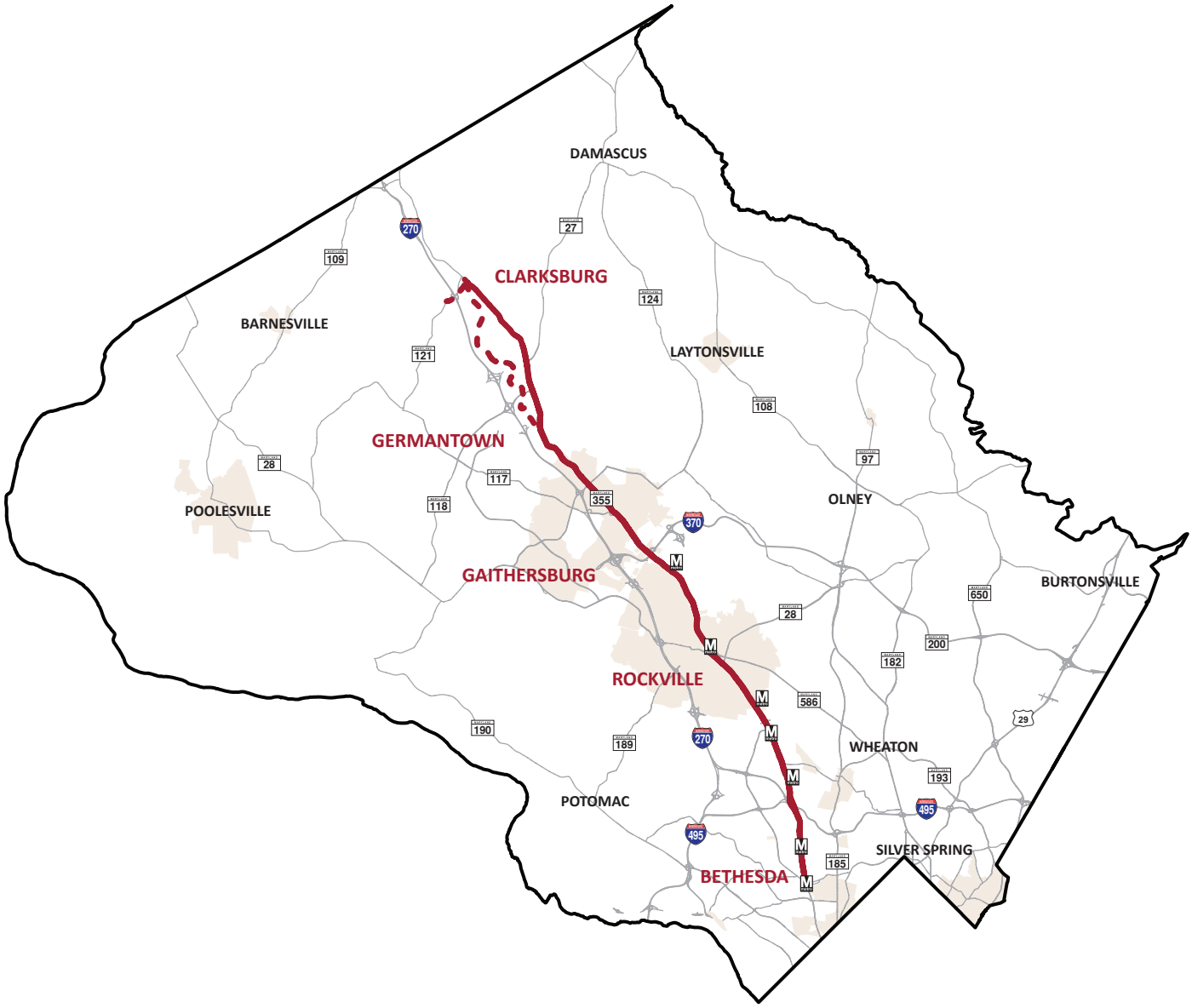
MD 355 BUS RAPID TRANSIT CORRIDOR PLANNING STUDY

CONCEPTUAL ALTERNATIVES REPORT

APRIL 2017

Montgomery County RAPID TRANSIT MD 355



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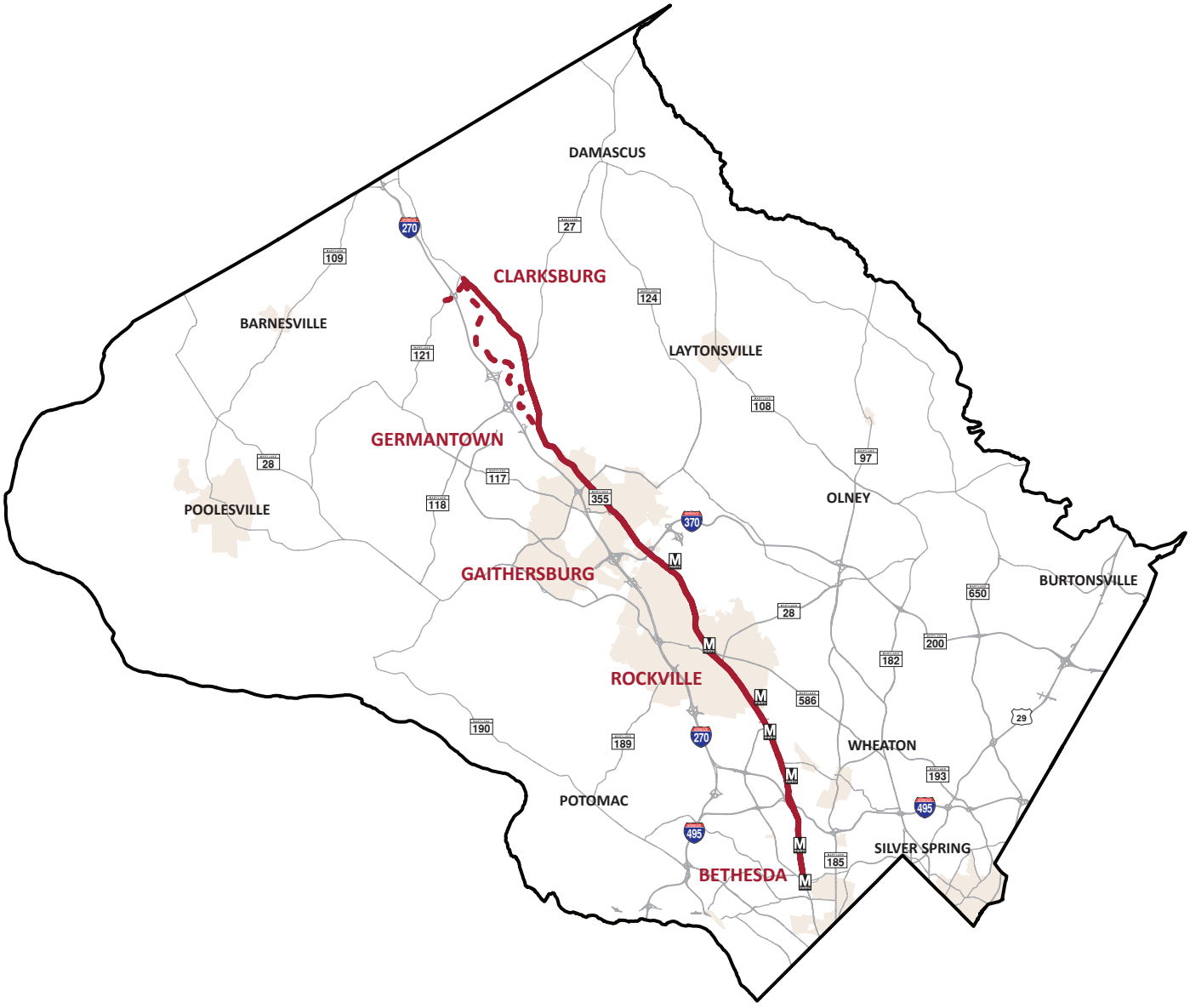
Montgomery County RAPID TRANSIT

MD 355

EXECUTIVE SUMMARY



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Executive Summary

Introduction

The Maryland Department of Transportation's (MDOT) Maryland Transit Administration (MTA) and the State Highway Administration (SHA), in partnership with the Montgomery County Department of Transportation (MCDOT), is currently conducting the MD 355 Bus Rapid Transit (BRT) Corridor Planning Study. BRT is a modern, permanent mode of transportation that combines features of both a bus system and a light rail system. Like a light rail system, BRT vehicles utilize dedicated lanes but can leave the dedicated lanes to serve local destinations as needed. However, BRT uses vehicles with rubber tires on a dedicated paved surface rather than steel wheels on steel rail. The benefit of a BRT system over a light rail system is the combination of modern technology and design, which improve the overall experience of the rider, at a lower cost and quicker construction time.

Montgomery County is the most populous county in Maryland. As of 2014, the Study Corridor is home to over 300,000 residents and over 282,000 jobs. The Study Corridor was identified based on an assessment of the regional travel demand model's Transportation Analysis Zones (TAZ) within Montgomery County that would have reasonable access to stations along the proposed BRT service. A substantial amount of growth is forecasted for the Study Corridor between 2015 and 2040, particularly around the proposed White Flint redevelopment. Population in the Study Corridor is expected to increase by 33 percent - an increase of more than 100,000 residents, while employment is expected to grow by 28 percent, for an additional 86,000 jobs.

Traffic congestion in portions of the Study Corridor is already a significant issue, with very slow peak period and peak direction travel speeds with multiple intersections and intersection-to-intersection links operating at Level of Service (LOS) E or F. The future 2040 No-Build conditions show that the significant growth in population and employment in the Study Corridor will further degrade traffic conditions. This congestion is a contributing factor affecting the reliability of the existing transit service.

By far the predominant type of trip made in the Study Corridor is non-work trips, which account for 88 percent of travel within the Study Corridor. These trips are made frequently, and are usually shorter distance trips than commuter travel. These types of short trips between key trip activity centers along MD 355 represent the largest potential market for a BRT service.

This Conceptual Alternatives (CA) Report documents the study to evaluate preliminary concepts for providing enhanced premium transit service along MD 355 from Clarksburg to Bethesda in Montgomery County as shown in ***Figure ES-1***. The Study Corridor is approximately 21 miles in length and would serve many activity centers including Clarksburg, Metropolitan Grove, Gaithersburg, Shady Grove/King Farm, Montgomery College, Rockville, Twinbrook, White Flint, Grosvenor, Medical Center, and Bethesda.

History

Montgomery County first proposed BRT as the most appropriate mode for improving transit in the Study Corridor in the 1993 Strategic Transit Plan. In 2011, MCDOT completed the Countywide BRT Study to identify key corridors within the County that could support premium rapid transit service. Acting upon the findings from the 2011 Countywide BRT Study, the Maryland-National Capital Park and Planning Commission (M-NCPPC) developed the Countywide Transit Corridors Functional Master Plan. The Functional Master Plan was approved and adopted by the Montgomery County Council in December 2013.

Process

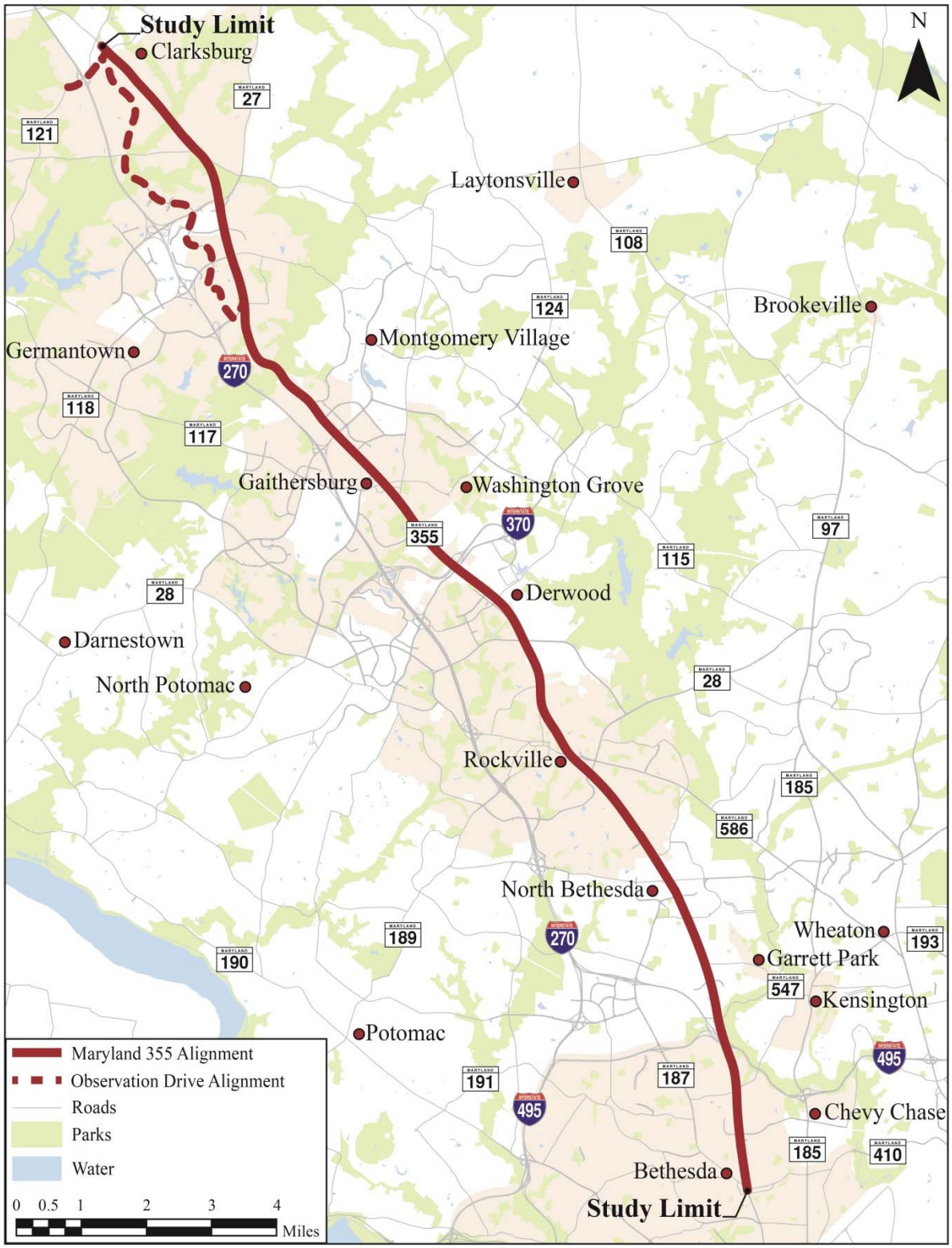
The MD 355 BRT Corridor Planning Study began in the Fall of 2014 and used the recommendations from the 2013 Countywide Transit Corridors Functional Master Plan as a starting point in the development of the Conceptual Alternatives. The study will conclude with a recommended alternative. Coordination with the City of Rockville, City of Gaithersburg, and M-NCPPC has been ongoing throughout the study.

The Corridor Planning Study is using a three-step process to recommend an alternative. This Conceptual Alternatives (CA) Report completes two of the three steps of the Corridor Planning Study. The recommendations of the study would be used in the future for environmental analysis and documentation as required by either the National Environmental Policy Act (NEPA) or the Maryland Environmental Policy Act (MEPA).

Steps to Recommend an Alternative:

- Step 1: Identify Constraints (Completed):
  The first step consisted of data collection on existing transit operations, highway data such as traffic volumes and crash statistics, environmental information and aerial mapping. This information was used to prepare a Draft Preliminary Purpose and Need document. This information and document were presented to the Corridor Advisory Committee (CAC) groups and general public at Open Houses in Spring 2016. Input received by the public was used to identify constraints along the Study Corridor.
- Step 2: Comparative Screening (Current phase):
  With the information developed under Step 1, a set of Conceptual Alternatives was developed for testing purposes. These alternatives were evaluated to answer questions about the project termini, alignment, running way operations, station locations and service plan. A set of screening criteria was identified to qualitatively compare the different BRT Alternatives and address questions related to transit ridership, travel times, person throughput, accessibility, impacts and costs. The screening criteria results are discussed in Chapters 5 and 7. This report represents the culmination of Step 2 and presents the alternatives that will be studied in the next phase.
- Step 3: Detailed Analysis (Next phase):
  A narrower set of alternatives will be investigated in further detail in the next phase of the project. These alternatives will be quantitatively compared using a set of selection criteria and ultimately an alternative will be recommended (the Recommended Alternative) to be studied under NEPA or MEPA.

Figure ES-1: Study Limits



Draft Preliminary Purpose and Need

A separate standalone Draft Preliminary Purpose and Need document was developed for the MD 355 BRT Corridor Planning Study in April 2016. It documents the Preliminary Purpose and Need for the project, including the existing and future transportation needs in the MD 355 Corridor that the project proposes to address. It also describes how the alternatives under consideration will be evaluated in the selection a Recommended Alternative. An Open House was held in the Spring of 2016 to present the information included in the Draft Preliminary Purpose and Need document and to receive input from the public. The Draft Preliminary Purpose and Need document provides background information for a formal Purpose and Need statement to be reviewed and approved by the appropriate agencies at a future phase of the study.

To guide the development and implementation of an enhanced premium bus service in Montgomery County, the goals and objectives outlined in ***Table ES-1*** were developed.

Table ES-1: Bus Rapid Transit Goals and Objectives

Goals		Objectives
1	**Improve quality of transit service**	✓ Make bus trips faster ✓ Make door-to-door transit travel time competitive with door-to-door automobile travel time ✓ Increase transit ridership ✓ Provide an appealing transit service that attracts new riders
2	**Improve mobility opportunities and choices**	✓ Serve as many travelers as possible by efficiently utilizing the existing right-of-way ✓ Balance travel times for automobiles and transit users ✓ Enhance pedestrian and bicycle options in the corridor ✓ Create direct transfers between premium bus and other modes
3	**Develop transit services that enhance quality of life**	✓ Provide premium transit service convenient to households and jobs within the corridor ✓ Minimize impacts to private property ✓ Serve transit dependent populations ✓ Engage public in process
4	**Develop transit services that support master planned development**	✓ Improve alternative transportation service to and between activity centers ✓ Increase trips by non-automobile modes to support development in the Master Plan ✓ Select station locations that support infill and redevelopment
5	**Support sustainable and cost effective transportation solutions**	✓ Maintain environmental quality ✓ Minimize cost of building and operating transportation services

Problem Definition

Based upon analysis of the MD 355 corridor and feedback from elected officials, County planners, local residents, community and business leaders, and other stakeholders, the following four transportation challenges were identified that define the needs for the project:

1. Growth and development in the Study Corridor
2. Roadway congestion and safety
3. Lack of competitive travel options
4. Transit reliant passengers

Project Purpose

The purpose of the project is to provide a new, higher speed, high frequency, premium transit service along MD 355 between Bethesda and Clarksburg that will:

- Enhance transit connectivity and multimodal integration along the corridor as part of a coordinated regional transit system;
- Improve the ability for buses to move along the corridor (bus mobility) with improved operational efficiency, on-time performance / reliability, and travel times;
- Address current and future bus ridership demands;
- Attract new riders and provide improved service options for existing riders as an alternative to congested automobile travel through the corridor;
- Support approved Master Planned residential and commercial growth along the corridor;
- Improve transit access to major employment and activity centers;
- Achieve Master Planned non-auto driver modal share;
- Provide a sustainable and cost effective transit service; and
- Improve the safety of travel for all modes along the corridor.

BRT Alternative Components

The Alternatives are composed of three components:

1. **Running way:** A designated facility such as a striped/signed lane or exclusive busway in which the vehicle would travel between stations
2. **Station locations:** Specific locations where passengers can access the service and the service can support the local land uses (residential, commercial, etc.)
3. **Service plan:** The way in which BRT operates, including service frequency, hours of service, routing and connecting services.

Conceptual Alternatives

Six Conceptual Alternatives were identified for preliminary analysis. Alternative 1 (No-Build) and Alternative 2 Transportation System Management (TSM) will automatically move forward to the next phase of the study. This report compares Alternatives 3A, 3B, 4A and 4B, known collectively as the BRT Alternatives. The BRT Alternatives are being evaluated to identify refinements and determine those that should be carried forward to the next phase, in addition to Alternatives 1 and 2.

Alternatives Automatically Moving Forward to Next Phase

> **Alternative 1 – No-Build Alternative:** No improvements to infrastructure or bus service along the MD 355 Study Corridor beyond those improvements already planned and programmed in the Metropolitan Washington Council of Governments (MWCOG) Constrained Long-Range Plan (CLRP).

Alternative 2 – Transportation System Management (TSM): Enhanced bus service operating in mixed traffic in existing lanes along with minor infrastructure improvements at select intersections. The minor infrastructure improvements would require widening for intersection improvements to benefit transit service or queue jumps at select intersections. Transit Signal Priority (TSP) would be included at select intersections.

BRT Alternatives Proposed at this Stage of Analysis

Alternative 3A: New BRT service from the Clarksburg Outlets to the Grosvenor Metrorail Station. The service would be in mixed traffic from the Clarksburg Outlets to Middlebrook Road along Observation Drive and on dedicated median lanes from Middlebrook Road to the Grosvenor Metrorail Station along MD 355.

Alternative 3B: New BRT service from Redgrave Place in Clarksburg to the Bethesda Metrorail Station. The service would be mostly on dedicated median lanes from Redgrave Place to the Bethesda Metrorail Station, running its full length along MD 355.

Alternative 4A: New BRT service from Redgrave Place in Clarksburg to the Grosvenor Metrorail Station. The service would be mostly on dedicated curb lanes from Redgrave Place to the Grosvenor Metrorail Station, running its full length along MD 355.

Alternative 4B: New BRT service from Redgrave Place in Clarksburg to the Bethesda Metrorail Station. The service would be mostly on dedicated curb lanes from Redgrave Place to the Bethesda Metrorail Station, running its full length along MD 355.

Station Locations and Service Plan

The Countywide Transit Corridors Functional Master Plan made recommendations on where stations should be located along the corridor. A few adjustments were made in this study to these original station locations based on coordination with the City of Gaithersburg, City of Rockville, M-NCPPC, MCDOT and in response to CAC comments.

The Service Plan includes three proposed BRT route patterns. The three route patterns and service frequency are described on ***Table ES-2***.

Table ES-2: BRT Service Plan

BRT ROUTE	Northern Terminal	Southern Terminal	Service Frequency (Minutes)
Orange	Redgrave Place or Clarksburg Outlets	Rockville Metrorail Station	3.5 – 5
Blue	Lakeforest Transit Center	Rockville Metrorail Station	12
Purple	Montgomery College Rockville	Grosvenor or Bethesda Metrorail Station	10

Alternatives Evaluation

The BRT Alternatives were evaluated using a set of defined criteria to understand the transit benefits to each alternative, screen out elements within the alternatives that show the least transit benefits, and to develop a refined set of alternatives that will be analyzed in further detail in the next phase of the project.

A summary of the qualitative comparison using the defined screening criteria is shown in ***Table ES-3***. Additional information on the screening criteria can be found in Chapters 5 (Transit and Transportation Analysis) and 7 (Conceptual Alternatives Evaluation) of this document.

Table ES-3: Screening Criteria Summary Results

	Alt 3A	Alt 3B	Alt 4A	Alt 4B
Increase in total daily transit ridership	Medium	Higher	Lower	Higher
Increase in total daily bus ridership	Medium	Higher	Lower	Higher
Total daily BRT ridership	Medium	Higher	Lower	Higher
Boardings by station – North Section *(Section 7)*	Higher	Medium	Medium	Lower
Boardings by station – Central Section *(Section 6 through Section 2)*	Lower	Higher	Lower	Higher
Boardings by station – South Section *(Section 1)*	**Same for Alternatives 3B and 4B**			
BRT travel time	**See Chapter 4 for detailed breakdown**			
BRT travel time vs. local bus travel time				
BRT travel time vs. auto travel time				
Change in peak hour person throughput				
Change in daily person throughput				
Increase in jobs within 45 minutes along the corridor	Medium	Higher	Lower	Lower
Increase in jobs within 60 minutes along the corridor	Medium	Higher	Lower	Medium
Increase in households within 45-60 minutes of activity centers	Lower	Higher	Lower	Higher
Total property impacts[1]	Medium	Higher	Medium	Lower
Total operating costs	Higher	Medium	Lower	Medium
Construction costs[1]	Medium	Higher	Medium	Lower

[1] *For a detailed breakdown of impacts and costs by section refer to Chapter 3.*

Summary of Findings

The results of the alternatives evaluation have yielded important information about the alternatives, particularly in the areas listed below. Summary takeaways regarding a range of screening data and findings can be found in Chapter 7. These takeaways will help the team make data driven decisions regarding how to refine the alternatives to be studied in the next phase of the project. Key findings include:

- **Comparison of the Two Northern Alignment Alternatives:** In Section 7 – MD 355 (Alternatives 3B, 4A, and 4B) and Observation Drive (Alternative 3A), it takes twice as long (or more) for the BRT to travel along

Observation Drive. This alignment however has over 50 percent higher ridership compared to MD 355 due to the higher number of large trip generators.

- **Comparison of the Two Southern Limits:** In Section 1 – Grosvenor Metrorail Station (Alternatives 3A and 4A) and Bethesda Metrorail Station (Alternatives 3B and 4B), approximately 15 percent of ridership is generated at stations south of the Grosvenor Metrorail Station. The improved transit access to key activity centers south of the Grosvenor Metrorail Station increases the ridership on the central section (Middlebrook Road to Grosvenor Metrorail Station) by more than 10 percent.
- **Differences in Ridership for New BRT service:** When comparing the Alternatives, higher ridership is primarily driven by:
    - Observation Drive alignment
    - Extending service to Bethesda Metrorail Station
    - Median running way sections
- **Effects of Lane Repurposing in Sections 1 and 3 (Alternatives 3B and 4B):**
    - Even though transit person throughput increases between 80 percent and 130 percent within the different sections with repurposed lanes compared to the No-Build, total person throughput (which includes auto and transit) drops by up to 15 percent due to a decrease in auto person throughput outweighing the increase in transit throughput. Conversely, lane repurposing results in lower impacts and lower construction costs.
- **Operational Characteristics for the Bi-Directional Running Way (Alternatives 3A and 4A) Section 3**
    - BRT travel times are up to 25 percent longer and BRT ridership is up to 25 percent lower in Alternatives with bi-directional operations. In addition, the average delay per BRT trip, with bi-directional operations, ranges from 1 minute 30 seconds to more than 3 minutes. The wider footprint of the bi-directional running way results in construction costs more than 13 percent higher compared to lane repurposing options.
- **Median vs. Curb Running Way Comparison**
    - In general the median running way sections have up to 20 percent shorter travel times generating higher ridership within those sections. Conversely the median running way has a wider footprint and results in more than 25 percent higher property impacts and 60 percent higher construction costs compared to the curb running way.
- **BRT Service Features that are Affecting Operational Costs**
    - The orange BRT route (Clarksburg to Rockville via Observation Drive) is more than double the cost to operate than the other BRT routes in the service plan. The higher ridership along Observation Drive compared to MD 355 would require more frequent service to meet passenger demand and the mixed traffic operation on Observation Drive would result in slower travel speeds. These two factors combined would require more buses in service, thus resulting in higher operational costs.

- **BRT Service Features that are Affecting Property Impacts and Construction Costs**
  - The median running way has a wider footprint and results in more than 25 percent higher property impacts and 60 percent higher construction costs compared to the curb running way. The mixed traffic running way along Observation Drive reduces property impacts and construction costs on Alternative 3A. Extending the service to Bethesda Metrorail Station results in higher property impacts and construction costs due to additional stations.

Public Involvement

Public Involvement played an important and active role in the MD 355 BRT Corridor Planning Study. These efforts included a regularly updated website with all project information, the formation, initiation and collaboration of two CACs and holding two sets of Public Open House meetings (four total public meetings) with the general public.

Corridor Advisory Committees

Upon the Montgomery County Council's approval of the Countywide Transit Corridors Functional Master Plan (2013), the Council called for the formation of a CAC for the MD 355 BRT Corridor Planning Study. Two CACs were initiated, split geographically, comprised of stakeholders representing the MD 355 study corridor. The MD 355 South CAC includes approximately 45 stakeholders focused on the southern part of the study corridor from Bethesda to Rockville. The MD 355 North CAC includes approximately 25 stakeholders focused on the northern part of the study corridor from Rockville to Clarksburg.

The CAC provides residents, business owners, and interested stakeholders the opportunity to provide input, discuss study assumptions and methodologies and to share information from the meetings with the community groups they represent. The CAC meetings kicked-off in February 2015 and have met regularly through the study. Nine meetings have been held for each CAC through November 2016.

The meetings have covered a wide range of topics beginning with an introduction to BRT and concluding with the review of the Alternatives screening criteria and analysis results. Additional meeting topics included:

- MD 355 Corridor Overview
  - Existing transit service
  - Existing and future No-Build traffic operations
- Project Development Process and Schedule
- Goals and Objectives / Draft Preliminary Purpose and Need
- Conceptual Alternatives Development
  - Running ways
  - Station Locations
  - Service Plan
- Screening Criteria Results and Key Takeaways

The MD 355 North and South CACs were run concurrently with each CAC following the same schedule and being provided similar content. Each CAC had a professional facilitator to lead the meetings and to be the point of contact for all correspondence with the members. While each CAC meeting was unique in terms of content and structure the general approach to the CAC meetings was to make structured presentations followed by opportunities to ask questions or make comments. Each CAC meeting typically wrapped up with breakout exercises or table-top discussions designed to provide opportunities for the CAC members to provide input and feedback on elements of the study. An additional meeting was held for both CACs to discuss the Draft Preliminary Purpose and Need.

All materials presented at CAC meetings were placed on the project website for review by the public. These materials included agendas, presentations, maps and meeting summaries. In addition, a video of each CAC meeting (starting with CAC meeting No. 4) is also on the website for the public to review.

Public Open House Meetings

In addition to the CAC process, two sets of Open Houses were conducted for the MD 355 BRT Corridor Planning Study for members of the public. In the Spring of 2016, the first Open Houses took place on April 28, 2016 at Bethesda-Chevy Chase High School and on May 3, 2016, at Gaithersburg High School. These Open Houses provided the first opportunity to share information to the public about the MD 355 Corridor Planning Study. Each Open House meeting was two hours in duration and included identical information including:

- A 10-minute power point presentation repeated throughout the Open House that welcomed attendees, introduced and oriented people to the planning study and Open House
- Display Boards focused on:
  - BRT elements
  - The study process and schedule
  - Existing conditions of MD 355
  - Draft Preliminary Purpose and Need
- Comment tables for the public to share feedback, ask questions an provide comments

In the Winter of 2017, the second round of Open Houses took place on February 7, 2017, at Montgomery College – Gaithersburg Campus and on February 8, 2017, at the Montgomery County Executive Office Building. These Open Houses provided an opportunity to share updated information to the public about the MD 355 Corridor Planning Study. Each Open House was two hours in duration and included identical information including:

- A 10-minute power point presentation repeated throughout the Open House that welcomed attendees, presented background information on BRT Systems and the study, and introduced the information provided at the meeting
- Display Boards focused on:
  - BRT elements and Alternative Components
  - Conceptual Alternatives under Consideration
  - Steps to Recommending an Alternative and Screening Criteria
  - Qualitative Screening Criteria
  - Preliminary Analysis Takeaways
  - Station Design Prototypes
- Comment tables for the public to share feedback, ask questions an provide comments

Extensive public outreach efforts were made to make the public aware of the MD 355 Public Open Houses. Among the outreach efforts utilized were:

- A postcard sharing information about the Open Houses was sent to all addresses within ½-mile of the corridor – approximately 78,000 postcards were mailed. The postcard was in English but there were also notifications in Spanish, Russian, Korean and Chinese
- 5,000 flyers (English and Spanish) were produced and distributed to CAC members, Civic Organizations, Governmental and Community Organizations, Businesses and other locations
- Advertisements were placed in newspapers including non-English speaking newspapers
- Press releases, social media posts and Public Service Announcements

Alternatives Advancing to Next Phase

Four Alternatives, including No-Build and TSM, have been identified to advance to the next phase of the study. These alternatives have been refined based on the analysis conducted, input received from the CACs and public, and coordination with project stakeholders. These alternatives will be studied in greater detail in Step 3 of the Corridor Planning Process and ultimately an alternative will be recommended to be studied under NEPA or MEPA.

Two BRT alternatives will be moving forward to the next phase, a median alternative and a curb alternative. Maintaining the existing naming convention, the median alternative will be referred to as Alternative 3C and the curb alternative will be referred to as Alternative 4C.

The alternatives advancing to the next project phase are:

Alternative 1 – No-Build Alternative: No improvements to infrastructure or bus service along the MD 355 Study Corridor beyond those improvements already planned and programmed in the Metropolitan Washington Council of Governments (MWCOG) Constrained Long-Range Plan (CLRP).

Alternative 2 – Transportation System Management (TSM): Enhanced bus service operating in mixed traffic in existing lanes along with minor infrastructure improvements at select intersections. The minor infrastructure improvements would require widening for intersection improvements to benefit transit service or queue jumps at select intersections. Transit Signal Priority (TSP) would be included at select intersections.

Alternative 3C – Median Option: New BRT service between the Clarksburg Outlets and the Bethesda Metrorail Station, primarily in median lanes. The service would be on dedicated lanes between Middlebrook Road and the Grosvenor Metrorail Station along MD 355 and in mixed traffic between the Clarksburg Outlets and Middlebrook Road, along Observation Drive, and between the Grosvenor Metrorail Station and the Bethesda Metrorail Station, along MD 355.

Alternative 4C – Curb Option: New BRT service between the Clarksburg Outlets and the Bethesda Metrorail Station, primarily in curb lanes. The service would be on dedicated curb lanes between Middlebrook Road and MD 124 and between Summit Avenue and the Bethesda Metrorail Station along MD 355 and in mixed traffic between the Clarksburg Outlets and Middlebrook Road, along Observation Drive, and between MD 124 and Summit Avenue, along MD 355. The option of routing the BRT in the curb along MD 355 from Redgrave Place to Middlebrook Road (Section 7) may be considered if the widening of MD 355, as envisioned in the County's Master Plan of Highways and Transitways, is pursued as a separate project.

At the conclusion of this phase, the only change proposed related to station locations for the refined alternatives is for the northern termini station for Alternatives 2, 3C and 4C to be at the Clarksburg Outlets. No further refinements regarding station locations or service plans are being made. The next phase of the study will conduct additional analysis related to station locations and service plan and determine if any changes are warranted.

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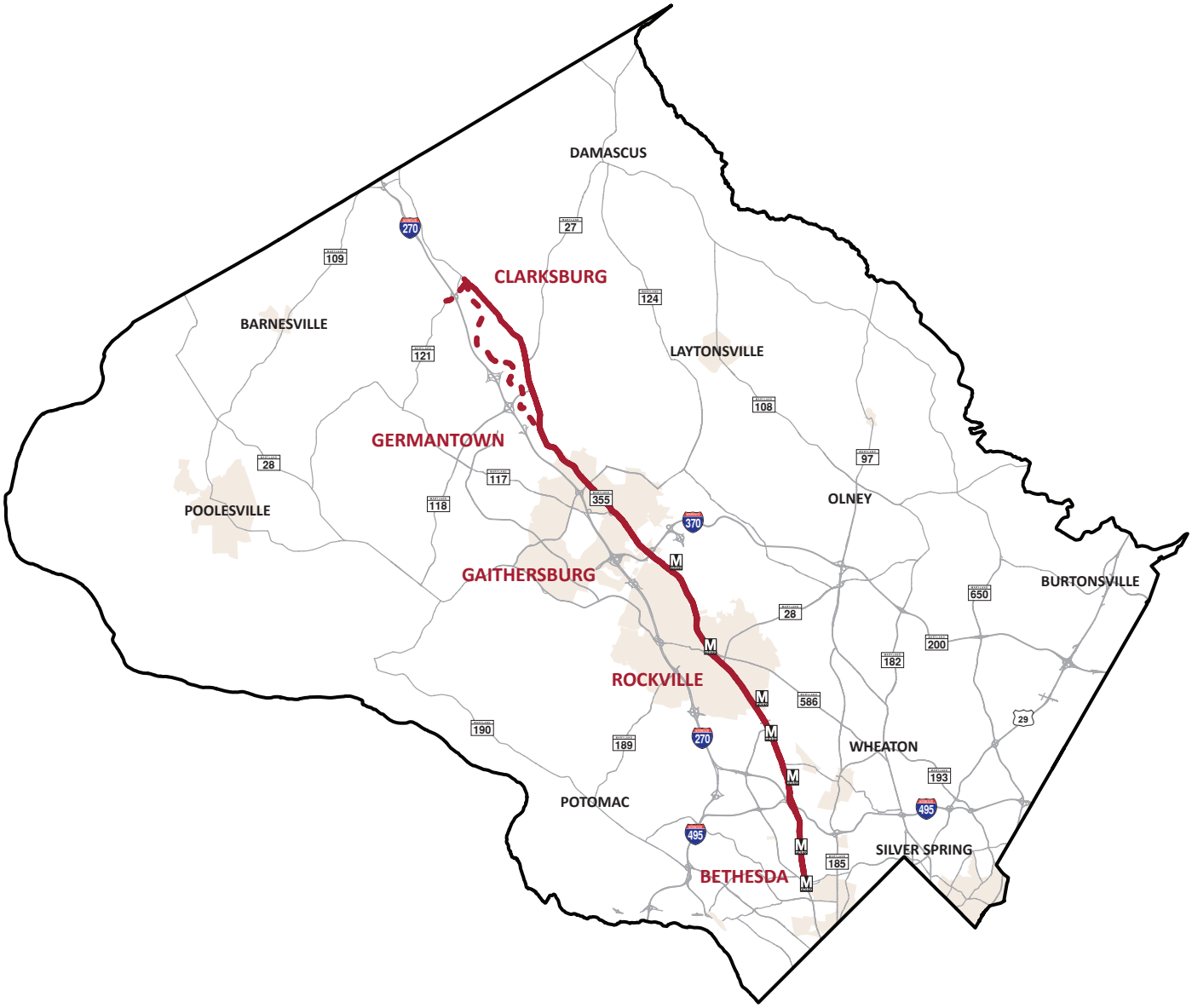

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APPENDICES

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ACRONYMS

The following acronyms are used within this document or in documents referenced within this Conceptual Alternatives Report.

ADT	Average Daily Traffic
BIBI	Benthic Index of Biotic Integrity
BRT	Bus Rapid Transit
CA	Conceptual Alternatives
CAC	Corridor Advisory Committee
CCT	Corridor Cities Transitway
CLRP	Constrained Long-Range Transportation Plan
DC	District of Columbia
DNR	Maryland Department of Natural Resources
FIDS	Forest Interior Dwelling Species
FWS	Fish and Wildlife Service
LOS	Levels of Service
MBSS	Maryland Biological Stream Survey
MCDOT	Montgomery County Department of Transportation
MDE	Maryland Department of the Environment
MDOT	Maryland Department of Transportation
MEPA	Maryland Environmental Policy Act
MHT	Maryland Historical Trust
MIHP	Maryland Inventory of Historic Properties
M-NCPPC	Maryland National Capital Park and Planning Commission
MTA	MDOT - Maryland Transit Administration
MWCOG	Metropolitan Washington Council of Governments
NEPA	National Environmental Policy Act
NR	National Register Listed
NRE	National Register Eligible
NRHP	National Register of Historic Places
SHA	MDOT - State Highway Administration
SPA	Special Protection Areas
TSM	Transportation System Management
TSP	Transit Signal Priority
USACE	U.S. Army Corp of Engineers
WHS	Wildlife and Heritage Service
WMATA	Washington Metropolitan Area Transit Authority

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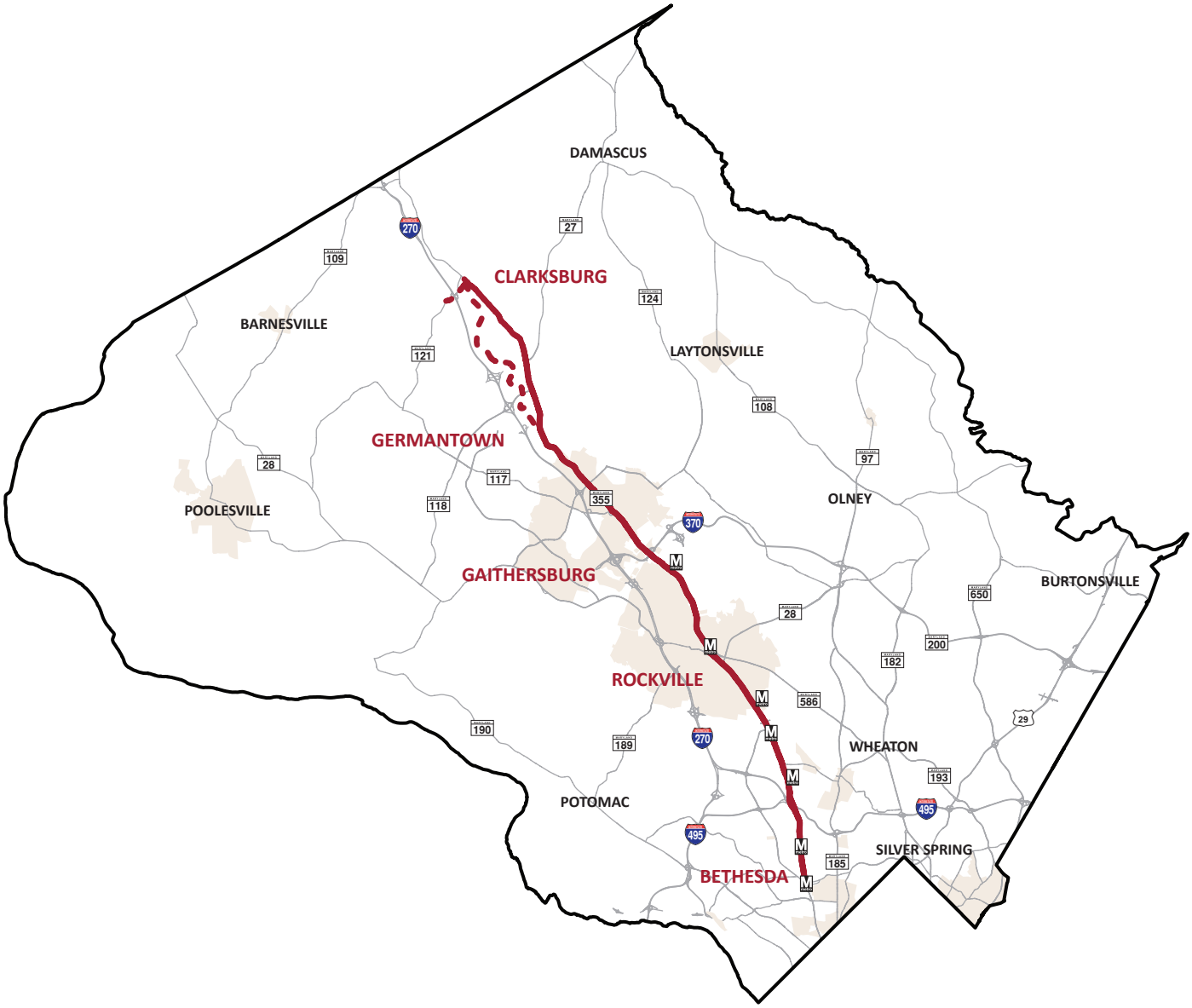

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Chapter 1.0

Project Overview

1.1 Introduction

The Maryland Department of Transportation (MDOT) including the Maryland Transit Administration (MTA) and the State Highway Administration (SHA) in partnership with the Montgomery County Department of Transportation (MCDOT) is currently conducting the MD 355 Bus Rapid Transit (BRT) Corridor Planning Study. BRT is a modern, permanent mode of transportation that combines features of both a bus system and a light rail system. Like a light rail system, BRT vehicles utilize dedicated lanes but can leave the dedicated lanes to serve local destinations as needed. However, BRT uses vehicles with rubber tires on a dedicated paved surface rather than steel wheels on steel rail. BRT also has the option to travel on local roadways. The benefit of a BRT system over a light rail system is that you still get the modern technology and design, which improve the overall experience of the rider, but at a lower cost and quicker construction time.

The study is evaluating preliminary concepts for providing enhanced premium transit service along MD 355 from Bethesda to Clarksburg in Montgomery County as shown in ***Figure 1-1***. Within the limits of the study area MD 355 changes names multiple times (Frederick Road, Hungerford Drive, Rockville Pike, and Wisconsin Avenue) as it traverses different municipal boundaries including the cities of Rockville and Gaithersburg. The corridor is approximately 21 miles in length and serves many activity centers including: Clarksburg, Metropolitan Grove, Gaithersburg, Shady Grove/King Farm, Montgomery College, Rockville, Twinbrook, White Flint, Grosvenor, Medical Center and Bethesda.

This study is part of a larger countywide effort to establish a BRT network on major transportation corridors within Montgomery County. Currently, three of the corridors – MD 355, MD 586 and US 29 – in addition to the Corridor Cities Transitway, are being studied.

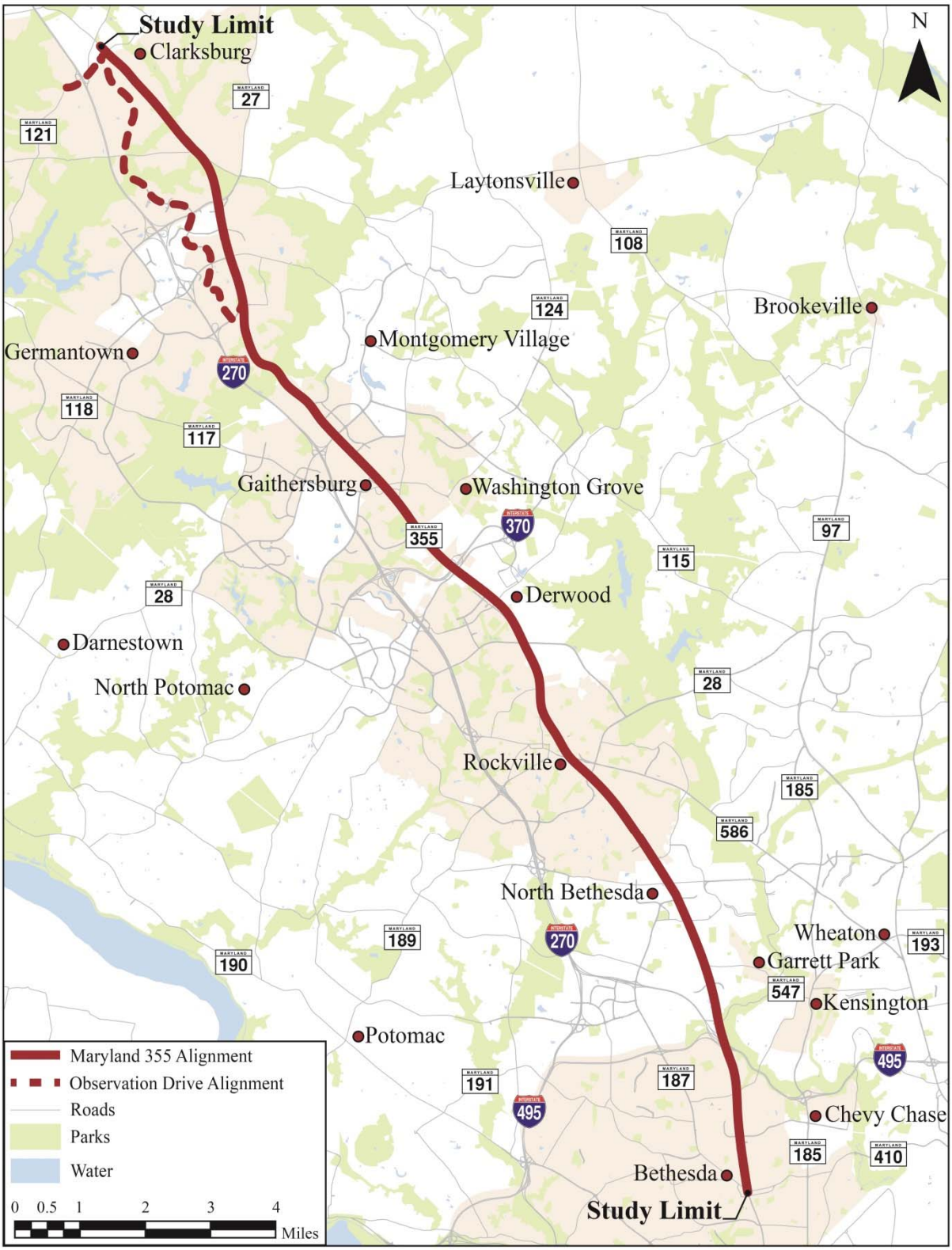
1.2 Project Background

Montgomery County first proposed BRT as the most appropriate mode for improving transit in the corridor in the 1993 Strategic Transit Plan.

In 2011, MCDOT completed the Countywide BRT Study to identify key corridors within the County that could support premium BRT service. The study was a proactive effort to explore transit improvements that could address existing travel demand and anticipated growth in vehicle trips in Montgomery County. Out of the 23 initial BRT corridors evaluated for feasibility, 16 corridors were ultimately recommended including the MD 355 corridor from Clarksburg to Bethesda, with a future extension to Friendship Heights if and when the District of Columbia (DC) incorporates into its master plan (or equivalent) dedicated BRT lanes from Friendship Heights to the National Cathedral area and Georgetown.

Acting upon the findings from the 2011 Countywide BRT Study, the Maryland-National Capital Park and Planning Commission (M-NCPPC) developed a Countywide Transit Corridor Functional Master Plan. This plan was approved and adopted by the Montgomery County Council in December 2013.

Figure 1-1: Study Limits



The Functional Master Plan proposes the development of a BRT network throughout Montgomery County to support mobility, land use and economic development goals. To ensure network integrity and achieve the County's vision, it recommends and provides the basis for rights-of-way reservations required to accommodate enhanced transit improvements in individual transit corridors. The Functional Master Plan also makes recommendations on the allocation of roadway space for vehicular traffic, transit, pedestrians and bicycles.

The Functional Master Plan contains recommendations for ten BRT corridors in the County, including two corridors along MD 355. The MD 355 North Corridor extends from Redgrave Place in Clarksburg to the Rockville Metrorail Station. Along the MD 355 North Corridor the Functional Master Plan recommends mixed traffic between Redgrave Place and MD 118 (Germantown Road) and a maximum of one additional transit lane from MD 118 to the Rockville Metrorail Station. The MD 355 South Corridor extends from the Rockville Metrorail Station to the Bethesda Metrorail Station. Along MD 355 South Corridor the Master Plan recommends a maximum of two additional transit lanes between the Rockville Metrorail Station and I-495 and a maximum of one additional transit lane inside the Capital Beltway (I-495). The Master Plan did not make any recommendations within the Cities of Rockville and Gaithersburg, as the cities have their own planning authority.

Figure 1-2: Emerald Express (EmX) BRT Lane County, Oregon

The Countywide BRT Study identifies BRT as the preferred mode of transit because of its ability to provide better service to existing transit passengers and attract potential new riders. BRT can provide a fast, convenient, and reliable alternative to automobile trips in congested roadways, and may move more people in the same space as a general purpose lane. The system may act as a bridge between rail and existing local bus service, allowing for roadway capacity to better serve planned developments within the community. BRT can also be implemented more easily and quickly than light rail, at a lower capital cost, and is far more flexible than fixed transit systems such as light rail. BRT typically combines dedicated running ways, specialized buses, rail-like stations, and automated information systems into an integrated system with a unique brand identity. BRT stations are spaced further apart than local bus stops, and often include passenger shelters and level loading platforms;

The MCDOT Countywide Bus Rapid Transit Study identifies BRT as the preferred mode of transit that would combine the most attractive features of light rail at a lower capital cost. The Countywide Transit Corridors Functional Master Plan establishes the basis for rights-of-way reservations required to accommodate enhanced transit improvements in individual corridors.

real-time passenger information systems; and off-board fare collection. BRT vehicles are typically specialized articulated buses with low-floors, multiple doors on both sides of the bus resulting in easy and efficient entry and exiting, higher capacity, increased passenger circulation, bicycle provisions, and brand identity. Finally, BRT can be implemented in phases, integrating improvements in vehicles, stations and running ways as operating and capital funds become available, and as the related varying levels of transit-supportive land use and densities materialize along segments of the corridors.

The City of Rockville performed an Integration Study in 2016 to identify possible design solutions for integrating BRT into the Rockville Town Center area. The study evaluated a wide range of alternatives within the town center and retained three to be studied in greater detail. These alternatives include BRT in mixed traffic with near side pull-outs, dedicated lanes in median and dedicated lanes in median with through traffic in a tunnel. The study concluded that the dedicated lanes in median with through traffic in tunnel alternatives would offer the greatest opportunities for transportation and urban design improvement in the central portion of the MD 355 – Rockville Pike corridor. The study also concluded that the mixed traffic alternative through the City of Rockville would offer a viable cost effective, short term interim solution. In addition, in 2016, the City of Rockville adopted the Rockville Pike Neighborhood Plan that established the typical section for MD 355 (Rockville Pike) between Richard Montgomery Drive / Dodge Street and the City's corporate limits near Bou Avenue. The plan includes provisions for a two-lane median BRT.

The City of Gaithersburg conducted a study in 2016 on the accommodation of a future MD 355 BRT route in the City focusing on the section with the greatest physical constraints; between Summit Avenue and Odenhall Avenue. The Gaithersburg study compared four different alternatives and recommended a hybrid alternative that would balance land impacts, BRT and traffic operations through the focal segment within the city. In addition, the station locations as proposed in the Functional Master Plan were revised as part of this study. In November 2015, the City Council established their position on the BRT and advocated for a dual lane-median through the City of Gaithersburg and the modified station locations identified in the City study. However, the City did not adopt the proposed right-of-way and instead chose to delay a decision until the MD 355 BRT Corridor Planning Study developed a set of refined alternatives for detailed analysis.

1.3 MD 355 BRT Corridor Planning Process

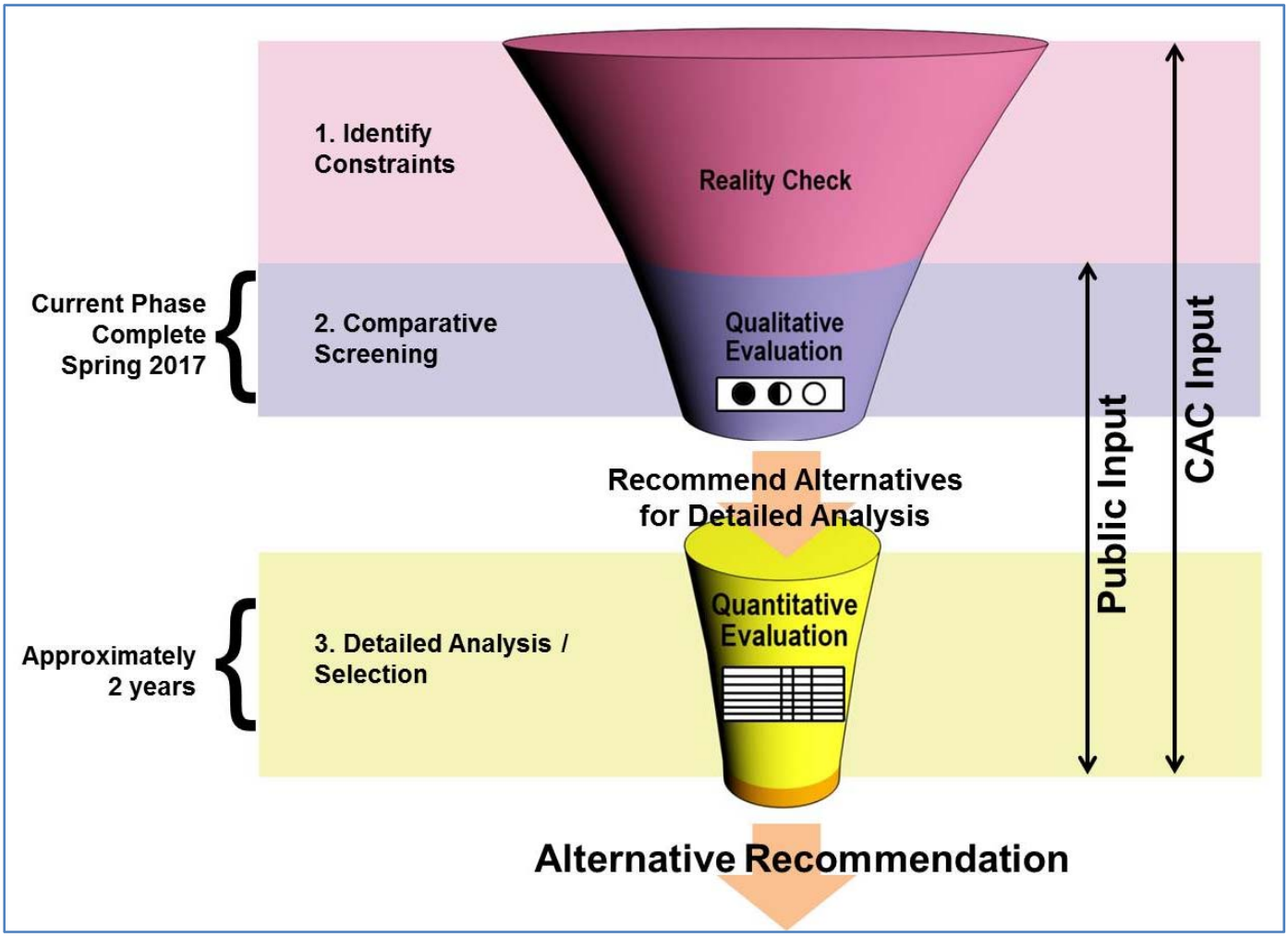
The MD 355 BRT Corridor Planning Study utilized the recommendations from the Countywide Transit Corridor Functional Master Plan as a starting point in the development of the conceptual alternatives. Coordination with the City of Rockville, City of Gaithersburg and M-NCPPC has been ongoing throughout the study.

As shown in ***Figure 1-3***, the Corridor Planning Study is using a three-step process to recommend an alternative. The recommendations of the study would be used in the future for environmental analysis and documentation as required by either the National Environmental Policy Act (NEPA) or the Maryland Environmental Policy Act (MEPA).

1.3.1 STEP 1: Identify Constraints

The first step consisted on data collection of existing transit operations, highway data such as traffic volumes and crash statistics, environmental information, as-builts and aerial mapping. This information was used to prepare a Draft Preliminary Purpose and Need document. This information and document were presented to the Corridor Advisory Committee (CAC) and general public at Open Houses in Spring 2016. Input received by the public was used to identify constraints along the corridor.

Figure 1-3: Corridor Planning Process



1.3.2 STEP 2: Comparative Screening (Current Phase)

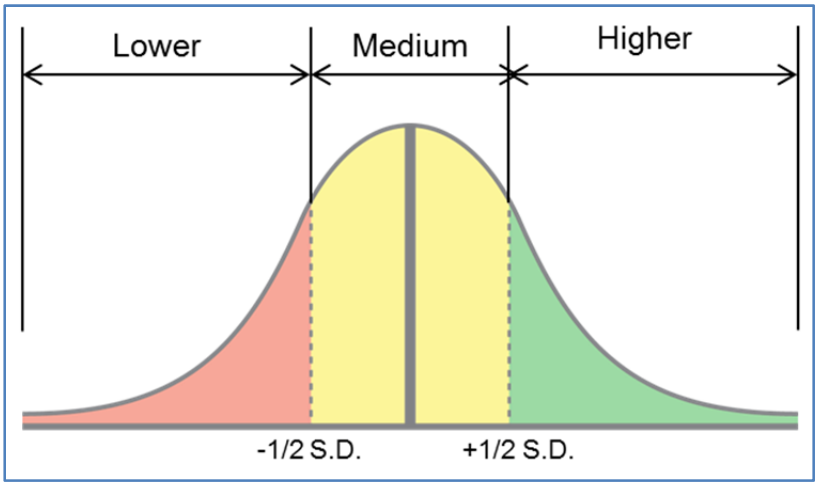
With the information developed under Step 1, a set of Conceptual Alternatives was developed for testing purposes. These alternatives were evaluated to answer questions about the project termini, alignment, running way operations, station locations and service plan. A set of screening criteria was identified to qualitatively compare the BRT Alternatives. The analysis performed during this step and the comparison of alternatives will be used to screen out elements that show the least benefit, to improve the alternatives being tested and to develop a refined set of alternatives that will be analyzed in further detail in the next phase of the project. The screening criteria identified for this step are shown on ***Table 1-1***. This report represents the culmination of Step 2 and will present the alternatives that will be studied in the next phase.

Table 1-1: Screening Criteria

Screening Criteria	
Transit Ridership	✓ Increase in total daily transit ridership ✓ Increase in total daily bus ridership ✓ Total daily BRT ridership ✓ Boardings by Station
Travel Time	✓ BRT travel time ✓ BRT travel time vs. Local bus travel time ✓ BRT travel time vs. Auto travel time
Person Throughput	✓ Increase in AM peak hour total person throughput ✓ Increase in PM peak hour total person throughput ✓ Increase in total daily person throughput
Accessibility	✓ Increase in jobs within 45 and 60 minutes along the corridor ✓ Increase in households within 45 and 60 minutes of activity centers
Property Impacts	✓ Number of total properties impacted
Costs	✓ Total operating costs ✓ Total capital costs

Given the preliminary nature of the analysis during this stage, the alternatives were compared qualitatively. The standard deviation for the results of each screening criteria was calculated and the following methodology (see ***Figure 1-4***) was used to assign the alternatives a higher, medium or lower ranking.

Figure 1-4: Screening Criteria - Qualitative Methodology



- The higher ranking is established for numbers more than half a standard deviation higher than the mean.
- The medium raking is established for numbers that are within half a standard deviation of the mean.
- The lower ranking is established for numbers more than half a standard deviation lower than the mean.

1.3.3 STEP 3: Detailed Analysis

A refined set of alternatives will be investigated in further detail in the next phase of the project. These alternatives will be compared using a set of selection criteria and ultimately an alternative will be recommended to be studied under NEPA or MEPA.

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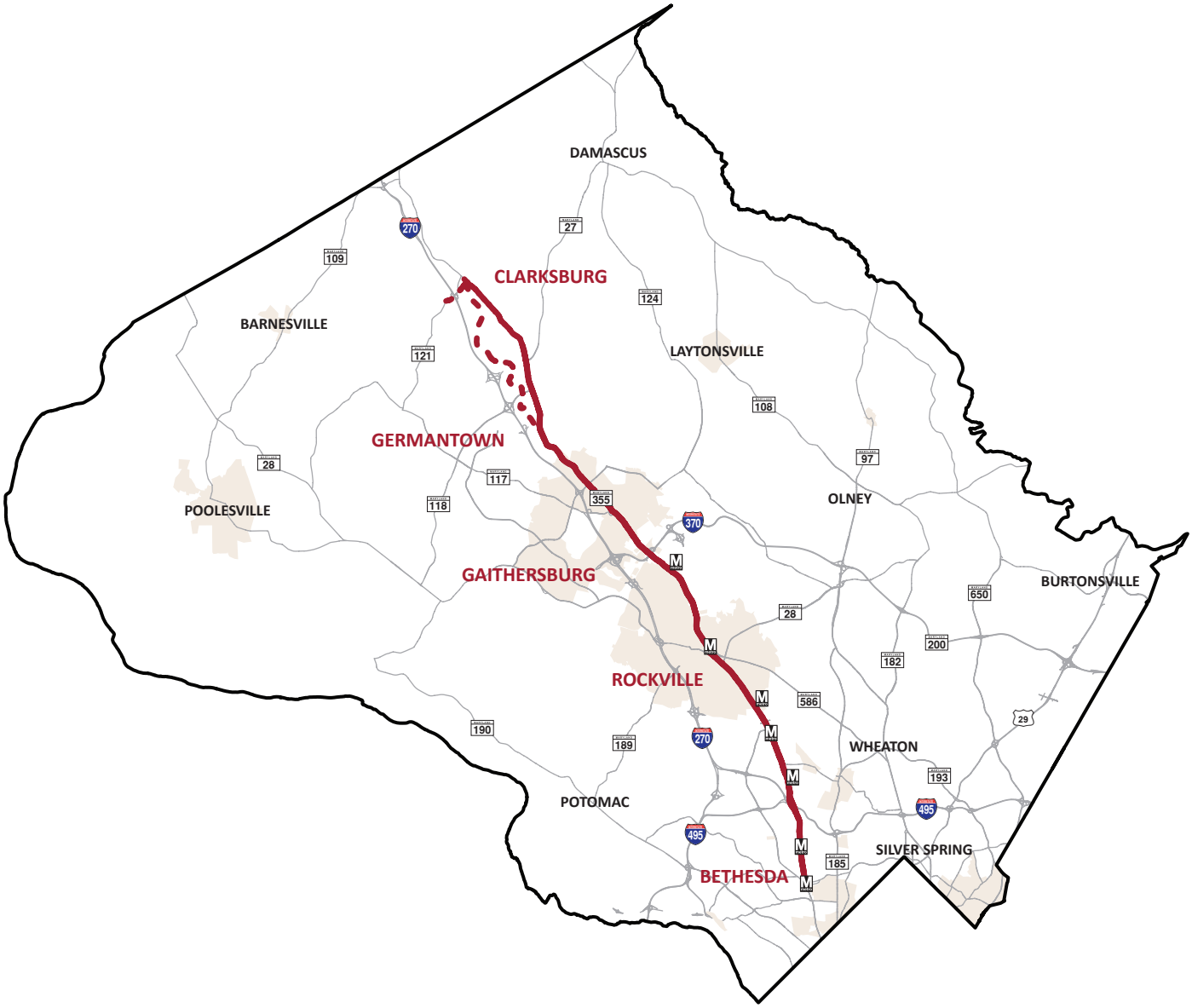
Montgomery County
RAPID TRANSIT
MD 355



MARYLAND DEPARTMENT OF TRANSPORTATION

Montgomery County Department of Transportation

2.0 DRAFT PRELIMINARY PURPOSE AND NEED

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Chapter 2.0

Draft Preliminary Purpose and Need

2.1 Introduction

A separate standalone Draft Preliminary Purpose and Need document was developed for the MD 355 BRT Corridor Planning Study. It describes the existing and future transportation needs in the MD 355 Corridor that the project proposes to address. It also describes how the alternatives under consideration will be evaluated in the selection a Recommended Alternative. Open Houses were held in the Spring of 2016 to present the elements of the document and to receive input from the public. The Draft Preliminary Purpose and Need document will provide background information for a formal Purpose and Need statement to be reviewed and approved by the appropriate agencies at a future phase of the study.

2.2 Goals and Objectives

The goals and objectives outlined in Table 2-1 were presented in the Draft Preliminary Purpose and Need document to guide the development and implementation of an enhanced premium transit system in Montgomery County. These goals and measurable objectives provide a consistent framework for development of the full BRT system from the planning phase of each corridor to the beginning of service and ongoing operations. They provide a starting point for the development of individual corridor project purpose statements and will assist in the development of measures of effectiveness appropriate to each phase of the BRT system development and deployment.

Table 2-1: Bus Rapid Transit Goals and Objectives

Goals		Objectives
1	**Improve quality of transit service**	✓ Make bus trips faster ✓ Make door-to-door transit travel time competitive with door-to-door automobile travel time ✓ Increase transit ridership ✓ Provide an appealing transit service that attracts new riders
2	**Improve mobility opportunities and choices**	✓ Serve as many travelers as possible by efficiently utilizing the existing right-of-way ✓ Balance travel times for automobiles and transit users ✓ Enhance pedestrian and bicycle options in the corridor ✓ Create direct transfers between premium bus and other modes
3	**Develop transit services that enhance quality of life**	✓ Provide premium transit service convenient to households and jobs within the corridor ✓ Minimize impacts to private property ✓ Serve transit dependent populations ✓ Engage public in process
4	**Develop transit services that support master planned development**	✓ Improve alternative transportation service to and between activity centers ✓ Increase trips by non-automobile modes to support development in the Master Plan ✓ Select station locations that support infill and redevelopment
5	**Support sustainable and cost effective transportation solutions**	✓ Maintain environmental quality ✓ Minimize cost of building and operating transportation services

2.3 Existing Conditions

The MD 355 BRT Study Corridor is shown in ***Figure 2-1***. MD 355 changes names multiple times (Frederick Road, Hungerford Drive, Rockville Pike, and Wisconsin Avenue) along the Study Corridor as it traverses different municipal boundaries such as the Cities of Rockville and Gaithersburg. The following sections describe the existing transit services, land use, and roadway conditions. Demographics and environmental conditions can be found in Chapter 3.

For purposes of the analysis a Study Corridor was developed that covers the areas most likely to be impacted by the implementation of BRT along MD 355. As shown in ***Figure 2-2***, the Study Corridor was subdivided into five distinct districts to help better define existing and future travel patterns and potential ridership markets.

2.3.1 Existing Transit Service

Transit plays a major role in the Washington regional transportation system, and includes multiple bus operators, two commuter rail systems, and the regional Metrorail system. These transit systems provide connections to work sites and other economic opportunities throughout the DC Metropolitan region. Within Montgomery County, current transit operations include:

- Metrorail Service: The Red Line includes 11 stations fully located within Montgomery County (plus Friendship Heights located on the border with DC). Seven Metrorail stations are located within the MD 355 BRT Study limits.
- Local Bus Service: Ride On and Metrobus service throughout Montgomery County, with Metrobus providing connections into the neighboring jurisdictions of DC and Prince George's County.
- Commuter Bus Service: Maryland Transit Administration (MTA) express services into and through Montgomery County (primarily during the peak periods) from Frederick County, Washington County, and Howard County.
- Commuter Rail Service: Maryland Area Regional Commuter (MARC) service on the Brunswick Line from Frederick and West Virginia, and Amtrak's Capitol Limited Line.

Figure 2-1: MD 355 BRT Study Corridor

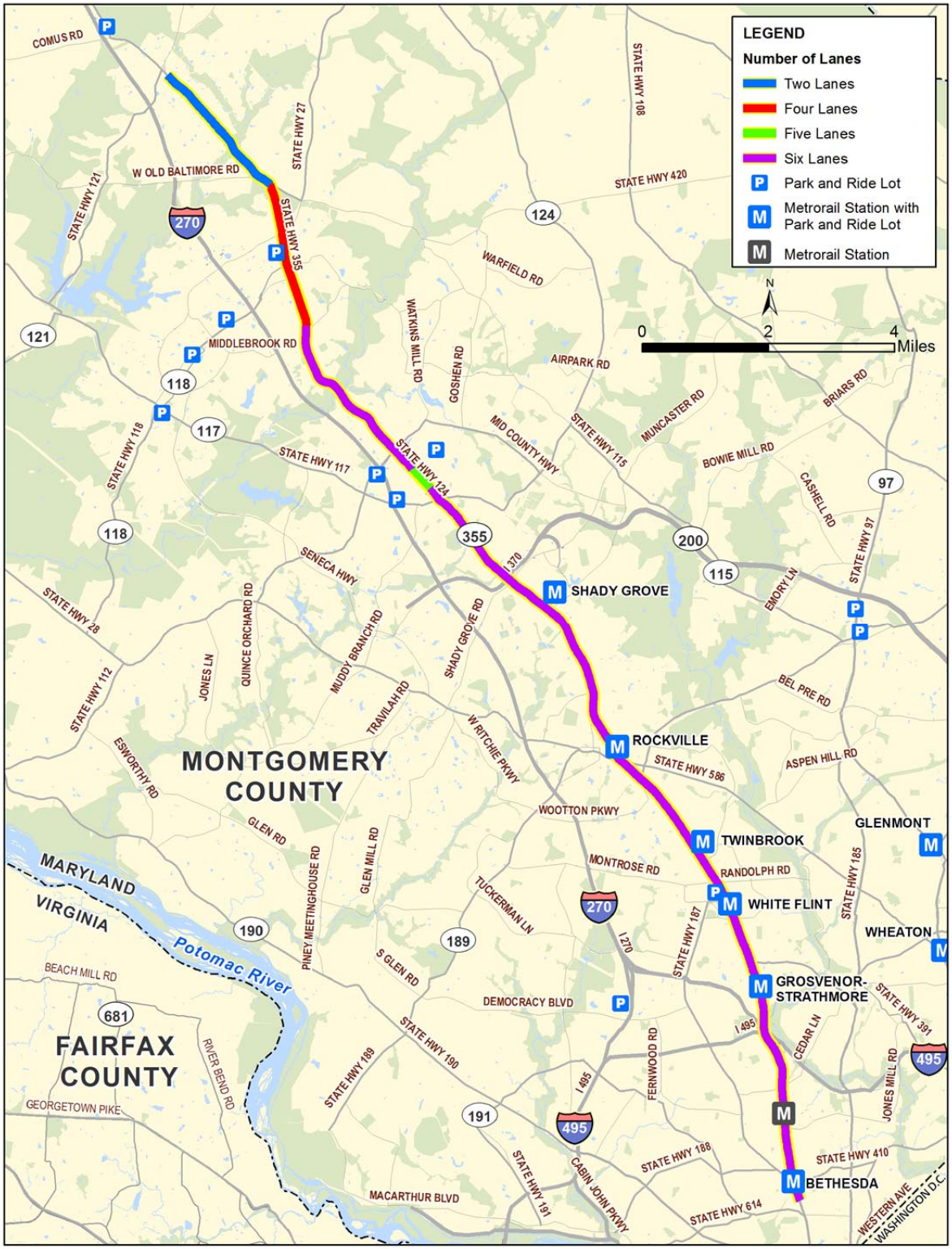
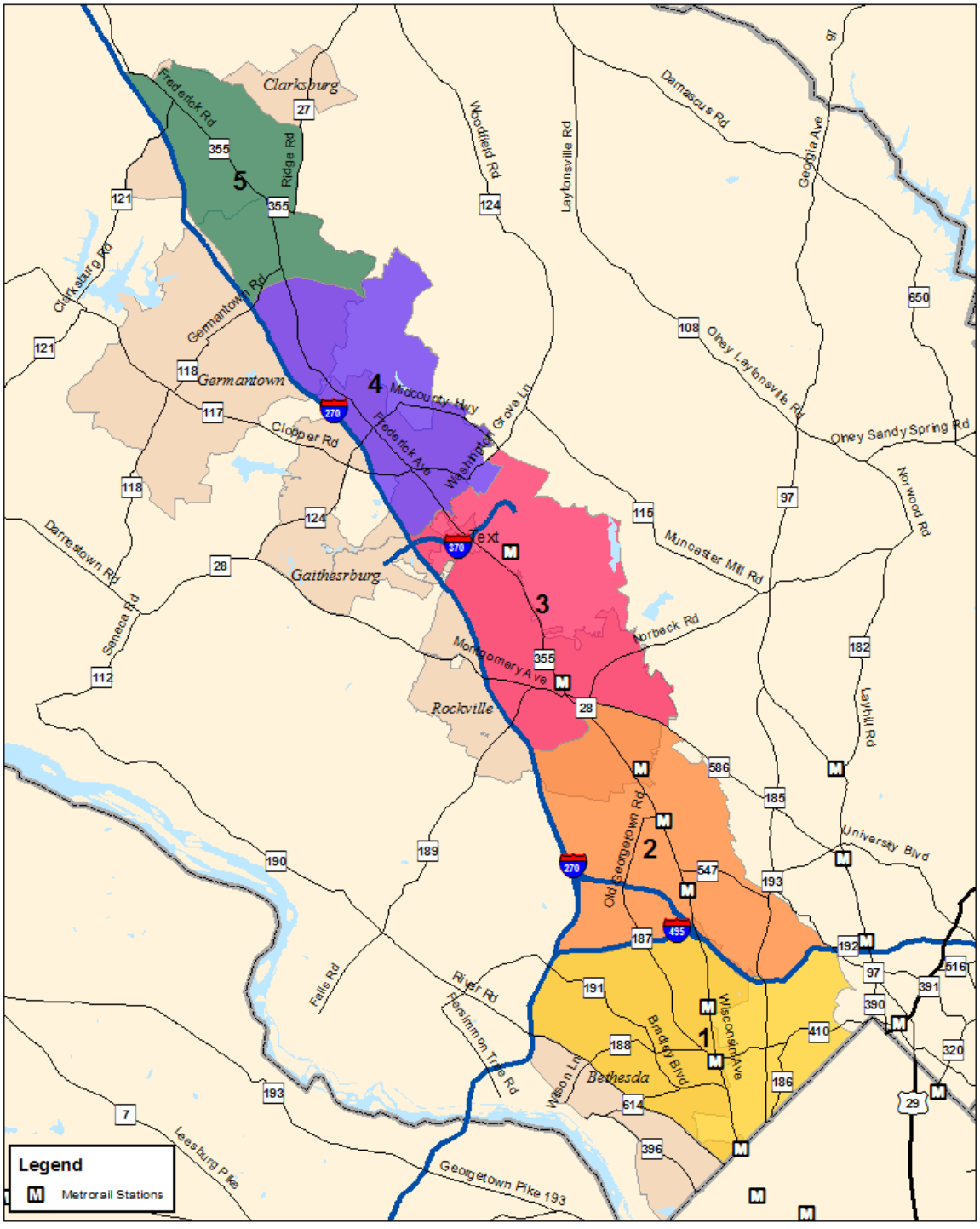


Figure 2-2: MD 355 Study Corridor and Districts

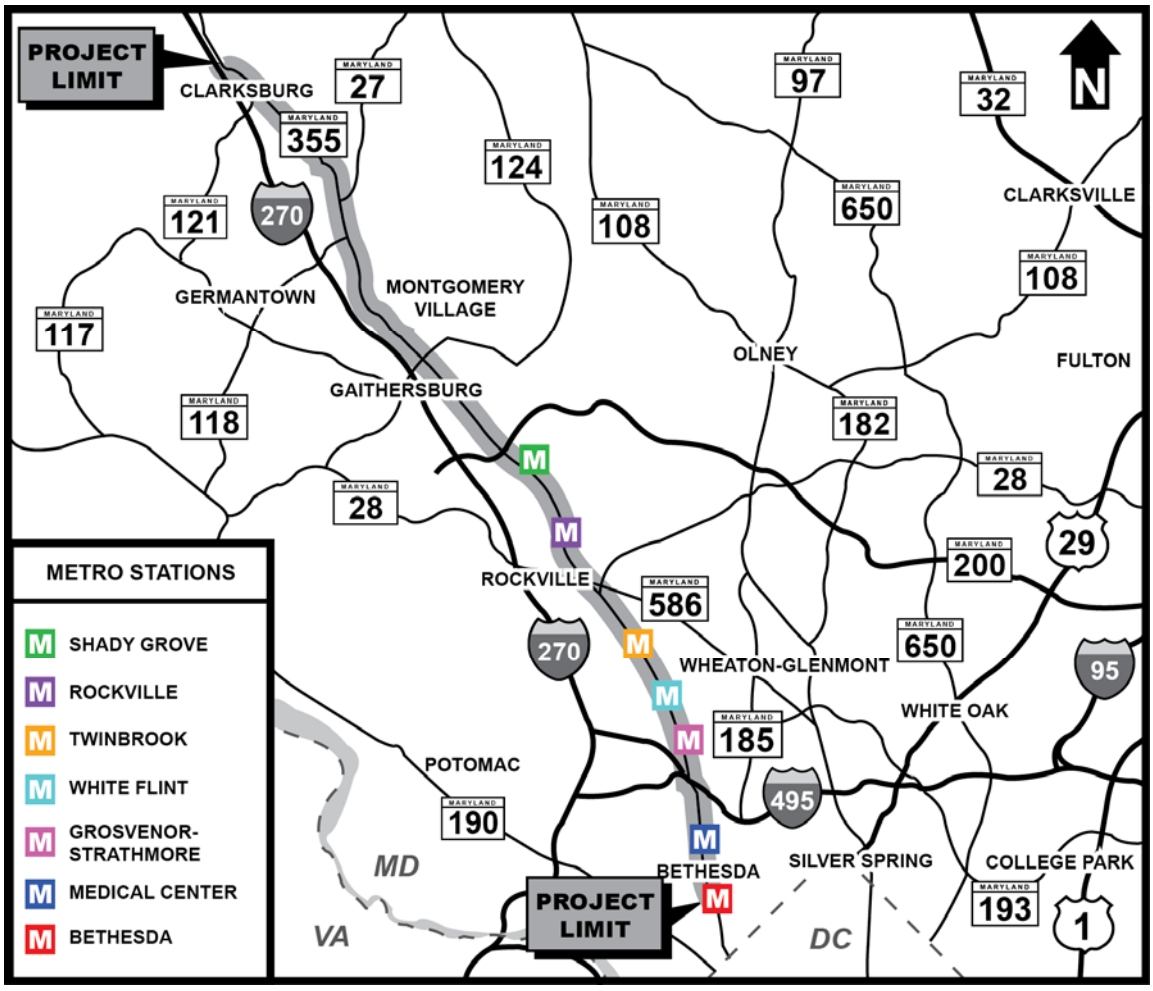


A. Metrorail

MD 355 parallels portions of the western branch of the Washington Metropolitan Area Transit Authority's (WMATA) Metrorail Red Line between Shady Grove Metrorail Station and Bethesda Metrorail Station. As shown in ***Figure 2-3***, Red Line Metrorail Stations within the MD 355 Study Corridor include Shady Grove,

Rockville, Twinbrook, White Flint, Grosvenor, Medical Center and Bethesda. Existing rail connections within the Study Corridor also include the MARC Brunswick Line and Amtrak's Capitol Limited Line, both accessible at the Rockville Metrorail Station.

Figure 2-3: Red Line Metrorail Stations along MD 355 Study Corridor



B. Local Bus Service

Local bus service within the MD 355 BRT corridor is currently provided by Montgomery County's Ride On and WMATA's Metrobus. Fifty-six (56) bus routes operate within the MD 355 Study Corridor; thirty-nine (39) are operated by Ride On and seventeen (17) by WMATA (***Appendix A***). No existing Metrobus or Ride On bus route serves the full length of the MD 355 Corridor. Ride On Routes 46, 55, and 75 combined provide local north-south service along the corridor between Clarksburg and Medical Center, primarily along MD 355. Routes 46 and 55 operate at approximately 12 to 15-minute average headways during the morning and afternoon peak-hours, respectively.

Based on current Ride On timetables, the travel times between the Rockville Metrorail Station and Medical Center Metrorail Station in Bethesda is approximately 36 minutes (compared to 15 minutes on the Red Line Metrorail), and 67 minutes between the Germantown's Transit Center and Rockville. On-time performance evaluations conducted by Montgomery County estimate these buses operate on-schedule (defined as no more

than one minute early and no more than four minutes late) between 71-74 percent of the time. Montgomery County currently has an on-time performance goal of 90 percent.

Existing transit usage may be assessed by considering the transit mode share, which is the percentage of trips made by transit. Transit usage in the Washington D.C. region is highest for commute-to-work trips, estimated at approximately 14 percent transit mode share. Montgomery County data shows transit usage similar to that of the region as a whole; 17 percent of trips made by County residents are made by transit, while 10 percent of trips made by commuters traveling to the County are made by transit. The largest existing transit market in the region is for commute-to-work trips destined for the District of Columbia, with an approximately 40 percent transit mode share. Transit is also used for non-commute trips in Montgomery County, although at a much lower mode share than commute-to-work trips. Three percent of non-commute trips in Montgomery County are estimated to be made via transit.

C. Commuter Bus Service

MTA Commuter Bus Service is a vital link that connects thousands of suburban residents with jobs in the Baltimore and Washington D.C. Metropolitan Areas. MTA Commuter Bus Routes 505 and 515 parallel the MD 355 corridor on I-270 and run between Frederick County and the Shady Grove Metrorail station, with some trips also extended to the Rock Spring Business Park. These commuter buses accommodate long-distance inter-county trips during the morning and afternoon peak periods, and are not intended to serve MD 355 and the short local trips generated along the Study Corridor.

D. Commuter Rail Service

MARC's Brunswick Line operates between West Virginia and Union Station in Washington D.C., and intersects the Study Corridor at the Rockville Metrorail Station. The MARC line also stops in Germantown and Gaithersburg, but the stations are not located along MD 355. Similar to the MTA Commuter Bus Service, the MARC line serves long-distance trips during the morning and afternoon peak-periods, and does not serve MD 355 and the intra-county trips generated throughout the corridor. In addition, the Amtrak Capitol Limited train runs daily between Washington D.C. and Chicago and makes a stop at the Rockville Metrorail Station.

2.3.2 Land Use

The MD 355 Corridor spans various local jurisdictions and Master and Sector Plans. The character of MD 355 also changes throughout the corridor, ranging from rural in the north towards Clarksburg to a suburban and urban setting from Gaithersburg to Bethesda in the south. Similarly, the land use in the north is primarily low density residential with small commercial developments, and the densities increase as the corridor traverses more urbanized settings, such as Rockville, White Flint or Bethesda. Many of these plans propose enhanced transit throughout the area to accommodate high density mixed-use development and redevelopment opportunities. Some key areas for potential development and re-development in these Master and Sector plans include:

- Germantown Master Plan
- Clarksburg Town Center District Transit Oriented Development
- Great Seneca Science Corridor Master Plan
- Shady Grove Transit Oriented Development and industry/technology corridor development
- Rockville Pike Plan
- Twinbrook Transit Oriented Development
- White Flint Transit Oriented Development

2.3.3 Existing Roadway Conditions

MD 355 is a vibrant economic spine that extends the entire length of Montgomery County, running the gamut from urban mixed-use centers in the south, through a range of suburban communities of varying densities before entering an almost rural environment in the northernmost reaches of the County. The roadway changes in character as it crosses multiple local jurisdictions, spanning areas of high urban density that include features such as wide sidewalks, on-street parking, and minimal to no shoulders, to more rural areas containing wide shoulders and open drainage systems. MD 355 is generally a six-lane roadway between Germantown and Bethesda, with wider cross sections that incorporate multiple turning lanes at many signalized intersections, and a five-lane section through Gaithersburg. It transitions to a four-lane facility just north of MD 27 (Ridge Road) and then to a two-lane road south of Clarksburg. Walk accessibility is highest in the southern half of the corridor clustered around the existing Metrorail stations, and around Bethesda in particular, with facilities such as the pedestrian underpasses at White Flint and Grosvenor Metrorail Stations. Several sections of MD 355 also have bicycle facilities, such as paved off-road paths that are wider than regular sidewalks, intended for commuter and recreational users.

Congestion is a major issue in the corridor, due in part to the amount of economic activity occurring directly along MD 355. Significant forecasted growth in the corridor and the County as a whole is likely to cause increases in congestion. Out of the existing 85 signalized intersections, 10 are operating at Level of Service (LOS) F in the morning peak-hour and 17 in the afternoon peak-hour. Existing LOS and average delay for key signalized intersections along the corridor are shown in ***Table 2-2***. LOS is calculated from an average intersection delay, capacity or travel time/speed and is rated with letters A through F. LOS E and F signify close to failing or failing intersections/segments.

Table 2-2: Key Intersection Level of Service (LOS) and Average Delay

MD 355 Intersections	2015 Morning Peak LOS (Average Delay In Sec)	2015 Evening Peak LOS (Average Delay In Sec)
MD 121 (Clarksburg Rd)	D (52.6)	E (56.6)
MD 27 (Ridge Rd)	D (46.6)	E (70.2)
MD 118 (Germantown Rd)	D (46.7)	E (61.0)
Middlebrook Rd	D (44.6)	E (75.8)
MD 124 (Mont. Vil. Ave)	E (58.1)	F (96.6)
Shady Grove Road	F (95.6)	E (76.5)
Gude Drive	F (81.0)	D (53.7)
MD 28 (Veirs Mill Rd)	C (34.2)	D (38.5)
Twinbrook Parkway / Rollins Ave	C (21.3)	C (33.6)
MD 187 (Old Georgetown Rd)	D (45.3)	D (46.6)
MD 547 (Strathmore Ave)	C (34.4)	D (49.8)
Cedar Lane	E (61.5)	F (105.1)
Jones Bridge Rd / Center Drive	D (49.0)	D (54.6)
MD 410 (East-West Hwy) / MD 187 (Old Georgetown Rd)	D (53.9)	E (56.3)

Improving public safety is always a primary objective for all transportation projects and a key component for a successful BRT system. Approximately 1,900 total crashes occurred along MD 355 within the study limits over the three-year period from 2011 to 2013, with five of them resulting in fatalities and 65 involving pedestrians. Crashes involving pedestrians are a particular concern in this study due to the need for access to the proposed BRT stations. Sections between MD 28 (Veirs Mill Rd) and Game Preserve Road and between MD 410 (East-West Hwy) and Cedar Lane had the highest occurrence of pedestrian crashes in the corridor.

2.4 Problem Definition

Based upon analysis of the MD 355 corridor and feedback from elected officials, County planners, residents, community and business leaders and other stakeholders, the following four transportation problems were identified. These problems and issues define the needs for the project's purpose.

1. Growth and development in the Study Corridor
2. Roadway congestion and safety
3. Lack of competitive travel options
4. Transit reliant passengers

2.4.1 Growth and Development in the Study Corridor

Population and employment growth: Based on the Metropolitan Washington Council of Governments (MWCOG) population and employment forecasts, Montgomery County is expected to experience a 20 percent increase in population and a 40 percent increase in jobs by 2040. The land use forecasts show an additional 202,000 people and 210,000 jobs in Montgomery County in 2040 compared to 2014. The Study Corridor is expected to experience a 33 percent increase in population and a 28 percent increase in jobs by 2040. The land use forecasts show an additional 101,000 people and 86,000 jobs in the Study Corridor in 2040 compared to 2014 as seen in ***Figure 2-4*** and ***Figure 2-5***.

Figure 2-4: Population Growth – 2014 to 2040

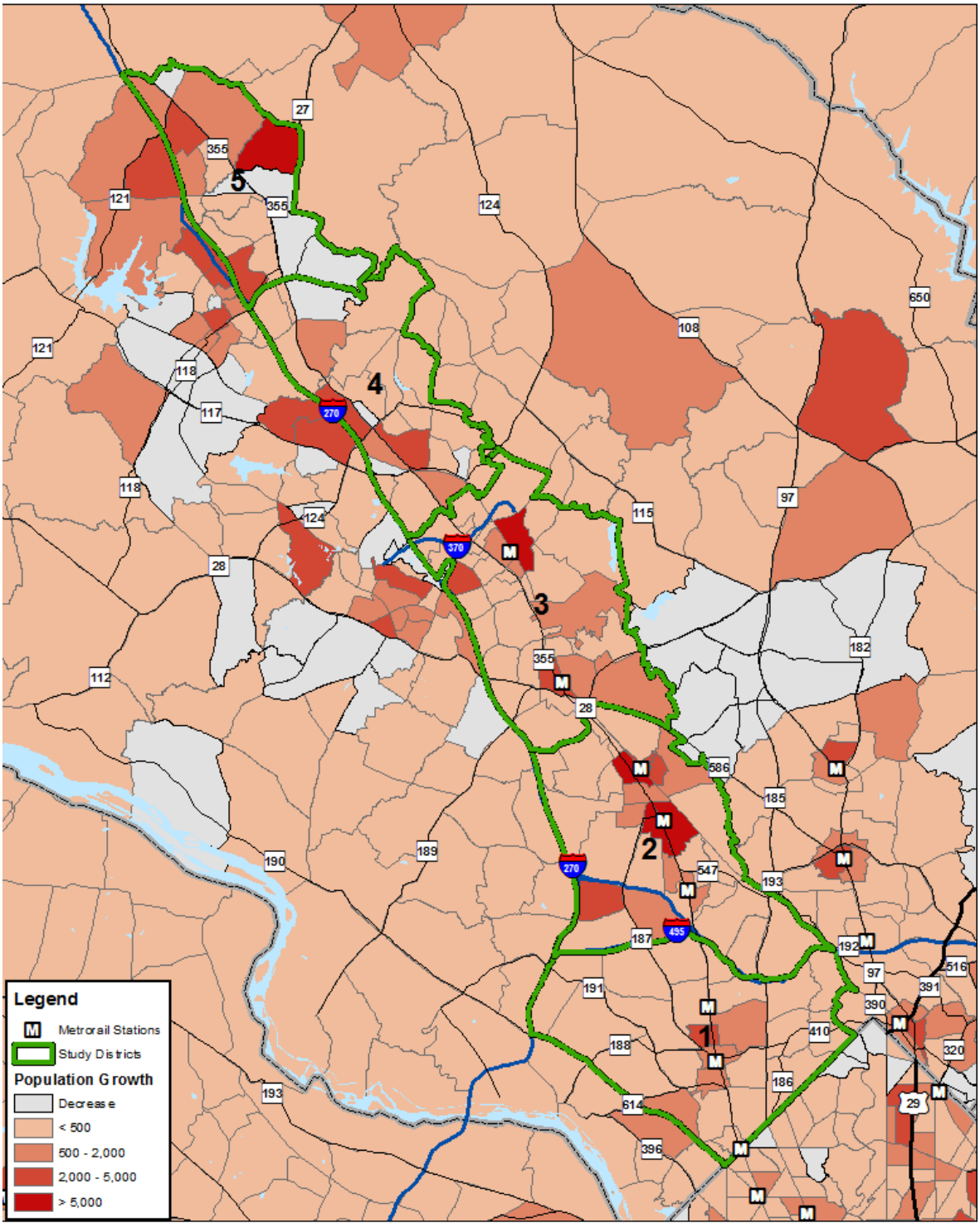
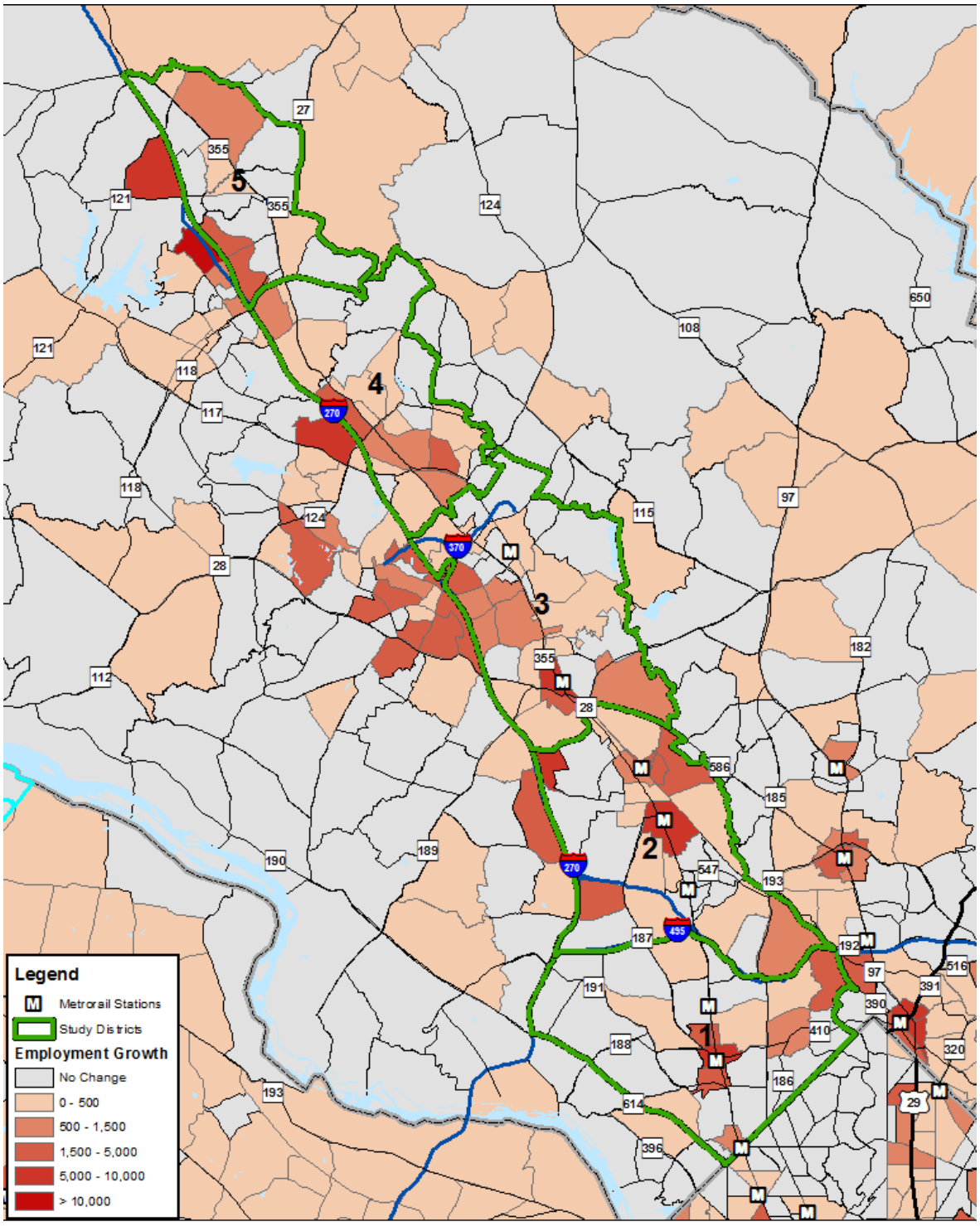


Figure 2-5: Employment Growth – 2014 to 2040

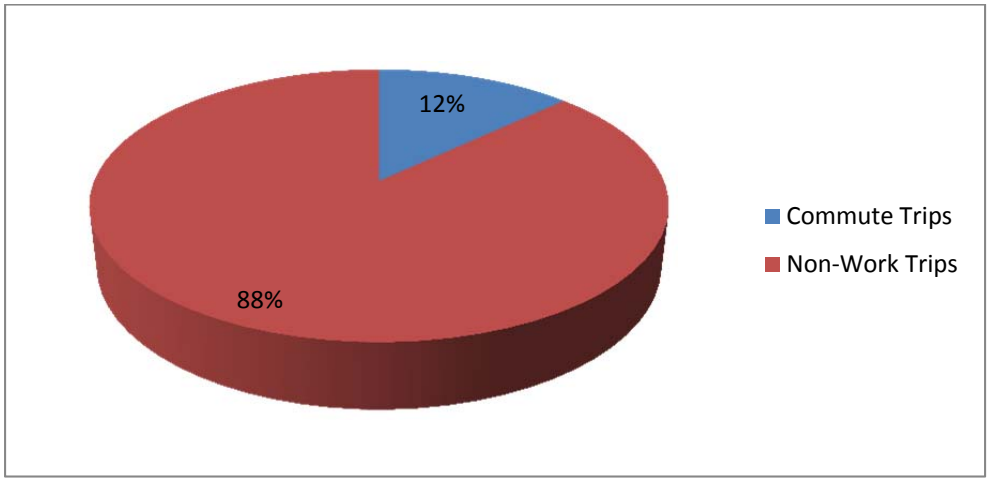


Transit supportive development: The Master Plans and Sector Plans covering the Study Corridor propose improving the transit services in the region, including along MD 355, to accommodate the forecasted population and

employment growth in the region. A high quality transit system connecting the residential, commercial, and other activity centers will support planned growth in the Study Corridor.

Trips growth: Work trips are projected to grow by 40 percent from 2014 to 2040, and non-work travel is projected to grow by 25 percent over the same period within the Study Corridor. As seen in ***Figure 2-6***, non-work trips are the dominant trip type, accounting for 88 percent of overall existing travel within the Study Corridor. These trips are typically frequent and short with less than ten percent occurring between non-adjacent districts. In addition, there are a large number of intra-zonal trips in the Study Corridor, and increased densities and mixed-use developments along the corridor are forecast to increase the demand for this type of highly localized trip as well. These non-work travelers are a key potential market for BRT users as they are poorly served by the existing bus services and outside the commuter market that relies on the existing Metrorail or MARC services.

Figure 2-6: 2040 Trips in Corridor



- **Montgomery County population and employment are forecasted to grow by 20 percent and 40 percent, respectively**
- **Locally planned growth in the corridor aims to be transit supportive**
- **Trips along MD 355 are forecasted to grow between 25-40 percent**
- **Most short trips are non-work related**

2.4.2 Roadway Congestion

Increasing congestion and travel times: The future 2040 No-Build Average Daily Traffic (ADT) along MD 355 will increase between 13 percent and 23 percent from 2015. Of the 85 total intersections along MD 355 that were analyzed as part of the 2040 No-Build effort, 14 showed LOS F in the morning peak-hour, and 19 in the evening peak-hour.

Higher than average crash rates: Approximately 1,900 total crashes occurred along MD 355 within the study limits over a three-year period from 2011 to 2013, with five of them resulting in fatalities and 65 of them involving pedestrians. The most prevalent crashes were rear end (41 percent), angle (19 percent), left turn (13 percent), and sideswipe (13 percent) collisions. The prevalence of these crash types suggests a corridor that has congested conditions with frequent stops and turns from side streets and parking lots. Crashes along the corridor increase travel times, and reduce reliability, that impact not only private vehicles but also buses. BRT systems on dedicated lanes are impacted less by conditions of roadway traffic, and therefore, more reliable.

- **Congested conditions will worsen, with traffic increasing between 13 percent and 23 percent by 2040**
- **Congested conditions likely contribute to higher than average crash rates**

2.4.3 Lack of Competitive Travel Options

Existing transit service connectivity and reliability: Metrorail and local bus services (Metrobus and Ride On) are the only existing transit options along MD 355, none of which span the entire length of the corridor. As of February 2017, Metrorail's Red Line operates at three to six minute headways during the weekday peak-periods and at 12-16 minute headways during weekends and off-peak hours. The system is heavily used, particularly by commuters. However, it does not provide a short trip service and only spans to Shady Grove Road, the northern end of the Red Line. Ride On routes 46 and 55 operate at 12-15 minute headways during the weekday peak-periods, and vary from 10-30 minutes during off-peak and weekend hours. These routes provide all-day service. Route 75 operates only at 30 minute headways and provides service only on weekdays between 5:15 am to 7:15 pm. Travel times are significantly higher compared to automobile travel due to the high number of stops and required transfers, in addition to the overall roadway congestion.

The on-time performance for the exiting Ride On service is not adequate for the transit usage in the corridor, ranging between 71 and 74 percent. The importance of reliable transit service along the MD 355 corridor is critical to provide the transit customer a good and consistent level of service. Unreliable transit service results in increased labor and maintenance cost and reduced efficiency, and diminishes the use of transit service as a viable alternative to automobile travel.

Corridor travel market and transit accessibility: Non-work trips are the dominant trip type within the Study Corridor, accounting for 88 percent of overall existing travel. These trips are typically frequent and short with less than ten percent occurring between non-adjacent districts. These travel patterns within the Study Corridor present an interesting opportunity for a potential BRT system along MD 355, which would provide high-quality transit service that could accommodate these types of trips. The BRT would provide better transit accessibility to locations between the existing Metrorail stations in the southern portion of the corridor while simultaneously providing higher quality service than the existing local bus routes. Combining these two features of BRT could make this service attractive to the many short, non-work trips in the corridor. Passengers would benefit from both frequent service and quick access to activity centers near BRT stops and quick, direct service from and to locations of interest along the MD 355 corridor. In the northern half of the corridor, a potential BRT service could also provide enhanced access to the Metrorail system.

- **Existing bus service is piecemeal and time consuming**
- **Metro only serves a portion of potential transit market**
- **On-time performance (reliability) is not adequate for the transit usage in the corridor**
- **88 percent of all trips along MD 355 are short non-work trips**
- **Over 90% of non-work trips occur within adjacent districts**
- **Gaps in job accessibility using transit**

2.4.4 Transit-Reliant Passengers

Based on the latest US Census, a large number of public transit customers living along MD 355 are transit dependent as shown in ***Table 2-3***. This core market includes customers who use public transportation as a primary travel mode due to age, mobility impairments, economic level, or lack of access to an automobile. Furthermore, as shown in ***Figure 2-7*** many households in the Washington D.C. region opt to have a single or no automobile and decide their

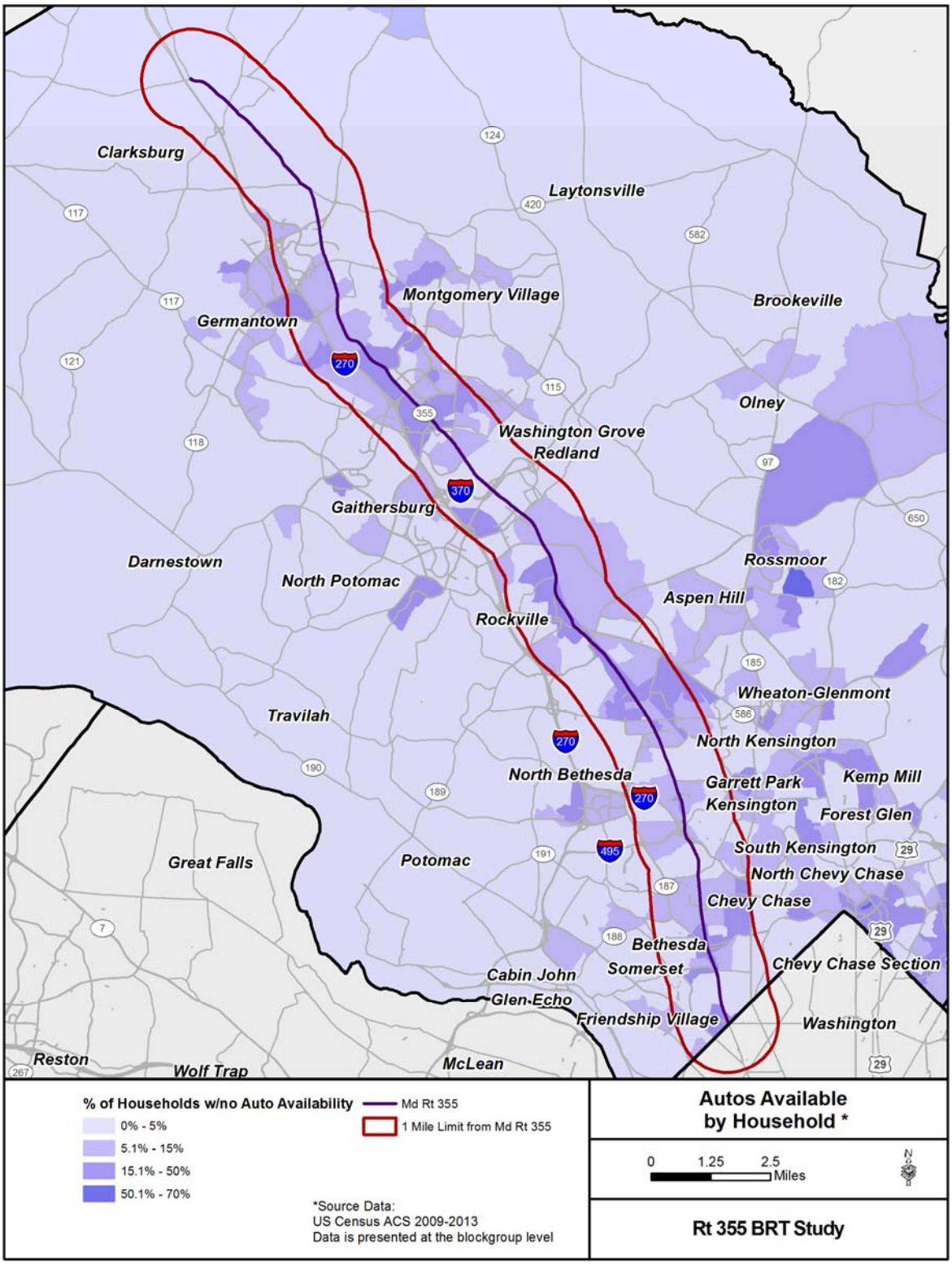
place of residence based on the availability of high quality transit services. Households with no automobiles available are more likely to rely on transit for their mobility needs. A BRT system along MD 355 increases the potential to attract new riders and provides an alternative to existing transit users and current automobile users. In addition, many residents of new transit oriented development projects proposed to be built along MD 355 may be higher income households. While such residents may be carless by choice, they nevertheless may rely on vehicle sharing services to meet trip needs currently addressed by car ownership.

Table 2-3: Core Transit Market Demographics

Demographic	Percentage of Study Corridor Population
Age < 19 years old	22.8%
Disabled	7.8%
Below poverty line	7.0%

- **Demographics along MD 355 reflect potential transit reliant customers**
- **Zero car households within Study Corridor (See *Figure 2-7*)**

Figure 2-7: MD 355 Study Corridor Zero Car Households



2.5 Project Purpose

The purpose of the project is to provide a new higher speed, high frequency, premium transit service along MD 355 between Clarksburg and Bethesda that will:

- Enhance transit connectivity and multimodal integration along the corridor as part of a coordinated regional transit system;
- Improve the ability for buses to move along the corridor (bus mobility) with improved operational efficiency, on-time performance / reliability, and travel times;
- Address current and future bus ridership demands;
- Attract new riders and provide improved service options for existing riders as an alternative to congested automobile travel through the corridor;
- Support approved Master Planned residential and commercial growth along the corridor;
- Improve transit access to major employment and activity centers;
- Achieve Master Planned non-auto driver modal share;
- Provide a sustainable and cost effective transit service; and
- Improve the safety of travel for all modes along the corridor.

This purpose statement has been consolidated into five distinct goals to guide the development of alternatives and as an evaluation measure for comparing alternatives:

- **Improve the quality of transit service** by increasing travel speed, reliability, frequency and ease of use thus better serving existing riders and attracting new riders.
- **Improve mobility opportunities and choices** by strengthening the north/south transit connectivity to existing and proposed transit systems and major employment and activity centers; thus, improving neighborhood, local and regional connectivity.
- **Develop transit services that enhance quality of life** by improving access to housing and jobs and better serving transit-reliant customers by engaging the public to ensure we address customer needs/priorities.
- **Develop transit services that support Master Plan development** by increasing transit connectivity to activity center to enable increases in non-automobile trips.
- **Support sustainable and cost effective transportation solutions.**

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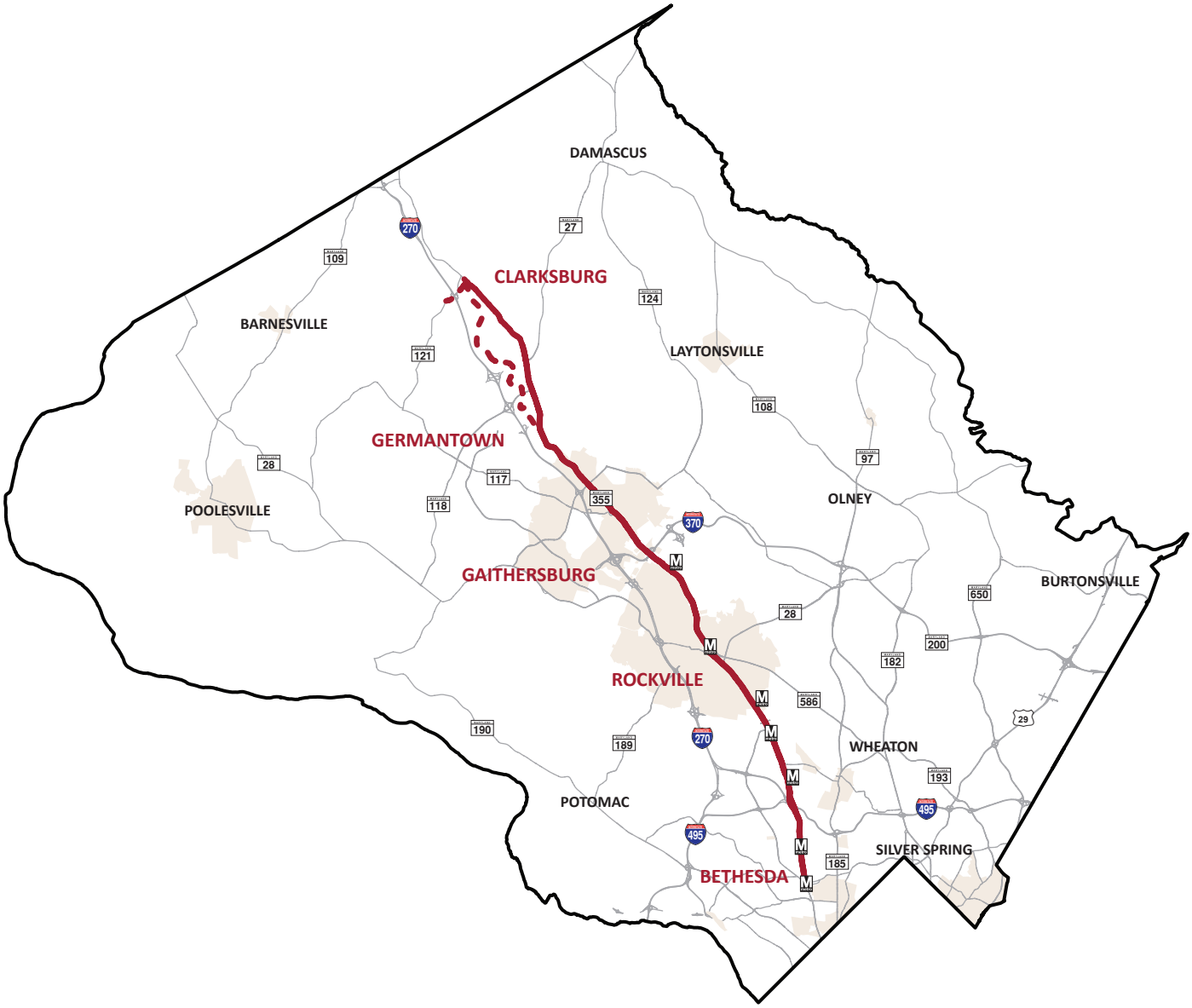
Montgomery County
RAPID TRANSIT
MD 355



MARYLAND DEPARTMENT OF TRANSPORTATION

MCDOT
Montgomery County
Department of Transportation

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Chapter 3.0

Environmental Summary

3.1 Introduction

This section describes the existing socioeconomic, cultural and natural resources in the project area. A desktop level inventory of the environmental resources was conducted using existing data obtained via GIS datasets and coordination with regulatory agencies. Natural resources were confirmed via a windshield survey however, no field work was conducted during this project phase (see ***Appendix B*** for **Environmental Resources Mapping**). The environmental study area boundary for this phase of analysis was established 200 feet from the existing edge of pavement on either side of the road. The study area for environmental resources covers a larger area than the project Study Corridor evaluated for engineering purposes.

The project team developed the Conceptual Alternatives with the resources shown on project mapping. Potential environmental impacts were calculated to determine if there was a significant difference in impacts between alternatives and to help refine the alternatives to be evaluated in the next phase. During the next phase, more detailed engineering analysis will be conducted including avoidance and minimization options for the alternatives retained.

3.2 Socioeconomic and Community Resources

MD 355 connects several major activity centers, including Clarksburg, Germantown, the City of Gaithersburg, the City of Rockville, White Flint and the Bethesda Central Business District.

The 2010 Census data was used to determine the general population and racial/ethnic demographics within the environmental study area and the American Community Survey 5-Year Estimates were used to determine income demographics. The regional demographics include information provided by the Census of Population and Housing. This information helps governments decide how best to distribute funds and assistance. The information provided to the Census Bureau includes the population and census tract – block groups, the regional racial and ethnic characteristics, regional age, gender, and disability characteristics, and regional income characteristics.

The environmental study area consists of 42 census tracts and 76 block groups, as designated in the 2009-2013 American Community Survey 5-Year Estimates. Block groups were selected as a unit of measure to provide the most comprehensive and representative demographic data for the environmental study area at the smallest scale (see ***Appendix C*** for **Environmental Justice Census Block Map**).

Montgomery County, with a 2010 population of 971,777, is the most populous County within Maryland. Since 2000, growth throughout the state and within Montgomery County has steadily increased by approximately ten percent. By 2040, growth is expected to increase by 30 percent throughout the state and by 38 percent within Montgomery County. By 2040, Montgomery County's population is expected to exceed 1.2 million. A breakdown of the population and population growth, gender, age, and disability, household incomes by region are as follows:

Table 3-1: Regional Population and Population Growth

	2000	2010	2040	2000-2010 % Change	2000-2040 % Change
Maryland	5,296,486	5,773,552	6,889,700*	9%	30%
Montgomery County	873,341	971,777	1,206,800*	11%	38%

*Maryland Department of Planning, Maryland State Data Center, July 2014

Table 3-2: Regional Distribution by Gender, Age, and Disability

	Male	Female	19 and under	20-24	25-34	35-49	50-64	65 +	Disabled
Maryland	48.5%	51.5%	25.6%	6.9%	13.6%	20.7%	20.2%	13%	10.3%
Montgomery County	48.2%	51.8%	26.1%	5.5%	13.8%	22.1%	20.1%	12.7%	7.5%

Source: U.S. Census Bureau; State and County Quick Facts, Montgomery County, MD, 2013; 2009-2013 American Community Survey 5-Year Estimates

Table 3-3: Regional Income

	Median Household Income	% Population Below Poverty Level
Maryland	$73,538	9.8%
Montgomery County	$98,221	6.7%

Source: U.S. Census Bureau; State and County Quick Facts, Montgomery County, MD, 2009-2013 American Community Survey, 5-Year Estimates.

3.2.1 Environmental Justice

In compliance with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, MDOT will avoid disproportionately high adverse effects on minority and low-income populations throughout the study area. Further outreach and additional research of study area demographics and economic characteristics will be completed as the study progresses.

According to the existing 2013 census tract-block group data and field reviews, low-income and / or minority populations reside throughout the Study Corridor. Several low-income and / or minority block groups were identified within the northern Germantown area, Gaithersburg, and northern Rockville. (See ***Appendix C*** for ***Environmental Justice Census Block Map.***)

Table 3-4: Environmental Study Area Racial and Ethnic Distribution (Percentage)

Geography	Population	White	Black or African American	American Indian & Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Other	Two or More Races	Hispanic or Latino
Environmental study area	123,988	50.4%	13.1%	0.2%	17.4%	0.1%	0.3%	2.8%	15.7%

Source: 2009-2013 American Community Survey, 5 year estimates 1 Data, Race, Combination of Two Races, & Not Hispanic or Latino; *Compiled using the 2010 Census racial populations categories (Black or African American, American Indian and Alaska Native, Asian or Other Pacific Islander, Hispanic or Latino) which correspond to the definition of minority (Black, Hispanic, Asian-American, American Indian and Alaska Native) in accordance with EO 12898 on Environmental Justice (See Section II).

Limited English Proficient individuals do not speak English as their primary language and have a limited ability to read, speak, write, or understand English. Different treatment based upon an individual's inability to speak, read, write, or understand English may be considered a type of national origin discrimination under Title VI of *The Civil Rights Act of 1964*.

The identification of Limited English Proficiency populations was based primarily on the U.S. Census Bureau's American FactFinder 2014 census tract data. The language spoken in the home was determined for each census tract with at least 1,000 speakers of a specific language. Individual census tract percentages within the study area were averaged by dividing the total number speakers in the home that speak a specified language by the overall number of speakers over the age of five within the study area.

Census tract data for languages spoken at home by the study area population was reviewed and the languages that have at least 1,000 speakers are listed below in ***Table 3-5***.

Table 3-5: Languages Spoken in the Home with Populations Exceeding 1,000 Speakers

Indo-European Languages	Asian and Pacific Islander Languages	Other Languages
Spanish	Chinese	Persian (Farsi)
French	Korean	Hindi
Portuguese	Vietnamese	Other Indic Languages
Russian	Tagalog	African Languages
	Other Asian Languages	

Source: U.S. Census Bureau; American FactFinder 2014 data

Approximately 61 percent of the population over the age of five within the study area only speaks English in the home. Approximately 14.3 percent of the population within the study area speaks Spanish in the home. Of that total, 55.9 percent of the population speaks English very well, and the remaining 44.1 percent of Spanish speaking residents speak English less than very well. Additional research would be required to determine which Asian languages are spoken in the home and the breakdown of each Asian language within the study area. Asian populations are scattered throughout the study area, clustered mainly to the north and south with some populations located in the middle.

The location of existing bus routes and stops along MD 355 can be expected to change, which could alter commuting activities. Right-of-way needs will be determined after project alternatives are identified. Further research, including outreach would be conducted to identify socioeconomic resources and community characteristics to ensure that the project would not disproportionately or adversely affect any minority, low income, or Limited English Proficient populations.

3.2.2 Section 4(f) of the U.S. Department of Transportation of 1966

Section 4(f) of the U.S. Department of Transportation Act of 1966 as amended (49 USC Section 303) stipulates that the U.S. Department of Transportation (USDOT) agencies cannot approve the use of land from a significant publicly owned public park, recreation area, wildlife or waterfowl refuge, or any significant historic site unless there is no feasible and prudent avoidance alternative to use of land from the property and the action includes all possible planning to minimize harm or the use of the Section 4(f) property include any measures to minimize harm.

Several community resources are located within the project area. Parks within the study area include 14 local or regional parks, two activity and community centers, and one neighborhood conservation area. In addition, one area that was identified as proposed park property would be an addition to an existing park, Little Seneca Greenway Stream Valley Park. Parks within the study area are owned and maintained by the M-NCPPC Department of Parks, the City of Rockville Department of Recreation and Parks, the City of Gaithersburg Department of Parks, Recreation and Culture, and the Department of Natural Resources (DNR) Park Service, Public schools are managed by the Montgomery County Board of Education (see ***Appendix D*** for ***Community Resources Mapping***).

Table 3-6: Community Resources

Facility	Location	Total Park Acres	Park Acreage Within Study Area	Amenities	Owner
Clarksburg Triangle Urban Park	23365 Frederick Rd., Clarksburg, MD	2.5	1.30	Basketball Court, Outdoor Tennis Court, Playground	M-NCPPC
Dowden's Ordinary Special Park	23169 Stringtown Rd., Clarksburg, MD	2.7	1.36	Playground	M-NCPPC
Little Seneca Greenway Stream Valley Park	I-270 north to Clarksburg, MD	266.3	3.2	Trails	M-NCPPC
Little Seneca Greenway Stream Valley Park - *PROPOSED*	Adjacent to existing Little Seneca Greenway Stream Valley Park.	8.8	1.9	Proposed addition to the existing Little Seneca Greenway SVP. No existing amenities. Potential natural surface trails in the future.	M-NCPPC
Clarksburg Neighborhood Park	22501 Wims Rd. at MD 355, Clarksburg, MD	3.8	1.68	Tennis courts, playground, recreation center, and basketball court	M-NCPPC
North Germantown Greenway Stream Valley Park	I-270 to Blunt Rd., Clarksburg, MD	380.81	3.74	Paved trail and significant natural corridors and open spaces	M-NCPPC
Ridge Road Recreational Park	21155 Frederick Rd., Germantown, MD	79.0	11.28	Tennis and volleyball courts, baseball, softball and soccer fields, dog park, inline hockey rink, picnic shelters, playground, and trails	M-NCPPC
Germantown East Local Park	19910 Frederick Rd, Germantown, MD	7.3	2.65	Undeveloped	M-NCPPC
Great Seneca Stream Valley Park- Unit 1	Frederick Rd Rt.355 to Watkins Mill Rd., Germantown, MD	460.6	6.25	Trail and natural areas	M-NCPPC
Seneca Creek State Park	11950 Clopper Rd, Gaithersburg, MD	6,294	6.18	Biking, boat rental, canoeing, comfort station, convenience store, fishing, hiking, hunting, information center, picnic tables, playground, and water fountains	DNR Park Service

Facility	Location	Total Park Acres	Park Acreage Within Study Area	Amenities	Owner
Bohrer Park at Summit Hill Farm and Activity Center	506 S Frederick Ave., Gaithersburg, MD	59	3.79	Paved walking and biking trail, miniature golf course, the Activity Center, skate park and water park, historic Manor House, Wilmot House, historic Log Smokehouse, barn, parking, several open fields, playground area, horseshoe pit, volleyball net, two ponds, covered picnic canopies, picnic tables, lounge chairs, two play areas, bath house, snack bar, and three picnic pavilions.	City of Gaithersburg
Casey Community Center	810 S. Frederick Ave., Gaithersburg, MD	3.8	0.74	Community center used for numerous functions, including wedding receptions, family parties, etc.	City of Gaithersburg
King Farm Farmstead Park	16100 Frederick Rd., Rockville, MD	7.6	1.89	Garden plots large, rentable picnic shelters, grills, historic buildings	City of Rockville
King Farm Stream Valley Park	W. Gude Dr. and Redland Blvd., Rockville, MD	28.4	1.89	Open space, park shelter, paths	City of Rockville
Promenade Park	Monroe St. and Rockville Pk., Rockville, MD	0.4	0.14	Park benches/sitting area and path	City of Rockville
Veterans Park	Veirs Mill Rd. and Rockville Pk., Rockville, MD	0.9	0.87	Park benches, artwork, and large illuminated American Flag	City of Rockville
Rock Creek Stream Valley Park	D.C. Line to East West	3,960	13.32	Basketball Court, Community Gardens, Exercise Course, Playground, Trails	M-NCPPC
Elmhirst Parkway Neighborhood Conservation Area	4700 Elmhirst La., Bethesda, MD	7.6	0.79	Undeveloped Open Space	M-NCPPC

Source: Montgomery County M-NCPPC GIS information

In addition to the identified publicly owned public parks, publicly owned schools often have facilities, such as playgrounds or athletic facilities that are open to the public that would be subject to the provisions of Section 4(f). The following schools are within half a mile of MD 355:

- Clarksburg Elementary School
- Clarksburg High School
- Rocky Hill Middle School
- Neelsville Middle School
- Gaithersburg High School
- Rock Terrace School
- Richard Montgomery High School

Additional community resources within the environmental study area include:

- 2 post offices
- 2 law enforcement facilities
- 4 fire departments
- 5 cemeteries
- 21 religious facilities

No wildlife management areas, scenic rivers, or state wildlands are located within the study area.

3.3 Cultural Resources

Historic resources that are eligible for or listed in the National Register of Historic Places (NRHP) are protected by the provisions of Section 106 of the National Historic Preservation Act (36 CFR Part 800) and the Maryland Historical Trust (MHT) Act of 1985 (as amended, §§ 5A-325 and 5A-326 of the Annotated Code of Maryland). The Area of Potential Effects for historic resources has not been defined due to the preliminary nature of the project scope. Review of SHA cultural resources databases and the Maryland Historical Trust - Maryland Inventory of Historic Properties (MIHP) reveals the presence of over 100 standing structures, including five historic standing structures listed in the NRHP National Register Listed (NR) and 18 resources that are eligible for listing in the NRHP National Register Eligible (NRE).

Significant NR resources are listed as follows:

- Bethesda Theatre NR (**NR- 1214** and **M: 35-14-4**) (see ***Figure 3-1***)
- Bethesda Naval Hospital Tower NR (**NR-417** and **M: 35-8**) (see ***Figure 3-2***)
- Bethesda Meeting House NR (**NR-421** and **M: 35-5**) (see ***Figure 3-3***)
- Montrose Schoolhouse NR (**NR-722** and **M: 30-02**) (see ***Figure 3-4***)
- Third Addition to Rockville and Old St. Mary's Church and Cemetery NR (**NR-506** and **M: 26-12**)

Figure 3-1: Bethesda Theater

Figure 3-2: Bethesda Naval Hospital Tower

Figure 3-3: Bethesda Meeting House

Figure 3-4: Montrose Schoolhouse

Significant NRE resources are listed as follows:

- Bethesda Naval Medical Center NRE (**M:35-98**)
- Brookes, Russell and Walker Avenues Historic District (Gaithersburg) NRE (**M:21-165**)
- Casey Barn NRE (**M:21-183**)
- Clarksburg Historic District NRE (**M:13-10**)
- Convent of the Sisters of Visitation NRE (Building 60/NIH) (**M: 35-9-6**) (see ***Figure 3-5***)
- Corby Estate (Strathmore Hall Arts Center) NRE (**M:30-12**)
- George Freeland Peter Estate NRE (**M:35-9-1**)
- Graff/King Property (Billy King Farm) NRE (**M: 20-32**)
- Locust Hill Estates, center part only NRE (**M:35-120**)
- National Library of Medicine NRE (NIH) (**M:35-9-8**) (see ***Figure 3-6***)
- NIH Historic Core NRE (**M:35-9-2**)
- NIH Memorial Laboratory NRE (**M:35-9-5**)
- NIH Officers' Quarters NRE (**M:35-9-7**)
- Observatory Heights Historic District (Gaithersburg) NRE (**M:21-185**)
- Realty Park Historic District (Gaithersburg) NRE (**M:21-202**)
- Sprigg Poole House NRE (**M:26-21-4**) (see ***Figure 3-7***)
- Summit Hall NRE (**M:21-3**)
- Wilson Estate (Tree Tops/NIH) NRE (**M:35-9-3**)

Figure 3-5: Covenant of the Sisters of Visitation

Figure 3-6: National Library of Medicine

Figure 3-7: Sprigg Poole House

The following resources were evaluated and were determined to be not eligible for listing in the NRHP:

- Cedarcroft **(M:35-6)** determined not eligible for NRHP 5-27-2010
- Montouri Estate **(M:30-9)** determined not eligible for NRHP 3-4-2002
- NIH Animal Building (Building 9) **(M:35-9-4)** determined not eligible for NRHP 8-23-2000
- Old Gaithersburg Survey District **(M:21-2)** determined not eligible for NRHP 2-24-2001
- Rebecca Key Offutt Property (Simmons Building), determined not eligible for NRHP 3-2-2000
- SHA Bridge No. 15054 (**M:13-57**) determined not eligible for NRHP 4-3-2001

In addition to the above mentioned resources, 83 inventory-level resources were identified within the environmental study area that would require further evaluation. These resources are as follows:

- John Gibson House **(M:13-10-2)**
- Elizabeth Powers House **(M:13-10-7)**
- Clark-Waters House **(M:13-10-5)**
- Leonidas Willson House **(M:13-10-6)**
- Willson Store **(M:13-10-4)**
- Horace Willson House **(M:13-10-3)**

- Hammer Hill **(M:13-10-11)**
- Columbus Woodward House (John Henry Wims House) **(M:13-10-9)**
- Dowden's Ordinary, site **(M:13-53)**
- Maurice & Sarah Mason House **(M:13-42)**
- Warner Wims House **(M:13-51)**
- Clarksburg Negro School, site **(M:13-34)**
- Lloyd & Sarah Gibbs House, site **(M:13-38)**
- John Wesley Methodist Church **(M:13-48)**
- Waters Log House **(M:13-20)**
- Londonderry **(M:19-4)**
- Neelsville Presbyterian Church **(M:19-5)** (see ***Figure 3-8***)
- Cider Barrel **(M:19-33)** (see ***Figure 3-9***)
- Seneca State Park **(M:19-38)**
- Foster & Rosalie Summers House **(M:21-169)**
- Garrison W. Beall House **(M:21-167)**
- Henry H. Fraley House **(M:21-155)**
- Lewis Reed Residence **(M:21-154)**
- Grace United Methodist Church **(M:21-164)**
- Big A Auto Parts (Lyric Theater) **(M:21-147)**
- Metropolitan Branch, B&O RR **(M:37-16)**
- Gaithersburg Wye (The Wood Lot) **(M:21-166)**
- PEPCO Substation **(M:21-124)**
- St. Martin's School **(M:21-159)**
- 20 S. Summit Ave. **(M:21-120)**
- Inns of Court **(M:21-125)**
- Ballet 106 **(M:21-126)**
- T-shaped Frame House-DeSellum & Francis Avenues **(M:21-009)**
- Thomas Fulks House **(M:21-129)**
- Salvation Army Community House (Severance House) **(M:21-158)**
- Ascension P.E. Chapel **(M:21-136)**
- Realty Park Historic District **(M:21-202)**
- Brookes, Russell, and Walker Avenues Historic District **(M:21-165)**
- Chestnut Street and North Frederick Avenue Historic District **(M:21-105)**
- Observatory Heights Historic District **(M:21-185)**
- Holiday Motel Property **(M: 20-43)**
- Charles & Roberta Ricketts Property **(M:20-34)**
- Haiti (Martin's Lane Survey District) **(M:26-16)**
- Brewer-Offutt-WINX House **(M:26-12-04)**
  St. Mary's Church & Cemetery **(M:26-12-06)**
- Simmons Building (Rebecca Key Offutt Property) **(M:26-21-01)**
- Tyson Wheeler Funeral Home **(M:26-21-02)**
- Dixie Cream Donut Shop (Montgomery Donuts) **(M:26-21-05)**
- Congressional Airport (Congressional Shopping Plaza) **(M:26-21-06)**
- Halpine Store (Radio Shack) **(M:26-21-03)**
- Wilkins Estate (Parklawn Cemetery) **(M:30-01)**
- Mantouri Estate **(M:30-9)**
- Rainbow Motel **(M:30-10)**
- Stone Ridge (Country Day School of the Sacred Heart) **(M:35-007)**
- Old Bethesda Commercial District (Bethesda Commercial District) **(M:35-014)**
- Little Tavern **(M:35-014-03)**
- Madonna of the Trails **(M:35-014-02)**
- Bethesda Post Office (Darcy's Store**) (M:35-014-05)**
- Brooks Photographers **(M:35-014-06)**
- One Step Up, Dan Daniels Printing, Games People Play **(M:35-014-A)**
- National Institutes of Health, Bethesda Campus **(M:35-9)**
- Metropolitan Branch, B&O Railroad **(M:37-16)**
- Georgetown Branch, B&O Railroad **(M:35-142)**
- No Documentation on File for the following properties: **(M:21-46, M:21-131, M:21-132, M:21-150, M:21-191, M:21-192, M:21-193, M:21-194, M:21-195, M:21-196, M:21-200, M:21-198, M:212-88, M:21-21, M:21-97, M:21-96, M:21-81, M:21-47, M:30-26)**

Figure 3-8: Neelsville Presbyterian Church

Figure 3-9: Cider Barrel

3.3.1 Archeological Resources

Three historic archeological sites, **18MO562** (Dowden's Ordinary), **18MO599** (Hammerhill Road) and **18MO734** (Neelsville Blacksmith Shop and Residence) have been identified within the study area. Although there is no Determination of Eligibility form on file for Dowden's Ordinary, aerial photographs show that the site was excavated prior to the construction of Dowden's Ordinary Park. Previous coordination with MHT reveals that the Hammerhill Road site is not NRE. In addition, coordination with MHT indicates that the Neelsville Blacksmith Shop and Residence is NRE. This archeological site is historic with no standing structure associated with it and it is strictly an underground resource. Only one section of MD 355 within the study area, between West Old Baltimore Road and Cool Brook Lane, has not been included in prior surveys. The majority of the survey area has been included in prior surveys and there are no intact, eligible, or potentially eligible resources in the immediate vicinity of the roadway.

Additional architectural investigations and archeological surveys would be required to determine the presence of significant resources within the study area. Coordination with the MHT would be required to determine project effects to significant cultural resources once alternatives are identified. If federal funds are used for this project, any encroachment on a significant historic site or archeological resource would require the development and evaluation

of avoidance and minimization alternatives under Section 106 of the National Historic Preservation Act (36 CFR Part 800), as well as Section 4(f) of the US DOT Act of 1966.

3.4 Natural Environmental Resources

Natural environmental resource data was collected along MD 355 for the entire environmental study area. A review of National Wetland Inventory and Maryland DNR mapping identifies numerous streams and wetlands within the study area. Major streams associated with 100-year floodplains include Great Seneca Creek, Muddy Branch, and Rock Creek.

Nontidal wetlands, including palustrine forested, palustrine scrub-shrub, and palustrine emergent are scattered throughout the study area along its entire length. Coordination with DNR's Wildlife and Heritage Service (WHS), dated June 1, 2015, indicates that there is one area that contains a wetland that is designated as a Nontidal Wetland of Special State Concern. This wetland, known as Germantown Bog and may contain state threatened plant species. Three state-listed threatened species have been documented within Germantown Bog, as follows:

Scientific name	Common Name	State Status
Carex buxbaumii	Buxbaum's Sedge	Threatened
Sanguisorba Canadensis	Canadian Burnet	Threatened
Spenopholis pensylvanica	Swamp Oats	Threatened

It is possible that any of the identified species could occur within the project's limits of disturbance in areas of appropriate wetland habitat of seepages, fens, or swamp. DNR has also noted that the project could alter the hydrology that exists in the rare species habitat, making it less suitable for these protected species. Further coordination with WHS may be required as the project progresses to minimize the potential for adverse impacts to these sensitive species areas. In addition, WHS indicates that the forested areas adjacent to the MD 355 corridor could contain habitat for Forest Interior Dwelling Species (FIDS). Populations of FIDS are declining in Maryland and throughout the United States and conservation of this habitat is strongly encouraged by DNR. Guidelines to minimize potential impacts to FIDS habitat and other native forest plants and wildlife have been provided by DNR and include the following:

- Avoid placement of new roads or related construction in the forest interior. If forest loss or disturbance is absolutely unavoidable, restrict development to the perimeter of the forest (i.e., within 300 feet of the existing forest edge), and avoid road placement in areas of high quality FIDS habitat (e.g., old-growth forest). Maximize the amount of remaining contiguous forested habitat.
- Maintain forest habitat as close as possible to the road, and maintain canopy closure where possible.
- Maintain grass height at least 10 inches during the breeding season (April through August).
- Do not remove or disturb forest habitat April through August, the breeding season for most FIDS. This seasonal restriction may be expanded to February through August if certain early nesting FIDS (e.g., Barred Owl) are present.

The project area is within the Green Infrastructure Network. The proposed project would be along existing roadways. Coordination with U.S. Department of the Interior, Fish and Wildlife Service (FWS), dated February 23, 2016, indicates there are no known federally listed threatened or endangered species in the project area.

3.4.1 Water Resources

The environmental study area falls within the Cabin John Creek, The Potomac River Montgomery County, the Rock Creek, and the Seneca Creek Maryland 8-digit watersheds. There are no Tier II watersheds within the environmental study area. The four watersheds meet the approved Total Maximum Daily Load requirements for water quality standards and are in compliance with the Clean Water Act Sections 303(d), 305(b), and 314 and the Safe Water Drinking Act.

Table 3-7: TMDLs for Watersheds within the Environmental Study Area

Watershed	Approved TMDLs (Approval Year)
Cabin John Creek	Bacteria - E.coli (2006), Phosphorus (2009), Sediments (2011)
Potomac River Montgomery County	Phosphorus (2012), Sediments (2012)
Rock Creek	Bacteria - Enterococcus (2007), Sediments (2011)
Seneca Creek	Phosphorus (2009), Sediments (2011)

Coordination with DNR's Project Review Division, dated June 18, 2015, indicates that Rock Creek, Muddy Branch, Ten Mile Creek, Watts Branch, Cabin John Creek and their tributaries are classified as Use I waters with an in stream construction restriction from March 1 through June 15, inclusive. If yellow perch are documented within the study area for these Use I waters, in stream work restrictions are extended from February 15 through June 15. Crabbs Branch and their unnamed tributaries, as well as Little Seneca Creek and its four unnamed tributaries, are classified as Use IV waters. Great Seneca Creek and unnamed tributaries are classified as Use I and IV waters. In stream work within Use IV waters is prohibited from March 1 through May 31, inclusive, during any year. In stream construction will require permits from Maryland Department of the Environment (MDE) and the US Army Corps of Engineers. Stormwater management and water quality control plans will also require a permit from MDE.

Data from the DNR Maryland Biological Stream Survey (MBSS) was gathered to characterize the overall stream condition and aquatic communities of the streams crossed by the project. MBSS has ranked the quality of the habitat and biological communities of many of the environmental study area streams based on detailed field sampling and comparison with "least-impaired" reference stream conditions.

The major streams and their tributaries in the environmental study area provide aquatic habitat to both fish and benthic macroinvertebrates. Both benthic macroinvertebrates and fish are useful indicators of stream health, as they integrate stressors at a site over time. The presence, numbers, and types of organisms convey important information about water quality. Data from the MBSS is used to calculate a Benthic Index of Biotic Integrity (BIBI) and a Fish Index of Biotic Integrity, which provide a summary of the biotic conditions at a site. Qualitative ratings of stream health are based on IBI scores and range from good (4.0 – 5.0), denoting minimally impacted conditions, to very poor (1.0 – 1.9), indicating severe degradation.

The aquatic health of the four watersheds is variable, averaging Fair (3) for the FIBI and Poor (2) for the BIBI. Lower scores for both categories indicate low diversity, often dominated by taxa that are more tolerant of stream impacts; higher scores indicate higher taxa diversity and the presence of more sensitive species. The four sites that scored "Good" in the FIBI category and the one site scoring "Good" in the BIBI are associated with parklands and forested habitats. Parks are generally undisturbed by construction and other modifications, and serve as buffers to these streams. However, all the sites examined in the Rock Creek watershed scored Fair or worse, despite some of these sites being buffered by protected parklands. As all four watersheds are dominated by urban and built

landscapes, streams in these watersheds will be subject to higher runoff inputs, contributing to lowered stream health even in spite of protected lands providing buffers. The Seneca Creek watershed, generally the least intensely developed watershed in the environmental study area, had slightly higher aquatic community scores overall.

3.4.2 Wetlands

Twenty-eight potential wetlands occur within the environmental study area. Nontidal wetland types include palustrine forested, palustrine scrub-shrub, and palustrine emergent. Nontidal wetlands include ditches, fields, and forests. These wetlands are scattered throughout the environmental study area along its entire length, and are identified in ***Appendix B Environmental Resources Mapping***.

While wetland resources are adequately identified for the purposes of this existing resource inventory, field delineations completed in accordance with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0)* (USACE, November 2010) would be required to confirm the exact limits of all waters of the U.S., including wetlands in the environmental study area at a later stage.

3.4.3 Floodplains

The 100-year floodplain was identified using Flood Insurance Rate Maps and the corresponding GIS layer produced by the Federal Emergency Management Agency (FEMA). Nontidal floodplains are regulated at the state level by MDE. Any construction in nontidal floodplains would require a Waterway Construction Permit from MDE.

Portions of the environmental study area either cross or border several floodplain areas, including Great Seneca Creek, Muddy Branch, and Rock Creek. These stream areas fall within the 100-year floodplain. None of these floodplains have regulated floodways in the portions that intersect the environmental study area. These floodways were designated though detailed hydrologic studies conducted by FEMA and are regulated by FEMA, MDE, and localities through the permitting process to ensure that development in the floodplain does not raise the base elevation of a designated floodway by more than a maximum of one foot or a smaller increment as determined by MDE.

3.4.4 Special Protection Areas

Montgomery County has designated four areas of the County as Special Protection Areas (SPAs). These are defined as a part of the County that has high-quality or unusually sensitive water resources (e.g., high quality streams, sensitive wetlands, or highly-erodible soils) or other environmental features, and where those resources or features are threatened by land use changes unless extraordinary or special protective measures are being taken (Montgomery County DEP 2015). The Clarksburg SPA crosses the northern end of the environmental study area, from Redgrave Place to Henderson Corner Road. The watersheds in this SPA are associated with Great Seneca Creek, Little Seneca Creek and Ten Mile Creek.

3.5 Hazardous Materials

A review of websites, including the Environmental Protection Agency's (EPA) Superfund Site Search and EPA's Resource Conservation and Recovery Act online database, identified numerous hazardous materials sites that would warrant additional investigation within the MD 355 BRT corridor. However, there are no Superfund sites within or adjacent to the study area. If required, coordination with MDE would occur during construction to minimize the potential for adverse effects as a result of treatment, storage, cleanup or disposal of hazardous waste. Environmental Data Resources, Inc. will be consulted to determine the presence of hazardous waste sites within the study area when alternatives are developed.

Montgomery County
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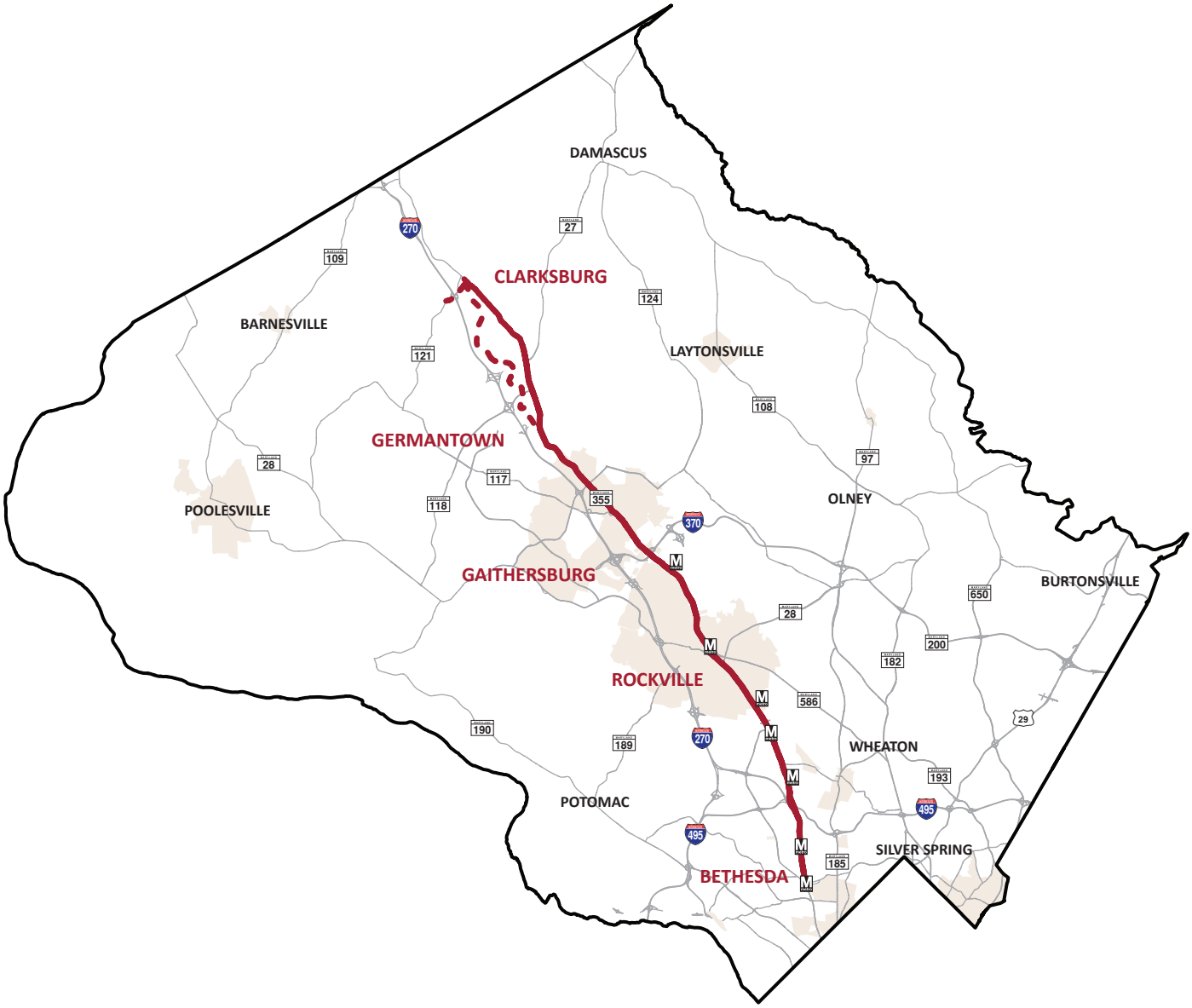
MD 355



MARYLAND DEPARTMENT OF TRANSPORTATION

Montgomery County Department of Transportation

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Chapter 4.0

Conceptual Alternatives

4.1 Introduction

The Countywide Transit Corridors Functional Master Plan developed by M-NCPPC and approved by the Montgomery County Council was used as a foundation for developing a set of Conceptual Alternatives. The study team made adjustments to the recommendations on the plan based on the coordination efforts with the Cities of Rockville and Gaithersburg, the M-NCPPC and MCDOT and in response to comments from the CAC.

The Conceptual Alternatives were evaluated against the No-Build and against each other. As shown in ***Figure 4-1*** the Conceptual Alternatives have three main components:

Figure 4-1: Conceptual Alternatives Components

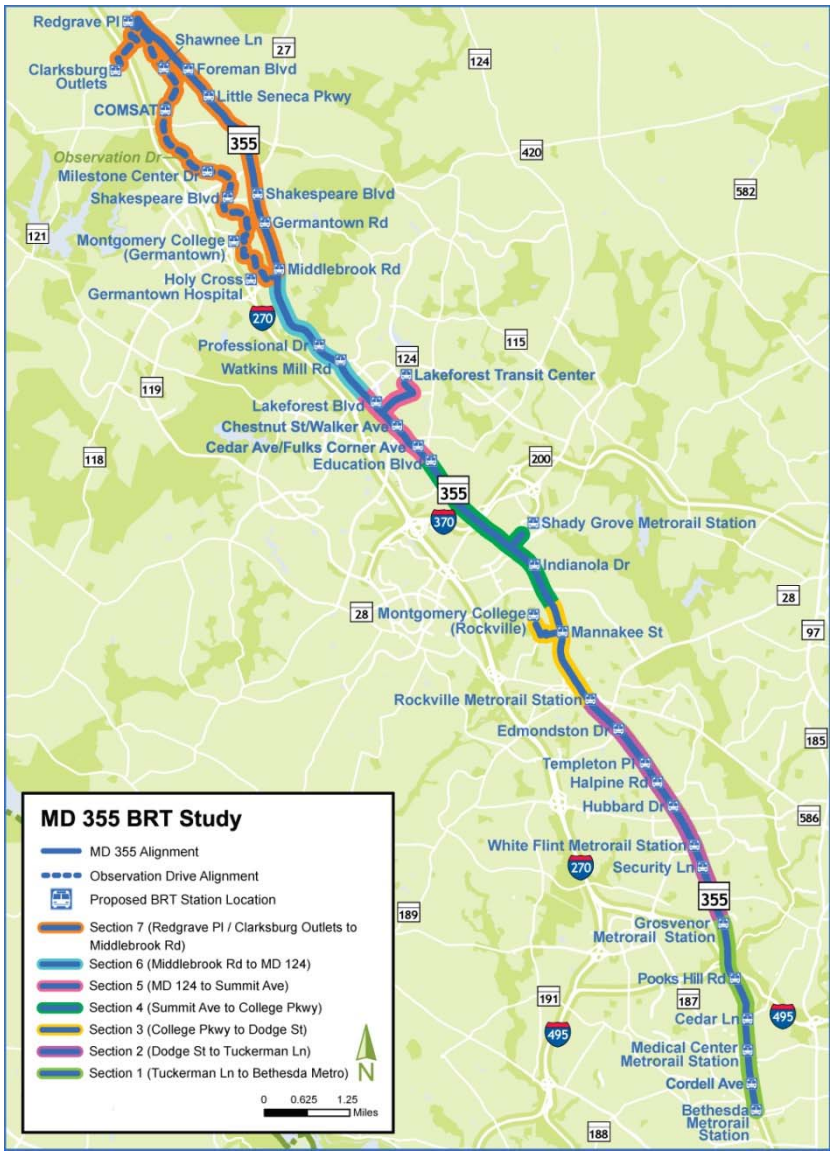
1. **Running way:** A designated facility such as a striped/signed lane or exclusive busway in which the vehicle would travel between stations
2. **Station location:** Specific locations where passengers can access the service and the service can support the local land uses (residential, commercial, etc.)
3. **Service plan:** The way in which BRT operates, including service frequency, hours of service, routing and connecting services

4.2 Running Way

Transit service can be provided via a variety of running way treatments: a dedicated two-lane median running way, dedicated curb lanes, a dedicated one-lane median running way (to accommodate transit service in one direction or in both directions), or running in mixed traffic. The dedicated lanes can be achieved either by widening the roadway and right-of-way or by repurposing existing travel lanes. The running ways can be mixed and matched along different segments of the corridor to best fit within the surrounding area. This mix and match approach recognizes that one single running way option will not be the best solution for the entire corridor.

Given the varying existing conditions along MD 355 from a rural setting in Clarksburg to an urban setting in Bethesda, the corridor was divided into seven different sections as shown in ***Figure 4-2***. Each section has its own characteristics, opportunities, challenges, constraints.

Figure 4-2: MD 355 Corridor Sections



Some of the main characteristics and challenges of each section are identified below in ***Table 4-1.***

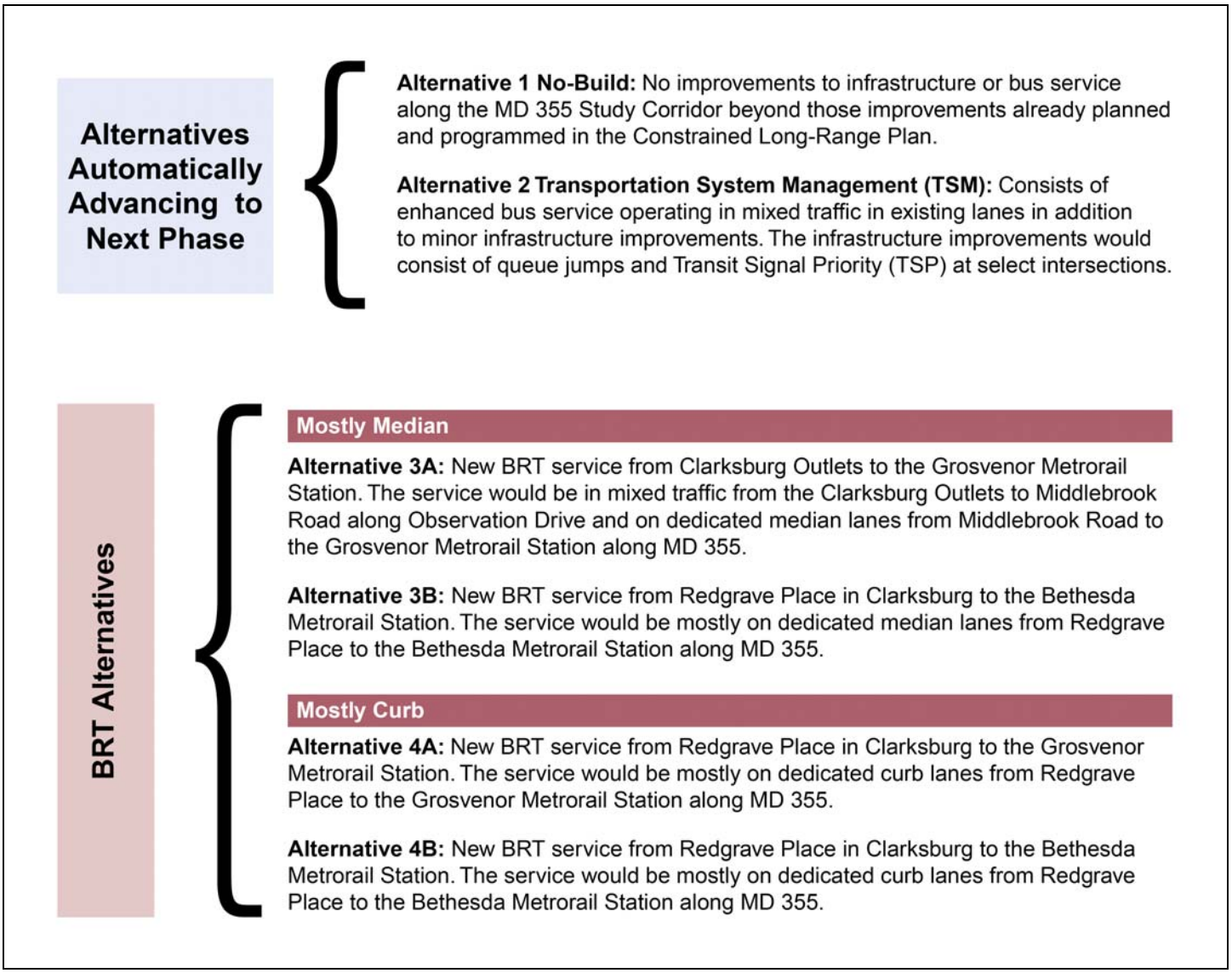
Table 4-1: Corridor Sections

SECTION 7	**CLARKSBURG / GERMANTOWN** | Approx. 4.7 to 6.2 miles *(Clarksburg to Middlebrook Road)* • MD 355 transitions from a six lane to a four lane roadway at Middlebrook Road and then to a two lane roadway north of MD 27 • Character and land use along MD 355 changes considerably from a suburban to a rural environment • Two different alignments being evaluated north of Middlebrook Road. One along MD 355 and the second along Observation Drive • Several parks located adjacent to roadway • Potential future connection to the Corridor Cities Transitway
SECTION 6	**GERMANTOWN / MONTGOMERY VILLAGE** | Approx. 3.2 miles *(Middlebrook Road to MD 124 [Montgomery Village Avenue])* • Predominantly a six lane roadway section • Predominantly suburban in nature • Park located adjacent to roadway
SECTION 5	**GAITHERSBURG** | Approx. 1.4 miles *(MD 124 [Montgomery Village Avenue] to Summit Avenue)* • Five lane roadway section • Center left turn lane used to access businesses • Buildings in close proximity to roadway • Cemetery located adjacent to roadway
SECTION 4	**SHADY GROVE / ROCKVILLE** | Approx. 3.2 miles *(Summit Avenue to College Parkway)* • Predominantly a six lane roadway section • Commercial properties on the east side of the road and pockets of residential on the west side • Two parks and community center located adjacent to roadway • Potential connection to Corridor Cities Transitway
SECTION 3	**ROCKVILLE TOWN CENTER** | Approx. 1.8 miles *(College Parkway to Dodge Street)* • Predominantly a six lane roadway section • Buildings in close proximity to the roadway • Service roads providing some inter-parcel connectivity • Rail tracks on east side in close proximity to roadway • Park and historic property adjacent to roadway
SECTION 2	**ROCKVILLE / WHITE FLINT** | Approx. 4.1 miles *(Dodge Street to Grosvenor Metro Station)* • Predominantly a six lane roadway section • Land use is commercial • Service roads providing some inter-parcel connectivity
SECTION 1	**BETHESDA** | Approx. 3.2 miles *(Grosvenor Metro Station to Bethesda Metrorail Station)* • Predominantly a six lane roadway section • Predominantly urban in nature • Buildings in close proximity to roadway south of Jones Bridge Road • Federal properties abutting both sides of roadway • Three listed historic properties • Beltway bridges • Potential connection to Purple Line

For preliminary analysis purposes, six Conceptual Alternatives were identified (see ***Figure 4-3)***. Alternative 1 (No-Build) and Alternative 2 (TSM) will automatically be moving forward to the next phase of the study to act as a basis of comparison to the refined alternatives. For purposes of this document, Alternatives 3A, 3B, 4A and 4B will be referred to as the BRT Alternatives. It is possible that one or more of the alternatives recommended for detailed study may be a hybrid of the Conceptual Alternatives as currently proposed.

The Countywide Transit Corridors Functional Master Plan made recommendations on the number of additional transit lanes and the proposed right-of-way required to accommodate the recommended typical section. In coordination with MCDOT, the MD 355 BRT Corridor Planning Study is evaluating a different running way configuration in Sections 4, 6 and 7 compared to the recommendations in the Functional Master Plan. Even though the running ways that are being investigated are different from the recommendation of the Functional Master Plan, they would still fit within the proposed right-of-way recommended in the Functional Master Plan.

Figure 4-3: Conceptual Alternatives



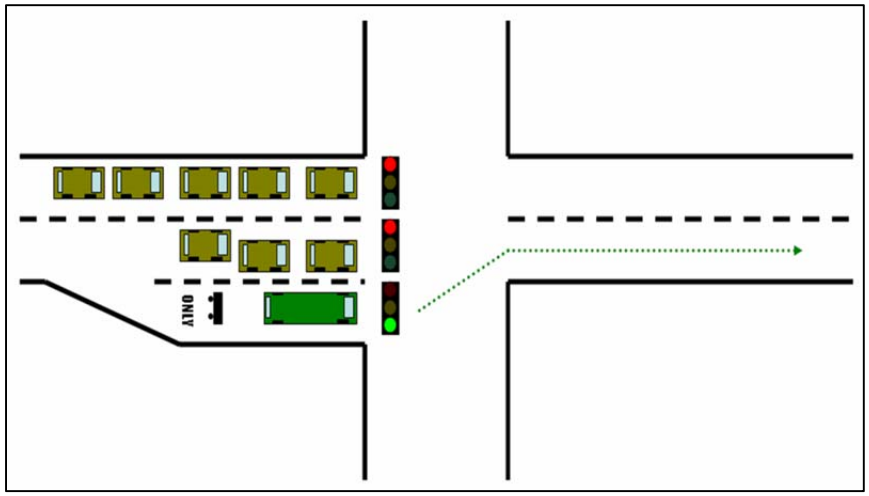
A. Alternative 1 – No-Build

Alternative 1 would consist of no improvements to infrastructure or bus service along the MD 355 Study Corridor beyond those improvements already planned and programmed in the Metropolitan Washington Council of Governments (MWCOG) Constrained Long-Range Transportation Plan (CLRP).

B. Alternative 2 – Transportation System Management (TSM)

Alternative 2 would consist of an enhanced bus service operating in mixed traffic in existing lanes in addition to minor infrastructure improvements at selected intersections. The minor infrastructure improvements would require widening at selected intersections to benefit transit service. These improvements in the form of queue jumps would enable the bus to utilize the additional travel lane on the approach to a signalized intersection and avoid waiting on the queue with all other vehicles as shown in ***Figure 4-4***.

Figure 4-4: Queue Jump



The feasibility of constructing queue jumps at selected intersections would depend on the available right-of-way and the required length of the queue bypass lane. The proposed queue jumps would serve as dedicated transit and right turn lanes.

Alternative 2 could also include Transit Signal Priority (TSP) at select intersections. TSP would require signal modifications to either extend the green phase to allow an approaching bus to pass through the intersection prior to turning to red or to provide an early green phase to a bus waiting at a red light. The application of TSP at select intersections will follow Montgomery County's TSP intersection guidance.

This alternative will be moving forward to the next phase of the study and will therefore not be used at this time for comparison purposes between the other BRT alternatives.

C. Alternative 3A

Alternative 3A (***Appendix E – Figure 1***) would provide new BRT service from the Clarksburg Outlets to the Grosvenor Metrorail Station, primarily in median lanes. The service would be in mixed traffic from the Clarksburg Outlets to Middlebrook Road along Observation Drive and on dedicated median lanes from Middlebrook Road to the Grosvenor Metrorail Station along MD 355. The following is a description of the alternative by section:

Section 7 – Clarksburg / Germantown: BRT service would operate in mixed traffic along Observation Drive as shown in ***Figure 4-5***. This change from the Countywide Transit Corridors Functional Master Plan was due to several comments from the North CAC group that requested the team investigate an alignment option along Observation Drive. The BRT would operate along the existing and planned Observation Drive roadway footprint. There are plans to extend Observation Drive north of its current termini and to tie it into Stringtown Road in Clarksburg. New BRT stations would be constructed along the BRT route, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections. The northern termini would be at the Clarksburg Outlets.

Section 6 – Germantown / Montgomery Village: BRT service would operate in two dedicated median lanes where feasible as shown in ***Figure 4-6***. The BRT lanes would narrow to one bi-directional BRT lane approaching the Middlebrook Road intersection to minimize property impacts and over the Middle Great Seneca Creek bridge in order to avoid impacts to the structure. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 5 – Gaithersburg: BRT service would operate in one dedicated bi-directional median lane as shown in ***Figure 4-7***. Passing areas would be created where feasible to accommodate BRT service in both directions. The dedicated BRT lane would be created by repurposing the center left turn lane. All left turns would be made at signalized intersections. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections.

Section 4 – Shady Grove / Rockville: BRT service would operate in two dedicated median lanes where feasible as shown in ***Figure 4-8***. The BRT lanes would narrow to one bi-directional BRT lane north of the Deer Park Road intersection to minimize residential displacements. The BRT lanes would also narrow to one bi-directional BRT lane under the I-370 overpass (between Shady Grove Road and South Westland Drive) in order to avoid impacts to the structure. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 3 – Rockville Town Center: BRT service would operate in one dedicated bi-directional median lane as shown in ***Figure 4-9***. Passing areas would be created where feasible to accommodate BRT service in both directions. The dedicated BRT lane would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 2 – Rockville / White Flint: BRT service would operate in two dedicated median lanes, where feasible, as shown in ***Figure 4-10***. The dedicated BRT lanes would be created by widening the roadway to the outside. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 1 – Bethesda: No BRT service would operate between the Bethesda Metrorail Station and the Grosvenor Metrorail Station.

Figure 4-5: Alternative 3A - Section 7: Clarksburg / Germantown

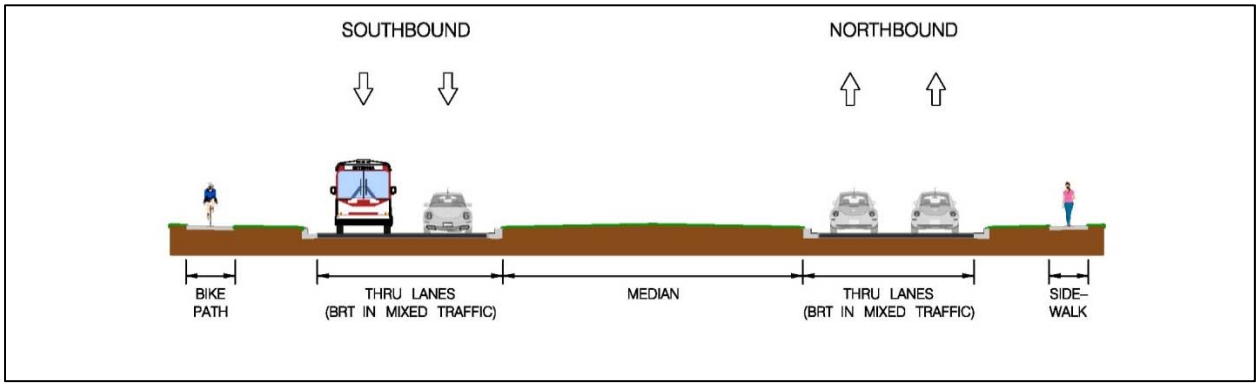


Figure 4-6: Alternative 3A - Section 6: Germantown / Montgomery Village

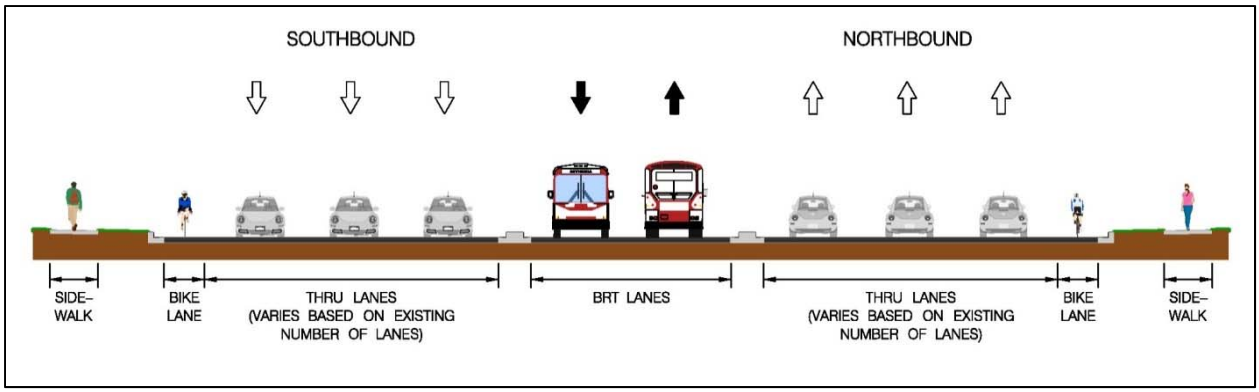


Figure 4-7: Alternative 3A - Section 5: Gaithersburg

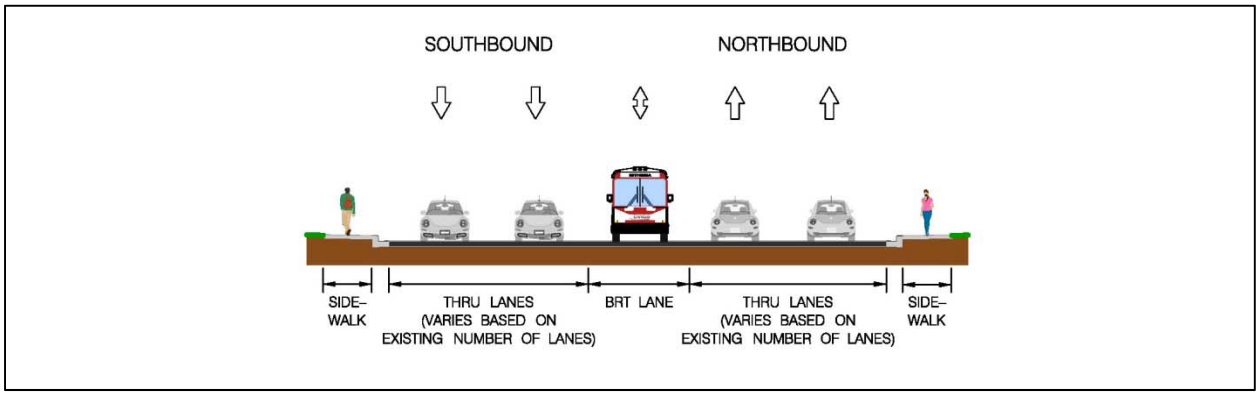


Figure 4-8: Alternative 3A - Section 4: Shady Grove / Rockville

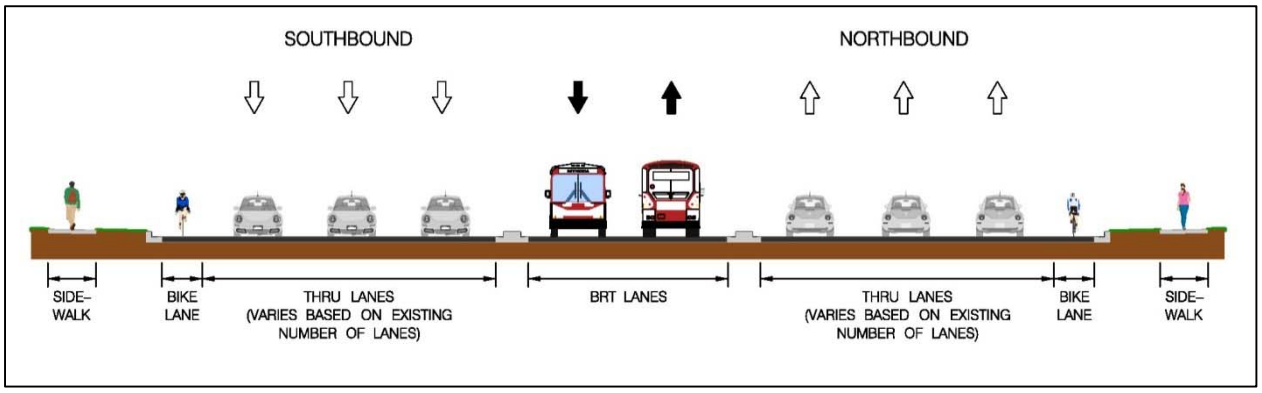


Figure 4-9: Alternative 3A - Section 3: Rockville Town Center

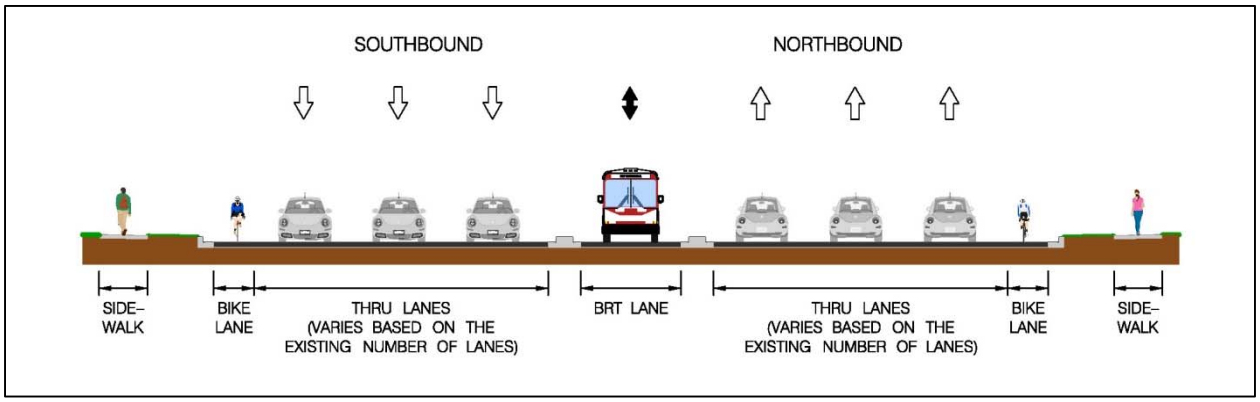
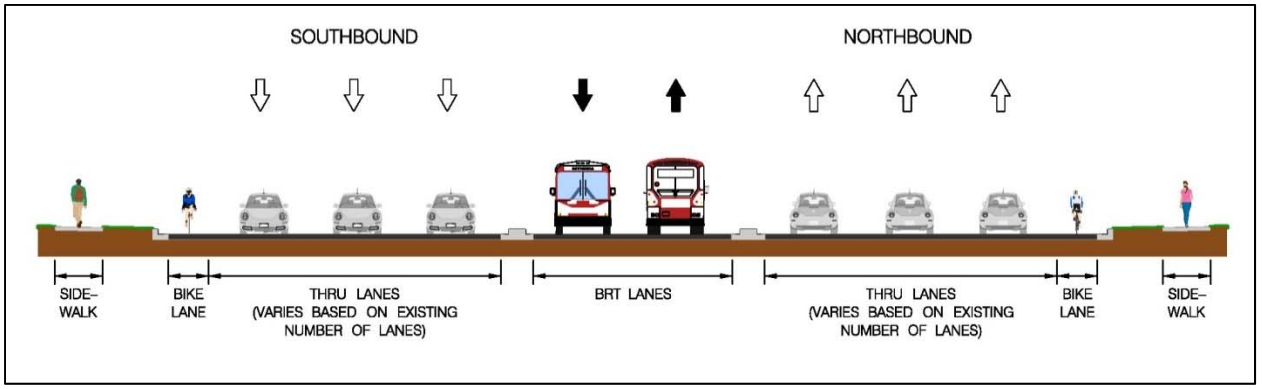


Figure 4-10: Alternative 3A - Section 2: Rockville / White Flint



D. Alternative 3B

Alternative 3B (***Appendix E – Figure 2***) would provide new BRT service from Redgrave Place in Clarksburg to the Bethesda Metrorail Station, primarily in median lanes. The service would be on dedicated lanes from Redgrave Place to the Bethesda Metrorail Station along MD 355. Only Sections 7, 3, and 1 are different than what was previously described in Alternative 3A. The following is a description of the alternative by section:

Section 7 – Clarksburg / Germantown: BRT service would operate in two dedicated median lanes where feasible as shown in ***Figure 4-11***. The two dedicated median BRT lanes would narrow to one bi-directional BRT lane approaching the MD 121 (Stringtown Road) intersection to minimize property impacts. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 6 – Germantown / Montgomery Village: As in Alternative 3A, BRT service would operate in two dedicated median lanes where feasible as shown in ***Figure 4-12***. The two dedicated median BRT lanes would narrow to one bi-directional BRT lane over the Middle Great Seneca Creek Bridge in order to avoid impacts to the structure and approaching the Middlebrook Road intersection to minimize property impacts. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 5 – Gaithersburg: As in Alternative 3A, BRT service would be provided in one dedicated bi-directional median lane as shown in ***Figure 4-13***. Passing areas would be created wherever feasible to accommodate BRT service in both directions. The dedicated BRT lane would be created by repurposing the center left turn lane. All left turns would be made at signalized intersections. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections.

Section 4 – Shady Grove / Rockville: As in Alternative 3A, BRT service would operate in two dedicated median lanes where feasible as shown in ***Figure 4-14***. The two dedicated median BRT lanes would narrow to one bi-directional BRT lane under the I-370 overpass (between Shady Grove Road and South Westland Drive) in order to avoid impacts to the structure. The lanes would also narrow to one bi-directional BRT lane north of the Deer Park Road intersection to minimize residential displacements. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 3 – Rockville Town Center: BRT service would operate in two dedicated median lanes as shown in ***Figure 4-15***. The dedicated BRT lanes would be created by repurposing two existing travel lanes in this section. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections.

Section 2 – Rockville / White Flint: As in Alternative 3A, BRT service would operate in two dedicated median lanes, where feasible, as shown in ***Figure 4-16***. The dedicated BRT lanes would be created by widening the roadway to the outside. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 1 – Bethesda: BRT service would operate between the Grosvenor Metrorail Station to the Bethesda Metrorail Station on the curb lane. No median running way was investigated due to the proposed dynamic lane operation that would prohibit stations located in the median. In order to minimize property impacts in this very constrained area, an off-peak direction lane would be repurposed to create a reversible roadway with different AM and PM lane configurations as shown in ***Figure 4-17*** and ***Figure 4-18*** for the AM peak period and as shown in ***Figure 4-19*** and ***Figure 4-20*** for the PM peak period. The lane repurposing would occur between the Pooks Hill Road and the Bethesda Metrorail Station; the BRT would run in mixed traffic between Tuckerman Lane and Pooks Hill Road over the bridges of the Capital Beltway. New BRT stations would be constructed along the BRT route, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Figure 4-11: Alternative 3B - Section 7: Clarksburg / Germantown

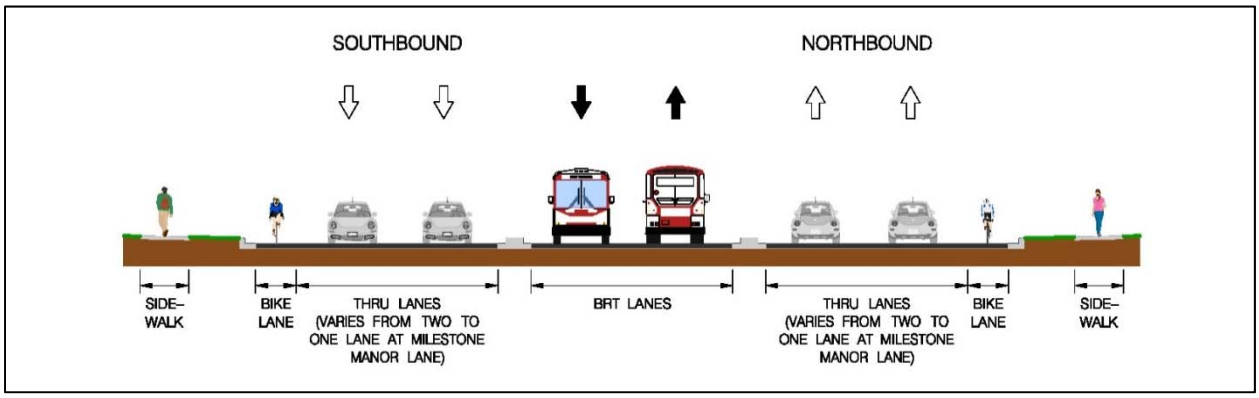


Figure 4-12: Alternative 3B - Section 6: Germantown / Montgomery Village

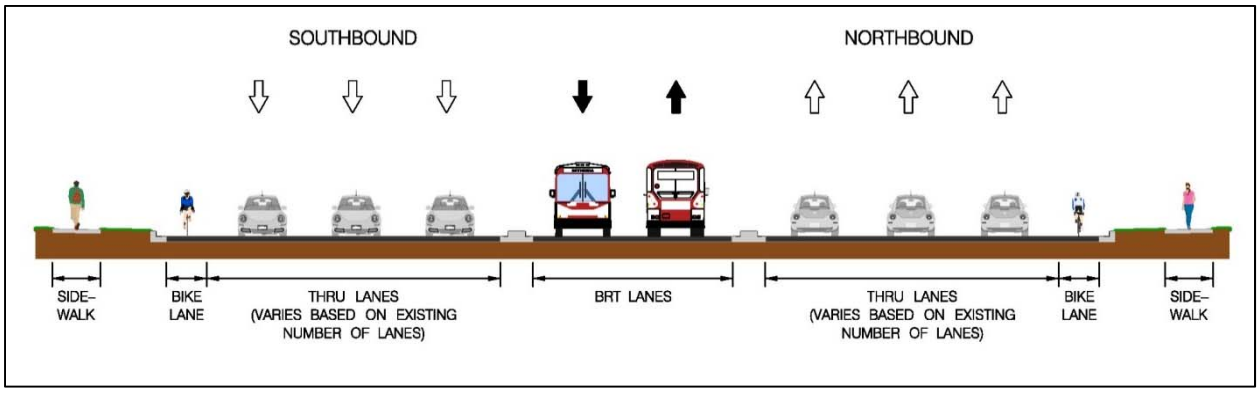


Figure 4-13: Alternative 3B - Section 5: Gaithersburg

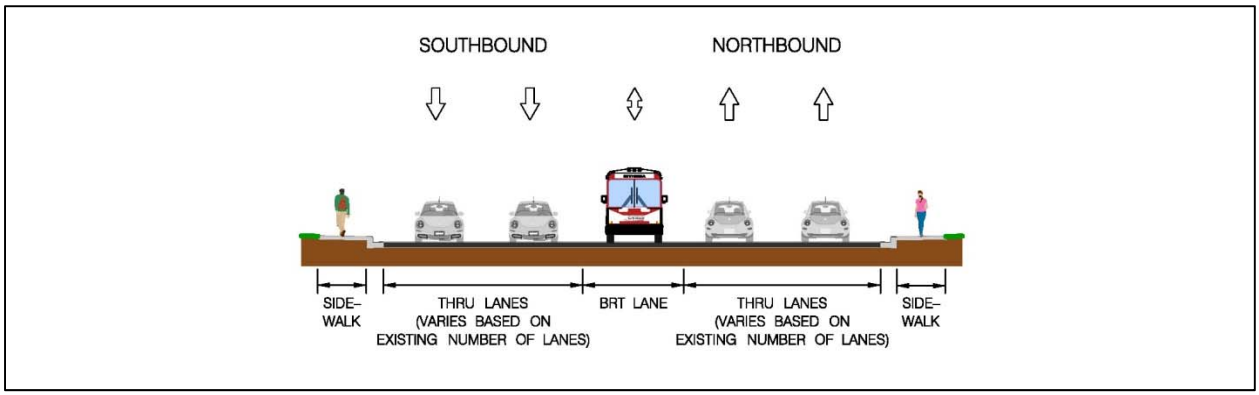


Figure 4-14: Alternative 3B - Section 4: Shady Grove / Rockville

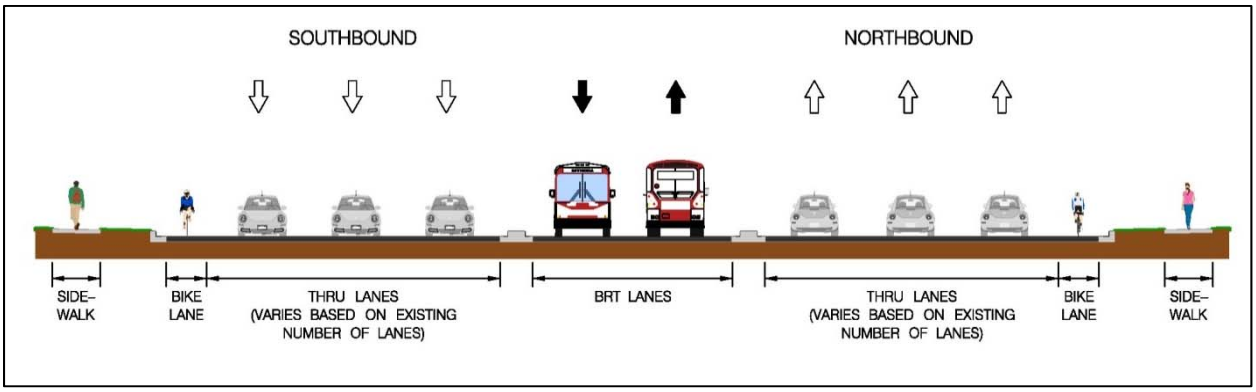


Figure 4-15: Alternative 3B - Section 3: Rockville Town Center

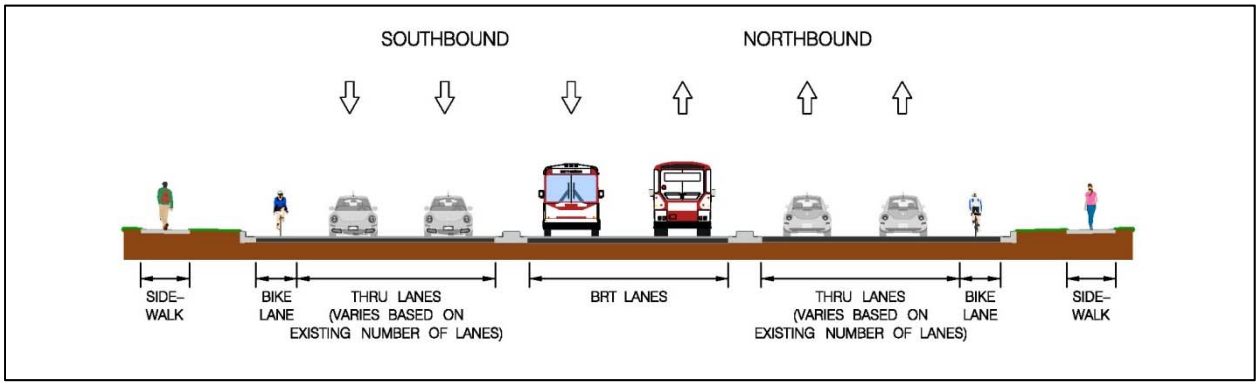


Figure 4-16: Alternative 3B - Section 2: Rockville / White Flint

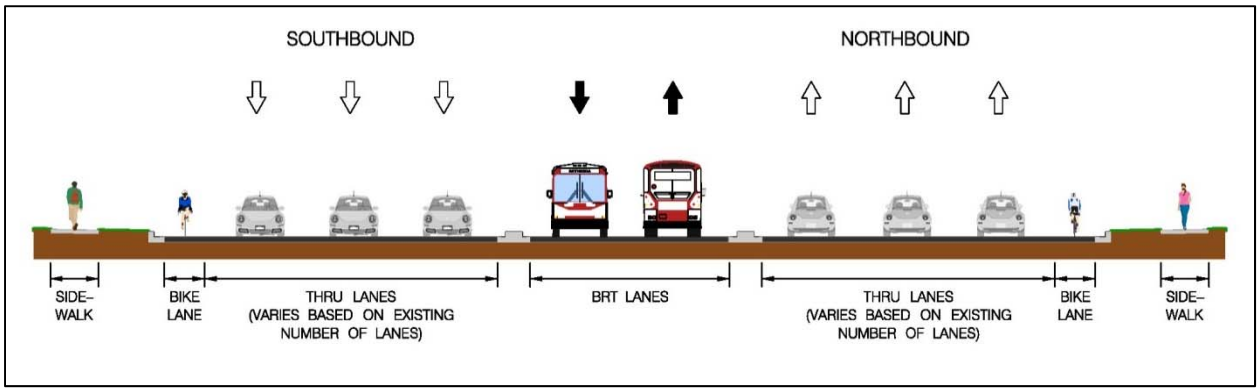


Figure 4-17: Alternative 3B - Section 1: Bethesda - AM Peak Period – Pooks Hill Road to Jones Bridge Road

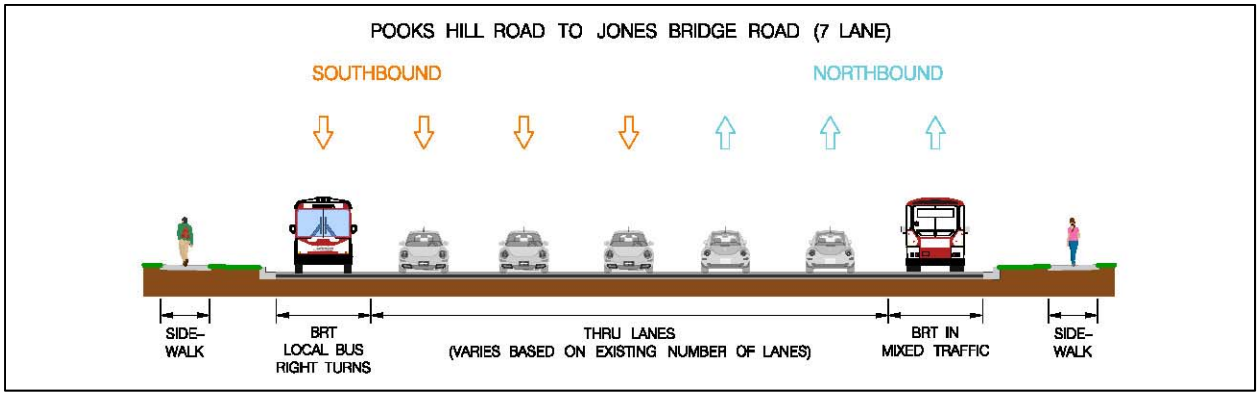


Figure 4-18: Alternative 3B - Section 1: Bethesda - AM Peak Period - Jones Bridge Road to Bethesda Metrorail Station

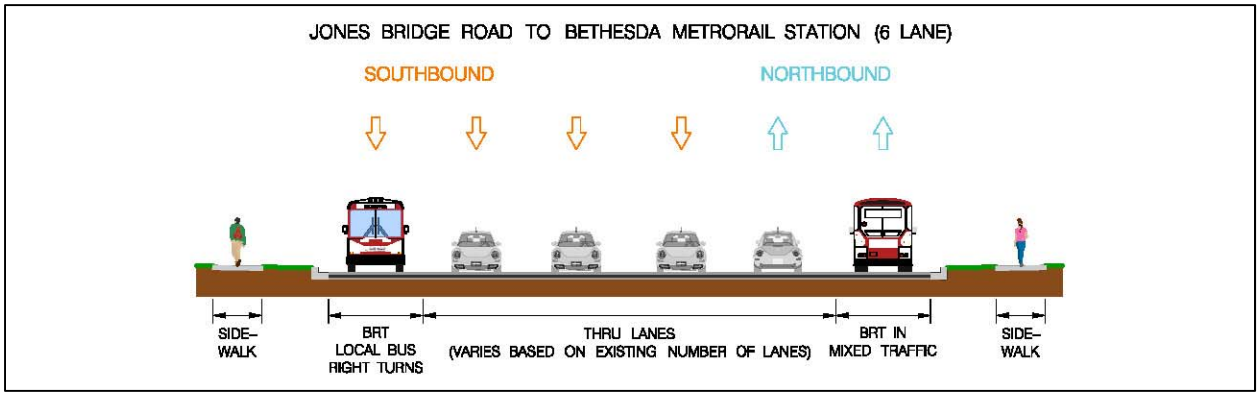


Figure 4-19: Alternative 3B - Section 1: Bethesda - PM Peak Period – Pooks Hill Road to Jones Bridge Road

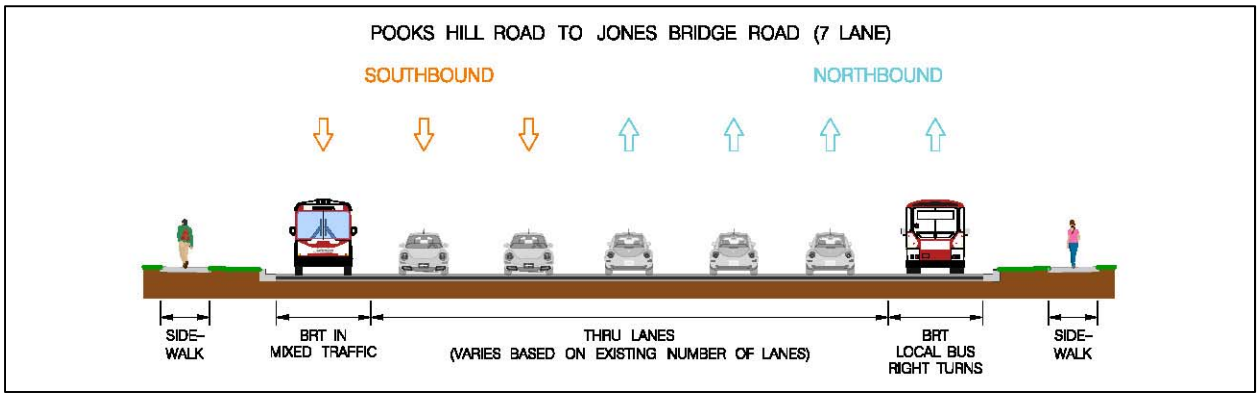
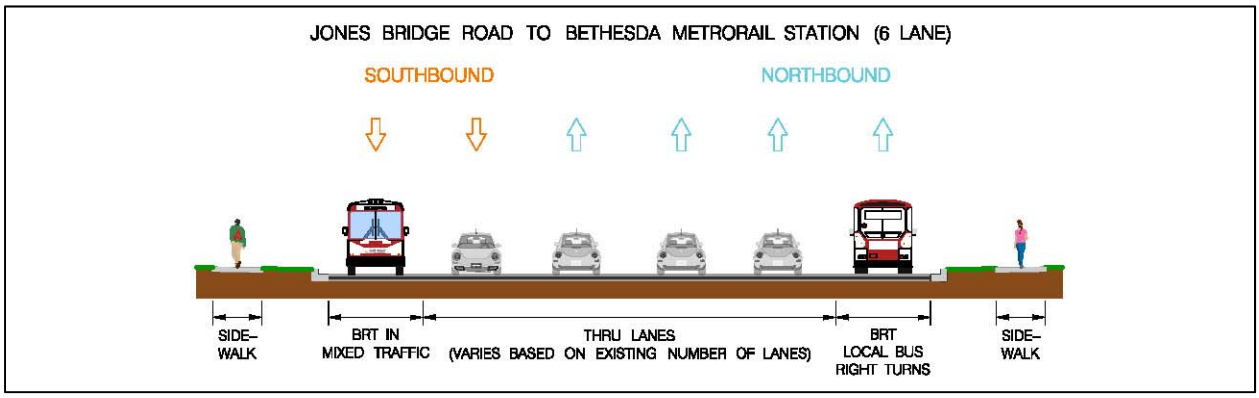


Figure 4-20: Alternative 3B - Section 1: Bethesda - PM Peak Period - Jones Bridge Road to Bethesda Metrorail Station



E. Alternative 4A

Alternative 4A (***Appendix E – Figure 3***) would provide new BRT service from Redgrave Place in Clarksburg to the Grosvenor Metrorail Station, primarily in curb lanes. The service would be on dedicated lanes from Redgrave Place to the Grosvenor Metrorail Station along MD 355. The following is a description of the alternative by section:

Section 7 – Clarksburg / Germantown: BRT service would operate in two dedicated curb lanes where feasible as shown in ***Figure 4-21***. The BRT would run in mixed traffic north of MD 121 (Stringtown Road). The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 6 – Germantown / Montgomery Village: BRT service would operate in two dedicated curb lanes where feasible as shown in ***Figure 4-22***. The BRT would run in mixed traffic in the vicinity of the Middle Great Seneca Creek Bridge, Seneca Creek State Park, and Great Seneca Stream Valley Park in order to avoid impacts to the structure and minimize environmental impacts. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. The curb lanes would be shared with local buses and all turns to and from MD 355. New BRT stations would be constructed along the

BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 5 – Gaithersburg: BRT service would operate in one dedicated bi-directional median lane as shown in ***Figure 4-23***. Passing areas would be created wherever feasible to accommodate BRT service in both directions. The dedicated BRT lane would be created by repurposing the center left turn lane. All left turns would be made at signalized intersections. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections.

Section 4 – Shady Grove / Rockville: As in Alternatives 3A and 3B, BRT service would operate in two dedicated median lanes where feasible as shown in ***Figure 4-24***. The BRT would stay in the median in this section to reduce the number of transitions from median to curb operation. The two dedicated median BRT lanes would narrow to one bi-directional BRT lane under the I-370 overpass (between Shady Grove Road and South Westland Drive) in order to avoid impacts to the structure. The median would also narrow to one bi-directional BRT lane north of the Deer Park Road intersection to minimize property impacts. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 3 – Rockville Town Center: As in Alternative 3A, BRT service would operate in one dedicated bi-directional median lane as shown in ***Figure 4-25***. Passing areas would be created wherever feasible to accommodate BRT service in both directions. The bi-directional BRT lane would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 2 – Rockville / White Flint: BRT service would operate in two dedicated curb lanes where feasible as shown in ***Figure 4-26***. The BRT would run in mixed traffic in the vicinity of the Montrose Parkway interchange in order to avoid impacts to the structure. The dedicated BRT lanes would be created by widening the roadway to the outside. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 1 – Bethesda: Same as Alternative 3A, no BRT service would operate between the Grosvenor Metrorail Station and the Bethesda Metrorail Station.

Figure 4-21: Alternative 4A - Section 7: Clarksburg / Germantown

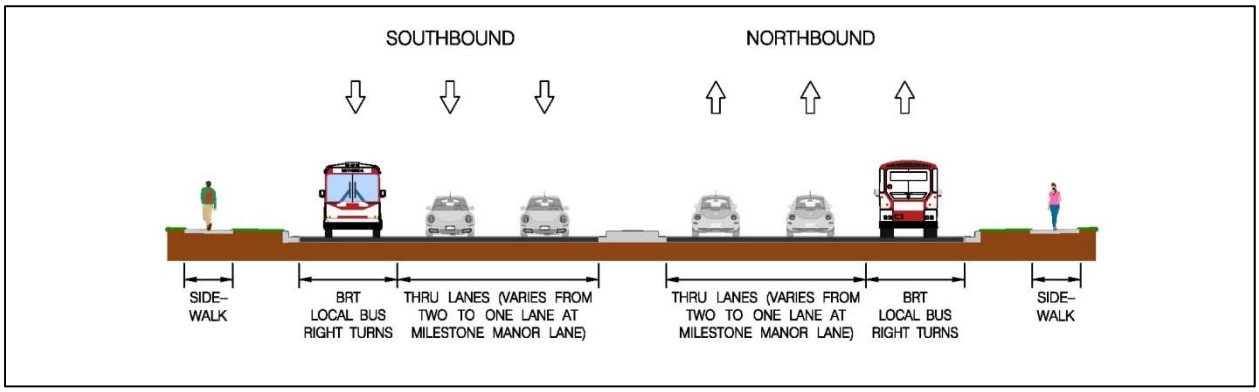


Figure 4-22: Alternative 4A - Section 6: Germantown / Montgomery Village

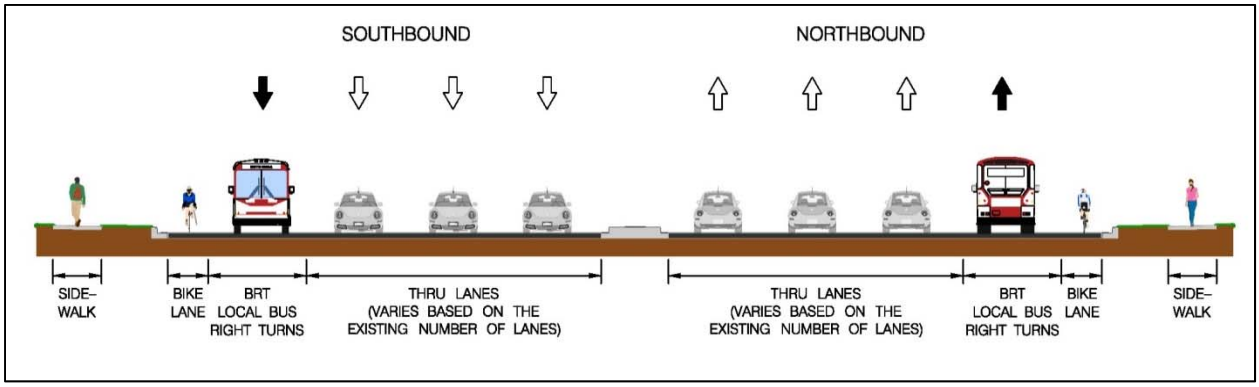


Figure 4-23: Alternative 4A - Section 5: Gaithersburg

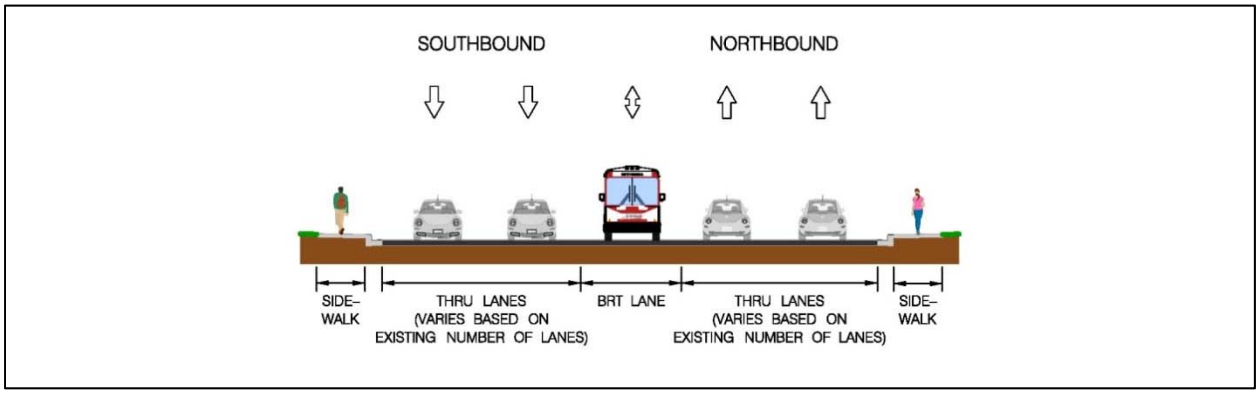


Figure 4-24: Alternative 4A - Section 4: Shady Grove / Rockville

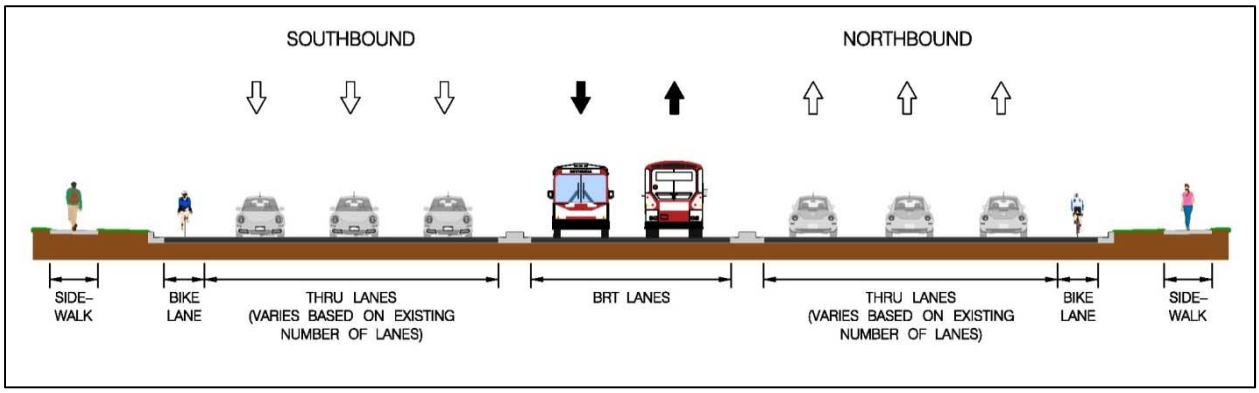


Figure 4-25: Alternative 4A - Section 3: Rockville Town Center

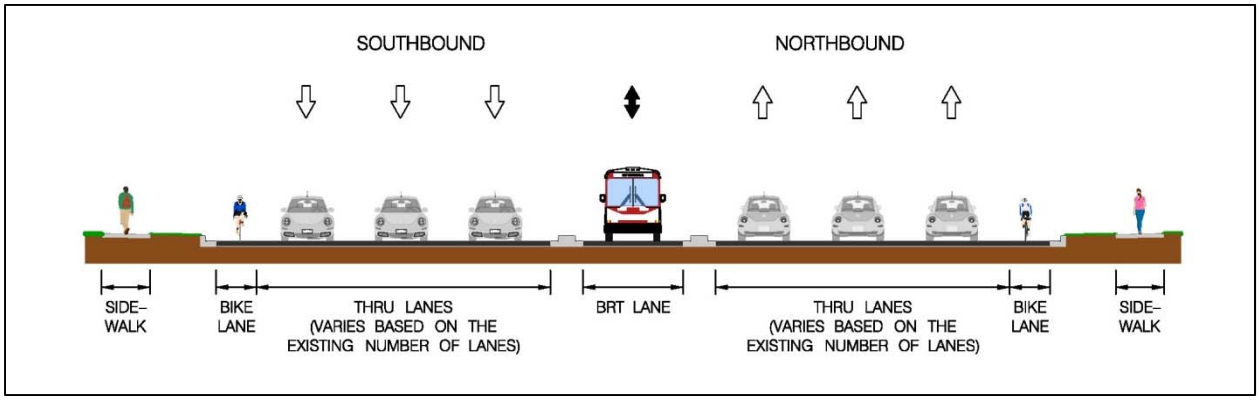
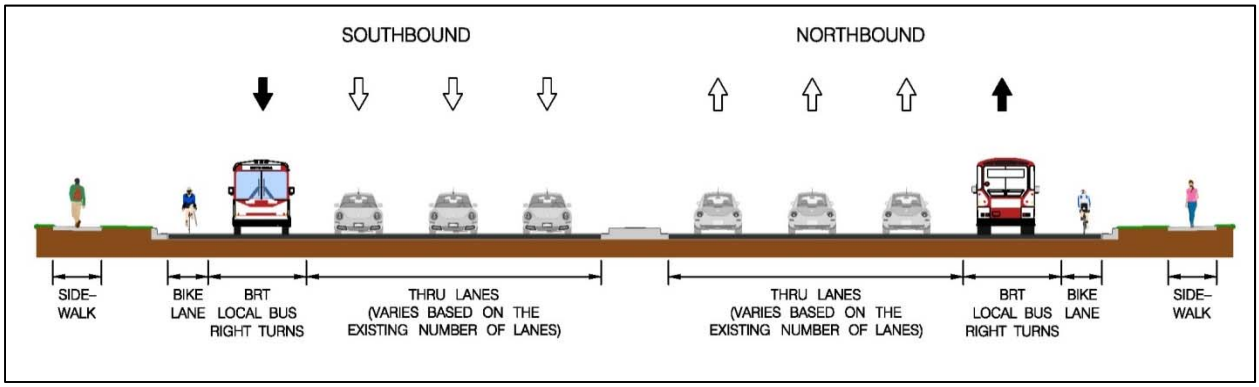


Figure 4-26: Alternative 4A - Section 2: Rockville / White Flint



F. Alternative 4B

Alternative 4B (***Appendix E – Figure 4***) would provide new BRT service from Redgrave Place in Clarksburg to the Bethesda Metrorail Station, primarily in curb lanes. The service would be on dedicated curb lanes from Redgrave Place to the Bethesda Metrorail Station along MD 355. The following is a description of the alternative by section:

Section 7 – Clarksburg / Germantown: BRT service would operate in two dedicated curb lanes where feasible as shown in ***Figure 4-27***. The BRT would run in mixed traffic north of MD 121 (Stringtown Road).

The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 6 – Germantown / Montgomery Village: BRT service would operate in two dedicated curb lanes where feasible as shown in ***Figure 4-28***. The BRT would run in mixed traffic in the vicinity of the Middle Great Seneca Creek Bridge, Seneca Creek State Park, and Great Seneca Stream Valley Park, in order to avoid impacts to the structure and minimize environmental impacts. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 5 – Gaithersburg: BRT service would operate in one dedicated bi-directional median lane as shown in ***Figure 4-29***. Passing areas would be created wherever feasible to accommodate BRT service in both directions. The dedicated BRT lane would be created by repurposing the center left turn lane. All left turns would be made at signalized intersections. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections.

Section 4 – Shady Grove / Rockville: BRT service would operate in two dedicated curb lanes where feasible as shown in ***Figure 4-30***. The BRT would run in mixed traffic in the vicinity of the I-370 overpass in order to avoid impacts to the structure. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 3 – Rockville Town Center: BRT service would operate in two dedicated curb lanes as shown in ***Figure 4-31***. The dedicated BRT lane would be created by repurposing the two existing outside travel lanes in this section. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at the signalized intersections.

Section 2 – Rockville / White Flint: Same as Alternative 4A, BRT service would operate in two dedicated curb lanes where feasible as shown in ***Figure 4-32***. The BRT would run in mixed traffic in the vicinity of the Montrose Parkway interchange in order to avoid impacts to the structure. The dedicated BRT lanes would be created by widening the roadway to the outside. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 1 – Bethesda: As in Alternative 3B, BRT service would operate between the Grosvenor Metrorail Station to the Bethesda Metrorail Station on the curb lane. In order to minimize property impacts in this very constrained area, an off-peak direction lane would be repurposed to create a reversible roadway with different AM and PM lane configurations as shown in ***Figure 4-33*** and ***Figure 4-34*** for the AM peak period, and as shown in ***Figure 4-35*** and ***Figure 4-36*** for the PM peak period. The lane repurposing would occur between Pooks Hill Road to the Bethesda Metrorail Station; the BRT would run in mixed traffic between

Tuckerman Lane and Pooks Hill Road over the bridges of the Capital Beltway. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Figure 4-27: Alternative 4B - Section 7: Clarksburg / Germantown

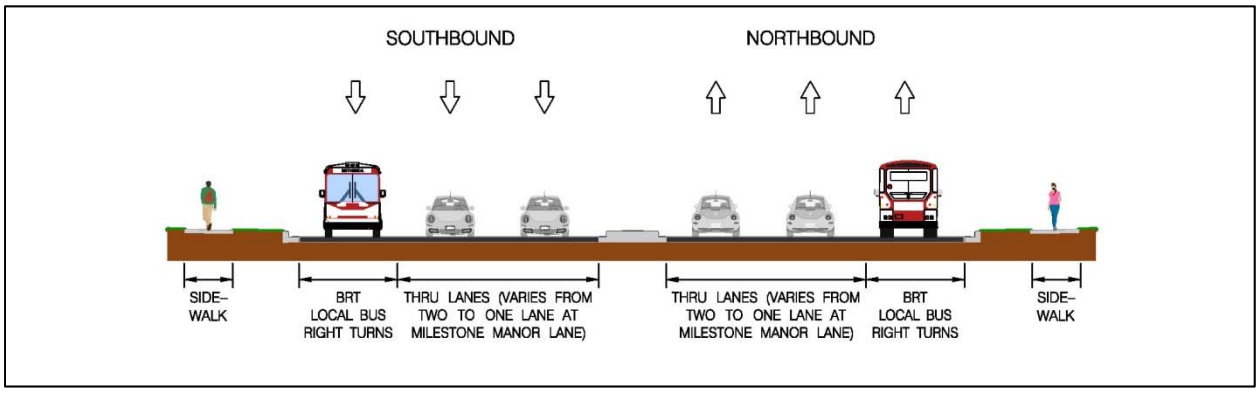


Figure 4-28: Alternative 4B - Section 6: Germantown / Montgomery Village

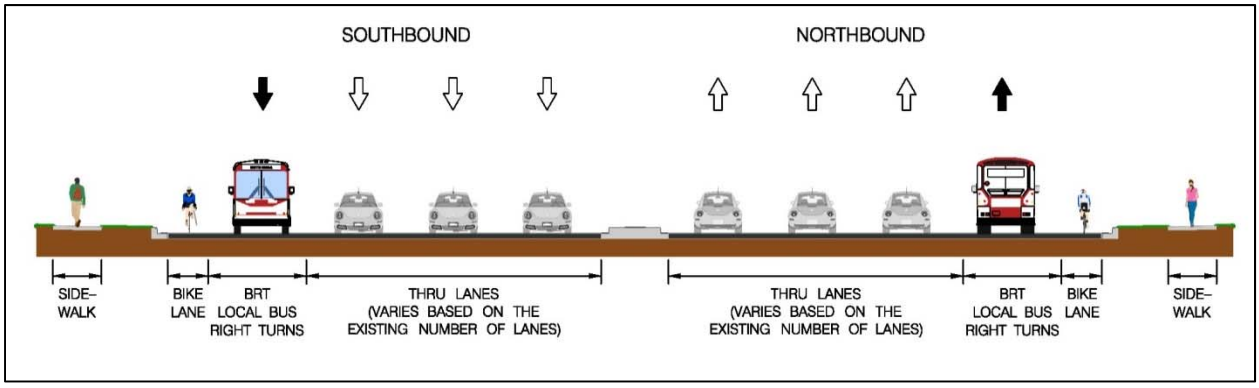


Figure 4-29: Alternative 4B - Section 5: Gaithersburg

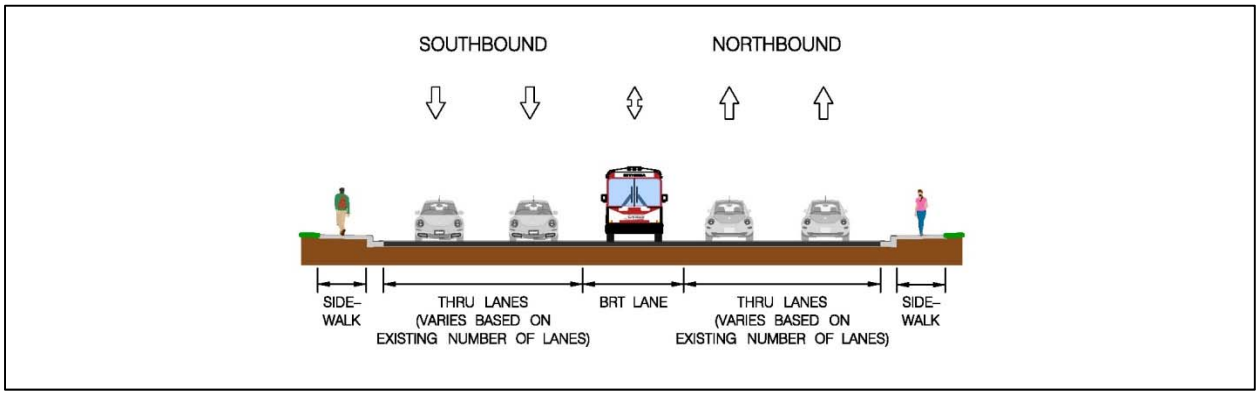


Figure 4-30: Alternative 4B - Section 4: Shady Grove / Rockville

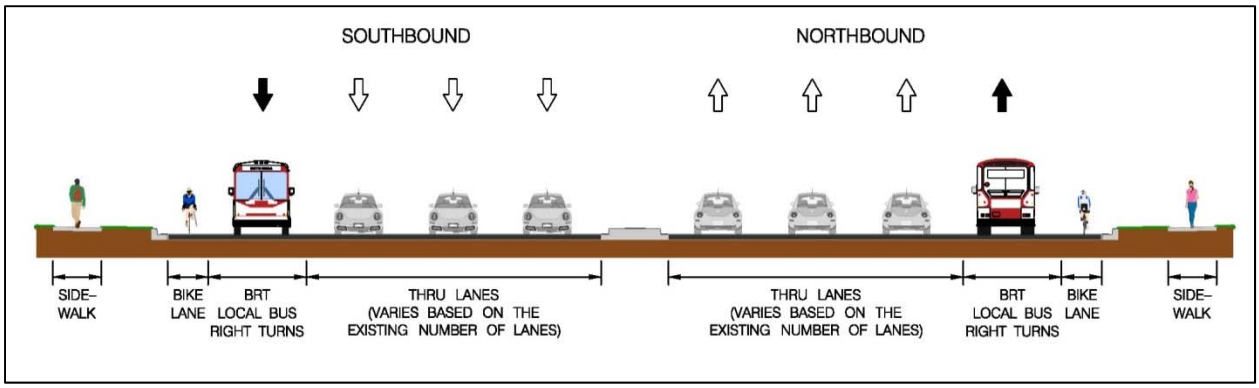


Figure 4-31: Alternative 4B - Section 3: Rockville Town Center

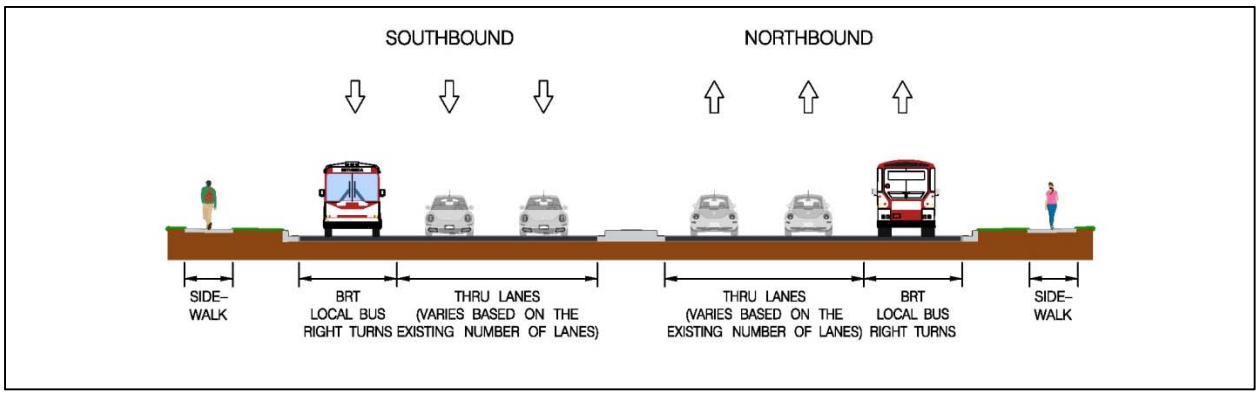


Figure 4-32: Alternative 4B - Section 2: Rockville / White Flint

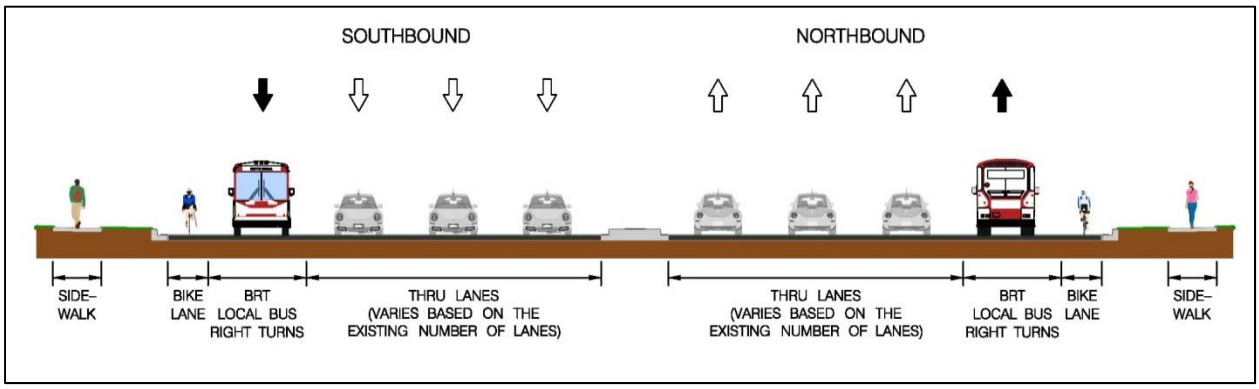


Figure 4-33: Alternative 4B - Section 1: Bethesda - AM Peak Period – Pooks Hill Road to Jones Bridge Road

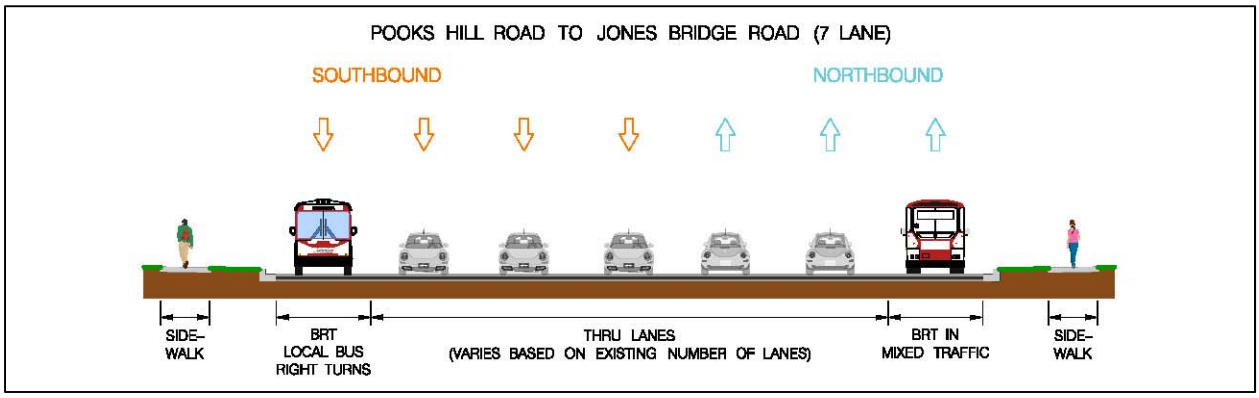


Figure 4-34: Alternative 4B - Section 1: Bethesda - AM Peak Period - Jones Bridge Road to Bethesda Metrorail Station

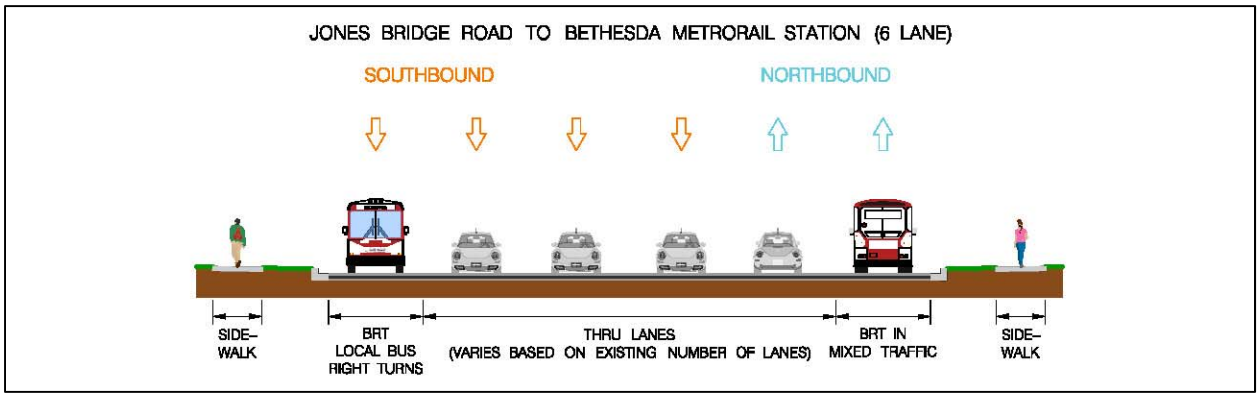


Figure 4-35: Alternative 4B - Section 1: Bethesda - PM Peak Period – Pooks Hill Road to Jones Bridge Road

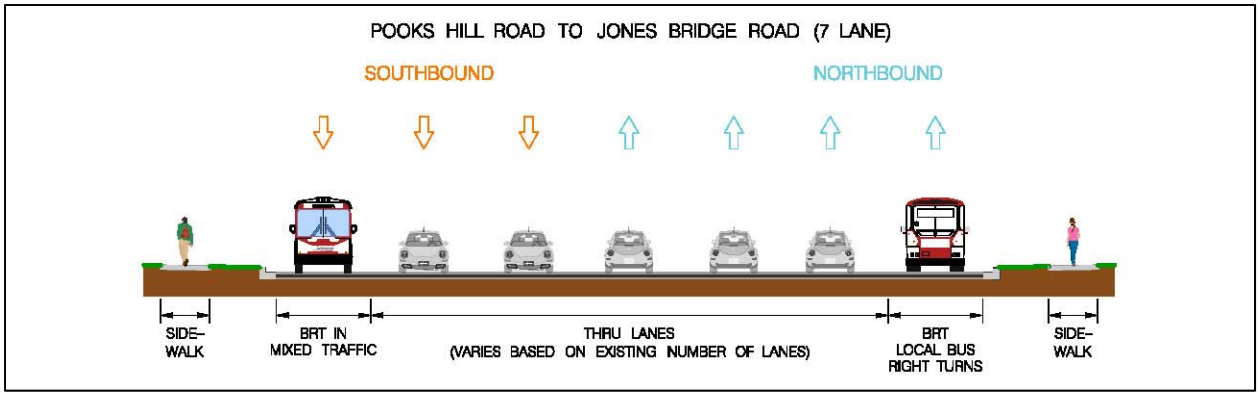
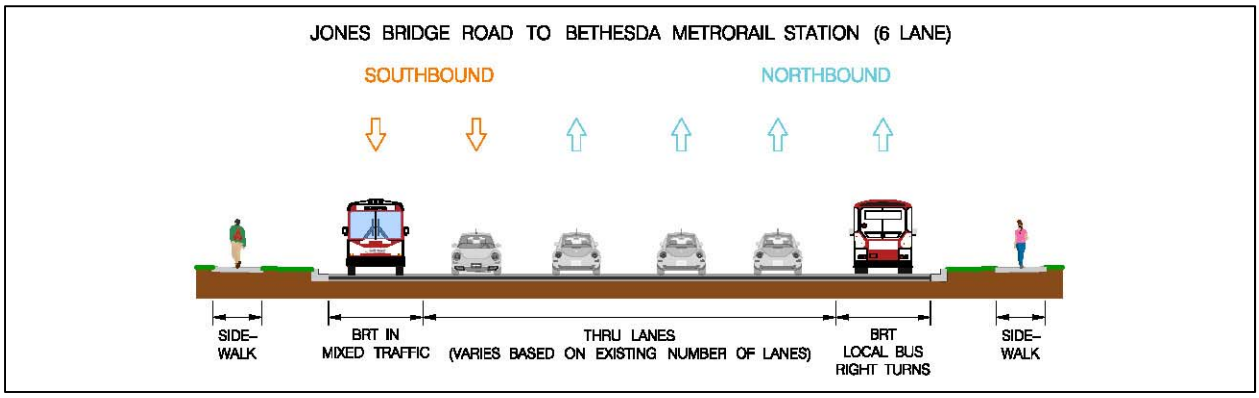


Figure 4-36: Alternative 4B - Section 1: Bethesda - PM Peak Period - Jones Bridge Road to Bethesda Metrorail Station



4.3 Station Locations and Service Plan

In addition to the running way, the two other elements that define the alternatives are the station locations and BRT service plan.

The Service Plan includes three proposed BRT route patterns. The three route patterns and service frequency are described on ***Table 4-2*** and ***Figure 4-37***.

Table 4-2: BRT Service Plan

BRT Route	Northern Terminal	Southern Terminal	Service Frequency (Minutes)
Orange	Redgrave Place or Clarksburg Outlets	Rockville Metrorail Station	10
Blue	Lakeforest Transit Center	Rockville Metrorail Station	12
Purple	Montgomery College – Rockville Campus	Grosvenor or Bethesda Metrorail Station	3.5 – 5

The Countywide Transit Corridors Functional Master Plan made recommendations on where stations should be located along the MD 355 corridor. Adjustments were made to these original station locations based on coordination with the City of Gaithersburg, City of Rockville, M-NCPPC, MCDOT and in response to CAC comments. The station location modified since the Functional Master Plan are described on ***Table 4-3***.

Table 4-3: Preliminary Station Locations – Modifications

Master Plan Station Location	Proposed Modification	Reason
Shawnee Lane	Eliminated	Serves very similar area to Foreman Boulevard Station.
West Old Baltimore Road	Eliminated	Low density. Lack of pedestrian access.
MD 27 Ridge Road	Eliminated	Congested intersection. Serves very similar area to Shakespeare Boulevard Station.
MD 124 (Montgomery Village Avenue)	Eliminated	Eliminated based on City of Gaithersburg BRT Study.
Lakeforest Transit Center	Added	Comment from CAC
Brookes Avenue	Moved to Chestnut Street / Walker Avenue	Moved based on City of Gaithersburg BRT Study.
Odenhall Avenue	Moved to Lakeforest Boulevard	Moved based on City of Gaithersburg BRT Study.
Cedar Avenue / Fulks Corner Avenue	Added	Added based on City of Gaithersburg BRT Study.
Shady Grove Road	Eliminated	Congested intersection. Low density. Comment from CAC.
King Farm Boulevard	Move to Shady Grove Metro	Closer connection to Metro. Shuttle available from King Farm to Metro. Comment from CAC.
Gude Drive	Move to Indianola Drive	Better serve residential and commercial areas.
Montgomery College (Rockville)	Added	Closer connection to Montgomery College.

The City of Gaithersburg BRT Study identified an additional station at North Westland Drive. In consultation with City of Gaithersburg it was determined that a better location for this station would be South Westland Drive since a signal already exists at this intersection. However, this station would be planned as a future station and the alternatives should not preclude the construction of a station at this intersection.

As discussed earlier in this Chapter, the Observation Drive alignment was included as part of Alternative 3A. The station locations included as part of the Observation Drive alignment are described on ***Table 4-4***.

Table 4-4: Preliminary Station Locations – Observation Drive Alignment (Alternative 3A)

Master Plan Station Location	Proposed Modification	Reason
Clarksburg Outlets	Proposed	Serves existing and future commercial and residential areas. Proposed by member of public.
North of MD 121 (Future Clarksburg Town Center)	Proposed	Consistent with CCT Master Plan
Shawnee Lane	Proposed	Consistent with CCT Master Plan
COMSAT	Proposed	Connection to Corridor Cities Transitway (CCT)
Milestone Center Drive	Proposed	Serves commercial and residential areas
Shakespeare Boulevard	Proposed	Serves existing and future commercial areas
Montgomery College (Germantown)	Proposed	Serves Montgomery College
Holy Cross Hospital	Proposed	Serves hospital
Middlebrook Road	Eliminated	Transition from dedicated to mixed traffic and intersection geometry.

The station locations are shown in ***Figure 4-37 and Table 4-5.***

Figure 4-37: Proposed Station Locations and Service Plan

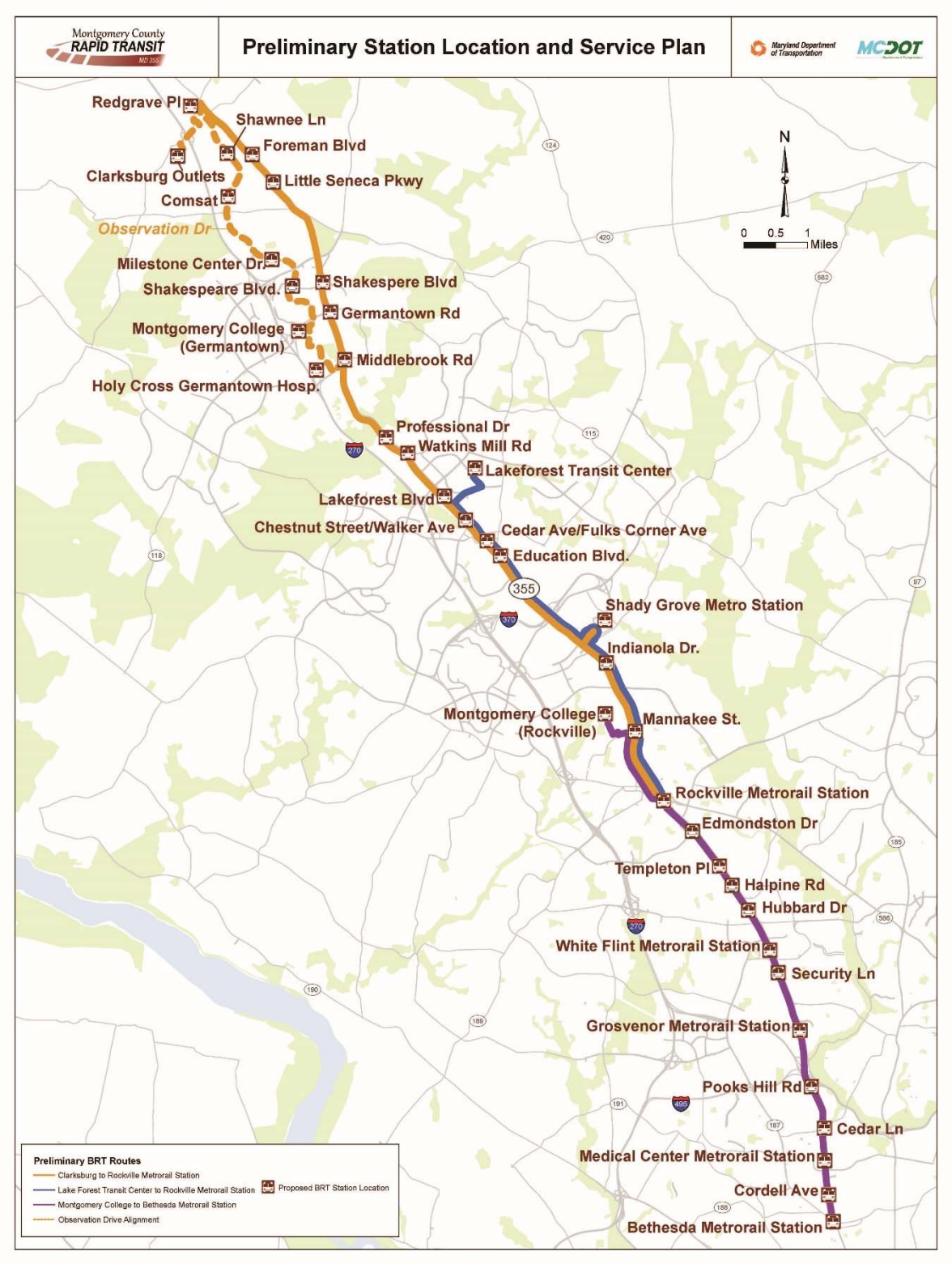
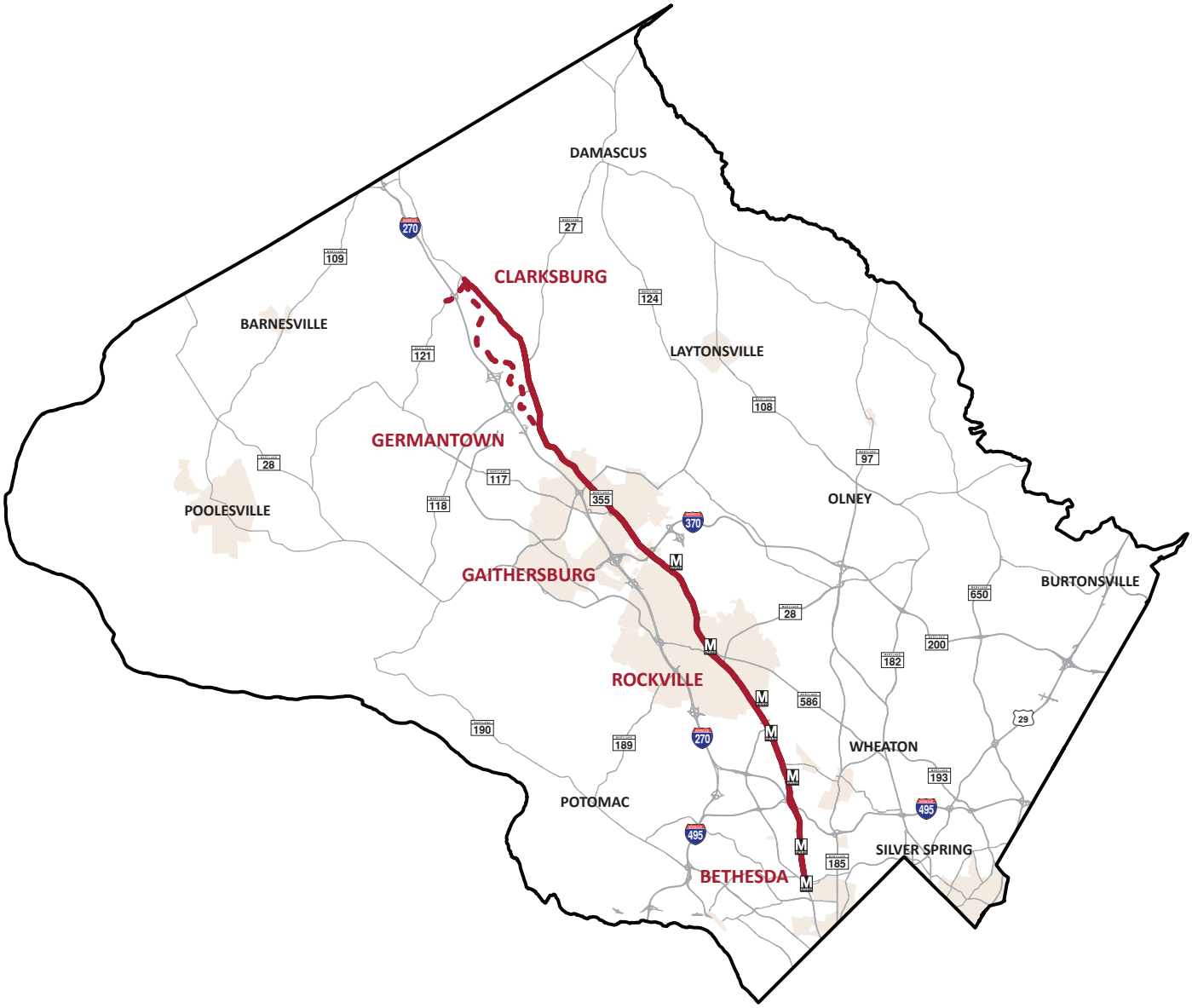


Table 4-5: Station Location by Alternative

	Alternative				Route		
	3A	3B	4A	4B	Purple	Blue	Orange
Clarksburg Outlets	●						
Redgrave Place	●	●	●	●			
Shawnee Lane (Observation Drive)	●						
COMSAT (Observation Drive)	●						
Milestone Center Drive (Observation Drive)	●						
Shakespeare Boulevard (Observation Drive)	●						
Montgomery College – Germ. (Observation Drive)	●						
Holy Cross Hospital (Observation Drive)	●						
Foreman Boulevard		●	●	●			
Little Seneca Parkway		●	●	●			
Shakespeare Boulevard		●	●	●			
MD 118 (Germantown Rd)		●	●	●			
Middlebrook Road		●	●	●			
Professional Drive	●	●	●	●			
Watkins Mill Road	●	●	●	●			
Lakeforest Transit Center	●	●	●	●			
Lakeforest Boulevard	●	●	●	●			
Chestnut Street / Walker Avenue	●	●	●	●			
Cedar Avenue / Fulks Corner Avenue	●	●	●	●			
Education Boulevard	●	●	●	●			
Shady Grove Metrorail Station	●	●	●	●			
Indianola Drive	●	●	●	●			

	Alternative				Route		
	3A	3B	4A	4B	Purple	Blue	Orange
Montgomery College (Rockville Campus)	●	●	●	●			
Mannakee Street	●	●	●	●			
Rockville Metrorail Station	●	●	●	●			
Edmonston Drive	●	●	●	●			
Templeton Place	●	●	●	●			
Halpine Road	●	●	●	●			
Hubbard Drive	●	●	●	●			
White Flint Metrorail Station	●	●	●	●			
Security Lane	●	●	●	●			
Grosvenor Metrorail Station	●	●	●	●			
Pooks Hill Road		●		●			
Cedar Lane		●		●			
Medical Center Metrorail Station		●		●			
Cordell Avenue		●		●			
Bethesda Metrorail Station		●		●			
Total Number of Stations	**27**	**30**	**25**	**30**			

Montgomery County
RAPID TRANSIT
MD 355



MARYLAND DEPARTMENT OF TRANSPORTATION

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Montgomery County
Department of Transportation

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Chapter 5.0

Transit and Transportation Analysis

5.1 Introduction

The purpose of this chapter is to outline the results of the evaluation of the transit and transportation components of each of the four BRT alternatives. These evaluation results were used to identify those elements of each BRT alternative that provide the least benefit or result in the highest costs relative to the overall goals for the MD 355 BRT. These elements are then screened out as the BRT alternatives that are moving forward into the next phase of the project are developed and selected. It is very important to note that this evaluation reflects the preliminary level of design and analysis detail that is commensurate with this early stage of the project. To that end, the evaluation and comparison of alternatives that is documented here is done at a qualitative level and is based on a series of screening criteria that, combined, provide an understanding of the full range of transit and transportation costs and benefits of each BRT alternative. The framework for the comparison of alternatives is a ranking of each alternative, for each screening criteria, based on a three-tier ranking system that incorporates the ranks of lower, medium, or higher. These rankings in turn are based on underlying data generated utilizing traffic simulation and ridership forecasting models of the four BRT alternatives. As noted, the underlying data generated reflects a level of accuracy and detail that is commensurate with the project's early stages. The implementation of a new, proposed express bus service by MCDOT along MD 355 in late 2017, may have an impact on future travel forecast and selection criteria results in future phases of the study.

The ranking of each alternative is based on how each alternative falls around the mean of the underlying data for each specific criterion. For each criterion, a ranking of medium was given to those alternatives that fall within one-half a standard deviation around the mean either below or above the mean. A ranking of lower was given to alternatives that fall outside a one-half standard deviation below the mean and a ranking of higher was given to alternatives that fall outside a one-half standard deviation above the mean. This approach is summarized in ***Table 5-1*** and additional detail on the methodology utilized for this qualitative assessment can be found in Chapter 1 – Project Overview.

Table 5-1: Alternatives Ranking Approach

Ranking	Measurement
Lower	Less than ½ a standard deviation below the mean of the data for the four BRT alternatives, Completed for each criterion based on the underlying data for each criterion.
Medium	½ a standard deviation below the mean of the data for the four BRT alternatives to ½ standard deviation above the mean of the data for the four BRT alternatives. Completed for each criterion based on the underlying data for each criterion
Higher	Greater than ½ a standard deviation above the mean of the data for the four BRT alternatives. Completed for each criterion based on the underlying data for each criterion

5.2 Transit Ridership Screening Criteria Evaluation Results

This section contains the results of the six transit ridership-related screening criteria. Each criterion also includes a brief description of how it was measured. A summary table showing rankings for each alternative relative to corridor wide screening criteria is provided in Chapter 7 – Conceptual Alternatives Evaluation.

5.2.1 Increase in Total Daily Transit Ridership

In evaluating the different BRT alternatives, it is important to understand the impact of the alternative on total transit ridership within the corridor (not just on the BRT). For instance, a key question is whether the alternative is attracting new riders to the transit system or is it simply pulling riders from existing transit modes within the corridor. To that end, this criterion measures the incremental increase in total corridor transit ridership compared to the No-Build condition, for each alternative. Each of the BRT alternatives evaluated results in a forecasted increase in transit ridership when compared to the No-Build, so the rankings outlined below are based on a comparison of the relative size of the incremental change in total transit ridership for each alternative (the ridership data used in the analysis is derived from ridership forecasting models developed for each alternative). Modes included in the measure of total transit ridership in the No-Build are corridor Metrorail service (Metrorail Red Line) and the three primary Ride On services that generally run their full length on MD 355 within the corridor (RO 75, RO 55, and RO 46). Modes included in the BRT alternatives ridership comparison are the modes noted in the previous sentence as well as BRT. Again, this criterion ranks each alternative based on the size of the incremental change in transit ridership between the No-Build and BRT Alternatives (the lower the ranking, the lower was the incremental change in ridership). The ranking of each BRT alternative relative to this criterion is shown below in ***Table 5-2***.

Table 5-2: Increase in Total Daily Transit Ridership

Alternative			
3A	3B	4A	4B
Medium	Higher	Lower	Higher

As noted, total daily transit ridership increases for all four BRT alternatives relative to the No-Build, meaning each BRT alternative results in higher corridor transit ridership. Alternatives 3B and 4B rank higher relative to this screening criterion because they have larger incremental increases compared to the No-Build, which in turn is due to the additional ridership that occurs south of the Grosvenor Metrorail Station on these alternatives (Alternatives 3B and 4B run all the way to Bethesda while Alternatives 3A and 4A terminate at Grosvenor). In addition, Alternative 3A is higher than Alternative 4A because of higher ridership along the 3A Observation Drive alignment than along the 4A MD 355 alignment.

5.2.2 Increase in Total Daily Bus Ridership

This screening criterion is comparable to the "Increase in Total Transit Ridership" criterion in that it evaluates the incremental change in ridership, in this case the change in Total Daily Bus Ridership compared to the No-Build. As with the "Total Transit Ridership" criterion, each of the BRT alternatives experiences an increase in bus ridership when compared to the No-Build so the rankings outlined below are based on a comparison of the relative size of the incremental change in total daily bus ridership. Modes included in this measure of total bus ridership in the No-Build are the three primary Ride On services in the corridor (RO 75, RO 55, and RO 46) The BRT alternatives modes include the three local Ride On services plus BRT. The ranking of each BRT alternative relative to this criterion is shown below in ***Table 5-3***.

Table 5-3: Increase in Total Daily Bus Ridership

Alternative			
3A	3B	4A	4B
Medium	Higher	Lower	Higher

As noted, total daily bus ridership increases for all four BRT alternatives relative to the No-Build, meaning each BRT alternative results in higher corridor bus ridership. Alternatives 3B and 4B rank higher relative to this screening criterion because they have larger incremental increases when compared to the No-Build, which in turn is due to the additional BRT ridership that occurs south of the Grosvenor Metrorail Station on these alternatives.

5.2.3 Total Daily BRT Ridership

This screening criterion ranks each of the four BRT alternatives based on the alternative's total BRT ridership. Unlike the previous two criteria, this criterion does not measure the change compared to the No-Build since BRT service is not part of the No-Build. The ranking of each BRT alternative relative to this criterion is shown below in ***Table 5-4***.

Table 5-4: Total Daily BRT Ridership

Alternative			
3A	3B	4A	4B
Medium	Higher	Lower	Higher

As with the other two ridership-related criteria, the two alternatives with service running all the way to Bethesda, Alternatives 3B and 4B, have the highest daily BRT ridership and therefore rank highest relative to this criterion. It should also be noted that the data underlying the rankings in ***Table 5-4*** indicate that a large number of Ride On riders move to the new BRT service in each of the BRT alternatives, resulting in a decrease in ridership on the three key corridor Ride On services. As noted above, however, total corridor transit ridership and corridor bus ridership does increase.

5.2.4 Boardings by Station – North Section (Section 7)

This screening criterion ranks each of the four BRT alternatives based on boardings per station in alignment Section 7 at the northern end of the alignment (the section of the alignment north of Middlebrook Road). Three of the alternatives, 3B, 4A, and 4B, run between Redgrave Place and Middlebrook Road via MD 355 in this northern section, while the final alternative, 3A, runs between the Clarksburg Outlets and Middlebrook Road via Observation Drive. The purpose in using the different alignments was to test potential ridership demand on Observation Drive, which was suggested as an alternative alignment by CAC members early in the planning process (the MD 355 alignment was the one identified in the original Countywide Transit Functional Master Plan). The ranking of each alternative relative to this criterion is shown below in ***Table 5-5***.

Table 5-5: Boardings by Station - North Section (Section 7)

Alternative			
3A	3B	4A	4B
Higher	Medium	Medium	Lower

The most relevant point regarding the rankings shown in ***Table 5-5*** is that Alternative 3A, which represents the Observation Drive alignment, ranks the highest of the four alternatives. This higher ranking reflects the larger number of trip generators and activity centers along Observation Drive compared to MD 355 north of Middlebrook Road.

Key takeaway: Over 50 percent higher ridership identified along Observation Drive (Alternative 3A) in Section 7 when compared to MD 355 in Section 7. This higher ridership reflects the larger number of trip generators and activity centers along Observation Drive.

5.2.5 Boardings by Station – Central Section (Section 6 through Section 2)

This screening criterion ranks each of the four BRT alternatives based on boardings per station in the Central section of the alignment between Middlebrook Road and the Grosvenor Metrorail Station (this overall Central Section is comprised of five alignment sections). These alignment sections, in turn, are the basis for the engineering and planning analysis that is outlined in this document. The results of the ranking are contained below in ***Table 5-6***, and are provided for each of the five alignment sections that comprise the overall Central Section.

Table 5-6: Boardings by Station - Central Section (Section 6 through Section 2)

	Alternative			
	3A	3B	4A	4B
Section 6	Higher	Higher	Lower	Lower
Section 5	Higher	Medium	Medium	Lower
Section 4	Higher	Medium	Lower	Lower
Section 3	Lower	Higher	Lower	Higher
Section 2	Lower	Higher	Lower	Higher
Central Section Overall	Lower	Higher	Lower	Higher

The rankings show that the two alternatives that run to Bethesda, Alternatives 3B and 4B, rank higher relative to this screening criterion than Alternatives 3A and 4A, meaning they have the highest boardings within the Central Section of the four alternatives evaluated. The higher boardings on these two alternatives within the Central Section means that the alternatives that run all the way to Bethesda expand the BRT market and provide access via BRT to activity centers that are not accessible on the alternatives that terminate at the Grosvenor Metrorail Station. This increased access to markets for Alternatives 3B and 4B yields higher boardings in the Central Section than Alternatives 3A and 4A. A review of the rankings in ***Table 5-6*** also show that in general the median running way sections in the Central section have higher rankings based on higher ridership/boarding activity than the other running way types. This reflects the generally shorter travel times on the median alternatives.

Key takeaways:

- ***In general, the median running way sections generate higher ridership / boarding activity than the other running way types along the entire alignment.***
- ***BRT ridership is up to 25 percent lower in alternatives with bi-directional operations (Alternatives 3A and 4A in those alignment sections where bi-directional operations are in place (Sections 3 and 5).***
- ***Extending BRT service to the Bethesda Metrorail Station increases the ridership on the line's central section (alignment Sections 6 through 2) by more than 10 percent.***

5.2.6 Boardings by Station – South Section (Section 1)

As noted above, only two of the four alternatives, 3B and 4B run the full length of the alignment to Bethesda. There is no appreciable difference in boardings south of Grosvenor (Section 1) on these two alternatives and therefore there is no ranking of the two.

Key takeaway: Approximately 15 percent of corridor ridership is generated at stations south of Grosvenor Metrorail Station.

5.3 Travel Time Screening Criteria Evaluation Results

5.3.1 BRT Travel Time – AM Peak Southbound

This screening criterion is a straight comparison of BRT travel time by alignment section, by alternative, for the AM peak southbound direction (note: though the degree of peak/reverse peak directionality varies from section to section during the AM peak, the overall AM peak direction remains in the southbound direction in all alignment sections). The underlying data for the rankings presented here is derived from the traffic simulation models developed for each of the BRT Alternatives. These models yielded the underlying speeds and travel times used in the rankings contained in all of Section 5.3.

The criterion provides insight into where the BRT is receiving a run time benefit from the proposed running way treatments of each alternative compared to the other alternatives (note: the lower the BRT travel time, the greater the positive benefit and thus the higher the ranking. In this instance, therefore, a ranking of lower is denoted in green, indicating a lower travel time and thus a higher benefit. Conversely, a higher BRT travel time has a lower positive benefit and therefore is denoted in red). The results of this comparison are outlined below in ***Table 5-7***.

Table 5-7: BRT Travel Time - AM Peak Southbound

	Alternative			
	3A	3B	4A	4B
Section 7	Higher	Lower	Medium	Medium
Section 6	Lower	Medium	Higher	Higher
Section 5	Lower	Medium	Higher	Lower
Section 4	Lower	Medium	Medium	Higher
Section 3	Higher	Lower	Higher	Lower
Section 2	Lower	Lower	Medium	Higher
Section 1	Same for Alternatives 3B and 4B			

The rankings show in ***Table 5-7*** show that the two median Alternatives (Alternatives 3A and 3B) have lower BRT travel times, meaning the median running way generally provides a greater travel time benefit than the curb running alternatives. The rankings also show that the bi-directional operations in Section 3, in Alternatives 3A and 4A, have higher BRT travel times than in the two Alternatives (3B and 4B) that do not have the bi-directional operations.

Key takeaway: It takes twice as long (or more) for the BRT to travel along Observation Drive compared to MD 355 due to mixed traffic operations and higher ridership leading to longer dwell times at stations.

5.3.2 BRT Travel Time – PM Peak Northbound

This screening criterion is a companion criterion to the AM Peak BRT Travel Time criterion discussed in the previous section (5.3.1) and compares BRT travel time across alternatives for the PM peak northbound direction (PM peak, peak direction). As with the AM peak criterion, this criterion provides insight into where the BRT is receiving a run time benefit from the proposed running way treatments of each alternative compared to the other alternatives. The results of the rankings for this criterion are outlined in ***Table 5-8***.

Table 5-8: BRT Travel Time - PM Peak Northbound

	Alternative			
	3A	3B	4A	4B
Section 7	Higher	Medium	Lower	Lower
Section 6	Medium	Lower	Medium	Higher
Section 5	Lower	Medium	Higher	Medium
Section 4	Lower	Medium	Medium	Higher
Section 3	Higher	Lower	Higher	Medium
Section 2	Lower	Lower	Higher	Medium
Section 1	Same for Alternatives 3B and 4B			

The rankings in ***Table 5-8*** show that, as in the AM peak, the two median alternatives (Alternatives 3A and 3B) have lower BRT travel times, meaning the median running way generally provides a greater travel time benefit than the curb running alternatives. The rankings also show that the bi-directional operations in Section 3, in Alternatives 3A and 4A, have higher BRT travel times than in the two Alternatives (3B and 4B) that do not have the bi-directional operations (this is also comparable to the AM peak data). This increased travel time under bi-directional operations in Section 3 is the result of delays associated with BRT vehicles waiting for vehicles coming in the opposite direction to pass.

Key takeaways:

- ***In general, the median running way sections have up to 20 percent shorter BRT travel times, compared to the curb running way, generating higher ridership within those sections.***
- ***The bi-directional operations in Section 3 have up to 25 percent longer BRT travel times compared to the other alternatives. These results are consistent for both AM and PM peaks.***
- ***BRT travel times along Observation Drive are twice as long as BRT travel times on MD 355 due to mixed traffic operations and longer dwell times at stops due to higher ridership.***

5.3.3 BRT Travel Time versus Local Bus Travel Time – AM Peak Southbound

This screening criterion is measured as a ratio of BRT travel time to local bus time (calculated as: BRT Travel Time/Local Bus Travel Time) by section, by alternative, for AM peak southbound trips (peak direction). The lower the ratio, the lower the BRT travel time is when it is compared to local bus, and thus conversely the faster BRT runs when compared to local bus. Therefore, the lower the ratio, the more attractive BRT is compared to local bus and thus the greater the benefit BRT provides. This formulation is reflected below in ***Table 5-9,*** with the "lower" ranking (representing a lower ratio) denoted in green, which represents the highest benefit (of note is the fact that the data underlying the rankings in this section indicate that in every BRT Alternative/Section combination in ***Table 5-9*** except one, BRT travel times are lower than local bus times. This means the comparison between

alternatives/alignment sections is actually a measure of how much BRT benefit relative to local bus is provided under each alternative, by section.

Table 5-9: BRT Travel Time versus Local Bus Travel Times - AM Peak Southbound

	Alternative			
	3A	3B	4A	4B
Section 7	No local bus	Lower	Higher	Higher
Section 6	Lower	Lower	Higher	Higher
Section 5	Lower	Higher	Medium	Higher
Section 4	Lower	Lower	Lower	Higher
Section 3	Higher	Lower	Higher	Medium
Section 2	Lower	Lower	Higher	Medium
Section 1	Same for Alternatives 3B and 4B			

The rankings presented in ***Table 5-9*** show that the two median alternatives (Alternatives 3A and 3B) generally have the highest number of lower rankings, meaning they have the lowest ratio of BRT travel time to local bus travel time throughout the length of the alignment. This result means the median running way generally provides a BRT greater travel time benefit than the curb running alternatives. The rankings also show that the BRT/Local Bus travel time ratio is higher in the alternatives (Alternatives 3A and 4A) that have bi-directional operations in Section 3 than in the alternatives that do not have bi-directional operations in Section 3 (Alternatives 3B and 4B).

5.3.4 BRT Travel Time versus Local Bus Travel Time – PM Peak Northbound

This screening criterion is a companion criterion to the BRT Travel Time versus Local Bus Travel Time criterion discussed in the previous section and compares the ratio of BRT travel time to local bus travel time by section, by alternative, for PM peak northbound trips (peak direction). As with the AM peak criterion, the lower the ratio, the more attractive BRT is when compared to local bus, and therefore the lower ranking as outlined below in ***Table 5-10*** is denoted in green, which represents the highest BRT benefit (as is similar to the AM peak data, the data underlying the rankings in ***Table 5-10*** indicate that PM peak BRT travel time is lower than local bus travel time in every BRT Alternative/Section combination. This means that the comparison between alternative/alignment sections is actually a measure of how much BRT benefit relative to local bus is provided under each alternative, by section).

Table 5-10: BRT Travel Time versus Local Bus Travel Times - PM Peak Northbound

	Alternative			
	3A	3B	4A	4B
Section 7	No local bus	Lower	Higher	Higher
Section 6	Higher	Lower	Medium	Medium
Section 5	Lower	Medium	Higher	Medium
Section 4	Lower	Medium	Medium	Higher
Section 3	Higher	Lower	Medium	Medium
Section 2	Lower	Lower	Higher	Higher
Section 1	Same for Alternatives 3B and 4B			

The rankings presented in ***Table 5-10*** show that that the two median alternatives (Alternatives 3A and 3B) generally have the lowest ratio of BRT travel time to local bus time. This result means the median running way generally provides a greater BRT travel time benefit than the curb running alternatives.

> ***Key takeaway: The median running way generally provides a greater BRT travel time benefit than the curb running alternatives when BRT travel time is compared to local bus travel times. These results are consistent for both AM and PM peaks.***

5.3.5 BRT Travel Time versus Auto Travel Time – AM Peak Southbound

This screening criterion is measured as a ratio of BRT travel time to auto travel time by section, by alternative, for AM peak southbound trips (peak direction). The lower the ratio, the lower BRT travel time is when it is compared to auto, and thus conversely the faster BRT runs when compared to auto. Further, the criterion provides a good understanding of where BRT is most competitive with auto travel times and thus potentially makes it an attractive alternative to the auto for making and completing trips. It should be noted that unlike the data underlying the BRT to local bus comparisons, the data underlying the BRT/Auto rankings shows that BRT does not always perform better than auto. Therefore, the rankings outlined below in ***Table 5-11*** may represent instances where BRT travel time is actually higher than auto travel time.

Table 5-11: BRT Travel Time versus Auto Travel Times - AM Peak Southbound

	Alternative			
	3A	3B	4A	4B
Section 7	Higher	Lower	Medium	Medium
Section 6	Lower	Higher	Higher	Medium
Section 5	Lower	Medium	Lower	Higher
Section 4	Medium	Lower	Medium	Higher
Section 3	Higher	Lower	Higher	Lower
Section 2	Lower	Lower	Higher	Higher
Section 1	n/a	Higher	n/a	Lower

As with the other travel time metrics discussed in previous sections, the "lower" rankings occur more frequently on the median alternatives, Alternatives 3A and 3B. This higher proportion of "lower" rankings means that generally under the median options BRT is more competitive with the automobile, thus making BRT a more attractive option for travelers making a choice between BRT and auto.

5.3.6 BRT Travel Time versus Auto Travel Time – PM Peak Northbound

As with the data in the previous section, this screening criterion is measured as a ratio of BRT travel time to auto travel time by section, by alternative. In this instance the rankings are for PM peak northbound trips (peak direction). The lower the ratio the lower BRT travel time is when compared to auto. Further, the criterion provides a good understanding of where BRT is most competitive with auto travel time, and thus potentially makes it an attractive alternative to the auto for making and completing trips. As with the AM peak rankings, the data underlying the rankings show that BRT does not always perform better than auto. Therefore, the rankings outlined in ***Table 5-12*** may represent instances where BRT travel time is actually higher than auto travel time.

Table 5-12: BRT Travel Times versus Auto Travel Times - PM Peak Northbound

	Alternative			
	3A	3B	4A	4B
Section 7	Higher	Lower	Medium	Medium
Section 6	Higher	Lower	Medium	Medium
Section 5	Higher	Lower	Medium	Medium
Section 4	Lower	Medium	Lower	Higher
Section 3	Higher	Lower	Medium	Higher
Section 2	Lower	Lower	Higher	Higher
Section 1	n/a	Lower	n/a	Higher

In the PM, northbound direction, the general trend of Alternatives 3A and 3B having the best BRT travel time performance when compared to auto changes somewhat. Alternative 3B still performs well compared to the other alternatives but the 3A performance does not stand out as dramatically as some of the other travel-time related criterion discussed in previous sections. The change in ranking that occurs in the two sections with bi-directional operations (Section 3 and Section 5) reflects the exacerbated negative impacts of these bi-directional operations on BRT travel times in the PM peak. The change in Section 7 relates to higher overall PM peak delay along Observation Drive, which impacts BRT vehicles running in mixed traffic and includes delay related to accessing and leaving stops. The change in Section 6 is likely due to cascading impacts to travel times from Sections 7 and 5, especially delay related to waiting to enter bi-directional operations in Section 5.

5.4 Person Throughput Criteria Evaluation Results

5.4.1 Increase in AM Peak Hour Total Person Throughput

This criterion measures how efficiently the MD 355 corridor is being used to move people, not just vehicles. Specifically, this criterion measures the increase in the number of people crossing an east-west screen line that is located at the center (on a north/south axis) of each alignment section under the BRT Alternative compared to the No-Build (the data underlying these rankings indicate that in the large majority of alignment sections, total throughput increases. In a few instances, however, the BRT Alternative actually results in a decrease in throughput. Those locations where throughput declines are specifically noted in ***Table 5-13***). The total person throughput in each alternative consists of a combination of people crossing each screen line in either autos or transit, and in both directions. The higher the change in combined transit and auto throughput in each section, under each alternative, the more efficiently the MD 355 corridor is being utilized under the BRT alternative, and thus also the higher the ranking, as presented below in ***Table 5-13***.

Table 5-13: Increase in AM Peak Hour Total Person Throughput (Auto and Transit Combined-Both Directions)

	Alternative			
	3A	3B	4A	4B
Section 7	n/a	Medium	Higher	Lower
Section 6	Higher	Medium	Medium	Lower
Section 5	Higher	Medium	Medium	Lower
Section 4	Higher	Medium	Medium	Lower
Section 3	Higher	Decrease	Lower	Decrease
Section 2	Higher	Higher	Lower	Medium
Section 1	n/a	Decrease	n/a	Decrease

Note: Section 7 under Alternative 3A is labeled as n/a because Observation Drive was not modeled in the No-Build. Therefore, there is no forecasted No-Build data against which to compare the BRT results.

As noted, it should be emphasized that the underlying data representing the rankings shown in ***Table 5-13*** indicates that transit throughput increases in all alignment sections under all alternatives, compared to the No-Build. In those sections where throughput actually decreases, the decrease is due to a decline in auto throughput that outweighs the increase in transit throughput.

Two key points from the rankings in ***Table 5-13*** are as follows:

1. The two median running way alternatives generally have the highest increase in throughput, though Alternative 3A performs the best of all alternatives.
2. Throughput actually decreases in Sections 3 and 1 under Alternatives 3B and 4B due to the decrease in auto throughput. The decline in auto throughput, in turn, is due to lane repurposing in these two Sections. In Section 3, Alternatives 3B and 4B propose lane repurposing by removing a traffic lane in each direction and providing that lane to transit (BRT under Alternative 3B and BRT and local bus under Alternative 4B). In Section 1, the peak direction curb lane would be repurposed to provide transit dedication but the number of peak-direction general traffic lanes would be maintained through a dynamic lane configuration that changes depending on time of day. However, in order to support the same number of general traffic lanes in the peak direction, the number of general traffic lanes in the off-peak direction would decrease.

As noted, these roadway configuration changes and the decrease in the amount of lane capacity available to accommodate general traffic result in a decrease in auto throughput in both Sections 3 and 1.

5.4.2 Increase in PM Peak Hour Total Person Throughput

This section contains companion data to the data presented in the previous section, with the data presented here representing PM peak data. The rankings by alternative are shown in ***Table 5-14***. The same general trends and findings outlined above for the AM peak also apply to the PM peak.

Table 5-14: Increase in PM Peak Hour Total Person Throughput (Auto and Transit Combined – Both Directions)

	Alternative			
	3A	3B	4A	4B
Section 7	n/a	Medium	Higher	Lower
Section 6	Higher	Medium	Medium	Lower
Section 5	Higher	Medium	Lower	Lower
Section 4	Higher	Medium	Medium	Lower
Section 3	Lower	Decrease	Higher	Decrease
Section 2	Higher	Higher	Lower	Lower
Section 1	n/a	Decrease	n/a	Decrease

5.4.3 Increase in Daily Total Person Throughput

The data presented in this report section is a companion to the AM and PM data presented in the two previous sections, and presents total daily throughput in ***Table 5-15***. The same general throughput trends observed for the AM and PM peak periods also apply to the daily rankings.

Table 5-15: Total Person Throughput - Total Daily (Auto and Transit Combined – Both Directions)

	Alternative			
	3A	3B	4A	4B
Section 7	n/a	Medium	Higher	Lower
Section 6	Higher	Medium	Lower	Lower
Section 5	Higher	Medium	Medium	Lower
Section 4	Higher	Medium	Medium	Lower
Section 3	Higher	Decrease	Lower	Decrease
Section 2	Lower	Higher	Lower	Higher
Section 1	n/a	Higher	n/a	Lower

Key takeaways:

- ***Transit throughput increases between 80 percent and 130 percent within the different sections with repurposed lanes compared to the No-Build.***
- ***Total person throughput decreases by up to 15 percent in sections where lane repurposing is being proposed due to a decrease in auto person throughput outweighing increase in transit person throughput.***
- ***The two median running way alternatives generally have the highest increase in throughput.***

5.5 Accessibility Criteria Evaluation Results

5.5.1 Increase in Accessibility to Jobs within 45 and 60 Minutes Along the Corridor

The rankings presented in this section relate to the number of jobs that can be reached from the corridor via transit within 45 and 60 minutes. The concept underlying this criterion is that as transit service improves both in terms of

transit travel times and service frequency compared to the No-Build, the number of jobs that are accessible via transit from the corridor within a certain time frame (45 and 60 minutes for this analysis) would increase. Further, as more jobs become accessible by transit, transit would become a more competitive mobility option for travelers making their trip-to-work mode choice. The rankings for each alternative for this criterion are shown below in ***Table 5-16***.

Table 5-16: Increase in Accessibility to Jobs within 45 and 60 Minutes

	Alternative			
	3A	3B	4A	4B
45 Minutes	Medium	Higher	Lower	Lower
60 Minutes	Medium	Higher	Lower	Medium

It should be noted that the data underlying the rankings shown in ***Table 5-16*** indicate that increases in accessibility from the No-Build occur under all four BRT alternatives.

The rankings in ***Table 5-16*** generally track with the ranking contained in other sections that are focused on travel times, with the best accessibility performance being the two median running Alternatives 3A and 3B. Alternative 4A's accessibility ranking is also impacted by the fact that it does not run the full length of the corridor to Bethesda but rather terminates at Grosvenor. While 3A also terminates at Grosvenor, its better performance relative to 4A reflects that fact that it runs along Observation Drive, which provides greater access to the large number of trip generators located along the Observation Drive alignment.

5.5.2 Increase in Household Accessibility to Corridor Regional Activity Centers within 45 and 60 Minutes

The accessibility concept underlying this criterion is the same as described in the section above and measures household accessibility to Regional Activity Centers located within the MD 355 corridor for employment and other activities. The rankings for this criterion are contained in ***Table 5-17*** below.

Table 5-17: Increase in Household Accessibility to Corridor Regional Activity Centers within 45 and 60 Minutes

	Alternative			
	3A	3B	4A	4B
45 Minutes	Lower	Higher	Lower	Higher
60 Minutes	Lower	Higher	Lower	Higher

The rankings show that the two alternatives that run the full length of the corridor to Bethesda rank higher while the two alternatives that terminate at Grosvenor have lower accessibility (though it is important to note that the data underlying the rankings indicate that all alternatives have an increase in household accessibility). In essence, terminating at Grosvenor hinders enhanced transit access to two key corridor activity centers, Medical Center and Bethesda, thus the lower rankings.

> ***Key takeaway: Extending service to the Bethesda Metrorail Station (Alternatives 3B and 4B) increases accessibility to households from activity centers by approximately 40 to 75 percent.***

5.6 Property Impacts Screening Criteria Evaluation Results

This section contains a description of the results of property impacts evaluation. Additional information on the methodology utilized for this qualitative assessment can be found in Chapter 1 – Project Overview. A summary table

showing rankings for each alternative relative to corridor wide screening criteria is provided in Chapter 7 – Conceptual Alternatives Evaluation. A higher ranking for the property impacts screening criteria means more property impacts than the other alternatives. On the other hand a lower ranking means less property impacts.

5.6.1 Total Property Impacts

This screening criterion ranks each of the BRT alternatives based on the alternative's total property impacts (area of right-of-way required) as a result of the necessary roadway widening and property needs for stations.

Table 5-18: Total Property Impacts

	Alternative			
	3A	3B	4A	4B
Section 7	Lower	Higher	Medium	Medium
Section 6	Higher	Higher	Lower	Lower
Section 5	Same for all Alternatives			
Section 4	Higher	Higher	Higher	Lower
Section 3	Higher	Medium	Higher	Lower
Section 2	Higher	Higher	Lower	Lower
Section 1	Same for Alternatives 3B and 4B			
Total	Medium	Higher	Medium	Lower

In general the median running way alternatives (Alternative 3A and Alternative 3B) result in higher property impacts compared to the curb running way alternatives (Alternative 4A and Alternative 4B). This is due to the wider footprint necessary under the median running way due to the separation between the running way and the travel lanes.

Key takeaways:

- ***The wider footprint of the median running way generally results in over 25 percent higher property impacts. Alternative 3B has the higher impacts due to the running way being mostly in the median.***
- ***The mixed traffic running way along Observation Drive (Alternative 3A) results in lower property impacts than alternatives along MD 355 in Section 7.***
- ***The running ways where lane repurposing is being proposed results in lower impacts.***
- ***Extending service to the Bethesda Metrorail Station results in higher property impacts due to additional stations.***

5.7 Costs Screening Criteria Evaluation Results

This section contains a description of the results of costs evaluation. Additional information on the methodology utilized for this qualitative assessment can be found in Chapter 1 – Project Overview. A summary table showing rankings for each alternative relative to corridor-wide screening criteria is provided in Chapter 7 – Conceptual Alternatives Evaluation. A higher ranking for the costs screening criteria means a more expensive alternative than

the other alternatives. On the other hand, a lower ranking means a less expensive alternative compared to the other alternatives.

5.7.1 Total Operating Costs

This screening criterion ranks each of the BRT alternatives based on the alternative's total operating costs. Operating costs are the annual costs required to provide and maintain the BRT service.

Table 5-19: Total Operating Costs

Alternative			
3A	3B	4A	4B
Higher	Medium	Lower	Medium

Key takeaway: Higher operating costs for Alternative 3A are a result of higher ridership along Observation Drive requiring more frequent service and longer travel times due to longer alignment. These factors require more buses in service to maintain service frequency.

5.7.2 Total Construction Costs

This screening criterion ranks each of the BRT alternatives based on the alternative's total construction costs.

Table 5-20: Total Construction Costs

	Alternative			
	3A	3B	4A	4B
Section 7	Lower	Higher	Medium	Medium
Section 6	Higher	Higher	Lower	Lower
Section 5	Same for all Alternatives			
Section 4	Higher	Higher	Higher	Lower
Section 3	Higher	Medium	Higher	Lower
Section 2	Higher	Higher	Lower	Lower
Section 1	Same for Alternatives 3B and 4B			
Total	Medium	Higher	Medium	Lower

In general the median running way alternatives (Alternative 3A and Alternative 3B) result in higher costs compared to the curb running way alternatives (Alternative 4A and Alternative 4B). This is due to the wider footprint necessary under the median running way due to the separation between the running way and the travel lanes. This wider footprint results in a larger reconstruction of the roadway and greater utility relocation and stormwater management costs.

Key takeaways:

- ***The median running has a wider footprint and generally results in 60 percent higher construction costs compared to the curb running way. Higher costs are driven by additional***

roadway reconstruction, utility relocation and stormwater management costs. Alternative 3B has the higher impacts due to the running way being mostly in the median.

- ***Mixed traffic running way along Observation Drive is reducing construction costs on Alternative 3A***
- ***Extending service to the Bethesda Metrorail Station results in higher construction costs due to additional stations.***
- ***Wider footprint of the bi-directional running way results in construction costs more than 13 percent higher compared to lane repurposing options in Section 3.***

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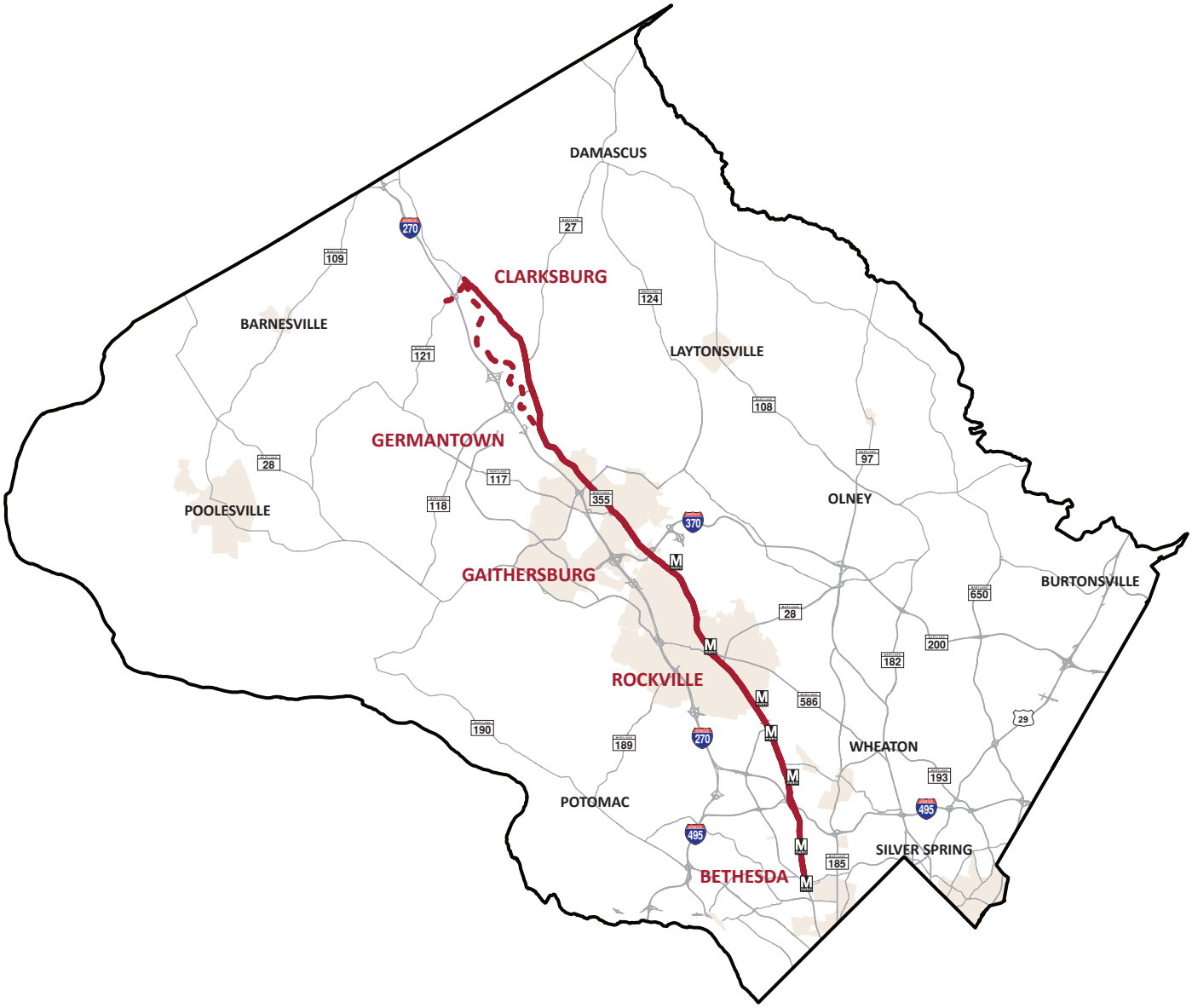
MD 355



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Chapter 6.0

Public Involvement

6.1 Introduction

Public Involvement played an important and active role in the MD 355 BRT Corridor Planning Study. These efforts included the project website, the CACs and two Public Open House meetings.

6.2 Project Website

The website (www.montgomerycountymd.gov/brt) has been in place from the beginning of the study, and is regularly updated with new information related to the project, CAC meetings and Public Open Houses. The website offers the public the opportunity to submit comments related to the Public Open Houses or email the project team.

6.3 Corridor Advisory Committees

Upon the Montgomery County Council's approval of the Countywide Transit Corridors Functional Master Plan (2013), the Council called for the formation of a CAC for the MD 355 BRT Corridor Planning Study. At the outset of the MD 355 BRT Corridor Planning Study, the project initiated two CACs; see ***Figure 6-1***, comprised of stakeholders representing the MD 355 Study Corridor.

Figure 6-1: CAC Kickoff Meeting February 28, 2015

Meetings with the CAC members began with a kickoff meeting on February 28, 2015 and will continue throughout the study. The CAC provides residents, business owners, and interested stakeholders the opportunity to provide input, discuss study assumptions and methodologies and to share information from the meetings with the community groups they represent.

The MD 355 South CAC includes approximately 45 stake - holders focused on the southern part of the Study Corridor from Bethesda to Rockville. The MD 355 North CAC includes approximately 25 stakeholders focused on the northern part of the Study Corridor from Rockville to Clarksburg. The members of the CAC are affiliated with the following:

The CAC provides residents, business owners and interested stakeholders the opportunity to provide input and comment on the materials presented throughout the planning process.

Table 6-1: MD 355 South Corridor Advisory Committee - Affiliations

Bethesda Crest Homeowners Association	Grosvenor Park Condo Citizens Association
Town of Garret Park	Greater Bethesda Chamber of Commerce
Town of Somerset	Federal Realty Investment Trust
Hungerford Civic Association	Fallswood Condo Association
Chevy Chase West Neighborhood Association	East Bethesda Citizens Association
U.S. Naval Support Activity, Bethesda	Streetscape Partners
Twinbrook Citizens Association	Grosvenor Park II Condos
Parkside Condos	Montgomery County Civic Federation, Inc.
Greater Capital Area Association of Realtors	Strathmore Place Community Association
Locust Hill Citizens Association	The Forum Condominium, Friends of White Flint
Rockville Traffic & Transportation Commission	Lerner Enterprises
Glenbrook Village Homeowners Association	IMG Rebel
Saul Centers, Inc.	National Institutes of Health
Randolph Civic Association	Maplewood Citizens Association
Montgomery County Sierra Club	Cohen Siegel Investors, LLC
Midtown Bethesda North Condos	Douglas Development
Linowes and Blocher, LLP	Pasernak & Fidis, PC
Garret Park Estates / White Flint Park Citizens Association	

These affiliations were confirmed through consultations with the CAC members after the selection process.

Table 6-2: MD 355 North Corridor Advisory Committee - Affiliations

Montgomery County Civic Federation	West End Citizens Association
Gaithersburg-Germantown Chamber, Rodgers Consulting, Inc.	Seneca Crossing Section 1 Homeowners Association
Watkins Mill Town Center	Clarksburg Civic Association
Montgomery College	Upcounty Citizens Advisory Board
Greenridge Baptist Church	TAME (Transit Alternatives to Mid-County Highway) Coalition
King's Farm Citizen Assembly	Cider Barrel Mobile Home Court
Rockville Community Coalition	College Gardens Civic Association

The Mission Statements for the MD 355 CACs are to:

- Give community participants the opportunity to provide input on planning and design.
- Provide the opportunity to discuss study assumptions and methodologies.
- Fulfill County Council requirements for transparency and community involvement.
- Provide the opportunity for interaction and information-sharing among impacted residents/communities, property owners of businesses/institutions, transportation agency representatives, and transportation system users.
- Study and discuss potential community impacts in a comprehensive manner that supports cost-effective and context- and community- sensitive implementation outcomes.
- Serve as a clearinghouse for sharing of timely and accurate information on the studies and plans in each corridor.
- Share information from the CAC meetings with the community groups that you represent and share input received from them during subsequent CAC meetings.
- Provide leadership and build consensus within the community to coalesce diverse interests and address stakeholder issues.

The MD 355 North and South CACs were run concurrently with each CAC following the same schedule and being provided similar content. Each CAC had a professional facilitator to lead the meetings and to be the point of contact for all correspondence before and after CAC meetings.

While each CAC meeting was unique in terms of content and structure the general approach to the CAC meetings was to make structured presentations followed by opportunities to ask questions or make comments. Each meeting typically wrapped up with breakout exercises or table-top discussions designed to provide opportunities for the CAC members to provide feedback on the planning study. Each CAC meeting typically lasted between 2.5 and 3 hours.

6.3.1 CAC Schedule of Meetings

The following is the CAC meeting schedule through the publication of this report.

MD 355 South CAC

- Meeting No.1 – February 28, 2015
- Meeting No.2 – April 16, 2015

- Meeting No.3 – June 4, 2015
- Meeting No.4 – August 31, 2015
- Meeting No.5 – December 15, 2015
- Meeting No.6 – March 7, 2016
- Meeting No.7 – June 14, 2016
- Meeting No.8 – October 25, 2016
- Meeting No.9 – November 9, 2016

MD 355 North CAC

- Meeting No.1 – February 28, 2015
- Meeting No.2 – April 14, 2015
- Meeting No.3 – June 3, 2015
- Meeting No.4 – September 1, 2015
- Meeting No.5 – December 10, 2015
- Meeting No.6 – March 3, 2016
- Meeting No.7 – June 17, 2016
- Meeting No.8 – October 19, 2016
- Meeting No.9 – October 26, 2016

In addition to the above referenced CAC meetings, there was a combined (north and south) MD 355 CAC Open House on February 2, 2016. The purpose was to allow members of the CAC to discuss the Draft Preliminary Purpose and Need document with the project team prior to submitting questions and comments on the document.

All information related to the CAC effort to date is posted on the project website.

Figure 6-2: South CAC Meeting

Figure 6-3: North CAC Meeting

6.3.2 CAC Meeting Topics

Over the course of the study, CAC members have learned about many topics relevant to the BRT Corridor Planning Process. The following topics were covered:

- Meeting No. 1
  - What is BRT?
  - MD 355 Corridor Overview
- Meeting No. 2
  - Project Development Process
  - Existing Conditions
- Meeting No. 3
  - Transit Ridership
  - Traffic Operations
  - Draft Preliminary Purpose and Need
  - BRT Running way options
- Meeting No. 4
  - Existing Traffic Volumes and Traffic Volume History on MD 355
  - Regional Travel Demand and Forecasts
  - 2040 Future No-Build Traffic
  - Crash History
- Meeting No. 5
  - Project Process & Schedule
  - Goals and Objectives / Draft Preliminary Purpose and Need
- Meeting No. 6
  - Preview of Public Open House
  - Conceptual Alternatives Development
    - Preliminary Station Locations
    - Preliminary Service Plan

- Meeting No. 7
  - Public Open House Summary
  - Alternatives Screening Criteria
  - Conceptual Alternatives Development
    - Running ways
- Meeting No. 8
  - Screening Criteria Results - Part One
  - Key Takeaways
- Meeting No. 9
  - Screening Criteria Results – Part Two
  - Key Takeaways
  - Public Meeting Preview

6.3.3 CAC Meeting Exercises

An important role of the CACs is to provide input and feedback to the project team. Examples of interactive exercises and discussions included:

- A map exercise to gain feedback from the CAC on:
  - How they use transit
  - Why they travel on the MD 355 corridor
  - Ways to make transit use more attractive
- An exercise to identify "Strengths" of the MD 355 Corridor which described what they like or works well and identify "Opportunities" of the MD 355 Corridor which are things that could work better.
- An exercise to identify "Needs, Values and Concerns" related to transit investment in the MD 355 Corridor.
- A breakout discussion on the location of proposed station locations, service plans and appropriate running ways for sections of the corridor.

Figure 6-4: CAC Meeting No. 5 Meeting Exercise on Potential Station Locations

6.3.4 CAC Meeting Materials

All materials presented at CAC meetings are placed on the website for review by the public. These materials included agendas, presentations, mapping, meeting summaries and video recordings.

6.3.5 CAC Meeting Summaries

A detailed meeting summary summarizing each MD 355 CAC meeting was produced after each meeting. The meeting summary was developed by the project team and reviewed by the CAC members before being made final. These CAC meeting summaries were placed on the project website to allow for public review. In addition, a video of each CAC meeting (starting with CAC meeting No.4) is also on the website for the public to review.

6.4 MD 355 Public Open House Meetings

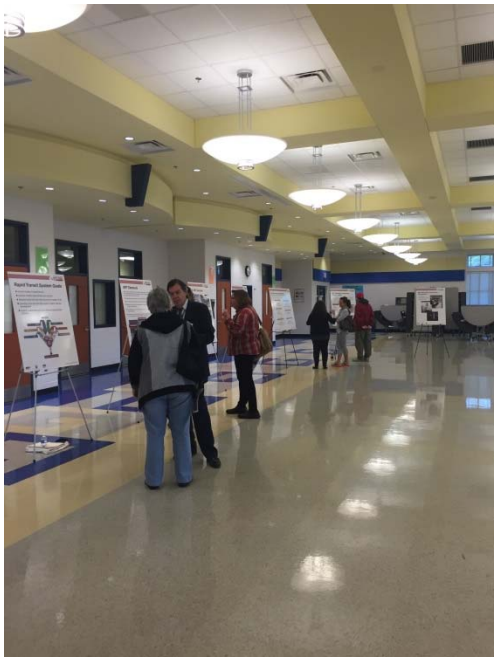
Two sets of Public Open House meetings (with two meetings for each instance) were conducted for the MD 355 BRT Corridor Planning Study for members of the public.

6.4.1 MD 355 Public Open House Meetings – Spring 2016

In the Spring of 2016, the first public open house meeting took place on April 28, 2016 at Bethesda-Chevy Chase High School and the second took place on May 3, 2016, at Gaithersburg High School.

Figure 6-5: Public Open House (Bethesda-Chevy Chase High School)

Figure 6-6: Public Open House (Gaithersburg High School)



These Open Houses provided the first opportunity to share information to the public about the MD 355 Corridor Planning Study. Each Open House was two hours in duration and included identical information including:

- A 10-minute PowerPoint repeated throughout the Open House that welcomed, introduced and oriented people to the planning study and the Open House.
- Display Boards focused on:
  - BRT Elements
  - The study process and schedule
  - Existing conditions of MD 355
  - Draft Preliminary Purpose and Need
- Comment tables for the public to share feedback, ask questions and provide comments

A brochure summarizing the content of the meeting was developed and provided to all the attendees. This brochure can be found in ***Appendix F***. Approximately 160 people attended the Open Houses and approximately 50 comments were received and can be found in ***Appendix G***. The following is a summary of the comments received:

- Relation of BRT service to Metro
- BRT amenities
- Impact to traffic operations
- Improved bicycle facilities
- Dedicated BRT lanes to attract riders
- Fixing existing infrastructure (roads, Metro)
- Parking needs at northern stations

- Service should be frequent (5-10 min)

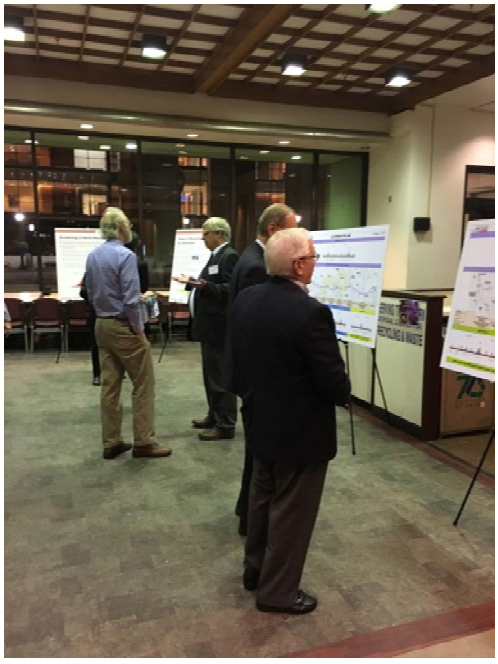
Information related to the Open Houses is posted on the project website.

6.4.2 MD 355 Public Open House Meetings – Winter 2017

In the Winter of 2017, the first public meeting took place on February 7, 2017 at Montgomery College – Germantown Campus and the second took place February 8, 2017, at the Executive Office Building in Rockville.

Figure 6-7: Public Open House (Montgomery College - Germantown)

Figure 6-8: Public Open House (Executive Office Building - Rockville)



These Open Houses provided an opportunity to share updated information to the public about the MD 355 Corridor Planning Study and present the BRT Conceptual Alternatives. Each Open House was two hours in duration and included identical information including:

- A 10-minute PowerPoint repeated throughout the Open House that welcomed attendees, presented background information on BRT systems and the Study, and introduced the information provided at the meeting.
- Display Boards focused on:
  - BRT Elements and Alternative Components
  - Conceptual Alternatives Under Consideration
  - Steps to Recommending and Alternative and Screening Criteria
  - Qualitative Screening Criteria
  - Preliminary Analysis Takeaways
  - Station Design Prototypes
- Comment tables for the public to share feedback, ask questions and provide comments

A brochure summarizing the content of the meeting was developed and provided to all the attendees. This brochure can be found in ***Appendix F***. Approximately 130 people attended the Open Houses and approximately 40 comments were received and can be found in ***Appendix G***. The following is a summary of the comments received:

- Preservation of the Cider Barrel
- Transit improvements needed from the northern part of the County to Metro
- Station locations recommendations and access to proposed stations
- Phasing of the project
- Proposed service plan adjustments
- Concerns about BRT in Section 1 and impacts to traffic operations and access

Information related to the Open Houses is posted on the project website.

6.4.3 MD 355 Public Open House Meetings – Outreach Efforts

Significant efforts were made to make the public aware of the MD 355 Public Open Houses. Among the outreach efforts utilized were:

- A postcard sharing information about the Open Houses was sent to all addresses within ½ mile of the corridor - approximately 78,000 postcards were mailed. The postcard was in English but there were also notifications in Spanish, Russian, Korean and Chinese.
- 5,000 flyers (English and Spanish) were produced and distributed to CAC members, Civic Organizations, Governmental and Community Organizations, Businesses and other locations to make people aware of the Open Houses. See ***Figure 6-9*** and ***Figure 6-10***.
- Advertisements were placed in newspapers including non-English speaking newspapers.
- Press releases, social media posts and Public Service Announcements were also used to make people aware of the Open Houses.

Figure 6-9: MD 355 BRT Open House – Spring 2016 Flyer

MD 355 BUS RAPID TRANSIT CORRIDOR PLANNING STUDY

OPEN HOUSES

Montgomery County RAPID TRANSIT MD 355

Thursday, April 28
6:30 PM - 8:30 PM
Bethesda – Chevy Chase
High School Cafeteria
4301 East-West Highway
Bethesda, MD 20814

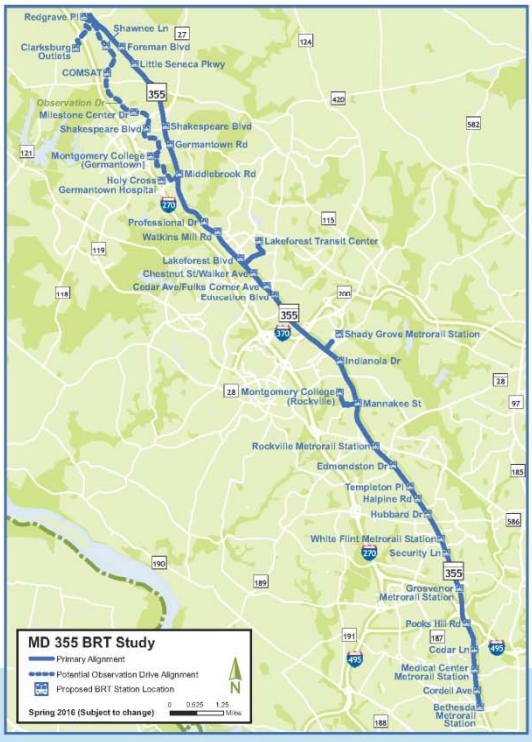
Tuesday, May 3
6:30 PM - 8:30 PM
Gaithersburg
High School Cafeteria
101 Education Blvd.
Gaithersburg, MD 20877

The same information will be available at each meeting. Stop by anytime.

The Maryland Department of Transportation, in partnership with Montgomery County Department of Transportation, is conducting a study for developing Bus Rapid Transit (BRT) along a portion of the MD 355 corridor, as shown on the map below. Two public Open Houses will be held to provide information and gather community input about potential BRT service from Bethesda to Clarksburg. At the Open Houses, you will meet the project team and be able to review:

- BRT elements - how it works, what it looks like, etc.
- The study process and schedule
- Existing conditions inventory
- Draft preliminary purpose and need

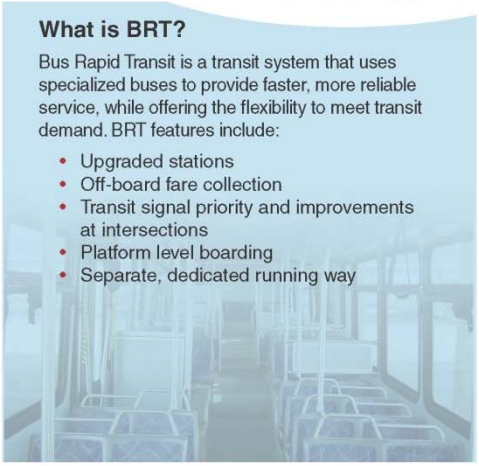
We welcome your comments at the Open Houses.



What is BRT?

Bus Rapid Transit is a transit system that uses specialized buses to provide faster, more reliable service, while offering the flexibility to meet transit demand. BRT features include:

- Upgraded stations
- Off-board fare collection
- Transit signal priority and improvements at intersections
- Platform level boarding
- Separate, dedicated running way



Your comments and suggestions are very important to us!

Project information can be found at **montgomerycountymd.gov/rts/**. We encourage you to submit questions or comments to **md355brt@mta.maryland.gov** or by mail to Maryland Transit Administration, 6 St. Paul Street, Suite 902, Baltimore, MD 21202.

Locations are accessible for people with disabilities. For more information or to request additional accommodations, an interpreter, or this information translated or in an alternate format, please contact the department listed below.

Los sitios tienen acceso para personas con discapacidades. Para mayor información o para requerir acomodos adicionales, un intérprete o esta información traducida o en formato alterno, por favor contacte al departamento enlistado abajo.

К площадкам обеспечен доступ для людей с ограниченными возможностями. За дополнительной информацией или для запроса на получение дополнительных приспособлений, услуг переводчика либо перевода данной информации или ее получения в другом формате, обращайтесь в отдел, указанный ниже.

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地点方便残障人士进入。欲了解更多信息或要求其它安排、口译服务、翻译本信息或本信息的其它格式，请与以下列出的部门联系。

MTA Corridor Manager
410-767-1380 • 866-743-3682 • TTY 410-539-3497

MTA Maryland

Figure 6-10: MD 355 BRT Open House – Winter 2017 Flyer

MD 355 BUS RAPID TRANSIT CORRIDOR PLANNING STUDY

OPEN HOUSES

Montgomery County RAPID TRANSIT MD 355

Tuesday, February 7, 2017
6:30 PM - 8:30 PM

Montgomery College (Germantown Campus)*
Bioscience Education Building

20200 Observation Drive
Germantown, MD 20876

Snow Date: Tuesday, February 14, 2017

***The Montgomery College Germantown Campus** is accessible via Ride On Route 83 or via the Shady Grove Station on Metrorail Red Line to Ride On Route 55 to the on-campus stop.

Wednesday, February 8, 2017
6:30 PM - 8:30 PM

Executive Office Building (EOB)*
Cafeteria – Terrace Level

101 Monroe Street
Rockville, MD 20850

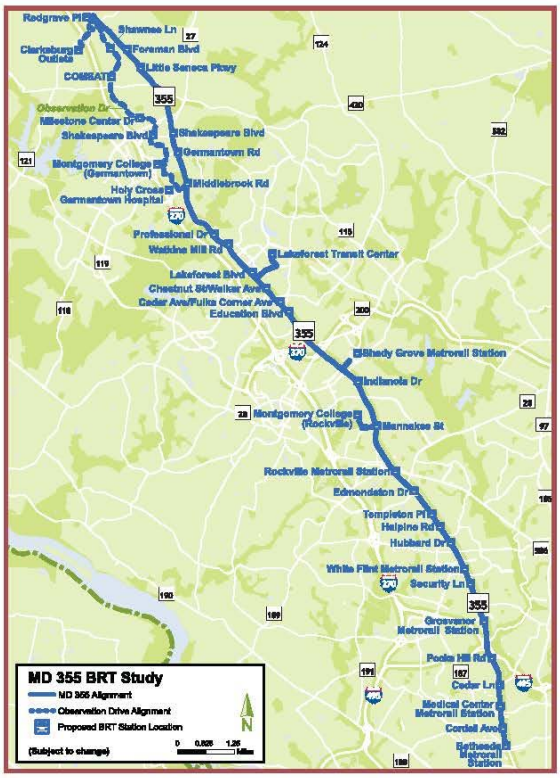
Snow Date: Monday, February 13, 2017

Parking will be available in the parking garage below the **EOB**. Enter off of Monroe Street, park on the G-2 (lowest) level.

***The EOB** is accessible via the Rockville Station on the Metrorail Red Line, Metrobus routes Q1, Q2, Q4, Q5 and Q6, and Ride On routes 44, 46, 47, 54, 56 and 63.

The same information will be available at each Open House. Stop by anytime.

The Maryland Department of Transportation, in partnership with the Montgomery County Department of Transportation, is conducting a study for developing Bus Rapid Transit (BRT) along a portion of the MD 355 corridor (as well as Observation Drive), as shown on the map below. Conceptual Alternatives have been developed and will be presented at two public Open Houses. The Open Houses will be held to provide information and seek comments from the public. The public's input is important in determining which Conceptual Alternatives will be refined and studied in more detail during the next phase of the BRT study.



What is Bus Rapid Transit?

Bus Rapid Transit is a transit system that uses specialized vehicles to provide faster, more reliable service, while offering flexibility to meet transit demand. BRT features may include:

- **Frequent, all-day service**
- **Dedicated, BRT-only lanes**
- **Fare payment before boarding**
- **Easy, level boarding**
- **Stations**
- **Transit signal priority and improvements at intersections**

At the Open Houses, you will meet the project team, and review and provide feedback on:

- **Conceptual Alternatives**
- **Results of Preliminary Analysis**
- **Station Design Concepts**
- **Next Steps**

Your comments and suggestions are very important to us!

Project information can be found at **montgomerycountymd.gov/brt/**. We encourage you to submit questions or comments to **md355brt@mta.maryland.gov** or by mail to Maryland Transit Administration, 6 St. Paul Street, Suite 902, Baltimore, MD 21202.

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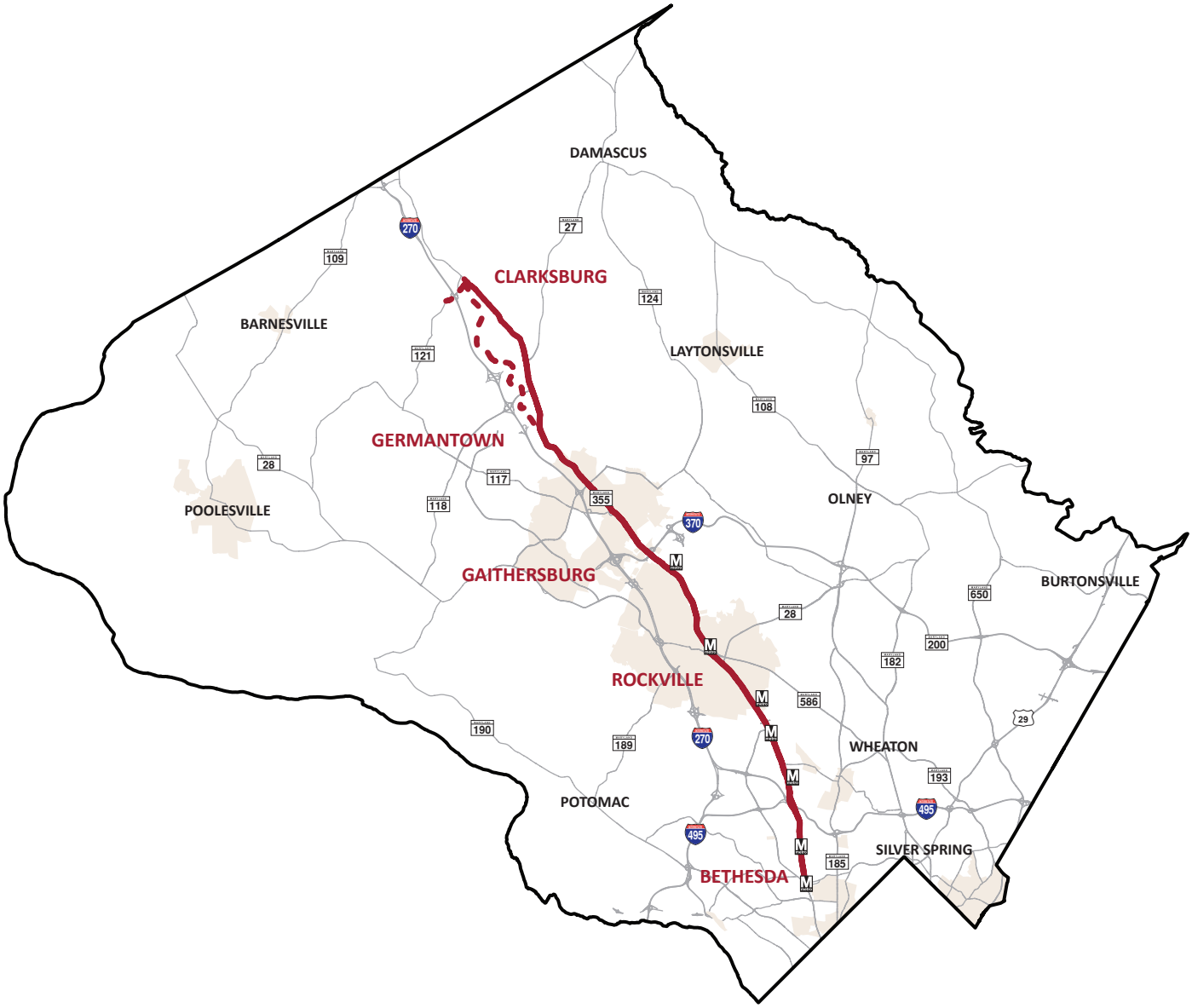
MTA Corridor Manager
410-767-3752 • 866-743-3682 • TTY 410-539-3497

Maryland Department of Transportation

MCDOT Montgomery County Department of Transportation

Montgomery County
RAPID TRANSIT
MD 355

7.0 CONCEPTUAL ALTERNATIVES EVALUATION



MARYLAND DEPARTMENT OF TRANSPORTATION

MCDOT
Montgomery County
Department of Transportation

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Chapter 7.0

Conceptual Alternatives Evaluation

7.1 Introduction

As discussed in previous sections of this Conceptual Alternatives Report, the Conceptual Alternatives were qualitatively compared using a set of screening criteria. The screening criteria identified during this stage of the process address transit ridership, travel times, person throughput, accessibility, impacts and costs.

The findings from this preliminary analysis will be used to answer questions about the project limits, alignment, running way operations, station locations and service plan. The screening criteria will also be used to screen out alternatives that show the least benefit in terms of the goals of the MD 355 BRT project, thus allowing a more detailed analysis on a refined set of alternatives in the next phase of the project.

7.2 Screening Criteria Results

The results of the screening criteria have been documented in Chapter 5. The summary table of the corridor level screening criteria is shown in ***Table 7-1***.

Table 7-1: Screening Criteria Summary Results

	Alt 3A	Alt 3B	Alt 4A	Alt 4B
Increase in total daily transit ridership	Medium	Higher	Lower	Higher
Increase in total daily bus ridership	Medium	Higher	Lower	Higher
Total daily BRT ridership	Medium	Higher	Lower	Higher
Boardings by station – North Section *(Section 7)*	Higher	Medium	Medium	Lower
Boardings by station – Central Section *(Section 6 through Section 2)*	Lower	Higher	Lower	Higher
Boardings by station – South Section *(Section 1)*	Same for Alternatives 3B and 4B			
BRT travel time	See Chapter 5 for detailed breakdown			
BRT travel time vs. local bus travel time				
BRT travel time vs. auto travel time				
Change in peak hour person throughput				
Change in daily person throughput				
Increase in jobs within 45 minutes along the corridor	Medium	Higher	Lower	Lower
Increase in jobs within 60 minutes along the corridor	Medium	Higher	Lower	Medium
Increase in households within 45 and 60 minutes of activity centers	Lower	Higher	Lower	Higher
Total property impacts[1]	Medium	Higher	Medium	Lower
Total operating costs	Higher	Medium	Lower	Medium
Construction costs[1]	Medium	Higher	Medium	Lower

[1] For a detailed breakdown of impacts and costs by section refer to Chapter 5.

7.3 Screening Criteria Analysis

The results of the screening criteria have yielded important information about the BRT Alternatives.

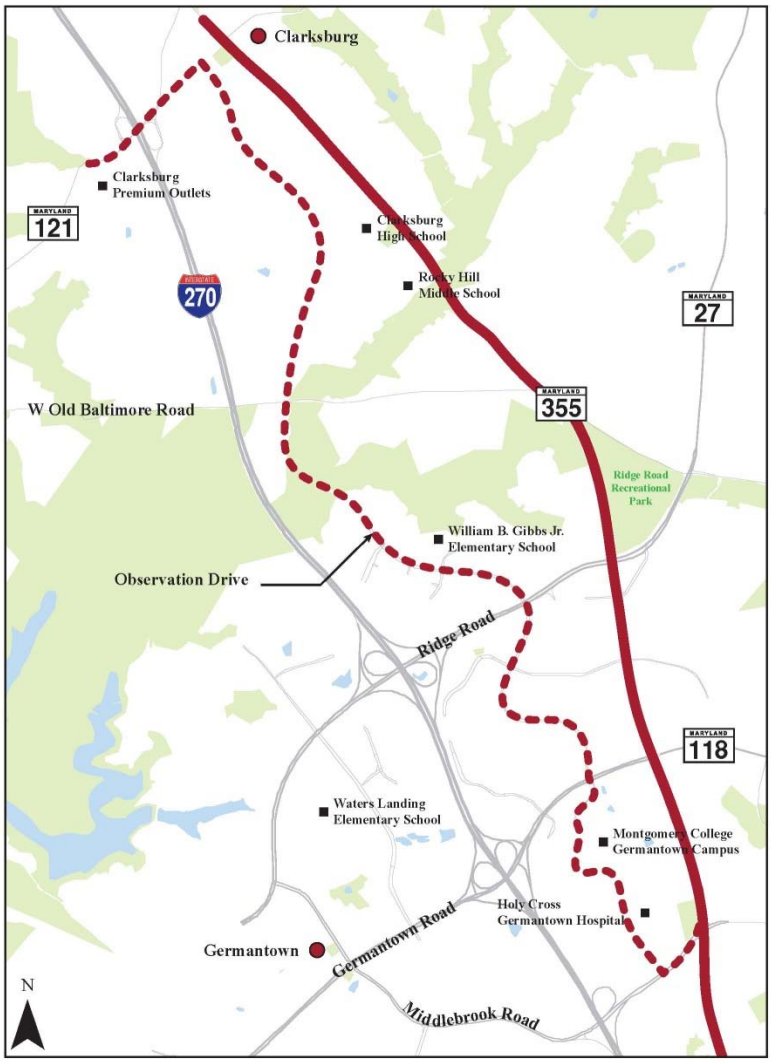
7.3.1 Northern Alignment - MD 355 and Observation Drive

During the development of the BRT Alternatives, some CAC members recommended investigating a parallel route to MD 355 in the northern end of the project. Observation Drive is a north-south County roadway that parallels MD 355 between Middlebrook Road and Woodcutter Drive / Waters Discover Lane. There are plans to extend Observation Drive north of its current termini and to tie it into Stringtown Road in Clarksburg.

At the request of the CAC, the study team included a BRT Alternative (Alternative 3A) to test the BRT running in mixed traffic along Observation Drive compared to a MD 355 alignment (see ***Figure 7-1***). The findings from the screening criteria results reveal:

- **Over 50 percent higher ridership identified along Observation Drive compared to MD 355.**
- **It takes twice as long (or more) for the BRT to travel along Observation Drive compared to MD 355.**
- **Observation Drive has higher ridership despite longer BRT travel times due to higher number of large trip generators.**
- **Observation Drive has operational costs that are over 40 percent higher than the other alternatives due to higher ridership and longer travel times, each of which results in more buses and service.**
- **The mixed traffic running way along Observation Drive (Alternative 3A) results in lower property impacts and lower construction costs than alternatives along MD 355.**

Figure 7-1: MD 355 and Observation Drive Alignment



7.3.2 Southern Termini – Grosvenor Metrorail Station or Bethesda Metrorail Station

Another significant difference in the alternatives evaluated is the southern terminus. Alternatives 3A and 4A evaluated terminating BRT service at the Grosvenor Metrorail Station while Alternatives 3B and 4B evaluated extending the BRT service to the Bethesda Metrorail Station.

The section between the Grosvenor Metrorail Station and the Bethesda Metrorail Station (Section 1) has significant constraints that were outlined in Chapter 3. These constraints limit the running way options that could be investigated in this section to running in mixed traffic and lane repurposing. Both running way options would limit the infrastructure improvements to the existing pavement width. The findings from the screening criteria reveal:

- **Approximately 15 percent of total corridor ridership is generated at stations south of Grosvenor Metrorail Station.**
- **Extending service to Bethesda Metrorail Station:**
  - **Increases the ridership on the central section (Middlebrook Road to Grosvenor Metrorail Station – Sections 6-2) by more than ten percent.**
  - **Increases accessibility for households to activity centers by approximately 40 to 75%.**
  - **Provides improved transit access to key activity centers including Medical Center and downtown Bethesda without having to transfer to Metrorail.**
- **Terminating service at Grosvenor Metrorail Station would result in lower property impacts, operational costs and construction costs.**

Figure 7-2: Southern Termini

7.3.3 Differences in Ridership for New BRT Service Between the Alternatives

Ridership can vary depending on the service plans developed for each BRT Alternative. Station locations and travel times can affect the desire and ability of transit riders to utilize the BRT. The findings from the screening criteria reveal:

- **Providing service along Observation Drive increases ridership due to a higher number of large trip generators.**
- **Extending service to Bethesda increases ridership by expanding the BRT market and providing improved transit access to additional activity centers without having to transfer to Metrorail.**
- **In general, the median running way sections have up to 20 percent shorter BRT travel times, compared to the curb running way, thus generating higher ridership within those sections.**

7.3.4 Effects of Lane Repurposing in Sections 3 and 1 (Alternatives 3B and 4B)

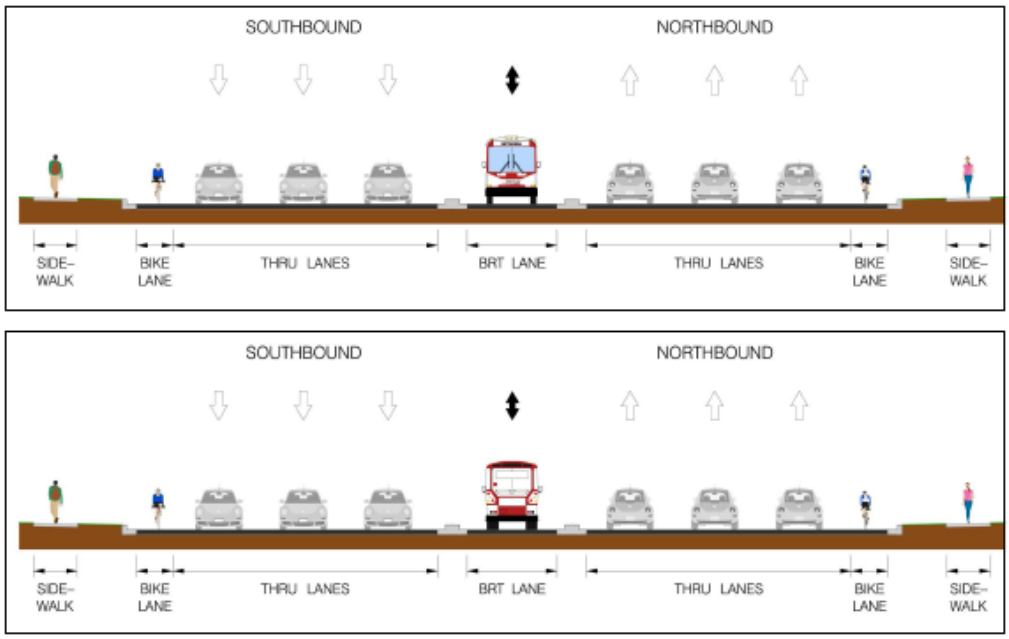
Lane repurposing running way options were evaluated for areas with significant right-of-way constraints including Sections 5 (Gaithersburg), 3 (Rockville Town Center) and 1 (Bethesda). Lane repurposing was evaluated in these sections in an effort to minimize impacts. The lane repurposing running way options investigated would convert a traffic lane to a dedicated bus lane. The findings from the screening criteria in Sections 3 and 1 reveal:

- **Transit person throughput increases between 80 percent and 130 percent within the different sections with repurposed lanes compared to the No-Build.**
- **Total person throughput decreases by up to 15 percent in Sections 3 and 1 where lane repurposing is being proposed due to a decrease in auto throughput outweighing an increase in transit throughput.**
- **The running ways where lane repurposing is being proposed results in lower impacts and lower construction costs.**

7.3.5 Operational Characteristics for the Bi-directional Running Way (Alternatives 3A and 4A) in Section 3

A bi-directional running way was evaluated in Section 3 (Rockville Town Center).

Figure 7-3: Bi-directional Running Way in Section 3



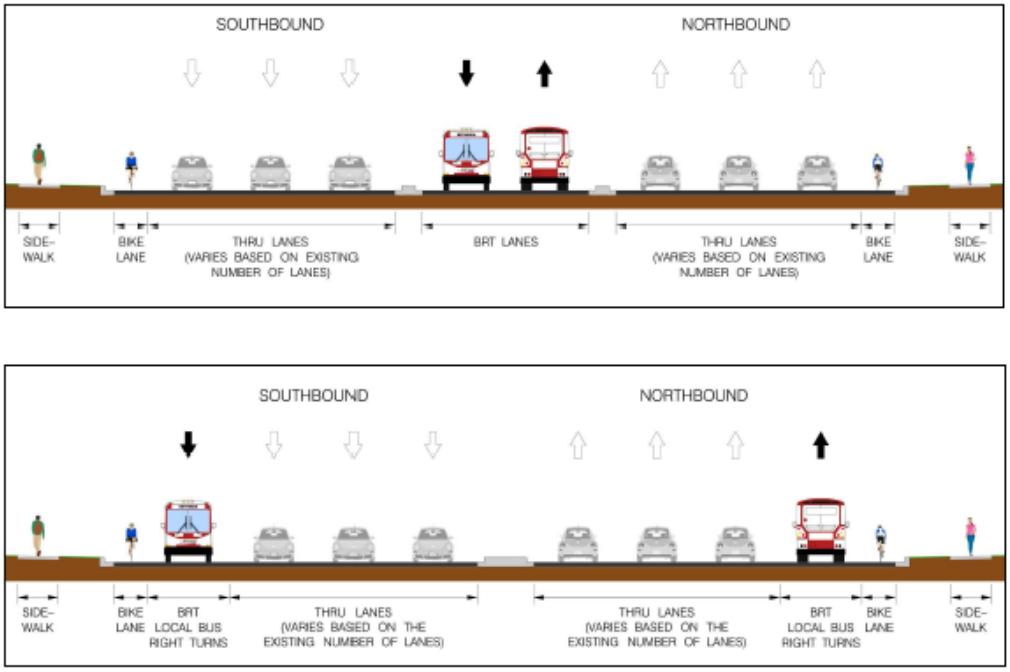
A bi-directional running way provides for two-way operations in a single dedicated lane, therefore minimizing the required footprint and associated impacts. The findings from the screening criteria in Section 3 reveal:

- **BRT travel times are up to 25 percent longer in alternatives with bi-directional operations (Alternatives 3A and 4A).**
- **BRT ridership is up to 25 percent lower in Section 3 in alternatives with bi-directional operations (Alternatives 3A and 4A).**
- **Average delay per BRT trip ranges from a low of 1 minute 30 seconds to more than 3 minutes.**
- **The wider footprint of the bi-directional running way results in construction costs more than 13% higher compared to lane repurposing options.**

7.3.6 Median and Curb Running Way Comparison

Running way options evaluated for Section 7 (Clarksburg / Germantown), Section 6 (Germantown / Montgomery Village), Section 4 (Shady Grove / Rockville), and Section 2 (Rockville / White Flint) included both median and curb.

Figure 7-4: Median vs Curb Running Way



The screening criteria results revealed certain tradeoffs and correlations between curb and median running ways:

- **In general, the median running way sections have up to 20 percent shorter BRT travel times generating higher ridership within those sections**
- **Median running way has a wider footprint and results in more than 25 percent higher property impacts and 60% higher construction costs compared to the curb running way**

7.3.7 BRT Service Features that are affecting Operational Costs

Ridership and travel times affect operations of the BRT, and the required service plans yield varying operational costs for each BRT Alternative. The findings from the screening criteria reveal:

- **Orange BRT Route (Clarksburg to Rockville along Observation Drive) is more than double the cost to operate than the other BRT Routes in the service plan.**
- **Higher ridership originating along Observation Drive on the BRT Orange route requires more frequent service to provide the capacity to meet ridership demand, thus resulting in more vehicles in service. The more vehicles required for service, the higher are operating costs.**
- **Longer travel times along Observation Drive due to mixed traffic operations also require more vehicles in service, thus also resulting in higher operating costs.**

7.3.8 BRT Service Features that are affecting Property Impacts and Constructions Costs

The differences in running way options for the BRT Alternatives can influence the amount of property impacts depending on the proposed footprints. Similarly, the construction costs can be affected by the running way options

and their need for individual elements, ranging from the total rebuild of the existing infrastructure with new features, to utilizing the existing infrastructure. The findings from the screening criteria reveal:

- **Median running way has a wider footprint and results in over 25 percent higher property impacts and 60 percent higher construction costs compared to the curb running way.**
- **Mixed traffic running way along Observation Drive is reducing property impacts and construction costs on Alternative 3A.**
- **Extending service to Bethesda Metrorail Station results in higher property impacts and construction costs due to additional stations.**

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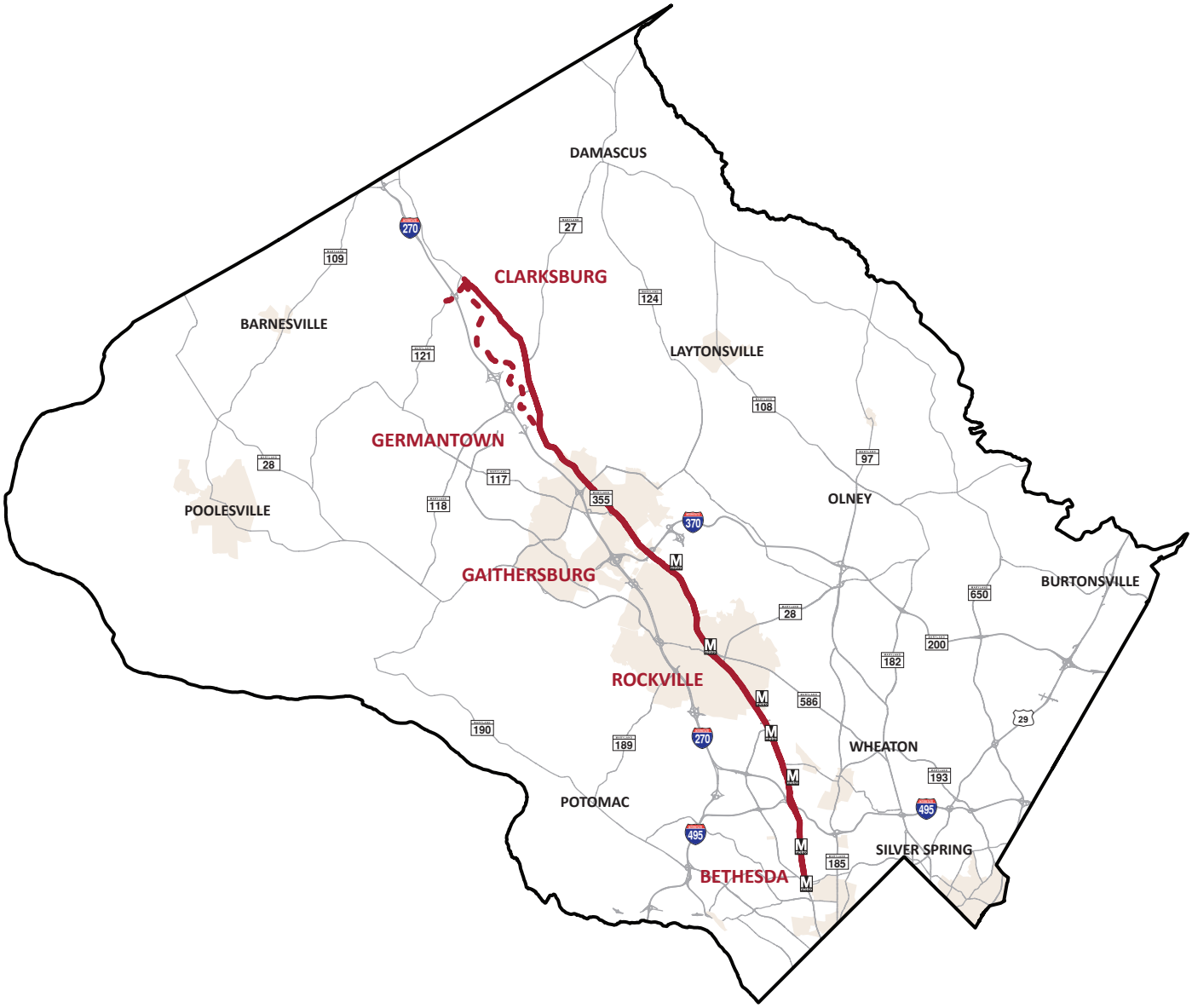
MD 355

8.0 ALTERNATIVES ADVANCING TO NEXT PHASE



MARYLAND DEPARTMENT OF TRANSPORTATION

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Chapter 8.0

Alternatives Advancing to Next Phase

8.1 Introduction

This chapter of the Conceptual Alternatives Report represents the culmination of planning process Step 2, as outlined in Section 1.3, and presents the alternatives that will be studied in the next project phase. The refined alternatives moving forward are based on the analysis completed during this phase, input received from the CACs and public, and coordination with project stakeholders.

The alternatives refined and identified will be studied in greater detail in Step 3 of the Corridor Planning Process and ultimately an alternative will be recommended to be studied under NEPA or MEPA.

8.2 Input from Public and Coordination with Project Stakeholders

8.2.1 Input from the Public

As described in Chapter 6 (Public Involvement), the MD 355 BRT Corridor Planning Study has had a strong public outreach process to gather input and feedback from residents, business owners and other stakeholders. At the conclusion of the preliminary analysis, takeaways and qualitative data results were presented to the CACs at meeting No. 8 and meeting No. 9. At meeting No. 9, an exercise was conducted to obtain input from the members on what the alternatives moving to the next phase should be. This information was also presented to the broader public at the two open houses held in February 2017.

The input provided by the CACs was summarized and can be found on the project website (www.montgomerycountymd.gov/brt). All comments received by the public at the open houses can be found in ***Appendix G***. Input from the CACs and the public was reviewed and some of the recommendations proposed have been included in one or more of the refined alternatives described in Section 8.4. These recommendations included:

- Maintaining a median and a curb alternative in the next phase
- Alignment along Observation Drive north of Middlebrook Road
- Investigating a peak reversible BRT for Section 3
- BRT running in mixed traffic in Section 1

8.2.2 Coordination with Project Stakeholders

In addition to input from the public, the project team has met with other project stakeholders including the City of Gaithersburg and the City of Rockville to receive their input on the alternatives that should advance to the next phase, particularly within their jurisdictions.

The City of Gaithersburg representatives indicated that the bi-directional dedicated median lane in Section 5 should continue forward under a median alternative. In addition, they recommended that the BRT run in mixed traffic in the

curb alternatives. These recommendations have been included as part of the refined alternatives described in Section 8.4.

8.3 Section Analysis

The analytic framework for determining which elements of BRT Alternatives 3A, 3B, 4A, and 4B will be advancing to the next phase of the MD 355 BRT study is the engineering, transit and transportation analysis outlined in Chapter 5 of this report.

The focus of this section of Chapter 8 is to outline the alternatives refinement process in more detail. The description of the alternatives refinement process is structured around each of the alignment sections used for the engineering and transportation analysis. Each section description includes the following subsections:

- Description of alignment configuration options/elements considered in current phase of work
- Description of alignment configuration options/elements dropped from further consideration
- Description of alignment configuration options/elements retained for more detailed analysis in the next phase of work

The final alignment configurations within each section will be combined to yield the full corridor-length refined BRT Alternatives moving forward into the next project phase in addition to Alternative 1 (No-Build) and Alternative 2 (TSM) along MD 355. These full-length alternative descriptions are outlined in Section 8.4.

8.3.1 Sections 6, 4 and 2

8.3.1.1 Alignment Configuration Options/Elements Considered

Two alignment configurations were considered in Section 6 (Middlebrook Road to MD 124), Section 4 (Summit Avenue to College Parkway) and Section 2 (Dodge Street to Grosvenor Metrorail Station).

The first configuration is two dedicated median BRT lanes that would be achieved through the widening of MD 355. Under this configuration, BRT service would have a dedicated lane in each direction of service, with the lanes used only by BRT.

The second configuration is two dedicated curb lanes that would also be achieved through the widening of MD 355. As with the median dedicated lanes, BRT service would have a dedicated lane in each direction of service. In this instance, however, the BRT service would share the dedicated curb lane with local transit service and right turning vehicles.

8.3.1.2 Alignment Configuration Options/Elements Dropped

The engineering and transportation analysis completed during this project phase showed that while there were differences between the curb and median options in Sections 6, 4, and 2, the differences were not great enough to decisively indicate that only one of the options should move forward for incorporation into the refined BRT alternatives. Therefore, it was determined that one refined BRT Alternative would incorporate dedicated median lanes achieved through widening and that the second refined BRT Alternative would incorporate dedicated curb lanes, also achieved through widening. The alternative incorporating the dedicated median lanes is labeled as Alternative 3C and the alternative incorporating the dedicated curb lanes is labeled as Alternative 4C. The

roadway configuration in Sections 6, 4 and 2 will impact the final running way configuration in Sections 7, 5, 3 and 1. The differences in running way configuration in Section 7, 5, 3 and 1 between Alternatives 3C and 4C are outlined in more detail below.

8.3.1.3 Alignment Configuration Options/Elements Retained

As noted in Section 8.3.1.2, both alignment configurations considered in the current phase of work, dedicated median transit lanes and dedicated curb transit lanes, will be retained for incorporation into either refined Alternative 3C (dedicated median lanes in Sections 6, 4 and 2) or refined Alternative 4C (dedicated curb lanes in Section 6, 4 and 2).

8.3.2 Section 7 (Clarksburg to Middlebrook Road)

8.3.2.1 Alignment Configuration Options/Elements Considered

There were two different alignments considered in Section 7, with two different alignment configurations further considered in one of the alignments. These are outlined below

- Alignment 1 – MD 355 between Redgrave Place and Middlebrook Road – This alignment was the original alignment identified in the BRT master plan, and would involve service continuing on MD 355 north of Middlebrook Road to the northern terminal at Redgrave Place. This alignment was part of current Alternatives 3B, 4A, and 4B. In Alternative 3B the alignment configuration would consist of two dedicated median lanes supporting BRT service in each direction. The median lanes would be achieved through roadway widening. Under Alternatives 4A and 4B, the alignment configuration would consist of new dedicated curb BRT lanes supporting BRT service in each direction. These curb lanes would also be achieved through roadway widening.
- Alignment 2 – Observation Drive between the Clarksburg Outlets and Middlebrook Road – This alignment was added after the project planning process began based on feedback from project stakeholders, including CAC members. This alignment was included as part of Alternative 3A. The alignment configuration for Observation Drive assumed BRT vehicles would run in mixed traffic with TSM treatments applied where feasible.

8.3.2.2 Alignment Configuration Options/Elements Dropped

A review of ridership results for each of the four BRT Alternatives shows substantially higher ridership on Observation Drive due to the larger number of activity centers located there when compared to MD 355. The physical impacts and construction costs associated with the Observation Drive alignment are also lower because there will be no right-of-way expansion. For that reason, the MD 355 alignment, north of Middlebrook Road, was dropped from further consideration as refinements to the BRT Alternatives. The option of routing the BRT in the curb along MD 355 from Redgrave Place to Middlebrook Road (Section 7) may be considered if the widening of MD 355, as envisioned in the County's Master Plan of Highways and Transitways, is pursued as a separate project.

8.3.2.3 Alignment Configuration Options/Elements Retained

Based on the analysis noted above, the Observation Drive alignment, with operations in mixed traffic, will be incorporated into both refined BRT Alternatives 3C and 4C.

8.3.3 Section 5 (MD 124 to Summit Avenue)

8.3.3.1 Alignment Configuration Options/Elements Considered

All four BRT Alternatives (3A, 3B, 4A, 4B) have the same alignment configuration in Section 5. This configuration consists of bi-directional operations along a single repurposed center left turn lane, which currently accommodates left turns from both directions. Bi-directional operations consist of a single dedicated median transit lane that would accommodate BRT vehicles running in bother directions. BRT vehicles running in one direction would have to wait while a BRT vehicle coming in the opposite direction passes. Passing areas would be provided where feasible.

8.3.3.2 Alignment Configuration Options/Elements Dropped

The bi-directional configuration under each of the BRT Alternatives will be retained for incorporation into one of the refined BRT Alternatives moving forward. This is described in more detail in Section 8.3.3.3.

8.3.3.3 Alignment Configuration Options/Elements Retained

As noted in subsection 8.3.3.2, the median bi-directional configuration will remain as a configuration option. This configuration will be incorporated into the median Alternative 3C, which has median running in adjacent Alignment Sections 6 and 4. For refined BRT Alternative 4C, BRT vehicles would run in mixed traffic, with TSM treatments applied wherever feasible. Running vehicles in mixed traffic under 4C would help to avoid operational delays and complications associated with vehicles having to move over from the curb in either Section 4 or 6 to access the Section 5 median bi-directional lane, and then to move back over to the curb for vehicles exiting Section 5.

8.3.4 Section 3 (College Parkway to Dodge Street)

8.3.4.1 Alignment Configuration Options/Elements Considered

Section 3, which is in the heart of the Rockville Town Center, faces constrained right-of-way. This constrained right-of-way dictated the options that were available to the project team when developing the BRT Alternatives (3A, 3B, 4A, and 4B). Within this context, three alignment configuration options were tested in Section 3, as outlined below:

- Bi-directional operations – this configuration option was part of BRT Alternatives 3A and 4A and consisted of a single dedicated median transit lane that would accommodate BRT vehicles running in both directions. Under this configuration, BRT vehicles running in one direction would have to wait while a BRT vehicle coming in the opposite direction is passing. Passing areas to support vehicles passing each other would be incorporated into the dedicated lane where feasible. This single dedicated lane would be achieved through widening MD 355.
- Lane repurposing – dedicated median lanes – this configuration was part of BRT Alternative 3B and would consist of two dedicated median lanes supporting BRT traffic in each direction (a dedicated lane for each direction). These two dedicated median lanes would be achieved through lane repurposing.

- Lane repurposing – dedicated curb lanes – this configuration was part of BRT Alternative 4B and would consist of two dedicated curb lanes supporting BRT traffic in each direction (a dedicated lane for each direction: in addition, these lanes would be used by local bus and right turning vehicles). These two dedicated median lanes would be achieved through lane repurposing of two existing lanes, requiring little to no infrastructure modifications.

8.3.4.2 Alignment Configuration Options/Elements Dropped

Significant impact analysis was completed for each of the three alignment configuration options described above, with a focus on understanding both the impacts to transit operations and to general traffic. The analysis showed that all three of the configurations described above had transit or traffic operational challenges. Specifically, it was determined that the delays to BRT vehicles under the bi-directional configuration (Alternatives 3A and 4A) would be quite substantial, to the point that BRT operations would be highly degraded. Given these significant impacts to BRT operations, it was determined that the bi-directional alignment configuration would be dropped from further consideration and would not be incorporated into either of the refined BRT Alternatives As noted above in Section 8.3.3 , bi-directional operations were retained in Section 5. The reason for retaining the bi-directional operation in Section 5 but dropping it in Section 3 is that the delays to BRT operations are much more significant in Section 3 when compared to Section 5. This is due to the longer length of Section 3 as well as the fact that there is more frequent service in Section 3 based on the configuration of route patterns in the Section. Each of these factors results in greater opportunities for BRT vehicle conflicts and thus greater delay.

The detailed analysis completed also showed that both lane repurposing options would have significant negative impacts on traffic operations and person throughput, so the lane repurposing options were also dropped from further consideration.

Since all configuration options considered in the current project phase were determined to be untenable, the project team developed and tested a series of configuration scenarios to determine configurations that would be more effective in terms of both BRT and general traffic operations. The configurations selected for incorporation into Alternatives 3C and 4C are outlined in subsection 8.3.4.3.

8.3.4.3 Alignment Configuration Options/Elements Retained

Based on the scenario testing noted above, the following configurations are recommended for incorporation into the two refined BRT Alternatives moving forward into the next project phase.

- Dedicated Median Lane - a single dedicated median lane is recommended for incorporation into the median refined BRT Alternative (3C). The single dedicated median lane would be achieved through the widening of MD 355.
  The transit operations element of this configuration has not been finalized and two potential transit operational configurations will be evaluated in the next phase.
  - The first operational option would be to run southbound BRT vehicles in the dedicated BRT lane throughout the day. Northbound BRT traffic would run in mixed traffic with TSM elements applied wherever feasible.

- The second operational option would be to run BRT vehicles in the dedicated BRT lane in the southbound direction in the AM peak and the northbound direction in the PM peak. This second option was mentioned as a potential option for Section 3 by several CAC members in CAC Meeting No. 9.

- Dedicated Curb Lane – a single dedicated curb lane in the southbound direction is recommended for incorporation into the curb refined BRT Alternative 4C. Northbound BRT traffic would run in mixed traffic with TSM elements applied wherever feasible.

8.3.5 Section 1 (Grosvenor Metrorail Station to Bethesda Metrorail Station)

8.3.5.1 Alignment Configuration Options/Elements Considered

Only two of the BRT Alternatives (3B and 4B) run the full length of the corridor to Bethesda (the other two Alternatives (3A and 4A) terminate at Grosvenor). The roadway configuration in Section 1 is the same for both Alternatives 3B and 4B and consists of the following elements:

- There would be a dedicated curb transit lane in the peak direction (southbound in the AM peak and northbound in the PM peak). The dedicated lane would be achieved through repurposing the curb general traffic lane to dedicate it to transit. Given the right-of-way constraints in Section 1, there would be no expansion of the current cross-section.
- Currently there are three general traffic lanes in each direction in Section 1. Under the BRT Alternative alignments, peak direction general traffic lane capacity would be maintained through a dynamic reconfiguration of lanes throughout the day.
- In order to maintain general traffic lane capacity in the peak direction, off-peak direction capacity would be reduced in some portions of Section 1.

8.3.5.2 Alignment Configuration Options/Elements Dropped

Detailed analysis was completed to determine the efficacy of lane repurposing in Section 1 given the potential for significant traffic impacts due to the removal of off-peak direction general traffic lane capacity (within some portions of Section 1) and required modifications to current signal cycles. The analysis showed that lane repurposing did not meet two key metrics (increase in person throughput and a net improvement in person travel time) used by the project team to determine if lane repurposing is a viable option.

However, due to the desire by members of the project team to continue evaluating lane repurposing in order to determine if any changes to the proposed configuration or any mitigation measures could improve the metrics described above, the proposed repurposing configuration will be carried forward as part of one alternative so that additional analysis and alternatives comparison can be completed.

8.3.5.3 Alignment Configuration Options/Elements Retained

As explained in Section 8.3.5.2, it was determined that the curb lane repurposing configuration would be retained for further analysis in the next phase of the project. This dedicated transit curb lane will be incorporated into the overall curb BRT Alternative (Alternative 4C). This configuration would allow for a seamless transition from the dedicated curb configuration in Section 2 to a dedicated curb configuration in Section 1.

Since it was determined that a median configuration in Section 1 is not feasible, the Section 1 configuration for the dedicated median BRT Alternative (Alternative 3C) will be BRT operations in mixed traffic with TSM treatments applied where feasible.

It should be noted that the forecasted ridership in Section 1 led the project team to make the decision that both refined BRT Alternatives (3C and 4C) would run the full length of the project alignment to Bethesda. As noted earlier in the document, up to 15% of total daily boardings would occur in Section 1, south of Grosvenor. For that reason, the team determined that an alternative terminating at Grosvenor would not be retained.

8.4 Alternatives Advancing to Next Phase

8.4.1 Running Way

Four Alternatives have been identified to advance to the next and more detailed phase of the study. As discussed earlier in the document in Chapter 4, Alternative 1 and Alternative 2 are automatically moving forward to the next phase of the study to act as a basis of comparison to the refined alternatives. Based on the information presented in Section 8.2, two additional alternatives will be moving forward to the next phase, a median alternative and a curb alternative. Maintaining the existing naming convention, the median alternative will be referred to as Alternative 3C and the curb alternative will be referred to as Alternative 4C.

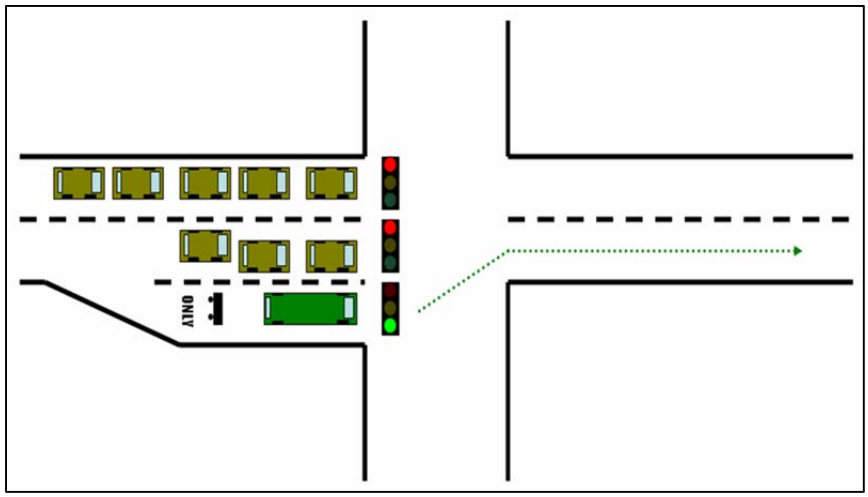
A. Alternative 1 – No-Build

As introduced in Chapter 4, Alternative 1 would consist of no improvements to infrastructure or bus service along the MD 355 Study Corridor beyond those improvements already planned and programmed in the MWCOG CLRP.

B. Alternative 2 – Transportation System Management (TSM)

Alternative 2 ***(Appendix H – Figure 1)*** would consist of enhanced bus service operating in mixed traffic in existing lanes from the Clarksburg Outlets to MD 355 along Clarksburg Road and in mixed traffic in existing lanes from Clarksburg Road to the Bethesda Metrorail Station along MD 355. In addition, minor infrastructure improvements at selected intersections would be included along the alignment where feasible. The minor infrastructure improvements would require widening at selected intersections to benefit transit service. These improvements in the form of queue jumps, would enable the bus to utilize the additional travel lane on the approach to a signalized intersection and avoid waiting on the queue with all other vehicles as shown in ***Figure 8-1***.

Figure 8-1: Queue Jump



The proposed queue jumps would serve as dedicated transit and right turn lanes. Based on preliminary traffic analysis and engineering assessment, the following intersections would be candidates for implementing queue jumps:

- Southbound MD 355 and Little Seneca Parkway
- Northbound MD 355 and Germantown Road
- Northbound MD 355 and Middlebrook Road
- Northbound MD 355 and Redland Boulevard
- Southbound MD 355 and Indianola Drive
- Southbound MD 355 and Rockville Corporate Center
- Southbound MD 355 and Gude Drive
- Northbound and southbound MD 355 and Park Road
- Northbound MD 355 and Church Street
- Northbound and southbound MD 355 at First Street
- Northbound MD 355 at Edmonston Drive
- Northbound MD 355 at Marinelli Road
- Northbound MD 355 and Nicholson Lane
- Northbound and southbound MD 355 at Strathmore Avenue

- Northbound MD 355 at Tuckerman Lane
- Southbound MD 355 at Jones Bridge Road

The feasibility of constructing queue jumps at selected intersections would depend on the available right-of-way and the required length of the queue bypass lane. Additional analysis conducted in the next phase using updated traffic analysis for the specific alternative, should determine if these or other locations in the corridor are feasible to implement.

Alternative 2 could also include TSP at select intersections. TSP would require signal modifications to either extend the green phase to allow an approaching bus to pass through the intersection prior to turning to red or to provide an early green phase to a bus waiting at a red light. The application of TSP at a select intersection will follow Montgomery County's TSP intersection guidance.

C. Alternative 3C – Median Option

Alternative 3C (***Appendix H – Figure 2***) would provide new BRT service between the Clarksburg Outlets and the Bethesda Metrorail Station, primarily in median lanes. The service would be on dedicated lanes between Middlebrook Road and the Grosvenor Metrorail Station along MD 355 and in mixed traffic between the Clarksburg Outlets and Middlebrook Road, along Observation Drive, and between the Grosvenor Metrorail Station and the Bethesda Metrorail Station, along MD 355. The following is a description of the alternative by section:

Section 7 – Clarksburg / Germantown: BRT service would be provided in mixed traffic along Observation Drive as shown in ***Figure 8-2***. Opportunities to implement TSM strategies in Section 7 will be investigated in the next project phase. The BRT would operate along the existing and planned Observation Drive roadway footprint. There are plans to extend Observation Drive north of its current termini and to tie it into Stringtown Road in Clarksburg. New BRT stations would be constructed along the BRT route, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections. The northern termini would be at the Clarksburg Outlets. Phase II of the CCT I planned to be in the median of Observation Drive. Once this infrastructure is built the MD 355 BRT could take advantage of these dedicated lanes if needed.

Section 6 – Germantown / Montgomery Village: BRT service would be provided in two dedicated median lanes where feasible as shown in ***Figure 8-3***. The two dedicated median BRT lanes would narrow to one bi-directional BRT lane over the Middle Great Seneca Creek Bridge to avoid impacts to the structure and approaching the Middlebrook Road intersection to minimize property impacts. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 5 – Gaithersburg: BRT service would be provided in one dedicated bi-directional median lane as shown in ***Figure 8-4***. Passing areas would be created wherever feasible to accommodate BRT service in both directions. The dedicated BRT lane would be created by repurposing the center left turn lane. All left turns would be made at signalized intersections. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections.

Section 4 – Shady Grove / Rockville: BRT service would be provided in two dedicated median lanes where feasible as shown in ***Figure 8-5***. The two dedicated median BRT lanes would narrow to one bi-directional BRT lane between Summit Avenue and Deer Park Road to minimize residential displacements. The lanes would also narrow to one bi-directional BRT lane under the I-370 overpass (between South Westland Drive and Shady Grove Road) to avoid impacts to the structure. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 3 – Rockville Town Center: BRT service would be provided in one dedicated median lane as shown in ***Figure 8-6***. Given the preliminary results of the analysis of the bi-directional running way, the BRT operation will be determined as part of the next phase of the study. The BRT operation could include a peak reversible operation as suggested by members of the CAC, or some other configuration to reduce the BRT delay in this section. The dedicated BRT lane would be created by widening the roadway to the outside. All existing travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections.

Section 2 – Rockville / White Flint: BRT service would be provided in two dedicated median lanes as shown in ***Figure 8-7***. The dedicated BRT lanes would be created by widening the roadway to the outside. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the sidewalks and crosswalks at signalized intersections. All existing un-signalized left turn movements would be removed. Those turns would be made at the next signalized intersection.

Section 1 – Bethesda: BRT service would be provided between the Grosvenor Metrorail Station and the Bethesda Metrorail Station in mixed traffic as shown in ***Figure 8-8***. Opportunities to implement TSM strategies in Section 1 will be investigated in the next project phase.

Figure 8-2: Alternative 3C - Section 7: Clarksburg / Germantown

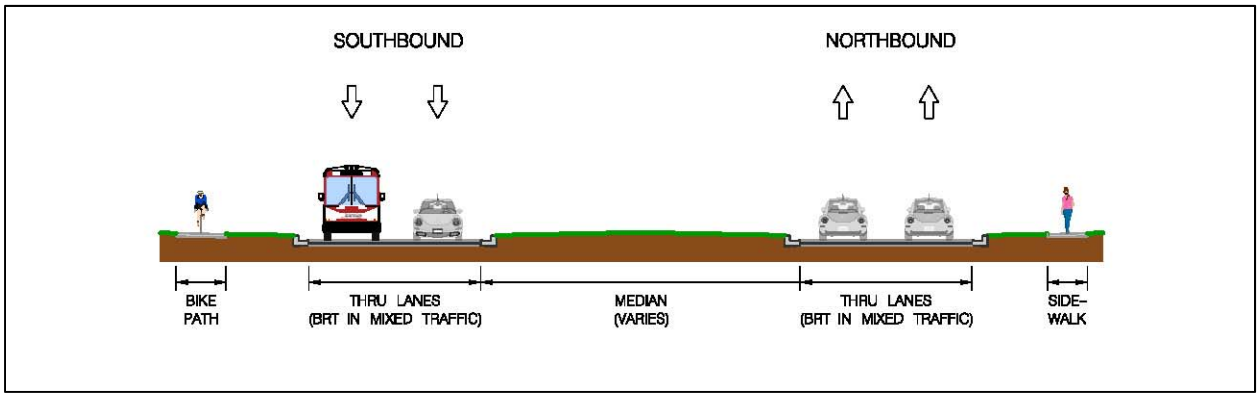


Figure 8-3: Alternative 3C - Section 6: Germantown / Montgomery Village

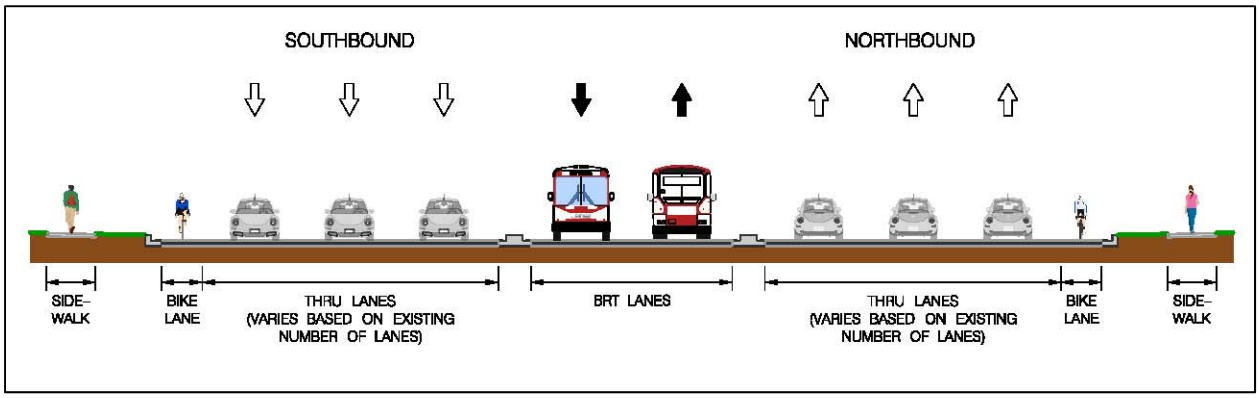


Figure 8-4: Alternative 3C - Section 5: Gaithersburg

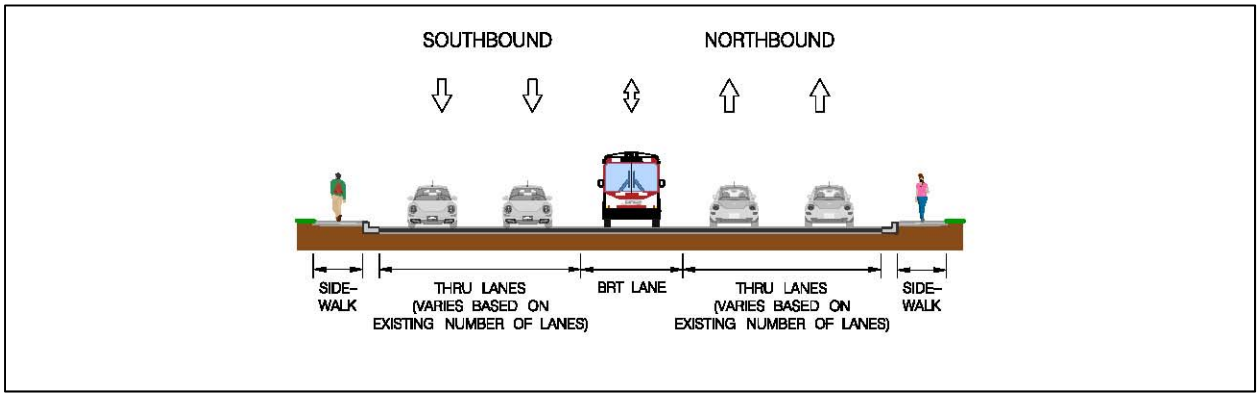


Figure 8-5: Alternative 3C - Section 4: Shady Grove / Rockville

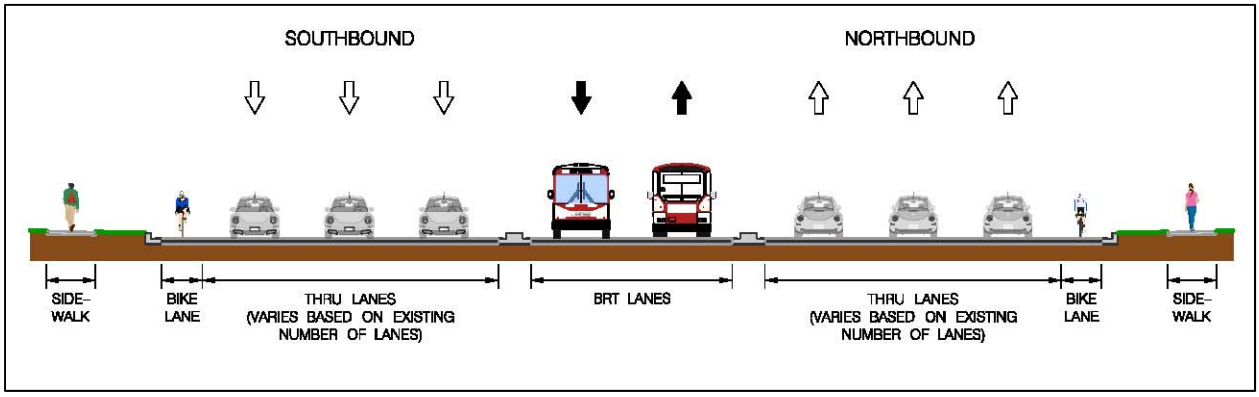


Figure 8-6: Alternative 3C - Section 3: Rockville Town Center

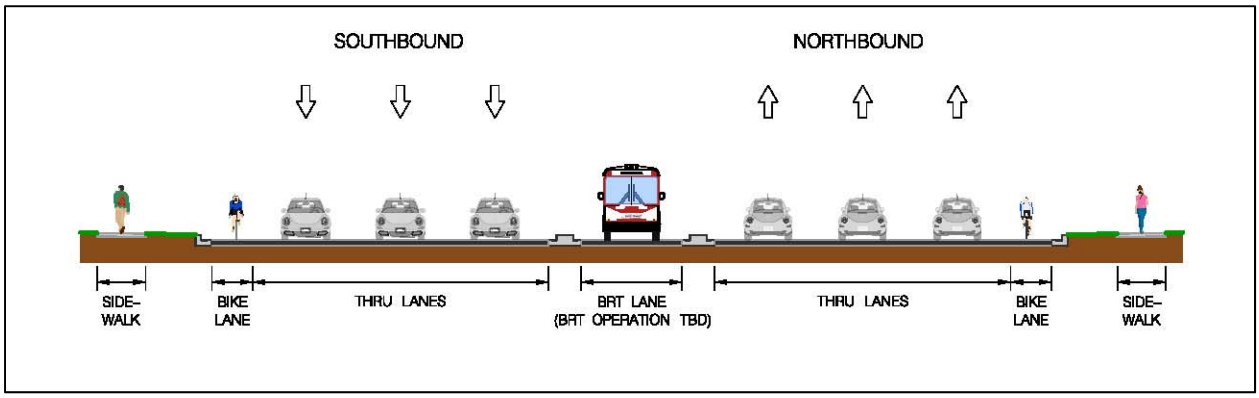


Figure 8-7: Alternative 3C - Section 2: Rockville / White Flint

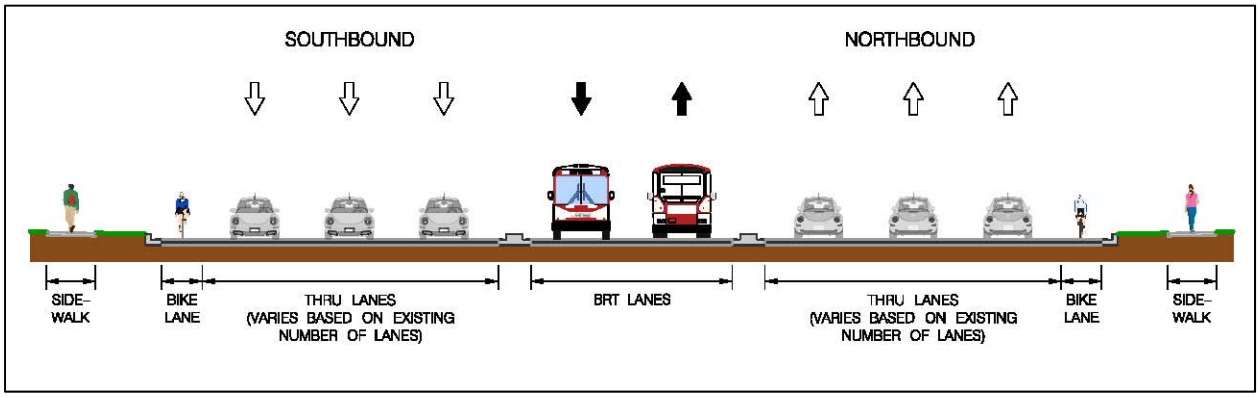
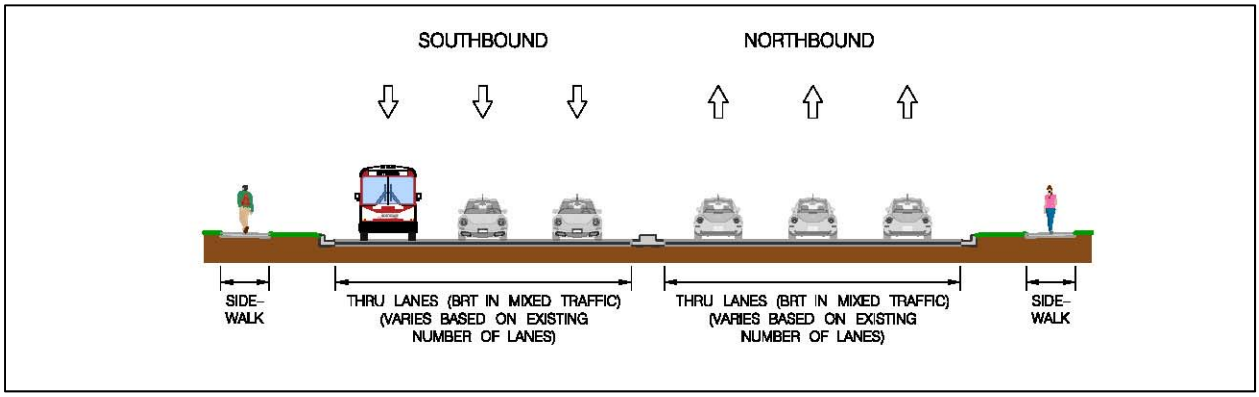


Figure 8-8: Alternative 3C - Section 1: Bethesda



D. Alternative 4C – Curb Option

Alternative 4C (***Appendix H – Figure 3***) would provide new BRT service between the Clarksburg Outlets and the Bethesda Metrorail Station, primarily in curb lanes. The service would be on dedicated curb lanes between Middlebrook Road and MD 124 and between Summit Avenue and the Bethesda Metrorail Station along MD 355 and in mixed traffic between the Clarksburg Outlets and Middlebrook Road, along Observation Drive, and

between MD 124 and Summit Avenue, along MD 355. The following is a description of the alternative by section:

Section 7 – Clarksburg / Germantown: BRT service would be provided in mixed traffic along Observation Drive as shown in ***Figure 8-9***. Opportunities to implement TSM strategies in Section 7 will be investigated in the next phase. The BRT would operate along the existing and planned Observation Drive roadway footprint. There are plans to extend Observation Drive north of its current termini and to tie it into Stringtown Road in Clarksburg. The stations will be located along the curb. The northern termini would be at the Clarksburg Outlets. The option of routing the BRT in the curb along MD 355 from Redgrave Place to Middlebrook Road (Section 7) may be considered if the widening of MD 355, as envisioned in the County's Master Plan of Highways and Transitways, is pursued as a separate project.

Section 6 – Germantown / Montgomery Village: BRT service would be provided in two dedicated curb lanes where feasible as shown in ***Figure 8-10***. The BRT would run in mixed traffic in the vicinity of the Middle Great Seneca Creek Bridge, Seneca Creek State Park, and Great Seneca Stream Valley Park, in order to avoid impacts to the structure and minimize environmental impacts. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 5 – Gaithersburg: BRT service would be provided in mixed traffic as shown in ***Figure 8-11***. Opportunities to implement TSM strategies in Section 5 will be investigated in the next phase. New BRT stations would be constructed along the BRT route, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 4 – Shady Grove / Rockville: BRT service would be provided in two dedicated curb lanes where feasible as shown in ***Figure 8-12***. The BRT would run in mixed traffic in the vicinity of the I-370 overpass in order to avoid impacts to the structure. The dedicated BRT lanes would be created by widening the roadway to the outside. All existing travel lanes would be maintained. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 3 – Rockville Town Center: BRT service would be provided in one dedicated southbound curb lane as shown in ***Figure 8-13***. The BRT in the southbound direction would utilize this dedicated lane and the BRT in the northbound direction would run in mixed traffic. The dedicated BRT lane would be created by widening the roadway to the outside. The dedicated curb lane would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 2 – Rockville / White Flint: BRT service would be provided in two dedicated curb lanes where feasible as shown in ***Figure 8-14***. The BRT would run in mixed traffic in the vicinity of the Montrose Parkway interchange in order to avoid impacts to the structure. The dedicated BRT lanes would be created by widening the roadway to the outside. The curb lanes would also be shared with local buses and right turns to and from MD 355. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Section 1 – Bethesda: BRT service would be provided between the Grosvenor Metrorail Station and the Bethesda Metrorail Station on the curb lane. In order to minimize property impacts in this very constrained area, an off-peak direction lane would be repurposed to create a reversible roadway with different AM and PM lane configurations as shown in ***Figure 8-15*** and ***Figure 8-16*** for the AM peak period, and as shown in ***Figure 8-17*** and ***Figure 8-18*** for the PM peak period. The lane repurposing would occur between Pooks Hill Road and the Bethesda Metrorail Station; the BRT would run in mixed traffic between Tuckerman Lane and Pooks Hill Road over the bridges of the Capital Beltway. New BRT stations would be constructed along the BRT route on the curb, and passengers would access the curb stations by using the sidewalks and crosswalks at signalized intersections.

Figure 8-9: Alternative 4C - Section 7: Clarksburg / Germantown

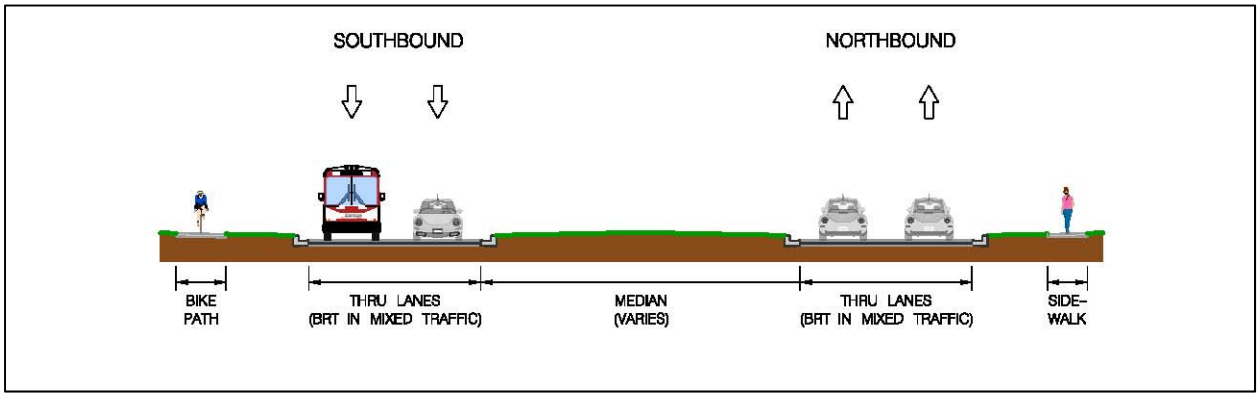


Figure 8-10: Alternative 4C - Section 6: Germantown / Montgomery Village

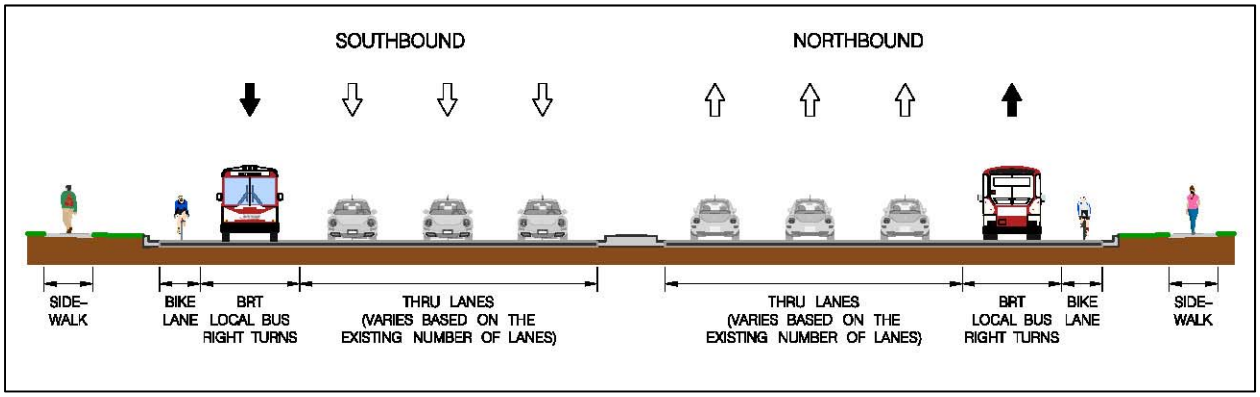


Figure 8-11: Alternative 4C - Section 5: Gaithersburg

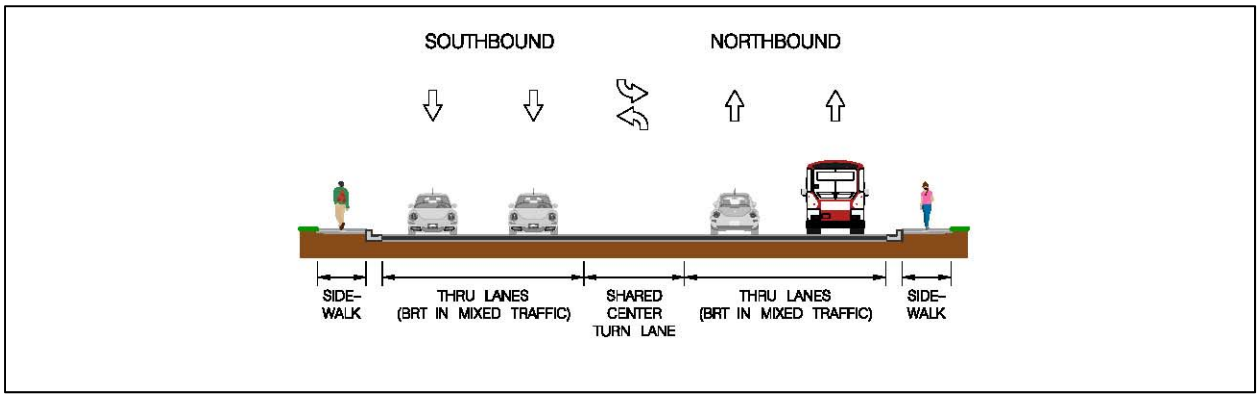


Figure 8-12: Alternative 4C - Section 4: Shady Grove / Rockville

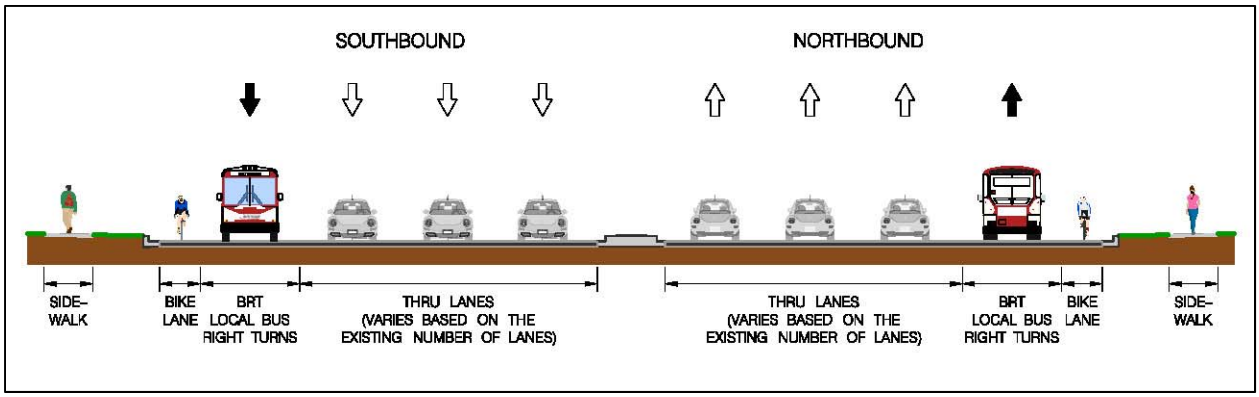


Figure 8-13: Alternative 4C - Section 3: Rockville Town Center

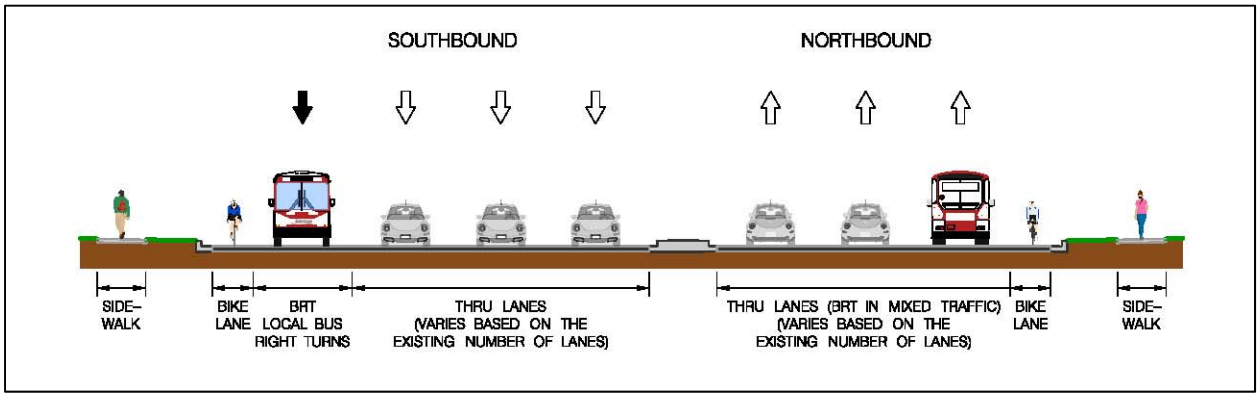


Figure 8-14: Alternative 4C - Section 2: Rockville / White Flint

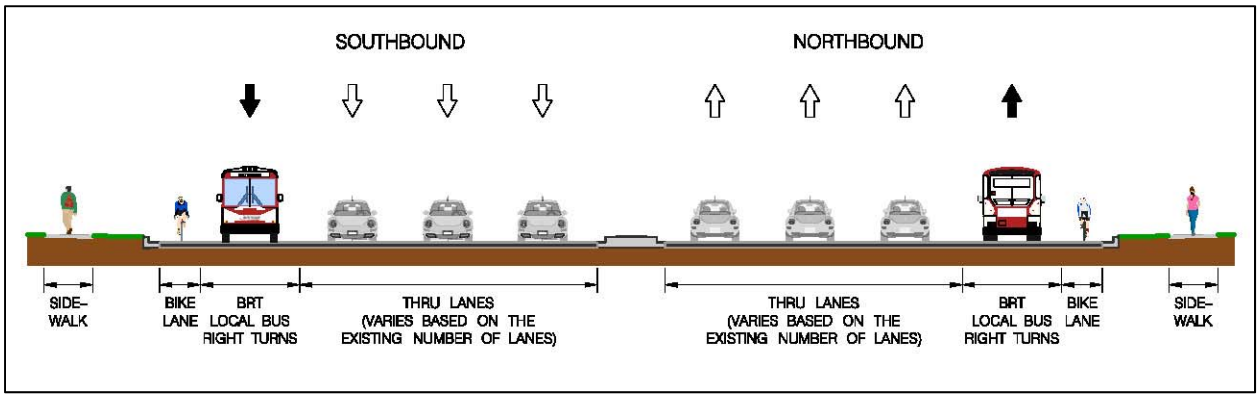


Figure 8-15: Alternative 4C - Section 1: AM Peak Period – Pooks Hill Road to Jones Bridge Road

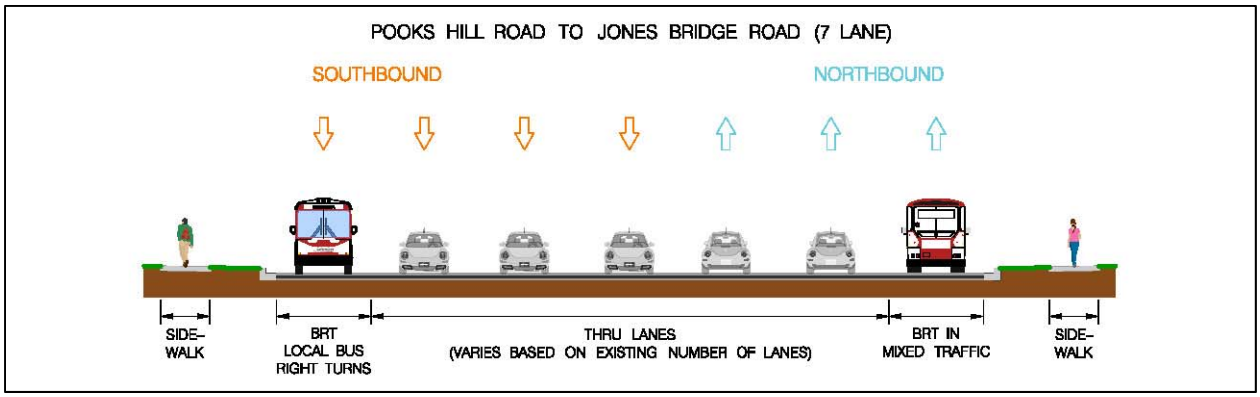


Figure 8-16: Alternative 4C - Section 1: AM Peak Period – Jones Bridge Road to Bethesda Metrorail Station

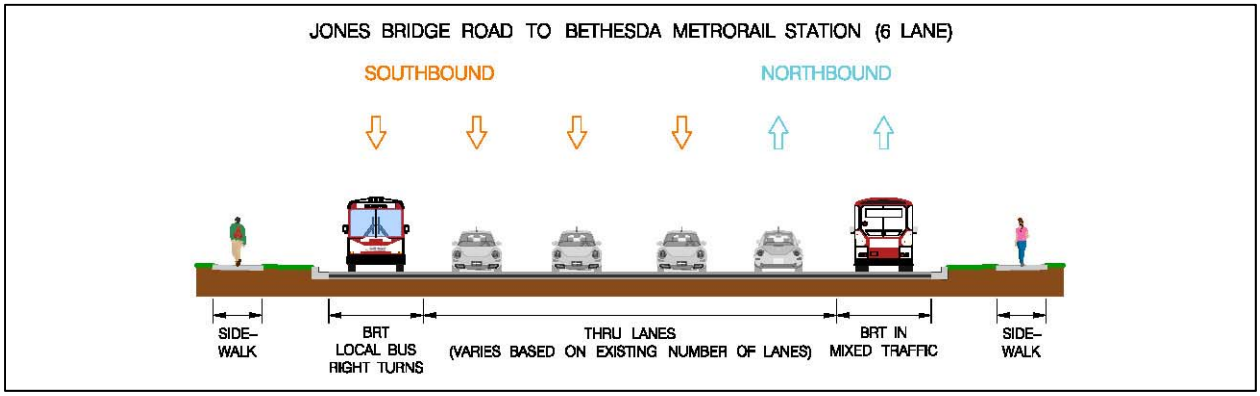


Figure 8-17: Alternative 4C - Section 1: PM Peak Period – Pooks Hill Road to Jones Bridge Road

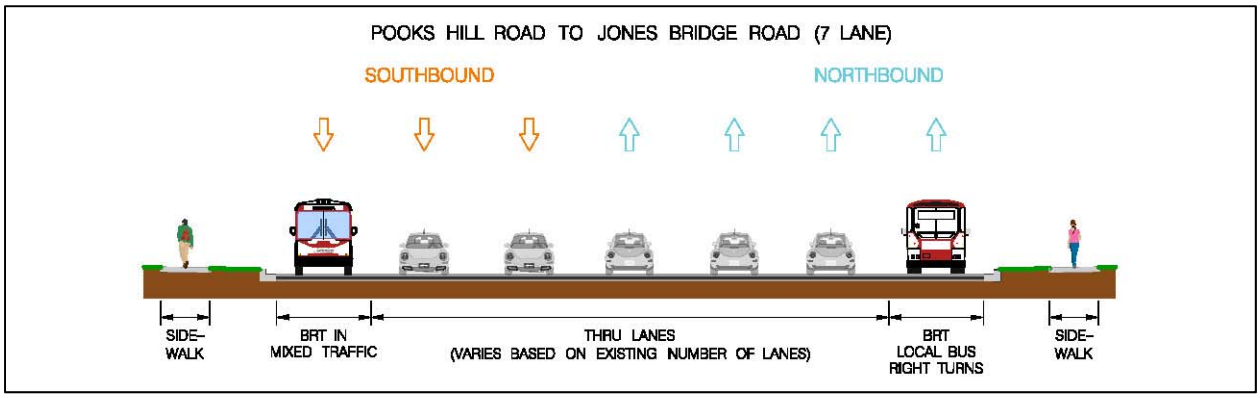
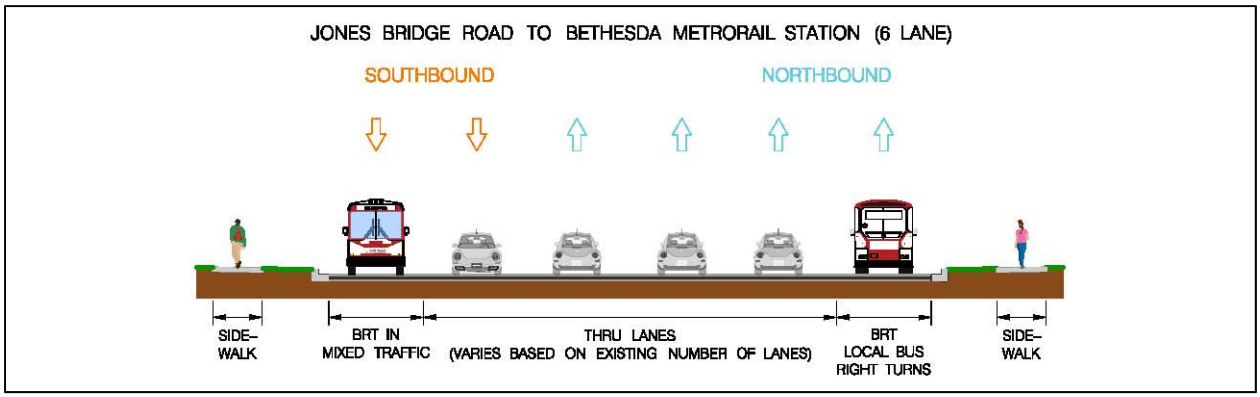


Figure 8-18: Alternative 4C - Section 1: PM Peak Period – Jones Bridge Road to Bethesda Metrorail Station



8.4.2 Station Locations and Service Plan

At the conclusion of this phase, the only change proposed for the refined alternatives is for the northern termini station for Alternatives 2, 3C and 4C to be at the Clarksburg Outlets. No further refinements regarding station locations or service plans are being made. The next phase of the study will conduct additional analysis related to station locations and service plan, and determine if any changes are warranted. The station locations and service plan are shown in ***Table 8-1***.

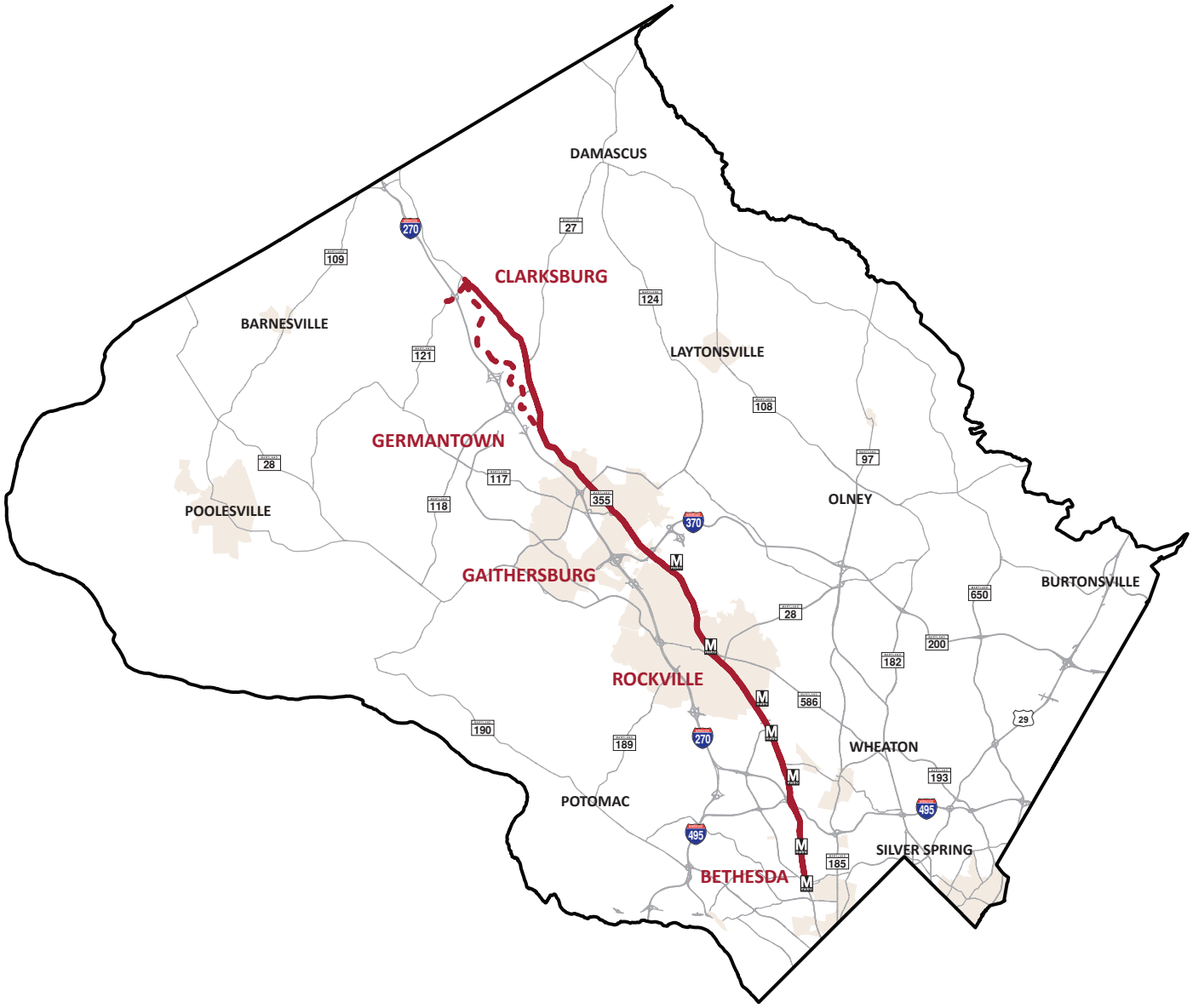
Table 8-1: Station Location by Alternative

	Alternative			Route		
	2	3C	4C	Purple	Blue	Orange
Clarksburg Outlets	●	●	●			
Redgrave Place	●	●	●			
Shawnee Lane (Observation Drive)		●	●			
COMSAT (Observation Drive)		●	●			
Milestone Center Drive (Observation Drive)		●	●			
Shakespeare Boulevard (Observation Drive)		●	●			
Montgomery College – Germ. (Observation Drive)		●	●			
Holy Cross Hospital (Observation Drive)		●	●			
Foreman Boulevard	●					
Little Seneca Parkway	●					
Shakespeare Boulevard	●					
MD 118 (Germantown Rd)	●					
Middlebrook Road	●					
Professional Drive	●	●	●			
Watkins Mill Road	●	●	●			
Lakeforest Transit Center	●	●	●			
Lakeforest Boulevard	●	●	●			
Chestnut Street / Walker Avenue	●	●	●			
Cedar Avenue / Fulks Corner Avenue	●	●	●			
Education Boulevard	●	●	●			
Shady Grove Metrorail Station	●	●	●			
Indianola Drive	●	●	●			

	Alternative			Route		
	2	3C	4C	Purple	Blue	Orange
Montgomery College (Rockville Campus)	●	●	●			
Mannakee Street	●	●	●			
Rockville Metrorail Station	●	●	●			
Edmonston Drive	●	●	●			
Templeton Place	●	●	●			
Halpine Road	●	●	●			
Hubbard Drive	●	●	●			
White Flint Metrorail Station	●	●	●			
Security Lane	●	●	●			
Grosvenor Metrorail Station	●	●	●			
Pooks Hill Road	●	●	●			
Cedar Lane	●	●	●			
Medical Center Metrorail Station	●	●	●			
Cordell Avenue	●	●	●			
Bethesda Metrorail Station	●	●	●			
Total Number of Stations	**31**	**32**	**32**			

Montgomery County RAPID TRANSIT

MD 355



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