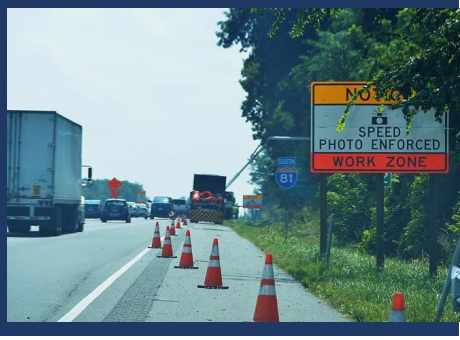
I-81 and I-70

Transportation Systems Management & Operations Plan

Final Report



June 30, 2020

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Table of Contents

Introduction

Transportation Systems Management & Operations (TSMO) is a set of integrated strategies used to optimize the operational performance of existing infrastructure. The Washington County Interstate TSMO Plan complements the on-going planning and construction efforts for the area's interstates, I-81 and I-70. The plan does not replace the additional capacity needs for the interstates in Washington County, but provides potential lower cost strategies and technology advancements until funding for capital projects becomes available. TSMO strategies planned together can provide additional efficiencies to extend the performance of the corridor.

The continued widening of I-81 is the top priority for Washington County with construction for Phase 1 nearing completion and Phase 2 under design. I-81 widening is identified as the region's top priority and a fiscally constrained project in the Hagerstown/Eastern Panhandle Metropolitan Planning Organization's (HEPMPO) 2045 Long Range Transportation Plan. Maryland Department of Transportation (MDOT) received a Finding of No Significant Impact (FONSI) from the Federal Highway Administration (FHWA) in February 2010 for all widening Phases and associated interchange improvements along I-81. Phase 1 includes the construction of a new Potomac River Bridge and interstate improvements including the addition of a third lane to Williamsport (Exit 1). MDOT has been seeking construction funding for the remaining Phases 2-4 that include the entire 12 miles from the Potomac River to the Pennsylvania state line as shown in **Figure 1**. The widening of I-81 is vital to the County as it will expand highway capacity to meet freight demand and improve safety, economic development, and mobility.

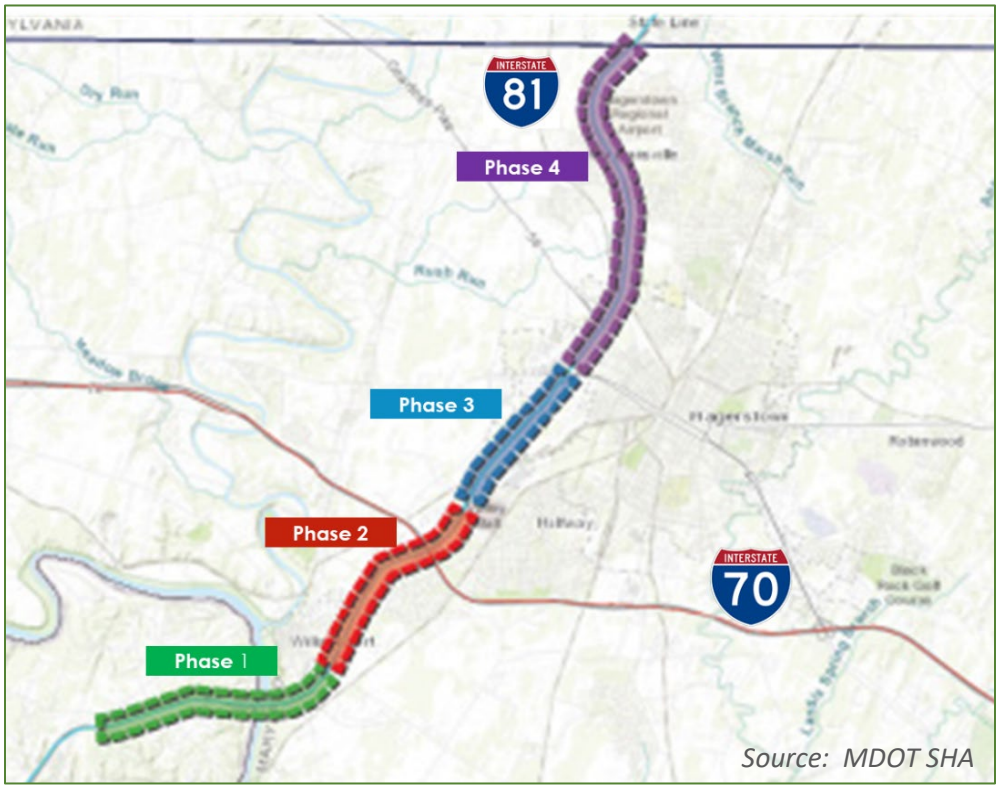


Figure 1: Major Capital Projects for I-81 Widening by Phase

Both I-81 and I-70 are priority freight corridors on the National Highway Freight Network, impacted by on-going construction activities, weather-related travel impacts and severe accidents. This plan identifies potential strategies to effectively manage and operate existing facilities to their full potential. TSMO strategies focus on safety improvements, traffic operations, Intelligent Transportation Systems (ITS) technologies, and other support systems to optimize the flow of traffic during times of congestion. The Plan will build upon the *Maryland TSMO Strategic Plan* completed by the MDOT State Highway Administration (MDOT SHA) in October 2018 and the incident management activities and coverage of the Coordinated Highways Action Response Team (CHART).

The HEPMPO and its planning partners have joined together to identify safe, efficient, and innovative transportation stratgies for Washington County interstates. The study area includes the entire length of I-81 in Maryland and I-70 from the Frederick County line to the Clear Springs Exit 18. The limits of the study area match the CHART interstate coverage for Washington County. The map in **Figure 2** provides the study limits.

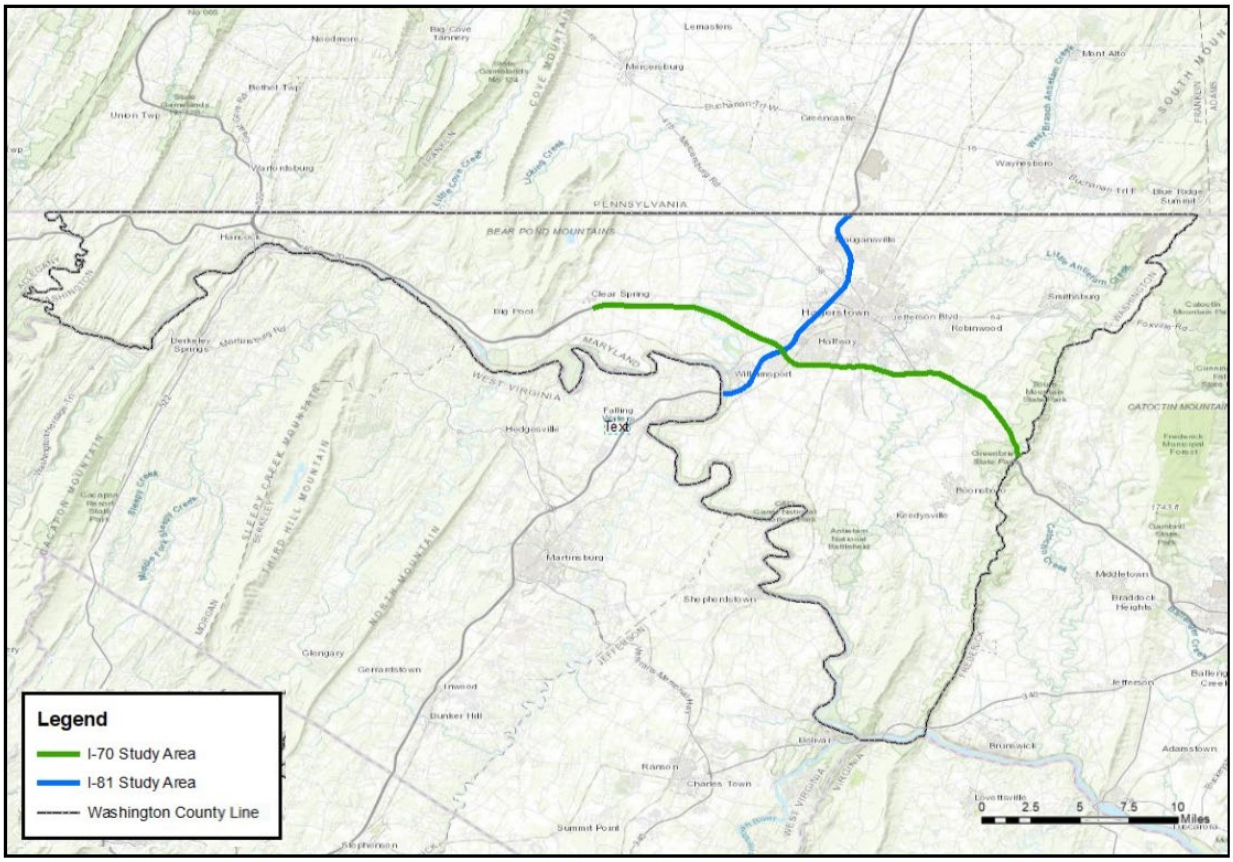


Figure 2: I-81 and I-70 Study Area Limits

TSMO Stakeholder Group

The TSMO Stakeholder Group was created to provide state and local expertise and guidance in developing the TSMO Plan. The group consisted of representatives from the HEPMPO, MDOT SHA, Washington County, City of Hagerstown, and the county and state police departments. The stakeholder group assisted with the data collection efforts, provided key direction for the plan development, and reviewed the alternative strategies in the plan. Many of the stakeholders participated in the development of the *Maryland TSMO Strategic Plan* and are developing similar plans across the State. The specific offices and departments that were represented in the TSMO Stakeholder Group include:

MDOT SHA Defines TSMO as:
An integrated approach to programmatic optimization of planning, engineering, operations, and maintenance in implementing new and existing multimodal systems, services and projects to preserve capacity and improve the security, safety, and reliability of our Transportation System

- HEPMPO
- MDOT SHA Office of CHART and ITS Development
- MDOT SHA Office of Planning and Preliminary Engineering (OPPE)
    - Travel Forecasting and Analysis Division
    - Regional Intermodal Planning Division
- MDOT SHA District 6
- Washington County Engineering
- Washington County Department of Public Works
- City of Hagerstown Engineering
- Washington County Sheriff's Department
- Maryland State Police (MSP)

Federal and State TSMO Initiatives

FHWA's Organizing and Planning for Operations Program supports the integration of TSMO strategies into the planning process for the purpose of improving transportation system efficiency, reliability, and operations. This program is led by the FHWA Office of Operations and Office of Planning, Environment and Realty in coordination with the Federal Transit Administration (FTA), which work with metropolitan planning organizations, State and local departments of transportation, transit agencies, and other organizations to maximize the performance of existing infrastructure through multimodal and multi-agency programs and projects. FHWA's website provides additional resources on TSMO (FHWA TSMO Website) and highlights the elements of TSMO program planning as shown in **Figure 3**.

MDOT's strategic plan (MDOT SHA TSMO Strategic Plan) establishes the purpose, vision, goals, objectives, and performance measures for TSMO planning activities and identifies potential strategies to implement TSMO across the State of Maryland. MDOT's strategic plan supports the development of more detailed corridor TSMO assessments to identify appropriate strategies for each corridor.

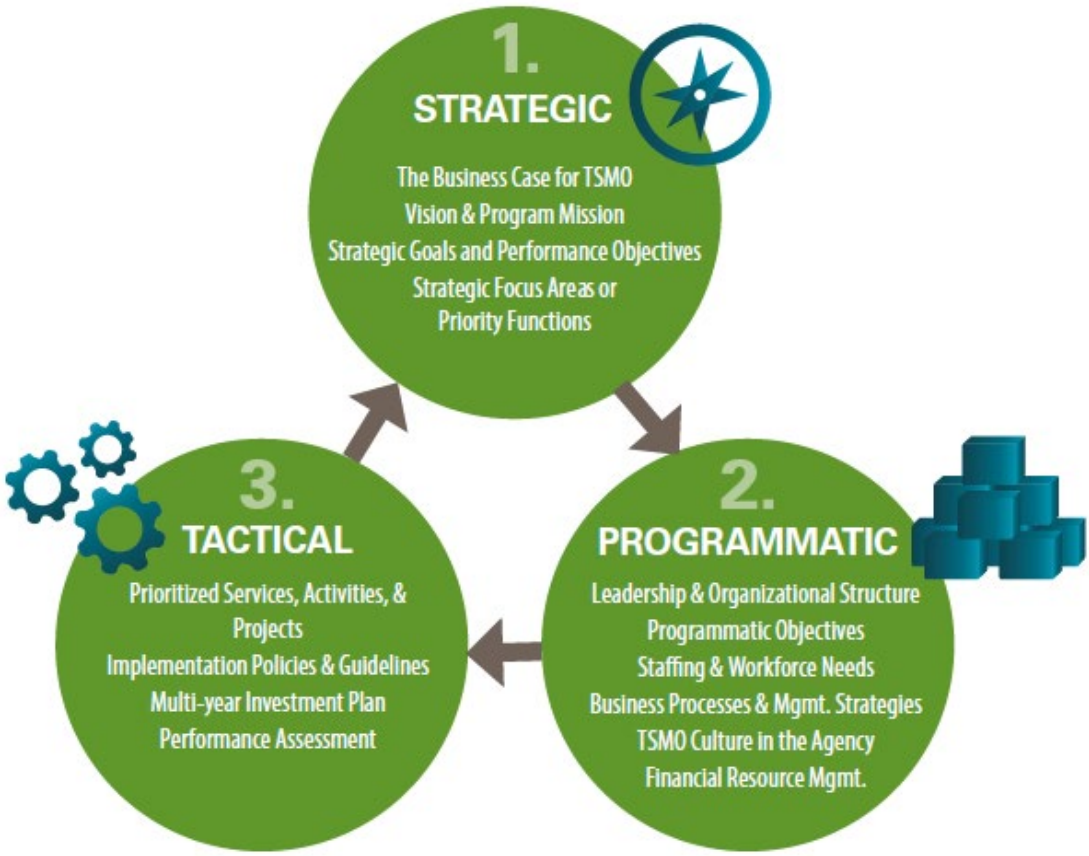
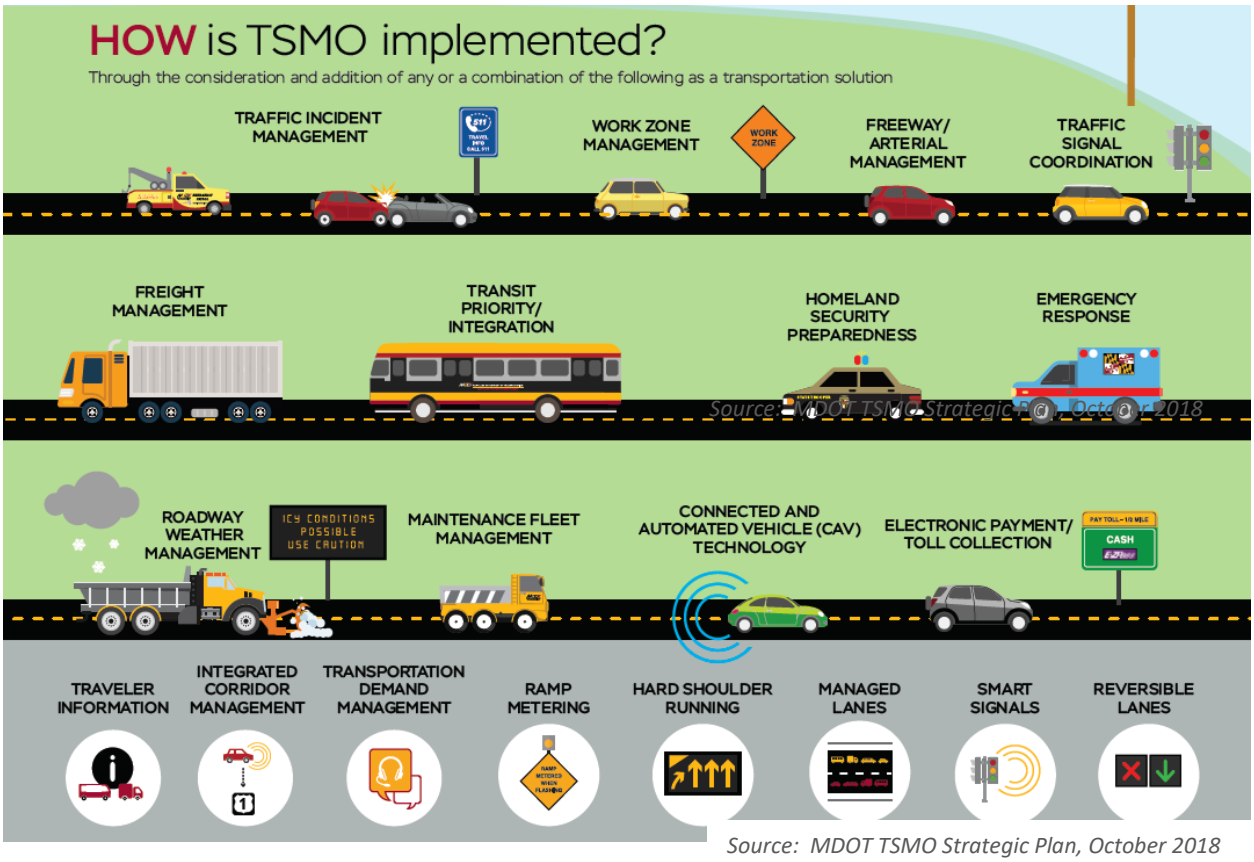


Figure 3: FHWA - TSMO Elements of Program Planning

TSMO Strategies

TSMO includes lower cost strategies that take little or no extra right-of-way (ROW) and can be deployed in shorter time periods than major infrastructure projects. For many corridors, TSMO can serve as an interim strategy to improve safety and operations until more significant capacity improvements can be funded and constructed.

Figure 4 provides some examples of TSMO strategies and include many activities that MDOT is already doing or implementing in corridors across the state. On freeway corridors, these strategies often target strategies to improve safety as vehicle incidents are a key source of traffic congestion, fatalities, and other injuries. TSMO not only provides public agencies with a growing toolbox of individual strategies but encourages combining them to achieve greater performance on the entire system.



Source: MDOT TSMO Strategic Plan, October 2018

Figure 4: Example TSMO Strategies

Study Goals and Objectives

The MDOT TSMO Strategic Plan provides a project planning development process for identifying opportunities and needs of corridors as part of local and district planning efforts. The I-70 and I-81 interstate corridors are high priority corridors for HEPMPO, MDOT and Washington County for safety, reliability, and congestion management. The process requires a baseline assessment or screening to evaluate traffic incidents, crashes and other activities that impact traffic flow, and an analysis to identify potential traffic improvement strategies with a focus on technology advancements like integrated transportation systems (ITS), low-cost safety measures, and traffic flow improvements.

The types of strategies for consideration in this study are identified in **Table 1**. Many of these strategies rely on the support of MDOT SHA, MSP, and emergency response agencies, as well as City and County traffic management departments. To be effective, TSMO strategies rely on coordinated efforts between agencies, active communication flows, and advanced technologies. These systems promote real-time operation management of the system that can provide early warning of traffic incidents, detour routes to control traffic flow, and delivering data for optimizing system efficiency. The strategies are not independent as they can provide synergistic effects with each other.

Table 1: Potential TSMO Strategies

TSMO Strategies		
Work Zone Management	Transit Management	Ramp Management
Traffic Incident Management	Truck Management	Traveler Information Improvements
Special Event Management	Traffic Signal Coordination	Active Transportation
Road Weather Management	Traveler Information	Integrated Corridor Management
Access Management	Connected and Automated Vehicle Deployment	Transportation Demand Management
Smart Truck Parking	Truck Travel Advisory Systems	Connected Automated Infrastructure

The TSMO study goals (**Figure 5**) for Washington County's interstate corridors integrate MDOT SHA TSMO Goals from the State level. They are based on federal guidelines, incorporate performance measures, and utilize localized experience and expertise.

1. Meet **federal requirements** as it relates to ITS Planning
2. Incorporate **MDOT Statewide TSMO Goals** for operations planning at a regional level
3. Utilize objectives-driven **performance-based planning processes** for operations and congestion management planning
4. **Integrate ITS and operations planning** into the overall transportation planning process per FHWA guidance
5. **Identify and prioritize TSMO strategies / projects** as part of the MPO TIP and LRTP

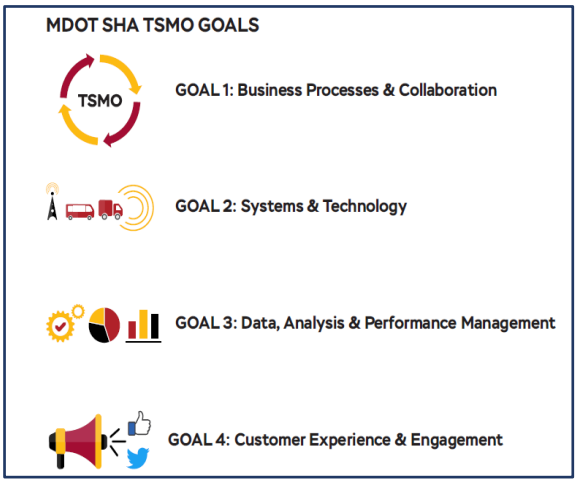


Figure 5: TSMO Study Goals

The study objectives were coordinated through the TSMO Stakeholder Group as provided in **Figure 6**. A baseline assessment includes an evaluation of historic incidents and their impact on the transportation system that includes interstates and major arterials that are used for traffic detour routes. The forecast assessment examines future network performance based on expected demographic, regional travel, and freight growth. The community agencies and business outreach utilized an on-line survey to assess issues and needs along each interstate corridor. Based on the congestion assessment, incident contributing factors, and input from outreach and direction from the stakeholder group, the study aims to identify low-cost safety measures, traffic flow improvements and technology-based measures that complement existing projects programmed in the regional Transportation Improvement Program (TIP)

and Long Range Transportation Plan (LRTP). The final action plan with multiple strategies and projects aims to prioritize the projects according to the priorities and goals established in the Maryland Statewide TSMO, freight and LRTP plans.

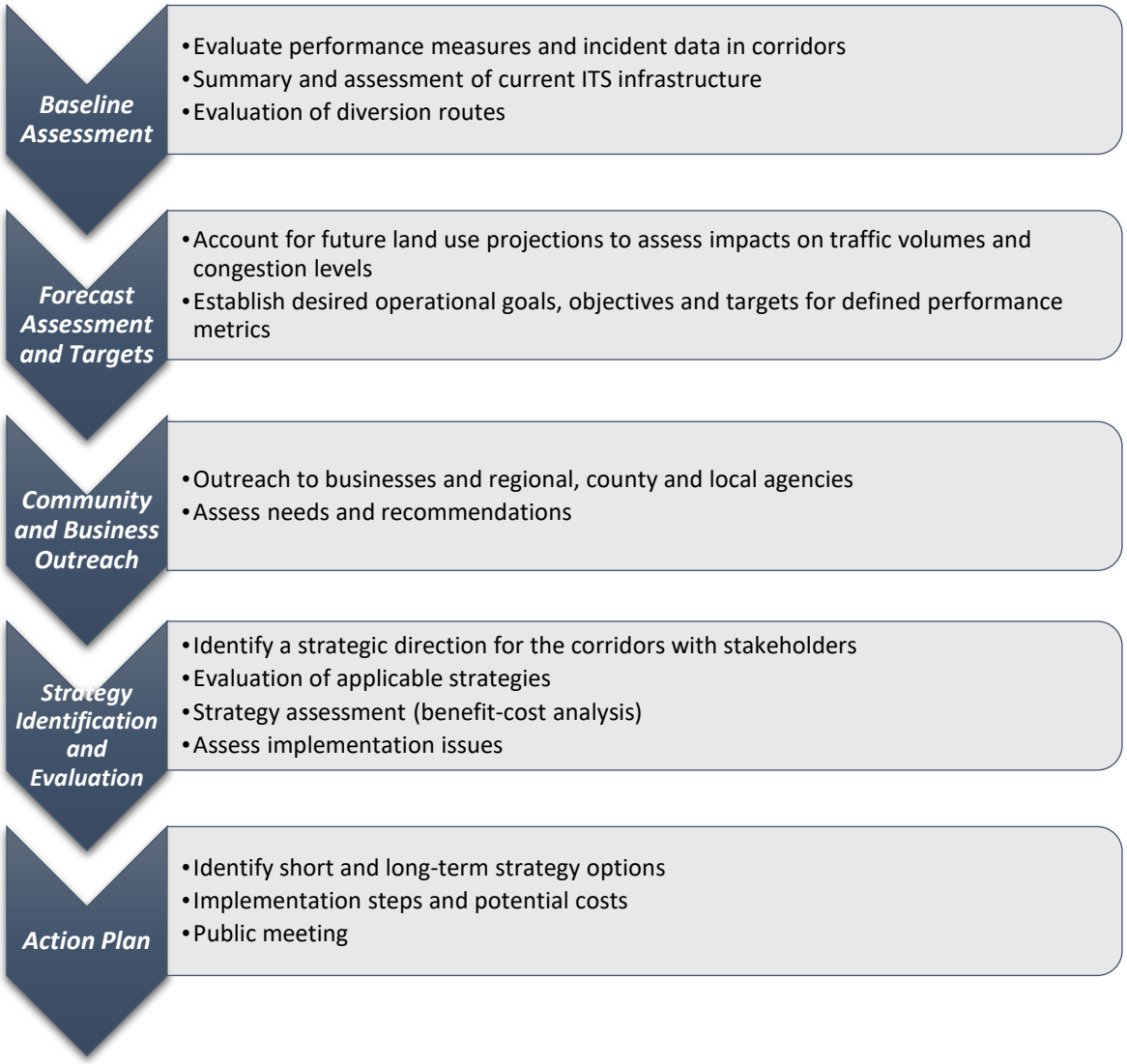


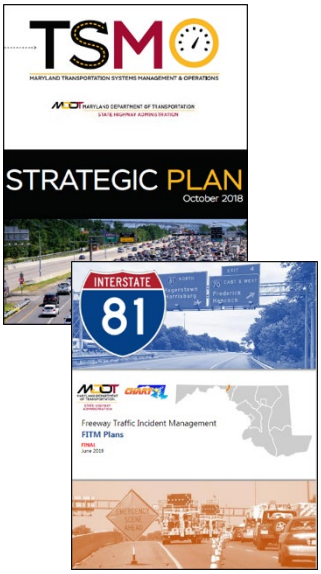
Figure 6: TSMO Study Objectives

Previous Studies and Resources

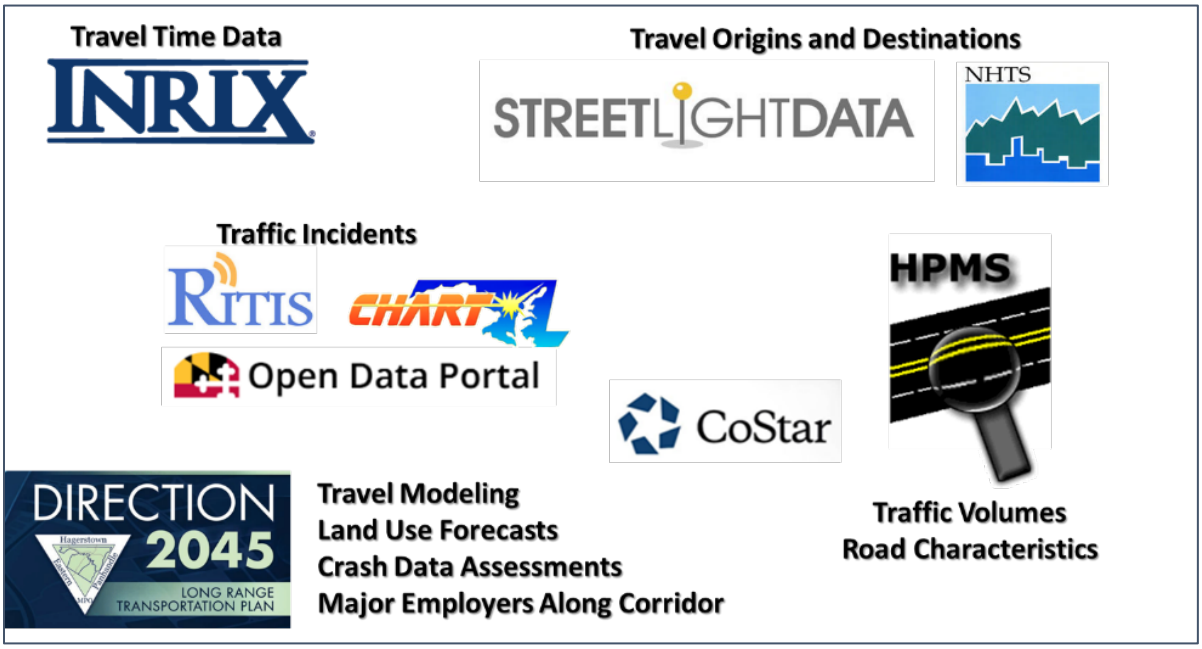
There are state, federal, and local resources and guidance documents available for implementing TSMO strategies. Typical state and regional project implementation efforts have been focused on capital projects, design, and construction and maintenance programming. For example, HEPMPO is responsible for managing the TIP for the region that allocates federal funding for multimodal and infrastructure projects. As the funding sources become limited and state and local matching of funding becomes difficult, TSMO provides near-term strategies to address some of the regional needs and safety concerns. Existing TSMO resources provided the planning and implementation process, data sources,

and strategic goals to assist in developing a corridor level TSMO strategy. The studies and resources include:

- *MDOT SHA TSMO Strategic Plan*
- *MDOT SHA Improving I-81 in Maryland*
- *MDOT SHA CHART – Freeway Incident Traffic Management (FITM) Plans for I-81 and I-70*
- *MDOT Connected and Automated Vehicle (CAV) Strategic Action Plan*
- *MDOT Maryland Statewide Truck Parking Study*
- *FHWA Developing and Sustaining a Transportation Systems Management and Operations Mission for your Organization: A Primer for Program Planning*
- *FHWA Model Transportation Systems Management and Operations: Deployments in Corridors and Subareas Primer*
- *HEPMPO – Direction 245 Long Range Transportation Plan (LRTP)*
- *HEPMPO – Regional Traffic Safety and Improvement Study*



Nonrecurring events like traffic accidents, construction activity, and adverse weather events can have a significant impact on travel delays. Detecting and responding to these events stretch between emergency management crews and transportation agencies. Agencies like CHART, utilize technology and data management techniques to improve traffic monitoring and incident response times, communicating with partners by capturing real-time traffic data. These data sources provide extensive incident information, travel time information, traffic volumes and patterns, as well as potential freight development and truck traffic. Effective TSMO management offers opportunities to improve the system performance and improve reliability for travel and freight commerce throughout the region.



Community & Business Outreach

A community outreach survey was sent to local agencies, business organizations and industries, and other interest groups. The survey was open for 30 days in November of 2019 and provided insights from a business perspective on the interstate performance. It also identified potential safety problem areas and ideas on lower-cost strategies including incident response technologies, safety improvements, signage, and other strategies to optimize the flow of traffic.

The survey was publicized by HEPMPO, featured in an article by the Herald-Mail Newspaper, and shared by the Washington County Chamber of Commerce and Washington County Public Relations and Marketing Department (**Appendix C**). A few of the survey screens are provide in **Figure 7**.

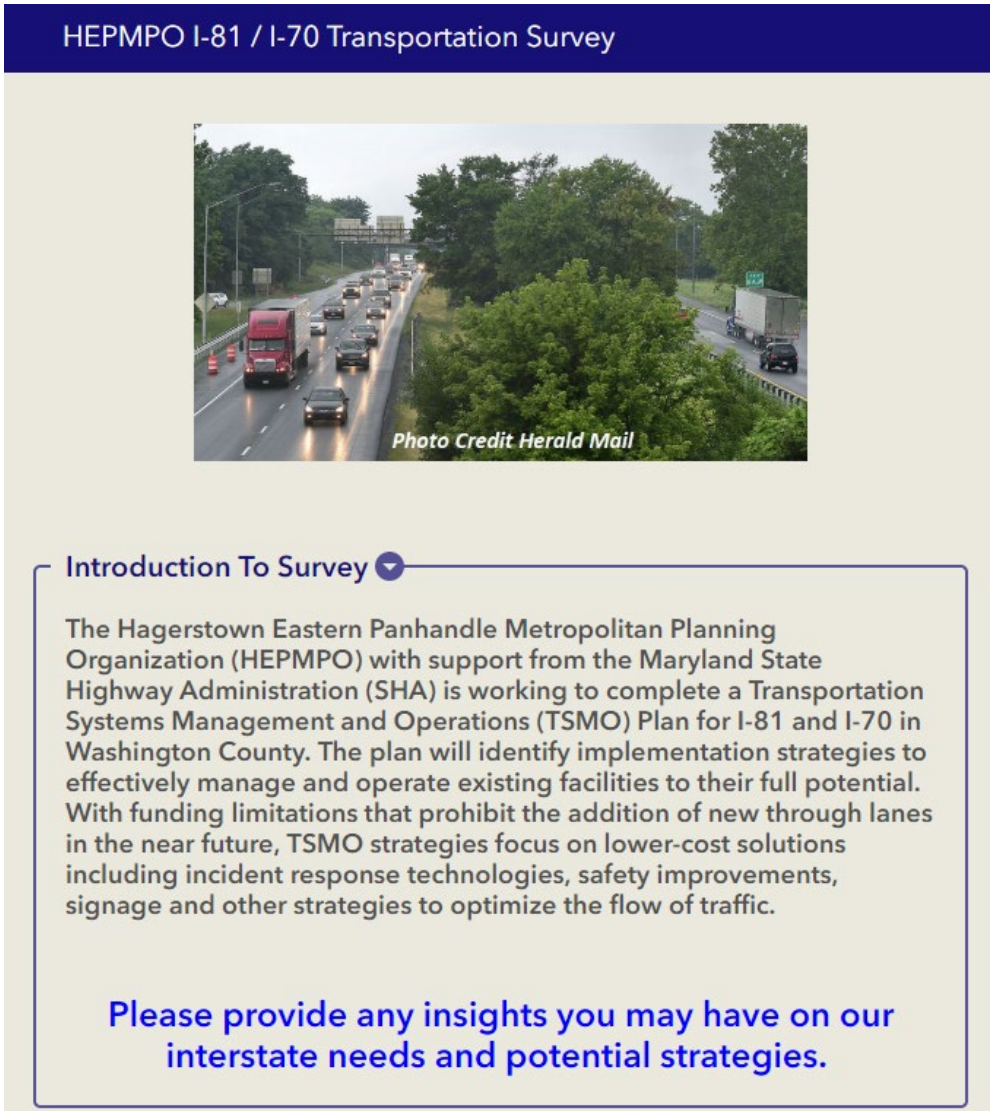
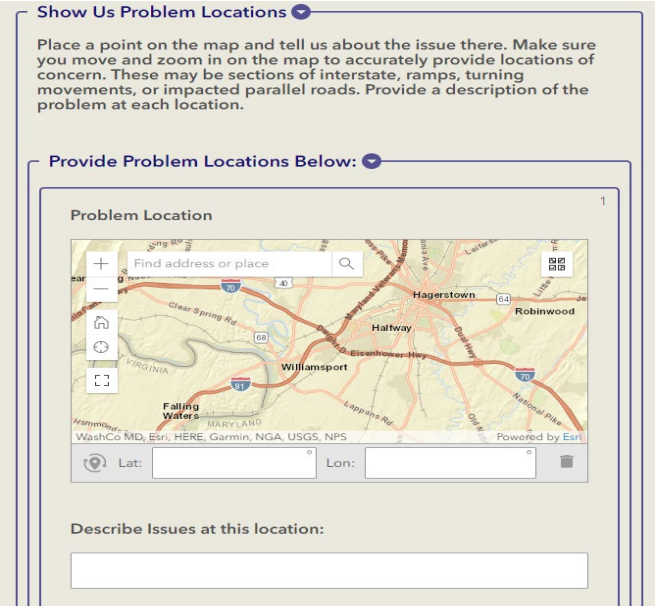


Figure 7: TSMO Community and Business Outreach Survey



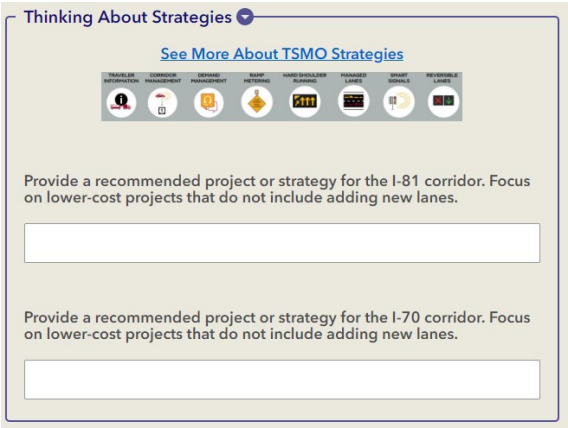


Figure 7 (Continued): TSMO Community and Business Outreach Survey

Survey Assessment

There was a total of 84 responses to the survey, which represented a variety of business interests and population in the region. Respondents included public services; finance; insurance and real estate agencies; transportation and public utilities; retail stores; freight industry; and other companies that utilize the interstates for business purposes. The survey provided valuable comments, areas of concern, and potential recommendations.

Seventy-two percent of respondents said they have been impacted by traffic congestion on I-81 and I-70. The primary concerns related to interstate congestion are ranked below based on the number of responses. Top responses include delays resulting from crashes, peak period traffic congestion, safety, weather, and construction delays. The survey allowed for multiple selections and were consistent between I-81 and I-70. The overall results are provided in **Figure 8**.

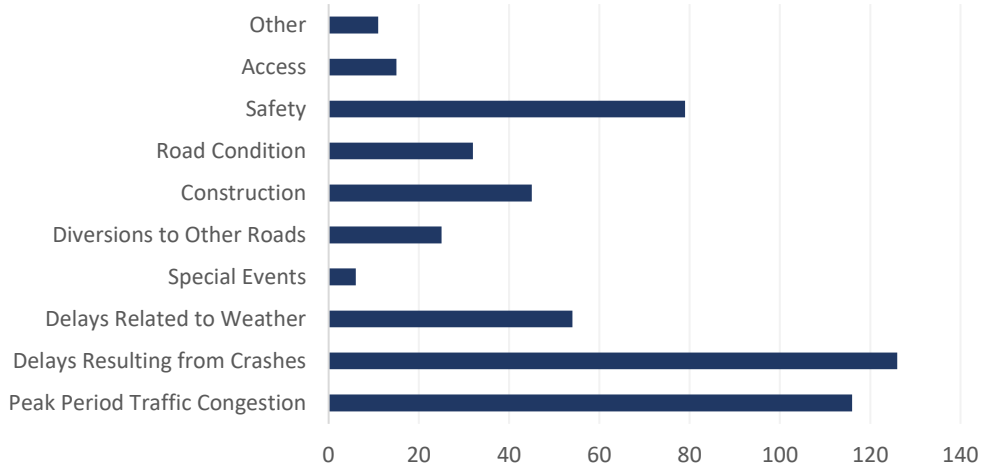


Figure 8: TSMO Survey – Primary Concerns along the Interstates

The survey asked the respondents to place a point on the map and tell about the issue there. The results are shown in **Figure 9** and highlighted below.

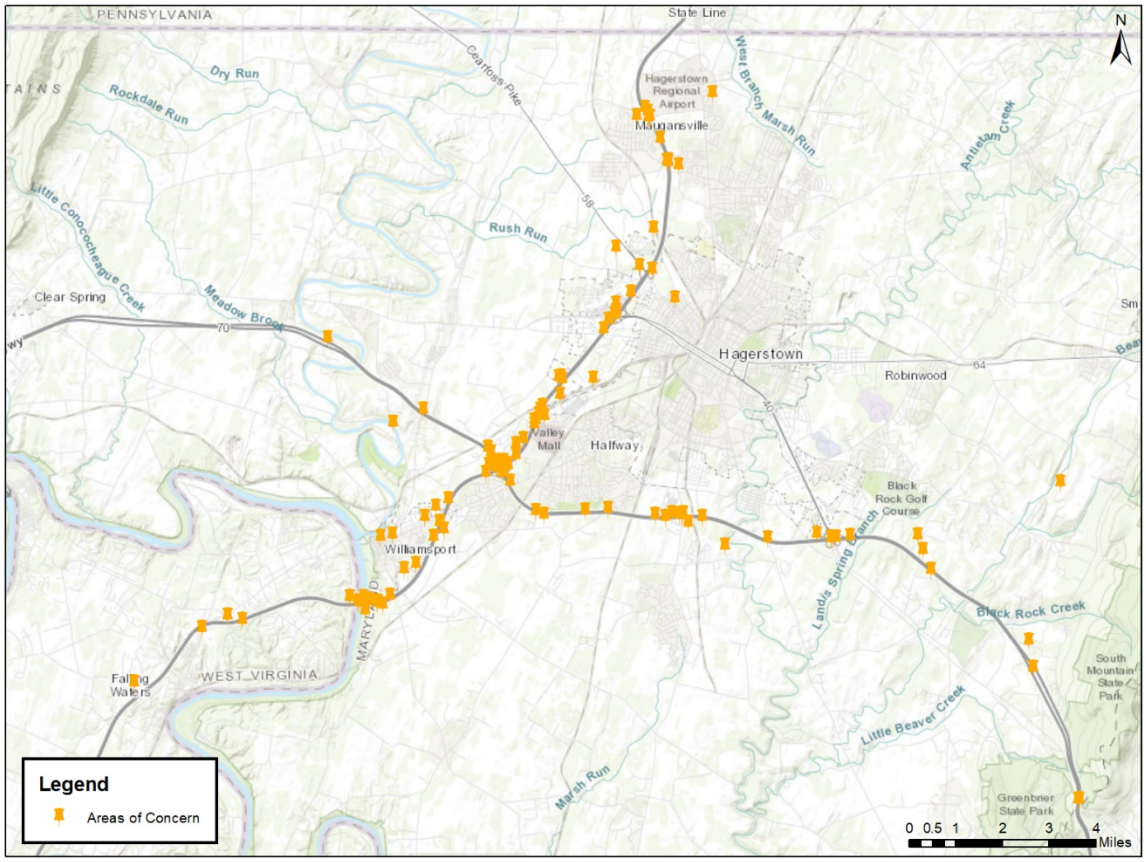


Figure 9: TSMO Survey – Areas of Concern

- The largest concentration of points is located at the I-70/I-81 interchange. 25 participants placed points along the highways and ramps, many with descriptions involving "congestion."
- Several other major interchanges contained point concentrations. Many participants cited "congestion", "accidents", and "unsafe merging" as descriptions.
- Several points are concentrated at the Potomac River Bridge at the West Virginia border. Participants often cited "accidents" as an issue, with varying causes from congestion, construction, merging, visibility, and weather.
- Outlying points not located on the main corridors cited several issues with detour routes, as well as noise pollution from automobile traffic.

Baseline Assessment

An assessment of available travel data and performance measures was conducted to guide the identification of operational and safety issues on I-81 and I-70 in Washington County. The data assessments included evaluation of existing development, travel patterns, traffic delay, travel time performance measures, crash and other incident locations, incident response times, and the impacts of incidents on nearby roadways. The key data resources used for the baseline assessment are provided in **Table 2**. A summary of primary conclusions is provided in the sections below.

Table 2: Data Sources for Baseline Assessment

Data Source	Extracted Data
Maryland Open Data Portal	• Annual average Daily Traffic data • 2015-2018 Traffic Incident data
Regional Integrated Transportation Information System (RITIS)	• 2015-2019 Delay, Travel time data
MDOT State Highway Administration (SHA)	• 2015 – 2018 Crash Data • Detour routes • Signal timing data
Coordinated Highways Action Response Team (CHART)	• Incident response times
STREETLIGHT DATA	• Travel Origin and Destinations
CoStar	• Freight Developments
Maryland State Police	• 2015-2018 CAD 89 Report Data

Corridor Delay

Traffic delay has been summarized using information extracted from the RITIS "*User-Cost Delay*" reports for the years 2015 through 2019. The report is based on historic INRIX travel time data collected for passenger cars and trucks operating on I-81 and I-70. For I-70 corridor, 2019 has annual delay totals that is the highest since 2016. The annual delay on I-70 is typically 4-5 times higher than that experienced on I-81. **Figures 10 and 11** summarize the delay for each corridor.

A "planning-level" methodology has been applied to assess the potential portion of recurring vs. non-recurring delay on each corridor. Recurring or peak period congestion takes place virtually every day when and where traffic demand exceeds the existing roadway capacity. Non-recurring congestion is caused by irregular events such as crashes, roadway hazards, highway construction, adverse weather, and special events. Both need to be addressed in different ways to effectively deal with the full spectrum of congestion. Using the RITIS delay estimates for every hour over the 5-year period, any portion of hourly delay that fell below the 25th percentile or above the 75th percentile value for each time period is considered non-recurring.

The results indicate that non-recurring delay is the primary delay source for both the I-81 and I-70 corridors. ***I-81 has the highest non-recurring values, ranging between 66-84% of the total delay. I-70 has more consistent values (over the 5-year period) ranging between 60-63% of the total delay.*** *The high levels of non-recurring delay provide emphasis to strategies aimed at improving traffic safety and providing timely information to motorists.*

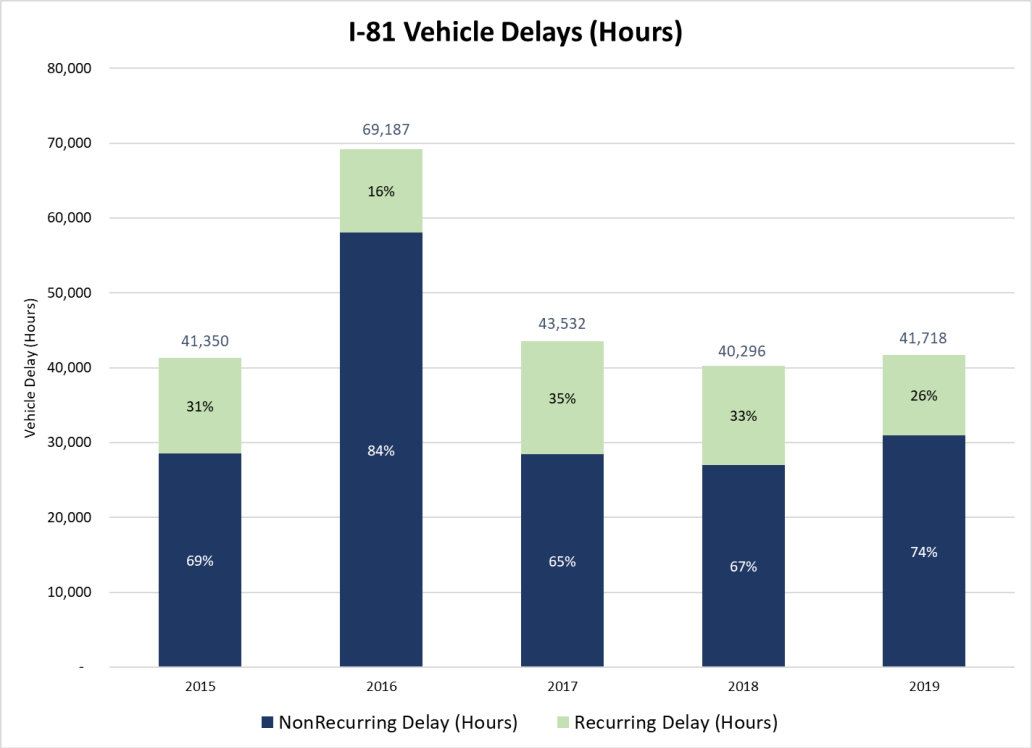


Figure 10: I-81 Corridor Delays (2015-2019)

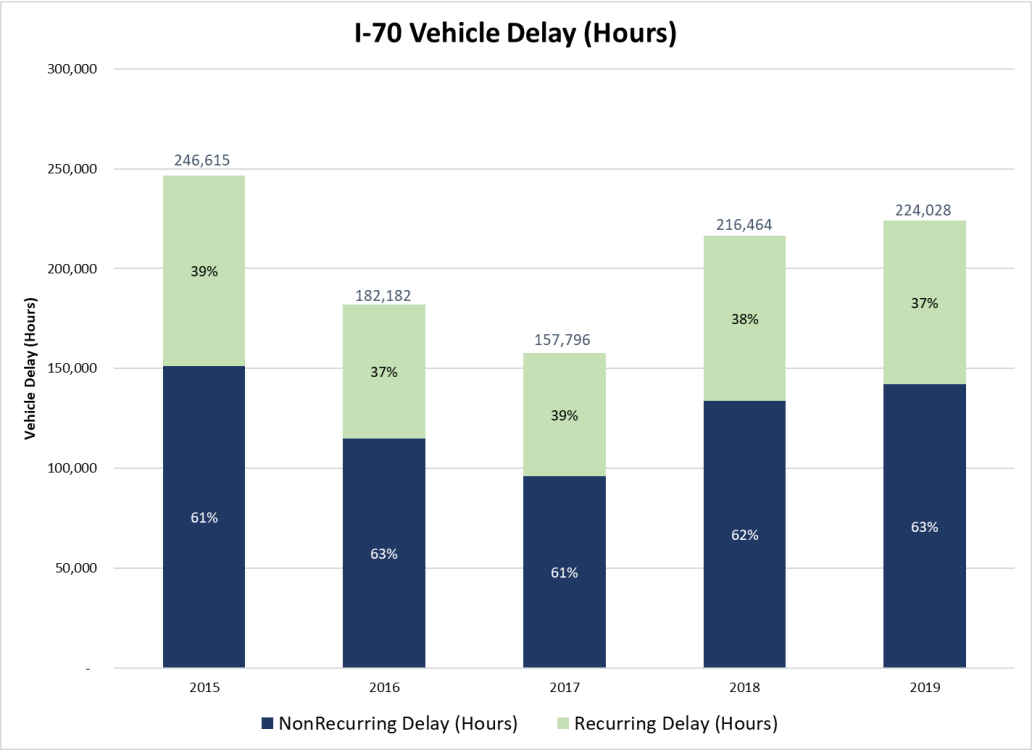


Figure 11: I-70 Corridor Delay (2015-2019)

Travel Time Measures

Travel time performance measures using the INRIX data have been prepared to help in assessing both the locations and time periods of historic traffic congestion.

The Travel Time Index (**TTI)** is the ratio of the measured average travel time during a specific time period to the travel time required to make that same trip at free-flow (e.g. typically at nighttime) speeds. For example, a TTI of 1.30 for the PM peak hour indicates a 20-minute free-flow trip requires, on average, about 26 minutes during the evening rush-hour (i.e. 30% higher travel time). Typically, TTI values over 1.25 indicate moderate levels of traffic congestion. Values over 1.50 indicate more severe levels of congestion, especially in smaller urban areas.

The Planning Time Index (**PTI**) ratio compares the near-worst case travel time during a specific time period to the travel time required to make that same trip at free-flow speeds. PTI is computed as the 95th percentile travel time divided by the free-flow travel time and is often used to measure travel reliability. For example, a PTI of 1.60 for the PM peak hour indicates a 15-minute free-flow trip may require planning for 24 minutes during the peak period (i.e. 60% higher travel time) to ensure on-time arrival 95 percent of the time. PTI is useful because it can be directly compared to the TTI (a measure of average congestion) on similar numeric scales. Typically, PTI values between 1.5 and 2.5 indicate moderate levels of congestion (e.g. unreliable travel). PTI values over 2.5 indicate more severe reliability and congestion issues. Since PTI utilizes worst-case travel times, it is not only impacted by everyday congestion but also traffic incidents, work zones, weather, and other events.

Figures 12 and 13 summarize the TTI and PTI measure reports extracted from RITIS for I-81 and I-70 for the 2018-2019 period. **Table 3** provides some of the key conclusions drawn from this data.

Table 3: Key Conclusions based on TTI & PTI Measures

Corridor	Measure	Identified Issues 2018-2019
I-81	TTI	• Minor "Recurring" (Frequent) Congestion levels on weekdays only • Southbound during 3-6pm (weekdays) Between Exit 8 and WV border • Higher levels of night-time congestion at construction site at southern end of corridor
	PTI	• Medium Levels of "Non-Recurring" Congestion • Southbound and Northbound during 3-6pm (weekdays) at US-40 and Halfway Blvd Interchanges • Higher levels of Southbound night-time congestion at construction site at southern end of I-81 corridor
I-70	TTI	• Minor "Recurring" (Frequent) Congestion • Westbound 3-6pm (weekdays)
	PTI	• Higher Levels of "Non-Recurring" Congestion • Westbound during 3-6pm (weekdays) • Eastbound during 3-7pm (weekends) (DC / Baltimore thru traffic)

Travel Time Index (TTI)

Planning Time Index (PTI)

Figure 12: I-81 TTI and PTI Measures (2018-2019)
(By Road Direction, Hour, and Weekday vs Weekend)

Travel Time Index (TTI)

Planning Time Index (PTI)

Figure 13: I-70 TTI and PTI Performance Measures (2018-2019)
(By Road Direction, Hour, and Weekday vs Weekend)

Travel time data for trucks were pulled from RITIS using the FHWA the National Performance Management Research Data Set (NPMRDS) data within the Performance Summaries tool from year 2017 to 2019. **Tables 4 and 5** show the truck travel time index from year 2017 to 2019, which is close to averaging 1.1 meaning that it is within the light congestion range.

Table 4 : I-81 Truck Travel Time Index

	I81 Southbound			I81 Northbound		
	2017	2018	2019	2017	2018	2019
Monday	1.12	1.11	1.09	1.09	1.08	1.08
Tuesday	1.16	1.14	1.1	1.11	1.09	1.12
Wednesday	1.15	1.13	1.1	1.1	1.1	1.1
Thursday	1.13	1.19	1.15	1.14	1.12	1.09
Friday	1.13	1.15	1.11	1.1	1.11	1.1
Saturday	1.09	1.09	1.09	1.09	1.09	1.08
Sunday	1.09	1.09	1.07	1.09	1.08	1.08
Weekends	1.09	1.09	1.08	1.09	1.09	1.08
Weekdays	1.14	1.14	1.11	1.11	1.1	1.1
All Days	1.12	1.13	1.1	1.1	1.1	1.09

Table 5: I-70 Truck Travel Time Index

	I70 Eastbound			I70 Westbound		
	2017	2018	2019	2017	2018	2019
Monday	1.16	1.15	1.15	1.14	1.14	1.12
Tuesday	1.15	1.14	1.13	1.14	1.14	1.12
Wednesday	1.15	1.14	1.14	1.15	1.14	1.13
Thursday	1.16	1.15	1.15	1.15	1.15	1.14
Friday	1.15	1.16	1.16	1.17	1.19	1.18
Saturday	1.15	1.15	1.14	1.15	1.14	1.12
Sunday	1.18	1.18	1.18	1.14	1.14	1.13
Weekends	1.17	1.16	1.16	1.15	1.14	1.12
Weekdays	1.15	1.15	1.15	1.15	1.15	1.14
All Days	1.16	1.15	1.15	1.15	1.15	1.13

Incidents and Crashes

Crash data locations and MDOT SHA crash summary reports have been acquired for each corridor. The data was used to provide insights into safety issues and areas of concern within the corridor. Each corridor contains crash rate categories that are significantly higher than the statewide average. An additional evaluation of corridor crash data shows the following characteristics in **Table 6**.

Table 6: I-81 and I-70 Crash Characteristics

Corridor	Highlighted Crash Characteristics
I-81	• Highest percentage of crashes occurred between 11am-6pm with nearly 10% of all crashes occurring in the 4-5pm hour • The primary collision type categories included Single Vehicle (45%); Same Direction Rear End (32%), Same Direction Sideswipe (11%) and Other (12%) • **Truck related crash rate is nearly 3 times statewide average** • Wet surfaces were attributed to 20% of the crashes (not significantly above state average) • About 32% of crashes occurred during evening or night hours (not significantly above state average) • Speed (based on conditions) was noted most often as the probable cause for crashes
I-70	• Highest percentage of crashes occurred between 5am-7pm. Crashes are more evenly distributed among the daylight hours as compared to I-81 • The primary collision type categories included Single Vehicle (42%); Same Direction Rear End (40%), Same Direction Sideswipe (9%) and Other (9). **The Rear End crashes are significantly higher than the statewide average**. • **Truck related crash rate is above the statewide average** • Wet surfaces were attributed to 22% of the crashes (not significantly above state average) • About 29% of crashes occurred during evening or night hours (not significantly above state average) • Failure to give full attention and speed were noted most often as probable cause for crashes

Crash data points were used to guide the potential location and prioritization of TSMO strategies along each corridor. The evaluation of I-81 crash data noted that between years 2015-2018 nearly 63% of the crashes occurred within construction zones. This high number of crashes points to the need for further evaluation of Traffic Control Plans and operational mitigations in construction sites within the county. For this TSMO study, construction crashes were removed from the I-81 crash database to help determine other focal areas for strategy application. These locations would include assessments of roadway, traffic signing and pavement marking strategies.

Figures 14 and 15 provide a heat map of crash point locations that resulted in tow and/or injury for each corridor. The mapping was done separately by travel direction to assist in determining the underlying issues.

The results provide important insights into where strategies may be most appropriate. *For I-81 Northbound, the highest density of crashes occurred at the Halfway Boulevard, US-40, Maugans Avenue and Showalter Road interchanges. For I-81 Southbound, crashes were most concentrated at the US-40 and I-170 interchanges. For I-70 crash density locations were consistent by direction and included most of the interchanges and the eastern portion of the corridor near the Frederick County line.*

Figure 14: I-81 Crash Heatmap (2015-2018)

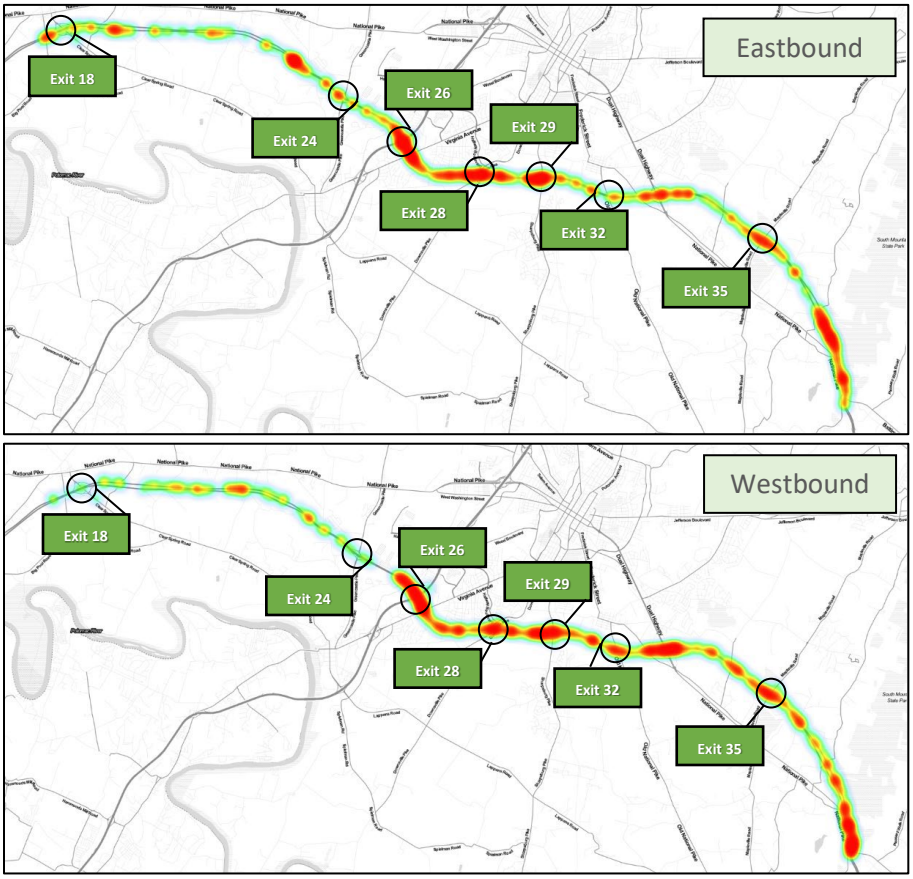


Figure 15: I-70 Crash Heatmap (2015-2018)

Assessing Other Crash Data Sources

Most traffic incidents get reported to law enforcement agencies first, via Public Safety Answering Points (PSAPs) that respond to 911 calls. These computer-aided dispatch (CAD) systems provide additional data on minor incidents that may not be reflected in MDOT SHA's crash data system. An evaluation was conducted on Code 89 Collision Reports obtained from the Maryland State Police. These reports represent incidents that involve no personal injuries, no lane closure and/or where the vehicle can be driven away. In these cases, the incident is assigned as case number; however, no detailed report is completed. These case reports can provide insights into safety issues and priority locations.

Figure 16 provides the Code 89 incidents along I-81 and I-70 were assembled from 2015-2018 reports returned over 2500 records. Heat maps were prepared to illustrate high density locations of these incidents. The information points to similar locations as identified through the MDOT SHA crash analysis. These include:

- I-81 and I-70 Interchange (Exit 4) to Halfway Blvd interchange (Exit 5) (Included in the Phase 2 Section of planned I-81 widening)
- I-81 WV border to Exit 1 section (I81 widening – Phase 1 construction section)
- I-70 Exits 28, 29 sections
- I-70 and US 40 Interchange section (Exit 32)

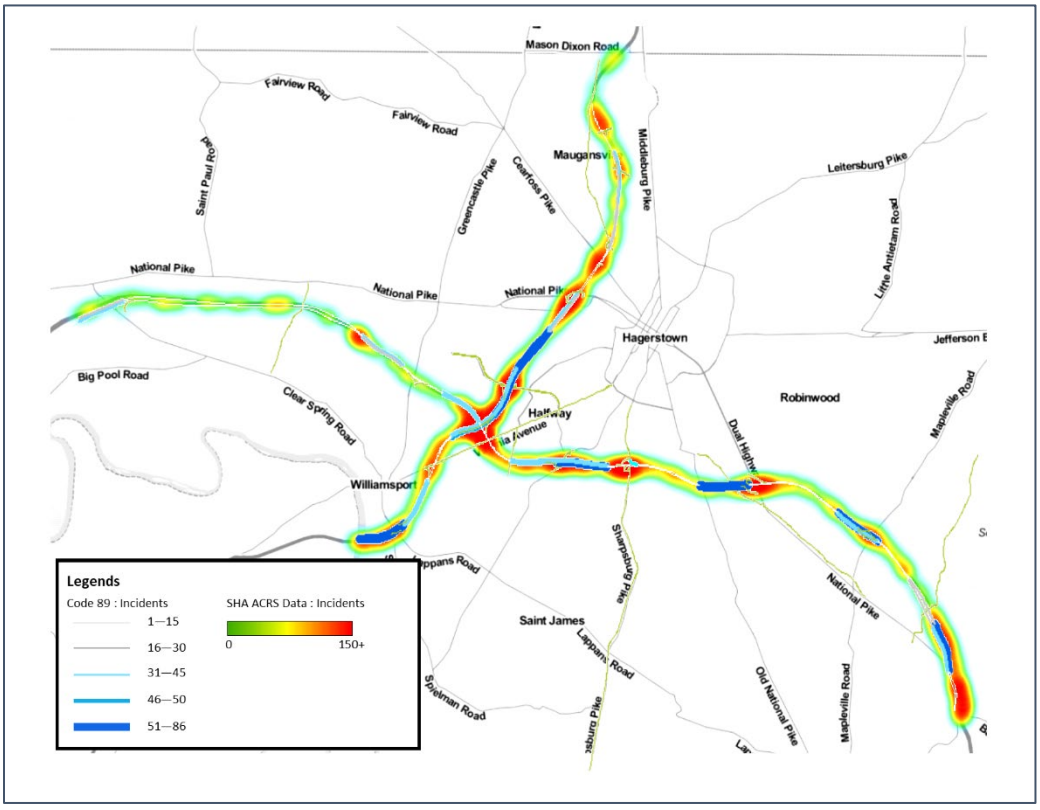


Figure 16: Code 89 Incidents Overlaid on MDOT SHA Crash Data

The remarks and narratives were also reviewed within the Code 89 reports as shown in **Table 7**. Tabulations were conducted on keywords that indicate some type of causal factor. Over 50% of the incidents provide some crash related incidents where almost 21% of them were hit or struck by either an object or vehicles. Hitting deer was also notable incident in the report (11.03%).

Table 7: Code 89 report remark and narrative keywords

Incident Types	Incident Counts	Incident Percentage
Accident	229	9.02%
Tractor Trailer	228	8.98%
Hit Deer	280	11.03%
Hit another vehicle or object	209	8.23%
Struck by objects or vehicle	321	12.64%
Rear end crash	51	2.01%
Side swipe crash	29	1.14%
Head on crash	2	0.08%
Ice thrown	14	0.55%
Total	**1363**	**53.68%**
Total Minor Incident Reported (2015 - 2018)	*2539*	*100%*

Tables 8 and 9 provide the raw crash numbers at each milepost and an assessment of the number of crashes involving trucks. Where truck crashes are a higher percentage than the expected truck volume, the locations are highlighted. For I-81, the truck volumes represent up to 27 percent of the traffic and 19 percent on I-70 segments near I-81 Interchange. These high percentages correlate to a significantly high number of crashes involving trucks. In the Phase 1 construction zone, 47 percent of the crashes involve trucks and up to 38 percent on other segments throughout the I-81 corridor. These are twice to three times higher than I-70 and significantly higher that the statewide average of truck involved accidents.

Table 8: I-81 Crash Numbers (2015-2018)

I-81 Mile Marker	Interchange / Exit No.	2015 - 2018 Traffic Volume (AADT)	Total Number of Crashes (2015-2018)	Number of Truck-Related Crashes	Percentage of Truck-Related Crashes	2015 – 2018 Truck Volume	Percentage of Trucks in Traffic Flow
WV Border - MM 1	MD 68 / 1	63,255	60	28	47%	13,284	21%
MM 1 - MM 2	MD 68 / 1	61,323	32	14	44%	13,491	22%
MM 2 - MM 3	US 11 / 2	68,714	47	17	36%	15,117	22%
MM 3 - MM 4	I-70 / 4	76,511	87	33	38%	15,302	20%
MM 4 - MM 5	Halfway Blvd / 5	76,976	104	29	28%	16,935	22%
MM 5 - MM 6	None	76,976	23	4	17%	14,625	19%
MM 6 - MM 7	US 40 / 6	61,601	73	13	18%	9,856	16%
MM 7 - MM 8	MD 58 / 7	66,148	59	16	27%	13,230	20%
MM 8 - MM 9	Maugansville Rd / 8	66,876	35	6	17%	12,038	18%
MM 9 - MM 10	Maugans Ave / 9	55,521	34	6	18%	12,215	22%
MM 10 - MM 11	Showalter Rd / 10	58,592	40	11	28%	15,820	27%
MM 11 - MM 12	None	58,592	16	6	38%	15,820	27%
MM 12 - PA Border	PA 163 / PA 1	58,592	3	1	33%	15,820	27%

% truck-related crashes > % trucks in traffic

Table 9: I-70 Crash Numbers (2015-2018)

I-70 Mile Marker	Interchange / Exit No.	2015 - 2018 Traffic Volume (AADT)	Total Number of Crashes (2015-2018)	Number of Truck-Related Crashes	Percentage of Truck-Related Crashes	2015 – 2018 Truck Volume	Percentage of Trucks in Traffic Flow
>MM18	Clear Spring / 18	34,821	17	0	0%	6,616	19%
MM 18 - MM 19	Clear Spring / 18	34,821	25	4	16%	2,786	8%
MM 19 - MM 20	None	34,821	18	1	6%	2,786	8%
MM 20 - MM 21	None	34,821	16	2	13%	2,786	8%
MM 21 - MM 22	None	34,821	23	4	17%	2,786	8%
MM 22 - MM 23	None	34,821	18	3	17%	2,786	8%
MM 23 - MM 24	None	34,821	39	3	8%	2,786	8%
MM 24 - MM 25	MD 63 / 24	41,566	21	2	10%	7,897	19%
MM 25 - MM 26	I-81 / 26	41,566	44	12	27%	7,897	19%
MM 26 - MM 27	I-81 / 26	62,276	102	18	18%	7,473	12%
MM 27 - MM 28	MD 632 / 28	62,276	47	6	13%	7,473	12%
MM 28 - MM 29	MD 632 / 28	62,276	70	8	11%	7,473	12%
MM 29 - MM 30	MD 65 / 29	62,671	85	12	14%	6,894	11%
MM 30 - MM 31	None	62,671	28	7	25%	6,894	11%
MM 31 - MM 32	US 40 / 32	71,788	43	6	14%	7,897	11%
MM 32 - MM 33	US 40 / 32	71,788	61	8	13%	8,615	12%
MM 33 - MM 34	None	71,788	25	3	12%	8,615	12%
MM 34 - MM 35	MD 66 / 35	71,788	50	9	18%	8,615	12%
MM 35 - MM 36	None	76,933	29	0	0%	7,693	10%
MM 36 - MM 37	None	76,933	35	12	34%	7,693	10%
MM 37 - MM 38	None	76,933	53	5	9%	7,693	10%
MM 38 - Border	None	76,933	68	14	21%	7,693	10%

% truck-related crashes > % trucks in traffic flow

Incidents Clearance Times

An evaluation of incident clearance times was conducted to provide insights into opportunities for improved incident response strategies. Information maintained by CHART was extracted from the RITIS platform for all incidents between 2015 and 2019. Overall, the 2018 Performance Evaluation and Benefit Analysis for CHART shows Washington County incident clearance times are the lowest in Western Maryland and are consistent with the Washington and Baltimore Regions. The average incident duration with injuries range from 45 to 75 minutes and for disabled vehicles 21 to 25 minutes.

The RITIS data was consistent with the information obtained from CHART. The data is broken down into the following categories of incidents: injury-related, no injury, and disabled vehicle. Separate tabulations were developed for incidents involving the closure of all lanes of traffic. **Tables 10-13** summarize the incident response times for I-81 and I-70.

At this time, it is difficult to identify specific opportunities or issues related to the available clearance time data. Incident clearance usually does not account for time after the crash occurs to the time the crash is reported. Additional monitoring of these clearance times through incident after action reviews or through formal Traffic Incident Management (TIM) teams may be needed to identify specific issues, needs or strategies. Some notes on the data include:

- For both I-81 and I-70, injury related crashes requiring a more involved investigation by the MSP Crash Team take longer time to clear and result in more significant traffic delays, especially when all lanes are closed.
- For I-81, the off-peak incident clearance time on the southbound direction is higher compared to other time periods and directions along I-81.
- For I-70, the off-peak incident clearance time on the eastbound direction is higher compared to other time periods and directions along I-70 for the no injury crash category.

Table 10: I-81 Incident Clearance Time with Full Closures

INTERSTATE 81	I-81 INCIDENT CLEARANCE TIME WITH FULL CLOSURES (2015 - 2019)							
	Injury Related Crashes: 182				No Injury Related Crashes: 417		Disabled Vehicles: 1,349	
Time Period	NORTH 87 crashes		SOUTH 95 crashes		NORTH 205 crashes	SOUTH 212 crashes	NORTH 702 crashes	SOUTH 647 crashes
6 AM - 9 AM	1 h	20 m	1 h	10 m	57 m	26 m	12 m	9 m
3 PM - 7 PM		42 m		52 m	37 m	30 m	12 m	11 m
Off-Peak	1 h	3 m	1 h	30 m	41 m	1 h 1 m	11 m	11 m

Table 11: I-81 Incident Clearance Time without Full Closures

INTERSTATE 81	I-81 INCIDENT CLEARANCE TIME WITHOUT FULL CLOSURES (2015 - 2019)							
	Injury Related Crash: 108				No Injury Related Crash: 357		Disabled Vehicles: 1,345	
Time Period	NORTH 53 crashes		SOUTH 55 crashes		NORTH 175 crashes	SOUTH 182 crashes	NORTH 700 crashes	SOUTH 645 crashes
6 AM - 9 AM	40 m		47 m		19 m	26 m	12 m	9 m
3 PM - 7 PM	27 m		29 m		28 m	27 m	12 m	11 m
Off-Peak	51 m		44 m		34 m	43 m	11 m	11 m

Table 12: I-70 Incident Clearance Time with Full Closure

INTERSTATE 70	I-70 INCIDENT CLEARANCE TIME WITH FULL CLOSURES (2015 - 2019)							
	Injury Related Crash: 403				No Injury Related Crash: 877		Disabled Vehicles: 164	
Time Period	EAST 213 crashes		WEST 190 crashes		EAST 436 crashes	WEST 441 crashes	EAST 102 crashes	WEST 62 crashes
6 AM - 9 AM	1 h	18 m	1 h	39 m	56 m	1 h 5 m	40 m	11 m
3 PM - 7 PM		41 m	1 h	1 m	40 m	30 m	29 m	34 m
Off-Peak	1 h	16 m	1 h	3 m	1 h	44 m	26 m	26 m

Table 13: I-70 Incident Clearance Time without Full Closure

I-70 INCIDENT CLEARANCE TIME WITHOUT FULL CLOSURES (2015 - 2019)												
	Injury Related Crash: 291				No Injury Related Crash: 644				Disabled Vehicles: 155			
Time Period	EAST	143 crashes	WEST	148 crashes	EAST	290 crashes	WEST	354 crashes	EAST	97 crashes	WEST	58 crashes
6 AM - 9 AM	1 h	8 m	1 h	58 m		32 m	1 h	6 m		37 m		11 m
3 PM - 7 PM		42 m	1 h	4 m		43 m		30 m		27 m		34 m
Off-Peak	1 h	7 m	1 h	4 m	1 h	5 m		44 m		26 m		19 m

Incidents Diversion Impacts

Illustrative cases were developed to identify the impact of severe incidents and crashes on nearby routes within the County. The incident detour impacts were analyzed using the RITIS *Congestion Scan* tool based on INRIX travel time probe data. Major incidents that created long queues and clearance duration were analyzed. These scenarios have been compared to the detour routes provided in MDOT SHA's Freeway Incident Traffic Management Plans.

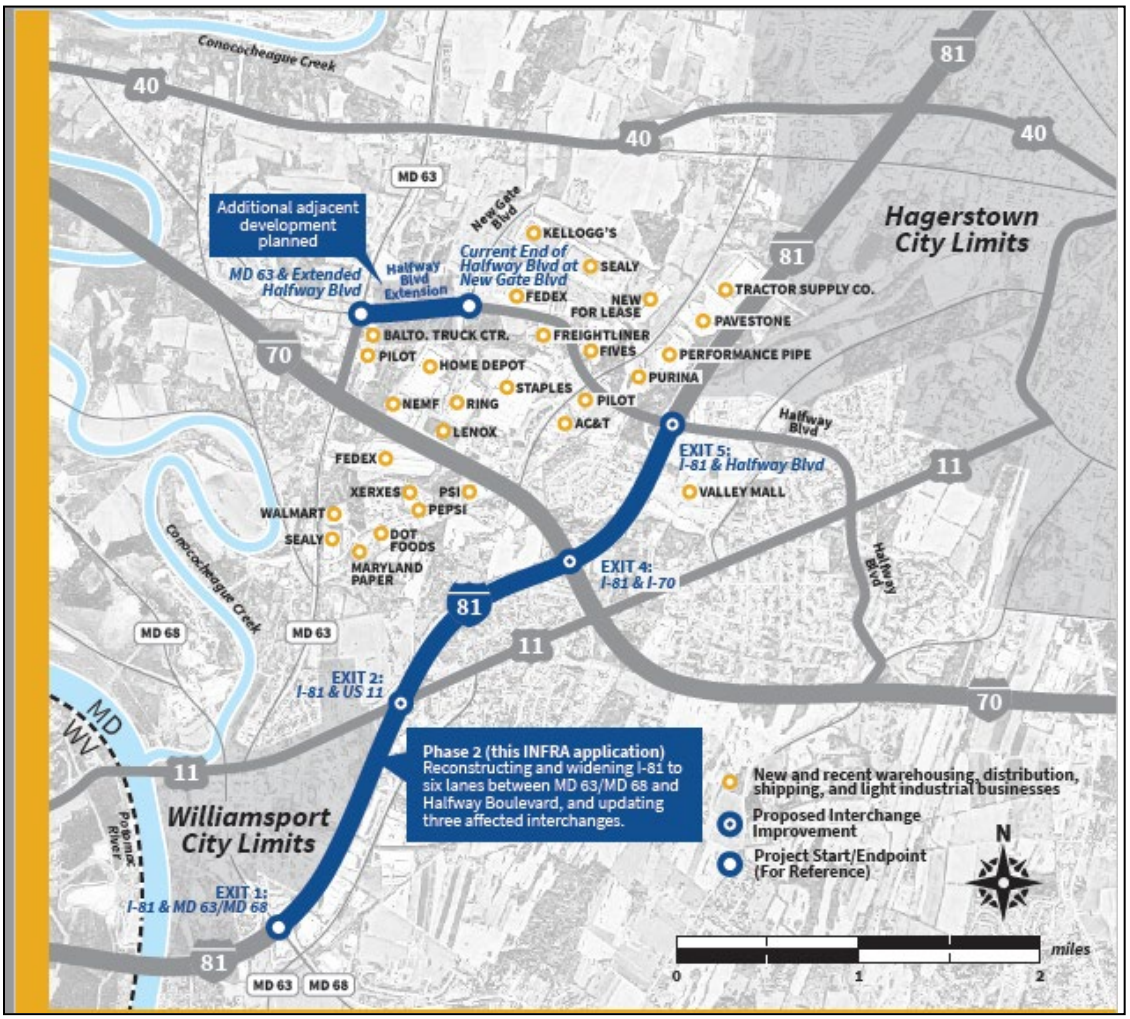
Delays caused by incidents have direct impacts on freight flow that may result in economic losses, and compounding delay throughout the area and secondary crashes become more likely. Consistent with public, business, and stakeholder insights, major incidents have had significant impacts on the regional and city roadways, especially in downtown Hagerstown. The incidents typically create significant congestion and queuing on MD 63, US 40, and US 11.

Traffic Forecast Assessment

Evaluating future conditions provides additional insights into the need for corridor improvements and the identification of future areas of concern that might help in prioritizing TSMO investments. The forecast assessment provides a summary of anticipated corridor development, the growth of traffic volumes, and forecasted levels of service related to traffic congestion. These results included information from Maryland's Statewide Travel Demand Model.

Land Use and Traffic Volumes

I-81 is the most heavily trafficked freight corridor in Maryland's State highway system according to the I-81 INFRA Grant Application to widen I-81 from the Exit 1 to Exit 5 Halfway Boulevard. The corridor serves two inland ports located in Greencastle, PA and Front Royal, VA that truck goods from the Chesapeake Bay, as well as, a significant number of shipping and fulfillment facilities located just over the border in West Virginian and Pennsylvania. In addition, Washington County has a growing freight industry that relies on truck travel as shown in **Figure 17**.



Source: 2019 I-81/Halfway Boulevard Freight Connection INFRA Application

Figure 17: I-81 Freight Development Locations in Washington County

In addition to the facilities already identified in the region, two new major freight generating projects were approved by the County along I-81 during development of this plan. Trammel Crow distribution center is an Amazon facility located at Vista Business Park on Crayton Boulevard and NorthPoint Development is a four-warehouse facility on Wessel Boulevard.

The high volumes of truck traffic not only absorb the limited capacity on the interstates, they are major safety problem as shown in the high number of crashes involving trucks. The geometric design of the interstate system, especially along I-81 cause merging, weaving, and other distractions leading to traffic incidents and delay problems. The current truck volumes range from 16 to 27 percent of the total traffic volumes along I-81 and range from 8 to 19 percent along I-70 based on 2018 traffic volumes.

Forecasting traffic provides a vision of how the roadways will perform as traffic volumes continue to grow. Future travel accounts for the growing economy that include increases in employment, households, and population. The sources used to estimate the traffic forecast include the **HEPMPO LRTP** – ***Direction 2045*** that utilizes a regional travel demand model and the MDOT Statewide Travel Model that was used for the ***I-81 INFRA Grant Application***.

The average annual daily traffic (AADT) for 2018 is as high as 77,000 on some sections of I-81 and I-70. The forecast traffic volumes are provided in **Figure 18** for I-81 and **Figure 19** for I-70 and represent less than a one percent per year increase. However, by 2045, the interstates will be heavily congested with truck volumes increasing over 50 percent in critical sections of the interstate. The increased traffic volumes could have significant impacts on the number of traffic and truck related incidents.

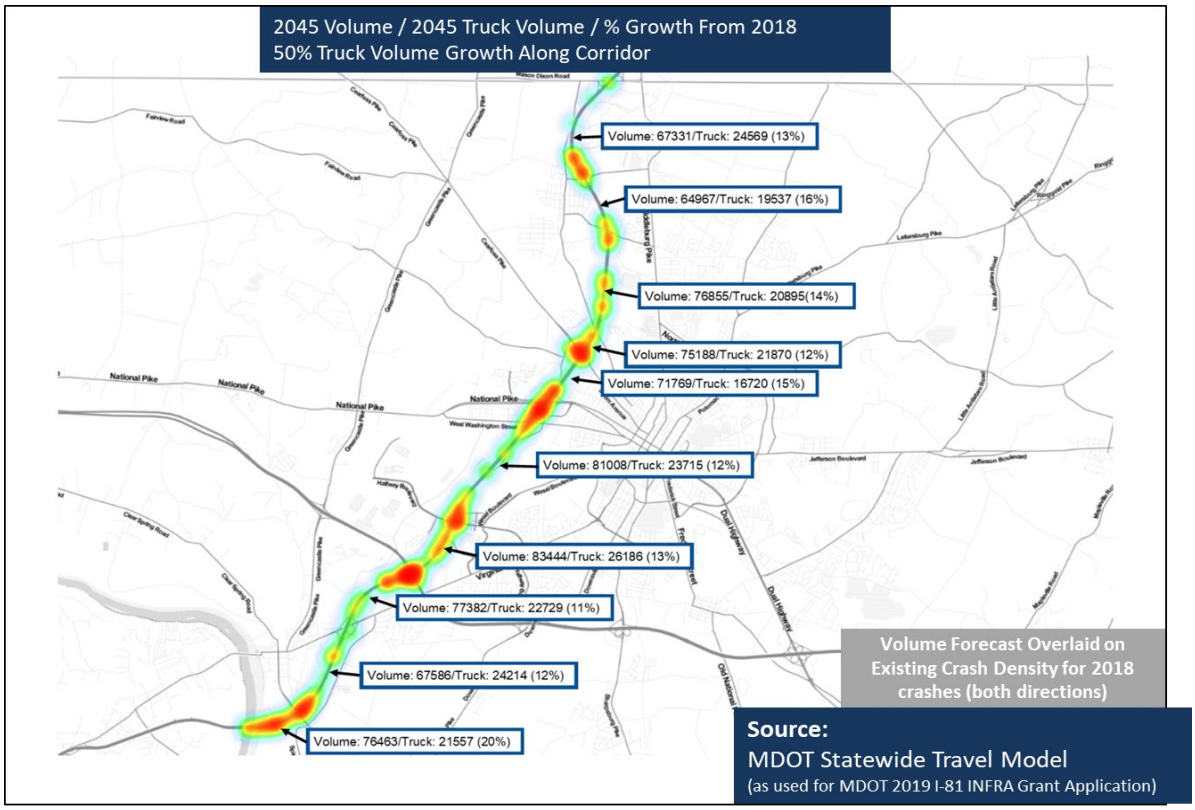


Figure 18: I-81 2045 Traffic Volume Forecast

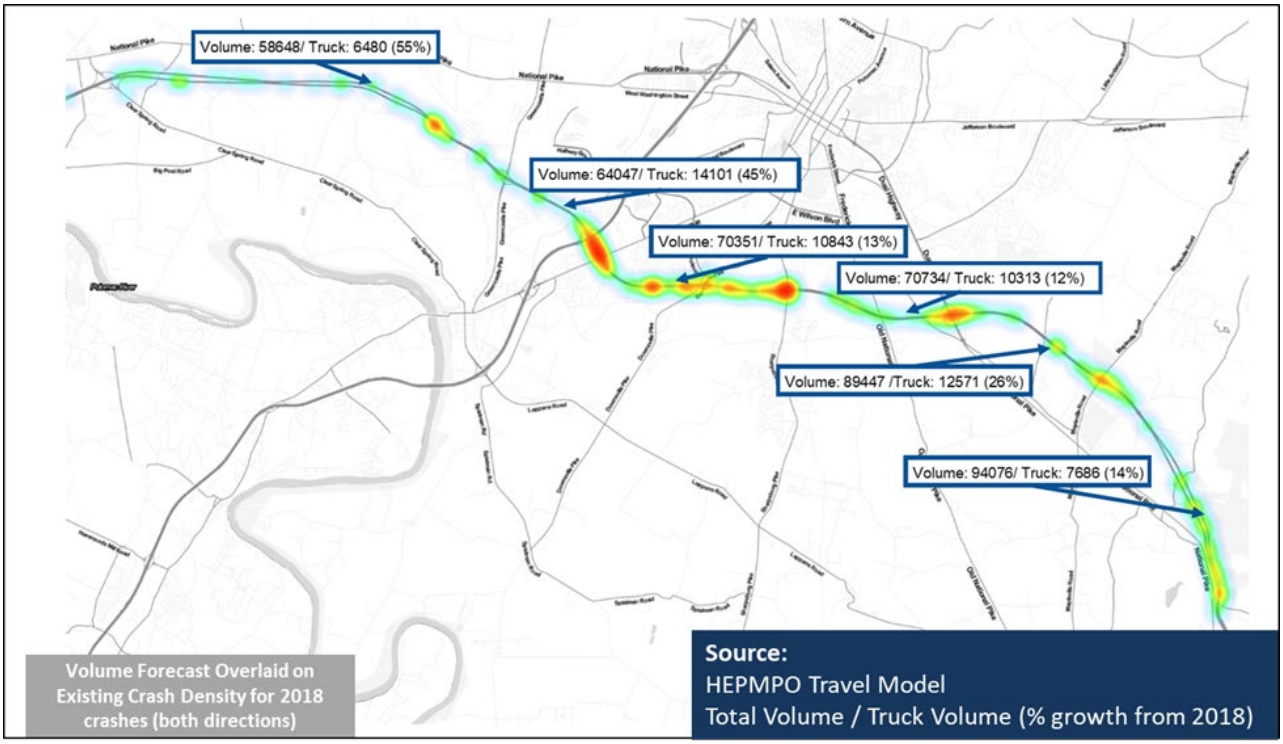


Figure 19: I-70 2045 Traffic Volume Forecast

Level of Service

Level of Service (LOS) is a qualitative measure used to evaluate the operating conditions of the roadway. LOS is used to analyze highways by categorizing traffic flow from A to F with A being the best at free flow conditions to F the worse at over capacity. Assigning LOS levels consider demand volume under prevailing conditions in vehicles per hour, the number of lanes, number of trucks and buses, and the travel times through the corridor. LOS A, B, and C are considered acceptable for traffic conditions, but D, E, and F represent traffic delays, increased number of incidents, and a complete breakdown in traffic flow when demand exceed the capacity of the roadway.

For the future forecast assessment, both I-81 and I-70 show segments of the interstate reaching LOS E and F. The assessment assumes the current roadway configuration with no additional capacity added except for the I-81 portion currently under construction to Exit 1 (Phase 1) including the Potomac River Bridge and extending the interstate widening to I-70 (Exit 4). The portion between Exit 1 and Exit 4 is not programmed yet for construction but is assumed to be completed prior to 2045. Therefore, the southern portion of I-81 was analyzed with three lanes of capacity in each direction and the remaining portions of I-81 and I-70 with two lanes in each direction. The Phase 2 widening provides significant capacity improvements that reduce the LOS from beyond capacity (LOS F) to acceptable traffic conditions (LOS C).

Figure 20 and **Figure 21** present the future LOS assessment for each interstate as a comparison between 2018 and 2045.

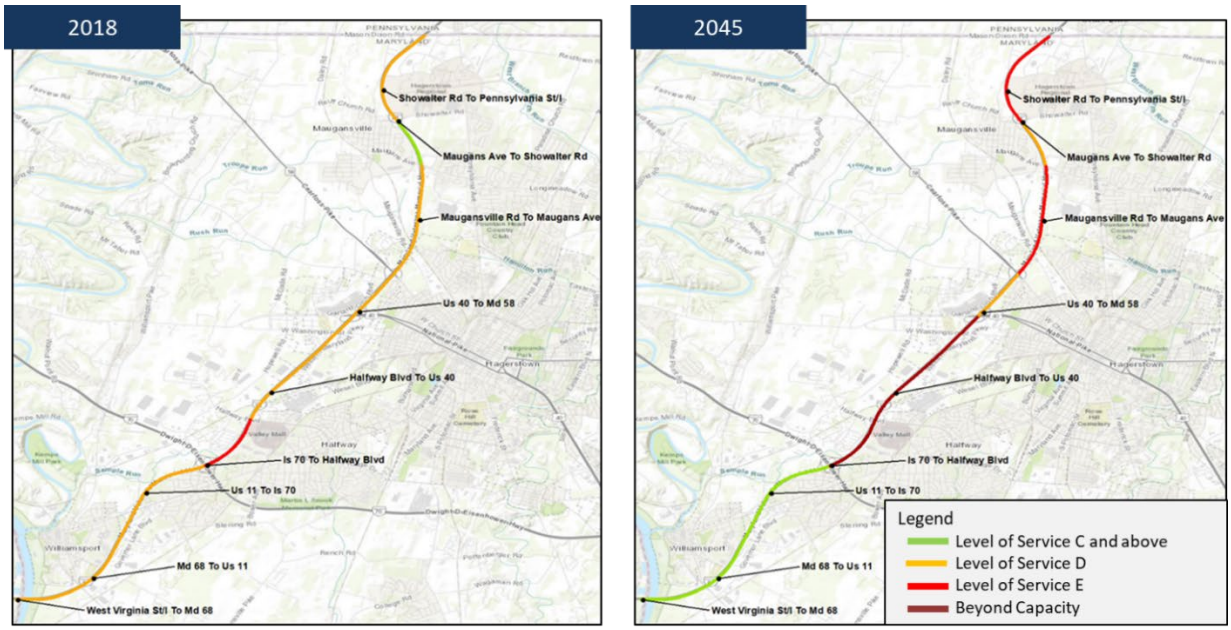


Figure 20: Highway Capacity Manual (HCM) Level of Service Analysis for I-81

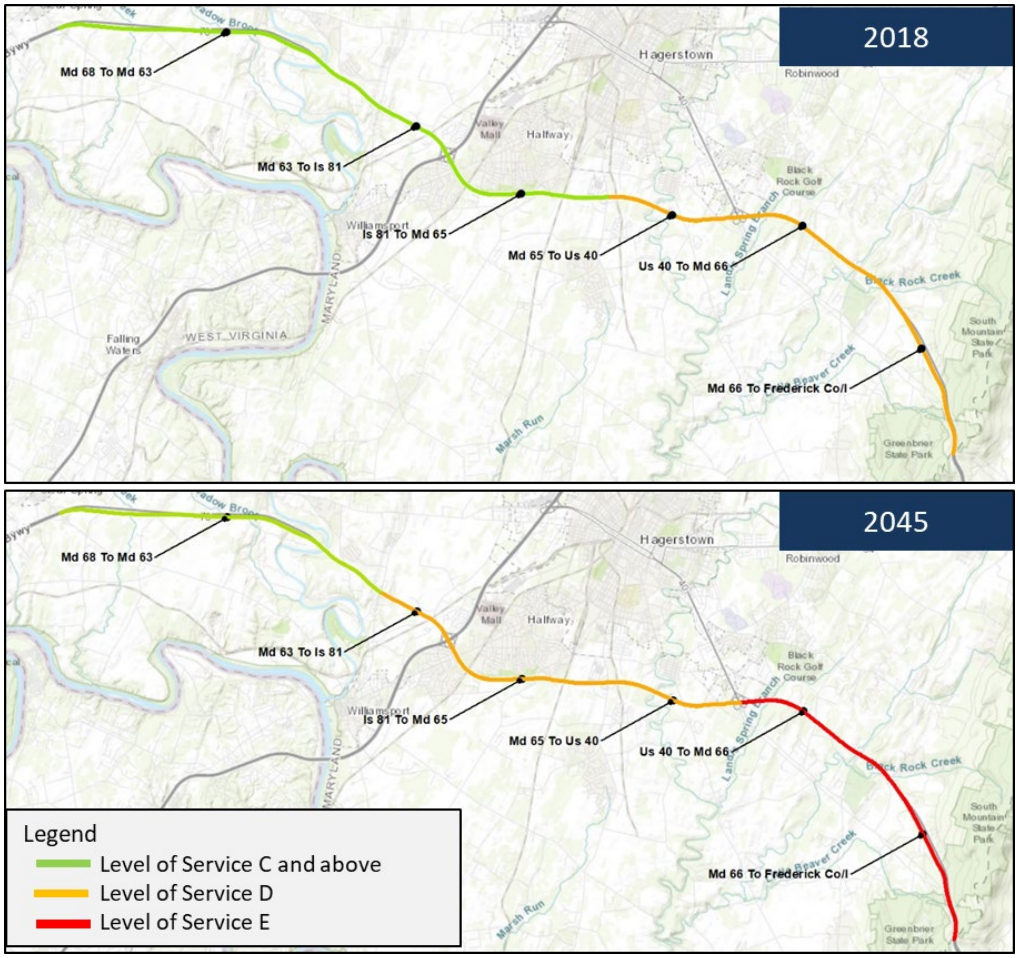
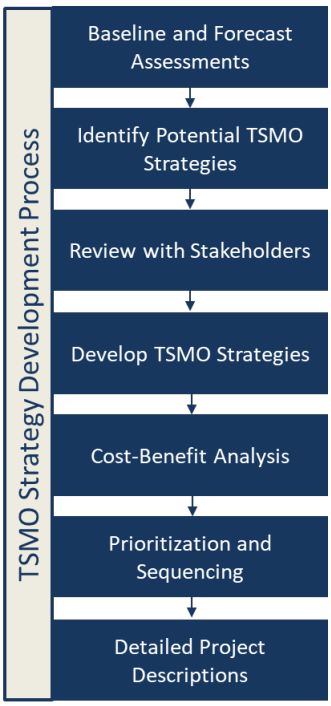


Figure 21: Highway Capacity Manual (HCM) Level of Service Analysis for I-70

Strategy Identification & Evaluation

TSMO Strategy Development Process



The TSMO strategy development process was developed with the TSMO Stakeholder Group to understand and evaluate the causes and potential improvements to traffic congestion. The process utilizes the baseline and forecast assessments, which provide insights into the locations and causes of congestion along each interstate corridor. In addition, the project stakeholders provided important input on strategic direction, incident motivators, and viable strategies for consideration.

This TSMO study has developed a more detailed strategy toolbox as a resource for MDOT SHA and HEPMPO in identifying and programming lower cost strategies along I-81 and I-70. Within the study's action plan, estimated costs, and qualitative assessments of benefits have been used to classify the strategies into short- and long-term categories.

As shown in **Figure 22**, the strategy toolbox has focused on three categories of projects to address the study goals and the identified crash motivators. These categories include geometric and safety improvements, traffic flow and signals for identified detour routes, and the expansion of ITS technology. The capital projects for additional interstate capacity (new lanes) are planned strategies and not considered as part of the TSMO strategy toolbox.

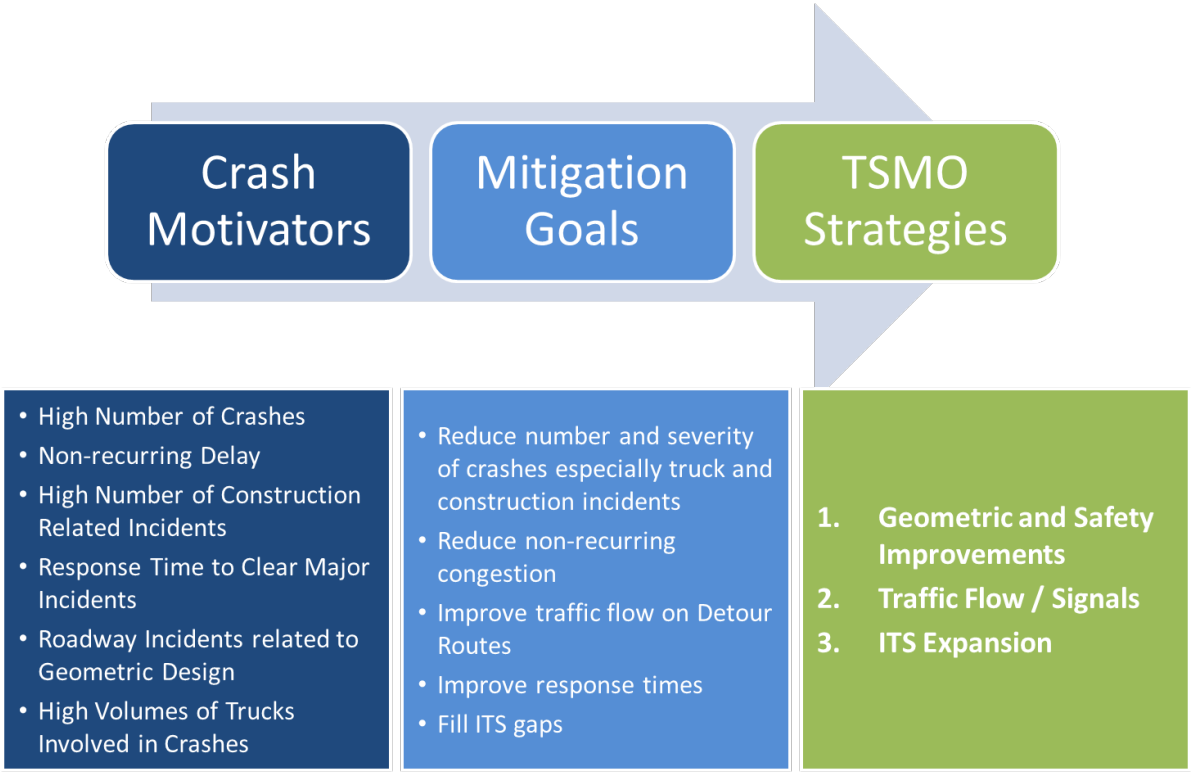


Figure 22: TSMO Strategy Development Process

TSMO Strategy Toolbox

The following sections provide a detailed assessment of potential TSMO strategies that may be applied along each corridor to improve safety and traffic operations. The strategies are intended as a more refined toolbox of strategies to guide and assist MDOT SHA and the HEPMPO in developing specific project recommendations for each corridor. **Table 14** summarizes each strategy group and the types of strategies included in each group.

Table 14: I-81 and I-70 TSMO Strategy Toolbox

TSMO Strategy Group	Content
Geometric and Safety Improvements	• Improved signage, overhead, warning type signs and guide signs • Lane restriping to widen lanes, merge areas, and adding guiderails • Trim vegetation, extend axillary lanes and merging lanes
Traffic Flow and Signals	• Detour route planning and signal coordination • Signal technology devices • Incident management coordination techniques
ITS Expansion	• Temporary or permanent ITS devices • Smart work zones • Traveler information and truck management • Connected vehicles • Incident management and response times

The locations and types of strategies contained within the toolbox are summarized in **Figure 23**. These strategies include interchange reconfiguration and ITS projects that have already been identified and programmed by MDOT SHA. Other strategies were developed through engineering assessments of existing locations of crashes or traffic congestion.

The evaluation of low-cost capital improvements, operational recommendations, and ITS strategies include improvement schematics detailing the location with information on procedures and technology requirements. These detailed assessments are organized by the three TSMO strategy groups provided above and for each interstate corridor by direction.

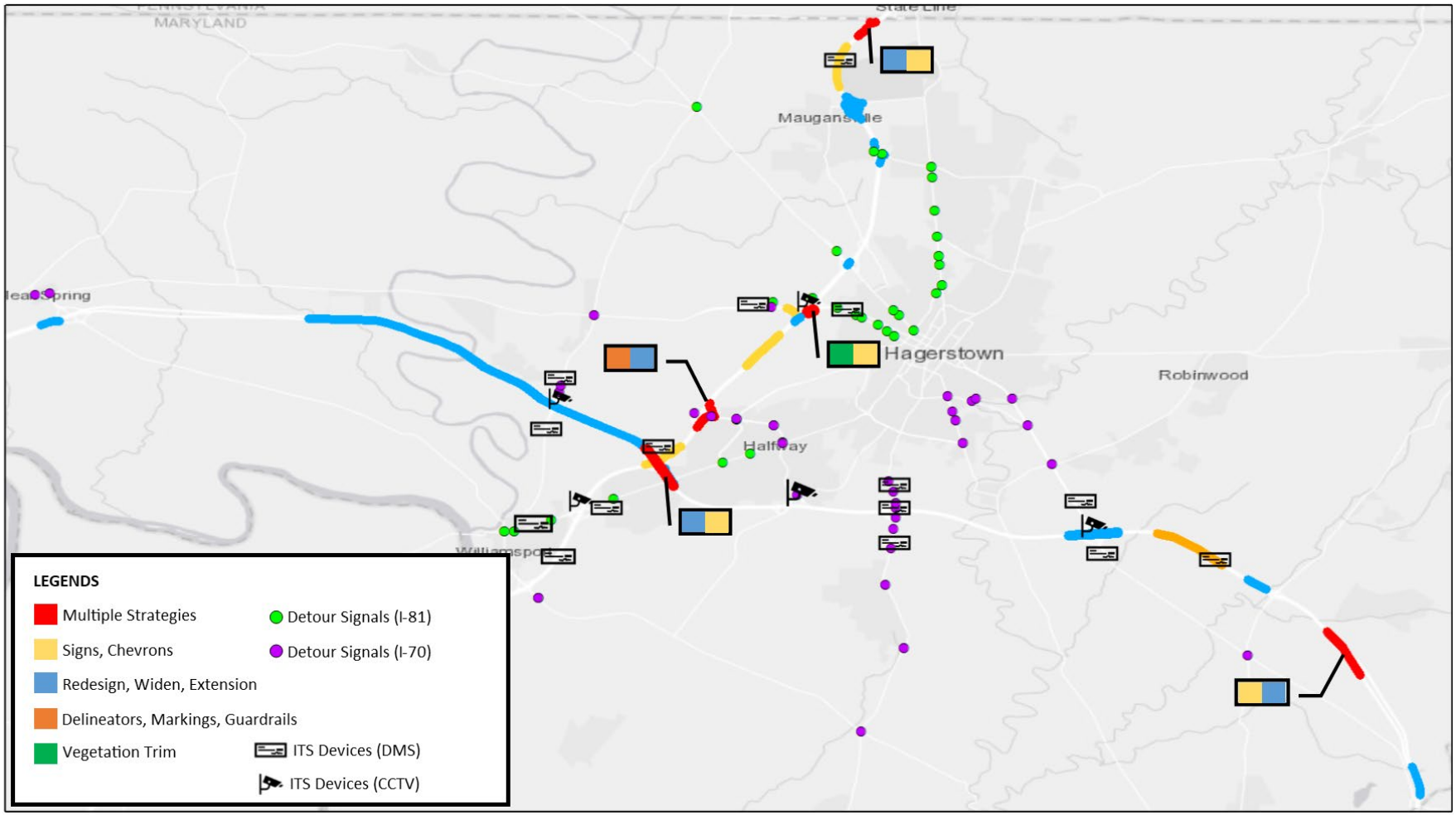


Figure 23: Summary of TSMO Strategy Toolbox by Type and Location

Geometric and Safety Improvement Toolbox

The geometric and safety improvement strategies are provided for I-81 and I-70 by direction. Additional graphics are provided for the safety improvements and can be found in **Appendix A**.

Mitigation Southbound I-81

PA Exit 1 (Mason Dixon Road): Off-Ramp

Potential problems:

- Ramp curve: vehicles taking ramp too fast- run off road crashes
- Vehicles stopped and queued at end of short ramp around curve – rear end crashes

Low-cost mitigations:

- Upgrade exit gore sign to include advisory speed (E13-1P) (per MD MUTCD Standards)
- Install ramp curve ahead speed advisory sign (W13-7 (Modified)) per typical detail Figure 2C-3 MUTCD
- Add Exit Stop ahead warning sign (W13-1(1) per MD MUTCD Standards Figure 2C-3a
- Add chevrons to hi-lite curve
- Trim vegetation so curve in ramp and queued vehicles can be seen farther in advance

PA Exit 1 (Mason Dixon Road): Adjacent to On-Ramp

Potential Problems:

- Heavy truck traffic utilizing on-ramp
- Signs indicate slow moving trucks
- There is a “Permit Load” waiting area adjacent to On-Ramp

Low-cost mitigations:

- Extend On-Ramp acceleration lane to allow trucks to get up to speed prior to merging, thus not causing an unexpected slow-down in mainline traffic flow
- This should enable removal of "Watch for Slow Moving Trucks Next ½ Mile" warning sign on mainline SB I-81

MD Exits 10A, 10B (Showalter Road) and Exit 9 (Maugans Avenue): Vicinity of Decision/Conflict Areas of On and Off Ramps

Potential Problems:

- Close spacing between Ramps and hence not enough room to properly space advance guide signs
- Heavy truck traffic (27%) may obscure view of the few advance guide signs that are installed
- Change in exit numbering between first exit encountered in Maryland (which is remainder of Exit 1 from PA) to next exit encountered in Maryland (which is Exit 10 – last numbered MD exit from south)
- The blue service signs are not numbered per MUTCD (nationwide) convention of having the next exit encountered listed first (at the top) on the signs

Low-cost mitigations:

- Revise Blue Service Signs to Be MUTCD compliant i.e. list lodging, then food, then gas (per MUTCD) AND list first exit encountered at top of sign then next exit encountered in second (bottom) panel (also per MUTCD).
- This should enable information on blue service signs to supplement function of advance guide signs

MD Exits 10A and 10B (Showalter Road): Vicinity of Weaving Lanes of Cloverleaf

Potential Problems:

- Heavy traffic volume utilizing very short weaving areas
- Narrow weaving lane with no shoulder on bridge

Mitigation Strategies:

- Revise interchange design to eliminate weaving lane. Relocate cloverleaf On-Ramp per MDOT SHA proposed Interchange Improvements

MD Exit 9 (Maugans Avenue): Off-Ramp Terminus

Potential Problems:

- Heavy traffic volume utilizing one lane at terminus
- Existing ramp shoulder looks like it is wide enough to accommodate a lane for right turn traffic, but at the very end, there is a grass bulb-out that stops traffic flow. Based on skid marks in Google Maps it appears this causes an unexpected stoppage frequently


MULTIPLE SKID-MARKS INDICATES A RECURRING PROBLEM

Mitigation Strategies:

- Revise interchange design to widen off ramp and provide right-turn lane. Redesign per MDOT SHA proposed Interchange Improvements

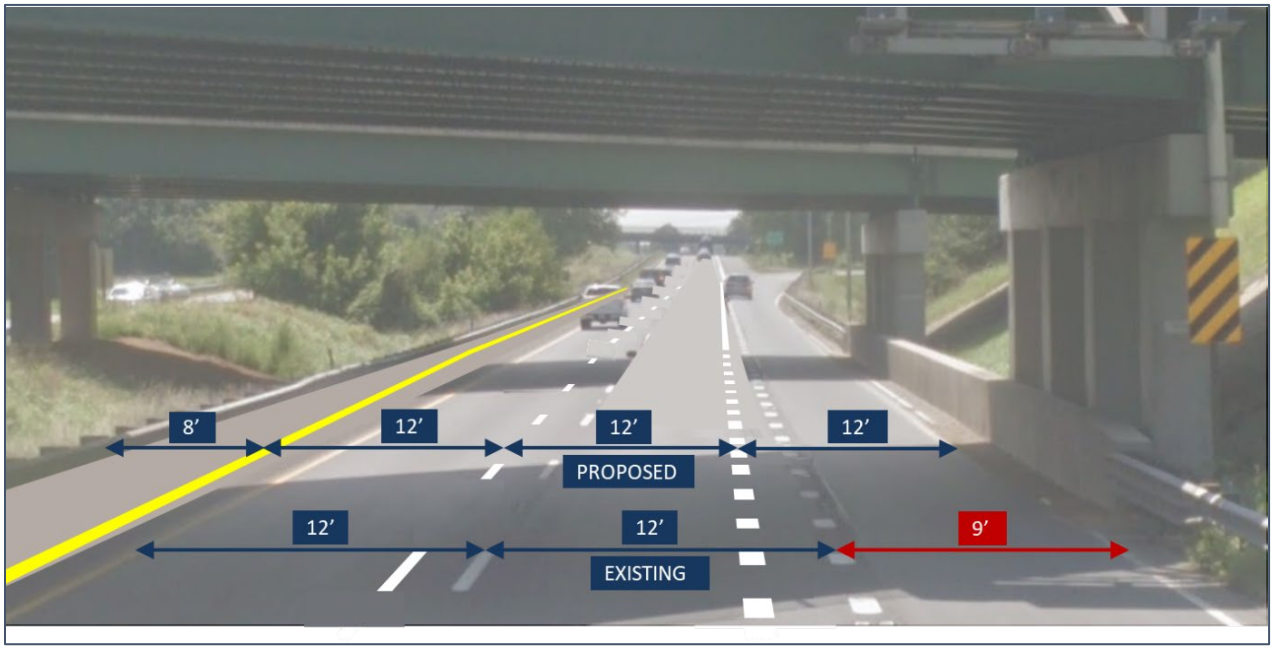
MD Exit 7 (Salem Avenue): Constricted Area Under Salem Avenue Overpass

Potential Problems:

- Deceleration Lane appears substandard/narrow (9'?)
- No shoulders on outside or inside lanes for recovery area or evasive action (which is more commonly needed in decision areas)

Low-cost mitigations:

- Widen roadway to provide enough pavement for three 12' lanes and provide a sufficient shoulder (8') for evasive action



MD Exit 6 (US 40): Adjacent to Decision Areas (Off Ramps)

Potential Problems:

- Unknown – the area was recently reconstructed to provide a decision lane between exits 7 and 6 on SB I-81. Crash history no longer relevant to current lane configuration.

Low-cost mitigations:

- Continue to monitor crash history to see if there is a change in crash patterns with revised roadway lane configuration.

MD Exit 6 (US 40): Adjacent to EB US 40 On-ramp to I-81 SB

Potential Problems:

- Acceleration lane continues for a long time, motorists may not realize it is a merge lane

Low-cost mitigations:

- Add a 'merge right' (W4-1) sign at gore (per MUTCD standards) so motorists on ramp and motorists on mainline realize a merge is necessary
- Add chevron gore markings to neutral area of on-ramp to reflect standard 'gore' markings, thus reinforcing idea that the ramp is a merge condition.

MD Exit 5 (Halfway Boulevard): Between Exits 6 and 5

Potential Problems:

- Service signs supplement advance guide signs and list upcoming exits in wrong order. May lead to driver confusion and unintended lane switching

Low-cost mitigations:

- Revise Blue Service Signs to Be MUTCD compliant i.e. list lodging, then food, then gas (per MUTCD) AND list first exit encountered at top of sign then next exit encountered in second (bottom) panel (also per MUTCD).
- This should enable information on blue service signs to supplement function of advance guide signs.

MD Exit 4 (I-70): Adjacent to Approach to Deceleration Lane for Exits 4B-A Collector Distributor Road

Potential Problems:

- Close spacing between Exits and hence not enough room to properly space advance guide signs
- Guide signs do not clearly indicate there will be exit options for eastbound and westbound I-70
- ½ mile advance guide sign is actually closer to ¼ mile placement, thus providing motorists with less distance than they think they have to make a decision to exit
- Evidence of gore sign knock downs and gore tire tracks at exit 4B (I-70 west) indicates driver confusion and last-minute decision making.

Low-cost mitigations:

- Revise advance signing scheme to more closely match current MUTCD standards for collector distributor exit type
- Add yellow exit only type panels to bottom of advance guide signs where applicable
- Add an additional ½ mile advance guide sign prior to the Halfway Boulevard On-Ramp on I-81 SB
- Update Exit Gore signs to provide exit letter designations
- Revise overhead sign letter sizes, sign configuration and OH sign support location for Exit 4B in keeping with MUTCD standards

Mitigation Northbound I-81

Safety improvements for each location can be found in **Appendix A.**

MD Exit 5 (Halfway Boulevard): Top of NB Off-Ramp (5A)

Potential Problems:

- Yellow line pavement markings completely worn at top of ramp along curve. No curve delineation or signing
- Crosswalk and complicated merge condition at top of ramp, likely cause backups on ramp at peak hours

Low-cost mitigations:

- Refresh pavement markings on ramp
- Add chevrons at curve
- Add 'watch for stopped vehicles' sign in advance of congested area on ramp

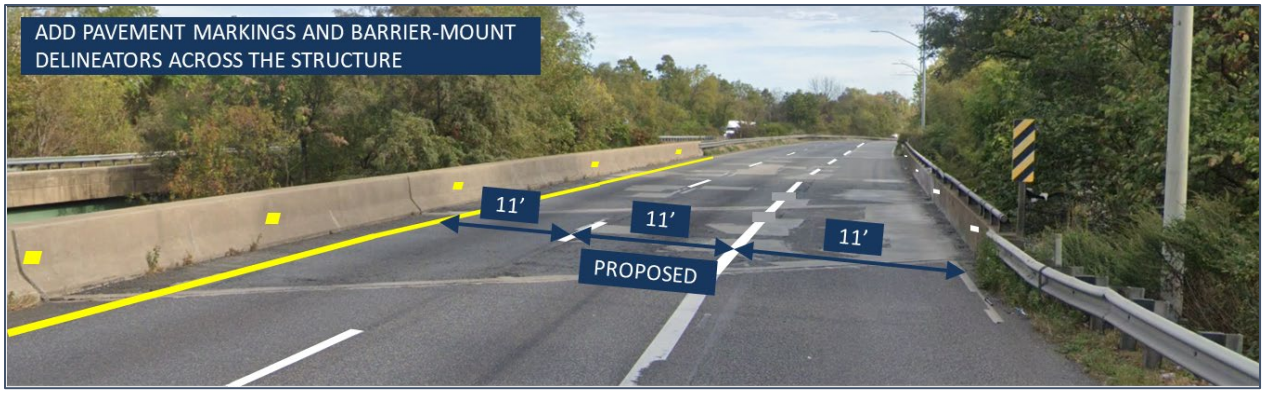
MD Exit 5 (Halfway Boulevard): Adjacent to On-Ramp Acceleration Lane (5B)

Potential Problems:

- Pavement markings of acceleration lane and both mainline I-81 northbound lanes completely worn off on RR bridge
- Patchwork repairs on RR bridge make discerning any pavement marking remnants impossible
- Substandard/ narrow acceleration lane width
- No shoulder adjacent to acceleration lane for recovery or evasive maneuver
- No retroreflective guidance at nighttime

Low-cost mitigations:

- Restripe lane markings across RR bridge.
- Widen acceleration lane to 11’ (and thereby narrow mainline lanes to 11’ across RR bridge since there is no additional room). The proposed revision would balance the widths of all three lanes to address the crash history at this location. Safety studies have shown that in situations where available width is constrained, it is safer to provide an 11’ lane with a 1’ shoulder as opposed to a 12’ lane with no shoulder.
- Add barrier and guiderail delineators across RR bridge
- Add a right side 10’ shoulder adjacent to acceleration lane for recovery and evasive maneuver (past RR bridge)



MD Exit 6 (US 40): EB US 40 On-Ramp to I-81 NB

Potential Problems:

- Sharply curved ramp resulting in crash hot spot

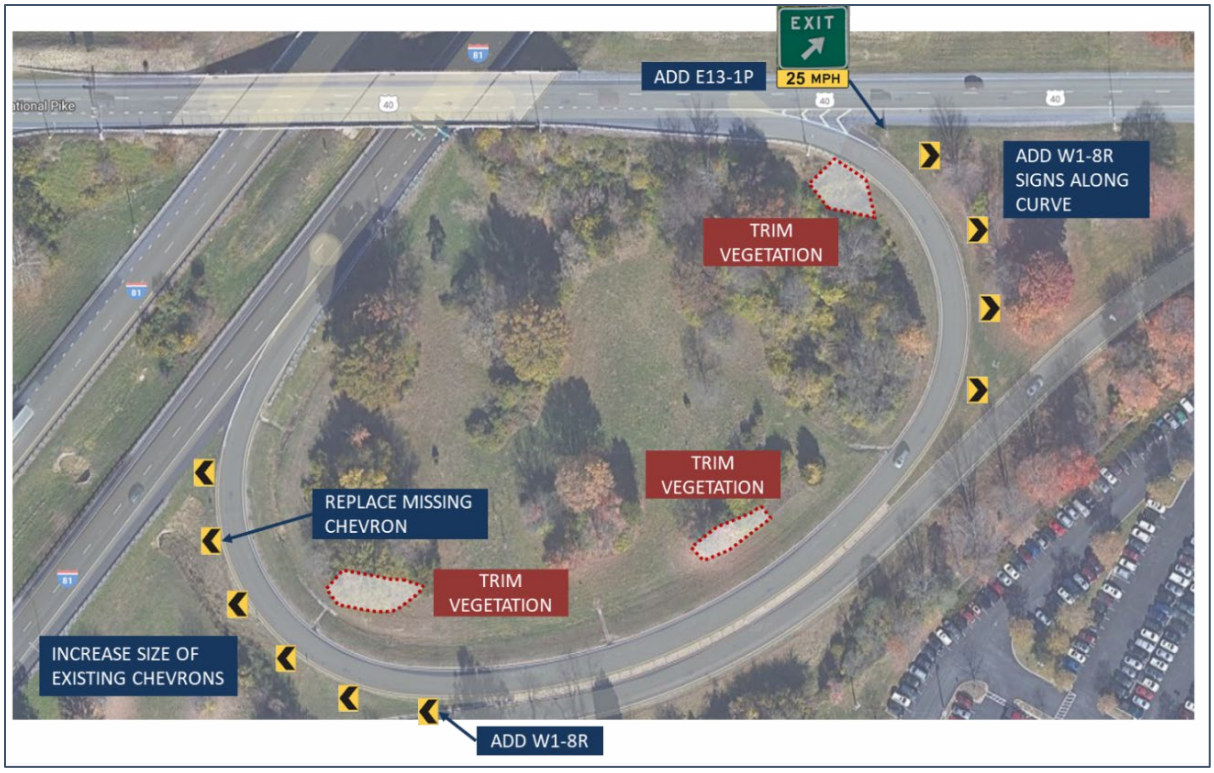
Low-cost mitigations:

- Upgrade exit gore sign to include advisory speed (E13-1P) (per MD MUTCD Standards)
- Add chevrons to hi-lite curve at beginning of ramp off of US 40 EB
- Increase size of existing chevrons at base of ramp near I-81 and add two additional chevrons (one to beginning of group and one to end of group)
- Trim vegetation so curves in ramp can be seen farther in advance

MD Exit 6 (US 40): In Advance of Exit 6A Off-Ramp Deceleration Lane

Potential Problems:

- Short Deceleration lane may force motorists to slow down on mainline prior to pulling off onto ramp (some skid marks)
- Heavy volumes of on and off traffic accessing US 40 may cause slowdowns on mainline I-81. Approach to this exit a confined 4’ left shoulder bounded by guiderail, thus leaving no recovery area evasion area for the ‘fast lane”. (FHWA standard for interstates with heavy truck traffic is 10’ left shoulders)



Low-cost mitigations:

- Extend length of deceleration lane of Ramp 6A, thus allowing slowdown to occur off mainline
- Add a built-up, compacted (gravel or grass) 10’ shoulder for evasion or recovery. Replace existing guiderail placed at 4’ off travel lane with a guiderail at least 10’ off travel way, or cable median barrier.

MD Exit 9 (Maugans Avenue): At Exit 9 Northbound

Potential Problems:

- Congestion and backups on ramp

Mitigation Strategies:

- Revise interchange design to widen off ramp and provide dual right-turn lanes. Redesign per MDOT SHA proposed Interchange Improvements

MD Exits 10A and 10B (Showalter Road): Vicinity of Weaving Lanes of Cloverleaf

Potential Problems:

- Heavy traffic volume utilizing very short weaving areas
- Narrow weaving lane with no shoulder on bridge

Mitigation Strategies:

- Revise interchange design to eliminate weaving lane. Relocate cloverleaf On-Ramp per MDOT SHA proposed Interchange Improvements

Mitigation I-70 Both Directions

The safety improvements for each location can be found in **Appendix B.** The potential problems for both directions include:

Exit 32 (US 40 Interchange): Crash Hot Spots at Interchange Decision Areas

Potential problems:

- Heavy traffic volume utilizing short weaving lanes
- Short acceleration lanes at on-ramps
- Short deceleration lanes at off-ramps

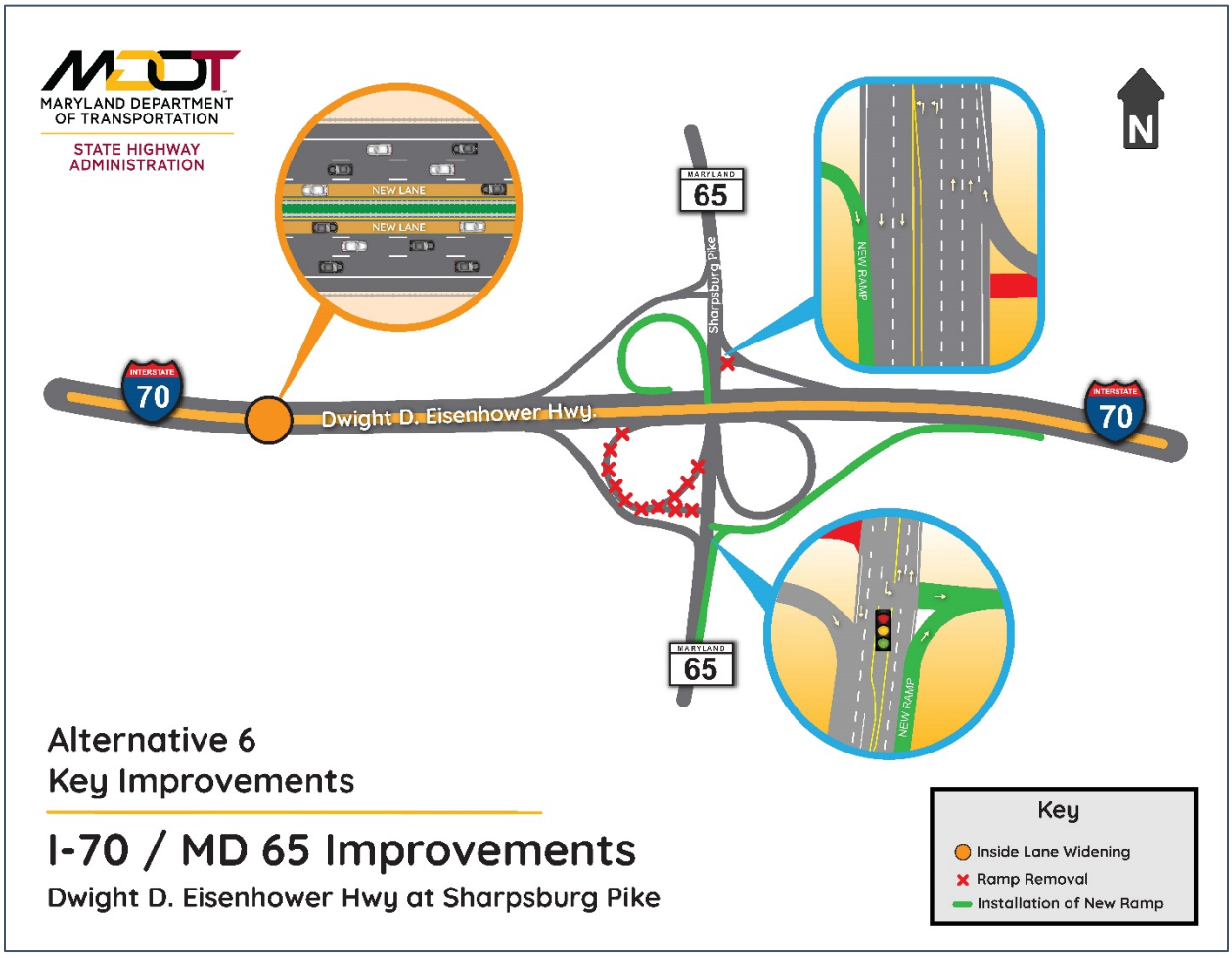
Recommended low-cost mitigations:

- Incorporate MDOT SHA's planned study of a half cloverleaf/half diamond interchange at I-70 Exit 32 to address merge weave concerns, or
- Separate conflicting traffic movements and merge areas. Revise interchange design to provide a collector-distributor (C-D) lane.

Exit 29 (MD 65 Interchange): Crash Hot Spot at I-70 Eastbound Weaving Lanes of Cloverleaf

Potential Problems:

- Heavy traffic volume utilizing very short weaving area on eastbound I-70
- Narrow weaving lane with no shoulder on bridge



Recommended mitigations:

- Revise interchange design to eliminate weaving lane. Relocate cloverleaf off-ramp per MDOT SHA proposed interchange improvements. The project is currently in the planning phase. FHWA approval for the preferred alternative will be finalized once funding for design has been programmed in the MDOT Consolidated Transportation Program.

Exit 26 (I-81 Interchange): Crash Hot Spots at Decision Areas / On- Ramp Merge

Potential Problems:

- Heavy traffic volume focused on two directions of merging at one time (EB and WB (on-ramp merging into CD lane and CD lane merging into I70 traffic))
- Reduced shoulder width adjacent to EB merge lane, thus no recovery area for evasive maneuver if acceleration is misjudged

Recommended mitigations:

- Extend physical barrier of C-D lanes and more clearly separate discrete merge areas.
- Provide sufficient (8’ to 12’) shoulders in merge areas and adjacent to extended physical barrier.

Exits 24 (MD 63) thru Exit 35 (MD 66) – Hagerstown Area: High Crash Rate/Density through Hagerstown Area

Potential Problems:

- Close spacing between Exits: Six interchanges within a 10-mile stretch
- Heavy volumes of on and off traffic at many interchanges cause slowdowns and additional capacity reductions through ‘friction’ of merges and diverge actions

Recommended low-cost mitigations:

- Conduct an interstate speed study in order to evaluate reducing speed limit from 70 miles per hour (mph) to 60 - 65 mph through high ramp density/congested area, i.e. around Hagerstown corridor

Exit 26 (I-81 Interchange): Crash Hot Spots at Decision Areas / On- Ramp Merge Areas and Crash Hot Spots Adjacent to C-D Lane on I-70

Potential Problems:

- Close spacing between Exits and hence not enough room to properly space advance guide signs
- Guide signs do not clearly indicate there will be exit options for eastbound and westbound I-81
- Arrow/diversion guide sign is not visible at beginning of EB exit lane development, thus motorists are unaware of the distance they think they have to make a decision to exit
- Evidence of guiderail replacement at (I-81 east) gore indicates driver confusion and last-minute decision making.

Recommended low-cost mitigations:

- Revise advance signing scheme to more closely match current MUTCD standards for collector distributor exit type
- Include A and B exit panels on advance signing
- Relocate and relabel Exit Gore signs to provide exit letter designations and clearly differentiate CD exit lane from I-81 N Exit on EB I-70 Exit ramps
- Revise overhead sign letter sizes, sign configuration and OH sign support location in keeping with MUTCD standards

Mitigation Eastbound I-70

Exit 18 (MD 68): Crash Hot Spots Adjacent-To and In Advance of On-Ramp Acceleration Lane

Potential problems:

- Short Acceleration lane and merge length
- On-ramp and through traffic on uphill grade, making reaching travel speed/merge speed for on-ramp traffic difficult/impossible.

Recommended low-cost mitigations:

- Extend On-Ramp acceleration lane and shoulder to allow vehicles to get up to speed prior to merging, thus not causing an unexpected slow-down in mainline traffic flow

MM 21 to MM 26 (between MD 68 and I-81 Interchange): Crash Trend Indicating Higher Proportion of Wet Pavement Crashes

Potential problems:

- 44% to 70% of the crashes in this section (per studied mile) occurred on wet pavement, whereas the study corridor average was 30%

Recommended low-cost mitigations:

- Consider installation of high friction surface treatment (HFST) in affected areas

MM 33 to MM 34 (Near MD 68): Crash Trend Indicating Higher Proportion of Crashes Occur Outside of Daylight Hours

Potential problems:

- 50% of crashes in this section occurred outside of daylight hours, whereas the study corridor average was 36%
- Google Maps photographs show many damaged and/or missing delineators and raised pavement markers through this section. Also shows existing pavement markings worn.

Recommended low-cost mitigations:

- Improve/upgrade/replace delineation and retro-reflectivity of pavement marking

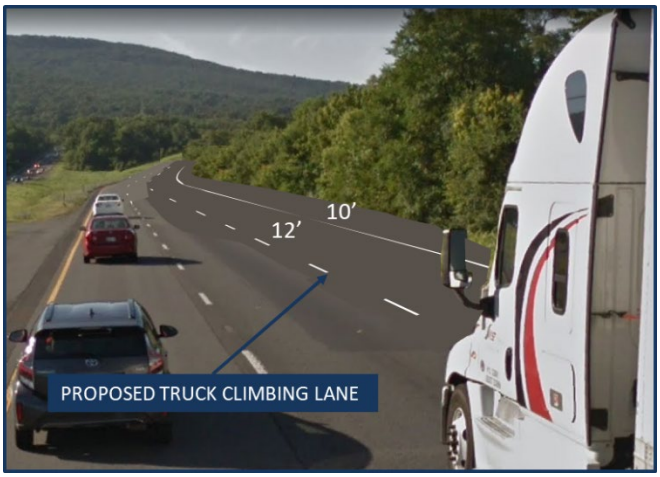
MM 36 (After MD 68): Crash Hot Spots Associated with Climbing Lane and In Advance of Climbing Lane

Potential problems:

- Slowing trucks cause queueing and congestion in remaining left-most lane
- Trucks passing other, slower trucks in climbing lane cause additional congestion in left-most lane
- Vehicles may jockey for position in advance of climbing lane

Recommended low-cost mitigations:

- Begin climbing lane ½ mile in advance of where it currently begins to allow trucks to get out of the way prior to slowing down mainline traffic, and to give trucks room to sort themselves out prior to significant slowdown mid-hill.



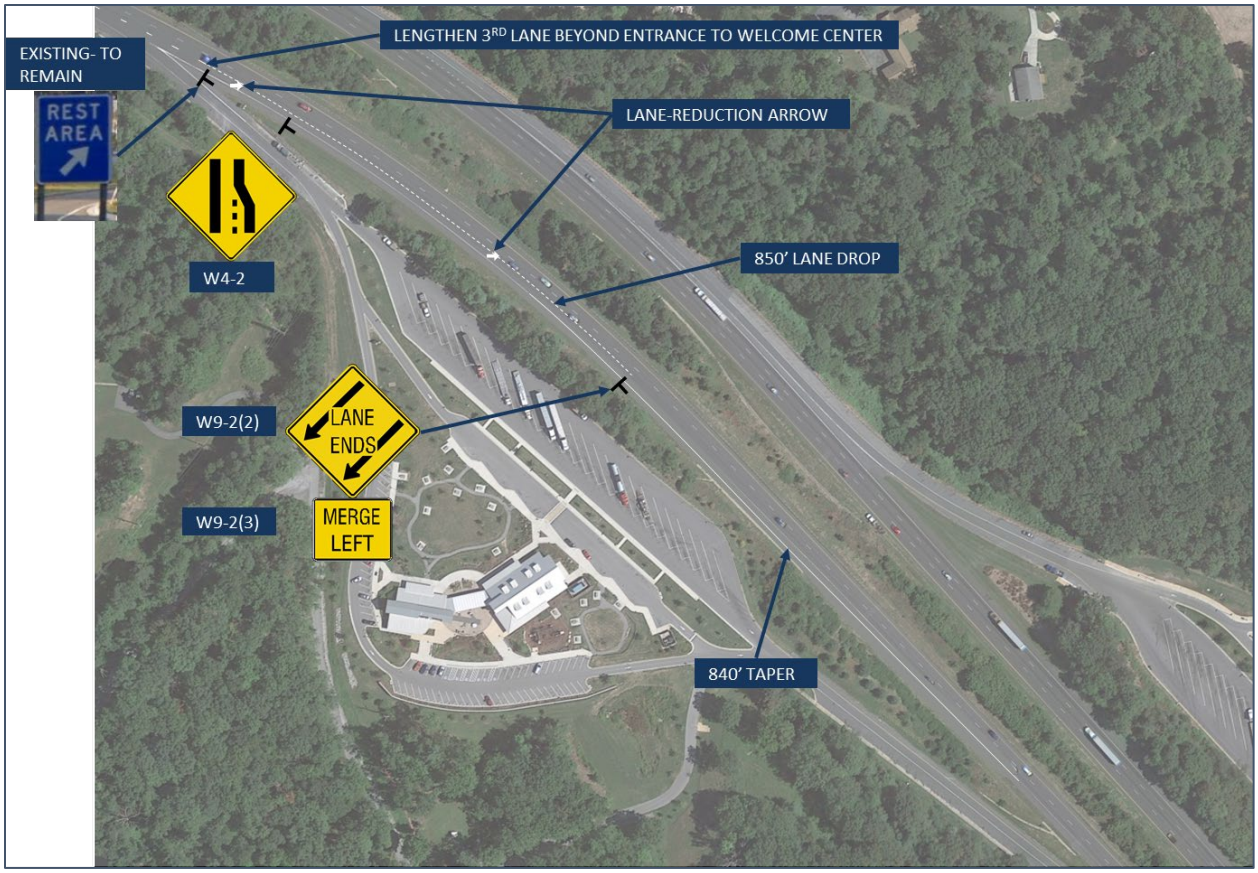
MM 38.5 (South Mountain) to Welcome Center (Beyond Washington County Eastern Study Limits): Crash Hot Spots Associated with Climbing Lane, Welcome Center and Termination of Climbing Lane

Potential problems:

- Welcome Center exit occurs at natural terminus of climbing lane
- Advance signing for Welcome Center exit conflicts with advance signing for climbing lane end/merge left, resulting in potential confusion of motorists
- Truck volume for parking needs exceeds capacity of Welcome Center Truck Parking, resulting in large volume of trucks parking on shoulders in advance of Welcome Center. Truck.
    a. Truck Parking may block advance signing for welcome center and climbing lane terminus
    b. Truck parking and maneuvering onto and off the shoulder adjacent to climbing lane may cause additional lane changing due to extreme slowing of trucks to park or to rejoin traffic from shoulder on hill
- Slowing trucks cause queueing and congestion in remaining left-most lane
- Trucks passing other, slower trucks in climbing lane cause additional congestion in left-most lane
- Vehicles may jockey for position while in climbing lane
- Confusion and conflicting movements may occur due to exiting for Welcome Center conflicting with leftward merge for trucks getting out of climbing lane as a result of conflicting signing and these movements and confusion may conflict with trucks using climbing lane as slow-down/acceleration lane for shoulder parking

Recommended low-cost mitigations:

- Extend/Lengthen termination of climbing lane sufficiently to allow required advance signing and lane end taper to occur past Welcome Center exit
- Revise pavement marking arrows, lane-ends signing and other advance signing on approach to MD Welcome Center (located just past study limits to the east) to eliminate confusion
- Prohibit shoulder parking in advance of Welcome Center
- Enforce NO Parking on Shoulder in advance of Welcome Center, consider modifying nearby park and ride lots to accommodate trucks
- Explore additional parking options and provide advanced automated signage informing truck drivers of parking availability. Coordinate with the MDOT SHA for possible inclusion into the Statewide Truck Parking Study.



Mitigation Westbound I-70

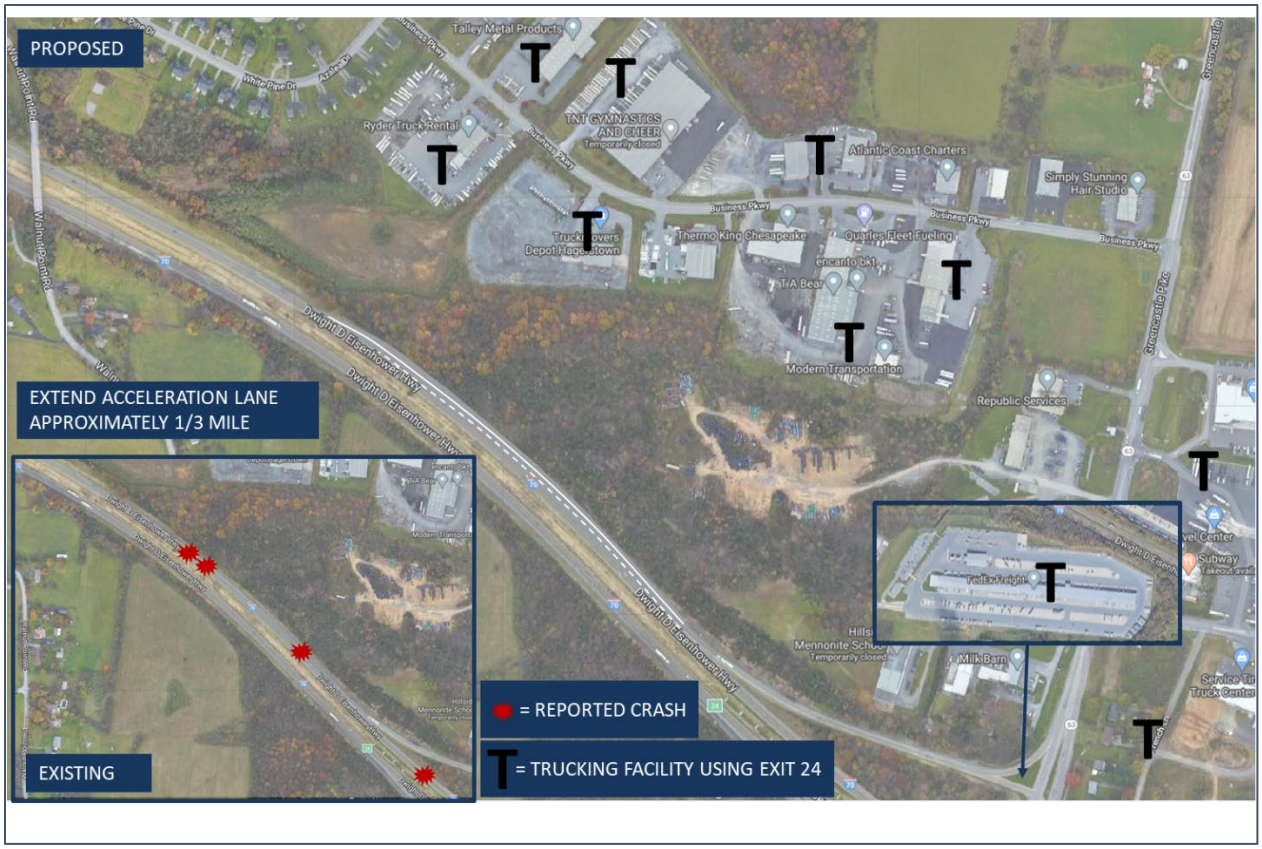
Exit 24 (MD 63): Crash Hot Spots Adjacent-To and In Advance of On-Ramp Acceleration Lane

Potential problems:

- Short Acceleration lane and merge length
- On-ramp and through traffic on uphill grade, making reaching travel speed/merge speed for on-ramp traffic difficult/impossible.
- Heavy Truck Volume utilizing ramp, making acceleration uphill challenging

Recommended low-cost mitigations:

- Extend On-Ramp acceleration lane and shoulder to allow vehicles to get up to speed prior to merging, thus not causing an unexpected slow-down in mainline traffic flow and unnecessary lane switching of mainline traffic



Exit 35 (MD 66): Crash Hot Spots Adjacent-To and In Advance of On-Ramp Acceleration Lane

Potential problems:

- Short Acceleration lane and merge length
- On-ramp and through traffic on uphill grade, making reaching travel speed/merge speed for on-ramp traffic difficult/impossible.

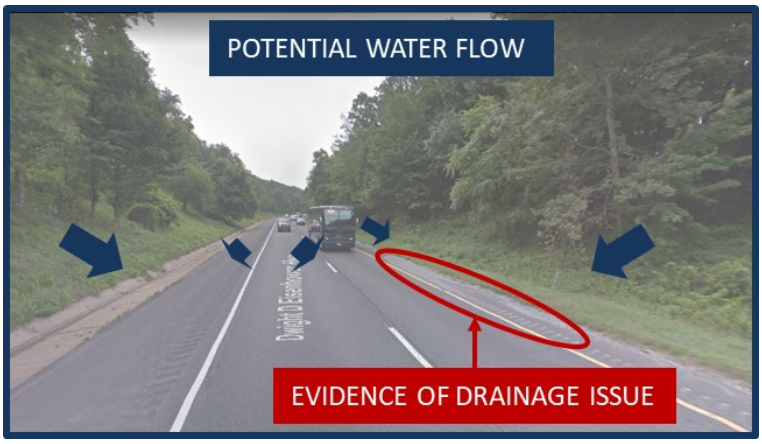
Recommended low-cost mitigations:

- Extend On-Ramp acceleration lane and shoulder to allow vehicles to get up to speed prior to merging, thus not causing an unexpected slow-down in mainline traffic flow

MM 37.25 (Before MD 66)– Drainage Issue: Crash Hot Spot on Mainline I-70 on Downhill Throughway

Potential problems:

- Evidence of drainage issue
- Sediment along shoulder indicates sheet-flow across roadway or overflow of swale.
- Sheet flow or icing on roadway potential
- Gravel and debris on roadway potential
- Hydro-plane potential



Recommended low-cost mitigations:

- Drainage at this location should be investigated and addressed. Confirm tributary areas, observe during heavy rain events, check swale overflow and cross slope of roadway, confirm swales are sized correctly

Traffic Signals & Signage Toolbox

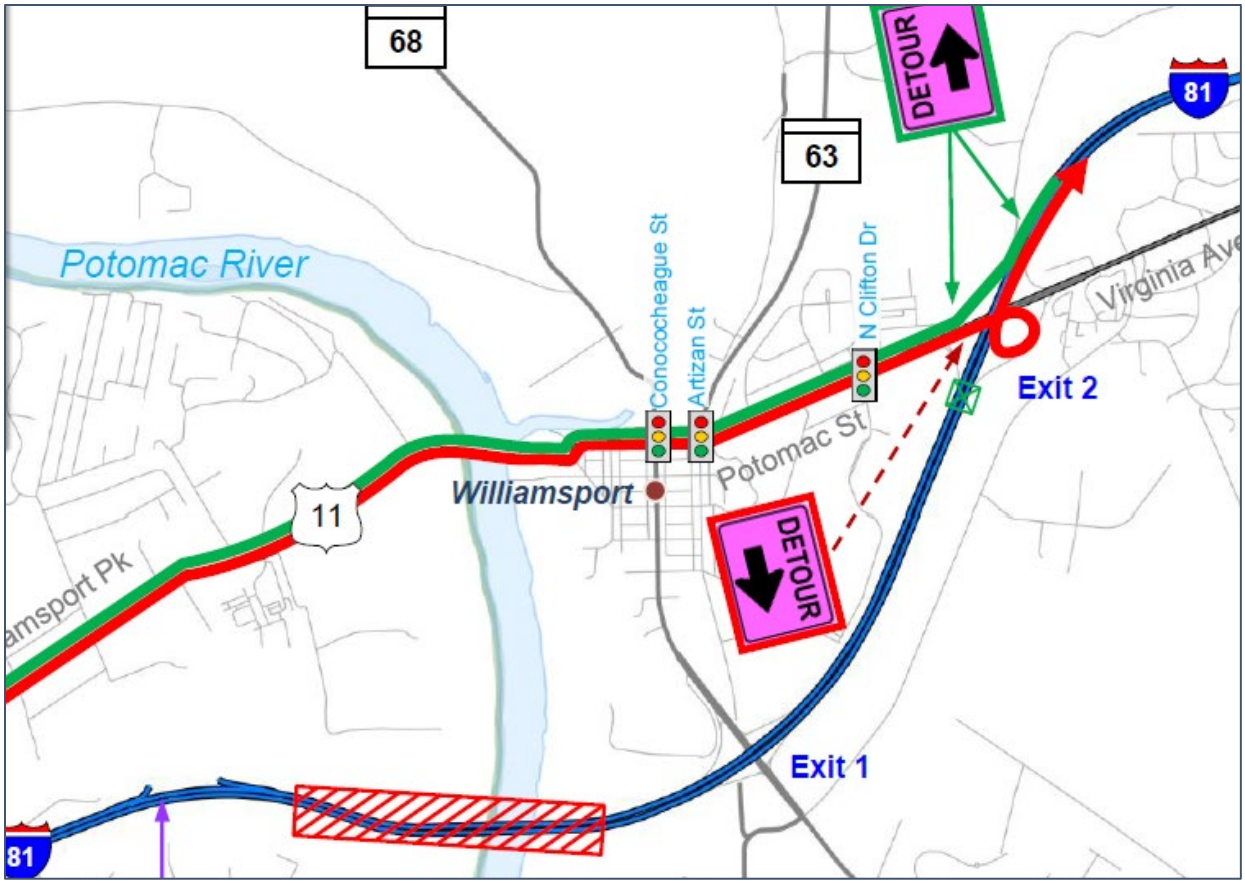
Outreach and Needs Assessment

Meetings were held with MDOT SHA Office of Traffic and Safety (OOTS) Division to discuss current signal assets as they related to incident management and specifically to traffic signal timing plans on detour routes during incidents on I-70 and I-81. The result of these meetings are as follows:

- Currently CHART and the OOTS Traffic Operations Division are two separate offices and communications between the two offices are improving but still sporadic as it relates to incidents.
- Currently a Signal Technician sits in the Statewide Operations Center (SOC) during AM and PM peak hours which aids in improving communications, however the technician use CCTV to detect and manage queues through manual timing adjustments but is not part of the process flow on the incident management timeline.
- Currently most controllers are Econolite ASC-3S. MDOT SHA is starting to roll-out Cobalt controllers therefore controllers shouldn't be a limitation.
- Currently rolling out cellular modem implementation and can reprioritize corridors. Dial up communication may still be present if cellular communication is not currently planned.
- MDOT SHA uses the Econolite CENTRACS server for timing upload/download and generally relies on manual timing implementation during incidents if incident timings exist.
- In general, incident timings have not been developed for the corridors parallel to I-70 or I-81
- General MDOT SHA rule of thumb is that mainline lefts and side streets use video detection with mainline advance using micro loops about 5 seconds upstream from stop bar. Most coordinated systems (+/-90%) will run free overnight. Hagerstown signals in the downtown area are likely pre-timed with no detection.
- During incidents typically don't have police directing traffic at intersections. Police direction of traffic generally only used for planned events for University of Maryland, College Park.
- MDOT SHA has removed most of the traffic responsive systems as they found that the systems struggled to differentiate between normal peak hour traffic versus incident traffic. Did identify that this could have been how the system was set-up and trigger detectors that were defined.
- MDOT SHA is working with adaptive systems, mostly Centracs Adaptive which is the ACS Lite variant and is not very aggressive in timing. Currently testing Econolite Edaptive but found that not very aggressive in increasing cycle length. Also have one SynchroGreen system which they like the system but signal technicians find the Trafficware controllers lacking.
- MDOT SHA does anticipate cycle length maximums in downtown Hagerstown with 130-140 second cycles being the maximum cycle length.

Further the study team reviewed the current Maryland Freeway Incident Traffic Management (FITM) Plans and had the following takeaways:

- FITM Plan details show detour sign and equipment that would need to be mobilized during an incident. This signage and equipment require placement during each incident. An example of this is show in **Figure 24**.
- FITM Plans have references to signals, but signal information is incomplete as highlighted below.



Intersection	Operated By	Control Type*	Operation Type**
US 11 (Williamsport Pk) @ Grade Rd	WV DOH		
US 11 (E Potomac St) @ MD 68 (Conococheague St)	SHA		
US 11 (E Potomac St) @ MD 63 (Artizan St)	SHA		
US 11 (E Potomac St) @ N Clifton Dr	SHA		

* Control Type: Remote or On-Site ** C = Coordinated; U = Uncoordinated; TBC = Time-Base Coordinated

Figure 24: Sample of MDOT SHA/CHART FITM Detour Routes

Based on combining the above research, the current incident management status along I-70 and I-81 is as follows:

- During an incident detour signage is required to be placed manually which limits the detour duration that these signs can be effectively placed. Shorter detour durations would effectively not justify the manual implementation of detour signage due to the set-up and tear down time associated with sign placement. This leaves shorter detour durations with motorists selecting detour route alternatives on their own.
- Equipment and personnel are in place to implement signal response plans during incident detours; however, gaps exist in the current processes of involving signal technicians in the incident management timeline. This is evidenced by incomplete signal information in the FITM Plans.

- Incident management timings do not exist for I-70 and I-81 in Washington County. As manual police control of signalized intersections is not used during incident detours, the existing signal timing plans will need to accommodate normal daily traffic plus detoured traffic volumes likely resulting in undue congestion along the detour route.

TSMO Strategies

Based on current understanding of the existing state of signals and detour route implementation during emergencies, the project team has identified the following strategies with short term meaning three to five years and long term greater than five years:

Short Term

- Revise incident management processes to include a traffic signal technician in the incident management timeline. This would involve notification to a signal technician when incident detour route is being implemented, and end of incident and return to normal operation for detour route signal timing implementation. This would benefit other locations in Maryland beyond Washington County. This strategy is considered cost neutral as the signal personnel are already in place.

Long Term

- Implement incident management detour route signal timings for manual implementation on routes parallel to I-70 and I-81. These detour routes would coincide with Maryland FITM Plan detour routes. This strategy would allow for signal timings that can reasonably accommodate existing traffic and detoured traffic volume during a detour implementation. This strategy is not an all or nothing proposition and can be a phased roll-out with prioritization of each FITM detour route. See below for further identification of prioritization and costs.
- Implement static detour signs similar to those found in Pennsylvania for colored detour routes (**Figure 25**) using sign placement as currently shown on FITM Plans. This strategy would focus only on the detour directional signs along the route and would still require manual placement of advanced detour warning signs, cones, PDMS, arrow boards, and personnel during a detour. However, by placement of static color-coded detour routes signs, detour route information can be conveyed to the motorist via DMS or other means earlier in the incident management timeframe while personnel are still mobilizing other equipment and responding to the incident scene. Like incident detour route signal timing implementation, this strategy can be a phased roll-out with prioritization of each FITM detour route. See below for further identification of prioritization and costs.

Figure 25: Color Coded Detour Signs

- Further advance research and testing of adaptive and responsive systems for traffic signal timing response on an automatic basis during incident management. This strategy is considered cost neutral as it relies on current testing of adaptive and response systems within the state. If implemented, this strategy would build upon incident management signal timing implementations and provide ability for timings to automatically be implemented by the system

versus manually implemented. Roll-out of these systems would also be accomplished via a phased roll-out prioritization of FITM Plan detour routes. Based on research conducted, these systems would require detection upgrades based on system detection requirements at the time of implementation. This strategy would also require capital costs and annual maintenance costs on a by intersection basis. As an Econolite central server and Econolite controllers are currently implemented, it would be logical that an Econolite Edaptive Adaptive System would likely be implemented. Costs for such a system include a $9,000 system fee per signal corridor, $1,700 system set-up fee and 1-year annual maintenance per intersection, and a continuous $730/intersection annual maintenance (cloud-based subscription) fee based on current pricing.

- Advance research in GPS partnerships to explore coordination of FITM routes during major incidents. Partnering with companies, such as WAZE and Google Maps, with State agencies could provide the ability to input work zone information, identify road closures and offer preferred detours routes within the apps.

Incident Management Detour Route Signal Timing Prioritization and Estimated Costs

Methodology

Current FITM plans for I-70 and I-81 in Washington County contain forty (40) different detour routes based on location of incident. The first step of prioritization was to combine detour routes prior to proceed with prioritization ranking. This combination was performed using two combination means as follows:

- Incident locations that had both primary and secondary detour routes combined the secondary detour route with the corresponding primary detour route, because the future development of timing plans is assumed to be completed concurrently for the primary and secondary detour routes. An example of this would be I-70 between exit 26 and exit 28.
- Detour routes were then reviewed and all FITM Plan detour routes that used the same route were combined. An example of this would be I-70 with an incident between exit 18 and 24 and with an incident between ramps at exit 24. Another example using both primary/secondary combination and like route combination would be I-81 with an incident between exit 2 and exit 4 and an incident between ramps at exit 4.

Once detour routes were combined, a prioritization ranking methodology was developed as follows:

- Implementation of traffic signal timings, similar to **Figure 26**, along each combined FITM detour route was determined to be a function of two main independent variables, crash experience and number of signals along the detour route.
- Crash data between 2015 to 2018 was reviewed based on location of each crash and applied to the FITM Plan incident management detour

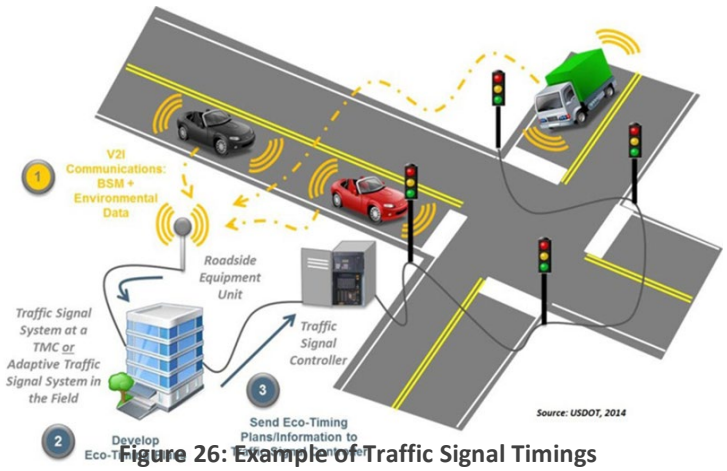


Figure 26: Example of Traffic Signal Timings

route incident locations. Where detour routes were combined, total number of crashes was also combined. Crashes that pertained to construction activities were not considered as part of this prioritization as construction activities are time and location dependent and not indicative of future crash experiences. Crash data was then normalized between all combined detour routes creating a crash factor using the following formula:
    - Number of crashes for detour route/maximum number of crashes per detour routes.
    - This is percentage based where the detour route with the highest number of crashes has a factor of 1.
- Number of signals along the detour route for each detour route were similarly calculated using FITM Plans. The number of signals was selected as an indicator where existing congestion may occur using the logic that the greater the number of signals along a detour route likely indicates the greater degree of both existing congestion, as well as, the greater degree of incident management congestion expected. As detour routes were combined, the FITM Plans were reviewed to identify the number of signals for each detour route and then a total number of unique signals for the combination of detour routes. This was done as due to detour route overlap; the same signals may be used for one or more detour routes. The number of signals along the detour route was similarly normalized between all combined detour routes creating a signal factor using the following formula:
    - Number of unique signals for detour route/maximum number of unique signals per detour routes
    - This therefore is percentage based where the signal factor with the highest number of crashes has a factor of 1.
- Realizing that prioritization of detour routes using crash experience and number of unique signals is not equally weighted among the independent variables selected, a factor of 75% for crash experience and 25% for number of unique signals were applied. The resulting calculations after weighting factors for crash experience and number of unique signals were then added together and multiplies by 100 to determine the rating factor used for detour route prioritization. The resulting formula is as follows:
    - Rating Factor = 100 * (.75*crash experience factor + .25* number of unique signals factor)
- The rating factors were then used to rank the detour routes in order of prioritization.

Costs

Costs were developed based on past experience of timing development costing $3,500/intersection in engineering and upwards of $3,500 for timing implementation for a total cost of detour timing implementation of $7,000/intersection. These costs are conservative in nature for planning purposes and do not include data collection of detour volumes for timing information. Engineering design costs include 24 hour turning movement count video data collection intersection counts and modeling and analysis of four (4) peaks (AM, PM, mid-day, and off-peak) for three different detour scenarios (direction 1, direction 2, and b-directional detour). It is possible to develop detour timings without counts and analysis, however, use of counts and analysis was selected as it provides a basis for detour route timing development based on potential projected impacts during an incident. Further, implementation of detour route timings is based on bid prices experienced upwards of $3,500/intersection. However, this is based on an outside contractor implementing the times. If MDOT SHA signal technicians implement the timings in the Centracs central server, cost reductions may be experienced. **Table 15** provides a summary of detour route prioritization and cost estimates per detour route. Additional data collection efforts are not included in the cost estimates.

Table 15: Traffic Signal Incident Management Timing Implementation Prioritization and Cost Estimate

Route	Incident Location	Number of Crashes (2015-2018)	Number of Signals on Detour	Number of Unique Signals	Rating Factor	Rank	Cost/Signal	Detour Total Cost
INTERSTATE 70	BETWEEN RAMPS AT EXIT 18	8	2	2	5.4	23	$7,000	$14,000
	BETWEEN EXIT 18 & EXIT 24	145	4	4	63.9	2	$7,000	$28,000
	BETWEEN RAMPS AT EXIT 24		4					
	BETWEEN EXIT 24 & EXIT 26	54	4	4	26.4	8	$7,000	$28,000
	BETWEEN RAMPS AT EXIT 26 – WB Only		4					
	BETWEEN RAMPS AT EXIT 26 – EB Only	17	1	1	8.0	18	$7,000	$7,000
	BETWEEN EXIT 26 & EXIT 28 – Primary	83	6	7	40.5	4	$7,000	$49,000
	BETWEEN EXIT 26 & EXIT 28 – Secondary		2					
	BETWEEN EXIT 28 & EXIT 29	62	7	7	32.8	5	$7,000	$49,000
	BETWEEN RAMPS AT EXIT 29 – WB Only	11	2	2	6.6	21	$7,000	$14,000
	BETWEEN EXIT 29 & EXIT 32	92	13	13	51.5	3	$7,000	$91,000
	BETWEEN RAMPS AT EXIT 32 – WB Only		13					
	BETWEEN RAMPS AT EXIT 32 – EB Only	11	1	1	5.6	22	$7,000	$7,000
	BETWEEN EXIT 32 & EXIT 35	67	1	1	28.7	6	$7,000	$7,000
	BETWEEN RAMPS AT EXIT 35	18	0	0	7.4	19	$7,000	$0
	BETWEEN EXIT 35 & EXIT 42	182	2	2	77.1	1	$7,000	$14,000
INTERSTATE 81	BETWEEN RAMPS AT EXIT 1	6	0	0	2.5	26	$7,000	$0
	BETWEEN EXIT 1 & EXIT 2 – Primary	7	2	6	5.0	24	$7,000	$42,000
	BETWEEN EXIT 1 & EXIT 2 – Secondary		4					
	BETWEEN RAMPS AT EXIT 2		2					
	BETWEEN EXIT 2 & EXIT 4 – Primary	18	8	10	15.8	12	$7,000	$70,000
	BETWEEN EXIT 2 & EXIT 4 – Secondary (NB Only)		3					
	BETWEEN RAMPS AT EXIT 4		8					
	BETWEEN EXIT 4 & EXIT 5 – Primary	12	3	8	8.1	17	$7,000	$56,000
	BETWEEN EXIT 4 & EXIT 5 – Secondary		8					
	BETWEEN RAMPS AT EXIT 5	2	20	20	21.7	9	$7,000	$140,000
	BETWEEN EXIT 5 & EXIT 6 – Primary	27	4	25	15.3	13	$7,000	$175,000
	BETWEEN EXIT 5 & EXIT 6 – Secondary		21					
	BETWEEN RAMPS AT EXIT 6	12	15	15	20.6	11	$7,000	$105,000

Route	Incident Location	Number of Crashes (2015-2018)	Number of Signals on Detour	Number of Unique Signals	Rating Factor	Rank	Cost/Signal	Detour Total Cost
INTERSTATE 81	BETWEEN EXIT 6 & EXIT 7 – Primary	11	4	19	8.7	16	$7,000	$133,000
	BETWEEN EXIT 6 & EXIT 7 – Secondary		15					
	BETWEEN RAMPS AT EXIT 7	2	20	20	21.7	10	$7,000	$140,000
	BETWEEN EXIT 7 & EXIT 8 – Primary	26	1	25	11.8	14	$7,000	$175,000
	BETWEEEN EXIT 7 & EXIT 8 – Secondary		24					
	BETWEEN EXIT 8 & EXIT 9 – Primary		1					
	BETWEEN EXIT 8 & EXIT 9 – Secondary		24					
	BETWEEN RAMPS AT EXIT 9	5	2	2	4.1	25	$7,000	$14,000
	BETWEEN EXIT 9 & EXIT 10	9	22	22	26.6	7	$7,000	$154,000
	BETWEEN RAMPS AT EXIT 10	12	2	2	7.0	20	$7,000	$14,000
	BETWEEN EXIT 10 (MD) & EXIT 1 (PA)	19	1	1	8.9	15	$7,000	$7,000

Incident Management Detour Route Color Coded Detour Route Static Signing Implementation and Estimated Costs

Methodology

The methodology to prioritize detour routes for selection of color-coded detour route static signing, shown in **Figure 27,** was similar to that used for the Incident Management Detour Route Signal Timing Prioritization as it relates to combination of FITM Plan detour routes and creation of a crash experience factor. The difference in approach is that prioritization for detour route static signing uses only crash experience factor as a prioritization factor. Similarly, FITM Plans were reviewed to identify number of unique static sign locations for each combined detour route.

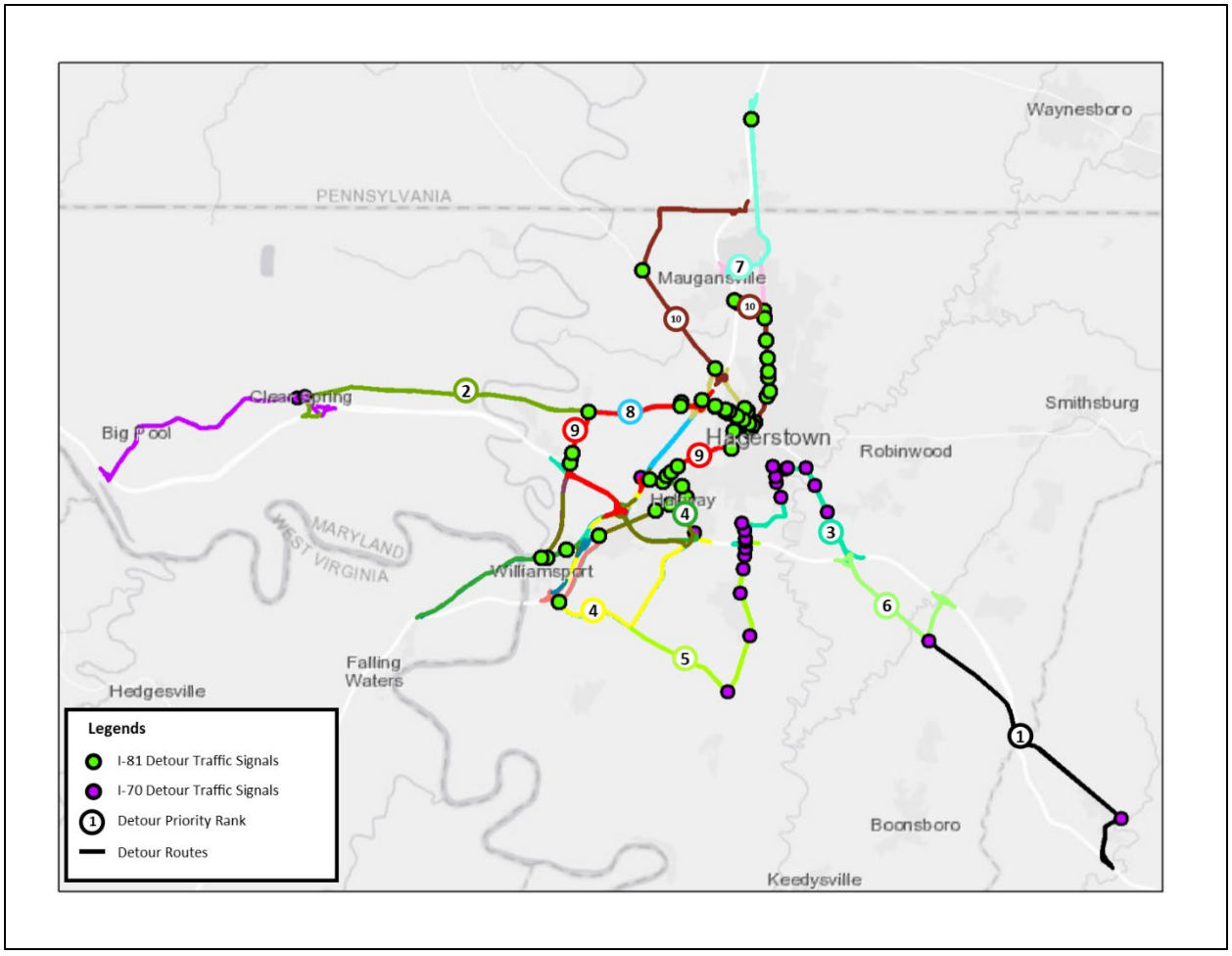


Figure 27: Detour Route Prioritization

Costs

Costs were developed assuming that static signs would be ground mounted at locations currently shown on the FITM Plans. It is also assumed that only detour directional signs would be implemented on a static basis, and that advanced detour signs would need to be implemented once field personnel are mobilized to the incident scene. A past bid price of $300/static ground mounted sign was used. **Table 16** provides a summary of detour route prioritization and cost estimates per detour route.

Table 16: Traffic Signal Incident Management Color Coded Static Sign Implementation Prioritization and Cost Estimate

Route	Incident Location	Number of Crashes (2015-2018)	Number of Signs on Detour	Number of Unique Signs	Rating Factor	Rank	Cost/Sign	Detour Total Cost
INTERSTATE 70	**BETWEEN RAMPS AT EXIT 18**	8	12	12	4.4	21	$300	$3,600
	BETWEEN EXIT 18 & EXIT 24	145	13	13	79.7	2	$300	$3,900
	BETWEEN RAMPS AT EXIT 24		13					
	BETWEEN EXIT 24 & EXIT 26	54	15	15	29.7	7	$300	$4,500
	BETWEEN RAMPS AT EXIT 26 – WB Only		15					
	BETWEEN RAMPS AT EXIT 26 – EB Only	17	7	7	9.3	13	$300	$2,100
	BETWEEN EXIT 26 & EXIT 28 – Primary	83	10	24	45.6	4	$300	$7,200
	BETWEEN EXIT 26 & EXIT 28 – Secondary		14					
	BETWEEN EXIT 28 & EXIT 29	62	10	10	34.1	6	$300	$3,000
	BETWEEN RAMPS AT EXIT 29 – WB Only	11	3	3	6.0	17	$300	$900
	BETWEEN EXIT 29 & EXIT 32	92	19	19	50.5	3	$300	$5,700
	BETWEEN RAMPS AT EXIT 32 – WB Only		10					
	BETWEEN RAMPS AT EXIT 32 – EB Only	11	3	3	6.0	17	$300	$900
	BETWEEN EXIT 32 & EXIT 35	67	7	7	36.8	5	$300	$2,100
	BETWEEN RAMPS AT EXIT 35	18	4	4	9.9	11	$300	$1,200
	BETWEEN EXIT 35 & EXIT 42	182	14	14	100.0	1	$300	$4,200
INTERSTATE 81	**BETWEEN RAMPS AT EXIT 1**	6	5	5	3.3	23	$300	$1,500
	BETWEEN EXIT 1 & EXIT 2 – Primary	7	10	15	3.8	22	$300	$4,500
	BETWEEN EXIT 1 & EXIT 2 – Secondary		5					
	BETWEEN RAMPS AT EXIT 2		10					
	BETWEEN EXIT 2 & EXIT 4 – Primary	18	12	22	9.9	11	$300	$6,600
	BETWEEN EXIT 2 & EXIT 4 – Secondary (NB Only)		6					
	BETWEEN RAMPS AT EXIT 4		14					
	BETWEEN EXIT 4 & EXIT 5 – Primary	12	9	23	6.6	14	$300	$6,900
	BETWEEN EXIT 4 & EXIT 5 – Secondary		14					
	BETWEEN RAMPS AT EXIT 5	2	10	10	1.1	25	$300	$3,000
	BETWEEN EXIT 5 & EXIT 6 – Primary	27	10	22	14.8	8	$300	$6,600

Route	Incident Location	Number of Crashes (2015-2018)	Number of Signs on Detour	Number of Unique Signs	Rating Factor	Rank	Cost/Sign	Detour Total Cost
INTERSTATE 81	**BETWEEN EXIT 5 & EXIT 6 – Secondary**		12					
	BETWEEN RAMPS AT EXIT 6	12	9	9	6.6	14	$300	$2,700
	BETWEEN EXIT 6 & EXIT 7 – Primary	11	10	18	6.0	17	$300	$5,400
	BETWEEN EXIT 6 & EXIT 7 – Secondary		8					
	BETWEEN RAMPS AT EXIT 7	2	10	10	1.1	25	$300	$3,000
	BETWEEN EXIT 7 & EXIT 8 – Primary	26	9	20	14.3	9	$300	$6,000
	BETWEEEN EXIT 7 & EXIT 8 – Secondary		11					
	BETWEEN EXIT 8 & EXIT 9 – Primary		9					
	BETWEEN EXIT 8 & EXIT 9 – Secondary		11					
	BETWEEN RAMPS AT EXIT 9	5	4	4	2.7	24	$300	$1,200
	BETWEEN EXIT 9 & EXIT 10	9	10	10	4.9	20	$300	$3,000
	BETWEEN RAMPS AT EXIT 10	12	8	8	6.6	14	$300	$2,400
	BETWEEN EXIT 10 (MD) & EXIT 1 (PA)	19	9	9	10.4	10	$300	$2,700

ITS Expansion Toolbox

Current ITS Infrastructure

The existing and planned ITS deployed within the project limits, shown in **Figure 28**, are comprised of the following devices and associated quantities:

- Dynamic Message Signs (DMS) - 3
- Closed Circuit Television (CCTV) cameras - 10
- Roadway Weather Information Systems (RWIS) - 2
- Highway Advisory Radio (HAR) – 1

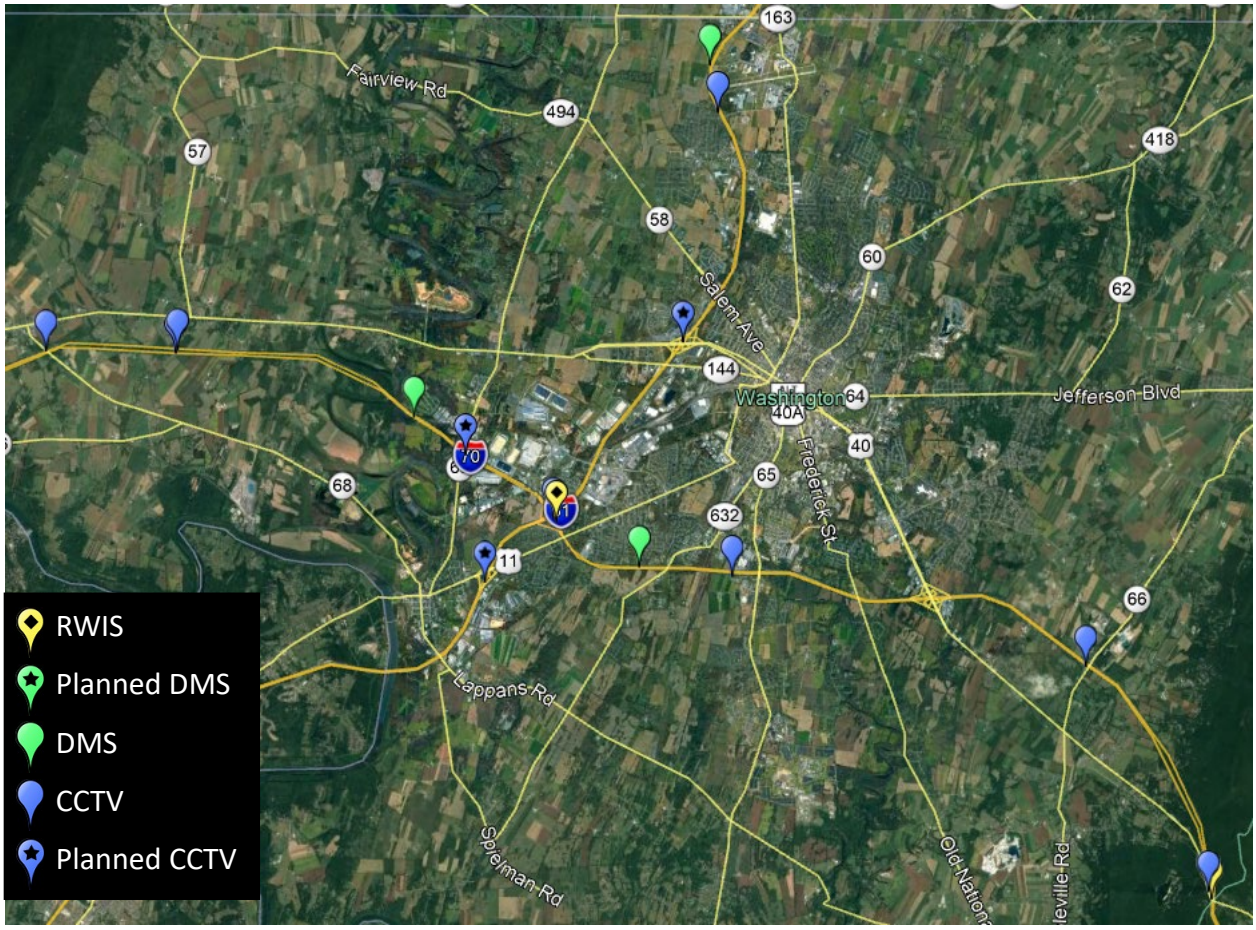


Figure 28: Existing and Planned ITS

The existing DMS, shown in **Figure 29 and Figure 30**, are full sized, typically over the roadway, monochrome, with 3 separate lines and capability to display 21 characters per line at 18" character height. This is considered a character based DMS. What this means is the messages are limited to 3 lines of 21 characters. These DMS cannot display images/graphics or change colors from Amber.

Figure 29: Existing DMS I-81 SB MP 11.2

Figure 30: Existing DMS I-70 WB Exit 28

The baseline assessment identified the following gaps within the existing ITS deployment.

- Existing ITS devices are very limited across the county.
- No existing devices to warn drivers prior to entering the highway of incidents.
- Missing coverage at key intersections as identified by the crash hotspots.
- Limited availability to manage traffic on the highway through construction dynamically.
- Truck parking availability.

Expansion of ITS along the Highway

Based on the evaluation of the existing ITS deployment and identification of gaps the following strategies were formulized.

- Expansion of permanent ITS devices along the highway
- Adding temporary or permanent ITS devices at pre-entry locations
- Smart work zones
- Traveler information improvements
- Truck management
- 5G Connected Vehicles
- Incident management and response times

Based on the identified crash hotspots discussed in the **Incidents and Crashes Section,** there is a clear need to have the ability to disseminate traveler information more frequently than what is currently available. By adding additional CCTV and DMS at or in advance of the hotspots can aid in for situational awareness and dissemination of imperative traveler information. The selected locations considered traffic volumes on ramps, whether they are part of key detour routes, crash rates and the density of business locations near the interchange. Other interchanges were determined as little need for additional ITS deployment, lack communications infrastructure or have lower traffic volumes.

Figure 31 shows the recommendation for additional ITS devices along the highways while **Figure 32** highlights how the ITS devices correspond to the crash hot spots.

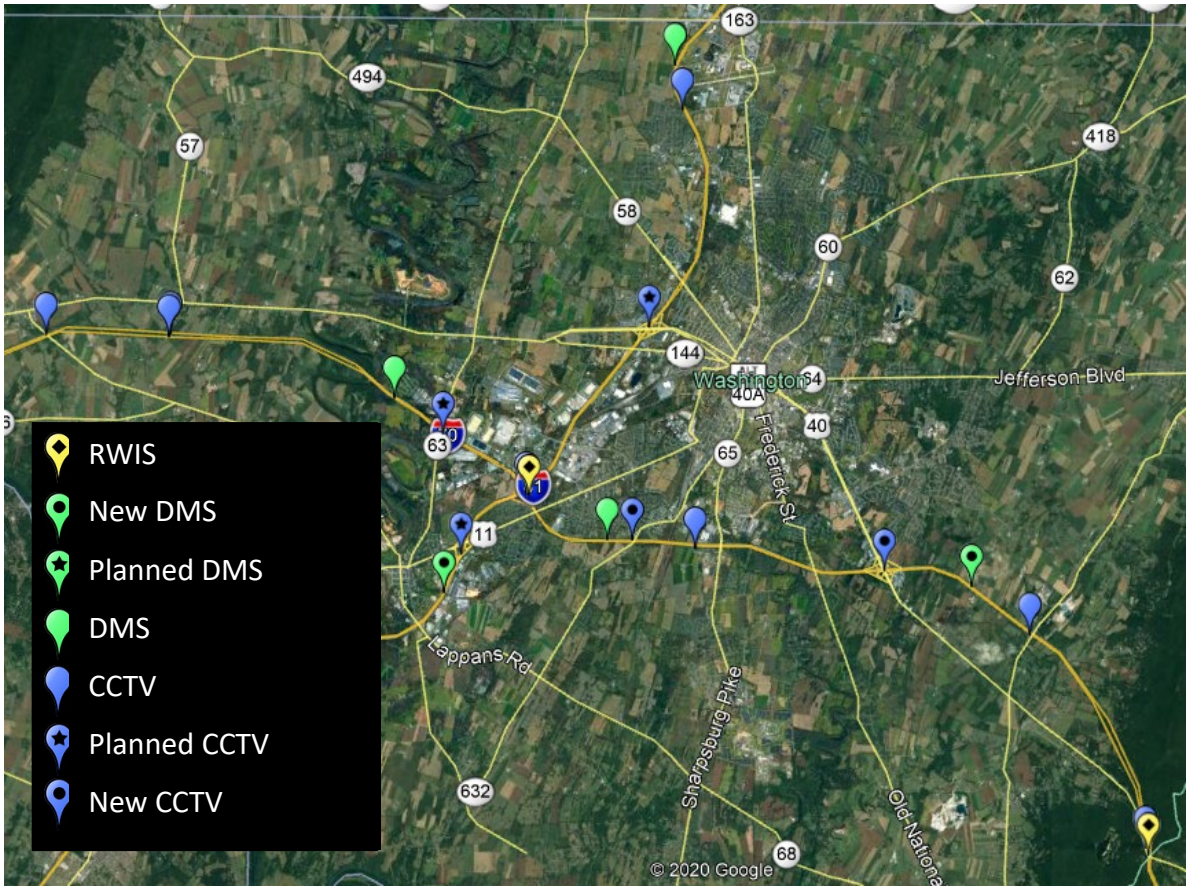


Figure 31: Additional Coverage on Interstates

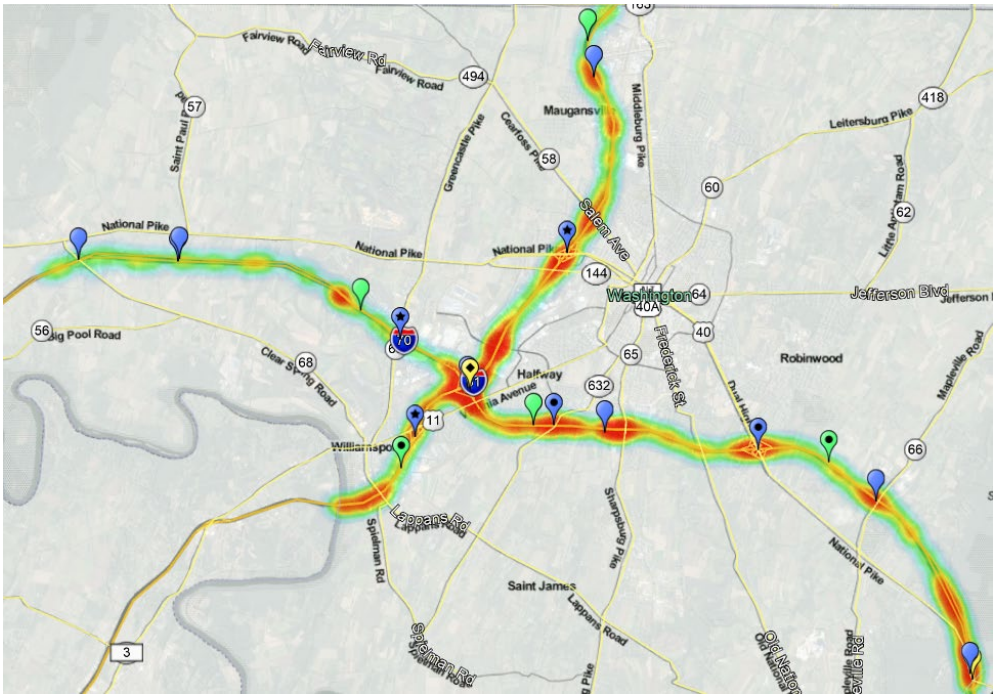


Figure 32: Hot Spots and Highway ITS Expansion

Table 17 provides the approximate locations for highway ITS expansion. These locations are subject to field verification for validity.

Table 18: Proposed ITS Locations - Highways

Device Type	Location	Direction	Notes
DMS	I-81 ~ MP 1.5	Northbound	Over the road installation or pedestal mounted in the median
DMS	I-70	Westbound	Located prior to the 1-mile Hagerstown Static sign. Consider mounting in the median or the DMS closer to the White Hall Rd bridge.
CCTV	I-70 Intersection with MD 632	Eastbound	Locate in the Southwest quadrant of the intersection.
CCTV	I-70 Intersection with US 40	Eastbound	Locate in the median on US 40.

It is not uncommon for residents of a city, state, or country to speak more than one language. DMS help communicate to multi-lingual nations through the functionality of showing symbols. According to a study from the University of Rhode Island, DMS graphics produce a 35 percent faster recognition time than text alone. Graphics give more impact to a message, and they reduce the number of frames needed to make the message effective.

While monochrome DMS works efficiently, investing 9.5 percent more into a full-color dynamic message sign gives you a variety of benefits, including the safety of commuters by taking advantage of the graphics feature. A breakdown of a typical installation budget shows that, when agencies choose a traditional 66mm amber DMS, the sign will make up 33 percent of the total site cost. An equal-sized 20mm full-color DMS will take up just 6 percent more of the total site cost.

Based on this information it is recommended to invest in full-color, high-resolution (20mm), full matrix DMS as part of the expansion of ITS on the highway. **Figure 33 - 35** show the difference in resolution for full matrix DMS, as well as use of color.

Figure 33: High Resolution, Full Color (20mm)

Figure 34: Medium Resolution, Full Color (34mm)

Figure 35: Low Resolution, Amber (66mm)

Pre-Entry Deployment

The ability to inform drivers prior to getting onto the highway is a valuable tool to have. By reducing the number of vehicles entering the highway enroute to an existing queue will ultimately improve incident response to opening the roadway. This can be accomplished by deploying a Highway Access Alert System using smaller DMSs or message boards along the arterial roads feeding into the highways. Permanent DMS or temporary portable changeable message board (PCMS) near the on ramps or at key locations help to maximize visibility. Once the capability exists, messages can be sent through in-vehicle alerts as well, which may lessen the need for DMS.

Figure 36 - Figure 44 are examples of pre-entry DMS installed by the Pennsylvania Turnpike Commission in advance of every interchange onto their roadway. The boards are smaller, which are full matrix, 3 lines capable of 10 characters per line, 12” character height. The PTC also installed high-resolution full color DMS, which have the capability of displaying colors as well as images/photos on them. Since these displays are on slower speed roadways, the size of the text can be smaller - 12” characters for speeds of less than 45 mph, 9” characters for speeds of less than 35 mph, and 6” characters for speeds under 25 mph.

Figure 36: PA Turnpike Willow Grove Interchange Pre-Entry

Figure 37: PA Turnpike Norristown Interchange Pre-Entry

Figure 38: PA Turnpike Fort Washington Interchange Pre-Entry

Figure 39: PA Turnpike Fort Washington Interchange Pre-Entry

Figure 40: PA Turnpike Virginia Drive Interchange Pre-Entry

Figure 41: PA Turnpike Valley Forge Interchange Pre-Entry Mall Blvd

Figure 42: PA Turnpike Breezewood Interchange Pre-Entry

Figure 43: PA Turnpike SR29 Interchange Pre-Entry Rt 9

Figure 44: PA Turnpike Irwin Interchange Pre-Entry

The above figures show the versatility for mounting smaller signs. The majority of these DMS were post mounted as a traffic sign would be. They have breakaway posts to ensure safety and reduce the need for guardrail installations. There is flexibility on mounting height and combination of static sign and DMS to maximize limited right-of-way.

As part of the strategy toolbox, key interchanges and potential locations for the deployment of pre-entry DMS were identified. These locations chosen, shown in **Figure 45 - Figure 47**, are based off of traffic volumes, key detour routes, and nearby businesses. In most instances, two signs can cover an intersection. In certain locations based on existing signage, it is recommended to place a combination of static and dynamic DMS.

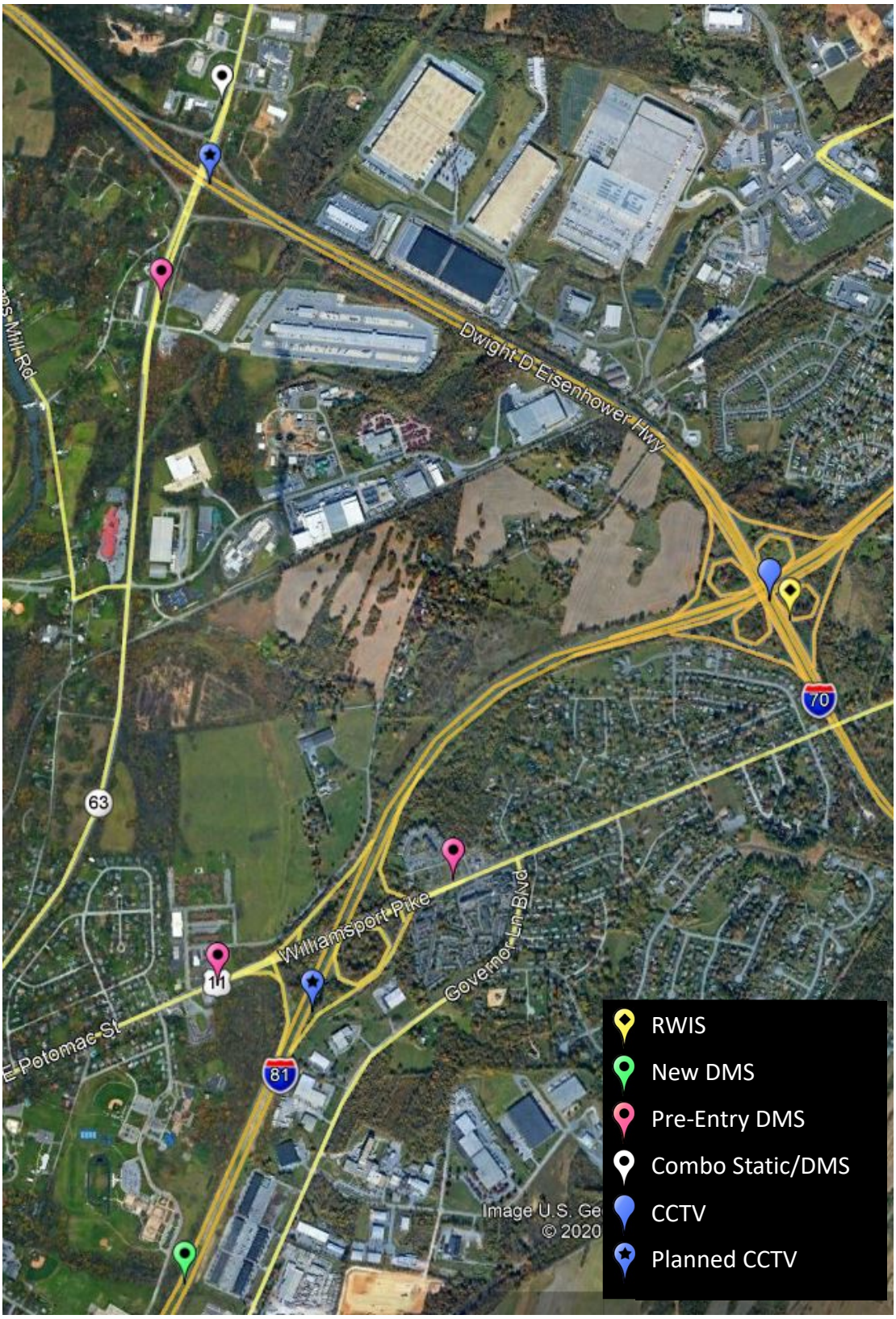


Figure 45: Arterials US 11 and MD 63

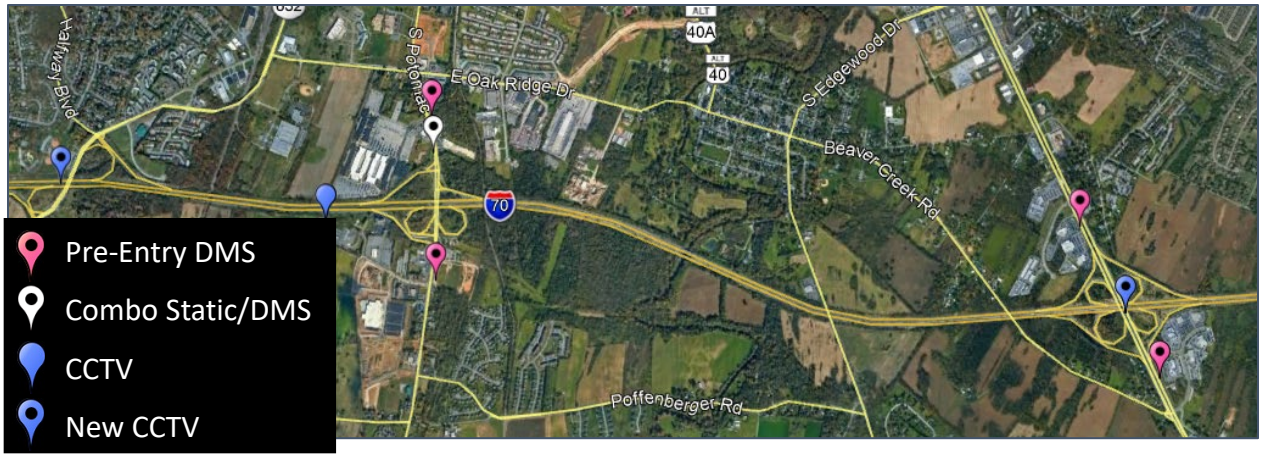


Figure 46: Arterials MD 632, MD 65, and US 40

Figure 47: Arterial US 40

Currently, there is a large amount of construction along I-70 and I-81 that cause most of the traffic incidents, whether it be accidents or congestion. The use of pre-entry DMS would provide drivers with additional information and ability to make route changes prior to getting on the highway by posting travel times through the corridor.

Figure 48 shows an overall image of the ITS buildout in the project area. **Table 18** provides approximate pre-entry locations and how it correlates to the crash hot spots highlighted in **Figure 49**. The proposed locations are subject to field verification for validity.

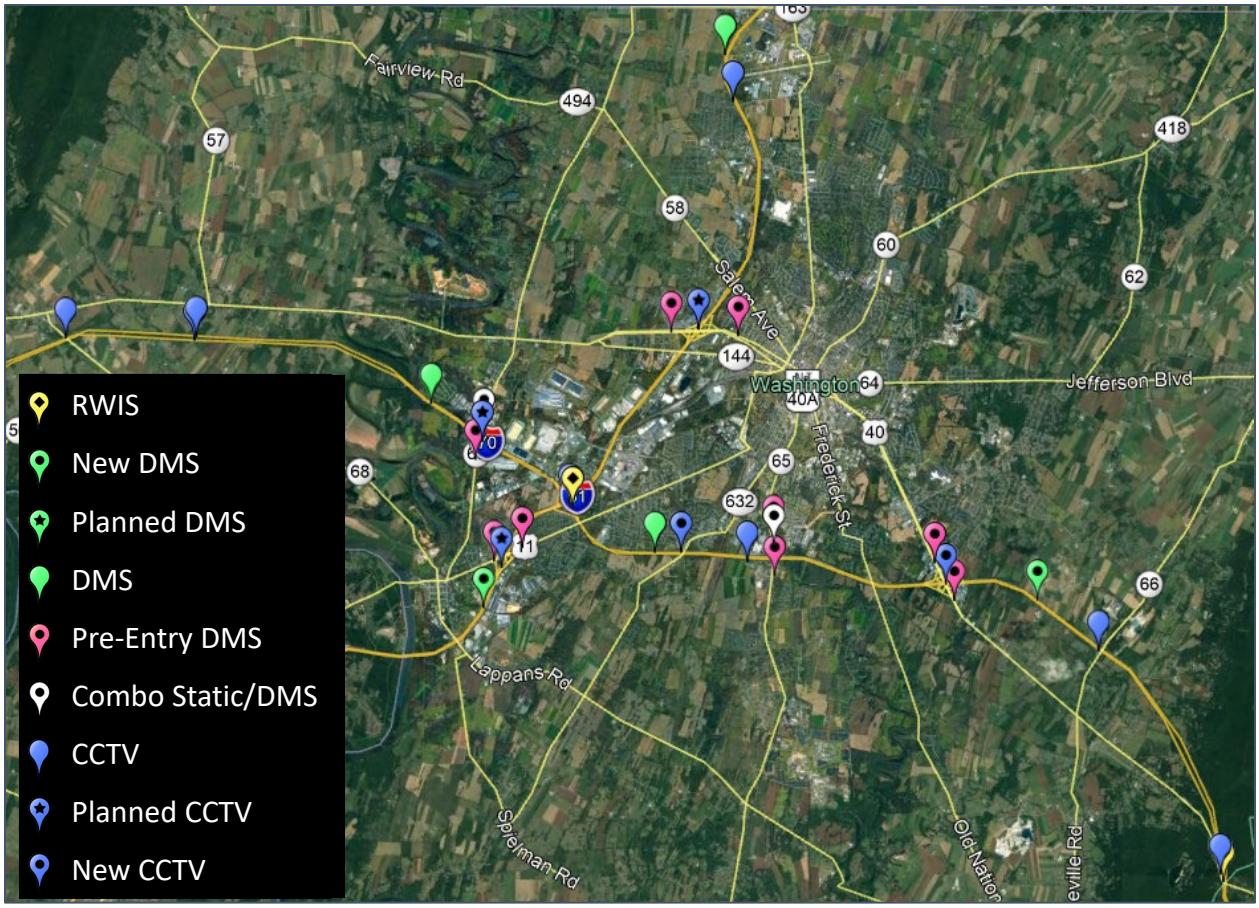


Figure 48: ITS Buildout

Table 19: Pre-Entry DMS Locations

Device Type	Location	Direction	Notes
Pre-Entry Permanent DMS	US 40 @ I-70 Interchange	Northbound	Consider mounting in median across from I-70 directional sign.
Pre-Entry Permanent DMS	US 40 @ I-70 Interchange	Southbound	Cantilever from the median 800’ North of the I-70 directional sign.
Pre-Entry Permanent DMS	MD 65 @ I-70 Interchange; Across from the Burger King	Northbound	On the backside of the swale beyond the utility lines.
Pre-Entry Permanent DMS Combo Static Sign	MD 65 @ I-70 Interchange	Southbound	Utilize existing location of the Hancock and Frederick exit sign.
Pre-Entry Permanent DMS	Greencastle Pike @ I-70 Interchange	Northbound	Locating the sign on the hillside just beyond the end of the curb prior to the ramps.

Device Type	Location	Direction	Notes
Pre-Entry Permanent DMS Combo Static Sign	Greencastle Pike @ I-70 Interchange	Southbound	Utilize existing location of the Hancock, Hagerstown exit sign.
Pre-Entry Permanent DMS	US 11 @ I-81 Interchange	Northbound	Locate in the median between the I-81NB ramp and US11. Combine I-81 sign onto DMS structure.
Pre-Entry Permanent DMS	US 11 @ I-81 Interchange	Southbound	Locate at the existing I-81 shield signs.
Pre-Entry Permanent DMS	US 40 @ I-81 Interchange	Eastbound	Located ~800 ft before the I-81 overhead sign structure.
Pre-Entry Permanent DMS	US 40 @ I-81 Interchange	Westbound	Located in the median across from the Harrisburg Roanoke ½ mile sign.

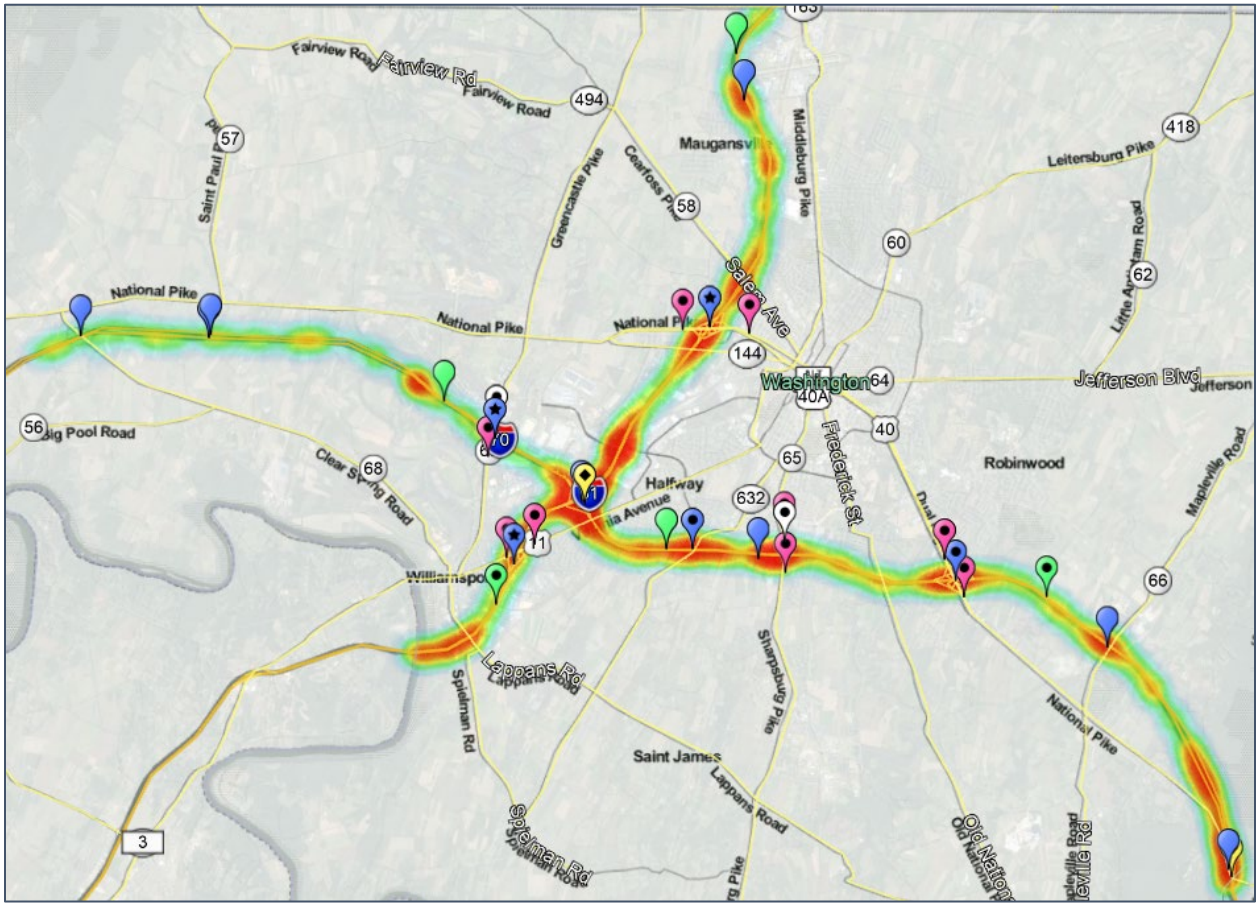


Figure 49: ITS Buildout vs Crash Hot Spots

Smart Work Zones

Smart Work Zone (SWZ) systems are a way to improve management of work zones through utilization of advanced technologies. The most common type of smart work zone is the Travel Times system through the work zone. Pre-entry signs can be utilized to provide travel times for different routes.

Most smart work zone systems can be integrated with existing statewide Advance Traffic Management Systems (ATMS) to allow the use of existing ITS as part of the work zone. This is optional and dependent on the clients' needs.

The Travel Time SWZ would be comprised of multiple PCMS setup along the corridor leading up to the work zone. They would be located at major decision points to allow drivers to leave the highway if travel times are long. Depending on the length of the work zone, there may be PCMS located within to provide information. To obtain the travel times, portable detectors would be setup at a predefined separation distance, commonly every ½ mile leading up and every ¼ mile through the work zone. If the state agency already has probe data, then that can be utilized as well.

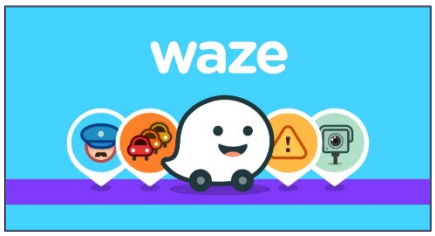
If construction calls for long term lane closures that will result in queued traffic, SWZ can be used for Queue Management. This is a separate system to the Travel Time system but can utilize the same type of equipment. It would be suggested to include portable CCTV for monitoring the roadway. This system will alert drivers at predefined distances from the lane closure if there is queued traffic ahead and how far ahead they can expect to hit the queue.

As part of the Queue Management, or as stand alone, a Variable Speed Limit SWZ system could be deployed depending on the need. There are specific portable speed limit signs for work zones or the full matrix PCMS could be utilized.

The final SWZ system is the Truck Entering/Exiting Work Zone. This system is useful if the work zone requires the movement of large trucks in and out of the work zone directly from live traffic. This system can be utilized to notifying driver of the truck moving slowly in the lane ahead of them.

Deployment of SWZ is recommended in this area due to the extended construction efforts to expand I-81 and I-70 in an attempt to accommodate more traffic.

Traveler Information Improvements



In the advent of Waze and Google maps for travel times, many states noticed inaccurate information being reported, especially when it came to properly identify work zones or road closures. Partnering with companies, such as WAZE and Google, will foster a better relationship for improved reporting. Most companies will allow State agencies the ability to input work zone information and dictate road closures. Another feature that can be offered is to include written detours for road closures within the apps. The State should continue to move forward with fostering its relationship with WAZE to improve reporting of incidents and work zone information.

Truck Management

With the prevalence of fulfillment centers and warehouses in the region and the surge of delivery services and expedited deliveries, more trucks are being seen on the roadways. Currently, aging infrastructure cannot support the number of parking spaces needed for truck drivers to take their required breaks as identified in **Figure 50**. Finding ways to manage truck parking has become increasingly difficult with limits on expansions due to ROW and funding. In 2020, Maryland completed a Truck Parking Study (MDOT SHA Truck Parking Study) that looked at truck parking needs across the state and identified locations that can add capacity quickly and effectively.

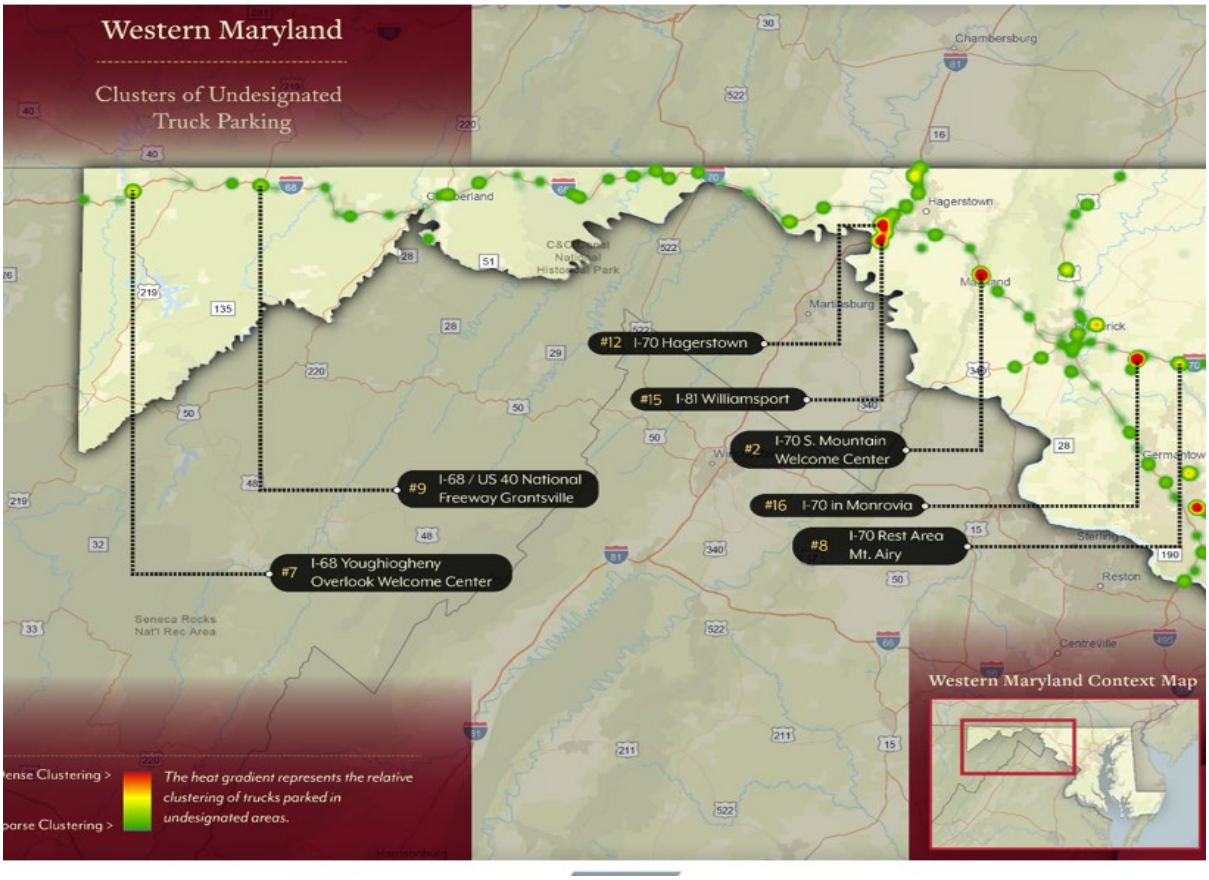


Figure 50: MDOT SHA Parking Study – Clusters of Undesignated Truck Parking

Currently, there are two public truck parking areas, the I-70 EB and WB Welcome centers, and one private parking area located at the crossroads of I-81 and I-70. The parking study identified the two public areas as potential projects to move into design for 10+ additional spots. However, this will still not provide enough spaces to cover the demand.

Many states across the country have begun to use technology to provide truck drivers with more parking information. These static signs with dynamic inserts provide the number of spaces available at rest areas and truck parking centers off the highway. Utilization of existing large DMS to supplement these signs would be an option.

It is recommended to coordinate with the States' truck parking study efforts to improve spaces available and dissemination of parking information. Examples would be extending the Drivewyze partnership with MSP that supported truck turnover locations to freight drivers, additional parking sensors and additional information to in-vehicle drivers.

Connected Vehicles

Connected Vehicle (CV) is technology that will enable cars, buses, trucks, trains, roads and other infrastructure, and smartphones and other devices to "talk" to one another. Cars on the highway, for example, would use short-range radio signals to communicate with each other so every vehicle on the road would be aware of where other nearby vehicles are. Drivers would receive notifications and alerts of dangerous situations, such as someone about to run a red light as they are nearing an intersection or an oncoming car, out of sight beyond a curve, swerving into their lane to avoid an object on the road. CVs could dramatically reduce the number of fatalities and serious injuries caused by accidents on our roads and highways.

There are a number of CV applications that would be beneficial in assisting with traffic management. These also fall in line with the SWZ applications previously discussed.

- Detour Routing
- Incident Management
- Queue Management
- General Travel information
- Queue around curve warning
- Truck turn over location warnings
- EMS signal pre-emption and advanced warning to drivers

Through deployment of roadside units whether permanent or temporary, information sent to PCMS would be broadcast to the vehicles that had the receiving equipment within them.

The State has an existing Connected & Automated Vehicle (CAV) Vision and CAV Strategic Action (completed 12/2017) plan that should be referenced, and any deployments aligned with the strategies approved.

While this technology is still perceived as a longer-term solution, there are some existing applications that could be done relating to a 'connected' vehicle. Some states have developed smart phone apps, such as 511, that will provide the drivers with important information along their trip. By utilizing geofencing along the roadway you are able to create a virtual work zone within the app. Then when the vehicle passes into the geofence it will be sent a notice. This notice can be for example what is being shown on the PCMS or imperative traveler information such as a curve warning.

The recommendation is to continue following this technology as it adapts and improves in the future years.

Incident Management and Response Times

Having highly effective Incident Management can mean the difference in traffic management. These efficiencies rely heavily on well-established processes and policies. Washington County agencies, MDOT SHA/CHART, and the MSP have been leaders in coordinating for incident management. Below are some of the improvements that have been implemented.

- Western Region CHART personnel attends the Washington County Transportation Advisory Committee monthly meetings. These meeting are attended by representatives from MDOT SHA District 6, most of the police departments in the county, Washington County Highway Department, Hagerstown Public Works, Washington County Board of Education, and a representative from the Washington County Commissioners.
- Western Region Traffic Operations (WRTO) has been in operation since the spring of 2017. WRTO begins the Sunday prior to Memorial Day weekend and ends the last Sunday of September. The goal of WRTO is to supplement the normally assigned weekend shifts and provide overlapping coverage to mitigate any traffic issues.
- The CHART emergency traffic patrols (ETP) actively patrols when WRTO is not in operation.
- Extra emergency response technician (ERT) is assigned to Washington County (Zone 3) in Washington County on a Friday nights during peak rush hour time periods. Normal patrol routes are on I-70 between MD 17 and MD 63 When additional patrols are in place, units will range out west further even to I-68 and the Sidling Hill Cut.
- The advent of the Maryland First Radio System (700 mhz) allowed more direct communications between Maryland State Police Hagerstown Barrack, CHART's Hagerstown Shop and the traffic operations center (TOC-7).
- Drone technology has been deployed by MSP at least once to map accident locations.
- TOC-7 communicates routinely with PennDOT and WVDOT whenever extensive road closures occur on I-81.
- Heavy duty tow trucks with radios for direct communication with the TOC as well as on board GPS units are deployed whenever a significant winter weather event impacts Washington County or Western Region.
- Traffic Incident Management (TIM) Training is given to emergency personnel.

Some additional ways to expand upon the current process improvements being made by the local state officials include installation of Mobile CCTV on the maintenance and response vehicles in the region. This will provide improved situational awareness for the traffic management center (TMC) operators. Allowing more accurate understanding of the incident and deploying the correct EMS to the scene. Often these mobile CCTV have the capability to be controlled remotely by the TMC to take the responsibility off of the first responder.

Drones have started to become more than just a hobbyist's toy. These devices can greatly improve situational awareness. They provide the birds eye view of the entire incident scene. They have also been looked at to assist in accident investigation and reconstruction by police.

It is recommended to continue to work on process and communication improvements between the operators, local EMS and maintenance staff.

Strategy Toolbox Summary and Action Plan

The strategies presented in the previous sections serve as a resource to achieve TSMO goals for the I-81 and I-70 corridors in Washington County. To support future evaluation and advancement of these strategies, each strategy has been assigned an estimated cost and associated into short term and long-term categories to aid in prioritization as summarized in **Figure 51** and **Figure 52**. These costs include construction and design costs.

The advancement of these and other TSMO strategies will require further review and assessment by MDOT SHA engineering staff to identify whether strategies are consistent with Department practices, viable based on estimated costs, and to further assess strategy prioritization. The HEPMPO will continue to integrate these needs and strategy concepts into their MPO planning processes and public outreach efforts.

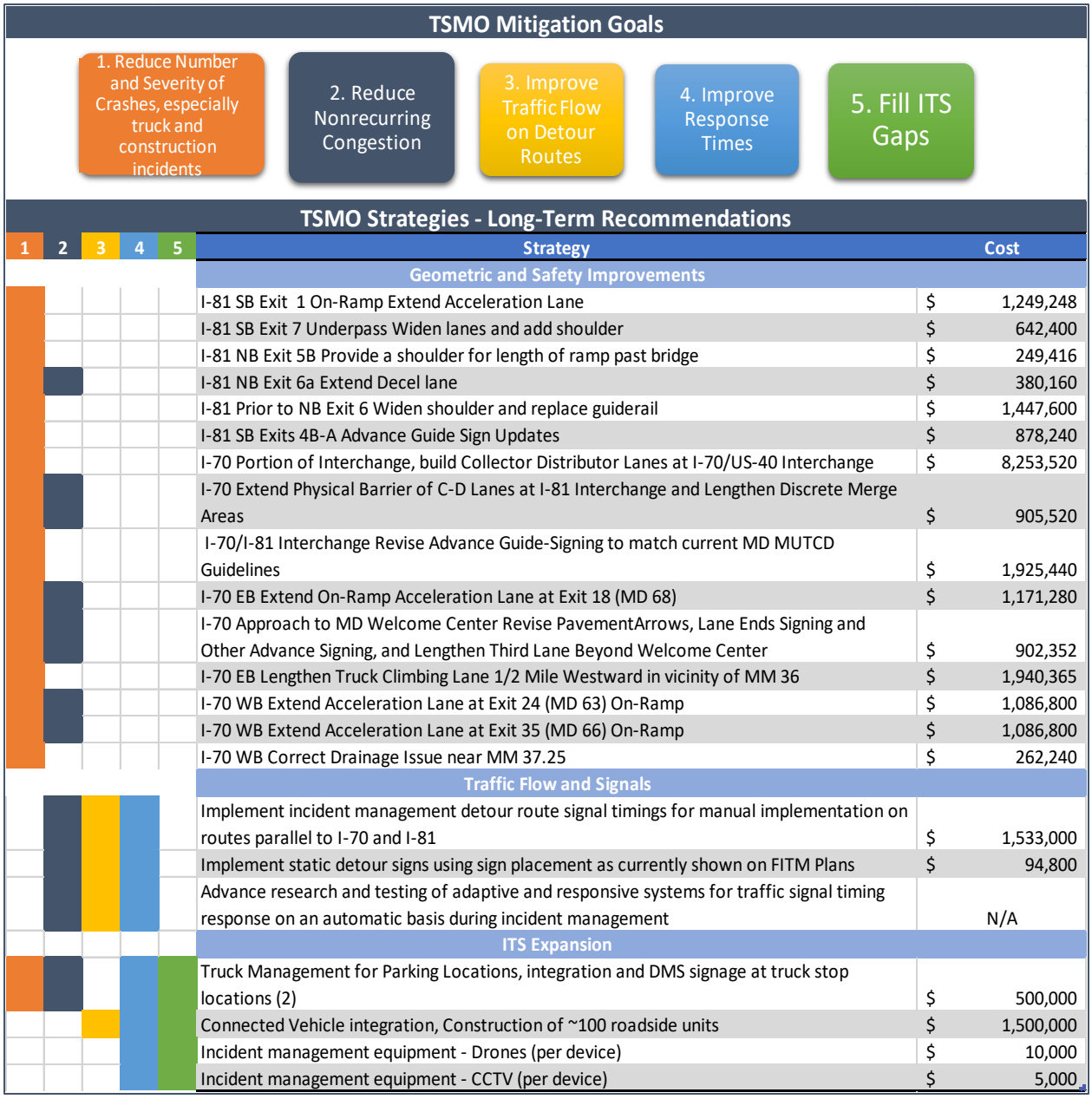
Ultimately, the implementation of some of these strategies will require funding sources. Both MDOT SHA and HEPMPO can continue to evaluate appropriate resources that may be available within the TIP and LRTP processes. The TSMO concepts should also be included within the project scoping checklists. As such, the TSMO strategies included within this report may be incorporated into larger construction projects occurring in the areas recommended within this plan.

New technology including connected and autonomous vehicles have been discussed within this report; however, many unknowns exist regarding the timing and benefits that may be achieved from these technology advancements. As this plan and strategies are revisited, the issue of regional planning for connected and autonomous vehicles should be re-examined in context of the recommended capacity, geometric, signal and ITS strategies.

TSMO Strategies - Short-Term Recommendations

1	2	3	4	5	Strategy	Cost
					Geometric and Safety Improvements	
■					I-81 SB Exit 1 Off-Ramp Upgrade Exit Signing	$ 39,072
■					I-81 SB Exit 10A &9 Replace Service Signs	$ 130,240
■	■				I-81 NB & SB Exits10 A & B SHA Interchange Improvements	Use SHA Estimate
■	■				I-81 Exit 9 SHA Improvements	Use SHA Estimate
■					I-81 SB Exit 5 Service Signs and Gore Merge Sign	$ 183,920
■					I-81 NB Exit 5A Off Ramp Restripe and add signs	$ 31,680
■					US 40 EB On Ramp to I-81 SB (add gore merge sign and nuetral area gore markings)	$ 26,752
■					US 40 EB On-ramp to I-81 NB- add chevron and speed advisory signs, trim vegetation	$ 45,408
■					I-81 NB Exit 5B On-Ramp Restripe on Briodge and add delineators	$ 222,000
■	■				I-70 Revise Exit 29 (MD 65) Interchange Configuration (SHA RECONFIGURATION)	Use SHA Estimate
■	■				I-70 Reduce Speed Limit Around Hagerstown Exits	$ 12,320
■					I-70 EB Install High Friction Surface Treatment (HFST) between MP 21 and MP 26	$ 1,813,370
■					I-70 Improve Delineation and Retro-reflectivity of pavement Markings MP 33-34 EB	$ 110,880
					Traffic Flow and Signals	
	■	■	■		Include traffic signal technician in the incident management timeline for detour route implementation	N/A
					ITS Expansion	
	■		■	■	Install Digital Message Signs (DMS), I-81 NB at MP 1.5 and I-70 WB 1 mile prior to Hagerstown Sign	$ 1,102,296
	■		■	■	Install Closed Circuit TVs on I-70 EB at Exit 32, US 40 and Exit 28, MD 632	$ 356,616
	■		■	■	Install Pre-Entry Permanent DMS Signs at I-70, Exit 32 US 40 NB & SB	$ 456,456
	■		■	■	Install Pre-Entry Permanent DMS Signs at I-70, Exit 29 MD 65 NB & Combo Static Sign SB	$ 460,356
	■		■	■	Install Pre-Entry Permanent DMS Signs at I-70, Exit 24 MD 63 NB & Combo Static Sign SB	$ 460,356
	■		■	■	Install Pre-Entry Permanent DMS Signs at I-81, Exit 2 US 11 NB & SB	$ 456,456
	■		■	■	Install Pre-Entry Permanent DMS Signs at I-81, Exit 6 US 40 EB & WB	$ 456,456
■	■				Incorporate SMART Work Zones with ATMS, PCMS, Queue Management, Portable CCTV and Speed Limit Signs	$ 1,250,000
	■	■	■		Traveler Information Improvements with Agreements with WAZE and Google	N/A

Figure 51: Short-Term TSMO Strategy Toolbox and Costs



TSMO Strategies - Long-Term Recommendations

1	2	3	4	5	Strategy	Cost
					Geometric and Safety Improvements	
■					I-81 SB Exit 1 On-Ramp Extend Acceleration Lane	$ 1,249,248
■					I-81 SB Exit 7 Underpass Widen lanes and add shoulder	$ 642,400
■					I-81 NB Exit 5B Provide a shoulder for length of ramp past bridge	$ 249,416
■	■				I-81 NB Exit 6a Extend Decel lane	$ 380,160
■					I-81 Prior to NB Exit 6 Widen shoulder and replace guiderail	$ 1,447,600
■					I-81 SB Exits 4B-A Advance Guide Sign Updates	$ 878,240
■					I-70 Portion of Interchange, build Collector Distributor Lanes at I-70/US-40 Interchange	$ 8,253,520
■	■				I-70 Extend Physical Barrier of C-D Lanes at I-81 Interchange and Lengthen Discrete Merge Areas	$ 905,520
■					I-70/I-81 Interchange Revise Advance Guide-Signing to match current MD MUTCD Guidelines	$ 1,925,440
■	■				I-70 EB Extend On-Ramp Acceleration Lane at Exit 18 (MD 68)	$ 1,171,280
■	■				I-70 Approach to MD Welcome Center Revise PavementArrows, Lane Ends Signing and Other Advance Signing, and Lengthen Third Lane Beyond Welcome Center	$ 902,352
■					I-70 EB Lengthen Truck Climbing Lane 1/2 Mile Westward in vicinity of MM 36	$ 1,940,365
■	■				I-70 WB Extend Acceleration Lane at Exit 24 (MD 63) On-Ramp	$ 1,086,800
■	■				I-70 WB Extend Acceleration Lane at Exit 35 (MD 66) On-Ramp	$ 1,086,800
■					I-70 WB Correct Drainage Issue near MM 37.25	$ 262,240
					Traffic Flow and Signals	
	■	■	■		Implement incident management detour route signal timings for manual implementation on routes parallel to I-70 and I-81	$ 1,533,000
	■	■	■		Implement static detour signs using sign placement as currently shown on FITM Plans	$ 94,800
	■	■	■		Advance research and testing of adaptive and responsive systems for traffic signal timing response on an automatic basis during incident management	N/A
					ITS Expansion	
■	■		■	■	Truck Management for Parking Locations, integration and DMS signage at truck stop locations (2)	$ 500,000
		■	■	■	Connected Vehicle integration, Construction of ~100 roadside units	$ 1,500,000
			■	■	Incident management equipment - Drones (per device)	$ 10,000
			■	■	Incident management equipment - CCTV (per device)	$ 5,000

Figure 52: Long-Term TSMO Strategy Toolbox and Costs

Appendix A
Mitigation Strategies for I-81

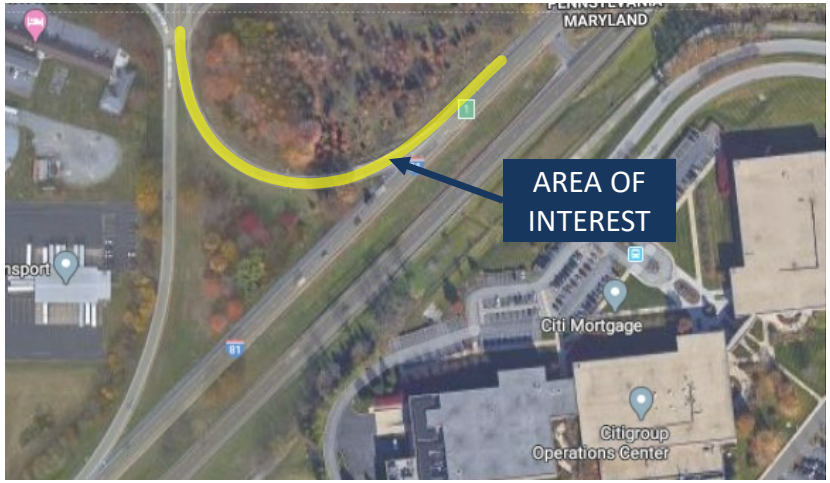
I-81 Mitigations and Cost Estimates

Mitigation	Typical Unit Price	Typical Unit of Measure	SB Exit 1 Off-Ramp Upgrade Exit Signing		SB Exit 1 On-Ramp Extend Acceleration Lane		SB EXIT 10A &9 Replace Service Signs		SHA NB &SB INTERCHANGE IMPROVEMENTS EXITS10 A & B		SHA EXIT 9 IMPROVEMENTS		SB EXIT 7 Underpass Widen lanes and add shoulder		SB EXIT 5 Service Signs and Gore Merge Sign		NB EXIT 5A Off Ramp Restripe and add signs	
ITEM/TYPE OF WORK			QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST
Add Pavement Markings	$1	LF		$0	$3,300	$3,300		$0		$0		$0	$6,000	$6,000		$0	$2,000	$2,000
Add Delineators	$35	EA		$0		$0		$0		$0		$0		$0		$0		$0
Add WARNING TYPE SIGNS (Chevrons, Curve Ahead, Advisory Exit Speed, etc)	$500	EA	$8	$4,000	$5	$2,500		$0		$0		$0		$0	$1	$500	$4	$2,000
Add or Replace Ground Mounted Guide Sign or Services Signs	$30,000	EA		$0	$1	$30,000	$2	$60,000		$0		$0		$0	$3	$90,000		$0
Install New Overhead Guide Sign Structure	$140,000	EA		$0		$0		$0		$0		$0		$0		$0		$0
Install New Overhead Guide Sign Cantilever Structure	$90,000	EA		$0		$0		$0		$0		$0		$0		$0		$0
Install New Overhead Guide Sign	$15,000	EA		$0		$0		$0		$0		$0		$0		$0		$0
Trim Vegetation	$2,100	100 FT	$2	$4,200		$0		$0		$0		$0		$0		$0		$0
Add 12' Widening (Shoulder or Lane)	$200,000	1000 FT		$0	$3	$660,000		$0		$0		$0	$2	$300,000		$0		$0
Guiderail	$30	LF		$0		$0		$0		$0		$0	$1,500	$45,000		$0		$0
Impact Attenuating Device	$2,000	EA		$0		$0		$0		$0		$0		$0		$0		$0
PROJECT ITEMS																		
Equipment Package	$2,000	LS		$2,000		$2,000		$2,000						$2,000		$2,000		$2,000
Construction Surveying	$8,000	LS		$8,000		$8,000		$8,000						$8,000		$8,000		$8,000
CPM Schedule	$2,000	LS		$2,000		$2,000		$2,000						$2,000		$2,000		$2,000
Unforeseen Water Pollution Control	$2,000	PDA		$2,000		$2,000		$2,000						$2,000		$2,000		$2,000
PERCENTAGE ITEMS																		
Mobilization (4%)				$888		$28,392		$2,960		$0		$0		$14,600		$4,180		$720
Maintenance and Protection of Traffic (10%)				$2,220		$70,980		$7,400		$0		$0		$36,500		$10,450		$1,800
Contingencies (25%)				$5,550		$177,450		$18,500		$0		$0		$91,250		$26,125		$4,500
Inspection (12%)				$2,664		$85,176		$8,880		$0		$0		$43,800		$12,540		$2,160
Engineering (25%)				$5,550		$177,450		$18,500		$0		$0		$91,250		$26,125		$4,500
TOTAL				$39,072		$1,249,248		$130,240	$2,000,000		$4,000,000			$642,400		$183,920		$31,680
									SHA Estimate		SHA Estimate							

I-81 Mitigations and Cost Estimates

Mitigation	Typical Unit Price	Typical Unit of Measure	NB EXIT 5B On-Ramp Restripe on Briodge, add delineators and provide a shoulder for length of ramp past bridge		US EB On Ramp to I-81 SB (add gore merge sign and nuetral area gore markings		US 40 EB On-ramp to I-81 NB- add chevron and speed advisory signs, trim vegetation		NB Exit 6a Extend Decel lane		Prior to NB EXIT 6 Widen shoulder and replace guiderail		SB Exits 4B-A advance Guide Sign Updates	
ITEM/TYPE OF WORK			QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST
Add Pavement Markings	$1	LF	$2,000	$2,000	$700	$700		$0	$2,000	$2,000	$3,500	$3,500		$0
Add Delineators	$35	EA	$10	$350		$0		$0		$0		$0		$0
Add WARNING TYPE SIGNS (Chevrons, Curve Ahead, Advisory Exit Speed, etc)	$500	EA	$1	$500	$1	$500	$11	$5,500		$0		$0		$0
Add or Replace Ground Mounted Guide Sign or Services Signs	$30,000	EA		$0		$0		$0		$0		$0	$3	$90,000
Install New Overhead Guide Sign Structure	$140,000	EA		$0		$0		$0		$0		$0	$1	$140,000
Install New Overhead Guide Sign Cantilever Structure	$90,000	EA		$0		$0		$0		$0		$0	$2	$180,000
Install New Overhead Guide Sign	$15,000	EA		$0		$0		$0		$0		$0	$5	$75,000
Trim Vegetation	$2,100	100 FT	$10	$21,000		$0	$3	$6,300		$0		$0		$0
Add 12' Widening (Shoulder or Lane)	$200,000	1000 FT	$1	$200,000		$0		$0	$1	$200,000	$4	$700,000		$0
Guiderail	$30	LF	$1,000	$30,000		$0		$0		$0	$3,500	$105,000		$0
Impact Attenuating Device	$2,000	EA		$0		$0		$0		$0		$0		$0
PROJECT ITEMS														
Equipment Package	$2,000	LS		$2,000		$2,000		$2,000		$2,000		$2,000		$2,000
Construction Surveying	$8,000	LS		$8,000		$8,000		$8,000		$8,000		$8,000		$8,000
CPM Schedule	$2,000	LS		$2,000		$2,000		$2,000		$2,000		$2,000		$2,000
Unforeseen Water Pollution Control	$2,000	PDA		$2,000		$2,000		$2,000		$2,000		$2,000		$2,000
PERCENTAGE ITEMS														
Mobilization (4%)				$10,714		$608		$1,032		$8,640		$32,900		$19,960
Maintenance and Protection of Traffic (10%)				$26,785		$1,520		$2,580		$21,600		$82,250		$49,900
Contingencies (25%)				$66,963		$3,800		$6,450		$54,000		$205,625		$124,750
Inspection (12%)				$32,142		$1,824		$3,096		$25,920		$98,700		$59,880
Engineering (25%)				$66,963		$3,800		$6,450		$54,000		$205,625		$124,750
TOTAL				$471,416		$26,752		$45,408		$380,160		$1,447,600		$878,240

SB EXIT 1 OFF RAMP (MASON DIXON RD)



SB EXIT 1 ON RAMP (MASON DIXON RD)

SB EXIT 10A & 9 (SHOWALTER RD & MAUGANS AVE)

GIVEN THAT THE FIRST EXIT ENCOUNTERED IN MD-SB IS NUMBERED EXIT 1, THEN NEXT SIGNING IS TRAIL BLAZER WITH EXIT 9 ON TOP – SENDS A MESSAGE TO TRAVELERS TO THINK:

A) EXIT NUMBERS ARE INCREASING AND
B) NEXT EXIT WILL BE EXIT 9 – PRESUMABLY 8 MILES AWAY

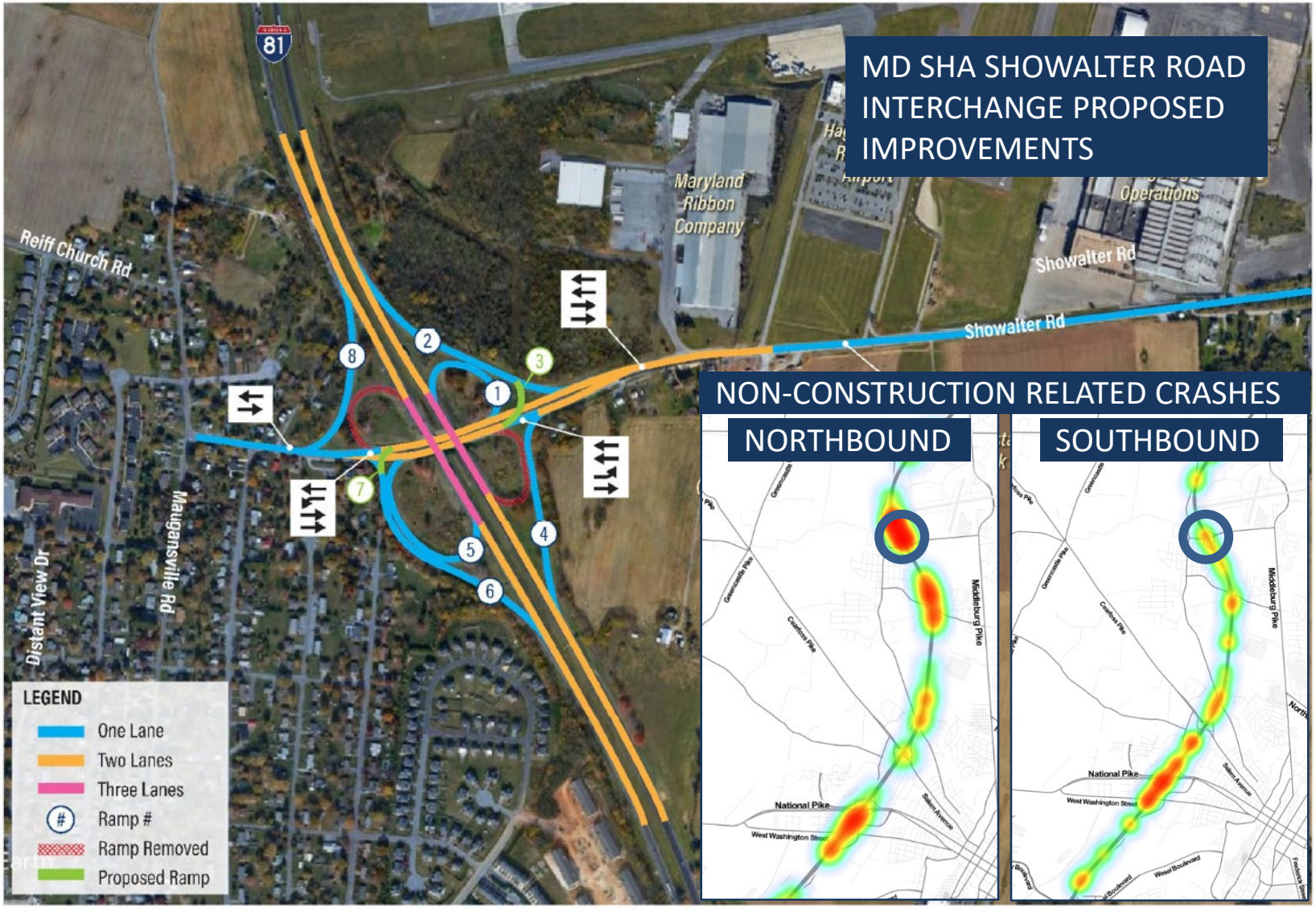
THIS MAY LEAD TO UNEXPECTEDLY ENCOUNTERING EXITS 10B-A IN LESS THAN 1 MILE AND UNEXPECTED LANE CHANGING.

= REPORTED CRASH

SB EXIT 10 ADVANCED SIGNAGE (SHOWALTER RD)

NB & SB EXIT 10A-10B (SHOWALTER RD)

I-81 AT SHOWALTER ROAD | FIGURE 6: PROPOSED GEOMETRY



SB EXIT 9 OFF RAMP (MAUGANS AVE)

MULTIPLE SKID-MARKS INDICATES A RECURRING PROBLEM

SB NON-CONSTRUCTION RELATED CRASHES

PROPOSED DITCH/ POTENTIAL SWM ESD

EXISTING SIGNS AND LIGHT POLE TO BE RELOCATED

RELOCATE UTILITY POLE, HANDBOX, AND ELECTRICAL BOX

MODIFY EXISTING TRAFFIC SIGNAL TO RELOCATE/REPLACE IMPACTED MAST ARM POLE FOR PROPOSED DOUBLE LEFT

TO MAUGANSVILLE

I-81 (MARYLAND VE

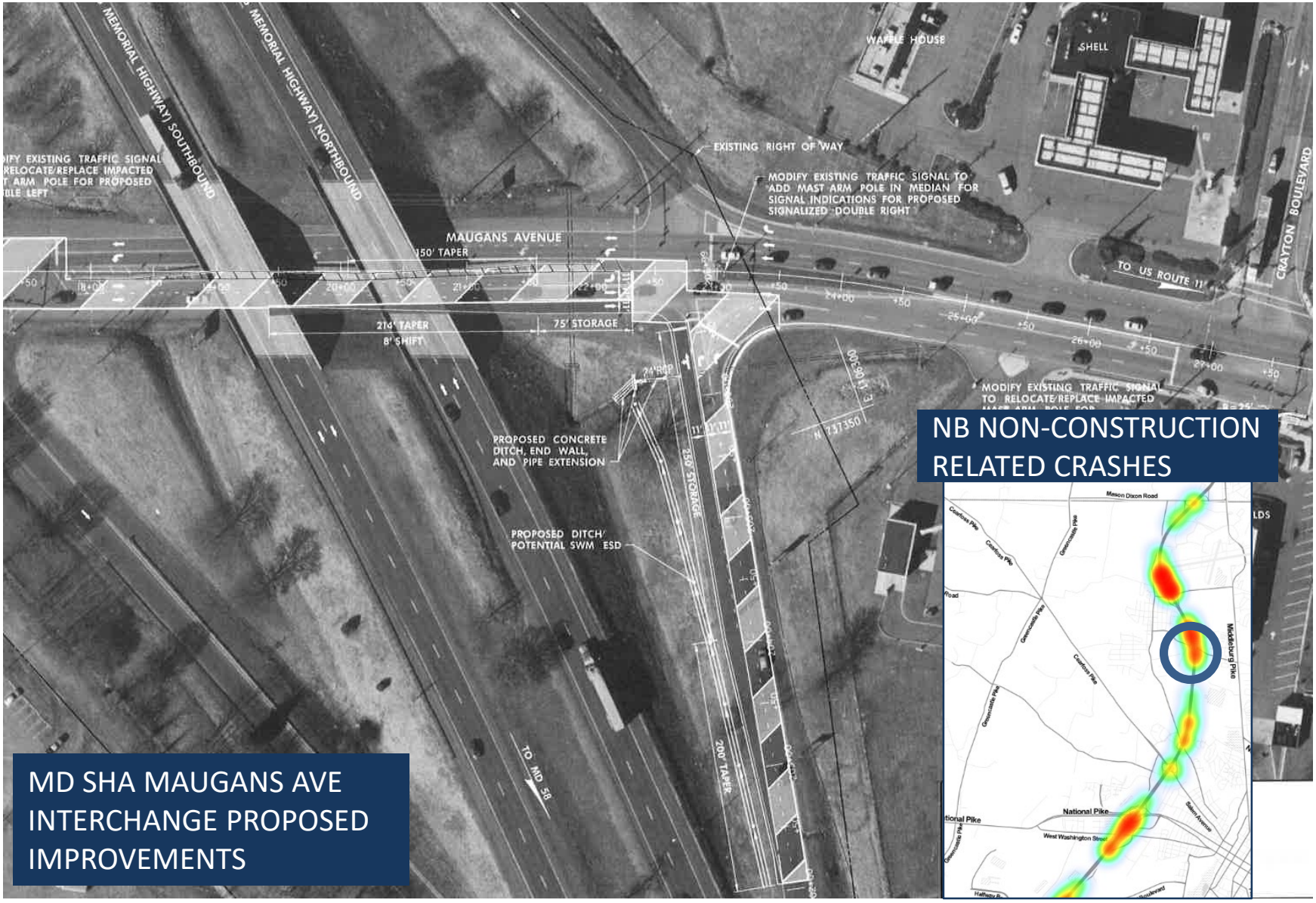
150' TAPER

180' STORAGE

SOUTHBOUND

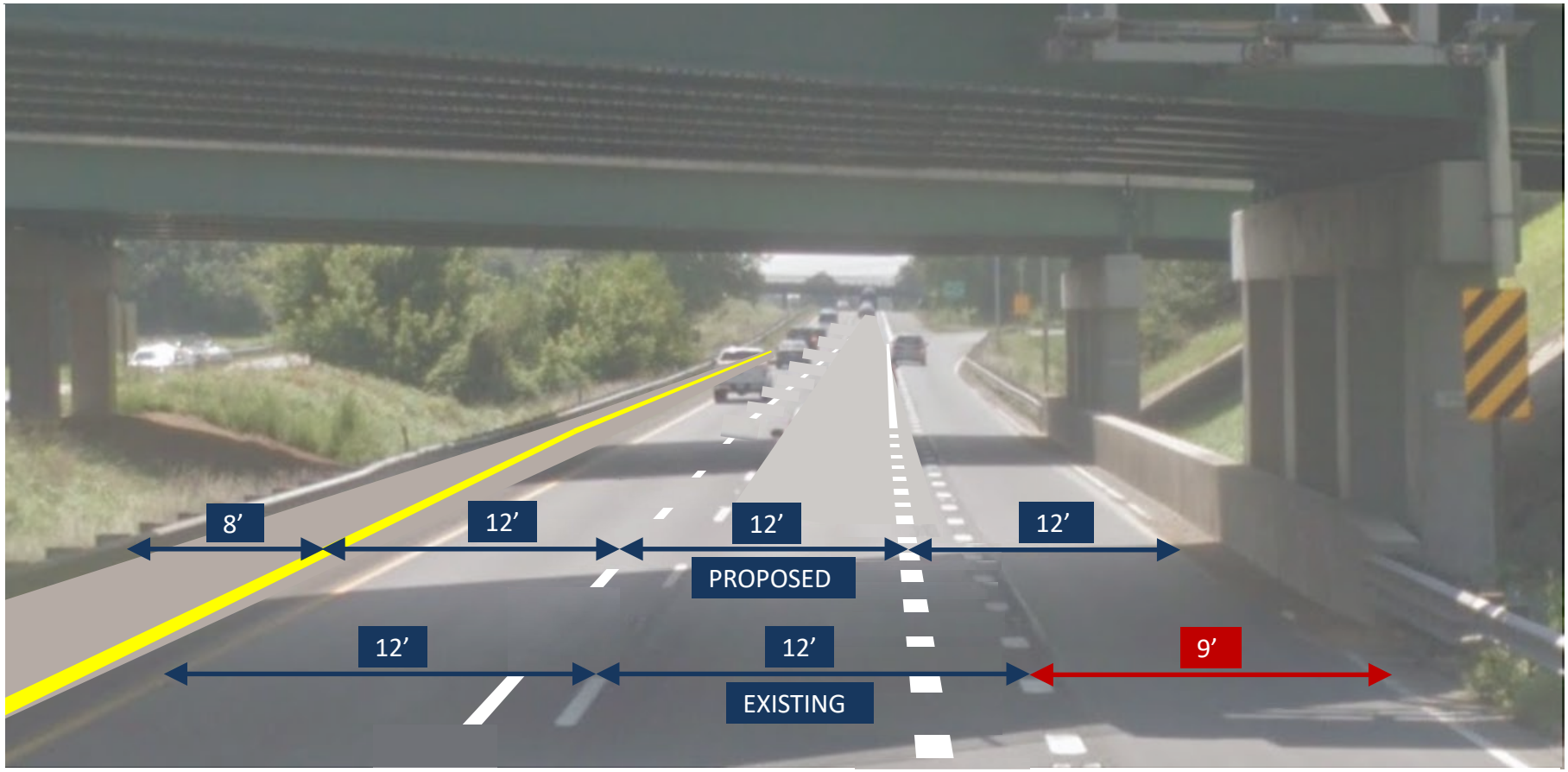
MD SHA MAUGANS AVE INTERCHANGE PROPOSED IMPROVEMENTS

NB EXIT 9 OFF RAMP (MAUGANS AVE)



MD SHA MAUGANS AVE INTERCHANGE PROPOSED IMPROVEMENTS

SB EXIT 7 UNDERPASS (SALEM AVE)



9’ DECELERATION LANE AND LACK OF SHOULDERS LEAVES NO RECOVERY AREA OR SPACE FOR EVASIVE ACTION, WHICH IS MORE FREQUENTLY NEEDED IN SPEED CHANGE LANE AREAS. RECOMMEND WIDENING LANE TO 12’ AND PROVIDING AN 8’ LEFT SHOULDER.

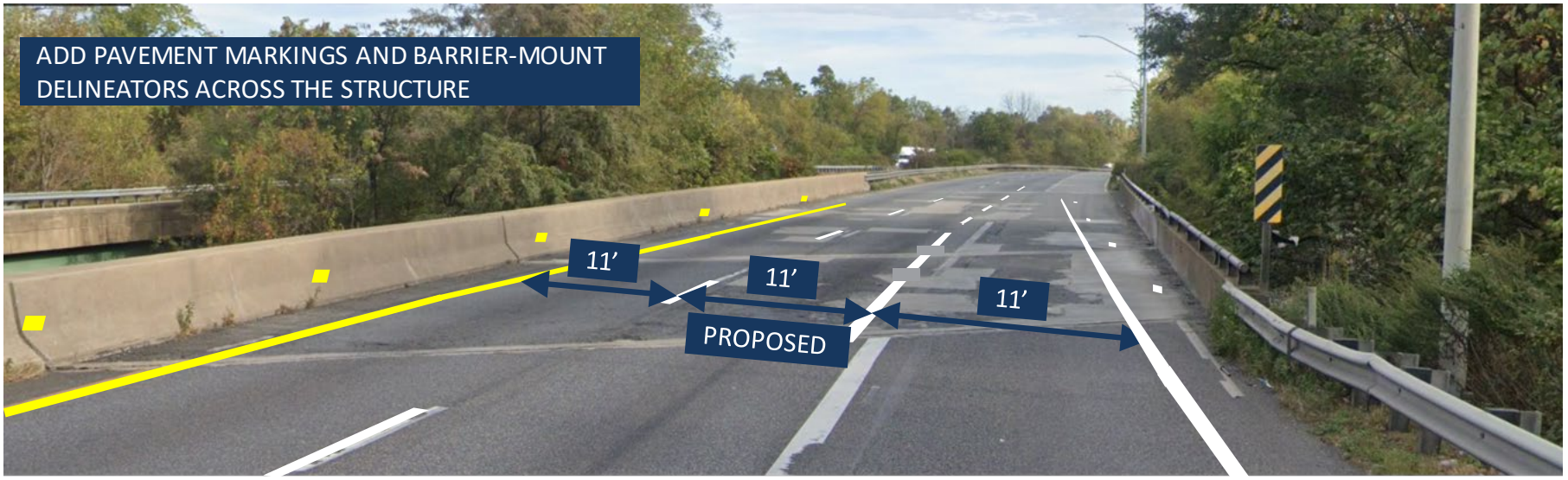
SB EXIT 5 SPECIFIC SERVICE SIGNS (HALFWAY BLVD)

EXIT 5B IS ENCOUNTERED FIRST, THEREFORE SHOULD BE LISTED FIRST (ON TOP) OF SPECIFIC SERVICE SIGNS PER MUTCD.

LODGING SERVICE SIGNS ARE TO PRECEDE FOOD SERVICE SIGNS PER MUTCD.

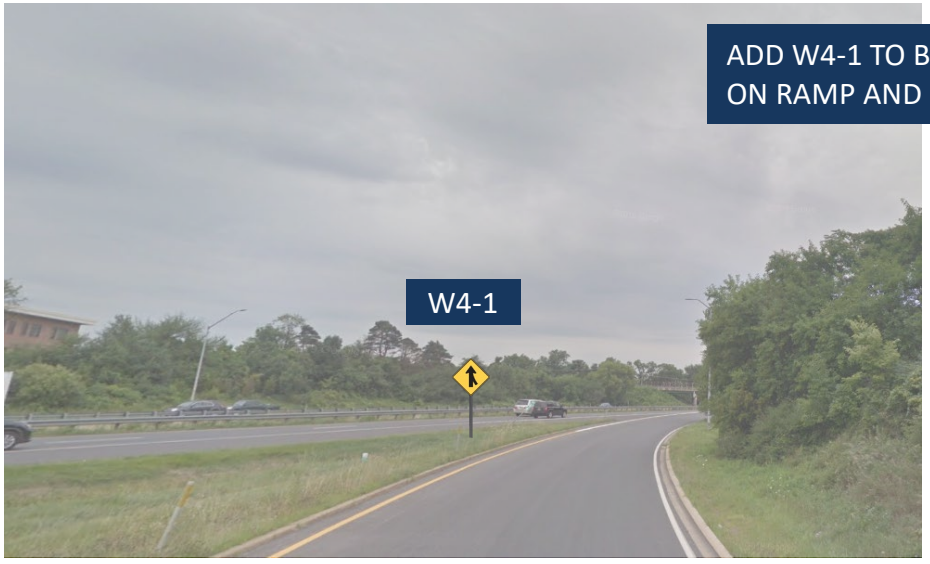
NB EXIT 5A OFF RAMP (HALFWAY BLVD)

NB EXIT 5B ON RAMP (HALFWAY BLVD)



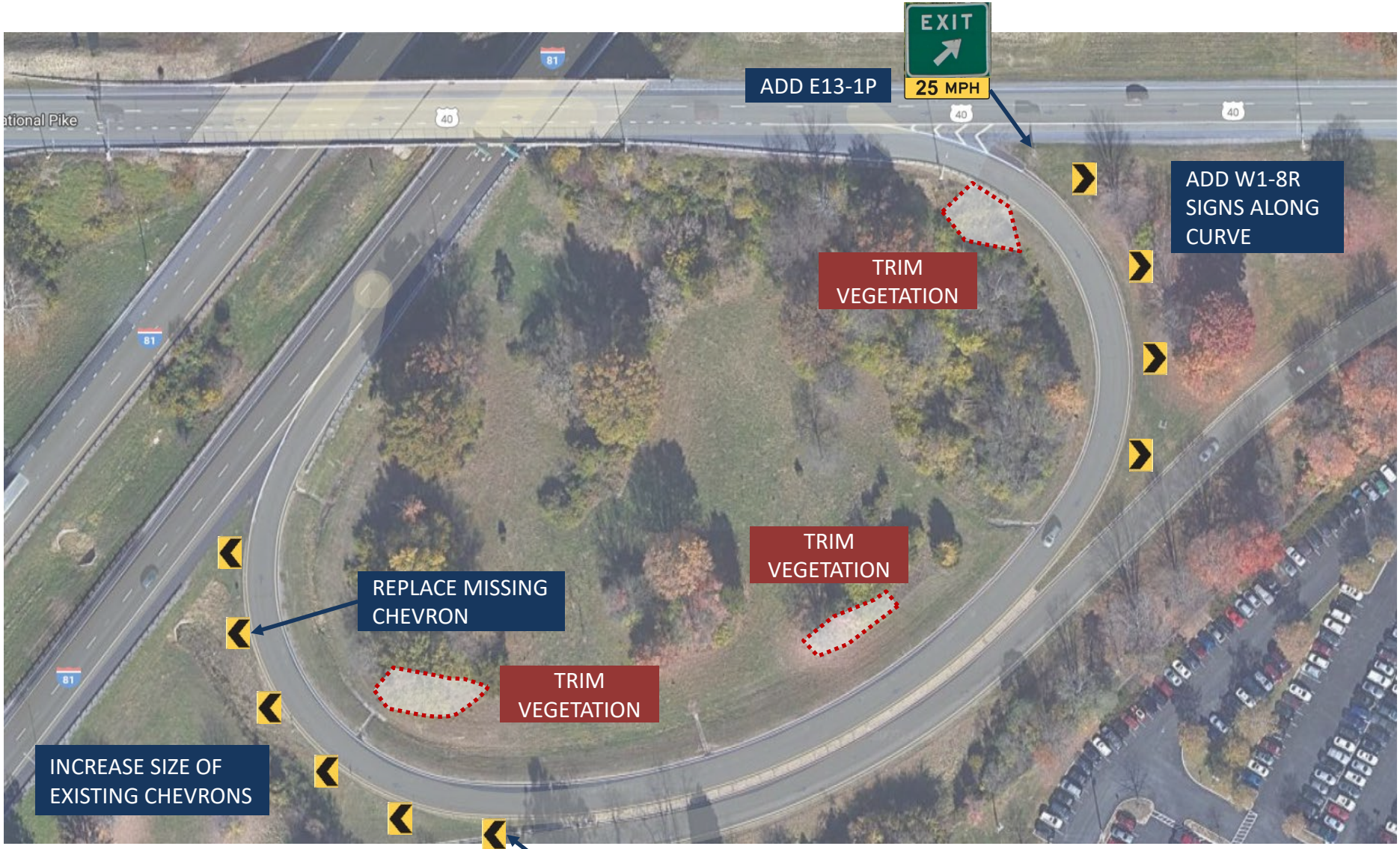
US 40 EB ON RAMP TO I-81 SB

ADD W4-1 TO BE VISIBLE FROM ON RAMP AND MAINLINE

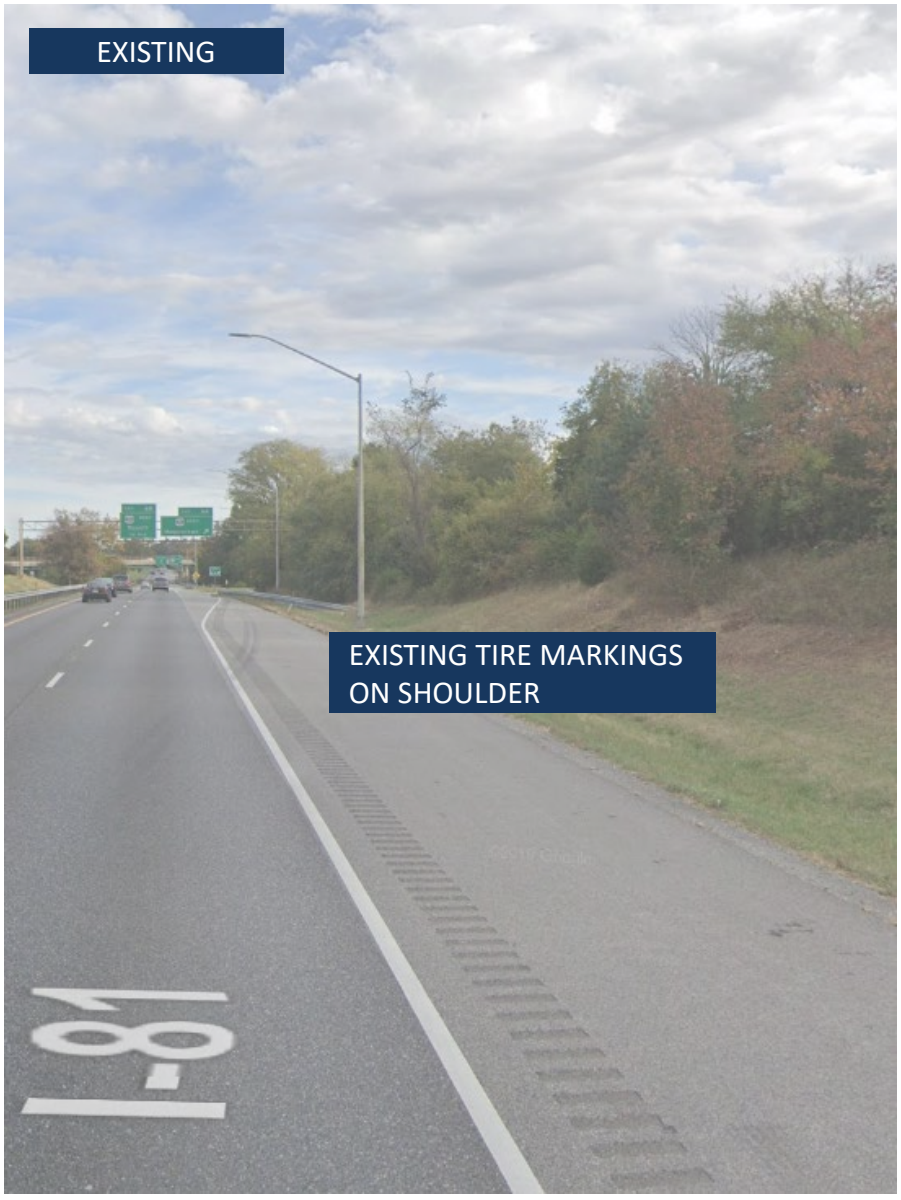


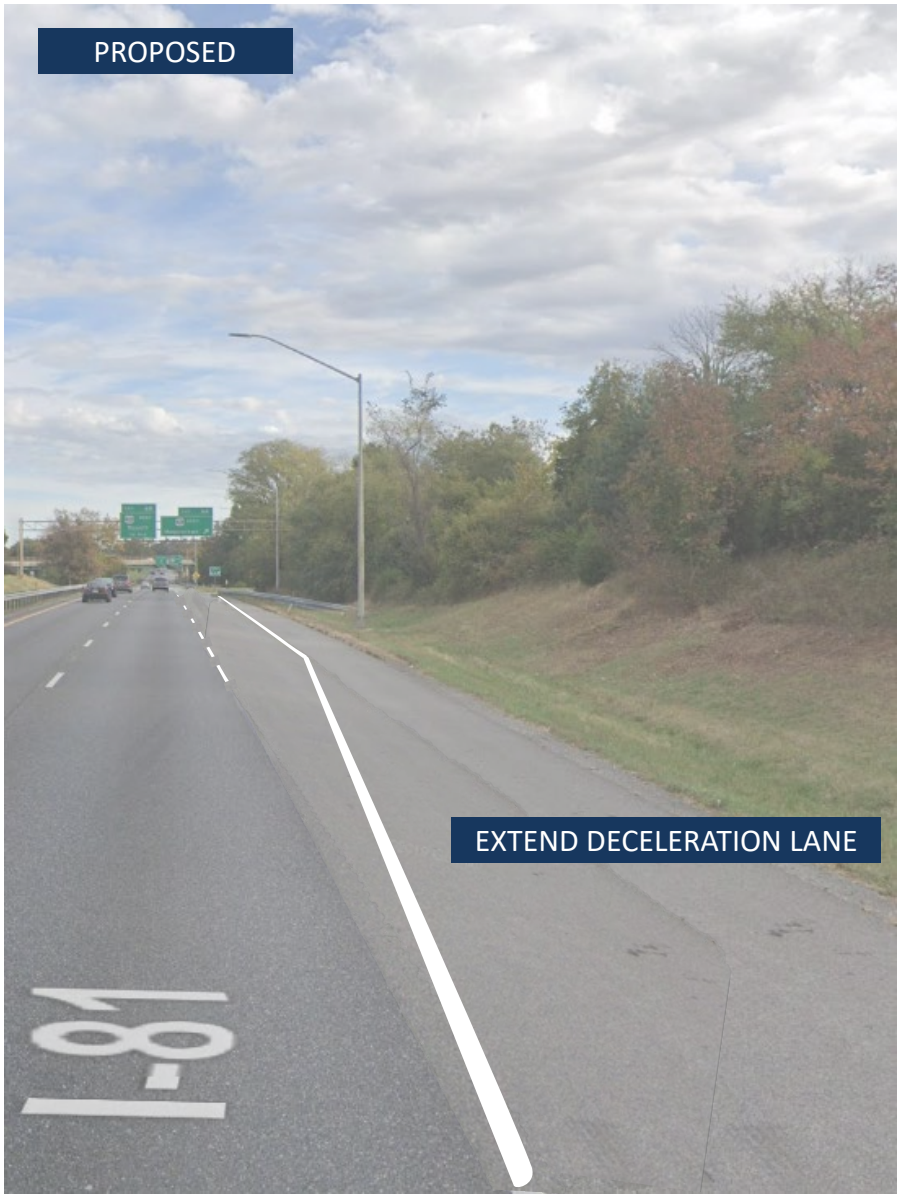
US 40 EB ON RAMP TO I-81 NB

US 40 EB ON RAMP TO I-81 NB



NB EXIT 6A (US 40 EAST)



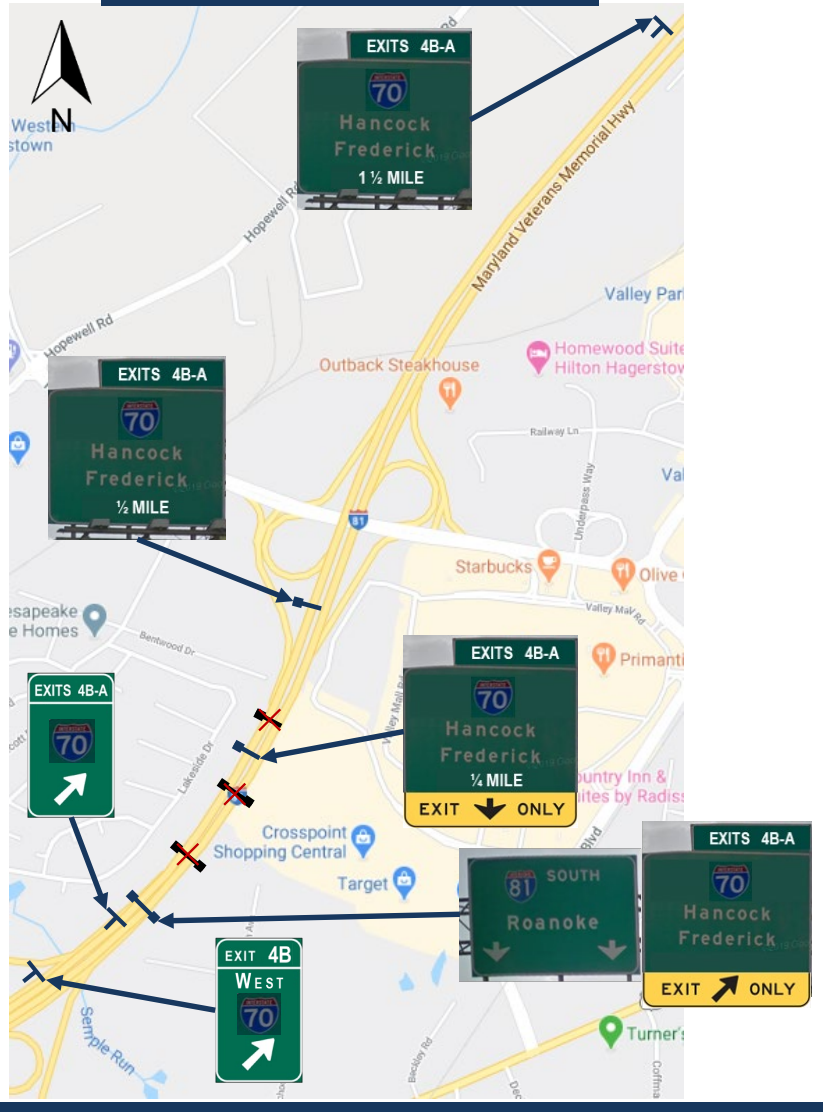


PRIOR TO NB EXIT 6 (US 40 EAST)

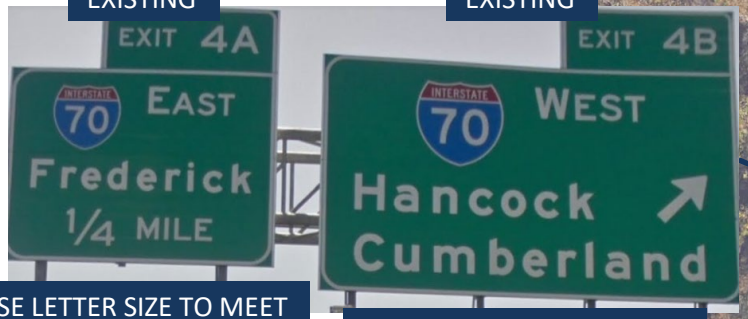
SB EXIT 4B-A GUIDE SIGNS (US 70)

EXISTING ADVANCE GUIDE SIGNS

PROPOSED ADVANCE GUIDE SIGNS



SB EXIT 4B OFF RAMP (US 70)

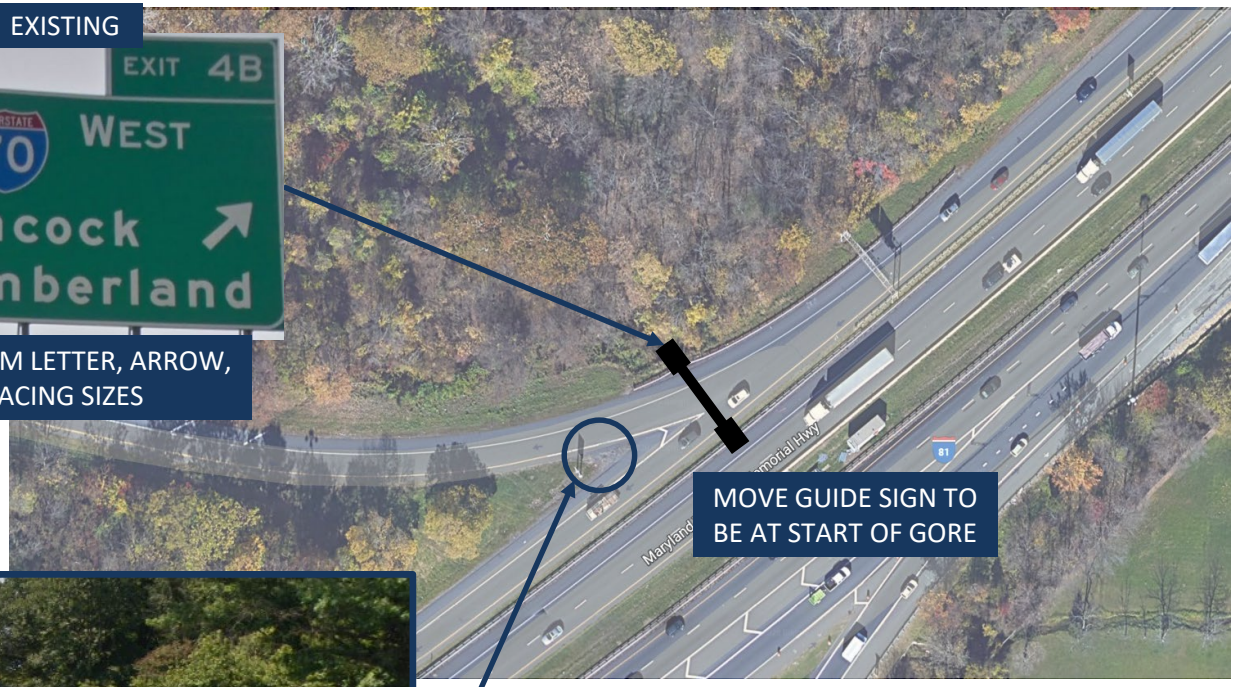


EXISTING

EXISTING

INCREASE LETTER SIZE TO MEET MUTCD REQUIREMENTS

CONFIRM LETTER, ARROW, AND SPACING SIZES



MOVE GUIDE SIGN TO BE AT START OF GORE

ADD E1-5P

EXISTING REFLECTORS ON SUPPORTS

EXISTING TIRE TRACKS THROUGH GORE

INDICATED DRIVER CONFUSION/MISSING EXIT
- REFLECTORS ON SUPPORTS INDICATES FREQUENT KNOCK DOWNS'
- TIRE TRACKS THROUGH GRASS AND GRAVEL

DEDUCE ADVANCE SIGNING INADEQUATE – REVISE TO MEET CURRENT MUTCD STANDARDS IN EFFORT TO PROVIDE MORE CLARITY TO DRIVERS

Appendix B
Mitigation Strategies for I-70

I-70 Mitigations and Cost Estimates

Mitigation	Typical Unit Price	Typical Unit of Measure	Build Collector Distributor Lanes at I-70/US-40 Interchange on I-70 portions of Interchange		Revise Exit 29 (MD 65) Interchange Configuration (SHA PROPOSED RECONFIGURATION)		Extend Physical Barrier of C-D Lanes at I-81 Interchange and Lengthen Discrete Merge Areas		Reduce Speed Limit Around Hagerstown Exits		Revise Advance Guide-Signing for I-70/I-81 Interchange to match current MD MUTCD Guidelines		Extend On-Ramp Acceleration Lane to EB I-70 at Exit 18 (MD 68)		Install HFST between MP 21 and MP 26 EB I-70	
ITEM/TYPE OF WORK			QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST
Add Pavement Markings	$1	LF	60,000	$60,000		$0	10,000	$10,000		$0		$0	6,000	$6,000		$0
Add Pavement Marking Legends	$500	EA		$0		$0		$0		$0		$0		$0		$0
Add Raised Pavement Markers	$30	EA		$0		$0		$0		$0		$0		$0		$0
Add Delineators	$35	EA		$0		$0		$0		$0		$0		$0		$0
Add WARNING TYPE SIGNS (Chevrons, Curve Ahead, Advisory Exit Speed, etc)	$500	EA	8	$4,000		$0	6	$3,000	14	$7,000	8	$4,000	1	$500		$0
Add or Replace Ground Mounted Guide Sign or Services Signs	$30,000	EA	6	$180,000		$0		$0		$0	6	$180,000		$0		$0
Install New Overhead Guide Sign Structure	$140,000	EA	2	$280,000		$0		$0		$0	2	$280,000		$0		$0
Install New Overhead Guide Sign Cantilever Structure	$90,000	EA	4	$360,000		$0		$0		$0	4	$360,000		$0		$0
Install New Overhead Guide Sign	$15,000	EA	10	$150,000		$0		$0		$0	18	$270,000		$0		$0
Trim Vegetation	$2,100	100 FT		$0		$0		$0		$0		$0		$0		$0
Add 12' Widening (Shoulder or Lane)	$200,000	1000 FT	13	$2,640,000		$0	2	$300,000		$0		$0	3	$600,000		$0
Guiderail	$30	LF		$0		$0		$0		$0		$0	1,500	$45,000		$0
Impact Attenuating Device	$2,000	EA	2	$4,000		$0		$0		$0		$0		$0		$0
Median Barrier	$75	LF	13,300	$997,500		$0	2,500	$187,500		$0		$0		$0		$0
High Friction Surface Treatment	$18	SY		$0		$0		$0		$0		$0		$0	70,500	$1,269,000
Interchange Reconstruction/Reconfiguration	$35,000,000	EA		$0		$0		$0		$0		$0		$0		$0
Drainage earthwork etc	$50	SY		$0		$0		$0		$0				$0		$0
PROJECT ITEMS																
Equipment Package	$2,000	LS		$2,000		$2,000		$2,000						$2,000		$2,000
Construction Surveying	$8,000	LS		$8,000		$8,000		$8,000						$8,000		$8,000
CPM Schedule	$2,000	LS		$2,000		$2,000		$2,000						$2,000		$2,000
Unforeseen Water Pollution Control	$2,000	PDA		$2,000		$2,000		$2,000						$2,000		$2,000
PERCENTAGE ITEMS																
Mobilization (4%)				$187,580		$560		$20,580		$280		$43,760		$26,620		$51,320
Maintenance and Protection of Traffic (10%)				$468,950		$1,400		$51,450		$700		$109,400		$66,550		$128,300
Contingencies (25%)				$1,172,375		$3,500		$128,625		$1,750		$273,500		$166,375		$320,750
Inspection (12%)				$562,740		$1,680		$61,740		$840		$131,280		$79,860		$20,000
Engineering (25%)				$1,172,375		$3,500		$128,625		$1,750		$273,500		$166,375		$10,000
TOTAL				$8,253,520		$60,000,000		$905,520		$12,320		$1,925,440		$1,171,280		$1,813,370

SHA Estimate

I-70 Mitigations and Cost Estimates

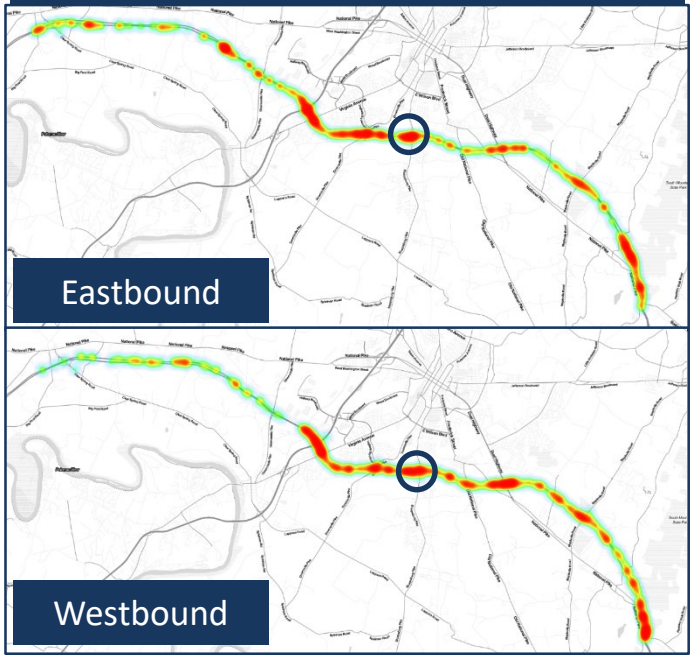
Mitigation	Typical Unit Price	Typical Unit of Measure	Improve Delineation and Retro-reflectivity of pavement Markings MP 33-34 EB		Revise PavementArrows, Lane Ends Signing and Other Advance Signing on Approach to MD Welcome Center (EB) Lengthen Third Lane Beyond Welcome Center		Lengthen Truck Climbing Lane 1/2 Mile Westward in vicinity of MM 36 EB		Extend Acceleration Lane at Exit 24 (MD 63) On-Ramp (WB)		Extend Acceleration Lane at Exit 35 (MD 66) On-Ramp (WB)		Correct Drainage Issue near MM 37.25 WB	
ITEM/TYPE OF WORK			QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST
Add Pavement Markings	$1	LF	30,000	$30,000	3,700	$3,700	5,280	$5,280	3,000	$3,000	3,000	$3,000		$0
Add Pavement Marking Legends	$500	EA		$0	6	$3,000		$0		$0		$0		$0
Add Raised Pavement Markers	$30	EA	400	$12,000		$0		$0		$0		$0		$0
Add Delineators	$35	EA	200	$7,000		$0		$0		$0		$0		$0
Add WARNING TYPE SIGNS (Chevrons, Curve Ahead, Advisory Exit Speed, etc)	$500	EA		$0	4	$2,000	4	$2,000	1	$500	1	$500		$0
Add or Replace Ground Mounted Guide Sign or Services Signs	$30,000	EA		$0	3	$90,000		$0		$0		$0		$0
Install New Overhead Guide Sign Structure	$140,000	EA		$0		$0		$0		$0		$0		$0
Install New Overhead Guide Sign Cantilever Structure	$90,000	EA		$0		$0		$0		$0		$0		$0
Install New Overhead Guide Sign	$15,000	EA		$0		$0		$0		$0		$0		$0
Trim Vegetation	$2,100	100 FT		$0		$0		$0		$0		$0		$0
Add 12' Widening (Shoulder or Lane)	$200,000	1000 FT		$0	2	$400,000	5	$1,000,000	3	$600,000	3	$600,000		$0
Guiderail	$30	LF		$0		$0	2,640	$79,200		$0		$0		$0
Impact Attenuating Device	$2,000	EA		$0		$0	1	$2,000		$0		$0		$0
Median Barrier	$75	LF		$0		$0		$0		$0		$0		$0
High Friction Surface Treatment	$18	SY		$0		$0		$0		$0		$0		$0
Interchange Reconstruction/Reconfiguration	$35,000,000	EA		$0		$0		$0		$0		$0		$0
Drainage earthwork etc	$50	SY		$0		$0		$0		$0		$0	2,700	$135,000
PROJECT ITEMS														
Equipment Package	$2,000	LS		$2,000		$2,000		$2,000		$2,000		$2,000		$2,000
Construction Surveying	$8,000	LS		$8,000		$8,000		$8,000		$8,000		$8,000		$8,000
CPM Schedule	$2,000	LS		$2,000		$2,000		$2,000		$2,000		$2,000		$2,000
Unforeseen Water Pollution Control	$2,000	PDA		$2,000		$2,000		$2,000		$2,000		$2,000		$2,000
PERCENTAGE ITEMS														
Mobilization (4%)				$2,520		$20,508		$44,099		$24,700		$24,700		$5,960
Maintenance and Protection of Traffic (10%)				$6,300		$51,270		$110,248		$61,750		$61,750		$14,900
Contingencies (25%)				$15,750		$128,175		$275,620		$154,375		$154,375		$37,250
Inspection (12%)				$7,560		$61,524		$132,298		$74,100		$74,100		$17,880
Engineering (25%)				$15,750		$128,175		$275,620		$154,375		$154,375		$37,250
TOTAL				$110,880		$902,352		$1,940,365		$1,086,800		$1,086,800		$262,240

Build Collector Distributor Lanes at I-70/US-40 Interchange

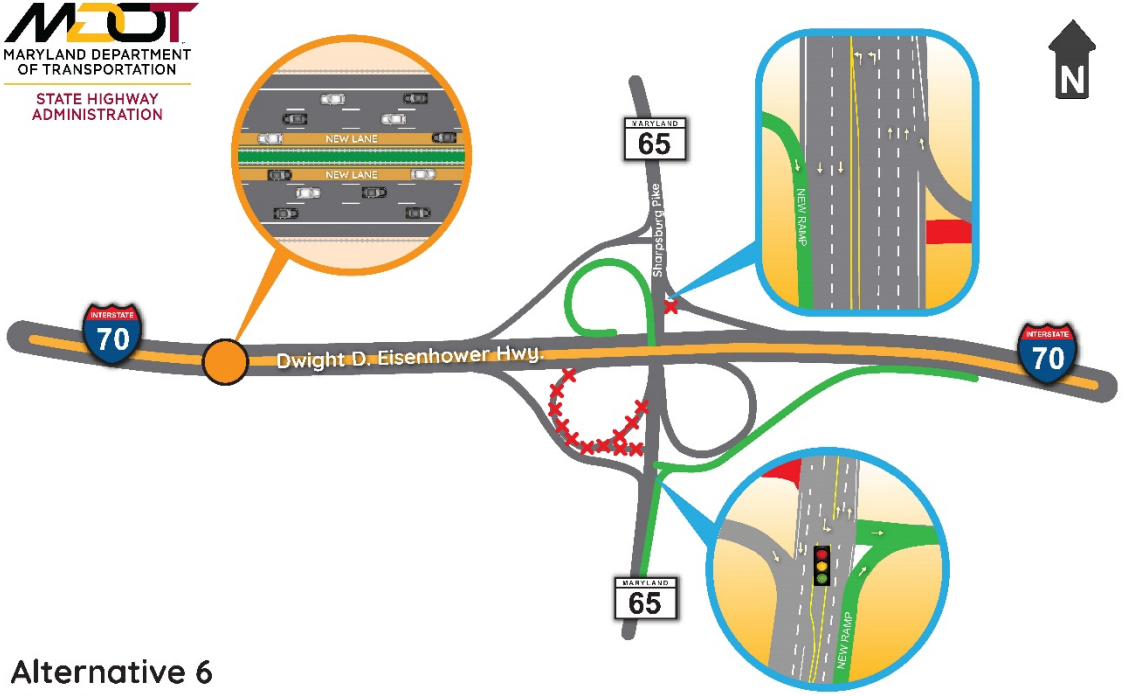
Revise Exit 29 Interchange Configuration

MD SHA MD-65 INTERCHANGE
PROPOSED IMPROVEMENTS

REPORTABLE CRASHES (2015-2018)



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION



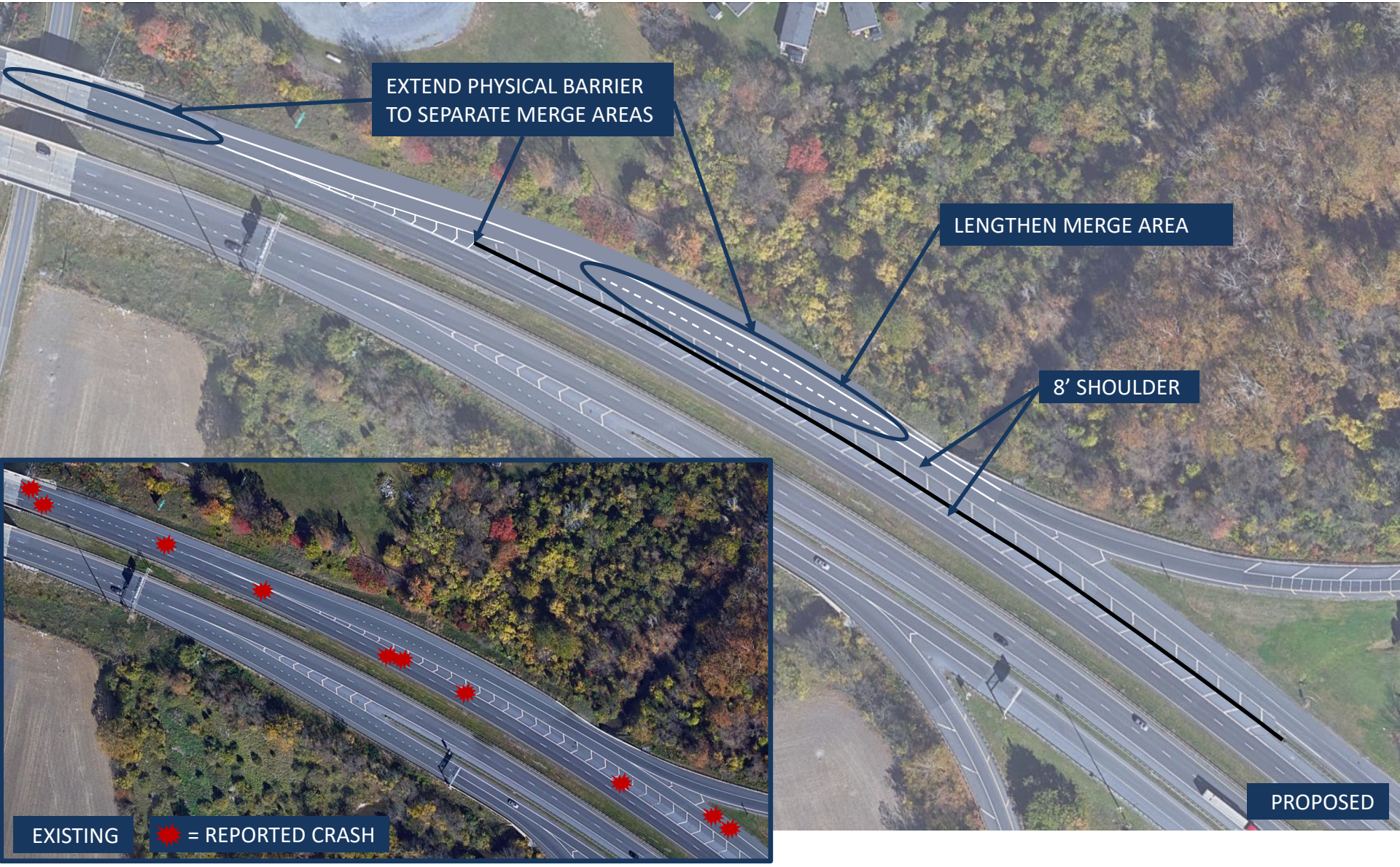
Alternative 6
Key Improvements

I-70 / MD 65 Improvements

Dwight D. Eisenhower Hwy at Sharpsburg Pike

Key
- Inside Lane Widening
- Ramp Removal
- Installation of New Ramp

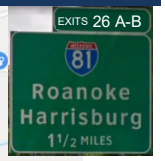
Extend Physical Barrier of C-D lanes at I-81 Interchange



Revise Advance Guide-Signing for I-70/I-81 Interchange

EXISTING- TO BE REVISED

PROPOSED

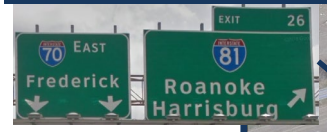


EXISTING- TO BE REVISED

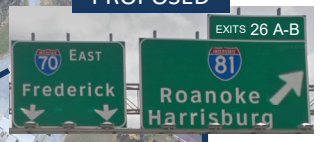
PROPOSED

SEE BLOW-UP FOR DETAIL

EXISTING – TO BE REVISED



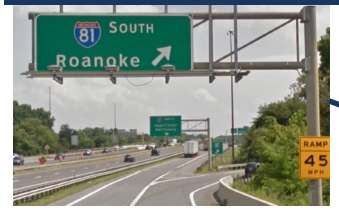
PROPOSED



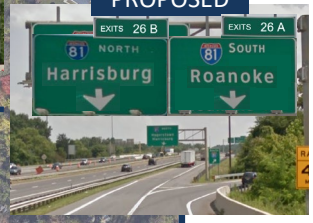
EXISTING- TO BE REMOVED

PROPOSED

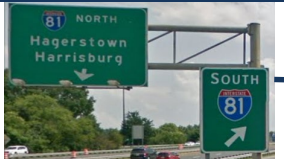
EXISTING- TO BE REMOVED



PROPOSED



EXISTING – TO BE REVISED



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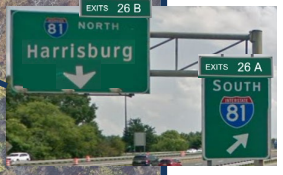
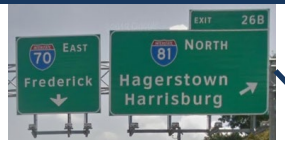
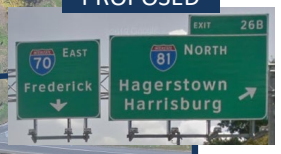


EXISTING- TO BE REMOVED



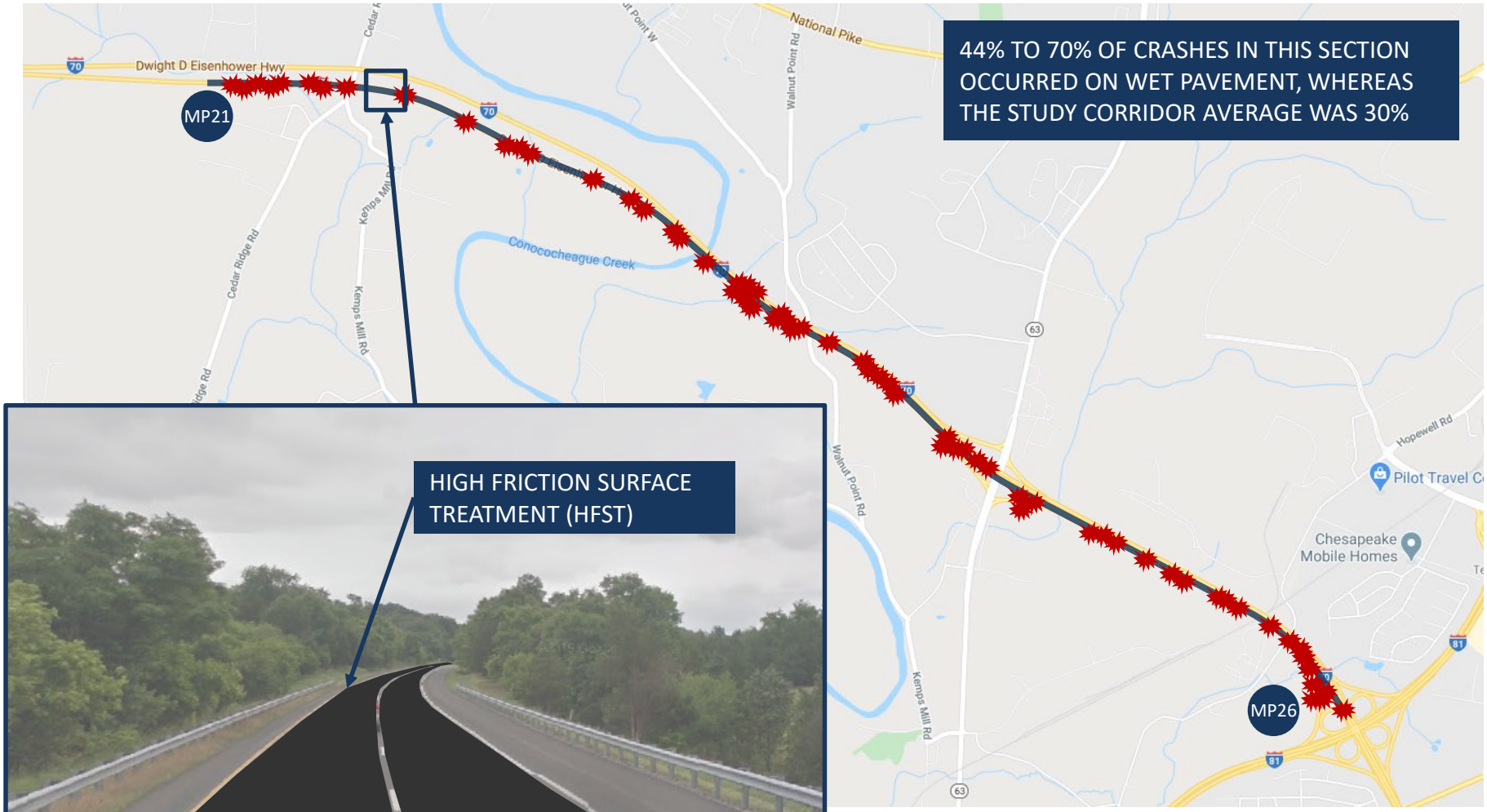
PROPOSED



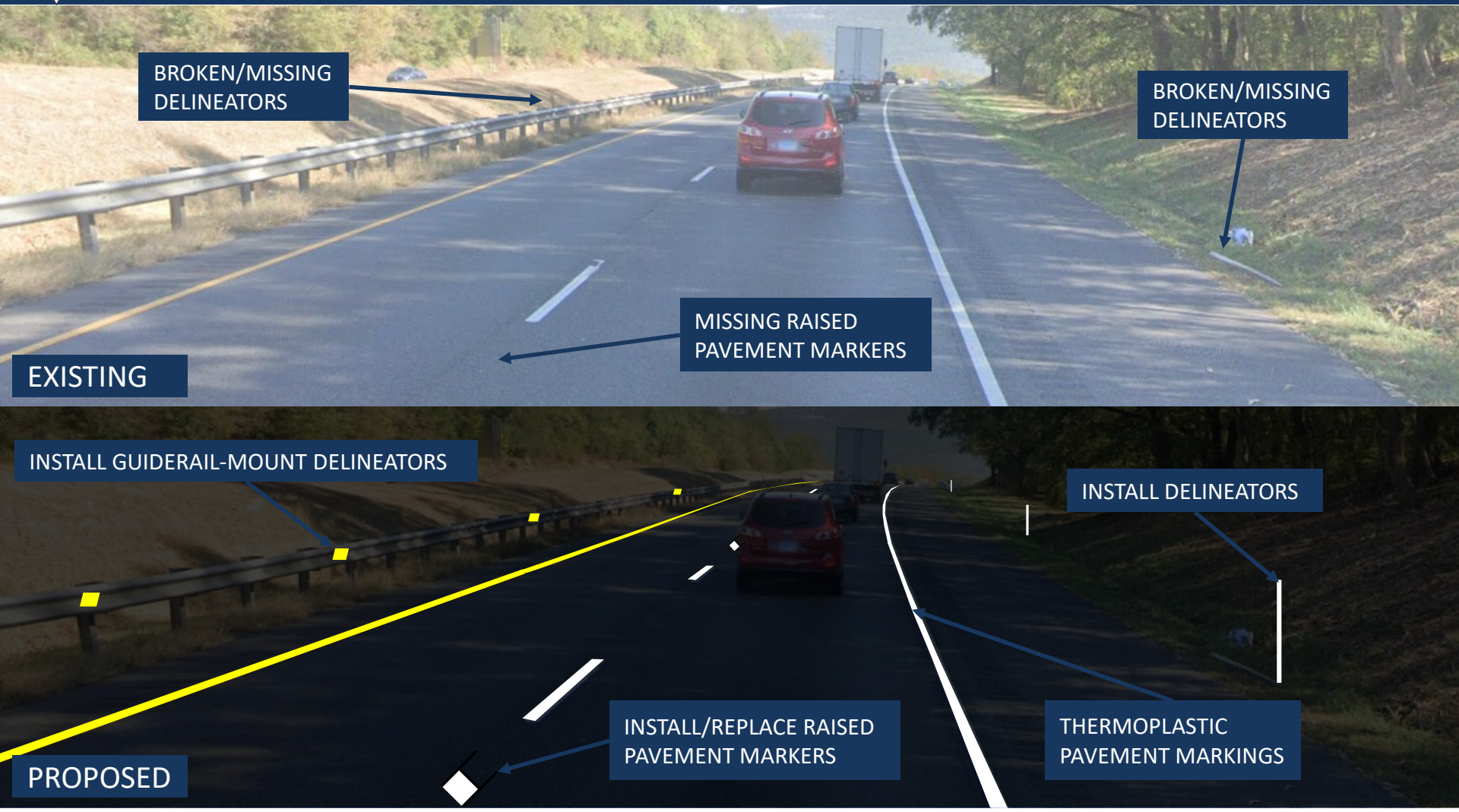
= REPORTED CRASH

Extend On-Ramp Acceleration Lane to EB I-70 at Exit 18

Install HFST between MP 21 and MP 26 EB I-70

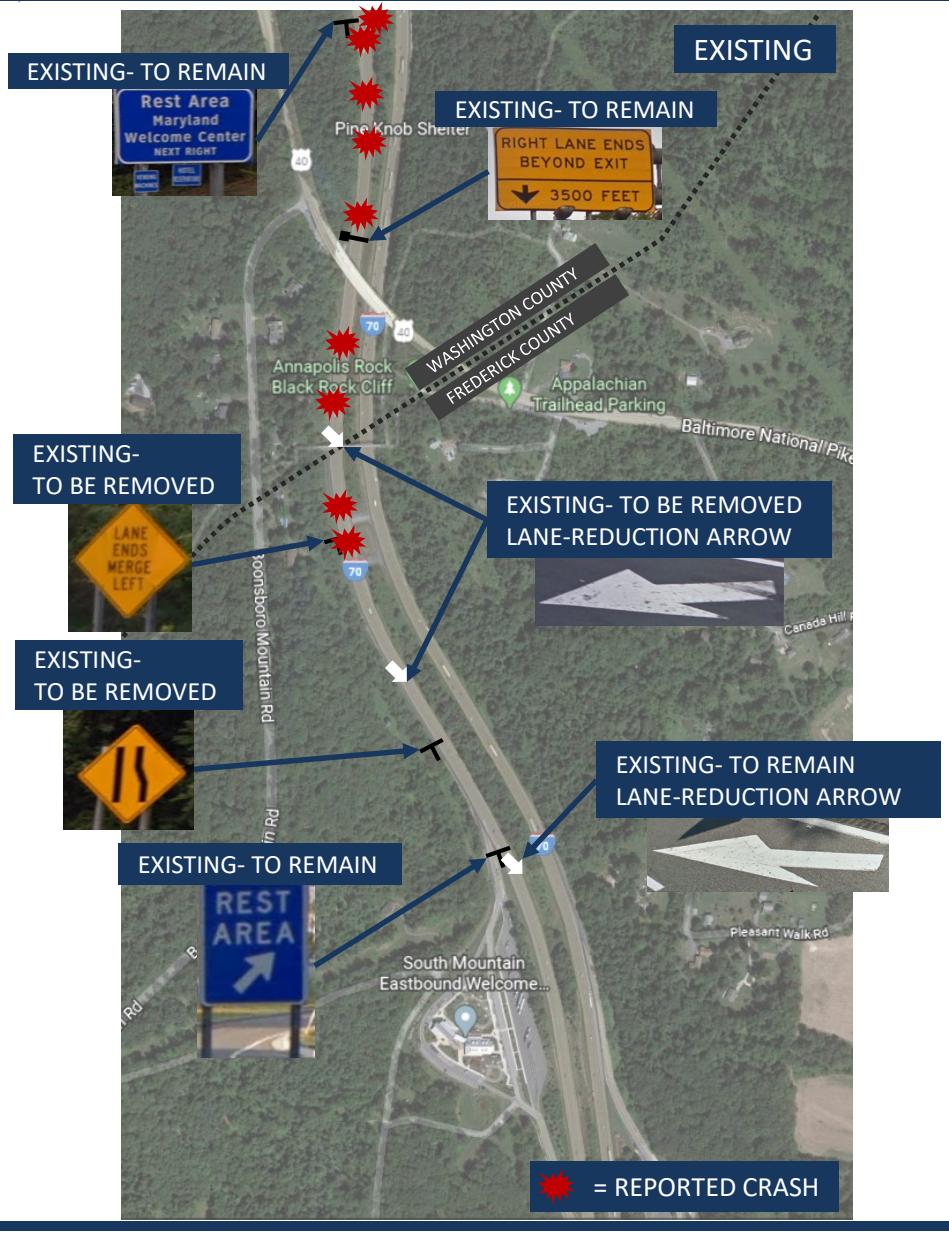


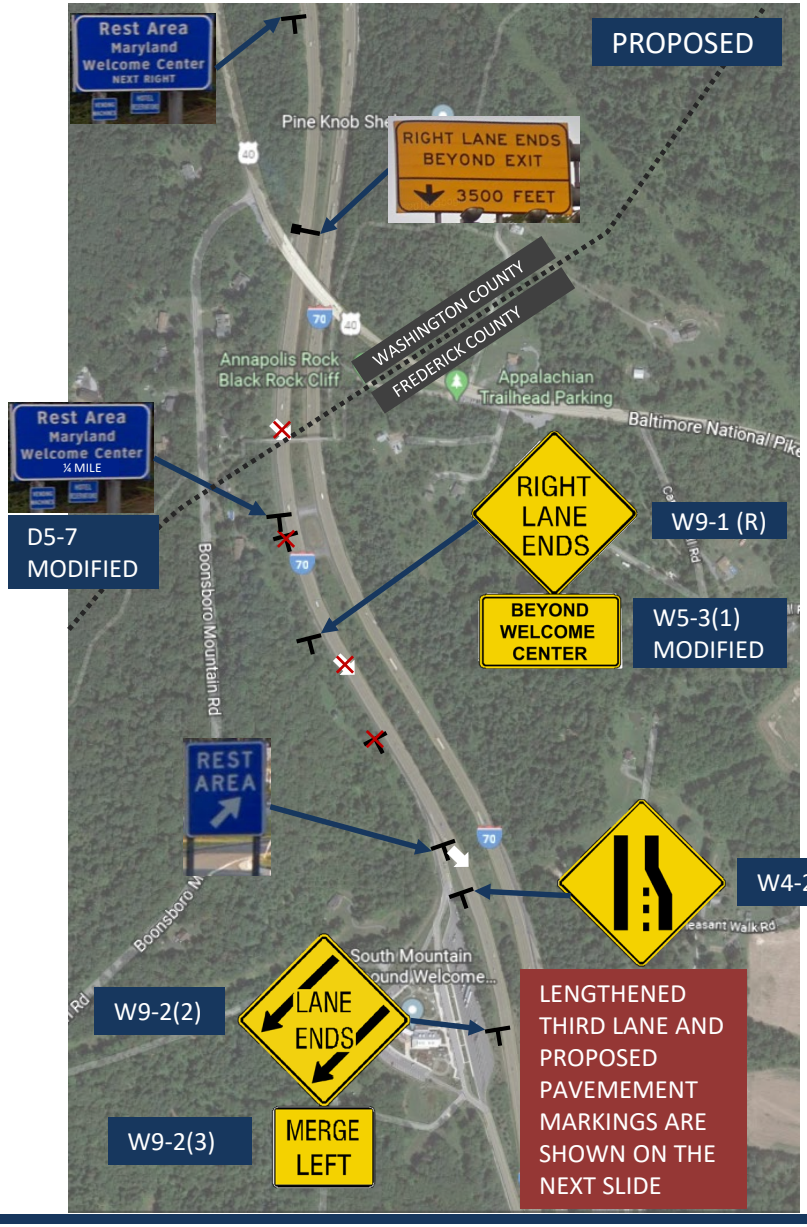
Improve Delineation and Pavement Markings from MP 33-34 EB



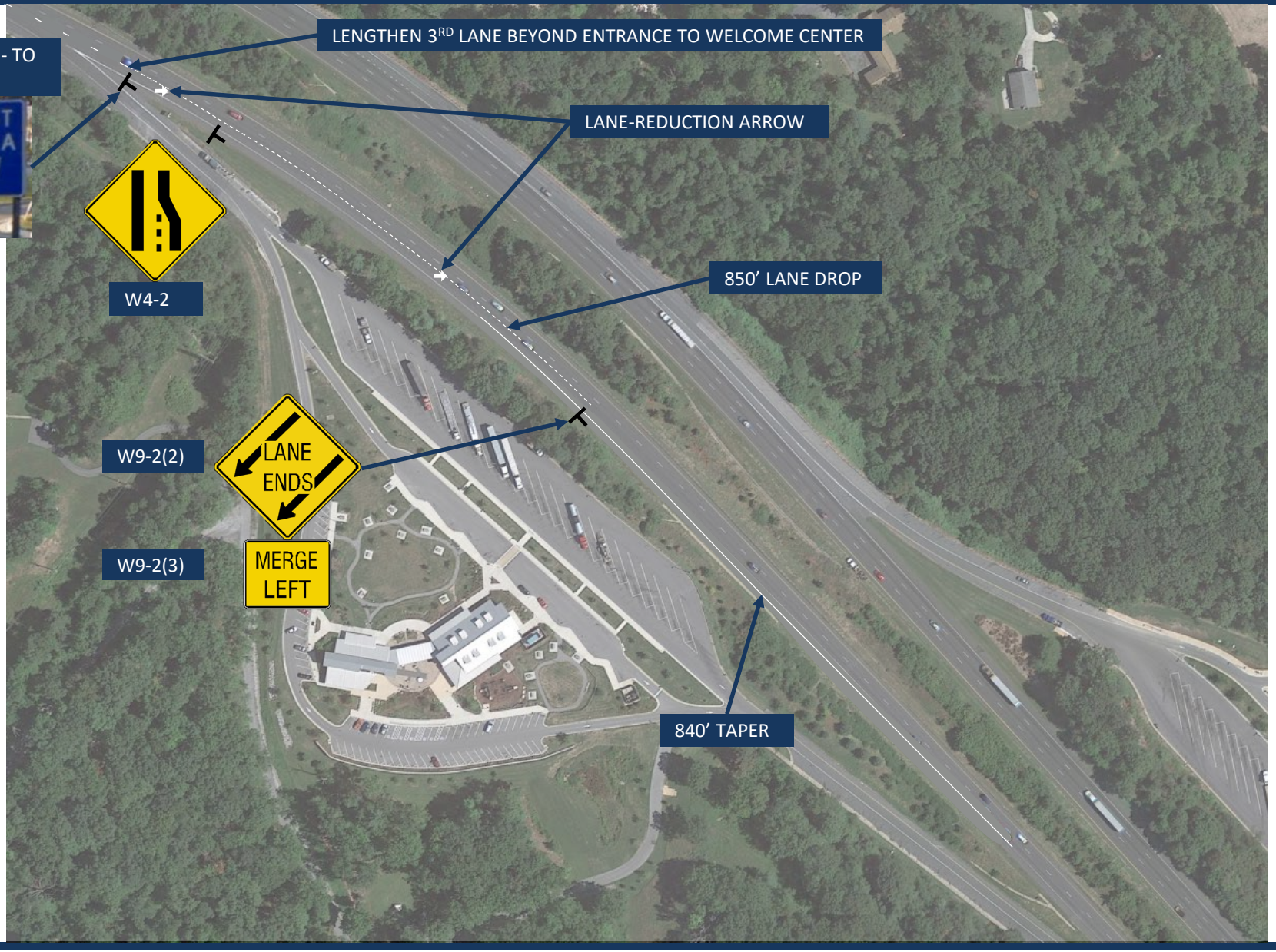
50% OF CRASHES OCCURRED OUTSIDE OF DAYLIGHT HOURS, WHEREAS CORRIDOR AVERAGE WAS 36%

Advanced Signing and Pavement Markings for Welcome Center



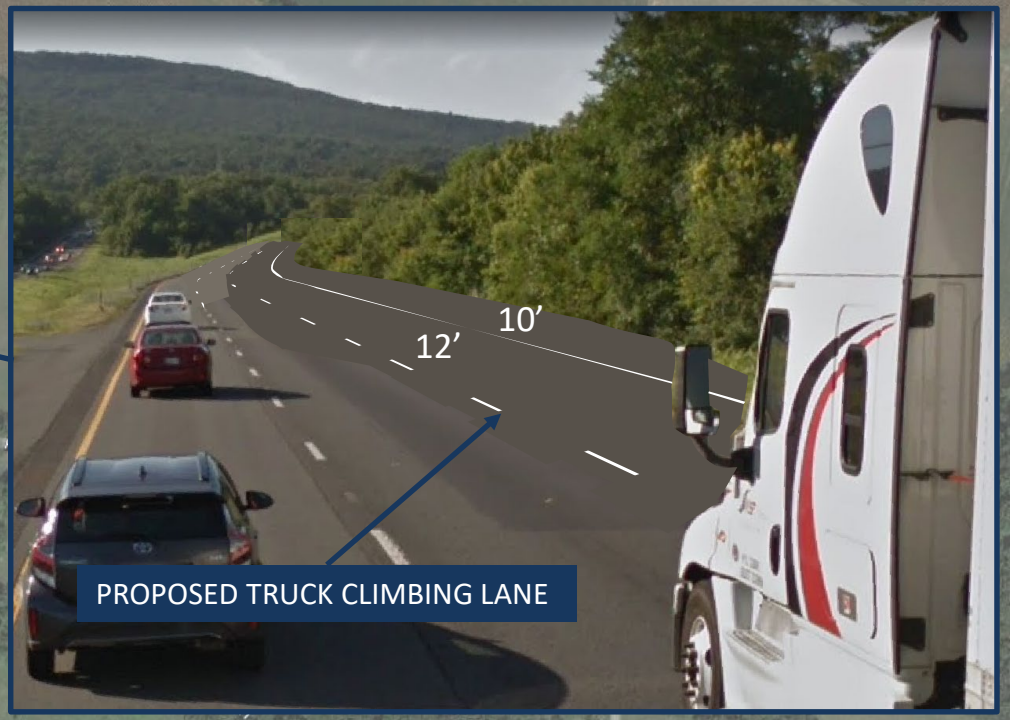


Advanced Signing and Pavement Markings for Welcome Center



Lengthen Truck Climbing Lane West of Exit 35

START OF PROPOSED TRUCK CLIMBING LANE

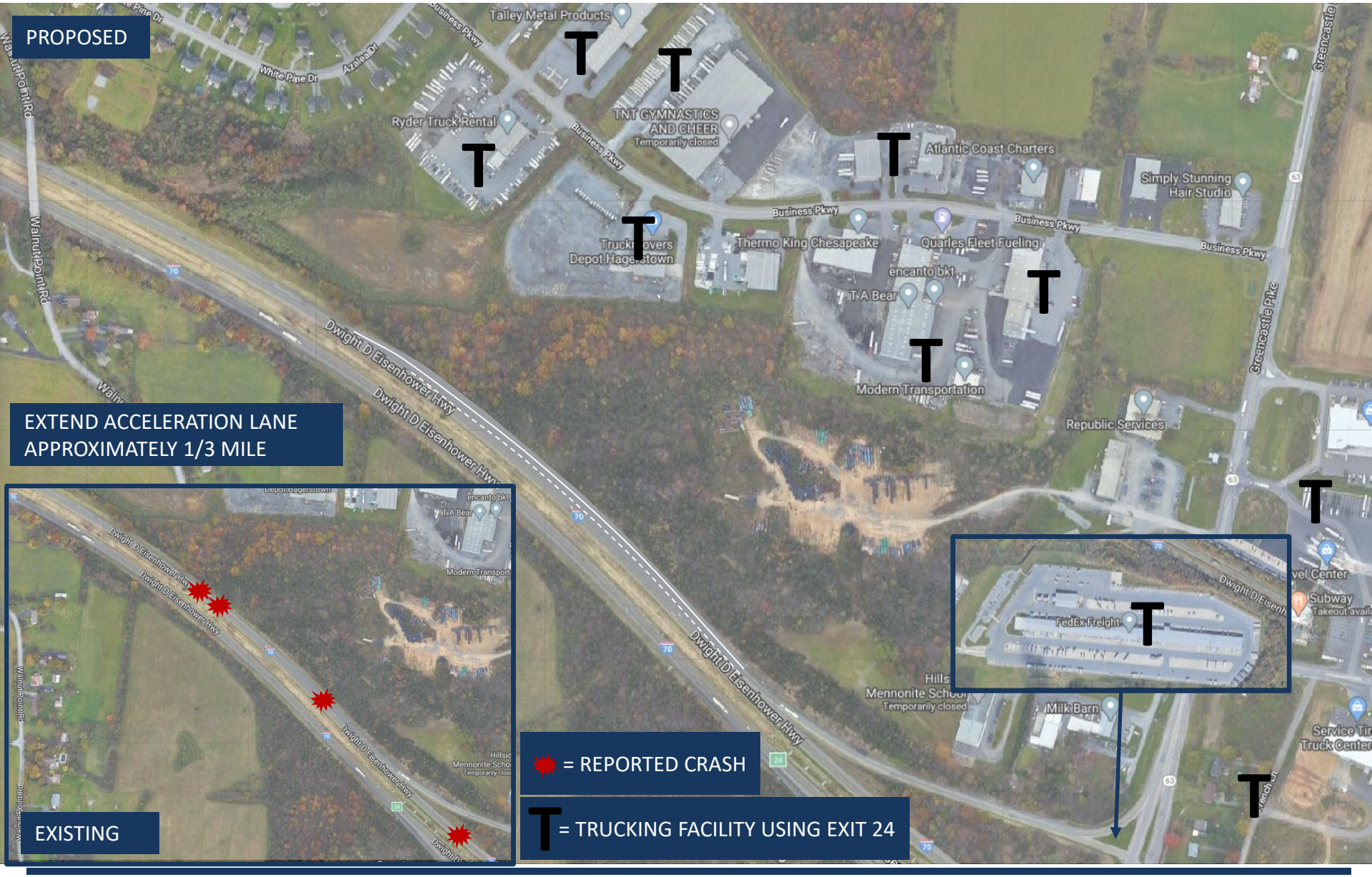


START OF EXISTING CLIMBING LANE

EXTEND CLIMBING LANE ½ MILE

= REPORTED CRASH

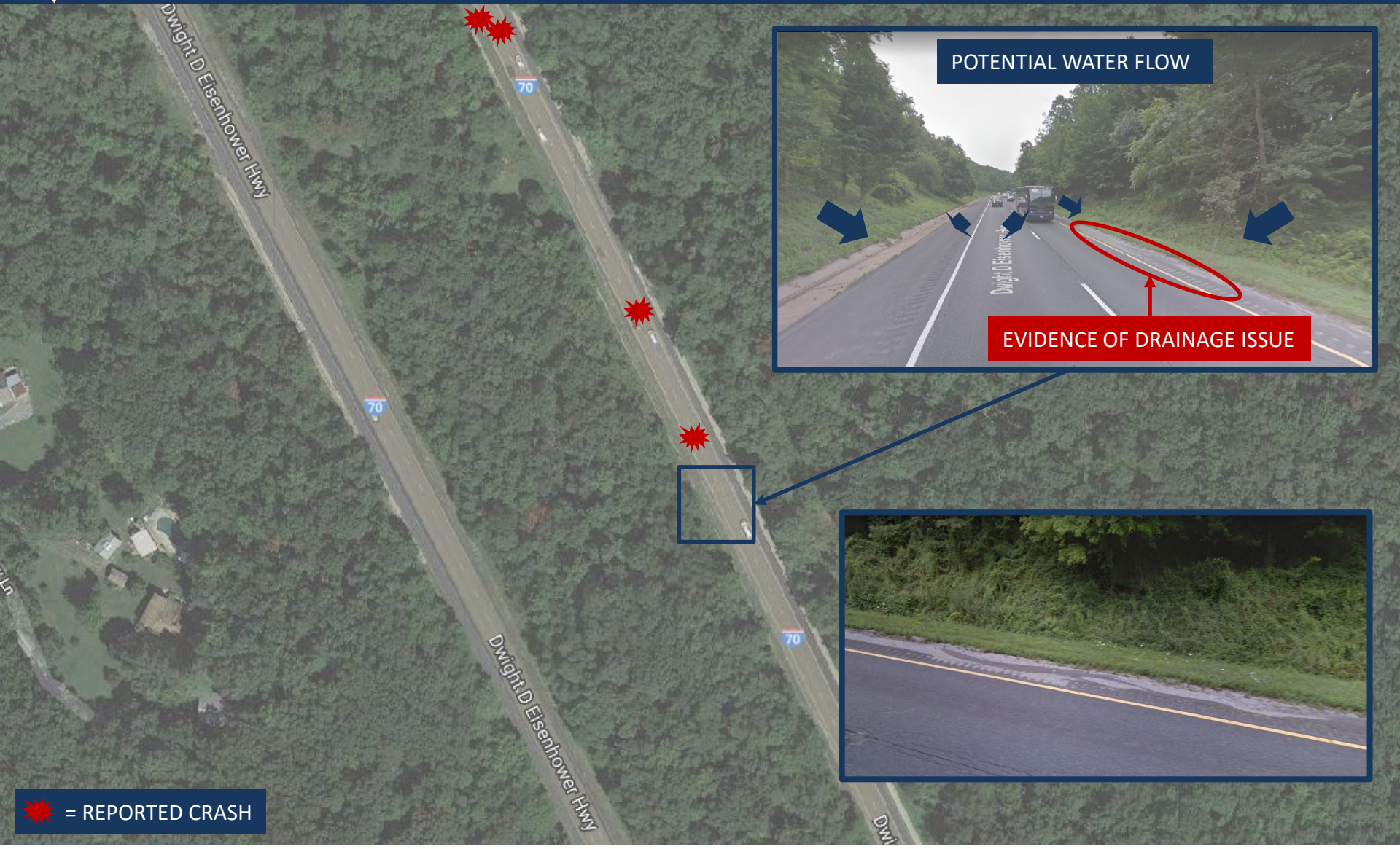
Extend Acceleration Lane at Exit 24 (MD-63) On-Ramp (WB)



Extend Acceleration Lane at Exit 35 (MD-66) On-Ramp (WB)

EXTEND ACCELERATION LANE
TO BE APPROXIMATELY ¼ MILE

Correct Drainage Issue Near MM 37.25 WB



Appendix C
Community Outreach Notifications

BUSINESS SURVEY: I-81 / I-70 TRANSPORTATION STUDY

Greetings,

The Hagerstown/Eastern Panhandle Metropolitan Planning Organization (HEPMPO) with support from the Maryland State Highway Administration (SHA) is working to complete a Transportation Systems Management and Operations (TSMO) Plan for I-81 and I-70 in Washington County.

The plan will identify implementation strategies to effectively manage and operate existing facilities to their full potential. With funding limitations prohibiting the addition of new through lanes in the near future, TSMO strategies focus on lower-cost solutions including incident response technologies, safety improvements, signage and other strategies to optimize the flow of traffic.

The Hagerstown/Eastern Panhandle Metropolitan Planning Organization is seeking insight from businesses and industries along I-81 and I-70 on their interstate needs and any potential strategies through an online survey.

Please take some time to complete the survey to help ensure a successful plan. The survey is open from Nov. 1st - 30th and can be accessed below:

TAKE THE SURVEY

www.Hagerstown.org • phone 301.739.2015 • fax 301.739.1278

https://www.heraldmailmedia.com/news/local/planning-officials-ask-businesses-for-feedback-to-improve-i-/article_16a4c30d-d7ea-561f-a657-dce2ee562a98.html

Planning officials ask businesses for feedback to improve I-81, I-70

Julie E. Greene
Nov 18, 2019

Transportation and planning officials are seeking feedback from businesses and industries in the area regarding Interstates 81 and 70.

The Hagerstown/Eastern Panhandle Metropolitan Planning Organization, with support from the Maryland State Highway Administration, is working on transportation needs and potential strategies.

With limited funds prohibiting further widening of the interstates in the near future, the group is focusing on lower-cost solutions, according to the survey. Ideas include incident-response technologies, safety improvements, signs, and other strategies to optimize traffic flow.

The planning organization is working on a Transportation Systems Management and Operations plan for the interstates in Washington County.

The organization is asking businesses to go to https://bit.ly/2OoeVTT to complete an online survey, which is due Nov. 30.

The survey asks if businesses are affected by traffic congestions on I-81 and I-70 and where their primary concerns are along those routes.

Participants are asked about their primary concerns along each interstate. The available answers include peak-period traffic congestion, crash-related delays, weather-related delays and special events. Businesses that answer the survey also have the opportunity to recommend a project or strategy for either interstate.

Julie E. Greene

Julie Greene covers Washington County government and the town of Funkstown for Herald-Mail Media. She can be reached at 301-791-6245 or by email at julieg@herald-mail.com.

Mullenax, Matt

From: Washington County Government <pr@washco-md.net>
Sent: Monday, November 18, 2019 12:33 PM
To: Mullenax, Matt
Subject: Survey on I-81 and I-70 Transportation Needs and Strategies

[EXTERNAL SENDER]

Washington County
PUBLIC RELATIONS & MARKETING

100 W. Washington Street, Suite 1401
Hagerstown, MD 21740 | 240.313.2380

FOR IMMEDIATE RELEASE

CONTACT:
Danielle Weaver, Director
Phone: 240-313-2380
Email: dweaver@washco-md.net

Brittany Higgins, Public Relations Coordinator
Phone: 240-313-2380
Email: bhiggins@washco-md.net

NEW SURVEY ON I-81 AND I-70 TRANSPORTATION NEEDS AND STRATEGIES

The Hagerstown/Eastern Panhandle Metropolitan Planning Organization (HEPMPO) with support from the Maryland State Highway Administration (SHA) is working to complete a Transportation Systems Management and Operations (TSMO) Plan for I-81 and I-70 in Washington County. HEMPMO is seeking insight from businesses and industries on transportation needs and potential strategies through an online survey. Please take some time to complete the survey to help ensure a successful plan. The deadline is November 30, 2019.

CLICK HERE FOR SURVEY!

Appendix D
Newspaper Articles and Public Comments

https://www.heraldmailmedia.com/news/local/interstate-plan-open-for-public-comments/article_7c3889c1-8758-5d84-be42-feae30e137e9.html

Interstate plan open for public comments

By Mike Lewis mlewis@herald-mail.com
May 20, 2020

The public is being asked to comment on a plan to improve traffic flows on Interstates 70 and 81.

Unlike other studies that have focused on adding lanes or other major construction, the 131-page draft examines other measures to improve highway operation and efficiency.

Some of those suggestions include updating signs, improving pavement markings and coordinating the timing of traffic signals when detours are needed.

"This is the first type of plan like this that has ever been done in our region," said Matt Mullenax, executive director of the Hagerstown/Eastern Panhandle Metropolitan Planning Organization. "It's very different. It's definitely a direction that (Maryland Department of Transportation) as a whole is heading."

For the past several months, the organization has worked with the Michael Baker International consulting and engineering firm to come up with the document, which is now ready for public comment. The study takes in all of I-81 in Washington County and I-70 from Clear Spring (exit 18) east to the Frederick County line.

Mullenax presented the draft at Wednesday's meeting of the HEPMPO Interstate Council. The meeting was conducted online in keeping with limits on gatherings to stem the spread of the novel coronavirus.

The plan focuses on improving the operations of the interstates without adding capacity, which usually means widening. The strategies fall into three categories: geometric and safety improvement, traffic flow and signal updates, and intelligent transportation system additions such as digital signs, closed circuit TV cameras and "connected" vehicles using 5G technology.

"The study covers a multitude of different areas," Mullenax said after the meeting.

The specific examples range from trimming vegetation for better visibility to reconfiguring on-ramps for better safety. The study also includes estimated costs.

For example, some of the specific recommendations include:

• Installing full-color digital signs to inform drivers about crashes, detours, etc. Based on crash hotspots, "there is a clear need to have the ability to disseminate traveler information more frequently than what is currently available," the document states.

• Revising the design of I-81 Exits 10A and 10B (Showalter Road) and relocating the cloverleaf on-ramp per the Maryland State Highway Administration's proposed interchange improvements.

• Reducing the speed limit from 70 mph to 55-65 mph on I-70 through the congested area around Hagerstown.

Draft interstate plan
May 20, 2020

Submit comments

Written comments may be:

- Emailed to mmullenax@hepmpo.net.
- Mailed to the HEPMPO office at 33 W. Washington St., Suite 402, Hagerstown, MD 21740.
- Submitted online by visiting www.hepmpo.net/contact.

Mike Lewis

Mike Lewis covers business and economic issues and the town of Hancock for Herald-Mail Media. He can be reached by email at mlewis@herald-mail.com.

https://www.journal-news.net/journal-news/public-urged-to-comment-on-epta-interstate-development-plans/article_3be9d246-70e6-5afc-8229-a32db11a4a99.html

FEATURED

Public urged to comment on EPTA, Interstate development plans

By Breanna Francis bfrancis@journal-news.net
May 20, 2020

MARTINSBURG — As the 2019-20 fiscal year comes to a close and many organizations gear up for a new year of projects, the Hagerstown Eastern Panhandle Metropolitan Planning Organization has opened up a public comment period regarding two development plans — one with a local transit authority and another regarding traffic flow and development of two local interstates.

The first public comment period allows for the public to review the Eastern Panhandle Transit Authority's Transit Development Plan, which is described in a release as an "effort to better utilize existing transit resources and determine ways to expand public transit coverage within and beyond its existing service area in Berkeley and Jefferson Counties over the next five years."

EPTA's Public Transit Development Plan is a five-year plan for EPTA officials to follow for the planned growth of their organization. Executive Director Elaine Bartoldson said she is excited about the direction the newest plan will take the entity after the successes seen with the last plan.

“In 2014, we did a similar plan that launched in 2015. We’ve followed that plan with the exception of the expansion of Spring Mills, which was based on funding, and we’ve realized that growth using that plan,” Bartoldson said. “It’s a wonderful playbook for our organization, and I’m looking forward to the new plan.”

The plan outlines expanding some services, the hours of some of the routes and eliminates some evening routes but expands day routes.

It also suggests expansions of service in Jefferson County on the weekends, which Bartoldson said is important as the need is clearly there.

Bartoldson said the public can suggest services to specific areas and give positive or negative comments on the plan and added that any and all comments are helpful, because she said there may be items EPTA is overlooking that the public may see as a need.

“We’re very excited about the project, and we are looking forward to future opportunities for growth,” Nic Diehl, EPTA board chairman, said.

In addition to the EPTA's public comment period, HEPMPO announced another public comment period for the draft of the Interstate 81 and Interstate 70 Transportation Systems Management & Operations Plan, which is focused on "non-capacity adding strategies to enhance operations along I-81 and I-70 in Washington County MD. These strategies fall into three categories: geometric and safety improvements, traffic flow/signals and intelligent transportation systems expansion."

According to the presentation, the Washington County Interstate TSMO Plan complements the ongoing planning and construction efforts for the area's interstates, I-81 and I-70.

"Both I-81 and I-70 are priority freight corridors on the National Highway Freight Network, impacted by ongoing construction activities and have a history of weather-related travel impacts and severe accidents," the presentation said. "This plan identifies potential implementation strategies to effectively manage and operate existing facilities to their full potential. With capital-funding limitations that prohibit capacity expansion of the interstates, TSMO strategies focus on safety improvements, traffic operations, Intelligent Transportation Systems (ITS) technologies and other support systems to provide a more cost-effective approach to optimize the flow of traffic during times of congestion."

According to the release, the study area includes the entire length of I-81 in Maryland and I-70 from the Frederick County, Maryland, line to the Clear Spring, Maryland, Exit 18 and will focus on identifying areas where traffic pattern changes and technology can be beneficial to easing heavy traffic flow and accidents.

HEPMPO said via a press release that the public comment period for the EPTA Transit Development Plan will end June 17, and a video and presentation detailing the proposed service recommendations is available online at their website at hepmpo.net.

Written comments can mailed to the EPTA's office at 446 Novak Dr., Martinsburg, WV 25405, sent via email to info@eptawv.com or direct message online at EP Transit on Facebook.

The public comment period for the interstate study draft ends June 19 and all questions and all written comments should be directed to Matt Mullenax at 240-313-2081, mmullenax@hepmpo.net or mailed to the HEPMPO office at 33 W. Washington St., Suite 402, Hagerstown, Md. 21740.

https://www.heraldmailmedia.com/news/local/virtual-hearing-thursday-for-road-plan/article_3ef142b1-ce41-5d2e-92d6-ce20664674de.html

Virtual hearing Thursday for road plan

By Mike Lewis mlewis@herald-mail.com
Jun 9, 2020

A tractor-trailer leaves Interstate 70 for I-81 near Hagerstown in this 2019 file photo.

File photo

For the second time in two days, a regional transportation group will hold a virtual meeting with the public.

The second meeting, a virtual hearing on the Interstate 81 and Interstate 70 draft Transportation Systems Management and Operations Plan, is set for 5 p.m. Thursday, according to the Hagerstown/Eastern Panhandle Metropolitan Planning Organization.

The first, a virtual question-and-answer session on the Eastern Panhandle Transit Authority's draft transit development plan, was held Tuesday. The public-comment period for the draft transit plan will end June 17, according to EPTA and HEPMPO.

The public-comment period on the draft interstate transportation management plan will end June 19.

Matt Mullenax, HEPMPO's executive director, said the virtual sessions help the organization reach the public during the COVID-19 pandemic.

On Thursday, people will be able to take part in the meeting through WebEx meeting software, which provides video and audio-only options.

Meeting information, including a link to information about joining the session, can be found under "Upcoming Events" at www.hepmpo.net.

"We're going to walk through the draft study," Mullenax said.

The transportation management plan focuses on ways to improve the operations of I-81 and I-70 without adding capacity, which typically means building more lanes.

The strategies fall into three broad categories: geometric and safety improvements, traffic flow/signals and intelligent transportation systems expansion. The specific recommendations range from trimming vegetation to reconfiguring on-ramps to installing more digital information signs.

To help explain the main points, the consulting firm Michael Baker International has prepared a StoryMap.

"It's sort of a combination between PowerPoint and mapping software," Mullenax said.

The StoryMap provides maps of the region as well as photos, data from various studies and other information, he said.

To see the StoryMap or download a copy of the plan, go to www.hepmpo.net and scroll to the respective links under "Announcements."

Questions and all written comments should be directed to Mullenax at 240-313-2081 or mmullenax@hepmpo.net, or mailed to the HEPMPO office at 33 W. Washington St., Suite 402, Hagerstown, MD 21740.

To comment online, visit www.hepmpo.net/contact.

Only written comments will be accepted.

Learn more

• To see the StoryMap presentation, download the plan or learn how to participate in Thuesday's virtual meeting, visit www.hepmpo.net.

Mike Lewis

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https://www.heraldmailmedia.com/news/local/planners-go-online-for-interstate-hearing/article_735fd421-853d-5438-86a9-63fedfb87b00.html

Planners go online for interstate hearing

By Mike Lewis mlewis@herald-mail.com
Jun 12, 2020

The Hagerstown/Eastern Panhandle Metropolitan Planning Organization conducted a virtual public hearing Thursday on the draft of its Interstate 81 Interstate 70 Transportation Systems Management and Operations Plan.

Submitted photo

State officials joined some local residents Thursday in a virtual public hearing about improving traffic flow on interstates in Washington County.

Because of the COVID-19 pandemic, the Hagerstown/Eastern Panhandle Metropolitan Planning Organization opted for an online platform rather than an in-person public hearing. The topic was the draft Interstate 81 and Interstate 70 Transportation Systems Management and Operations Plan.

Among the 20 or so people listening in was Subrat Mahapatra of the Maryland Department of Transportation. He called the plan “a huge opportunity” and said it aligns with work the state is already doing.

The final plan is due by July 1, said Matt Mullenax, HEPMPO’s executive director.

After Thursday’s hearing, Mullenax said work to implement some of the ideas has “kind of already started.”

Some of the ideas in the document are already coming up as state and local officials consider improvements, he said.

The plan focuses on ways to improve the operations of I-81 and I-70 without adding capacity, which typically means building more lanes.

The strategies fall into three broad categories: geometric and safety improvements, traffic flow/signals and intelligent transportation systems expansion.

The specific recommendations range from trimming vegetation to reconfiguring on-ramps to installing more digital information signs.

During Thursday’s session, Jim Frazier of the Michael Baker International consulting firm reviewed highlights of the plan. The ideas are mapped out for each section of the interstate. The area covers the length of I-81 through Maryland and I-70 from Clear Spring east to the Washington-Frederick county line.

Some of the recommendations, such as changing signs or trimming vegetation, are designed to help prevent wrecks.

Others are designed to improve traffic flow after crashes or other incidents happen.

For example, digital signs could warn motorists about wrecks or other problems ahead. And when interstate traffic is detoured onto Hagerstown streets or state highways, traffic signals could be synchronized to maximize traffic flow. Technology now allows for signal timing to be adjusted remotely, he said.

Frazier also reviewed comments HEPMPO has already received about the plan.

One of those comments objects to the idea of lowering the speed limit from 70 mph to 55 mph on I-70 near Hagerstown.

The document does not specifically recommend lowering the speed limit, Frazier said. It does note that a safety study could be conducted to see if the lower limit would reduce the number of crashes.

More information about the plan is available at www.hepmpo.net.

The public comment period ends June 19.

Questions and all written comments should be directed to Mullenax at 240-313-2081 or mmullenax@hepmpo.net, or mailed to the HEPMPO office at 33 W. Washington St., Suite 402, Hagerstown, MD 21740.

To comment online, visit www.hepmpo.net/contact.

Only written comments will be accepted.

Pennies to Stay Cool This Summe

Draft TSMO plan
Jun 11, 2020

Mike Lewis

Mike Lewis covers business and economic issues and the town of Hancock for Herald-Mail Media. He can be reached by email at mlewis@herald-mail.com.

Date	Comment	Response
May 21, 2020	I would like to know why tolls are not being considered for I-81 in Maryland? This would both reduce traffic and produce revenue for the state. In Virginia, there was a plan to add tolls to I-81 that would have had variable toll rates for cars and trucks, with the option of an annual pass for residents. I think this would be a perfect fit for the Maryland section of I-81. The Virginia plan was sunk by business and trucking groups--I feel that the Maryland legislature and our transportation board will be less likely to be swayed by these abhorrent lobbyists. Thank you for your work and consideration.	Thank you for your comment and interest in our area's transportation. As MDOT SHA and their partners in neighboring states have studied options for I-81, tolls were not the focus for this study. The TSMO study identified alternatives to capacity expansion focusing on low-cost options for safety, traffic flow and technology advancements. The I-81 Corridor Coalition website provides a resource of information that may interest you too. https://www.i-81coalition.org/
May 21, 2020	I read the article in today's Herald Mail about a plan to improve traffic flow on Interstate 70 in Hagerstown. One part of the plan I object to is the recommendation to lower the speed limit on I-70. The speed limit was studied within the past five years and it was found to be safe to raise the speed limit to 70mph. Myself and the vast majority of drivers feel comfortable driving at 70mph on this stretch of road and would prefer not to be in violation for doing so in the future.	Thank you for your comment and concerns of the I-70 speed limits. Our study performed detailed analysis on the crash data, causes of accidents and identified speed as a contributor to many incidents. From a safety standpoint, the study only identified an interstate speed study to evaluate if a lower the speed limit would improve safety in the high ramp density and congested areas.
May 21, 2020	Lengthening the on ramp for South bound I-81 at exit 7 Salem Ave made a big difference in safety and traffic flow. Thank You! The study mentions the Showalter Road exit and that's great but there are other exits on & off that need attention. Showalter Road doesn't create the interruption of flow nearly as much as the exits to the south. The congestion begins at or past Exit 9 Maugans Ave south bound and ends there north bound. I believe the SHA would agree since the speed limit is reduced south of that exit (south bound). Lengthening the acceleration/deceleration lanes for the ramps beginning with Maugans Ave south to Exit 1 would really help. Traffic speed in many cases significantly reduces at off ramps particularly when there is very little deceleration lane available. Maugans Ave Exit 9 North bound not so long ago backed up onto the interstate. My wife exits there on weekdays for work and she had to stop on the shoulder of I-81 many times in the morning. Scott Hobbs was very helpful with that situation when I	Thank you for your insights and interest in our area's transportation. You identified many concerns and challenges throughout the region that we all face daily. Our TSMO study identified many geometric and safety improvements, as well as MDOT SHA planned interchange improvements. Many of the study's strategies along with on-going planning at the State level provide future enhancements that strive to reduce highly congested areas and improve traffic flow and safety throughout the region.

Date	Comment	Response
	contacted him. There was a signal timing issue on Maugans Ave at McDonalds that created the back up. Scott & I discussed the timing of that light, he asked the state to change it. To my knowledge there hasn't been a back-up there since. So I know that even the simplest solutions make a big difference. Since lengthening on/off ramps is expensive you are looking for less expensive ways of improving traffic flow. We are long overdue for an actual move right law in this state. Traffic can't flow smoothly if motorists are traveling side by side at the same speed creating backups. If the state won't do it maybe Washington County could? I don't know the statistics, but it seems counter-productive to flow of traffic when you reduce the speed. The reduction in speed near exit 9 doesn't help with separation of motorists. (congestion) I realize safety is always a concern, but bunch ups aren't safe. Motorists have to be on high alert with bunch ups/backups which creates stress and loss of patience for some. Instead of slowing traffic down, enforce move right via warnings or citations for impeding traffic if the state won't implement an actual move right law. I can't tell you how many times I've gotten behind two motorists doing the same speed side by side for miles creating a 10,15,20, or more car backups. I-70 is no different than I-81 when it comes to the length of on/off ramps. If we can't get a third lane from the Dual Hwy to I-81 the next best thing is to increase the ramps. We have been told (indirectly via The Herald Mail) that SHA Engineers consider the Cloverleaf exit at the Dual Hwy to be safe but by what standards and what time period? 1956? I live in Tammany Manor outside Williamsport (I-70/I-81 corridor) and travel east to Frederick every day of the week. So I urge you to do the same (post COVID-19) at 6am headed east and 5pm headed west thru the week between exit 32 & I-81 to see what so many of us do. The ramps need to be longer. There is very little deceleration length on off ramps in both directions at Rt 66, Dual Hwy, Sharpsburg Pike, Downsville Pike is better but could still use more as well as the I-81 exit. Lengthening that off ramp back to the Rt 11 over pass helped a lot (Thank You) but because of the volume of traffic exiting and the reduction in speed (by motorists) that lane could began just past the Bower Ave overpass. The "improvements" to the on ramps at exit 29 Sharpsburg Pike in both directions helped traffic on the Pike but did nothing for the flow of I-70. The east bound	

Date	Comment	Response
	on ramp should not enter traffic west of the Sharpsburg Pike but rather east of it. There is already a light at that intersection so it wouldn't affect the flow of traffic significantly but with a proper acceleration lane would increase the flow of east bound I-70 tremendously. The west bound on ramp should extend to meet the Downsvile Pike off ramp.It made a tremendous difference at exit 7 Salem Ave to Exit 6 Dual Hwy. I'm not sure what the SHA was looking to accomplish. I'm sorry this is so long but this subject is on my mind daily. I believe that in order to make improvements to our interstates you have to listen to the citizens that travel them the most, so Thank You for the opportunity to do so. Please keep in mind that many of the folks traveling I-70 have to travel from as far away as Baltimore and DC/Northern Va. They sit quite often several places along the way so the stress has to be unbelievable. I couldn't do it. To and from Frederick is bad enough.	
May 29, 2020	There are at least 2 areas of concern in the Hagerstown area regarding Interstate 70. At exit 32 westbound & exit 29 eastbound, traffic entering & exiting the interstate must utilize the same lane. At times with heavy traffic, this is difficult, sometimes causing accidents. This was an awful traffic design &, if I were an interstate design or fixer, this would be a priority to remedy. As traffic increases on our highways, as it will after the shutdowns are lifted completely, this will be an increasing problem area.	Thank you for your comment and interest in our area's transportation. MDOT SHA has planned design improvements for both Exit 32 and Exit 29 interchanges you mentioned. Our TSMO study identifies them on pages 41 and 42. Exit 29 should be under design soon and Exit 32 improvements are still in the study phase, but our study also provides an alternative to add a collector / distributor lane.
June 10, 2020	I have a couple of questions about the proposed safety improvements to I-70 East, at 32-B. I am referencing page 41/pg. 45 pdf. If you click on the link for Appendix B on that page, it takes you to Appendix C. The only information that I found under Appendix B (B-4) is the same photo that is listed on Page 41 of the Plan. Is it the I-70 Mitigations and Cost Estimates (B-2) to see the safety improvements as referenced in the Plan? Are there any drawings of the proposed improvement for Exit 32, like the one represented for I-70, Exit 29 (pg. 46/pg.42 pdf)? I am thrilled that I-70 E, Exit 32-B is finally being looked at for a re-design. I can't tell you the number of near	Thank you for your review of our TSMO Plan and interest in our area's transportation. The links for the appendices will be corrected in the final version of the report. The Exit 32, Dual Highway Interchange is of significant concern to us as well. It has been identified as a hot-spot crash location due to the short acceleration / deceleration lanes. MDOT SHA is currently studying a redesign but does not have any re-configuration graphics of the interchange available for the

Date	Comment	Response
	misses I've had on that exit. There have been times that I had to go to the next exit due to vehicles not yielding the right of way and I could not enter the exit. Hopefully, the improvements will finally solve the on/off ramps issues.  The safety improvements for each location can be found in **Appendix B.** The potential problems for both directions include: **Exit 32 - US 40 Interchange: Crash Hot Spots at Interchange Decision Areas** Potential problems: • Heavy traffic volume utilizing short weaving lanes • Short acceleration lanes at on-ramps • Short deceleration lanes at off-ramps RETAINING WALL AT CENTER PIER MAY BE REQUIRED Thank you. I saw on Facebook that there was another accident on I-70EB onto RT40 EB on the ramp this morning. I hope that that this Exit is re-designed ASAP. Or at least create a second access to I-70EB via a cross-over from RT40E across RT40W to I-70EB ramp.	report. Once they become available, we will post on our social media outlets.
June 19, 2020	Thank you for coming to our office to hear our comments on the TSMO draft plan. As we discussed, the main issues we would like to convey on HEPMPO's Transportation plan are the following: 1. While we support any initiatives or projects like TSMO to improve the efficiency of I-70 and I-81 these should not in any way be promoted as an "alternative" to adding lane capacity or a "solution" to our current capacity issues (mainly % of trucks on the highways). These types of projects in respect to I-70 and I-81 should only be viewed as one of the many "improvements" we can implement to help traffic move more efficiently, improve safety, and lessen delays from accidents on our highways. While they are less costly than lane capacity, that doesn't mean they will have the same impact as an additional lane or that they are a "more cost effective approach" as noted in the report on Page 1. These are strategies that complement more impactful projects like an additional lane and will be at least some relief until a third lane can be	Thank you for your continued support to our transportation needs and interest in reviewing our TSMO Plan. We appreciate your comments and have incorporated them into the final report. It was not our intention to disregard the importance and priority for the region and county to continue widening the entire length of I-81. The State and County are supportive and continue to seek funding through grants and other means to fund the next phases of the widening efforts. The TSMO strategies identified serve as an effective complement to the major capital improvement projects planned for the region and is not considered an ultimate solution, but strategies to improve safety,

Date	Comment	Response
	funded. That is better reflected in narrative at the top of page 5. 2. The importance of adding lane capacity needs to be a significant part of the narrative at the beginning of the document as well as in other appropriate sections (such as bottom of page 30). Our community has been fighting for over 20 years to get a third lane on I-81 and adding a new lane on both highways continues to be the top 2 items in our unfunded section of our LRTP. This document should not be written in a way that implies TSMO is an equivalent replacement for adding a lane. The early pages of the narrative in the plan are misleading and should be reworded to reflect this belief - including the diagram used at the bottom of Page 2. This diagram wrongly implies TSMO is going to provide more capacity and lessen more congestion than adding a lane. We strongly disagree with this portrayal. It is reminiscent of when CSX came to our HEPMPO and showed pictures of empty highways as a result of a new inter modal facility – while that project may lessen the growth rate of trucks, the number of trucks would still grow each year and our congestion would continue to get worse. This diagram should be removed or replaced. 1. On Page 20 the first high crash rate area on I-81 is listed in the chart as the section between I-70 and Halfway Blvd. A third lane was to be added to this section as part of the Phase 2 on the I-81 widening project. This is currently in design stage and was the part of our recent INFRA grant application for MDOT. This could be another section to note the value of a third lane. 3. There is limited mention of our growing and sustaining our local economy as a strategy for TSMO's. Our region's economy should be considered along with "safety, mobility, reliability, and asset management" (chart on page 3). We recommend this thought is included somewhere in the narrative as economic support should be a major influencer to the projects we do and how they are designed.	efficiency and mobility throughout the county.

Date	Comment	Response
	4. Finally, the report (page 44) implies that lowering speeds on I-70 between the MD66 exit and I-81 should drop to 55 mph. While some lowering of the speed limits in this area may be worthy of consideration, we would caution an across the board drop to this level. The report states that rear-end collisions on I-70 are a targeted area of concern because they exceed the state average. Lowering speeds too much to 55 would add to the tailgating of drivers in a hurry and could add to these crash figures. The congestion on this section of I-70 varies depending on the time of day (rush hour) and day of the week. A 55 mph speed limit may be more suitable at rush hour than the majority of hours during the week. The 2-lane section of I-81 North in the Mechanicsburg, PA area is an example of this. While in the early morning rush hours the lower speed may be helpful, the other times of day have limited traffic in that area, and the 55 mph limit causes tailgating and driver conflicts as one person goes 55mph and obstructs the person behind him that wants to go faster. As requested, Below is a link to my pdf with handwritten notes on the plan (file size was too large to email). Most of the notations reflect the comments above, while there are a few others that are only minor thoughts such as including road names with exit numbers when able, or listing any benchmarks we should strive to for our incident clearance times. I would like to submit all of these comments on behalf of The Greater Hagerstown Committee's Transportation Forum. Please include our comments as part of the public record. We appreciate the work that HEPMPO is doing to maintain and plan for transportation infrastructure to carry our community into the future. We also appreciate the time and effort that went into this report and recognize TSMO as one of several strategies we should implement as part of this effort – noting that the need to add a third lane is still our community's top priority.	

Date	Comment	Response
June 15, 2020	My name is [redacted] and as a former employee of the Washington County Planning Commission, a former Manufacturing Engineer with Fairchild, Goodrich Aerospace, Lockheed Martin, and as a former Business Development Manager with the Maryland Department of Business & Economic Development (DBED), I am writing a recommendation pursuant to an article in the Saturday, June 13, 2020 edition of the Herald-Mail titled "Planners go online for hearing on interstate improvements." The intention of my recommendation is to help alleviate or relieve some traffic congestion on Interstate 81 where it intersects with Interstate 70. During my employment with DBED I made a similar recommendation that I am about to make for Washington County while attending a meeting in Frederick County with the Maryland Department of Transportation (MDOT). My recommendation then, which was accepted and implemented, was where US 15/US 340 intersects with Interstate 70 was to continue the access lane east from the US 340/US15 to the exit lane for Interstate 270, making the acceleration/de-acceleration lane a continuous lane, therefore substantially reducing traffic conflict points by reducing the need for traffic to merge onto the right lane of Interstate 70 at the US 340/US 15 Intersection only to exit onto Interstate 270 which was less than a half a mile away. At the same time my suggestion reduced the "mixing" component of traffic flowing from one lane to another as it flowed east towards Interstate 70 or Interstate 270. The dedicated traffic lane from the US 340/US15 to Interstate 270 was economically implemented by re-striping and slight repositioning the lanes of traffic on Interstate 70. There is a similar situation in Washington County where traffic enters Interstate 81 at Exit 4 from Interstate 70 Exit 26 traveling north to only to exit onto Halfway Boulevard from Exit 5 on Interstate 81 which is approximately a half a mile from the Interstate 70 access point at Interstate 81. The traffic exits Interstate 70 onto Interstate 81 flowing north to Exit 5 or Halfway Boulevard that is a destination for the many shopping complexes located off of the intersection. As in my Frederick County model, traffic has to merge onto the right lane of Interstate 81 from Interstate 70 exit only to exit onto Halfway Boulevard, which is less than a half a	Thank you for your comment and interest in our area's transportation. The area between the I-81/I-70 Interchange and Halfway Blvd is a safety concern with a high number of crashes. An auxiliary lane was recently constructed and is now open to traffic that eliminates traffic from merging onto I-81 Northbound to exit at Halfway Blvd. This improvement should improve the safety at this interchange.

Date	Comment	Response
	mile north from the point of its access on Interstate 81. If the acceleration lane at Exit 4 on Interstate 81 was extended to the de-acceleration lane at Exit 5 it would reduce the need for traffic headed to Halfway Boulevard to merge onto Interstate 81 therefore reducing the number of traffic conflict points and reducing the mixing of traffic as it flows north on Interstate 81 trying merge or exit onto Halfway Boulevard. Once again, my concept could be economically implemented by possibly using the existing shoulder, re-striping, or maybe slight repositioning of the existing lanes of traffic to extend the Interstate 70 access lane on Interstate 81 to the Halfway Boulevard exit lane. If my recommendation is implemented as suggested, its function could be maintained and utilized after the north bound lane of Interstate 81 is widen to three lanes. Since my idea was accepted and implemented by the MDOT for the US 15/340, Interstate 70/270 interchange, my suggestion for the I-70, I-81, and Halfway Boulevard interchanges would be a concept that is also viable and would be easily implemented. I know that my recommendation only relates to a short section of Interstate 81, but it impacts on traffic congestion during peak loading periods would be significant. Finally, I would like to thank you in advance for taking the time to review my recommendation and if you should have any questions concerning my suggestion or if you would like to meet with me in person to discuss my concept in detail, please do not hesitate to contact me.	