Appendix D

Congestion Management

Congestion Management

Congestion management involves applying strategies to improve transportation system performance and reliability. This helps to reduce the adverse impacts of congestion on the movement of people and goods.

A Congestion Management Process (CMP) is a systematic and regionally accepted approach for managing congestion. Such an approach can provide accurate, up-to-date information on transportation system performance. This enables transportation planners and decision makers to assess alternative strategies for managing congestion that meet state and local needs. The CMP is intended to move these congestion management strategies into the funding and implementation stages.

Congestion Management Process

The CMP, as defined in federal regulations, is intended to serve as a systematic process that provides for safe, effective and integrated management and operation of the multimodal transportation system. Federal requirements state that the CMP shall be developed and implemented as an integrated part of the metropolitan transportation planning process. The process includes:

1. Developing regional congestion management objectives,
2. Defining the CMP network,
3. Developing multimodal performance measures,
4. Collecting data and monitoring system performance,
5. Analyzing areas of congestion,
6. Identifying and applying strategies to implement regional objectives and
7. Evaluating the effectiveness of CMP strategies.

Congestion and Air Quality

A CMP is required in metropolitan areas with population exceeding 200,000, known as Transportation Management Areas (TMAs). In TMAs designated as ozone or carbon monoxide non-attainment areas, including Baltimore, the CMP takes on a greater significance. Federal law prohibits projects

that result in a significant increase in the number of single-occupant vehicles (SOVs) from being programmed in these areas unless the project is addressed in the region's CMP.

Baltimore region CMP Approach

Although a CMP is required in every TMA, federal regulations are not prescriptive regarding the methods and approaches used to implement a CMP. This flexibility recognizes that different metropolitan areas may face different conditions regarding traffic congestion and may have different approaches for dealing with congestion.

In 2019, we worked with a consultant to refine and develop our CMP. The CMP is intended to be an integral component of the transportation planning process. Since the CMP is intended as a regional process that is fully integrated into the metropolitan transportation planning process, development of the CMP should engage a wide array of stakeholders who play an important role in transportation planning and operations within the region. In fact, the CMP development offers an opportunity to engage a wide array of stakeholders at the state and local levels, as well as federal partners and private industry.

We convened a CMP committee to provide input and guidance and serve as the main conduit for coordination with regional partners to develop the regional CMP. The CMP Committee is comprised of representatives from local planning, transportation, public works and emergency management agencies as well as state and federal transportation agencies. The following sections describe the key elements of the regional CMP.

1. Developing Congestion Management Objectives

Congestion management objectives define what the region wants to achieve regarding congestion management. They are an essential part of an objectives-driven, performance-based approach to planning for operations. Congestion management objectives serve as one of the primary points of connection between the CMP and the long-range transportation plan (LRTP), and serve as a basis for defining the direction of the CMP and its performance measures.

Following is information on how five of the nine *Resilience 2050* goals detailed in Chapter 4 relate either directly or indirectly to the Baltimore region's CMP.

Goal: Improve System Safety

While the emphasis of this goal is to protect the traveling public, reducing traffic incidents (including bicycle/pedestrian fatalities and injuries) will have the secondary effect of easing nonrecurring congestion related to incident delay.

Goal: Improve and Maintain the Existing Infrastructure

As with the safety goal, the emphasis of this goal does not directly address congestion management. However, keeping pavement, bridges, signals and intelligent transportation systems (ITS) infrastructure in a state of good repair can help to maintain traffic flow and reduce delay. In addition, maintaining and replacing transit vehicles on a timely basis can help to encourage the use of transit as an alternative to single-occupant vehicles. Maintaining sidewalks, bikeways and shared use paths in a state of good repair can encourage travelers to use these modes, which could also reduce roadway congestion.

Goal: Improve Accessibility

This involves planning for an integrated transportation system that is accessible, resilient, sustainable, equitable and reliable for all system users and that provides for improved connectivity among all modes and across inter-jurisdictional and inter-regional boundaries. Related strategies that have guided transportation investment decisions in the Baltimore region include expanding transit options and investing in high quality, safe, sustainable and comfortable bicycle and pedestrian facilities.

Goal: Increase Mobility

Improving mobility and travel time reliability is a critical issue for travelers, particularly in relation to incidents, weather conditions and special events. Reliability is important for both motorists and transit service, and the region has established targets for travel time reliability. This involves integrating Transportation System Management and Operations (TSMO) strategies that improve the performance and reliability of the existing transportation infrastructure to relieve congestion and reduce delay. There are unique issues associated with freight and goods movement. The region has established a target for truck travel time reliability and analyzes performance data for freight priority corridors. Improving performance and reliability includes addressing these concerns:

- **Recurring delay** – Dealing with recurring delay can involve applying such approaches as ITS, better signal timing, implementing flextime or telework arrangements at major employment centers, hard shoulder running and judicious capacity adding projects. Another approach that might be considered in the future is instituting congestion pricing or tolls.
- **Nonrecurring delay** – This involves incident management and providing information on delays related to incidents, construction, special events or weather to transportation system users.

Goal: Foster Participation and Cooperation among All Stakeholders

Improved coordination among localities, modes and agencies within the region is a key priority for the CMP Committee.

This objective enhances inter-jurisdictional coordination and promotes informed decision-making to optimize transportation system performance.

2. Defining the CMP Network

The CMP network involves defining two aspects of the system that are examined as part of the planning process: (1) the geographic boundaries or area of application and (2) the system components and network of surface transportation facilities.

The primary area covered under the CMP network includes our member jurisdictions: the cities of Baltimore and Annapolis and the counties of Anne Arundel, Baltimore, Carroll, Harford, Howard and Queen Anne's. The travel demand model also includes and considers the effects of transportation facilities and operations within areas covered by other MPOs (such as the Washington, DC metropolitan area, southern Pennsylvania, and Cecil County, Maryland).

The CMP network identifies geographic boundaries as well as the system components including roads, transit network and freight network. We monitor the identified network to assess operations. This network incorporates all available data throughout the region for multiple modes of transportation. The system components include:

- Highway system (interstates, arterials and local roads),
- Transit system (MDOT MTA bus, light rail, metro, MARC and local transit service providers) and
- Freight routes / intermodal connections (such as intermodal terminals and airports).

3. Developing Multimodal Performance Measures

Performance measures are a critical component of the CMP. They are used to assess the performance of the region's transportation network, identify regional and local congestion and mobility issues and support the identification of strategies. As per the Metropolitan Transportation Planning Final Rule 23 CFR450.320 (a) and (b) released in 2007, the development of a CMP should result in multimodal system performance measures and strategies that can be reflected in the TIP and LRTP. For the CMP, the intent is to be able to explore congestion and mobility issues across the transportation system network in order to identify locations with problems and the source of those problems.

Volume-to-Capacity-Based Measures

Measures relying on volume-to-capacity ratios traditionally have been used in CMPs. This is because: (a) data on traffic volumes are usually relatively easy to obtain and often already exist, (b) travel demand models are designed to estimate future volumes on the transportation network and (c) estimates of capacity can be derived using documents such as the Highway Capacity Manual (HCM). A limitation of volume-to-capacity measures is that they may not be readily understood by the public.

Delay and Travel Time Reliability Measures

We mapped this information in the form of a CMP Analysis Tool using ArcGIS online. Several performance metrics identified by the consultant in collaboration with the CMP Committee have been integrated into this tool for use by regional stakeholders. This will help to identify areas with mobility challenges or potential needs, which will support the identification of strategies to address these problems or needs. The tool will use performance measures we adopted as required by the Infrastructure Investment and Jobs Act (IIJA). These measures will be updated annually. A few of the core measures include:

- Annual hours of peak-hour excessive delay (PHED),
- Level of Travel Time Reliability (LOTTR) – Interstate System: percentage of person-miles traveled on the interstate system that are reliable,
- Level of Travel Time Reliability (LOTTR) – Non-Interstate System: percentage of person-miles traveled on the non-interstate NHS that are reliable and
- Truck Travel Time Reliability (TTTR) Index: ratio of interstate system mileage indicating reliable truck travel times.

Chapter 5 includes information on these measures as well as the targets we adopted to assess system performance.

The PHED measure represents the annual hours of peak-hour excessive delay that occur within an urbanized area on the National Highway System (NHS). By law, the state and the MPO must coordinate to set a single unified set of performance targets for the urbanized area. The threshold for excessive delay is based on the travel time at 20 miles per hour or 60 percent of the posted speed limit travel time, whichever is greater, and is measured in 15-minute intervals.

Peak travel hours are defined as 6:00-10:00 a.m. local time on weekday mornings and 3:00-7:00 p.m. or 4:00-8:00 p.m. local time on weekday afternoons, providing flexibility to state DOTs and MPOs. MDOT calculated the PHED values by uploading posted speed limit data on segments of the NHS in the Baltimore urbanized area into a tool in the Regional Integrated Transportation Information System (RITIS).

Level of Travel Time Reliability (LOTTR) compares the time it takes to travel segments of the NHS in congested conditions (as shown by the 80th percentile time) relative to the time it takes to make a trip in “normal” conditions (as shown by the 50th percentile time). If the 80th percentile travel time divided by the 50th percentile travel time is less than 1.5, then travel time is considered to be reliable. As an example, traffic that takes 45 minutes to travel a segment that in normal conditions takes 30 minutes results in a ratio of 1.5. This measure uses data from FHWA’s National Performance Management Research Data Set (NPMRDS) or equivalent. Data are collected in 15-minute segments during all time periods between 6:00 a.m. and 8:00 p.m. local time.

The TTTR index compares the time it takes trucks to travel segments of the NHS in congested conditions (as shown by the 95th percentile time) relative to the time it takes to

make a trip in "normal" conditions (as shown by the 50th percentile time). The TTTR ratio is generated by dividing the 95th percentile time by the normal time (50th percentile) for each segment. For example, say a truck takes 56 minutes to travel a segment of the NHS that normally takes 30 minutes. This translates into a ratio of 1.87 (56 minutes / 30 minutes). Reporting for purposes of calculating the TTTR index is divided into five periods: morning peak (6:00-10:00 a.m.), midday (10:00 a.m.-4:00 p.m.) and afternoon peak (4:00-8:00 p.m.) Mondays through Fridays; weekends (6:00 a.m.-8:00 p.m.); and overnights for all days (8:00 p.m.-6:00 a.m.). The TTTR index is calculated by multiplying each segment's largest ratio of the five periods by its length, then dividing the sum of all length-weighted segments by the total length of interstate.

These measures can be translated using various assumptions into other measures such as user costs, and can be used in the process of validating travel demand forecasting models.

Variability of Congestion/Reliability

The variability or change in congestion on a day-to-day basis provides a measure of reliability. Recurring congestion is generally predictable, regularly occurring and typically caused by excess demand compared to the capacity of the system.

On the other hand, nonrecurring congestion — caused by transient events such as traffic incidents, weather conditions, work zones or special events — results in unreliable travel times. Nonrecurring congestion and the unreliable travel times that result are often the most frustrating form of congestion to travelers. Moreover, FHWA has estimated that nonrecurring sources of congestion are responsible for a significant amount of travel delay.

Since the transportation planning models used in metropolitan transportation planning are designed to address recurring congestion issues, many regions have found it challenging to incorporate measures of nonrecurring congestion as part of their CMP. Some MPOs have used crash data as a surrogate measure for nonrecurring congestion under the premise that traffic incidents are directly linked to nonrecurring congestion. Others have begun to gather archived real-time traffic data from operating agencies to examine the variability in traffic volumes, speeds and/or travel times on a daily basis.

We are working on developing travel time measures using both traditional sources of data and new technologies that take advantage of operations data such as probes and ITS devices.

4. Collecting Data and Monitoring System Performance

Data collection and system monitoring are needed to make effective decisions, and are typically an ongoing activity.

According to federal regulation, the CMP must include:

> *Establishment of a coordinated program for data collection and system performance monitoring to define the extent and duration of congestion, to contribute in determining the causes of congestion and evaluate the efficiency and effectiveness of implemented actions.*

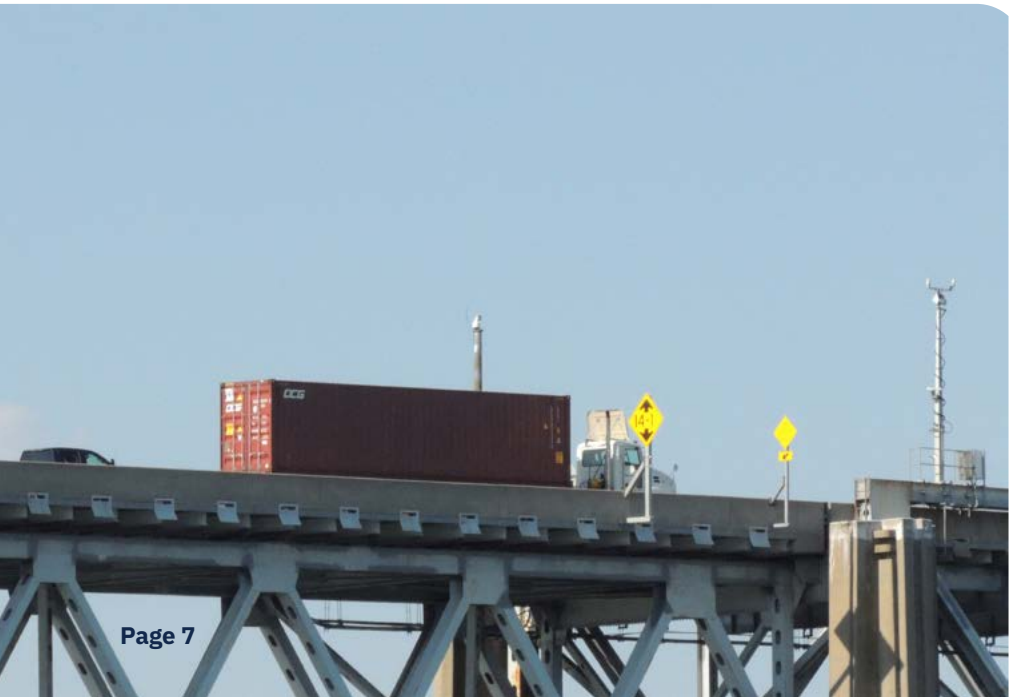
To the extent possible, this data collection program should be coordinated with existing data sources (including archived operational/ITS data) and with operations managers in the metropolitan area.

Using Vehicle Probe Data to Monitor Traffic

Since 2013, we have been in partnership with The Eastern Transportation Coalition and University of Maryland Center for Advanced Transportation Technology Lab (CATT Lab). This setup enables partners to have access to continuous (24/7) probe data to monitor traffic conditions throughout the region. Access to the data is through the Probe Data Analytics (PDA) Suite, an online set of tools that can be accessed through a web browser. This eliminates the need for the many hours of processing of raw data that our previous approach (collecting GPS speed data) required.

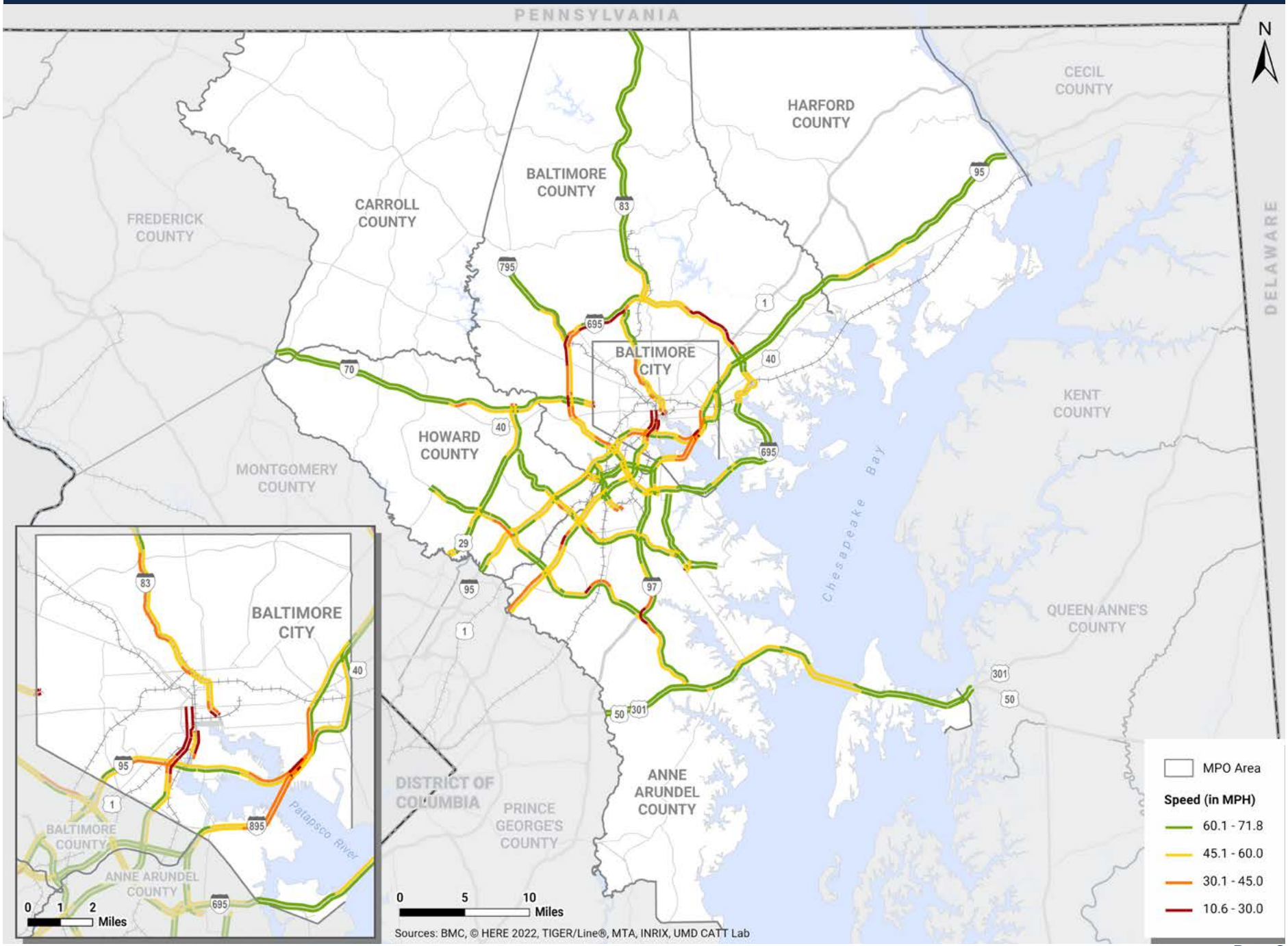
The PDA Suite began in 2008 with the primary goal of enabling Coalition members to acquire reliable travel time and speed data for their roadways without the need for sensors and other hardware.

Maps 1 and 2 show probe data for the Baltimore region, depicting average 2022 travel speeds on freeways and major arterials for the a.m. and p.m. peak periods, respectively.

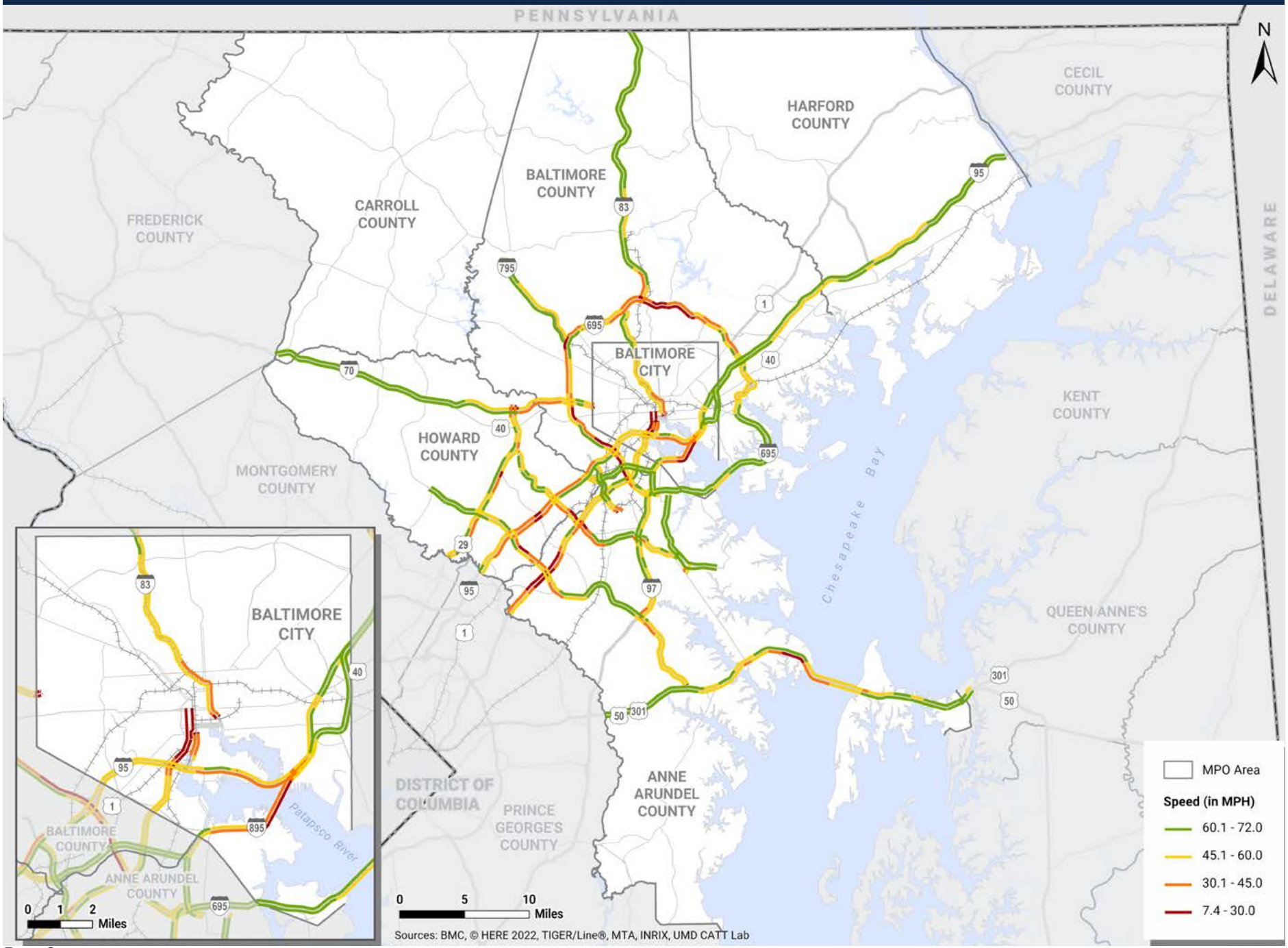


Since 2013, we have been in partnership with The Eastern Transportation Coalition and University of Maryland Center for Advanced Transportation Technology Lab (CATT Lab).

Map 1 - 2022 Average Travel Speeds for A.M. Peak Period



Map 2 - 2022 Average Travel Speeds for P.M. Peak Period



5. Analyzing Areas of Congestion

Methods to Support Analysis of Congestion and Mobility Needs

We began developing the "Quarterly Congestion Analysis Report" in 2013 using probe data from the PDA Suite. This report identifies the top ten bottlenecks in the Baltimore region.

The PDA tool determines bottleneck conditions by comparing the current reported speed to the reference speed for each segment of road. INRIX provides reference speed values for each segment. These represent the 85th percentile observed speed for all time periods, with a maximum value of 65 mph. If the reported speed falls below 60 percent of the reference, the road segment is flagged as a potential bottleneck. If the reported speed stays below 60 percent for five minutes, the segment is confirmed as a bottleneck location. Adjacent road segments meeting this condition are joined together to form the bottleneck queue. When reported speeds on every segment associated with a bottleneck queue have returned to values greater than 60 percent of their reference values and have remained that way for 10 minutes, the bottleneck is considered cleared. The process ignores bottlenecks whose total queue length, determined by adding the length of each road segment associated with the bottleneck, is less than 0.3 miles.

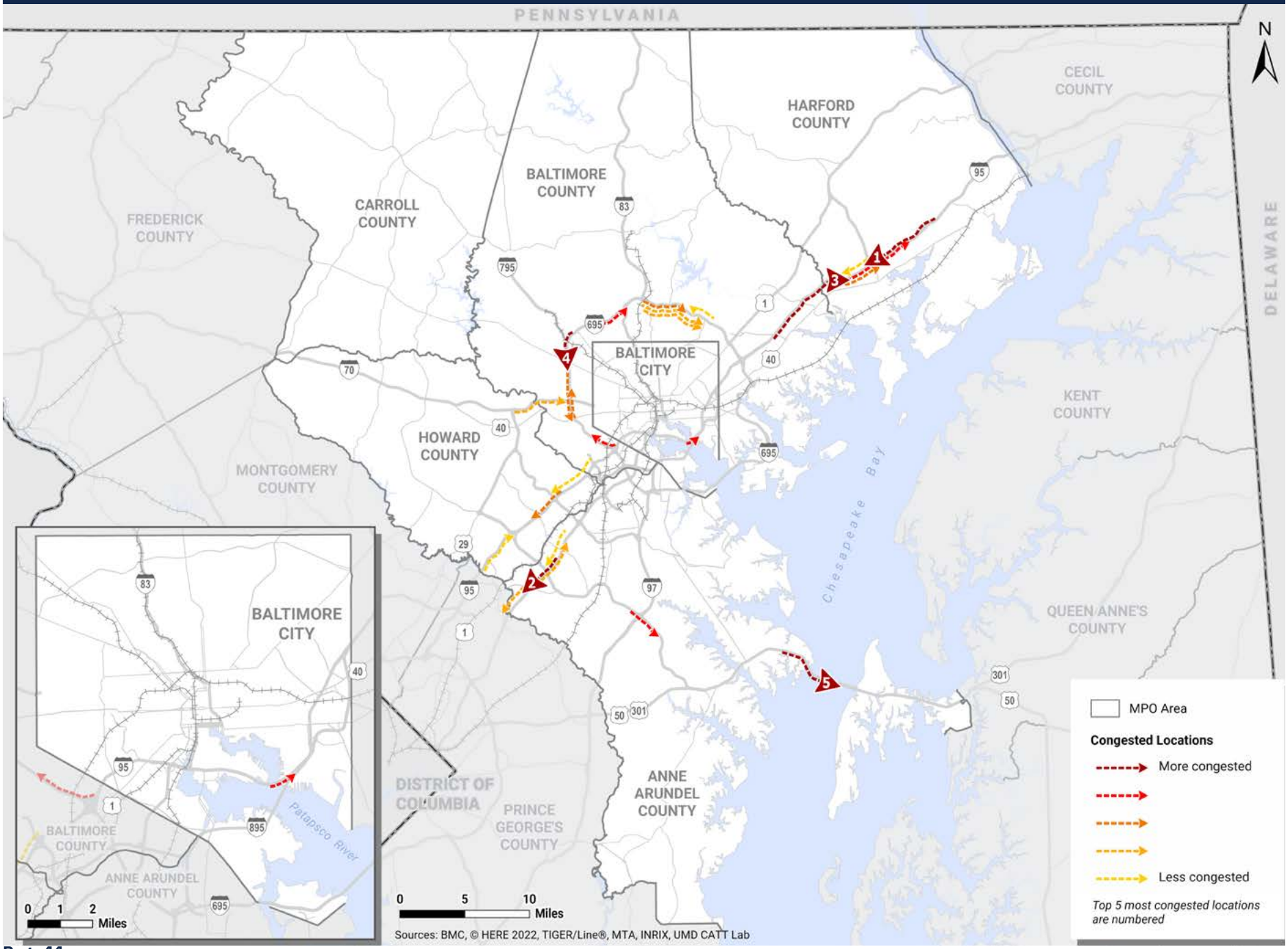
The quarterly report identifies the top bottlenecks in the Baltimore region and ranks them by Impact Factor. This is calculated by multiplying the number of times a bottleneck occurred by its average duration by its average length.

Along with the ranking, staff attempt to assess what is causing the congestion and utilize tools in the PDA Suite to illustrate what is occurring at each location. From the bottleneck report, staff can create specialized maps showing congested locations. Map 3 shows an example depicting the top 25 congested locations in 2022 based on PDA data.

In addition to the bottleneck rankings, we have recently developed the CMP Analysis Tool using ArcGIS online, which maps bottlenecks and several other performance metrics. This tool supports the analysis of congestion and mobility issues by transportation agency staff to identify regional and local priorities. It may also be used by interested parties, including land use planners, community groups and the public to better understand congestion and mobility issues and engage in the transportation decision-making process (and to consider policies related to issues such as land use, parking, incentives and travel demand management).

Our CMP is intended to accomplish more than just presenting data on congestion. It will identify congestion and mobility needs and the causes of congestion in order to support identification of solutions. The CMP Analysis Tool will be used with the intent to provide updated information on congestion and mobility issues on an annual basis to support identification of priorities by local governments and partners.

Map 3 - Top 25 Congested Locations in 2022 (Top 5 Most Congested Locations Numbered)



Analysis of Congestion in Selected Corridors

Each year, Maryland's 23 counties and Baltimore City send "priority letters" to MDOT. This is the formal process for local jurisdictions to submit project requests for the state's Consolidated Transportation Program (CTP). These letters list the projects that each jurisdiction considers critical to addressing their transportation needs, which often include alleviating traffic congestion and addressing safety concerns.

TSMO is a key tool for addressing both recurring and nonrecurring congestion, and the MDOT SHA TSMO Strategic Plan notes that TSMO will be a critical component of future programs and projects. However, TSMO projects often do not fit neatly into the traditional priority letter project categories of "highway," "transit" and "bicycle and pedestrian," or even within one jurisdiction. We will work with MDOT to develop a process for local jurisdictions to submit TSMO projects in their priority letters. In addition, MDOT SHA is embarking on a TSMO stakeholder outreach and education process. We will participate in this process, as well as investigate other approaches as needed, to ensure all approaches for congestion management are considered.

Conducting corridor studies to identify operational issues is one way we have aided local jurisdictions in addressing congestion and improving the priority letter process. We developed a template for conducting corridor studies and coordinate with local and state partners through the CMP Committee to identify corridors to study in the future. Analysis along the selected corridors will help local jurisdictions better understand the connections between congestion, safety, land use, freight movement and operations. This process also will establish linkages among local jurisdiction priorities, the LRTP and the TIP. Data we gather and analyze will provide information for subsequent NEPA analysis.

Our technical analysis focuses on better understanding the extent, duration and causes of congestion along the corridor and on developing potential operational countermeasures for short-term efficiency and safety. Such analyses will try to capture both recurring and nonrecurring congestion.

6. Identifying and Applying Strategies

The CMP must identify and analyze reasonable travel demand reduction and operational management strategies. If the analysis demonstrates that these strategies cannot fully satisfy the need for additional capacity and additional SOV capacity is warranted, then the CMP must identify strategies to manage the SOV facility safely and effectively, along with other travel demand reduction and operational management strategies appropriate for the corridor.

Coordinating with TSMO Activities

As stated in 23 CFR 450.320, "The congestion management process shall be developed, established, and implemented as part of the metropolitan transportation planning process that includes coordination with transportation system management and operations activities." MDOT SHA recently completed an updated TSMO Strategic Plan that states, ". . . TSMO will drive how we design and implement future programs and projects." We will continue to work closely with our partners on TSMO activities, which are a critical component to addressing congestion.

Resilience 2050 Strategies

In November 2021, we approved the following strategies under the goal of Increase Mobility. These strategies will help the region reduce congestion and improve traffic flow:

- Continue to coordinate with MDOT and local agencies to improve travel time reliability through performance-based planning and programming.
- Continue to refine and implement a CMP that incorporates TSMO strategies to optimize the performance of the existing transportation system and minimize impact and costs.
- Analyze congestion causes and mitigation strategies for corridors and locations experiencing recurring high congestion levels.
- Consider how all modes — roadway, transit, pedestrian, bicycle and shared mobility — can work together to address system capacity needs.
- Support a regional multimodal freight network for safe and efficient freight movement.
- Increase mobility, including traffic and transit incident response and recovery, through traffic and transit system management and operations techniques.
- Reduce the effects of non-recurring incidents (such as crashes, weather-related delays and special events) by enhancing methods of sharing information across agencies and modes, responding to and managing these incidents and sharing information with travelers.
- Develop and support a regional, long-distance bikeway network, including consistent guide signage.

Other strategies that might be considered in the future to help the region ease congestion are:

- Work more closely with other adjacent metropolitan areas to develop inter-regional approaches to measuring and managing congestion, including performance measures adopted and applied on an inter-regional basis. The Baltimore region has taken some initial steps in this area by meeting periodically with traffic and operations staff from adjacent MPOs and other state DOTs to discuss inter-regional approaches to improving mobility and managing congestion.

- Select relatively low-cost congestion management projects ("spot" improvements, signal timing) that could be funded with CMAQ or potentially PL or STBG funds.

Specific Strategies – Preferred Alternative Projects

We requested detailed information from jurisdictions and agencies submitting projects for consideration for *Resilience 2050*. Some of this information relates to strategies, either in place or under consideration, which could provide congestion management benefits for each proposed project. The strategies are drawn from the CMP and include:

- Demand Management and Regional Strategies, including:
  - Commuter-related programs (such as employer outreach and commuter benefits policies) and
  - Promoting regional coordination (such as intra-jurisdictional projects/strategies),
- TSMO Strategies, including:
  - Intersection control (such as traffic signal coordination and ramp metering),
  - Real-time monitoring (such as active traffic management and traveler information systems) and
  - Operational improvements (such as movable barriers, reversible commuter lanes and geometric improvements),
- Public Transportation Strategies, including:
  - Operational improvements (such as transit signal priority and optimizing transit service),
  - New infrastructure (such as bus rapid transit and network expansion) and
  - User-oriented improvements (such as trip-planner applications and real-time data),
- Bicycle/Pedestrian and Micromobility Strategies, including:
  - Infrastructure additions (such as new bike lanes and streetscape elements),
  - Infrastructure improvements (such as traffic calming) and
  - Sharing programs (such as bikeshare programs and micromobility) and
- Road Capacity Strategies, including:
  - Roadway changes (such as new lanes and spot improvements),
  - Intersection changes (such as grade separated intersections and intersection improvements) and
  - Freight improvements (such as addressing freight bottlenecks, rail/port access and truck parking).

Tables 1-7 show the specific strategies proposed for each project in the preferred alternative, based on information provided by the local jurisdictions and operating agencies, as well as knowledge of existing operational characteristics along these project corridors.

Table 1 - Transit Expansion Projects: 2028-2039

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
1*	Anne Arundel County	Anne Arundel Countywide Microtransit	Countywide	Expand microtransit service in Anne Arundel County from 1 zone in the south to 7 zones, providing on-demand transit services to connect to existing fixed route services across the entire county.	• Public Transportation: User-oriented improvements (trip-planner application, real-time data, universal farecards, etc.)
2	TBD Anne Arundel County	Annapolis to New Carrollton Transit	New Carrollton to Parole 21.0 miles	New Express Bus service between Parole and New Carrollton with stops at major communities along the way.	• Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.)
3	TBD Anne Arundel County	Glen Burnie to Annapolis Transit	Cromwell / Glen Burnie to Annapolis / Parole 16.0 miles	New Express Bus service between Annapolis / Parole and Glen Burnie along I-97.	• Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.)
• 4 • 5 • 6	MDOT MTA 3 Locations in Baltimore City	MDOT MTA Transit Hubs: • Charles Center • Mondawmin • Penn Station	Jurisdiction: • Baltimore City • Baltimore City • Baltimore City	MDOT MTA has identified transit hub locations as part of the Regional Transit Plan. Typically, a transit hub includes enhanced amenities (shelters, benches, information). The Penn Station project has received $5M in Congressionally Designated Funding for multimodal access improvements to the station and a Federal RAISE discretionary grant to further fund investments around the station.	• Commuter-related programs (employer outreach, commuter benefits policies, parking cash out policies, etc.) • Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
7	MDOT SHA Harford County	Transit Signal Priority	MD 22 corridor from MD 543 to Long Drive / Technology Drive 7.4 miles MD 924 corridor from MacPhail Road to Woodsdale Road 4.7 miles	Construct queue jump lanes along MD 22 and MD 924 and install equipment on buses that syncs with traffic signals along these corridors.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.)
8	TBD Howard County	US 29 Bus Rapid Transit	US 40 to MD 198 (Burtonsville, MD) 16.0 miles	Connect Ellicott City to Columbia, Maple Lawn and Burtonsville at MD 198 in Montgomery County, including separated facilities on US 29 to integrate with Montgomery County improvements and the development of a transit center in Downtown Columbia.	• TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Public Transportation: User-oriented improvements (trip-planner application, real-time data, universal farecards, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
9	MDOT MTA Regional	East-West Transit Corridor *(Project now known as the Red Line)*	Ellicott City to Essex 17.0 miles	New east-west transit service to connect major Baltimore region destinations like West Baltimore, Downtown, East Baltimore and the western suburbs as identified in the RTP.	• Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Public Transportation: User-oriented improvements (trip-planner application, real-time data, universal farecards, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
10	MDOT MTA Regional	MDOT MTA Commuter Service	Harford County to Downtown Baltimore and Harbor East	Additional MDOT MTA commuter bus service from Harford County to Downtown Baltimore and Harbor East.	• Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.)
11	TBD Regional	Annapolis to Fort Meade to Columbia Transit	Annapolis / Parole to Fort Meade to Columbia 25.0 miles	New Express Bus service between Parole and Columbia with primary service to Fort Meade and stops at major communities along the way.	• Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.)

Table 2 - Roadway Expansion Projects: 2028-2039

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
12	MDOT SHA Anne Arundel County	MD 198	MD 295 to MD 32 2.7 miles	Widen from 2 to 4 lanes and construct a continuous center median. Widen ramp at MD 295. Provide bicycle and pedestrian facilities within project limits.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
13	MDOT SHA Anne Arundel County	MD 3	MD 450 to MD 32 6.2 miles	Targeted widening from 4 to 5 lanes, including intersection improvements, access controls to address safety, TSMO strategies to address congestion and bicycle and pedestrian improvements.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
14	MDOT SHA Anne Arundel County	MD 170	Norcross Lane to Wieker Road 0.8 miles	Widen from 2 to 4 lanes, resurface and restripe along MD 170 and along MD 174 to create new turn lanes and increased capacity at the MD 170 / MD 174 intersection, including sidewalks and bicycle compatible shoulders.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
15	MDOT Baltimore County	I-695 at Broening Highway Interchange		Construct a partial interchange at Exit 44 of I-695 to support redevelopment at Sparrows Point.	• TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Roadway changes (new lanes, spot improvements, etc.)
16	MDOT SHA Baltimore County	I-795	Owings Mills Boulevard to Franklin Boulevard 2.6 miles	Widen from 4 to 6 lanes and construct a full interchange at Dolfield Boulevard, including TSMO strategies.	• TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Roadway changes (new lanes, spot improvements, etc.)
17	MDOT SHA Baltimore County	MD 140	Painters Mill Road to Owings Mills Boulevard 0.4 miles	Widen from 4 to 6 lanes, including a raised median, bicycle accommodations and pedestrian facilities.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
18	MDOT SHA Carroll County	MD 97	Bachmans Valley Road to MD 140 in Westminster 2.4 miles	Widen from 3 to 5 lanes, with a full interchange at Meadow Branch Road and bicycle and pedestrian facilities.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)
19	MDOT SHA Harford County	MD 543	MD 136 to I-95 1.9 miles	Widen from 2 to 4 lanes, including intersection upgrades at MD 136, turn lanes, capacity upgrades to the MD 543 / I-95 interchange and bicycle and pedestrian access. Improvement will fix queuing problems on MD 543 through the intersection with MD 7.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
20	Howard County	Broken Land Parkway at Snowden River Parkway	Broken Land Parkway from south of MD 32 to north of Snowden River Parkway; Snowden River Parkway from east of Minstrel Way to Patuxent Woods Drive 0.25 miles	Capacity, operational and safety improvements at this signalized intersection as well as access improvements to the MD 32 / Broken Land Parkway interchange ramps.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)
21	Howard County	Snowden River Parkway Widening	Broken Land Parkway to Oakland Mills Road 1.1 miles	Widen from 4 to 6 lanes, including auxiliary lanes and pedestrian, bicycle and transit improvements on both sides of the road.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
22	MDOT SHA Howard County	I-95	MD 32 to MD 100 6.0 miles	Create peak hour part-time shoulder use lanes.	• TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Roadway changes (new lanes, spot improvements, etc.)
23	MDOT SHA Howard County	MD 175 / MD 108 Interchange	0.25 miles in all directions from the current intersection and a direct connection of MD 108 to Columbia Gateway Drive. 0.25 miles	This T-intersection experiences significant congestion and an even worse collision experience. Existing intersection exhibits a collision rate higher than almost all intersections in Howard County. A partial grade-separation with direct access into Columbia Gateway will improve intersection capacity and alleviate the high collision rate.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)
24	MDOT SHA Howard County	TSMO System 1	I-70 from I-695 to MD 32 (11.0 miles) US 29 from MD 99 to MD 100 (4.0 miles) US 40 from I-695 to I-70 (10.0 miles)	Implement a combination of information technology and geometric improvements to address safety and operations within TSMO System 1 including I-70, US 29 and US 40.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
25	MDOT SHA Howard County	US 29	Patuxent River Bridge to Seneca Drive 1.7 miles	Widen northbound US 29 from 2 to 3 lanes, including improvements at intersection with Rivers Edge Road.	• Roadway changes (new lanes, spot improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
26	MDOT SHA Queen Anne's County	MD 18	Kent Narrows to Bay Bridge – MD 18 and MD 835 on east side of Kent Narrows to MD 18 5.0 miles	Widen from 2 to 4 lanes, including right-of-way acquisition, utility relocation, new pedestrian improvements and reconstruction of intersections to improve capacity, safety and mobility on the only alternate route to US 50/301 on the island.	• Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
27	MDOT SHA Queen Anne's County	MD 8 / US 50/301 Interchange and Service Roads	Skip Jack Parkway south to Davidson Drive; east to Thompson Creek service road 2.0 miles	Widen from 2 to 4 lanes, convert MD 8 overpass to full divergent diamond interchange with US 50/301, and add Thompson Creek and Cox Creek service roads to improve traffic flow, add capacity and allow for alternate routes to services and residential areas. Provide for bike and pedestrian improvements along existing and new routes.	• Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)

Table 3 - Transit Expansion Projects: 2040-2050

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
28	TBD Harford County	Aberdeen MARC Station	US 40 at MD 132 (Bel Air Avenue)	Transit Oriented Development (TOD), new train station, additional parking, US 40 "Green Boulevard" and remove pedestrian overpass and replace with Station Square Plaza - a new pedestrian underpass and green, terraced plaza / amphitheater.	• Commuter-related programs (employer outreach, commuter benefits policies, parking cash out policies, etc.) • Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Public Transportation: User-oriented improvements (trip-planner application, real-time data, universal farecards, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
29	TBD Howard County	US 1 Corridor Bus Rapid Transit	Dorsey MARC Station to College Park Purple Line Station 19.5 miles	Bus Rapid Transit will emulate light rail operation at a lower cost, and is designed to link Howard County commuters from the Dorsey MARC to the Laurel MARC Station and the City of Laurel as well as to College Park and the Purple Line Light Rail.	• Commuter-related programs (employer outreach, commuter benefits policies, parking cash out policies, etc.) • Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Public Transportation: User-oriented improvements (trip-planner application, real-time data, universal farecards, etc.) • Bicycle/Pedestrian and Micromobility: Sharing programs (bikeshare programs, micromobility, etc.) • Roadway changes (new lanes, spot improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
• 30 • 31 • 32 • 33 • 34 • 35 • 36 • 37 • 38 • 39 • 40 • 41 • 42 • 43	MDOT MTA 14 Locations throughout the region	MDOT MTA Transit Hubs: • BWI Airport • Glen Burnie • Bayview Medical Center • Camden Station • Johns Hopkins Hospital • Lexington Market • Penn-North • Rogers Avenue • State / Cultural Center • UM Medical Center • Essex • Owings Mills • Patapsco • White Marsh	Jurisdiction: • Anne Arundel • Anne Arundel • Baltimore City • Baltimore City • Baltimore City • Baltimore City • Baltimore City • Baltimore City • Baltimore City • Baltimore Co • Baltimore Co • Baltimore Co • Baltimore Co	MDOT MTA has identified transit hub locations as part of the Regional Transit Plan. Typically, a transit hub includes enhanced amenities (shelters, benches, information).	• Commuter-related programs (employer outreach, commuter benefits policies, parking cash out policies, etc.) • Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
44	MDOT MTA Regional	North-South Transit Corridor	Towson to Downtown Baltimore (potentially Lutherville to Port Covington) 14.0 miles	New North-South transit service to connect Towson to Downtown Baltimore, with associated investments to significantly improve the speed and reliability of transit service in this busy corridor.	• Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Public Transportation: User-oriented improvements (trip-planner application, real-time data, universal farecards, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
45	TBD Regional	Bus Rapid Transit to BWI	Dorsey MARC Station to BWI Light Rail Station 9.7 miles	New Bus Rapid Transit service from the Dorsey MARC station to Arundel Mills to BWI consolidated rental car facility to the BWI light rail station.	• Commuter-related programs (employer outreach, commuter benefits policies, parking cash out policies, etc.) • TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Public Transportation: User-oriented improvements (trip-planner application, real-time data, universal farecards, etc.)
46	TBD Regional	Chesapeake Bay Ferry Service		Establish a passenger ferry between numerous ports along the Chesapeake Bay.	• Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.)

Table 4 - Roadway Expansion Projects: 2040-2050

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
47	MDOT SHA Anne Arundel County	I-97	MD 32 to US 50/301 6.5 miles	Widen from 4 to 6 lanes, adding managed lanes (HOV lanes) to address capacity needs. Investigate need for additional interchange access in Crownsville.	• TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)
48	MDOT SHA Anne Arundel County	MD 2	US 50 to MD 100 10.0 miles	Widen existing 4-lane sections to 6 lanes to create a continuous typical section throughout corridor, including intersection improvements and pedestrian facilities throughout to connect MD 2 to the B&A Trail at various locations.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
49	MDOT SHA Anne Arundel County	MD 214	MD 424 to Shoreham Beach Road 7.5 miles	Widen from 2 to 4 lanes east of MD 2, bicycle improvements throughout most of the corridor and pedestrian improvements in segments. Traffic signal warrant assessments recommended at MD 214 / Riva Road and MD 214 / Stepneys Lane intersections.	• TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
50	MDOT SHA Anne Arundel County	MD 175	Reece Road to MD 170 2.7 miles	Widen from 4 to 6 lanes, including improvements at the MD 32 interchange and bicycle and pedestrian facilities.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
51	MDOT SHA Anne Arundel County	MD 177	MD 2 to Lake Shore Drive 6.1 miles	Widen from 2 to 4 lanes, including intersection improvements and improved bicycle and pedestrian infrastructure in accordance with the County Study and MDOT SHA MD 177 Operational Analysis.	• TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
52	MDOT SHA Anne Arundel County	MD 295	MD 100 to I-195 3.3 miles	Widen from 4 to 6 lanes, including a new full interchange at Hanover Road and an extension of Hanover Road from the CSX railroad tracks to MD 170.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
53	MDOT SHA Anne Arundel County	MD 713	MD 175 to MD 176 2.6 miles	Construct corridorwide improvements including reconstruction and widening, intersection improvements and bicycle and pedestrian accommodations. Primary widening is from 2 to 4 lanes between MD 175 and Stoney Run Drive.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
54	MDOT SHA Baltimore County	MD 7 at MD 43 Interchange		Upgrade interchange from partial to full, including two new ramps to accommodate full movements at interchange.	• TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Roadway changes (new lanes, spot improvements, etc.)
55	MDOT SHA Carroll County	MD 140	Market Street to Sullivan Road 2.5 miles	Widen from 6 to 8 lanes, with a full interchange at MD 97, continuous flow intersections at Center Street and Englar Road, and bicycle and pedestrian facilities.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
56	MDOT SHA Carroll County	MD 26	MD 32 to the Liberty Reservoir 2.5 miles	Widen from 4 to 6 lanes, including a raised median, intersection improvements and pedestrian facilities.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
57	MDOT SHA Carroll County	MD 27 Corridor Improvements	Carroll County Line to Leishear Road 3.2 miles	Widen to a consistent four lanes, including dedicated turn lanes, signalized traffic control, boulevard separation of lanes and controlled intersections to allow pedestrian crossings.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
58	MDOT SHA Carroll County	MD 32	Howard County Line to MD 26 3.4 miles	Widen from 2 to 4 lanes with pedestrian and bicycle facilities.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
59	Harford County	Abingdon Road	MD 924 to US 40 3.0 miles	Capacity improvements including turn lanes, bicycle lanes and sidewalks.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
60	Harford County	Perryman Access - Mitchell Lane	US 40 in the vicinity of Mitchell Lane to Canning House Road 2.0 miles	Construct a new 2-lane road and bridge over Cranberry Run in Perryman, including turn lanes and bicycle and pedestrian access.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)
61	Harford County	Thomas Run Road	MD 22 to West Medical Hall Road 0.8 miles	Streetscape and capacity improvements, including center turn lane, sidewalks, bicycle accessibility, pedestrian-scale lighting with banners, crosswalks and street furniture.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.)
62	MDOT SHA Harford County	MD 152	US 1 to I-95 4.3 miles	Capacity improvements including turn lanes and bicycle and pedestrian access where applicable.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
63	MDOT SHA Harford County	MD 22	MD 543 to I-95 7.9 miles	Widen existing 2 and 3 lane sections to 4 and 5 lanes, including an HOV lane from Old Post Road to the Aberdeen Proving Ground (APG) gate, bicycle and pedestrian access and transit queue jump lanes and transit priority system where applicable.	• Commuter-related programs (employer outreach, commuter benefits policies, parking cash out policies, etc.) • Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
64	MDOT SHA Harford County	MD 24	US 1 Bypass to south of Singer Road 5.0 miles	Widen from 4 to 6 lanes, including sidewalks and bicycle accommodations where appropriate.	• TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
65	MDOT SHA Harford County	MD 24 (Rock Spring Road)	US 1 Bypass to MD 23 1.8 miles	Widen from 2 to 4 lanes, including turn lanes and completion of shared use path adjacent to the roadway from Forest Valley Road to Red Pump Road.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
66	MDOT SHA Harford County	MD 24 at Singer Road Interchange		Elevate grade of cross street through movement as well as left turn movements from all directions while allowing MD 24 through and right turn movements as well as side street right turn movements to operate with free-flowing movements as described in MD 924 study.	• Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)
67	MDOT SHA Harford County	US 1	MD 152 to MD 147 / US 1 Business 1.3 miles	Widen from 4 to 6 lanes, including bicycle and pedestrian accommodations.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
68	MDOT SHA Harford County	US 1	Baltimore County Line to MD 152 1.4 miles	Widen from 4 to 6 lanes, including turn lanes and bicycle and pedestrian access where applicable.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
69	MDOT SHA Harford County	US 1 Bypass	MD 147 / US 1 Business to Hickory Bypass 4.6 miles	Widen from 2 to 4 lanes and improve US 1 / MD 24 and US 1 / MD 924 interchanges.	• Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
70	MDOT SHA Harford County	US 40	MD 543 to Loflin Road 1.7 miles	Widen from 4 to 6 lanes, including turn lanes, a partial interchange reconstruction at MD 543 and bicycle and pedestrian access.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
71	MDOT SHA Harford County	US 40 at MD 22 Interchange		Improve capacity, reconfigure the existing interchange, restrict all left turn movements (allowing room for designated bike lanes) and relocate the existing signal from MD 22 to US 40.	• Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)
72	MDOT SHA Howard County	MD 100 Widening	I-95 to Anne Arundel County Line 2.0 miles	Widen from 4 to 6 lanes with additional merge/ diverge lanes.	• Roadway changes (new lanes, spot improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
73	MDOT SHA Howard County	MD 108	Trotter Road to Guilford Road 1.7 miles	Improvements as articulated in the 2014 Clarksville Pike Streetscape Plan & Design Guidelines / Traffic Study. Includes selected road capacity enhancements, sidewalks, shared use paths and traffic signal upgrades.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
74	MDOT SHA Howard County	MD 175	Oceano Avenue to Anne Arundel County Line 0.5 miles	Widen from 2 to 4 lanes, including bicycle, transit and pedestrian improvements consistent with Anne Arundel County widening proposals.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)
75	MDOT SHA Howard County	MD 175 at I-95 Interchange	1.0 miles	Improve existing full interchange consistent with preferred options in the MDOT SHA MD 175 Improvement Study.	• Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
76	MDOT SHA Howard County	MD 32	North of I-70 to Carroll County Line 4.0 miles	Widen from 2 to 4 lanes to provide safety, capacity, operational and access improvements on MD 32.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Roadway changes (new lanes, spot improvements, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
77	MDOT SHA Howard County	US 1	Baltimore County Line to MD 175 5.5 miles	Widen from 4 to 6 lanes and construct the revised typical section in the State / County MOU for US 1 revitalization, including connecting community destinations in the US 1 corridor to support safety and access as per the US 1 safety evaluation, functional plans and the regional active transportation priority project.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
78	MDOT SHA Howard County	US 1 at MD 175 Interchange	0.5 miles	Construct a new grade-separated Single Point Urban Interchange, with MD 175 passing over US 1.	• Intersection changes (grade separated intersections, intersection improvements, etc.)
79	MDOT SHA Howard County	US 1 Revitalization Breakout Projects	MD 175 to Whiskey Bottom Road 4.5 miles	Widen from 4 to 6 lanes along with bicycle, pedestrian, transit, streetscape and access improvements consistent with the US 1 Design Manual. Involve the private sector development community under the auspices of the US 1 State / County MOU and the US 1 Design Manual.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)

Table 5 - Transit System Preservation Projects: 2028-2039

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
A	MDOT MTA Baltimore City	Eastern Bus Division		Reconstruct the Eastern Bus Division as an electric bus facility.	• Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.)
B	MDOT MTA Regional	Zero-Emission Bus Transition Phase 1	MDOT MTA's core service area in the Baltimore region	Transition 50% of MDOT MTA's 760-bus fleet to zero-emission by 2030. Includes procurement of over 350 Battery Electric Buses by 2030, training the transit workforce and retrofitting Kirk and Northwest bus divisions with charging infrastructure. Beyond 2030, MDOT MTA is preparing to have a 95% zero-emission fleet by 2045.	• Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.)
C	MDOT MTA Regional	Light Rail Fleet Mid-life Overhaul	Hunt Valley to BWI/Glen Burnie	Overhaul the entire Light Rail fleet, extending the fleet's life by approximately 15 years, improving safety and reliability, providing a more comfortable and secure ride and lowering maintenance costs.	• Promoting regional coordination (intra-jurisdictional projects/ strategies, etc.)

Table 6 - Roadway System Preservation Projects: 2028-2039

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
D	Baltimore City	Druid Park Lake Drive Complete Streets	Greenspring Avenue in the northeast to I-83 in the southeast along Druid Hill Park 2.2 miles	Redesign Druid Park Lake Drive to implement guidelines and recommendations in the City's Complete Streets Manual. Reduce automobile traffic by removing travel lanes and adding or improving infrastructure and accessible connections for pedestrians, persons with disabilities, bicyclists, transit users and e-scooters.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.)
E	Baltimore City	Keith Avenue / Broening Highway Improvements	Clinton Street to the Baltimore City Line Southeast of Ralls Avenue 2.5 miles	Keith Avenue and Broening Highway are part of Baltimore City's critical freight route network, connecting I-95 and the Seagirt and Dundalk Terminal Port facilities. Improvements are needed to upgrade roadway conditions, improve wayfinding and integrate Complete Streets amenities to better accommodate safety for transit, pedestrians and bicyclists.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
F	Baltimore City	Russell Street Complete Streets Improvements	Annapolis Road to South Greene & South Paca Streets 1.0 miles	Russell Street (MD 295) in south Baltimore is in need of investments to improve asset conditions and multimodal Complete Streets infrastructure for automobile traffic and pedestrian, transit and freight movement. Transportation improvements will support safe mobility and economic development in the city's growing southern edge and Camden Yards.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)
G	Baltimore City	US 40 Highway Deconstruction	Smallwood Street to Greene Street 1.5 miles	US 40 is a depressed expressway built in the 1970s cutting through neighborhoods in West Baltimore. It was intended to connect with I-70, but that connection was never made. Building this fragment of an expressway has caused irreparable damage to community cohesion and economic stability. Deconstructing the highway will offer over 60 acres for redevelopment and improvements to adjacent streets.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
H	Baltimore City	Vietnam Veterans Memorial Bridge and Hanover / Potee Street Corridor Improvements	Patapsco Avenue to Wells Street 2.2 miles	Rehabilitate or replace the Vietnam Veterans Memorial Bridge and improve multimodal Complete Streets infrastructure along the Hanover / Potee Streets (MD 2) corridor in south Baltimore. Transportation improvements will improve accommodations for pedestrians, bicycles, transit, freight and auto traffic to support safe mobility and economic development.	• TSMO: Intersection control (traffic signal coordination, ramp metering, transit signal priority, etc.) • TSMO: Real-time monitoring (active traffic management, real time parking information, traveler information systems, road weather information systems, etc.) • TSMO: Operational improvements (movable barriers, reversible commuter lanes, geometric improvements, shoulder lane use, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.) • Bicycle/Pedestrian and Micromobility: Infrastructure improvements (traffic calming, etc.) • Roadway changes (new lanes, spot improvements, etc.) • Intersection changes (grade separated intersections, intersection improvements, etc.) • Freight improvements (address freight bottlenecks, rail/port access, truck parking, etc.)
I	MDOT SHA Carroll County	MD 31 Corridor Improvements	MD 31 from Church Street to High Street and High Street from Main Street to Coe Drive 0.7 miles	Improve sidewalks, enhance bicycle and pedestrian accessibility and improve the roadway.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.)
J	MDOT SHA Carroll County	MD 851 Urban Reconstruction	Cooper Drive to South Branch of the Patapsco River 1.0 miles	Roadway reconstruction and improvements to pedestrian and bicycle facilities, as well as streetscape amenities.	• Bicycle/Pedestrian and Micromobility: Infrastructure addition (new bike lanes, streetscape elements, etc.)

Table 7 - Transit System Preservation Projects: 2040-2050

ID	Operating Agency / Jurisdiction	Name	Limits / Length	Description	Likely Congestion Management Strategies
K	MDOT MTA Regional	Fleet Replacement with Low-Floor Light Rail Vehicles		Transition to low-floor Light Rail Vehicles when replacement is needed. This will require significant station retrofits, modifying maintenance facilities and amending standard operating practices.	• Promoting regional coordination (intra-jurisdictional projects/strategies, etc.) • Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.)
L	MDOT MTA Regional	Zero-Emission Bus Transition Phase 2	MDOT MTA's core service area in the Baltimore region	Transition to a 95% zero-emission fleet by 2045. Capital costs for phase 2 are rough estimates and include retrofitting for Washington Boulevard, a 5th Division and Battery Electric Buses.	• Promoting regional coordination (intra-jurisdictional projects/strategies, etc.) • Public Transportation: New infrastructure (bus rapid transit, network expansion, etc.)
M	MDOT MTA Regional	MARC Rolling Stock Overhauls and Replacements	Penn, Camden and Brunswick MARC Lines	Short-term, medium-term and long-term plans to replace and overhaul MARC locomotives and train sets, including: • GP39H-2 Locomotive Mid-Life Overhaul • MP36PH-3C Mid-Life Overhaul • MARC III and MARC IV Railcar Overhaul • Railcar Fleet Replacement • Locomotive Fleet Replacement	• Public Transportation: Operational improvements (transit signal priority, optimizing transit service, etc.) • Public Transportation: User-oriented improvements (trip-planner application, real-time data, universal farecards, etc.)

Establishing Implementation Schedules / Identifying Possible Funding Sources

This appendix mentions MDOT's TSMO activities. MDOT's TSMO program provides funding for specific projects focused on management and operational approaches. In addition, the preceding tables showing preferred alternative projects and the periods in which they might be implemented can be the basis for additional planning. TIP projects, which have specific implementation schedules and committed funding, flow from the projects and programs identified in the LRTP. Some of these TIP projects focus on mitigating traffic congestion.

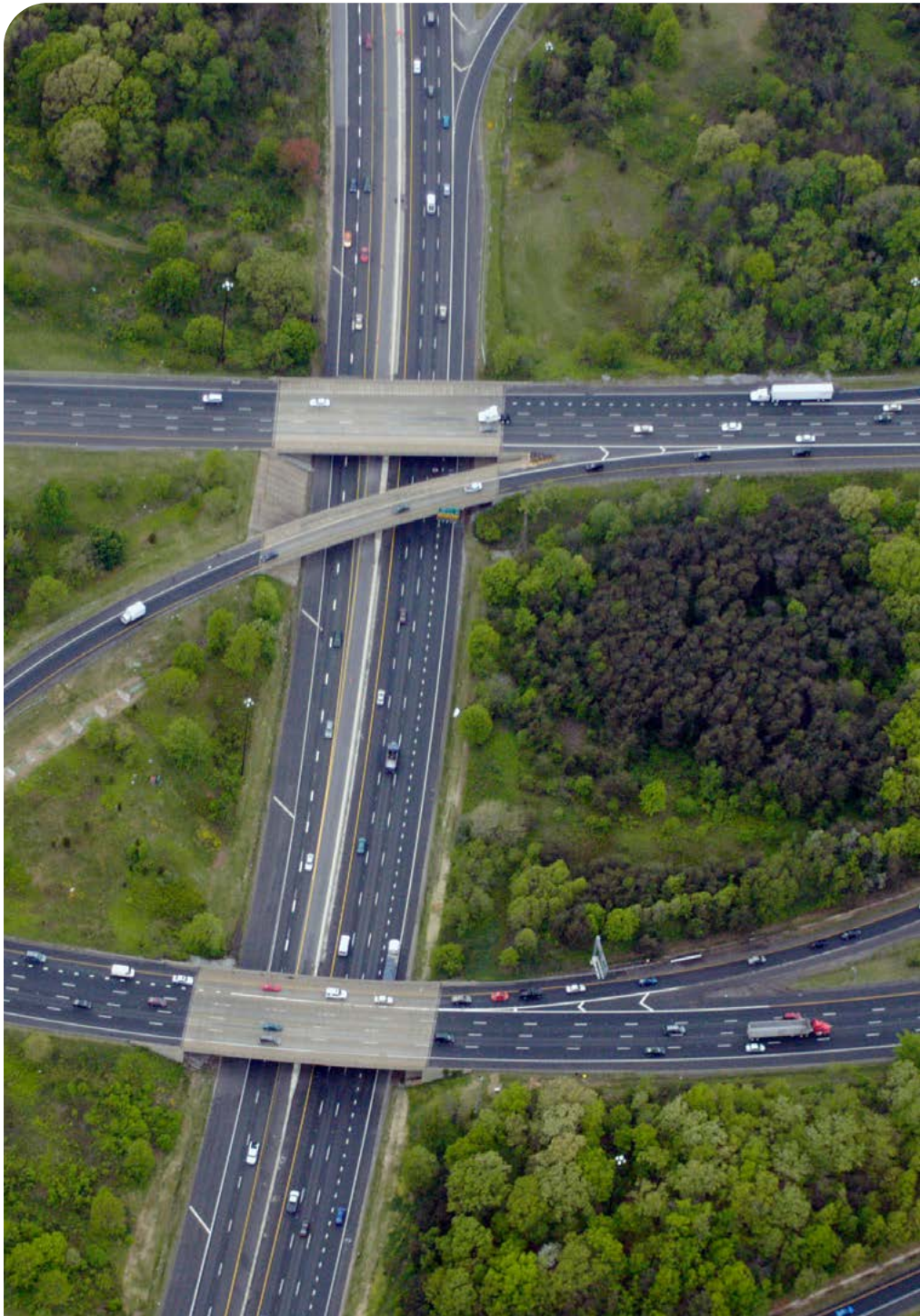
7. Evaluating Effectiveness of CMP Strategies

The final step in the CMP is to evaluate the effectiveness of implemented CMP strategies. The assessment of strategies occurs earlier in the process. At that point, the assessment focuses on identifying viable strategies and analyzing likely benefits to help prioritize and select strategies to address congestion and mobility needs. In this final step, the evaluation focuses on quantifying the impacts of implemented strategies in order to understand their actual effectiveness and/or cost-effectiveness.

Evaluating post-implementation benefits provides a feedback loop to help ensure that information on the effectiveness of strategies informs future strategy selection and implementation. Strong findings of effectiveness from implemented strategies can encourage their further implementation, while weak effectiveness may suggest using alternative solutions. In addition, findings from post-implementation studies can help to identify the characteristics of a corridor or situation under which certain strategies are most effective. Finally, results will be useful for communicating with the public and decision-makers about the benefits of strategies such as demand management and operational improvements, where projects/programs are often not as readily visible to the public.

As noted in the discussion under steps 4 and 5, data from the PDA Suite and analyses using the PDA Suite, our CMP Analysis Tool and other data provide information on congestion problem areas. The ongoing program provides us and other planners with feedback on the performance of the highway system and provides insight for future decisions.

In addition, the IIJA performance measures and targets aimed at mitigating congestion and improving travel time reliability will provide us and our partners with a systematic, coordinated approach to monitoring progress and guiding investment decisions. The CMP Committee meetings can be used as platforms for the local agencies to share information on evaluation practices and findings with other local stakeholders. Coordination with state and local agencies that helps to illuminate the findings will be valuable to support future strategy choices.



Local agencies can share information on evaluation practices and findings at CMP Committee meetings.