Montgomery County
RAPID TRANSIT
US 29

US 29 Bus Rapid Transit (BRT)
Corridor Planning Study

From Silver Spring Transit Center
to Burtonsville Park and Ride

Preliminary Purpose and Need Document
– DRAFT –
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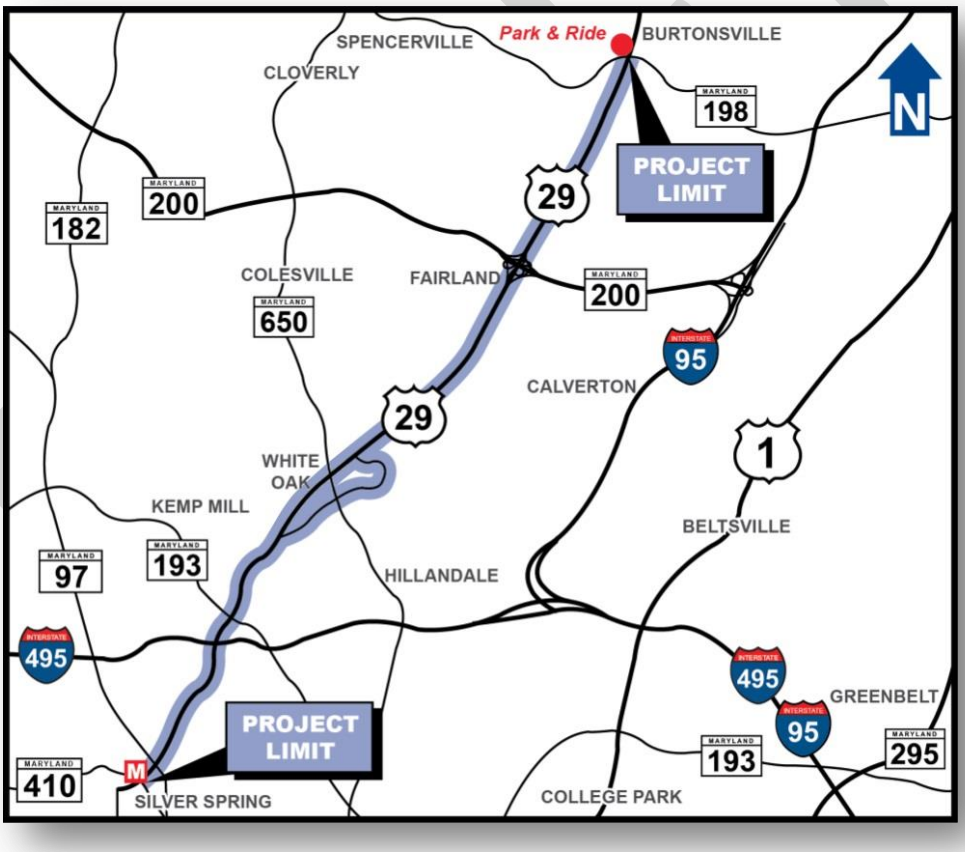

Montgomery County, Maryland
December 2015

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1 Introduction

Montgomery County is proposing a new Bus Rapid Transit (BRT) line along US 29 between the Silver Spring Transit Center and the Burtonsville Park and Ride in Montgomery County, Maryland. At the county's request, the Maryland Department of Transportation has initiated a corridor study to identify transportation needs and evaluate potential build alternatives for accommodating enhanced transit service via BRT.

This Preliminary Purpose and Need report documents the existing and future transportation needs in the US 29 study corridor that a BRT project could potentially address. The study team has designated it as "preliminary" as it is intended to provide the initial foundation for a potential future formal Purpose and Need statement in the event the project moves into a future development phase as part of the federal National Environmental Protection Act (NEPA) approval process.

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 further 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. Improvements to county transit systems have been discussed many times in many planning documents since that Strategic Transit Plan was developed and are summarized in **Appendix B**.

In 2011, 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 US 29. 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 and the recommendations for enhanced transit included in several other local area and sector plans, Maryland-National Capital Park and Planning Commission (M-NCPPC) developed a Countywide Transit Corridors Functional Master Plan. This Functional Master Plan was approved and adopted by the County Council in December 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, the document outlines recommendations 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 Functional Master Plan also makes recommendations on the allocation of space for transportation system facilities related to motor vehicle traffic, transit, pedestrians, and bicycles. One of several corridors included in the Functional Master Plan, is US 29 (Colesville Road/Columbia Pike) from the Silver Spring Transit Center to the Burtonsville Park and Ride.

While the focus of the US 29 corridor study is enhanced bus transit services, the study team acknowledges that other forms of premium transit are available, and have been considered by the MCDOT in previous feasibility studies. The US 29 corridor is recognized as a potential fit for the overall county BRT system for the following reasons:

1. Planned development in the corridor will create additional vehicle trips that will increase congestion and could be addressed with high quality transit options.
2. Existing traffic challenges could be addressed with BRT.

3. Silver Spring Transit Center provides a multi-modal hub link to get to downtown Washington, D.C. and other bus routes;
4. The corridor has an existing strong transit market with robust bus ridership.
5. US 29 north of New Hampshire Avenue has a wide median that could potentially accommodate lanes for BRT service

1.1.1 Goals and Objectives

To guide the development and implementation of the bus rapid transit system, the study team has developed a list of goals and objectives outlined in **Table 1**. 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.

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 Auto Travel
		Increase Transit Ridership
		Provide an Appealing Transit Service that will Attract New Riders
2	**Improve mobility opportunities and choices**	Serve as Many Travelers as Possible by Efficiently Utilizing the Right-of-Way
		Balance Travel Times for Automobiles and Transit Users
		Enhance Pedestrian and Bicycle Options in the Corridors
		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 Private Property Impacts
		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 the Support In fill and Redevelopment
5	**Support sustainable and cost effective transportation solutions**	Maintain Environmental Quality
		Minimize cost of Building and Operating Transportation Services

2 Existing Conditions

2.1 Description of Study Area and Study Corridor

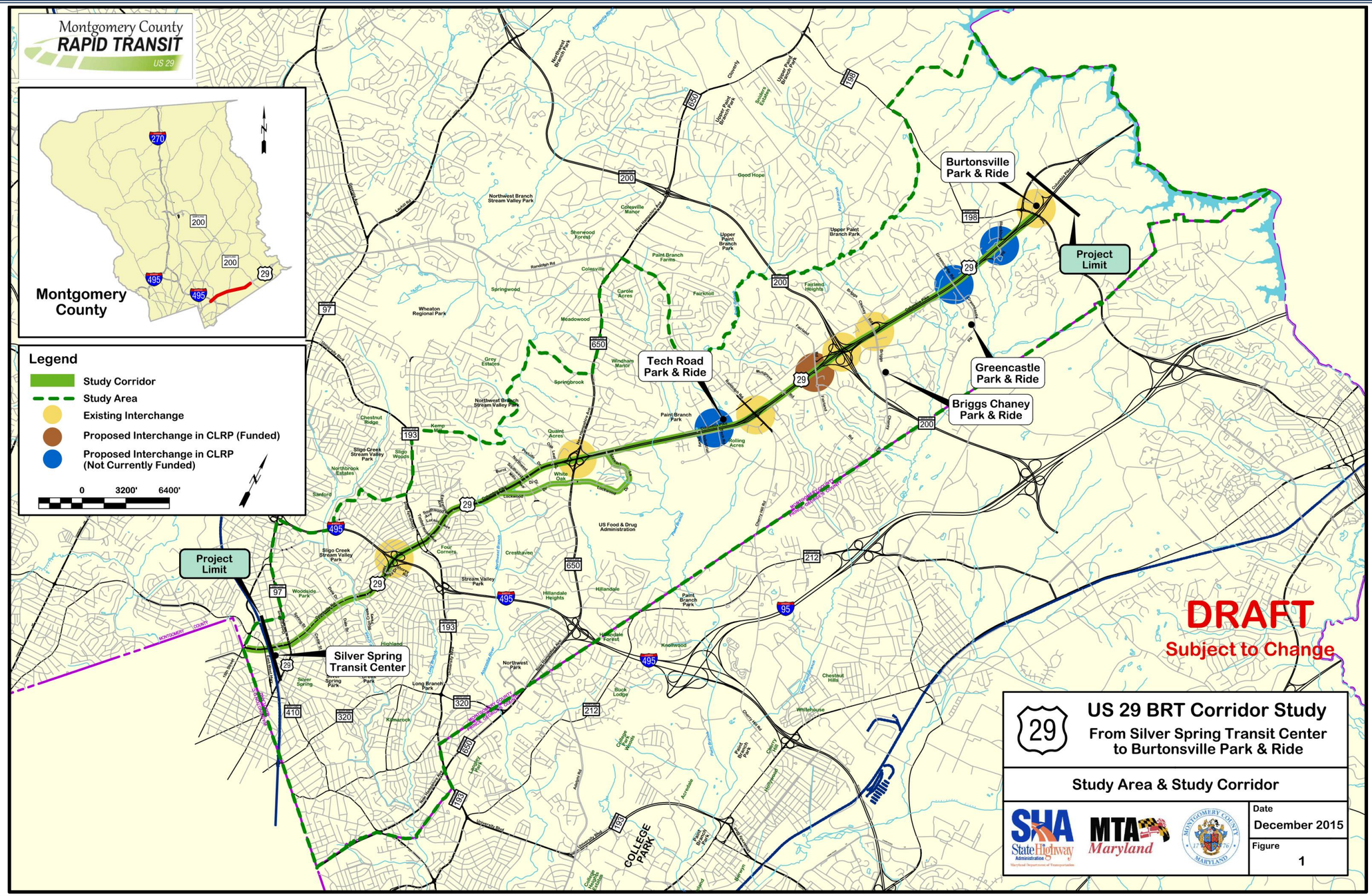
This study focuses on US 29 in eastern Montgomery County, MD and the surrounding communities, employment areas, activity centers, and infrastructure facilities it serves. On a larger scale, Montgomery County is part of the northern Washington, D.C. metropolitan area, and US 29 is a major north-south highway within the National Highway System that begins in the Howard County, MD near Ellicott City and ends in Pensacola, FL. Within Maryland, US 29 is a multi-lane highway, where opposing traffic flows are separated by access controlled interchanges and dividing medians in some sections. US 29 provides the westernmost north-south route between Washington D.C. and the Baltimore area.

In order to provide a more complete assessment of the existing features and needs of the transportation and community facilities in the area, the study team has identified two concentric areas of focus that surround the segment of US 29 under investigation. The Study Area and the Study Corridor. The larger Study Area surrounds the Study Corridor and has been defined for the purposes of evaluating travel demand, traffic patterns, community features, and socio-economic demographics. The smaller Study Corridor is contained within the Study Area has been defined for the purposes of evaluating adjacent land uses, natural and cultural resources, existing infrastructure elements, and transportation operations and safety.

The Study Area, as shown in **Figure 1**, is defined as an aggregate of Transportation Analysis Zones (TAZs) of the TPB/MWCOG model and bounded by:

- The border of Montgomery County (with Prince George's County) on the east,
- The border of Montgomery County (with Howard County) on the north,
- The border of Montgomery County (with District of Columbia) on the south,
- A study team generated border Approximately 1 mile west of US 29, based on TAZs.

Located within the Study Area, the twelve-mile Study Corridor (also shown in **Figure 1**) is comprised of the existing community and infrastructure features and facilities located adjacent to the existing US 29 right-of-way. The Study Corridor has a south terminus at Silver Spring Transit Center and a north terminus at Burtonsville Park and Ride, and includes a spur on Lockwood Drive and Stewart Lane, which runs through a high-density and high-ridership area of White Oak. The corridor intersects with major arterial roadways such as University Boulevard (MD 193), New Hampshire Avenue (MD 650), East Randolph Road, Cherry Hill Road, Fairland Road, Spencerville Road, and highways such as I-495 and MD 200.


Montgomery County RAPID TRANSIT US 29
Montgomery County
Legend
Study Corridor
Study Area
Existing Interchange
Proposed Interchange in CLRP (Funded)
Proposed Interchange in CLRP (Not Currently Funded)
0 3200' 6400'
Burtonsville Park & Ride
Project Limit
Tech Road Park & Ride
Greencastle Park & Ride
Briggs Chaney Park & Ride
Project Limit
Silver Spring Transit Center
DRAFT
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US 29 BRT Corridor Study
From Silver Spring Transit Center to Burtonsville Park & Ride
Study Area & Study Corridor
Date
December 2015
Figure
1

2.1.1 Land Use

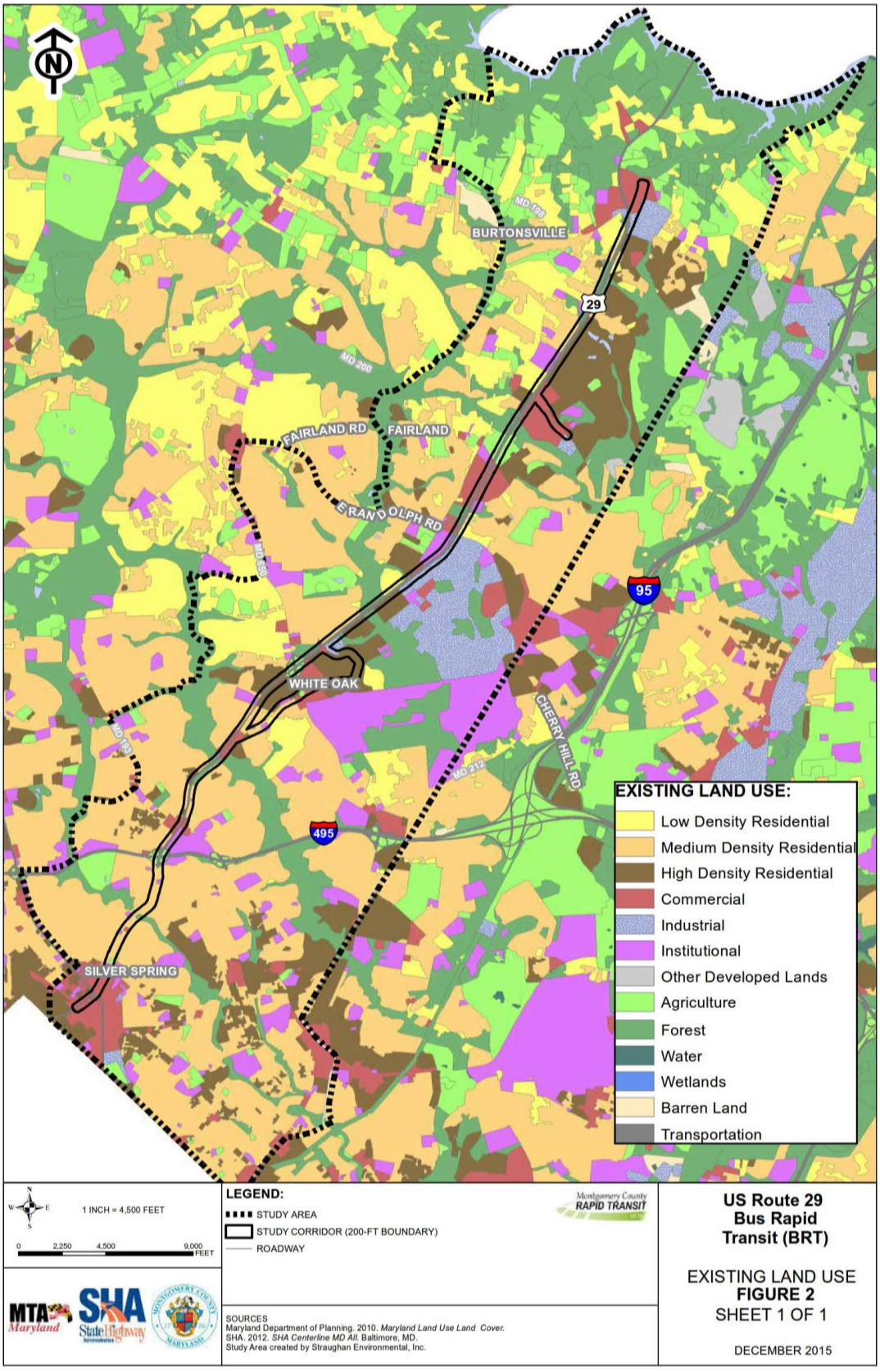
The US 29 serves as the spine that links the residential communities from Silver Spring to Burtonsville, with the regional activity and growth generators at Silver Spring and White Oak, and the robust activity centers that are a short distance away in Washington, D.C., and Howard County. US 29, and the well-established and well-patronized transit services in the study corridor offer good transportation, however, current challenges show that it may not meet needs of the study corridor as it grows.

Residential land uses are located throughout the study area (**Figure 2**). The majority is low and medium density, with some concentrations of high-density residential development near MD 650. Four Corners, Fairland, Burtonsville, and White Oak are just a few of the 14 residential communities in the study corridor. These and others like it are stable communities, many of them among the most desirable communities in Montgomery County. Commercial and institutional land uses are also dispersed throughout the corridor. Some industrial uses are located in the northern half of the study corridor near Industrial Parkway and Tech Road. A summary of Land use types and corresponding acreages within the study corridor are provided in **Table 2**.

Table 2: Land Uses and Acreage within Study Corridor

Land Use Type	Area (Acreage)
Low Density Residential	23
Medium Density Residential	132
High Density Residential	106
Commercial	136
Industrial	27
Institutional	33
Open Urban Land	14
Agriculture	11
Forest	52
Water/Wetlands	4
Transportation	132

Source: Maryland Department of Planning and SHA


BURTONSVILLE
MD 198
29
MD 200
FAIRLAND RD
FAIRLAND
E RANDOLPH RD
MD 650
95
WHITE OAK
CHERRY HILL RD
MD 212
MD 193
495
SILVER SPRING
EXISTING LAND USE:
Low Density Residential
Medium Density Residential
High Density Residential
Commercial
Industrial
Institutional
Other Developed Lands
Agriculture
Forest
Water
Wetlands
Barren Land
Transportation
1 INCH = 4,500 FEET
0 2,250 4,500 9,000 FEET
LEGEND:
STUDY AREA
STUDY CORRIDOR (200-FT BOUNDARY)
ROADWAY
SOURCES
Maryland Department of Planning. 2010. Maryland Land Use Land Cover.
SHA. 2012. SHA Centerline MD All. Baltimore, MD.
Study Area created by Straughan Environmental, Inc.
US Route 29
Bus Rapid
Transit (BRT)
EXISTING LAND USE
FIGURE 2
SHEET 1 OF 1
DECEMBER 2015

The commercial/retail uses are concentrated near the Silver Spring Transit Center, White Oak, and Burtonsville. White Oak and Silver Spring are regional activity centers that are expected to drive growth in the area, as envisioned by the approved and adopted White Oak Science Gateway Master Plan and the Silver Spring Central Business District (CBD) Sector Plan.

The White Oak Science Gateway Master Plan covers nearly 3,000 acres and envisions development that comprise the existing FDA Headquarters and Research Center, a Life Sciences/FDA Village, and the Hillandale Community.

The Silver Spring CBD Sector Plan Center envisioned and laid the foundation for much of the development that has happened in the CBD. Downtown Silver Spring is home to the Discovery Communications, the National Oceanic and Atmospheric Administration, and numerous retail, civic and entertainment venues that were envisioned for its revitalization and new development. The Sector Plan also drives the vision for future development.

2.1.2 Population and Jobs

In 2014, population in the study corridor is estimated at 137,495 according to the Maryland Washington Council of Governments (MWCOG) Transportation Planning Board (TPB). Nearly 60% of the population in the corridor is minorities and 5% of the households in the corridor are considered low-income.

The MWCOG/TPB estimates the 2014 number of households at 52,064 and employment at 67,125 jobs in the corridor. The activity centers at White Oak and Silver Spring are expected to drive future growth in the corridor.

Based on the 2010 decennial Census, as well as more recent American Community Surveys, Maryland has the highest median household income in the country. The most recent 5-yr estimate is $72,483.

2.1.3 Transit-Dependent Populations

U.S. Census data are used in determining potential minority or low-income populations (see **Appendix C, Table 8**). Consistent with SHA's guidelines, minority populations are identified as Block Groups with a meaningfully greater percentage of minorities than that of a greater geographic region. For this planning study, Block Groups with minority populations greater than or equal to that of Montgomery County are considered potential environmental justice populations. Minority populations will include persons who identify themselves as Black or African-American, Asian, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander,

Other, Two or More Races, or any person of Hispanic descent. Likewise, low-income populations will include Block Groups with meaningfully greater percentage of persons living below the federal poverty level than that of a greater geographic region. For this planning study, Block Groups with the percentage of persons living below poverty greater than or equal to that of Montgomery County are considered potential environmental justice populations.

Based on the 100 percent count data from the 2010 U.S. Census, 48 of the 99 Block Groups within the project vicinity are potential minority populations. Based on the 2009-2013 U.S. Census American Community Survey Estimates, 19 of the 99 Block Groups are potentially low-income populations (see **Appendix C**, **Sub-Appendix A**, **Figure 1**). The Block Groups with potential minority populations are concentrated immediately along either side of US 29 north of New Hampshire Avenue (MD 650), as well as the southern portion of the study area near downtown Silver Spring. The Block Groups with potential low-income populations are dispersed throughout the study area with the only concentration just northeast of the US 29 and Intercounty Connector (MD 200) interchange.

Corridor Snapshot

- Two regional activity centers, Silver Spring and White Oak/FDA, serve as an engine for activities and travel in the study area.
- Strong employment growth in these two regional activity centers is forecasted for 2040, with a growth of almost 80% over current levels.
- Intra-study-area trips represent a significant share of travel market for the study area, with approximately 40% of total trips in 2014 and are expected to increase by nearly 30% in 2040.
- DC-bound commuting trips were a major out-flow of trips from the study area, with approximately 20,000 residents living in the study area and commuting to DC.
- Another major DC-bound commuting flow of approximately 10,000 was from Howard County.
- Severe congestion exists north of the beltway on the US 29 corridor and is forecast to exacerbate in the future 2040 condition.
- The study area has a strong transit market, including an average weekday daily Metrorail ridership of approximately 13,000 for Silver Spring Station and more than 15,000 boardings for the Metrobus Z line buses, Ride On buses, and MTA commuter buses.

2.2 Existing Transit Services

One of the attractions of the US 29 Corridor Study Area is its transit service. Montgomery County Ride On, Washington Metropolitan Transit Authority (WMATA) Metrobus Z Line bus, and the MTA Commuter Bus operate in the corridor. WMATA provides Metrorail service at the Silver Spring Station, which is near the recently built Silver Spring Transit Center.

The Transit Center serves as a hub for the Metrorail, MARC, Ride On and Metrobus, and local shuttle services. It is also a future stop for the planned Purple Line Light Rail, scheduled to be completed in 2021. The MTA MARC Brunswick Commuter Rail Line stops in Silver Spring, less than a block away from the Metrorail station. Understanding the transit services – Ride On, Metrobus, Metrorail and MARC – as they operate and perform today provides insight into the challenges that exist for the future. **Figure 3** shows the transit services in the US 29 Study Area.

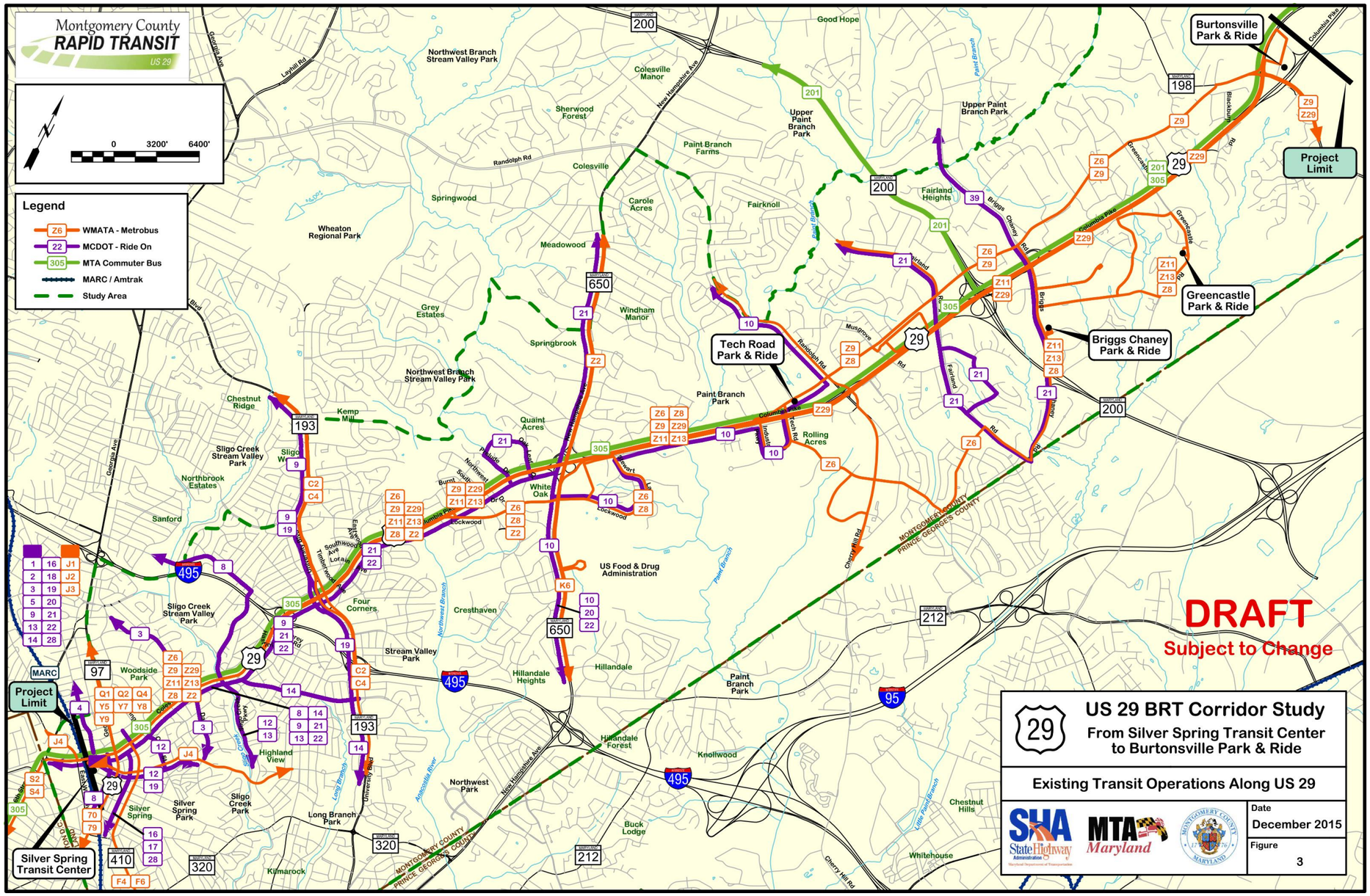
2.2.1 Montgomery Ride On Bus

Table 3 provides a summary of the Montgomery County Transit Ride On Service that covers portions of the US 29 BRT Study Corridor Area with a 20-30 peak period headways. Four of the routes, the 8, 9, and 10, these services generally make frequent, all day stops throughout the corridor at and operate at headways ranging from 20-30 minutes. Routes 13, 21 and 22, which operate on a more limited, peak period stop schedule - only stopping during weekday morning and evening peak travel times - and operate with a lower frequency.

Table 3: Montgomery Ride On Bus Services Summary

Bus Routes	From	To	Headway Peak	Headway Off-Peak	Span of Service
Route 8	Silver Spring	Wheaton	25-30 min	30 min	Weekday (5:50am – 8:31pm) Saturday (7:15am – 7:46pm)
Route 9	Silver Spring	Wheaton	20-30 min	20-30 min	Weekday (4:46am – 10:58pm) Weekend (6:30am – 9:55pm)
Route 10	Twinbrook	Station-Hillandale	20-30 min	20-30 min	Weekday (4:39am – 11:07pm) Weekend (6:39am – 11:08pm)
Route 13	Silver Spring	Takoma	25-30 min	n/a	Weekday (5:50am – 7:45pm) No Mid-Day Service
Route 21	Silver Spring	Briggs Chaney Park and Ride	20-30 min	n/a	Weekday (5:36am – 7:58pm) No Mid-Day Service
Route 22	Silver Spring	Hillandale	20-30 min	n/a	Weekday (5:45am – 7:25pm) No Mid-Day Service

Source: Montgomery County Ride On



Sources: WMATA Metrobus, Ride-On, MTA.

2.2.2 Metrobus

Several Metrobus Z Line buses serve the US 29 Corridor and the rest of the study area. These Z Line buses are mostly weekday services, except for Z8. Several are peak services only, including Z2, Z9/Z29, and Z11/Z13. The Z2, Z6, and Z8 lines provide local service, while Z9/Z29 and Z11/Z13 provide express service.

Most buses run on headways of 6-15 minutes, as summarized in **Table 4**. The Z lines serve the area between Silver Spring Metro and Lockwood Drive/New Hampshire Avenue and offer combined average service headway of 10 minutes in the AM peak and 6-7 minutes in the PM peak. The combined average service headway declines further north; 15 minutes in the AM and 8.5 minutes in the PM from Lockwood Drive/New Hampshire Avenue to US 29 and Industrial Parkway, and 30 minutes north of Industrial Parkway.

The study corridor is a portion of WMATA's Colesville Road/Columbia corridor. This is part of WMATA's Priority Corridor Network (PCN), which is a set of strategies for improving bus service travel times, reliability, capacity, efficiency, and system access. As part of the PCN initiative, WMATA recently conducted the Metrobus Z Line Study. The Z-line study made a series of short, medium, and long-term recommendations for service, operational, traffic operations, and passenger facility improvements. Proposed improvements ranged from modifying span of service (additional weekday and weekend service), adding stop amenities (trashcans, benches, etc.), implementing traffic signal optimizations, to providing new limited stop express service routes. More details from the Z-line are located in **Section 3.1.2** of this document and on-line at: http://www.metrobus-studies.com/Z_Line/Z_Line.html

Table 4: Metrobus Services Summary

Bus Routes	From	To	Headway Peak	Headway Off-Peak	Span of Service
Z2	Silver Spring	Olney	6-15 min	n/a	Weekday (5:32am – 8:06pm) No Mid-Day Service
Z6	Silver Spring	Burtonsville Crossing Park and Ride	6-15 min	20-30 min	Weekday (5:03am – 10:24pm)
Z8	Silver Spring	Greencastle Park and Ride	6-15 min	20-30 min	Weekday (4:50am – 2:19am) Weekend (4:54am – 1:24am)
Z11, Z13	Silver Spring	Greencastle Park and Ride	6-15 min	n/a	Weekday (5:18am – 8:13pm) No Mid-Day Service
Z9, Z29	Silver Spring	Greencastle Park and Ride	6-15 min	n/a	Weekday (5:20am – 7:18pm) No Mid-Day Service

Source: WMATA

2.2.3 Metrorail

The Silver Spring Metrorail station (**Figure 4**) is located at the south end of the study area. The other Metrorail stations close to the study area include Forest Glen, Glenmont, and Wheaton. The Red Line is the busiest Metrorail line running through downtown District of Columbia (DC) and connecting Montgomery County and downtown DC. The U-shaped Red Line alignment is approximately 31.9 miles from Shady Grove to Glenmont, and the US 29 Study Area is on its east leg. As shown in **Table 5**, the Red Line has frequent service during the weekday rush hours, and it provides reasonably frequent services during off-peak hours and weekends. It does not, however, run through the entire study area.

Figure 4: Silver Spring Metrorail Station

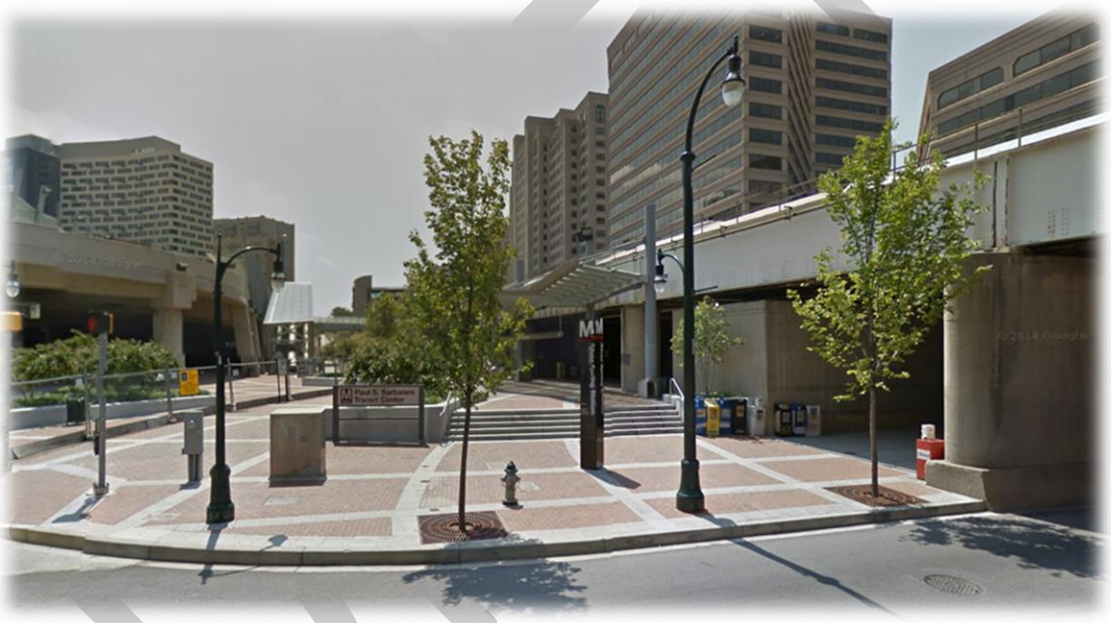


Table 5: Metrorail Service Summary

	Headways				
Weekday	**AM Peak**	**Midday**	**PM Peak**	**Evening**	**Late Night**
Monday to Friday	3-6 min	12 min	3-6 min	6-10 min	15-18 min
Weekend	**Daytime**			**Late Night**	
Saturday	12 min			15 min	
Sunday	15 min			15 min	

Source: WMATA.

2.2.4 MTA Commuter Services: Bus and MARC

MTA provides commuter bus services between Columbia/Ellicott City and District of Columbia, including Route 305, 315, and 325, as show in **Table 6**. These commuter buses operate in the peak direction during peak periods, with 20-minute headway. In the southbound direction, Route 305 and 315 typically pick up passengers in Howard County and at the Burtonsville Park and Ride and discharge passengers at only two locations in the study area – at Fenton Street, and the Silver Spring Metrorail Station. The commuter bus does not provide service for trips originating within the US 29 Corridor Study Area.

Table 6: MTA Commuter Bus Services Summary

Bus Routes	From	To	Headway Peak	Headway Off-Peak	Span of Service
Route 305	Columbia Mall	Washington, D.C. (Library of Congress)	About 20 min	n/a	Weekday (5:08am – 9:01am and 1:45pm - 8:13pm) No Mid-Day Service
Route 315	Lette Plaza in Ellicott City	Silver Spring and Washington, D.C. (Navy Yard)	About 20 min	n/a	Weekday (5:16am – 8:47am and 3:32pm – 7:27pm) No Mid-Day Service
Route 325	Harper's Farm Village Center in Columbia	Silver Spring and Washington, D.C. (Library of Congress)	About 20 min	n/a	Weekday (6:26am – 8:41am and 4:05pm – 6:02pm) No Mid-Day Service
Route 201	Gaithersburg Park and Ride	BWI Marshall Airport and MARC/Amtrak Rail Station	About 60 min	About 60 min	Weekday (4:35am – 6:35pm) Weekend (4:32am – 6:32pm)
Route 202	Gaithersburg	DOT/Ft. Meade	About 60 min	About 60 min	Weekday (5:10am – 6:33pm)

Source: MTA.

The MARC Brunswick Line provides service between Washington, DC, and Martinsburg, West Virginia. Nine inbound trains stop at the Silver Spring station in the morning and nine outbound trains stop at the Silver Spring station in the afternoon and evening, Monday through Thursday. On Fridays, there is an additional outbound train. Like the Commuter Bus, the MARC are true commuter services, providing very limited service, generally at one-to-two stops in the study area.

2.3 Transit Usage

The sections above illustrate that the study area has a strong transit market. The magnitude of the existing transit ridership by different transit modes and providers is shown in **Table 7** and includes the following:

- With a daily ridership of approximately 13,000, Silver Spring Station is one of top suburban stations for the Metrorail system. Average Daily Ridership in the study area is summarized in Table 5.

- The combined ridership of the Metrobus Z Line Buses, Ride On Buses, and MTA Commuter Buses totals 15,000, with 11,000 on the US 29 Corridor.

- Local services Z6 and Z8 carry the largest ridership on the US 29 Corridor, accounting for over 60 percent of the ridership on the corridor.

- Transit travel patterns indicate the strongest transit market is on the southern portion of the US 29 corridor. The heaviest concentration of inbound boardings is within White Oak along Stewart Lane and Lockwood Drive, and the dominant concentration of inbound alightings is south of New Hampshire Avenue and Lockwood Drive. Outbound, the boardings are predominately concentrated in the line segment between Silver Spring and New Hampshire Avenue and Lockwood Drive, while the alightings are heavily concentrated along Stewart Lane and Lockwood Drive.

- The stops with the most boardings and alightings are between New Hampshire Avenue and Lockwood Drive and Silver Spring and include Silver Spring Station, New Hampshire Avenue and Lockwood Drive, Colesville Road and University Boulevard, and Colesville Road and Spring Street. Active stops also include Tech Road, Castle Boulevard, the Briggs Chaney Park and Ride, and Burtonsville Park and Ride.

- Transit load profiles show a predominant concentration of transit rider volumes in the southern portion of the US 29 corridor and a large increase in loads along Stewart Lane and Lockwood Drive. Transit activity shown in **Figures 5a and 5b**, below.

Figure 5a: 2015 Peak Average Daily Weekday Boardings for Northbound and Southbound WMATA Stops on US29

Source: WMATA APC data for Routes Z2, Z6, Z8, Z9/29, Z11/13

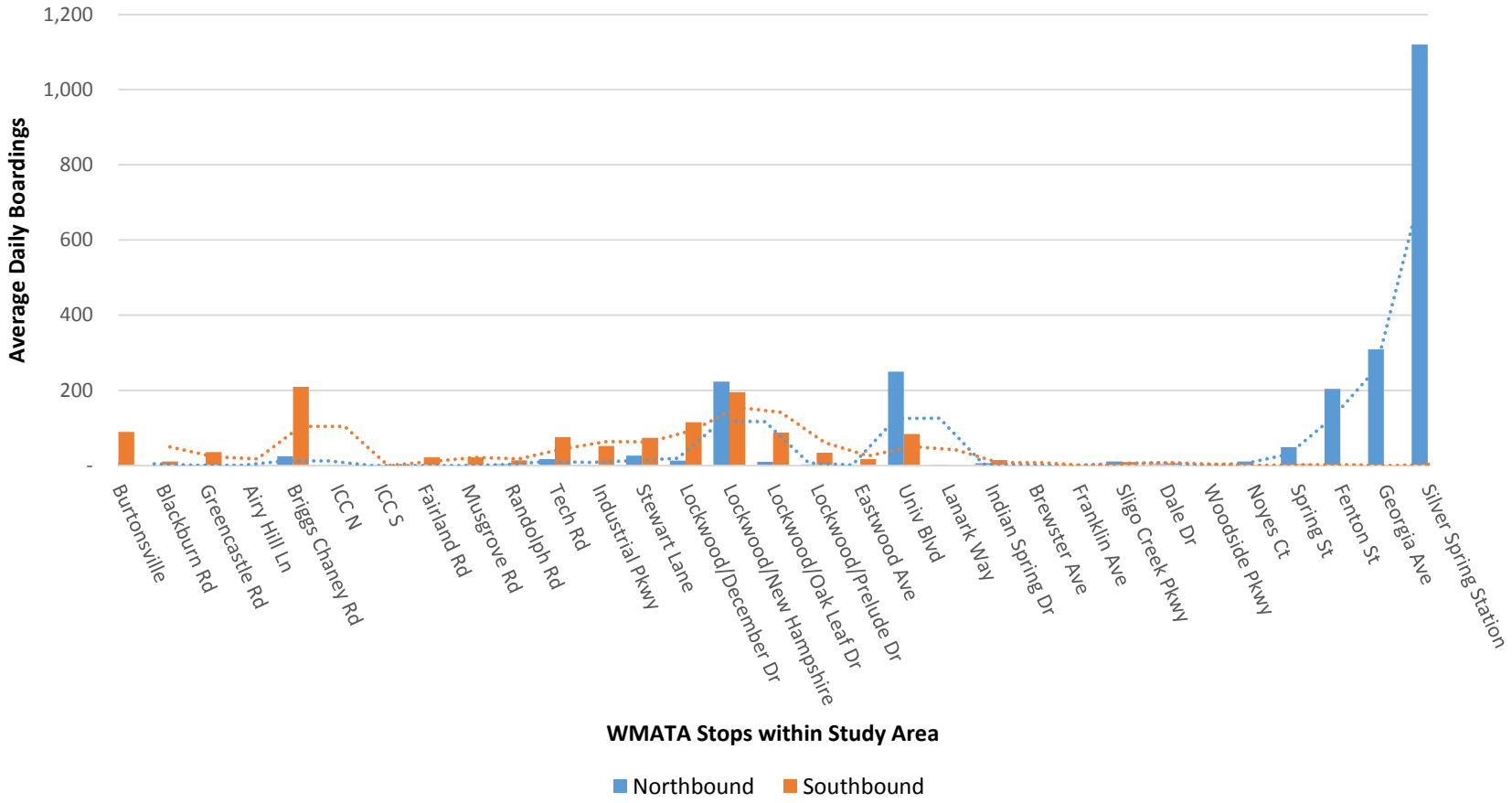


Figure 5b: 2015 Peak Average Daily Weekday Boardings for Northbound and Southbound Ride On Stops on US29

Source: Ride On data for Routes 8, 9, 10, 21, 22

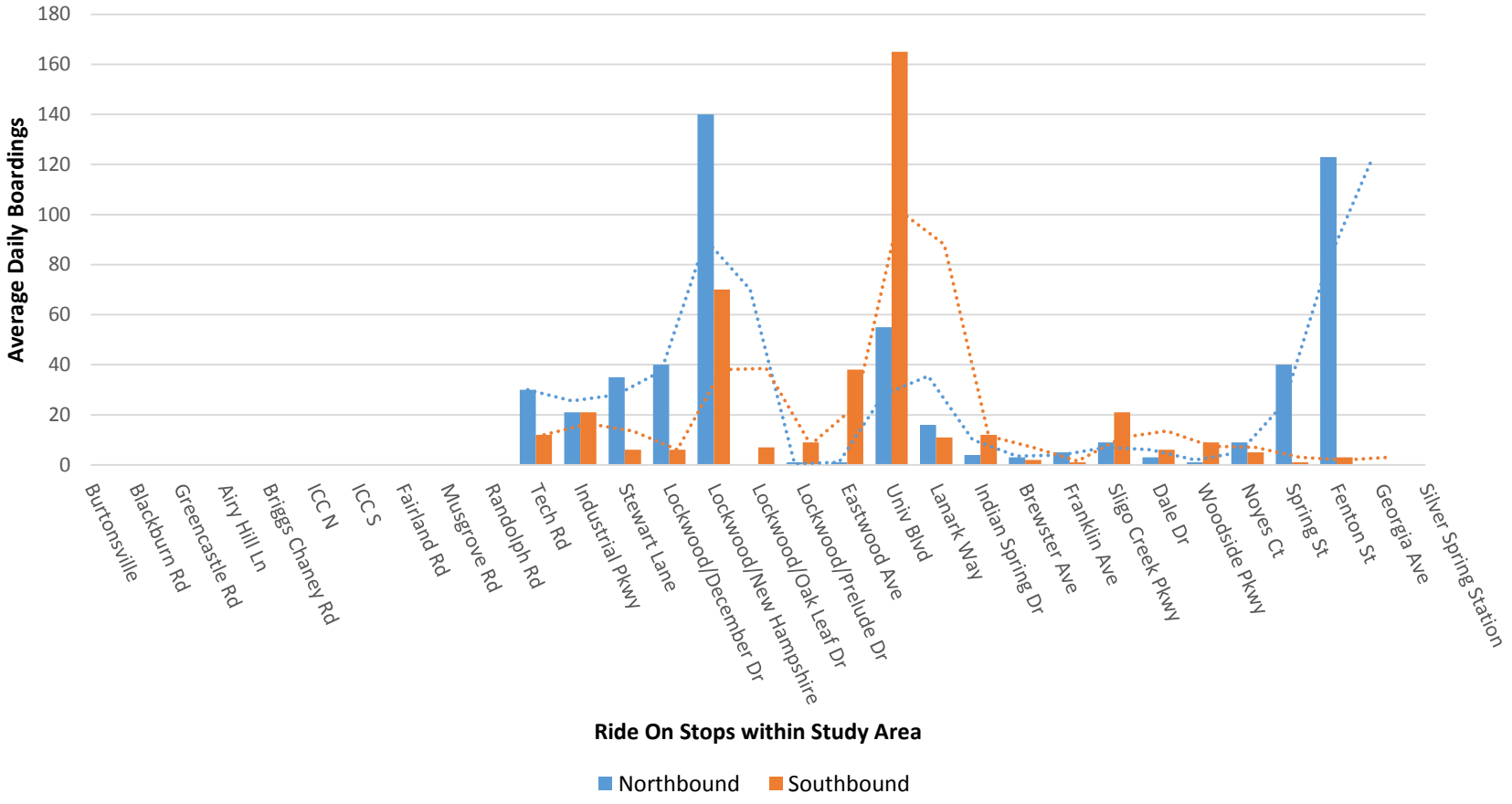


Table 7: Average Daily Ridership in the US 29 Study Corridor

Operator	Station/Route Name	Daily Ridership
WMATA Metrorail	Silver Spring	13,195
	Forest Glen	2,442
	Wheaton	4,227
WMATA Metrobus	Z2	853
	Z6	3,330
	Z8	3,923
	Z9/29	642
	Z11/13	1172
Montgomery Ride On	9	255
	10	346
	21	104
	22	260
MTA	201	85
	202	60
	305	155
	315	161
	325	43

Source: Metrorail: 2014 10-Year Historical Metrorail Ridership.
Metrobus: 16-JUL-14 Washington Metropolitan Area Transit Authority (WMATA) Ridership by Route and Stop.
Ride On Bus: FY13 Montgomery County US 29 Boarding and Alighting Data.
MTA: Feb 2015 MTA Average Ridership.

2.4 Roadway Characteristics

The roadway classification of US 29 changes from a principal arterial with traffic signals in the southern portion of the BRT corridor around Silver Spring and White Oak to a limited-access highway in the northern portion of the BRT corridor around Fairland and Burtonsville.

Along the US 29 BRT study corridor, there are six interchanges, 23 signalized and 22 unsignalized intersections, and numerous driveways. Some segments of the roadway include shoulders, medians, sidewalks, and curb and gutter that vary in design and utilization along the route. Utility poles and light poles are scattered throughout the corridor.

Along the Lockwood Drive/Stewart Lane segment, there are two signalized and 15 unsignalized intersections, and numerous driveways. This does not include the two intersections at US 29 /

Lockwood Drive and US 29 / Stewart Lane that were counted in the section above. Some segments of this roadway also include shoulders, sidewalks, and curb and gutter. Street parking is present in the northbound and southbound directions along Lockwood Drive and Stewart Lane where shoulders are provided. Utility and light poles are located within the right-of-way.

South of MD 650, US 29 has posted speeds of 30 to 45 mph. North of MD 650, US 29 has posted speeds of 45 to 55 mph. The posted speed limit along the Lockwood Drive/Stewart Lane segment is 30 mph.

There are four overpasses that cross over US 29; three grade separated roads and one rail line (shown above in **Figure 1**). These four facilities have column support structures in the median of US 29. In addition, there are three grade-separated underpasses that cross under US 29. All intersections along the Lockwood Drive/Stewart Lane corridor are at grade.

2.5 Existing Traffic Operations

The following is a discussion on the existing and future 2040 no-build traffic operations.

2.5.1 Corridor Travel Patterns - Study Area Daily Trip Patterns

Potential travel markets for the US 29 BRT depends on travel patterns related to the US 29 BRT study area.[1]

Major travel patterns and potential markets for the proposed US 29 BRT include:

- Internal trips within the US 29 Study Area represent a significant share of travel market for the study area, with 37 percent of total trips of the study area in 2014;
- Internal trips are expected to increase by 29% in 2040, compared with those in 2014;
- DC-bound commuting trips were a major out-flow of trips from the study area, with 19,500 residents in the study area commuting to DC for work, based on the 2006-2010 CTPP;
- Another major DC-bound commuting flow of approximately 10,000 was from Columbia and Ellicott City areas north of the US 29 BRT Corridor, which can use US 29 as a commuting route to DC;

[1] Appendix A includes additional information on travel patterns in the study area. Tables 2.4 and 2.5 in Appendix A show the district-level flows of daily person trips for 2014 and 2040, respectively, based on the TPB/MWCOG Version 2.3.57 model results. Figure 2.11 highlights the major worker flows, which are the potential markets for the US 29 BRT, based on the 2006- 2010 CTPP. Similarly, Figure 2.12 displays the major flow patterns of outbound person trips from a home or non-home location, based on the 2014 TPB/MWCOG model results, while Figure 2.13 shows the 2040 flow patterns.

- A smaller number of workers also commuted to work in the study area from Columbia and Ellicott City areas (3,400) and DC (4,000);

Trips to the study area are forecast to increase significantly because of strong employment growth, for example, by 29% from Columbia and Ellicott City areas and DC.

2.5.2 Roadway Congestion

Roadway congestion presents a daily reminder of the high levels of activity that define this corridor, and the congestion is anticipated to worsen as growth and economic development continue to expand in the corridor and the region. Several roadway sections exceed their volume to capacity ratio to the point that they are considered "failing". There are six roadway sections that operate at Level of Service[2] (LOS) F and nine that are at LOS E (See **Appendix A, Table 1A in Sub-Appendix C** for more details on LOS). These grades represent very poor existing traffic operations for the corridor that lead to extended travel times and vehicles detouring to other facilities.

Current Average Daily Traffic (ADT) volumes in the study corridor range from a low of approximately 39,600 vehicles south of Fenton Street to a high of 79,400 vehicles north of Crestmoor Drive. Shown in **Table 8** below is the variation of traffic across the corridor at major crossroads.

Table 8: Existing 2015 Average Daily Traffic

Roadway Sections (North to South)	2015 Existing Average Daily Traffic (vehicles) *Lowest - Highest*
Sandy Spring Road (MD 198) to Cherry Hill Road/E. Randolph Road	70,900 – 73,700
Cherry Hill Road/E. Randolph Road to New Hampshire Avenue (MD 650)	59,800 – 71,600
New Hampshire Avenue (MD 650) to University Boulevard (MD 193)	65,500 – 79,400
University Boulevard (MD 193) to Capital Beltway (I-495)	74,000
Capital Beltway (I-495) to Georgia Avenue (MD 97)	39,600 - 65,200

[2] Level of Service is a traffic analysis tool used to communicate the operational integrity of roadway segments and intersections. Similar to school grading systems, LOS grade of A through C are considered acceptable operations with little to no delay. Grades of D, E, and F are signs of poor traffic operations that show potentially long delays and congestion.

2.6 Existing Environmental Resources

The US 29 BRT study area contains multiple properties that have been inventoried during historic resource surveys and entered into the Maryland Inventory of Historic Properties. A list of those resources is listed in **Table 9**, below. Of those historic resources on the Maryland Inventory of Historic Properties, some resources have not been evaluated for National Register of Historic Places (NHRP) eligibility, but most have had eligibility determinations and have been listed, determined eligible, or determined not eligible for the NRHP. Two of the resources (the Silver Spring Theater and Shopping Center, M:36-7-1) have preservation easements on the property.

Table 9: MIHP Resources and Preservation Easements

MIHP Number	Resource Name	Town	NRHP Eligibility
M: 15-88	Henry S. Krusen House (Bricefield Property)	Burtonsville	Not Eligible (demolished)
M: 32-05	Polychrome Historic District (Polychrome Houses)	Woodmoor	Listed NR-1169
M: 32-7	Argyle Park Neighborhood	Silver Spring	Not Eligible
M: 32-11	North Hills of Sligo Park	Silver Spring	Not Eligible
M: 32-12	Indian Spring Club Estates/Indian Spring Terrace/Indian Spring Manor	Silver Spring	Not Eligible
M: 32-15	Sligo Creek Parkway	Silver Spring, Takoma Park, Hyattsville	Eligible
M: 32-16	Fairway, Chalfonte, Country Club Park, Country Club View	Silver Spring	Not Eligible
M: 32-21	Choi Property	Silver Spring	Not Eligible
M: 33-22	Robert B. Morse Water Filtration Plant	Woodmoor	Eligible
M: 33-26	Bridge 15035	Silver Spring	Eligible
M: 33-27	Bridge 15009, Burnt Mills Bridge	Woodmoor	Not Eligible
M: 34-3	Pease House (Duvall House)	Burtonsville	Not Evaluated (demolished)
M: 34-18	Carroll House (John Hardesty Property)	Burtonsville	Not Eligible
M: 34-19	Samuel S. Aitcheson House (Walter Fehr Property)	Burtonsville	Not Eligible
M: 34-21	Willard Marlow House I & II (William Ellin Property)	Colesville	Not Eligible
M: 34-39	John Hardisty House	Burtonsville	Not Eligible (demolished)

Table 9: MIHP Resources and Preservation Easements

MIHP Number	Resource Name	Town	NRHP Eligibility
M: 34-40	Jackson Yang Property	Burtonsville	Not Eligible
M: 34-41	Carroll and V.E. Ricketts Property	Burtonsville	Not Eligible
M: 34-43	Stephen C. Beaver III House	Silver Spring	Not Eligible
M: 34-53	Fairland Data Center	Silver Spring	Not Eligible
M: 35-142	Georgetown Branch, B&O Railroad	Chevy Chase	Not Eligible
M: 36-7	Old Silver Spring Commercial Area	Silver Spring	
M: 36-7-1	Silver Theatre and Silver Spring Shopping Center	Silver Spring	Eligible
M: 36-7-1	Preservation Easement, Silver Spring Shopping Center (E-568)	Silver Spring	not applicable (n/a)
M: 36-7-1	Preservation Easement, Silver Theatre (E-581)	Silver Spring	n/a
M: 36-7-2	Montgomery Arms	Silver Spring	Eligible
M: 36-7-3	J.C. Penney Co. Building	Silver Spring	Facadectomy
M: 36-7-4	City Springs (No Documentation on File)	Silver Spring	Not Evaluated
M: 36-9	Mrs. K's Toll House	Silver Spring	Not Evaluated
M: 36-18	Woodside Park Historic District	Silver Spring	Not Evaluated

In addition, many other properties over forty-five years of age are located adjacent the project limits that have not been previously inventoried or evaluated for the NHRP. These unevaluated properties include, but are not limited to, the following:

- Calverton Neighborhood
- 12721 Deer Park Drive
- Rolling Acres, Section 1
- Springbrook Village
- 1302 Milestone Drive
- Burnt Mills Townhouses (1968)
- Burnt Mills Village
- Burnt Mills Manor
- Woodmoor
- Northwood Park View
- Northwood Park
- Indian Spring View
- Four Corners Commercial Area
- Seven Oaks
- South Woodside Park
- Bridge 151010
- First India United Methodist
- Silver Spring Library
- 8915 Colesville Road
- Colesville Towers Road
- 1000 Noyes Drive
- 8808 Colesville Road
- Colespring Plaza, 1001 Spring Street
- Spring-Colesville Parking Garage, 1000 Spring Street
- 8728 Colesville Road
- 8727 Colesville Road
- 8501 Colesville Road

Several significant pockets of natural resources dot the corridor. The study area is located entirely within the Anacostia River watershed, spanning from the watershed's northern most boundary to the southern limit. There are four main tributaries of the Patuxent River and sub-basins of the Anacostia that cross through the US 29 study area including Sligo Creek, Northwest Branch (See **Figure 1 and Figure 6**), Paint Branch, and Little Paint Branch.

Figure 6: Northwest Branch, looking towards southeast

Based on preliminary review of available data, nine potential wetland systems were identified within the study area. Three of these wetland systems were identified along the west side of Wexhall Drive, parallel to US 29. Another system was identified near US 29 within an existing forest conservation easement. Two other wetlands were identified on the east side of US 29 near Randolph Road. A potential linear wetland was identified along northbound US 29 just north of Stewart Lane. Finally, two potential wetlands were identified along southbound US 29, one at Prelude Drive and one within Sligo Creek Stream Valley Park. There are no Wetlands of Special State Concern (WSSC) or associated 100-foot buffers located within the study area.

Six streams were identified by the Department of Natural Resources (DNR) as crossing under US 29; Sligo Creek, Northwest Branch, Paint Branch, and three small tributaries associated with Little Paint Branch. Several potential intermittent and ephemeral streams associated with these large perennial waters are also located within the study area.

The study area crosses the 100-year floodplain associated with Sligo Creek, Northwest Branch, and Paint Branch. Authorization from The Maryland Department of the Environment (MDE)is required for project activities that occur within floodplains, including bridges or culverts and temporary construction impacts. Any construction in non-tidal floodplains would require a Waterway Construction Permit from the MDE.

There is no Federal or state parkland located within the study area. One water supply park, the T. Howard Duckett Watershed is owned by the Washington Suburban Sanitary Commission (WSSC) and is located just north of the study limits along the Patuxent River. All other parkland within the study area is owned by the M-NCPPC. See **Appendix C, Table 10** for a detailed list of the parklands.

3 Needs, Problems and Issues

Based upon analysis of this US 29 corridor and feedback from elected officials, county planners, local residents and travelers, the study team has identified the following transportation problems and issues:

1. Limited appeal of existing transit services despite a strong market for transit trips
2. Roadway congestion and safety
3. Limited connectivity of facilities for pedestrians and bicyclists
4. Planned growth within the study area

3.1 Problems and Issues

These factors establish the basis of the needs for transit-related enhancements and ultimately define the purpose of this study, as described in **Section 3**.

3.1.1 Limited appeal of existing corridor transit services

Despite strong transit demand, existing corridor bus service is not attractive due to slow travel speeds, high delay, poor connectivity, unreliable service, and limited pedestrian and bicycle access

The existing transit services in the US 29 corridor have limited appeal as a travel option due to bus overcrowding, lengthy waiting and dwell times, and overall reliability.

Currently, the transit share for all trip purposes in the corridor is 10%, which is higher than transit share in Montgomery County on average. Single-occupant vehicle is the primary travel mode for all trip purposes, accounting for almost 46% of all trips in the study area in 2014. For Home-Based Work (HBW) trips, transit plays an important role, with about 35% of modal share in the study area. For Home-Based Non-Work (HBNW) and Non Home-Based (NHB) trips, transit

only accounts for about 3-4% of trips, while high-occupant vehicle shares are respectively 56% and 45%. More detailed information on transportation mode share provided in **Appendix A, Section 2.2**)

Currently, bus travel times along the corridor take up to an average of over 20% longer than automobile trips, reaching as high as 60% longer in certain segments. Latest on-time performance evaluations indicate a 66% on-time performance for the most heavily utilized bus route in the corridor (WMATA Z8), with average travel speeds between 8 and 18 miles per hour during the peak-hours in the most urbanized sections of Silver Spring. See **Tables 10a and 10b** for a summary of anticipated changes in average bus travel times and speeds. **Table 11** provides a summary of on-time bus performance. It is anticipated that 2040 future bus travel times will increase by a total of 13 minutes in the morning and 14 minutes in the evening peak hours.

There is a great potential for increasing the transit share in the study area, but achieving such a goal requires higher-quality transit service.

Table 10a: Existing 2015 vs. No-Build 2040 Average Bus Travel Times

	Southbound			Northbound		
	2015 Existing	2040 No-Build	Percent Increase	2015 Existing	2040 No-Build	Percent Increase
AM Cars & Trucks	34 min	45 min	32%	21 min	21 min	0%
AM Buses*	34 min	47 min	29%	25 min	25 min	0%
PM Cars & Trucks	23 min	25 min	9%	25 min	37 min	48%
PM Buses*	27 min	30 min	11%	30 min	44 min	47%

*This % increase does not affect buses individually; it is a network-wide bus miles traveled comparison.

Table 10b: Existing 2015 vs. No-Build 2040 Average Bus Speeds

	Southbound			Northbound		
	2015 Existing	2040 No-Build	Percent Difference	2015 Existing	2040 No-Build	Percent Difference
AM Cars & Trucks	21 mph	16 mph	27%	32 mph	33 mph	3%
AM Buses	20 mph	17 mph	16%	21 mph	21 mph	0%
PM Cars & Trucks	29 mph	29 mph	0%	27 mph	22 mph	20%
PM Buses	23 mph	22 mph	4%	27 mph	24 mph	12%

Table 11: Existing 2015 On-Time Bus Performance

Bus Service	On-Time Performance
Weekday AM	81%
Weekday PM	49%
Weekday Midday	68%
Weekend AM	90%
Weekend PM	82%
Weekend Midday	79%

Source: WMATA and Ride On

3.1.2 Limitations in Existing Transit Service

Service and reliability of existing transit services may be in need of enhancements to address know performance issues

A review of current services reveals that the MTA 305, 315, and 325 Commuter Bus and the Metrobus Z29 do not serve the entire corridor. Specifically, the MTA Commuter buses only serve limited stop locations during peak am and pm hours (stops at Burtonsville, Fenton Street, and Silver Spring), and Z29 limits riders from boarding/alighting between Blackburn and Spring St, with the exception of Oak Leaf Drive, Prelude Drive, and University Boulevard. Other Z-line routes serve most of the corridor but there are service gaps north of the Tech Road Park and Ride with routes deviating from the US 29 corridor. MCDOT Ride On service is fairly consistent from Silver Spring to Randolph Road but does not extend north of that location. Unlike the south portion of the corridor, which has a strong transit market, the north portion of the corridor is not well-served by transit.

The Metrobus Z Line provides service from Silver Spring to the Burtonsville Park and Ride. Like other traffic, the Z Line experiences delays due to traffic congestion that causes buses to queue or sit through multiple traffic signal cycles at intersections throughout the corridor. Similar issues are present along Lockwood Drive and Stewart Lane.

At this time there are lags in service that make it harder for users to utilize different transit options to travel the corridor. The WMATA Z-line study offered the following potential short-term operational changes to address these service issues (these improvements are tentatively scheduled to occur in March 2016):

- **Z6**: Improve weekday schedule reliability
- **Z6**: Add Saturday service between Silver Spring Transit Center and Castle Boulevard

- **Z8**: Reduce Saturday frequency to coordinate with new Z6 trips for added frequency on overlapping portions of routes Z6 and Z8
- **Z9, Z29**: Restructure service, combine with Z11, Z13
- **Z11, Z13**: Restructure service, combine with Z9, Z29

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 options that could elect to take the bus if it offered comfort and convenience.

Another issue with existing bus service, which is generally true of all non-BRT bus systems, is onboard fare collection, which is a major source of delay. Fares are usually taken as riders board the bus through one access point. This adds to dwell time – the time the bus stays at the bus stop to allow for boardings, alightings, and fare collection – which makes the bus a less appealing travel option. Also, congestion in the roadway, particularly during peak hours, affects the frequency of buses as buses progress slowly through the congested corridor. Longer wait times cause a greater number of passengers to gather at a bus stop. When a large group of passengers boards a bus at one time, fare collection takes longer, buses are further delayed, and on-time performance is affected due to the increased dwell time at these stops.

Other contributors to inefficient bus service are closely-spaced bus stops, inefficient pedestrian movements, delays at poorly operating signalized intersections, merging movements into and out of traffic at stops. Bus speeds developed from field verified data collection efforts, show that along US 29 vary from 8 mph to 54 mph as shown in **Table 12**. Note that bus speeds are calculated directly from the travel times and thus include the dwell times at each stop.

Table 12: Existing 2015 Average Daily Traffic Speeds

US 29 Northbound	2015 AM (mph)	2015 PM (mph)
MD 97/Georgia Ave to Dale Dr	14	11
Dale Dr to Sligo Creek Pkwy	12	14
Sligo Creek Pkwy to Franklin Ave	24	19
Franklin Ave to I-495 Southern Ramp	34	33
I-495 Southern Ramp to I-495 Northern Ramp	39	37
I-495 Northern Ramp to EB MD 193	21	12

US 29 Northbound	2015 AM	2015 PM
EB MD 193 to WB MD 193	33	33
WB MD 193 to MD 650 Southern Ramp	33	29
MD 650 Southern Ramp to MD 650 Northern Ramp	42	35
MD 650 Northern Ramp to Fairland Rd	32	25
Fairland Rd to Briggs Chaney Rd	51	44
Briggs Chaney Rd to Greencastle Rd	34	28
Greencastle Rd to Blackburn Rd	43	44
Blackburn Rd to MD 198	54	54

US 29 Southbound	2015 AM (mph)	2015 PM (mph)
MD 198 to Greencastle Rd	17	40
Greencastle Rd to Briggs Chaney Rd	52	49
Briggs Chaney Rd to Fairland Rd	43	31
Fairland Rd to MD 650 Northern Ramp	19	36
MD 650 Northern Ramp to MD 650 Southern Ramp	8	42
MD 650 Southern Ramp to MD 193 Northern Ramp	12	26
MD 193 Northern Ramp to MD 193 Southern Ramp	23	15
MD 193 Southern Ramp to I-495 Northern Ramp	36	29
I-495 Northern Ramp to I-495 Southern Ramp	38	39
I-495 Southern Ramp to Franklin Ave	26	29
Franklin Ave to Sligo Creek Pkwy	16	8
Sligo Creek Pkwy to Dale Dr	20	11
Dale Dr to MD 97/Georgia Ave	19	12

Source: SHA and TPB/MWCOG

3.1.3 Growing BRT Market

Despite transit service issues, there is a growing market for a BRT service that is competitive with auto travel

As identified in the Countywide Bus Rapid Transit Study (2011) and in the Corridor Transitways Functional Master Plan (2013), Montgomery County seeks to enhance the existing and planned transit and transportation options throughout the County. In order to maintain or improve transit modal share, a higher quality of transit service is needed to attract new transit riders, including those who would regularly drive between points along the study corridor, or those who would benefit from longer trips and fewer stops, as offered by BRT. Generally, riders are attracted to transit service when travel times are reduced, reliability is increased, and they feel comfortable and safe.

Based on projected 2040 growth in population (13%), households (17%), and employment (78%) as shown in **Appendix A, Table 2.1**, and anticipated increases in daily trip production (13%) and attractions (43%) as shown in **Appendix A, Table 2.2**, the numbers show a potential increase in transportation demands. Combine these demographic and travel demand growth metrics with the anticipated growth in transit usage (7%), and there is strong evidence for a growing market for transportation facilities and services that could potentially be served by BRT.

3.1.4 Transit Demand and Dependency

Twelve percent[3] of metropolitan Washington D.C. area households without a private vehicle rely on transit, as do many low-income, disabled and elderly corridor residents – Some young adults are seeking independence from private vehicle ownership and multi-modal options

- *Five percent of study area households live below the poverty level*
- *Six percent of study area's population is disabled, and Silver Spring, White Oak, and Fairland communities have populations with 10 percent of the population disabled*
- *Twelve percent of study area's population is 65 years and older, 34% is 40 to 64 years old*
- *Many young adults are looking for locations to live and work that offer reliable multi-modal options*

The above data summaries provide evidence that there is a current and potentially growing need for transit services in the region and within the study area for those who do not currently own a private vehicle. While anticipated growth in employment may decrease the number of households living below the poverty level, there is a significant population within the study area that is aging and may require transit services. By providing improved connectivity and mobility through premium transit services, these transit-dependent populations may be better served.

In addition, according to recent reports by the American Public Transportation Association (APTA)[4], Millennials (those born between early 1980's and early 2000's – or today's young adults) are looking to find employment and homes in communities that have a multitude of transportation choices. In addition, a 2014 study by the Rockefeller Foundation and Transportation for America[5] reported that four in five millennials in 10 major U.S. cities say they want to live in places where they have a variety of options to get to jobs, school or daily needs. Millennials are "driven by pragmatism, with 46 percent saying a need to save money drives

[3] US Department of Commerce, Bureau of the Census, *Statistical Brief: Housing in Metropolitan Areas – Motor Vehicles Available*, August 2015
[4] American Public Transportation Association, *Millennials & Mobility: Understanding the Millennial Mindset*, 2015
[5] Rockefeller Foundation and Transportation for America, *Survey: To recruit and keep millennials, give them walkable places with good transit and other options*, 2014

their choices. Forty-six percent also note convenience of transit and multi-modal options, 44 percent want exercise, and 35 percent say they want to live in a transit-friendly neighborhood.

According to the APTA study and the Rockefeller/Transportation for America, Millennials would like to see the following from public transit in the next 10 years:

- 70 percent who currently do not have regular access to a vehicle say they could not afford to live in an area without access to public transportation
- 86 percent say that it is important that their city offer a low-cost public transportation system with affordable fares, especially for those earning less than $30,000 a year
- 64 percent say that the expense of owning a car is a major reason they want be less reliant on one, including 77 percent of millennials who earn less than $30,000 a year
- 91 percent believe that investing in quality public transportation systems creates more jobs and improves the economy.61 percent want more reliable systems
- 55 percent want real-time updates
- 55 percent want Wi-Fi or 3G/4G wherever they go
- 44 percent want a more user-friendly and intuitive travel experience.

3.2 Roadway Congestion and Safety

3.2.1 Congestion exists and will worsen as traffic volumes increase

The US 29 corridor is characterized by variable traffic congestion (depending on location within the corridor) that hinders bus mobility and results in unpredictable service and travel times (see **Appendix A, Table 3 in Sub-Appendix C**). This is especially true in the southern section near downtown Silver Spring, which has a more dense urban fabric and more narrow right-of-way This congestion also frequently causes existing Metrobus and Ride On bus service on US 29 to operate behind schedule.

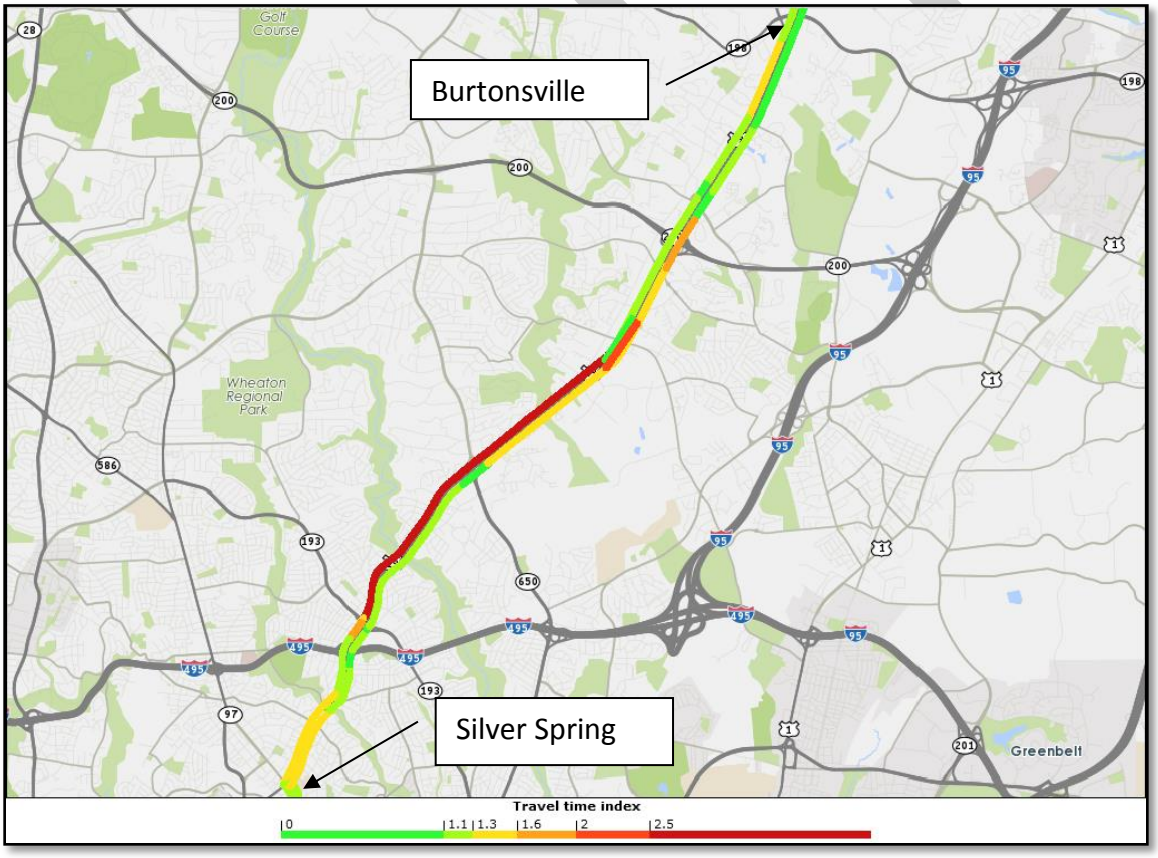
A preliminary review of the corridor congestion was collected from the Regional Integrated Transportation Information System (RITIS) for the two selected peak hours, 8:00-9:00am and 5:00-6:00pm, and averaged over the entire 2014 year for a typical Tuesday, Wednesday, and Thursday. Shown below in **Figures 7 and 8** are the Travel Time Indices (TTI) congestion maps.

TTI refers to the travel time represented as a percentage of the ideal travel time. This means the actual travel time under congestion is divided by the free-flow travel time for an estimate of the proportional time increase. The TTI value represents the travel time multiplicative needed to travel that same segment of roadway under congested conditions. Note that the color designations on the TTI maps shown below do not refer to LOS, which will be represented in later sections of this report.

The map below suggests congestion concerns for US 29 southbound in the morning peak hour, starting from Cherry Hill Road/E. Randolph Road and extending to University Boulevard (MD 193) with a 2.5 TTI. Additionally the Silver Spring downtown area experiences some delays between Sligo Creek Parkway and Georgia Avenue (MD 97) in both northbound and southbound directions.

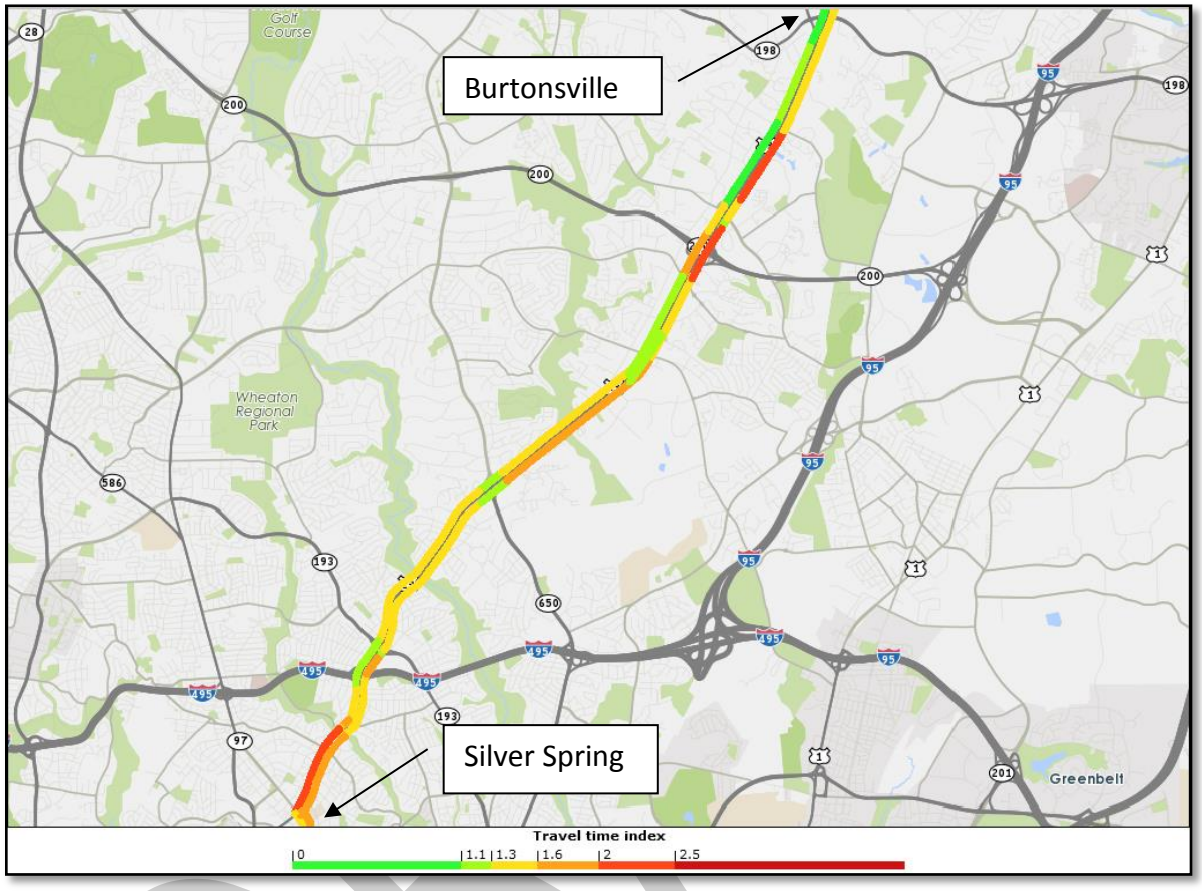
Under the afternoon peak hour congestion delays were noted throughout the US 29 corridor. The average congestion appears to be above a 1.3 TTI (yellow) with only spot locations operating between 0-1.3 TTI (green). The southbound direction of US 29 in Silver Spring also operates poorly while the northbound US 29 corridor has a larger number of segments above 1.6 TTI (orange and red). More details on TTI calculations are provided in **Appendix A**.

Figure 7: Morning Peak Hour Congestion Map in TTI



Source: RITIS.org, 2015.

Figure 8: Afternoon Peak Hour Congestion Map in TTI



Source: RITIS.org, 2015.

Congestion, when measured by Average Daily Traffic volumes and the Intersection Level of Service further demonstrate congestion problem in the US 29 Study Corridor, and the implications for bus travel times.

3.2.2 Average Daily Traffic

The Future 2040 No-Build ADT ranges from a low of approximately 41,700 vehicles south of Fenton Street to a high of 88,100 vehicles north of Crestmoor Drive (**Table 13**), an increase of 4% to 13% over existing 2015 volumes. This increase is representative of the anticipated growth in population, households, and economic development, and will exacerbate congestion In the US 29 Study Corridor.

Table 13: Existing 2015 Average Daily Traffic

Roadway Sections (North to South)	2015 Existing Average Daily Traffic (vehicles) *Lowest – Highest*	2040 No-Build Average Daily Traffic (vehicles) *Lowest - Highest*
Sandy Spring Road (MD 198) to Cherry Hill Road/E. Randolph Road	70,900 – 73,700	73,900 – 82,900
Cherry Hill Road/E. Randolph Road to New Hampshire Road (MD 650)	59,800 – 71,600	67,700 – 79,300
New Hampshire Road (MD 650) to University Boulevard (MD 193)	65,500 – 79,400	72,600 – 88,100
University Boulevard (MD 193) to Capital Beltway (I-495)	74,000	81,900
Capital Beltway (I-495) to Georgia Avenue (MD 97)	39,600 - 65,200	41,700 – 72,400

Source: 2015 Existing Data from Vehicle counts. 2040 No-Build Data from TPB/MWCOG regional transportation model Version 2.3.57, with land use forecast Round 8.3

3.2.3 Intersection Level of Service

Intersection LOS is calculated based on approach vehicular delays and has a recorded unit of seconds of delay per vehicle (sec/veh). The approach delays are weighted based on vehicular volumes and added to provide a total intersection delay, which is then translated to a LOS grade based on the latest 2010 Highway Capacity Manual (HCM).

Review of the US 29 operational results suggests two intersections fail, defined as delay greater than 80 sec/veh and also known as LOS F, under existing 2015 conditions: one in the AM peak hour and one in the PM peak hour. Additionally, four intersections operate poorly at LOS E with delays between 55 and 80 sec/veh). This happens in the PM peak hour for three out of the four intersections (see **Appendix A, Sub-Appendix C, Table 1A** for more detail).

Along US 29 alone, seven intersections are noted to fail under the AM and/or PM peak 2040 No-Build conditions. Seven intersections, associated with the US 29 corridor side streets, are also noted to fail under the AM and/or PM peak No-Build conditions. Also, eight intersections that were operating acceptably under Existing 2015 conditions now deteriorate to LOS E under 2040 No-Build conditions. The Future 2040 No-Build AM peak experiences five new major delay locations (i.e., LOS E or LOS F), while the 2040 No-Build PM peak experiences sixteen new major delay locations when compared to Existing 2015 conditions.

These poorly operating and failing intersections affect the speed with which buses could travel through the corridor.

Appendix A provides detailed LOS by intersection and arterial segment. Under these current and projected traffic conditions, motor vehicle and bus performance, including speed, reliability, and passenger comfort, are expected to decline in conjunction with these deteriorating traffic conditions.

3.2.4 Congested conditions contributing to higher than average crash rates

- *The segment of US 29 south of MD 97 has a significantly higher crash rate than the statewide average for similar state-owned roadways.*

Coinciding with high levels of roadway congestion, corridors often experience safety issues. The segment between MD 97 and Spring Street, which includes portions of US 29 closest to the Silver Spring CBD, was identified as a significantly higher than statewide average rate for similar state-owned roadways. A total of 1,088 crashes were reported along the US 29 corridor during the three-year study period from 2011 to 2013. Three (3) crashes resulted in three (3) fatalities. Four hundred forty-seven (447) of the crashes resulted in injuries to 649 vehicle occupants. There were 25 incidents involving pedestrians and/or bicyclists. Additional details related to reported crashes along US 29 are provided in **Appendix A**.

3.3 Limited connectivity for pedestrians and bicyclists

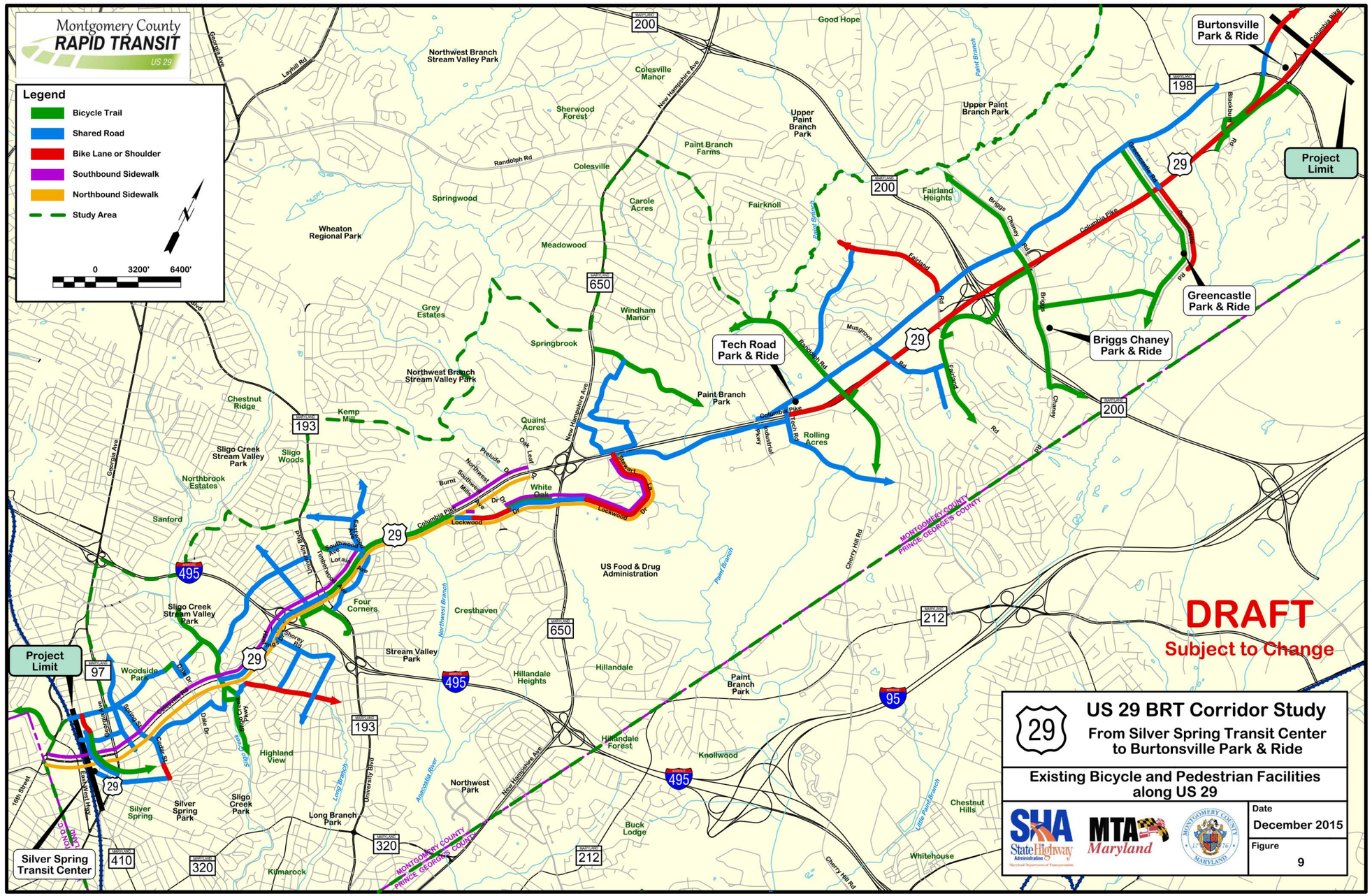
Accommodations for walking and bicycling to be an essential component of planning, design, construction, operations, and maintenance activities of any project, but they're especially important for a premium transit service. A preliminary analysis of pedestrian connections in the US 29 BRT study corridor reveal that sidewalks exist predominantly south of New Hampshire Avenue in the northbound direction from 16th Street to Oak Leaf Drive and on all of Lockwood Drive and Stewart Lane. In the southbound direction, sidewalks are intermittent between MD 650 and Southwood Ave, then continuous from Southwood Ave to the Transit Center. from The size and condition of these sidewalks must be reviewed further as these are also important determining factors for the likelihood sidewalks would be used to access transit services. There are no sidewalks on US 29 between New Hampshire Avenue and MD 198, making pedestrian movements difficult and impacting their ability to safely walk to existing bus stops.

The 2005 Montgomery County's Countywide Bikeways Functional Master Plan (currently being updated) states that "current state and county policies require that all new roads and highways be designed to accommodate bicycles and that all road improvement projects to incorporate

bicycle elements where feasible." This is in acknowledgement of the health benefits of bicycling and its role as a viable mode of transportation.

"Share the Road" signed bicycle routes exist throughout the corridor. There are signs along sections of US 29 indicating bicyclists may share the road with motorists and areas where bicyclists may use the shoulder. All other bicycle routes enter and exit the corridor at various points. Lockwood Drive and Stewart Lane have a mix of shared roadway, striped bike lanes, and shoulders provided for bicyclists. See **Figure 9** for existing pedestrian and bicycle facilities along the corridor. Similar to sidewalks, bicycle routes must be reviewed to determine how they would relate to and support connectivity to proposed transit improvements.

Further analysis of pedestrian and bicycle routes, in the context of the vehicles, existing transit services, and proposed transit improvements would support the County's goal for multi-modal transportation in the US 29 Study Corridor. This comprehensive approach will improve the Transit-Oriented Development (TOD) potential in the corridor and increase the focus on accessibility and safety for pedestrians and bicyclists.



Source: Montgomery County Department of Transportation

3.4 Growth and development within the Study Area

3.4.1 Regional, county and corridor growth will increase VMT by 2040, exacerbating congestion

Located in the most populous county in Maryland and in the second largest jurisdiction in the metropolitan area, the study area, like Montgomery County, is expected to experience growth. Growth forecasts for the study area are based on the latest land use forecasts in Round 8.3 of the National Capital Region Transportation Planning Board (TPB) and Metropolitan Washington Council of Governments (MWCOG). **Table 14** summarizes population, households, and employment for the base year 2014 and horizon year 2040 for the US 29 BRT Corridor Planning Study Area.

Table 14: Population, Household, and Employment Growth, 2014 and 2040

	Population			Households			Employment		
	2014	2040	Percent Change	2014	2040	Percent Change	2014	2040	Percent Change
Study Area	137,492	155,497	13%	52,064	60,920	17%	67,125	119,653	78%

Source: MWCOG/TPB Round 8.3 Cooperative Forecasting.

As population, households, and employment opportunities grows within the study area the following are anticipated:

- Internal trips are expected to increase by 29% in 2040, compared with those in 2014 (137,000 trips in 2014 to 176,300 trips in 2040);
- Total vehicle miles travelled are anticipated to increase by 15%
- Metrorail usage at Silver Spring and the adjacent Forest Glen and Wheaton Stations are forecasted to grow by 40%
- Metrobus Z-line ridership is expected to grow by 36%.

3.4.2 Growth and development are concentrated in Silver Spring and White Oak

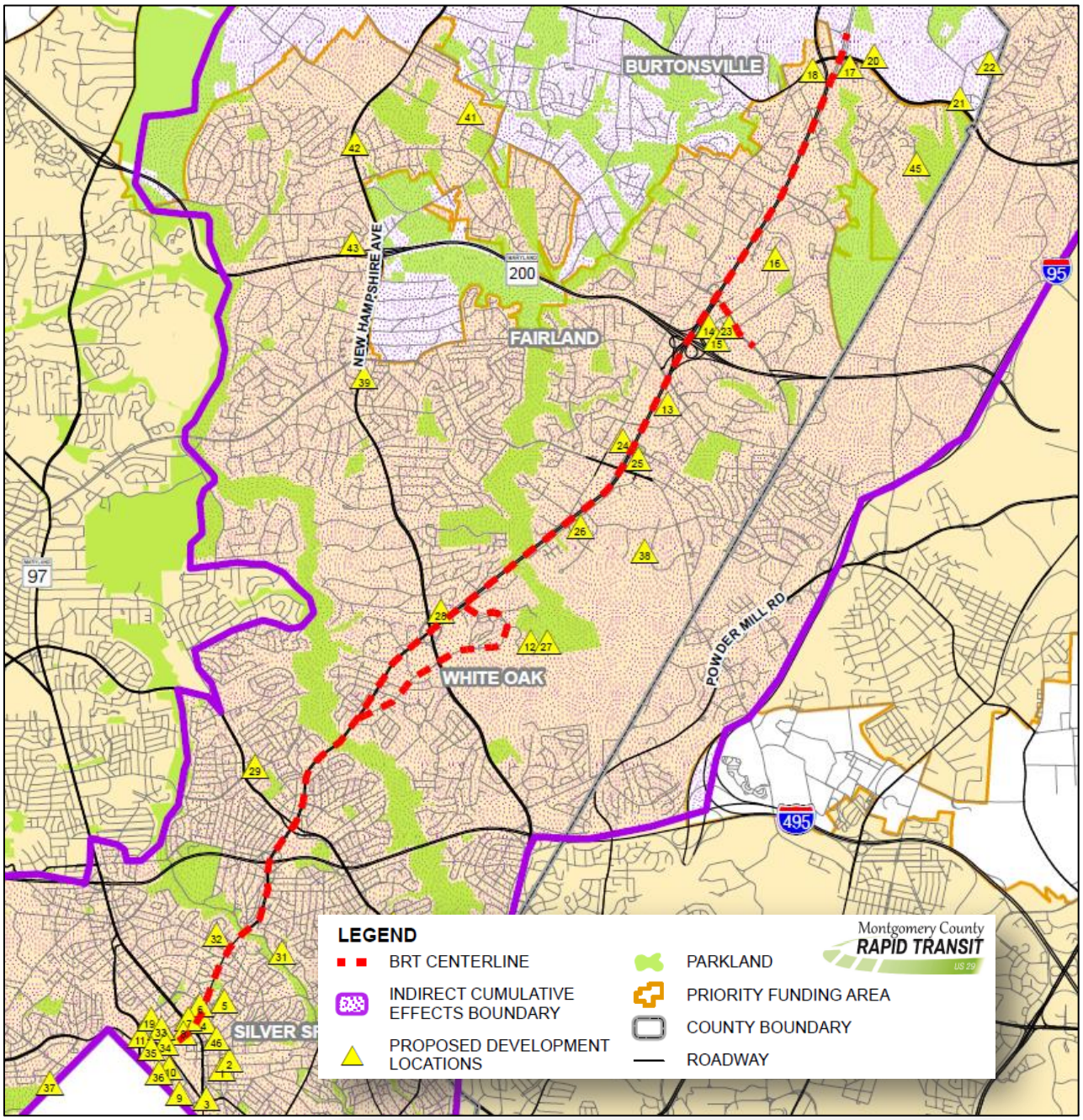
Redevelopment will drive growth in Montgomery County and the study area. Reasonably foreseeable development projects within the US 29 BRT vicinity include both pending and recently approved development projects identified by the Development Activity Information

Center (DAIC). The locations of these projects are illustrated in **Figure 10**, which shows that development activity is largely concentrated in the vicinity of Silver Spring. The County also anticipates a concentration of development, not illustrated in the map, in White Oak as envisioned in the White Oak Science Gateway Master Plan. Additional development proposed for Fairland and Burtonsville results in development projects throughout the US 29 corridor – projects that would benefit from multi-modal transportation networks with high quality transit services. Montgomery County identifies the following planned transportation facilities in the vicinity of the US 29 BRT corridor or related to the BRT project (Source: TPB/MWCOG and the 2014 Constrained Long Range Plan):

- Extension of Old Columbia Pike to Lockwood Drive
- Connector roads between Plum Orchard Court, Whitethorn Court, and Cherry Hill Road
- Provision of local grid of streets and access roads in Burtonsville
- Purple Line Transitway
- Interchange at Musgrove Road/Fairland Road

Current transportation infrastructure in the US 29 BRT study corridor between the Silver Spring Transit Center and Burtonsville Park and Ride is generally congested and unable to support continued growth in eastern Montgomery County. Based on the White Oak Gateway Master Plan, "transportation problems, and attempts to solve or relieve traffic congestion, have characterized the eastern County for 30 years." The US 29 corridor will need a substantial transit upgrade in order to handle future growth demand. Additional transit options along US 29 would support the planned development and growth radiating outward from Silver Spring, thus capitalizing on public investments in transit by producing local and regional benefits. Direct benefits of this TOD could include increased ridership, revitalization of neighborhoods, financial gains for joint development opportunities, increases in the supply of affordable housing, and profits to those who own land and businesses near transit stops. Secondary benefits include congestion relief, land conservation, reduced outlays for roads, and improved safety for pedestrians and cyclists (United States Department of Transportation (US DOT, 2012))

Figure 10: Proposed Development in the US 29 Study Corridor



Source: DAIC.

3.5 Summary of Needs for the Corridor and Study Area

Based on the problems and issues identified, four specific needs for the corridor and study area have been categorized as the following:

- *Transit demand and attractiveness* – Transit demand and ridership in the US 29 corridor continues to grow. A high-quality transit service is needed to maintain current transit riders and attract new riders.
- *Mobility* – Traffic congestion currently impedes bus and rider mobility and results in unpredictable bus service, longer travel times, and delayed schedules. Corridor-wide enhancements to address efficiency and reliability are needed to improve mobility for transit riders.
- *System connectivity* – A high-quality, continuous transit service from Silver Spring to Burtonsville that can support the surrounding mixed used development along the corridor is needed to connect transit customers to local and regional employment and activity centers.
- *Livability* – Transit improvements are needed throughout the US 29 corridor to create a transportation network that enhances choices for transportation users and promotes positive effects on the surrounding communities and residents' quality of life.

4 Purpose

4.1 Purpose of the Project

The purpose of the project is to provide a new higher speed, high frequency, premium transit service along US 29 between the Silver Spring Transit Center and the Burtonsville Park & Ride near MD 198 that will:

- Enhance transit connectivity and multi-modal 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 (refer back to **goals and objectives** presented in Section 1) 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 demand and transit dependent populations
- **Develop transit services that support master planned development**
- **Support sustainable and cost effective transportation solutions**

4.2 Improve Quality of Transit Service

Dense land uses, economic activity, automobile dependency, and a lack of convenient and reliable transit service have created congested roadway conditions along segments of the US 29

corridor. Existing bus operation efficiency and reliability are hindered due to buses being confined to shared travel lanes on congested roadways, idling at failing overcrowded signalized intersections, and waiting at stops for the time-consuming process of passenger boarding and alighting at the many bus stops dotting the corridor. The current low speed of transit services, limited accessibility, and route deviation needs make transit use noncompetitive compared to automobile travel.

As noted previously, 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 that could elect to take transit if it offered comfort, convenience, and reliability. A higher-quality transit service is needed to increase transit ridership and attract new riders that would otherwise opt to use an automobile.

A higher level of transit service is needed to meet transit demand and serve new and existing transit riders in the corridor. The transit system must serve both those who would regularly drive between points along the study corridor and those seeking the longer trips and fewer stops typically offered by BRT. Generally, riders are attracted to transit service when travel times are reduced, reliability is increased, multi-modal connectivity is accommodated, and they feel comfortable and safe.

4.3 Improve Mobility Opportunities and Choices

US 29 is slated for major redevelopment and growth as outlines in the local Master Plans and Sector Plans. The growth that happens because of this planned development would lead to considerable increases in challenges for drivers, pedestrians, bicyclists and transit riders along the US 29 Study Corridor without changes to the current infrastructure. A multi-modal transportation plan that provides alternative options for safe transportation through and within the study corridor is requisite to support growth while maintaining – and enhancing – the quality of life.

The Corridor currently lacks a high quality, convenient and reliable transit connection from Burtonsville to Silver Spring 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 Silver Spring and adjoining areas of Montgomery County, but the high capital investment costs currently prohibits the extension of Metro lines to locations further north. Existing Metrobus Z-line routes run the length corridor, however; they

require several deviations from US 29 to travel the entire Study Area and their service is unreliable due to the roadway congestion and multiple stops.

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 dedicated BRT lane may move more people than a stream of single occupancy vehicles utilizing that same space. This metric allows planners to find a better balance between automobile and transit services to maximize the person throughput, utilizing limited right-of-way. This optimization of roadway usage and safety 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 the overall efficiency of a regional transportation network.

4.4 Develop Transit Services that Enhance Quality of Life

A December 2008 report from the Task Force on the Future for Growth and Development in Maryland, *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. These communities serve a wide range of citizens with interests that change over the course of their lives and depending upon their role as resident, business owner, employee, student, service provider or service recipient.

Transit, including BRT, also has numerous societal and environmental benefits. It can reduce traffic congestion, fuel consumption, and air pollution. Transit increases mobility, reduces time spent in congestion, and increases foot traffic and customers for area businesses.

Improved transit along this corridor could benefit low-income and transit-dependent households 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. In addition, there is evidence that fiscally and environmentally conscious younger generations are seeking communities that offer a wide range of affordable, convenient, and safe multi-modal transportation options. According to the 2006-2010 US Census Bureau data, residents of approximately five percent of households within the study area live below the poverty level. 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 25 percent of income for families who live in auto-dependent neighborhoods, thereby reserving more of the family income for other costs.

Development of new transit services and infrastructure has the potential to improve the accessibility of businesses and communities but at the cost of some right-of-way expansion and limits on the use of the current right-of-way. Before selecting a specific solution to the challenge of providing future transit service, there is a robust conversation of the effects the changes could have on property owners and businesses. Recognizing the importance of public dialogue on these sensitive issues, the Montgomery County Council has created Corridor Advisory Committees. The mission of these CAC is to:

- Give community participants the opportunity to provide input to all 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; and
- Provide leadership and build consensus within the community to coalesce diverse interests and address stakeholder issues.

4.5 Develop Transit Services that Support Master Planned Development

Additional transit options along US 29 would support the planned development and growth radiating outward from Silver Spring, thus capitalizing on public investments in transit by producing local and regional benefits. Direct benefits of this transit-supported development could include increased ridership, potential revitalization of neighborhoods, financial gains for joint development opportunities, increases in the supply of affordable housing, and profits to those who own land and businesses near transit stops. Secondary benefits include congestion relief, land conservation, reduced outlays for roads, and improved safety for pedestrians and cyclists (US DOT, 2012).

Current Master Plans and Sector Plans propose TODs at the Burtonsville, White Oak, Tech Road, Four Corners, and Silver Spring planning areas.

Transit service improvements along US 29 would support the planned development and growth around the approved TODs, thus capitalizing on public investments in transit by producing local and regional benefits. Other benefits of TODs could include increased ridership, financial gains for joint development opportunities, increases in the supply of affordable housing, and profits 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.

4.6 Support Sustainable and Cost Effective Transportation Solutions

Solutions are only feasible if they adequately address both physical and financial constraints. In a corridor as large as US 29, there are a number of physical constraints, such as limited right-of-way, intersection spacing, bridges and overpasses, and protected environmental and cultural resources. Financial constraints include factors such as operational cost, capital costs, and third party investment interests. The county, according to the Functional Master Plan, prioritizes transit investment along US 29 to meet physical 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.

Preserving environmental resources is a key component in enhancing the quality of life, but is also an essential metric for sustainability and can heavily influence initial capital costs. 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 US 29 must incorporate these natural and cultural activity centers, and minimize their impacts to control the overall monetary, social, and ecological costs.

5 Evaluation Criteria and Measures of Effectiveness

Add text once study team coordination and adoption of measures of effectiveness are finalized