MD 355 Bus Rapid Transit Corridor Planning Study

From Bethesda to Clarksburg

PRELIMINARY PURPOSE AND NEED DOCUMENT

Montgomery County, Maryland

April 2016

SHA State Highway Administration

MTA Maryland

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1 Introduction

Montgomery County is proposing a new Bus Rapid Transit (BRT) line along MD 355 from Bethesda to Clarksburg. At the county's request, the Maryland Department of Transportation has initiated a corridor study to evaluate alternatives for accommodating BRT.

This Preliminary Purpose and Need documents the existing and future transportation needs in the MD 355 study corridor that a BRT project could address and is intended to provide background for a formal Purpose and Need statement in the event the project moves into a future development phase.

What is Bus Rapid Transit (BRT)?

BRT is an innovative, high-capacity, and lower-cost public transit solution that could significantly improve urban mobility. This integrated system uses specialized buses on roadways or dedicated lanes to quickly and efficiently transport passengers to their destinations, while offering the flexibility to meet transit demand (e.g. higher frequencies, all-day service, etc.). BRT systems can easily be customized to community needs and incorporate state-of-the-art technologies that result in more passengers and less congestion. BRT stations typically include passenger shelters and loading platforms, level bus boarding, real-time bus arrival information, automated fare purchase with off-board fare collection, and site treatments such as landscaping and lighting. BRT vehicles are typically specialized buses with low floors that have multiple doors on both sides of the vehicle, increased passenger circulation and bicycle provisions, higher capacity through use of articulated buses, enhanced passenger amenities, and potential for a unique brand identity.

BRT service features stations that are spaced farther apart than local bus stops. Buses may operate in dedicated lanes reserved exclusively for BRT or in shared travel lanes used by BRT buses and other traffic. Traffic signal priority, queue jumpers, and station pull-outs may be used in combination with shared traffic lanes and dedicated BRT lanes to improve speed and operations. In cities where BRT has been implemented, it has been described as a bus that offers the convenience of rail transit with a lower capital cost, because it does not require an investment in trains, track, or catenaries.

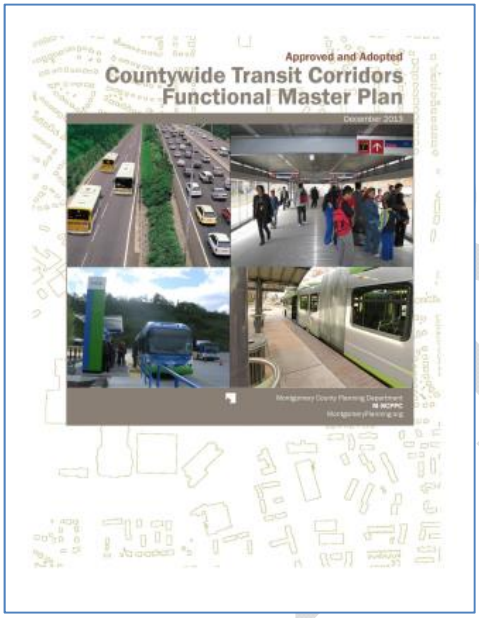
1.1 Bus Rapid Transit Planning in Montgomery County

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

In 2011, Montgomery County Department of Transportation (MCDOT) completed a Countywide Bus Rapid Transit Study which provided an initial look at the possibility of BRT along several main county transportation routes, including MD 355. The Study was a proactive effort to explore transit improvements that could address the existing travel demand and anticipated growth in vehicle trips in Montgomery County. The study provided an overview of multiple study corridors, of associated existing and future transit demand, and of potential improvement recommendations for each.

Acting upon the findings from the 2011 document, Maryland-National Capital Park and Planning Commission (M-NCPPC) developed a Countywide Transit Corridors Functional Master Plan (**Figure 1**). This Functional Master Plan was approved and adopted by the County Council in December 2013.

Figure 1 - Countywide Transit Corridors Functional Master Plan (2013)



The Functional Master Plan proposes the development of a BRT network throughout the County to support the County's mobility, land use, and economic development goals. To ensure network integrity and achieve the County's vision, it recommends and provides the basis for the rights-of-way reservations required to accommodate enhanced transit improvements (i.e., bus lanes, stations, roadway widening, etc.) in individual transit corridors. The Master Plan also makes recommendations on the allocation of roadway space for traffic, transit, pedestrians, and bicycles. One of several corridors included in the Master Plan is MD 355 from Bethesda to Clarksburg.

BRT can be implemented more easily and quickly than light rail, at a lower capital cost, and is far more flexible. 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 farther apart than local bus stops and often include enhanced passenger shelters, level boarding platforms, real-time passenger information systems, and off-board fare collection. BRT vehicles are typically specialized articulated buses with low-floors, multiple doors to enable quick loading and unloading, 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 densities materialize along segments of the corridors.

1.2 Goals and Objectives

To guide the development and implementation of a premium bus service, the goals and objectives outlined in **Table 1** have been developed. These goals and measurable objectives provide a consistent framework for development of the entire system from the project planning phase for each corridor through the opening of service and ongoing operations. They provide a starting point for the development of individual project purpose statements for individual corridor studies. They also assist in the development of measures of effectiveness appropriate to each phase of the BRT system development and deployment.

This document serves as a Preliminary Purpose and Need for the MD 355 Bus Rapid Transit Corridor Planning Study. It documents the Purpose and Need for the project, including the existing and future transportation needs in the MD 355 Corridor that the project is proposing to address. In addition, this report includes how recommended improvements will be evaluated in selecting a Locally Preferred Alternative (LPA). This document is subject to public input and will be revised as the study progresses. Ultimately, this document will provide background information for a formal Purpose and Need statement be reviewed and approved by the appropriate agencies at a future phase of study.

Table 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 Description of Study Corridor

The MD 355 Study Corridor is shown in **Figure 2**. The Corridor is approximately 21.2 miles long between the Bethesda and Clarksburg. MD 355 changes names multiple times (Wisconsin Avenue, Rockville Pike, Hungerford Drive, and Frederick Road) along the Study Corridor as it traverses different municipal boundaries such as the Cities of Rockville and Gaithersburg. The following sections describe the existing roadway conditions and transit services. Further details regarding existing conditions are presented in **Appendix A**.

2.1 Land Use and Demographics

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 an urbanized setting from Bethesda to Gaithersburg in the south, to more rural in the north towards Clarksburg. 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 Bethesda, White Flint, or Rockville. The existing land use is shown in **Appendix B**.

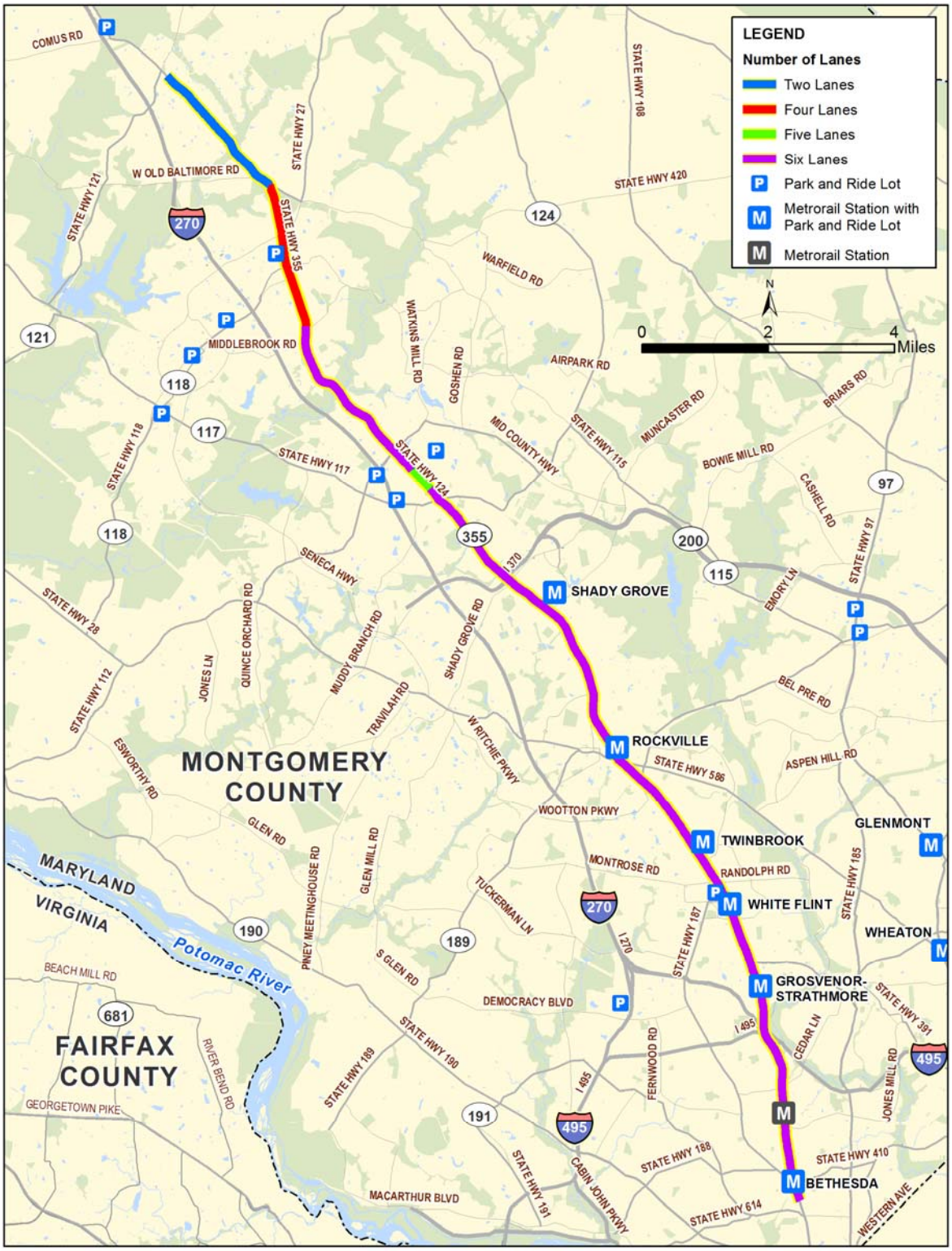
The MD 355 corridor is addressed in numerous master plans including:

- *Clarksburg Master Plan (1994)*
- *Germantown Master Plan* (1989)
- *Germantown Employment Area Sector Plan* (2009)
- *City of Gaithersburg Master Plan* (2010)
- *Great Seneca Science Corridor Master Plan* (2010)
- *Shady Grove Sector Plan* (2006)
- *Rockville Comprehensive Plan* (2002)
- *Town Center Master Plan* (2001)
- *White Flint Sector Plan* (2010)
- *North Bethesda-Garrett Park Master Plan* (1992)
- *Bethesda CBD Sector Plan* (1994)

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 included in these Master/ Sector Plans include:

- White Flint Transit Oriented Development
- Shady Grove Transit Oriented Development and industry/ technology corridor development
- Twinbrook Transit Oriented Development
- Clarksburg Town Center District Transit Oriented Development

Figure 2 - Project Limits



Based on the 2010 census data, Montgomery County has a population of approximately one million people. The county's population is primarily White, comprising about 63 percent, followed by African-American and Hispanics, both at about 18 percent, and Asians composing about 15 percent of the total population. Demographic data on gender, age, and disability are shown in **Table 2.**

Table 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%**
Montgomer	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

***Environmental Justice** is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.*

Further discussion of demographics and potential transit users is included in Section 3. The planning process will ensure that Environmental Justice regulatory requirements are met. This includes the evaluation of socioeconomic benefits and impacts, including any special considerations that may be required for minority, low income, or other disadvantaged population.

2.2 Existing Transit Service

Transit plays a major role in the regional transportation system, and includes multiple bus operators, two commuter rail systems, and the regional Metrorail system that provide connections to work sites and other economic opportunities throughout the District of Columbia (DC) Metropolitan region. An existing transit services map along MD 355 is shown in **Appendix C**. Within Montgomery County, current transit operations include:

- Metrorail Service (**Figure 3** and **Figure 4**): Red Line includes 11 stations fully located within Montgomery County (plus Friendship Heights located on the border with DC).
- Local Bus Service: Ride On and Metrobus 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) into and through Montgomery County (primarily during the peak periods) from Frederick County, Washington County, and Howard County.
- Commuter Rail Service: MARC service on the Brunswick Line from Frederick and West Virginia.

2.2.1 Metrorail

MD 355 parallels the Washington Metropolitan Area Transit Authority's (WMATA) Metrorail Red Line. 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.

Metro's Red Line is a U-shaped route that travels into and out of DC along two north-south branches. The MD 355 BRT Corridor parallels the western branch of the Red Line, from Bethesda Metrorail Station to Shady Grove Metrorail Station. Red Line Metrorail Stations along the MD 355 project area are shown in **Figure 5**. Red Line Metrorail hours of operations and headways are shown in **Table 3**. An overview of the Red Line Metrorail Stations parallel to MD 355 is presented in **Table 4.**

Figure 3 - Red Line Metrorail

Figure 4 - WMATA Metrorail System Map

Figure 5 - Red Line Metrorail Stations along MD 355 Project Area

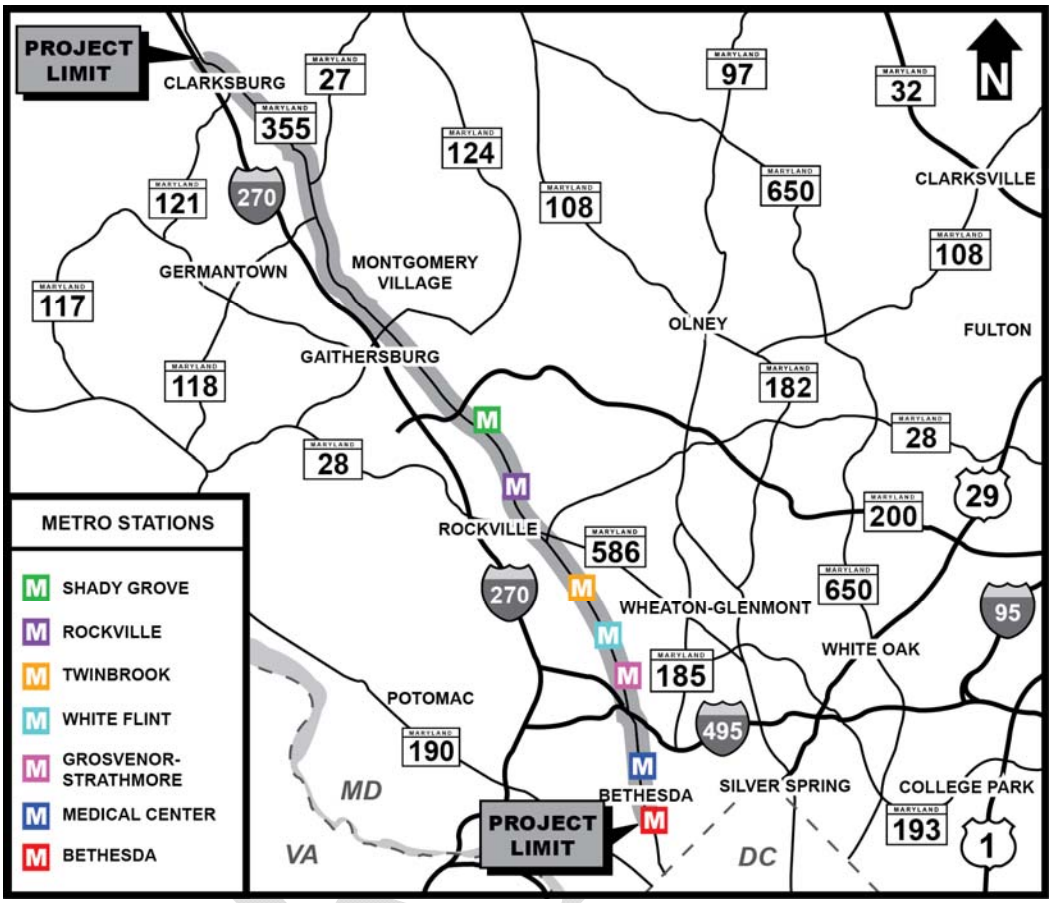


Table 3 - Red Line Metrorail Operations

Day of Week	Start of First Trip	Start of Last Trip	Morning Headway* (mins)	Mid-Day Headway (mins)	Evening Headway* (mins)
Weekday	5:00 AM	11:37 PM	3-6**	12	3-6**
Friday	5:00 AM	2:37 AM	3-6**	12	3-6**
Saturday	7:00 AM	2:37 AM	12	12	12
Sunday	7:00 AM	11:37 PM	15	15	15

** Morning and evening headways for peak direction only*
*** Additional trains operate between Grosvenor and Silver Spring during the morning and evening peak periods*

Table 4 - Overview of Existing Metrorail Stations

Station	Weekday Ridership	Parking Spaces	Bike Racks	Bus Connections
Bethesda	20,480	869 long-term 85 short-term operated by Montgomery County	48 bike racks 44 lockers	WMATA Metrobus (J2, J3, J4, J7 and J9), Montgomery County Ride On (29, 30, 32, 34, 36, 47 and 70) and the Bethesda Circulator.
Medical Center	11,630	None	88 bike racks 38 lockers	WMATA Metrobus (J1, J2, J3, J7 and J9) and Montgomery County Ride On (30, 33, 34, 46 and 70).
Grosvenor	10,720	75 short-term 1,894 all-day	40 bike racks 30 lockers	WMATA Metrobus (J5) and Montgomery County Ride On (6, 37, 46 and 96).
White Flint	7,270	1,270 all-day	32 bike racks 20 lockers	WMATA Metrobus (C8) and Montgomery County Ride On (5, 26, 38, 42, 46 and 81).
Twinbrook	8,410	38 short-term 1,097 all-day	68 bike racks 26 lockers	WMATA Metrobus (C4 and J5) and Montgomery County Ride On (10, 26, 44, 45, 93).
Rockville (MARC Brunswick Line and Amtrak)	9,180	22 short-term 645 all-day	69 bike racks 40 lockers	WMATA Metrobus (Q1, Q2, Q4, Q5 and Q6) and Montgomery County Ride On (44, 46, 47, 54, 56, 63 and 81).
Shady Grove	25,100	76 short-term 5,745 all-day	32 bike racks 60 lockers	WMATA Metrobus (Q1, Q2, Q5 and Q6), Montgomery County Ride On (46, 53, 55, 57, 59, 63, 66, 67, 79, 90) and MTA Commuter Bus (201, 202, 505 and 515).

2.2.2 Local Bus Service

Local bus service along the MD 355 Corridor is currently provided by WMATA's Metrobus (**Figure 6**) and Montgomery County's Ride On. Fifty-six bus routes operate within the MD 355 Study Area; thirty-nine are operated by Ride On, seventeen by WMATA. No existing Metrobus or Ride On bus route serves the full length of the MD 355 Corridor. Existing bus routes that operate directly on MD 355 are presented in **Table 5**.

Figure 6 - WMATA Metrobus

Table 5 - Existing Bus Routes Overview

Operator (# routes along MD 355)	Bus Routes along MD 355	Approximate Daily Passenger
WMATA Metrobus (17 routes)	- C4, C5, C8, J1, J2, J3, J4, J5, J6, J7 and J9 - Q1, Q2,Q5 and Q6	- 9,900 to 11,100 - Highest usage at Rockville and Shady Grove Metrorail Stations, and at Montgomery College
Ride On (3 routes)	- 46 (Shady Grove Metrorail Station to Medical Center Metrorail Station) - 55 (Germantown Transit Center to Rockville Metrorail Station) - 75 (Montgomery County Correctional Facility in Clarksburg, to Germantown Transit Center)	- 3,683 - 7.920 (highest ridership in the Ride-On system) - 479

Ride-On ridership based on FY 2014 data
WMATA ridership

The Ride On bus (**Figure 7**) Routes 46, 55, and 75 provide local north-south service primarily along MD 355. Routes 46 and 55 operate with approximately 12 to 15 minute average headways during the morning and afternoon peak-hours. Average headways are presented in **Table 6**. Ride On bus route maps for Routes 46, 55, and 75 are shown in **Appendix D**

Table 6 - Ride-On Routes Average Headways

Route	Day of Week	Peak Direction Morning Peak Headway	Mid-Day Headway	Peak Direction Evening Peak Headway
46	Weekday	15	15	15
	Saturday	20-30	20-30	20-30
	Sunday	30	30	30
55	Weekday	12	10-12	12
	Saturday	20	15	15
	Sunday	30	20	20
75	Weekday	30	30	30

Source: Ride On Timetables

Figure 7 - Ride On Bus

Current Ride On timetable schedules estimate travel times from Medical Center Metrorail Station in Bethesda to Rockville Metrorail Station to be approximately 36 minutes (compared to 15 minutes on the Red Line Metrorail), and 67 minutes from Rockville to Germantown's Transit Center. On-time performance evaluations conducted by Montgomery County estimate these buses to 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 region is highest for commute-to-work trips, estimated at approximately 14 percent transit mode share. Montgomery County data shows transit usage similar to the region as a whole; county residents show a 17 percent transit mode share, while commuters traveling to the County show a 10 percent transit mode share. The major existing transit market in the region is for commute-to-work trips destined for DC with 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. Non-commute trips in Montgomery are estimated at approximately three percent of mode share. Further details on transit share are presented in Appendix A.

Ride-On Travel Time:

- *~36 minutes from Bethesda to Rockville*
- *~67 minutes from Rockville to Germantown*
- *On-Time Performance 71-75 percent*

2.2.3 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. Commuter Bus Routes 505 and 515 parallel the MD 355 corridor in Montgomery County, connecting Washington and Frederick Counties with Montgomery County, respectively. 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.

2.2.4 MARC Train Service

MARC's Brunswick Line spans from West Virginia to 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 do not serve MD 355 and the intra-county trips generated throughout the corridor.

2.3 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 from Bethesda to Germantown, 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 Rd) 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 underpass in White Flint. 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 growth in the corridor and the County as a whole is likely to cause increases in congestion. The existing average daily volumes along MD 355 are shown in **Table 7**. Travel speeds along MD 355 during the morning and afternoon peak-hour are below posted speeds as well, as shown in **Table 8**.

MD 355 Study Area Quick Facts:

- *Classified as Urban Other Principal Arterial (south of MD 27/Ridge Rd)/ Urban Minor Arterial (north of MD 27)*
- *Posted Speeds 30-50 MPH*
- *21.2 miles in length*
- *85 signalized and 80 un-signalized intersections*
- *Annual Average Daily Traffic 7,700 to 67,800 vehicles*
- *Approximately 1,900 crashes between 2011-2013*

Table 7 - 2015 Average Daily Volumes

Roadway Sections (North to South)	Range of 2015 Average Daily Volumes (counted)
MD 121 (Clarksburg Rd) to MD 27 (Ridge Rd)	7,700 – 22,200
MD 27 (Ridge Rd) to MD 124 (Mont. Village Ave)	21,200 – 39,800
MD 124 (Mont. Village Ave) to I-370	26,500 - 43,900
I-370 to MD 28 (Veirs Mill Rd)	41,400 - 50,600
MD 28 (Veirs Mill Rd) to I-495	40,800 – 60,800
I-495 to MD 410 (East-West Hwy)	28,800 – 67,800

Table 8 - 2015 Average Travel Speeds

Roadway Sections (North to South)	2015 Average Speed (mph) (AM/PM)	2015 Average Travel Time (min) (AM/PM)
MD 121 (Clarksburg Rd) to MD 27 (Ridge Rd)	16 / 34	12 / 6
MD 27 (Ridge Rd) to Professional Dr	27 / 28	7 / 7
Professional Dr to I-370	19 / 21	12 / 11
I-370 to Edmonston Dr	17 / 19	16 / 14
Edmonston Dr to Twinbook Pkwy	26 / 21	3 / 4
Twinbrook Parkway to MD 547 (Strathmore Ave)	22 / 15	5 / 7
MD 547 (Strathmore Ave) to Pooks Hill Rd	21 / 22	4 / 4
Pooks Hill Rd to MD 410 (East-West Hwy)	14 / 11	9 / 12
Total Corridor	**19 / 20**	**68 / 65**

Out of the existing 85 signalized intersections, ten are failing in the morning peak-hour and 17 are failing in the afternoon peak-hour. Key signalized intersections along the corridor are shown in **Figure 8** and existing Levels of Service (LOS) are shown in **Table 9**.

What is Level of Service?

Level of Service (LOS) is a rating system to describe traffic quality at an intersection or segment of roadway.

LOS is calculated from intersection delay, capacity, or travel time/ speed, and is rated with letters A through F. LOS E and F signify failing or close to failing intersections/ segments.

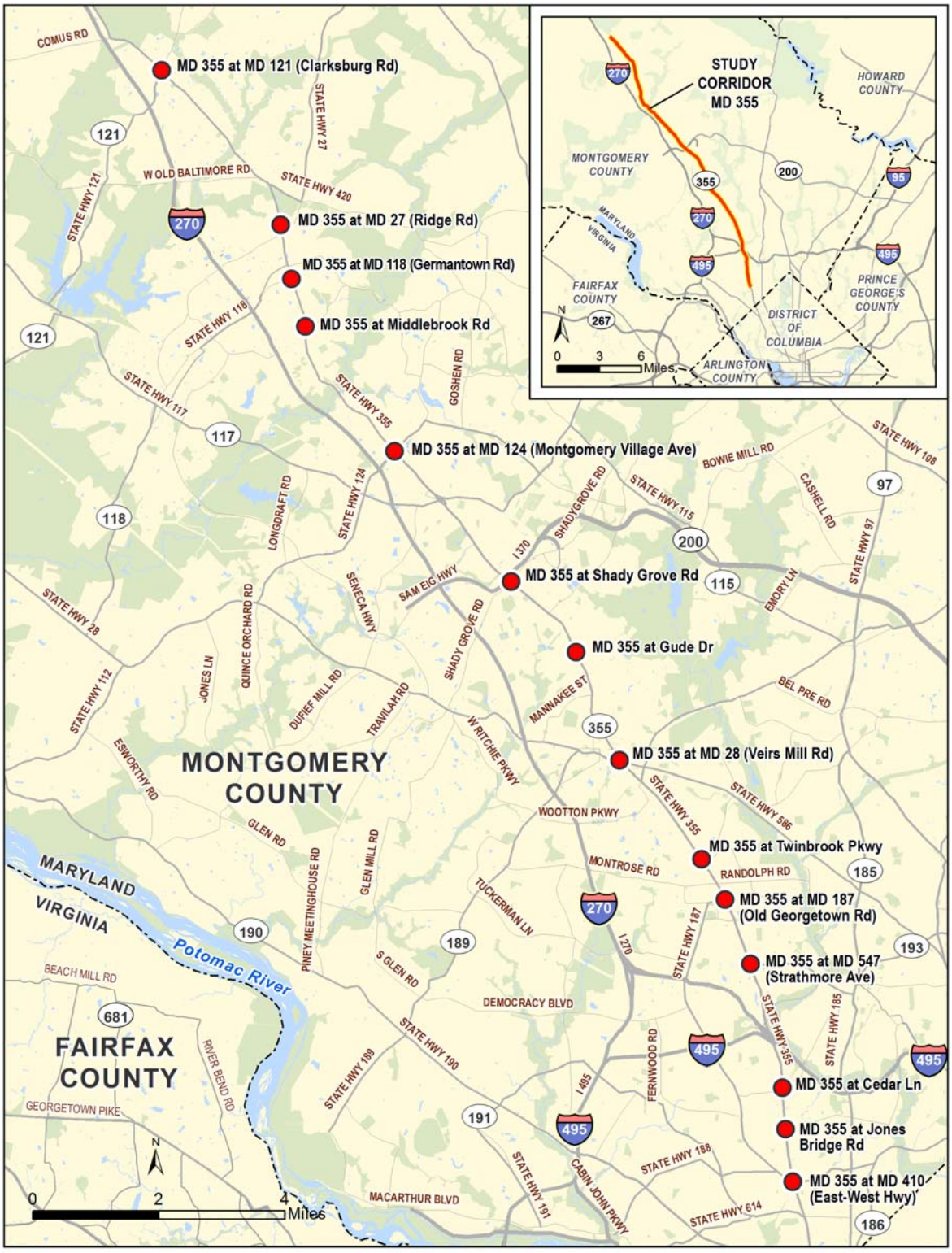
Table 9 - Key Intersections Level of Service

MD 355 Intersections	2015 Morning Peak LOS (Delay)	2015 Evening Peak LOS (Delay)
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 of them 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 pedestrian crashes in the corridor.

The most prevalent roadway 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. Segments between MD 410 (East-West Hwy) and Cedar Lane and between I-370 and Game Preserve Road experienced crash rates significantly higher than statewide averages for similar types of facilities.

Figure 8 - Key Intersections



2.4 Existing Environmental Resources

The planning efforts for MD 355 include the development of an environmental inventory, identifying key cultural and natural resources along the corridor. These resources contribute to the character, health, and vitality of the corridor and must be taken into careful consideration when planning any transportation improvements. Any transportation use of a publicly-owned public park, recreation area or significant historic site would require further evaluation under Section 4(f) of the US Department of Transportation (US DOT) Act of 1966 if it is determined that federal funds would be used for the proposed project. The following describes the resources along the study area that will require coordination with Local, State, or Federal regulatory agencies as the planning study is underway. Additional details on environmental and socioeconomic resources, including community resources and environmental features maps, are provided in **Appendix E**.

Environmental Inventory Overview:

- *Over 100 Historic structures and Districts*
- *17 Parks*
- *7 Natural Areas*
- *4 Watersheds*
- *16 Streams*
- *28 Wetlands*

Figure 9 - Bethesda Theater

Over 100 historic structures and districts have been identified along the MD 355 Corridor. Of these, 18 are included in the Maryland Inventory of Historic Places and five are included in the National Register of Historic Places (NRHP). Some key sites include the Montrose Schoolhouse, the Third Addition to Rockville and Old St. Mary's Church and Cemetery, the Bethesda Meeting House, the Bethesda Naval Hospital Tower, and the Bethesda Theatre (**Figure 9**). MD 355 also bisects historic districts, such as those in Gaithersburg and Clarksburg.

Fifteen previous archeological investigations have been conducted within the Study Area and three archeological sites, Dowden's Ordinary, Hammerhill Road, and Neelsville Blacksmith Shop and Residence, have been identified within the project limits. Of those archeological sites, only the Neelsville Blacksmith Shop and Residence is eligible for listing in the NRHP. Plans for a preferred alternative will be needed before a final assessment of potential impacts can be made. Depending on the extent of the project, additional archeological investigations may need to be conducted within the Project Area.

Natural areas abutting the MD 355 BRT Corridor are located to the north of I-495. Rock Creek Stream Valley Park abuts the corridor to the east, in the vicinity of I-495. Seneca Creek Stream Valley Park is located north of Gaithersburg and abuts MD 355 to the west. Great Seneca

Stream Valley Park is located directly adjacent to Seneca Creek Stream Valley Park and abuts the proposed project area to the east. North Germantown Greenway Stream Valley Park abuts the corridor to the west, just north of Ridge Road. Ridge Road Recreational Park is located directly adjacent to North Germantown Greenway Stream Valley Park, to the east of MD 355. Little Seneca Greenway Stream Valley Park crosses the corridor south of Clarksburg.

M-NCPPC identifies 17 parks located along the corridor. Parks along the corridor are owned by the Maryland Department of Natural Resources (1 park), M-NCPPC (10 parks), the City of Gaithersburg (2 parks), and the City of Rockville (4 parks). In addition, M-NCPPC is planning to expand the Little Seneca Greenway Stream Valley Park along the MD 355 Corridor. Coordination with park officials is ongoing to identify additional park resources. Particular attention will be required for those parks and resources directly adjacent to MD 355, as they may be directly impacted should the roadway require any widening.

Figure 10 - Muddy Branch

The MD 355 Corridor spans multiple watersheds including Cabin John Creek, Potomac River Montgomery County, Rock Creek, and Seneca Creek. Sixteen streams fall within the Study Area, the majority of which are unnamed tributaries. However, larger, named streams crossed by the Project Area include Little Seneca Creek, Great Seneca Creek, Muddy Branch (**Figure 10**), and Rock Creek. A majority of the identified streams flow through the Study Area and underneath MD 355. Many of these streams are protected for recreational use, public water supply, or for aquatic life, and will require close coordination with regulating agencies throughout the study.

MD 355 falls within the 100-year floodplain of Great Seneca Creek, Muddy Branch, and Rock Creek. None of these floodplains have regulated floodways in the portions that intersect the Study Area. Should there be any disturbance to wetlands or waterways, including modifications to existing drainage structures, or disturbance within the Federal Emergency Management Agency designated floodplain, permits will be required from Maryland Department of the Environment and U.S. Army Corps of Engineers.

Twenty-eight potential non-tidal wetlands occur within the study area. While wetland resources are adequately identified for the purposes of this existing resource inventory, field delineations would be required to confirm the exact limits of all waters of the U.S., including wetlands in the study area, at a later stage. The Germantown Bog, located within the study area, is considered a Nontidal Wetland of Special State Concern and may contain threatened plan species such as the

Buxbaum's Sedge, Canada Burnet, and the Swamp Oats. The Northern Long Eared Bat, a federally listed threatened species, is also known to inhabit within the study area.

Throughout the MD 355 Corridor Study Area, developed areas contain small clusters of trees. Heavily forested areas border MD 355, primarily around the stream valleys, especially north of Gaithersburg. A formal forest stand delineation and/or roadside tree survey will be required to fully assess the potential for impacts on trees and vegetation within the MD 355 Corridor.

3 Problem Definition

The existing transit services along the corridor are segmented, unreliable, and do not adequately serve the transit reliant population and the forecasted travel patterns along MD 355. By 2040, the MD 355 Study Area is expected to grow significantly in population and employment, increasing the congestion to an already saturated roadway network.

3.1 Growth and Development in the Study Area

3.1.1 Population and Employment Growth

- **Montgomery County population and employment are forecasted to grow by 20 percent and 40 percent, respectively**
- **MD 355 study area population and employment are forecasted to grow between 15-56 percent and 13-47 percent, respectively**

The MD 355 Corridor spans several Master Plans and Sector Plans, including: Clarksburg Master Plan (1994), Germantown Master Plan (1989), Germantown Employment Sector Area Sector Plan (2009), City of Gaithersburg Master Plan (2009), Great Seneca Science Corridor Master Plan (2010), Shady Grove Sector Plan (2006), City of Rockville Master Plan (2002), White Flint Sector Plan (2010), Northern Bethesda/ Garrett Park Master Plan (1992), Bethesda Chevy-Chase Master Plan (1990), Woodmont Triangle Amendment to the Bethesda Central District Business Master Plan (2006), and the Bethesda Central District Business Master Plan (1994). These plans lay out the future vision for these areas, including changes in land use and expected growth in population and employment.

The planned changes, including approved and pipeline developments, are included in the regional land use forecast prepared by the Washington Metropolitan Council of Governments (MWCOG). By 2040, the Washington D.C. regional population is expected to increase by more than 1.8 million people to a total of 8.8 million people (a 26 percent increase). Similarly, the regional employment totals are projected to increase nearly 1.5 million jobs to a total of 5.5 million jobs (a 36 percent increase).

This regional growth will be driven partly by household, population, and employment growth in Montgomery County (**Table 10**), which is expected to experience a 20 percent increase in population and a 40 percent increase in jobs over the same time period. The land use forecasts show an additional 202,000 people and 210,000 jobs in Montgomery County in 2040 compared to 2014.

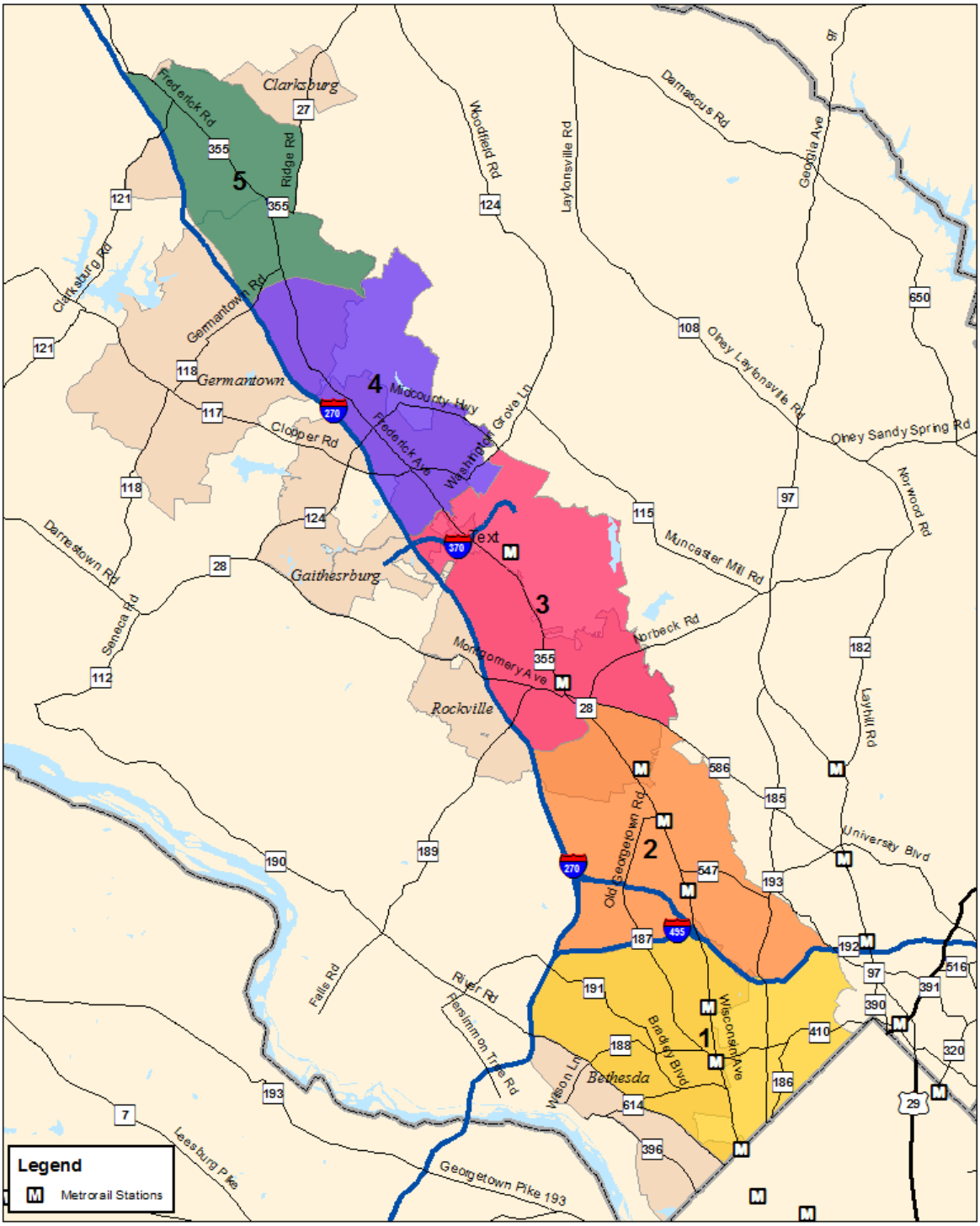
Table 10 - Montgomery County Demographic Growth

	2014	2040	Growth	Percent Growth
Households	374,000	464,000	90,000	24%
Population	1,011,000	1,213,000	202,000	20%
Employment	528,000	738,000	210,000	40%

Source: MWCOG Round 8.3 Cooperative Land Use Forecast

For purposes of this analysis, a study area was developed that covers the areas most likely to be impacted by the implementation of BRT along MD 355. As shown in **Figure 11**, the study area was subdivided into five districts to help better define existing and future travel patterns and potential ridership markets.

Figure 11 - MD 355 Study Area and Districts



As shown on **Table 11**, some districts are forecasted to grow in population and employment by over 40 percent.

Table 11 - MD 355 Study Area District Demographic Growth

District	Population Growth				Employment Growth			
	2014	2040	Growth	Percent Growth	2014	2040	Growth	Percent Growth
1	87,900	101,800	13,900	15.9%	94,500	114,100	17,600	20.1%
2	80,200	122,700	42,500	53.0%	84,600	122,100	37,500	46.7%
3	48,000	68,000	20,000	41.5%	61,300	78,700	17,400	36.3%
4	66,000	76,200	10,200	15.5%	30,600	39,500	8,900	13.4%
5	26,000	40,600	14,600	56.2%	9,800	14,800	5,000	19.4%
Total	308,100	409,300	101,200	32.9%	282,800	369,200	86,300	28.0%

Source: MWCOG Round 8.3 Cooperative Land Use Forecast

3.1.2 Transit Supportive Development

- **Locally planned growth in the corridor aims to be transit supportive**

The framework for much of the growth, development, and redevelopment along MD 355 is included in a series of Master Plans and Sector Plans covering the study corridor. These plans are developed and adopted for the purpose of guiding the amount of growth, the type of growth, and the distribution of growth within the areas covered by the plans. These plans propose improving the transit services in the region, including along MD 355, to accommodate the forecasted population and employment growth in the region. Many of these plans dedicate right-of-way for a BRT system along MD 355 to support the planned development throughout the corridor. A high quality transit system connecting the residential, commercial, and other activity centers will support planned growth in the study area.

Key Master and Sector Plans Transit Developments:

- *White Flint Sector Plan (2010-2012) – Re-development with transit along MD 355*
- *Twinbrook Sector Plan (2009) - Mixed use redevelopment surrounding Metrorail station*
- *Shady Grove Plan (2006) - Mixed use redevelopment surrounding Metrorail station*
- *Germantown (2009) and Great Seneca Science Corridor Master Plan (2010) – Development and redevelopment to be focused around proposed Corridor Cities Transitway alignment and stations*

3.1.3 Trips Growth

- **Trips along MD 355 forecasted to grow between 25-40 percent**
- **Most are short trips and non-work related**

Work trips within the study corridor are projected to grow by 40 percent from 2014 to 2040, and non-work travel within the corridor is projected to grow by 25 percent over the same period. Most trips within the study corridor are short, with more than two-thirds of trips occurring within the same district or between adjacent districts. Work trips account for only 12 percent of overall existing travel in the study corridor and will account for 13 percent of overall travel in 2040.

Existing and Future Travel Patterns:

- *12% Commuter work trips*
- *88% Non-work trips*
- *Work trips to grow 40% by 2040*
- *Non-work trips to grow by 25% by 2040*

Many more commute trips are made to the study corridor on a daily basis from the portions of Montgomery County outside of the corridor than commuter trips from within the study corridor. Commute trips from east and west of the County to jobs in the MD 355 corridor could not access a BRT system on MD 355 by walking, and would need to access a BRT system via transfer from a feeder bus system or by driving to a park-and-ride lot.

Non-work trips are the dominant trip type within the 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. 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.

3.2 Roadway Congestion

3.2.1 Increasing Congestion and Travel Times

- **Congested conditions will worsen, with traffic increasing by over 20 percent and peak period travel time increasing up to 30 percent by 2040**

The future No Build 2040 Average Daily Traffic (ADT) volumes on MD 355 range from a low of approximately 8,600 vehicles south of MD 121 (Clarksburg Rd) in Clarksburg to a high of 80,200 vehicles just south of the Capital Beltway; an increase of 13 percent and 23 percent respectively from 2015. Existing and forecasted ADT volumes and growth are shown in **Table 12**.

Table 12 - 2040 Forecast ADT Volumes and Growth

Roadway Sections (North to South)	Range of 2015 Average Daily Volumes (counted)	Range of 2040 Average Daily Volumes (forecasted)	Total Average Traffic Growth 2015 to 2040
MD 121 (Clarksburg Rd) to MD 27 (Ridge Rd)	7,700 – 22,200	8,600 – 25,300	13%
MD 27 (Ridge Rd) to MD 124 (Mont. Village Ave)	21,200 – 39,800	23,500 - 45,900	13%
MD 124 (Mont. Village Ave) to I-370	26,500 - 43,900	33,000 - 53,700	23%
I-370 to MD 28 (Veirs Mill Rd)	41,400 - 50,600	50,100 - 61,000	21%
MD 28 (Veirs Mill Rd) to I-495	40,800 – 60,800	51,200 – 73,325	23%
I-495 to MD 410 (East-West Hwy)	28,800 – 67,800	33,800 – 80,200	18%

The traffic analysis model assumes the construction of projects included in the Constrained Long Range Plan (CLRP), as well as signal timing optimization at intersections to accommodate the projected 2040 traffic volumes. This results in individual locations in the corridor showing an improved Level of Service in the 2040 No-Build condition versus existing traffic conditions. Level of Service for key intersections for 2015 and 2040 are shown in **Table 13**. However, overall speeds in the corridor are still forecast to be slower in 2040 under the No-Build than in 2015. Average speeds and travel times for 2015 and 2040 are shown in **Table 14**.

Table 13 - 2015 and 2040 Key Intersections Level of Service

MD 355 Intersections	2015 Morning Peak LOS (Delay)	2015 Evening Peak LOS (Delay)	2040 Morning Peak LOS (Delay)	2040 Evening Peak LOS (Delay)
MD 121 (Clarksburg Rd)	D (52.6)	E (56.6)	D (48.6)	E (74.0)
MD 27 (Ridge Rd)	D (46.6)	E (70.2)	D (48.6)	E (64.6)
MD 118 (Germantown Rd)	D (46.7)	E (61.0)	E (64.5)	E (55.1)
Middlebrook Rd	D (44.6)	E (75.8)	D (54.0)	F (102.4)
MD 124 (Mont. Vil. Ave)	E (58.1)	F (96.6)	D (45.4)	F (86.4)
Shady Grove Rd	F (95.6)	E (76.5)	E (120.5)	E (67.4)
Gude Dr	F (81.0)	D (53.7)	F (85.4)	D (50.8)
MD 28 (Veirs Mill Rd)	C (34.2)	D (38.5)	D (37.6)	D (37.6)
Twinbrook Pkwy / Rollins Ave	C (21.3)	C (33.6)	C (26.0)	C (27.3)
MD 187 (Old Georgetown Rd)	D (45.3)	D (46.6)	E (78.2)	E (63.7)
MD 547 (Strathmore Ave)	C (34.4)	D (49.8)	D (51.9)	E (64.0)
Cedar Ln	E (61.5)	F (105.1)	C (29.9)	E (61.1)
Jones Bridge Rd / Center Dr	D (49.0)	D (54.6)	D (43.1)	D (42.6)
MD 410 (East-West Hwy) / MD 187 (Old Georgetown Rd)	D (53.9)	E (56.3)	E (56.4)	D (49.8)

Table 14 - 2015 and 2040 Average Speed and Travel Times

Roadway Sections (North to South)	2015 Average Speed (mph) (AM/PM)	2040 Average Speed (mph) (AM/PM)	2015 Average Travel Time (min) (AM/PM)	2040 Average Travel Time (min) (AM/PM)
MD 121 (Clarksburg Rd) to MD 27 (Ridge Rd)	16 / 34	15 / 29	12 / 6	12 / 7
MD 27 (Ridge Rd) to Professional Dr	27 / 28	17 / 28	7 / 7	11 / 7
Professional Dr to I-370	19 / 21	10 / 20	12 / 11	22 / 11
I-370 to Edmonston Dr	17 / 19	14 / 16	16 / 14	19 / 17
Edmonston Dr to Twinbook Pkwy	26 / 21	22 /19	3 / 4	3 / 4
Twinbrook Pkwy to MD 547 (Strathmore Ave)	22 / 15	18 / 11	5 / 7	6 / 10
MD 547 (Strathmore Ave) to Pooks Hill Rd	21 / 22	14 / 23	4 / 4	6 / 4
Pooks Hill Rd to MD 410 (East-West Hwy)	14 / 11	12 / 18	9 / 12	10 / 7
Total Corridor	**19 / 20**	**14 / 18**	**68 / 65**	**89 / 67**

Of the 85 total intersections along MD 355 that were analyzed as part of the 2040 No Build effort, 14 showed failing levels of service in the morning peak-hour, and 19 in the evening peak-hour. With the forecasted growth in traffic volumes for the Corridor, roadway speeds are expected to drop between 2015 and 2040. Average speeds are expected to drop by two to five miles per hour in both directions during peak-hours. By 2040, the time to traverse the study area along MD 355 southbound in the morning peak-hour will increase from 68 minutes in 2015 to 89 minutes, and the time to travel the study area northbound in the evening peak will increase from 75 minutes to 84 minutes based on the expected speeds and delays.

Level of Service by 2040:

- *85 signalized intersections*
- *14 failing during AM Peak*
- *19 failing during PM Peak*
- *Average Peak Hour Speeds 17-25MPH*

3.2.2 Higher Than Average Crash Rates

- **Congested conditions already contribute to higher than average crash rates**

Table 15 displays the crashes that occurred between 2011 and 2013 for each of nine segments of the MD 355 corridor. Approximately 1,900 total crashes occurred along MD 355 within the study limits over the three year period, 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.

Table 15 - Crash Data

Roadway Sections (North to South)	Total Crashes (2011 to 2013)	Crashes Per Mile	Significantly High Crash Types
MD 121 (Clarksburg Rd) to MD 27 (Ridge Rd)	109	33	Opposite Direction, Rear End, Left Turn
MD 27 (Ridge Rd) to Game Preserve Rd	193	66	Left Turn, Angle
Game Preserve Rd to I-370	382	94	Opposite Direction, Left Turn, Pedestrian
I-370 to MD 28 (Veirs Mill Rd)	339	97	Left Turn, Pedestrian
MD 28 (Veirs Mill Rd) to MD 547 (Strathmore Ave)	444	114	Left Turn, Angle
MD 547 (Strathmore Ave) to I-495	132	101	Opposite Direction
I-495 to Cedar Ln	94	127	Sideswipe
Cedar Ln to Woodmont Ave	112	144	Rear End, Left Turn, Pedestrian
Woodmont Ave to MD 410 (East-West Hwy)	112	122	Rear End, Sideswipe, Left Turn, Angle, Pedestrian

With the projected increases in traffic volumes, travel times, and delays between 2015 and 2040, it is expected that not only will traffic travel slower on average, but that there will be larger variations on a daily basis on how well traffic flows along MD 355. With the roadway network operating closer to capacity and saturation, incidents such as crashes, poor weather, construction, etc. will cause wider variability in how long it takes to travel the corridor. These slower average speeds and more unpredictable conditions will impact not only the private vehicles using MD 355, but also buses using the roadway. The resulting increase in travel times and reduced reliability could have a negative effect on transit use. BRT systems by their design provide a mode and facility that are less impacted by the conditions of roadway traffic and are therefore more reliable.

3.3 Lack of Competitive Travel Options

3.3.1 Existing Transit Service Connectivity and Reliability

- **Existing bus service is piecemeal and time consuming**
- **Metro only serves a portion of potential transit market**

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. 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. WMATA is planning to run all trips throughout the day to the Shady Grove Metrorail Station, starting in 2019. Currently, during peak periods, half of trips terminate at Grosvenor Metrorail Station and half run the full length of the Red Line

to Shady Grove. This change would result in all trips running to Shady Grove during peak periods, with peak period service frequency to Shady Grove changing from the current six minutes to a train every three minutes.

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. Based on WMATA's 2015 second quarter Vital Signs Report, the Red Line is operating at an average on-time performance of 89.3 percent in 2015. WMATA's on-time performance is measured based on adherence to the weekday schedule headways, within plus or minus two minutes, and has a target goal of 91 percent. WMATA's Metrobus has an on-time performance of 77.6 percent, with a target goal of 79 percent.

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. Estimated Ride On travel times along MD 355 based on the timetables are presented in **Table 16**.

Table 16 - Morning Peak Ride-On Travel Times

Route	Origin	Destination	Bus[1] Travel Time (min)	Automobile[2] Travel Time (min)
46	Montgomery College	Rockville Metrorail	10	2-3
	Rockville Metrorail	White Flint Metrorail	17	10-11
	White Flint Metrorail	Medical Center Metrorail	19	10-17
55	Germantown Transit Center	Lakeforest Mall	31	10-12
	Lakeforest Mall	Shady Grove	17	8-11
	Shady Grove	Rockville Metrorail	19	6-8
75	MC Correctional Facility	Germantown Transit Center	27	11-21

Note 1: Bus travel time from Ride On timetables
Note 2: Automobile travel time from SHA traffic model

The total travel time from Clarksburg to Medical Center Metrorail Station by bus is approximately 130 minutes, under the best case scenario without lag time between transfers and if buses run perfectly on schedule. Travel times are significantly high compared to automobile travel due to the high number of stops and required transfers, in addition to the overall roadway congestion. Based on the Ride On timetables (which account for boarding, alighting, and congestion delays), buses travel at an average of 12 to 13 miles per hour in the southern portion of the corridor between Bethesda and Germantown during the peak-period. North of Germantown, buses travel at approximately 20 miles per hour. Comparatively, in those same segments,

Corridor On-Time Transit Performance

	Goal	*Actual*
Metrobus	*79%*	*77.6%*
Metrorail	*91%*	*89.3%*
Ride On	*90%*	*71-74%*

automobiles travel at an average speed of 20 to 23 miles per hour in the southern segment and 23 miles per hour in the northern segment during peak-periods. In terms of travel times, bus trips take 58-70 percent longer than automobile trips in the section between Rockville and Germantown, and 10-35 percent longer elsewhere in the corridor.

As previously mentioned, the on-time performance for the existing 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 the transit service as a viable alternative to automobile travel.

3.3.2 Corridor Travel Market and Transit Accessibility

- **88 percent of all trips along MD 355 are short non-work trips**
- **Over 90 percent of non-work trips occur within adjacent districts**
- **Gaps in job accessibility using transit**

Work trips within the study corridor are projected to grow by 40 percent from 2014 to 2040, and non-work travel within the study corridor is projected to grow by 25 percent over the same period. Most trips within the Study Corridor are short, with more than two-thirds of trips occurring within the same district or between adjacent districts. Work trips account for only 12 percent of overall existing travel in the study corridor and will account for 13 percent of overall travel in 2040. 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.

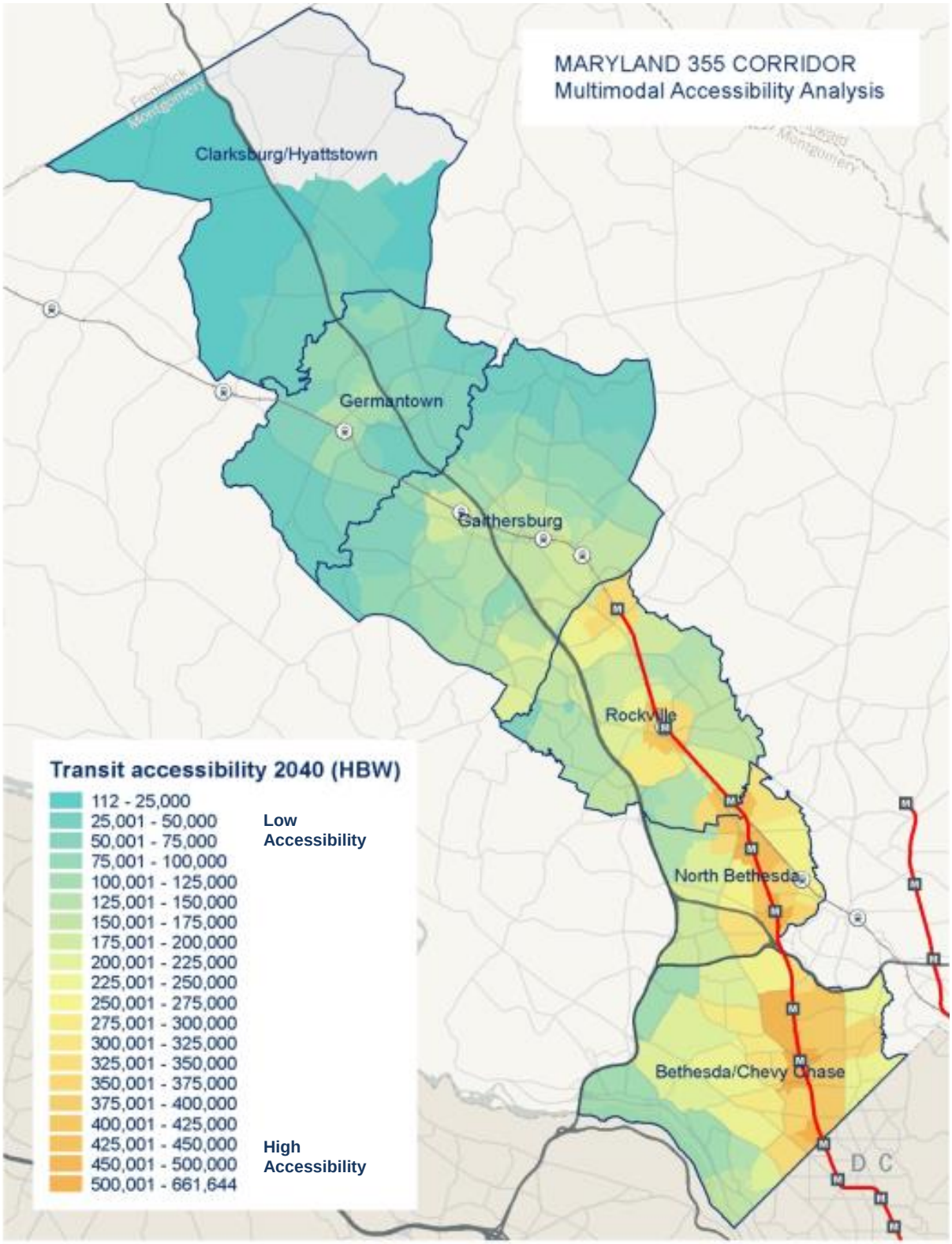
These travel patterns within the study corridor present an interesting opportunity for a potential BRT system along MD 355, which would provide high-quality transit service that could accommodate these types of trips. The BRT would provide better transit accessibility to locations between the existing 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.

According to the CLRP, transit in the region is planned to undergo some significant changes and improvements by 2040, including the construction of a number of new fixed-guideway transit lines by jurisdictions in the form of BRT, streetcar, and light rail. These and other major expansions of the transit system in the region, in addition to other smaller-scale planned improvements to the transit network (such as headway improvements on bus routes and implementation of eight-car trains throughout the Metrorail system) will increase the competitiveness of transit in the region as a whole and in Montgomery County in particular.

These improvements, combined with the projected land use growth and resulting increase in congestion are forecast to increase both the number and percentage of regional trips made by

transit by 2040. However, it is limited by the low accessibility to jobs using transit from many areas within the study corridor. Even with all the proposed transit projects included in the CLRP, gaps still remain in accessibility to jobs using transit along MD 355. **Figure 12** highlights the gaps in transit accessibility to jobs within 45 minutes along the corridor in 2040, the orange representing areas with high accessibility, concentrated around the existing Metrorail stations, and green showing low accessibility in the northern segments of the corridor.

Figure 12 - 2040 Multimodal Accessibility Map



3.4 Transit Reliant Passengers

- **Demographics along MD 355 reflect potential transit reliant customers**
- **Zero car households within study area**

A large number of public transit customers living along MD 355 are transit dependent. 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. **Table 17** shows demographics for this core market of transit-reliant users who would benefit from a high quality transit service along MD 355.

Table 17 - Core Transit Market Demographics

Demographic	Percentage of Project Study Area Population
Age < 19 years old	22.8%
Disabled	7.8%
Below Poverty Line	7.0%

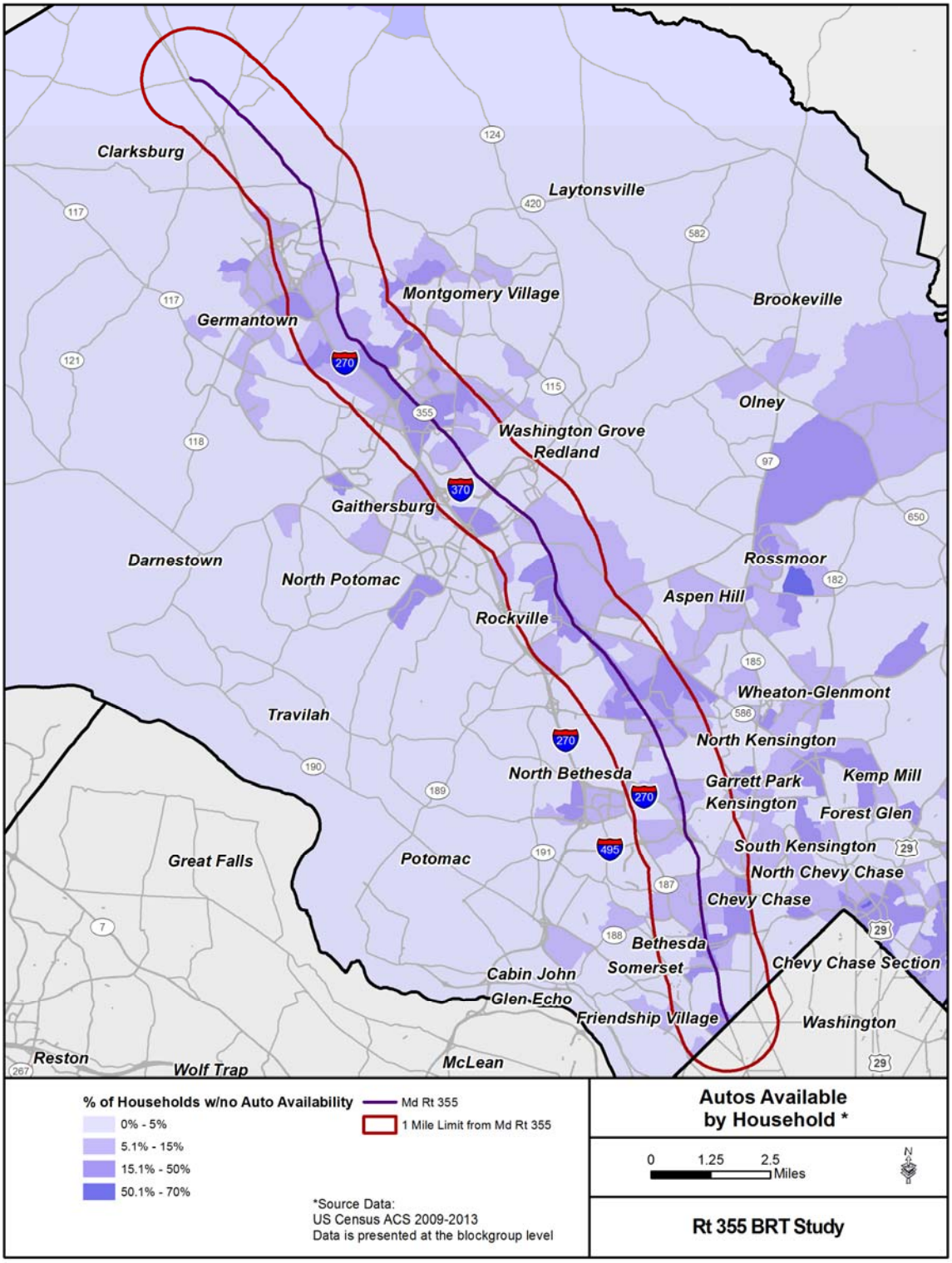
Source: 2009-2013 American Community Survey, 5-year estimates

Furthermore, 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 automobile 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. As shown in **Figure 13**, there are a number of areas within the study area where there is a fairly heavy concentration of households without access to an automobile. These include, from north to south:

- Portions of Gaithersburg/Germantown between the Lake Forest Mall and Germantown Road
- Rockville Town Center
- The southern part of Rockville near the Twinbrook Metrorail Station and north of Montrose Road
- In Bethesda

In addition, many residents of new transit-oriented development projects proposed to be built along MD 355 may be higher-income, higher educated households. While such residents may be car-less by choice, they nevertheless may rely on vehicle-sharing services to meet trip needs currently addressed by car ownership.

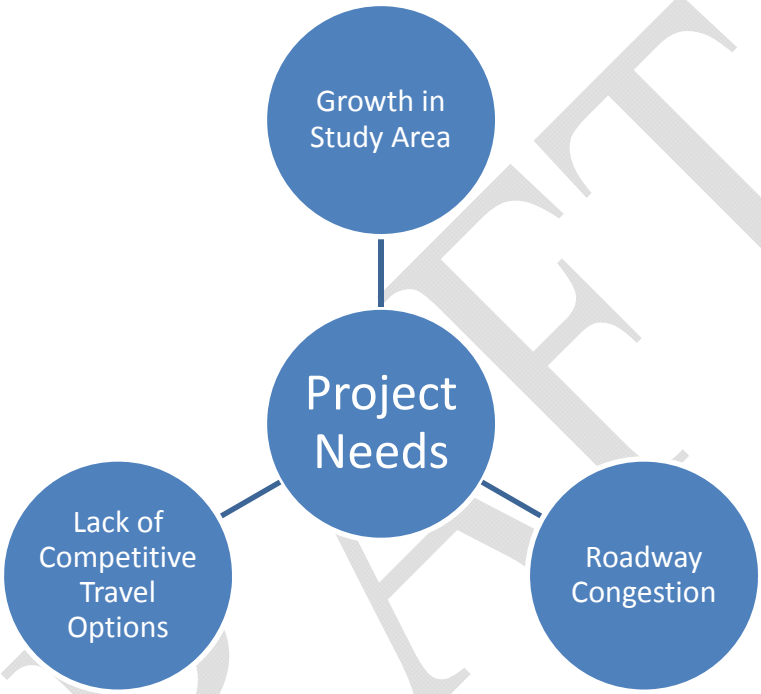
Figure 13 - Study Area Zero Car Households



3.5 Summary of MD 355 Corridor Needs

The problems and issues identified in this section define the needs for the MD 355 corridor. These needs provide the foundation for the statement of the project's purpose. Three categories of needs were identified for the MD 355 BRT study, as shown in **Figure 14**, and summarized below.

Figure 14 - Project Needs



- Growth in study area
  - Montgomery County population and employment are forecasted to grow by 20 percent and 40 percent, respectively
  - MD 355 study area population and employment are forecasted to grow between 15-56 percent and 13-47 percent, respectively
- Roadway congestion
  - Congested conditions will worsen, with traffic increasing by over 20 percent and peak period travel time increasing up to 30 percent by 2040 which contributes to unpredictable and slow travel times for automobiles and buses in the corridor
  - Congested conditions already contribute to higher than average crash rates
- Lack of competitive travel options
  - Existing bus service is piecemeal and time consuming
  - Metro only serves a portion of potential transit market
  - 88 percent of all trips along MD 355 are short non-work trips
  - Over 90 percent of non-work trips occur within adjacent districts
  - Demographics along MD 355 reflect potential transit reliant customers
  - Zero car households within study area

4 Purpose

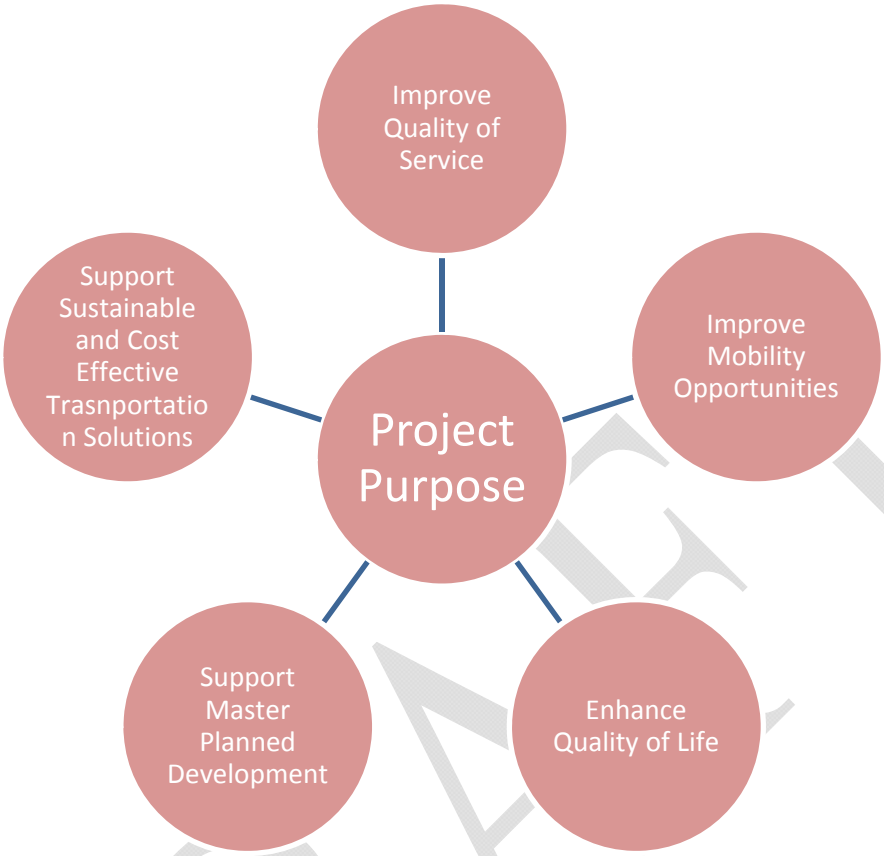
The purpose of the project is to provide a new higher speed, high frequency, premium transit service along MD 355 between Bethesda and Clarksburg that will:

- 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

This purpose statement has been consolidated into five distinct goals to guide the development of alternatives and as an evaluation measure for comparing alternatives: (**Figure 15**):

- **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 and engaging the public to ensure compatibility with customer's needs and 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**

Figure 15 - Project Purpose



4.1 Improve the Quality of Transit Service

Automobile use has created congested conditions in various segments of the MD 355 Corridor. Bus travel has slowed down due to buses sharing the lane with mixed traffic on congested roadways, making frequent stops and having long dwell times at stops due to slow passenger boarding due to on-board fare collection. This has led to reductions in the reliability of the transit system. Currently, bus travel times along the corridor take up to an average of over 40 percent longer than automobile trips, reaching as high as 70 percent longer in certain segments. Latest on-time performance evaluations indicate a 71 percent on-time performance for the most heavily utilized bus route in the corridor, with average travel speeds between 12 and 13 miles per hour during the peak-hours in the most urbanized sections of the corridor. The current low speed of transit services, limited accessibility, and mode transfer needs make transit use noncompetitive compared to automobile travel.

The existing Metrorail system along MD 355 is heavily utilized. However, it does not span the entirety of the corridor, forcing many users to find alternative travel modes to reach the closest Metrorail station. The unreliable bus service to these stations results in the increased use of automobiles to reach the stations, which increases the need for expanded parking facilities and roadway improvements. Furthermore, Metrorail is primarily used for long-distance commuter trips destined for Washington D.C., Bethesda and other job centers, and does not well-serve the

larger portion of non-commuter transit users requiring shorter trips (more frequent stops) along the corridor.

The growing demand for transit in the region, coupled with the reliability issues (adherence to schedule, bus bunching, slow travel times) creates an unacceptable level of service for those individuals who rely on public transit as their primary mode of transportation. Furthermore, the issues associated with the current bus service do not make it attractive to those individuals with access to alternate transportation modes. A higher-quality transit service is needed to increase transit ridership and attract new riders that would otherwise opt to use an automobile.

4.2 Improve Mobility Opportunities and Choices

MD 355 is a key north-south spine for Montgomery County, slated for major redevelopment and growth as supported by all local Master Plans and Sector Plans. The planned and approved changes will further exacerbate the existing roadway congestion along MD 355 and will require alternative travel mode opportunities and choices to support future land uses.

The corridor is currently lacking a high-quality continuous transit connection from Bethesda to Clarksburg that can support its planned growth. The existing transit options, as well utilized as they are, have deficiencies that cannot be easily addressed. The Metrorail system connects Washington D.C. with northern Rockville, but the high capital investment cost prohibits its extension to locations farther north. The MARC line provides longer distance travel opportunities along certain stretches of the study corridor, but it does not address the short distance trips required to support the forecasted growth. The MARC's Brunswick Line has two stations along the study corridor, located in Gaithersburg and Rockville. The trains operate peak direction service only at average headways of 22 minutes and 38 minutes in the morning and afternoon peak-periods, respectively.

Finally, the existing bus routes are segmented throughout the corridor, requiring multiple transfers to travel the entire study area, and their service is unreliable due to roadway congestion and multiple stops along MD 355.

A well-utilized transit service has the potential for a higher person throughput than a general purpose lane for automobile users. This means that a BRT vehicle operating in a dedicated lane may move more people than a stream of single occupancy vehicles utilizing that same space. This metric allows for planners to find a better balance between automobile and transit services to maximize the person throughput using limited right-of-way. This optimization of roadway usage facilitates the inclusion of other roadway users, such as pedestrians and cyclists, further improving the access to multimodal facilities. The improved connectivity between automobile, transit, pedestrian, and cyclists increases choices and the overall efficiency of a regional transportation network.

4.3 Provide Transit Services that Enhance Quality of Life

The USDOT has developed a policy of transportation planning and programs as a way of improving community quality of life, enhancing environmental performance, and increasing transportation and housing choice while lowering costs and supporting economic vitality. Places

with coordinated transportation, housing, and commercial development give people access to affordable and environmentally sustainable transportation alternatives.

The fundamental principles of livability are derived from the place-based needs and desires of the community. The past, existing, and future characteristics of each community are therefore used to identify how livability is defined for that specific community. Adopted local Master Plans and Sector Plans support the important interrelationship between compact, mixed use development and efficient transportation, including improved transit services along the MD 355 Corridor as a means to reduce automobile dependency. One such example is the redevelopment of the City of Rockville with the creation of a new Town Center, as proposed in its Master Plan (**Figure 16**). Livability principles expressed by the communities in these plans also include integration of transportation and land use planning, an efficient transit system, improved access to housing, jobs, and services, and conservation of environmental resources.

Figure 16 - Rockville Town Center

As with the development of Master Plans and Sector Plans, any proposed transportation improvement along MD 355 incorporates a formal public involvement process to ensure compatibility with the communities' character, needs, and planned vision, as well as to comply with all Local, State, and Federal regulations.

A well planned transit system may also enhance the quality of life by minimizing private property impacts, reducing roadway congestion and improving safety for pedestrians and cyclists. Congestion relief also leads to reduced fuel consumption and improved air quality. Transit increases mobility, reduces time spent in congestion, and increases foot traffic and customers for businesses along the corridor.

BRT along the MD 355 Corridor could also enhance quality of life for low-income families by offering additional public transit choices and generally support the potential for proximate affordable housing. This could translate to improved access to healthcare, education, and employment opportunities, as well as greater mobility and reduced commuting costs. According to the May 2007 FTA and U.S. Department of Housing and Urban Development publication, *Realizing the Potential: Expanding Housing Opportunities Near Transit*, families that live near transit spend just nine percent of their household income on transportation compared to twenty-five percent of income for families who live in auto-dependent neighborhoods.

4.4 Develop Transit Services that Support Master Planned Development

A December 2008 report from the Future for Growth and Development in Maryland Task Force, *Where Do We Grow From Here?*, advised that by 2030, the State of Maryland could lose

650,000 acres of rural land to development unless growth policies change to encourage more compact, walkable communities that are easily accessible and in close proximity to employment, retail, and services.

Figure 17 - MD 355 White Flint Master Plan

Transit Oriented Developments (TODs) are defined as compact, mixed-use developments near transit facilities and high-quality walking environments. The goal of TOD is to embrace the transit element and create sustainable communities where people of all ages and incomes have transportation and housing choices, increasing location efficiency where people can walk, bike, and take transit. In addition, TOD projects have demonstrated an increase in local transit ridership and a reduction in automobile congestion, providing value for both the public and private sector. Current Master Plans and Sector Plans propose TODs at the Bethesda, White Flint (**Figure 17**), Twinbrook, Rockville, and Shady Grove Metrorail stations.

Transit service improvements along MD 355 would support the planned development and growth around the proposed TODs, thus capitalizing on public investments in transit by producing local and regional benefits. Other benefits of TODs could include increased ridership, joint development opportunities, increases in the supply of affordable housing, and returns on investment to those who own land and businesses near transit stops. Furthermore, strategic selection of station locations for a high quality transit service may support infill and redevelopment, which serve as catalysts for revitalizing neighborhoods.

4.5 Support Sustainable and Cost Effective Transportation Solutions

Solutions are only feasible if they adequately and honestly address both physical impacts and financial constraints. In a corridor as large as MD 355, there are a number of physical constraints, such as limited right-of-way, intersection spacing, bridges and overpasses, utilities, and protected environmental resources. Financial constraints include factors such as operational costs, capital costs, and third party investment interests. The Countywide Transit Corridor Functional Master Plan prioritizes transit investment along MD 355 to reduce physical impacts and financial constraints, leveraging transportation innovation to support economic development in the County, prioritizing transit usage to increase the overall connectivity and mobility along the corridor.

Cost effectiveness compares the total cost of various alternatives that achieve a specific level of benefit, such as a target level of ridership, time savings, etc. The alternative that can reach the

target benefit for the least cost is considered the most cost effective alternative. The total cost of an alternative takes into consideration the planning, design, and construction cost of roadway improvements, right-of-way acquisition, maintenance of the facility, and operation of the transit service. Total costs are usually expressed in ranges, and by extension cost effectiveness measures, to capture the inherent risk involved in major transportation projects, such as the volatility in construction prices and the real estate market.

Preserving environmental resources is a key component in enhancing the quality of life, but it is also an essential metric for sustainability and driver of capital cost. Environmental resources are in many cases activity centers for outdoor recreation and tourism. The commitment to environmental stewardship also requires stringent mitigation measures for impacts to environmental resources. A successful transit service along MD 355 must carefully consider these natural and cultural activity centers and minimize their impacts to control the overall capital investment cost.

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