract similar ridership.
- Travel times are very similar across the alternatives because of the dedicated guideways.
- Closer station spacing provides more access for minority and low-income populations.
- Tunnel construction involves more cost, environmental complexity, and implementation time.

West Baltimore County

- CMS/SSA contributes significant ridership and future job access.
- Travel times for bus rapid and light rail transit are similar before entering tunnels from CMS/SSA.
- Travel time is significantly longer to serve both Ellicott City and CMS/SSA (Alternative 1).

Howard County

- Serving Howard County produces less than 3,000 daily boardings over five miles.
- Lowest future job access per mile.
- Alternatives 1 & 3 serve the lowest minority population per mile and lowest low-income population per mile.

PUBLIC OUTREACH SUMMARY

The project team solicited public comment on the seven preliminary East-West Corridor alternatives online and in person between June and August 2022.

Support for Individual Alternatives

Public feedback on the preliminary alternatives was received via the project website, several pop-ups throughout the study area and two open house events.

Rank	Overall	Website	Pop-up
1	Alternative 4	Alternative 6	Alternative 4
2	Alternative 6	Alternative 4	Alternative 3
3	Alternative 3	Alternative 3	Alternative 5
4	Alternative 2	Alternative 1	Alternative 2
5	Alternative 5	Alternative 2	Alternative 6
6	Alternative 1	Alternative 5	Alternative 7
7	Alternative 7	Alternative 7	Alternative 1

- An east-west transit project had strong support from the public.
- Overall, Alternatives 4 and 6 had the most support. Alternative 6 had significantly less support among pop-up in-person commenters, who were mostly transit riders.
- Overall, Alternatives 1 and 7 had the least support.

Modes

- Online respondents preferred LRT and HRT over BRT.
- Pop-up respondents approved and disapproved of BRT in about equal number. Respondents expressed concerns that BRT would not be implemented with all the characteristics of fully-featured BRT.
- Although most pop-up respondents approved of both rail modes, LRT received more support than HRT.

Locations Served

- Locations or alignments that generated strong support included Essex, Downtown, Route 40/Harlem Park, Johns Hopkins Hospital.
- There was a stronger preference to serve Westview and the Catonsville commercial area than Woodlawn, especially given the rise in telework for CMS/SSA employees.
- There was roughly equal support for alignments north and south of Patterson Park.

Guideway

- There is strong support for a transit street on Baltimore Street through Downtown Baltimore as a means of ensuring reliability and speedy travel times. Alignments without the transit street were explicitly criticized for this omission.
- While tunnelling was supported as a way to fully separate the transit service from private traffic, many commenters expressed concern about the costs, property takings, and climate change resilience.

OUTREACH SUMMARY

Over the course of June and July 2022, the project team collected:

- **283 responses** on the web survey
- **239 comments** from in-person events
- **22 letters and emails.**

The team also conducted or distributed:

- **10 pop-ups at transit stops**
- **5 pop-ups at community events**
- **2 open houses** totaling 30 participants
- **8 in-reach events** at bus divisions to reach current MTA bus operators
- **3 canvassing days** with 30 interactions with the public and 400 postcards distributed
- **2 virtual public meetings** with a total of 89 participants
- **4 presentations** at advocacy or advisory meetings
- **3 email-blasts** to approximately 1,250 individuals, with a 45 to 55 percent open rate and a 6 to 15 percent click rate

Additional Study

- Open house participants requested specific information about potential property impacts.
- Respondents expressed interest in studying the alternatives' role in developing a multimodal transit hub in Downtown Baltimore.
- Comment letters requested detailed modeling of walk access to stations and systemwide access to destinations.

EAST-WEST FEASIBILITY STUDY CONCLUSIONS

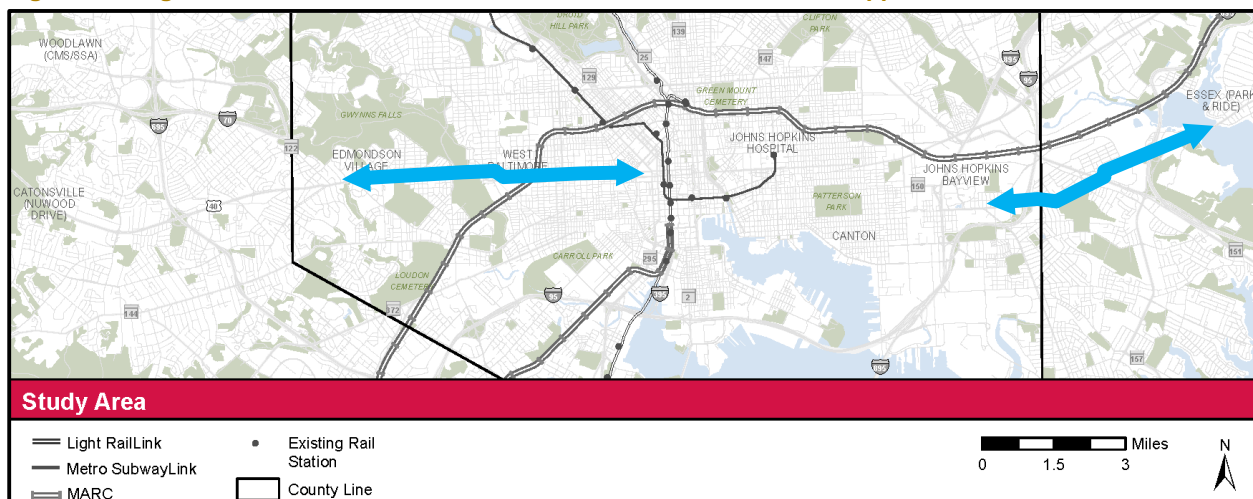
Based on the measures of effectiveness results and public feedback, the project team has identified the following findings and conclusions. These will guide the development of Alternatives to study in more detail in the next phase, the East-West Corridor Alternatives Analysis.

Alignment Segments that Demonstrated Good Performance and Public Support

The segment of US 40 through West Baltimore demonstrated public support. Baltimore City and the public are optimistic about opportunities to re-envision US 40 through West Baltimore and there is a desire to revisit and rethink transit plans along the highway. Baltimore City and MDOT MTA have partnered to submit on a Reconnecting Communities Pilot program federal grant application to fund the planning of the redevelopment of the US 40 highway in West Baltimore.

The segment of Eastern Avenue from Bayview to Essex Park & Ride performed well and demonstrated public support. Figure 15 shows the segments that demonstrated good performance and public support.

Figure 15: Alignments that Demonstrated Good Performance and Public Support



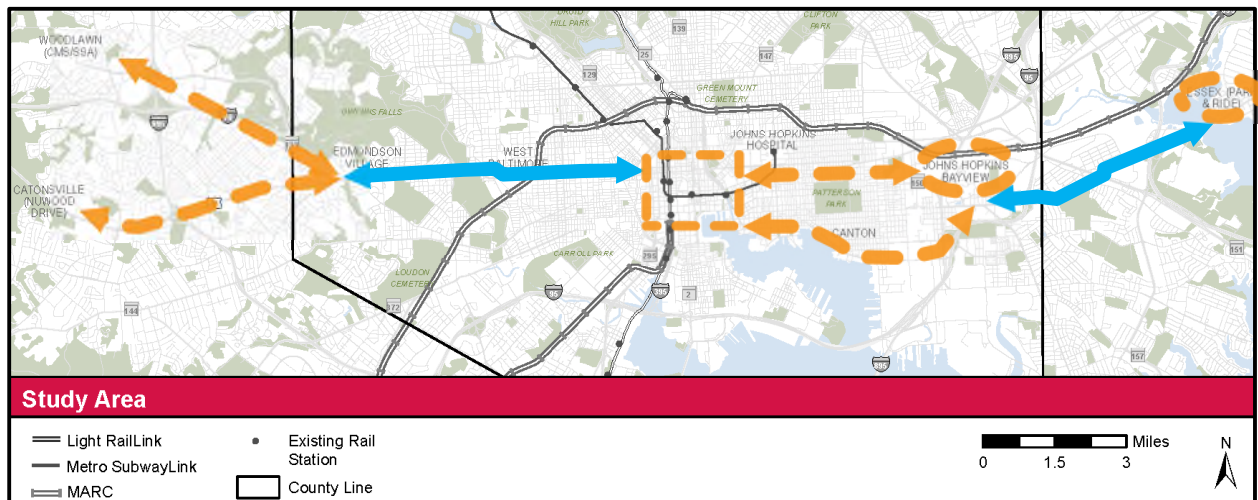
Additional Analysis and Input Needs

Options for the western segment of the corridor, west of Edmondson Village, need additional analysis and input. CMS/SSA performed well in ridership projections. However, ridership modeling was based on pre-pandemic travel patterns, and the project team heard from CMS/SSA employees that telework is currently dominant within their workforce. Catonsville received stronger support from the public compared to CMS/SSA. Major retailers along US 40 in Catonsville draw residents from Baltimore City.

Options for the Downtown Baltimore segment of the corridor need additional analysis and input. The public voiced concerns about tunneling under Fremont Avenue into Downtown. The public and Baltimore City expressed an openness to re-evaluate the need for a downtown tunnel and explore an at-grade solution. The public and Baltimore City also expressed strong support for the Baltimore Street transit street east of Martin Luther King, Jr. Boulevard.

Based on the analysis and public feedback received there are two alignments through East Baltimore that performed well – north and south of Patterson Park. Both of these alignments require additional analysis and input to determine their feasibility and impacts. Figure 16 shows the segments that demonstrated good performance and public support and the segments that require additional analysis and input.

Figure 16: Options Needing Additional Analysis and Input



Low Performing Alignment Segments

The segment from Catonsville to Howard County did not perform well. The Ellicott City termini is not very productive from a ridership perspective. Although it did receive some public support to extend the transit network, there are no major anchor origins/destinations. It may be more appropriate to consider connecting feeder bus service to rather than advance a Howard County alignment as part of the East-West Corridor project. The next phase of planning will include studying feeder bus service to extend access to the US 40 corridor in Howard County.

The segment from CMS/SSA to Howard County did not perform well. Preliminary Alternative 1 connecting Ellicott City and CMS/SSA provides a more circuitous route. The project team received public feedback concerns about the mixed-traffic segment and travel time.

The transit street segment on West Baltimore Street west of Martin Luther King Jr. Boulevard did not perform well. There is lack of public support for a transit street in West Baltimore. In contrast, the segment of US 40 through West Baltimore performed well and demonstrated public support.

The segment of US 40 in Downtown Baltimore did not perform well. Preliminary Alternative 2 alignment along Franklin/Mulberry Streets through Downtown had low ridership projections and lacked central business district access and connections to Metro Subway and Light Rail.

The segment from Johns Hopkins Hospital to Fells Point did not perform well. Preliminary Alternative 1 alignment between Downtown, Johns Hopkins Hospital, and Fells Point is too indirect.

The segment through Canton along Eastern and Fleet Streets did not perform well. The Eastern and Fleet Streets couplet through Canton lacks public support.

Mode Conclusions

Bus Rapid Transit (BRT) demonstrated good performance from a ridership perspective compared to the rail modes at a significantly lower cost. From public input, the greatest advantage of BRT was its faster implementation timeframe, and the greatest disadvantage was concern about meeting the requirements of "true BRT." BRT is recommended to advance for further study and alternatives development.

Light Rail Transit (LRT) performed similarly to BRT from a ridership perspective but with shorter travel times and higher costs. The public demonstrated extensive support for expanding LRT in the region but expressed concern about potential impacts to homes and risks in project delivery and implementation. LRT is recommended to advance for further study and alternatives development.

Heavy Rail Transit (HRT) performed similarly to BRT and LRT from a ridership perspective but with the shortest travel times and highest costs. The public demonstrated extensive support for expanding HRT in the region but expressed concern about its high costs and long implementation timeframe. HRT is recommended to be investigated for feasibility, cost, and risk, and potentially advanced for alternatives development.

NEXT STEPS

During Winter 2022/23, MDOT MTA along with its regional partners and decisionmakers will identify alternatives to be studied in the Alternatives Analysis (AA) phase, based on the results of this Feasibility Study. In Spring/Summer 2023, the Project Team will present alternative alignments, modes and station locations and the public engagement plan for stakeholder and public feedback. Additionally, the project team will initiate coordination with outreach advisory groups, stakeholders likely to be served by a stop on one or more alternatives, and environmental agencies. The AA phase is expected to take one to two years to complete, depending on the number and complexity of alternatives included for study, and will ultimately reach a preferred alternative.