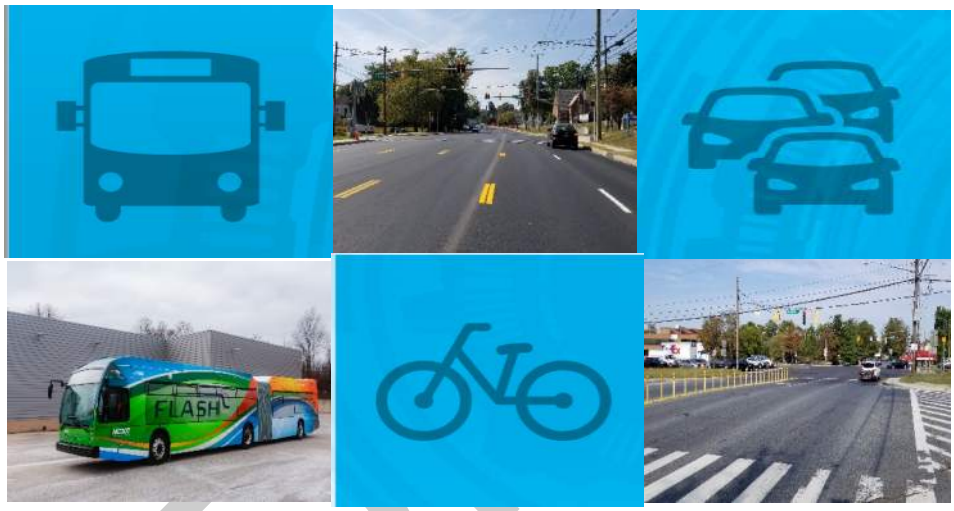
Draft

US 29 Mobility & Reliability Study

Technical Report

July 2020



MCDOT
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Introduction

The Montgomery County Department of Transportation has completed a study to identify improvements on US 29 to complement the investment in FLASH service and improve transit, carpool, or overall vehicle corridor travel time and reliability performance, as well as pedestrian and bicycle access within the Flash station area and adjacent neighborhoods between Silver Spring and Tech Road. The focus of this study is to:

- examine conceptual intersection and traffic operational improvements that will benefit both transit travel and general traffic and have independent merit beyond the FLASH Project;
- identify new multi-modal bicycle and pedestrian infrastructure improvements; and
- explore an alternative transit priority guideway design concept.

Specifically, this study evaluates the median/ reversible bus lane concept developed by two US 29 Corridor Advisory Committee members, along with other alternative bus priority alternatives and targeted intersection and segment improvements.

This report is organized to present existing conditions, identify alternative improvement concepts and to present future No Action and Build conditions. The study scope includes: 1) documenting previous studies and recommendations; 2) reviewing existing traffic/ transit/ station area walking and biking conditions; 3) forecasting future traffic projections; 4) developing and evaluating a menu of improvement options; and 5) recommending a mobility improvement package for the corridor.

Throughout the study, public engagement was performed to solicit input on transportation issues and concerns, existing condition data, alternatives to be evaluated and draft recommendations. Meetings with the US 29 South, Central and North US 29 Corridor Advisory Committee were held in May and June 2018, an existing conditions public open house meeting in White Oak was held in November, 2018 and a draft recommendations virtual public open house was held in July 2020. Additional recurring stakeholder coordination occurred with the Maryland DOT State Highway Administration, Maryland-National Capital Park and Planning Commission and County Council/ Executive.

Existing Conditions

Study Area and Study Corridor

The study network includes US 29 from the Silver Spring Transit Center to the Burtonsville Park and Ride (approximately 10 miles) and the spurs on Lockwood Drive/Stewart Lane (approximately two miles) and Briggs Chaney Road/Castle Boulevard (two miles), located within or adjacent-to the existing US 29 right-of-way for up to 200-feet on either side of the existing edge of pavement.

FLASH Stations included in the current study corridor (see inset map) include:

- Silver Spring Transit Center
- Fenton Street
- Four Corners
- Burnt Mills
- Oak Leaf Drive
- White Oak Transit Center
- April Lane
- Tech Road

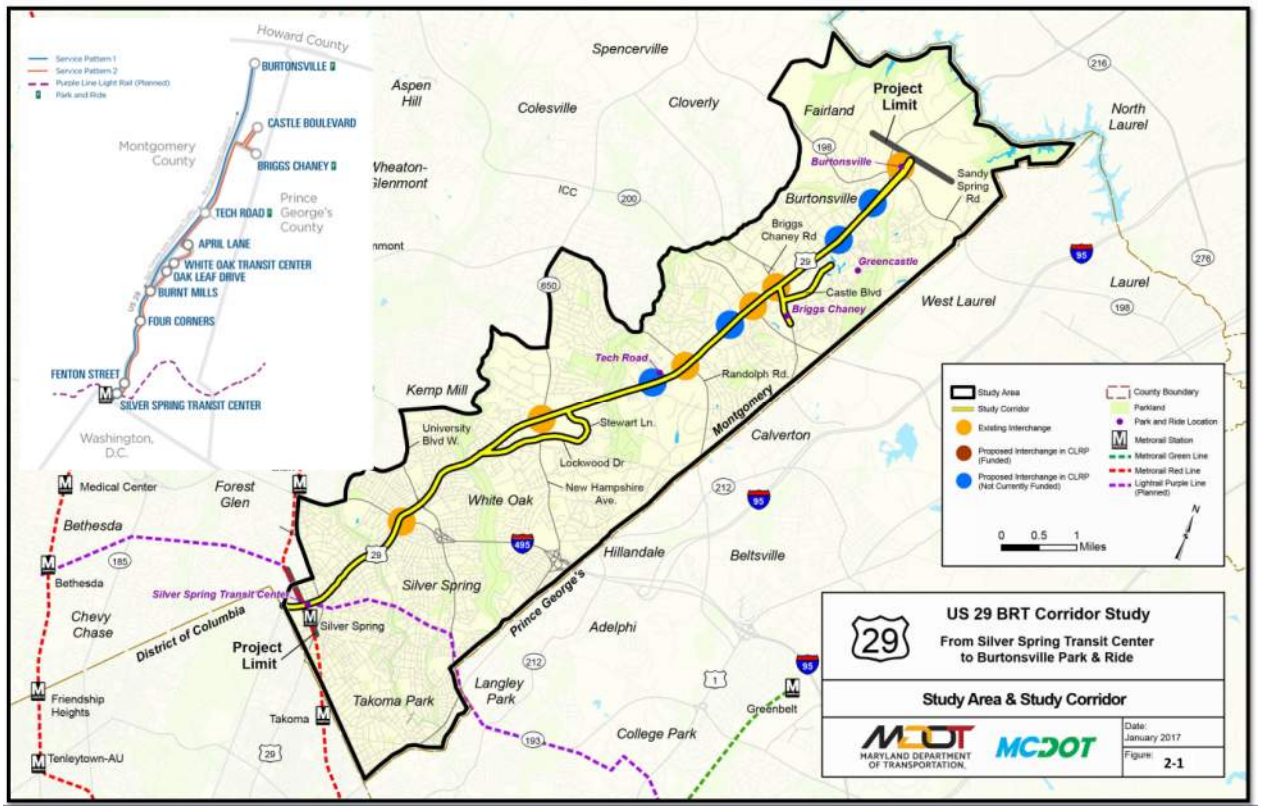


Figure 1: BRT study area and Study Corridor (Source: US 29 BRT Corridor Planning Study Report, MCDOT, 2017)

Land Use

US 29 within the BRT corridor 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. At a regional level, US 29 is classified as a principal arterial in the southern segment and an expressway in the northern segment. It connects Washington, DC to Columbia and Ellicott City in Howard County.

Residential communities are located throughout the study area There is a mixture of low, medium, and high-density residential areas, with concentrations of high-density residential development near Briggs Chaney Road, New Hampshire Avenue (MD 650), and in downtown Silver Spring. Commercial and institutional land uses are also dispersed throughout the corridor in Four Corners, White Oak, Fairland, and Burtonsville. Some industrial uses are located near Industrial Parkway and Tech Road.

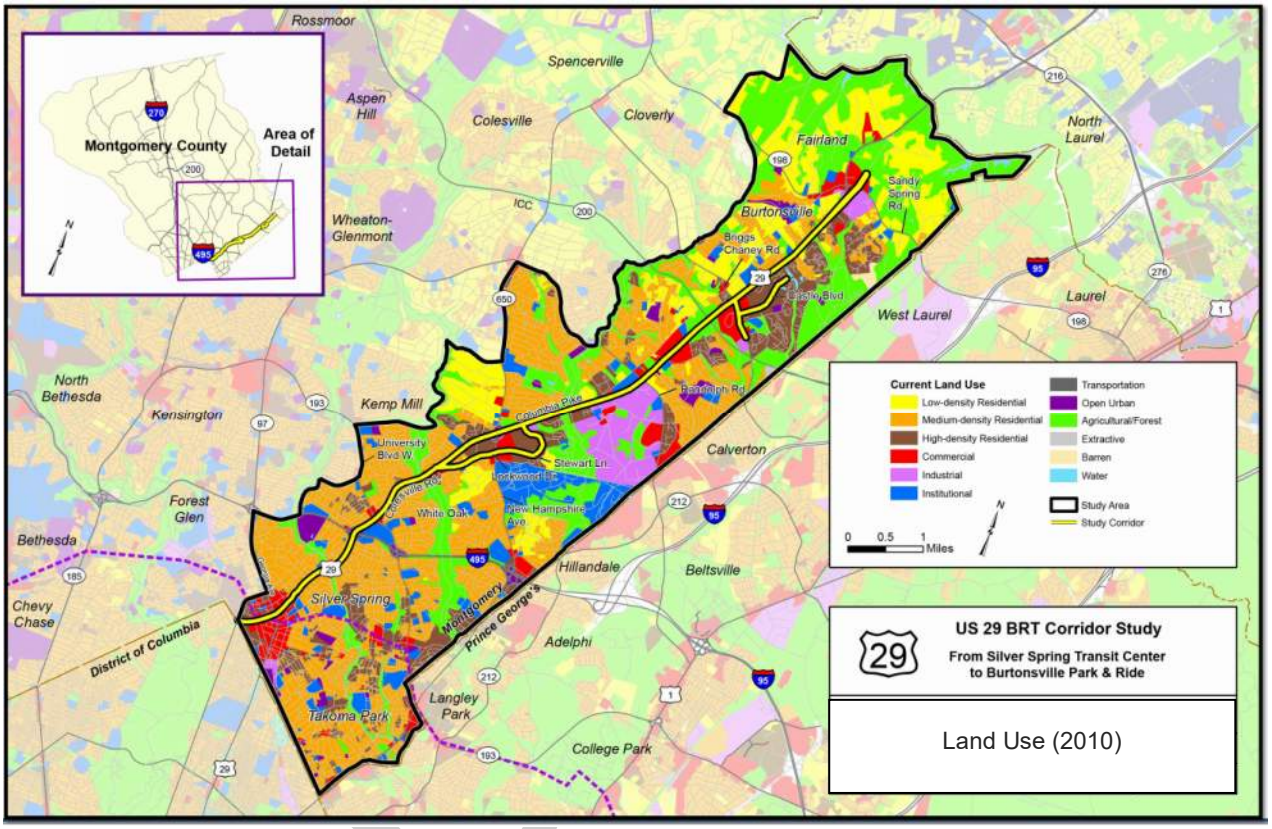


Figure 2: US 29 Corridor Existing Land Use (Source: Maryland Department of Planning and MDOT SHA)

Population, Jobs, and Income

In 2017 the Round 9.1 Cooperative Forecasts used in the COG travel model estimated the population in the study area to be 136,948. According to 2010 decennial US Census data, nearly 62 percent of study area residents are minorities and five percent of the households in the study area are considered low-income and living below the poverty line

The Round 9.1 Cooperative Forecasts estimates for the 2017 number of households at 53,115 and employment at 61,880 jobs in the study corridor. The activity centers at White Oak and Silver Spring are expected to drive future growth in the study area.

Based on the 2017 American Community Surveys, Maryland has the highest median household income in the country. The most recent 12 month estimate is $78,916. Montgomery County is the second wealthiest county within the state, with a median household income of $103,178. The percentage of the population living below the poverty line for the State and the County are ten percent and seven percent respectively.

The average median household income in the corridor is $95,292, which is about three percent lower than the County's median income. The percentage of the population living below the poverty line in the study area is five percent, which is two percent less than the County's overall population living below poverty. The areas with the highest median household income are concentrated in the northwest portion of the study area and Four Corners in the vicinity of US 29 and University Boulevard (MD 193). The areas with the lowest median household incomes are in the northeast section of the study area, as well as the southern portion of the study area near downtown Silver Spring.

Corridor Travel Patterns

In Travel Analysis, population, households, and employment are estimated for Traffic Analysis Zones as the basic building blocks of estimating travel throughout the region and in the study area. TAZs are geographic areas commonly used in conventional transportation planning models. The size of each zone may vary, depending on the policies and procedures of the metropolitan planning organization, but are typically generated to define an area occupied by approximately 3,000 people. These TAZs include US Census based data on socio-economic characteristics, employment, number of households and household income, and number of vehicles to compute existing and forecasted trips.

The TAZs developed for the study corridor are based upon a combination of the Metropolitan Washington Council of Governments/Transportation Planning Board (MWCOG/TPB) Regional Travel Demand Model, The Maryland-National Capital Park and Planning Commission (M-NCPPC) Travel/4 model, The White Oak Master Plan sub area, and additional refinements designed to better capture the travel in the study area. The Round 9.1 Cooperative Forecasts were used for Montgomery County along with additional refinements from the MNCPPC Planning department and inputs from updates to the White Oak Master Plan and White Oak developers.

US 29 serves vehicles travelling to, from, and through the subarea. As shown in **Figure 3**, market areas were defined for the Washington region in order to capture these travel patterns.

The 2017 average weekday vehicle trips to and from the US 29 study area are shown in **Table 1**. Some highlights from this table are:

- Approximately 312,000 vehicle trips move to and from the subarea on an average weekday
- 113,998 internal trips within the US 29 study area represent 37 percent of the total trips to and from the subarea
- While trips to and from Washington DC-are notable at 7%, trips to/from other nearby market areas also are significant with the largest market being to/from Southern Maryland (Prince George's, Anne Arundel, and other counties to the south)at 17%, Montgomery County inside I-495 at 9%, I-270 East at 10% and MD 97 East at 8%
- Trips to/from Columbia and other markets to the north were not as significant

It is worth noting that the Census Bureau also shows that 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 Census Transportation Planning Products.

Because US 29 is also a major travel corridor serving the region's travel needs, trips to and from the subarea only tell part of the story. To better understand the travel through the corridor and the origins and destinations of through trips using US 29 as well as trips with an origin or destination within the study corridor, a select link analysis was also performed. These flows are shown statistically in **Table 2** and illustratively using bandwidths in **Figure 4.** Highlights include:

- While the maximum weekday volume at any one point along US 29 is from 60,000 to 70,000, the total daily trips using the corridor is 165,000
- Trips using US 29 originating from anywhere in the region and destined to US 29 are the largest volume at 58,400 vehicles
- Trips using US 29 and destined for external areas beyond the region are the next largest volume at 22,000
- Trips using US 29 and destined to the District are the third largest volume at 19,300
- Trips using US 29 and destined to Columbia are the fourth largest volume at 15,700
- Trips using US 29 and destined to Southern Maryland (Prince George's, Charles and St. Mary's County) are the fifth largest volume at 14,200
- Trips using US 29 and destined to Virginia or West Virginia are also notable at 11,100, as are trips using US 29 and destined within the County inside I-495 at 7,900

Note that these through trips have the potential to be diverted to other parallel facilities including I-95, I-295 and US 1.

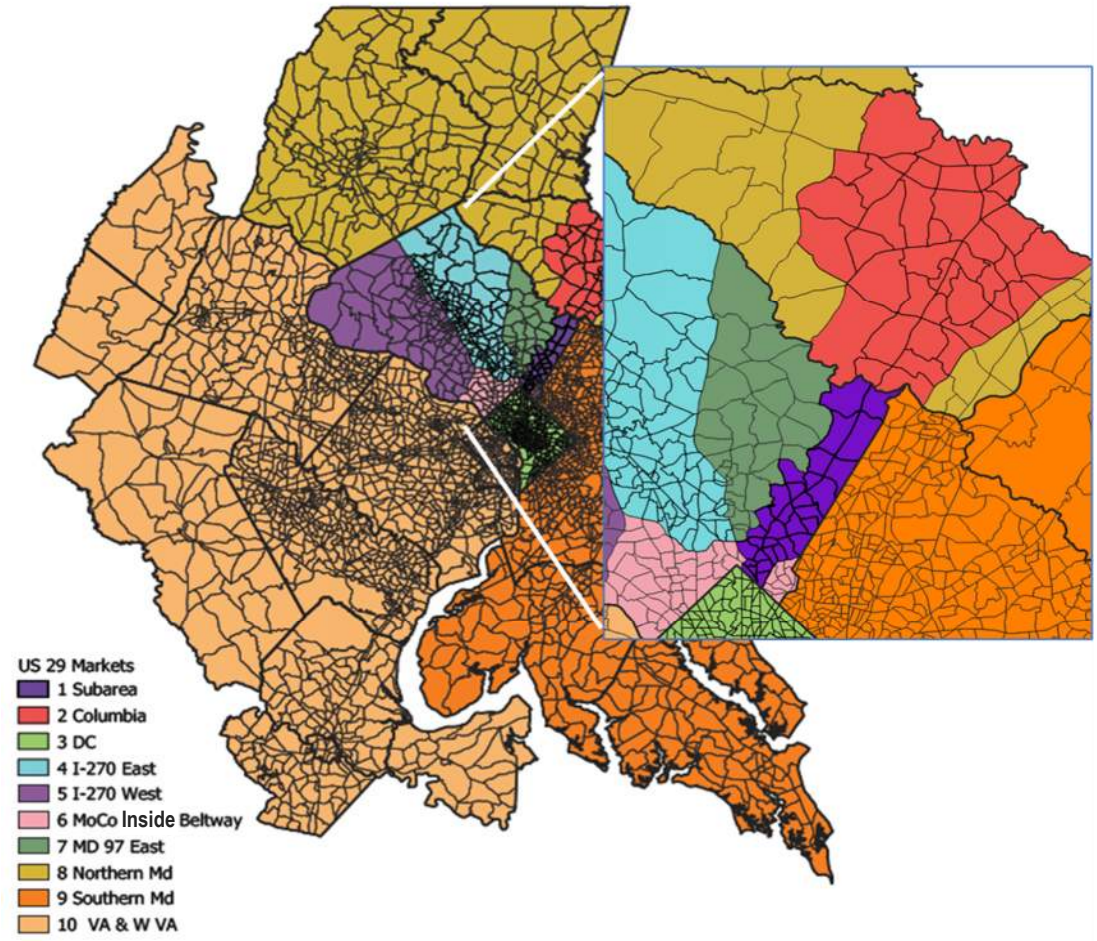


Figure 3 US 29 Travel Market Subareas

Table 1 2017 Daily Vehicle Trips To and From the US 29 Subarea

	To Subarea		From Subarea	
	Trips	% Trips	Trips	% Trips
Market Area				
1 US 29 Subarea	113998	36.60%	113998	36.59%
2 Columbia	7540	2.42%	7472	2.40%
3 DC	22454	7.21%	22568	7.24%
4 I-270 East	29987	9.63%	29936	9.61%
5 I-270 West	8199	2.63%	8228	2.64%
6 MoCo Inside I-495	27582	8.86%	27694	8.89%
7 MD 97 East	25261	8.11%	25212	8.09%
8 Northern MD	5059	1.62%	5074	1.63%
9 Southern MD	53980	17.33%	54017	17.34%
10 Va & W. Va	7518	2.41%	7461	2.39%
11 External Sta.	9887	3.17%	9898	3.18%
TOTAL	311465	100.00%	311558	100.00%

Table 2 2017 Average Weekday Vehicle Trips using US 29

		US 29 Subarea	Columbia	DC	I-270 East	I-270 West	MoCo Inside I-495	MD 97 East	Northern MD	Southern MD	Va & W. Va	External Sta.	
Origin Name	**Orig**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Tot**
1 US 29 Subarea	**1**	24492	3765	5366	1451	591	4465	2782	1157	7910	1572	4425	57976
2 Columbia	**2**	3811	0	4448	1808	512	1313	1125	0	1203	1605	35	15860
3 DC	**3**	5417	4408	0	2	0	0	1596	524	1510	0	7725	21182
4 I-270 East	**4**	1771	1847	4	0	0	22	0	180	944	0	1442	6210
5 I-270 West	**5**	727	544	1	0	0	0	0	44	371	0	189	1876
6 MoCo Inside I-495	**6**	4641	1395	0	9	1	0	259	89	386	0	1520	8300
7 MD 97 East	**7**	3046	1122	2029	0	1	361	11	132	794	259	839	8594
8 Northern MD	**8**	1190	0	697	123	29	67	105	0	102	32	0	2345
9 Southern MD	**9**	7089	1018	371	292	66	170	429	70	3	18	816	10342
10 Va & W. Va	**10**	1774	1619	0	0	0	0	179	23	40	0	4708	8343
11 External Sta.	**11**	4430	25	6442	1284	179	1507	676	0	997	7574	424	23538
	Tot	58388	15743	19358	4969	1379	7905	7162	2219	14260	11060	22123	164566

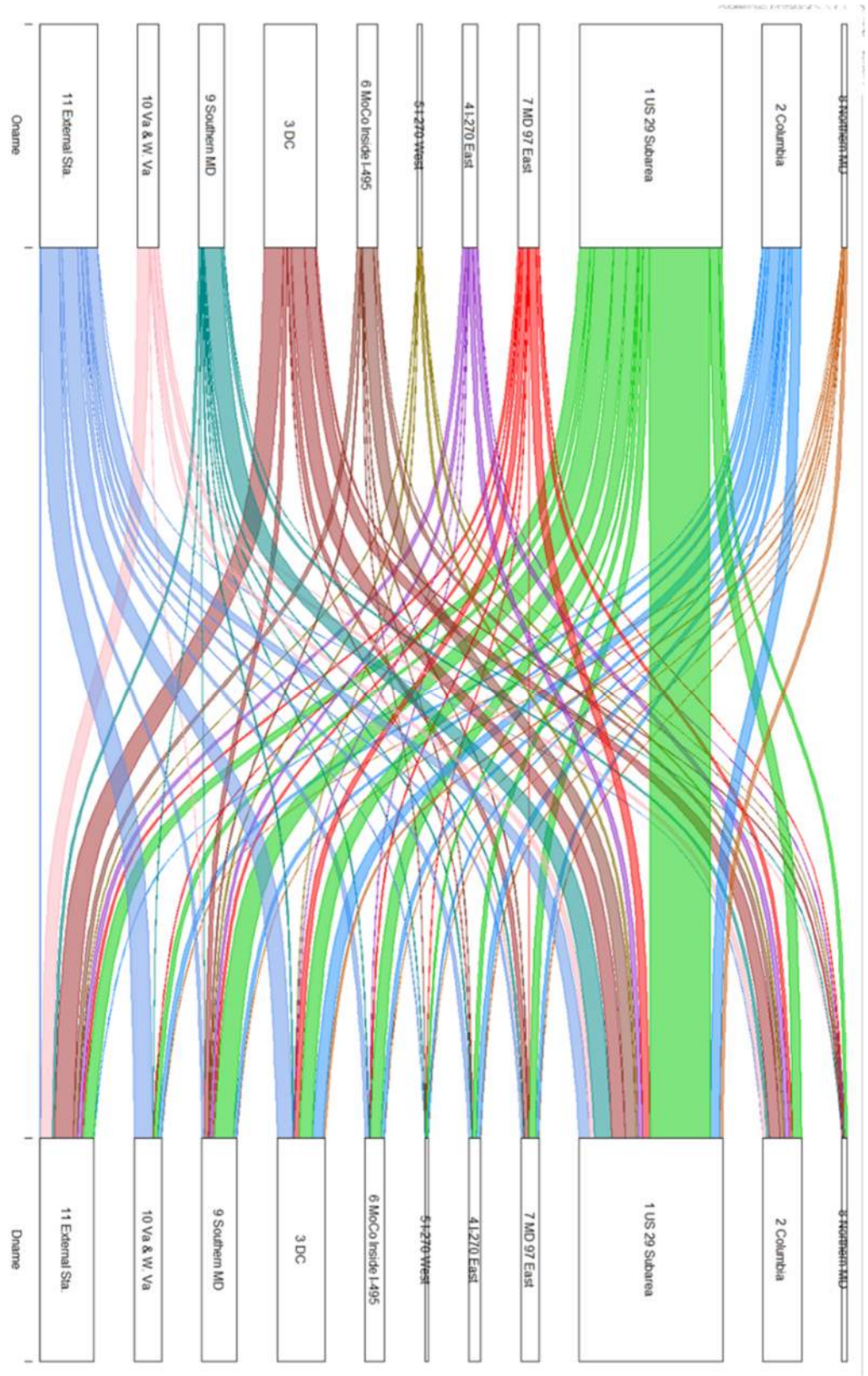


Figure 4 2017 Average Weekday Vehicle Trip Origins and Destinations Using the US29 Corridor

Previous Studies

This section summarizes previous transportation studies conducted within the corridor, corridor and regional traffic and transit studies, and current functional and master plans. Studies and plans reviewed in this section are listed in Table 3.

Table 3. Summary of US 29 Studies and Plans

US 29 Bus Rapid Transit (BRT) County and State Studies		
US 29 Busway Feasibility Study	MCDOT	1996
US 29 Bus Operations Analysis	MDOT SHA	2001
Existing Conditions: Signal Systems and Operations on Corridors Rapid Transit System Transit Signal Priority Technical Memorandum 2 & Rapid Transit System Transit Signal Priority Findings and Recommendations Technical Memorandum 3	MCDOT	2013
US 29 Transit Reliability and Travel Time	MCDOT	2015
US 29 Bus Rapid Transit Corridor Planning Study Preliminary Purpose and Need Document	MDOT SHA	2015
US 29 Managed Lane Feasibility Analysis	MCDOT	2016
TIGER Grant Application	MCDOT	2016
US 29 Bus Rapid Transit Corridor Planning Study - Corridor Study Report	MCDOT, MDOT MTA, MDOT SHA	2017
US 29 Bus Rapid Transit Corridor Planning Study/Preliminary Conceptual Alternatives & Traffic Operations Analysis Results	MCDOT, MDOT MTA, MDOT SHA	2017
US 29 Bus Rapid Transit Montgomery County Council T&E Committee Work session	MCDOT	2017
US 29 BRT Dedicated Lanes Concept	Emerson/Smoot, Better BRT	2016, 2018
US 29 Before/After Study from MD 198 to MD 193	MDOT SHA	2006
Pedestrian Roadway Safety Audit University Boulevard (MD 193) and Colesville Road (US 29)	MCDOT	2011
US 29/Cherry Hill Transit Oriented Development Scenario Planning Report	M-NCPPC	2011
US 29 Fairland/Musgrove Interchange Study	MDOT SHA	2014

US 29 Bus Rapid Transit Regional Traffic Impact	UMD	2016
US 29 Existing Conditions Report	MCDOT	2017
US 29 Reversible Lane Removal Study	MDOT SHA District 3	2018
Countywide and Regional Transit Studies		
Countywide Bus Rapid Transit Study Consultant's Report	MCDOT	2011
Demand and Service Planning Report for the Proposed Montgomery County Maryland BRT System	MCDOT	2012
Montgomery County Rapid Transit System Service Planning and Integration Report	MCDOT	2014
County Executive's Transit Task Force Final Report and Recommendations	Montgomery County	2015
Z Line Study	WMATA	2015
Howard County Bus Rapid Transit Phase II Study Technical Report	Howard County	2016
Related Regional Studies		
MD 193 Road Diet Study	MDOT SHA	2016
Maryland State Highway Mobility Report	MDOT SHA	2016
Mobility Assessment Report	M-NCPPC	2017
Functional and Master Plans		
Montgomery County Master & Sector Plans (Fairland, Four Corners, North & West Silver Spring, Silver Spring Streetscape and White Oak)	M-NCPPC	Varies
Purple Line Functional Plan	M-NCPPC	2010
Burtonsville Crossroads Neighborhood Plan	M-NCPPC	2012
Countywide Transit Corridors Functional Plan	M-NCPPC	2013
White Oak Science Gateway Master Plan and Local Area Transportation Review (LATR) Intersection Improvement Cost Evaluation Study	M-NCPPC	2014
Silver Spring CBD Bicycle and Pedestrian Priority Area	M-NCPPC	2015
Federal Research Center Master Plan Draft Environmental Impact Statement	GSA-USFDA	2018

Countywide Bike Master Plan	MCDOT	2018

US 29 Bus Rapid Transit (BRT) County and State Studies

US 29 Busway Feasibility Study – MCDOT, January 1996

The study proposes a 3.4-mile busway along US 29 from Sligo Creek Parkway to north of Stewart Lane. Recommended roadway improvements include the elimination of 30 left turns along the corridor, mountable curbs for busway and emergency vehicle use, dedicated reversible lane in center of the road with medians on either side. Expansion and closure of the median at Lorain Ave, Timberwood Avenue, and Lanark Way is also recommended, as is a contraflow dedicated lane in the Four Corners section. Signal phasing improvements are also recommended throughout the corridor, as well as two new signals at Hastings Drive and Crestmoor Drive.

Recommendations for non-motorized improvements include crosswalks, pedestrian-actuated signal heads, and median refuge areas at strategic locations throughout the corridor, and sidewalks for pedestrians and bicycles on both sides of US 29 for the length of the busway.

US 29 Bus Operations Analysis – MDOT SHA, October 2001

The study addresses vehicular and bus travel times and delays along US 29 between the Burtonsville Crossing Shopping Center and Silver Spring Metro Station, and predicts operations under year 2007 traffic conditions, when grade separations at the intersections of US 29 and MD 198, Briggs Chaney Road and Randolph Road were to be built and operational. The study concludes that 2007 bus operations are not expected to deteriorate, and rather expected to improve over the 2001 signalized intersection conditions in light of proposed grade separations.

Existing Conditions: Signal Systems and Operations on Corridors Rapid Transit System Transit Signal Priority Technical Memorandum 2 & RTS Transit Signal Priority Findings and Recommendations Technical Memorandum 3 – MCDOT, 2013 and 2014

The primary goal of the study is to define the appropriate metrics for the implementation of TSP systems on each RTS corridor, building on what was developed for TSP for local bus operations. Technical Memorandum 2 describes the existing conditions of signal systems and traffic/transit operations on the proposed RTS corridors within Montgomery County. Recommendations for the US 29 corridor include a mix of two-lane median busways, mixed traffic operations, dedicated curb lanes in the peak hour direction and curb lanes via lane-repurposing.

Technical Memorandum 3 summarizes the current status of TSP and RTS within Montgomery County, develops a preliminary concept of operations for key RTS operational scenarios, and estimates costs for TSP components. Recommendations include testing for advanced TSP strategies and technologies (phase rotation, phase omission, phase insertion, predictive priority, adaptive signals, etc.), developing policies for synergistic priority strategies and developing a services hierarchy.

US 29 Transit Reliability and Travel Time – MCDOT, March 2015

The memorandum documents the US 29 corridor travel time and on time performance (OTP) analysis carried out using Automatic Vehicle Location (AVL)/Automatic Passenger Counter (APC) data provided by WMATA and Ride On for a period from October 3 to October 7, 2016. It was determined that BRT would provide an end to end travel time savings of around 26% from Burtonsville to Silver Spring, but this savings varies between specific Origin/Destination pairs depending on the directness of the current service, location, and other factors. A savings as high as 60% could occur between Burtonsville and White Oak,

and a savings of only 0% to 2% from Four Corners to the Silver Spring Transit Center. BRT may also improve reliability over current bus service.

US 29 Bus Rapid Transit Corridor Planning Study Preliminary Purpose and Need Document – MDOT SHA, December 2015

This document identifies existing and future transportation needs in the US 29 corridor study that BRT would address and provides an initial foundation for a NEPA Purpose and Need statement in the event the project moves into a future development phase. Based on the problems and issues identified, four specific needs for the US 29 corridor and study area are discussed: transit demand and attractiveness, mobility, system connectivity, and livability. The preliminary purpose statement includes five goals to guide development of BRT alternatives: to improve the quality of transit service, to improve mobility opportunities and choices, to develop transit services that enhance quality of life, and to develop transit services that support master planned development.

US 29 Managed Lane Feasibility Analysis – MCDOT, January 2016

The analysis assesses the feasibility of converting vehicle travel lanes along US 29 to a managed lane to serve the proposed BRT system, HOV-compliant vehicles, and right turns based on resulting traffic impacts. The study concludes that redistributing traffic volumes based on the managed lane scenario would result in uneven lane utilization which causes some lanes within each segment to perform at or above capacity even after considering potential shifts from SOV to HOV. Therefore, a managed lane is only recommended in the southern (Silver Spring to Sligo) and northern (MD 193 to MD 650) segments of the corridor.

TIGER Grant Application – MCDOT, April 2016

The TIGER Grant Application seeks to secure funds for a 14-mile BRT service along US 29 from Burtonsville Park and Ride to Silver Spring Transit Center. The BRT line would use the existing roadway pavement where possible, and would include managed lanes, Bus on Shoulder, and a small segment of mixed traffic.

US 29 Bus Rapid Transit Corridor Planning Study - Corridor Study Report – MCDOT, MDOT MTA, MDOT SHA, April 2017

The report documents the evaluation of alternatives to provide new BRT service along US 29. Alternatives evaluated include the No -Build and the three conceptual alternatives identified in the US 29 Bus Rapid Transit Corridor Planning Study - Preliminary Conceptual Alternatives & Traffic Operations Analysis Results. Among other items, it compares the alternatives in light of ridership, accessibility to jobs and activity centers, Level of Service during peak hours, and construction costs. It also documents potential impacts to properties, historic resources, natural resources, and minority and low-income populations. It is anticipated that these communities will benefit directly from the new transit service provided.

US 29 Bus Rapid Transit Corridor Planning Study/Preliminary Conceptual Alternatives & Traffic Operations Analysis Results – MCDOT, MDOT MTA, MDOT SHA, April 2017

The report documents traffic modeling assumptions and analysis results performed in support of the US 29 BRT Corridor Planning Study, which evaluates alternatives to provide new BRT services along US 29. The traffic operations analysis portion of this study includes the traffic modeling and analysis findings for the 2040 No-Build, Alternative A: Peak Direction Curbside BAT Lanes (South)/Dedicated Median Shoulder BRT Lanes (North); Alternative B: Curbside Managed Lanes (South)/Bus-on-Outside-Shoulder (North), and Alternative B Modified: Curbside Managed Lanes (South)/Dedicated Median Shoulder BRT Lanes (North).

The study concludes that Alternative B Modified provides the highest level of transit service (i.e., fastest and moves the most amount of people) but significantly degrades Single Occupancy Vehicle (SOV) service. Alternative B seems to be relatively mid-range for improvement to level of transit service without as much

of an impact on SOV service. Recommended refinements for future study include signal timing and TSP enhancements, alternative BRT alignments, modification to the lane repurposing segments, geometric improvements to increase capacity at constrained locations, enhanced Transportation Demand Management to reduce SOV demand, and improvements to traffic flow through the BRT transition areas.

US 29 Bus Rapid Transit Montgomery County Council T&E Committee Work session – MCDOT, May 2017

The Committee unanimously recommended the programming of funds for the TIGER project as a Fiscal Year 2018 appropriation of $9.5 million and an amendment to the Fiscal Year 2017 -2022 CIP to the Rapid Transit System project for $31.5 million to fund the first stage of implementation of a 14-mile-long US 29 Bus Rapid Transit (BRT) line between Burtonsville and the Silver Spring Metro Station. Summary of public outreach activities were also presented as well as funding for MetroExtra service.

US 29 Related Transit Advocate Concepts

US 29 BRT Dedicated Lanes Draft Concept – Emerson/Smoot, 2016 and Better BRT, 2018

As part of the Better BRT plan, this concept proposes upgrades to the current BRT plan along most of the US 29 corridor. Suggested improvements include reducing travel lane widths to provide for a median busway. The busway would be 2 lanes where right-of-way permitted and a single reversible lane where constrained south of Granville Drive and south of Sligo Creek Parkway.

US 29 Related Traffic and Transit Studies

US 29 Before/After Study From MD 198 to MD 193 – MDOT SHA, 2006

The study evaluates weekday peak period traffic operations and overall transportation system impacts in lieu of highway improvements on US 29 between Sandy Spring Road and University Boulevard. Year 2000 is the before condition and Year 2006 is the after condition. The study conducts a total build-out analysis of US 29 with proposed interchanges at Greencastle Road, Fairland/Musgrove Road, Tech Road, and Stewart Lane. It also develops year 2015 traffic forecasts for US 29 and conceptual lane arrangements from the preferred alternatives at Briggs Chaney Road intersection (completed 2008).

Pedestrian Roadway Safety Audit University Boulevard (MD 193) and Colesville Road (US 29) – MCDOT, July 2011

This document summarizes the results of a pedestrian road safety audit for the intersection of US 29 and MD 193 in Silver Spring, MD (Four Corners). The document identifies a variety of issues related to pedestrian and bicycle safety and develops general suggestions to improve pedestrian and bicycle safety in the study area including signage and signal improvements, deterrents to mid-block crossings, and coordination with transit services to improve bus stop waiting areas.

US 29/Cherry Hill Transit Oriented Development Scenario Planning Report – M-NCPPC , June 2011

The report examines the results of a Transit-Oriented Development (TOD) scenario planning exercise in a study area primarily located in the Cherry Hill Employment Area, east of US 29 south of Cherry Hill Road. The planning exercise includes three main components: 1) a literature review examining TOD best practices, particularly in relation to the large USFDA Federal Research Center campus; 2) a transit sketch-planning analysis; and 3) a land-use scenario testing analysis. The report concludes that the study area is a good candidate for increased bus service and potentially light rail transit (LRT) or BRT in the future with some higher-density development around station areas.

US 29 Fairland/Musgrove Interchange Study – MDOT SHA, 2014

MDOT SHA evaluated the geometric, environmental, cost and traffic operations of a new interchange. Recommendations include grade separation at the intersections of US 29 at Fairland Road and Musgrove Road and construction of a service road starting at Musgrove Road and merging with US 29 prior to Tech Road.

US 29 Bus Rapid Transit Regional Traffic Impact – UMD, 2016

The study team uses advanced traffic modeling applications with predictive routing capabilities to evaluate the potential impacts of traffic diversions post-BRT implementation due to potential increased traffic congestion along US 29. The study concludes that during the PM Peak period, implementation of BRT results in an average speed change from 36 to 35 miles per hour, average vehicle miles traveled from 7.2 to 7.4, and average travel time per trip change from 13.3 minutes to 13.5 minutes over 2015 No-Build conditions.

US 29 Existing Conditions Report – MCDOT, August 2017

The report reviews and summarizes recent studies and plans for Ride On and Metrobus service on, to and near the US 29 corridor. It examines the Ride On and Metrobus routes that intersect and operate on the US 29 corridor. The report will be used to inform design of a feeder bus network that will comprehensively and efficiently serve the communities surrounding the corridor.

The study also identifies service gaps and recommends all-day service for the White Oak Shopping Center along Stewart Lane and Lockwood Drive, Calverton and Downtown Silver Spring. It also recommends additional peak hour service for Downtown Silver Spring and Forest Glen.

US 29 Reversible Lane Removal Study – MDOT SHA District 3

This study reviews the traffic and safety effects of removing the reversible lane along US 29. Due to funding issues, it is currently on hold and has not been completed.

Countywide and Regional Transit Studies

Countywide Bus Rapid Transit Study Consultant's Report – MCDOT, July 2011

This study analyzes the feasibility of a BRT network in Montgomery County via an initial screening to identify eligible county roads and potential design options within the right-of-way, and to determine travel demand along identified corridors as well as capital and operating costs for the network. A 13.5-mile potential route is identified along US 29 from Burtonsville Park-and-Ride at its northern terminus and the future Silver Spring Transit Center at its southern terminus and includes 11 station locations along the route. The plan uses density thresholds as a method to identify where BRT may be appropriate and makes general land use recommendations key to the success of BRT, including Transit-Oriented Development.

Demand and Service Planning Report for the Proposed Montgomery County Maryland BRT System – MCDOT, 2012

Of the 160 miles of BRT infrastructure on surface roads previously identified, this study recommends a phased approach to realistically building and operating a full BRT network in Montgomery County. The study estimates present passenger demands on the bus system based on operational data to evaluate potential initial ridership of the first three selected BRT corridors.

Montgomery County Rapid Transit System Service Planning and Integration Report – MCDOT, May 2014

The report builds upon the body of knowledge that has been developed for a BRT network in Montgomery County and provides guidance for further Rapid Transit System (RTS) planning among the key BRT

corridors: Randolph Road, MD 355, Georgia Avenue, Veirs Mill Road, New Hampshire Avenue, and US 29. The study also examines integration of planned BRT and local bus service, as well as a summary of regional land use plans. The concept for US 29 focuses on connecting activity centers, multimodal transit nodes, as well as providing transportation opportunities from Burtonsville to Silver Spring. Local service modifications include use of the US 29 BRT infrastructure, where accessible, by Metrobus Z routes, MTA Commuter buses, and Ride On. Metrobus Route Z8 would continue with half the headways of service.

County Executive's Transit Task Force Final Report and Recommendations – Montgomery County, October 2015

The Transit Task Force reconvened in April 2015 to study legislation proposed in the 2015 Session of the Maryland General Assembly, develop procedures for soliciting community and business input, provide advice on the proposed legislation, and identify potential funding sources relating to the RTS network as part of an overall financial plan. The Task Force proposes an additional half cent sales tax to fund transit and supports legislation to empower the County to develop its transit authority. Recommendations in the report include: establishing special tax districts; introducing a new excise tax on commercial property rentals to finance the transit system; creating a dedicated fund for transit; requiring the transit authority to submit annual and long-term budgets and financial audits; requiring council approval for eminent domain and ensuring the transit authority adheres to county ethics; and allowing the transit authority to enter into multi-jurisdiction agreements.

Z Line Study – WMATA, January 2015

WMATA, with input from Montgomery County, completed a study for seven Metrobus routes that provide connections along the US 29 corridor: Z2 Colesville-Ashton Line, Z6 Calverton-Westfarm Line, Z8 Fairland Line, Z9/Z29 Laurel-Burtonsville Express Line and Z11/Z13 Greencastle-Briggs Chaney Express Line. Developed through public outreach and technical analysis, a summary of plan recommendations follows.

Z Line service improvements are proposed for short-term (1-2 years) implementation and include adding trips to Z8 weekday mid-day service, adding trips to Z8 Saturday service, adding an additional Z6 weekday evening trip, and adjusting schedules to reflect observed run times. Mid-term (3-4 years) recommendations include implementing Z6 Saturday service and modifying Z8 frequency and implementing new peak MetroExtra service. Long-term (5-6 years) recommendations include expanding some Z Line mid-day and Saturday service areas.

Operational improvements include implementing dedicated supervision to proactively manage bus departures and adding additional stops on Z Lines Express Services (Z9, Z11, Z13, and Z29). Proposed passenger facility improvements include ADA compliance and pedestrian safety improvements; the addition of amenities such as shelters, benches and trash receptacles; signal timing and phasing; stop locations; and addressing general congestion along US 29.

Howard County Bus Rapid Transit Phase II Study Technical Report – Howard County, April 2016

This report documents Howard County BRT Phase II Study efforts, analysis, and results. The study focuses on US 29, Broken Land Parkway and US 1. The study examines specific route alignment and stations, ancillary feeder transit services, landside services such as park and ride and pedestrian accessibility, preliminary operating costs, and land use plans to support high quality transit service within and between the study corridors.

Based upon the recommended BRT system for US 29 and related local/feeder bus service, the study documents a significant travel market and demand for high quality BRT to and from Howard County for each of the three corridors. Among other items, recommended next steps include coordination with Montgomery County on US 29 corridor planning and preliminary engineering.

Related Regional Studies

MD 193 Road Diet Study – MDOT SHA, March 2016

MDOT SHA performed a roadway study along the MD 193 (University Boulevard) corridor from US 29 (Columbia Pike) to MD 320 (Piney Branch Road) per request by area elected officials and residents. The purpose of the study was to determine if a reduction of the road capacity from 6 lanes to 4 lanes is feasible. The study concluded that if a road diet is implemented, peak hour volume increases 2.5% and 6.5% north and south of I-495, respectively.

Maryland State Highway Mobility Report – MDOT SHA, 2016

The report documents the annual measurements of congestion along Maryland state highways including travel time reliability. US 29 from MD 650 to I-495 was ranked as one of the top 10 congested arterial segments in the State.

Mobility Assessment Report – M-NCPPC, February 2017

The report summarizes the trends, data, and analysis used to track and measure transportation mobility conditions in Montgomery County to provide information to residents and public officials regarding the current state of the county's transportation system, as well as how the system is changing and evolving. Although there are no specific recommendations, the report documents recent ridership and travel trends.

Approximately 40 percent of residents from Silver Spring, Friendship Heights and Grosvenor commute via public transportation. Ride On routes on US 29 saw an increase of 10 percent or more ridership from 2013 to 2015. MetroBus routes Z9/Z29 saw a 6.1 percent increase in ridership, while Metro Bus routes Z11 and Z13 on US 29 saw a weekday average decrease in ridership of -26.4 percent.

Forty percent of roadway mileage inside the Beltway experiences moderate to heavy or higher levels of congestion compared to approximately 13 percent outside beltway. Columbia Pike experiences two peak periods between University Blvd and Sandy Spring Rd in the southbound AM peak south of Randolph/ Cherry Hill Road and in the northbound PM peak between New Hampshire Avenue and Randolph/ Cherry Hill Road. Columbia Pike from Sandy Spring Rd to Howard County border has a sharp peak in congestion during the evening commute from 4 to 5 PM northbound and generally on Thursdays and Fridays. Colesville Road from I-495 to DC border is 87 percent congested throughout the evening commute in the southbound direction. In the northbound direction, both morning and evening commutes reach similar congestion levels.

The county has invested in many capital construction projects, regulatory changes, planning methods and data that seek to encourage a diverse transportation system. These include Bicycle Pedestrian Priority Areas (BiPPA), and currently five locations are being evaluated for BiPPA in Montgomery County. The Planning Department is preparing the Bicycle Master Plan and several capital improvement projects supporting bicycle and pedestrian travel. In the top twenty intersections with the highest pedestrian use, Colesville Road at Georgia Avenue and Fenton Street are #5 and #14, respectively. In the top twenty intersections that bicycle activities were observed, Colesville Road at Georgia Avenue was #13 with 54 bicyclists. However, there is very little activity along US 29 outside of the Silver Spring CBD.

Functional and Master Planning Documents

Fairland Master Plan, 1997

The plan reinforces existing development patterns with adjustments from the 1993 General Plan. Specific to transportation, the plan recommends enhancing mobility by providing safe and efficient transportation systems with a wide range of alternatives.

The plan does not make specific transit recommendations, however it does recommend grade-separated interchanges for all east-west crossings of US 29, and recommends reserving the ROW for all future transit improvements. It endorses sidewalks and walkways to improve pedestrian access to public transit, commercial centers, schools, parks and places of employment. The plan also supports safe and convenient bikeway network that connects to local community centers, services and recreational facilities and expands commuting opportunities for biking.

Four Corners Master Plan, 1996

The plan balances transportation needs of regional through traffic and local traffic by recommending road improvements at main intersections and enhanced system for cyclists and pedestrians to create a more conducive multi-modal environment.

The plan encourages increased use of transit with bus service that connects Four Corners with Silver Spring and Forest Glen Metro Stations. It also recommends intersection improvements for Colesville Road and University Boulevard, including pedestrian and streetscape amenities. It promotes use of transit ridesharing and other traffic mitigation measures, including compressed workweeks and telecommuting among employees and residents in and near the US 29 corridor. It suggests pedestrian circulation and safety should be improved by constructing sidewalks that connect neighborhoods to the commercial district, schools, transit stops, parks and other community facilities. It states that the existing bikeway network should also be expanded to support local and regional systems and enhance value as an alternate means of transportation.

North and West Silver Spring Master Plan, 2000

The plan seeks to enhance stable residential neighborhoods, upgrade local commercial centers and generally improve connectivity. The plan's recommendations are designed to enhance and sustain area neighborhoods with upgraded infrastructure and a neighborhood friendly transportation system.

The plan generally calls for improved transit on US 29, and for the investigation of the feasibility of a transit center in White Oak Shopping Center. The plan suggests adding a separate right-turn lane on westbound Dale Drive at Colesville Road, which would require pavement widening, and it also calls for pedestrian circulation along Colesville Road including wide, tree-lined sidewalks on both sides of the street and safe pedestrian crossings.

Silver Spring Streetscape Plan, 1992

This plan describes an overall concept for the Silver Spring Central Business District steetscape system including street trees, lighting, paving, layout concepts and materials.

White Oak Master Plan, 1997

In addition to recommendations for residential communities and commercial centers, the plan recommends safe and attractive transportation improvements that enhance local circulation and convenience for all modes of travel within and through the communities of the White Oak Master Plan area. The plan proposes two transit centers, one in Colesville and another in White Oak. It proposes grade separated intersections along US 29. The plan also proposes a system of walkways and bikeways, and sidewalk improvements to enhance pedestrian and bicycle experience and improve community character.

Purple Line Functional Plan – M-NCPPC, September 2010

The plan identifies the Purple Line alignment and station locations throughout Montgomery County. No specific roadway or automobile improvements are recommended for US 29, however two stations on or near the US 29 corridor include the Fenton Street Station with platforms located adjacent to the Silver Spring Library, and the Silver Spring Transit Center Station, which is also a stop on the US 29 BRT. The

Silver Spring Transit Center Station also includes enhanced access from the Purple Line to Metrorail Red Line, local buses, MARC, inter-city bus and taxi service at Transit Center.

Burtonsville Crossroads Neighborhood Plan – M-NCPPC, December 2012

The plan is an amendment to the 1997 Fairland Master Plan and other regional plans which include the Burtonsville crossroads area. The Burtonsville Park and Ride is presented as an opportunity to link local businesses to the larger region, including access to US 29 and the planned Montgomery County BRT network (the Park and Ride is the planned northern terminus of the US 29 BRT route). The Park and Ride lot, located behind the Burtonsville Crossing Shopping Center, includes 500 spaces with access from US 29, Business 29 (Old Columbia Pike), and MD 198. It is served by MTA Commuter Bus, University of Maryland Shuttle, and ICC Bus to and from Baltimore-Washington International Airport, and Metrobus, including routes to Silver Spring, Amtrak and Metrorail stations. The plan calls for a shift from single-use to mixed-used zoning in the area around the Park and Ride, which would provide a mix of commercial and housing opportunities, support infill, and require privately owned public use space to be accessible to the public. It also recommends improving the grid pattern of local streets, adding streetscape to Business 29, and improving the bikeway along US 29.

Countywide Transit Corridors Functional Plan – M-NCPPC, December 2013

The plan recommends implementing a 102-mile Bus Rapid Transit (BRT) network and expanding right-of-way for CSX Metropolitan Branch to allow for enhanced MARC commuter rail service. The plan calls for dedicated bus lanes from Stewart Lane to Sligo Creek Parkway and from Georgia Avenue to Sixteenth Street, two additional dedicated lanes from MD 198 to Stewart Lane, and a dedicated lane in the peak-hour peak direction from Sligo Creek Parkway to Georgia Avenue. Station locations are identified at 11 locations throughout the corridor including the Burtonsville and Briggs Chaney park and rides, and White Oak and Silver Spring transit centers.

Roadway and traffic signal improvements are not specifically recommended in the plan. However, accommodation for pedestrians and bicyclists is recommended, particularly at transit-oriented development areas, established or developing activity centers, around Metro stations, and at transfer points between BRT routes.

White Oak Science Gateway Master Plan and Local Area Transportation Review (LATR) Intersection Improvement Cost Evaluation Study - M-NCPPC, 2014

The master plan is an amendment to several Master Plans in Montgomery County covering approximately 3,000 acres and makes recommendations for land use, density, zoning, transportation, environment, historic resources, parks and community facilities. The plan envisions White Oak's major centers – Hillandale, White Oak, and Life Sciences/FDA Village evolving from conventional, auto-dependent suburban shopping centers, business parks, and light industrial areas into vibrant, mixed-use, transit-served nodes.

The purpose of the LATR Study is to address potential LATR-scale costs for inclusion in a proposed per-trip fee that may be paid by new development in lieu of performing a complete LATR analysis and independently mitigating individual development's traffic impacts. The study concludes that for all study intersections on US 29, with the exception of Randolph Road/Cherry Hill Road, a proposed per-trip fee may be established by County Council and paid by new development in lieu of conducting a complete LATR analysis and independently mitigating individual development's traffic impacts.

Silver Spring CBD Bicycle and Pedestrian Priority Area – M-NCPPC, June 2015

This document proposes a Bicycle and Pedestrian Priority Area (BiPPA) for the Silver Spring Central Business District. The objective of the BiPPA is to enhance safe bicycle and pedestrian access to support cohesive neighborhoods, aging infrastructure, and improve long-range connectivity and circulation.

Federal Research Center Master Plan Draft Environmental Impact Statement – GSA-USFDA, February 2018

This document evaluates a new Master Plan for the 130-acre Federal Research Center to accommodate a projected employee population of 18,000. The proposed action includes: development up to an additional 1,191, 309 gsf of office space and 557,525 gsf of special/shared use space to support FDA's mission for a total of up to 8,977,671 gsf; 11,709 parking spaces for FDA employees and support staff; 1,615 visitor parking spaces; and reconfiguration of the East Loop Road. The document evaluates installation of traffic adaptive/demand responsive signal systems on US 29, MD 650, and Cherry Hill Rd, changing the AM and PM peak periods cycle length to 150 seconds, and proposes grade separated interchanges at US 29 and Stewart Lane, Tech Road, and Musgrove Road. The EIS also calls for a transit hub near the Federal Research Center, and coordination with Montgomery County and SHA to enhance pedestrian and bicycle connections to and networks.

Countywide Bike Master Plan – MCDOT, May 2018

The Bicycle Master Plan sets forth a vision for Montgomery County as a world-class bicycling community, where people in all areas of the county have access to a comfortable, safe, and connected bicycle network, and where bicycling is a viable transportation option that improves the quality of life.

A number of new bikeways are recommended in the study area including a separated bikeway from Northwest Branch to Lorain Ave and from University Blvd to the I-495 bridge on the east side of US 29 as part of the Burtonsville to Silver Spring Breezeway. A separated bikeway is also recommended from Sandy Spring Road (MD 198) to Blackburn Road on the east side and from Tech Road to Rachel Carson Greenway on the west side of US 29.

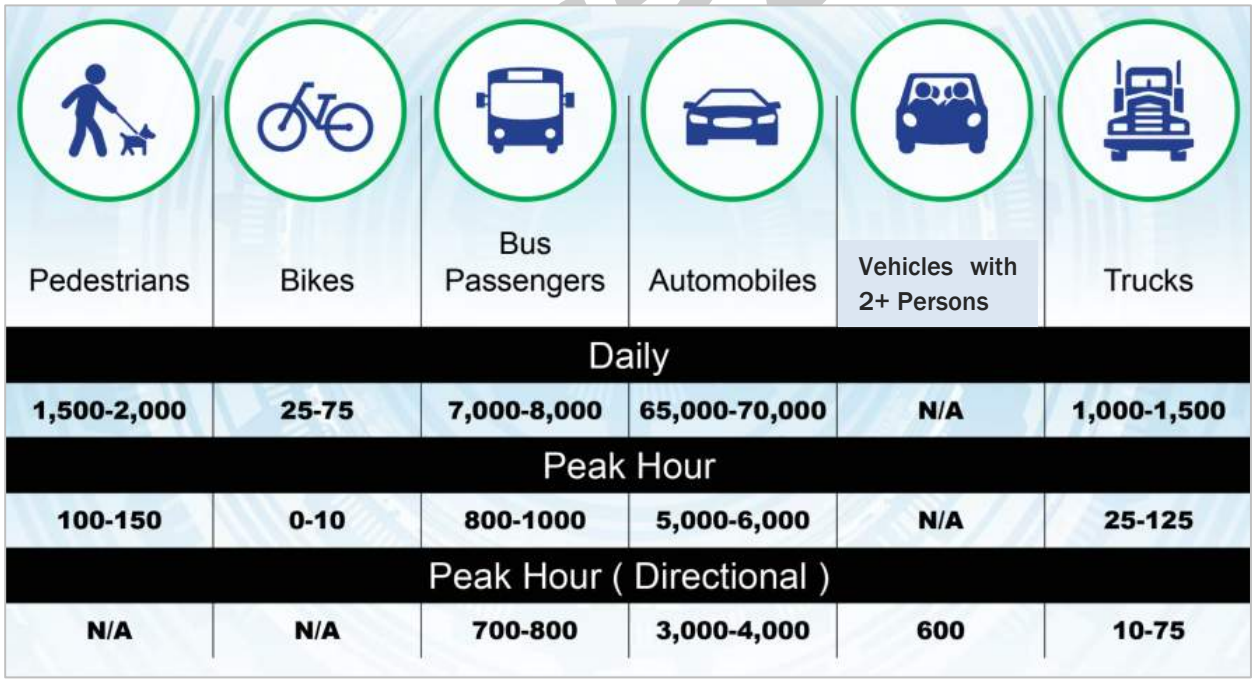
Existing Roadway Conditions and Traffic Operations

Roadway Characteristics

The roadway classification of US 29 changes from a principal arterial with traffic signals in the southern portion around Silver Spring and White Oak to a limited-access highway north of MD 650. The typical cross section along the US 29 corridor varies between four-lane, five-lane, and six-lane sections with additional turn and merge/diverge lanes. A reversible-lane segment extends approximately one mile from the MD 97 (Georgia Avenue) intersection to just south of the Sligo Creek Parkway intersection. This section, south of Sligo Creek Parkway, is undivided, while the section north of Sligo Creek Parkway is divided using a combination of curb and grass medians, with breaks at intersections along the US 29 corridor.

Traffic Volumes and Travel Times

The Average Daily Traffic (ADT) and travel times vary along the US 29 study corridor. Vehicular ADT ranges between 65,000 and 70,000 vehicles per day, and there are roughly 7,000 – 8,000 bus passengers per day. The peak direction of traffic flow is southbound during the AM peak and northbound in the PM peak. Passenger vehicle travel times in the corridor from Tech Road to Georgia Avenue range from under 15 minutes in the off-peak direction to over 25 minutes in the peak direction. Express buses operate only in the peak directions with travel times no more than 5 minutes greater than those for passenger vehicles, while local buses operate in both directions with travel times approximately 10 minutes greater than those for passenger vehicles.



Pedestrians	Bikes	Bus Passengers	Automobiles	Vehicles with 2+ Persons	Trucks
Daily					
1,500-2,000	25-75	7,000-8,000	65,000-70,000	N/A	1,000-1,500
Peak Hour					
100-150	0-10	800-1000	5,000-6,000	N/A	25-125
Peak Hour (Directional)					
N/A	N/A	700-800	3,000-4,000	600	10-75

Figure 5 2018 US 29 Traffic Volumes by Mode

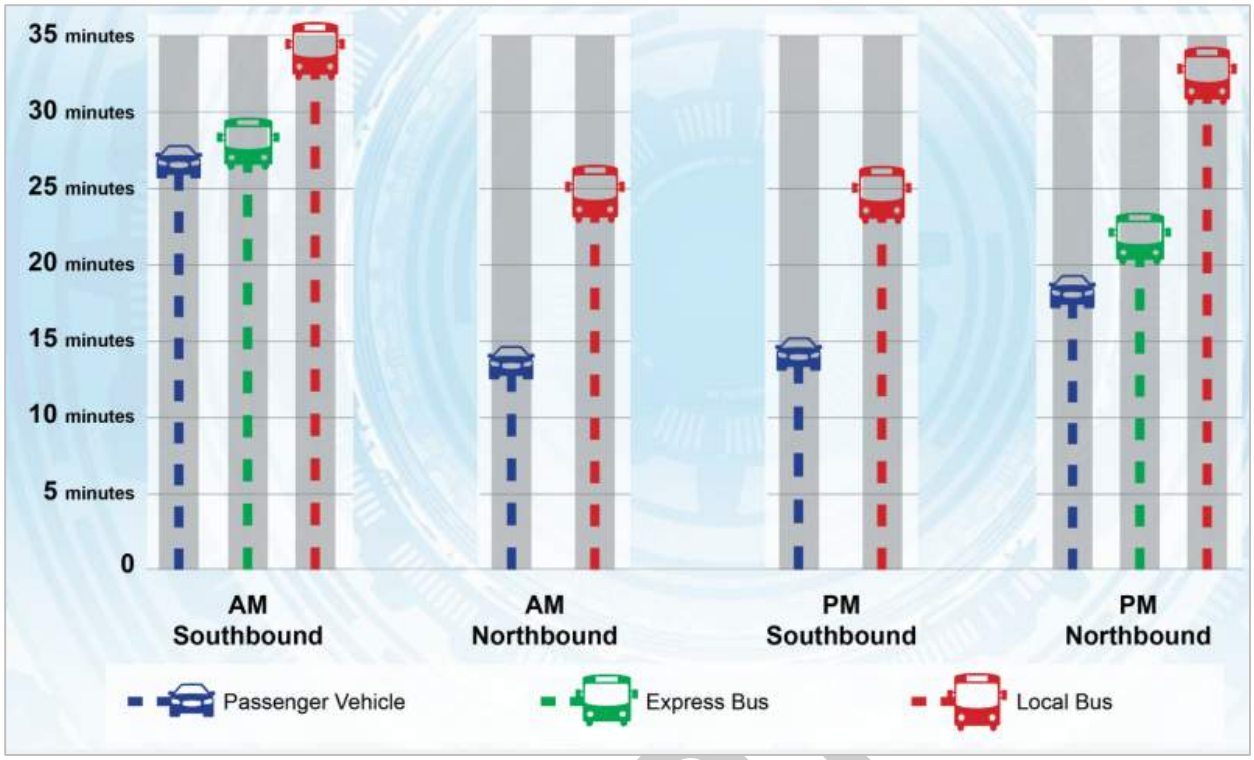


Figure 6. Existing Travel Times by Mode from Tech Road to Georgia Avenue (Sources: INRIX, WMATA and Ride ON AVL and field measured GPS)

Turning movement counts were developed for all study intersections along the corridor. The most recent counts were downloaded from the State Highway Administration's (SHA) Internet Traffic Monitoring System (I-TMS). Other sources of data, including previous reports of the US 29 corridor, were also used if collected more recently.

The raw intersection counts were then balanced between intersections and interchanges using a zero-balancing approach. This method disregards minor driveway volumes between intersections and assumes a zero difference between intersections. Peak hour volumes were rounded to the nearest 5 vehicles.

Appendix I displays balanced peak hour turning movement counts for the study intersections.

Model Development and Calibration

The intersections in the study area were coded into a Synchro network to perform capacity analysis. Synchro is a deterministic and macroscopic signal analysis computer software program that models street networks and traffic signal systems. Geometric data such as number of lanes, lane configuration, storage lengths, tapers, and distances between intersections were input into Synchro. Additionally, existing signal timings and phasing were obtained from Montgomery County Department of Transportation. These timings were coded into a Synchro traffic model along with existing traffic volumes. The model was calibrated to match field verified conditions.

Synchro software and the National Academy of Science's Transportation Research Board *Highway Capacity Manual* (HCM) methodology do not account for the potential impacts of upstream or downstream bottlenecks at intersections or on freeway segments/junctions (i.e. merge, diverge, weaving areas). Therefore, *VISSIM,* a microsimulation tool, was utilized to evaluate the overall operations of the corridor and the interaction between segments/roadways. The *VISSIM* model can account for these impacts and can also model specific transit inputs (i.e. BRT) that Synchro cannot. The VISSIM results reflect the impact

of adjacent signals, ramp terminals, junctions, etc. on each analysis segment/point and identify areas plagued by heavy congestion, long queues, and/or slow speeds
The microsimulation traffic analysis in *VISSIM* was conducted according MDOT-SHA coding and calibration guidelines. A base *VISSIM* model was developed using existing scaled aerial photography for the project Study Area. The existing AM and PM peak hour volumes and lane configurations were then input in *VISSIM*.

To confirm the calibration of the model, the simulated traffic volumes, speeds, and travel times along US 29 were compared to the INRIX (Fall 2017) and field collected data (Spring 2017). Default parameters were changed as needed during calibration to ensure model outputs were within the accepted model calibration thresholds.

Modeled Measures of Effectiveness

Intersection capacity analyses were performed using the industry HCM methodology. Synchro implements HCM methods of analysis, which were used for the intersection capacity analysis of all study intersections during weekday AM and PM peak hours.

Performance measures of effectiveness from the Synchro model include level of service (LOS), volume-to-capacity (v/c) ratio, and average vehicle delay. Key performance measures are defined as follows:

Level of Service (LOS) is a qualitative measure describing operational conditions of an intersection or any other transportation facility. LOS measures the quality of traffic service, and may be determined for intersections, roadway segments, or arterial corridors on the basis of delay, congested speed, volume to capacity (v/c) ratio, or vehicle density by functional class. At intersections, LOS is a letter designation that corresponds to a certain range of roadway operating conditions. The levels of service range from 'A' to 'F', with 'A' indicating the best operating conditions and 'F' indicating the worst, or a failing, operating condition.

The volume-to-capacity ratio (v/c ratio) is the ratio of current flow rate to the capacity of the intersection. This ratio is often used to determine how sufficient capacity is on a given roadway. Generally speaking, a ratio of 1.0 indicates that the roadway is operating at capacity. A ratio of greater than 1.0 indicates that the facility is operating above capacity as the number of vehicles exceeds the roadway capacity.

Delay (Control delay) is the portion of delay attributed to traffic signal operation for signalized intersections. Control delay (overall delay) can be categorized into deceleration delay, stopped delay, and acceleration delay.

Additional metrics include ***travel time*** and ***person throughput.*** Person throughput is defined as the number of distinct persons able to travel the system/ network during the analysis period. Typical person-throughput by mode per lane per hour is shown in **Figure 7**. It should be noted that the parts of US 29 which operate as a limited access expressway and display higher vehicle occupancy rates could have slightly higher motor vehicle person throughputs.

Table 4 and **Table 5** show each Level of Service and their corresponding delay values for signalized and unsignalized intersections, respectively. Detailed capacity analysis worksheets and outputs are included in **Appendix II** for existing and future conditions

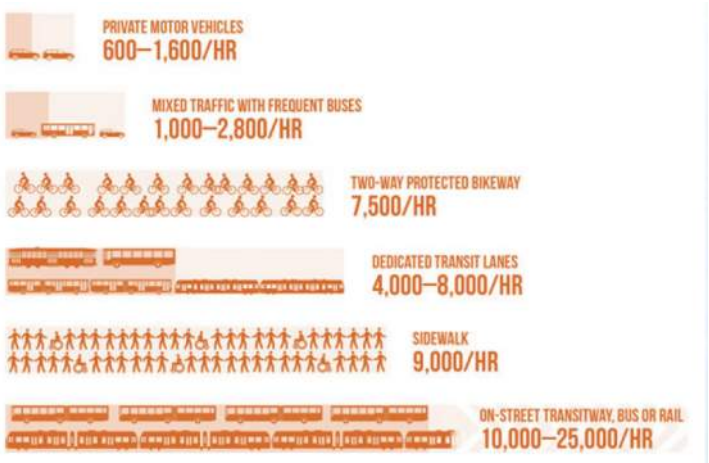


Figure 7. Person throughput illustration

Table 4. Signalized Intersection Level of Service Delay Ranges

Signalized Intersections		
Level of service	**Delay range (sec)**	**General Description**
A	≤10	Free Flow
B	>10 and ≤20	Stable Flow (slight delays)
C	>20 and ≤35	Stable Flow (acceptable delays)
D	>35 and ≤55	Approaching Unstable Flow (high delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 and ≤80	Unstable Flow (excessive delay)
F	>80	Forced Flow (congested and queues fail to clear)

Table 5. Unsignalized Intersection Level of Service Delay Ranges

Unsignalized Intersections	
Level of service	**Delay range (sec)**
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Key measures of effectiveness from VISSIM evaluated for this study include travel times (minutes), speeds (mph) and throughput (vehicles/hour) which is then converted to person throughput using average vehicle occupancy.

Roadway Congestion and Safety

The US 29 corridor is characterized by variable traffic volumes and associated congestion (depending on location within the corridor) that hinders both general vehicle and transit bus mobility and results in unpredictable travel times and unreliable transit service. The congestion is most prevalent south of MD 650, particularly around MD 193 (Four Corners), I-495 and downtown Silver Spring. This congestion also frequently causes existing Metrobus and Ride On bus services on US 29 to operate behind schedule.

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 in the US 29 corridor exceed their volume to capacity ratio to the point that they are considered as “unstable and Breakdown flow” sections. There are several intersections and roadway sections that operate at Level of Service (LOS) F. This represents very poor existing traffic operations for the corridor that lead to extended and more variable travel times and vehicles detouring to other facilities.

Based on the Synchro/HCM analysis **Table 6** summarizes the intersections which operate with a LOS E or LOS F during at least one peak hour:

Table 6: Existing Failing Intersections

Intersection	LOS	
	AM	PM
US 29 & Blackburn Rd	-	-
US 29 & Greencastle Rd	F	F
US 29 & Fairland Rd	-	-
US 29 & Musgrove Road	-	-
US 29 & Tech Rd	F	F
US 29 & Industrial Parkway	-	-
US 29 & Milestone Drive/Stewart Lane	-	-
US 29 & Prelude Drive	-	-
US 29 & Burnt Mills Avenue	-	-
US 29 & Lockwood Drive	-	-
US 29 & Burnt Mills Shopping Ctr	-	F
US 29 & Southwood Ave	E	-
US 29 & MD 193 Eastbound	-	-
US 29 & Lanark Way	-	-
US 29 & Franklin Ave	-	-
US 29 & Sligo Creek Parkway & St. Andrews Way	F	F
US 29 & MD 391 (Dale Dr)	F	F
US 29 & Spring St	F	-
US 29 & Fenton St	-	-
Colesville Rd & 2nd Ave/Wayne Ave	-	-

In addition to failing intersections several segments also experience failing link level of service. Some of these failing links are due to intersection operations while others are due to congestion at ramp merge/diverge areas with intersecting corridors (e.g. I-495). The link levels of service are based on percent of base free-flow speed and were calculated from the VISSIM model outputs. **Table 7** summarizes the failing segments during at least one peak hour.

Table 7: Existing Failing Segments

US 29 Segment Limits		LOS			
		AM		PM	
North	South	SB	NB	SB	NB
Blackburn Rd	Greencastle Rd	-	-	-	-
Greencastle Rd	Fairland Rd	-	-	-	-
Fairland Rd	Musgrove Rd	-	-	-	-
Musgrove Rd	Tech Rd	F	-	-	-
Tech Rd	Industrial Pkwy	-	F	-	F
Industrial Pkwy	Stewart Ln Slip Ramp	F	-	-	-
Stewart Ln Slip Ramp	Stewart Ln	F	-	-	-
Stewart Ln	Prelude Dr	F	-	-	-
Prelude Dr	Burnt Mills Ave	F	-	-	-
Burnt Mills Ave	Lockwood Dr	F	-	-	-
Lockwood Dr	Burnt Mills SC	F	-	-	-
Burnt Mills SC	Southwood Ave	F	-	-	E
Southwood Ave	MD 193 WB	F	-	-	-
MD 193 WB	MD 193 EB	F	-	-	-
MD 193 EB	Lanark Way	-	-	-	E
Lanark Way	N. 495 Interchange	-	-	-	-
Franklin Ave	Sligo Creek Pkwy	E	-	F	-
Sligo Creek Pkwy	Dale Dr	-	-	F	F
Dale Dr	Spring St	-	-	-	F
Spring St	Fenton St	-	F	E-	E
Fenton St	Georgia Ave	-	-	E	-
Georgia Avenue	Wayne Avenue	F	F	F	F

Other performance measures such as travel times and vehicle throughput were output from the calibrated existing VISSIM models. Person-throughput was subsequently calculated from the vehicle throughput. These are summarized in **Table 8 and Table 9,** respectively. The model results are consistent with the results shown in the *Traffic Volumes and Travel Times* section above.

The 'Time to Enter' value is the calculated additional delay to account for vehicles on US 29 that are delayed outside of the corridor endpoints due to congestion/queues extending beyond these endpoints.

Table 8. VISSIM Modeled Travel Times from MD 198 to Georgia Avenue

Passenger Vehicle Travel Times (min) - AM Peak Hour			
US 29 - Southbound		**US 29 - Northbound**	
Segment	**Existing Conditions**	**Segment**	**Existing Conditions**
Time to Enter[1]	2.7	Greencastle to MD 198	1.3
MD 198 to Greencastle	2.8	Fairland to Greencastle	2.3
Greencastle to Fairland	2.3	Cherry Hill to Fairland	1.7
Fairland to Cherry Hill	1.5	MD 650 to Cherry Hill	3.4
Cherry Hill to MD 650	7.2	MD 193 to MD 650	3.5
MD 650 to MD 193	11.9	Franklin to MD 193	1.5
MD 193 to Franklin	1.8	Georgia to Franklin	4.5
Franklin to Georgia	4.1	Time to Enter[1]	4.8
Total	**34.3**	**Total**	**23.1**

Passenger Vehicle Travel Times (min) - PM Peak Hour			
US 29 - Southbound		**US 29 - Northbound**	
Segment	**Existing Conditions**	**Segment**	**Existing Conditions**
Time to Enter[1]	0.9	Greencastle to MD 198	1.1
MD 198 to Greencastle	1.6	Fairland to Greencastle	3.7
Greencastle to Fairland	2.6	Cherry Hill to Fairland	1.4
Fairland to Cherry Hill	1.6	MD 650 to Cherry Hill	4.4
Cherry Hill to MD 650	3.2	MD 193 to MD 650	5.3
MD 650 to MD 193	4.1	Franklin to MD 193	1.9
MD 193 to Franklin	1.5	Georgia to Franklin	5.6
Franklin to Georgia	4.8	Time to Enter[1]	8.1
Total	**20.3**	**Total**	**31.4**

*Time to enter includes the delay for vehicles waiting to enter the corridor

Table 9. VISSIM Modeled Person Throughput

AM Peak Hour					
Location	Existing Conditions				
	Vehicle Throughput		Person Throughout		
	Passenger Cars	Buses	Passenger Cars	Buses	Total
Southbound					
South of Blackburn	3700	8	4250	250	4500
South of Musgrove	3400	16	3900	475	4375
South of Industrial	2950	26	3400	775	4175
South of Lockwood	3275	32	3775	950	4725
South of MD 193	3475	35	4000	1050	5050
South of Hastings	2500	35	2875	1050	3925
South of Dale Dr	2425	43	2800	1300	4100
Northbound					
South of Blackburn	2500	0	2875	0	2875
South of Musgrove	1875	0	2150	0	2150
South of Industrial	2025	5	2325	150	2475
South of Lockwood	2025	10	2325	300	2625
South of MD 193	1600	12	1850	350	2200
South of Hastings	1600	12	1850	350	2200
South of Dale Dr	1050	18	1200	550	1750
PM Peak Hour					
Location	Existing Conditions				
	Vehicle Throughput		Person Throughout		
	Passenger Cars	Buses	Passenger Cars	Buses	Total
Southbound					
South of Blackburn	2700	0	3100	0	3100
South of Musgrove	2075	0	2375	0	2375
South of Industrial	2425	5	2800	150	2950
South of Lockwood	2425	11	2800	325	3125
South of MD 193	2100	14	2425	425	2850
South of Hastings	1675	14	1925	425	2350
South of Dale Dr	1325	18	1525	550	2075
Northbound					
South of Blackburn	3025	8	3475	250	3725
South of Musgrove	3150	15	3625	450	4075
South of Industrial	3100	18	3575	550	4125
South of Lockwood	3425	24	3950	725	4675
South of MD 193	3075	27	3525	800	4325
South of Hastings	3075	27	3525	800	4325
South of Dale Dr	2425	34	2800	1025	3825

Throughput calculations assumed an average vehicle occupancy of 1.15 persons per passenger vehicle and 75% occupancy of buses (based on performance data collected as part of the US 29 TIGER FLASH grant application) with a maximum average capacity of 40 persons per bus. During the morning peak hour, modeled person throughput varies between 4,000 and 5,000 persons in the peak southbound direction and 1,750 and 3,000 in the off-peak northbound direction. During the evening peak hour, modeled person throughput varies between 3,800 and 4,700 in the peak northbound direction and 2,000 and 3,100 in the off-peak southbound direction.

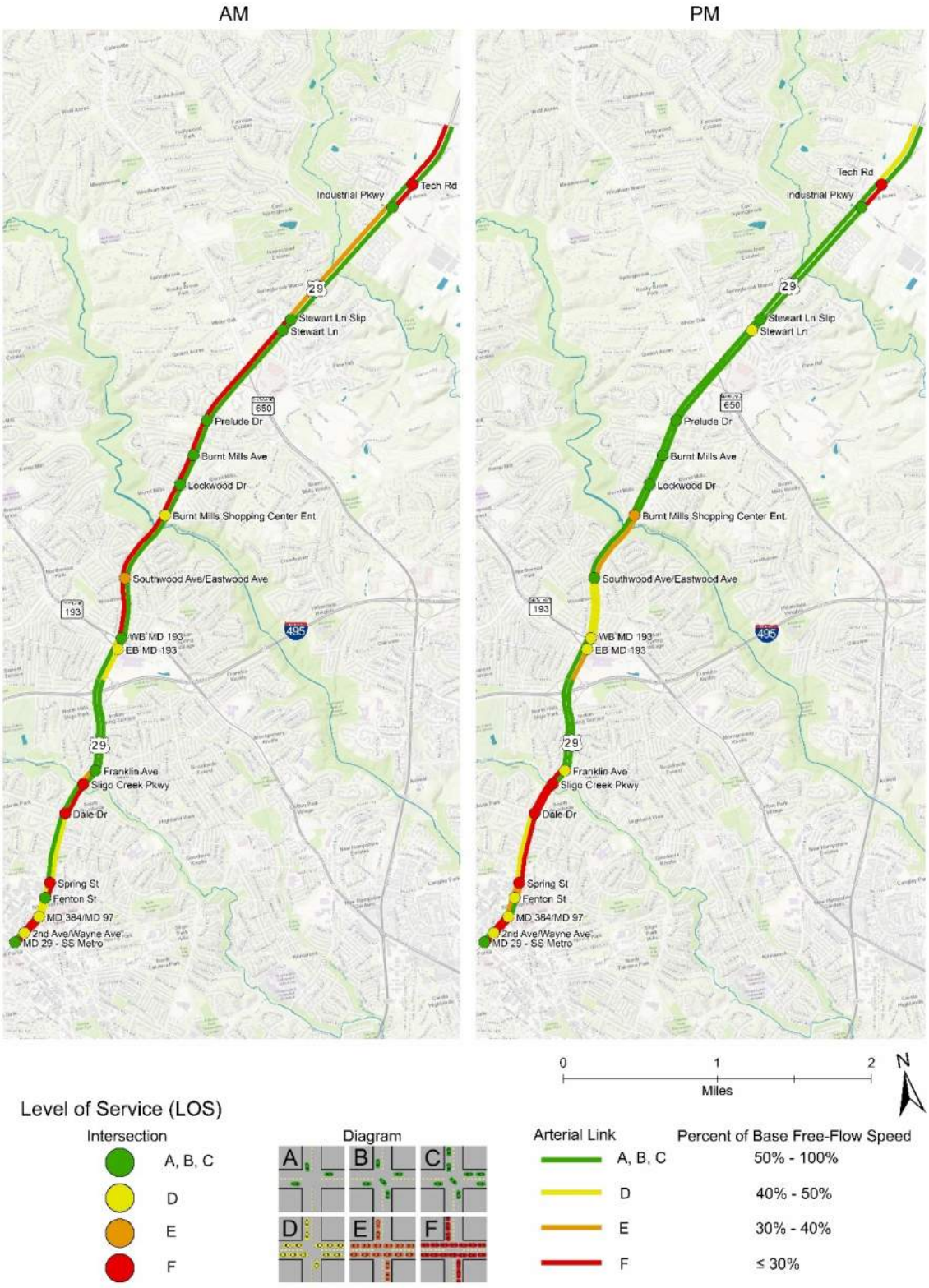


Figure 8 – Existing Conditions Level of Service

Transit Conditions

All current transit service along the US 29 corridor is provided by three operators: Montgomery County Ride On, Washington Metropolitan Area Transit Authority (WMATA) Metrobus Z-line bus, and the MDOT MTA Commuter Bus. WMATA provides Metrorail Red Line service at the Silver Spring Station, which is near the Silver Spring Transit Center.

The Transit Center serves as a hub for the Metrorail, MARC, Ride On, Metrobus, and local shuttle services. It is also a future stop for the Purple Line Light Rail. The MTA MARC Brunswick Commuter Rail Line stops in Silver Spring are less than a block away from the Metrorail station.

Montgomery County Ride On Bus

Montgomery County Ride On bus service covers portions of the US 29 corridor. Four of the routes, the 8, 9, 10, and 14 generally make frequent, all day stops within the corridor and operate at headways ranging from 20-30 minutes. Routes 13, 21 and 22, operate on a limited peak period schedule with headways ranging from 25-30 minutes, providing service during weekday morning and evening peak travel times with no mid-day/off peak service.

Metrobus

The 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 all day local service, while Z9/Z29 and Z11/Z13 provides limited stop express service with no off-peak services.

The Z-lines serve the area between Silver Spring Transit Center and Lockwood Drive/New Hampshire Avenue and offer a combined average service headway of 10 minutes in the a.m. peak period (6 a.m. to 9 a.m.) and six to seven minutes in the p.m. peak (4 p.m. to 7 p.m.). The combined average service headway declines farther north; 15 minutes in the a.m. and eight-and-a-half minutes in the p.m. from Lockwood Drive/New Hampshire Avenue to US 29 and Industrial Parkway, and 30 minutes north of Industrial Parkway.

Metrorail

The Silver Spring Metrorail Red Line Station is located at the south end of the study corridor. 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 DC and connecting Montgomery County and downtown DC. The U-shaped Red Line alignment is approximately 31.9 miles long from Shady Grove to Glenmont and crosses perpendicular to US 29 on the east leg of its rail alignment. The Red Line has frequent service during the weekday rush hours, and it provides reasonably frequent services during off-peak hours and weekends.

FLASH

Beginning in late 2020, the County will initiate FLASH premium bus service with 11 stations. The service will use existing bus-on-shoulder lanes on US 29 in the northern section of the corridor. In other sections, it will operate in mixed traffic as well as along portions of Lockwood Drive, Stewart Lane, Briggs Chaney Road, and Castle Boulevard. Service plans include two route patterns running every 7.5 minutes during the peak period (AM and PM rush hours) and every 15 minutes during the off-peak. The span of service is from 5 am to midnight, 7 days/week. Figure 9 illustrates the existing transit routes. Proposed FLASH service routes are shown in the inset map.

Table 10 summarizes existing transit service providers, route miles and stops within and crossing the US 29 corridor. Tables 11 and 12 summarize Ride On and WMATA ridership by route, segmented within the study area and along US 29 proper.

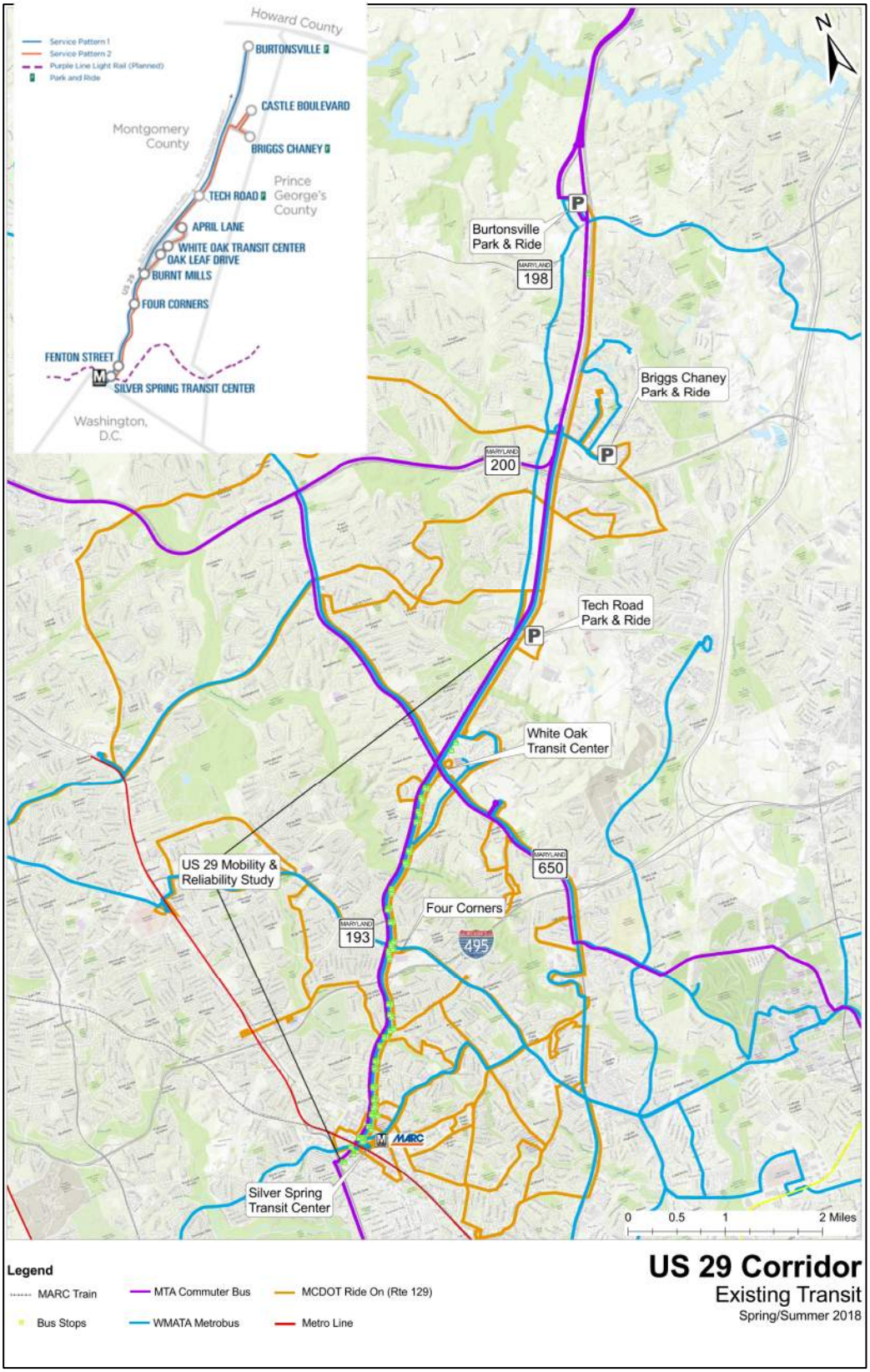


Figure 9. Existing US 29 Corridor Transit Services

Table 10. Existing Transit Operations along US 29 Corridor

		Route Miles within Corridor	Stops/ Stations within Corridor
Serving US 29 Corridor			
Ride On			
8	SSTC to Sligo Creek Pkwy	1.27	15
9	SSTC to MD 193	2.28	22
12	SSTC to at Spring St.	0.61	6
13	SSTC to Sligo Creek Pkwy	1.29	15
14	On US 29 at Franklin Ave.	1.47	16
21	SSTC to MD 650	4.98	43
22	SSTC to MD 650	4.66	45
129	Started in May 2018 SSTC to Burtonsville	13.25	25
WMATA			
Z2	SSTC to MD 650	4.54	53
Z6	SSTC to Tech Rd & Briggs Chaney to Burtonsville	11.56	110
Z7	SSTC to Briggs Chaney	11.19	61
Z8	SSTC to Burtonsville	11.91	113
Z11	SSTC to Briggs Chaney, Green Castle, Burtonsville	12.03	34
MTA			
305	Burtonsville to SSTC and DC Core	10.73	5
315	On US 29: Burtonsville to SSTC and DC Core	10.60	5
325	On US 29: Burtonsville to SSTC and DC Core	10.10	4
Primarily Service Crossing US 29			
Ride On			
10	No stops on 29, Stops at Tech Road & Lockwood Dr.	3.33	19
16	On US 29: Georgia to Fenton	0.64	3
17	On US 29: Georgia to Fenton	0.50	3
20	On US 29: Georgia to Fenton	0.62	4
WMATA			
F4	On US 29: Georgia to SSTC	0.5	5

Table 11. RideOn Ridership

	Within Study Area		On US 29/ FLASH alignment		Total	
	Boardings	Alightings	Boardings	Alightings	Boardings	Alightings
Weekday Ridership (Routes serving US 29/ FLASH route)						
8	85	114	191	167	276	281
9	262	233	352	359	614	592
12	259	310	262	194	520	504
129			255	208	255	208
13	54	54	48	63	102	117
14	547	609	221	205	768	815
21	108	142	178	144	286	286
22	200	195	283	288	483	483
Total	**1,515**	**1,656**	**1,789**	**1,628**	**3,304**	**3,284**
Weekday Ridership (Routes primarily crossing US 29)						
10	578	631	358	293	936	924
16	1,354	1,206	116	100	1,470	1,306
17	469	437	179	131	648	567
20	2,223	2,325	470	398	2,722	2,723

Table 11. RideOn Ridership (continued)

	Within Study Area		On US 29/ FLASH alignment		Total	
	Boardings	Alightings	Boardings	Alightings	Boardings	Alightings
Saturday Ridership (Routes serving US 29/ FLASH route)						
8	37	43	141	130	178	173
9	139	128	215	224	354	352
12	151	186	148	119	298	305
14	232	225	97	107	329	332
Total	**559**	**581**	**601**	**580**	**1,159**	**1,161**
Saturday Ridership (Routes primarily crossing US 29)						
10	386.63	400.12	253.66	214.71	640.29	614.83
16	1,263	1,107	91	83	1,353	1,190
17	238	230	110	82	348	312
20	1,672	1,727	295	240	1,967	1,967
Total	**3,556**	**3,464**	**750**	**620**	**4,309**	**4,084**
Sunday Ridership (Routes serving US 29/ FLASH route)						
9	140.18	136.62	239.92	248.32	380.10	384.94
12	163.88	197.27	165.58	116.94	329.46	314.21
Total	**304.06**	**333.89**	**405.50**	**365.26**	**709.56**	**699.15**
Sunday Ridership (Routes primarily crossing US 29)						
10	436	421	315	238	751	658
16	976	845	82	75	1,058	920
17	167	177	90	56	257	233
20	1,255	1,293	236	198	1,490	1,491
Total	**2,834**	**2,736**	**723**	**566**	**3,557**	**3,303**

Table 12. WMATA Ridership

	Within Study Area		On US 29/ FLASH alignment		Total	
	Boardings	Alightings	Boardings	Boardings	Alightings	Boardings
Weekday Ridership (Routes serving US 29/ FLASH route)						
Z11	105	66	706	745	811	811
Z2	157	193	425	386	582	579
Z6	496	430	1,977	2,044	2,473	2,473
Z7	18	18	327	342	345	360
Z8	83	71	2,749	2,761	2,832	2,832
Total	**859**	**777**	**6,185**	**6,278**	**7,044**	**7,055**
Weekday Ridership (Routes primarily crossing US 29)						
F4	625.78	621.37	495.39	590.21	1,121.17	1,211.58
Saturday Ridership (Routes serving US 29/ FLASH route)						
Z11	3	1	19	20	22	22
Z6	311	258	1,485	1,538	1,796	1,796
Z7	1	1	10	10	11	11
Z8	2	5	2,245	2,242	2,247	2,247
Total	**317**	**265**	**3,760**	**3,810**	**4,076**	**4,076**
Saturday Ridership (Routes primarily crossing US 29)						
F4	374	368	333	374	706	374
Sunday Ridership (Routes serving US 29/ FLASH route)						
Z8	1	5	2,644	2,640	2,645	2,645
Sunday Ridership (Routes primarily crossing US 29)						
F4	229	216	239	247	2,434	2,434

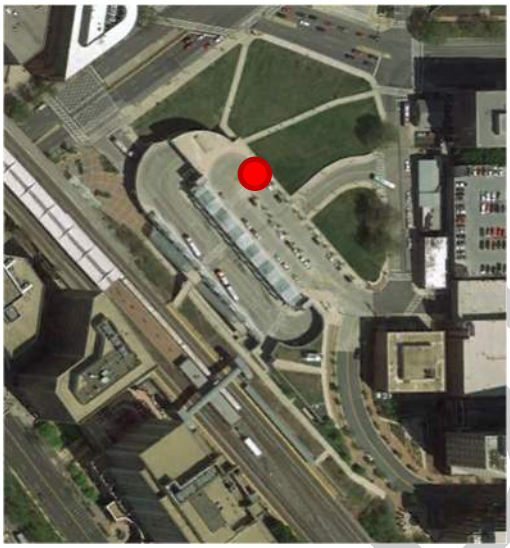
Existing FLASH Station Accessibility

This section of the report documents existing walking and biking conditions including gaps and barriers, land use, key connections, location and quality of existing bicycle facilities, and planned bicycle facilities at the stations between Silver Spring and Tech Road.

Station 1 – Silver Spring Transit Center

Station 1 is located inside the Silver Spring Transit Center, a transportation hub connecting a Metrorail station, MARC train station and 20 Montgomery County Ride On and 24 Metrobus bus stops as well as routes for FDA Shuttle, University of Maryland shuttle, MetroAccess and Intercity Buses. The site will also include a station location for the new Purple Line, to be constructed between the Silver Spring Transit Center and the corner of US 29 and Wayne Avenue, slated for completion in 2022. The transit center is located in the area bounded by US 29, Wayne Avenue, Ramsey Avenue, Ripley Street, and the MARC tracks. The BRT station will be located in the northernmost portion of the transit center's second level.

Development Patterns



BRT Station Location

Ground Level of Silver Spring Transit Center

The area within a half mile radius of Station 1 is characterized by commercial land use, primarily retail and office use with some residential use. Multi-family residential buildings are present on the main corridor while single family detached housing is located away from US 29. The station is located in downtown Silver Spring, a central business district that includes an arts and entertainment district. NOAA's Silver Spring campus, a four-building complex housing 80 percent of the agency's Washington-area employees, is located adjacent to the Silver Spring Transit Center. Maryland Department of Parole and Probation – Silver Spring Field Office is also located in Downtown Silver Spring, and the Silver Spring Civic Building, District Court for Montgomery County, Silver Spring Library and Fire Station are located within the half-mile radius of Station 1.

According to UrbanTurf, four future developments in Downtown Silver Spring will result in the construction of 18,181 residential units, 137,000 square feet of publicly owned and operated spaces,140,150 square feet of public use and amenities, and 64,200 square feet of retail space.

Key Connections

Due to the status of this location as a major transportation hub and the high number of pedestrian generators in the area, accessible pedestrian connectivity is of utmost importance. Downtown Silver Spring streets have wide sidewalks for the most part, accommodating pedestrian traffic well. Sidewalks on Georgia Avenue and US 29 are approximately 20 feet wide and narrower side streets have 10 feet wide sidewalks. With a major transit hub surrounded by more than 5,000 dwelling units and 7 million square feet of office space, US 29, 2nd Avenue, Wayne Avenue, East-West Highway and Fenton Street should accommodate pedestrians and have facilities to ensure safe pedestrian crossings. Although the sidewalk infrastructure is present and provides adequate space for pedestrians, crosswalk improvements are necessary for a better connectivity and safer pedestrian environment. The improvements will help a more accessible path between the Silver Spring Transit Center and the NOAA buildings and destinations on East West Highway, such as the Blair Park Shopping Center. Improved pedestrian accessibility to south of the Metro Platform also creates a better connection between the transit station and the neighborhoods of Colonial Village and Shepherd Park in northeast Washington D.C. Pedestrian friendly crosswalks with medians in the downtown Silver Spring core encourages walking to local retail and community amenities such as the Silver Spring Public Library and the AFI Cinema. Expanding and improving the pedestrian network north of downtown Silver Spring provides connectivity to the Woodside Park neighborhood.

Bicycle Access

Low stress[1] bicycle routes (appropriate for children and novice riders) that provide access between FLASH stations and local destinations are summarized. In addition, existing bicycle facilities, projects under development, and planned facilities within each station area are listed.

Current very low stress bicycle routes include Spring Street parallel to Colesville Road and 2nd Avenue perpendicular to Colesville Road

Existing Facilities

- Separated bike lanes intersecting Colesville Road on 2nd Avenue

Capital Projects

- Dixon Ave Separated Bike Lanes
- Metropolitan Branch Trail Phase 2

Planned Facilities

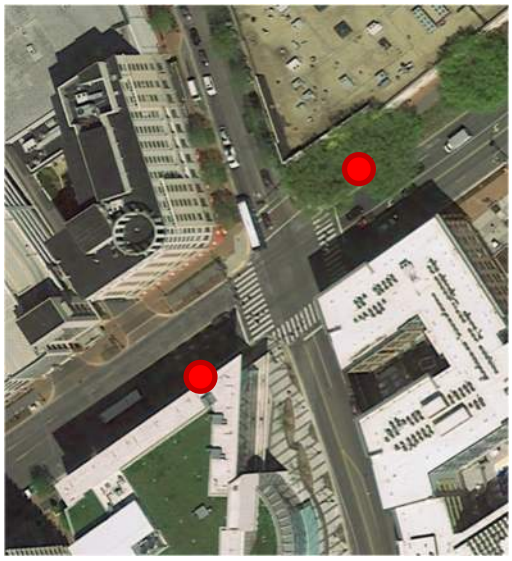
The Montgomery County Bicycle Master Plan recommends many improvements in the Downtown Silver Spring area in order to provide safe and defined routes for bicyclists. The area is less than half a mile to the border of Washington D.C. and within a mile of the Montgomery College Takoma Park campus, a number of parks such as Jessup Blair Local Park, Acorn Park, and other neighborhood parks in Maryland as well as Rock Creek Park in Washington D.C.

- Separated bike lanes along Colesville Road between 16th St and Georgia Ave
- Separated bike lanes intersecting Colesville Road on MD 410

[1] As defined by Montgomery County's modified Bike LTS methodology (https://mcatlas.org/bikestress/documentation/ModifiedLevelOfTrafficStressMethodology.pdf)

Station 2 – Fenton Street

Station 2 is located on US 29 near Fenton Street. The northbound stop is located south of Fenton Street (near-side of the intersection) and the southbound stop is located north of Fenton Street (near-side of the intersection). The proposed northbound BRT station is collocated with an existing bus stop serving five WMATA routes, eleven RideOn routes and four MTA Commuter Bus routes. The northbound bus stop has an existing bus shelter. The southbound BRT station at Fenton Street is a new location south of an existing far-side bus stop on US 29 near Spring Street.



BRT Station Locations

Northbound (above) and Southbound BRT Station Locations

Development Patterns

The area within a half mile radius of Station 2 is characterized by commercial and residential land use, primarily retail and multi-family and single-family residential units. Multi-family residential buildings are present on the main corridor closer to the station and to the south, while single-family detached housing is located further north off of US 29 and on local streets away from US 29. The station is located in downtown Silver Spring, a central business district that includes an arts and entertainment district. The AFI Silver Theatre, a 675-seat cinema, is located adjacent to the proposed northbound station location. Hotels and apartments are located near the proposed southbound bus station location. Two biotechnology companies are within a block of the Fenton Street BRT Station. The Silver Spring Civic Building, District Court for Montgomery County, Silver Spring Library and Fire Station are located within the half-mile radius of Station 2. Maryland Department of Parole and Probation – Silver Spring Field Office is also located in Downtown Silver Spring. NOAA's Silver Spring campus, a four-building complex housing 80 percent of the agency's Washington-area employees, is located within a half mile radius of Station 2.

According to UrbanTurf, four future developments in Downtown Silver Spring will result in the construction of 1,8181 residential units, 137,000 square feet of publicly owned and operated spaces,140,150 square feet of public use and amenities, and 64,200 square feet of retail space.

Key Connections

Due to the close proximity to mixed-use developments with both day and night uses, and the high number of pedestrian generators in the area, accessible pedestrian connectivity is critical. Downtown Silver Spring streets have wide sidewalks for the most part, accommodating pedestrian traffic well. Sidewalks on US 29

are approximately 20 feet wide and side streets have 10 feet wide sidewalks. The sidewalk infrastructure exists in the corridor; however, the condition of these sidewalks need improvement in order to provide an accessible pedestrian environment for all users. Expanding the network of sidewalks and improving crosswalks near Station 2 improves the quality of walkability in downtown Silver Spring. Fenton Street and its surrounding area has a diverse foot traffic generated by employees in the area, those traveling to the commercial corridor and Silver Spring residents. Pedestrian-friendly crosswalks with medians in the downtown Silver Spring core encourages walking to local retail and community amenities, such as the Silver Spring Public Library and the AFI Cinema. Expanding and improving the pedestrian network north of downtown Silver Spring provides connectivity to the Woodside Park neighborhood.

Bicycle Access

Current very low stress bicycle routes include Alton Parkway and Ellsworth Drive parallel to US 29 and Spring Street perpendicular to US 29.

Existing Facilities

- Separated bike lanes intersecting US 29 at Spring Street/Cedar Street

Capital Projects

- Cameron Street to Planning Place Bikeway
- Fenton Street Bikeway
- Dale Drive Shared-Use Pathway

Planned Facilities

The Montgomery County Bicycle Master Plan recommends many improvements in the Downtown Silver Spring area to provide safe and defined routes for bicyclists. The area is less than half a mile to the Silver Spring Transit Center and the NOAA Headquarters, and within a mile to the border of Washington D.C. and a number of parks such as Nolte Local Park and Sligo Creek Golf Course, Bullis Park and two schools, the Silver Spring International Middle School and the Sligo Creek Elementary School.

- Neighborhood greenways parallel to US 29 on Alton Parkway and Ellsworth Drive

Station 3 – University Boulevard

Station 3 is located on US 29 near University Boulevard. The northbound stop is located south of University Boulevard across from Lanark Way, backing Montgomery Blair High School. The proposed northbound BRT station is collocated with an existing bus stop serving three Metrobus routes and two Montgomery County RideOn routes. The southbound stop is located on US 29 north of University Boulevard and south of Timberwood Avenue. The southbound BRT station at University Boulevard is collocated with an existing stop serving four Metrobus routes. That stop includes an existing bus shelter.

Northbound BRT Station Locations

Southbound BRT Station Locations

Development Patterns

The area within a half mile radius of Station 3 is characterized primarily by residential land use, but also includes a small portion of commercial use and several institutional uses. Small commercial strips are located to the north, east, and west of the intersection of University Boulevard and US 29. Three schools (Montgomery Blair High School, St Bernadette School and Silver Spring Day School) are to the south and east of the intersection, off of University Boulevard. Other community-focused uses, including a YMCA, funeral house, a church and a retirement community are within a half mile of the proposed stations.

No major development plans were found for the area within a half mile radius of Station 3.

Key Connections

Due to the nature of the area, with majority residential development, three schools and a central area with multiple shopping centers, the area surrounding Station 3 should have a well-connected network of accessible pedestrian paths. The area has great potential to encourage pedestrian activity with the correct infrastructure in place.

A comprehensive sidewalk infrastructure exists in the corridor, although the condition of these sidewalks needs improvement in order to provide an accessible pedestrian environment for all users. Sidewalks in the area are generally between five to ten feet wide, although some narrow sidewalks are adjacent to US 29 and University Boulevard with no buffer between the roadway and sidewalks. Sidewalk improvements would benefit students who walk to school, as well as residents in Woodmoor, South Four Corners and Indian Spring Terrace. The retirement community further west on University Boulevard would also benefit from wider sidewalks as the members of this community are less likely to be driving to destinations they are interested in traveling.

Neighborhoods south of I-495 are disconnected from the central commercial area and the future Station 3 location by the highway.

Bicycle Access

Current very low stress bicycle routes include most neighborhood streets in the vicinity of Four Corners, but US 29 and MD 193 (Univ Blvd) are barriers that prevent very low stress access from these streets to other locations in the vicinity of Four Corners.

Existing Facilities

- Sidepath along US 29 and MD 193 (Univ Blvd) on frontage of Montgomery Blair HS

Capital Projects

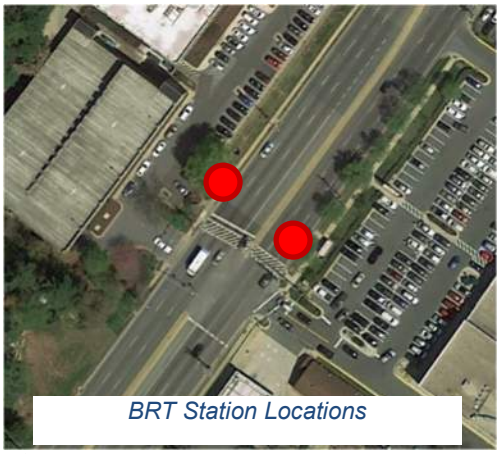
- Franklin Ave Sidewalks

Planned Facilities

- Sidepaths intersecting US 29 along MD 193 (Univ Blvd)
- Neighborhood greenways parallel to US 29 on Brunett Ave/Southwood Ave and Pierce Drive/Woodmoor Circle (also including short separated bikeway segment along Lexington Dr)

Station 4 – Burnt Mills

Station 4 is located on US 29 south of Lockwood Drive. The northbound stop is adjacent to the Burnt Mills Shopping Center, collocated with an existing bus stop, at the far side of the Shoppes of Burnt Mills Entrance intersection. This bus stop has an existing bus shelter in place. The existing northbound bus stop serves three Metrobus routes and three Montgomery County Ride On routes. The southbound stop is located in front of an office complex collocated with an existing bus stop. This bus stop is at the near-side of the intersection of the Shoppes of Burnt Mills, and serves three Metrobus routes and three Montgomery County Ride On routes.



BRT Station Locations

Northbound BRT Station Location

Southbound BRT Station Location

Development Patterns

The area within a half mile radius of Station 4 is mostly residential with only the immediate surrounding of the station characterized by commercial and office space.

Three medical office buildings on the west side of US 29 are the dominant land use in the immediate vicinity of Station 4. There is also a retail strip located on the east side of US 29, along with two gas stations on the east and west side of the corridor. Other uses in the half mile radius of Station 4 are a Dance School at the corner of Lockwood Drive and US 29, a Hebrew Congregation and Church (both on Lockwood Drive).

The residential land use near the station is primarily single-family homes with a few townhomes and apartment buildings. The Northwest Branch of the Anacostia River separates the neighborhoods of White Oak and Burnt Mills to the north from Northwood Park and Woodmoor to the south.

Key Connections

The area surrounding Station 4 could benefit significantly from having a BRT station and increased pedestrian and bicycle amenities along US 29 in the future. While sidewalks are present on US 29, they are narrow in some areas at around 4 feet wide with no buffer between the pedestrian space and vehicles traveling on US 29. Trails that run perpendicular to US 29 along Northwest Branch seem to have poor connectivity across the river and could be better utilized if the paths crossed the river. Providing residents

a safe pedestrian environment where they are able to walk from the neighborhood to the commercial strip would reduce the need to drive for the short distance. Employees in the office buildings will also benefit with safer connectivity between the two sides of US 29. The disconnected and poor condition sidewalks are also lacking safe intersection crosswalk conditions. In addition to sidewalks along the roads in the area, adding connections from the neighborhood to US 29 would shorten the distance pedestrians need to travel. For example, a well-used dirt path exists between Wheeler Drive and US 29, however it is not ADA accessible and improvements could be made.

Bicycle Access

Current very low stress bicycle routes include most neighborhood streets in the vicinity of Burnt Mills, but US 29 is a barrier that prevents very low stress access from these streets to others. The only very low stress bicycle route to cross US 29 in this area is at Burnt Mills Avenue.

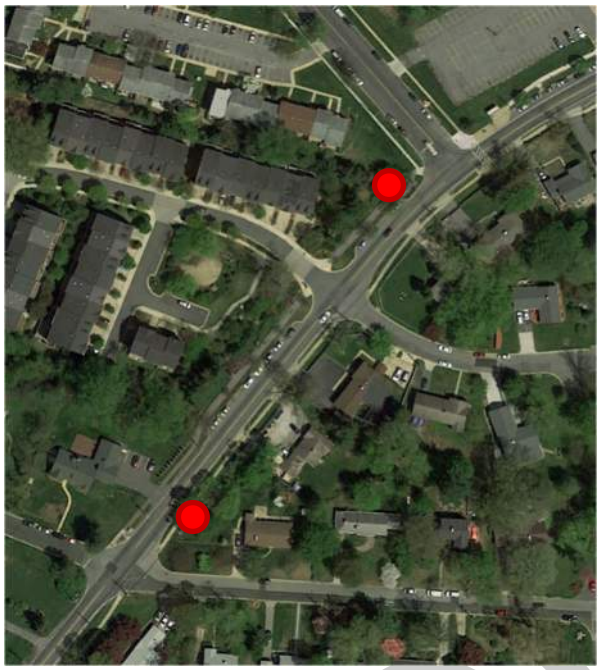
Planned Facilities

The Montgomery County Bicycle Master Plan recommends improvements for Burnt Mills and White Oak in order to provide connectivity for bicyclists along the US 29 corridor and parallel roads that would be lower stress routes for cyclists. Bicycle connectivity would help link Burnt Mills to New Hampshire Avenue and the FDA Headquarters located approximately 2.5 miles north.

- Sidepaths on US 29 and on Lockwood Drive

Station 5 – Oak Leaf Drive

Station 5 is located on Lockwood Drive north of Northwest Drive and south of Oak Leaf Drive. The northbound bus stop is at the far-side of the Northwest Drive on Lockwood Drive. It is collocated at with an existing bus stop serving three Metrobus routes and one Montgomery County Ride On route. There are no bus amenities at this location. The southbound stop is a new bus stop location at the far-side of Oak Leaf Drive.



BRT Station Locations

Northbound BRT Station Locations

Southbound BRT Station Locations

Development Patterns

The area within a half-mile radius of Station 5 is mostly residential The northeastern portion of the half-mile radius is primarily commercial, and the US FDA campus occupies the easternmost portion of the station environs.

Townhomes and single family residences make up the majority of housing stock in the half-mile radius of the proposed BRT stop. A few large apartment buildings are located further from the proposed station location, near the US 29/New Hampshire Avenue interchange. The White Oak neighborhood in this area is surrounded by multiple uses which result in both day and night activities in the area.

The three institutional land uses in the area are two churches and a Hebrew Congregation on Lockwood Drive. The Burnt Mills Elementary School is located off Northwest Drive west of Columbia Pike.

The 28-acre White Oak Shopping Center is at the northern edge of the Station 5's half-mile walkshed. The shopping center south of Lockwood Drive (across from White Oak Shopping Center) is an office building and a series of ancillary retail uses.

The U.S. Food and Drug Administration White Oak campus is east of New Hampshire Avenue and approximately 8,000 employees work on this campus.

The Commercial area east of New Hampshire Avenue and north of the FDA Campus is planned to be redeveloped. The plan is for a mixed-use walkable center to replace White Oak Shopping Center and open spaces for the communities. The development area is approximately 40 acres and will include residential and commercial uses. This will add some foot traffic and increase the travel destinations near Station 5.

Key Connections

The area surrounding Station 5 could benefit significantly from having proper pedestrian and bicycle amenities due to the existing land uses and the future BRT station. Lockwood Drive has sidewalks; however, the network is a series of different types of sidewalks at various widths. The sidewalk is typically four feet with places that have 10 feet wide sidewalks. The residential streets crossing Lockwood Drive do not have sidewalks for the most part, and those that do have narrow, subpar sidewalks. An elementary school is on Northwest Drive and it is critical to have safe pedestrian routes to the school for elementary school students to comfortably walk to and from school.

Due to the narrower street width on Lockwood Drive than Columbia Pike, encouraging pedestrians to walk on Lockwood Drive parallel to that segment of Columbia Pike would require proper infrastructure. Crosswalks near the proposed BRT Station 5 should be accessible. The intersection of New Hampshire Avenue and Lockwood Drive should be improved for pedestrian safety, due to the wide crossing distances of both streets. Pedestrian improvements are necessary for those who walk to the White Oak Shopping Center.

Bicycle Access

Current very low stress bicycle routes include Northwest Drive intersecting Lockwood Drive, and most other neighborhood streets. However, US 29 and New Hampshire Avenue are barriers that prevent very low stress access from these routes to local destinations.

Planned Facilities

The Montgomery County Bicycle Master Plan recommends improvements for the White Oak area in order to provide connectivity for bicyclists along the US 29 corridor and parallel roads that would be lower stress routes for cyclists. Bicycle connectivity would help link the residential area south of White Oak Shopping Center and the FDA campus with these destinations.

- Sidepaths on US 29 and on Lockwood Drive
- Separated bikeway intersecting Lockwood Drive and US 29 on New Hampshire Avenue

Station 6 – White Oak Transit Center

Station 6 is located on Lockwood Drive east of New Hampshire Avenue and south of the White Oak Shopping Center. The location is currently referred to as the Lockwood Transit Hub and a number of buses use the proposed stop locations. The proposed northbound and southbound BRT stations are co-located with existing bus stops that serve three Metrobus routes and one Montgomery County RideOn route. Another bus station is located approximately 400 feet east of the proposed BRT bus stops. Both existing stations have bus shelters.

Planned BRT Station Platform Locations

Planned Southbound BRT Station Location

Planned Northbound BRT Station Location

Development Patterns

The area within a half mile radius of Station 6 is characterized by commercial land use, primarily retail and office uses with some residential uses, and a major governmental job center within walking distance. The variety of land uses in this area result in high levels of daytime and evening activity.

The White Oak Shopping Center, a 28-acre shopping center with an anchor store, a major supermarket and a large parking lot, is located adjacent to the proposed BRT station. The area south of Lockwood Drive across from White Oak Shopping Center includes an office building and a series of ancillary retail uses.

Townhomes and apartments make up the majority of housing stock in the half mile radius of the proposed BRT stop. Multi-family residential buildings are present on Lockwood Drive and Stewart Lane, and some single-family units west of New Hampshire Avenue are also within a half mile radius of the station.

The Food and Drug Administration (FDA) campus, with approximately 8,000 employees, is east of New Hampshire Avenue and south of Station 6. Dow Jones & Company has a printing plant located at the northeast edge of the half mile radius.

The commercial area east of New Hampshire Avenue and north of the FDA Campus, including White Oak Shopping Center is planned to be redeveloped as a mixed-use, walkable center. The development area is approximately 40 acres, and will include residential and commercial uses, as well as open spaces for the

communities. This will add foot traffic and increase the variety of travel destinations near Station 6. The White Oak Science Gateway Project is a long-term plan that will eventually result in rebuilding many of the areas east of Oak Leaf Drive to Stewart Lane, south of Columbia Pike.

Key Connections

Due to the status of this location as a transportation hub serving various types of land uses in the area, providing wider, ADA accessible and comfortable sidewalk connections are important. Sidewalk widths vary between 4 feet to 7 feet within the half-mile radius. The potential to widen some 4' sidewalk segments should be considered where feasible. Welcoming pedestrian environments will lead to the reduction of vehicle trips for those residents living in the half mile radius and encourage walking as a means to get to local destinations. Furthermore, a well-connected pedestrian network addresses the needs of commuters and those traveling by public transportation to Lockwood Drive. Safe crosswalks are critical to this connectivity; especially for those living west of New Hampshire Avenue and north of US 29.

Bicycle Access

The current very low stress bicycle route in this area is Lockwood Stewart Drive and other neighborhood streets. However, US 29 and New Hampshire Avenue are barriers that prevent very low stress access from these routes to local destinations.

Existing Facilities

- Bike lanes on Lockwood Drive

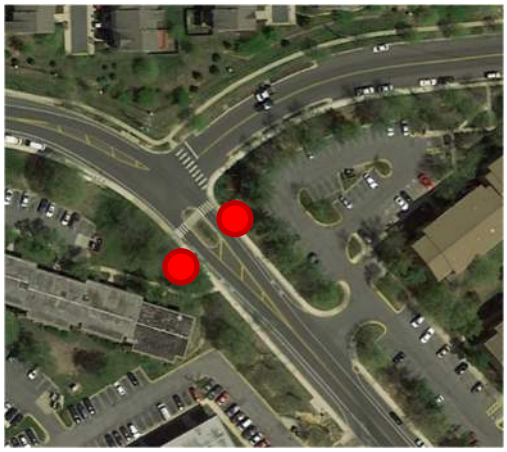
Planned Facilities

The Montgomery County Bicycle Master Plan recommends improvements for the White Oak area in order to provide connectivity for bicyclists along the US 29 corridor and parallel roads that would be lower stress routes for cyclists. Bicycle connectivity would help link the residential areas surrounding White Oak Shopping Center and the FDA campus with these destinations.

- Separated bikeway intersecting Lockwood Drive and US 29 on New Hampshire Avenue
- Separated bike lanes through White Oak Shopping Center continuing on Old Columbia Pike

Station 7 – Stewart Lane

Station 7 is located on Stewart Lane south of Columbia Pike between Lockwood Drive and April Lane. The proposed northbound bus stop is a near-side stop at April Lane and the southbound bus stop is a far-side bus stop at April Lane. Although there are no routes with stops at this location, existing Metrobus and Montgomery County Ride On bus stops are within 200 feet.



Planned BRT Station Locations

Planned BRT Station Locations (Looking northwest)

Development Patterns

The area within a half-mile radius of Station 7 is characterized by residential use, some commercial land use, both retail and office use, institutional use and is bordered by a major governmental job center to the south. The recommended BRT station location in this area would provide residents transit option as well as provide commute options for the office within a quarter mile of the proposed station location.

The residential community in the half-mile radius of the proposed BRT stop are mostly condominiums and townhomes. Single family residences are located northwest of Columbia Pike. A Montessori school is located across US 29 in the half-mile radius of the proposed location of Station 7. The White Oak Community Recreation Center is located within a quarter of a mile of Station 7.

The 28-acre White Oak Shopping Center, which features a department store, a major supermarket and a large parking lot, is located southwest of the proposed BRT station.

Dow Jones & Company has a printing plant located within a quarter mile of Station 7. The Food and Drug Administration (FDA) campus, with approximately 8,000 employees, is east of New Hampshire Avenue and at the southern edge of the half-mile radius of Station 7.

The commercial area east of New Hampshire Avenue and north of the FDA Campus, including White Oak Shopping Center is planned to be redeveloped as a mixed-use, walkable center. The development area is approximately 40 acres, and will include residential and commercial use, as well as open spaces for the communities. This will add foot traffic and increase the variety of travel destinations near Station 7. The White Oak Science Gateway Project is a long-term plan that will eventually result in rebuilding many of the areas east of Oak Leaf Drive to Stewart Lane, south of Columbia Pike.

Key Connections

Due to the residential nature of this location and nearby commercial use, accessible pedestrian connectivity is critical. Most of the area sidewalks are approximately five feet wide. These sidewalks should be wider for pedestrian safety. Welcoming pedestrian environments will lead to the reduction of vehicle trips for those

residents living in the area near Station 7 and encourage walking as a means to get to local destinations. Furthermore, a well-connected pedestrian network addresses the needs of commuters and those traveling by public transportation to Stewart Lane. Sidewalk connectivity within the neighborhood is also important. The neighborhood amenities such as the White Oak Community Recreation Center, would also benefit from the improved state of connectivity. Safe crosswalks are critical to this connectivity; especially for those crossing US 29 from the Spring Brook Manor neighborhood northwest of Columbia Pike.

Bicycle Access

The current very low stress bicycle route in this area is Lockwood Stewart Drive and other neighborhood streets. However, US 29 and New Hampshire Avenue are barriers that prevent very low stress access from these routes to local destinations.

Existing Facilities

- Bike lanes on Stewart Lane

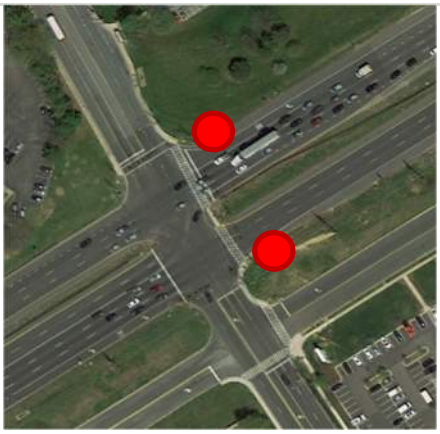
Planned Facilities

The Montgomery County Bicycle Master Plan recommends improvements for the White Oak area in order to provide connectivity for bicyclists along the US 29 corridor and parallel roads that would be lower stress routes for cyclists. Some initial bike lane markings have been painted on Stewart Lane and should be extended. Bicycle connectivity would help link the residential areas surrounding Station 7 with local destinations such as the White Oak Shopping Center and the FDA campus.

- Sidepaths on US 29 and on Lockwood Drive
- Neighborhood greenway/trails providing access from Sherbrooke Woods Lane and points west
- Trail connection from Lockwood Drive to Michelson Road and FDA Boulevard

Station 8 – Tech Road

Station 8 is located on Columbia Pike at the intersection of Tech Road. The proposed northbound location is at the far side of Tech Road and the proposed southbound location is at the near side of Tech Road. Although there are no routes with stops at this location, existing Metrobus and Montgomery County RideOn stops are within 300 feet on Tech Road and Old Columbia Pike. An existing park and ride lot is located northwest of the proposed southbound BRT Station.



Planned BRT Station Locations

Planned southbound BRT Station Location

Planned northbound BRT Station Location

Development Patterns

The area within a half mile radius of Station 8 is characterized by retail, industrial, residential and institutional land use. The variety of land use in this area result in high levels of daytime and evening activity on weekdays and weekends.

The Westech Corner shopping center on Tech Road consists of restaurants, a bank and two specialty stores. The shopping center is adjacent to the proposed northbound BRT station location. A hotel is also located by the shopping center. A storage facility is also located north of Westech Corner. Additional retail north of the shopping center include a home improvement retailer and a car dealership. The area south of Tech Road across from Westech Corner includes an office building and a bank at ground level. Two medical offices are also within quarter mile of the proposed BRT stations. Additional offices are located at the southern edge of the half mile radius of the proposed BRT stations.

The area south of Tech Road and north of Industrial Parkway, southeast of Columbia Pike is an industrial area with empty lots. A Montgomery County Public School bus depot is located in the southeast edge of the half mile radius.

The majority of residential land use is to the north and east of Columbia Pike. A mix of multi-family residential units and single-family dwelling units make up the residential land use. A religious organization's worldwide headquarters with (400 staff members) is located north of the proposed southbound Station 8. Other religious institutes are also located within the half mile radius of the proposed BRT stations.

The industrial area between Tech Road, Industrial Parkway and US 29 is slated for the White Oak Town Center, a proposed mixed use development. The development would include approximately 120 thousand

square feet of retail, 666 residential units, 76 unit hotel and a 56,000 square feet office building. The development would increase traffic to the area and would benefit from a BRT station located at its edge.

Key Connections

Due to the status of this location as an area with diverse land use, accessible pedestrian connectivity is critical. The area sidewalks are disconnected, narrow at approximately four feet wide and in poor condition. The sidewalk network should be connected and existing sidewalks should be wider. Welcoming pedestrian environments will lead to the reduction of vehicle trips for those residents living within the half mile radius and encourage walking as a means to get to local destinations. Furthermore, a well-connected pedestrian network addresses the needs of commuters and those traveling by public transportation to and from this area. As the existing bus stops and facilities indicate, this area has great potential for an added BRT station. The existing park and ride lot and numerous Ride On and Metrobus stations on Tech Road create a network of public transportation options. Due to the separation of many residential units northwest of Columbia Pike from the commercial and office use southeast of Columbia Pike, this area can improve in walkability by increasing safety at the intersections on US 29.

Bicycle Access

There are no very low stress bicycle routes in this area that provide access to the station area. Neighborhood streets on the west side of US 29 have low stress access to the Paint Branch Trail by the Randolph Road sidepath.

Planned Facilities

The Montgomery County Bicycle Master Plan recommends improvements for the White Oak area in order to provide connectivity for bicyclists along the US 29 corridor and parallel roads that would be lower stress routes for cyclists. Some initial bike lane markings have been painted on Old Columbia Pike north of Tech Road, however they should be improved and be extended. Bicycle connectivity would help link the residential areas surrounding Station 8 with local destinations and decrease vehicular use for practical distances.

- Sidepaths on both sides of US 29
- Separated bike lanes on Tech Road and Industrial Parkway, connecting through to FDA Boulevard
- Separated bike lanes on Broadbirch Drive, connecting through to Cherry Hill Road
- Sidepath along Old Columbia Pike, extending north.

Future Traffic Forecasts and Traffic Operations

Population, Households, and Employment

In 2017 the Round 9.1 Cooperative Forecasts used in the COG travel model estimated the population in the study area to be 136,948. This is expected to grow by 19 % by 2040 to 163,006. According to 2010 decennial US Census data, nearly 62 percent or study area residents are minorities and five percent of the households in the study area are considered low-income and living below the poverty line.

The Round 9.1 estimates for the 2017 number of households at 53,115 and employment at 61,880 jobs in the BRT corridor. These are expected to grow to 64,893 households (21%), and 89,403 jobs (44 %) by 2040. The activity centers at White Oak and Silver Spring are expected to drive future growth in the study area. **Table 13** below summarizes the demographic changes.

Table 13. US 29 Corridor Land Use 2017-2040 by District

Study Area Subdistrict	2017			2040			Change 2017-2040 (Value)			Change 2017-2040 (Percent)		
	Houses	Pop.	Jobs	Houses	Pop.	Jobs	Houses	Pop.	Jobs	Houses	Pop.	Jobs
Inside I-495	23,346	55,556	28,445	29,207	68,018	34,062	5,861	12,462	5,618	25.1	22.4	19.8
I-495 to MD 200	15,043	42,624	21,176	20,170	54,051	42,686	5,127	11,427	21,509	34.1	26.8	101.6
MD 200 to MD 198	14,377	37,715	9,809	15,099	39.679	10,127	722	1,964	318	5.0	5.2	3.2
North of MD 198	349	1,053	2,450	417	1,258	2,528	68	205	78	19.6	19.4	3.2
Total	53,115	136,948	61,880	64,893	163,006	89,403	11,778	26,058	27,523	22.1	19.0	44.5

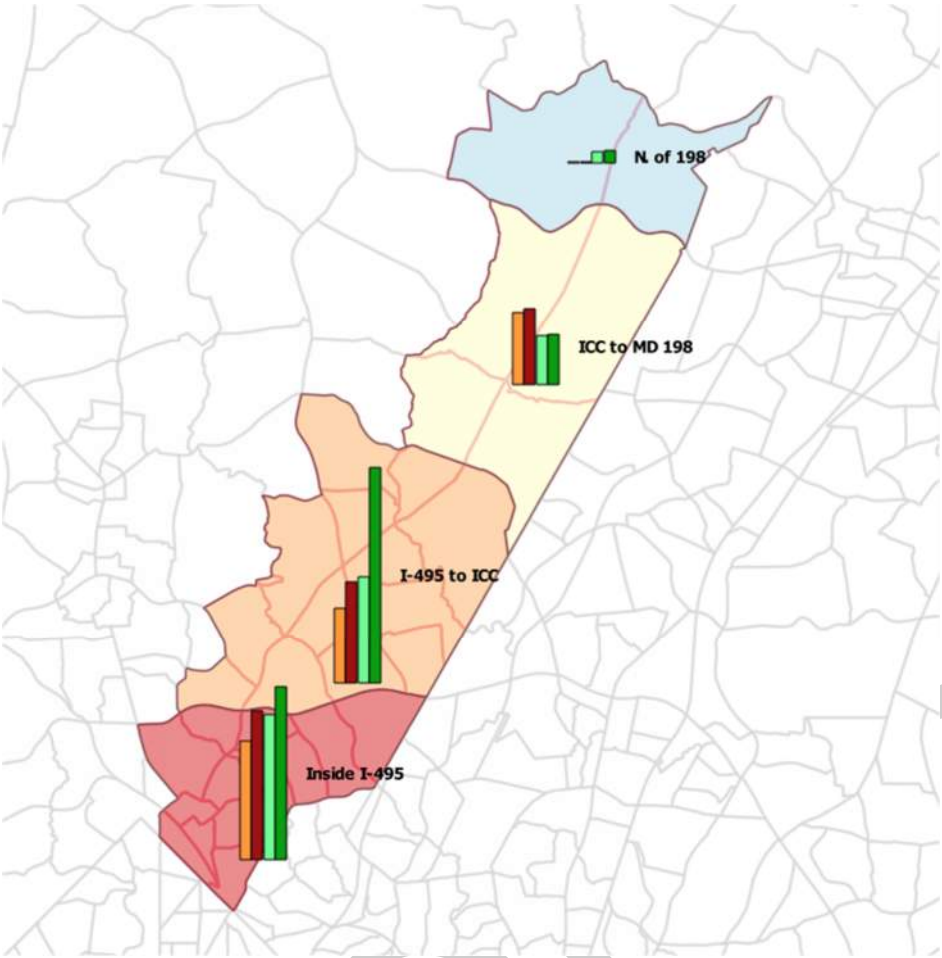


Figure 10 US 29 Corridor Land Use 2017 -2040 By District

As shown in **Figure 10**, population and employment in the corridor are both expected to grow between 2017 and 2040. The largest absolute increase in households (about 5,900) will take place south of I-495, and the largest absolute increase in employment (about 21,500) will take place between I-495 and MD 200. The largest relative increases in households (34%) and employment (102%) will take place between I-495 and MD 200. North of MD 200, relative and absolute household and employment growth is lower.

Activity centers at White Oak and Silver Spring are expected to drive future growth in the study area. As shown below in **Figure 11**, population and employment growth in those locations are much higher than in other parts of the corridor.

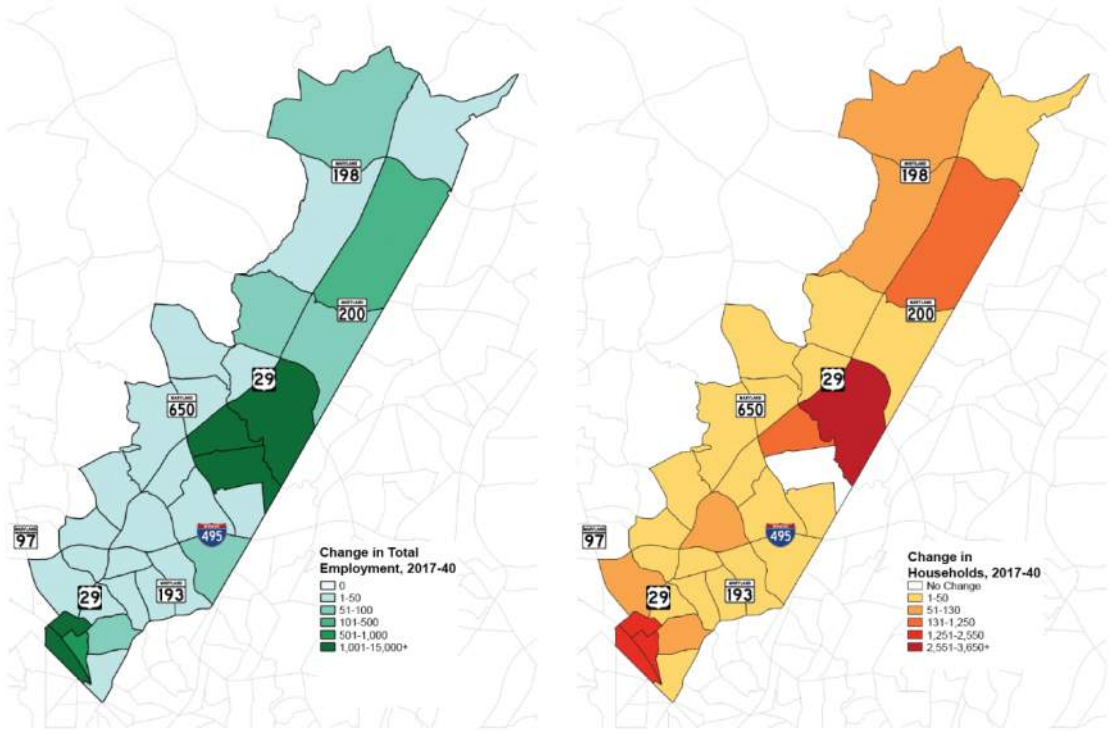


Figure 11. US 29 Subarea Change in Employment (left) and Households (right), 2017-40

Travel Forecasting Methodology

Travel Forecasting Model

The growth rates and traffic assignment patterns for input into the traffic analysis were developed using a subarea forecasting process based upon the MWCOG 2.3.70 Travel Demand Forecasting Model (TDFM) (the regional model adopted at the start of the study) with additional network and other inputs within the corridor from the MNCPPC Travel/4 Montgomery County travel forecasting model. The MWCOG 2.3.70 TDFM used the Round 9.0 Cooperative Forecasts for its land use (population, households, and employment) inputs which were updated with the Round 9.1 Cooperative Forecasts for Montgomery County along with other refinements from the MNCPPC Planning Department.

The MWCOG travel demand model is developed at the level of detail needed to support the regional constrained long-range plan and air quality analysis. Consequently, more detailed networks and Traffic Analysis Zones (TAZs) are often needed to capture the local traffic patterns and access locations for subarea/corridor studies and their operational analyses. This was found to be the case for the US 29 Mobility Study. The post mode choice assignment approach used was therefore developed to add the desired level of detail and mimic the previous MNCPPC Travel/3 model subarea process used for similar studies (such as the White Flint Sector Plan Update). This post mode choice assignment process has been

used successfully for recent analyses of the Germantown MARC Rail Area Sector Plan, and the MD 355 Phase II Montrose Parkway Extension Phase II Analysis.

The process included the following steps.

- Use as a foundation the 2017 and 2040 MWCOG 2.3.70 Travel forecasting Model networks and zone land use files. Update the land use within Montgomery County from the Round 9.0 to 9.1 Cooperative forecasts.
- Transfer 2017 and 2040 network detail, TAZ boundary splits within the US 29 Corridor "impact area" from the MNCPPC Travel/4 travel forecasting model. This included providing:
    - detailed “micro coding” for US 29 as a divided highway with accurate ramps
    - correcting the time of day lane changes for US 29 inside the beltway
    - coding the future BRT network routes and stop assumptions and removal of proposed interchanges at Tech Road, Musgrove Rd, and Fairland Pkwy.
- Check the network and other assumptions within the corridor for accurate number of lanes, time of day characteristics, distances, speeds, and functional classes.
- Conduct new base runs (2017, 2025, and 2040) of the regional model.
- Add additional network and TAZ detail for the study area including turn restrictions by time of day.
- Prepare a new detailed subarea forecast using post mode choice assignment and carry out reasonableness checks. This included:
    - Disaggregate the land use data (population, households, employment) from each MWCOG parent TAZ to its Subarea Study child TAZs
    - Take the updated base regional model person trip tables output from the mode choice model (by purpose and mode) and disaggregate them based upon the subarea TAZ land use and MWCOG trip production and attraction formulas.
    - Carry out the subarea post mode choice assignment using the detailed subarea network and TAZs (this also includes the auto driver and time of day steps in the MWCOG Model).
    - Carry out reasonableness checks on the results to the 2017 24-hour traffic counts and update assignment parameters including facility types and link specific free flow speeds and capacities and turn restrictions.
- Prepare the horizon year (2025, 2040) subarea detailed base forecasts:
    - Transfer the network assignment validation parameters to the 2025 and 2040 networks.
    - Create the 2025, 2040 subarea land use data file (zone.dbf) based future development plans, and inputs from MNCPPC, the county and other sources.
    - Incorporate the latest White Oak Master Plan and developer updates in the assumptions.
    - Take the MWCOG 2.3.57a person trip tables output from the mode choice model and disaggregate/expand them based upon the subarea TAZ land use and the MWCOG trip production and attraction formulas.
    - Carry out the subarea post mode choice assignment using the detailed subarea network and TAZs (this also includes the auto driver and time of day steps in the MWCOG Model).
- Prepare the link and turning movement growth factors used for the peak hour operational analyses.

This process is shown in **Figure 12.**

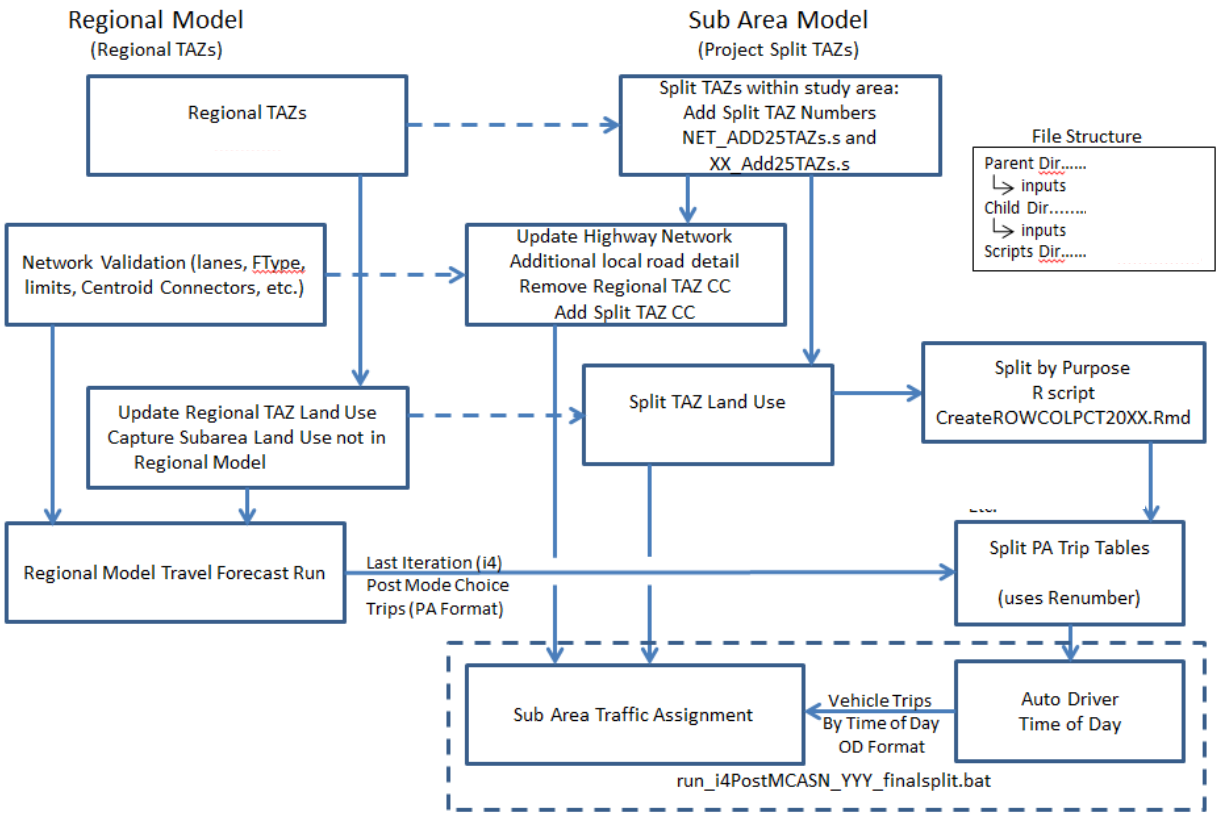


Figure 12 Subarea Assignment Process (MWCOG Base Model)

Post Processing

The model outputs daily vehicle trips (ADT) and traffic assignments for the study area. The Transportation Research Board's National Cooperative Highway Research Plan 255/765 post-processing methods were developed and applied to refine the model outputs for existing and projected traffic volumes and develop future year local traffic/intersection level data for the study intersections. This process developed a balanced 2025 and 2040 volume set of intersection level traffic counts, which are included in **Appendix I**.

2025 No Action Analysis

2025 No Action Scenario

Under the No Action scenarios, there are no changes from existing conditions in the study area except for the installation of a new traffic signal at the intersection of US 29 at Lanark Way.

Traffic Analysis Methodology

Intersection capacity analysis was performed at each study intersection under the 2025 No Action scenario. Future 2025 turning movement volumes were coded into a Synchro network to perform capacity analysis using the same methodology described in the Existing Conditions section. The results summarize operations of each study intersection using the same key measures of effectiveness. The turning movement volumes were also updated in the VISSIM models.

2025 No Action Results

Roadway Conditions and Traffic Operations

Arterial and intersection levels of service for the AM and PM Peak hours are shown in **Figure 13** below for vehicles and **Figure 14** for the BRT. Intersections which show a failing level of service (LOS E or LOS F) during at least one peak based on HCM methodology are shown **Table 14,** and segments which show a failing level of service during at least one peak are shown in **Table 15.**

Table 14: 2025 No Action Failing Intersections

Intersection	LOS	
	AM	PM
US 29 & Blackburn Rd	E	-
US 29 & Greencastle Rd	F	F
US 29 & Fairland Rd	E	-
US 29 & Musgrove Road	-	-
US 29 & Tech Rd	F	F
US 29 & Industrial Parkway	-	-
US 29 & Milestone Drive/Stewart Lane	-	E
US 29 & Prelude Drive	-	-
US 29 & Burnt Mills Avenue	-	-
US 29 & Lockwood Drive	-	-
US 29 & Burnt Mills Shopping Ctr	E	F
US 29 & Southwood Ave	F	-
US 29 & MD 193 Eastbound	-	-
US 29 & MD 193 Eastbound	E	-
US 29 & Lanark Way	E	-
US 29 & Hastings Way	-	-
US 29 & Franklin Ave	-	F
US 29 & Sligo Creek Parkway & St. Andrews Way	F	F
US 29 & MD 391 (Dale Dr)	F	F
US 29 & Spring St	F	F
US 29 & Fenton St	-	E
US 29 & Georgia Avenue	-	-
Colesville Rd & 2nd Ave/Wayne Ave	E	-

In addition to 15 failing intersections (eight more than existing conditions), 21 segments (4 more than existing conditions) also experience failing link level of service in at least one peak hour. Some of the failing links are due to intersection operations while others are due to congestion at ramp/merge areas with intersecting corridors. The link levels of service are based on percent of base free-flow speed and were calculated from the speeds output from the VISSIM model. The segments in **Table 15** below operate at LOS E or F in at least one direction in at least one peak hour:

Table 15: 2025 No Action Failing Segments

US 29 Segment Limits		LOS			
		AM		PM	
North	South	SB	NB	SB	NB
Blackburn Rd	Greencastle Rd	E	-	-	-
Greencastle Rd	Fairland Rd	-	-	-	F
Fairland Rd	Musgrove Rd	F	-	-	-
Musgrove Rd	Tech Rd	F	-	-	-
Tech Rd	Industrial Pkwy	F	F	-	F
Industrial Pkwy	Stewart Ln Slip Ramp	F	-	-	-
Stewart Ln Slip Ramp	Stewart Ln	F	-	-	-
Stewart Ln	Prelude Dr	F	-	-	-
Prelude Dr	Burnt Mills Ave	F	-	-	-
Burnt Mills Ave	Lockwood Dr	F	-	-	-
Lockwood Dr	Burnt Mills SC	F	-	-	-
Burnt Mills SC	Southwood Ave	F	-	E	F
Southwood Ave	MD 193 WB	F	-	F	F
MD 193 WB	MD 193 EB	-	-	F	F
MD 193 EB	Lanark Way	E	-	F	F
Lanark Way	N. 495 Interchange	E	E	F	E
Franklin Ave	Sligo Creek Pkwy	E	-	F	-
Sligo Creek Pkwy	Dale Dr	-	F	F	F
Dale Dr	Spring St	-	E	-	F
Spring St	Fenton St	-	F	F	F
Fenton St	Georgia Ave	-	E	E	-

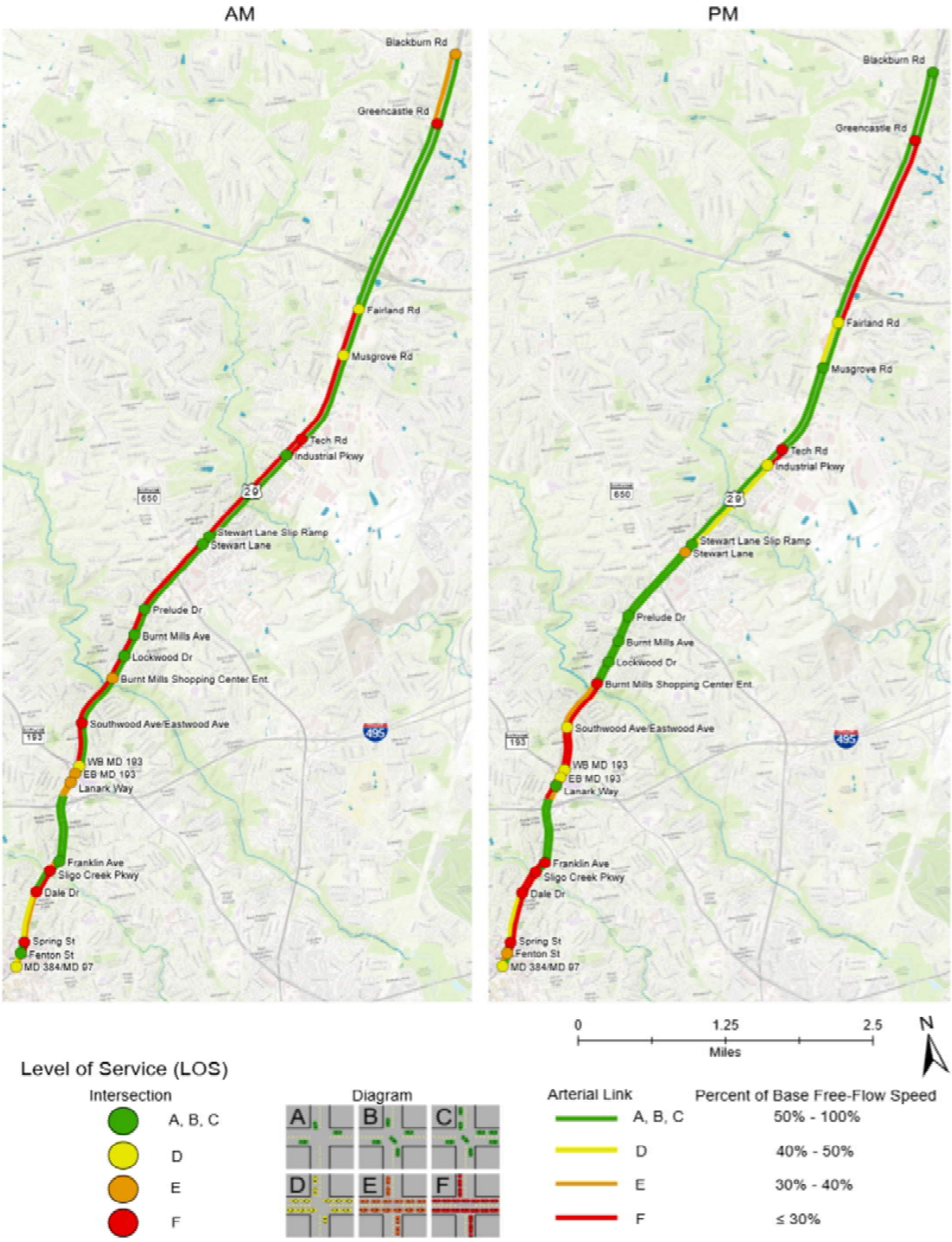


Figure 13: 2025 No Action Link and Intersection Level of Service - Vehicles

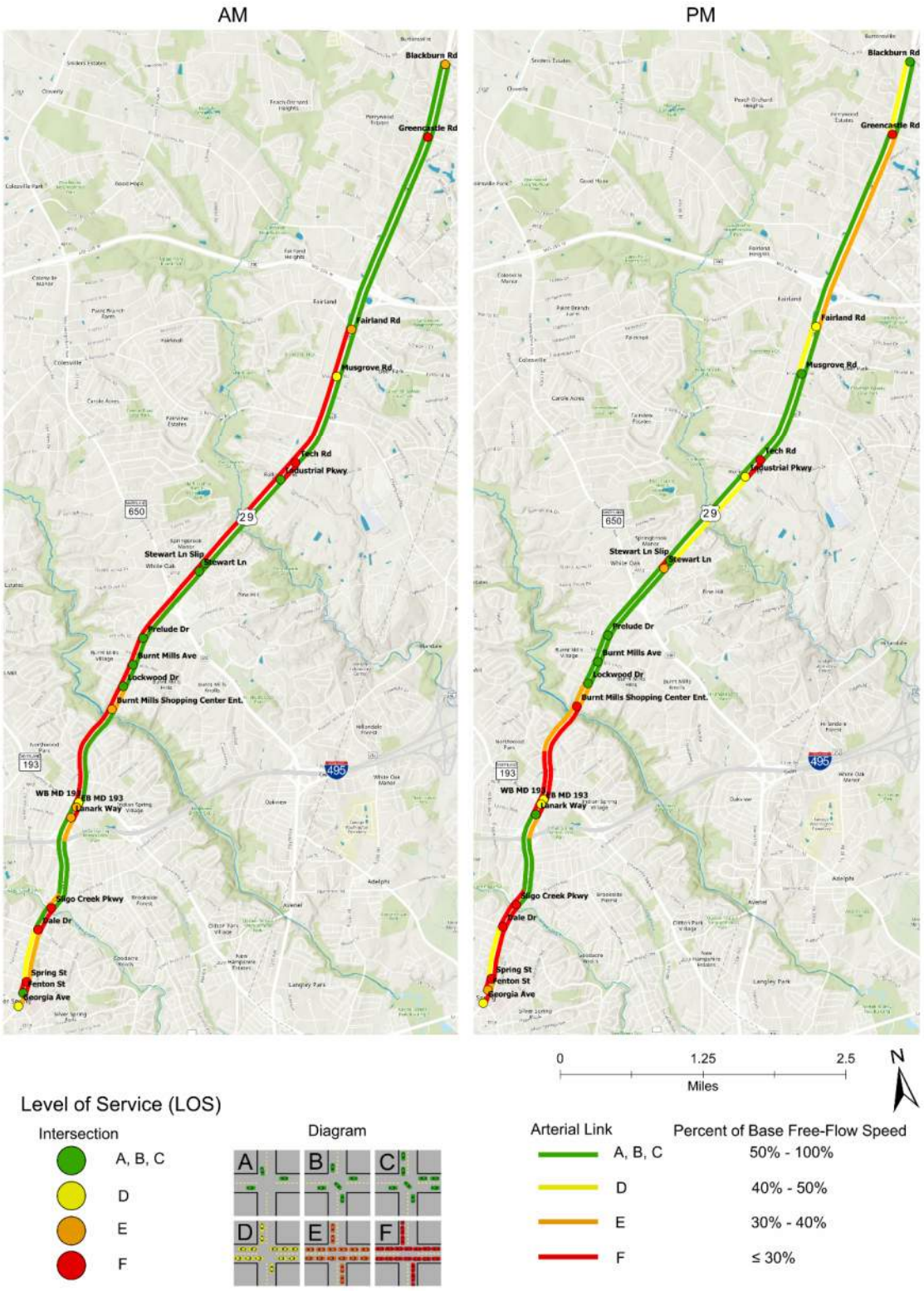


Figure 14: 2025 No Action Link and Intersection Level of Service - BRT

Travel Times

Travel times for 2025 No Action passenger vehicles and buses by peak period and travel direction are shown in **Figure 15** below. Without any improvements, travel times in the southbound AM are expected to nearly double for passenger vehicles; and increase by 10 minutes for peak hour peak direction buses in comparison to existing conditions.

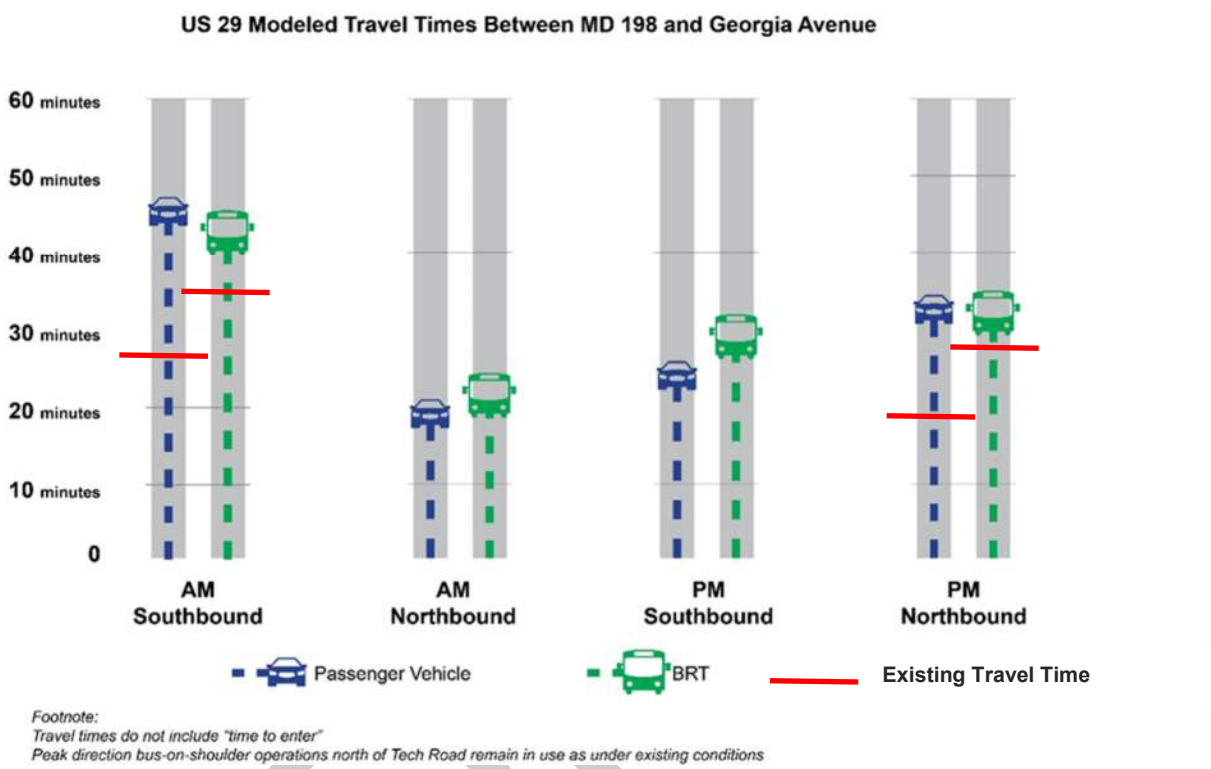


Figure 15: 2025 No-Action Modeled Travel Times Between MD 198 and Georgia Avenue

Alternatives Development and Evaluation

Building on previous studies and stakeholder input, a menu of improvement types was identified to address the project's goals. These improvement types included:

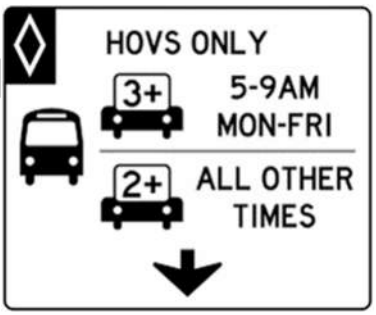
- **Targeted Intersection Improvements** to address roadway capacity needs and reduce bottlenecks
- **Robust Pedestrian and Bicycle** facility upgrades and new connections for station accessibility for walking and biking
- **Transportation Demand Management / Traffic Technology and Traveler Information** measures to reduce non-recurring congestion and encourage carpooling
- **Corridor-Level Design and Operational Treatments for Bus Priority**

Specifically, for the corridor level bus priority alternatives, the following options were evaluated based on concepts provided by the US 29 Bus Rapid Transit Corridor Advisory Committee:

- **Dedicated Median Bus Lane**: Buses would run at all times in an exclusive guideway within a physically separated right-of-way in the median of US 29. In some segments the median busway would provide two lanes, and others just a single reversible lane that would be used in the peak direction only. This option runs from MD 650 to Sligo Creek Parkway
- **Rush Hour Managed Bus/ HOV Lanes** – Buses would run in the left-travel lane during rush hour in the peak direction only along with carpool vehicles (2 or more persons). This option would run from Musgrove Road to Southwood Avenue and within the reversible lane from Sligo Creek Parkway to Spring Street. A subset of this option includes the peak hour use of existing shoulders for general traffic or bus/ HOV to provide additional capacity.
- **Full-time Bus on Shoulder** – Buses would run in the left or right shoulder north of Musgrove Road to the Burtonsville Park and Ride to bypass traffic congestion and queues.

WHAT IS A MANAGED LANE?

Managed Lanes restrict access to certain vehicle types such as High Occupancy Vehicles (HOVs) and buses or operate in unique configurations during certain times of day, such as rush hour shoulder use or a reversible lane



For intersection and interchange improvements, multiple geometric and traffic operational options were identified and screened based on cost, environmental impact, right-of-way impact, expected safety benefit, expected operational benefits, expected community support (e.g. traffic impacts to adjacent neighborhood), and degree of permitting required. A screening matrix is shown below in **Figure 16.** The options with the best propensity were included and evaluated in combination with the preferred corridor-wide alternative.

No.	Location	Improvement	Env.	Cost	ROW	Safety	Comm. Support	Operational Benefit	SHA/FHWA Permitting
1a	Greencastle Rd	Add Eastbound right turn lane	Low	$$	Low	Little change	Likely	More time for mainline	None
1b	Greencastle Rd	Second southbound left-turn lane	Low	$$	Low	Improves	Likely	More time for mainline	SHA Roadway
1c	Greencastle Rd	Remove WBL Phase	None	$	None	Decrease	Unlikely	More time for mainline	SHA Signal
2	Musgrove Rd to MD 650	Hard running shoulder	None	$$$	None	Decrease	Unknown	Additional through lane	SHA Roadway
3a	Tech Rd	Add Westbound right run lane	Low	$$	Low	Little change	Likely	More time for mainline	None
3b	Tech Rd	Removal of Split Phasing/Side Street Lane Conifgs	None	$	None	Decrease	Unknown	More time for mainline	SHA Signal
4	Industrial Parkway to Paint Branch	Widening for hard running shoulder	High (branch)	$$	Low	Decrease	Unknown	Additional through lane	SHA Roadway
5	MD 650	Widening for additional through lane	Low	$$	High	Little change	Unknown	Additional through lane	SHA Roadway
6	Lockwood Drive BRT Station	Median BRT Station w/ signal(widening, road closure)	Low	$$	High (gas station)	Little change	Unlikely (road closure)	More time for mainline (ped clearance moved)	SHA Roadway
7	Southwood Ave	Remove NBL Phase (AM)	None	$	None	Decrease	Unlikely	More time for mainline	SHA Signal
8	MD 193 BRT Station	BRT Station New Signal	Low	$$	Low	Little change	Likely	New Signal on US 29	SHA Roadway
9a	I-495 Option 1	Hard Running Shoulder on I-495	None	$$$	None	Decrease	Likely	Additional Lane I-495	FHWA (IAPA)
9b	I-495 Option 2	Dynamic Lane Control	None	$$	None	Unknown	Unknown	I-495 MD 193	FHWA (IAPA)
10a	Sligo Creek Parkway	Closure of 5th Leg	None	$	None	Little change	Unlikely	More time for mainline	None
10b	Sligo Creek Parkway	Side Street Widening	High	$$	Low	Improves	Unknown	Side Street Only	Park land
11a	Dale Drive	Left-turn Restrictions	None	$	None	Improves	Unlikely	High	SHA Roadway
11b	Dale Drive	Remove Side-street Protected lefts phase	None	$	None	Decrease	Unlikely	More time for mainline	SHA Roadway
12	Spring Street	Remove Split Phasing	None	$	None	Decrease	Unlikely	More time for mainline	SHA Roadway

Figure 16: Intersection Improvement Screening Matrix

Grade separation / Interchange Construction alternative – The study considered as a long-term option at the intersections of US 29 and Blackburn Road, Greencastle Road, Fairland Road, Musgrove Road, Tech Road, Industrial Road and Stewart Lane the removal of existing traffic signals and constructing new grade separated interchanges. However, preliminary modeling results indicated that interchange construction was found to negatively impact corridor travel times for all modes and thus was not retained for the final mobility package. The removal of the existing signals in the northern end of the corridor allows more vehicles to enter the study corridor and moves the bottleneck downstream to the segment between MD 650 and I-495. This creates a longer inbound AM rolling queue from I-495 north to Cherry Hill/ Randolph and beyond. Travel time savings from constructing the interchanges are therefore offset by additional delays and queues extending from intersections south of MD 650. Therefore, vehicles experienced little to no change in overall travel times from 2040 No-Action conditions.

Figure 17: Previous study interchange design concept for US 29/ Greencastle Road

Based on the qualitative screening and traffic operations analysis of individual intersection improvements the following intersection improvements were selected:

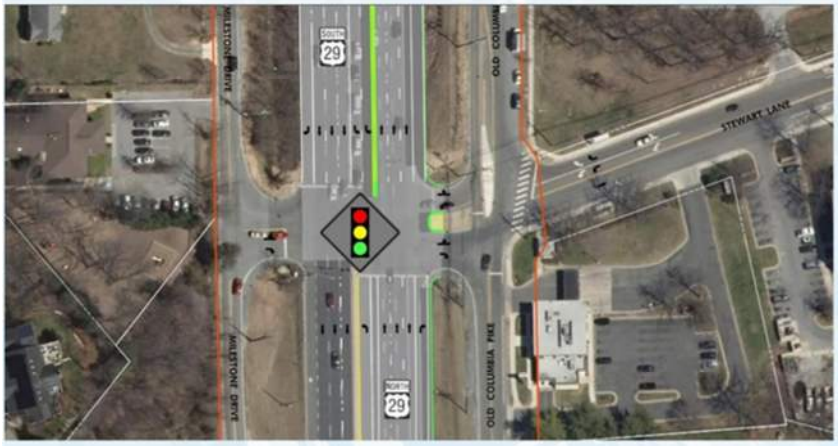
- US 29 at Greencastle Road
  - Add Eastbound Right-turn Lane
  - Add Second Southbound Left-turn Lane and Eastbound Receiving Lane
- US 29 at Tech Road
  - Add 2nd Southbound Left-turn Lane on US 29
  - Westbound Approach Widened to Provide Additional Right-turn Lane (Westbound lane configuration assumed to be Left, Left/Through, Through/Right, Right)
  - Eastbound approach reconfigured to Left, Through, Through/Right
- US 29 at Stewart Lane
  - Add a 2nd Southbound left-turn lane on US 29
- US 29 at MD 650
  - Widening of US 29 within the MD 650 interchange to provide 3 continuous southbound through lanes
- US 29 at I-495
  - Designate a 2nd exit lane onto the ramp from southbound US 29 to westbound I-495 (Outer Loop)
  - Revise pavement markings to create an extended acceleration lane for southbound US 29 to westbound I-495 entering traffic (additional ¼ to ½ mile), or implement hard running outside shoulder use during the AM peak period from the US 29 southbound on-ramp to the I-495 westbound off-ramp at Georgia Avenue (1 mile)
- US 29 at Sligo Creek Parkway
  - Side Street Lane Modifications
    - Provide an auxiliary through lane westbound, will reduce delays on the side street and increase capacity.

Concept plans and construction costs are shown in **Figure 18.**

Figure 18. Intersection / Interchange Improvement Concepts and Costs

Greencastle Road
- Add Eastbound Right-Turn Lane
- Add Second Southbound Left-Turn Lane and Eastbound Receiving Lane

$4-5M Construction



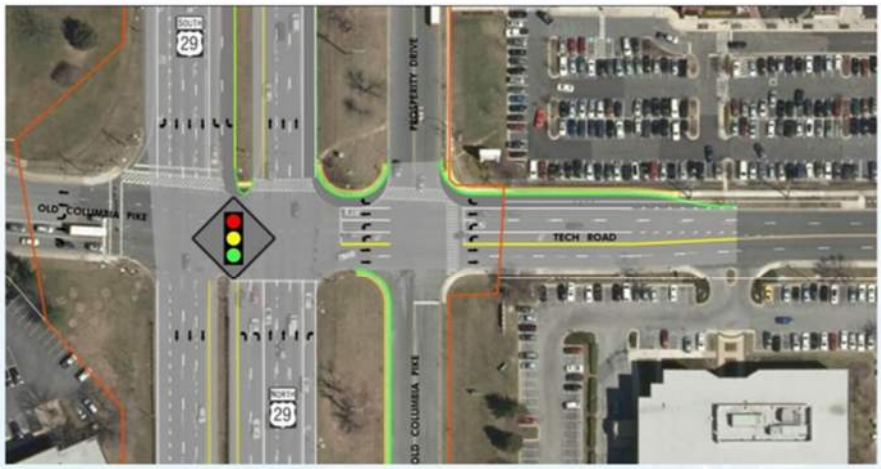
Stewart Lane
- Add a 2nd SB left turn lane on US 29 at Stewart Lane

$2-3M Construction

I-495 Wetsbound
- 2nd exit lane from SB US 29 to WB I-495

$2-3M Construction

Figure 18 (Continued). Intersection / Interchange Improvement Concepts and Costs



Tech Road

- Additional US 29 turn lanes (2nd SBL) and side street widening for additional westbound right-turn lane at Tech Road

$2-3M Construction

MD 650

- 3rd Southbound US 29 lane addition through MD 650

$6-7M Construction
- »Potential Additional Intersection / Ramp Configuration Revisions

Sligo Creek

- Sligo Creek Parkway enhancement at US 29 for 2nd westbound through lane

$3-4M Construction

Pedestrian and Bicycle Improvements

To support enhanced station access along the corridor and connectivity to adjacent neighborhoods, potential pedestrian and bicycle improvements were identified to provide a contiguous non-motorized network. The September 2017 Bicycle and Pedestrian Workshop Comments were reviewed for feasibility, as well as other relevant Master/ Sector Plan documents (e.g. White Oak, County Bikeway Master Plan). Any adverse impacts to existing pedestrian and bicycle facilities/accessibility due to other proposed roadway improvements were noted and mitigation identified and developed if needed. Station barriers and recommendations maps were created for all eight stations. Over 200 individual walking and biking recommendations including:

- New and reconstructed sidewalks – 19.0 miles
- Shared use paths – 13.8 Miles
- Off-Street Trails – 2.2 Miles
- Separated on-road bike lanes – 15.8 miles
- Shared roadway on-road bike lanes – 5.4 miles
- Bicycle/ pedestrian bridges – 5 structures
- ADA compliance updates
- US 29 pedestrian crossing improvements
- Bicycle parking

Full station area mapping illustrating multi-modal recommendations/ expanded walking and bicycle sheds and a summary listing of pedestrian and bicycle recommendations by project are included in **Appendix III.**

The estimated construction cost for all pedestrian and bicycle improvements is approximately $15-20M (excluding side paths and bridges)

Transportation Systems Management and Operations/ Transportation Demand Management

Transportation Systems Management and Operations (TSMO) is a cross-cutting approach defined by the US DOT Federal Highway Administration as “a set of strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system before extra capacity is needed”. This is accomplished through better integration, coordination, and systematic implementation of key operational strategies. Such strategies may include traveler information, active traffic management such as ramp metering, dynamic lane usage, dynamic pavement markings, performance-based curb usage/ pricing, variable speed limits, and smart traffic signals, traffic incident management and others to deliver performance-driven improvements to the existing system. **Figure 19** below illustrates a broad range of TSMO strategies.

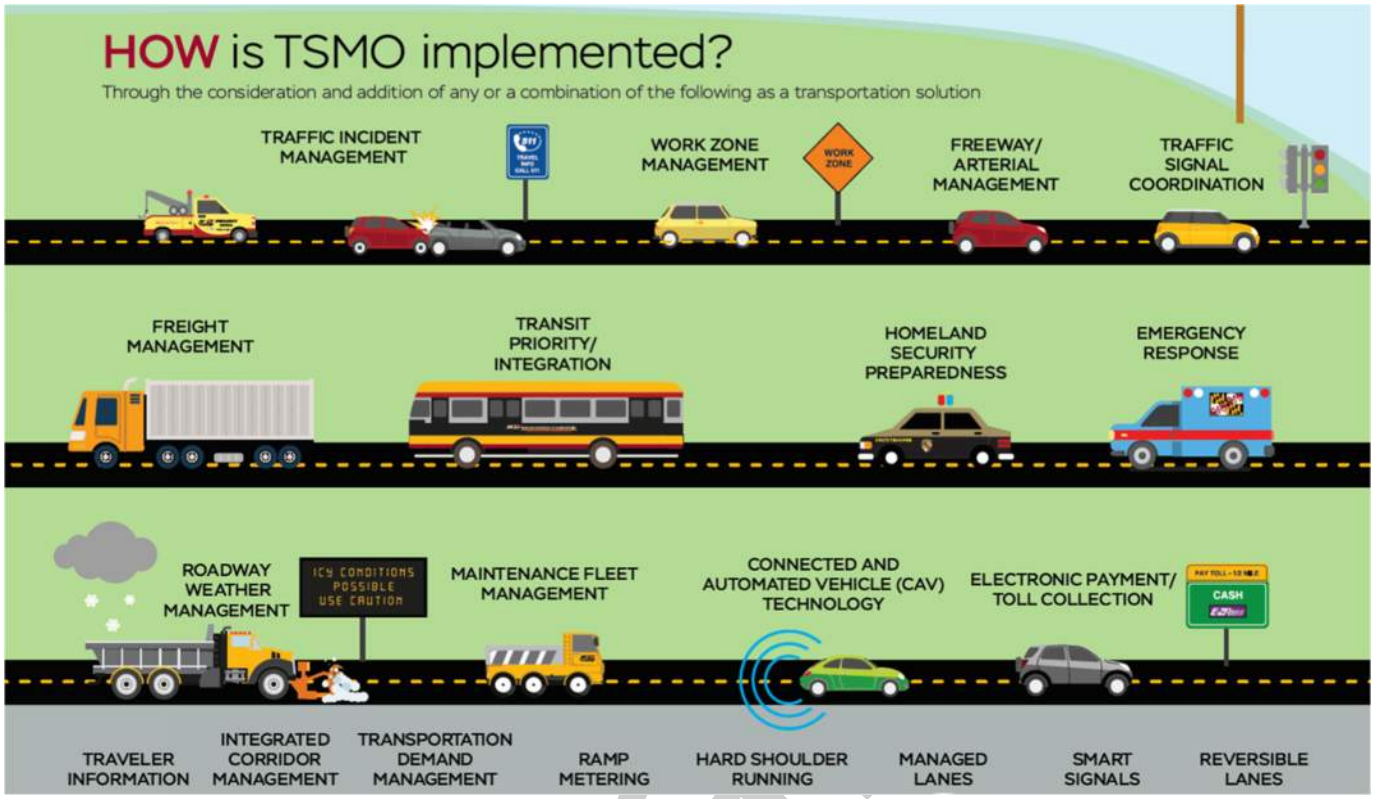


Figure 19 Transportation Systems Management and Operations Strategies

Specific strategies recommended for the US 29 corridor include the following

- Provide real-time travel time information from the County line to I-495 and Silver Spring: Traveler information can be disseminated through a variety of media including variable message boards, radio, internet, telephone, and in-vehicle or handheld navigation systems. Travelers who are informed about weather and driving conditions, delays and detours, parking and other situations that may affect their travel can use the information to make decisions and increase the mobility, safety, and satisfaction of their trip.

- Implement commuter incentive programs to encourage carpool, bus and bicycle use: creating and enhancing marketing and programming to connect commuters to alternative modes of travel in the corridor, carpool formation as well as innovative programs such as incentrip (https://www.commuterconnections.org/incentrip-app/) which reward commuters for choosing alternative commuting modes and time. By having more people using one vehicle, carpooling reduces each person's travel costs and results in less demand for roadway space.

- Develop an Integrated Corridor Management Plan for US 29, I-95, US 1 and the Baltimore Washington Parkway/ MD 295: Integrated corridor management (ICM) is an approach designed to actively monitor for atypical recurring and nonrecurring events on multiple parallel arterials or freeways within a corridor. Because of recurring congestion, even minor events on a single facility can have a huge impact on parallel facilities. ICM requires the institutional, operational, and technical integration of State and local agencies to combine their assets into one unified real-time response.

- Increase incident response patrols: Expanding service patrol coverage US 29 will help reduce incident response times and non-recurring congestion due to crashes and vehicle breakdowns.

- Implement smart signal timing technology for demand-responsive timing plans: the deployment of new traffic signal timing technology will enable traffic signal timing to automatically adjusts to unexpected traffic conditions, dynamically change timing based on real-time vehicle demand including cycle lengths, green intervals and coordination between signals

- Providing real-time commuter park and ride space availability – implementi ng signs with real-time park and ride lot space availability can be an easy tool to ensure that FLASH patrons do not spend unnecessary time searching for a parking space and missing a connection.

The estimated costs for these Transportation System Management and Operations strategies is $5 million per year

Corridor-Level Concept Geometric Design Elements, Impacts and Cost Evaluation

Concept-level geometric designs were developed after reviewing proposed dimensioned typical roadway sections, roadway capacity improvements and bus priority treatments. CADD design plans were created using existing aerial imagery, GIS layers and contours and as-built drawings. Proposed geometric improvements at intersections, interchanges and for bus priority were evaluated for compatibility with County, Maryland DOT and Federal Highway design standards, major quantities estimated for construction costs, and potential impacts tabulated for right-of-way, utilities, environmental and constructability. CADD roll plans for each design are included in **Appendix IV,** construction cost estimates are included in **Appendix V** and impacts are summarized in **Appendix VI**.

Notable assumptions in developing cost estimates for roadway and bus priority improvements are as follows:

- Utilities: At the concept level, existing above ground/overhead utilities were identified and impacts to them minimized where widening is proposed, but the location of the existing underground utilities is mostly unknown at this stage of the project. Therefore, per the recommendation of the SHA Cost Estimating Manual, 15% of the construction costs were estimated for utility relocations

- Right-of-Way: For the purposes of the concept design, existing right-of-way limits were established using GIS information. For conceptual impacts to existing right-of-way, all acquisitions were assumed to be total takes (no proposed easements) offset approximately 5' from the outer limits of the proposed sidewalk, curb and gutter, retaining wall or roadway widening. The cost of right-of-way was assumed to be $1M per acre based on recent property sales in corridor appearing on Zillow.

- Environmental: Impacts to the 100 year floodplain associated with Sligo Creek, Northwest Branch Anacostia River, and Paint Branch are anticipated with this project. Impacts to wetlands, wetland buffers, and waters of the US may also be anticipated. However, only GIS information is available for the floodplains and the other environmentally sensitive areas have not yet been delineated within the corridor. Therefore, an estimated extent of these impacts is unknown and environmental cost have not been included. Ultimately, any impacts to these environmentally sensitive areas is anticipated to required a Joint Permit Application (JPA) and may also require mitigation. Impacts to trees are anticipated to require a Roadside Tree Permit and may require plantings. The roadway widening proposed is anticipated to increase the impervious area and require stormwater management design to obtain SHA Plan Review Division (PRD) approval. Estimate quantities for excavation and right-of-way required for stormwater management have been included in the cost estimates per the recommendations provided in the SHA Cost Estimating Manual.

- Structures: Per the SHA Cost Estimating manual, square foot costs were used to estimate new bridge construction, bridge deck replacement, and retaining wall costs within the corridor. The heights of retaining walls were approximated using GIS contour data to conservatively estimate the average height of a wall along its proposed length.

- Pedestrian side paths and bridges: Roadway costs for median bus and managed lane alternatives do not included new side paths and pedestrian bridges, assumed to be implemented as a separate project

2025 Median Bus Lane Corridor Alternative Evaluation

2025 Median Bus Lane Scenario

The median bus lane concept (also known as the Emerson Smoot concept) has a dedicated median bus lane from Sligo Creek Parkway to Tech Road, with stops at Tech Road Station at Tech Road, Burnt Mills Station south of Burnt Mills Avenue, and Four Corners Station at University Boulevard. There will be a dual busway near the stations, from north of Stewart Lane, Southwest Drive to Burnt Mills Shopping Center, and from Timberwood Avenue to Granville Drive. Where there is not a dual busway, there will be a bidirectional busway.

Under the Median Bus Lane scenario, there are multiple changes from existing conditions including new traffic signals (at Oak Leaf Drive, Northwest Drive, Hillwood Drive, Crestmoor Drive, Timberwood Avenue, Lanark Way and Hastings Drive), new turn restrictions, and new crosswalks as shown in **Figure**

20. In addition, the cross-section of the roadway will change as shown in **Figure 21.** Key geometric design features include:

Lane Width Reductions:

The concept depends upon the reduction of lane widths from 11-12' to 10' in the inner lanes (non-curb lanes) and 12' to 11' in the curb lanes. In the 84' sections, this will result in two 31' carriageways and 20-22' of median space, in contrast to the current configuration of two 34' carriageways and a 16' median.

Reduction from eight to six lanes from I-495 to Timberwood Avenue
Through the Four Corners area, the concept proposes removing the existing left travel lanes on US 29 from Timberwood Avenue to the area of south of Lanark Way. The new configuration in this area will consist of two 31' roadways (northbound and southbound) and a 42' median space containing the two-lane busway and median stations.

Geometric Design Elements, Impacts and Costs

The preliminary engineering design of the Median Bus Lane alternative has proposed geometric design waivers, evaluated right-of-way impacts, ADA upgrades, bicycle compatibility, stormwater management and environmental impacts/ permitting, utility impacts/ relocations, structure / retaining wall needs, new traffic signal and estimated construction costs.

The total estimated construction cost for the full implementation of the Median Bus Lane alternative would be $106 million. The following additional impacts were noted.

- Design waivers: Reduced Lane Width / Bike Waiver south of MD 650
- Right-of-Way required: 9.8 Acres
- Utilities impacted: Various Underground and Overhead Utility Relocation in areas of Widening/Full Depth Reconstruction (Approximately $8.3M)
- Environmental impacts/ permitting: Impacts to Paint Branch & Northwest Branch for New Bridge Construction / Stormwater management/ Roadside Tree Permit

Traffic Analysis Methodology

Intersection capacity analysis was performed at each study intersection under the 2025 Median Bus Lane scenario. Future 2025 turning movement volumes were coded into a Synchro network to perform capacity analysis using the same methodology described in the Existing Conditions section. The results summarize operations of each study intersection using the same key measures of effectiveness. The turning movement volumes were also updated in the VISSIM models.

2025 Median Bus Lane Results

Roadway Conditions and Traffic Operations
Arterial and intersection levels of service for the AM and PM Peak hours are shown in **Figure 22** below for vehicles and **Figure 23** for the BRT. Intersections which show a failing level of service (LOS E or LOS F) during at least one peak based on HCM methodology are shown **Table 16.**

In addition to failing intersections, several segments also experience failing link level of service as shown in **Table 17**. Some of the failing links are due to intersection operations while others are due to congestion

at ramp/merge areas with intersecting corridors. The link levels of service are based on percent of base free-flow speed were calculated from the VISSIM model outputs.

Operational challenges with median bus lanes

The results of the traffic modeling and simulation of the median bus lane indicate several factors influencing the increased travel time for vehicle traffic and transit buses. The installation of multiple new traffic signals result in increased signal delay along the corridor. The reduction in roadway capacity through Four Corners with the elimination of the 4th travel lane reduces vehicle throughput and queue storage, which results in northbound congestion from Four Corners spilling back into downtown Silver Spring during PM peak period and southbound congestion from the I-495 interchange north to Cherry Hill/Randolph and beyond in the AM peak period. This additional congestion decreases bus speed and increases bus travel time in the mixed traffic segments prior to entering the median bus lane. That lost time cannot be recovered within the dedicated lane segment, thus no significant benefits to the buses are realized.

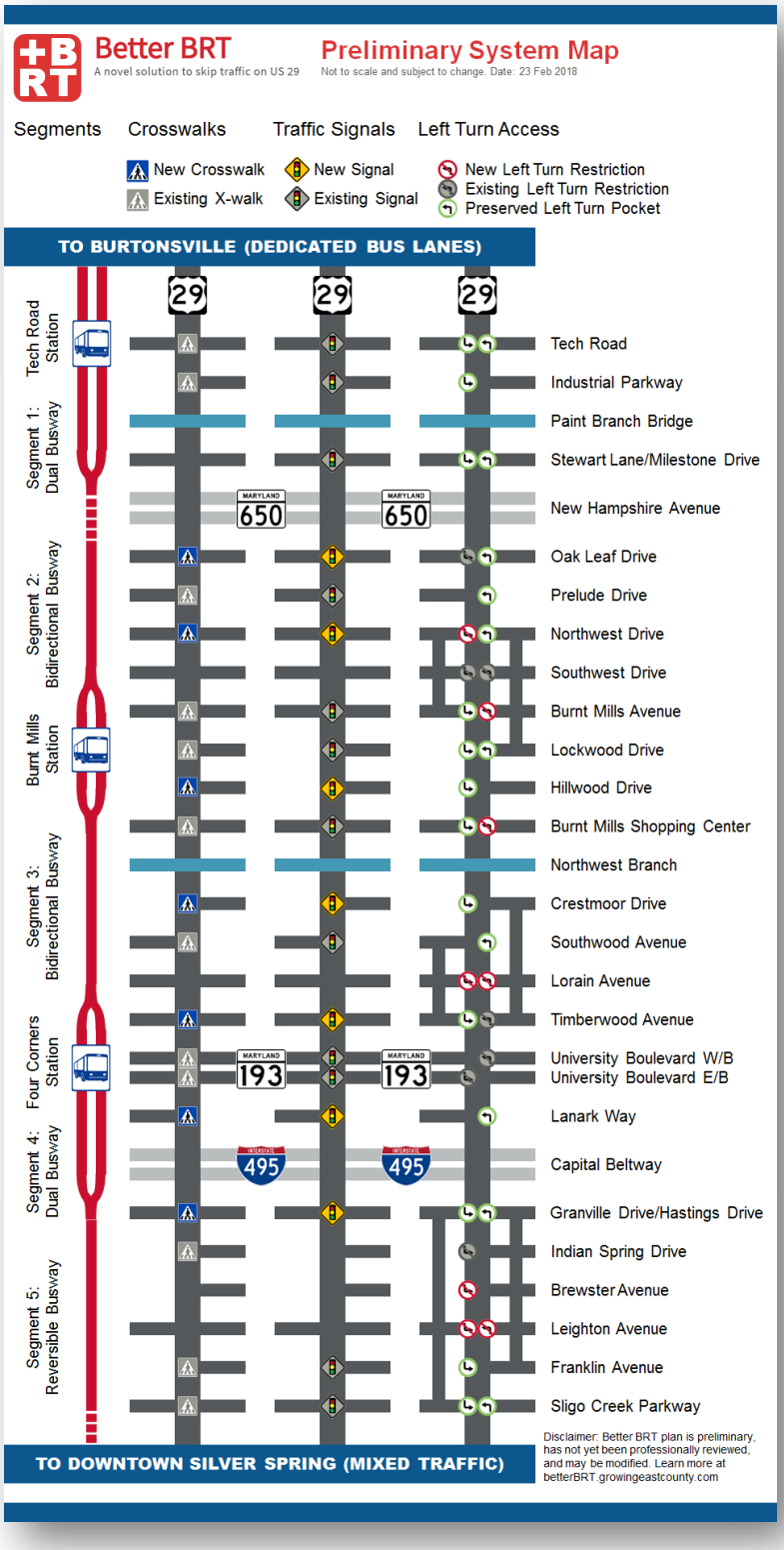
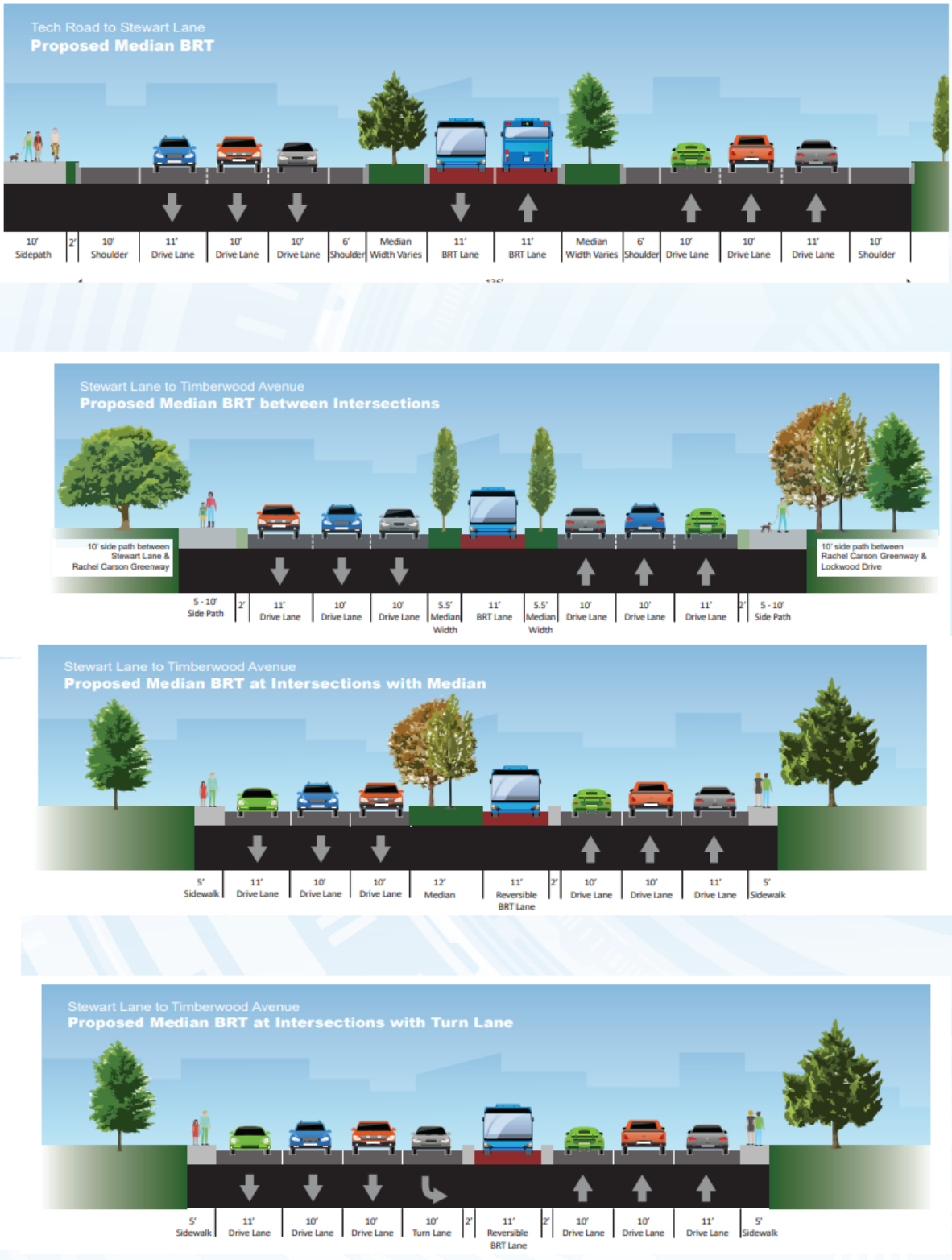
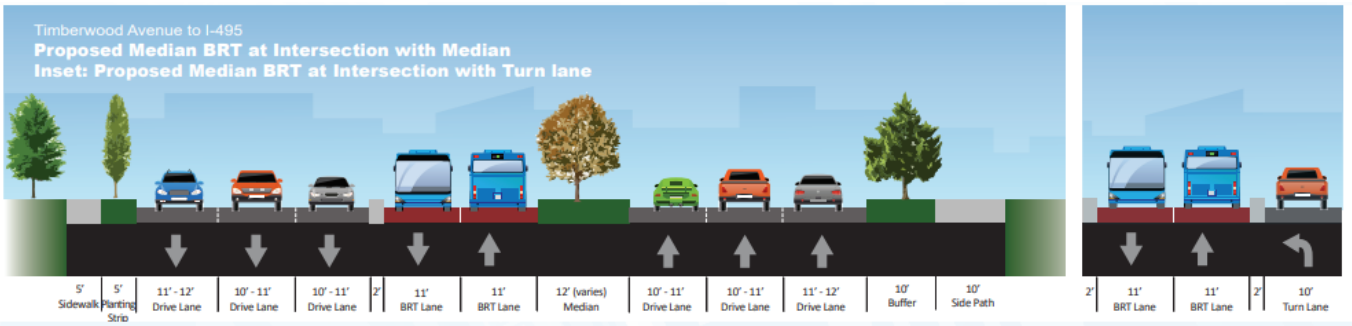
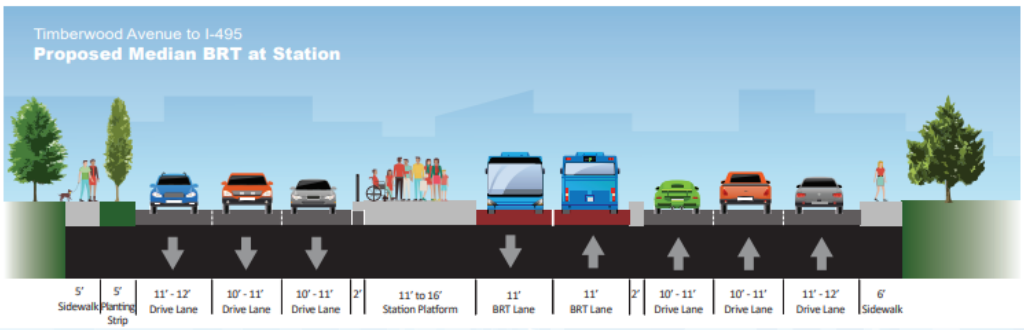


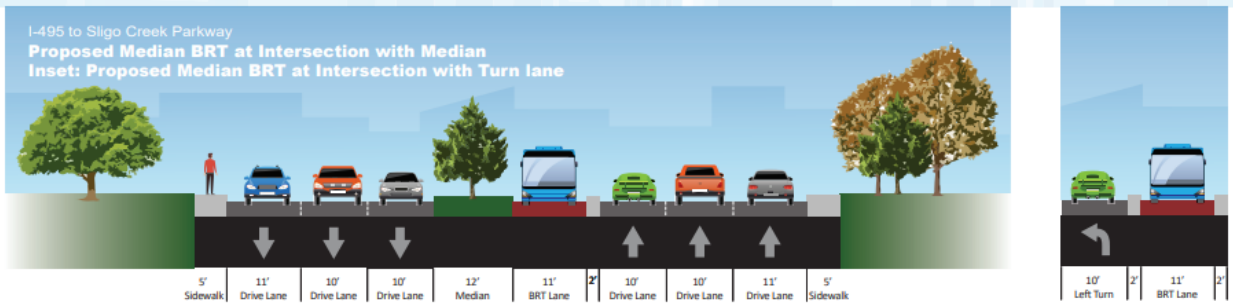
Figure 20: Median Bus Lane Concept (source: Better BRT)

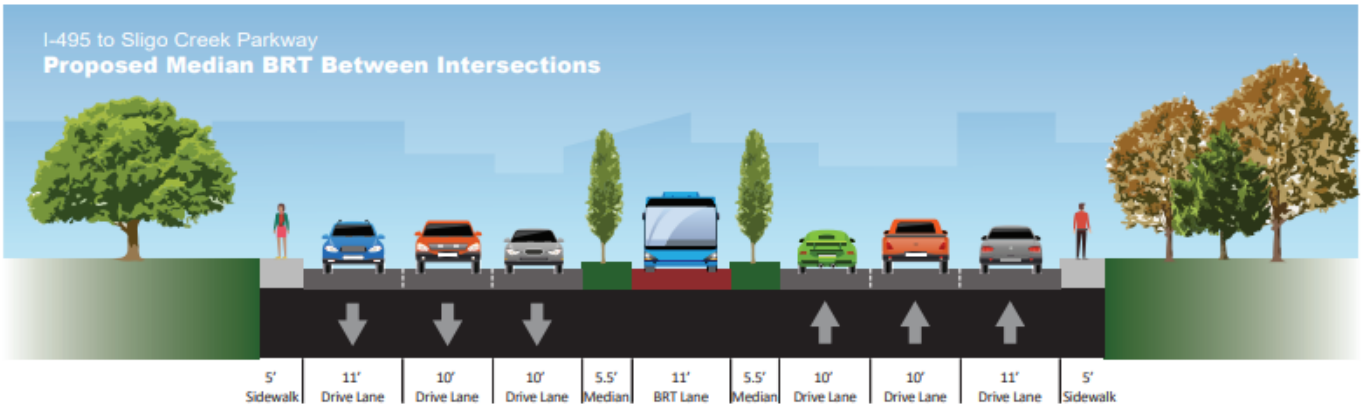
Figure 21: Median Bus Lane Typical Sections











= Carpool Lane = Bus Lane

Busses in mixed use traffic lanes between Sligo Creek Pkwy and Burnt Mills (NB) and Southwood (SB)

Table 16: 2025 Median Bus Lane Failing Intersections

Intersection	LOS	
	AM	PM
US 29 & Blackburn Rd	E	-
US 29 & Greencastle Rd	F	F
US 29 & Fairland Rd	E	-
US 29 & Musgrove Rd	-	-
US 29 & Tech Rd	F	F
US 29 & Industrial Pkwy	-	-
US 29 & Milestone Drive/Stewart Lane	-	E
US 29 & Prelude Drive	-	--
US 29 & Burnt Mills Avenue	-	-
US 29 & Lockwood Drive	-	-
US 29 & Burnt Mills Shopping Ctr	-	F
US 29 & Southwood Ave	F	-
US 29 & MD 193 Westbound	F	F
US 29 & MD 193 Eastbound	F	F
US 29 & Lanark Way	F	E
US 29 & Hastings Dr	-	E
US 29 & Franklin Ave	-	F
US 29 & Sligo Creek Parkway & St. Andrews Way	F	F
US 29 & MD 391 (Dale Dr)	F	F
US 29 & Spring St	F	F
US 29 & Fenton St	-	E
US 29 & Georgia Avenue	-	-
Colesville Rd & 2nd Ave/Wayne Ave	E	-

In addition to 17 failing intersections (two more than No Action conditions), 21 segments (same as No Action conditions) also experience failing link level of service in at least one peak hour.

Table 17: 2025 Median Bus Lane Failing Segments

US 29 Segment Limits		LOS			
		AM		PM	
North	South	SB	NB	SB	NB
Blackburn Rd	Greencastle Rd	E	-	-	-
Fairland Rd	Musgrove Rd	F	-	-	-
Musgrove Rd	Tech Rd	F	-	-	-
Tech Rd	Industrial Pkwy	F	F	-	E
Industrial Pkwy	Stewart Ln Slip Ramp	F	-	-	-
Stewart Ln Slip Ramp	Stewart Ln	F	-	-	-
Stewart Ln	Prelude	F	-	-	-
Prelude Dr	Burnt Mills Ave	F	-	-	-
Burnt Mills Ave	Lockwood Dr	F	-	-	-
Lockwood Dr	Burnt Mills SC	F	-	-	-
Burnt Mills SC	Southwood Ave	F	-	-	F
Southwood Ave	MD 193 WB	F	-	F	F
MD 193 WB	MD 193 EB	E	-	E	F
MD 193 EB	Lanark Way	F	F	F	F
Lanark Way	N. 495 Interchange	F	-	F	F
N. 495 Interchange	Franklin Ave	-	-	-	F
Franklin Ave	Sligo Creek Pkwy	F	-	F	F
Sligo Creek Pkwy	Dale Dr	-	F	F	F
Dale Dr	Spring	-	E	-	F
Spring St	Fenton St	-	F	F	F
Fenton St	Georgia Ave	-	E	F	F

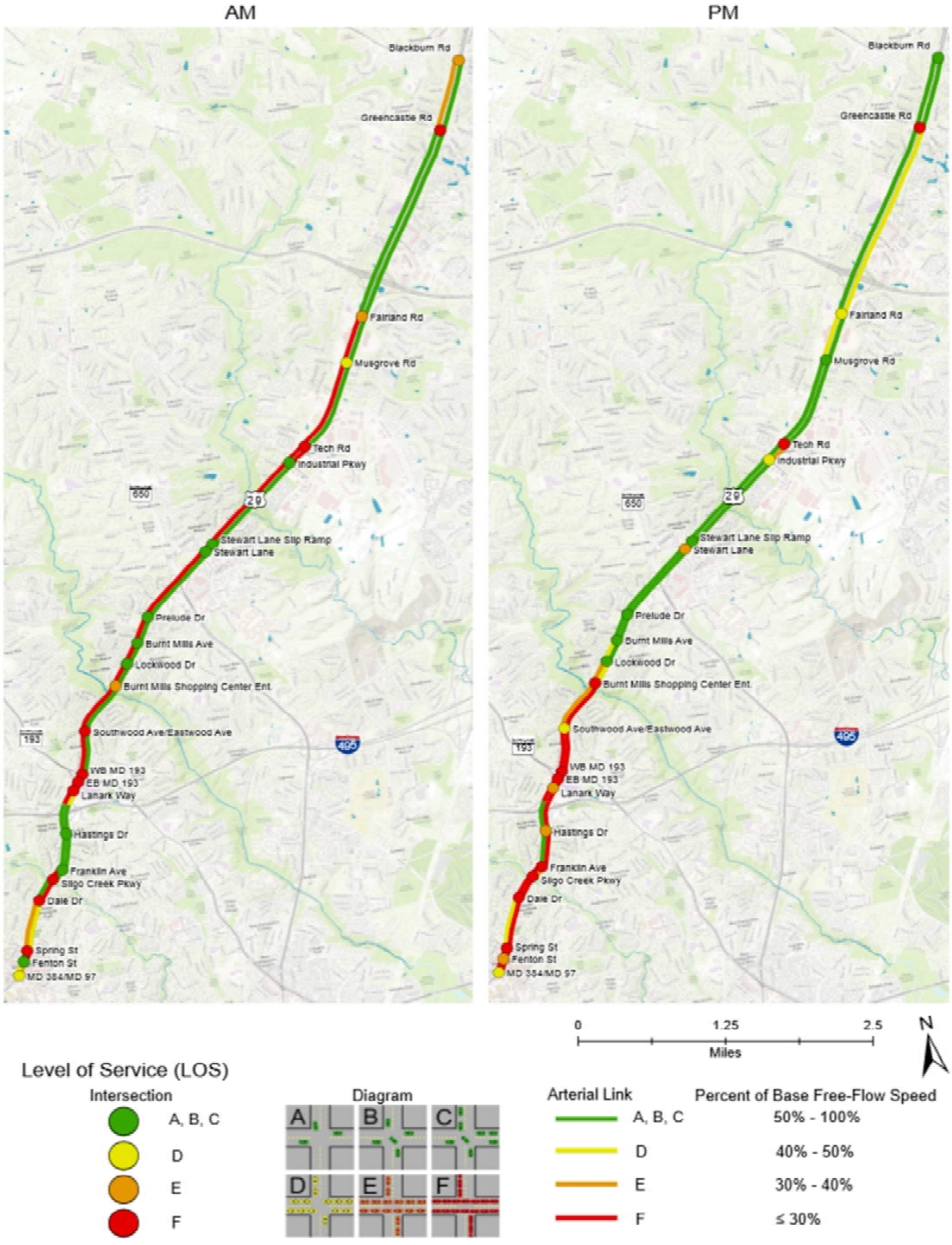


Figure 22: 2025 Median Bus Lane Link and Intersection Level of Service - Vehicles

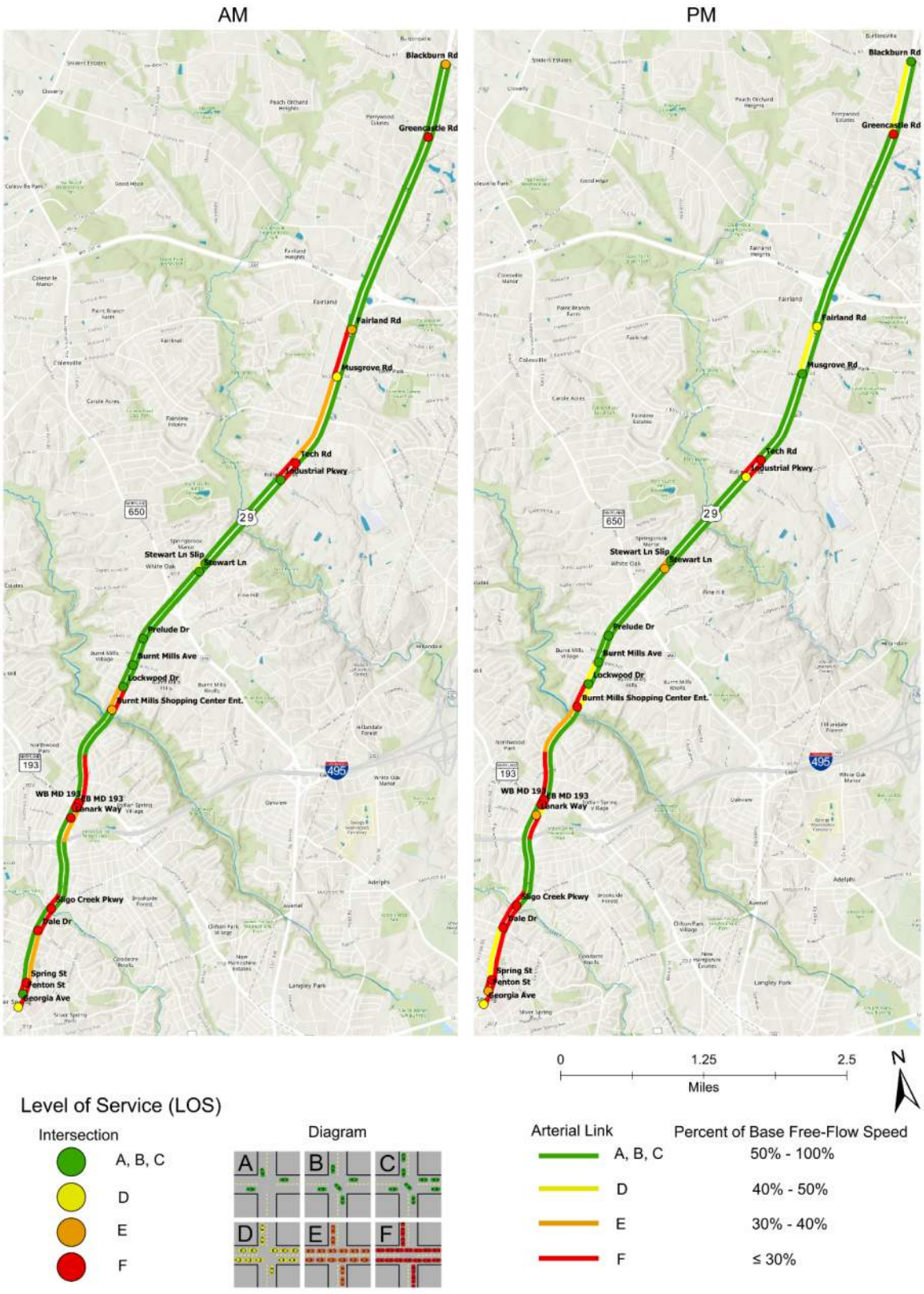


Figure 23: 2025 Median Bus Lane Link and Intersection Level of Service - BRT

Travel Times

Travel times for the 2025 Median Bus Lane scenarios for passenger vehicles and buses by peak period and travel direction are shown in **Figure 24** below. While savings over the No Action of about 15 minutes are realized in the southbound AM for buses, the median bus lane alternative does not provide any travel time savings in the northbound PM over the No Action condition.

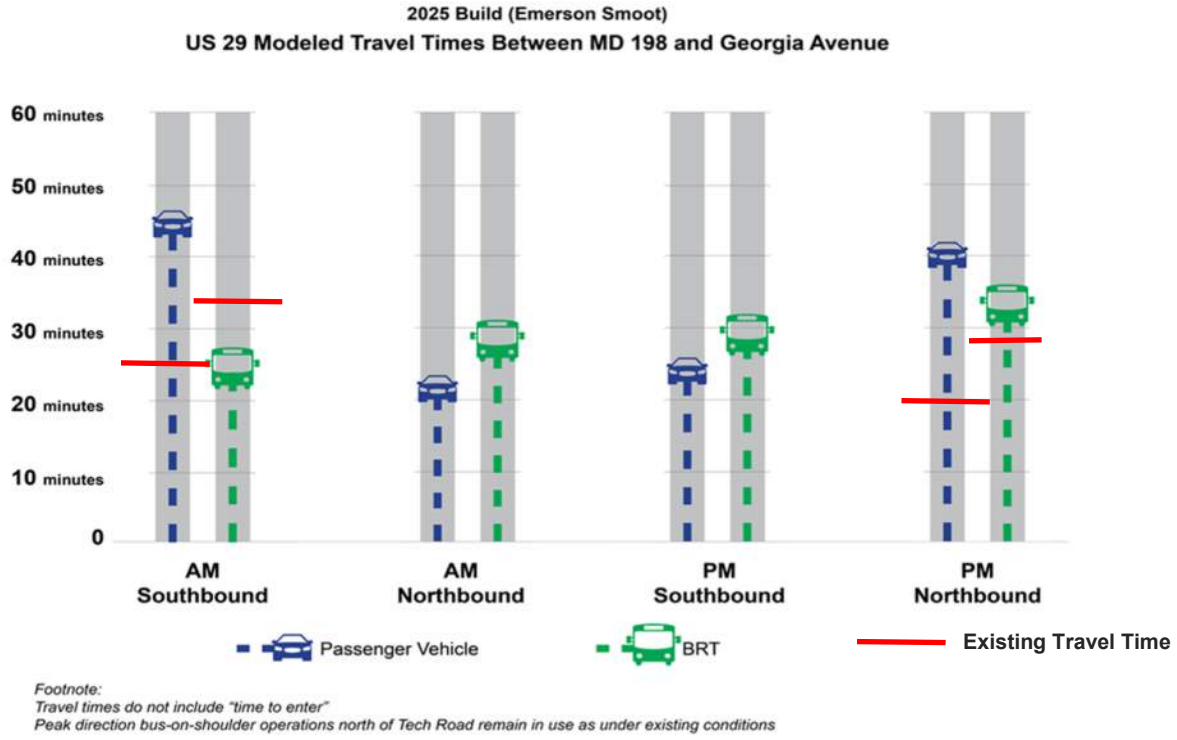


Figure 24: 2025 Median Bus Lane Travel Times Between MD 198 and Georgia Avenue

2025 Managed Lane Analysis

2025 Managed Lane Scenario

The managed lane concept is a combination of full-time bus/HOV lanes, peak period managed bus/HOV lanes, and hard shoulder running in multiple segments of the corridor. From Blackburn Road to Fairland Road, a full-time bus/HOV lane is proposed on the inner shoulder of both northbound and southbound US-29. From Musgrove Road to Stewart Lane, the inner lane becomes a bus/HOV lane in the southbound direction in the AM peak, with the outside shoulder being converted to a mixed-use lane. In the PM peak, the northbound inner lane becomes a bus/HOV lane and the outside shoulder is converted to a mixed-use lane. From MD 650 to Southwood Avenue, the inner lane becomes a bus/HOV lane in the southbound direction in the AM peak. In the PM peak, the northbound inner lane becomes a bus/HOV lane from Burnt Mills Avenue to MD 650. From Spring Street to Dale Drive, a managed lane in proposed. In the AM peak, there will be four southbound lanes, with the left lane serving as a bus/HOV lane, and two northbound lanes. In the PM peak, the northbound direction will have four lanes, with the inner lane serving as a bus/HOV lane. Typical sections of each segment are shown in **Figure 25**.

The components of the managed lane scenario are as follows:

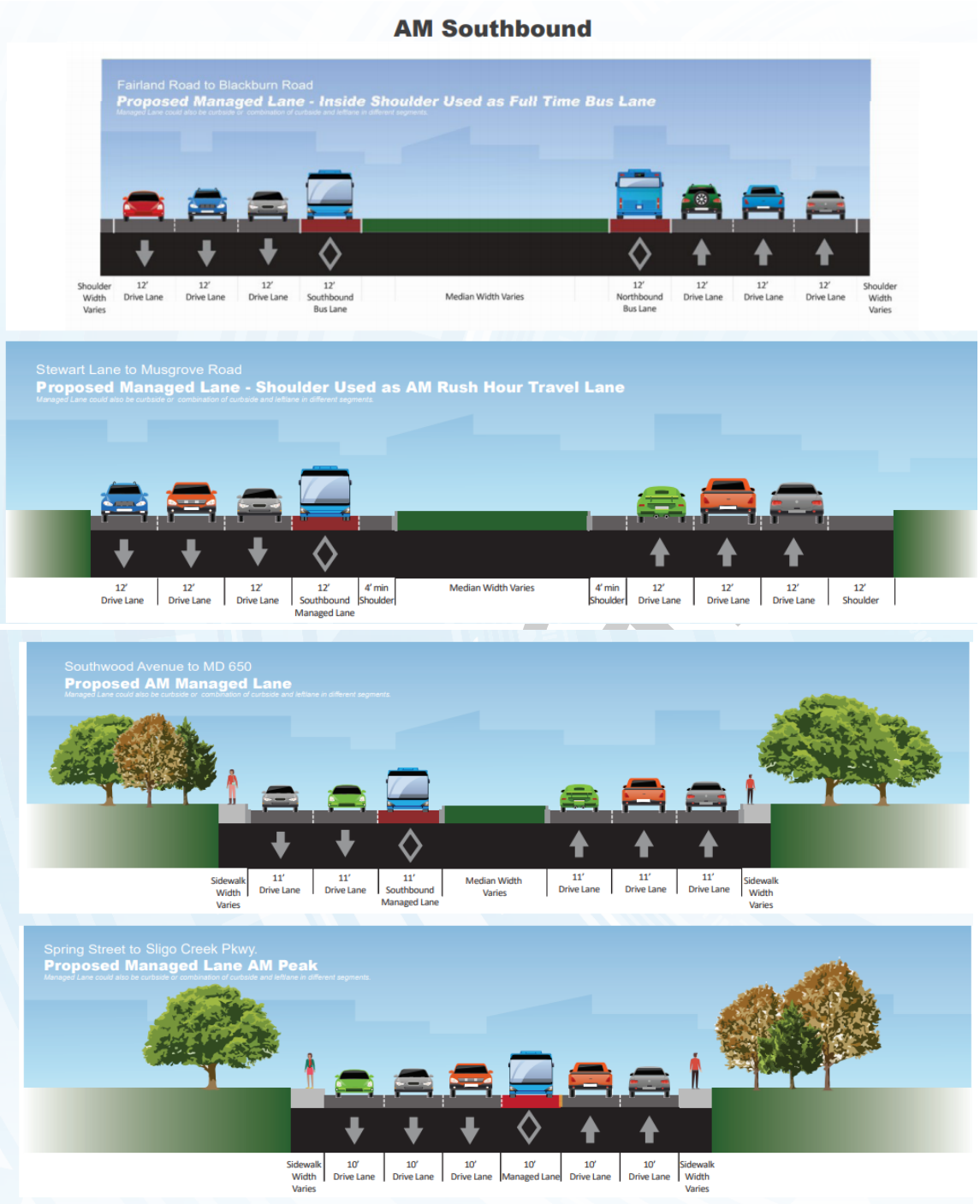
- Full time Bus on left Shoulder from Blackburn Road to Fairland Road
- Peak Period/Direction HOV + Bus Managed Lane/Hard Running Shoulder from Musgrove Road to Stewart Lane
- Peak Period/Direction HOV + Bus Managed Lane from MD 650 to Southwood Ave (SB limit) / Burnt Mills Ave (NB limit)
- Peak Period/Direction HOV + Bus Managed Lane from Dale Drive to Spring Street

Geometric Design Elements, Impacts and Costs

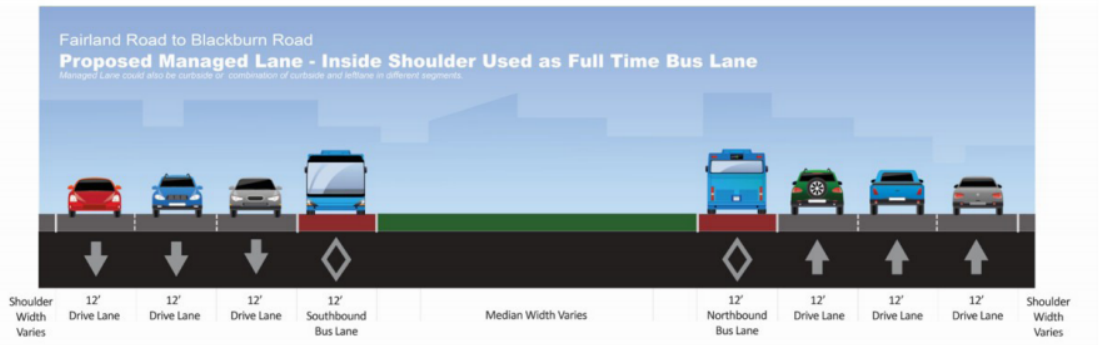
The estimated construction cost for the managed lane alternative is $50 million. The following impacts were noted based on the preliminary engineering design effort

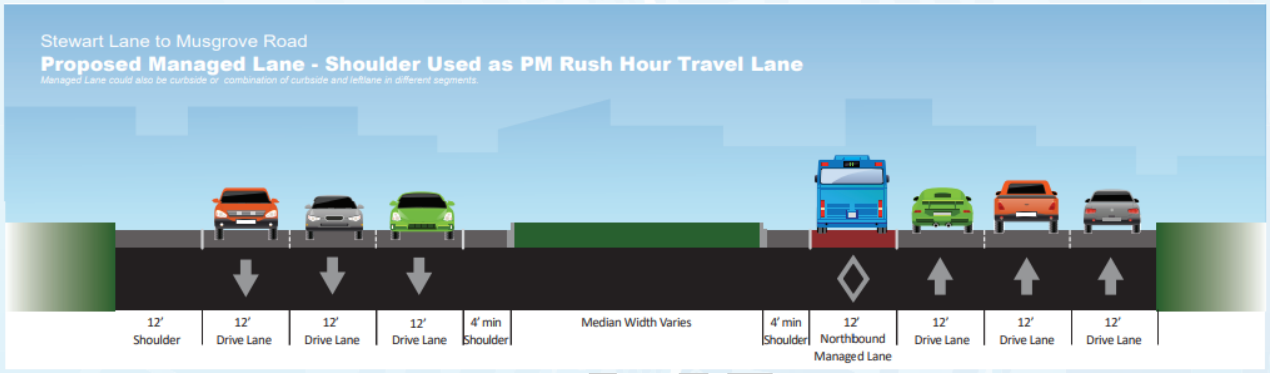
- Right-of-Way required: 2.2 Acres
- Utilities impacted: Various Underground and Overhead Utility Relocation in areas of Widening/Full Depth Reconstruction (Approximately $7.7M)
- Design waivers: Bike Waiver south of MD 650 and where shoulders are used during peak periods
- Environmental impacts/ permitting: SWM / Roadside Tree Permit

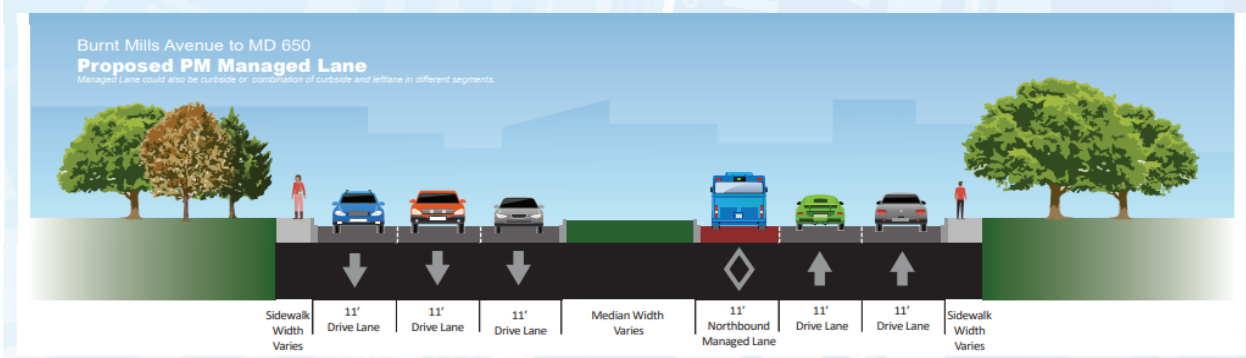
Figure 25: Managed Bus Lane Typical Sections

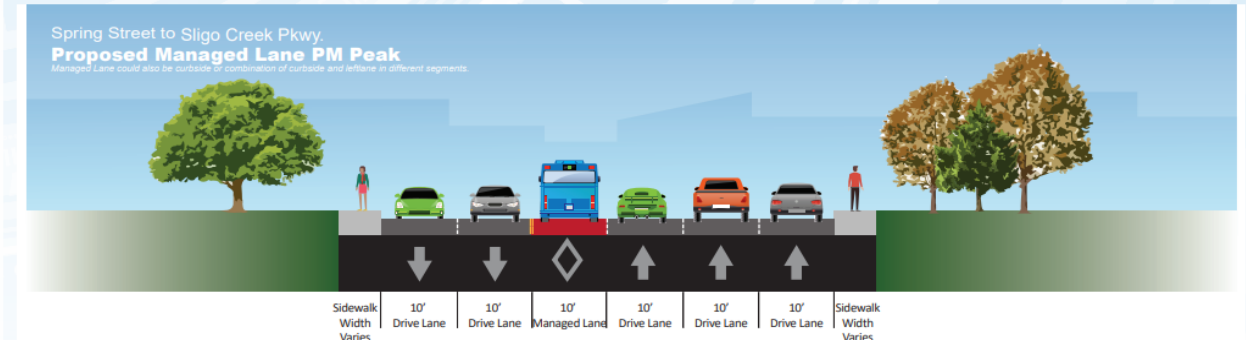


PM Northbound









◇ = Carpool Lane ■ = Bus Lane Busses in mixed use traffic lanes between Sligo Creek Pkwy and Burnt Mills (NB) and Southwood (SB)

Traffic Analysis Methodology

Intersection capacity analysis was performed at each study intersection under the 2025 Managed Lane scenario. Future 2025 turning movement volumes were coded into a Synchro network to perform capacity analysis using the same methodology described in the Existing Conditions section. The results summarize operations of each study intersection using the same key measures of effectiveness. The turning movement volumes were also updated in the VISSIM models.

2025 Managed Lane Results

Roadway Conditions and Traffic Operations

Arterial and intersection levels of service for the AM and PM Peak hours are shown in **Figure 26** below for vehicles and **Figure 27** for the BRT. Intersections which show a failing level of service (LOS E or LOS F) during at least one peak based on HCM methodology are shown **Table 18**. Only 7 intersections fail in at least one peak hour in the Managed Lane alternative, compared to 15 for the No Action and 17 for the Median Bus Lane. Seventeen segments fail in at least one peak hour, compared to 21 for the No Action and Median Bus Lane.

Table 18: 2025 Managed Lane Failing Intersections

Intersection	LOS	
	AM	PM
US 29 & Blackburn Rd	-	-
US 29 & Greencastle Rd	F	F
US 29 & Fairland Rd	E	-
US 29 & Musgrove Rd	-	-
US 29 & Tech Road	-	-
US 29 & Industrial Pkwy	-	-
US 29 & Milestone Drive/ Stewart Lane	-	-
US 29 & Prelude Dr	-	-
US 29 & Burnt Mills Ave	-	-
US 29 & Lockwood Drive	-	-
US 29 & Burnt Mills Shopping Center	-	-
US 29 & Southwood Ave	F	-
US 29 & MD 193 WB	-	-
US 29 & MD 193 EB	-	-
US 29 & Lanark Way	-	-
US 29 & Hastings Drive	-	-
US 29 & Franklin Ave	E	-
US 29 & Sligo Creek Parkway & St. Andrews Way	F	F
US 29 & MD 391 (Dale Dr)	F	F
US 29 & Spring St	F	F
US 29 & Fenton St	-	-
US 29 & Georgia Ave	-	-
Colesville Road & Wayne Ave/ 2nd Street	-	-

In addition to failing intersections, several segments also experience failing link level of service. Some of the failing links are due to intersection operations while others are due to congestion at ramp/merge areas with intersecting corridors. The link levels of service are based on percent of base free-flow speed were calculated from the VISSIM model outputs. The segments in **Table 19** fail in at least one direction during at least one hour:

Table 19: 2025 Managed Lane Failing Segments

US 29 Segment Limits		AM		PM	
North	South	SB	NB	SB	NB
Tech	Industrial	E	E	-	E
Industrial	Stewart Slip	F	-	-	-
Stewart Slip	Stewart	F	-	-	-
Stewart	Prelude	F	-	-	-
Prelude	Burnt Mills Ave	F	-	-	-
Burnt Mills Ave	Lockwood	F	-	-	-
Lockwood	Burnt Mills SC	E	-	-	-
Burnt Mills SC	Southwood	E	-	-	-
Southwood	MD 193 WB	F	-	-	-
MD 193 WB	MD 193 EB	F	-	-	-
MD 193 EB	Lanark	F	-	-	F
Lanark	N. 495 Interchange	F	-	-	E
Franklin	Sligo	E	-	F	-
Sligo	Dale	-	F	F	E
Dale	Spring	-	-	-	F
Spring	Fenton	-	F	F	E
Fenton	Georgia	-	-	E	-

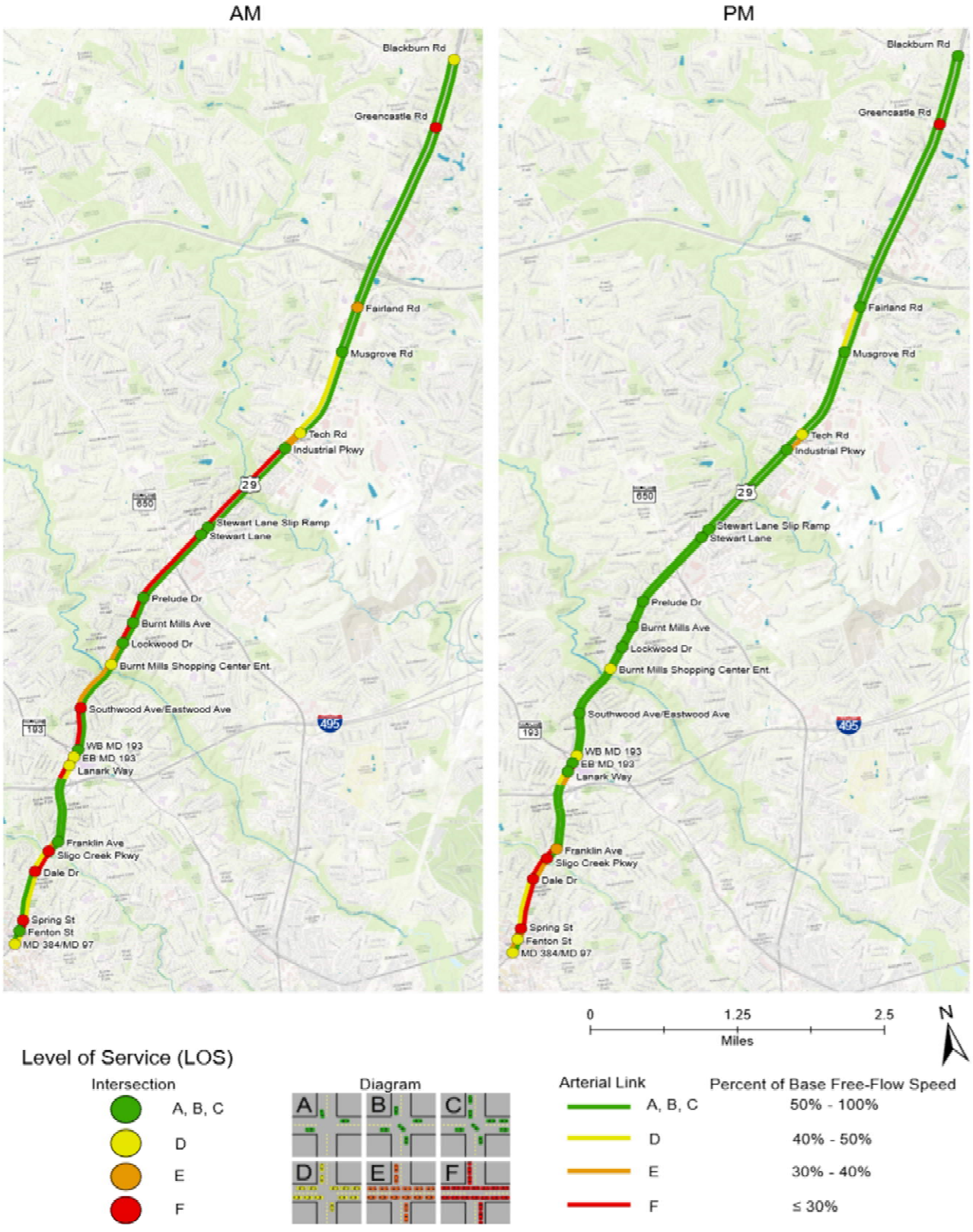


Figure 26: 2025 Managed Lane Link and Intersection Level of Service - Vehicles

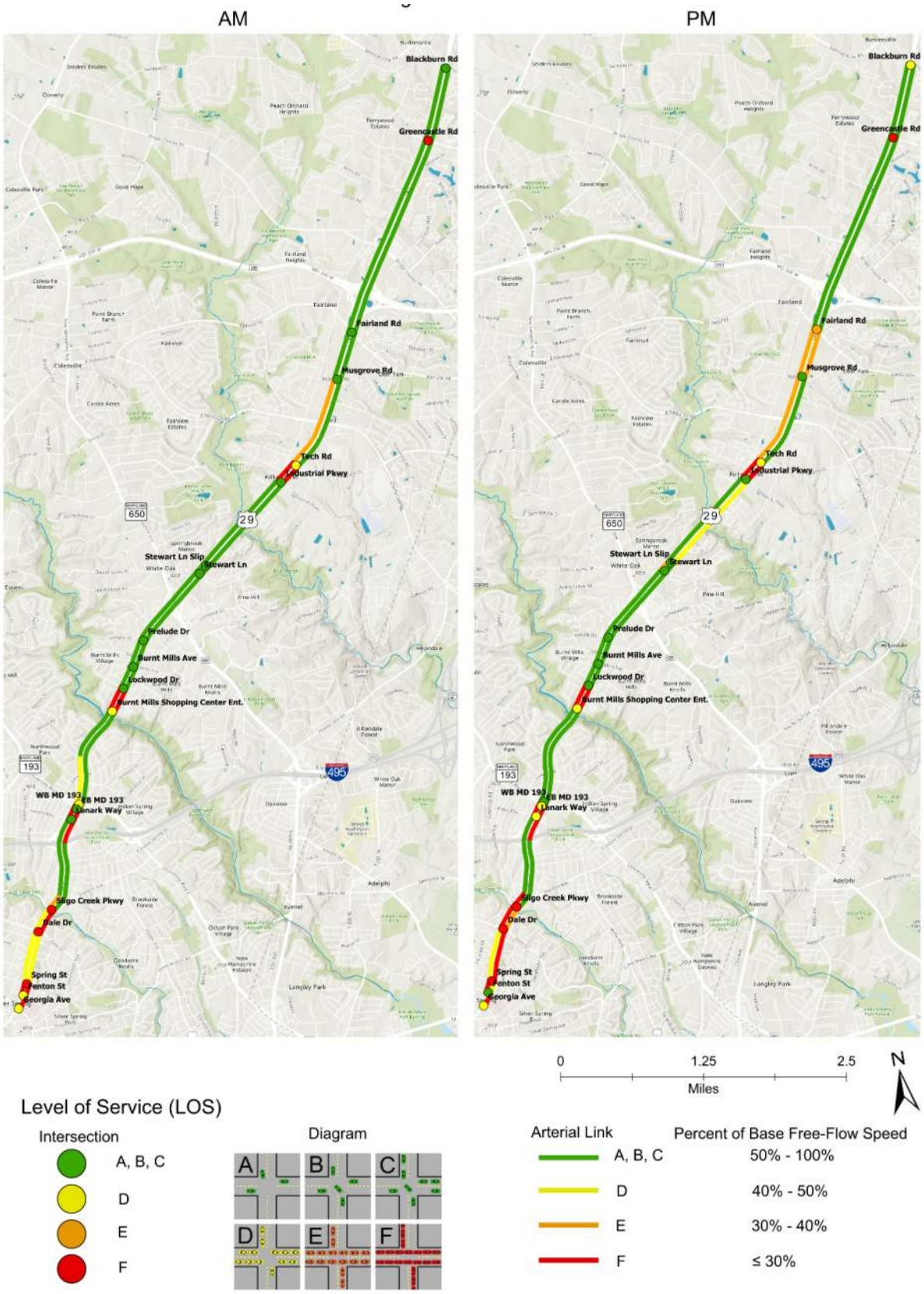


Figure 27: 2025 Managed Lane Link and Intersection Level of Service - BRT

Travel Times

Travel times for single occupancy passenger vehicles, high occupancy passenger vehicles, and buses by peak period and direction are shown in Figure 28 below. Travel times for buses and HOV are reduced by 20 and 15 minutes compared to the 2025 No Action, respectively in the southbound AM. In the northbound PM, travel time for all vehicles improves over the 2025 No Action by up to 10 minutes for buses and 15 minutes for passenger vehicles and HOV.

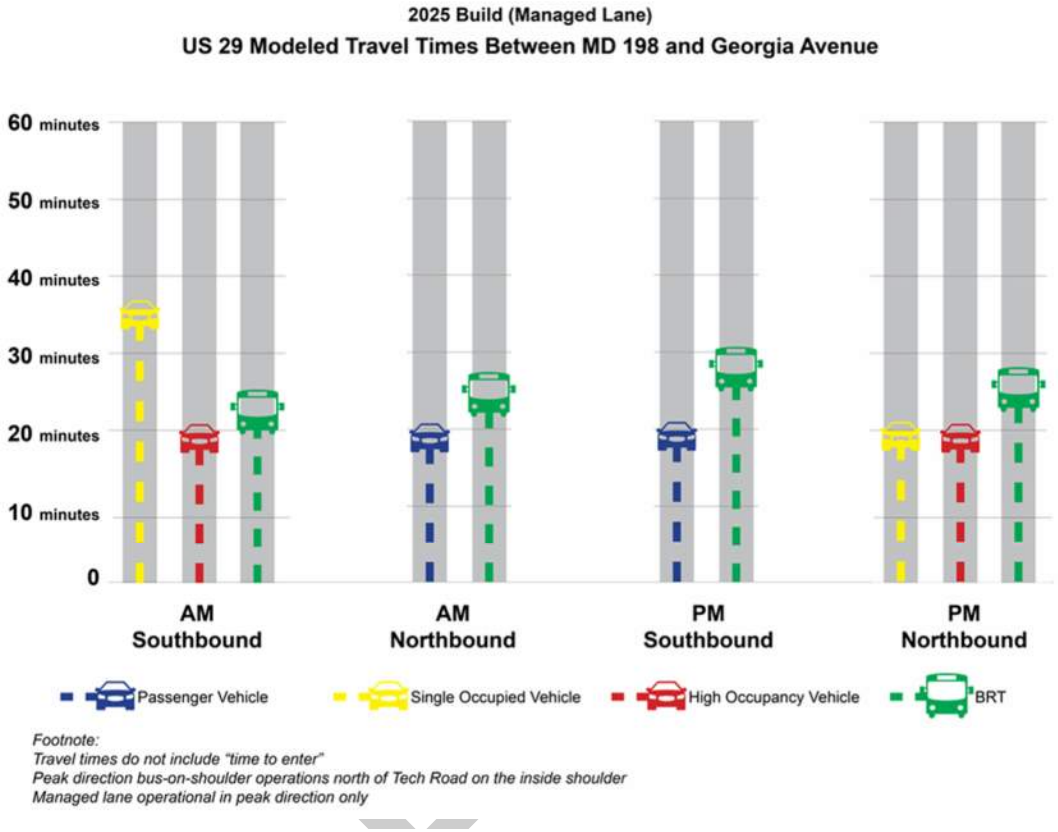


Figure 28: 2025 Managed Lane Travel Times Between MD 198 and Georgia Avenue

Comparison of Alternatives

The person throughout, travel times, and intersection level of service were compared for each alternative for the peak direction of each peak period. The results are summarized in **Figure 29, Figure 30** and **Figure 31** below. The managed lane/ HOV alternative moves 500 or more persons per hour per peak direction, provides faster bus travel times in both peak directions and improves intersection level of service (half fewer failing intersections) over the No Action and the Median Bus Lane option.

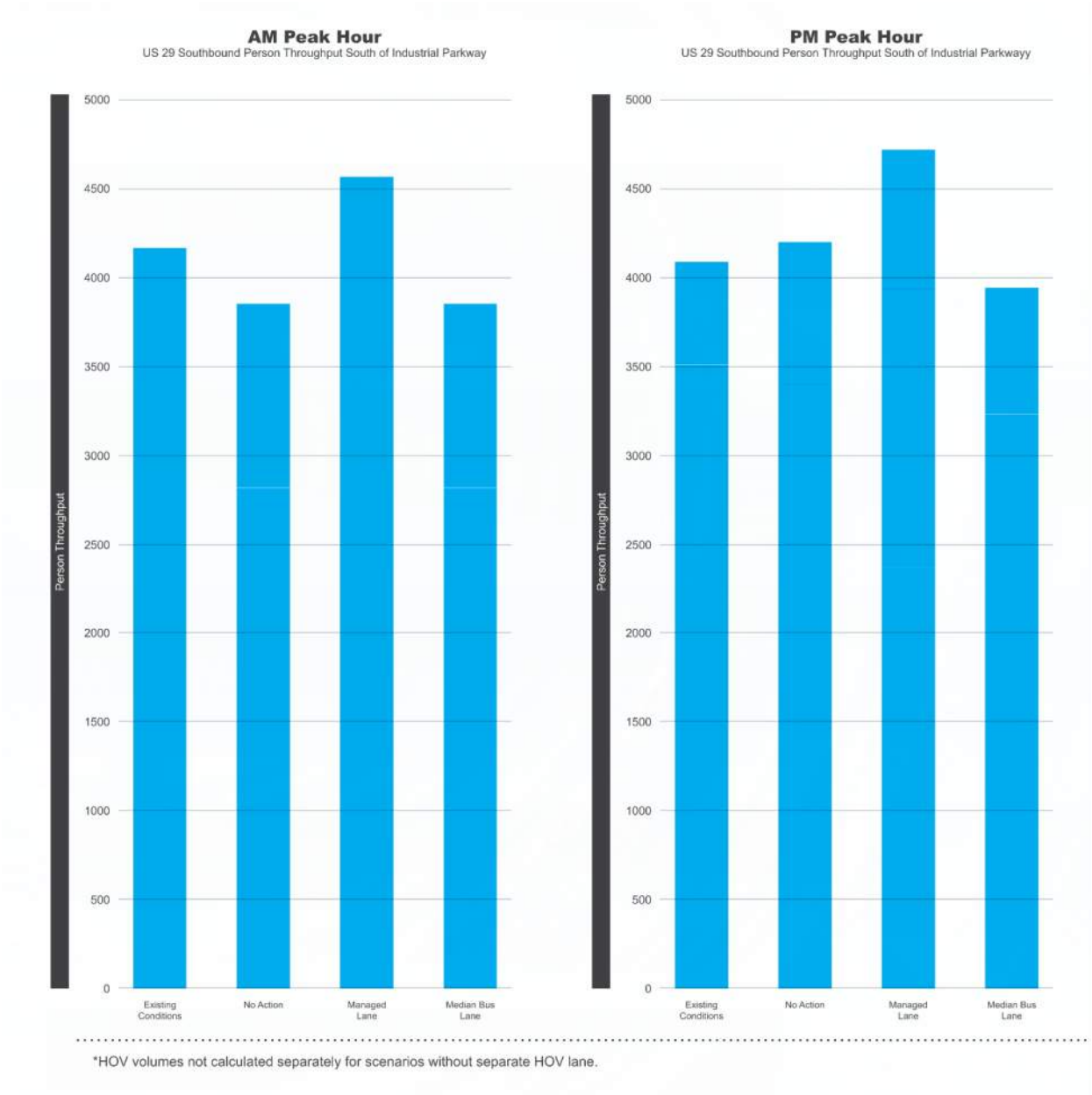


Figure 29: Person Throughput Comparison

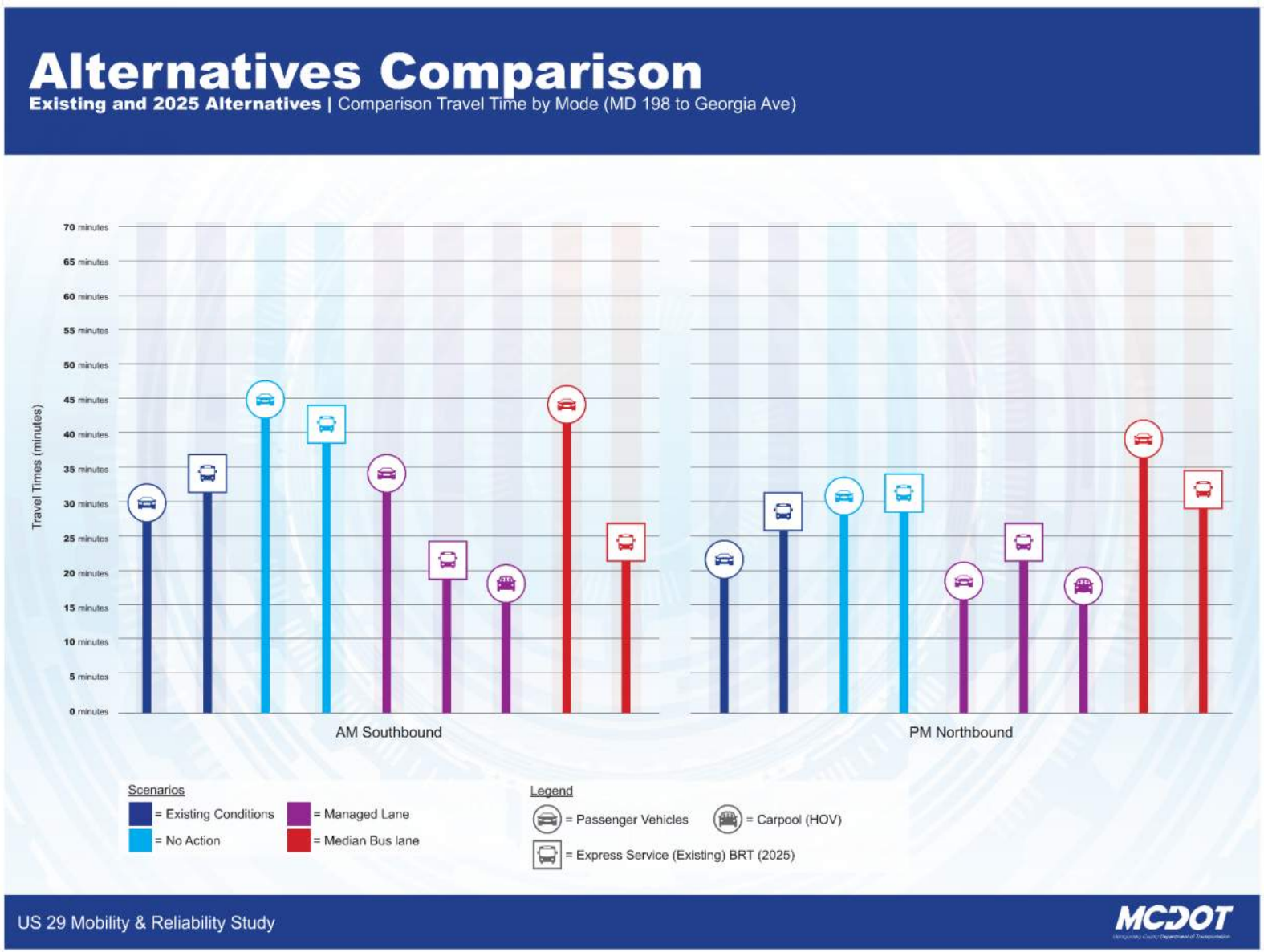


Figure 30: Travel Time Comparison

Figure 31: Intersection Level of Service Comparison

Intersection	No Action LOS		Median Bus Lane LOS		Managed Lane LOS	
	AM	PM				
US 29 & Blackburn Rd	E	-	E	-	-	-
US 29 & Greencastle Rd	F	F	F	F	F	F
US 29 & Fairland Rd	E	-	E	-	E	-
US 29 & Musgrove Road	-	-	-	-	-	-
US 29 & Tech Rd	F	F	F	F	-	-
US 29 & Industrial Parkway	-	-	-	-	-	-
US 29 & Milestone Drive/Stewart Lane	-	E	-	E	-	-
US 29 & Prelude Drive	-	-	-	--	-	-
US 29 & Burnt Mills Avenue	-	-	-	-	-	-
US 29 & Lockwood Drive	-	-	-	-	-	-
US 29 & Burnt Mills Shopping Ctr	E	F	-	F	-	-
US 29 & Southwood Ave	F	-	F	-	F	-
US 29 & MD 193 Westbound	-	-	F	F	-	-
US 29 & MD 193 Eastbound	E	-	F	F	-	-
US 29 & Lanark Way	E	-	F	E	-	-
US 29 & Hastings Drive	-	-	-	E	-	-
US 29 & Franklin Ave	-	F	-	F	E	-
US 29 & Sligo Creek Parkway & St. Andrews Way	F	F	F	F	F	F
US 29 & MD 391 (Dale Dr)	F	F	F	F	F	F
US 29 & Spring St	F	F	F	F	F	F
US 29 & Fenton St	-	E	-	E	-	-
US 29 & Georgia Avenue					-	-
Colesville Rd & 2nd Ave/Wayne Ave	E	-	E	-	-	-

Summary of Findings and Recommended Mobility Package

Summary of Findings

The US 29 Mobility and Reliability study documented existing land use, demographics, corridor travel patterns, previous studies and recommendations, transit service, walking and biking connections and gaps and traffic operations analysis (level of service, travel time and person throughput). A menu of mobility and reliability improvements were identified and evaluated to compliment the investment in FLASH bus service as well as enhance carpool, overall corridor travel time, as well as pedestrian and bicycle access from Tech Road to Silver Spring. The improvement options included intersection/ roadway capacity expansions, new/ upgraded pedestrian and bicycle infrastructure, traffic management and traveler information strategies, and corridor-wide bus priority geometric and operational treatments.

The findings indicate:

- Average daily traffic volumes along US 29 vary from 60,000 to 70,000
- The corridor is served by three transit operators (WMATA, RideOn and MTA) and there are between 7,000 to 8,000 bus passengers per day.
- Passenger vehicle travel times in the corridor from Tech Road to Georgia Avenue range from under 15 minutes in the off-peak direction to over 25 minutes in the peak direction.
- Several roadway sections in the US 29 corridor exceed their volume to capacity ratio under existing conditions.
- Several intersections operate with a LOS E or LOS F during at least one peak hour (US 29 at Tech, Burnt Mills Shopping Center, Southwood, Sligo Creek Parkway, Dale Drive and Spring Street)
- Over 30 previous studies were conducted in the corridor by the County or State over the past two decades recommending dozens of roadway, transit, pedestrian and bicycle improvements
- The eight Flash stations evaluated in this report were found to have significant gaps and barriers in pedestrian and bicycle accessibility. The station area (1/2 mile radius) serves between 9,000 households and 20,000 jobs in downtown Silver Spring to 700 households and 2,200 jobs in Tech Road
- The existing number of households (53,115) and jobs (61,880) are expected to grow to 64,893 households (21%), and 89,403 jobs (44 %) by 2040.
- Without any roadway improvements or shift in mode by 2040 every intersection in the corridor will operate at a LOS E or F in at least one peak hour, and travel times will double.
- Six major intersection/ interchange improvements were identified to remove critical bottlenecks
- Two corridor-wide bus priority options were evaluated, including a median bus lane and a managed bus / HOV lane to provide reliable transit operations
- Over 200 individual pedestrian and bicycle improvements were identified
- A suite of traffic management and traveler information strategies were identified
- The median bus lane alternative cost exceeded $100 million and included significant right-of-way and utility impacts. Operationally, travel time savings were limited for buses, and all intersections were anticipated to operate at a LOS E or F (it should be noted that intersection improvements were not included in the analysis).

- The managed lane alternative cost was approximately $50 million. Operationally, travel time savings of up to 15 minutes were predicted for transit and carpool modes. Only seven study intersections remained at a LOS E or F with the intersection/ interchange improvements included.
- Person throughput increased by over 500 persons per hour for the managed lane alternative compared to existing, No Action and median bus lane alternative

Recommendations and Phasing

Based on the results of the analysis, the managed bus/HOV lane alternative, in combination with the intersection improvements, is expected to perform better than the median bus lane for in year 2025 for overall traffic operations, person throughput and travel time reliability. The managed bus lane also costs at least $50 million less than the median bus lane with fewer right-of-way, utility, stormwater and environmental permitting impacts.

The following mobility package and phasing is recommended for implementation:

Musgrove Road to Stewart Lane:

Peak period/ peak direction managed bus /HOV lanes and hard shoulder running

MD 650 to Southwood Avenue (SB) and Burnt Mills Avenue (NB):

Peak period/ peak direction managed bus /HOV lanes

Dale Drive to Spring Street:

Convert reversible lane to peak period/ peak direction bus/ HOV lanes

In addition to the managed lanes, **intersection improvements** at Greencastle Road, Tech Road, Stewart Lane, and Sligo Creek Parkway, as well as **interchange improvements** at MD 650 and I-495

A managed lane from Blackburn Road to Fairland Road is not recommended, as the interchange construction at Blackburn Road, Greencastle Road, and Fairland Road necessitated by the managed lane would be more costly than the benefit the managed lane would provide.

Mobility package phasing is suggested as follows:

Short-term Recommendations:

- Prioritize pedestrian and bicycle improvements around bus stops
- Design and construct improvements at Greencastle Road, Tech Road, Stewart Lane, MD 650, Burnt Mills Avenue, I-495 (choice exit lane) and Sligo Creek Parkway.
- Implement technology-focused Traffic Management Solutions

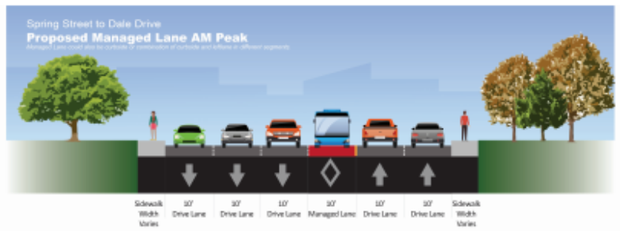
Mid-term Recommendations: Bus priority design elements.

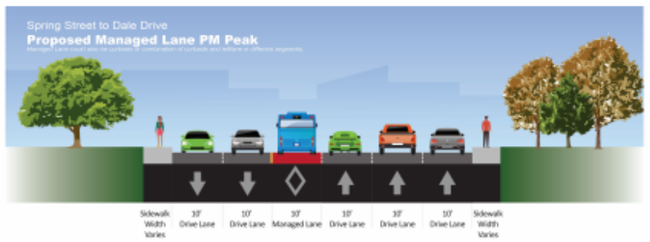
- Bus/HOV managed lane, peak period hard shoulder running from Tech to Stewart Lane.
- Peak period bus/HOV managed lane from MD 650 to Southlawn/ Burnt Mills

The total project cost is $100 million - $20 million (pedestrian/ bicycle), $5 million (traffic management) $25 million (intersection/ interchange improvements) and $50 million (bus priority improvements). Figure 32 illustrates the recommended improvements by segment.

Sligo Creek Pkwy to Spring Street
Peak Period/Direction HOV + Bus Managed Lane

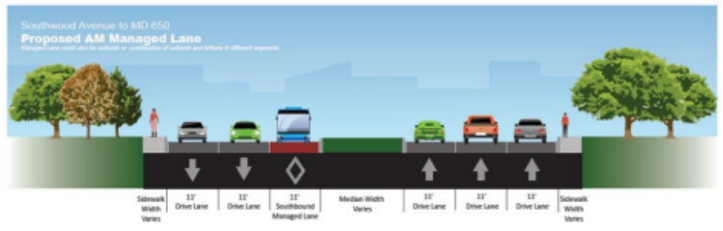
$0.5-1.5M Construction

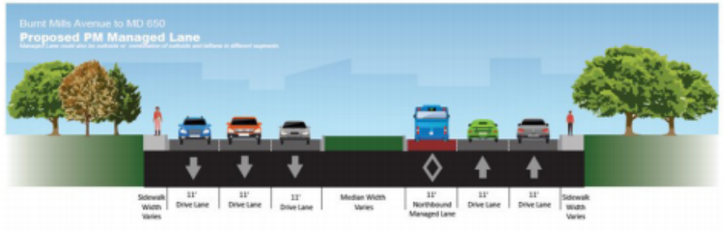


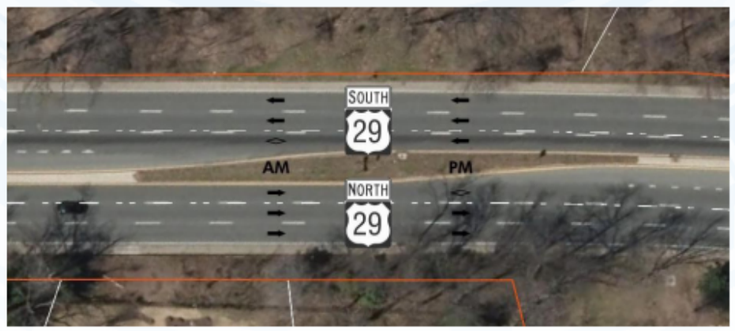


MD 650 to Southwood (SB) and Burnt Mills (NB)
Peak Period/Direction HOV + Bus Managed Lane

$4.0-5.0M Construction
- MD 650 to Burnt Mills
- Burnt Mills to Southwood

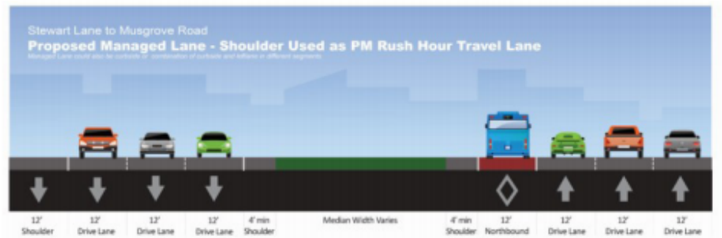


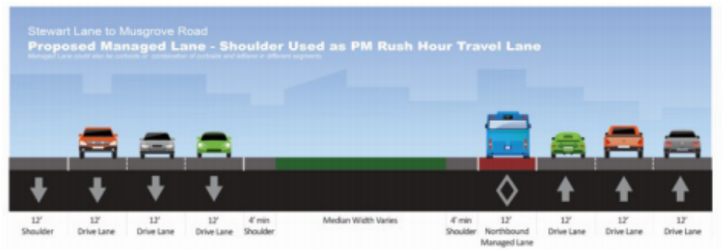




Musgrove to Stewart
Peak Period/ Direction HOV + Bus Managed Lane/Hard Running Shoulder

$45-50M Construction





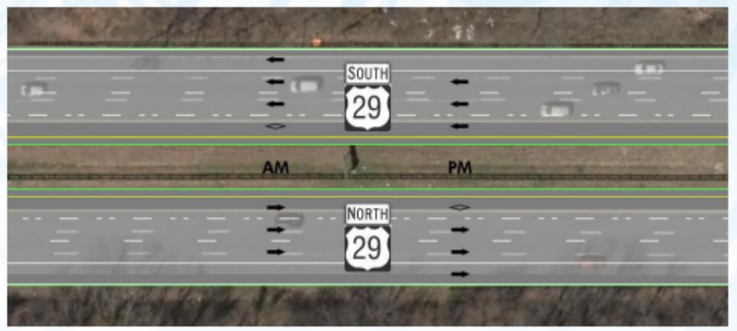


Figure 32: Mobility Package Recommendations by Segment