Appendix A

IAPA Framework Document (December 2020)

IAPA FRAMEWORK DOCUMENT

December 2020

U.S. Department of Transportation
Federal Highway Administration

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Table of Contents

List of Tables

List of Figures

Appendices

1 INTRODUCTION

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is currently conducting the I-495 & I-270 Managed Lanes Study (MLS). The Study is evaluating potential transportation improvements to portions of the I-495 and I-270 corridors in Montgomery and Prince George's Counties, Maryland, and Fairfax County, Virginia.

I-495 and I-270 in Maryland are the two most heavily traveled freeways in the National Capital Region, each with Average Annual Daily Traffic (AADT) volume up to 260,000 vehicles per day in 2018 (MDOT SHA, 2019). I-495 is the only circumferential route in the region that provides interregional connections to many radial routes in the region, such as I-270, US 29 (Colesville Road), I-95, the Baltimore-Washington Parkway, US 50 (John Hanson Highway), and MD 5 (Branch Avenue). I-270 is the only freeway link between I-495 and the fast-growing northwest suburbs in northern Montgomery County and the suburban areas in Frederick County. In addition to heavy commuter traffic demand, I-495 provides connectivity along the East Coast, as it merges with I-95 in Maryland for 25 miles around the east side of Washington DC. (Figure 1).

This Study is considering alternatives that address roadway congestion within the specific Study scope of 48 miles from I-495 from south of the George Washington Memorial Parkway in Fairfax County, Virginia, including improvements to the American Legion Bridge over the Potomac River, to west of MD 5, and along I-270 from I-495 to north of I-370, including the East and West I-270 Spurs.

Due to the magnitude of the Study, MDOT SHA intends to construct the improvements in phases, if a Build Alternative is selected. The I-495 & I-270 Managed Lanes Study Phase 1 (Figure 2) limits would extend along I-495 from the vicinity of the George Washington Memorial Parkway in Virginia, across and including the American Legion Bridge, to its interchange with I-270 at the West Spur and I-270 from its interchange with I-495 to north of I-370.

The Notice of Intent to Initiate NEPA Study occurred in Spring 2018. The Draft Environmental Impact Statement (DEIS) was published for public comment in July 2020[1]. The Final Environmental Impact Statement (FEIS) will be developed from the Fall 2020 to Spring 2021[2].

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1 https://495-270-p3.com/deis/

2 https://495-270-p3.com/environmental/study-timeline/

Figure 1: I-495 and I-270 MLS Corridors

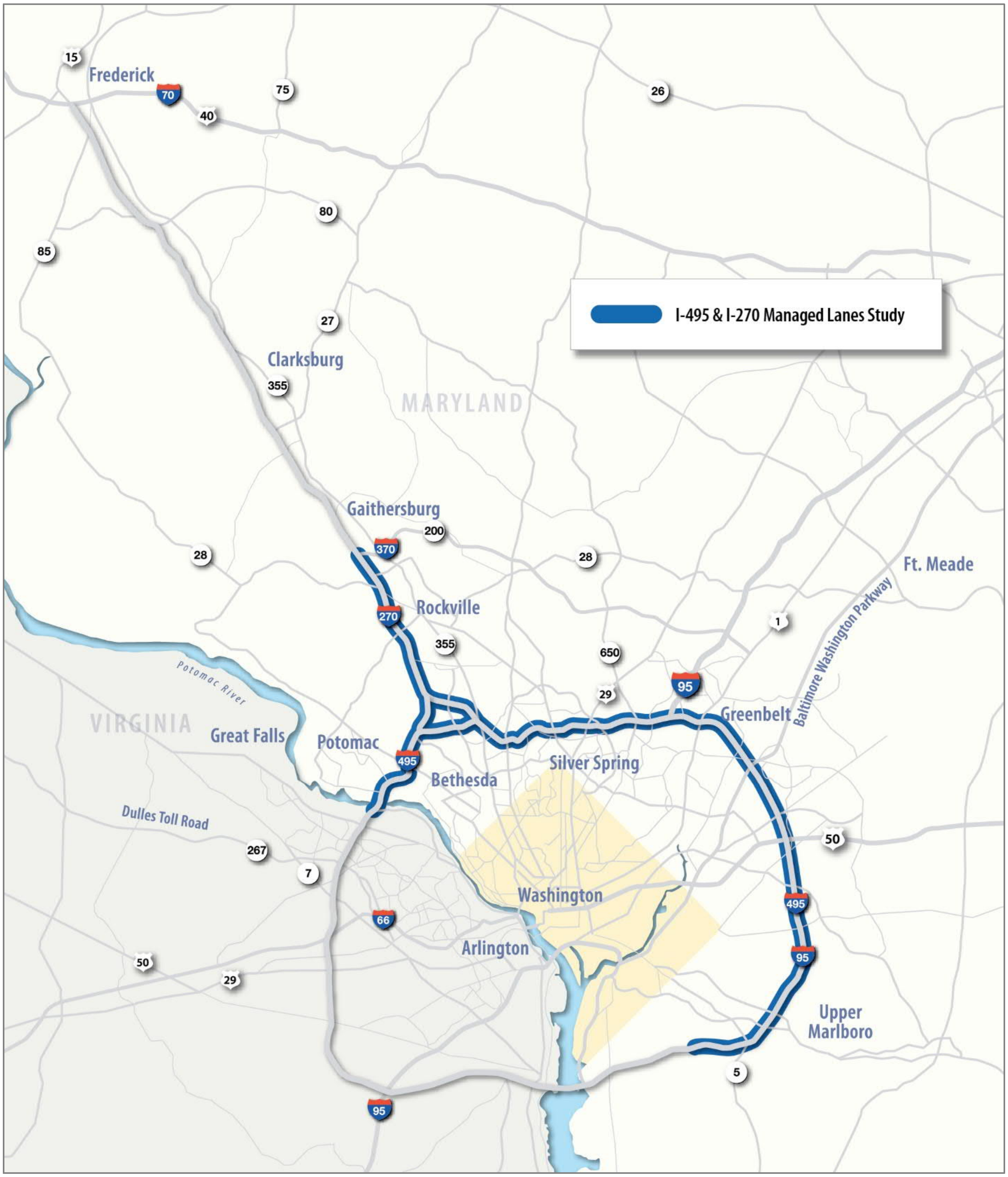
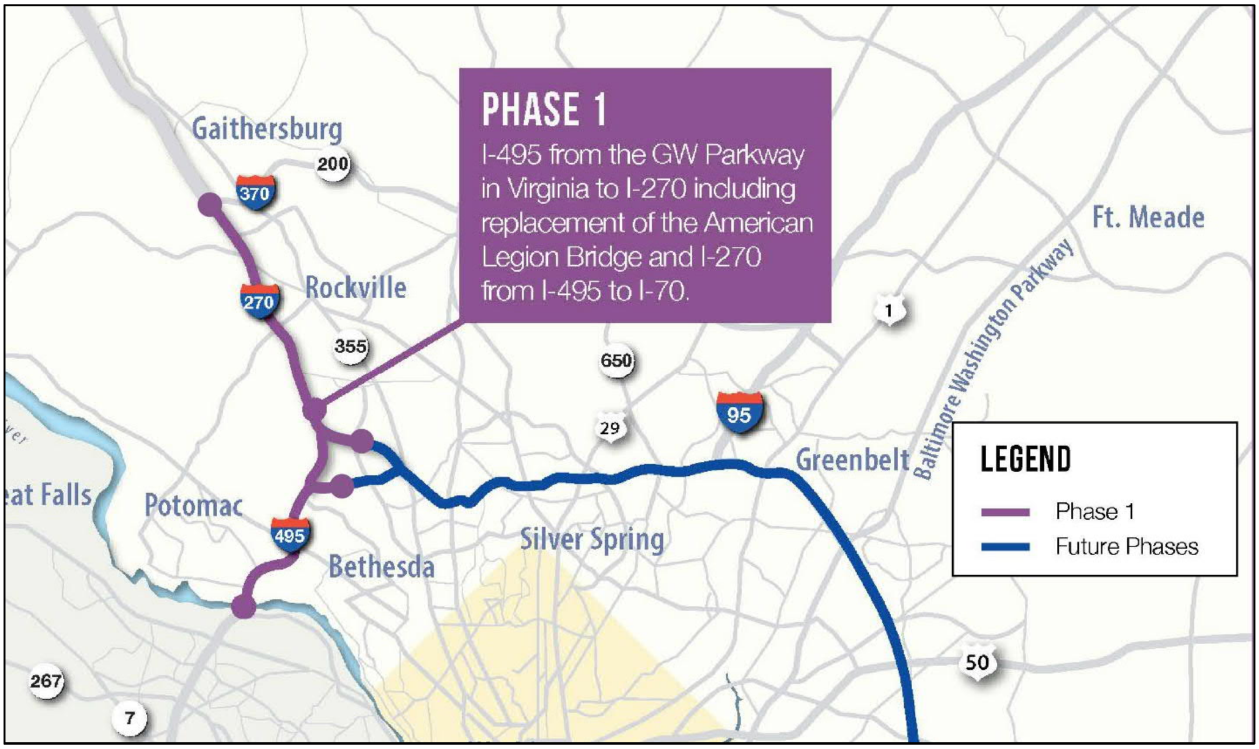


Figure 2: I-495 and I-270 MLS Phase 1 Limits



2 FRAMEWORK DOCUMENT PURPOSE

MDOT SHA is now beginning the development of an Interstate Access Point Approval (IAPA) report for the I-495 & I-270 Managed Lanes Study that will document information necessary to allow MDOT SHA to make informed decisions and to be acceptable to the Federal Highway Administration (FHWA) for safety, operations and engineering. This document and its analysis will use and build upon the traffic modeling and analysis completed for the Draft Environmental Impact Statement (DEIS), but will provide a more in-depth evaluation of operations and safety of the Recommended Preferred Alternative (RPA), which is expected to be identified in early 2021. The IAPA report will be reflective of the future design year of 2045 (while the design year for the DEIS reflected 2040), interim year (2027) analysis for the opening year of Phase 1, and revisions to the proposed managed lanes access points. The proposed managed lane access points continue to be refined as more detailed analyses are completed.

The IAPA for the MLS will document the information necessary to allow FHWA to make an informed decision regarding the potential impacts of a change in access. This document outlines the scope of work and assumptions for the traffic forecasting and analysis work in support of the IAPA.

3 SCOPE

As noted in the DEIS, the purpose of the MLS is to develop a travel demand management solution(s) that addresses congestion and improves trip reliability on I-495 and I-270 within the Study limits and enhances existing and planned multimodal mobility and connectivity. The Study's purpose is to address the following needs:

- Accommodate Existing Traffic and Long-Term Traffic Growth – High travel demand from commuter, business, and recreational trips results in severe congestion from 7 to 10 hours per day on the Study corridors, which is expected to deteriorate further by the planning horizon year of 2040. Additional roadway capacity is needed to address existing and future travel demand and congestion, reduce travel times, and allow travelers to use the facilities efficiently.

- Enhance Trip Reliability – Congestion on I-495 and I-270 results in unpredictable travel times. Travelers and freight commodities place a high value on reaching their destinations in a timely and safe manner, and in recent years, the Study corridors have become so unreliable that uncertain travel times are experienced daily. More dependable travel times are needed to ensure trip reliability.

- Provide Additional Roadway Travel Choices – Travelers on I-495 and I-270 do not have enough roadway options for efficient travel during extensive periods of congestion. Additional roadway management options are needed to improve travel choices, while retaining the general-purpose (GP) lanes.

- Accommodate Homeland Security – The National Capital Region is considered the main hub of government, military, and community installations related to homeland security. These agencies and installations rely on quick, unobstructed roadway access during a homeland security threat. Additional capacity would assist in accommodating a population evacuation and improving emergency response access should an event related to homeland security occur.

- Improve Movement of Goods and Services – I-495 and I-270 are major regional transportation networks that support the movement of passenger and freight travel within the National Capital Region. Existing congestion along both corridors increases the cost of doing business due to longer travel times and unreliable trips. The effects of this congestion on the movement of goods and services is a detriment to the health of the local, regional, and national economy. Efficient and reliable highway movement is necessary to accommodate passenger and freight travel, moving goods and services through the region.

Additional roadway capacity and improvements to enhance reliability must be financially viable. MDOT's traditional funding sources would be unable to effectively finance, construct, operate, and maintain improvements of this magnitude. Revenue sources that provide adequate funding, such as pricing options, are needed to achieve congestion relief and address existing high travel demand.

The preparation of the Environmental Impact Statement is being closely coordinated among MDOT SHA, FHWA, and the following agencies:

- US Army Corp of Engineers (USACE) Baltimore District
- US Environmental Protection Agency (EPA)
- National Park Service (NPS)
- National Capital Planning Commission (NCPC)
- Maryland Department of the Environment (MDE)
- Maryland Department of Natural Resources (MDNR)
- Virginia Department of Transportation (VDOT)
- Maryland-National Capital Park and Planning Commission (M-NCPPC)

The DEIS, published in July 2020, considered six Build alternatives and the No Build alternative. The RPA is expected in early 2021 after completion of and consideration of comments received from the DEIS comment period.

4 POLICY POINTS

FHWA's "Policy on Access to the Interstate System" (May 2017) includes two policy points:

1. *An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraphs 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*

2. *The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.*

The IAPA will address both policy points. Traffic operational analyses will be performed and documented in the IAPA. Details of the scope of the operational analyses are summarized in Section 7. Existing crash data will be summarized and both a qualitative and quantitative safety analysis will be performed to document the anticipated safety impacts of the proposed interchange. Details of the scope of the safety analyses are summarized in Section 8.

The MLS maintains all existing traffic movements at all existing interchanges. The MLS also adds managed lanes access to multiple interchanges, including three new proposed interchanges that will provide access to the managed lanes only (Figure 3). The methodology and assumptions for the operational analyses of these interchanges are summarized in Section 7. A conceptual signing plan depicting all major guide signs will be prepared and included in the IAPA. Design exceptions will be identified and provided in the IAPA.

The IAPA will comply with MDOT SHA's "Interstate Access Point Approval Process for the Maryland Department of Transportation State Highway Administration" (July 2017).

5 STUDY ASSUMPTIONS

During the NEPA process, a model was developed with defined geographical limits. As the MLS is considering improvements along I-495, I-270, and its interchanges, the model development began with determining the limits of these freeways to be included. This model will be used in the IAPA.

The Existing and No Build interchange locations are shown in Figure 4. Existing lane configurations for I-495 and I-270 are described in Tables 1 and 2, respectively. This list includes the Existing locations of HOV lanes and CD lanes. The Existing locations of the HOV lanes, as well as CD lanes, are shown in Figure 5. A list of interchanges with proposed Managed Lane access and proposed changes to General Purpose Lane access is included in Table 3.

VISSIM models will be used to provide operational analysis results for freeways, ramps, and ramp junction intersections. Synchro will be used to develop the signal timing and phasing for input into the future-year VISSIM models. This analysis will be supplemented with Synchro analysis of the ramp junction intersections and their adjacent intersections.

Figure 3: I-495 and I-270 MLS Access Locations

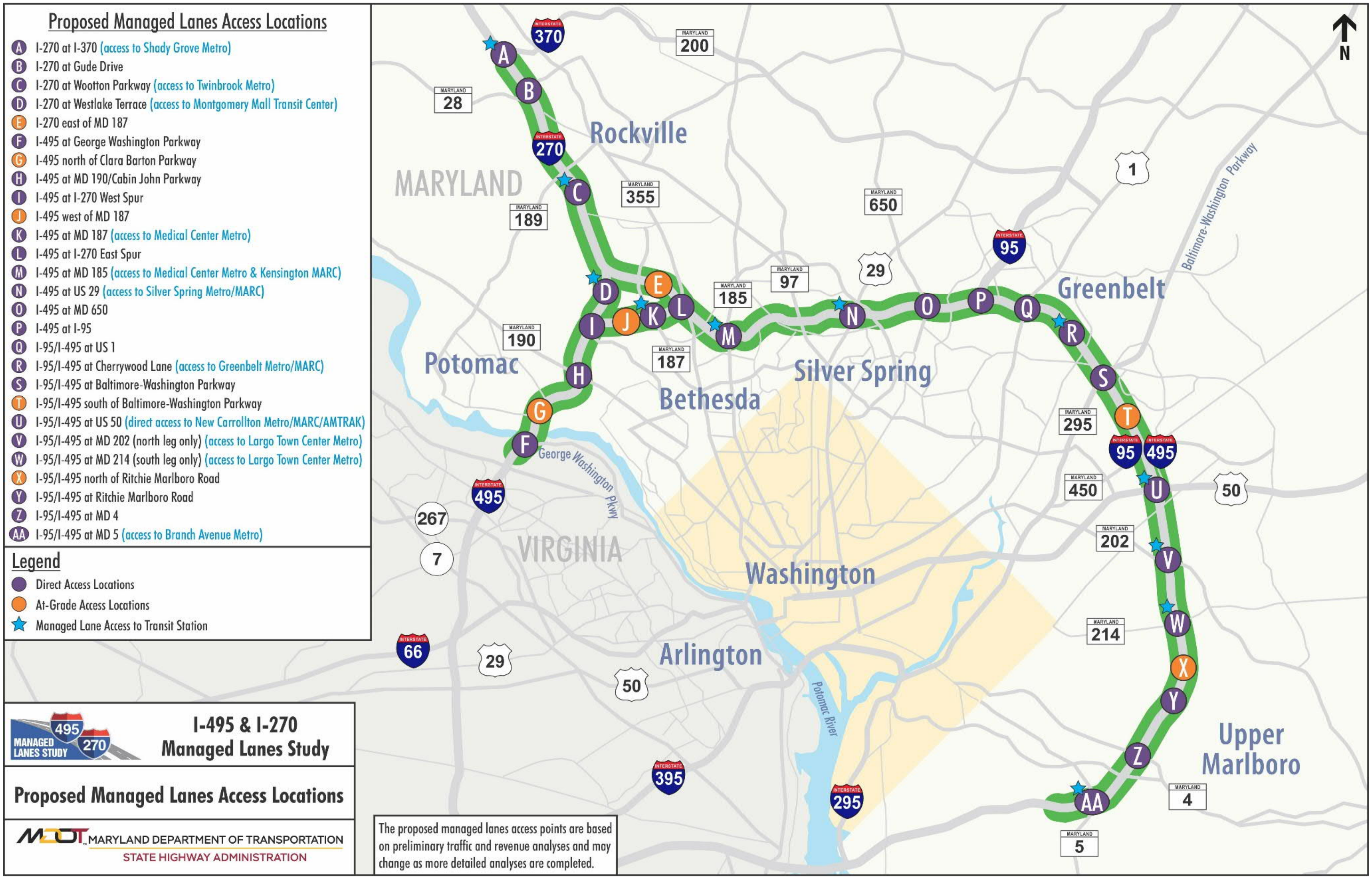


Figure 4: Limits of Traffic Model Network and Interchange Locations Included along I-495 and I-270 (Existing and No Build)

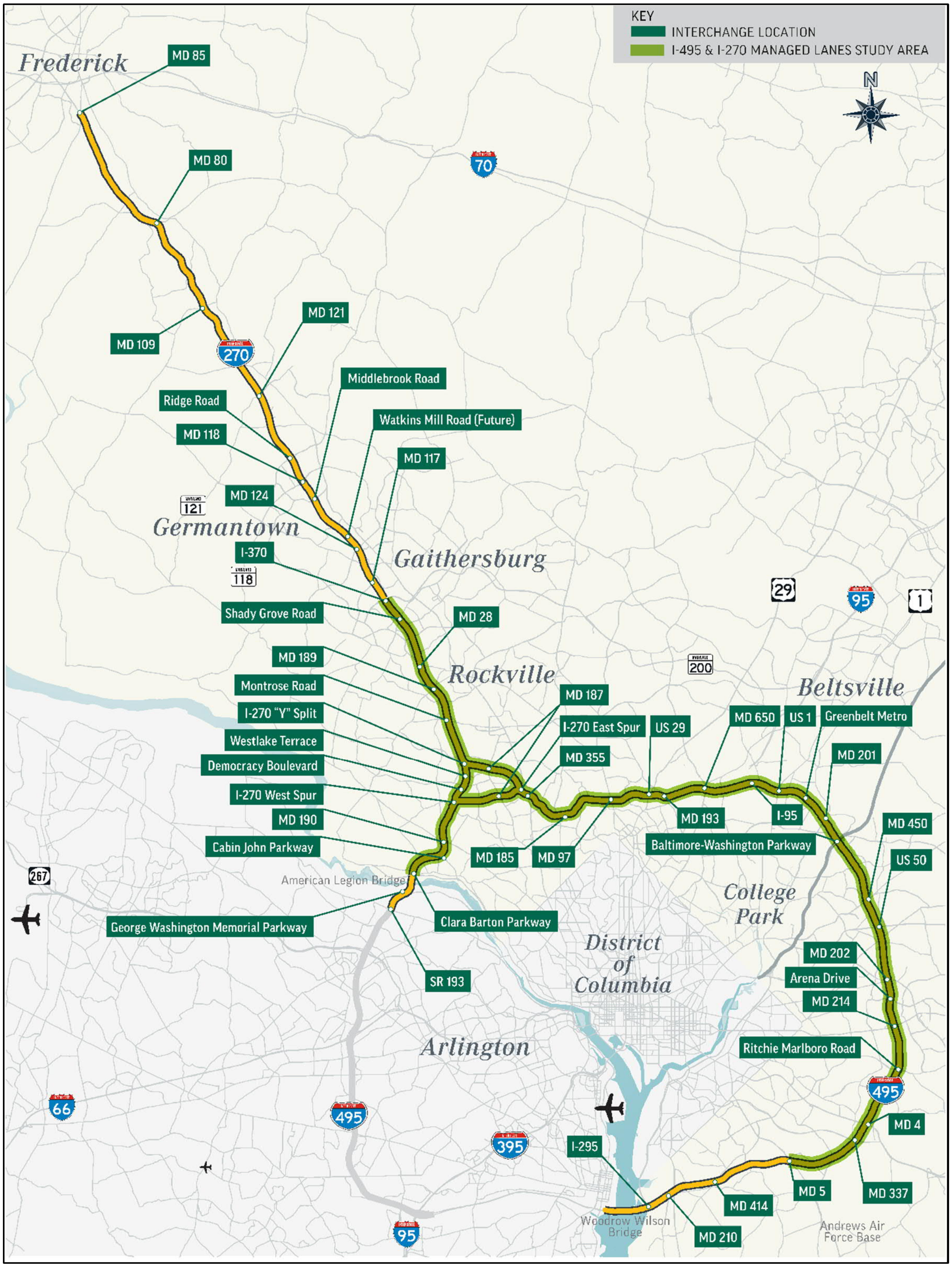


Table 1: I-495 Interchanges and Lane Configurations Included in Model (Existing)

Segment		# Lanes	
From	To	Inner Loop	Outer Loop
VA 193	George Washington Memorial Pkwy	4 + 1 aux	4 + 3 CD
George Washington Memorial Pkwy	Clara Barton Pkwy	4 + 1 aux	4 + 1 aux
Clara Barton Pkwy	Cabin John Pkwy	4	4
Cabin John Pkwy	MD 190	4	4
MD 190	I-270 West Spur	5	5
I-270 West Spur	MD 187	3	3
MD 187	I-270 East Spur/MD 355	3	3
I-270 East Spur/MD 355	MD 185	4	4
MD 185	MD 97	4	4
MD 97	US 29	4	4
US 29	MD 193	4 + 1 aux	4
MD 193	MD 650	4	4 to 5
MD 650	I-95	4 + 1 aux	5 + 1 aux
I-95	US 1	4 + 2 CD	4 + 2 aux
US 1	Greenbelt Metro	4	4
Greenbelt Metro	MD 201	4	4
MD 201	Baltimore-Washington Pkwy	4	4 + 1 aux
Baltimore-Washington Pkwy	MD 450	4	4
MD 450	US 50	4	4 + 1 aux
US 50	MD 202	4 to 3 + 2 CD + 1 aux	4 to 3 + 2 CD + 1 aux
MD 202	Arena Drive	3 + 2 CD + 1 aux	3 + 2 CD + 1 aux
Arena Drive	MD 214	4 + 1 aux	4 + 1 aux
MD 214	Ritchie Marlboro Road	4	4
Ritchie Marlboro Road	MD 4	4	4
MD 4	MD 337	4	4
MD 337	MD 5	4	4
MD 5	MD 414	4	4
MD 414	MD 210	4	4
MD 210	I-295	2 + 3 CD	2 + 3 CD
I-295	Woodrow Wilson Bridge	2 + 3 CD	2 + 3 CD

Table 2: I-270 Interchanges and Lane Configurations Included in Model (Existing)

Segment		# Lanes	
From	To	Southbound	Northbound
North of Split			
MD 85	MD 80	2	2
MD 80	MD 109	2	2
MD 109	MD 121	2	2
MD 121	Father Hurley Boulevard	3	2 + 1 HOV*
Father Hurley Boulevard	MD 118	3 + 1 aux	2 + 1 HOV* + 1 aux
MD 118	Middlebrook Road	3	3 + 1 HOV*
Middlebrook Road	Watkins Mill Road (Future)	4	3 + 1 HOV*
Watkins Mill Road (Future)	MD 124	4	3 + 1 HOV*
MD 124	MD 117	4	3 + 1 HOV* + 2 CD
MD 117	I-370	5 to 4 + 2 CD	3 + 1 HOV* + 3 CD
I-370	Shady Grove Road	3 + 1 HOV* + 3 CD	3 + 1 HOV* + 3 CD
Shady Grove Road	MD 28	3 + 1 HOV* + 2 CD	3 + 1 HOV* + 3 CD
MD 28	MD 189	3 + 1 HOV* + 2 CD	3 + 1 HOV* + 2 CD
MD 189	Montrose Road	3 + 1 HOV* + 2 CD	3 + 1 HOV* + 2 CD
Montrose Road	I-270 Split	5 + 1 HOV*	5 + 1 HOV*
East Spur			
I-270 Split	MD 187	3 to 2 + 1 HOV*	3 to 2 + 1 HOV*
MD 187	I-495	2 + 1 HOV*	2 + 1 HOV*
West Spur			
I-270 Split	Westlake Terrace	2 + 1 HOV*	2 + 1 HOV*
Westlake Terrace	Democracy Boulevard	2 + 1 HOV*	2 + 1 HOV*
Democracy Boulevard	I-495	3	3

**HOV lanes are in service from 6:00-9:00 AM Southbound and 3:30-6:30 PM Northbound on weekdays; lanes are for general purpose during other times*

Figure 5: Locations of High Occupancy Vehicle (HOV) and Collector-Distributor (CD) Lanes (Existing)

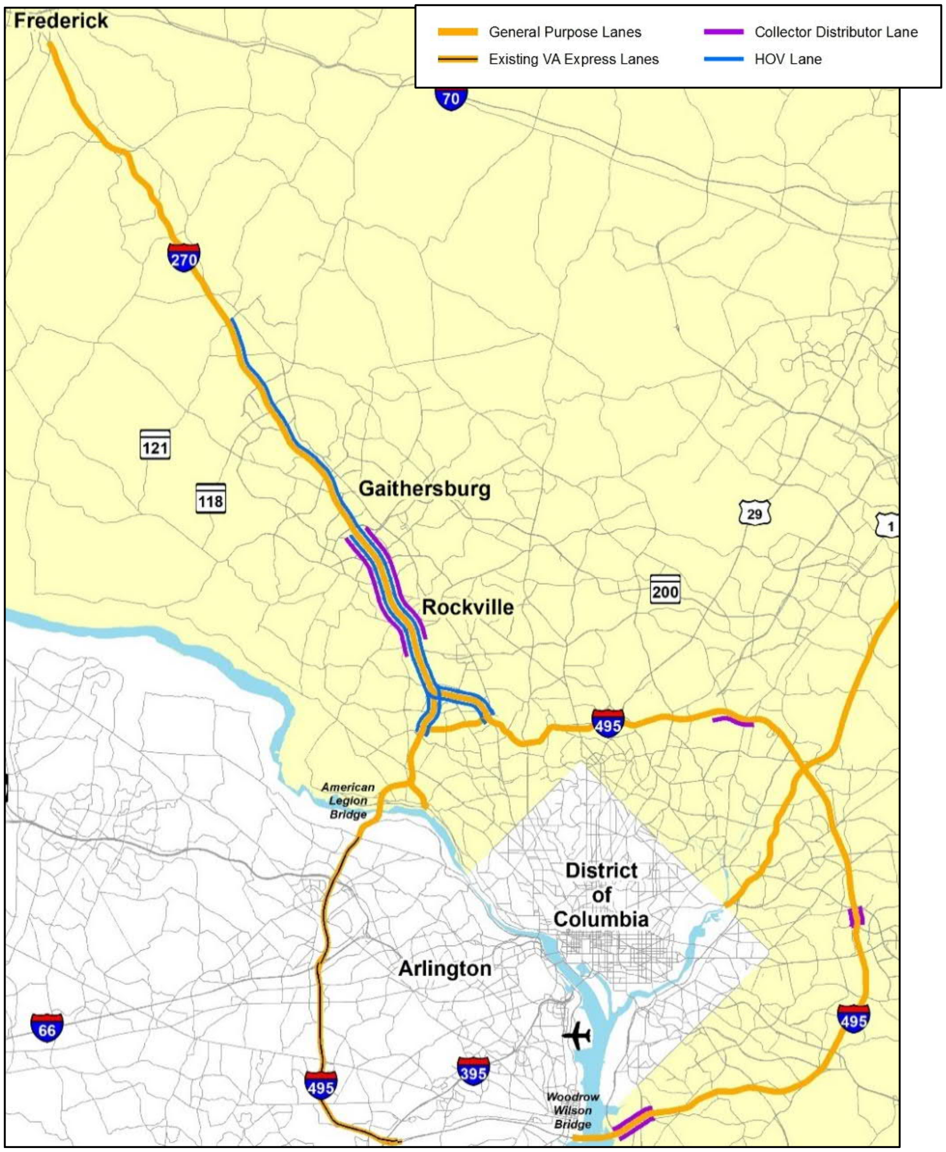


Table 3: Proposed Managed Lane Access and General Purpose Lane Access Changes

Interchange No.	Interchange Description	Proposed Managed Lanes Access	Proposed General Purpose Lanes Access
1	I-270 at MD 117	None	No change
2	I-270 at I-370	Full	No change
3	I-270 at Shady Grove Road	None	No change
4	I-270 at Gude Drive (new interchange)	Full	No change (no GPL access provided)
5	I-270 at MD 28	None	No change
6	I-270 at MD 189	None	No change
7	I-270 at Wootton Parkway (new interchange)	Full	No change (no GPL access provided)
8	I-270 at Montrose Road	None	No change
9	I-270 at I-270 Spur (Y-Split)	Full	No change
10	I-270 at Westlake Terrace	Full	Existing ramps to/from HOV lanes to/from the North replaced by ramps to/from MLs
11	I-270 at Democracy Boulevard	None	No change
12	I-270 at Rockledge Drive / MD 187	None	No change
13	I-270 east of MD 187	At-grade ramps from ML to GP EB and from GP to ML WB	No change
14	I-495 at VA 193	None	No change
15	I-495 at George Washington Memorial Parkway	Full	No change
16	I-495 with Clara Barton Parkway	None	No change
17	I-495 at MD 190 / Cabin John Parkway	Full	Replace loop ramp from MD 190 WB to I-495 Outer Loop with directional ramp and relocate directional ramp from MD 190 EB to I-495 Outer Loop to signal
18	I-495 at I-270 West Spur	Full	No change
19	I-495 west of MD 187	At-grade ramps from ML to GP EB and from GP to ML WB	No change
20	I-495 at MD 187	Full	Interchange reconfigured to a SPUI to provide access to/from GPLs and MLs via the same ramps

Table 3: Proposed Managed Lane Access and General Purpose Lane Access Changes (Continued)

Interchange No.	Interchange Description	Proposed Managed Lanes (ML) Access	Proposed General Purpose Lanes (GPL) Access
21	I-495 at I-270 East Spur / MD 355	Full access between I-495 and the I-270 East Spur; no direct ML access to MD 355	Convert ramp from NB MD 355 GP to I-495 Outer Loop GP from left-side on-ramp to right-side on-ramp
22	I-495 at MD 185	Full	No change
23	I-495 at MD 97	None	Replace all three loop ramps with directional ramps
24	I-495 at US 29	Full	Replace all three loop ramps with directional ramps; add movement from I-495 Outer Loop to US 29 NB
25	I-495 at MD 193	None	Replace both loop ramps with directional ramps; add movement from MD 193 SB to I-495 Outer Loop
26	I-495 at MD 650	Full	Replace loop ramps from MD 650 SB to I-495 Inner Loop and from I-495 Inner Loop to MD 650 NB with directional ramps and signalize, relocate directional ramp from MD 650 NB to I-495 Inner Loop to signal
27	I-495 at I-95	Full	Convert flyover ramp NB from Park and Ride to I-495 Outer Loop to loop ramp
28	I-495 at US 1	Full	No change
29	I-495 at Greenbelt Station / Cherrywood Lane	Full	Add ramps from I-495 Outer Loop to Greenbelt Metro Dr and from Greenbelt Metro Dr to I-495 Inner Loop (included in the No Build)
30	I-495 at MD 201	None	No change
31	I-495 at Baltimore Washington Parkway (MD 295)	Full	No change

Table 3: Proposed Managed Lane Access and General Purpose Lane Access Changes (Continued)

Interchange No.	Interchange Description	Proposed Managed Lanes (ML) Access	Proposed General Purpose Lanes (GPL) Access
32	I-495 south of Baltimore Washington Parkway (MD 295)	At-grade ramps (ML to GPL access on the inner loop; GPL to ML access on the outer loop)	No change
33	I-495 at MD 450	None	No change
34	I-495 at US 50/Pennsy Drive	Full	No change
35	I-495 at MD 202	To/from north	No change
36	I-495 at Arena Drive	None	No change
37	I-495 at MD 214	To/from south	No change
38	I-495 north of Ritchie Marlboro	At-grade ramps (GPL to ML access on the inner loop; ML to GPL access on the outer loop)	No change
39	I-495 at Ritchie Marlboro	Full	No change
40	I-495 at MD 4	Full	Replace all four loop ramps with directional ramps
41	I-495 at MD 337 / Suitland Road	None	No change
42	I-495 at MD 5	To/from east	No change
43	I-495 at MD 414	None	No change

5.1 I-495 DESCRIPTION

I-495 is a 64-mile circular freeway that runs through Maryland and Virginia and around the District of Columbia and includes 42 miles in Maryland. I-495 provides access to several roadways in the Washington, DC area, including:

- I-95, which runs along the east coast of the United States from Maine to Florida,
- I-270, which connects the Washington, DC area to Frederick County and western Maryland,
- US 29 and MD 295 (Baltimore-Washington Parkway), which provide connections from the Washington, DC Maryland suburbs to the Baltimore region,
- US 50, which provides access to Annapolis and the Eastern Shore, and
- MD 5, which provides access to southern Maryland.

For a 25-mile section in Prince George's County from the I-495/I-95 interchange to the Woodrow Wilson Bridge, I-495 runs concurrent with I-95. Collector-Distributor (CD) lanes are present along the Inner Loop from I-95 to US 1, in both directions from north of MD 202 to Arena Drive and from MD 210 to the Woodrow Wilson Bridge. The posted speed limit along I-495 is 55 mph.

5.2 I-270 DESCRIPTION

I-270 is a 35-mile freeway (including the I-270 Spur) that runs from I-495 to the southeast of I-70 in the northwest, near Frederick, Maryland. North of I-70, this roadway becomes US 15, which continues north into Pennsylvania. I-270 primarily serves as a commuter route to the Washington, DC area from Frederick County and the communities along the corridor. Two miles north of I-495, I-270 splits into an East Spur and a West Spur. Both directions of I-270 include High Occupancy Vehicle (HOV) and CD lanes. The I-270 Southbound HOV lane begins at I-370 and ends at I-495 along the East Spur and south of Democracy Boulevard along the West Spur. The I-270 Northbound HOV lane begins at I-495 along the East Spur and south of Democracy Boulevard along the West Spur and ends at MD 121. The HOV lanes are in service weekdays from 6:00-9:00 AM in the southbound direction and 3:30-6:30 PM in the northbound direction. General traffic may use these lanes at other times. The HOV lanes are designated HOV 2+, meaning two or more people must occupy the vehicle. Motorcycles and emergency vehicles (during an emergency) are also permitted in these lanes. Additionally, plug-in electric and plug-in hybrid electric vehicles registered in Maryland are permitted to drive in the HOV lanes with only one occupant. The CD lanes run along I-270 Southbound from north of I-370 to south of Montrose Road, and along I-270 Northbound from south of Montrose Road to north of MD 124. The CD lanes are barrier-separated, and the number of lanes vary along the corridor. The HOV lanes are not barrier-separated. The posted speed limit along I-270 is 55 mph from I-495 (both spurs) to MD 121, 65 mph from MD 121 to MD 85, and 55 mph from MD 85 to I-70.

5.3 CORRIDOR MODELING LIMITS

While the MLS limits extend along I-270 from I-495 to north of I-370 and along I-495 from south of the George Washington Memorial Parkway in Virginia to west of MD 5 in Maryland, as previously shown in Figure 1, all VISSIM modeling efforts were extended to the following limits:

- I-495 from VA 193 in Virginia to the Woodrow Wilson Bridge on the Maryland side
- I-270 from the I-70 ramp merges to I-495, including the East and West Spurs

Extending the modeling to these limits ensures that the model accounts for effects of congestion originating outside the MLS limits that impact the freeway segments within the MLS limits, and that it captures the full extent of congestion both within the MLS limits as well as outside of the MLS limits that impact the Study area. Every existing interchange along I-495 and I-270 within these modeling limits was included in the modeling analysis. The interchange that recently opened at I-270 at Watkins Mill Road was included in all future models. The modeled network includes a total of 50 interchanges: 29 along I-495, 18 along I-270, 1 interchange between I-270 and the I-270 Spurs, and 2 interchanges between I-495 and the I-270 Spurs.

5.4 TRAFFIC DATA COLLECTION

5.4.1 Traffic Volumes

Traffic count data was obtained from MDOT SHA's Internet Traffic Monitoring System (ITMS), which is available to the public. This data includes 59 counts from 2015, 97 counts from 2016, and 102 counts from 2017. For the MLS, intersection turning movement counts (TMC) and average daily traffic (ADT) counts were collected at 101 locations along the I-495 and I-270 corridors in 2018 to supplement existing traffic data. TMC data was collected using 24-hour video counts and ADT count data was collected over 48-hour periods at mainline and ramp locations. All counts were conducted during typical weekday conditions (Tuesdays, Wednesdays, and Thursdays while schools were in session).

The use of multiple years of data was necessary due to the vast quantity of data needed throughout the entire Study area (over 350 locations). Volume data along I-270 had previously been normalized as part of the I-270 Innovative Congestion Management (ICM) initiative; therefore, most of the new count data was used to supplement the information that had been collected previously.

For the IAPA, existing traffic counts were conducted where no count data was available to establish baseline volumes at the adjacent intersections for locations outside the limits of the MLS VISSIM model. This count data was used for analysis of adjacent intersections that were not previously studied during the NEPA process.

Existing traffic volumes were balanced through the study network, including the I-495 and I-270 along with the crossing roadways, so that no volume sinks were present along the access-controlled facilities. Along I-270, volumes were developed separately for the local, express, and HOV lanes where multiple facility types exist. For all roadways, ADT and peak period volumes were developed by direction.

Peak period hourly volumes were adjusted upward at some locations where drops in peak period traffic counts were due to upstream congestion and bottlenecks. This produces a set of peak period traffic volumes that reflect the actual traveler demand and not the resulting network throughput, which was needed so that VISSIM model volume inputs for existing (and future) conditions were adequate to represent actual congestion.

5.4.2 Signal Timings

Signal timing data was provided for signalized intersections within the study area to ensure that the Synchro and VISSIM models included accurate existing signal timings and phasing. Timing data was obtained from MDOT SHA's Office of Traffic and Safety (OOTS), Montgomery County Department of Transportation, Prince George's County Department of Public Works and Transportation, the City of Frederick, and the City of Rockville.

5.4.3 Travel Times and Speeds

INRIX speed and travel time data was provided by the Regional Integrated Transportation Information System (RITIS) for segments along both I-495 and I-270 for the month of May 2017 on Tuesdays, Wednesdays, and Thursdays. The speed and travel time data were averaged across all days, and any outliers caused by atypical issues were excluded.

5.4.4 Field Observations

Field observations were conducted during the peak periods along the adjacent arterials. Observations included queue measurements, speed measurements, signal timing verification, and lane distribution, in addition to other observations specific to the location. Existing roadway conditions during the peak periods were verified against Google Maps' typical traffic conditions.

5.5 ANALYSIS YEARS AND BACKGROUND PROJECTS

The opening year for Phase 1 of the MLS is anticipated to be 2027, and the design year for full MLS Build is 2045. The IAPA will include analysis of both Phase 1 and the full MLS. Traffic analysis will be performed for No Build and Phase 1 Build for 2027 within the Phase 1 limits. Traffic analysis will be performed for No Build, Phase 1, and full MLS Build for 2045.

The 2027 and 2045 analysis years assume completion of the following projects that are proposed or under construction in the area:

- I-270 Innovative Congestion Management (ICM) Improvements[3]: a Progressive Design-Build project to construct improvements along I-270 between I-70 and I-495, including the East and West Spurs. The project includes fourteen roadway improvements that increase capacity and vehicle throughput and address safety concerns and bottlenecks. The project also includes innovative technologies and techniques, including adaptive ramp metering and active traffic management strategies. Some of these improvements were completed in 2019, with the remaining improvements scheduled to be completed by Summer 2021. The proposed improvements of the I-270 ICM initiative are shown in Figure 6.
- I-270 at Watkins Mill Road Interchange[4]: a new interchange along I-270 at Watkins Mill Road, located north of the interchange at MD 124. Construction of this interchange was completed in June 2020.
- Greenbelt Metro Station Access Improvements: an MDOT SHA-proposed access improvements project at the Greenbelt Metro Station along I-495. The plans for these improvements are shown in Figure 7.
- VDOT I-495 Express Lanes Northern Extension (NEXT) Study[5]: VDOT is performing this study on a proposed extension of the I-495 Express Lanes from the I-495 at Dulles Toll Road interchange to the American Legion Bridge. The study began in April 2018 and has completed a draft Environmental Assessment which was released for public comment. Construction is anticipated to begin in 2021 and be completed by 2025.

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[3] https://www.roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=80
[4] https://mdot-sha-i270-watkins-mill-intrc-mo3515172r-maryland.hub.arcgis.com/
[5] http://www.495northernextension.org/

Figure 6: I-270 Innovative Congestion Management (ICM) Improvements

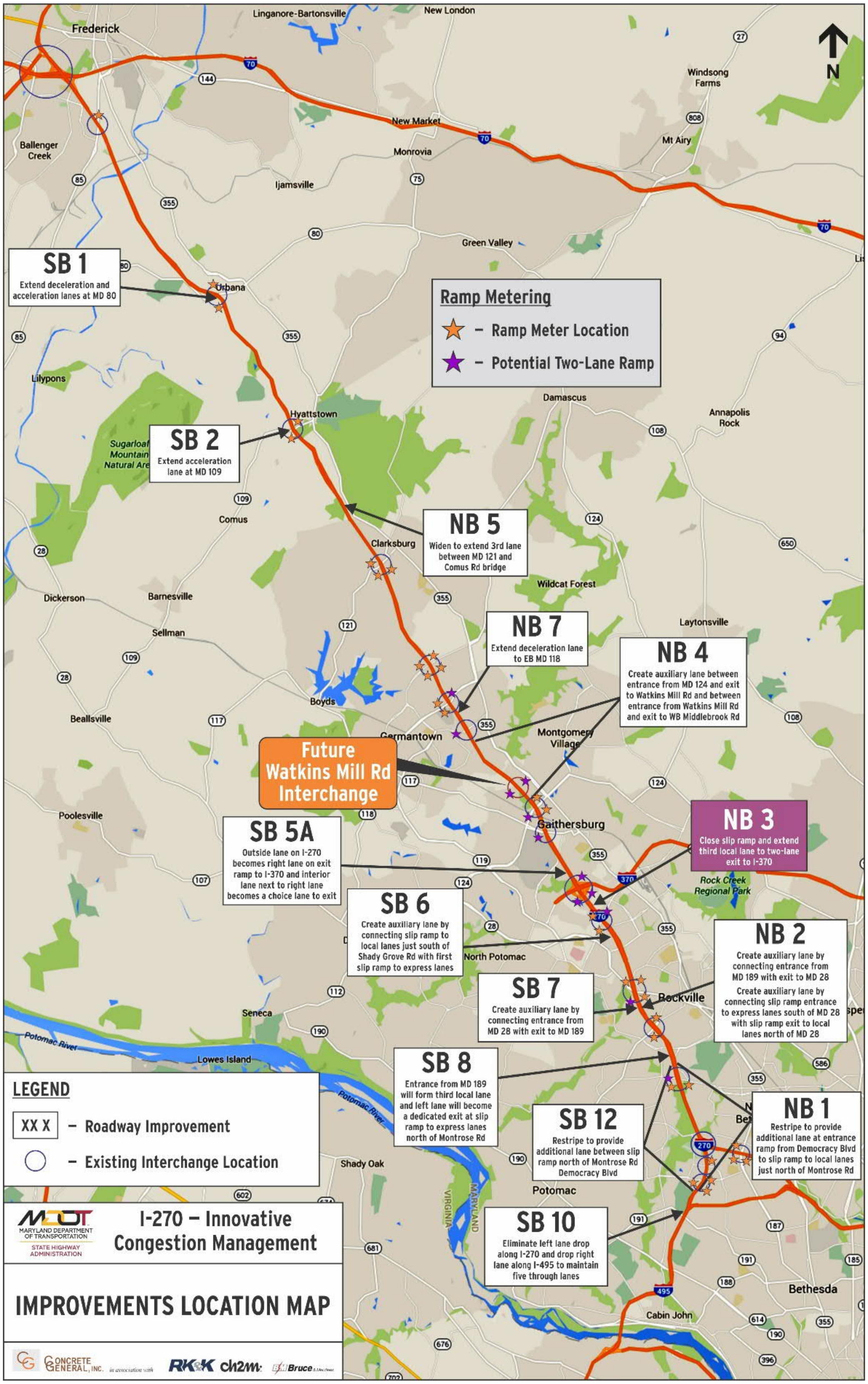
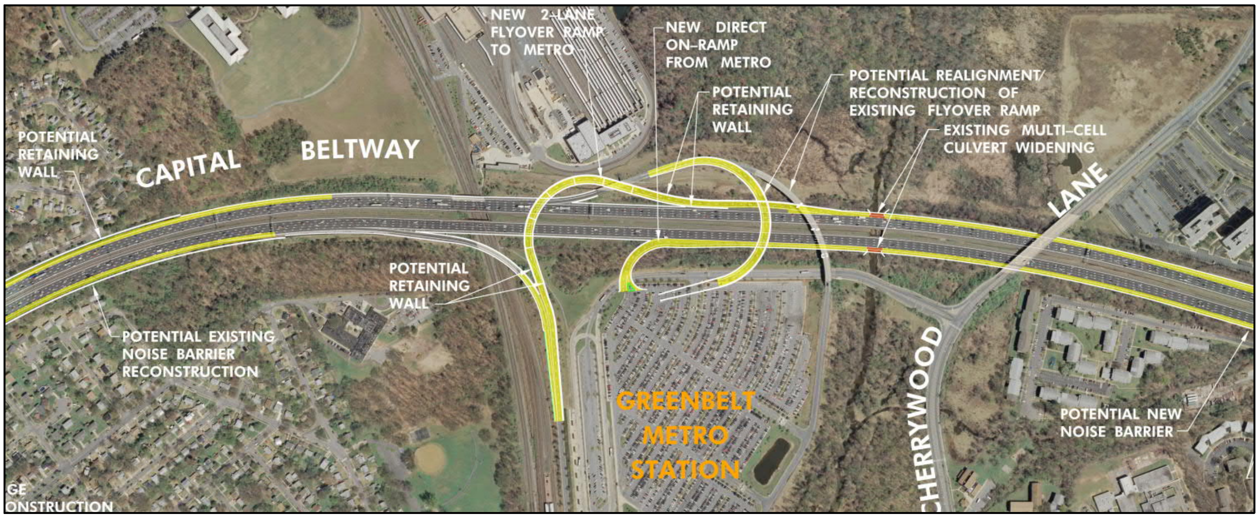


Figure 7: Greenbelt Metro Station Access Improvements



5.6 ANALYSIS SCENARIOS

The following scenarios will be evaluated for the weekday AM and PM peak periods:

- Existing Conditions (Year 2017)
- No Build Conditions (Year 2027 and Year 2045): This scenario will include VDOT NEXT and all projects included in the Washington region's Visualize 2045 – Financially Constrained Long-Range Plan (CLRP), adopted by the Metropolitan Washington Council of Governments (MWCOG) – Transportation Planning Board (TPB) in 2018 that are planned to be constructed by 2027 and 2045, including those listed above.
- Phase 1 Build Conditions (Year 2027): This scenario includes the No Build improvements plus Phase 1 of the I-495 & I-270 MLS and assumes No Build conditions outside the MLS and Phase 1 limits.
- Phase 1 Build Conditions (Year 2045): This scenario includes the No Build improvements plus Phase 1 of the I-495 & I-270 MLS and assumes No Build conditions outside the MLS and Phase 1 limits.
- Full MLS RPA Build Conditions (Year 2045): This scenario includes the No Build improvements plus the I-495 & I-270 MLS RPA for the limits of the Study.

Lane diagrams for the proposed Phase 1 and Full MLS RPA Build Conditions are included in Appendix A.

5.7 ANALYSIS PERIODS

Based on a review of hourly traffic volumes collected for the MLS, the identified peak periods for the VISSIM microsimulation analysis are 6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM. For the Synchro analysis of the adjacent intersections, the peak hours will be reported, which include 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM, the hours when speeds are the lowest. The operational analysis results will be summarized onto diagrams for these two peak hours.

6 TRAVEL DEMAND FORECASTING

The following is an overview of the methodology for the development of project forecasts for the I-495 & I-270 MLS. Forecasts are being developed for each of the scenarios listed in Section 5.6.

6.1 MWCOG MODEL

Regional travel demand models provide valuable insights and big-picture perspectives, helping to identify areas with anticipated growth, traffic impacts due to network changes and tolling policies, and corridors that will potentially require congestion mitigation. Since I-495 and I-270 in Maryland are the two most heavily traveled freeways in the National Capital Region, the study area's regional travel demand model will be used as the first step of the forecasting process.

6.1.1 MWCOG Model Assumptions

To provide consistency with regional planning efforts, the Metropolitan Washington Council of Governments (MWCOG) Travel Demand Forecasting Model, Version 2.3 Travel Model, Build 75 (adopted on October 17, 2018), also known as the Version 2.3.75 Travel Model Round 9.1 Cooperative Forecasts, will be used as the basis for the development of traffic forecasts for the IAPA. MWCOG previously conducted study area calibration and developed a modified model (Version 2.3.71) that was used for the analysis to support the DEIS. Modeling documentation confirmed that modifications and revisions from Version 2.3.71 were carried over into Version 2.3.75, which is the version of the model that will be used to develop traffic forecasts for the IAPA.

The official MWCOG model will be used, which MWCOG validates based on the user guide. The MWCOG validation memo is included in Appendix B. Validation is based upon the percent difference between estimated and observed volumes at the screenline level, and between link-level model estimates and observed counts.

For this reason, no further calibration will be conducted to maintain consistency with MWCOG practices and previous NEPA forecasting assumptions. Link and period level volumes from the MWCOG model will not be used directly for volume development. The regional travel demand model will be used solely to develop seed information and growth rates for input to the operational analysis.

6.1.2 MWCOG Base and Future Year Model Development

The MWCOG model will be used as a two-part process. First, core model runs will be conducted to capture regional behavior and impacts to the study area. Second, a post processor will be developed for the subarea extraction process to produce input data that reflected necessary details for the VISUM model analyses. Results from both the core model and post processor will be reviewed to ensure that results of the subarea extraction process reflected traffic assignment and trends of the core model runs.

Due to the magnitude and intricacy of the study area network, base year 2017 network adjustments will be made to improve the subarea extraction process and provide consistency with VISUM model details. These network changes will include interchange geometry refinements to improve traffic assignment and centroid connector placement to ensure proper trip loading to/from the traffic analysis zones (TAZs). For future year conditions, the same level of detail will be included. Additional network reviews will be conducted to confirm that future committed projects are reflected in the No Build models, as defined by the Constrained Long-Range Plan (CLRP) for the interim and design years. The Build modes will be developed by coding in the Recommended Preferred Alternative (RPA), which will include access point assumptions and expansion of the toll process to account for new links and connections outside of the CLRP assumptions.

Toll diversion for the build scenarios will be analyzed using a series of MWCOG origin-destination matrices results. These model results will distinguish toll eligible trips from non-toll eligible trips for each of the six vehicle classes. Toll eligible trips represent vehicles that are expected to access the managed lanes at some point during their trip, while non-toll eligible trips represent vehicles that are expected to conduct travels solely in general purpose lanes. MWCOG travel demand modeling accounts for many driver-related decisions during peak hour travels (e.g. toll costs, speed, capacity, distance, congestion, etc.), which will be reflected in the origin-destination matrices. After applying the appropriate calibration and growth adjustments, the MWCOG origin-destination matrices will be assigned to the VISUM network.

Through this process, input networks and trip tables will be produced for 2017 Existing, 2027 No Build, 2027 Phase 1 Build, 2045 No Build, 2045 Phase 1 Build, and 2045 RPA Build conditions for the VISUM analysis. Additional details will include:

- Subarea networks will reflect proper interchange configurations along the study corridors, including directional lanes, turn penalties, and ramp configurations
- Trip tables will be provided for four periods (i.e., AM, MID, PM, NT) for six different vehicle classes (i.e., SOV, HOV2, HOV3+, CMV, TRK, AIR)
- Trip tables will differentiate "toll eligible trips" for all six classes (i.e., those trips that would use one or more toll facilities for a portion of their trip)

6.2 VISUM MODEL DEVELOPMENT

A VISUM model (using PTV Visum 18) will be established to produce the daily, AM, and PM traffic volumes to streamline the process of reassigning traffic to the study roadway network at a more detailed and refined level than the MWCOG model that will be needed for the VISSIM microscopic operations analysis. The VISUM study area is extended beyond the VISSIM traffic analysis study area to account for potential shifts in traffic between competing roadways. The following sections provide further details regarding the development, calibration, and validation of the VISUM model.

6.2.1 VISUM Base Year Model Development

To develop the base year model, the Metropolitan Washington Council of Governments (MWCOG) model subarea network will be imported into VISUM and refined to include the detailed geometry of all roadways and intersections within the study area, including signalized intersections and key unsignalized intersections. Existing signal timing data provided by MDOT SHA will be coded into VISUM. Traffic Analysis Zones (TAZs) that serve multiple driveways/developments will be subdivided to ensure an accurate traffic assignment at the peak hour level. The MWCOG subarea origin-destination (O-D) matrices will be exported as AM and PM peak period matrices and used as a seed matrix for the initial VISUM traffic assignment, the starting point of the VISUM model development. The MWCOG matrices will be exported to align with the peak hour time periods. The MWCOG matrices will be aggregated appropriately for all vehicle classes to produce individual AM and PM peak hour assignments in VISUM.

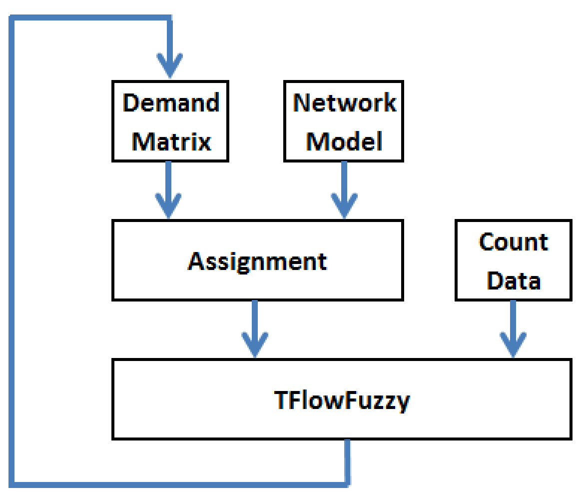
6.2.2 VISUM Model Calibration and Validation

Model calibration and validation refers to the process that confirms the model provides a reasonable approximation of reality (validation) and makes any adjustments to the model to bring it within desired validation targets (calibration). This ensures that the model accurately represents existing traffic conditions. Existing traffic count data will be the primary data used to assess the validity of the VISUM trip assignment. Field data, such as traffic control, signal timing, lane configurations, and travel speeds will be used as inputs into the model. All of these factors will be taken into consideration to produce a model that reflected realistic conditions and driver tendencies.

VISUM will be calibrated to match the existing link and turning movement volumes using its matrix estimation tool, TflowFuzzy. This built-in procedure adjusts the demand matrix so that its assignment results match observed traffic counts. The iterative process shown in Figure 8 will be used to estimate the peak hour O-D matrices using TflowFuzzy for the AM and PM peak periods.

For calibration purposes, target values will be established using industry standards in order to establish a calibrated model. The three main standards will include RMSE (root-mean-square-error), GEH (Geoffrey E. Havers statistic formula), and R^2 values. All three standards measure the differences between the traffic volumes predicted by a model and the traffic volumes that are observed and collected in the field. After calibration efforts are complete, all measures will fall within the acceptable targets.

Figure 8: VISUM Trip Assignment Iterative Process



6.2.3 VISUM Future Year Model Development

Following the validation of the base year 2017 VISUM model for the AM and PM peak hours, the future year VISUM model will be developed to establish the AM and PM peak hour forecasts for both 2045 No Build and Build conditions. To generate the future year VISUM model, the adjustments required for calibration of the base year scenario will also be applied to the future year trip tables generated from the MWCOG model. The peak hour correction matrices developed from the base year validation process will be applied to the future year trip tables. This process will be repeated for each of the six classes (i.e., SOV, HOV2, HOV3+, TRK, CMV, AIR) and all eight peak hours (i.e., 6 AM – 10 AM and 3 PM – 7 PM). The VISUM model network will be modified to reflect future committed projects as defined for the design year to establish the No Build models.

The 2045 forecasts will include a series of adjustments to maintain consistency with MDOT SHA volume projections and other studies provided by MDOT SHA Travel Forecasting and Analysis Division. Since the 2040 forecasts developed for the MLS modeling efforts reflect anticipated growth in key areas, the 2040 volume projections for the following arterials/interchanges will be taken into consideration: Watkins Mill, MD 124, MD 117, Middlebrook Road, MD 118, Greenbelt Metro, MD 201, US 1, and MD 121.

The No Build models will then be modified to incorporate the RPA lane configurations. A toll lane capacity of 1,700 vehicles/hour/lane will be assumed for the build scenarios to maintain consistency with previous 2040 forecasts developed for the DEIS. This threshold assumption was established since tolling prices are expected to be adjusted during the peak hours to maintain acceptable operating speeds on the toll lanes. Using a cost function to represent toll pricing in VISUM, toll volume refinements will be completed via an iterative process. Forecasts will be reviewed and adjusted to ensure that traffic projections in the general purpose and toll lanes generally align with MWCOG model trends without exceeding the established toll lane capacity. These finalized traffic volumes became the basis for VISSIM modeling efforts.

After coordination between MDOT and VDOT representatives, further volume adjustments will be made as necessary to ensure that future year forecasts are within an acceptable margin of error for travel demand forecasting at the American Legion Bridge (ALB) and the links immediately adjacent to the ALB. Forecasting efforts for MDOT and VDOT differed in terms of the starting-point (existing conditions volumes) and travel demand models. Therefore, the forecasting efforts will ensure that the 2045 traffic volumes in the vicinity of the ALB are consistent with VDOT 2045 forecasts, within 10 percent of throughputs at the ALB.

7 TRAFFIC OPERATIONAL ANALYSIS

7.1 VISSIM ANALYSIS

VISSIM microsimulation models will be used to provide operational analysis results for the following:

- Interstate mainline segments
- Ramp merge, diverge, and weave segments
- Ramp junctions/intersections

As part of the traffic analysis to support the DEIS, VISSIM models were developed using Version 10. These models include the peak periods of 6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM and are reflective of existing geometry, traffic volumes, and 2017 speeds across all lanes, including High Occupancy Vehicle (HOV) and Collector-Distributor (CD) lanes. The models do not include roadway improvements built after 2017, such as the improvements that are under construction along I-270 as part of the ICM project. To note, a portion of the ICM improvements were implemented in 2019; however, many other ICM improvements, including ramp metering, will not be fully implemented until 2021. The MLS Traffic Technical Report provides the modeling methodologies and assumptions in detail[6].

Using the DEIS VISSIM microsimulation models as a base, refinements were made to improve calibration in some areas, including coding error corrections and driver behavior modifications at spot locations to better reflect 2017 conditions. The validation targets for the I-270 and I-495 models include confirming the following:

- VISSIM travel times fall within a 95% confidence level of INRIX travel times. The cumulative upper and lower bounds of the 95% confidence intervals were determined by first calculating the margin of error for each segment along the corridor.
- VISSIM simulated volumes fall within +/- 10% of balanced traffic count volumes.

The complexity of the I-495 and I-270 VISSIM study area can be characterized by the size of the network, duration of the peak periods, and high variability of daily speeds and volumes. When evaluating the model simulated speeds and volumes compared to the field-collected data, the model is considered reasonably calibrated. This reasonableness provides the sensitivity necessary to evaluate the future year conditions for the purposes of the IAPA. Development and calibration of the VISSIM models are detailed in the "I-495 and I-270 Calibration Memo", which can be found in Appendix C. Using the calibrated existing models as a base, the future (2027 and 2045) No Build and Build models will be developed to account for changes to the network that occur between the baseline and future years.

The AM and PM VISSIM microsimulation models both include a seeding time of 1 hour in addition to four 1-hour simulation periods. Data is collected by VISSIM during the 4-hour peak periods of 6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM, which is reflective of the identified peak periods. The initialization (seeding) periods are necessary to populate the network and produce the appropriate congestion prior to data recording. Five (5) runs will be performed for each model scenario.

7.2 SYNCHRO CORRIDOR ANALYSIS

The VISSIM microsimulation model used in the Traffic Technical Report, which is part of the DEIS, did not include all of the signalized intersections required for the IAPA analysis (due to the size of the models, amount of data collection required, and model runtime). Therefore, Synchro models of the cross streets were developed and calibrated to evaluate operations on the cross streets and to ensure operations along

[6] https://495-270-p3.com/wp-content/uploads/2020/07/APP-C_MLS_Traffic-Tech-Report-Appendices.pdf

cross streets do not impact freeway operations. Synchro was also used to develop the signal timing and phasing for input into the future-year VISSIM models.

Synchro models were developed using Version 10.3. Arterial analysis including the adjacent intersections will be performed using Synchro for one adjacent intersection on arterials (on both sides) beyond service interchanges that are modified by the MLS, when within one mile. Additional intersections will be included where needed, such as where requested by FHWA, or where signals are closely spaced. Intersection delays and Level of Service (LOS) will be reported using the Highway Capacity Manual (HCM) 6th edition reports from Synchro in most cases, which are based on Chapter 19 of the HCM.

Synchro models were calibrated based on observed conditions in the field, including signal timings and observed queuing. The models were adjusted to match field conditions, including adjusting link speeds and turning speeds, linking origin-destination volumes, adjusting lane utilization and saturation flow rates, and adjusting lane alignments to better match queuing conditions. Signal timings and phasings were confirmed in the field and adjusted where needed to match field-recorded signal timings and phasings.

7.3 MEASURES OF EFFECTIVENESS

Analysis will be based on microsimulation results and HCM methodologies. Figure 9 and Table 4 show LOS criteria for freeways and ramps. Figure 10 shows an example of the Synchro analysis results for one interchange and its adjacent signals. Table 5 shows LOS criteria for signalized intersections, which is based on overall intersection delay. Table 6 shows LOS criteria for unsignalized intersections, which is based on the delay for the worst approach. Queues will be measured along I-495, I-270, and other connecting freeways (where queuing exists), along on-ramps and off-ramps, and along all approaches to ramp termini intersections. Tables of the measures of effectiveness (MOE) results, as well as figures summarizing MOEs from VISSIM and Synchro, will be provided. Per Federal Highway Administration's (FHWA) *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software (July 2004)*,

- Delay:
  - o "The HCM bases its LOS grades for intersections on estimates of mean control delay for the highest consecutive 15-minute period within the hour… The HCM does not use total delay to measure signal LOS. It uses 'control delay.' This is the component of total delay that results when a control signal causes a lane group to reduce speed or to stop."
  - o *Control delay from Synchro will be used. Synchro defines control delay as "the component of delay caused by the downstream control device and does not include Queue Delay." Average vehicle delay from VISSIM will be used. VISSIM defines vehicle delay as the difference between the theoretical travel time (i.e., "the travel time which could be achieved if there were no other vehicles and/or no signal controls or other reasons for stops") and the actual travel time. As VISSIM delay does not correlate to HCM-based delay, LOS will only be included with Synchro results.*
- Density
  - o "If microsimulation model reports of vehicle density are to be reported in terms of their LOS implications, it is important to first translate the densities reported by the software into the densities used by the HCM to report LOS for uninterrupted flow facilities."

  - *As VISSIM does not report HCM-based LOS for density, LOS will be reported by post-processing density using the HCM-based LOS that corresponds to the approximated density. Post processing includes applying passenger car equivalents (PCE) to VISSIM density outputs.*
- Queues
  - "HCM 2000 defines a queue as 'A line of vehicles, bicycles, or persons waiting to be served by the system in which the flow rate from the front of the queue determines the average speed within the queue. Slowly moving vehicles or people joining the rear of the queue are usually considered part of the queue.' These definitions are not implementable within a microsimulation environment since 'waiting to be served' and 'slowly' are not easily defined. Consequently, alternative definitions based on maximum speed, acceleration, and proximity to other vehicles have been developed for use in microsimulation."
  - *Average and maximum simulated queues from VISSIM will be reported. 50th and 95th percentile queue lengths from Synchro will be reported. It will be noted that these queues represent stopped vehicles.*

To address the above guidelines and in compliance with MDOT SHA's "Interstate Access Point Approval Process for the Maryland Department of Transportation State Highway Administration" (July 2017), MOEs to be documented include the following:

- Level of service (LOS)
  - VISSIM analysis results
    - Approximated average intersection vehicle delay (seconds/vehicle) results will be provided for all ramp termini intersections.
    - Approximated average vehicle delay (seconds/vehicle) will be reported for all ramp junction intersections.
    - Approximated average density (passenger cars/hour/lane) and LOS results will be provided for all mainline, merge, diverge, and weaving sections on I-495 and I-270, by lane and average of all lanes.
    - Approximated average density (passenger cars/hour/lane) and LOS results will be provided for all merge, diverge, and weaving sections on crossing roadways.
  - Synchro analysis results
    - HCM-based average control delay (seconds/vehicle) and LOS from Synchro will be provided by intersection and approach at all ramp termini intersections and the first signalized intersection on either side of the study interchange (additional intersections will be included at specific locations).
- Queues
  - VISSIM analysis results (average and maximum queue lengths) will be provided for all ramp termini intersections (all approaches and movements).
  - Synchro analysis results (50th and 95th percentile queue lengths) will be provided at all ramp termini intersections and the first signalized intersection on either side of the study interchange (additional intersections will be included where needed).
- Additional MOEs
  - Simulated volume (vehicles per hour) along I-270 and I-495.
  - Simulated average speed (mph) along I-270 and I-495 by lane and average of all lanes.

Figure 9: Freeway Level of Service (LOS) (VISSIM) – Per HCM Exhibit 12-15

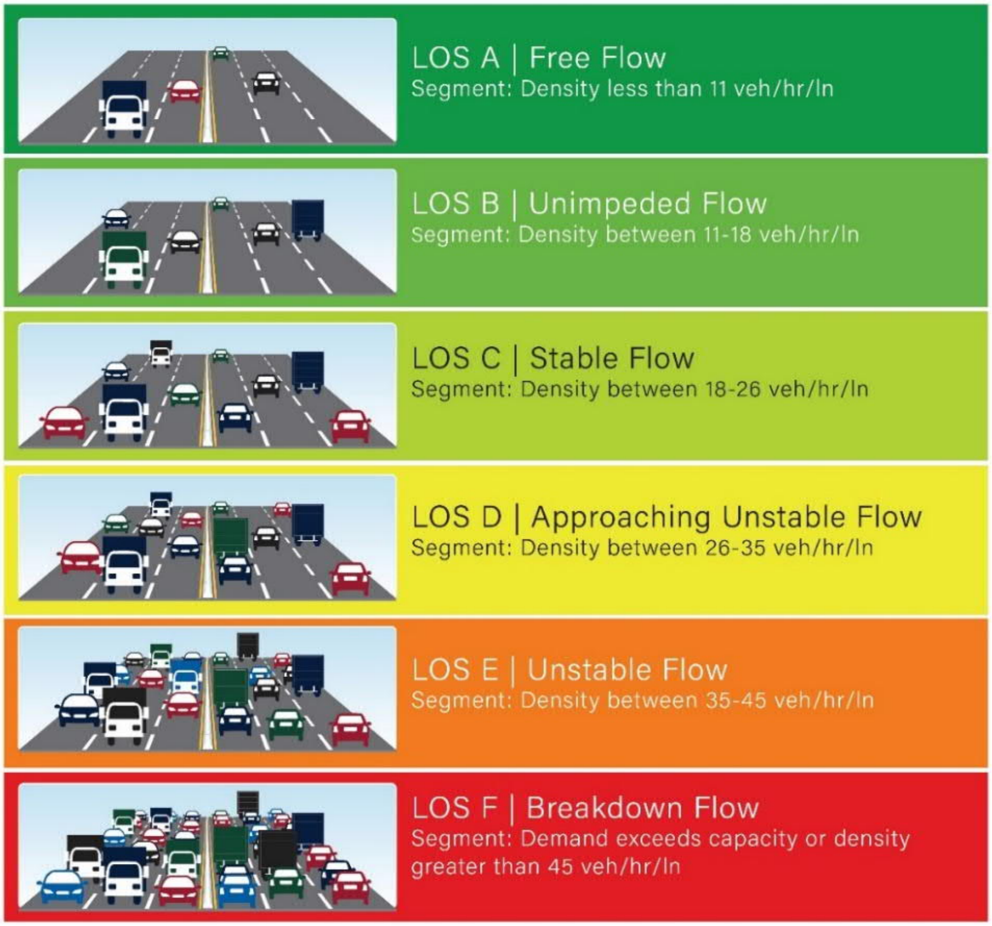


Table 4: Level of Service (LOS) Criteria – Freeways and Ramps (pc/hr/ln)

Level of Service	Freeway Segment (HCM 12-15)	Freeway Weaving (HCM 13-6)	Multilane/ C-D Road Weaving (HCM 13-6)	Freeway Merge and Diverge (HCM 14-3)*
A	0 – 11	0 – 10	0 – 12	0 – 10
B	> 11 – 18	> 10 – 20	> 12 – 24	> 10 – 20
C	> 18 – 26	> 20 – 28	> 24 – 32	> 20 – 28
D	> 26 – 35	> 28 – 35	> 32 – 36	> 28 – 35
E	> 35 – 45	> 35 – 43	> 36 – 40	> 35
F	Demand Exceeds Capacity or > 45	Demand Exceeds Capacity or > 43	Demand Exceeds Capacity or > 40	Demand Exceeds Capacity

*Per HCM, these criteria may also be applied to major merges and diverges; high-speed, uncontrolled merge or diverge ramps on multilane highway sections; and merges and diverges on freeway collector-distributor roadways.

Figure 10: Example Synchro Corridor Analysis Results

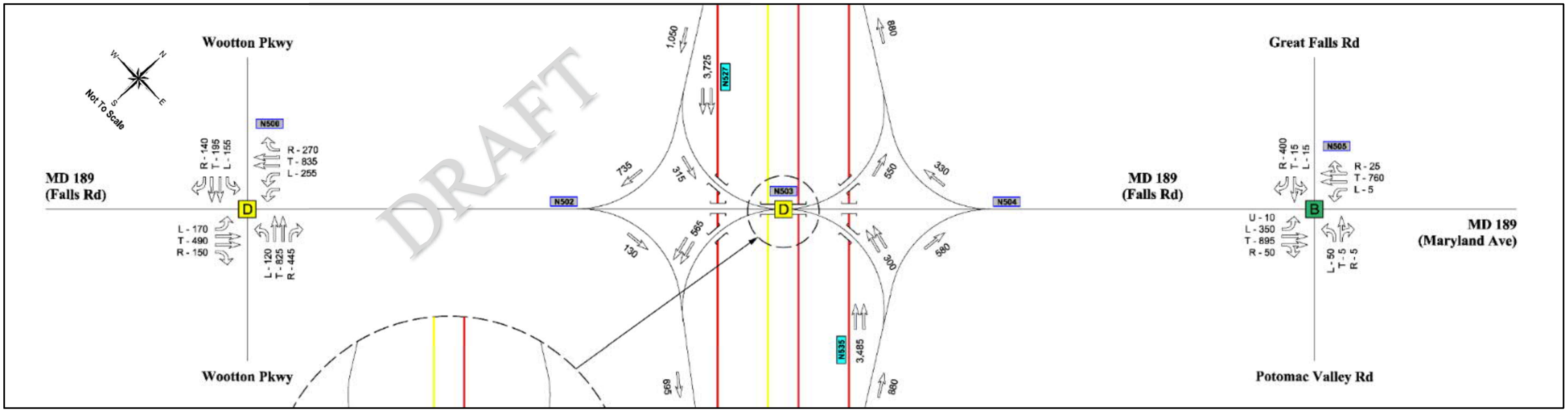


Table 5: Level of Service (LOS) Criteria for Signalized Intersections – Per HCM Exhibit 19-8

Level of Service	Control Delay (sec/veh)	Description
A	0 – 10	Free flow
B	> 10 – 20	Stable flow (slight delay)
C	> 20 – 35	Stable flow (acceptable delay)
D	> 35 – 55	Approaching unstable (tolerable delay)
E	> 55 – 80	Unstable flow (intolerable delay)
F	> 80	Forced flow (jammed)

Table 6: Level of Service (LOS) Criteria for Unsignalized Intersections – Per HCM Exhibit 20-2

Level of Service	Control Delay (sec/veh)	Description
A	0 – 10	Free flow
B	> 10 – 15	Stable flow (slight delay)
C	> 15 – 25	Stable flow (acceptable delay)
D	> 25 – 35	Approaching unstable (tolerable delay)
E	> 35 – 50	Unstable flow (intolerable delay)
F	> 50	Forced flow (jammed)

8 SAFETY ANALYSIS

Both a qualitative and quantitative safety analysis will be performed to document the anticipated safety impacts of the proposed improvements in the RPA. The section will include evaluating existing crash data and performing predictive safety analysis. The safety analysis results will be presented in a tabular format for comparison of the existing crash data, and the expected crashes for the future (2027 and 2045) No Build, Phase 1 Build, and RPA Build scenarios.

8.1 EXISTING CRASH DATA REVIEW AND QUALITATIVE ANALYSIS

A review of the existing crash history (including frequency and rates per 100 million vehicle miles) will identify existing traffic safety concerns and evaluate qualitatively whether the RPA will help address these traffic safety concerns. The existing safety analysis will consist of the following:

- Obtaining historical crash data for a 3-year period (2016, 2017, 2018) on all freeway segments, ramps, ramp terminals, and crossing roadways from MDOT SHA's Office of Traffic and Safety (OOTS).
- Identifying general crash patterns (severity, type, etc.), Candidate Safety Improvement Locations (CSIL), and segments with crash rates that exceed the statewide average crash rates.
- Reviewing conceptual plans and identifying potential safety concerns and mitigation measures.
- Performing a qualitative assessment of the relative level of safety and potential safety impacts of the proposed improvements, using the existing crash data as a point for comparison.

8.2 QUANTITATIVE SAFETY ANALYSIS

Predictive safety analyses will be performed to quantitatively compare the total, fatal and injury, and Property Damage Only (PDO) crashes in the future No Build, Phase 1 Build, and RPA Build scenarios based on Part C of the Highway Safety Manual (HSM). This analysis will be completed for all freeway segments ramps along I-495, I-270, and the I-270 spurs, and ramp terminals and crossing roadways with direct access to the MLS. A brief summary of the assumptions for the predictive analysis is provided below.

Predictive safety analysis for freeway sections along I-270 and I-495 will consist of the following activities:

- General purpose sections and collector-distributor lanes will be evaluated using the Interstate Safety Analysis Tool enhanced (ISATe). It should be noted that the HSM Chapter 18 predictive analysis for freeways does not account for HOV Lanes. Also, the historical crash data available does not provide the level of detail needed to determine within which lane a crash occurred (for example: the HOV or GP lane on I-270). Therefore, it will be assumed that the HOV lanes operate similar to a GP lane in order to use the HSM predictive methods for the freeway sections. In addition, the proposed ramp metering along I-270 as part of the ICM project is anticipated to be in operation in the near future. This condition is assumed to be part of all the future No Build and Build scenarios. While Ramp Metering will likely have an overall influence on the future crash experiences, ramp metering is not included in the methodologies of Chapters 18 and 19 of the Highway Safety Manual.
- Sufficient crash data on managed lane operations relevant to the current study in Maryland is not available. Due to the similar characteristics of the I-495 Express Lanes in Northern Virginia, and

the close proximity to the Maryland MLS, it is assumed that the proposed managed lanes along I-270 and I-495 in Maryland will operate in a similar manner to the Express Lanes in Virginia, with the exception that the Maryland managed lanes will allow access to heavy vehicles. Therefore, MDOT SHA will be submitting a request to VDOT for their approval to obtain and use the Safety Performance Function (SPF) models developed for 495 NEXT project to compute the expected number of crashes for the managed lanes in MDOT's MLS. If used, consideration will be given to account for the potential difference in expected crashes due to the presence of heavy vehicles. If MDOT SHA is not able to obtain approval from VDOT to use the SPFs they developed for the Express Lanes, the MLS safety analysis for the managed lanes will be primarily qualitative.

Predictive safety analysis for ramps, ramp terminal intersections, crossing roadway sections, and adjacent intersections along crossing roadways with new or modified access to I-270, I-495, or the proposed managed lanes facilities will consist of the following activities:

- The Interchange Safety Analysis Tool (ISATe) will be used to develop crash predictions for the proposed ramps and ramp terminals at the new direct access ramps to and from the managed lanes and where existing general-purpose access is being modified. ISATe tool will not be used for analyzing the ramp terminals where no improvements are proposed.
- HSM Chapter 12 Computation Spreadsheets will be used to evaluate arterials and adjacent intersections. The Highway Safety Manual Part C – Chapter 12 spreadsheet cannot be used to analyze roadway sections and adjacent intersections for arterials that have six or more through travel lanes.
- For situations where the ISATe tool and the HSM Chapter 12 Computation Spreadsheets cannot be used due to the limitations associated with specific geometric conditions (such as those mentioned above), a ratio-based equation will be utilized to best estimate a proportional increase in crashes based on traffic volume shifts caused by the proposed MLS.

9 SCHEDULE

The current schedule is summarized below including major milestones; however, the schedule is subject to further revisions as the MLS proceeds.

- Notice of Intent to Initiate NEPA Study: Spring 2018
- Preliminary Range of Alternatives: Summer 2018
- Alternatives Analysis & Environmental Technical Analysis: Fall 2018 – Spring 2019
- Public Workshops: Spring 2019
- Development of Draft Environmental Impact Statement (DEIS): Summer 2019-Summer 2020
- DEIS Issuance: July 10, 2020
- Virtual and in-person public hearings: August/September 2020
- Draft IAPA: February 2021
- Publish Final Environmental Impact Statement (FEIS): Spring 2021
- Final IAPA: July 2021
- Public Record of Decision (ROD): Fall 2021

10 FUNDING PLAN

The I-495 & I-270 MLS is being delivered through multiple public-private partnership (P3) agreements. All P3 agreements will be revenue risk where the P3 Developer will provide all up-front equity and debt necessary to deliver the improvements and will be repaid by future toll revenues. While MDOT is funding the ongoing studies and development, no State funding contribution is expected to the delivery of Phase 1 of the MLS.

11 PROPOSED GEOMETRIC DESIGN STANDARDS AND ANTICIPATED DESIGN EXCEPTIONS OR WAIVERS

All elements of the MLS will be designed in accordance with AASHTO standards to the extent practical. As the RPA is developed, the need for design exceptions to the 10 controlling criteria will be identified and documented.

12 FINAL DESIGN APPROACH

It is anticipated that the P3 Developer, once selected and on-board with MDOT SHA, will need to revise and/or supplement the IAPA for MDOT SHA and FHWA approval to reflect the final design that may have modifications/refinements to the RPA – as routinely done under typical projects that have advanced from the preliminary to final design phase. In addition, the P3 Developer will establish the construction phasing and schedule to better inform the IAPA. This may include:

- Opening year analysis for subsequent phases of the MLS
- Refined safety and operational analyses
- Design exceptions
- Conceptual signing plans

MDOT SHA will complete any needed environmental documentation to support any revisions to the IAPA.

13 PROPOSED IAPA CONTENT

The IAPA content will satisfy the requirements of the FHWA guidelines set forth in FHWA's Policy on Access to the Interstate System (May 2017). The proposed report organization and table of contents for the IAPA will follow the following outline:

I. Executive Summary
II. Introduction
III. Methodology
IV. Existing Conditions
V. Alternatives Considered
VI. Roadway Geometry
VII. Traffic Volumes
VIII. Traffic Analysis
IX. Safety Analysis
X. Appendices

Accepted and agreed upon by the Maryland Department of Transportation State Highway Administration and Federal Highway Administration:

12/18/2020

Jeffrey T. Folden, P.E., DBIA — Date
Deputy Director, I-495 & I-270 P3 Office
Maryland Department of Transportation State Highway Administration

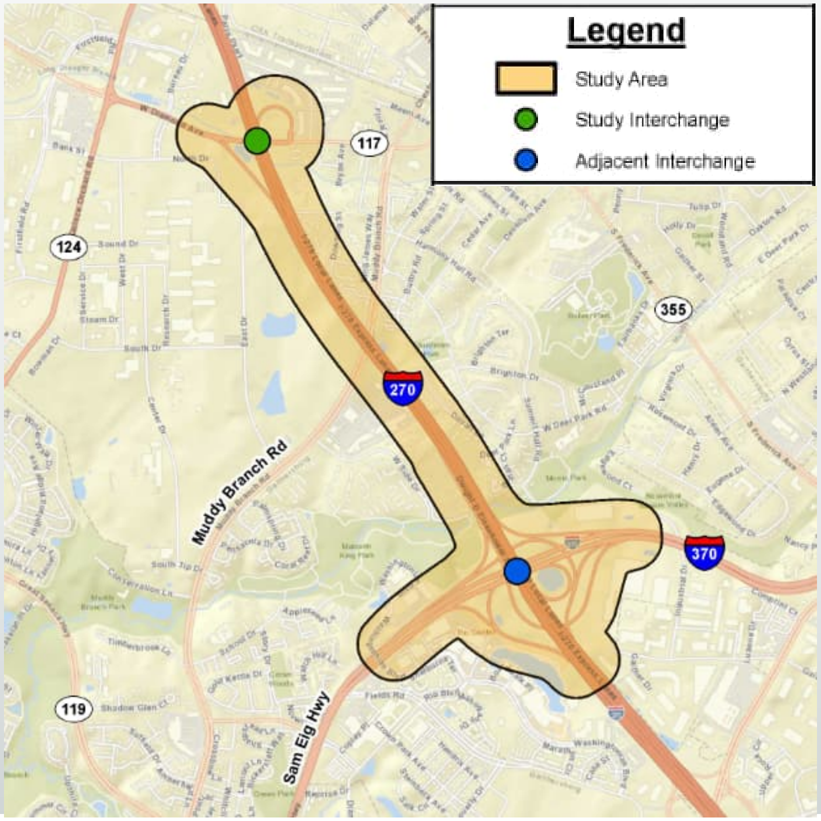
12/21/20

Keilyn Perez — Date
Area Engineer (District 3 and LPA Coordinator)
Federal Highway Administration, Maryland Division

MLS Areas of Influence

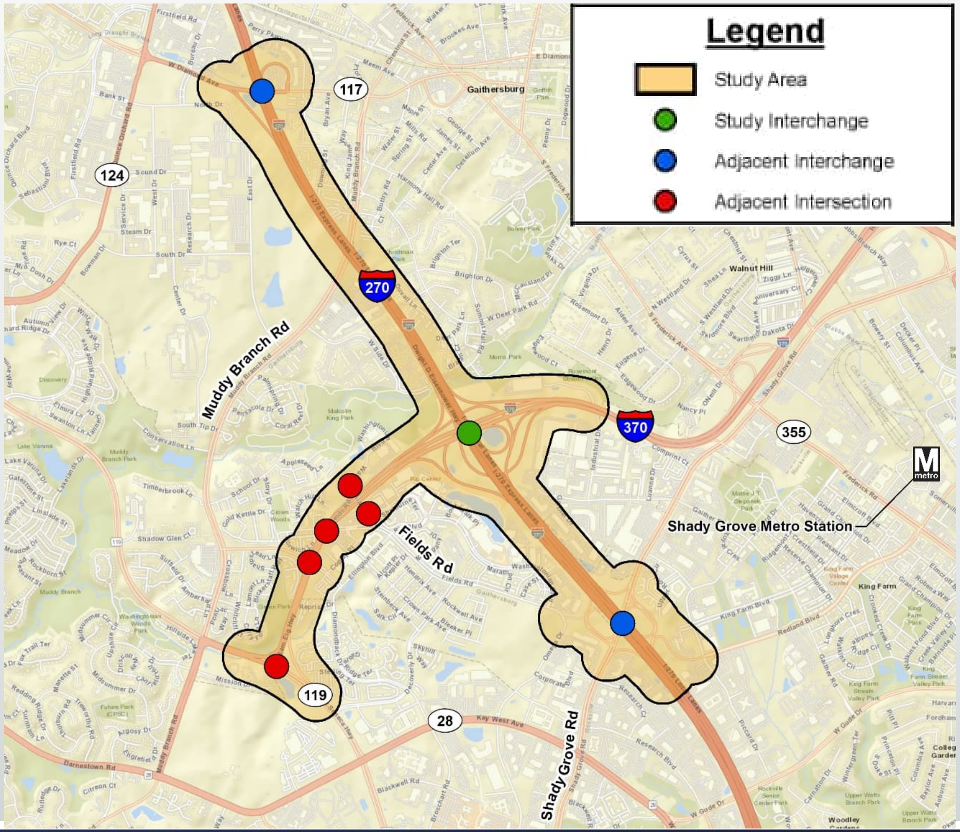
Area of Influence – I-270 at MD 117 Interchange

- One interchange north of MLS limits
- Adjacent I-270 Interchanges:
  - I-270 at I-370
  - No interchange to the north as Managed Lanes end south of MD 117



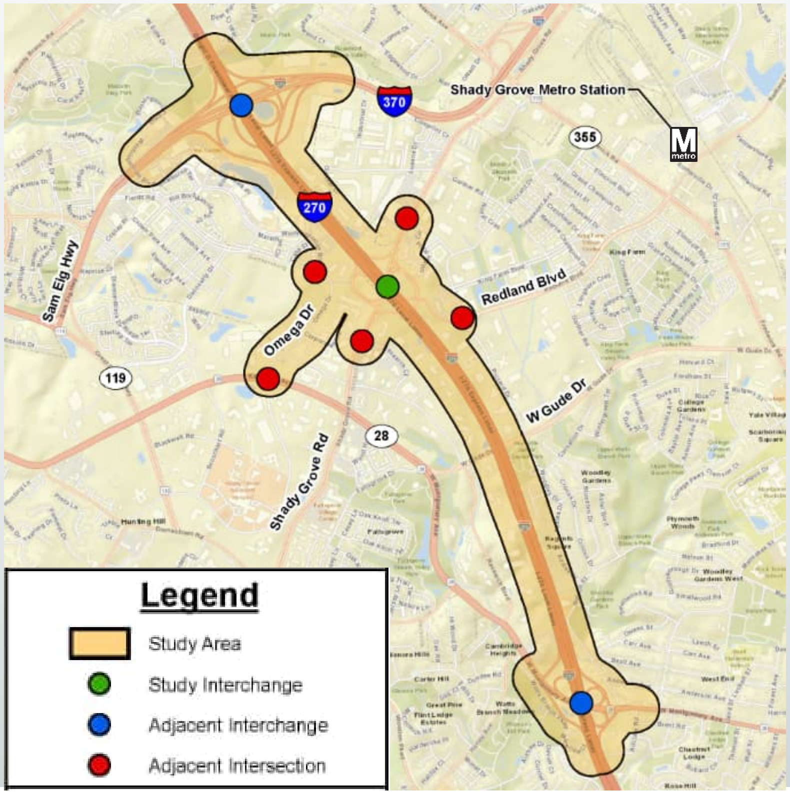
Area of Influence – I-270 at I-370 Interchange

- Direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at MD 117
  - I-270 at Shady Grove Rd
- Adjacent I-370 Intersections:
  - I-370 at Fields Rd
  - Washingtonian Blvd at I-370 EB Ramps
  - Washingtonian Blvd at I-270 EB Ramp
  - Sam Eig Hwy at Diamondback Dr
  - Sam Eig Hwy at MD 119



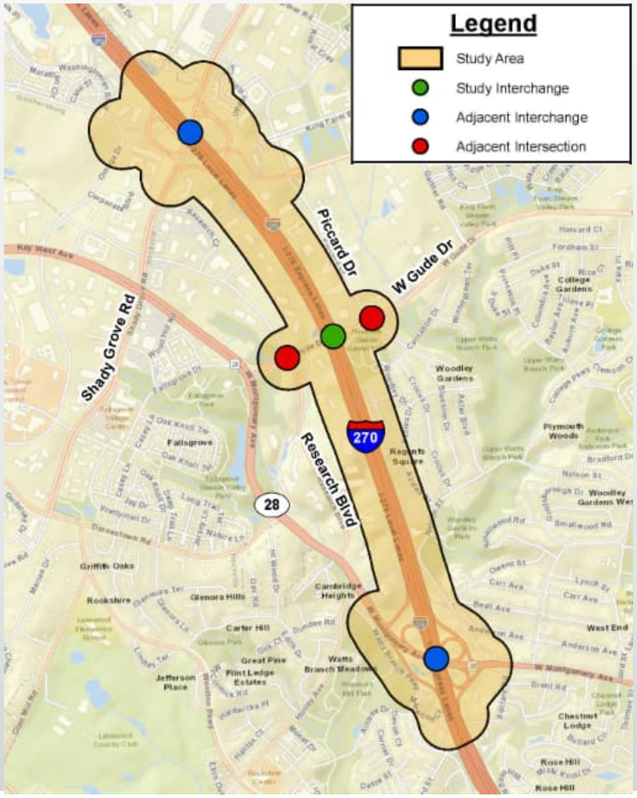
Area of Influence – I-270 at Shady Grove Rd Interchange

- No direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at I-370
  - I-270 at MD 28
- Adjacent Shady Grove Rd Intersections:
  - Shady Grove Rd and Choke Cherry Rd
  - Shady Grove Rd and Corporate Blvd
  - Redland Blvd and Piccard Dr
  - Fields Rd and Washingtonian Blvd
  - Omega Dr and MD 28



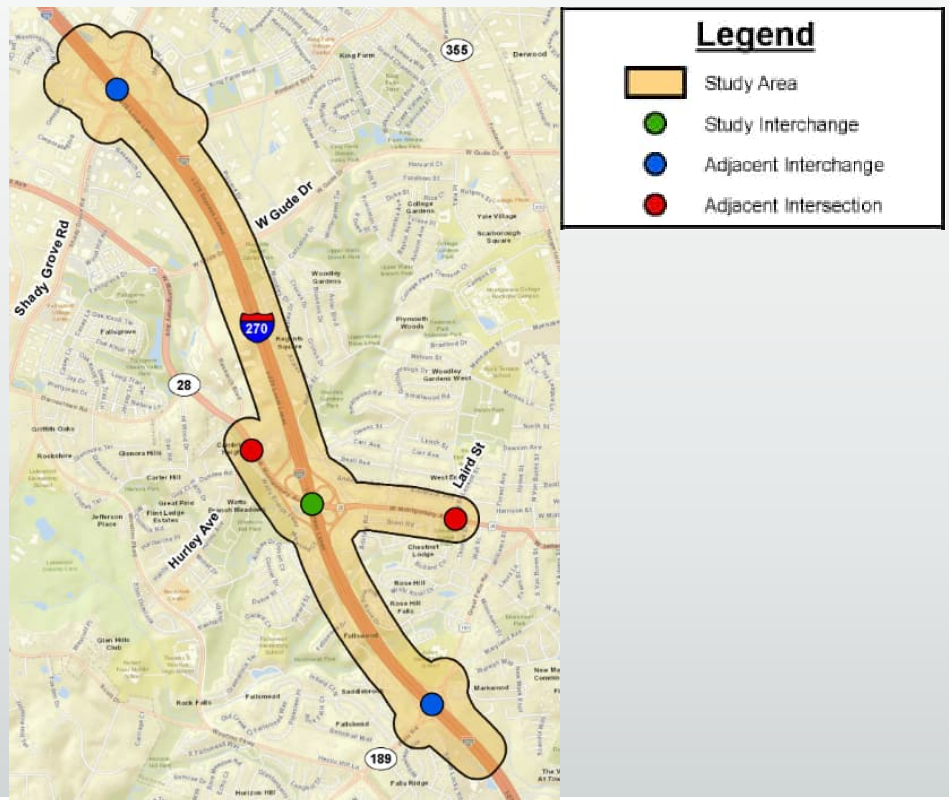
Area of Influence – I-270 at Gude Dr Interchange (future)

- Direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at Shady Grove Rd
  - I-270 at MD 28
- Adjacent Gude Dr Intersections:
  - Gude Dr and Research Blvd
  - Gude Dr and Piccard Dr



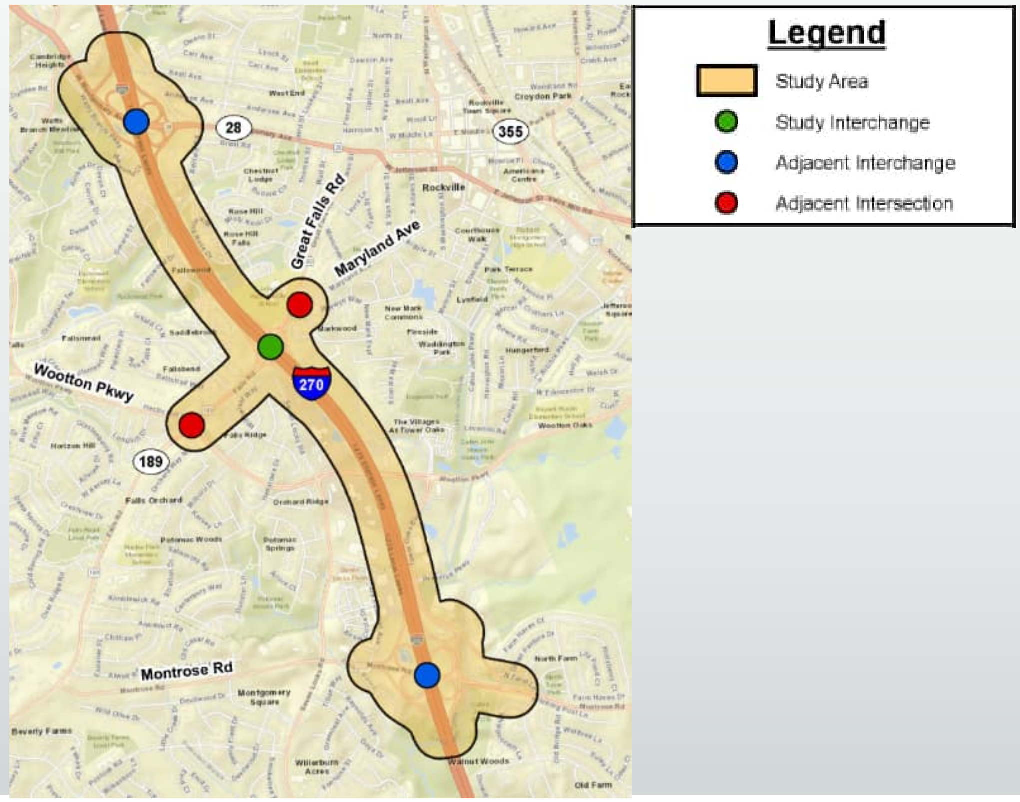
Area of Influence – I-270 at MD 28 Interchange

- No direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at Shady Grove Rd
  - I-270 at MD 189
- Adjacent MD 28 Intersections:
  - MD 28 and Hurley Ave
  - MD 28 and Bullard Cir/Laird St



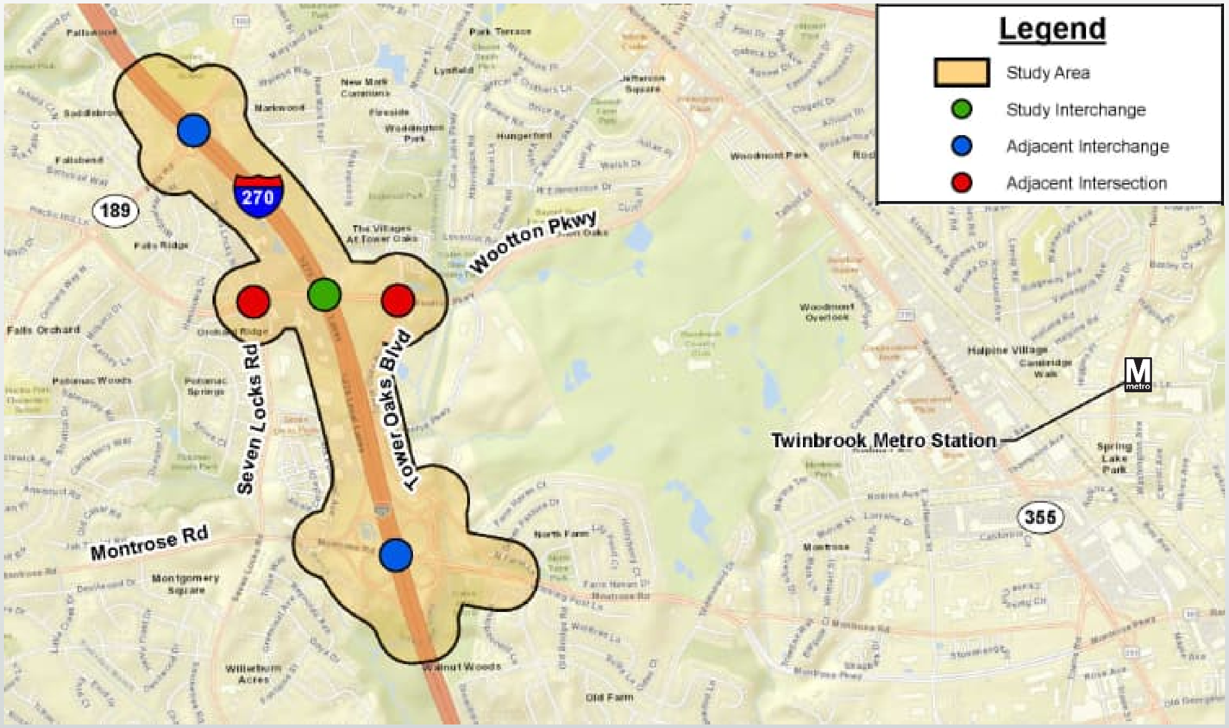
Area of Influence – I-270 at MD 189 Interchange

- No direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at MD 28
  - I-270 at Montrose Rd
- Adjacent MD 189 Intersections:
  - MD 189 and Wootton Pkwy
  - MD 189 and Great Falls Rd/Potomac Valley Rd



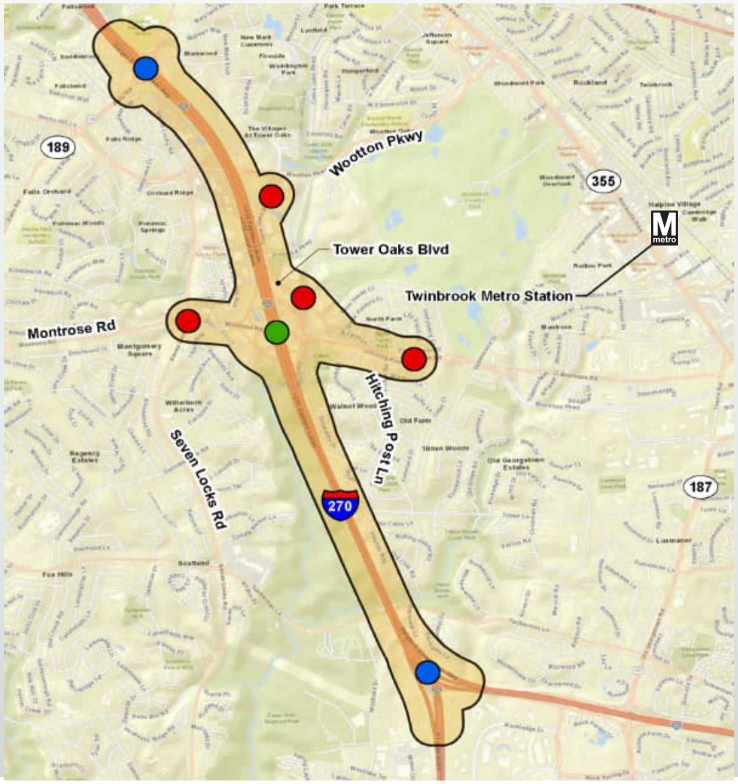
Area of Influence – I-270 at Wootton Pkwy Interchange (future)

- Direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at MD 189
  - I-270 at Montrose Rd
- Adjacent MD 189 Intersections:
  - Wootton Pkwy and Seven Locks Rd
  - Wootton Pkwy and Tower Oaks Blvd



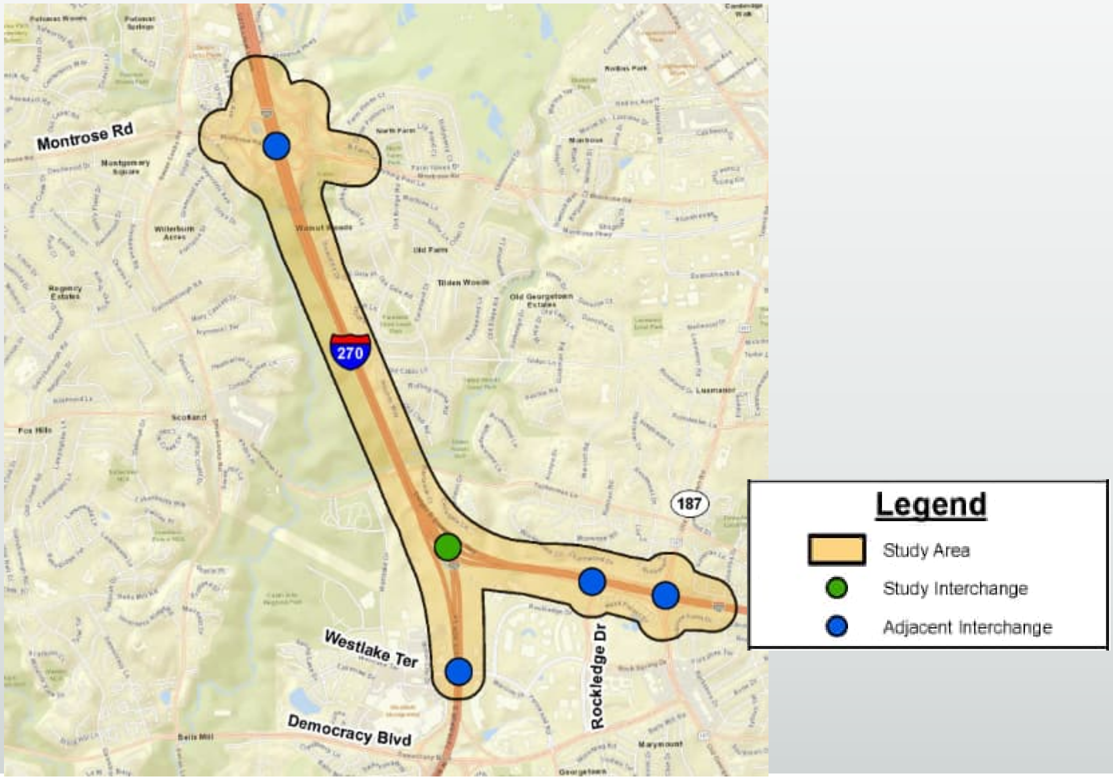
Area of Influence – I-270 at Montrose Rd Interchange

- No direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at MD 189
  - I-270 at I-270 Spur
- Adjacent Montrose Rd Intersections:
  - Montrose Rd and Seven Locks Rd
  - Montrose Rd and Hitching Post Ln/Farm Haven Dr
  - Tower Oaks Blvd and I-270 Northbound Ramps
  - Tower Oaks Blvd and Tower Oaks Tower Access Rd



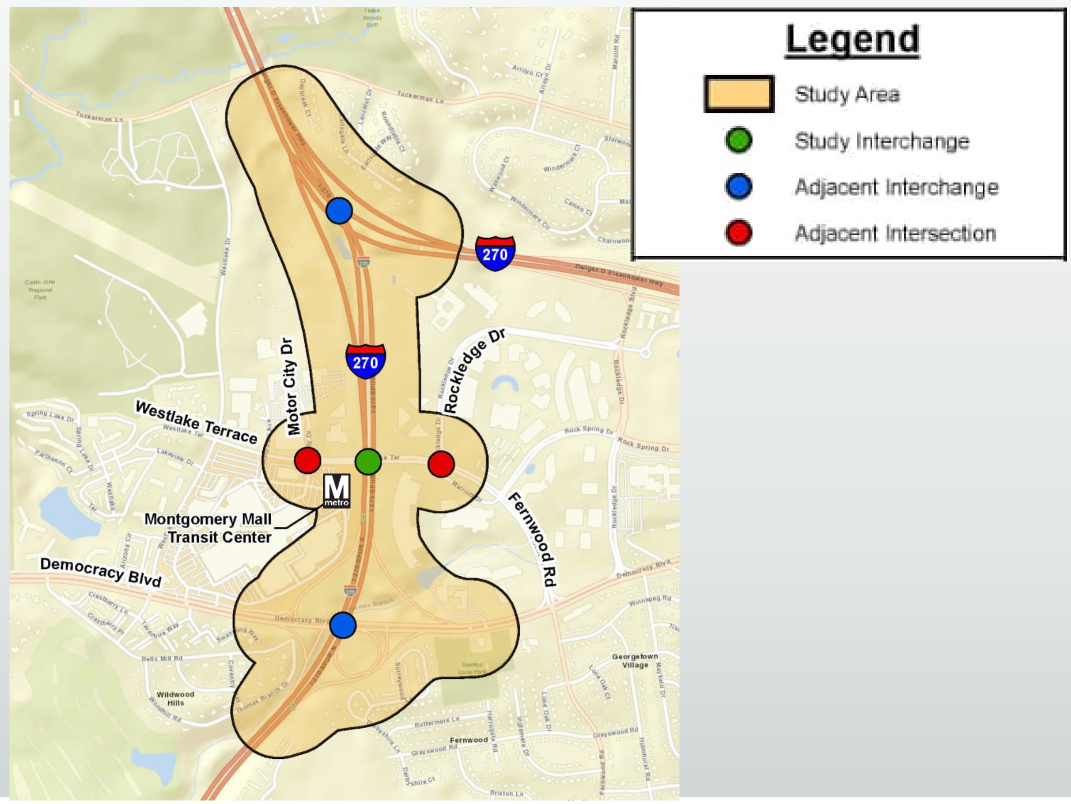
Area of Influence – I-270 at I-270 Spur (“Y Split”)

- Direct access to managed lanes
- Adjacent I-270 Interchange:
  - I-270 at Montrose Rd
- Adjacent I-270 West Spur Interchange:
  - I-270 at Westlake Terrace
- Adjacent I-270 East Spur Interchange:
  - I-270 Spur at Rockledge Dr



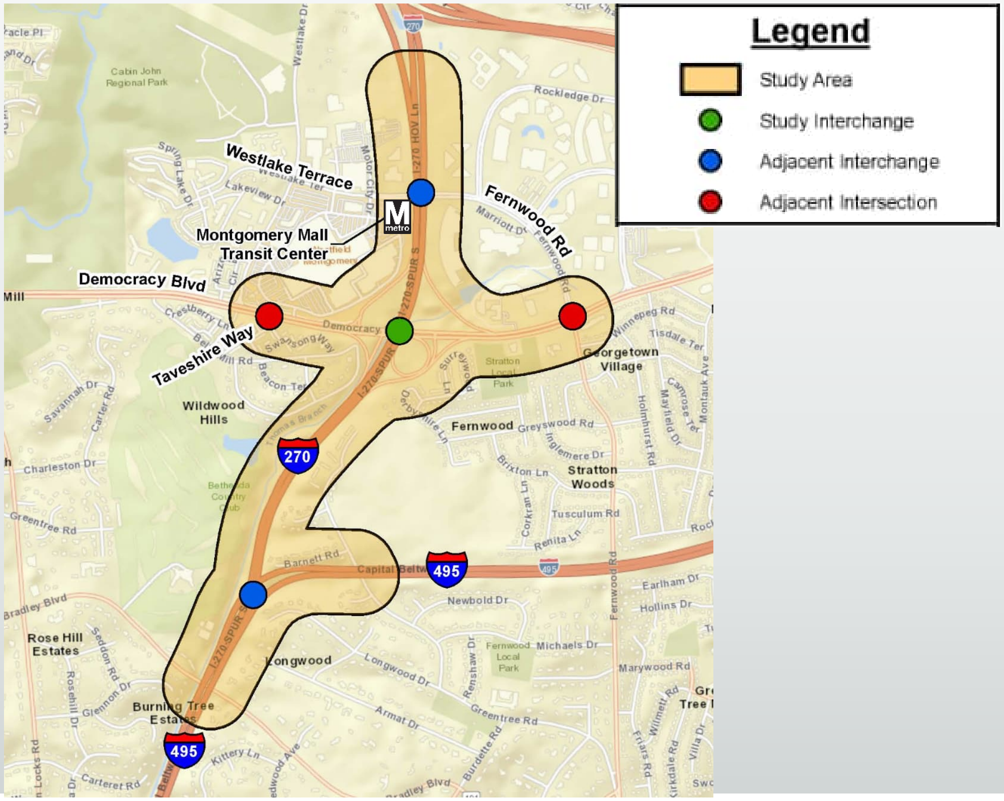
Area of Influence – I-270 (West Spur) at Westlake Terrace Interchange

- Direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at I-270 Spur
  - I-270 West Spur at Democracy Blvd
- Adjacent Westlake Terrace Intersections:
  - Westlake Terrace and Motor City Dr
  - Westlake Terrace and Rockledge Dr



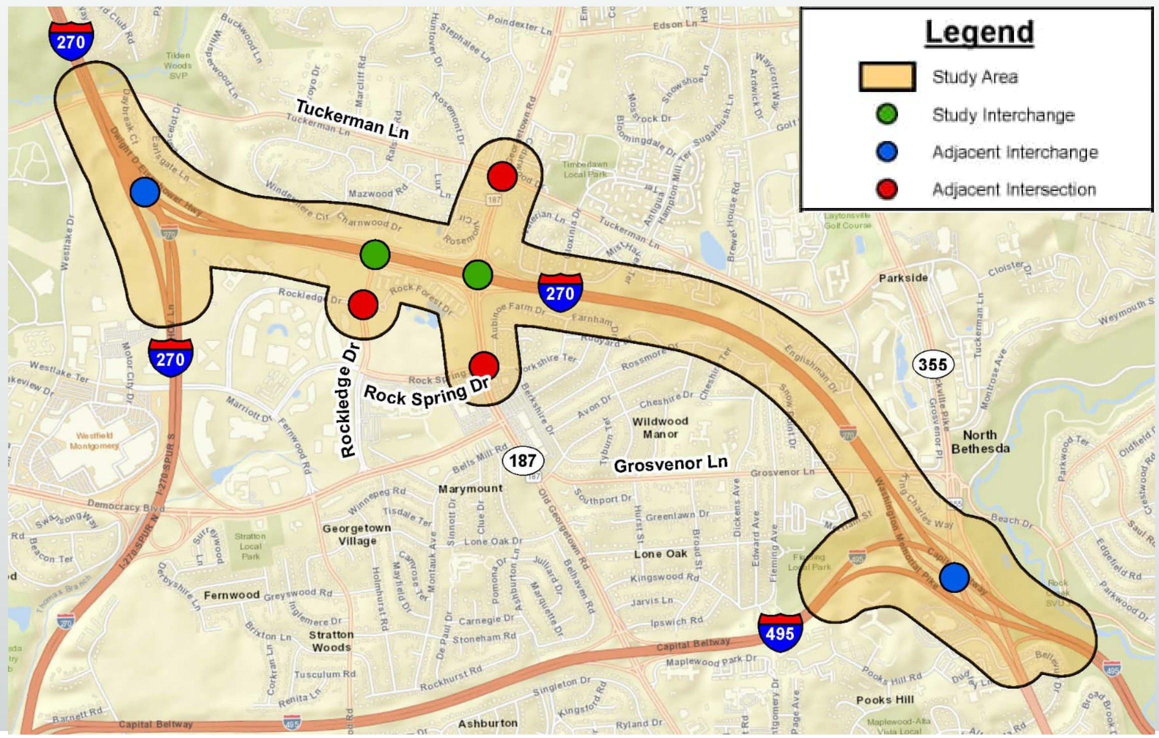
Area of Influence – I-270 West Spur at Democracy Blvd Interchange

- No direct access to managed lanes
- Adjacent I-270 West Spur Interchanges:
  - I-270 West Spur at Westlake Terrace
  - I-270 West Spur at I-495
- Adjacent Westlake Terrace Intersections:
  - Democracy Blvd and Taveshire Way
  - Democracy Blvd and Fernwood Rd



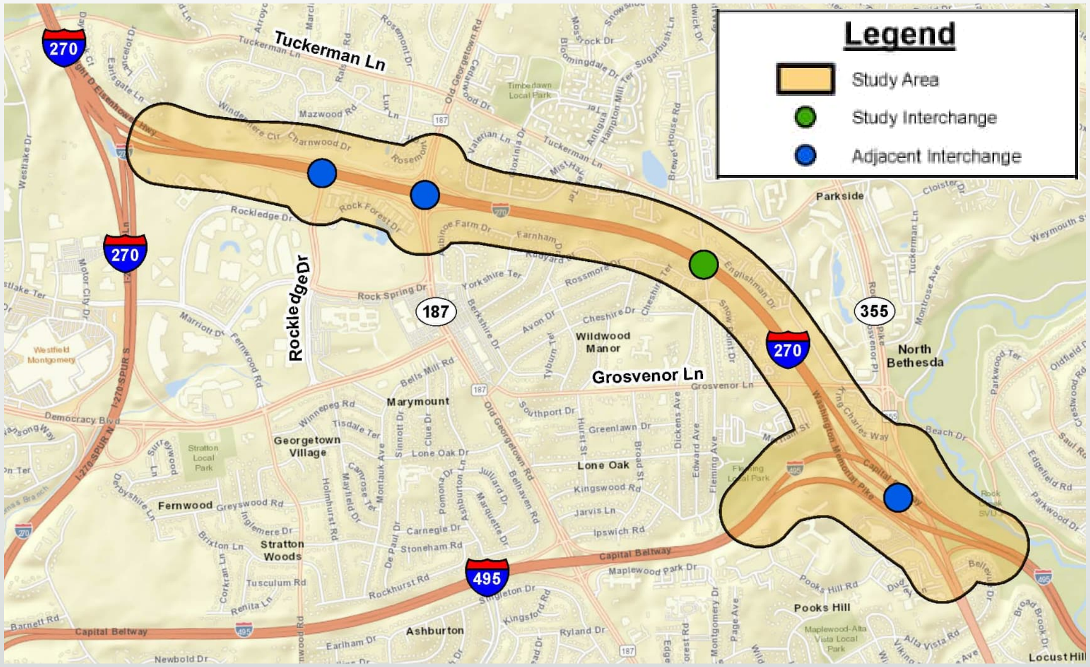
Area of Influence – I-270 East Spur at Rockledge Dr/MD 187 Interchange

- No direct access to managed lanes
- Adjacent I-270 East Spur Interchanges:
  - I-270 at I-270 Spur
  - I-270 East Spur / I-495 at MD 355
- Adjacent Intersections:
  - Rockledge Dr and Rockledge Blvd
  - MD 187 and Tuckerman Ln
  - MD 187 and Rock Spring Dr



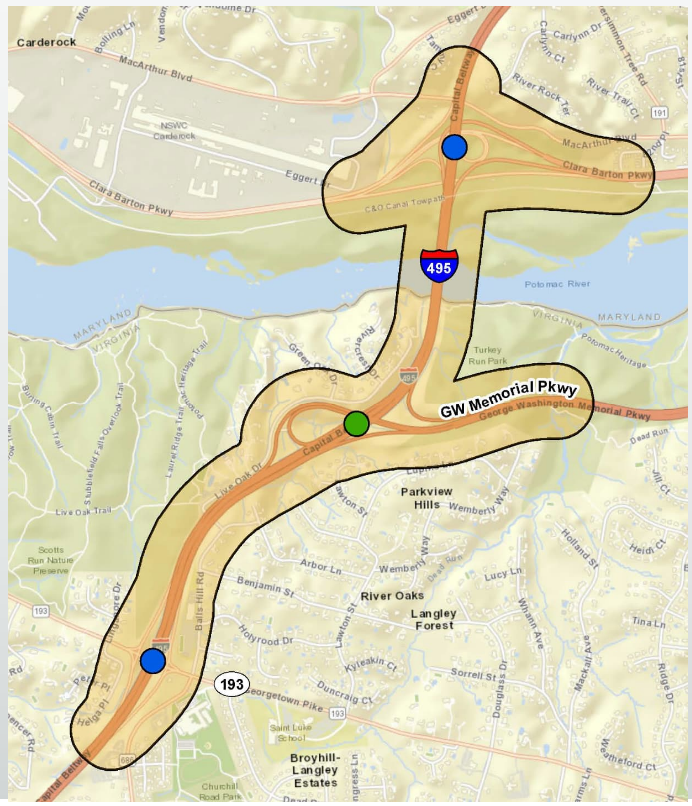
Area of Influence – I-270 East Spur east of MD 187

- Tie-in location
- Direct access to managed lanes
- Adjacent I-270 East Spur Interchanges:
  - I-270 East Spur at MD 187
  - I-270 East Spur / I-495 at MD 355



Area of Influence – I-495 at George Washington Pkwy Interchange

- Direct access to managed lanes
- Included in VDOT's Interchange Modification Report (IMR)
- Adjacent I-495 Interchanges:
  - I-495 at Clara Barton Pkwy
  - I-495 at VA 193

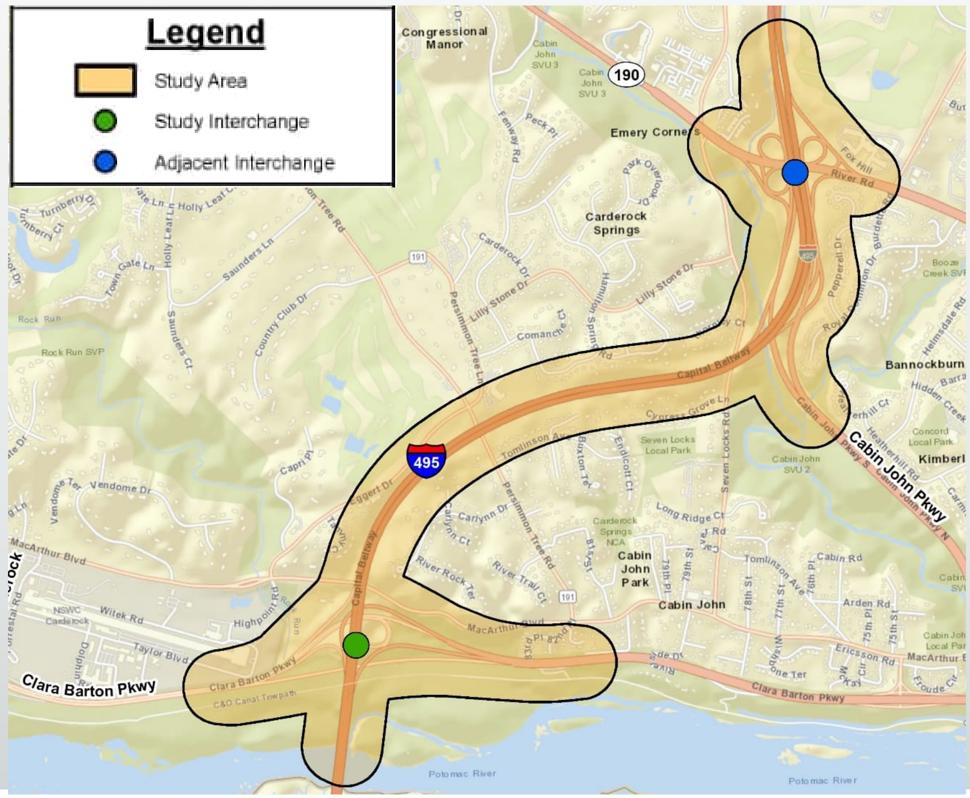


Legend

- Study Area
- Study Interchange
- Adjacent Interchange

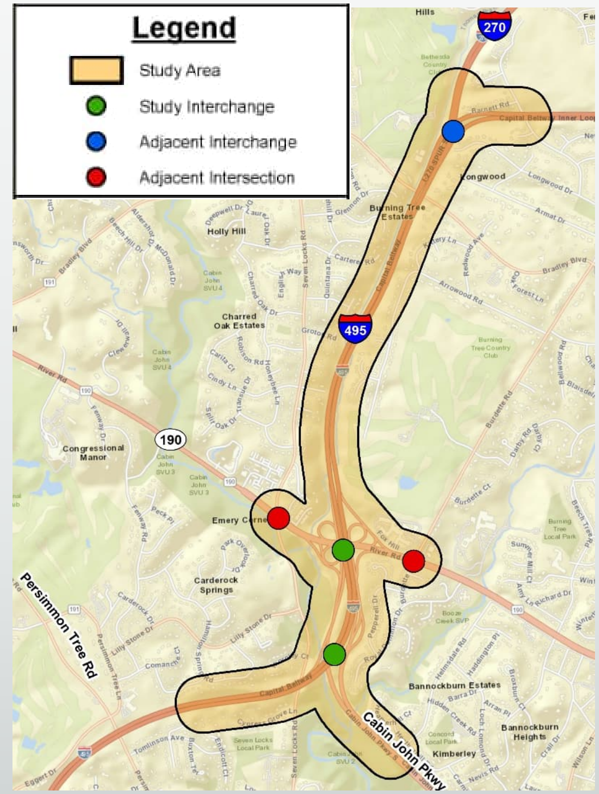
Area of Influence – I-495 at Clara Barton Pkwy Interchange

- No direct access to managed lanes
- Adjacent I-495 Interchanges:
  - I-495 at MD 190/Cabin John Pkwy
  - I-495 at VA George Washington Pkwy



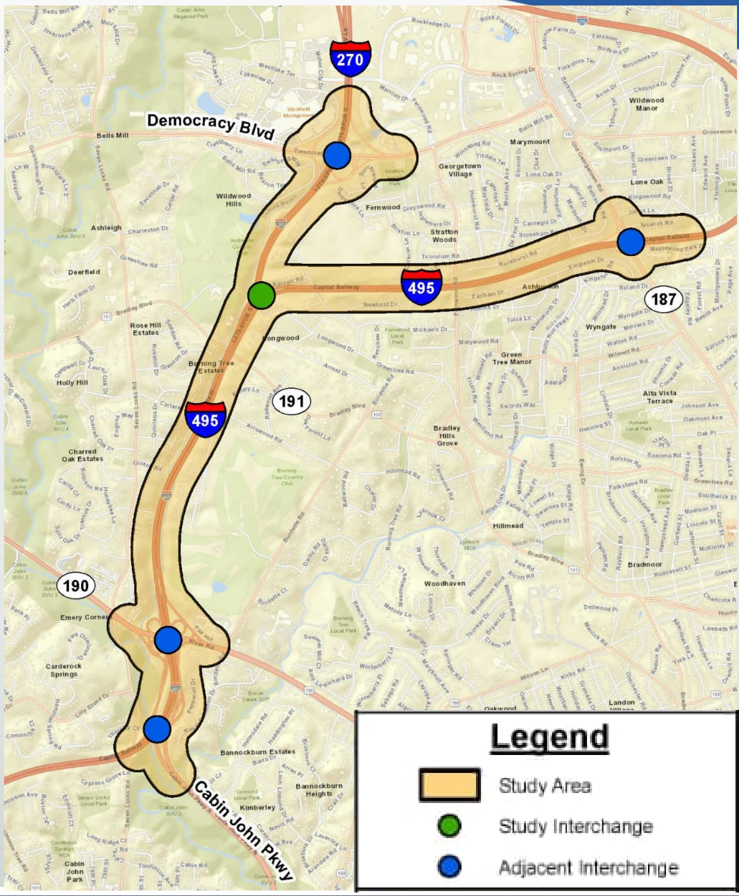
Area of Influence – I-495 at MD 190/Cabin John Pkwy Interchange

- Direct access to managed lanes
  - Includes access from General Purpose Lanes to Managed Lanes and access from Managed Lanes to General Purpose Lanes
- Adjacent I-495 Interchanges:
  - I-495 at I-270 West Spur
  - I-495 at Clara Barton Pkwy
- Adjacent MD 190 Intersections:
  - MD 190 and Seven Locks Rd
  - MD 190 and Burdette Rd



Area of Influence – I-495 at I-270 (West Spur)

- Direct access to managed lanes
- Adjacent I-495 Interchanges:
  - I-495 at MD 190/Cabin John Pkwy
  - I-495 at MD 187
- Adjacent I-270 Interchanges:
  - I-270 at Democracy Blvd



Area of Influence – I-495 West of MD 187

- At-grade access to managed lanes
- Adjacent I-495 Interchanges:
  - I-495 at I-270 West Spur
  - I-495 at MD 187