TSMO

MARYLAND TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

STRATEGIC PLAN

October 2018

Larry Hogan, Governor

Boyd K. Rutherford, Lt. Governor

Pete K. Rahn, MDOT Secretary

Gregory Slater, MDOT SHA Administrator

Message from the Administrator

Welcome to the now and the future of Maryland transportation. Transportation Systems Management and Operations (TSMO) is the lifeblood of our organization, and our force-multiplier - it connects all our dots. Every project we currently have in our record-construction season has elements of TSMO, and TSMO will drive how we design and implement future programs and projects.

TSMO is our integrated approach to optimizing the performance of existing and programmed infrastructure through the implementation of multimodal, intermodal, and often cross-jurisdictional systems, services, and projects. Implementing a planning process with a strong TSMO component is best accomplished by a new way of thinking about management and operations in transportation planning – one that is objectives-driven and performance-based.

Our success as an organization can no longer be gauged only by the addition of infrastructure. We need to assess how effectively the entire transportation system moves people and goods, recognizing that highways are only one component of that system. Increasing demands on our transportation infrastructure such as growing population, more drivers, and more vehicle miles traveled all pressurize the system, and the advent of technology presents just as many challenges as it does opportunities. TSMO strategies address current constraints by improving service efficiency, reducing traveler delays, improving access to information for travelers, and enhancing public safety and security.

With sound data management principles, TSMO planning efforts look at safety, mobility, reliability, system preservation, and economic development needs in a holistic manner to develop practical and innovative solutions such as: incident management; traffic signal coordination; work zone management; freight management; transit priority/integration; emergency response preparedness; and climate change adaptation.

Maryland's real-world application of TSMO is our Coordinated Highways Action Response Team (CHART), a program focused on the safety and efficient movement of people and goods on Maryland's highways. On average, CHART saves Maryland travelers more than $1.5 billion in delay and fuel costs every year. Beyond CHART, MDOT SHA utilizes other TSMO strategies like Smart Signal technology, Connected and Automated Vehicles (CAV) and ITS to maximize value and system performance. And we're working to implement other advanced TSMO strategies like Active Traffic Management (ATM) and Integrated Corridor Management (ICM) in Maryland.

We are also on the leading edge of looking at the impact of CAV to the future of transportation. CAV demands that operators of roadway infrastructure adopt policies and programs for the vehicles of the future. These technologies could improve safety, significantly alter transportation costs, and reduce congestion. This emerging industry could also create jobs, retain talent, boost the economy, and improve quality of life throughout the state. TSMO is at the center of this effort.

We recognize that we need an approach that balances adding capacity and making operational improvements if we are going to see dramatic effects on the level of service. Consequently, we are looking for ways to make better use of the existing transportation system through TSMO. A particularly good and timely example of MDOT SHA's implementation of TSMO is the $100 million investment to reduce heavy traffic congestion on the

34 mile, 12-lane Interstate 270. Using ATM techniques such as restriping to create auxiliary lanes and the closing of problematic slip ramps, we will increase capacity and vehicle throughput, address safety deficiencies, and eliminate existing bottlenecks. The $50 Million Smart Signal Project and the $151 Million Baltimore Beltway Hard Shoulder Running Project are other examples that show our Administration's commitment to mainstream TSMO strategies in Maryland.

This TSMO Strategic Plan will help us focus and expand TSMO initiatives beyond freeways – both technically and institutionally – to include arterial operations systems development, management, and communications plans that will include both MDOT SHA and non-MDOT SHA arterials and traffic operations systems.

We must explore options to facilitate Information Technology procurements and identify solutions regarding expanded incident management activities, arterial coordination with districts and local agencies, and potential infrastructure and system integration intensive strategies and approaches. We will mainstream operations at various levels of the agency, and we will continue to advance this program through hard work and innovation.

As someone who helped lead the development of this plan, I am happy to be at a point where we are ready to implement specific actions that will formalize a TSMO program within the agency. We are at the point where operations, planning for operations, and implementation of operational strategies are more critical than ever to address our congestion problems. The key to successfully implementing this strategic plan and our TSMO program is planning and programmatic integration within our own walls – offices and divisions must work together to consider and embrace TSMO ideologies whenever and wherever possible as solutions to transportation challenges.

This "cultural shift" towards transportation management and operations and the future of transportation will be bright here - we will be leading the way, not just in Maryland, but nationally. We are indeed delivering the power of go. Thank you.

Gregory I. Slater

Maryland Department of Transportation State Highway Administrator

Acknowledgments

The 2018 TSMO Strategic Plan has been produced by the MDOT SHA Office of CHART & ITS Development with oversight from the MDOT SHA TSMO Executive Committee and support from the Office of Planning & Preliminary Engineering. TSMO Working Group members from various offices and Districts provided subject matter expertise in developing this plan.

TSMO Executive Committee

» Tim Smith - Deputy Administrator for Operations/Chief Engineer
» Jason Ridgway - Deputy Administrator for Planning, Engineering, Real Estate & Environment (PERE)
» Joseph Sagal - Director, Office of CHART & ITS Development (CHART)
» Subrat Mahapatra - Deputy Director/TSMO Program Manager, Office of CHART & ITS Development
» Scott Pomento - Director, Office of Planning and Preliminary Engineering (OPPE)
» Cedric Ward - Director, Office of Traffic & Safety (OOTS)
» Eric Marabello - Director, Office of Highway Development (OHD)
» Wendy Wolcott - District Engineer, District 4
» John Concannon - District Engineer, District 7
» *John O'Neill - MDTA*
» *Sean Adgerson - MDOT MTA*

TSMO Working Group

» Subrat Mahapatra, Glenn McLaughlin, Scott Yinger, Mohammed Raqib, Richard Dye, Janet Frenkil, Jason Dicembre - CHART
» Anyesha Mookherjee, Jialin Tian, Steve Rochon, Ben Myrick, Vivian Figuereo, Dean Randolph, John Rotz – OOTS
» Erin Dey, Sandi Sauter, Scott Simons - Office of Maintenance (OOM)
» Allison Hardt, Will Gayle, Mark Howard – Office of Policy & Research (OPR)
» John Schofield, Lora Rakowski, Melissa Murray - Office of Communications (OC)
» Karuna Pujara, Eric Beckett, Lisa Shemer, Barry Kiedrowski, Craig Mackowiak, Carole Delion, L'Kiesha Markley - OPPE
» Laura Ridler, Moreshwar Kulkarni, Sean Campion - OHD
» Puskar Kar, Derek Gunn, Kim Tran, Erin Kuhn, Sutapa Samanta, Teri Soos, Jeffrey Wentz - Districts
» Kenya Lucas - Office of Chief Engineer Operations
» *Sushmita Mitra, Jim Harkness - MDTA*
» *Joe Davis, Kate Sylvester - MDOT MTA*

The University of Maryland Center for Advanced Transportation Technology (UMD CATT); Cambridge Systematics (CS); and Johnson, Mirmiran & Thompson (JMT) provided technical assistance in developing the Plan. MDOT SHA would like to acknowledge the contributions of the following individuals:

Joseph Sagal, Director
Office of CHART & ITS Development
Senior Manager Lead

Subrat Mahapatra, Deputy Director
Office of CHART & ITS Development
TSMO Program Manager

Tom Jacobs, UMD CATT
Principal Investigator

Erin Flanigan, CS
Principal Investigator

Rafael Almario, CS
Contributor

Candice Ottley-Francois, JMT
Contributor

Bridgett Freese, JMT
Contributor

Other Contributors: Doug Simmons, JMT; David Coyne, JMT; Clyde Munz, JMT; Elisabeth McCollum, JMT; Vincent Novak, JMT; Leo Sawada, Jacobs Engineering

ES

EXECUTIVE SUMMARY

This page left intentionally blank

Executive Summary

Transportation Systems Management and Operations (TSMO) has emerged as a formal discipline for transportation agencies throughout the country. The intent of TSMO is to effectively manage and operate existing facilities and systems to maximize their full service potential. TSMO strategies aim to address capacity limitations due to recurring and non-recurring congestion (crashes, incidents, severe weather, work zones, special events, and other factors) through business processes, ITS technologies and collaboration.

TSMO is not a new concept for Maryland. MDOT SHA is an effective and efficient agency in deploying TSMO strategies to actively manage Maryland's multimodal transportation network. A strong management and operations foundation has existed for a long time through the Coordinated Highways Action Response Team (CHART) Program and other multimodal programs. Related efforts such as the MDOT Excellerator Program, Federal MAP-21/FAST Act transportation performance management, MDOT SHA asset management initiatives, and recent customer-focused organizational modernization efforts have served as enabling drivers to solidify the TSMO Program. MDOT SHA adopted its first TSMO Strategic Implementation Plan in August 2016 and has made tremendous progress in the last two years. Consider the following:

The TSMO Executive Committee created a Deputy Director that was appointed within the Office of CHART & ITS Development to officially serve as the MDOT SHA TSMO Program Manager and oversee the execution of the TSMO Implementation Plan.

MDOT SHA is formalizing policies and guidance, and developing communications and outreach plans to mainstream TSMO as a culture in the organization.

The State has initiated the I-270 Innovative Congestion Management project which includes infrastructure upgrades, intelligent transportation solutions, and technology deployment designed to improve mobility in a heavily congested corridor.

The State is moving rapidly toward implementation of its Traffic Relief Plan involving Public-Private Partnerships (P3s) for delivering infrastructure projects and highway improvements on the Capital Beltway (I-495) and I-270.

MDOT SHA is implementing a Smart Signals program that will deploy adaptive signal control along 14 highly congested arterial corridors around the state.

MDOT SHA has completed a Connected Automated Vehicle (CAV) Strategic Plan, formed a CAV Working Group, and developed plans for a CAV pilot deployment corridor on US-1.

MDOT SHA plans to implement hard shoulder running operations on the Baltimore Beltway (I-695).

MDOT SHA is developing and implementing a TSMO Master Plan designed to maximize mobility and reliable travel on key corridors; including planning of advanced traffic management projects.

The 2018 TSMO Strategic Plan represents a complete refresh of the 2016 Plan and was needed because the TSMO environment has significantly shifted in just two short years. This Plan aims to build on recent successes and momentum to foster an agency wide culture of efficient management and operations of our systems.

A companion Implementation Plan identifies specific actions, responsibilities, and required resources for implementing this 2018 Strategic Plan. The Plan is intended to be a living document and will be updated regularly.

The 2018 TSMO Plan includes a business case for TSMO; re-establishes the purpose, vision, goals, objectives and performance measures for TSMO within MDOT SHA; and identifies the strategies required to implement TSMO in the areas of Business Processes & Collaboration; Systems & Technology; Data, Analysis, & Performance Management; and Customer Experience & Engagement.

MDOT SHA defines TSMO as:

An integrated approach to programmatic optimization of planning, engineering, operations, and maintenance in implementing new and existing multi-modal systems, services, and projects to preserve capacity and improve the security, safety, and reliability of our transportation system.

The 2018 TSMO Strategic Plan identifies a vision and purpose for MDOT SHA.

Our Vision

A customer-driven leader working to provide safe, efficient, and innovative transportation solutions that meet or exceed customer expectations.

Our Purpose

Implement a sustainable, organization-wide TSMO Program at MDOT SHA that fully maximizes the ability of Maryland's transportation system to consistently move people and goods.

As shown in Figure 1, four goals have been established to achieve the vision and purpose of the 2018 TSMO Strategic Plan. Several objectives have also been identified under each goal area. For each of the TSMO objectives, several strategies have been identified. Figure 2 shows a high-level summary of the 2018 TSMO Plan.

Figure 1

2018 MDOT SHA TSMO GOALS & OBJECTIVES

GOAL 1: Business Processes & Collaboration

Obj 1.1: Incorporate TSMO in MDOT SHA policies, programs and standard practices.
Obj 1.2: Implement and institutionalize a TSMO Master Plan.
Obj 1.3: Promote a culture to mainstream TSMO within and outside MDOT SHA at all levels.

GOAL 2: Systems & Technology

Obj 2.1: Develop and implement Advanced Traffic Management Systems (ATMS) with Active Traffic Management (ATM) capabilities.
Obj 2.2: Develop Integrated Corridor Management (ICM) capabilities for multimodal passenger and freight movement.
Obj 2.3: Develop and apply technological foundations for Connected and Automated Vehicles (CAV).

GOAL 3: Data, Analysis & Performance Management

Obj 3.1: Implement a comprehensive data-driven performance management program to support TSMO.
Obj 3.2: Advance data governance, analysis, and modeling capabilities to inform planning, operational, and TSMO decisions.

GOAL 4: Customer Experience & Engagement

Obj 4.1: Provide reliable and accessible real-time modal choice information to our customers.
Obj 4.2: Raise awareness of TSMO and its general understanding by the traveling public.

Figure 2

2018 MDOT SHA TSMO PLAN SUMMARY

TSMO
MARYLAND TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

Our Vision

A customer-driven leader working to provide safe, efficient, and innovative transportation solutions that meet or exceed customer expectations.

GOAL 1

Business Processes & Collaboration

Objective 1.1 Incorporate TSMO in MDOT SHA policies, programs and standard practices

Strategy 1.1a Develop TSMO policy and procedures to establish organizational structure and institutional framework

Strategy 1.1b Align TSMO strategies to existing business processes/ practices at all MDOT SHA Offices/ Districts and program areas

Strategy 1.1c Include TSMO projects/ strategies in the traditional planning, project development and programming process

Strategy 1.1d Develop project development protocols/ processes for various types of TSMO strategies/ projects

Objective 1.2 Implement and institutionalize a TSMO Master Plan

Strategy 1.2a Develop and maintain a consolidated list of potential TSMO strategies/ projects with inputs from CHART, OPPE, OOTS, OHD and Districts

Strategy 1.2b Develop and implement business processes and technologies to maintain and mainstream the TSMO Master plan

Strategy 1.2c Develop a business case to secure dedicated funding to implement TSMO strategies/ projects

Strategy 1.2d Leverage other program scopes and funding opportunities to implement TSMO strategies/ projects

Objective 1.3 Promote a culture to mainstream TSMO within and outside MDOT SHA at all levels

Strategy 1.3a Identify staffing resources for various MDOT Offices and Districts to support the TSMO Program

Strategy 1.3b Develop relevant TSMO education and training resources for MDOT Offices and District staff at all levels of organization

Strategy 1.3c Develop TSMO education, communication and outreach resources to raise TSMO awareness with MDOT TBUs, MPOs, FHWA, local agencies, other partners and stakeholders

Strategy 1.3d Continue participation in research and collaboration efforts to advance TSMO practices through TRB, FHWA, AASHTO, ITS America, University Research Centers etc

GOAL 2

Systems & Technology

Objective 2.1 Develop and implement Advanced Traffic Management Systems (ATMS) with Active Traffic Management (ATM) capabilities

Strategy 2.1a Launch the first set of TSMO Active Traffic Management (ATM) capabilities as part of the I-270 Innovative Congestion Management Project

Strategy 2.1b Complete an assessment of MDOT and MDOT SHA communications assets and incorporate enhancements into future projects

Strategy 2.1c Implement integrated traffic management projects including Traffic Relief Program (TRP) projects like I-695 TSMO and Smart Signals projects

Strategy 2.1d Develop Asset Management Systems for ITS devices and TSMO infrastructure

Objective 2.2 Develop Integrated Corridor Management (ICM) capabilities for multimodal passenger and freight movement

Strategy 2.2a Use the existing I-95 ICM Concept of Operations to identify opportunities for freeway and arterial management integrated operations

Strategy 2.2b Bring operations data regarding various transportation modes into a single platform in order to develop a Common Operating Picture (COP)

Strategy 2.2c Identify opportunities to improve coordinated transportation management including highway, transit, and freight operations

Strategy 2.2d Implement a Decision Support System that incorporates real-time data from existing systems and develops appropriate response strategies

Objective 2.3 Develop and apply technological foundations for Connected and Automated Vehicles (CAV)

Strategy 2.3a Align and coordinate TSMO Planning efforts with the MDOT SHA CAV Strategic Action Plan implementation

Strategy 2.3b Implement CAV technology deployment pilots on MDOT transportation infrastructure and develop a Maryland owned traffic management and CAV testing facility

Strategy 2.3c Collaborate with private sector and research community for CAV testing on MDOT infrastructure (roadways and facilities)

MDOT SHA TSMO Definition: *An integrated approach to programmatic optimization of planning, engineering, operations, and maintenance in implementing new and existing multi-modal systems, services, and projects to preserve capacity and improve the security, safety, and reliability of our transportation system.*

Our Purpose

Implement a sustainable, organization-wide TSMO Program at MDOT SHA that fully maximizes the ability of Maryland's transportation system to consistently move people and goods.

GOAL 3

Data, Analysis & Performance Management

Objective 3.1
Implement a comprehensive data driven performance management program to support TSMO

Strategy 3.1a
Monitor corridor and system level performance of Maryland highways and arterials from a mobility, reliability and access standpoint

Strategy 3.1b
Advance communication and visualization tools to assess performance, progress, benefits and challenges

Strategy 3.1c
Monitor work zone performance measures at a project, corridor and system level to improve work zone management

Strategy 3.1d
Develop next generation customer facing performance measures using big data innovations and advanced technologies

Objective 3.2
Advance data governance, analysis and modeling capabilities to inform planning, operational and TSMO decisions

Strategy 3.2a
Formalize a data governance plan that supports the MDOT SHA Program

Strategy 3.2b
Advance data analysis, methods and application tools to support TSMO decision-making at strategic, tactical and operational levels

Strategy 3.2c
Advance travel and traffic modeling applications to support multi-modal passenger and freight related TSMO strategies and projects

Strategy 3.2d
Develop and mainstream methods and tools that incorporate travel time reliability, accessibility, life-cycle planning and project development/ prioritization

GOAL 4

Customer Experience & Engagement

Objective 4.1
Provide reliable and accessible real-time modal choice information to our customers

Strategy 4.1a
Continue to improve CHART's capabilities for providing traffic information to regional integrated transportation data collection and distribution systems

Strategy 4.1b
Launch a One-MDOT traveler information application in partnership with other MDOT TBUs

Strategy 4.1c
Work in partnership with private-sector information providers, to share data on real-time operational conditions on the transportation network

Strategy 4.1d
Collaborate with other modes, MPOs, local agencies, major employers and businesses for active travel demand management including incentivization of travel choices and Mobility on Demand services

Objective 4.2
Raise awareness of TSMO and its general understanding by the traveling public

Strategy 4.2a
Develop education and outreach tools, including use of public-facing websites, social media applications etc.

Strategy 4.2b
Conduct market research to determine customer level of satisfaction with MDOT SHA TSMO Program implementation

Strategy 4.2c
Develop user groups, focus groups and charettes to foster continued engagement with customers on various TSMO focus areas

Strategy 4.2d
Develop tools and interfaces to seek customer perspectives and inputs

List of Acronyms

AASHTO: American Association of State Highway and Transportation Officials
ATM: Active Traffic Management
ATMS: Advanced Traffic Management System
CAV: Connected and Automated Vehicle
CHART: Coordinated Highways Action Response Team
FHWA: Federal Highway Administration
ICM: Integrated Corridor Management
ITS: Intelligent Transportation Systems
MDOT SHA: Maryland Department of Transportation State Highway Administration
MDOT TBU: Maryland Department of Transportation Business Unit
MPO: Metropolitan Planning Organization
OHD: Office of Highway Development
OOTS: Office of Traffic and Safety
OPPE: Office of Planning and Preliminary Engineering

Version 2.0 dated 6/19/2018

A key factor for successful TSMO implementation is to ensure that there is an organizational structure within MDOT SHA, to implement the TSMO Strategic Plan, in partnership with other Transportation Business Units (TBUs) and external stakeholders. This plan includes an organizational set up for TSMO within MDOT SHA including the creation of a new TSMO Program Manager position. The TSMO Program Manager facilitates institutional and programmatic TSMO strategy integration within existing MDOT SHA offices and programs. The TSMO Plan is implemented through the TSMO Executive Committee, the TSMO Working Group and TSMO task forces in the following general areas:

- TSMO Business Process & Policy
- Systems & Technology
- Data, Analysis & Performance Measures
- Training & Education
- Communications & Outreach
- Connected and Automated Vehicles (CAV)
- Freight & Multimodal

MDOT SHA has developed an organization structure to support implementation of the TSMO Plan. The TSMO Executive Committee provides strategic guidance, and the TSMO Working Group and task forces provide tactical support. Various offices and Districts develop and implement the TSMO operational action items within the agency, in efforts to build a TSMO culture.

The MDOT SHA TSMO Executive Committee and Working Group oversee the execution of this TSMO Strategic Plan to ensure that the agency aligns TSMO Purpose & Vision with the One MDOT Mission & Vision, MDOT Excellerator and the long range Maryland Transportation Plan. The focus will be to:

- Develop and formalize policies and guidance to mainstream TSMO as part of agency business processes, planning, engineering, operations, maintenance and programming decisions.
- Align the TSMO Plan with other agency-wide initiatives such as Organization Modernization, Asset Management, Practical Transportation and Performance Management.
- Develop systems and technology programs that enable MDOT SHA to provide Active Traffic Management, Integrated Corridor Management, and CAV technology solutions.
- Broaden the array of options in project feasibility studies to include TSMO alternatives and/or improvements as standard agency processes, including tradeoffs with capacity improvements.
- Consider mechanisms for evaluating TSMO strategies on a corridor basis.
- Review and modify current funding processes to identify and program TSMO improvement projects.
- Implement a tracking and reporting process focused on the TSMO master plan and contents of Transportation Improvement Program (TIP)/ State TIP (STIP) to better communicate and coordinate between MDOT SHA Planning, MPO, and local jurisdictions.
- Develop and formalize a TSMO performance management program that aligns with the MDOT Excellerator, MFR and the MDOT Attainment Report.
- Apply existing tools such as Regional Integrated Transportation Information System (RITIS) and, Maryland Statewide Transportation Model (MSTM), and develop new tools that support performance-based decision making.
- Develop and use reliability metrics and analytic tools that inform TSMO decisions at strategic, tactical, and operational levels.
- Develop a robust education and training program to generate awareness of TSMO at various levels.
- Develop and implement a comprehensive Communications and Outreach Plan to share and collaborate on TSMO efforts with other TBUs, MPOs, FHWA, other agencies, partners, stakeholders and customers.

This page left intentionally blank

TOC

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

This page left intentionally blank

1.0

OVERVIEW

1.1 INTRODUCTION

The mission of Departments of Transportation (DOTs) has changed over the years. 21st-century DOTs are not only concerned with building and maintaining roads, but also with ensuring maximum benefit from the transportation system that exists today. States with significant urbanized areas, like Maryland, are challenged with addressing growing mobility needs with limited resources and increasing demands for transportation improvements from the public. Funding limitations, limited right of way, and other resource constraints are the new transportation reality. The Maryland Department of Transportation State Highway Administration (MDOT SHA) understands this reality where transportation resources must be carefully allocated to meet agency objectives regarding safety, mobility, commerce, environmental preservation, and connecting customers to opportunities. With the agency's focus on Practical Transportation and current emphasis on Organization Modernization, Transportation System Management and Operations (TSMO) is gaining momentum as a critical program to maximize efficiency of the transportation system and achieve the MDOT mission.

TSMO has emerged as a formal discipline for transportation agencies throughout the country. The intent of TSMO is to effectively manage and operate existing facilities and systems to maximize their full service potential. TSMO strategies aim to better leverage capacity limitations due to recurring and non-recurring congestion, (crashes, incidents, construction, bad weather, special events and other factors). TSMO is not a new concept to MDOT SHA. A strong management and operations foundation has existed for a long time through the CHART Program, and other multimodal programs.

MDOT SHA is an effective and efficient agency in deploying TSMO strategies to actively manage Maryland's multimodal transportation network. The agency has been involved, at some level, in many TSMO Strategies such as :

- Traffic incident management
- Work zone management
- Traveler information services and demand management
- Road weather information
- Freeway management and managed lanes
- Active Traffic Management
- Integrated Corridor Management
- Traffic signal operation
- Electronic payment/toll collection
- Emergency response
- Freight management

1.2 BACKGROUND

In 2014, MDOT SHA received Federal Highway Administration (FHWA) Strategic Highway Research Program 2 (SHRP2) implementation assistance to administer the L06 program. The SHRP2 L06 project, titled Institutional Operations to Improve Systems Operations and Management, focused on undertaking a comprehensive and systematic examination of the way MDOT SHA should organize to execute operations programs successfully to improve travel time reliability.

While many TSMO strategies were already being implemented at MDOT SHA, L06 provided an opportunity to establish a more comprehensive programmatic approach to transportation systems operations and management. MDOT SHA embarked on this initiative that culminated with the adoption of a TSMO Strategic Implementation Plan in August 2016. This Strategic Implementation Plan, the first of its kind developed by MDOT SHA, included a Vision, Purpose, Goals, Objectives, and initial Strategies for Transportation System Management & Operations. A high-level summary of the plan, along with color-coded indicators of progress towards its implementation, is illustrated in Figure 3. Table 1 highlights progress made since 2016 in each of the Goal areas.

August 2016

Maryland Department of Transportation
SHA State Highway Administration

TSM&O
Transportation Systems Management and Operations

Pete K. Rahn, MDOT Secretary
Gregory C. Johnson, P.E., SHA Administrator

Vision: Maximize mobility and reliable travel for people and goods within Maryland by efficient use of management and operations of transportation systems

Mission: To establish and maintain a TSM&O program and implement supporting projects within Maryland SHA improving mobility and reliability for all people and goods through planned operations of transportation facilities

Goal 1.
Develop and implement a sustainable TSM&O program at SHA

Objective 1.1.
Incorporate TSM&O oriented practices in routine planning and programming business processes by 2018

- **Strategy 1.1a.** Identify and implement means of incorporating TSM&O into relevant agency policies
- **Strategy 1.1b.** Determine current and future TSM&O improvements and strategies that should be included in the planning process and estimate their relative effectiveness in responding to the specific causes of recurring and non-recurring congestion
- **Strategy 1.1c.** Develop modifications to the SHA Project Development Process (PDP) to accommodate TSM&O
- **Strategy 1.1d.** Develop a comprehensive ITS asset management process

Objective 1.2.
Promote culture supporting TSM&O both inside and outside of SHA and raise overall TSM&O awareness

- **Strategy 1.2a.** Identify staffing resources within SHA
- **Strategy 1.2b.** Develop a communications and outreach strategy and associated training, outreach, and communication products
- **Strategy 1.2c** Coordinate TSMO activities with other modes, MPOs, and local agencies with clear common objectives

Goal 2.
Improve travel time reliability for both people and freight

Objective 2.1.
Develop freeway and arterial master plans by April 2018

- **Strategy 2.1a.** Develop Arterial System Master Plan
- **Strategy 2.1b.** Develop Freeway Master Plan
- **Strategy 2.1c.** Stay apprised of new applications, systems, and technologies and plan to integrate as appropriate
- **Strategy 2.1d.** Work with MdTA, MDOT/MVA, and the private sector to develop and implement a connected and automated vehicle program in Maryland
- **Strategy 2.1e.** Establish a framework for an institutionalized approach to support funding and deployment of operational improvements (including freight) on freeways and arterials

Objective 2.2.
Develop Integrated Corridor Management (ICM) plans by December 2018

- **Strategy 2.2a.** Focus on integrated freeway and arterial management and operations
- **Strategy 2.2b.** Develop ICM Program Master Plan for consistent consideration of ICM on corridors that possess attributes necessary to apply ICM

Goal 3.
Develop data- and performance-driven approaches to support TSM&O planning, programming, implementation and evaluation decisions

Objective 3.1.
Implement a comprehensive, system level performance measurement program to monitor mobility and reliability targets by June 2017

- **Strategy 3.1a.** Develop a data supported system for performance reporting
- **Strategy 3.1b.** Continue participation in research and collaboration efforts to advance TSM&O practices through TRB, FHWA, AASHTO, ITS America, University research centers, and consultants

Objective 3.2.
Develop a TSM&O Program Performance Monitoring System

- **Strategy 3.2a.** Develop a monitoring program to assess progress, benefits and challenges

Objective 3.3.
Coordinate and ensure TSM&O is considered in SHA's Asset Management Program

- **Strategy 3.3a.** Incorporate TSM&O into Transportation Asset Management Plan (TAMP) and TAMP implementation

Objective 3.4.
Include reliability in existing traffic analyses and travel forecasting modelling tools

- **Strategy 3.4a.** Develop modelling tools that effectively incorporate travel time reliability and can be used to provide a framework for evaluating tradeoffs of various TSM&O operational strategies

Goal 4.
Improve the travelling public's experience on Maryland highways

Objective 4.1.
Achieve a user cost savings of at least $1 billion annually by effective congestion management and TSM&O

- **Strategy 4.1a.** Provide reliable and accessible real-time modal choice information to travelers and other stakeholders at all times
- **Strategy 4.1b.** Coordinate activities with other modes, MPOs, and local agencies to incentivize changing travel behavior

Objective 4.2.
Enhance travelling public's knowledge and understanding of TSM&O operational strategies and their respective benefits

- **Strategy 4.2a.** Develop education and outreach tools, including use of web-based and social media applications, targeted to the travelling public
- **Strategy 4.2b.** Conduct regular surveys targeted towards the traveling public to determine level of customer satisfaction with SHA's application of TSM&O operational strategies

Program Progress as of May 2018

- = Significant Progress (>75%)
- = Moderate Progress (26%-75%)
- = Nominal Progress (5-25%)

Table 1

2016 TSMO PLAN PROGRESS

GOAL 1: Develop and implement TSMO Program	GOAL 2: Improve travel time reliability for people & freight	GOAL 3: Develop data and performance driven approaches for TSMO Planning	GOAL 4: Improve traveling public's experience
Created TSMO Steering and Executive Committees	Developing statewide integrated freeway and arterial master plan	Completed Mobility Data Business Plan (in conjunction with FHWA pilot)	User cost saving from CHART, signal operations, and multi-modal strategies
Progress toward developing a TSMO Master Plan	Developing next-level TSMO communications infrastructure plan	Continued refinement of process collecting, integrating, and analyzing data in support of MDOT SHA's Annual Mobility Report and Mobility Dashboard	CHART working with MDTA on new 511 app
In process of developing TSMO website	Established MDOT SHA CAV Working Group	Developed multiple TRB papers supported by TSMO program	CHART continues to enhance provision of information to RITIS
In process of developing TSMO outreach materials for internal/ external outreach	Completed MDOT SHA CAV Strategic Action Plan	Held multiple FHWA workshops supporting various TSMO initiatives	Initiative approved to integrate other MDOT TBU data into RITIS
Identifying methods for evaluating capacity vs. TSMO options by adapting C11 methodology	Developing US 1 CAV Deployment Corridor (including AASHTO SPAT challenge)	Continued coordination with FHWA and AASHTO on SHA TSMO Program efforts	Developing outreach tools targeted to traveling public
Developed methodology for incorporating reliability (SHRP2 L08) into TSMO project planning	Completed I-95 Corridor ICM Concept of Operations	Continued program benefit cost reporting as part of Annual Mobility Report	
	Completed I-95 Corridor Analysis, Modeling, and Simulation (AMS) Plan	Continued to include CHART TIM program benefits in Annual Mobility Report	
	In process of using AMS to evaluate TSMO strategies	Developed methodology for identifying sources of unreliability (SHRP2 L02)	
		Developed post processor (based on SHRP2 C11) used in conjunction with Maryland Statewide Transportation Model	
		Integrated WISE optimization into Maryland Integrated Travel Analysis Modeling System	

1.3 ABOUT THE 2018 STRATEGIC PLAN

This 2018 TSMO Strategic Plan represents a complete refresh of the 2016 TSMO Plan and was needed because the TSMO environment has significantly shifted in just two short years. Consider that in the last two years:

- The TSMO Executive Committee appointed a Deputy Director within the Office of CHART and ITS Development to officially serve as the MDOT SHA TSMO Program Manager and oversee the execution of the TSMO Implementation Plan and its results.
- MDOT SHA is formalizing policies and guidance and developing communications and outreach plans to mainstream TSMO as a culture in the organization.
- The State has initiated the I-270 Innovative Congestion Management project which includes infrastructure upgrades, intelligent transportation solutions, and technology deployment designed to improve mobility in a heavily congested corridor.
- The State is moving rapidly toward implementation of its Traffic Relief Plan involving Public-Private Partnerships (P3s) for delivering infrastructure projects and highway improvements on the Capital Beltway (I-495) and I-270.
- MDOT SHA is implementing a Smart Signals program that will deploy adaptive signal control along 14 heavily congested arterial corridors around the state.
- MDOT SHA has completed a CAV Strategic Action Plan, formed a CAV Working Group, and has developed plans for a CAV pilot deployment corridor on US 1.
- MDOT SHA plans to implement hard shoulder running operations on the Baltimore Beltway (I-695).
- MDOT SHA is developing and implementing a TSMO Master Plan designed to maximize mobility and reliable travel on key corridors, including planning of advanced traffic management projects.

These are just a few examples of recent new initiatives; MDOT SHA continues its ongoing efforts to enhance and improve management and operations in the state.

The 2018 plan is organized in the following sections:

2.0 Making the Business Case

3.0 TSMO Strategic Plan

4.0 TSMO Organizational Structure

5.0 TSMO Master Plan

6.0 Partners & Stakeholders

7.0 Communication & Outreach

8.0 Training & Education

This page left intentionally blank

2.0

MAKING THE BUSINESS CASE

This page left intentionally blank

2.1 BROADER STATEWIDE PERSPECTIVE

Maryland is a vibrant mid-Atlantic state with a population of over 6.1 million. Although 42nd in size, it is ranked 19th in population and 5th in population density. Although it's a small state, it has a lot of geographic and socio-economic diversity and is often called "America in Miniature." Contained within the State's boundaries is the heavily congested Baltimore-Washington metropolitan region. The dense land use, economic activity, over-saturated conditions, and limited system expansion capabilities have, over time, presented unique challenges in the areas of mobility, reliability, and environmental and economic vitality. The State has a well-connected multimodal transportation system, but the sheer demand makes it one of the most congested regions in the nation. As a result of these over-saturated conditions, the transportation network is susceptible to reliability challenges, as small disruptions have potential network wide repercussions.

Furthermore, the State is challenged with addressing growing mobility needs with limited financial resources and increasing demands for transportation improvements from the public. The State is projected to add 1 million more people and 300,000 jobs by 2040. In 2017, Vehicle Miles of Travel (VMT) on Maryland roadways was 60 billion miles – an all-time high, and the State is projected to experience 30% more VMT over current levels by 2040. As the system experiences higher demand on what is already saturated levels of congestion, the congested lane miles of travel grow at a disproportionate level. Being a through state on the eastern seaboard and with Port of Baltimore operations, the State's roadways experience heavy truck movement which is projected to double by 2040. Right-of-way is becoming scarce and highway funds remain constrained. MDOT SHA has been fortunate with continued Administrative support for transportation infrastructure investments, but limited funding and other resource constraints are the new transportation reality.

In addition to the above state trends, there are some national and industry trends that are shaping the MDOT SHA mission. Customer needs are becoming more diverse with an aging population and millennials with different traveling preferences. Technology is playing a huge role in how and when people travel, including changes in the supply chains and freight delivery systems. Customer demands on the DOTs are also changing with expectations for more real-time, proactive transportation solutions and efficient/ timely project delivery. Smartphone applications, Original Equipment Manufacturers (OEMs) and agency ITS infrastructure are enabling traveler information and traveling choices more than ever. Transportation network companies (TNCs), and dynamic ride-share and ride-hailing applications have changed the driving and auto-ownership markets. Traditional automakers are rethinking their next generation business models with Mobility as a Service. And as CAVs become mainstream, there are a whole host of market dynamics, consumer preferences and technology disruptions at play.

To address these near and long-term realities, transportation resources must be carefully allocated to meet agency objectives regarding safety, mobility, commerce, and the environment. It is essential to make the most of the present system before adding new infrastructure. MDOT SHA is an effective and efficient agency and is beginning to deploy TSMO strategies to actively manage Maryland's multimodal transportation network. Expanding the diversity of approaches for improving mobility is essential to the agency's mission. This justifies the business case and the importance of aggressively deploying and institutionalizing a proactive TSMO program that will expand MDOT SHA's existing programs like the Coordinated Highways Action Response Team (CHART) and other multimodal programs.

When comparing TSMO improvements to capacity improvements, the return on investment and benefit cost analysis usually justifies the operational improvement. This is particularly evident when investigating the travel time reliability on severely congested roadways. Monetizing the improvements by selecting indicators such as value of time, value of travel time reliability, and fuel costs allows for direct comparisons. MDOT SHA monitors some of these costs through their annual mobility reporting process. The net cost and time savings outcomes favor TSMO from a traveler's perspective. Additionally, projects adding capacity often have huge environmental impacts, which delay project development as well as construction. The TSMO program will tailor messages to educate the audience that operating and managing the transportation system is just as important as improving or adding capacity.

2.2 RELATED MDOT AND MDOT SHA PROGRAMS & INITIATIVES

Development of a TSMO program is consistent with MDOT's mission. Additionally, mobility is a primary function of MDOT SHA; several initiatives such as the Excellerator, the Maryland Transportation Plan (MTP), the Attainment Report, Managing for Results, and the Maryland State Highway Mobility Report, all contain goals, objectives, and performance measures related to increasing the quality of mobility on Maryland's roadways. System reliability and the day-to-day experience of the traveling public are emphasized in the MDOT Excellerator Report, MDOT's Business Plan and all of Maryland's mobility plans. The MTP is the State's long- range plan with a 2035 horizon. This 20 year plan includes a purpose, vision and goals related to the quality of service provided by Maryland's transportation system. Identified transportation strategies in support of the Quality of Service goal include investing in user technologies and sharing of real-time data, as well as addressing bottlenecks. These strategies support reducing congestion through the improvement of vehicle travel times. Transportation projects promoting the Quality of Service goal improve travel time reliability for automobiles and trucks. The Maryland State Highway Mobility Report identifies mobility and reliability as key performance measures and documents strategies to decrease congestion and improve travel reliability.

The objectives of the TSMO program align with MDOT programmatic goals and positions MDOT SHA to meet its mobility goals. Bringing TSMO into the previously mentioned plans promotes travel time reliability. Furthermore, the federal MAP-21/ FAST Act system performance measures emphasize performance-based planning and support TSMO performance management. More detail on related MDOT and MDOT SHA programs and initiatives with which the TSMO Program is aligned is provided on the following pages.

With a One MDOT approach, MDOT SHA and other transportation business units (TBUs) are making great progress in achieving the MDOT mission. Exceptional customer service is at the core of all the policies, programs, and projects that drive the agency. Practical Transportation, Innovation, and Technology are key enablers to all the strategic, tactical and operational decisions of the agency. At MDOT SHA, there is a special emphasis on Modernization, Organization, Innovation, and Communication to deliver a great Customer Experience. There are several major initiatives described in this section that are key enablers for a successful and sustainable TSMO.

MDOT EXCELLERATOR

The MDOT Excellerator program comprises of 10 tangible results (TRs) that are critical components for the organization and drive MDOT's daily business decisions. The results of MDOT's performance are available to the public each quarter through the MDOT Excellerator Report. This program is an evolving performance process that is in a constant state of evaluation, analysis and action. MDOT is constantly working to improve performance and strives to reach exceptional customer service. The 10 TRs of the MDOT Excellerator program include:

- TR 1: Provide Exceptional Customer Service
- TR 2: Use Resources Wisely
- TR 3: Provide a Safe and Secure Transportation Infrastructure
- TR 4: Deliver Transportation Solutions and Services of Great Value
- TR 5: Provide an Efficient, Well Connected Transportation Experience
- TR 6: Communicate Effectively with Our Customers
- TR 7: Be Fair and Reasonable to Our Partners
- TR 8: Be a Good Neighbor
- TR 9: Be a Good Steward of Our Environment
- TR 10: Facilitate Economic Opportunity in Maryland

EACH TANGIBLE RESULT IS SUPPORTED BY A NUMBER OF PERFORMANCE MEASURES. MDOT SHA'S TSMO PROGRAM SUPPORTS THE FOLLOWING PERFORMANCE MEASURES:

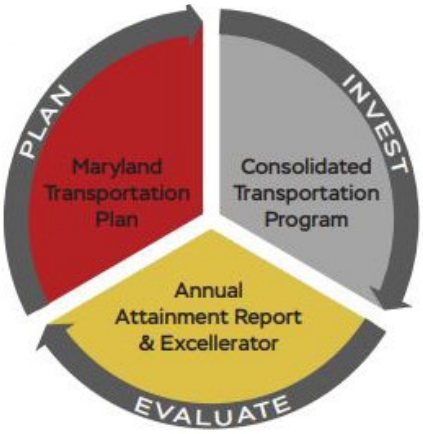
- 3.7 – Disabled Motorists Assisted by MDOT
- 5.1E – Planning Time Index for Highway Travel
- 5.2A – Restoring Transportation Services: Average Time to Restore Normal Operations After Disruptions
- 5.2B – Restoring Transportation Services: Average Time to Restore Normal Operations After a Weather Event
- 10.7A – Total User Cost Savings for the Traveling Public due to Congestion Management
- 10.8 Percent of VMT in Congested Conditions on Maryland Freeways and Arterials in the AM/PM Peak Hours.

MDOT SHA ORGANIZATION MODERNIZATION

Organizational Modernization is an MDOT SHA-wide initiative that is focused on how MDOT SHA should be organized now and in the future to take on our rapidly changing transportation environment.

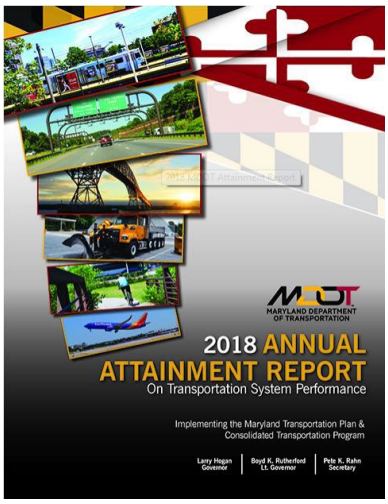
MDOT TRANSPORTATION PLAN (MTP)

Every five years, MDOT develops a 20-year mission for transportation in the State known as the Maryland Transportation Plan (MTP). The MTP outlines the State's overarching transportation priorities and helps create a larger context for transportation decision-making. An internal MDOT engagement session combined with the results of external surveys for Maryland residents help shape the development of the MTP goals and objectives. Within the goals and objectives, associated performance measures are being developed to evaluate how well we annually achieve the MTP goals.



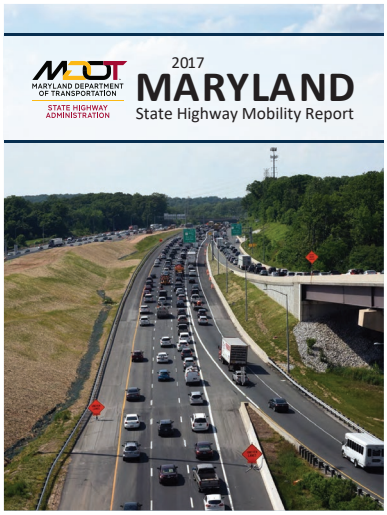
MDOT ATTAINMENT REPORT

To track MDOT's progress on meeting the goals and objectives of the MTP, MDOT publishes an Annual Attainment Report (AR) on Transportation System Performance to identify successes, challenges, and strategies for improving the transportation services delivered to Maryland residents. The goals outlined in the 2018 Attainment Report include Economic Prosperity, Safety & Security, System Preservation, Quality of Service, Environmental Stewardship, and Community Vitality.



MDOT STATE HIGHWAY ANNUAL MOBILITY REPORT

Since 2012, MDOT SHA has been producing an Annual Mobility Report. The mobility report demonstrates the agency's focus on applying a performance-based approach to provide a high quality and reliable highway system. The Mobility Report shows the congestion and reliability trends and how MDOT SHA policies, programs and projects are serving customers. In 2014, SHA improved accessibility to the contents of the Mobility Report by creating a web-based Mobility Dashboard. Currently the agency is working to develop real-time system performance dashboards.



COORDINATED HIGHWAYS ACTION RESPONSE TEAM (CHART)

The Coordinated Highways Action Response Team (CHART) represents the highway operations element of Maryland's TSMO Program, and is a joint initiative among the MDOT SHA, Maryland Transportation Authority (MDTA), and the Maryland State Police (MSP). CHART is the State's effort to improve mobility for Maryland's highways through its Advanced Traffic Management Systems (ATMS), service patrols, communication, systems integration, and incident response and management. CHART's mission is to improve mobility and safety in Maryland using ITS devices and interagency teamwork to address non-recurring congestion (i.e. crashes, vehicle breakdowns, work zones, special events, and weather events). In addition, CHART is one of 26 agencies from Maine to Florida that are part of the I-95 Corridor Coalition working cooperatively to improve inter-regional travel throughout the East Coast through consensus, cooperation, coordination, and communication. CHART is involved in:

- Emergency Preparedness - Redundant Power and Communication, Decentralized Communications and Emergency Operations Center (EOC), Activation and coordination with the Maryland Emergency Management Agency (MEMA)
- Emergency Weather Operations - Automatic Vehicle Location Fleet Management System and Resource Tracking System
- Incident Management – CHART Operations Centers, Emergency Traffic Patrols, and Emergency Response Units
- Traffic Management - Special Event and Work Zone Management. Coordinate current and planned road work through Lane Closure Permit System (LCPS)
- Traffic and Roadway Monitoring – CCTV Cameras, Traffic Detectors, and Cell phone #77
- Maryland 511 Traveler Information System - High-quality and Timely Travel Information to Motorists, CCTV Camera Video Sharing with First Responders, and Internet (www.traffic.maryland.gov)
- Public/Private Partnerships

Statewide Operations Center (SOC) Reconfiguration

The Statewide Operations Center (SOC) in Hanover, near BWI Airport is the main coordination hub. It is the command and control center of the CHART system, functioning 24 hours a day, seven days a week. MDOT SHA is undertaking an effort to reconfigure and upgrade the existing SOC operational space to facilitate information management and support functionality to meet evolving transportation management demands. The SOC is supported by three strategically located Traffic Operations Centers (TOCs) spread across the state using ATMS to support CHART's critical functions, including traffic monitoring and incident management.

Traffic Monitoring

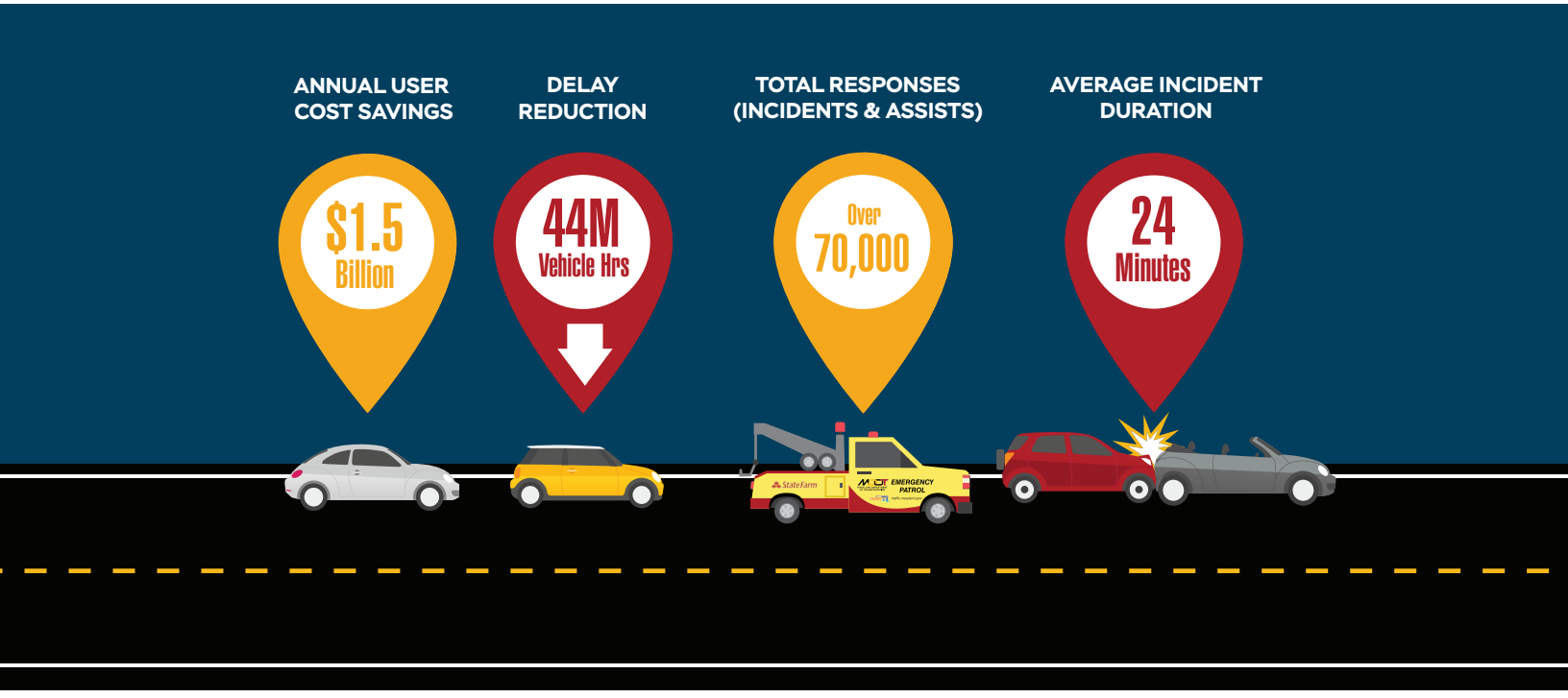
Traffic is monitored using a series of ITS devices. The data is used in conjunction with reports provided by radio communications, local government communications, and traffic signal systems to both detect and respond to incidents and disseminate 511 travel information to motorists. Presently, CHART and MDTA have access to:

- 800+ CCTV Cameras which include video feeds from other agencies
- 300+ Speed Detectors (including those shared through public/private partnerships)
- 200+ Dynamic Message Signs (DMS)
- 60+ Roadway Weather Information Systems (RWIS)
- 50+ Traveler Advisory Radios
- 15+ Variable Toll Rate Signs

Incident Management

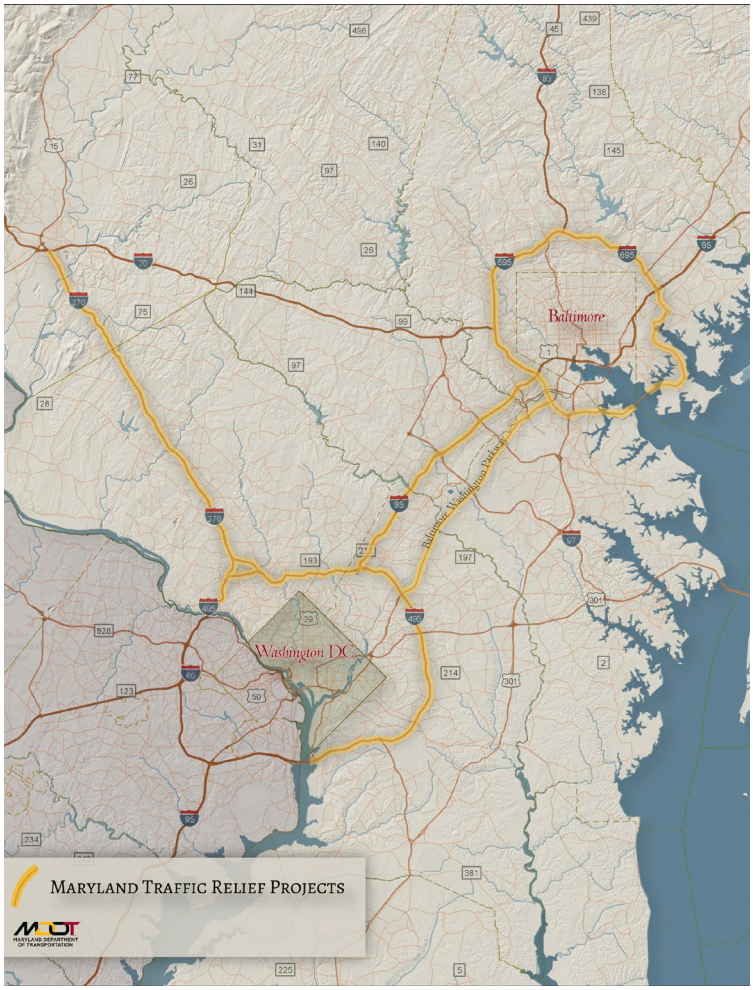
CHART has many different resources dedicated to traffic management that include:

- **Emergency Traffic Patrols (ETPs)** , which are used to provide emergency motorist assistance and to clear disabled vehicles from the travel lanes.
- **Emergency Response Units (ERUs)**, which establish overall traffic control at crash locations.
- **Freeway Incident Traffic Management (FITM) plans and response trailers,** which are pre-stocked with traffic control tools including detour signs, cones, and trailblazer signs that are used to quickly set up pre-planned detour routes when incidents require full roadway closure.
- **A "Clear the Road" policy,** which provides direction for the rapid removal of vehicles from the travel lanes rather than waiting for law enforcement or private towing services to remove disabled vehicles which are blocking travel lanes.
- **An Information Exchange Network (IEN) Clearinghouse, provided through the I-95 Corridor Coalition workstation at the SOC**, which shares regional incident and traveler information to member agencies.



TRAFFIC RELIEF PLAN PROJECTS

Maryland has the second highest commuting times in the nation and the National Capital Region faces the nation's worst congestion. To address this issue, Governor Hogan has initiated an ambitious Traffic Relief Plan to bring innovative solutions to address the transportation challenges on Maryland's most congested roads, including I-495, I-270, MD 295/ Baltimore Washington Parkway, I-695 and I-95. Once completed, the Traffic Relief Plan will ease congestion, reduce travel times and improve the quality of life for Marylanders.



Public/Private Partnership (P3)

The I-495 & I-270 P3 Program is a historic effort to reduce congestion for millions of Maryland drivers by seeking input from the private sector to design, build, finance, operate, and maintain improvements on both I-495 and I-270. The first element in the P3 Program will include a review of existing and future traffic, roadway, and environmental conditions to identify alternatives and assess potential impacts of implementing managed lanes.

Baltimore Region Transportation Improvements

In 2017, MDOT announced $461 million in new Baltimore Region Transportation Investments, including adding new lanes to 27 miles of I-695 and I-95 and a transformative project to add four new lanes to the entire length of the Baltimore Washington Parkway (MD 295), from Baltimore City to Washington, D.C. This $461 million investment brings MDOT's investment in new transportation projects in the Baltimore region to a total of $7 billion.

Baltimore Beltway (I-695) TSMO Project

This $151 million project proposes to use hard shoulder operations and other active traffic management (ATM) strategies along the Baltimore Beltway (I-695). The project spans 19 miles along I-695 between I-70 and MD 43.

Smart Signals

MDOT SHA has dedicated $50.3 million to deploy cutting-edge smart traffic signals to improve traffic operation and ease congestion for approximately 700,000 drivers per day on 14 major corridors across the state. The system uses real-time traffic conditions and computer software that adjusts the timing of traffic signals, synchronizes the entire corridor, and effectively deploys artificial intelligence to keep traffic moving.

I-270 INNOVATIVE CONGESTION MANAGEMENT PROJECT

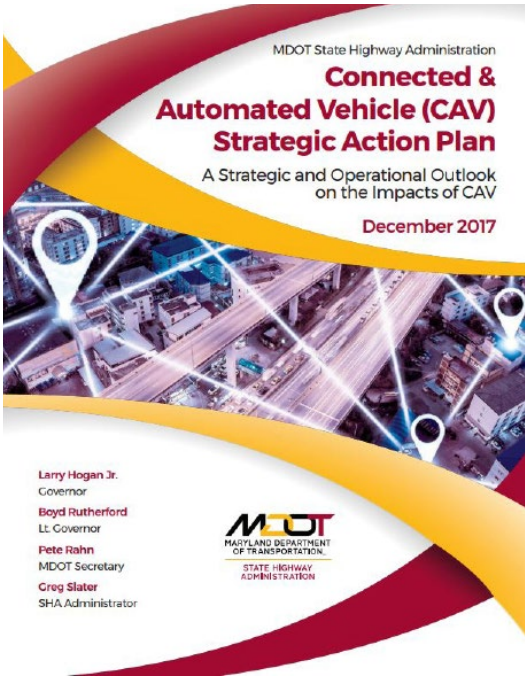
MDOT SHA is conducting a Progressive Design-Build contract to construct highway and traffic management improvements on I-270 between I-70 and the Capital Beltway (I-495). Fourteen roadway improvements are proposed to increase capacity and vehicle throughput while addressing safety concerns and bottleneck issues. This project will introduce innovative technologies and techniques such as adaptive ramp metering and active traffic management to improve traffic operations.

GEOMETRIC CONGESTION RELIEF PROJECTS

To meet the existing and future mobility needs on various corridors, MDOT SHA develops and implements a variety of capital projects. These congestion mitigation projects are identified through a performance-based approach and planned, designed and constructed using practical design principles.

MDOT SHA has established the Consolidated Transportation Program (CTP) which identifies the projected six-year outlay of funds to address system upgrades and maintenance. The CTP includes a wide range of projects that identify both short and long-term solutions to address transportation issues. These projects can range from corridor level capacity expansion by adding new lanes to grade separated interchanges to low cost localized geometric improvements (e.g. auxiliary lanes, turn lanes, extending accel / decel lanes, roundabouts etc.) Project delivery of major capital projects is typically led by the Office of Highway Development, whereas small scale localized improvements are typically implemented by the Districts. Other projects include upgrades to the freight network and new pedestrian and bicycle facilities.

CONNECTED AND AUTOMATED VEHICLE (CAV) PROGRAM EFFORTS



In 2017, MDOT SHA developed a Connected and Automated Vehicle (CAV) Strategic Action Plan through a comprehensive internal coordination effort led jointly by the Office of CHART and ITS Development and the Office of Planning and Preliminary Engineering. This CAV Strategic Action Plan will prepare Maryland's infrastructure, policy, and operations for the future, and help achieve the safety, mobility, and environmental benefits anticipated from CAV technology.

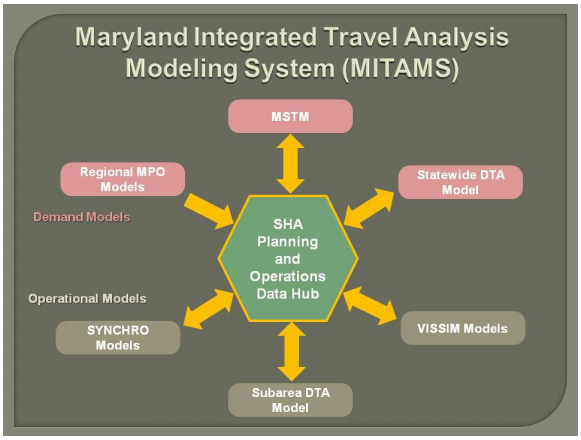
MDOT SHA has an internal CAV Working Group which meets on a regular basis to strategize and coordinate efforts related to CAV development, deployment and implementation, including but not limited to:

- US-1 Innovative Technology Deployment Corridor
- Smart Signals Program
- Participation in the National SPAT challenge – working to deploy infrastructure with Signal Phase and Timing (SPaT) broadcasts along 1 corridor with 20 or more intersections by 2020
- Evaluation of ITS Infrastructure to make Maryland roads CAV-ready
- Development of a Data Governance Plan for CAV data
- Development of a Communications and Outreach Plan for CAV efforts
- Participation in national CAV research efforts including the Connected Vehicle Pooled Fund Study, Dedicated Short Range Communications (DSRC) Community of Interest, I-95 Corridor Coalition, and others
- Participation in the MDOT CAV Working Group, which includes a diverse membership of transportation stakeholders such as elected officials, state and local agency representatives, highway safety organizations, and representatives from the private sector and automotive industry
- Participation in the MDOT CAV Freight Subgroup
- Development of several web-based internal and external CAV-related planning tools, including the CAV Technology Deployment Dashboard and the Connected and Automated Vehicle Public Policy across the US application

MDOT developed a one-stop shop point of entry for all entities interested in testing CAV technology in Maryland to apply through an Expression of Interest (EOI) process. Several MDOT SHA facilities are available for CAV testing through the EOI and are publicized on the Maryland Locations to Enable Testing Sites (LETS) for CAV web-mapping application.

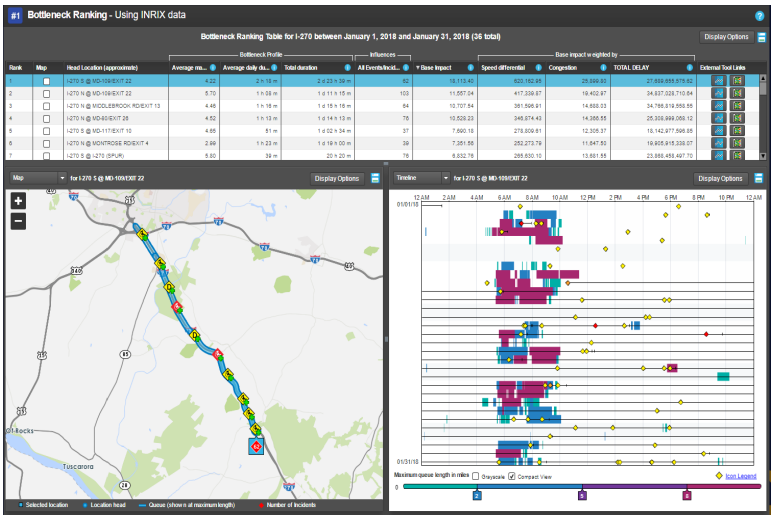
ANALYSIS, MODELING & SIMULATION TOOLS

MDOT SHA has successfully developed several effective modeling tools for traffic analysis and travel forecasting in recent years. Major models developed or in progress include the Maryland Statewide Transportation Model; Activity Based Regional Travel Model; Mesoscopic Models of Travel Demand and Traffic Dynamics for Sub area and Corridor Studies; Agent Based Travel Behavior Model; and the Model of Sustainability and Integrated Corridors. The Reliability Roadmap includes specific projects that will integrate related SHRP 2 analytic tools with these various modeling efforts. For example, the WISE optimization algorithm's integration into the Maryland Integrated Travel Analysis Modeling System.



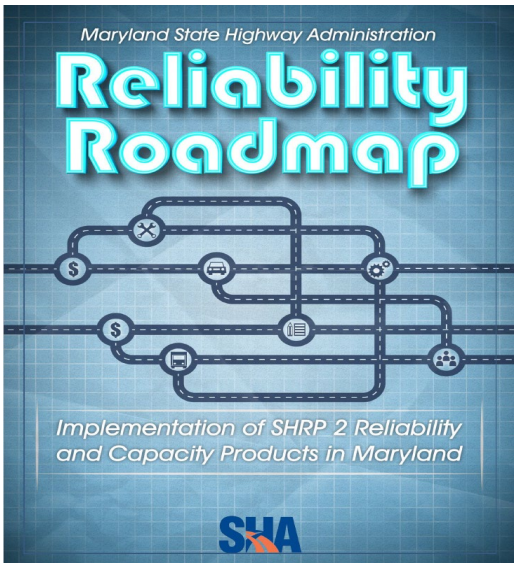
DATA & PERFORMANCE VIZUALIZATION EFFORTS

MDOT SHA uses big data aggregation and dissemination platforms such as the Regional Integrated Transportation Information System (RITIS). RITIS is a situational awareness, data archiving, and analytics application used by transportation agencies, first responders, researchers, and more. RITIS provides MDOT SHA with a broad spectrum of advanced analytics and visualization tools providing real-time situational awareness as well as in-depth archived data evaluation capabilities for state of the art performance based decision making. MDOT SHA also makes use of its Enterprise GIS platform to develop datasets, dashboards and outreach materials to support and communicate its data driven approach.



RELIABILITY PRODUCTS/TOOLS ROADMAP

The Reliability Roadmap includes a set of projects that provide a travel time reliability analytical framework that can effectively inform transportation investment decisions so that TSMO projects can compete on equal footing with traditional capacity projects. The Reliability Roadmap includes the application of SHRP 2 and other reliability products that could enhance the planning and preliminary engineering functions of SHA.



2.3 CUSTOMER PERSPECTIVE

Performance measurement and capturing impacts on the travel system are at the core of TSMO. Impacts to freight shippers, carriers, commuters, and weekend travelers can be captured through assessing the reliability of the roadways. TSMO especially promotes reliable travel and elevates the importance of travel time reliability. The economic health within communities across Maryland depends on a reliable transportation system and businesses rely on predictable travel time for delivery of their supplies and their products. Like freight shippers, drivers too have typical commute times that they plan for. When a trip takes twice as long as planned for, appointments get missed, meetings canceled, others are forced to wait, and the traveler is generally viewed as tardy. These outcomes adversely impact quality of life. Economic opportunities improve greatly for travelers and shippers when a reliable transportation system exists supported by a TSMO program.

Nonrecurring delay due to crashes, construction, weather, and other events is a significant part of the problem with regard to congestion. Nonrecurring conditions are addressed through TSMO improvements including real time management of the system. Implementers such as traffic engineers and transportation management center staff deal with congestion in real or near real time—they focus on dealing with the congestion that travelers are facing today. MDOT SHA's CHART Program focuses on crashes, construction, vehicle breakdowns, and weather which cause an estimated 60% of the total congestion. The most efficient way for an operating agency to address congestion is to target and manage congestion caused by these sources. This includes mitigating work zone traffic conditions through active traffic management. Active traffic management is an essential component of TSMO and is a primary solution to high demand caused by special events including concerts, sporting events, and work zones.

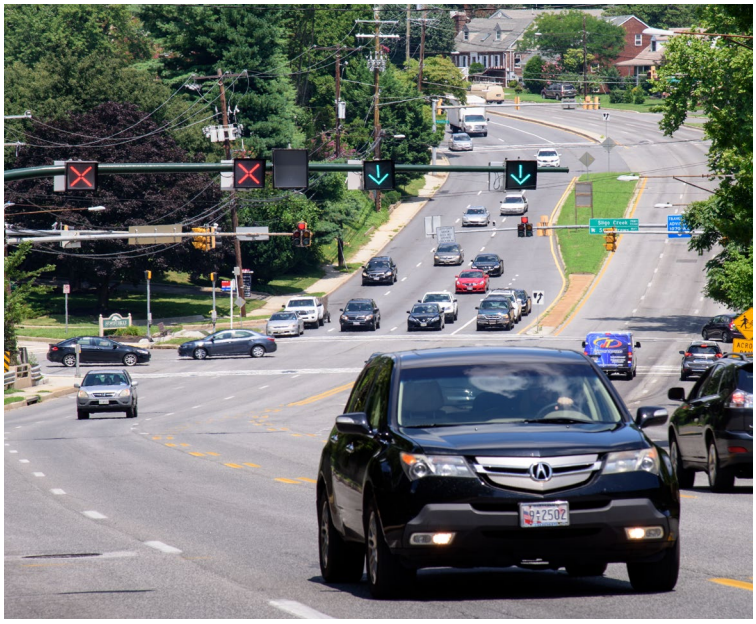
2.4 PERFORMANCE MANAGEMENT

TSMO strategies ensure more efficient and reliable travel. A TSMO program needs to include consideration of tools to measure, analyze, and assess the benefits of the strategies. A key measure to evaluate operational strategies is travel time reliability. MDOT SHA has already recognized this important connection through the development of its Reliability Roadmap–a plan to fully develop and integrate travel time reliability techniques into planning, programming, design and operations within the agency. A systemic approach provides a long-term solution to MDOT SHA's long-range needs. The TSMO program will account for transportation needs through the use of reliability metrics to assess future travel conditions.

To assess the performance, measures should be selected to allow for a comparable evaluation. Measuring the performance of the transportation system requires data and tools that are broadly available at the planning and programming levels. To meet demands for results, accountability, and demonstrated performance, operational data sets, for example third-party probe data, should continue to be acquired.

When comparing TSMO improvements to capacity improvements the return on investment and benefit-cost analysis almost always justifies the operational improvement. This is particularly evident when investigating the travel time reliability on severely congested roadways. Monetizing the improvements by selecting indicators such as value of time, value of travel time reliability, and fuel costs allows for direct comparisons. MDOT SHA monitors some of these costs through the Annual Mobility Report. The net cost-and-time savings outcome favors TSMO from a traveler's perspective. Additionally, projects adding capacity often have environmental impacts which delay project development as well as construction. The TSMO program will tailor messages to educate the audience that operating and managing the transportation system is just as important as improving or adding capacity.

2.5 TSMO PROGRAM OPPORTUNITIES



TSMO projects should be incorporated into planning. Institutionalizing TSMO in existing business processes includes integrating TSMO into long-range planning carried out by the OPPE and MDOT TSO Office of Planning and Capital Programming. Only a few of MDOT SHA program budgets include a TSMO line item or identifiable category. TSMO usually relies on informal arrangements for support from multiple line items rather than a specific, predictable line item. MDOT SHA will adapt processes for budgeting and accounting for TSMO projects to successfully incorporate TSMO into planning. The goal is to institutionalize planning for operations. Clear and concise messaging is critical in the early steps of formalizing the program. MDOT SHA's TSMO program has a clearly defined purpose, vision, goals, and objectives, and performance measures. Education on these goals and objectives should reach internal and external partners, TSMO partners, policy makers, and customers. MDOT SHA should provide state-wide leadership and support for TSMO. Involved parties at all levels should know the TSMO program will:

- Employ new technologies to improve coordination during incident management
- Decrease incident duration and incident delay
- Allow the traveling public to make better informed travel decisions
- Offer active traffic management and integrated corridor management solutions
- Enhance coordination between MDOT SHA and local traffic signal operators to optimize signal timing in response to conditions
- Enhance ability to manage traffic and increase safety near and within work zones and special event locations

The TSMO Plan will describe, contextualize, and interconnect program components and subcomponents. This plan will also create TSMO coordination among MDOT TBUs. Organizational roles, responsibilities, and strategic relationships (internal and external) will be established. Maryland's Plan will provide sufficient training to operational personnel. Distinct units with direct responsibilities for TSMO services, projects, and activities may evolve along with job descriptions. Training and professional development will promote a quality program. Evaluation and monitoring are important to the program's success. Performance evaluations will be built into the program to assist with recommending and prioritizing actions to improve program components and commit resources.

TSMO strategies can be implemented more economically and can more quickly resolve congestion problems than traditional capital improvements. Benefits to MDOT SHA from a TSMO program will include: improved safety, improved travel time reliability, capacity management on limited-access facilities and arterials, cost savings, real-time traveler information for all modes, rapid incident response, better traffic flow through work zones, reduced emissions, and synergies through improved interagency coordination. These components of a structured TSMO program can be even more successful if the services, projects, and activities are in alignment with the purpose, vision, goals, and objectives; contribute to measured performance; and are supported by effective leadership and organizational structures, effective business processes, and adequate resources.

3.0

TSMO STRATEGIC PLAN

This page left intentionally blank

TSMO
MARYLAND TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

WHAT is TSMO?

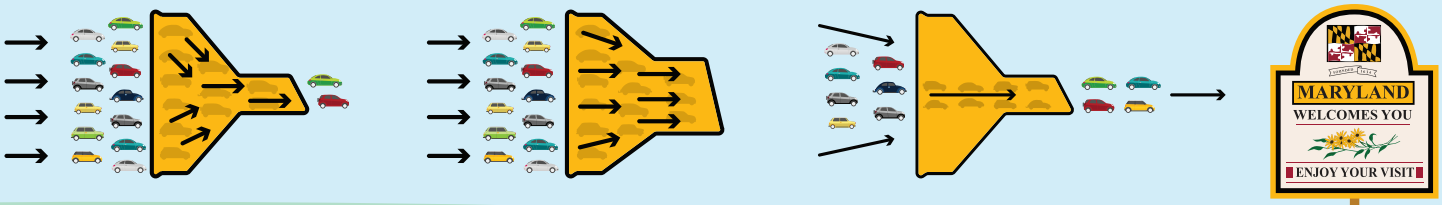
An integrated approach to programmatic optimization of **planning, engineering, operations, and maintenance** in implementing new and existing multi-modal systems, services, and projects to preserve capacity and improve the security, safety, and reliability of our transportation system.

HOW does TSMO work?

CONGESTION PROBLEM
When large volumes of vehicles try to use a road all at once, it creates traffic jams, making traffic move very slowly.

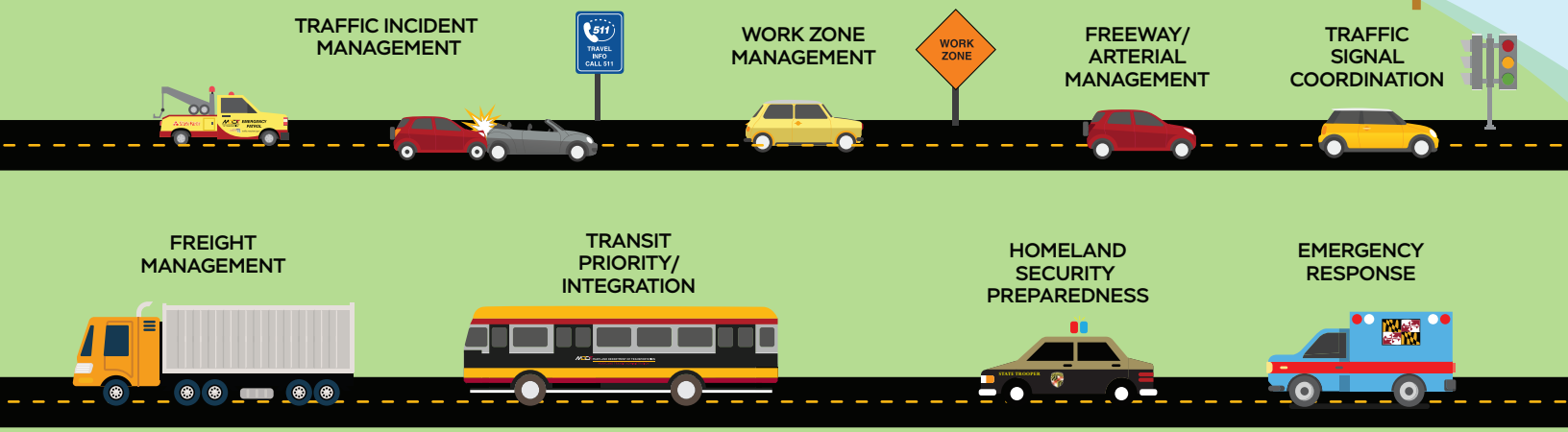
TRADITIONAL CAPACITY EXPANSION
Expanding the available capacity is one option to increase flow, but can be expensive, will take time, and isn't always feasible.

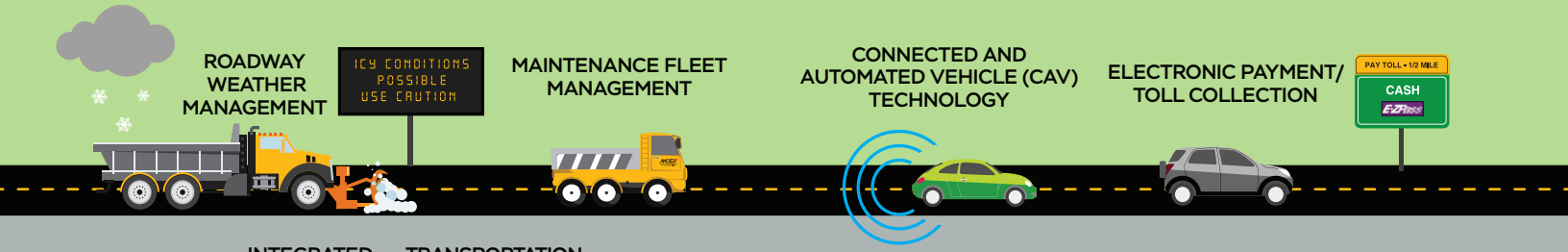
TSMO
A faster and more cost-effective alternative that uses technology to maximize existing capacity, optimizing the flow of traffic by timing it properly.

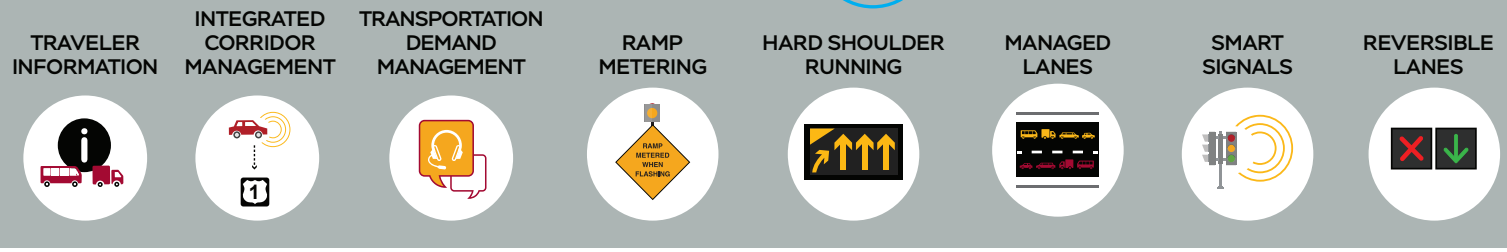


HOW is TSMO implemented?

Through the consideration and addition of any or a combination of the following as a transportation solution







TSMO makes sense.

Compared to capacity expansion, TSMO strategies:

- Address all sources of congestion - recurring + non-recurring
- Are inexpensive and cost-effective
- Take little or no extra right-of-way
- Can be deployed in months rather than years

PURPOSE

A customer-driven leader working to provide safe, efficient, and innovative transportation solutions that meet or exceed customer expectations.

VISION

Implement a sustainable, organization-wide TSMO Program at MDOT SHA that fully maximizes the ability of Maryland's transportation system to consistently move people and goods.

3.3 GOALS, OBJECTIVES AND STRATEGIES

Four goals have been established to achieve the purpose and vision of the 2018 TSMO Strategic Plan as illustrated in Figure 4. Several objectives and associated strategies have been identified under each goal area, as described in the following pages.

Figure 4

MDOT SHA TSMO GOALS

GOAL 1: Business Processes & Collaboration

GOAL 2: Systems & Technology

GOAL 3: Data, Analysis & Performance Management

GOAL 4: Customer Experience & Engagement

GOAL 1

Business Processes & Collaboration

Objective 1.1: Incorporate TSMO in MDOT SHA policies, programs and standard practices

Strategy 1.1a: Develop TSMO policy and procedures to establish organizational structure and institutional framework

Strategy 1.1b: Align TSMO strategies to existing business processes / practices at all MDOT SHA Offices / Districts and program areas

Strategy 1.1c: Include TSMO projects / strategies in the traditional planning, project development and programming process

Strategy 1.1d: Develop project development protocols/ processes for various types of TSMO strategies / projects

Objective 1.2: Implement and institutionalize a TSMO Master Plan

Strategy 1.2a: Develop and maintain a consolidated list of potential TSMO strategies / projects with inputs from CHART, OPPE, OOTS, OHD and Districts

Strategy 1.2b: Develop and implement business processes and technologies to maintain and mainstream the TSMO Master plan

Strategy 1.2c: Develop a business case to secure dedicated funding to implement TSMO strategies / projects

Strategy 1.2d: Leverage other program scopes and funding opportunities to implement TSMO strategies / projects

Objective 1.3: Promote a culture to mainstream TSMO within and outside MDOT SHA at all levels

Strategy 1.3a: Identify staffing resources for various MDOT Offices and Districts to support the TSMO Program

Strategy 1.3b: Develop relevant TSMO education and training resources for MDOT Offices and District staff at all levels of organization

Strategy 1.3c: Develop TSMO education, communication and outreach resources to raise TSMO awareness with MDOT TBUs, MPOs, FHWA, local agencies, other partners and stakeholders

Strategy 1.3d: Continue participation in research and collaboration efforts to advance TSMO practices through TRB, FHWA, AASHTO, ITS America, University Research Centers, National Operations Center of Excellence (NOCoE), etc.

GOAL 2

Systems & Technology

Objective 2.1: Develop and implement Advanced Traffic Management Systems (ATMS) with Active Traffic Management (ATM) capabilities

Strategy 2.1a: Launch the first set of TSMO Active Traffic Management (ATM) capabilities as part of the I-270 Innovative Congestion Management Project

Strategy 2.1b: Complete an assessment of MDOT and MDOT SHA communications assets and incorporate enhancements into future projects

Strategy 2.1c: Implement integrated traffic management projects including Traffic Relief Program (TRP) projects like I-695 TSMO and Smart Signals projects

Strategy 2.1d: Develop Asset Management Systems for ITS devices and TSMO infrastructure

Objective 2.2: Develop Integrated Corridor Management (ICM) capabilities for multimodal passenger and freight movement

Strategy 2.2a: Use the existing I-95 ICM Concept of Operations to identify opportunities for freeway and arterial management integrated operations

Strategy 2.2b: Bring operations data regarding various transportation modes into a single platform to develop a Common Operating Picture (COP)

Strategy 2.2c: Identify opportunities to improve coordinated transportation management including highway, transit, and freight operations

Strategy 2.2d: Implement a Decision Support System that incorporates real-time data from existing systems and develops appropriate response strategies

Objective 2.3: Develop and apply technological foundations for Connected and Automated Vehicles (CAV)

Strategy 2.3a: Align and coordinate TSMO Planning efforts with the MDOT SHA CAV Strategic Action Plan implementation

Strategy 2.3b: Implement CAV technology deployment pilots on MDOT transportation infrastructure and develop a Maryland owned traffic management and CAV testing facility

Strategy 2.3c: Collaborate with private sector and research community for CAV testing on MDOT infrastructure (roadways and facilities)

GOAL 3

Data, Analysis, & Performance Management

Objective 3.1: Implement a comprehensive data driven performance management program to support TSMO

Strategy 3.1a: Monitor corridor and system level performance of Maryland highways and arterials from a mobility, reliability, and access standpoint

Strategy 3.1b: Advance communication and visualization tools to assess performance, progress, benefits, and challenges

Strategy 3.1c: Monitor work zone performance measures at a project, corridor and system level to improve work zone management

Strategy 3.1d: Develop next generation customer facing performance measures using big data innovations and advanced technologies

Objective 3.2: Advance data governance, analysis and modeling capabilities to inform planning, operational and TSMO decisions

Strategy 3.2a: Formalize a data governance plan that supports the MDOT SHA Program

Strategy 3.2b: Advance data analysis, methods and application tools to support TSMO decision-making at strategic, tactical, and operational levels

Strategy 3.2c: Advance travel and traffic modeling applications to support multi-modal passenger and freight-related TSMO strategies and projects

Strategy 3.2d: Develop and mainstream methods and tools that incorporate travel time reliability, accessibility, life-cycle planning, and project development/prioritization

GOAL 4

Customer Experience & Engagement

Objective 4.1: Provide reliable and accessible real-time modal choice information to our customers

Strategy 4.1a: Continue to improve CHART's capabilities for providing traffic information to regional integrated transportation data collection and distribution systems

Strategy 4.1b: Launch a One MDOT traveler information application in partnership with other MDOT TBUs

Strategy 4.1c: Work in partnership with private-sector information providers, to share data on real-time operational conditions on the transportation network

Strategy 4.1d: Collaborate with other modes, MPOs, local agencies, major employers, and businesses for active travel demand management, including incentivization of travel choices and Mobility on Demand services

Objective 4.2: Raise awareness of TSMO and its general understanding by the traveling public

Strategy 4.2a: Develop education and outreach tools, including use of public-facing websites, social media applications etc.

Strategy 4.2b: Conduct market research to determine customer level of satisfaction with MDOT SHA TSMO Program implementation

Strategy 4.2c: Develop user groups, focus groups and charettes to foster continued engagement with customers on various TSMO focus areas

Strategy 4.2d: Develop tools and interfaces to seek customer perspectives and inputs

4.0

TSMO ORGANIZATIONAL STRUCTURE

This page left intentionally blank

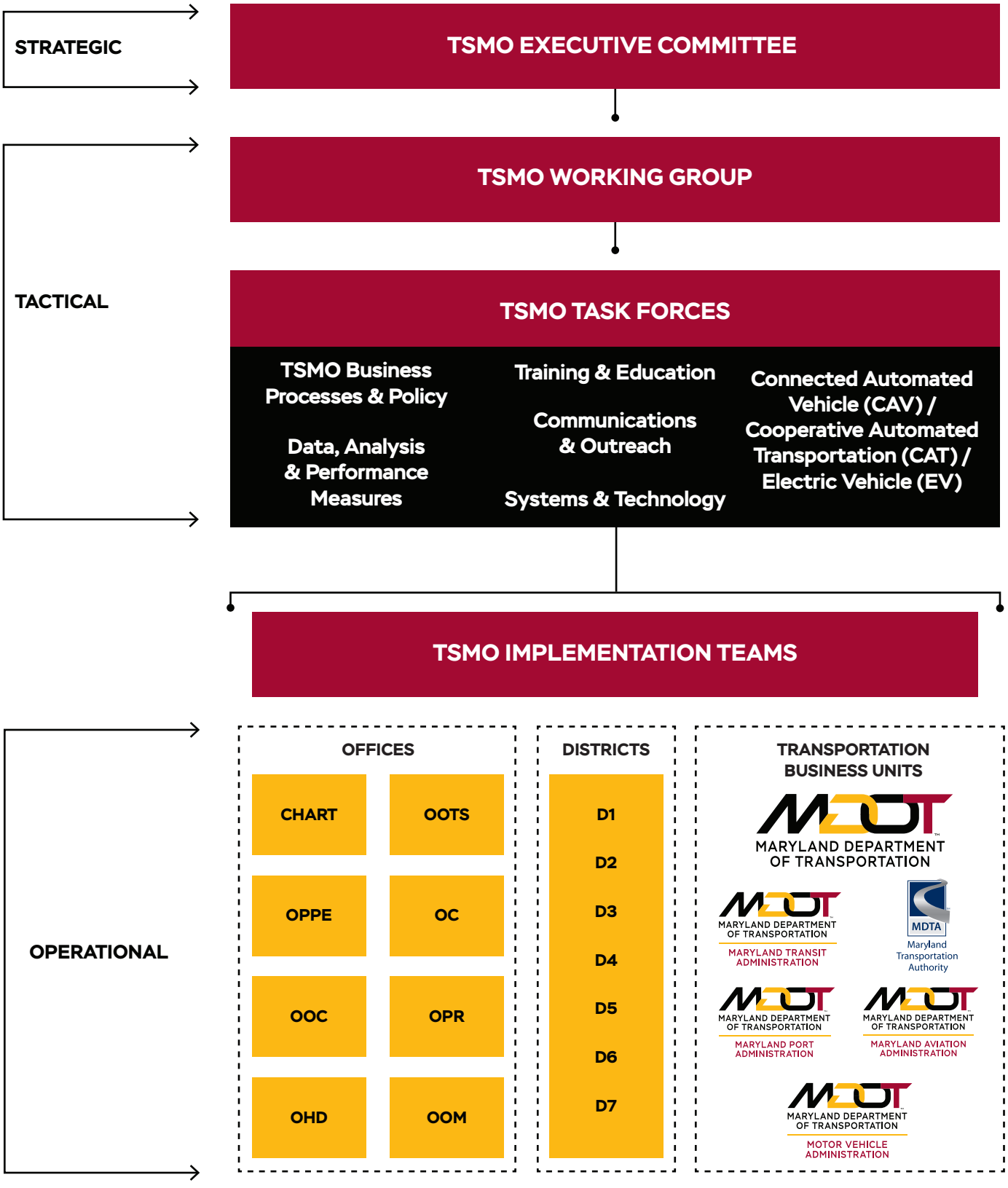
A key success factor for TSMO implementation is to ensure there is an organizational structure within MDOT SHA, as the responsible MDOT TBU to lead the TSMO Strategic Plan implementation in collaboration with other TBUs and external stakeholders. The MDOT SHA organizational structure includes:

1. **TSMO Executive Committee** that provides strategic direction and overall program governance
2. **TSMO Working Group** that is responsible for identifying and executing specific actions required to implement TSMO strategies at a tactical level
3. **TSMO Implementation Teams** the operational level which represents all of the existing MDOT SHA Offices and Districts that will either lead, or provide support for, carrying out implementation of actions identified at the tactical levels (see Figure 5)

Figure 5

MDOT SHA TSMO ORGANIZATIONAL STRUCTURE

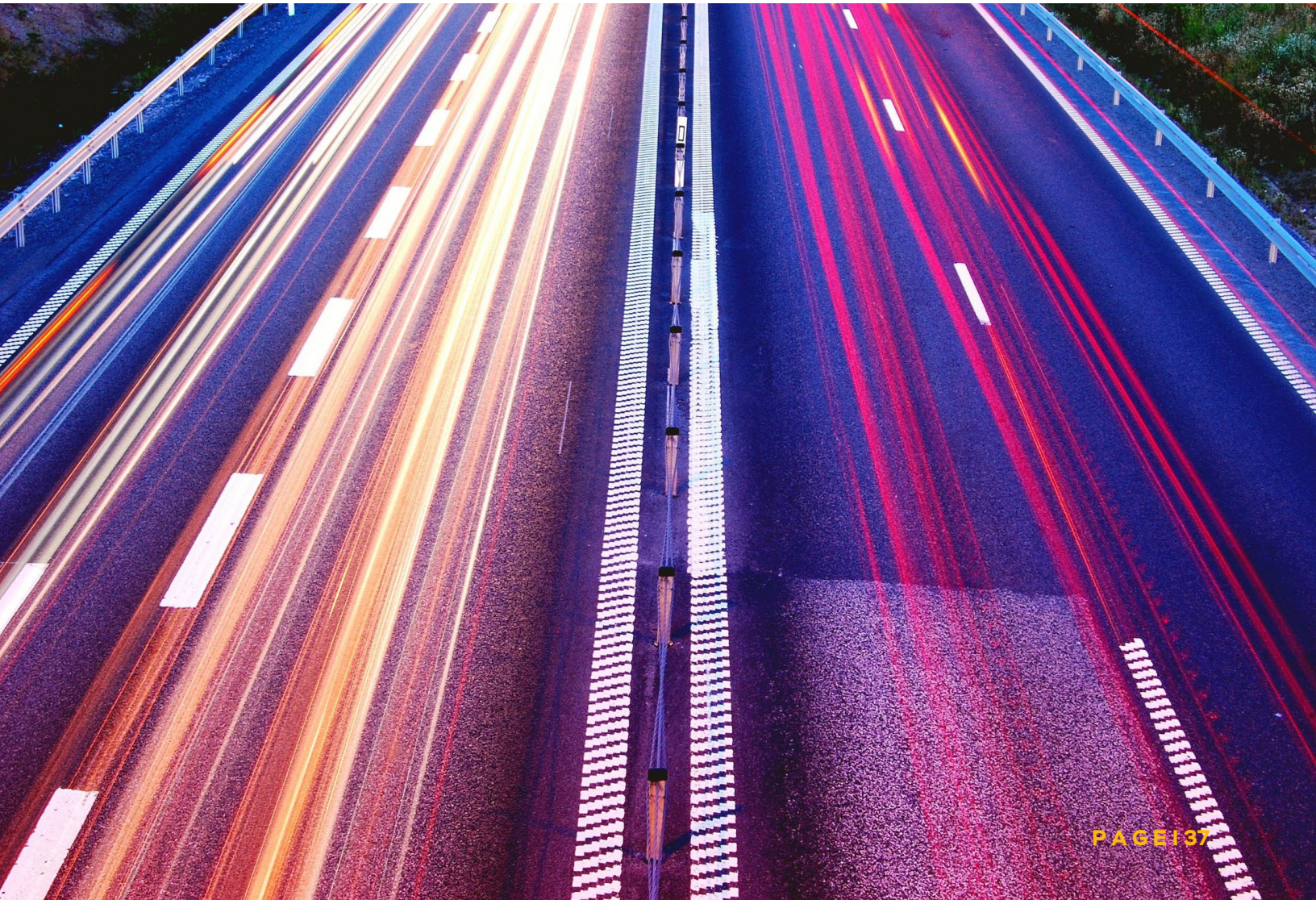
DECISION PARADIGM



4.1 Organizational Setup at MDOT SHA

TSMO Executive Committee

The TSMO Executive Committee provides overall governance and strategic level guidance to the MDOT SHA TSMO Program. Responsibilities of this committee include setting TSMO organizational policies and overall program direction, including oversight of the preparation, adoption, and implementation of the TSMO Strategic Plan. This also includes high-level management and coordination of resources (funding, personnel, etc.) required for tactical and operational actions/activities supporting delivery of TSMO Strategic Plan goals, objectives, and strategies. The TSMO Executive Committee is co-chaired by the Deputy Administrator/Chief Engineer for Operations and the Deputy Administrator/Chief Engineer for Planning, Engineering, Real Estate, and Environment. A Deputy Director/TSMO Program Manager position has been identified in the Office of CHART and ITS Development – which works in close coordination, collaboration, and communication with other MDOT SHA Offices, Districts, MDTA, and MDOT MTA (and other MDOT TBUs as necessary) in executing TSMO Program delivery. The following MDOT SHA offices and districts currently have leadership representation in the TSMO Executive Committee: Office of CHART & ITS; Office of Traffic Safety (OOTS); Office of Planning and Preliminary Engineering (OPPE); Office of Highway Development (OHD); District 4; and District 7.



TSMO Working Group and Task Forces

The TSMO Working Group is a cross disciplinary multi-office and multi-district collaborative group responsible for identifying and executing specific actions, deliverables and resources required to implement strategies in the Strategic Plan. It is led by the TSMO Program Manager, a Deputy Director within the Office of CHART and ITS Development. The Working Group executes its responsibilities through a variety of task forces as illustrated in Table 2. The TSMO Working Group coordinates the task activities of the Task Forces and serves as the interface between them and the TSMO Executive Committee. The TSMO Working Group is also responsible for coordinating the implementation of specific actions and projects at the operational level through the responsible MDOT SHA Offices, Districts and MDOT TBUs, as necessary.

Table 2

TSMO TASK FORCES AND ASSOCIATED RESPONSIBILITIES

TSMO Task Forces	Task Force Responsibilities
TSMO Business Processes & Policy	Responsible for developing and implementing business processes and supporting policies as required for TSMO project planning, project development, procurement, operations, and maintenance. Ensures incorporation of TSMO in MDOT SHA policies and standard practices and facilitates institutionalization of TSMO Program.
Training & Education	Responsible for development and maintenance of TSMO training and education curriculum, course development and delivery mechanisms that support all TSMO Strategic Plan goal areas. Works to promote culture to mainstream TSMO within and outside MDOT SHA at all levels.
Systems & Technology	Responsible for all systems and technology in support of TSMO including CHART field infrastructure, CHART ATMS, arterial CCTV and signal system infrastructure, signal software control, vehicle-based systems & technology, and telecommunications. Includes systems engineering, software development, system acquisition, and operations & maintenance. Works to anticipate and apply advancing systems and technologies including those related to Connected and Automated Vehicles (CAVs).
Data, Analysis, & Performance Measures	Responsible for implementing a comprehensive data driven performance management program to support TSMO. Works to advance data governance and modeling capabilities to inform planning, operational, and TSMO decisions.
Communication & Outreach	Responsible for TSMO communication and outreach both internally and externally including identification of audiences, development of TSMO messaging, and delivery mechanisms. Works to raise awareness of TSMO and its general understanding by the traveling public. Coordinates and collaborates with the Training & Education task force.
Connected and Automated Vehicle (CAV) / Cooperative Automated Transportation (CAT) / Electric Vehicle (EV)	Responsible for preparing MDOT SHA, both institutionally and technologically, for oncoming CAV / CAT / EV future by overseeing the MDOT SHA CAV Strategic Action Plan implementation, conducting deployment pilots, and developing test facilities. Works in close coordination with Systems & Technology task force and with the MDOT CAV Working Group.
Freight & Multimodal	Oversees CHART and four other Divisions and seven District Engineers Responsible for identification, development, and implementation of multi-modal passenger and freight related TSMO strategies and projects. Works in collaboration with all other task forces to ensure freight and multi-modal considerations are addressed in: business processes and policies; training and education; systems & technology; data, analysis, and performance measures; communications and outreach; and CAV / CAT / EV.

TSMO Implementation Teams

This operational level of the MDOT SHA TSMO Organization represents all the existing MDOT SHA Offices and Districts that either lead, or provide support for, carrying out implementation of actions identified by the TSMO Work Group and Task Forces. This level also includes other MDOT TBUs as may be required. In general, there will be representatives from the various Offices and Districts on the TSMO Working Group and Task Forces. The TSMO Implementation Teams include representation from:

- Office of CHART & ITS Development
- Office of Traffic & Safety
- Office of Maintenance
- Office of Chief Engineer (Operations)
- Office of Policy & Research
- Office of Planning & Preliminary Engineering
- Office of Highway Design
- District Offices (D1, D2, D3, D4, D5, D6 and D7)
- Maryland Transportation Authority (MDTA)
- MDOT The Secretary's Office (TSO)
- MDOT Maryland Transit Administration (MDOT MTA)
- MDOT Port Administration (MDOT MPA)
- MDOT Aviation Administration (MDOT MAA)
- MDOT Motor Vehicle Administration (MDOT MVA)

4.2 COORDINATION & COLLABORATION WITH OTHER MDOT TRANSPORTATION BUSINESS UNITS (TBUs)

The Maryland Department of Transportation is organized into six TBUs under the Secretary of Transportation that are, collectively, One MDOT with a single mission statement (Figure 6). This mission statement clearly defines and communicates the primary direction for the entire Department:

Figure 6

MARYLAND DEPARTMENT OF TRANSPORTATION

MISSION STATEMENT

"The Maryland Department of Transportation is a customer-driven leader that delivers safe, sustainable, intelligent, and exceptional transportation solutions in order to connect our customers to life's opportunities."

The MDOT SHA TSMO Program is key to helping MDOT SHA, as a TBU, achieve the One MDOT Mission. TSMO is not focused on a single mode; rather, it embraces multimodal strategies in meeting transportation challenges. Fortunately, One MDOT is inherently organized to be multimodal and MDOT SHA actively works with its other MDOT TBUs to implement TSMO strategies as appropriate. Figure 7 provides examples of internal offices within each TBU and the Secretary's Office that may be involved in working with MDOT SHA in delivery and support of the TSMO Program.

Figure 7

INTERNAL OFFICES OF MDOT

MARYLAND DEPARTMENT OF TRANSPORTATION

MDOT Level

Secretary of Transportation
Deputy Secretary for Operations
Office of Planning and Capital Programming
Maryland Motor Carrier Program
Office of Transportation Technology

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

SHA Executive Level

State Highway Administrator
Deputy Administrator for Operations/Chief Engineer
Deputy Administrator for Planning/Engineering, Real Estate & Environment (PERE)

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND TRANSIT ADMINISTRATION

Maryland Transit Administration

Core Operations
Operations Control Center
Maryland Rail Commuter (MARC) and Commuter Bus Operations
Office of Planning

MARYLAND DEPARTMENT OF TRANSPORTATION
MOTOR VEHICLE ADMINISTRATION

MVA Management

Administrator and Chair of MDOT Connected/ Automated Vehicle Task Force

MDTA

Maryland Transportation Authority (MDTA)

Deputy Executive Director
Division of Operations

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

Maryland Aviation Administration

Operations and Maintenance

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND PORT ADMINISTRATION

Maryland Port Administration

Operations

5.0

TSMO MASTER PLAN

This page left intentionally blank

5.1 OVERVIEW OF MDOT SHA TSMO MASTER PLAN

The TSMO Master Plan aims to formalize the planning, programming and delivery process of the TSMO program. Considering that there is a wide range of TSMO activities that happen all across the agency, the Master Plan serves as the one-stop location to understand various TSMO and other enabling projects undertaken/planned by various Offices and Districts. The TSMO Master Plan also provides opportunities to document both funded and unfunded needs of corridors and overall transportation network. The TSMO Master Plan is a living document, updated annually, to continually evaluate the TSMO efforts across Maryland. The document establishes a vision for the State of Maryland for all TSMO projects as it identifies corridor needs, risks, and opportunities for project advancement. The document also serves as a reporting mechanism to present data-driven performance measures to identify and prioritize potential TSMO projects and to track agency-wide TSMO efforts.

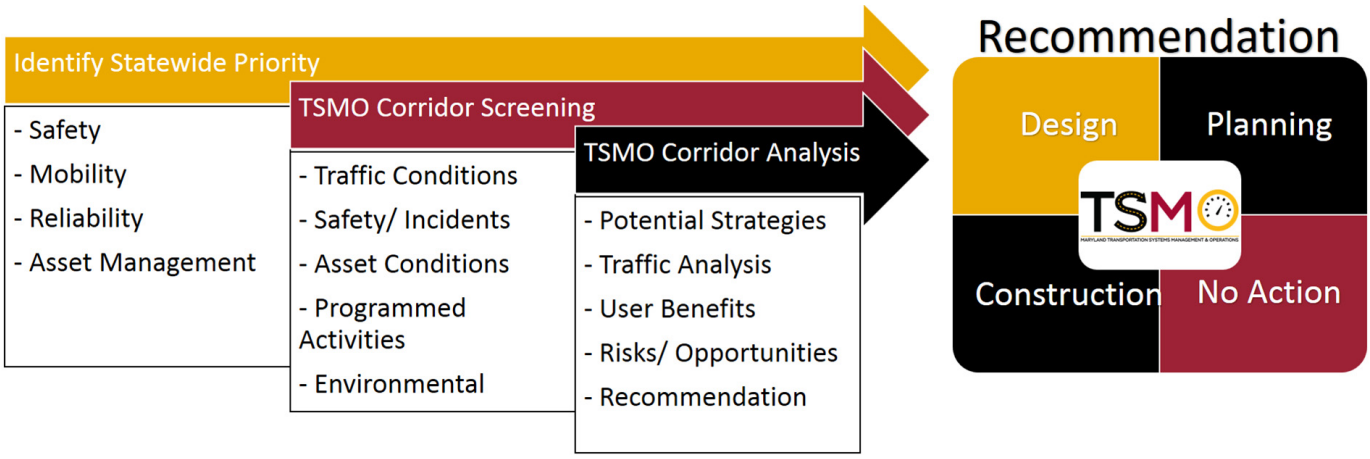
Performance-based metrics are essential to the success of the TSMO Program. Corridors and potential TSMO solutions identified in the Master Plan must meet the following general criteria to be selected for advancement:

- Clearly identified need within the corridor (safety, reliability, operations, etc.)
- Positive end user benefit for potential TSMO solutions
- Advance practical and sustainable solutions, consistent with Federal, State, and Local goals and objectives

The Master Plan helps promote a culture within the MDOT SHA and MDOT TBUs that incorporate the TSMO discipline within the project development process. It also helps in communicating Maryland's TSMO vision and goals to all stakeholders, thereby creating awareness and partnerships at local, regional, statewide and national levels.

5.2 TSMO PROJECT DEVELOPMENT PROCESS

There are three steps to the TSMO Project Development Process incorporated in the TSMO Master Plan effort: Identify Statewide Priorities, TSMO Corridor Screening, and TSMO Corridor Analysis, resulting in a TSMO Master Plan Recommendation.



Identify Statewide Priorities

The Master Plan utilizes the Annual Mobility Report, Strategic Highway Safety Plan, and the Transportation Asset Management Plan to identify TSMO corridors' needs based on the four focus areas: safety, mobility, asset management, and reliability. This information is overlaid with ongoing projects and programmed activities to identify underserved corridors or priority corridors.

TSMO Corridor Screening

After the corridor has been identified, MDOT SHA conducts a corridor screening using readily available Geographical Information System (GIS) data to provide a snapshot of the corridor, including the Annual Average Daily Traffic (AADT); Travel Time Index (TTI); Planning Time Index (PTI); statewide congestion and unreliability ranking; and failing signalized intersections for arterials. This allows for an overview of the entire corridor, as opposed to localized intersection or segment failures. This does not imply that TSMO tools must be applied for entire corridor; however, a corridor approach ensures that local TSMO projects are not shifting the issue downstream.

This planning-level screening also gathers information regarding crashes and other roadway incidents, including breakdowns of types of collisions, duration of roadway closure, and time of day for the event. The GIS analysis also overlays programmed Consolidated Transportation Program (CTP) projects as well as asset conditions, categorizing the pavement and structure conditions, to leverage potential synergies between already programmed capital and system preservation activities. Lastly, the corridor screening gathers environmental data to identify potential issues regarding Federal or State environmental regulatory requirements.

TSMO Corridor Analysis

The data gathered in the corridor screening is utilized to conduct a high-level TSMO Corridor Analysis to identify potential Active Traffic Management (ATM) strategies that leverage ITS applications and make efficient use of existing transportation assets. The TSMO Program promotes future thinking and planning to capitalize on the advances in technology and the transportation industry. Planning level concepts are developed to perform a high-level risk and opportunity assessment for the corridor to identify the following information:

- Overview of the challenges and opportunities along the corridor
- Potential TSMO strategies, including costs and end user benefits
- Identify potential risks and opportunities for project advancement
- Ensure consistency with past efforts, commitments, and future plans

The TSMO Corridor Analysis concludes with a TSMO Corridor Vision that maximizes its potential with the implementation of ATM strategies, under the current conditions. The recommendation identifies potential transportation projects to be scoped and initiate the planning, design, or procurement, as applicable. The conclusion of the analysis may indicate that applicable ATM strategies address current mobility and reliability concerns on the corridor may be contingent on other projects to be completed first to avoid simply shifting bottle neck locations.

The TSMO Master Plan recommends certain TSMO strategies for all evaluated corridors, but also applies a ranking system to prioritize strategies between TSMO corridors. The four main categories used are cost, risk, benefit / cost, and agency priority ranking. The agency ranking takes into consideration traffic parameters, such as annual average daily volumes, speeds, TTI, PTI, and crash density, but also includes qualitative parameters such as local priorities, constituent support/urgency and other factors.

The TSMO Master Plan is supported by a TSMO Performance and Project Portal that tracks all TSMO projects (and other relevant programs/projects) as they make their way from conceptualization, to engineering, to implementation.

6.0

PARTNERS & STAKEHOLDERS

This page left intentionally blank

Ensuring delivery of a successful MDOT SHA TSMO Program requires coordinating with many partners and stakeholders. Partners are individuals or organizations that may play a role in helping implement TSMO strategies. Stakeholders are individuals or organizations that may have a specific interest or connection to these strategies. The partners and stakeholders in Figures 8A and 8B are representative samples of a much longer list. While these figures are not intended to be all inclusive, they provide some context regarding the larger TSMO constituency beyond MDOT SHA or One MDOT.

EXTERNAL PARTNERS TO MDOT SHA

Figure 8A **State, Regional, County, and Local Governments and Coordinating Organizations**

STATEWIDE

- Legislature: Elected Officials and key staff
- Maryland Emergency Management Agency (MEMA)
- Maryland State Police
- Maryland Department of the Environment
- Maryland Department of Planning
- Maryland Department of Commerce

COUNTY AND LOCAL GOVERNMENT

- County Elected Officials
- County Transportation and Planning Agency management and technical leadership
- City of Baltimore
- Allegany County
- Anne Arundel County
- Baltimore County
- Calvert County
- Carroll County
- Caroline County
- Cecil County
- Dorchester County
- Frederick County
- Garrett County
- Harford County
- Howard County
- Kent County
- Montgomery County
- Prince George's County
- Queen Anne's County
- Saint Mary's County
- Somerset County
- Talbot County
- Washington County
- Wicomico County
- Worcester County
- Local County Jurisdictions

METROPOLITAN PLANNING ORGANIZATIONS (MPOS)

- National Capital Region Transportation Planning Board (TPB)
- Baltimore Regional Transportation Board (BRTB)
- Cumberland Area Metropolitan Planning Organization (CAMPO)
- Hagerstown/Eastern Panhandle Metropolitan Planning Organization (HEPMPO)
- Wilmington Area Planning Council (WILMAPCO)
- Salisbury/Wicomico Metropolitan Planning Organization (SWMPO)
- Calvert-St. Mary's Metropolitan Planning Organization (C-SMMPO)

REGIONAL PLANNING COUNCILS

- Baltimore Metropolitan Council (BMC)
- Metropolitan Washington Council of Governments (MWCOG)
- Mid-Shore Regional Council
- Tri-County Council for Southern Maryland
- Tri-County Council for the Lower Eastern Shore
- Tri-County Council for Western Maryland
- Upper Shore Regional Council

ADJACENT STATE DOTS, TRANSIT, AND INTERCITY RAIL RELATED ORGANIZATIONS

- Virginia Department of Transportation (VDOT)
- Delaware Department of Transportation (DelDOT)
- Pennsylvania Department of Transportation (PennDOT)
- District Department of Transportation (DDOT)
- I-95 Corridor Coalition
- Washington Metropolitan Area Transit Authority (WMATA)
- Metropolitan Area Transportation Operations Coordination (MATOC)

EXTERNAL PARTNERS TO MDOT SHA

Figure 8B

When engaging partners and stakeholders, it is key to anticipate their needs and possible concerns. When it comes to partners who are not already vested in TSMO, there may be skepticism as to its value. For example, locals may have concerns about more congestion on their roads, or concerns about speeding, cut-through traffic, or other unsafe conditions on local roads. Some of the biggest skeptics could be stakeholders that have become accustomed to adding new capacity to solve congestion problems. This includes the traveling public expectations of adding more capacity (as opposed to focusing on efficiency).

To address these anticipated perceived impacts and/or concerns there is a need to develop a communications and outreach strategy and associated products. Some specific partner and stakeholder involvement actions could include:

- Preparation of a Partner and Stakeholder Communications and Outreach Plan
- Creating concise communication products for target audiences (e.g. TSMO one-pagers, newsletters, storymaps, web content, informational videos, infographics, etc.)
- Providing opportunities for feedback and listening sessions that document concerns and answer questions related to implementation of the TSMO Program or a specific TSMO strategy
- Develop partner and stakeholder focus groups to understand needs and develop solution strategies in specific areas

The next section goes into additional detail regarding communication and outreach.

7.0

COMMUNICATION & OUTREACH

This page left intentionally blank

The success of the TSMO program in Maryland is dependent on effective communication and outreach both internally to MDOT SHA staff and other MDOT TBUs, and externally to partners, stakeholders, and the general public. Currently, few internal employees and a very small portion of the traveling public are aware of the term "TSMO," much less the concepts and practices underlying it and the strategies and benefits it can produce. A communication and outreach strategy will help MDOT SHA communicate benefits, educate stakeholders and customers, gain buy-in for both TSMO strategies and the TSMO Program, and gather institutional knowledge from agency staff that can help with effective implementation. To address the need for education and awareness building, a Communication and Outreach plan will be developed to propose a series of strategies, messages, and tactics to communicate TSMO practices and improve awareness both among MDOT SHA and MDOT employees and the traveling public. Since the asks, messaging, and level of information that will be shared vary greatly between the internal and external audiences, it will be key for the communication plan and strategy to address the needs of both. Examples include:

INTERNAL AUDIENCES

What is being asked of me in my daily role?

What does the future look like for my career?

What needs to be considered on existing and new projects? Who will I need to work/coordinate with?

How will/can TSMO components be incorporated?

Where is funding coming from?

What agency, local, regional, etc. changes will come about as a result of TSMO ?

What does the future of transportation in Maryland look like?

EXTERNAL AUDIENCES

What does TSMO mean for my commute, errands, bus ride, etc.?

When will I see changes and improvements?

How will my taxpayer money be used to fund TSMO projects and initiatives?

How/where do I access the technology?

Does this mean the future of driverless vehicles is here? Is it safe?

AUDIENCES FOR TSMO EDUCATION AND AWARENESS

The communication strategies used in the TSMO program will be informed by target audience.

INTERNAL

- MDOT SHA Employees in Offices & Districts (e.g. employees in Operations, Planning, Construction, Maintenance, CHART, senior leadership, etc.)
- MDOT Employees and other Business Units (e.g. MDOT MTA, MDOT MPA, etc.)

EXTERNAL

- Freight operators and stakeholders (e.g. shipping companies, trucking companies, etc.)
- MPOs and Local Agencies (e.g. Baltimore Metropolitan Council, Metropolitan Washington Council of Governments, city/county transportation and transit agencies, etc.)
- Advocacy Groups and the Traveling Public (e.g. the Central Maryland Transportation Alliance, commuters and daytime travelers, out-of-state visitors, ridesharing services, etc.)

Clear and concise messaging is critical in the early steps of formalizing the TSMO Program. For the internal audience, it is very important that all levels of MDOT SHA have an understanding and awareness of TSMO concepts and what is being asked of them as the TSMO Program advances and integrates. Employee and management understanding of how various Office/District functions relate to TSMO Program areas will be key for building an organizational culture. Education on TSMO goals and objectives should reach policy makers, TSMO partners, stakeholders, and customers. Involved parties, at all levels, should know that the TSMO program includes the following and that consideration should be given to incorporating all these elements into future projects and initiatives:

- Employ new technologies to improve coordination during incident management
- Decrease incident duration and incident delay
- Allow the traveling public to make better informed travel decisions
- Provide mobility benefits for transit, freight and highway modes
- Support transportation safety goals for MDOT SHA and partners
- Communicate and provide outreach to internal and external audiences
- Enhance coordination between MDOT SHA and local traffic signal operators to optimize signal timing in response to conditions
- Enhance ability to manage traffic and increase safety near and within work zones and special event locations
- Employ active traffic management strategies like ramp metering, dynamic hard shoulder use, smart signals, etc.
- Employ integrated corridor management strategies to move people and goods efficiently

External audiences should be informed of the following:

- What TSMO is and how it will impact them
- What the benefits are
- When they can expect to see implementation and improvements
- What the future of transportation looks like

Communication and outreach will play an integral role in achieving each of the four TSMO program goals. Specific strategies will emerge as the program moves into the implementation phase. Table 3 shows possible communication components for each of the four goal areas.

Table 3

COMMUNICATION COMPONENTS IN TSMO GOALS

TSMO Strategic/Implementation Goals		Sample Communication Component
Goal 1 	Business Processes & Collaboration	Development of TSMO messaging, education, and informational resources to inform MDOT SHA staff and management *Example: Training programs for offices, districts, and business units*
Goal 2 	Systems & Technology	Development of externally facing educational materials on various TSMO ATM strategies, Integrated Corridor Management, and Connected Automated Vehicles *Example: Develop and distribute informational infographic fly sheets per topic area like dynamic shoulder operations, ramp metering, etc.*
Goal 3 	Data, Analysis & Performance Management	Development of outreach materials to explain performance measures (such as travel time reliability) used in measuring TSMO Program outputs *Example: Develop and distribute informational infographic fly sheets per topic area like travel time reliability metrics, accessibility metrics, etc.*
Goal 4 	Customer Experience & Engagement	Develop messaging and education and outreach tools to inform the public *Example: Dedicated TSMO website and social media accounts, way to reach/interact with MDOT SHA staff and management, crowd sourcing closures, failing ITS devices, etc.*

COMMUNICATION CHANNELS

Methods already utilized by MDOT SHA as well as potential additional strategies and tools to advance the TSMO program goals are shown in Table 4 below. These suggested communication methods will be updated based on a more detailed communication and outreach plan, to be developed through the TSMO Communication & Outreach Taskforce with active lead by the Office of Communications (OC), and guidance from TSMO Executive Committee.

Table 4

SAMPLE TSMO COMMUNICATION METHODS

Communication Method	Audience	Message	Impact
Branding and Messaging	Internal/ External	What TSMO is, why it's important, what the benefits are/will be, what is needed from internal and external audiences	Consistent use of terms and messaging across strategies, ensure clear communication
Policy Memos from Administrator	Internal	Value of TSMO and role for MDOT SHA	Provide internal messaging and awareness; provide updates and progress/accomplishments
Intranet Homepage	Internal	Business case and updates	Inform employees of progress and provide educational/informational resources
Intranet Project Pages	Internal	Program Progress	Inform employees of progress and accomplishments
Email Newsletters/Bulletins (wide to narrow audience)	Internal/ External	Solicit input/feedback, inform progress, engage employees and the public	Involve and inform team members and the public of progress and accomplishments
Project Posters	Internal	Inform progress, engage employees	Deepen understanding of program purpose and project progress and accomplishments
Organization Calendar	Internal	Highlight TSMO appearances, presentations, and other TSMO activities outside of MDOT SHA	Heighten awareness of program
Brownbag Lunches/ Department Presentations	Internal	Inform staff about strategies, progress, projects	Deepen understanding of program purpose and project progress
Blog/News Articles	Internal/ External	Inform team members and public on strategies, progress, projects	Deepen understanding of benefits and gain buy in
Mass Media (newspaper, TV, etc.)	External	Inform public on strategies, progress, projects	Deepen understanding of benefits and gain buy in
Social Media (videos, social networks, photos)	External	Engage with external audiences	Deepen understanding of benefits and gain buy in

8.0

TRAINING & EDUCATION

This page left intentionally blank

TSMO TRAINING AND EDUCATION

In addition to internal communication and outreach efforts, development and implementation of a training and education curriculum, course development, and delivery mechanisms that support all TSMO Strategic Plan goal areas are equally important. This training and education will serve to increase awareness and ensure cross agency participation in TSMO efforts and promote a culture within MDOT SHA to mainstream TSMO at all levels. One of the main goals of internal training and education is to place TSMO components and concepts at the forefront of decision-making when MDOT SHA staff and offices are identifying capital investments and defining alternatives to improve mobility.

The Training and Education Task Force under the TSMO Working Group will be responsible for the development and maintenance of a TSMO training and education curriculum. The initial priority of the program will involve delivery of TSMO 101 introductory educational material through a number of District and Office level "Roadshow" meetings. The six to nine month Roadshow will have training sessions for executives/mid-level managers, as well as Town Hall style presentations and discussion with employees. Topics to be covered include:

- TSMO 101 – an introduction to the basics of TSMO (what, who, why, when, where, and how)
- MDOT SHA TSMO Program Overview – covers the Strategic Plan, Master Plan, and other key goals and objectives
- What TSMO means for each employee's role and what their future at MDOT SHA could look like
- What MDOT SHA is doing now to implement TSMO projects and how staff can consider TSMO on future projects and initiatives
- What the future looks like at MDOT SHA with the implementation of new technology (apps, CAV, CAT, EV, etc.)

Content for TSMO 101 education will be gathered through existing sources and materials available through organizations/agencies such as the National Operations Center of Excellence, the FHWA Office of Operations, and the Consortium for Innovative Transportation Education (CITE). In addition to the Roadshow, TSMO 101 will be made available via online web-based learning modules.

All MDOT SHA staff members will receive at least some level of TSMO awareness which can be accomplished by providing information via email blast, newsletters, posters, fact sheets, etc. Initial training and education efforts will be rolled out by TSMO staff and Executive Committee Members during the Roadshow to meet and greet with MDOT SHA employees and conduct the training. After the successful completion of internal efforts, the training will then be offered to other MDOT business units, local government agencies and departments, MPOs, etc. TSMO staff will also be looking for opportunities to partner with these stakeholders to develop and provide content and training where applicable.

In the mid to longer term, the Training and Education Task Force will work to assemble a comprehensive MDOT SHA TSMO curriculum. Delivery of this curriculum content may include classroom, e-Learning, and webinar sessions. It may include other programs such as job shadowing, On the Job (OTJ) training, coaching, mentoring, and peer accountability and support programs. To track training and education progress, consideration will be made regarding use of a Learning Management System (LMS) tool such as Moodle. Such systems allow for collection and tracking of robust learner data including that associated with content usage/activity, discussing forum activity, assignment submissions, and exam scores. The TSMO Training and Education Task Force will coordinate with other MDOT SHA Organization Development efforts. MDOT SHA already has a robust education and training program through the Office of Administration that offers a wide spectrum of training and course curriculum in different learning settings for all levels of the organization (see Table 5).

Table 5

MDOT SHA TRAINING PROGRAMS

Program/Course	Audience
Employee Development Training	All staff levels
Advanced Leadership Program (ALP)	Emerging Leaders
Online Learning	All staff levels
New Supervisor Training Program	Supervisors
Leadership Education and Development (LEAD)	Supervisors
Graduate Engineers Training Program (CERP)	New Transportation Professionals
Professional Enrichment Program (PEP)	All staff levels
Advanced Education Program	All staff levels

TSMO Training and Education subject matter, sessions, courses, etc. can easily be incorporated into the following existing programs:

- Employee Development Training
- Online Learning
- Graduate Engineers Training Progarm (GETP)
- Chief Engineers Rotation Program (CERP)
- Advanced Leadership Program (ALP)

In addition to leveraging existing structures and programs, the TSMO Training and Education program will raise awareness and develop/present new curriculum as necessary. Future training and education course materials will be developed using standard industry instructional design practices such as ADDIE (Analysis, Design, Development, Implementation, and Evaluation) or the Successive Approximation Model (SAM). Both use a form of iterative design and development based on working closely with subject matter experts and participants. Feedback is sought from participants to ensure clarity and effectiveness and changes are made to curriculum content if warranted.

This page left intentionally blank

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

For More Information Please Contact:

Joseph Sagal
Director
Office of CHART & ITS Development
jsagal@sha.state.md.us

Subrat Mahapatra
Deputy Director / TSMO Program Manager
Office of CHART & ITS Development
smahapatra@sha.state.md.us

7491 Connelley Drive
Hanover, MD
800-323-MSHA
TTY 800-735-2258

www.roads.maryland.gov