Michigan Department of Transportation (MDOT)

Transportation Systems Management and Operations (TSMO) Implementation and Strategic Plan

Version 7
January 2023

CAMBRIDGE SYSTEMATICS

1. Executive Summary

The Michigan Department of Transportation (MDOT) Transportation Systems Management and Operations (TSMO) Implementation and Strategic Plan documents Michigan's strategic direction, actions, and recommendations for operating and managing an optimized, integrated transportation network by delivering high-quality services for safe and reliable mobility for all users. Key components of the plan include:

- **The MDOT TSMO Mission, Vision, and Strategic Areas of Focus**, which provides guidance and values to steer Michigan's development of an innovative and cohesive TSMO program.
- **Summaries of engagement and outreach** that informed this plan, including several large-scale workshops and staff interview efforts.
- **Actions for implementation across MDOT's 10 TSMO business areas and five commonality areas**, which were documented in detailed action matrices with incremental steps, timelines, and staff leads. These matrices served as living documents associated with the plan and were updated and revised annually until all actions were ultimately completed or retired.
- **Priority TSMO recommendations**, which represent a series of priority actions that MDOT TSMO staff recommended the agency implement in order to advance MDOT's TSMO capabilities. All priority TSMO recommendations were completed or retired by March 2022.
- **Additional information in the appendices**, including national and peer state resources on TSMO, a history of foundational TSMO activities at MDOT, and summaries of key efforts and outreach events held since the plan was originally published.

Plan History

This plan was originally published in February 2018 and documented the outcomes of MDOT's formal TSMO planning and outreach efforts between 2015 and that time. This original material is captured in the main body of this plan. Since February 2018, the plan has been updated annually to record progress on the original strategic direction, actions, and recommendations. These updates have been captured in the yearly update (Section 2 "2023 Update", following the Executive Summary) and the appendices. **The 2023 Update highlights MDOT's continued work on the TSMO Community of Learning (CoL) and adds new content on how Maintenance and Fleet and Facilities support the TSMO program.** The appendices contain detailed summaries of key efforts and outreach events that have advanced TSMO since February 2018. Figure ES-1 provides a timeline of key events in MDOT's formal TSMO program planning and implementation.

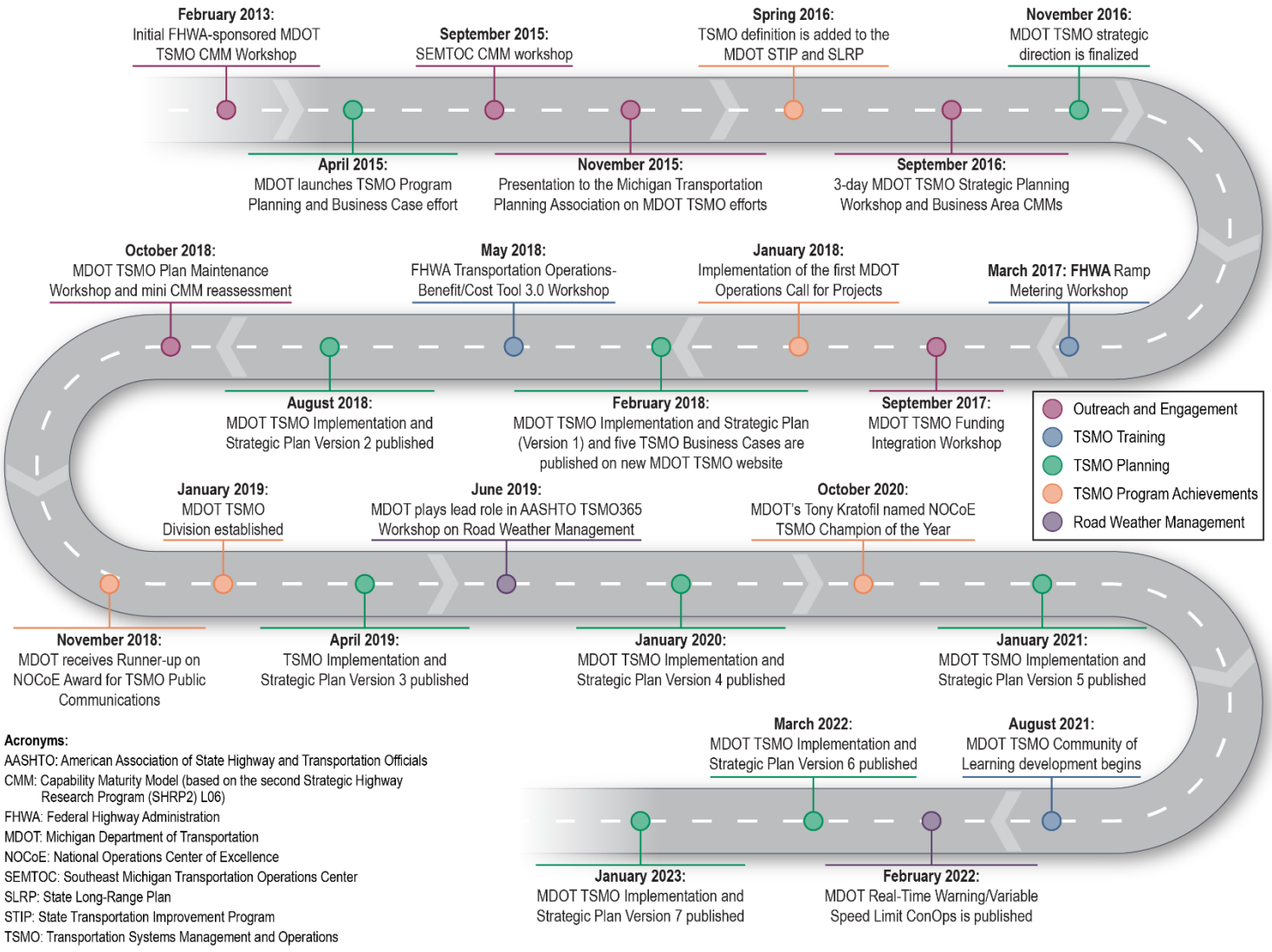


Figure ES-1. Timeline of Key Events in MDOT's TSMO Program Planning and Implementation.

1.1. TSMO MISSION, VISION, AND STRATEGIC AREAS OF FOCUS

The MDOT TSMO plan and program is guided by the MDOT TSMO Mission, Vision, and seven Strategic Areas of Focus (shown in Figure ES-2). These statements provide guidance and values to steer the implementation of the TSMO plan and program. They represent the views of the MDOT TSMO Core Team, sponsors, and a wide array of TSMO staff.

Note that, in 2023, the second Strategic Area of Focus was adapted to highlight how Maintenance activities are a critical part of the TSMO umbrella and this plan. Specifically, the words “and Maintenance” were added (now: “Integrate Operations and Maintenance Across all Business Areas”). Given Maintenance staff participation in the plan’s original workshops and outreach, and Maintenance’s significant contributions to MDOT’s TSMO work, this change reflects both the original spirit of this strategy and the current work happening at MDOT.

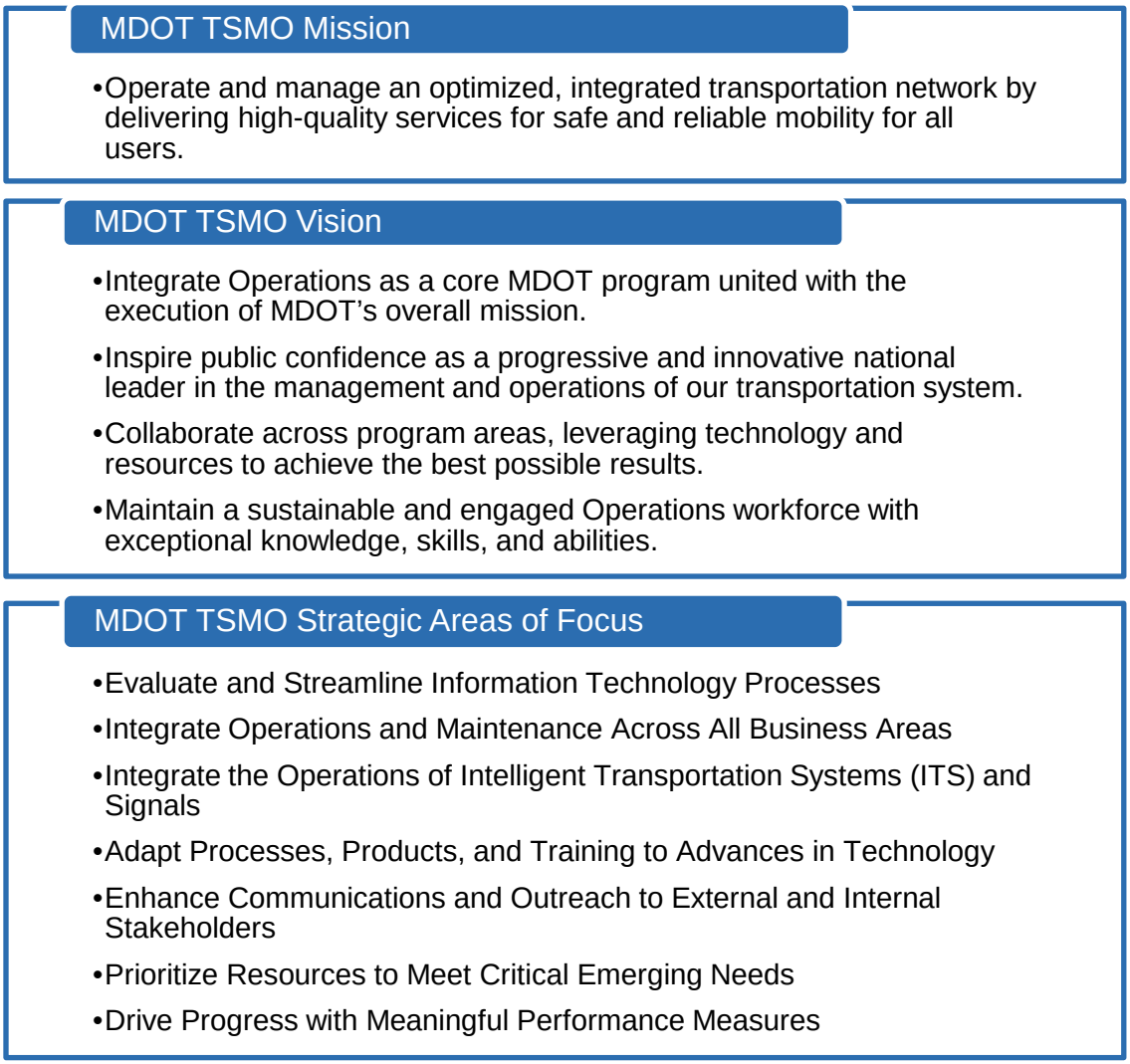


Figure ES-2. MDOT TSMO Mission, Vision, and Strategic Areas of Focus.

1.2. OUTREACH AND ENGAGEMENT

All aspects of this plan were informed by broad and regular engagement with MDOT staff and partners. Key engagement and outreach efforts that are further detailed in the plan's main body and appendices include:

- **September 2016 Workshop** – This three-day workshop with staff from across MDOT built consensus on the TSMO strategic direction and identified priority actions for the plan. In total, 57 MDOT staff attended the workshop. Staff participated in "mini" Capability Maturity Model (CMM) assessments for each of MDOT's TSMO business areas to brainstorm and prioritize actions for advancement. These priority actions informed the first iterations of the business area action matrices. See section 4 for more information on this workshop.
- **September 2017 TSMO Funding Integration Template Workshop** – This one-day workshop engaged TSMO sponsor leadership, template managers, and key staff for five TSMO-related templates to identify ways to break down silos and to better align and coordinate the five templates under the shared safety, mobility, and reliability goals of TSMO. The five templates that the workshop focused on were: Intelligent Transportation Systems (ITS); Signals; Safety; Congestion Mitigation and Air Quality (CMAQ); Operations (Operations Field Services (OFS), Contract Services Support and Maintenance (CSS&M). Outputs from this workshop provided updated actions for the TSMO Funding Integration Template commonality area and the plan's priority recommendations. See section 6.3 for more information on this workshop.
- **October 2018 Plan Maintenance Workshop** – This one-day workshop re-engaged the range of MDOT stakeholders who helped institutionalize MDOT's TSMO program between 2016 and 2018. During the workshop, MDOT leads for each of the 10 TSMO business areas and five TSMO commonality areas gave progress updates on the previously identified action items. Each area then held breakout discussions to update their actions as needed. The workshop also conducted a mini CMM reassessment (across all areas) and presented national updates on TSMO program planning. See appendix E for more information on this workshop.
- **Fall 2021 TSMO Community of Learning Interviews** – To inform the development of a MDOT TSMO CoL, MDOT held 12 group interviews with staff in the Central Office, Regions, and Transportation Service Centers (TSCs) to discuss TSMO training resources, needs, and preferences. A total of 33 MDOT staff participated in the interviews. Interviews were synthesized and used to shape the build out of the CoL.
- **Summer 2022: Ongoing Coordination with Bureau of Field Services (BFS) SharePoint Development Team** – The TSMO CoL team is working closely with the BFS team to create CoL content within the BFS SharePoint site, which was under development in 2022 and into 2023.

- **December 2022-January 2023** – The TSMO Program Plan team conducted outreach with Maintenance and Fleet and Facilities leads to create new content in the plan that highlights how Maintenance and Fleet and Facilities activities support the TSMO program. This content has been added to the 2023 Update.

1.3. ACTIONS TO ADVANCE MDOT'S TSMO BUSINESS AREAS AND COMMONALITY AREAS

To advance the TSMO strategic direction, MDOT identified 10 business areas (BAs) and 5 commonality areas (CAs) as focal points for developing actions (see Figure ES-3). The 10 BAs represent MDOT's core service areas that fall under the TSMO umbrella. Note that these were identified in 2016, and subsequent efforts have broadened the scope of MDOT's TSMO program. The five CAs represent key programmatic areas that are critical to advancing TSMO and span across the BAs.

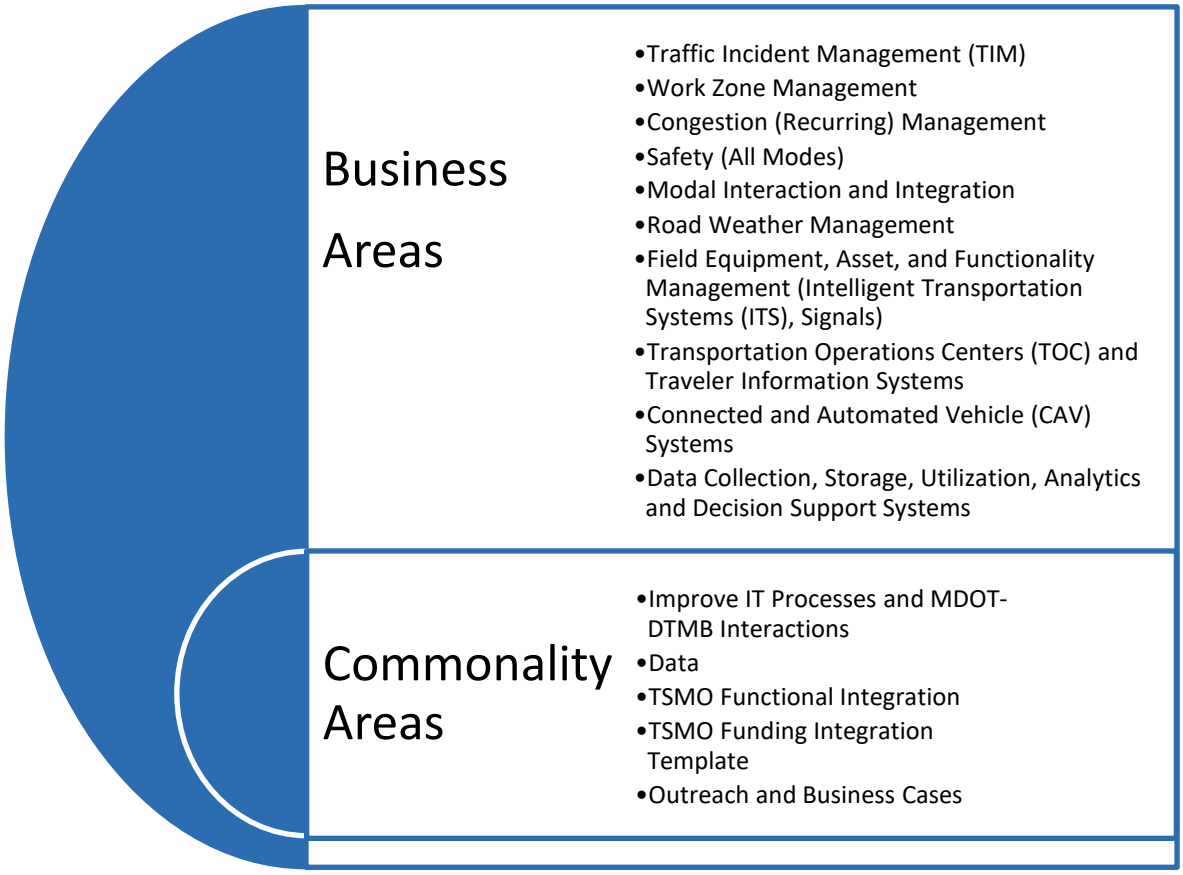


Figure ES-3. MDOT TSMO Business Areas and Commonality Areas.

Actions to advance these areas were identified and prioritized through engagement efforts. Priority actions were documented in action matrices for each BA and CA, and each action matrix details incremental steps, staff leads and support, partners,

resources, timelines, and measures of success. Figure 3 in the plan provides an example of these matrices. The most up-to-date versions of these matrices are "living documents" associated with this plan and maintained internally by MDOT. Section 6 provides additional information on the BA and CA actions and matrices.

1.4. PRIORITY TSMO RECOMMNEDATIONS (2023 UPDATES)

The first release of the TSMO Implementation and Strategic Plan in 2018 contained a list of priority recommendations from across the TSMO business areas and commonality areas ("baseline recommendations"). Since then, MDOT has advanced its TSMO program in many areas based on the original recommendations and actions contained in the plan. **These recommendations are presented in the 2023 Update along with updates as of January 2023**. For historical context, the original descriptions of actions are contained in greater detail in section 7. **As of March 2022, MDOT accomplished all original 2018 baseline recommendations.** Some new recommendations have been added to build on this progress, which are also noted in the 2023 Update.

1.5. APPENDICES: RESOURCES AND PROGRESS UPDATES

This plan contains a growing number of appendices, providing additional TSMO resources as well as progress updates on the MDOT TSMO program's key accomplishments and outreach efforts since the original 2018 publication. A brief summary of appendices is provided below.

- **Appendix A: Resources** – An inventory of TSMO resources from national and peer agency organizations, including research, guidance, tools, and peer TSMO plans.

- **Appendix B: Acronyms** – A list of acronyms used in this plan.

- **Appendix C: History of TSMO at MDOT** – An account of the historical, legacy activities that lay the foundation for MDOT's formal TSMO program, going back to MDOT's ITS leadership in the 1950s.

- **Appendix D: Accomplishments (2016-2019) –** Documentation of accomplishments on the actions specified in the TSMO business area and commonality area matrices. Accomplishments after 2019 are in the 2023 Update.

- **Appendix E: 2018 TSMO Plan Maintenance Workshop** – A summary of the October 2018 TSMO Plan Maintenance Workshop goals, activities, and outputs.

- **Appendix F: Ongoing Road Weather Management (RWM)** Efforts – A summary of outputs for Michigan from AASHTO's June 2019 "TSMO365" RWM Peer Exchange, in which MDOT participated.

2. 2023 Update

2.1. PRIORITY TSMO RECOMMNEDATIONS (2023 UPDATES)

The first release of the TSMO Implementation and Strategic Plan in 2018 contained a list of priority recommendations from across the TSMO business areas and commonality areas ("baseline recommendations"). Since then, MDOT has advanced its TSMO program in many areas based on the original recommendations and actions contained in the plan. These recommendations are presented in this section, along with updates as of January 2023. For historical context, the original descriptions of actions are contained in greater detail in section 7.

As of March 2022, MDOT accomplished all original 2018 baseline recommendations. Many of these accomplishments are now ongoing, routine activities. Table Update-1 shows the baseline recommendations along with a new January 2023 status. Accomplishments that represent ongoing activities are noted as "accomplished and in the maintenance phase." Three original baseline recommendations were retired due to changing circumstances. These are shown in Table Update-2.

To build on this progress, MDOT has since added new priority TSMO recommendations, based on where MDOT stands after these accomplishments. These added recommendations build on the baseline recommendations and the overall progress of the MDOT TSMO program. They are captured in Table Update-3, along with January 2023 status updates.

Table Update-1. Accomplished Baseline Recommendations

Accomplished Baseline Recommendations		
Baseline Recommendation		*January 2023 Status*
Develop a TSMO Functional Integration Group with two over-arching groupings (Advanced Operations and System Performance) and implement improvements for MDOT's Transportation Operations Center (TOC) structure.	→	This recommendation has been accomplished and is in the maintenance phase. MDOT's ITS User Group meets monthly, with attendance from TOC staff, and provides an avenue for open discussions to advance TSMO integration and coordination.

Accomplished Baseline Recommendations	
Baseline Recommendation	*January 2023 Status*
	This recommendation has been accomplished and is in the maintenance phase.
Integrate TSMO as a core program area in the Call for Projects.	→ Update for the 2024-2029 Call for Projects: To help lower funding demand in earlier years and accommodate inflation challenges, some projects were moved into 2029. High-priority projects, based on data-driven project prioritization, will be funded first in earlier years.
Establish a standard process for estimating the lifecycle Operations and Maintenance (O&M) costs of all TSMO projects.	→ This recommendation has been accomplished and is in the maintenance phase. The ITS Program Office assesses ITS device lifecycle costs. MDOT currently takes the following actions to assess and manage lifecycle costs: 1) Refine MDOT ITS O&M Costs to ensure consistent estimating practices are being followed; 2) Reduce Capital ITS projects to accommodate growth in O&M funding needs; and 3) Allocate annualized funding to support ITS Field Infrastructure Modernization.
Establish a TSMO template(s) to have reliable/sustainable funding.	→ This recommendation has been accomplished and is in the maintenance phase. The Operations Call for Projects coordinates funding across TSMO-related templates.
Establish a TSMO Steering Team that meets on a regular basis.	→ This recommendation has been accomplished and is in the maintenance phase. The Operations Steering Committee was formed in 2018 and generally meets twice per year satisfying this recommendation.

Accomplished Baseline Recommendations	
Baseline Recommendation	*January 2023 Status*
Increase flexibility of project delivery processes for high priority TSMO projects, allowing MDOT to more efficiently respond to needs and deliver projects.	This recommendation has been accomplished via the Operations Call for Projects process.
Determine what source/mechanism will fund the O&M of ITS, signals, and technology capital investments.	This recommendation has been accomplished. The 2025/26 Call for Projects designated an appropriate funding split for ITS Capital and O&M activities (based on existing devices), with reduced resources for device modernization.
Develop and implement a formal investment strategy for all business areas under the "TSMO umbrella."	MDOT has made significant progress on this recommendation by integrating ITS, Safety, Operations Freeway & Non-freeway, and Signals funding templates under the Operations Call for Projects, an important step in institutionalizing the funding streams to advance TSMO across all ten business areas. The Operations Steering Committee ensures consistency and alignment between the four templates so that project selection is coordinated.
Support road weather management advancements to ensure MDOT informs the national research agenda.	MDOT led the development of a Concept of Operations (ConOps) for expanding Michigan's Real-Time Warning (RTW) and Variable Speed Limit (VSL) program. This ConOps was designed so that MDOT and other agencies can use it as a template to further these programs in their state or region. MDOT collaborated with American Association of State Highway and Transportation Officials (AASHTO) community to develop and share this work. This work was complete in February 2022 and a link to the final

Accomplished Baseline Recommendations	
Baseline Recommendation	*January 2023 Status*
	report was posted to the MDOT TSMO website.
Explore opportunities to utilize MDOT's existing performance measure efforts to quantify meaningful performance of TSMO initiatives. →	This recommendation is accomplished within the maintenance/ongoing phase. MDOT will continue exploring and leveraging opportunities to use existing performance measurement efforts for TSMO. Performance measurement is a core part of the annual Call for Projects, which is a data-driven process. TSMO-related performance measures are also core to the TOCs' annual metrics report-out. MDOT recently completed a research project with Michigan State University on the performance of the US-23 Flex Route. MDOT is reporting out on recommendations and findings, which demonstrate the value of the Flex Routes and discuss locations in the state optimal for future Flex Route projects.

Table Update-2. Retired Baseline Recommendations.

Retired Baseline Recommendations	
Baseline Recommendation	*January 2023 Status*
Explore combining the MDOT Congestion Mitigation and Air Quality (CMAQ) Program funds into one funding source; regions would compete for CMAQ funds.	This recommendation has been retired. CMAQ funding has been limited to a few counties and local agencies that meet CMAQ requirements. This recommendation is no longer a priority in advancing TSMO in MDOT.
Determine one uniform emissions benefit calculation process for prioritizing projects statewide.	This recommendation has been retired. At the time it was recommended, this did not receive enough TSMO stakeholder support to complete the process. The concept is also based on CMAQ funding strategies, which have been retired within the Operations Call for Projects process.
Investigate the MDOT ITS Asset Management Database (AMD) as one potential tool for quantifying value of TSMO assets in the department.	MDOT determined the ITS AMD was not the right tool for quantifying full ITS value given its focus on uptime/downtime for performance-based vendor contracts. In 2022, this action was broadened to explore multiple methods for quantifying ITS asset value and developing common ITS metrics by system type.

Table Update-3. In-Progress Recommendations.

In-Progress Recommendations	
In-Progress Recommendation	*January 2023 Status*
Increase funding for templates under the Operations Call for Projects to meet demand for new projects, modernization, and Operations & Maintenance (O&M) costs (as detailed in the January 2022 Operations Steering Committee white paper)	Since January 2018, MDOT has successfully funded Operational Improvement projects through the integrated Operations Call for Projects. However, demand for funds from templates within this Call for Projects has grown to exceed budgets. This is

In-Progress Recommendations		
In-Progress Recommendation		*January 2023 Status*
		due to growing O&M costs for ITS and Signals technologies and growing demand for new technologies with significant potential to improve system performance. In January 2022, the Operations Steering Committee developed a white paper detailing the requested increase in funding levels, the gap between current demand and funding levels, and the rationale for why additional funding is needed. In 2022, funding challenges tied to broader forces, such as inflation, continued to create a gap. In January 2023, the Operations Steering Committee recommended to resubmit funding needs for ITS O&M based on the 2022 white paper.
Advance MDOT workforce knowledge of TSMO through training and technology transfer efforts	→	In 2021, MDOT launched the TSMO CoL to advance TSMO training and workforce development. As a first step, MDOT conducted broad outreach to assess currently used TSMO resources, training needs, and learning preferences via group interviews with 33 staff across the Central Office, Regions, and TSCs. Based on interview inputs, MDOT moved forward with a one-stop-shop SharePoint page for TSMO training resources, which is has been under development in 2022 going into 2023. The CoL team is currently working with the Bureau of Field Services (BFS) SharePoint team to build CoL content within the BFS site.
Obtain the appropriate number of full-time equivalents (FTE) required for	→	MDOT is continually assessing the appropriate number of FTEs, and getting approval to bring on this

In-Progress Recommendations	
In-Progress Recommendation	*January 2023 Status*
the optimal performance and maintenance of TSMO field activities.	number of FTEs and hire/retain staff in open backfill positions. The recommendation has been reframed from previously “Determine the appropriate number of FTEs” to now “Obtain the appropriate number of FTEs.”

2.2. SPOTLIGHT ON RECENT EFFORTS (VERSION 7 JANUARY 2023 UPDATE)

2.2.1. ADDED CONTENT ON MAINTENANCE AND FLEET AND FACILITIES IN THE TSMO PLAN

In 2023, the MDOT TSMO Implementation and Strategic Plan team conducted outreach to the Maintenance and Fleet and Facilities leads to discuss ways to better highlight these teams’ contributions to MDOT’s ongoing TSMO work. Both of these disciplines are important players in MDOT’s TSMO program. Maintenance and Fleet and Facilities shared ongoing actions and accomplishments that further MDOT’s TSMO program and should be included in the plan. These actions, accomplishments, and a summary of each discipline’s contributions to TSMO are discussed in the following subsections.

Maintenance & TSMO

Maintenance Services conducts a wide array of activities critical to the TSMO Program's mission of delivering high-quality services for safe and reliable mobility for all users. Maintenance Services provides specialized skills, technical support, and training to the regions to support safety, maintain the serviceability of the highway system, and support facilities while preserving our transportation infrastructure. Key areas of support from Maintenance Services include:

Maintenance Activities Supporting TSMO	
• Roadside operations and support • Statewide training and best practices • Asset management (Transportation Asset Management System) • Performance-based maintenance • Electrical services • Pump stations • Winter maintenance	• Procurement contracts for maintenance commodities and services, including road salt • Vegetation management • Property Damage Reclamation Process (PDRP) • Maintenance Local Agency Payments (MLAP) system • Chemical Storage Facility maintenance • Automatic Vehicle Location (AVL) and Maintenance Decision Support System (MDSS)

In addition to these activities, Maintenance Services is an important interface between MDOT and many local partners, promoting a culture of strong collaboration to keep Michigan's roadways safe and reliable.

Work under Maintenance has and continues to support the Mission, Vision, and Strategic Areas of Focus in the MDOT TSMO Plan. The tables below capture key ongoing actions, as well as recent accomplishments in support of the TSMO program.

Maintenance – Ongoing Actions									
Priority Actions	**Progress Noted**	**MDOT Staff**	**Supports Strategic Area of Focus**						
			1	**2**	**3**	**4**	**5**	**6**	**7**
Action 1: Continue the development of a 5-year Plan for pump stations, as part of the annual pump station program, which provides funding to pump stations. The Plan aims to structure and improve the funding selection process.	This effort has recently kicked off.	Jason Bodell		✓			✓	✓	
Action 2: Continue planning efforts for salt shed funding and maintenance.	This effort received the support of the County Road Association (CRA).	Jason Bodell, Justin Droste		✓			✓	✓	
Action 3: Continue planning efforts for advancing the Transportation Asset Management System (TAMS), integrating the needs of the regions.	Currently working to fill the staff lead for this effort.	To be determined (currently working to fill this position)		✓	✓		✓	✓	✓
Action 4: Implementation of Commercial Driver's License (CDL) Training program meeting Federal Motor Carrier Entry Lever Driver's Training (ELDT) requirements.	Hired a new position to lead the charge on this. Currently developing the training program.	Steve Stilson						✓	

Maintenance – Recent Accomplishments		
Actions	**Description**	**MDOT Staff**
Action 1: Advance training and workforce development initiatives.	Specific enhancements to training and workforce development include: • Revamped Transportation Maintenance Worker (TMW) work element management. • Offering annual training for snow plow operators. • Improved cadence/regularity of annual trainings.	Steve Stilson, Justin Droste, Ken Flore
Action 2: Implemented the Michigan Local Agency Payments (MLAP) in 2022	MLAP is a modern payment system for paying local agencies that conduct maintenance activities for MDOT.	Kelly Dent

Fleet and Facilities & TSMO

In July 2021, Fleet and Facilities was reorganized to sit within the MDOT TSMO Program, creating an opportunity to highlight how the continuing work of Fleet and Facilities supports the MDOT TSMO Plan.

As a business area, TSMO Fleet and Facilities Services:

- Provides expertise and statewide administrative support in the areas of fleet asset management, fleet procurement, Winter Maintenance Truck build-out, heavy equipment repair, and fleet safety;
- Delivers a statewide facilities capital improvement program designing and implementing various facility repairs or renovations;
- Ensures facility condition assessments are performed on regular intervals; and
- Provides expertise in facilities maintenance through licensed trades for MDOT's physical plant portfolio on an ongoing basis.

Fleet and Facilities Services aligns with other TSMO business areas with focus as a service provider in the areas of asset management, data collection, analytics, and decision support systems.

Work under Fleet and Facilities has and continues to support the Mission, Vision, and Strategic Areas of Focus in the MDOT TSMO Plan. These ties are noted in Fleet and Facilities' table of ongoing actions below.

Facilities										
Priority Actions	**Steps to Address Action**	**Progress Noted**	**MDOT Staff**	**Supports Strategic Area of Focus**						**Ties to TSMO**
				1	2	3	4	5	6	7
Action 1: Develop Frequently Asked Questions (FAQs) & Desk Reference Manuals for Facilities	**Step 1:** Building Trades Supervisor to build data base of FAQs and recurring theme issues	**Step 1 – Progress:** No progress to date.	Clark Moore, Building Trade Supervisor		✓		✓	✓			TSMO Mission; TSMO Vison – Integrate,

Facilities											
Priority Actions	**Steps to Address Action**	**Progress Noted**	**MDOT Staff**	**Supports Strategic Area of Focus**							**Ties to TSMO**
				1	**2**	**3**	**4**	**5**	**6**	**7**	
Maintenance. Supporting varying layers and levels of region staff with differing facilities maintenance, repair, etc. duties and roles. Build Community of Learning through this process and expand as opportunities arise through the process.	and provide written guidance/response. **Step 2:** Document various facilities support functions and define where and how those functions occur now; should be occurring; and provide written reference material to scenarios as job aides.	**Step 2 – Progress:** Initial list of task/functions and some areas of responsibility identified.	Brian Hight, Facilities Engineer Manager Diane Sevigny, SAM, Fleet & Facilities Diane Sevigny, Brian Hight, as leads								Collaborate, Maintain. TSMO Strategic – Integrate, Adapt, Enhance.
Action 2: Expand the use of X4, MDOT's Facilities Work order system, to include asset specific information on age/type/etc. of facilities equipment. At a minimum: HVAC and boiler components, back flow preventers, elevators, and fire alarm/suppression systems to understand asset age, liabilities,	**Step 1:** BTS and Maintenance team to gather appropriate and accurate data points. **Step 2:** Departmental Analyst to recommend best use of X4 and software system for recording, reporting, monitoring, scheduling maintenance in tandem with BTS recommendations on	**Step 1 – Progress:** Limited progress on data collection. **Step 2 – Progress:** No additional progress.	Clark Moore, Brian Hight, Phil Dunn	✓			✓		✓	✓	TSMO Mission; TSMO Vision – Integrate, Inspire, Maintain. TSMO Strategic – Evaluate, Adapt, Prioritize, Drive.

Facilities

Priority Actions	Steps to Address Action	Progress Noted	MDOT Staff	Supports Strategic Area of Focus							Ties to TSMO
				1	2	3	4	5	6	7	
condition, project needs, etc., and enact a viable asset management system to replace reactive maintenance on critical assets.	equipment maintenance needs.										
Action 3: Develop Prioritization Matrix Scoring method for facilities repair/capital maintenance requests – call for projects to create intentional decision making and data based decision making with limited resources in special maintenance/capital outlay program fund.	**Step 1:** Diane Sevigny, Brian Hight, Phil Dunn, Andy Bannasch, Bill Wahl, Jason Garza, Curt Carlson formed as a "steering committee" of sorts. Need to determine if TSC Managers should be invited or committee is sufficient as is.	**Step 1 – Progress:** Matrix format is developed for conversation about scoring and priorities. Categories and subcategories have been identified. Facilities repair/improvement request form has been developed. Subcommittee team meeting scheduled for 1/21/23.	Diane Sevigny, Brian Hight, as leads				✓	✓	✓	✓	MDOT TSMO Mission; TSMO Vision – Integrate, Inspire, Collaborate. TSMO Strategic – Adapt, Enhance, Prioritize, Drive

Fleet

Priority Actions	Steps to Address Action	Progress Noted	MDOT Staff	Supports Strategic Area of Focus							Ties to TSMO
				1	2	3	4	5	6	7	
Action 1: Asset Management – Surplus assets/auction process, communication/customer service to improve costs, safety, and productivity.	**Step 1:** Clear all "incomplete" title issues so future surplus/auction activity processes smoothly/timely with no negative impact on internal or external customers. **Step 2:** Promptly process surplus equipment requests (auction) to ensure best outcome on insurance rates, to ensure equipment that should not be used is not available to regions, etc.	**Step 1 – Progress:** Initial conversation to understand workflow.	Colby Page, Dan Murphy as lead.	✓			✓	✓	✓	✓	MDOT TSMO Mission TSMO Strategic—Adapt, Enhance, Prioritize, Drive
Action 2: Part Management / Inventory Controls – Proactive and accurate inventory controls/Eliminate Obsolete Inventory/Effectively	**Step 1:** Organize shelves, label/tag items and parts bins, move obsolete inventory to different area for disposition, ID inventory (physical count), Review M5 for correlation, Update M5	**Step 1 – Progress:** Initial work started; new student assistant expected.	Todd Wertman, Student Assistant/Garage as needed.				✓		✓		MDOT TSMO Strategic Areas of Focus: Adapt, Prioritize

Fleet											
Priority Actions	Steps to Address Action	Progress Noted	MDOT Staff	Supports Strategic Area of Focus							Ties to TSMO
				1	2	3	4	5	6	7	
Optimize and Utilize floor space.	to match physical count, Sustain organization and physical match to M5.										

2.2.2. ROAD WEATHER MANAGEMENT: CONCEPT OF OPERATIONS FOR REAL-TIME WARNINGS AND VARIABLE SPEED LIMITS

MDOT is a leader in advancing Road Weather Management (RWM) both at home and nationally. MDOT utilizes TSMO and ITS resources such as the Mi Drive traveler information website, Dynamic Message Signs, and Traffic Operations Centers to manage traffic safely and efficiently during weather events. MDOT also has deployed more targeted RWM technologies, such as Real-Time Warning systems and Variable Speed Limits. Nationally, MDOT plays a leading role in the American Association of State Highway and Transportation Officials (AASHTO) Committee on Transportation System Operations (CTSO) Community of Practice on Road Weather Management (Cop on RWM).

Building on this progress, in 2021 MDOT advanced the development of an Abbreviated Concept of Operations (ConOps) for Real-Time Warnings (RTW) and Variable Speed Limits (VSL). This document documented underlying purposes and needs for expanding MDOT's RTW and VSL program. As part of MDOT's RWM program, RTW and VSL systems serve as one application for providing motorists with necessary weather-related insights to make informed travel decisions. The ConOps outlined a framework for proactively identifying needs for RTW/VSL and deploying appropriate countermeasures to improve traffic operations. Although focused on Michigan applications and needs, the ConOps was designed to support the AASHTO RWM Community of Practice by forming a roadmap from which other interested states and transportation organizations could use to support their program.

In early 2022, this ConOps was finalized and published on the MDOT TSMO website. MDOT applied national best practices and peer insights in the development of this ConOps. The AASHTO CTSO CoP on RWM and peer agencies were engaged through the June 2019 AASHTO "TSMO365" RWM Peer Exchange, as well as two Listening Sessions focused on RTW and VSL that were spearheaded by MDOT as part of AASHTO CTSO CoP on RWM activities.

In 2022, it was recommended that the AASHTO CTSO CoP on RWM be blended into the AASHTO Snow and Ice Cooperative Program (SICOP) activities. CTSO will make the final decision on recommended changes between the CoP on RWM and SICOP.

2.2.3. TSMO COMMUNITY OF LEARNING

In 2021, MDOT launched the development of a TSMO Community of Learning (CoL) to advance training opportunities for staff to learn about TSMO and gain new skills. There are a range of existing TSMO training opportunities and resources at MDOT. Staff TSMO knowledge and awareness has increased significantly, but some gaps and challenges still remain. The TSMO CoL seeks to continue improving the maturity of MDOT's TSMO training and workforce development.

As a first step, MDOT conducted broad outreach to staff to inventory currently used TSMO resources, training needs, and learning preferences. In September and October 2021, MDOT held 12 group interviews with staff in the Central Office, Regions, and TSCs. A total of 33 MDOT staff participated in the interviews. The interviews focused on three main topics:

1. **Current Resources.** Existing TSMO-related resources used by MDOT staff.

2. **Training Needs**. Specific areas, topics, and content that MDOT staff identified as TSMO training needs.

3. **Format/Delivery Preferences**. Input from MDOT staff on what formats and delivery methods are most effective for reaching MDOT staff and being used by MDOT staff.

A full account of input received on each topic was captured in an interview summary document. This input was distilled into three main areas for action in 2022:

- **One-stop-shop/central repository:** Establish a central location for key MDOT TSMO resources, links to national/peer state resources, and links to other TSMO-related MDOT trainings/resources that exist. Based on input from MDOT's communications team, SharePoint will be the best platform to host this.

- **Additional short-form TSMO resources:** Develop additional short-form TSMO resources to address the TSMO-program-wide needs identified in the interviews. For example, navigational support for the repository, suggested "curricula" for MDOT training, who's who chart, how-to-guides, boilerplate language, packaging existing materials for broader consumption.

- **Summary of technical-area training needs and in-person training needs:** A number of the training needs highlighted by interviewees were specific to technical areas under the TSMO umbrella or were needs for in-person training programs. Such training requires significant input from staff and/or resource commitment from senior leaders. These key needs will be documented in concise summaries and presentations to share with group leaders and MDOT senior leaders.

Starting in January 2022, work on the SharePoint one-stop-shop began and is expected to be complete in 2023. The CoL team is currently coordinating with the Bureau of Field Services (BFS) SharePoint site development team to create the CoL one-stop-shop content within the BFS site. The CoL pages will organize existing resources and house any additional short-form TSMO resources. It is expected that additional short-form resources will be developed in association with the SharePoint development (e.g. training guides, how-to guides). It is also anticipated that the TSMO CoL pages will be dynamic and in need of annual updates and maintenance.

Table of Contents

Tables

Figures

3. Introduction

3.1. OVERVIEW OF THE PLAN

The Michigan Department of Transportation (MDOT) Transportation Systems Management and Operations (TSMO) Implementation and Strategic Plan documents Michigan's strategic direction, actions, and recommendations for operating and managing an optimized, integrated transportation network by delivering high-quality services for safe and reliable mobility for all users. Key components of the plan include:

- **The MDOT TSMO Mission, Vision, and Strategic Areas of Focus**, which provides guidance and values to steer Michigan's development of an innovative and cohesive TSMO program.
- **Summaries of engagement and outreach** that informed this plan, including several large-scale workshops and staff interview efforts.
- **Actions for implementation across MDOT's 10 TSMO business areas and five commonality areas**, which were documented in detailed action matrices with incremental steps, timelines, and staff leads. These matrices served as living documents associated with the plan and were updated and revised annually until all actions were ultimately completed or retired.
- **Priority TSMO recommendations**, which represent a series of priority actions that MDOT TSMO staff recommended the agency implement in order to advance MDOT's TSMO capabilities. All priority TSMO recommendations were completed or retired by March 2022.
- **Additional information in the appendices**, including national and peer state resources on TSMO, a history of foundational TSMO activities at MDOT, and summaries of key efforts and outreach events held since the plan was originally published.

Plan History

This plan was originally published in February 2018 and documented the outcomes of MDOT's formal TSMO planning and outreach efforts between 2015 and that time. This original material is captured in the main body of this plan. Since February 2018, the plan has been updated annually to record progress on the original strategic direction, actions, and recommendations. These updates have been captured in the yearly update (Section 2 "2023 Update", following the Executive Summary) and the appendices. The 2023 Update highlights MDOT's continued work on the TSMO Community of Learning (CoL) and adds new content on how Maintenance and Fleet and Facilities support the

TSMO program. The appendices contain detailed summaries of key efforts and outreach events that have advanced TSMO since February 2018.

3.2. WHAT IS TSMO?

MDOT developed the following definition of TSMO, now included in the MDOT State Transportation Improvement Program (STIP) and State Long-Range Plan (SLRP), to help raise awareness of what TSMO means at MDOT:

> **"**Transportation Systems Management and Operations (TSMO) is an integrated program to optimize the performance of existing multimodal infrastructure by implementing systems, services, and projects to maximize capacity and improve the security, safety, and reliability of the transportation system. MDOT employs TSMO strategies and solutions to provide more efficient use of existing transportation resources by implementing strategies, deploying technologies, and integrating systems to address freeway and arterial congestion, improve safety and mobility, and encourage sustainability.**"**

3.3. THE IMPORTANCE OF TSMO FOR MDOT

Across the United States, the traditional approach to managing traffic congestion has been to predict future (long-range) traffic volumes and to then fund major capital expansion projects to provide additional capacity based on these volumes. However, the Federal Highway Administration (FHWA) has estimated that, on average, only 40 percent of traffic congestion is due to insufficient capacity (bottlenecks), which typically requires capital expansion. The majority of traffic congestion (60 percent) is due to "nonrecurring" issues, such as crashes and other incidents (25 percent), bad weather (15 percent), work zones (10 percent), poor signal timing (5 percent), and special events (5 percent), which are issues that do not require capital expansion. In addition, it is becoming increasingly difficult and expensive to fund capital expansion projects as the cost of securing right of way grows.

Enter TSMO, a "toolbox" of cost-effective and quick-to-implement transportation solutions that can complement and enhance traditional capital expansion projects for the approximately 60 percent of traffic congestion that is due to the nonrecurring traffic issues listed above. TSMO solutions are specifically designed to address nonrecurring issues. TSMO solutions increase mobility, reliability, and safety during incidents, bad weather, work zones, and special events by better managing and operating the roads that MDOT has already built with better technology, better information, and better collaboration. And since TSMO solutions require relatively little capital investment, they are less expensive, less disruptive, and much faster to implement. Advancing TSMO has become a national movement spearheaded by FHWA and implemented with demonstrated success by peer states such as Iowa and Colorado. For more information

on existing TSMO resources from FHWA and peer states, please refer to the appendix of this plan.

Finally, advancing MDOT's TSMO capabilities, as detailed in this plan, is critical as MDOT continues to lead the nation in emerging transportation technologies such as connected and automated vehicles. A strong TSMO program will help MDOT best leverage these technologies to the benefit of Michigan residents and will strengthen Michigan's position as a leader in the auto industry.

3.4. BUILDING A TSMO FOUNDATION AT MDOT

MDOT's efforts to advance TSMO started in earnest in 2013 when MDOT hosted an FHWA-sponsored statewide TSMO Capability Maturity Model (CMM) workshop, which resulted in a series of initial actions to advance TSMO in the agency. Subsequently, MDOT began work to implement these actions. By 2016, MDOT had accomplished the following: meeting with the Michigan Transportation Planning Association (MTPA) to raise awareness of TSMO, adding the definition of TSMO to the STIP and SLRP (in addition to TSMO white papers in the appendix/links), and holding a second, Detroit Metro-specific CMM hosted by the Southeast Michigan Transportation Operations Center (SEMTOC). These foundational TSMO efforts, evolving into the TSMO Implementation and Strategic Plan and associated efforts such as the TSMO Business Cases, detailed below, have been driven by MDOT senior staff sponsors, who work with a TSMO Core Team to steer MDOT's advancing TSMO activities on a regular basis. The TSMO sponsors and Core Team members are shown in the call-out box above.

MDOT TSMO Sponsors and Core Team

MDOT's evolving TSMO efforts are driven by senior staff sponsors. The MDOT TSMO sponsors are:

TSMO Sponsors

- Gregg Brunner
- Todd White
- Kim Zimmer
- Region Engineer (TBD)

The sponsors work with a MDOT TSMO Core Team to steer the advancement of all MDOT's TSMO efforts on a regular basis.

TSMO Core Team:

- Steve Cook
- Region Associate Engineer (TBD)
- Mark Bott
- Collin Castle

It is important to note that MDOT had been conducting TSMO activities for many years prior to 2013, although not under the name "TSMO." In recognition of these early efforts, and to tie MDOT's legacy work to the TSMO objectives detailed in this plan, a forthcoming Appendix C: History of TSMO at MDOT will summarize the full story of MDOT's TSMO legacy.

MDOT TSMO Business Cases

From 2015 to February 2018, MDOT completed five TSMO business cases tailored to five key stakeholder groups:

The general public.

Legislators.

MDOT decision-makers and senior staff.

MDOT Operations staff.

Transportation partners/MDOT non-operations staff.

Making the Business Case for TSMO

For more information on the benefits, costs, and applications of TSMO for Michigan, please see MDOT's TSMO business cases, available at:

www.michigan.gov/tsmo

National research has shown that the wide variety of cost-effective benefits offered by TSMO are not well understood or recognized by most stakeholder groups. The MDOT TSMO business cases are, therefore, designed to promote outreach to and education of five key stakeholder groups for TSMO in Michigan. These one-to-four page business cases concisely summarize the mobility, safety, and reliability benefits that TSMO can bring to Michigan and highlight key examples of TSMO applications in the state. Understanding that these different stakeholder groups will likely have different levels of familiarity with the transportation industry, the five business cases were individually designed for each audience using tailored language and examples to speak directly to each group's interests. In the fall of 2018, MDOT entered its TSMO business cases and communications efforts into the National Operations Center of Excellence (NOCoE) TSMO Awards, under the Public Communications category. In November 2018 it was announced that MDOT won recognition as the runner-up in this category for its contribution to the advancement of TSMO awareness and understanding.

Launching the MDOT TSMO Implementation and Strategic Planning Process

Building on this foundational TSMO work, MDOT launched its TSMO Implementation and Strategic Planning process in late 2015. A major milestone in this effort was the September 2016 TSMO workshop, during which TSMO staff from across MDOT reached consensus on a MDOT TSMO Mission, Vision, and Strategic Areas of Focus, as well as identified priority action items that would drive the planning process forward. This workshop is detailed in the following section. This important workshop spurred much of the activity detailed in the remainder of this plan.

4. Outreach and Engagement

Building the MDOT TSMO program from the ground-up through outreach and engagement has been a critical aspect of the TSMO Implementation and Strategic Planning process from the beginning. Early on, the TSMO sponsors and Core Team engaged key TSMO staff from across the department during a three-day TSMO workshop, held in September 2016. During this workshop, more than 50 MDOT staff gathered to provide input and direction on MDOT's forthcoming TSMO Implementation and Strategic Plan. The input collected during this workshop (which is summarized in the sections below) served as the launch pad for the MDOT TSMO Implementation and Strategic Planning process.

4.1. SEPTEMBER 2016 WORKSHOP OVERVIEW

The workshop centered around 10 breakout sessions representing each of MDOT's 10 core TSMO business areas. These 10 TSMO business areas and the MDOT TSMO Implementation and Strategic Planning lead for each business area (during early implementation stages, 2016-2018) are shown in Table 1. As time has advanced, leadership of each business area may have shifted with staff changes and as actions are completed.. During the 10 breakout sessions, the business area leads directed each business area in brainstorming and identifying strengths, weaknesses, and action items for their TSMO business area using the CMM framework, a nationally proven TSMO self-assessment framework. This framework defines six dimensions of institutional capability, shown in Table 2, that are critical to TSMO advancement. Each business area was tasked with collectively identifying two to four action items for each of these six CMM dimensions, meaning each business area brainstormed 12 to 24 action items total. Given this, the action items that came out of the MDOT breakout sessions can be understood as a comprehensive set of strategies to advance the capabilities of the entire "umbrella" of TSMO activities at MDOT, as articulated by each of the 10 MDOT TSMO business areas. This framework for advancing TSMO at MDOT was brought forward and illustrated by a "TSMO umbrella" graphic developed by the TSMO sponsors and Core Team, as shown in Table 3.

Table 1. The 10 MDOT TSMO Business Areas.

10 MDOT TSMO Business Areas	
Business Area	MDOT Lead(s) as of 2018
Traffic Incident Management (TIM)	Dawn Miller
Work Zone Management	Chris Brookes
Congestion (Recurring) Management	Jason Firman
Safety (All Modes)	TBD
Modal Interaction and Integration	All priority actions completed
Road Weather Management	Suzette Peplinski
Field Equipment, Asset, and Functionality Management (Intelligent Transportation Systems (ITS), Signals)	Joe Gorman
Transportation Operations Centers (TOC) and Traveler Information Systems	Hilary Owen
Connected and Automated Vehicle (CAV) Systems	Elise Feldpausch
Data Collection, Storage, Utilization, Analytics and Decision Support Systems	Joe Gorman

Table 2. The Six CMM Dimensions of TSMO Self-Assessment.

CMM Self-Assessment Framework	
Dimension	Description
Business Processes	Formal scoping planning, programming, budgeting.
Systems and Technology	Systems architecture, standards, interoperability, standardization, and documentation.
Performance Measurement	Measures definition, data acquisition, analysis, and utilization.
Culture	Technical understanding, leadership, policy commitment, outreach, and program authority.
Organization and Staffing	Organizational structure, staff capacity, development, and retention.
Collaboration	Relationships with public safety agencies, local governments, metropolitan planning organizations (MPOs), and the private sector.

Table 3. The TSMO Umbrella Graphic: The 10 MDOT TSMO business areas under the "TSMO umbrella" each determined two to four action items for each of the six TSMO self-assessment dimensions.

	MDOT TSMO Business Areas									
TSMO Self-Assessment Dimensions	Traffic Incident Management	Work Zone Management	Congestion (Recurring) Management	Safety (All Modes)	Modal Interaction and Integration	Weather Management	Field Equipment, Asset, and Functionality Management (Signals, ITS)	TOCs and Traveler Information Systems	Connected and Autonomous Vehicle Systems	Data Collection, Storage, Utilization, Analytics and Decision Support Systems
Business Processes										
Systems and Technology										
Performance Management										
Culture										
Organization and Workforce										
Collaboration										

Two to Four Action Items Each

4.2. WORKSHOP OUTPUTS

The ultimate goal of the workshop was to provide input and direction on MDOT's TSMO Implementation and Strategic Plan across all 10 TSMO business areas, and the business area breakout sessions were tasked with identifying three to four priority action items from any dimension to bring forward to the entire group (out of the 12 to 24 actions, total, that each group identified). To prepare each breakout session for this ultimate goal, team leads for each business area attended plenary sessions on the first morning of the workshop where the MDOT TSMO Core Team, sponsors, and workshop support team provided guidance and direction.

On the last day of the workshop, after all 10 breakout sessions had been completed, the business area leads reconvened with the MDOT TSMO Core Team, sponsors, and workshop support team to form and discuss the three to four priority action items from each business area. This provided the opportunity to collect additional feedback on the priority action items and to collectively discuss the themes that emerged across all 10 business areas (these themes became the seven Strategic Areas of Focus). The group also discussed the feedback and inputs to-date on the draft TSMO Mission and Vision, providing final input to the TSMO Core Team before the finalization of the consensus TSMO Mission and Vision. The final outputs of the workshop are listed and described below.

- Final MDOT TSMO Mission and Vision.
    - Shown in the following section.
- Three to four priority actions per MDOT TSMO business area (34 actions total).
    - These were brought forward into 10 detailed action matrices.
- Seven Strategic Areas of Focus.
    - These Strategic Areas of Focus summarize themes from workshop discussion and the business area priority actions.

The workshop was able to both engage a wide spectrum of MDOT TSMO staff in focused breakout group meetings and to promote high-level discussions across business areas in order to obtain inputs that represent the full breadth of MDOT TSMO activities. This granted opportunities to provide input at different levels of strategic brainstorming. The workshop's combination of focused and cross-cutting engagement will strengthen both the efficacy of and support for the MDOT TSMO Implementation and Strategic Plan. The full participation list from the workshop is provided in Table 4 below.

Table 4. September 2016 TSMO Workshop Participation (56 Total).

Full Workshop Participant List					
Dayo	Akinyemi	Sarah	Gill	Will	Thompson
Deb	Alfonso	Joe	Gorman	Bill	Wahl
Niles	Annelin	Dawn	Gustafson	Davis	Woo
Paul	Arends	Jeff	Horne	Kim	Zimmer
Matt	Bellgowan	Kim	Johnson		
Luke	Biernbaum	Angie	Kremer		
Steve	Brink	Dan	Lund	TSMO Sponsors	
Chris	Brookes	Rob	Morosi	Tony	Kratofil
Gregg	Brunner	Michele	Mueller	Mark	Chaput (former sponsor)
Mike	Budai	Eric	Mueller	Mark	Geib
Wendi	Burton	Michelle	O'Neill		
Paula	Corlett	Hilary	Owen	TSMO Core Team	
Garrett	Dawe	Stephanie	Palmer	Steve	Cook
Josh	DeBruyn	Allison	Parrett	Janine	Cooper
Justin	Droste	Suzette	Peplinski	Collin	Castle
Sharon	Edgar	Greg	Perry	Mark	Bott
Elise	Feldpausch	Eileen	Phifer		
Jason	Firman	Jean	Ruestman		
Tim	Fischer	Brad	Sharlow		
Jen	Foley	Steve	Shaughnessy		
Jim	Gaus	Mia	Silver		
Scott	Geiger	Matt	Smith		
Brian	Giles	Tom	Tellier		

5. TSMO Strategic Direction

5.1. TSMO MISSION, VISION, AND STRATEGIC AREAS OF FOCUS

The MDOT TSMO plan and program is guided by the MDOT TSMO Mission, Vision, and seven Strategic Areas of Focus (shown in Figure 1). These statements provide guidance and values to steer the implementation of the TSMO plan and program. They represent the views of the MDOT TSMO Core Team, sponsors, and a wide array of TSMO staff.

MDOT TSMO Mission

- Operate and manage an optimized, integrated transportation network by delivering high-quality services for safe and reliable mobility for all users.

MDOT TSMO Vision

- Integrate Operations as a core MDOT program united with the execution of MDOT's overall mission.
- Inspire public confidence as a progressive and innovative national leader in the management and operations of our transportation system.
- Collaborate across program areas, leveraging technology and resources to achieve the best possible results.
- Maintain a sustainable and engaged Operations workforce with exceptional knowledge, skills, and abilities.

MDOT TSMO Strategic Areas of Focus

- Evaluate and Streamline Information Technology Processes
- Integrate Operations and Maintenance Across All Business Areas
- Integrate the Operations of Intelligent Transportation Systems (ITS) and Signals
- Adapt Processes, Products, and Training to Advances in Technology
- Enhance Communications and Outreach to External and Internal Stakeholders
- Prioritize Resources to Meet Critical Emerging Needs
- Drive Progress with Meaningful Performance Measures

Figure 1. MDOT TSMO Mission, Vision, and Strategic Areas of Focus.

5.2. STRATEGIC AREAS OF FOCUS

This section provides additional details on the seven Strategic Areas of Focus for the MDOT TSMO Implementation and Strategic Plan, listed below. The Strategic Areas of Focus are rooted in the discussions and actions items that were brought forward at the September 2016 TSMO workshop. To illustrate how the action items generated during the workshop support the resulting Strategic Areas of Focus, all priority action items from all 10 TSMO business areas have been sorted and listed (in tables) under the most relevant Strategic Area of Focus (or in some cases, Strategic Areas of Focus). The Strategic Areas of Focus recognize the importance of TSMO business case development and benefit/cost information in taking operations activities from conception to deployment. In general, workshop discussions have indicated that all seven Strategic Areas of Focus hold equal value with regard to TSMO implementation and sustainability at MDOT.

1. Evaluate and Streamline Information Technology Processes
2. Integrate Operations and Maintenance Across All Business Areas
3. Integrate the Operations of Intelligent Transportation Systems (ITS) and Signals
4. Adapt Processes, Products, and Training to Advances in Technology
5. Enhance Communications and Outreach to External and Internal Stakeholders
6. Prioritize Resources to Meet Critical Emerging Needs
7. Drive Progress with Meaningful Performance Measures

1. Evaluate and Streamline Information Technology Processes

Several TSMO business areas emphasized the importance of having effective, streamlined processes for procuring, developing, and maintaining information technology (IT). More specifically, the groups noted that some current processes that MDOT TSMO business areas use to work with the Department of Technology, Management, and Budget (DTMB) are structured in ways that unintentionally hinder MDOT's ability to advance TSMO to its full potential. Given how critical information technology is to capturing the full benefits of TSMO for the state, suggested avenues for improvement from the business area groups included: evaluating the effectiveness/impact of current processes; documenting existing issues, gaps, and success (e.g., the 2014 ITS World Congress on Belle Isle and Traffic Management Center (TMC)); and using this information to identify improvements and ways to collaborate more effectively. Other IT initiatives in the department to help improve programs and processes between MDOT and DTMB include the IT Vision and the Data Governance Council.

2. Integrate Operations and Maintenance Across All Business Areas

Integrating operations activities, programs, and processes across all business areas was a prominent discussion in every group, sometimes referred to more colloquially as "breaking down silos." These silos, or opportunities to better integrate, were many and

varied, and included opportunities related to funding (e.g., numerous sources of money, categories and requirements), functions, and the collection and use of data.

3. Integrate the Operations of ITS and Signals

Related to integrating operations across all MDOT TSMO business areas, the need to better integrate the processes and functions of ITS and Signals (as well as the Statewide TOC (STOC)) as MDOT's TSMO work advances was mentioned by several groups, elevating the integration of ITS and Signal to its own theme from the workshop. This Strategic Area of Focus, among other things, emphasizes the importance of increasing interoperability between ITS, Signals, and STOC, as well as streamlining these business areas to avoid working in silos, redundancies and conserve resources.

4. Adapt Processes, Products, and Training to Advances in Technology

While MDOT's TSMO activities operate within a larger system that is no doubt dynamic and moving forward, the general need to make sure that TSMO processes, products, and training keep up with advances in technology and other changes was identified in a wide variety of ways and supported by action items from the majority of business areas. The common thread is that MDOT should evolve its processes to ensure that TSMO is central to and well integrated with the larger organization, as that will help MDOT thrive in the new landscape of advanced transportation technologies and constrained abilities to physically expand the system.

5. Enhance Communications and Outreach to External and Internal Stakeholders

Numerous business areas identified actions associated with communications and outreach in some form. These generally fell into two key categories: (1) outreach to the public and external MDOT partners to increase support and understanding, and (2) "in-reach" within MDOT to increase awareness and collaboration among internal stakeholders. A key facet of this Strategic Area of Focus is that efforts to educate and openly communicate with stakeholders can greatly improve MDOT's TSMO program through increased understanding, support, and collaboration.

6. Prioritize Resources to Meet Critical Emerging Needs

The business area groups highlighted various ways that MDOT can better understand and document its critical TSMO needs going forward in order to more effectively prioritize resources. The prioritization aspect of this theme was key, as MDOT TSMO staff experts stressed that part of understanding these needs going forward is understanding what is *not* a critical need to MDOT TSMO and, therefore, can potentially open up resources and time to address more strategic needs.

7. Drive Progress with Meaningful Performance Measures

The theme of performance measures was prevalent in the business area breakout meetings and, importantly, staff emphasized the need to be strategic in taking action on performance measures. Performance measures are a necessary and valuable tool to advance TSMO but must (1) be rooted in easily collectable and reliable data and (2) provide real meaning or utility to the organization, the public, and/or decision-makers. Having the right data to support the performance measure and the right systems/processes in place to collect the data are as critical as the performance measures themselves in order to avoid placing unnecessary burdens on the relevant business units.

6. TSMO Actions and Implementation

6.1. TSMO BUSINESS AREA ACTION MATRICES

To move forward with the TSMO strategic direction documented in this plan, it is important to have a clear understanding of the details supporting each and every Strategic Area of Focus and priority action item. To help structure this, the three to four priority action items from each of the 10 TSMO business areas were documented in 10 individual matrices that also specified critical details such as:

- Specific, incremental steps to accomplish each priority action;
- The MDOT lead for each action, meaning the person responsible for managing support staff and other resources, and for reporting on progress;
- The MDOT support team for each action;
- Partners that will be important to coordinate with, or that can provide information and other resources;
- Available resources, both funding and other tools;
- Timelines for accomplishing the actions; and
- Performance measure to help track and report on progress.

These matrices will serve as a tool to track and guide progress moving forward with the MDOT TSMO Implementation and Strategic Plan. The matrices are broken down into each of the 10 TSMO business areas that were represented at the September 2016 workshop. An example matrix (for the Modal Interaction and Integration Business Area), as well as the blank matrix template, are shown in the following figure. The most up-to-date matrix for all MDOT TSMO business areas (at the time of this plan's publication) are accessible to the business area and commonality area teams and leads, as well as the TSMO sponsors and Core Team. The priority recommendations for action from each business area are provided in the Recommendations section.

Modal Interaction & Integration (Example)

Priority Actions	Steps to Address Action	Supports Strategic Area of Focus							MDOT Lead	MDOT Support	Partners	Resources	Timeline	Measures of Success
		1	2	3	4	5	6	7						
Action 1: Greater Operations participation in and support of M2D2.	**Step 1:** Outreach to M2D2 organizers.		✓		✓	✓			John Doe	Jonny, Janet	M2D2 champions	Collaboration, Staff time	1 month (12/2016)	Establish point of contact
	Step 2: Agree on Ops participation		✓		✓	✓			Jane Doe	Jonathon, Janie	M2D2 champions	Partnership, staff time	2 months (1/2017)	Gain agreement
	Step 3: Select Ops representative		✓		✓	✓			Joe Doe	Jon, Jean	MDOT partners	Partnership, staff time	3 months (2/2017)	Begin participation
Action 2: Gain agreement on good multimodal performance measures.	Step 1													
	Step 2													
	Step 3													
Action 3: Pilot and evaluate the need for a regional multimodal specialist.	Step 1													
	Step 2													
	Step 3													

Figure 2. Example Business Area Action Matrix for the Modal Interaction and Integration Business Area.

6.2. TSMO COMMONALITY AREAS

Given the cross-cutting nature of TSMO, certain priority action items (and steps) in many of the TSMO business area matrices overlapped with priority action items (and steps) in other business area matrices. To avoid redundancies and to help MDOT's TSMO program as a whole do more with existing resources, MDOT conducted a thorough review of all priority action items and steps presented in the 10 TSMO business areas in order to identify areas of overlap.

Five categories of overlap, called commonality areas, emerged from this review as the overlapping actions and steps all fell into one of five categories, listed below. These five commonality areas, like the business areas, were assigned an MDOT lead. A matrix was also created for each commonality area, comprised of the overlapping actions and steps from the business area matrices that fell within the purview of the commonality area. Key updates and recommendations for how to advance each commonality area are also provided in the following section, Recommendations. The MDOT TSMO commonality areas are shown in the table below.

Table 5. The Five MDOT TSMO Commonality Areas.

Five MDOT TSMO Commonality Areas		
Commonality Area	Lead(s) as of 2018	Status
Improve IT Processes and MDOT-DTMB Interactions	Andy Esch, John Jersey	Moved to a Business Area Matrix
Data	Joe Gorman	Actively Managing
TSMO Functional Integration	Hilary Owen	Completed
TSMO Funding Integration Template	Mark Bott	Completed
Outreach and Business Cases	Elise Feldpausch, Steve Cook	Completed

6.3. SEPTEMBER 2017 TSMO FUNDING INTEGRATION TEMPLATE WORK SESSION

As work progressed in the commonality areas, it became clear that additional coordination was needed to advance the TSMO Funding Integration Template Commonality Area. In particular, coordination was needed to help break down silos across five existing MDOT funding templates (listed below) that were critical to funding TSMO at MDOT but had inadvertently posed barriers to effectively fund MDOT's diverse and integrated TSMO activities.

MDOT funding templates critical to TSMO include:

1. Intelligent Transportation Systems (ITS)
2. Signals
3. Safety
4. Congestion Mitigation and Air Quality (CMAQ)
5. Operations (Operations Field Services (OFS), Contract Services Support and Maintenance (CSS&M))

To provide this coordination, the TSMO Core Team organized a one-day work session in September 2017 where TSMO sponsor leadership, template managers and staff for the five templates above, and key TSMO staff worked together to identify ways to break down silos and to better align and coordinate the five templates under the shared safety, mobility, and reliability goals of TSMO.

Background Research and Outreach

Leading up to the work session, each template manager was consulted to gather information and insights on the challenges and opportunities for better integrating the template at hand with the other TSMO-related templates. These insights were documented and presented at the beginning of the work session as a launch pad for the day's work. The table below summarizes key characteristics of the TSMO-related templates.

Table 6. TSMO-Related Templates at MDOT as of September 2017.

MDOT TSMO-Related Templates as of September 2017			
Template Designation	**Approximate Funding Level (millions/year, FY 2018 - 2023)**	**Funding Source**	**Requirements/Goals**
1. ITS	$12 - $16	80% federal/20% Michigan	ITS infrastructure
2. Signals	$18	100% federal	Signals projects to advance mobility and safety
3. Safety	$60 - $63	90% federal/10% Michigan **or** 100% federal	Reducing fatalities and injuries
4. CMAQ (Trunkline)	$34 - $36 CMAQ Set-Aside: $9 - $10	81.85% federal/18.15% Michigan (some projects eligible for 100% federal)	Air quality EPA requirement for projects to be in/near nonattainment/ maintenance areas/counties to be eligible for funds
5. Operations (OFS)	$6 (FY 2017)	100% Michigan	CSS&M
For Comparison			
Pavement R&R	$350 - $590	Approximately 80% federal/20% Michigan	Pavement condition state

The consultations with the template managers also allowed for the creation of mock process diagrams for each template based on the steps each manager described in the project identification, selection, and funding processes for their template. These process diagrams were printed on large foot posters that were hung on the walls during the work session. Work session participants used these aides to structure and ground discussions of challenges and opportunities to better align the templates. Participants noted during the work session that these diagrams were generally accurate and represented the first attempt to visually map the template processes.

The output of the work session was a series of vetted action items for the Funding Integration Template Commonality Area. These action items were brought forward to the TSMO sponsors and the MDOT Region Bureau Management Team (RBMT), and refined into a list of priority recommendations, which are captured in the following chapter under the Funding Integration Template Commonality Area recommendations.

7. Recommendations (2017)

The MDOT TSMO business areas began advancing their priority action items immediately following the September 2016 workshop. Many business areas, therefore, have been able to accomplish a good deal of progress to-date and have, through the process of implementing these actions, gained additional insight on what is needed to implement the optimized, integrated, cost-saving TSMO program envisioned by the MDOT TSMO Mission and Vision. Likewise, the commonality areas began their work in February 2017 and have gleaned similar insights. Based on progress to-date, each business area and commonality area were asked in summer 2017 for any priority recommendations that they would like to bring forward to the TSMO Core Team and sponsors. These recommendations went through a process of review by the MDOT Core Team, sponsors, and RBMT.

The original recommendations for advancing TSMO in Michigan are captured in the sub-sections that follow. Note that these recommendations have been further advanced by agency personnel and are updated in the Executive Summary of this document.

7.1. BUSINESS AREA RECOMMENDATIONS

While all 10 business areas were consulted for recommendations, only the Field Equipment, Asset, and Functionality Management (ITS, Signals) Business Area was at a point where it had a recommendation to bring forward to MDOT senior leadership.

Field Equipment, Asset, and Functionality Management (ITS, Signals)

1. Retool initial efforts (completed in 2012 to determine statewide Signals electrician needs) done to determine the appropriate number of FTEs required for the optimal performance, evolution, and maintenance of TSMO field activities and needs (determining the appropriate number of FTEs required to be able to maintain Signals at an optimal level statewide).

7.2. COMMONALITY AREA RECOMMENDATIONS

While all five commonality areas were consulted for recommendations, only the TSMO Functional Integration Commonality Area and the TSMO Funding Integration Template Commonality Area were at a point where they had recommendations to bring forward to MDOT senior leadership.

TSMO Functional Integration Recommendations

1. The proposed TSMO Functional Integration Group would have two over-arching groupings. A summary of these two groups, with recommendations for implementation, is shown below, followed by recommendations for improving MDOT's TOC structure.

2. *Advanced Operations:* Advanced Operations brings together ITS, Signals, STOC, and CAV areas. Recommendations are as follows:

    a. Move STOC to Construction Field Services (CFS) to co-locate with the ITS program office (aligns with STOC Needs Assessment document dated Aug. 10, 2017).

    b. Have STOC staff report directly to ITS program office.

    c. Have Signals unit report directly to ITS program office.

    d. Co-locate Signals with STOC and ITS program office.

    e. Establish a baseline real-time signal operations monitoring program, and determine the resources required to achieve the goals of the program.

    f. Increase resources to manage work load associated with real-time traffic signal operations program.

        OR

    g. Include real-time signal operations staffing and responsibilities in the contract for TOC operations as needed. Maintain internal technical experts to oversee these contract employees and establish goals and performance monitoring measures.

3. *System Performance:* More closely align areas of system operations and safety performance so that specific work tasks can be appropriately assigned based on priority and resource availability.

    a. Create a System Performance group to bring together traditional operations and traffic safety work areas. This would include Congestion and Mobility, Safety Programs, Geometrics, Signs, Sign Shop, and Pavement Marking.

    b. Evaluate the overlap of traffic modeling work tasks in Planning, Congestion and Mobility, Signals, and Geometrics. Define clear expectations as to where the responsibilities lie.

4. *TOC Organizational Structure:* There are challenges associated with having the TOCs report directly to the regions, but there are also benefits. With this in mind,

there are two alternate approaches to aligning the goals and creating consistency in TOC operations:

a. Create a central office oversight structure of all TOCs statewide. Have all TOCs report directly to the same central division.

OR

b. Establish an elevated TOC operations position at STOC with statewide oversight responsibilities. Currently, TOC operations is handled at the 13 level for most TOCs. Elevating the STOC position to a 14 level would more appropriately provide finality in the decision-making process for TOC operations decisions.

TSMO Funding Integration Template Recommendations

The recommendations below from the TSMO Funding Integration Template Commonality Area represent the finalized recommendations brought forward at the September 2017 Funding Integration Template work session.

Program Development Recommendations:

1. Integrate TSMO as a core program area in the Call for Projects.

    a. Develop a high-level MDOT policy (with leadership support) and include TSMO in the Call for Projects associated with the identified TSMO-related templates.

    b. Identify a champion to represent TSMO in the Call for Projects in each region.

    c. Add a TSMO representative to the Call for Projects Approval Committee.

2. Develop and implement a formal strategic plan and investment strategy for all business areas under the TSMO umbrella. This effort should be driven through the proposed TSMO Steering Team (recommendation noted below), and reflected in the Call for Projects instructions.

Funding/Financial Recommendations:

3. Establish a standard process for estimating the lifecycle O&M costs of all TSMO projects. Subsequently, this process should be more broadly applied to capacity improvement projects as well (in order to equitably compare costs between TSMO and capacity improvement projects).

4. Explore combining the MDOT CMAQ money into one funding source; regions would then compete for CMAQ funds (with a set-aside for smaller projects, such as signals and turn lanes).

a. Determine one uniform emissions benefit calculation process for prioritizing projects statewide (for CMAQ-eligible counties).

5. Determine what source/mechanism will fund the O&M of ITS, Signals, and technology capital investments going forward. (What is the most appropriate funding source and how much will be needed?)

    a. Clarify the definition of ITS and ITS maintenance costs in the ITS Template and know where these costs are coming from (increase visibility). For example: ITS capital where part of it is O&M from ITS (approximately $12 million to $17 million for capital and another for O&M).

6. Establish a TSMO template(s) to have reliable/sustainable funding plans for the following programs (note this is a business area recommendation, and not part of the September 2017 workshop):

    a. TIM

    b. Recurring congestion/mobility (to align with Moving Ahead for Progress in the 21st Century (MAP-21) Act requirements)

    c. Real-time signal performance

    d. CAV

Program/System Management Recommendations:

7. Establish a TSMO Steering Team to meet on a regular basis to develop and coordinate the sub-program template management.

    a. Expand upon the existing (although stagnant) ITS Steering Team to include Signals, Safety, TIM, and CAV.

8. Increase flexibility in MDOT's project delivery processes for high-priority TSMO projects, thereby allowing MDOT to more efficiently respond to needs and deliver projects.

    a. Pilot this recommendation with signals projects. Explore design-build-type contracts for signals projects.

8. Maintaining the TSMO Implementation and Strategic Plan

8.1. LIVING DOCUMENTS – MAINTENANCE OF THE MATRICES

Like the MDOT TSMO Strategic and Implementation Plan, each business area and commonality area action matrix are intended to be a living document that tracks the business or commonality area's progress to-date and details its plan for moving forward in terms of SMART (Specific, Measurable, Achievable, Realistic, and Time-bound) actions and steps. The ability to quickly adapt and take advantage of new technologies and evolving markets and travel behaviors will be key to the success of MDOT's TSMO program, as well as the health of MDOT's transportation system moving forward. These matrices, along with the MDOT TSMO Implementation and Strategic Plan should, therefore, be routinely maintained with updates as needed.

9. Links to Complementary MDOT Initiatives

A crucial part of launching MDOT's TSMO Implementation and Strategic planning process was coordinating with other MDOT department-wide goals and initiatives. The MDOT TSMO sponsors and Core Team took efforts to ensure that the MDOT TSMO Implementation and Strategic Plan complemented and supported the key MDOT department-wide initiatives listed in this section. The TSMO Implementation and Strategic Plan, and the TSMO program that it guides, is designed to support and help advance these complementary initiatives through coordinated, synergistic actions.

- 2017 MDOT Strategic Plan
    - In particular, the Mission, Vision, Values, and Strategic Areas of Focus.
- 2018 MDOT Strategic Plan for ITS
    - See more below
- 2017 MDOT CAV Technology Strategic Plan
    - See more below.
- 2018 Road Weather Information System (RWIS) Strategic Plan
- Technical Agenda - CMAQ/Operations Template
    - See more below.
- MDOT Strategic Plan for Operations
    - This plan was developed in 2013 and was originally more specially related to the I-94 corridor. It was then revised for statewide operations initiatives and will now be replaced by this TSMO Implementation and Strategic Plan.

9.1. 2018 STRATEGIC PLAN FOR ITS

The MDOT 2018 Strategic Plan for ITS serves as a compass for the MDOT ITS program—to help set priorities and make decisions that move forward the plan's goals and actions. The Strategic Plan for ITS is well-integrated and aligned with the MDOT TSMO Implementation and Strategic Plan, and it specifically demonstrates how its mission, vision, focus areas, and goals align with and support those outlined in this TSMO plan. The MDOT 2018 Strategic Plan for ITS mission, vision, and ITS focus areas are shown below.

ITS Mission and Vision Statements

- Mission: Provide high quality, adaptive, and integrated transportation technology solutions that improve safety and mobility for all users.

- Vision: Integrate MDOT's ITS Program into all TSMO business areas and leverage both proven and emerging transportation technologies to sustainably enhance safety, mobility, economic benefit, and support improved quality of life.

ITS Focus Areas (aligning with the TSMO Seven Strategic Areas of Focus)

1. Information Technology Processes
2. **TSMO Business Area Integration**
3. ITS/Signal Program Integration
4. Emerging Technologies
5. Partners and Outreach
6. Workforce Development
7. Performance-Based Priorities

9.2. MDOT CONNECTED AND AUTOMATED VEHICLE (CAV) PROGRAM STRATEGIC PLAN

The MDOT CAV Program Strategic Plan, developed in 2017 and undergoing final review, provides renewed support and direction for Michigan's robust CAV program. It summarizes more than a decade of research, development, and partnerships that have made Michigan the nation's leader in CAV technology advancement and deployment. The strategic plan is built on the following foundational components: MDOT's CAV mission and vision, six overarching CAV program goals, and five categories of CAV program strategies, each with a series of tactical goals for the state and MDOT. These components are summarized below.

MDOTs CAV Program Mission and Vision:

- Mission: The Michigan Department of Transportation will work to ensure Michigan remains the national leader in the evolution of CAV technologies, to deliver enhanced transportation safety and reliability, providing economic benefit and improved quality of life.

- Vision: The Michigan Department of Transportation will be recognized as a progressive and innovative leader, driving national efforts to explore and implement emerging mobility technologies.

MDOT CAV Program Goals:

- Goal 1: Serve as a national model to catalyze CAV deployment.
- Goal 2: Establish foundational systems to support wide-scale CAV deployment.
- Goal 3: Make Michigan the go-to state for CAV research and development.
- Goal 4: Accelerate CAV benefits to users.
- Goal 5: Exploit mutual benefit opportunities between CAV technologies and other department business processes and objectives.
- Goal 6: Use Michigan experience to lead dialogue on national standards and best practices.

MDOT CAV Program Strategies (Categories):

- Foundational actions to institutionalize CAV.
- CV infrastructure development.
- Application development and benefit acceleration.
- Michigan industry and workforce development.
- Partnering and promotion.

The MDOT TSMO Implementation and Strategic Plan is designed to help advance the department's CAV program mission, vision, and goals – supporting Michigan's role as a leader in CAV technology through a forward-looking TSMO program and assisting with the institutionalization of CAV with advanced CMM institutional capabilities.

9.3. TECHNICAL AGENDA – CMAQ/OPERATIONS TEMPLATE

In March 2017, MDOT initiated a technical agenda to develop processes and guidance for a CMAQ Improvement Program and Operations Template (the CMAQ/Operations Template). The technical agenda team was tasked with two assignments. First, to review past and current MDOT experience with other template applications to establish processes for distributing funds based on set criteria, for managing and measuring CMAQ/Operations Template investments and outcomes, for scoping and selecting operations projects, and for incorporating this template with the Call for Projects process. Second, to develop a guidance document to assist the department in selecting and implementing operational improvement, including: a generic concept of freeway

operations improvement as a baseline, project selection criteria, guidance on environmental impact analyses, definitions of the decision and approval process, public awareness and education considerations, guidance on cost estimations and benefit/cost analyses, and standards and considerations related to design, construction, and operations.

10. Appendix A: Resources

10.1. NATIONAL OPERATIONS CENTER OF EXCELLENCE (NOCOE) RESOURCES

The following table summarizes select TSMO resources available from the National Operations Center of Excellence (NOCoE). More TSMO resources can be found at the NOCoE website: https://transportationops.org/

Table 7. National Operations Center of Excellence (NOCoE) Resources.

Title	Date	Summary
Workforce Training Database *https://transportationops.org/training*	2022	This webpage within the NOCoE site provides a comprehensive and searchable database of TSMO industry trainings and courses.
NOCoE Case Studies *https://www.transportationops.org/nocoe-case-studies*	various	NOCoE Case Studies capture the strategies and practices currently being deployed to advance the TSMO industry. Case studies are developed in partnership with the authoring organization.

10.2. U.S. DEPARTMENT OF TRANSPORTATION / FEDERAL HIGHWAY ADMINISTRATION RESOURCES

The following table summarizes TSMO resources available from the U.S Department of Transportation (USDOT)/the Federal Highway Administration (FHWA). More TSMO resources can be found at the following USDOT/FHWA webpages:

- FHWA Office of Operations: https://ops.fhwa.dot.gov/
- FHWA Office of Operations "What is TSMO" website: https://ops.fhwa.dot.gov/tsmo/index.htm
- USDOT ITS Joint Program office (JPO): https://www.its.dot.gov/

Table 8. U.S. Department of Transportation and Federal Highway Administration Resources.

Title	Date	Summary
Advancing TSMO: Making the Business Case for Institutional, Organizational, and Procedural Changes (FHWA-HOP-19-017) *Available at: https://ops.fhwa.dot.gov/publications/publications.htm; search by title or publication number (FHWA-HOP-19-017)*	January 2019	This primer provides guidance and a framework to help transportation agencies make an effective business case for the benefits of implementing institutional, organizational, and procedural changes to support and advance TSMO.
Communicating with Other Programs TSMO Factsheets *https://ops.fhwa.dot.gov/plan4ops/focus_areas/integrating/tsmo_factsheets.htm*	various	Fact Sheets were developed to explain how TSMO relates to asset management, construction, design, environment, human resources, maintenance, performance management, planning, and safety.
Transportation Systems Management and Operations in Smart Connected Communities (FHWA-HOP-19-004) *Available at: https://ops.fhwa.dot.gov/publications/fhwahop19004/fhwahop19004.pdf*	December 2018	This primer describes the key characteristics of smart, connected communities and how they can benefit from closer collaboration with TSMO and how TSMO can benefit from these collaborations.
Organizing for TSMO – 2020 Peer Exchange Report (FHWA-HOP-20-046)	December 2020	This report summarizes the findings of a peer exchange that brought together

Title	Date	Summary
Available at: https://ops.fhwa.dot.gov/publications/fhwahop20046/index.htm		transportation agencies to discuss challenges, best practices, and lessons learned related to advancing organizational capabilities for TSMO.
Model Transportation Systems Management and Operations Deployments in Corridors and Subareas Primer (FHWA-HOP-18-026) *Available at: https://ops.fhwa.dot.gov/publications/fhwahop18026/fhwahop18026.pdf*	February 2018	This primer showcases six illustrative packages of TSMO strategy deployments with varied geographic, social, and institutional contexts to serve as examples for advancing TSMO.
Mainstreaming TSMO: Examples of Integrating TSMO Across a Transportation (FHWA-HOP-21-041) Agency *Available at: https://ops.fhwa.dot.gov/publications/fhwahop21041/index.htm*	October 2017	This infographic presents examples of how TSMO can be integrated into various agency functions.
Planning for Transportation Systems Management and Operations within Subareas - A Desk Reference (FHWA-HOP-16-074) *Available at: https://ops.fhwa.dot.gov/publications/fhwahop16074/index.htm*	October 2016	This desk reference is designed to equip State, regional, and local transportation operations and planning professionals with the knowledge and tools necessary to effectively plan for and implement TSMO within a subarea context.

10.3. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) COMMITTEE ON TRANSPORTATION SYSTEM OPERATIONS (CTSO) RESOURCES

Resources from the AASHTO CTSO can be found on the subcommittee's webpage: https://systemoperations.transportation.org/

10.4. TRANSPORTATION RESEARCH BOARD (TRB) NATIONAL COOPERATIVE HIHGWAY RESEARCH PROGRAM (NCHRP) RESOURCES

The following table summarizes TSMO resources available from the Transportation Research Board (TRB) National Cooperative Highway Research Program (NCHRP). More TSMO resources can be found at the NCHRP webpage: http://www.trb.org/NCHRP/NCHRP.aspx.

Table 9. National Cooperative Highway Research Program (NCHRP) Resources.

Title	Date	Summary
Transportation Systems Management and Operations (TSMO) Workforce Guidebook (NCHRP 20-07 Task 408) *Available at:* *https://transportationops.org/sites/transops/files/TSMO%20Workforce%20Guidebook%20NCHRP.pdf*	March 2019	This report presents the results of research for training, hiring, developing, and retaining a workforce needed for a successful TSMO program.
Transportation Operations Manual NCHRP 03-126 *Available soon*	Expected soon	The Transportation Operations Manual (TOM) will serve as an authoritative guide for transportation systems management and operations (TSMO). The manual takes a holistic view of the operation and management of the transportation system, both in urban and rural settings and for people and goods. The primary audiences will be staff at state, regional, and local transportation agencies. The manual describes a broad array of TSMO related subject areas and offers effective practices and guidance in each. The topics are generally covered in depth in other disparate documents and those documents are referenced widely in the manual..

10.5. PEER STATE RESOURCES

The following table summarizes TSMO resources available State Departments of Transportation (DOT) across the country.

Table 10. Peer State Resources.

State	Summary
Arizona	Arizona DOT restructured to establish a TSMO Division in 2016 and documented a TSMO Plan in 2017. *An overview of Arizona DOT's TSMO program is available at: https://azdot.gov/business/transportation-systems-management-and-operations-tsmo*
California	California DOT has been taking a regional/corridor focus to TSMO program planning. *Further information on Caltrans TSMO is available on their website at: https://dot.ca.gov/programs/traffic-operations/tsmo*
Colorado	CDOT created the Division of Transportation Systems Management and Operations (TSM&O) to align the core functional business areas that provide operational activities, programs, strategies, and services on a statewide basis. *Colorado DOT TSMO program overview available at: https://www.codot.gov/programs/operations*
Florida	Florida DOT's captures their statewide program, divided into five areas: deployments, ITS communications, ITS architecture, arterial management, and managed lanes. *Available at: https://www.fdot.gov/traffic/its/tsmo.shtm*
Iowa	Iowa DOT developed both a TSMO Strategic Plan and a TSMO Program Plan. *https://iowadot.gov/tsmo/*
Maryland	Maryland completed its TSMO plan in 2016 and updated the plan in 2018, with a strong focus on performance management. *https://www.roads.maryland.gov/OPPEN/2018_MDOT_TSMO_Strategic_Plan.pdf*
Ohio	Ohio DOT has a website showcasing numerous aspects of their TSMO Program.

State	Summary
	https://www.transportation.ohio.gov/programs/tsmo/tsmo-landing-page
Pennsylvania	PennDOT's TSMO program has strategic and programmatic plans as well as TSMO Performance Reports. *https://www.penndot.gov/ProjectAndPrograms/operations/Pages/default.aspx*
Tennessee	Tennessee DOT's TSMO program is located in the Transportation Management Office under Traffic Operations. The DOT has updated their TSMO Program Plan in 2022. *Traffic Operations Division webpage: https://www.tn.gov/tdot/traffic-operations-division/transportation-management-office.html*
Texas	The Texas DOT completed a statewide TSMO Strategic Plan in 2017 and have TSMO plans a majority of its 25 districts. Completed plans are posted on their website. *Available at: https://www.txdot.gov/inside-txdot/division/traffic/tsmo.html*
Washington	The Washington State DOT developed an interactive TSMO website *https://tsmowa.org/*

11. Appendix B: Acronyms

BFS	Bureau of Field Services
CAV	Connected and Automated Vehicles
CCTV	Closed-Circuit Television
CFP	Call for Projects
CMAQ	Congestion Mitigation and Air Quality
CMM	Capability Maturity Model
CoL	Community of Learning
CSS&M	Contract Service, Support, and Maintenance
DOT	Department of Transportation
DMS	Dynamic Message Sign
DTMB	Department of Technology, Management, and Budget
FCP	Freeway Courtesy Patrol
FHWA	Federal Highway Administration
FTE	Full-Time Equivalent
IT	Information Technology
ITS	Intelligent Transportation Systems
MAP-21	Moving Ahead for Progress in the 21st Century
MDOT	Michigan Department of Transportation
MITSC	Michigan Intelligent Transportation Systems Center
MTPA	Michigan Transportation Planning Association
OFS	Operations Field Services
O&M	Operations and Maintenance
RBMT	Region Bureau Management Team
RWIS	Road Weather Information Systems
SCANDI	Surveillance, Control, and Driver Information
SEMTOC	Southeast Michigan Transportation Operations Center
SLRP	State Long Range Plan
STIP	State Transportation Improvement Plan
STOC	Statewide Transportation Operations Center
TIM	Traffic Incident Management
TMC	Traffic Management Center
TOC	Transportation Operations Center
TSMO	Transportation Systems Management and Operations

12. Appendix C: History of TSMO at MDOT

The Michigan Department of Transportation (MDOT) has been providing Transportation Systems Management and Operations (TSMO) services for decades, even though it wasn't until around 2013 that the term "TSMO" caught on as a catchphrase for describing this set of operational strategies to improve the safety, reliability, and efficiency of Michigan's transportation system. While having a shorthand term like "TSMO" is a convenient way to summarize these diverse and interrelated strategies, it is also important to recognize the long legacy of these services at MDOT. This appendix provides a brief history of TSMO at MDOT.

12.1. LEGACY OF LEADERSHIP IN ITS

Trailblazing ITS in Detroit

Since the late 1950s, the Detroit metropolitan area has been a pioneer in several of what are now MDOT's 10 TSMO Business Areas, including: Field Equipment Management (Intelligent Transportation Systems (ITS) and Signals); Transportation Operations Centers (TOCs) and Traveler Information Systems; Congestion (Recurring) Management; and Traffic Incident Management (TIM). In its "History of ITS in Detroit[1]" publication, the Southeast Michigan Transportation Operations Center (SEMTOC) details four "eras" of ITS on southeast Michigan freeways:

1. John C. Lodge Proving Ground Project: 1957–1971.
2. Surveillance, Control, and Driver Information (SCANDI) Program: 1976–1991.
3. Michigan Intelligent Transportation System Center (MITSC): 1991–2012.
4. SEMTOC: 2012–Current.

John C. Lodge Proving Ground Project. In 1957, MDOT kicked off the first project in the nation to use Closed-Circuit Television (CCTV) to study freeway traffic—known as the John C. Lodge Proving Ground Project. This project was conducted in Detroit and included 14 CCTV cameras, 21 sets of overhead illuminated lane signals and speed signs, and speed sensors along the John C. Lodge Freeway (M-10). The project ran until 1971 and also established a small TOC housed in the Herman Keifer Hospital to monitor and control the new system—this TOC was also the first of its type in the nation.

Figure 3. The John C. Lodge Proving Ground Project TOC. (Source: A History of ITS in Detroit, SEMTOC.)

[1] "A History ITS in Detroit", Southeast Michigan Transportation Operations Center (SEMTOC), available at: http://www.michigan.gov/documents/mdot/History_of_ITS_in_Detroit_478054_7.pdf?20150105094341

SCANDI. The SCANDI program began in 1976 and expanded Detroit's ITS network to cover a total of 32.5 miles along segments of I-94, M-10, I-75, and I-375. The ITS devices deployed along these segments included (by 1991) 1,300 traffic detectors, 12 traffic cameras, 14 Dynamic Message Signs (DMS), 28 ramp meters, and 69 motorist-aid telephones. This new system enhanced MDOT's ability to coordinate with Michigan State Police and manage traffic incidents.

Figure 4. A motorist-aid telephone.
(Source: A History of ITS in Detroit, SEMTOC.)

MITSC. In 1991, Detroit's ITS operations staff and device communications were moved to a new TOC facility—the Michigan ITS Center, or MITSC. Detroit's ITS capabilities expanded considerably over the next two decades and included several important milestones, such as:

- In 1994, the Freeway Courtesy Patrol (FCP) began as a pilot program in Detroit. (MDOT assumed responsibility in 1999).
- In 1995, the Michigan State Police dispatch relocated to MITSC and established the first combined freeway operations and State Police dispatch center in Michigan.
- In 1998, Detroit's ITS coverage reached 180 miles of freeway and became the largest such system in the world at the time.
- In 2006, MDOT built an auxiliary TOC to help handle emergencies and special events.
- In 2009, MDOT opened the Blue Water Bridge TOC in Port Huron.
- In 2009, MITSC began converting its communications system to digital format.

Figure 5. An MDOT Freeway Courtesy Patrol dispatch responding to a motorist in need.
(Source: A History of ITS in Detroit, SEMTOC.)

SEMTOC. In 2012, MITSC relocated across the street to its current home and assumed the new name of SEMTOC. MDOT continues to work to enhance SEMTOC's capabilities and to integrate new technologies into its system. SEMTOC remains a key asset for TSMO strategies such as TIM and congestion management—helping the region tackle these challenges through continued collocation with the Michigan State Police and through pilot Integrated Corridor Management (ICM) projects. SEMTOC has also represented MDOT's role as a leader in transportation field—with Detroit hosting the ITS World Congress in 2014 (see more on this below) and with SEMTOC supporting MDOT's efforts to drive innovation in connected and automated vehicle technology (both discussed further below).

Figure 6. The new SEMTOC operations facility, opened in 2012.
(Source: A History of ITS in Detroit, SEMTOC.)

Expansion of TOCs Statewide

In parallel to the advancement of SEMTOC in Detroit, MDOT opened an additional TOC for the West Michigan region—the West Michigan Transportation Operations Center (WMTOC)—in 2006 and the Blue Water Bridge TOC – serving the bridge plaza and St. Clair County area. This ITS center oversees traffic monitoring systems covering freeway and non-freeway state trunkline in eight counties in the greater Grand Rapids, Muskegon, and Big Rapids area. Additionally, in 2011, MDOT opened the Statewide Transportation Operations Center (STOC) in Lansing, MI. STOC serves motorists in MDOT's Southwest, University, Bay, North, and Superior regions. It also provides overnight operations for the Grand region, which is served during the day by WMTOC. Together, Michigan's four TOCs have worked over the years to deploy, operate, and manage cutting-edge strategies and technologies that help Michigan travelers get where they need to go with greater safety, efficiency, and reliability.

Institutionalization of ITS at MDOT

MDOT has helped institutionalize its legacy in ITS—and maintain its momentum—via the formation of a formal ITS program with an annual ITS funding template, an ITS Steering Committee to oversee the ITS project funding process, and an ITS Strategic Plan. MDOT released an initial ITS Strategic Plan in 2008, which developed the MDOT ITS Mission to "develop and sustain a program at MDOT to improve safety, operational performance, and integration of the transportation system utilizing ITS technologies for economic benefit and improved quality of life." MDOT is currently developing an updated ITS Strategic Plan, which is expected in 2018.

2014 ITS World Congress in Detroit

Detroit was the proud host of the 2014 ITS World Congress, which was held in September 2014 at the Cobo Center and Belle Isle. The ITS World Congress is an annual conference organized by the Intelligent Transportation Society of America (ITS America), ERTICO (ITS Europe), and ITS Asia-Pacific. It brings together over 10,000 of the world's leading transportation technology, business, policy, and research professionals from over 65 countries with the goal of bringing greater levels of safety, reliability, sustainability, and connectivity to transportation systems worldwide. The theme of the 2014 ITS World Congress— "Reinventing Transportation in our Connected World"—focused on applying ITS to emerging connected vehicle technologies.

12.2. ADVANCEMENTS ACROSS TSMO BUSINESS AREAS

Traffic Incident Management

TIM is a term used to encompass the planned and coordinated multi-disciplinary processes used to detect, respond to, and clear traffic incidents as quickly as possible while protecting the safety of on-scene responders and the traveling public. MDOT is a national leader in TIM and steers TIM activities and improvements through its TIM Action Team. The TIM Action Team has helped formalize MDOT's TIM goals and propel progress through efforts such as the Michigan TIM Action Plan (2013-2016) and year-end reviews of TIM accomplishments and progress.

MDOT TIM Webpage

Mi-TIME resources on TIM training and other TIM education materials are available on MDOT's TIM webpage:

http://www.michigan.gov/mdot/0,4616,7-151-9615_11261_45350_67500---,00.html

Mi-TIME. A key component of MDOT's TIM work is the Michigan Traffic Incident Management Effort (Mi-TIME), which is a statewide partnership among Michigan agencies, law enforcement, fire, Emergency Medical Services (EMS), local road agencies, and towing services to work together to safely and efficiently clear traffic incidents from Michigan's roadways. Mi-TIME provides important training to responders on quickly and safely clearing incidents. This training has many benefits including enhancing responder and motorist safety, reducing delay due to incidents, and reducing secondary crashes. So far, Mi-TIME has trained more than 8,300 responders[2].

[2] 8,300 TIM responders trained as of December 13, 2020.

Roadway Weather Information System (RWIS)

Since 2008, MDOT has worked to install RWIS equipment with coverage across the state. The system is made up of a network of Environmental Sensor Stations (ESS), which combine several types of sensors to measure air and road surface temperatures, barometric pressure, wind, salt concentrations on the road surface, frost depth, and dew point. They also include cameras to verify conditions at the site. Using the data collected from the 68 existing stations installed since 2008, MDOT is able to better predict and respond to the impact of weather on the roadway. MDOT maintenance staff are the primary users accessing the data through the website, RoadDSS ("DSS" stands for Decision Support Systems). The public and local agencies can view the information through MDOT's MiDrive website. MDOT is continuing to improve coverage with new ESS in priority locations, such as the northern Lower Peninsula. MDOT is currently developing a RWIS Strategic Plan, which is expected in 2018.

WxTINFO. MDOT is also facilitating the Weather Response Traffic Information System (WxTINFO) project in partnership with the Federal Highway Administration (FHWA). WxTINFO will bring together near-time environmental and weather data from fixed sources (ESS, National Weather Service stations, ASOS, AWOS) and mobile sources to create a single system for roadway weather-related advisories. The system will alert MDOT operators and provide advisory messages for operators to post on dynamic message signs and the MiDrive website.

Additional TSMO Activities and Projects

In addition to TIM and RWIS, the strength of MDOT's TSMO program is built upon a diverse array of interrelated TSMO programs and projects. Some examples of advancements in these additional TSMO Business Areas are described below, although it should be noted that this list is not exhaustive.

Work Zone Management. MDOT runs a comprehensive Work Zone Safety and Mobility program that provides training and guidance (e.g. the Work Zone Safety and Mobility Manual) and conducts public outreach on safe driving in work zones.

Integrated Corridor Management (ICM). In 2012, MDOT—in partnership with the Southeast Michigan Council of Governments, the City of Detroit, and Oakland, Macomb, and Wayne counties—received funding for ICM implementations on three distinct corridors: I-75 in Oakland County, I-75 in Wayne County, and I-696 in Macomb County.

Active Traffic Management (ATM). MDOT has implemented ATM along US-23 between Brighton and Ann Arbor (known as FlexRoute23), which is estimated to provide 33 percent cost savings compared to only capital expansion alternatives - delivering equal capacity improvements blending capital expansion with TSMO strategies.

Truck Parking. MDOT deployed a pilot truck parking and information project along I-94 in southwest Michigan, a high-volume freight corridor. The project assesses the availability of parking for trucks in both private and public lots along the corridor and then provides that information in real time to the driver. As part of this project, a Truck Parking Information and Management System (TPIMS) was developed through the FHWA Truck Parking Facilities Discretionary Grant Program. The information in this system is distributed to the state's advanced transportation management system software for the TOCs to access, the MiDrive website, and the Truck Smart Parking Services website. A proposed TIGER grant will expand the TPIMS on the remainder of I-94 and I-75 corridors.

12.3. PIONEERING CONNECTED AND AUTOMATED VEHICLE ACTIVITIES

Over the years, Michigan has earned and maintained its reputation as the national leader in the auto industry by continuing to prove itself as a leader in emerging areas of innovation in the transportation field, such as TSMO, ITS, and—most recently—Connected and Automated Vehicles (CAV).

CAV Technology Testing and Development. Michigan has been the site of significant state- and federally-supported CAV research and testing initiatives. Starting in 2005, the United States Department of Transportation (USDOT) conducted a Connected Vehicle (CV) Proof of Concept (POC) in the Novi/Farmington Hills area. A few years later, the Ann Arbor Safety Pilot Model Deployment (SPMD)—led between 2012 and 2015 by University of Michigan Transportation Research Institute (UMTRI) with support from MDOT and the Michigan Economic Development Corporation (MEDC)—equipped 3,000 vehicles and 29 roadside locations with CV technology. This project allowed USDOT to collect data to evaluate and improve communications equipment interoperability. UMTRI is currently conducting the Ann Arbor Connected Vehicle Test Environment (2015-2018), a project that builds on the SPMD and aims to implement and further test CV technologies on vehicles and infrastructure such as traffic signals.

Michigan CAV Resources

More information on Michigan's array of CAV projects and programs is available through the following websites:

- ***Mcity:*** https://mcity.umich.edu/
- ***American Center for Mobility:*** http://www.acmwillowrun.org/
- ***Planet M:*** https://planetm.michiganbusiness.org/

MDOT has been leading several CV tests and pilot deployments aimed at enabling Dedicated Short Range Communications (DSRC). MDOT is focusing its efforts on four

initial CV applications: red light violation warning, work zone warning, road weather management, and pavement condition monitoring. To that effect, for example, MDOT has equipped 15 vehicles from its fleet with sensors capable of collecting and transmitting information on pavement condition, as part of the Vehicle-Based Information and Data Acquisition System (VIDAS) project. MDOT has also created a Data Use, Analysis, and Processing (DUAP) Program to integrate CV data, mobile data, and data from fixed sensors into a unified system and make it accessible to MDOT personnel.

MDOT, MEDC, and other Michigan public and private organizations are also supporting automated vehicle technology development and testing in various capacities. The University of Michigan Mobility Transformation Center's (MTC) "Mcity" program, a 32-acre test site on University of Michigan's campus, opened in 2015, was the first purpose-built CAV test facility with simulated urban and suburban driving environments. The American Center for Mobility (ACM), a larger test and development facility of more than 500 acres, will be completed in 2018 at the historic Willow Run site in Ypsilanti. ACM is a partnership between MDOT, MEDC, and other public and private organizations. Recently, Michigan has extended its investment in the Safety Pilot test bed to include automated vehicles at Mcity.

Planet M. Michigan is taking its leadership in CAV one step further via its Planet M initiative. Planet M—which is led by MEDC in partnership with mobility organizations, communities, educational institutions, research and development organizations, and government agencies like MDOT—has developed a "one-stop shop" website that serves as a gateway to all of Michigan's CAV efforts and resource. Planet M is a no-cost, concierge service that connects mobility-focused companies and investors to Michigan's CAV ecosystem. The goal of Planet M is to connect Michigan's assets with new and growing tech companies, startups, pilot programs, investors, accelerators and others looking to further expand the industry through innovative advancements that will define the future of transportation.

CAV Strategic Planning. In 2013, Michigan DOT released its Connected and Autonomous Vehicle Technology Strategic Plan, which lays out the design for aligning Michigan DOT's long-term transportation plans with recent advances in technology and policy regarding CAV. The plan is divided into six strategic areas of focus: (1) leadership, (2) safety, (3) customer service, (4) partnerships, (5) system linkages, and (6) efficiency. The 2018 MDOT CAV Program Strategic Plan is profiled in more detail in section 9.2 of the MDOT TSMO Implementation and Strategic Plan.

13. Appendix D: Accomplishments (2016-2019)

13.1. TSMO BUSINESS AREA ACCOMPLISHMENTS TO-DATE

Table 11 below shows the accomplishments made between 2016 (following the 2016 TSMO Planning Workshop) and 2019 across the action matrices of all 10 MDOT TSMO Business Areas (BA). The table both describes each accomplishment and connects it back to the specific action and sub-step that prescribed the accomplishment in the living action matrix for the given BA. After 2019, major program accomplishments have been recorded in the Executive Summary, given that many of these original actions were achieved or retired due to changing circumstances.

Table 11. TSMO Business Area Accomplishments To-Date

Accomplishments To-Date *Completed Actions from the 10 TSMO Business Areas (BA)*			
Business Area (BA)	**Completed Actions/Steps** *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	**Action/Step Description**	**MDOT Staff**
1. Work Zone Management	Action 1, Steps 1-3 (complete with ongoing activities) *(3 steps total in Action 1)*	The Work Zone unit is working to develop management buy-in and approval of the Maintenance of Traffic (MOT) and to establish a year-end review to better inform upper management on statewide work zone lessons learned (mobility/safety). Accomplishments to-date include: • Received approval for a standing invite to the MDOT Highway Operations Conference and for an annual meeting with the MDOT Region Bureau Management Team (RBMT). • Determined the appropriate personnel to sign off and approve final MOT method selection. • Ensured standing invites occur to Highway Ops and once a year meeting with RBMT.	Chris Brookes, Matt Chynoweth, Art Green, Kitty Rothwell

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
	Action 2, Step 1(complete), Step 2-3 (on hold), *(3 steps total in Action 2)*	The Work Zone unit is working to create a unified accessibility process to program Portable Changeable Message Signs (PCMS). Accomplishments to-date include: • Held discussions with industry partners. • Compiled a list of companies that provide PCMS. • Met to discuss requirements and information required from contractors (November 2018). • This Priority Action was tabled and other focus area were assessed via the added action items. This was a direct result of work zone fatalities and the creation of the Work Zone Safety Task Force (WZSTF) (2020 update).	Chris Brookes, John Jersey, Joe Brewer (DTMB)
	Action 3, Steps 1-3 (in progress) *(3 steps total in Action 3)*	The Work Zone unit is working to identify a regional work zone Subject Matter Expert (SME) to take ownership of each project. Accomplishments to-date include: • Identified the position as a Tech 12 level within the Region where 80 percent of the work tasks would be uniform and 20 would be specific to the region. • Developed a draft position description.	Chris Brookes, Tom Tellier, WZSTF Action team
	Action 4, Steps 1-3 (in progress) **> Revised and renamed as Action 5** *(3 steps total in Action 4)*	The Work Zone unit has revised and renamed the original Action 4 as Action 5. Under Action 5, the Work Zone unit is working to develop a statewide MOT boiler plate. Accomplishments to-date include: • Developed a first draft and circulated for comments (received over 1500 comments). • Developed a second draft to address comments.	Chris Brookes

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
		• Received feedback from industry. • Held an October 2018 meeting to address comments. • Tracked changes and updated Boiler Plate, updates occur at pre-determined frequencies (continuous improvement).	
	Action 5 Steps 1-3 (in progress) (3 steps total in Action 5)	The work zone unit is working to better understand and develop steps that might influence driver compliance in work zones by consistent enforcement of laws. Accomplishments to-date include: • Begin dialog with law enforcement	Kim Avery – WZSTF Action Team #1
	Action 6 Steps 1-3 (in progress) (3 steps total in Action 6)	The work zone unit is working to develop an improved balance between safety and mobility in work zones. Work on this action will begin in 2020.	Steve Brink WZSTF #2
	Action 7 Steps 1-3 (in progress) (3 steps total in Action 7)	The work zone unit is looking at ways that multi-faceted marketing approaches might help influence safety and mobility in work zones. Accomplishments to-date include: • Created social media approaches with “Work Zone Wednesdays” • Became a host state for the National Work Zone Awareness Week.	Lindsey Renner WZSTF #5

Accomplishments To-Date
Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
	Action 8 Steps 1-3 (in progress) (3 steps total in Action 8)	The Work Zone Unit working with spec and estimates and the ITS unit is focusing efforts on the proper and efficient use of new technology. Work will begin on this action in 2020.	Craig Innis WZSTF #007
2. Congestion (Recurring) Management	Action 1, Steps 1-5 (complete), Steps 6-10 (TBD) *(10 steps total in Action 1)* *Action 1 is no longer needed as Action 2 has been completed. Projects with operational issues are to be submitted through the Freeway and Non-Freeway template submittal process*	The Congestion (Recurring) Management unit is developing a proposed process for the MDOT scoping manual to require an analysis of existing congestion and mobility management for applicable projects. Accomplishments to-date include: • Established a scoping manual team responsible for Action • Reviewed the scoping manual. • Identified the types/stages of projects this process/analysis should apply to. • Identified the number of projects that could be affected. • Developed proposed guidance for incorporating this analysis into the scoping manual (in process).	Jason Firman, John Engle, Rosemary Edwards, Eric Mueller, Stephanie Palmer, Imad Gedaoun, Jason Ealy, Brad Sharlow
	Action 2, (complete) Updated in January 2021 the Freeway and Non-Freeway templates are combined into one	The Congestion (Recurring) Management unit is establishing two Call for Projects (CFPs), one for freeways and one for non-freeways, to give greater funding priority to quick and low-cost reliability and operations projects that address congestion management for key bottlenecks. Accomplishments to-date include:	Jason Firman, Denise Jones, Sponsors, CFP Approval Committee, Brad Sharlow, John Engle, Michelle O'Neill, Brad Sharlow, Craig Newell, Paul Arends

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
	Operations Template.	• Established a core group of representatives who will be responsible for Action 2. • Identified best practices from peer states. • Developed a CFP template request (submitted February 2017). • Established prioritization criteria for congestion management projects under these CFPs. • Submitted documents with the proposed Freeway and Non-Freeway Reliability and Operations CFPs to MDOT Sponsors for review and approval. • Trained staff on how to identify congestion projects and how to evaluate them. • Reviewed, and will revise as needed, CFP documents. • Combined the Freeway and Non-Freeway templates into on Operations Template. (2020)	Kim Zimmer, Dave Hoeh
	Action 3, Steps 1 and 2 (complete), Steps 3-5 (in progress)	The Congestion (Recurring) Management unit is evaluating/updating system needs for additional signal engineer positions. Accomplishments to-date include: • Evaluated changes with the recent move under ITS. • Assessed current performance of signalized arterials. • In process of prioritizing signals for proposed monitoring – working through summer of 2020.	Doug Adelman, Jason Firman, Scott Thayer, Mia Silver, Greg Brunner, Janine Cooper, Jason DeGrand, Suzette Peplinski, Stephanie Palmer, Nathan Bouvy, Joe McAttee
	Action 4 (in progress)	The Congestion (Recurring) Management unit is working to increase real-time, remote communications (fiber) with MDOT assets (signals). Accomplishments to-date include:	Jason Firman

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
		• Evaluated and submitted funds for Central Signal System to improve communication and performance reporting and to become more efficient. • Central Signal Software System has been approved, received funding, and will begin to integrate/install spring 2021 (first phase will incorporate about 400 signals).	
3. Modal Interaction and Integration	Action 1, Steps 1-3 (complete) *(3 steps total in Action 1)*	The Modal Interaction and Integration unit successfully worked to establish greater Operations participation in MDOT's Multi Modal Development and Delivery ("M2D2") initiative. Accomplishments to-date include: • This action has been accomplished. • Candidates who work in Operations at MDOT were identified, reviewed, and approved to serve on the M2D2 Implementation Team.	Jen Foley
	Action 2, Step 1 (in process) *(3 steps total in Action 2)*	The Modal Interaction and Integration unit is working to gain agreement on good multimodal performance measures. Accomplishments to-date include: • Identified team members to establish a group that will identify potential operations-related multimodal performance measures. • Team members meetings are being scheduled.	Will Thompson
	Action 3, Steps 1-3 (complete) *(3 steps total in Action 3)*	The Modal Interaction and Integration unit worked to pilot and evaluate the need for a regional multimodal specialist. Accomplishments to-date include: • This action has been completed.	Sharon Edgar

Accomplishments To-Date
Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
		• The Modal Interaction and Integration unit documented the role for the multimodal specialist and identified specific benefits that a dedicated position will have over the current strategy. • The recommendation currently was to not have a specialist in each region due to availability of resources. The team agreed to revisit this in FY 2020 to see if available resources can support the need.	
4. Transportation Operations Centers (TOCs) and Traveler Information Systems	Action 1, Steps 1-4 (complete) *(4 steps total in Action 1)*	The TOCs and Traveler Information Systems unit is working to better integrate Operations, Intelligent Transportation Systems (ITS), Signals, and Statewide TOC (STOC) work units. Accomplishments to-date include: • Defined what drives decisions for work units related to this BA (through informal surveys with work unit management). • Evaluated reporting structures for each TSMO-related work unit in light of the overarching goals of the MDOT TSMO program. • Developed a proposed high-level organizational structure to better align these functions; • Moved signals and the Statewide Transportation Operations Center (STOC) under ITS as of 9/24/18.	Hilary Owen, representatives from: Signals, ITS Program Office, Connected Vehicles, STOC, SEMTOC, WMTOC, TSC T&S, TSC Operations, and T&S / Safety Programs
	Action 2, Steps 1-4 This action item was essentially deleted as the tasks were completed under another Action Matrix	The TOCs and Traveler Information Systems unit is conducting a larger evaluation of processes for developing systems and software through DTMB. Accomplishments to-date include: • Two new DTMB positions assigned to ITS.	Andy Esch (as part of his Action Matrix), Hilary Owen, Erica Moore, John Kimble, Monica Coulter, John Jersey, TOC staff, ITS Program Office

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps (Using Action and Step #s from the BA Matrices, for internal MDOT reference)	Action/Step Description	MDOT Staff
	(4 steps total in Action 2)		
	Action 3, Steps 1-6 (complete) *(6 steps total in Action 3)*	The TOCs and Traveler Information Systems unit has worked to evaluate what TOCs and the public need from MiDrive, and what MiDrive should be going forward. Accomplishments to-date include: • This Action Item is complete. The new Mi Drive went live July 31, 2018.	Courtney Bates, Erica Moore, Elise Feldpausch, Nick Lorenzen, Hilary Owen,
	Action 4, Steps 1-3 (complete)	The TOCs and Traveler Information Systems established a goal of adapting capital program business processes to better suit TSMO/TOCs. Accomplishments to-date include: • Created list of all ongoing contracts and costs associated with traffic operations; identify current funding sources and mechanisms. • Developed/ updated process in project planning to require all capital projects to estimate and identify funding for ongoing operations prior to letting. • Established ongoing operations template that is separate from the capital template.	Hilary Owen, Mark Bott, Mark Geib, SEMTOC, WMTOC, STOC, ITS Program Office, Erica Moore

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
5. Safety	Action 1, Steps 1 and 3 (in progress), Step 2 (complete) *(3 steps total in Action 1)*	The Safety unit is working to initiate discussion on how best to include safety performance measures across all funding templates. Accomplishments to-date include: • Developed a matrix of all MDOT funding templates (with existing project selection criteria). • Identified best practices for how peer states include safety performance measures in funding/prioritization discussions and generated a report.	Garrett Dawe, Steve Shaughnessy
	Action 2, Steps 1 and 2 (complete), Step 3 (in progress) *(3 steps total in Action 2)*	The Safety unit is working to communicate the relationship between funding and safety performance outcomes to MDOT leadership as part of near-term target-setting. Accomplishments to-date include: • Expanded the proposed assessment of Michigan's Engineering Safety Program to include contacting peer states that have implemented TSMO and conduct interviews to determine, among other items: o If/how safety awareness amongst operations and maintenance staff has changed. o If/how selection of non-Safety projects is incorporating safety performance measures and/or requirements. • Researched the relationship between safety funding levels and traffic deaths per VMT in peer states. • Performed predictive analysis to determine how much funding levels need to increase in order to reach safety goals identified in latest SHSP.	Steve Shaughnessy

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
	Action 3, Step 1 (complete), Steps 2-3 (in progress) *(3 steps total in Action 3)*	The Safety unit is working to develop a safety objective to be included in performance evaluations. Accomplishments to-date include: • Presented the need to develop such an objective to the core team with general support. • Assembled a statewide team comprised of members from regional safety teams to develop draft safety performance objective(s) that is measurable and consistent with MDOT work rules and regulations.	Jim Gaus
6. Traffic Incident Management (TIM)	Action 1, Steps 1-3 (in progress) *(3 steps total in Action 1)*	The TIM unit is working to sustain the Mi-TIME training and outreach to staff and agencies. Accomplishments to-date include: • Designated MDOT champions in all seven MDOT regions to expand Mi-TIME training and outreach efforts in each region • Implemented Train-the-Trainer in February 2018 and added 50 new instructors (total number of instructors is now 196). • Rolled out Federal update of Mi-TIME training materials in February 2018 with refresher course for existing instructors; TIM Action Team goal to train 20% (6,500) of the first responder community by 12/31/18 was achieved 6/19/18; new goal is 50% (16,250) trained by 12/31/22 (8307 responders trained as of 12/13/20). • Mi-TIME Instructors received approval from State 911 Committee to provide CE credits to dispatchers attending 4-hour courses taught by pre-approved Mi-TIME instructors. • Estimated budget needs, supplies, and training materials; and continued to communicate with trainers on a regular basis.	Dawn Miller, Ron Tennant

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps (Using Action and Step #s from the BA Matrices, for internal MDOT reference)	Action/Step Description	MDOT Staff

		• Developing estimate for annual amount of Mi-TIME training materials required and annual cost
		• Arrange for Train the Trainer course in October 2021.
		  • March 2019: Mi-TIME instructors received updated training materials that reflected changes in Michigan's Move Over law.
		  • Bi-monthly communications during 2019 included: Mi-TIME instructors were invited to and informed of meetings and activities of TIM Action Team, notified of monthly Talking TIM webinars and the National Work Zone TIM training webinar, notified of the TIM Regional Conference.
		  • Group of responders receiving communications has grown from 116 in January 2019 to 285 in December 2019.
		• Regional TIM champions have been engaged to help coordinate and instruct Mi-TIME trainings statewide (December 2020).
		• Redesigned Mi-TIME responder training database to improve methods for: data entry, performance measurement and identifying future training targets. (January 2020).
		• Number of Mi-TIME instructors with pre-approval from the State 911 Committee to provide CE credits to dispatchers increased from 15 in 2019 to 31. (March 2020)
		• A TIM-related presentation submitted by the TIM Action Team was selected as a general session for the annual Traffic Safety Summit held in March 2020. Sgt. Robert Bemis (retired Pennsylvania State Trooper) was selected to speak about his experience being struck by a car in the line of duty. The crash which was also a secondary crash caused Sgt. Bemis permanent injuries.	

Accomplishments To-Date
Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
		• March 2020: Developed improved system to track instructor activity and identify inactive instructors	
	Action 2, Steps 1-3 (complete with ongoing work to maintain) *(3 steps total in Action 2)*	The TIM unit identified senior level TIM champions at MDOT. Accomplishments to-date include: • Identified the following senior level, influential candidates at MDOT who have agreed to champion TIM: o Gregg Brunner, Bureau of Field Services Director o Aaron Johnson, Superior Region Engineer, o Erick Kind, Grand Region Engineer, o Tom Tellier, Grand Associate Region Engineer, o Kim Zimmer, Bay Associate Region Engineer, o Colin Forbes, Metro Deputy Region Engineer, and o Janine Cooper, Southwest Associate Region Engineer. • In addition, Aaron Johnson and Gregg Brunner are Mi-TIME instructors; they have instructed 20 hours, and 56 hours, respectively, of Mi-TIME training.	Dawn Miller, Ron Tennant (TIM Action Team Co-Chair Grand Rapids FD)
	Action 3, Steps 1 and 2 (complete with ongoing work to maintain), Step 3 (in progress) *(3 steps total in Action 3)*	The TIM unit is working to promote the benefits of TIM/establish a stable funding stream for a sustainable TIM program. Accomplishment to-date include: • Completed research project with list of benefits for TIM (research results will be used along with TIM Action Plan accomplishments to prepare a summary of key Mi-TIME/TIM benefits).	Dawn Miller

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
	Action 4, Step 1 (complete with ongoing work to maintain) *(3 steps total in Action 4)*	The TIM unit is working to leverage existing data and prioritize the tactical use of this information. Accomplishments to-date include: • Completed site visits and TIM data assessment for EDC4 ("Every Day Counts") Innovation: Using Data to Improve TIM. • Completed comprehensive list of current TIM data collected by MDOT. • Identified possible sources to obtain more streamlined TIM data. • Determined priority TIM data and TIM focus areas for data (i.e. timestamps, secondary crashes, mobility impacts, etc.). • Began the evaluation of ATMS bug/enhancement list for priority items for TIM data. • ATMS has been upgraded and enhancements added to record TIM data more effectively. TIM Unit progressing to develop reports from ATMS data that will provide more meaningful lane closure data to align with responder training data. (May 2020)	Dawn Miller, Mark Burrows
7. Connected and Automated Vehicle (CAV) Systems	Action 1, Steps 1-3 (complete) *(3 steps total in Action 1)*	The CAV Systems unit is working to determine an internal "who's who" in automated vehicles (AV) and connected vehicles (CV) across MDOT (one for AV, one for CV) to facilitate collaboration; and to conduct outreach across MDOT to spread awareness of MDOT CAV activities and contacts. This includes developing an CAV "elevator speech" (Step 1), identifying CAV contacts/ambassadors across the entire agency (Step 2), and documenting a plan of outreach for each work area for use by the ambassadors (Step 3).	Elise Feldpausch

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
		Accomplishments to-date include: • Developed an outreach presentation and circulated it to all of the Metro Region Transportation Service Centers (TSCs) and Region Offices to give the presentation and to answer questions. • Provided an overview at the MDOT Operations Conference and are continuing to share updates in various ways (Metro Region Newsletter, creating infographics, etc.). • Applied outreach and information sharing material from Planet M for use in Action 1 Step 1. • Established CAV contacts/ambassadors in each of the MDOT regions (same as ITS), in addition to a number of Subject Matter Experts. • Applied MDOT CAV Program Strategic goals and strategies for outreach, for use in Action 1 Step 3.	
	Action 2, Steps 1-3 (complete). (3 steps total in Action 2)	The CAV Systems unit is pursuing a directive to integrate signals, ITS, and CAV for operability. Accomplishments to-date include: • A directive relating to CAV was issued by Executive Management. Groundwork has been laid to integrate ITS and Signals business practices and objectives in common areas (noting that CAV is a subset of ITS.) • A directive for Road-Side Unit (RSU) deployment at signalized intersections has been advanced. • Convened a working group with CAV, Signals, ITS, and Maintenance to determine action items, priorities, goals • Implemented strategies where work areas interoperate and work collectively.	Elise Feldpausch

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
	Action 3, Step 1 (complete), Steps 2-3 (in progress) *(3 steps total in Action 3)*	The CAV Systems unit is working to identify and evaluate CAV's potential to interact with and impact all systems within MDOT—for improvement in data sharing, integration, and ultimately improved mobility. Accomplishments to-date include: • Obtained direction from MDOT management to have each work area work openly with the CAV group to share data, information, and interoperability. • Coordinated with the TSMO Data Working Group to identify relevant systems and data elements and the opportunity for CAV data inclusion and use. • Systems within MDOT that will interface with CV have been identified however a traceability matrix has not been developed and will be developed in the future.	Elise Feldpausch
8. Road Weather Management	Action 1, Steps 1 and 2 (complete), Step 3 (in progress) *(3 steps total in Action 1)*	Action 1—Weather Data: The Road Weather Management unit is working to re-evaluate weather data/system needs and accessibility with internal and external partners; and to incorporate this into ConOps (Concept of Operations). Accomplishments to-date include: • Solicited input from local agencies, facilitated by the ITS Program Office. • Completed the Road Weather Information System (RWIS) Strategic Plan as a secondary re-evaluation of weather data/system needs. • Working to Increase field usage of data and benefits experienced (i.e. more agencies using data).	Elise Feldpausch

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
	Action 2, Steps 1-3 (complete) *(3 steps total in Action 2)*	Action 2—Maintenance Advisories: The Road Weather Management unit is working to continuously update policies to match evolving practices. Accomplishments to-date include: • Gathered input from stakeholders to prepare an annual summary of key evolving practices that MDOT can consider formalizing. • Established a process to review priority practices (in process). • Gained buy-in and consensus on recommended MDOT policy updates (in process). • Established and continued a process for communicating changes to maintenance staff (in process). • Developed a dynamic process for maintaining policy documents (in process).	Melissa Longworth
	Action 3, Steps 1-3 (complete) *(3 steps total in Action 3)*	Action 3—TOCs: The Road Weather Management unit is working to improve two-way communications between the TOCs and internal and external field staff about weather events. Accomplishments to-date include: • Gathered input from stakeholders and summarized key gaps in communications processes about and during weather events (in process). • Updated tools and SOPs to improve two-way communications, notifications, alerts, etc. during weather events. • Completed tabletop exercise of new SOPs; refine SOPs; integrate SOPs into practice	Suzette Peplinski

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
9. Data Collection, Storage, Utilization, Analytics, and Decision Support Systems	Action 1, Step 1 (complete), Steps 2-3 (in progress) *(3 steps total in Action 1)*	The Data unit is working to document TSMO systems, processes and data. Accomplishments to-date include: • Evaluated the 2013 MDOT ITS Investment Plan for update opportunities with a TSMO perspective. • Conducted evaluation of previous ITS strategic and investment plans for opportunities with a TSMO perspective as part of the MDOT 2018 ITS Strategic Plan process. • MDOT released the revised 2018 ITS Strategic Plan (last version was developed in 2008).	Joe Gorman, Mike Wroblewski, Collin Castle
	Action 2, Steps 1 and 2 (complete), Steps 3-4 (in progress) *(4 steps total in Action 2)*	The Data unit is working to establish a TSMO data group to meet regularly and serve as subgroup to Data Governance Council. Accomplishments to-date include: • Identified and met with leads in various MDOT bureaus/divisions that should engage in advancing TSMO and established the TSMO data group. • Established TSMO data group as a sub-group of the Data Governance Council (DGC).	Mike Wroblewski, Collin Castle,
	Action 3, Steps 1 and 2 (complete)	The Data unit is working to develop continual processes to keep the operations automation manager in communication with TSMO data group and data governance group. Accomplishments to-date include: • Coordinated with the TSMO Data Working Group to identify relevant systems, data elements and the opportunity for CAV data inclusion/use. • Identified the potential systems within MDOT that CAV would interact with.	Mike Wroblewski, Collin Castle, Justin Droste, Joe Gorman

Accomplishments To-Date
Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
		• Within the Data Use Analysis and Processing (DUAP) project existing and future potential application developments have been identified.	
10. Field Equipment Asset & Functionality Management	Action 1, Steps 1-4 (complete) Steps 5-8 *(in progress)* *8 steps total in Action 1*	The Field Equipment unit is working to coordinate the ITS planning process with the signals planning process (parts of this action are part of the larger TSMO Funding Integration Commonality Area). Accomplishments to-date include: • Advanced the coordination of ITS and signals planning processes through the work of the TSMO Funding Integration Commonality Area and the 2017 MDOT TSMO Funding Integration workshop. • Established a Traffic Signals Template. • Determined need to acquire a central system software for signals operations and a contract is underway to develop requirements and an RFP for procurement. • Established via Lean Process Improvement (LPI) the need for as-needed construction contract with statewide coverage. • Determined the best process for Asset Management Database for ITS and Signals	, Steve Cook, Denise Jones, Mark Bott, Collin Castle, Todd Kauffman, Dennis Kent, Hilary Owen, Erik Smalley, Jeff Reid, Craig Newell, Edward Fowler, Jason Firman, Joe Gorman, Elise Feldpausch, Greg Brunner, John Adrian
	Action 2, Steps 1-3 *(moved to commonality area Communications)*	The Field Equipment unit is working to conduct outreach on the benefits of ITS and signals. This action is part of the larger Outreach and Business Cases Commonality Area	Elise Feldpausch, Jesse Ball

Accomplishments To-Date

Completed Actions from the 10 TSMO Business Areas (BA)

Business Area (BA)	Completed Actions/Steps *(Using Action and Step #s from the BA Matrices, for internal MDOT reference)*	Action/Step Description	MDOT Staff
	3 steps total in Action 2	Accomplishments to-date include: • Published five business cases on the benefits of TSMO applications—including ITS and signals—in February 2018. • Moved action objects to the commonality area associated with communication and outreach.	
	Action 3, Steps 1-3 (complete in association with functionality optimization commonality area) *3 steps total in Action 3*	The Field Equipment unit helped advance reorganization to optimize interoperability between subject areas under the TSMO umbrella. This action was part of the larger TSMO Functional Integration Commonality Area. Accomplishments to-date include: • The proposed, integrated TSMO organization structure finalized and implemented as part of the TSMO Functional Integration Commonality Area's efforts.	Hilary Owen, Steve Cook, Elise Feldpausch

13.2. TSMO COMMONALITY AREA ACCOMPLISHMENTS (2016-2019)

Table 12 below shows the accomplishments made between 2016 (following the 2016 TSMO Planning Workshop) and 2019 across the five MDOT TSMO Commonality Areas (CA). The CAs represent areas in which there were related actions across the 10 BA actions matrices. Therefore, instead of connecting these accomplishments to specific actions and sub-steps in the action matrices, the table documents accomplishments in supporting and advancing work in these common areas. After 2019, major program accomplishments have been recorded in the Executive Summary, given that many of these original actions were achieved or retired due to changing circumstances.

Table 12. TSMO Commonality Area Accomplishments To-Date.

Accomplishments To-Date *Completed Actions from the 5 TSMO Commonality Areas (CA)*		
Commonality Area (CA)	**Action Description**	**MDOT Staff**

1. Improve IT Processes and MDOT-DTMB Collaboration	Accomplishments to-date include:
	Developed an on-going matrix to track and maintain actions, defining 3 actions:
	• Action 1: Establish and develop DTMB ITS support team
	  o Hired and assigned an Automation Manager to fully support TSMO activities.
	  o Gained executive approval and funding to build DTMB ITS technical support team.
	  o Hired and assigned Cyber Specialist and Project Manager.
	  o Implemented Lean Process Improvement (LPI) for the SafeStat replacement project.
	• Action 2: Pilot potential changes to ITS-DTMB collaborations such as: 1) letting ITS work (Centralized Signal Control System CSCS) through DTMB contracting process, and 2) putting ITS endpoint devices in the SOM Verizon VPN cloud. <On-going work>
	• Action 3: Integrate ITS IT with the DTMB/MDOT Call for Projects process.
		Spike Fuehr, John Jersey, Andy Esch, Collin Castle

Accomplishments To-Date

Completed Actions from the 5 TSMO Commonality Areas (CA)

Commonality Area (CA)	Action Description	MDOT Staff
	o Established a preapproved DTMB template for the networking of Internet of Thing (IoT) devices.	
2. Data	*See accomplishments under the Data Business Area (BA) in Table 11.*	Mike Wroblewski
3. TSMO Functional Integration	• Proposed high-level organizational structure for TSMO-related units at MDOT as part of the recommendations for the TSMO Functional Integration CA and for the TOCs and Traveler Information Systems BA. o Approved and implemented organizational changes from this proposal in early Fall 2018. • Drafted new signal specification drafted to ensure new signal installations are CAV ready. • SafeStat LPI documented process challenges and established path forward for an effective integrated traffic signal program. • Created Draft Operations Steering Committee Guidance Document. • Established TSMO template, including: Non-freeway Operations, Freeway Reliability, Safety, Signals, ITS, and ITS set-aside.	Hilary Owen

Accomplishments To-Date

Completed Actions from the 5 TSMO Commonality Areas (CA)

Commonality Area (CA)	Action Description	MDOT Staff
4. TSMO Funding Integration	• Held a 1-day MDOT CMAQ/Operations Funding Integration Work Session on September 20th, 2017 to collaboratively identify ways to better align the 5 TSMO-relevant funding templates under shared TSMO safety, mobility, and reliability goals. • Developed a proposal for a Trunkline Program Operations Template. This template is intended to provide funding for an integrated program to optimize the performance of existing multimodal infrastructure by implementing systems, services and projects to maximize capacity and/or improve the security, safety and reliability of the transportation system. The proposal outlines proposed funding sources, examples of eligible work activities, Operations Template funding and program categories, a recommended Operations Template manager, Region TSMO champions, program categories, and a transition plan. The proposal is undergoing review by MDOT senior leaders. o The Trunkline Operations Template was introduced September 4, 2018. o Submittal and approval of the FY 2019 Operations Program Templates will occur Fall 2018 through February 2019. o Submittal and approval of the FY 2020 and 2021 Operations Program Templates will occur October 2018/March 2019 through June 2019. • Created an Operations Steering Committee (Guidance Document), with implementation to take place in 2019.	Jason Firman, Steve Cook, Denise Jones, Mark Bott, Collin Castle, Todd Kauffman, Dennis Kent, Hilary Owen, Erik Smalley, Jeff Reid, Craig Newell, Edward Fowler
5. Outreach and Business Case	• Published 5 TSMO business cases, tailored to 5 key audiences (the general public, legislators, transportation partners, MDOT upper management, and MDOT technical staff). All business cases are currently available on the MDOT website at www.michigan.gov/tsmo. This website also includes a link to version 3 of the MDOT TSMO Implementation and Strategic Plan, for public viewing. Further, in the Appendix, this plan contains links to Federal and peer state TSMO resources.	Steve Cook, Elise Feldpausch

14. Appendix E: Summary of the 2018 TSMO Plan Maintenance Workshop

WORKSHOP OVERVIEW

In February 2018, MDOT published its MDOT Transportation Systems Management and Operations (TSMO) Implementation and Strategic Plan as well as five TSMO business cases tailored to key, Michigan stakeholders (all documents available at: www.michigan.gov/tsmo). These documents are supported by a series of living, internal action matrices that identify and track priority actions across MDOT's 10 primary TSMO Business Areas (BAs) and 5 Commonality Areas (CAs). The TSMO Plan, business cases, and matrices were all the result of considerable collaboration across the agency during and after a 3-day Workshop in 2016 that focused on the TSMO Plan's strategic direction and priority actions as well as a 1-day Work Session in 2017 that focused on breaking down silos for TSMO funding at MDOT.

Given this strong foundation and substantial momentum, the October 2, 2018 "TSMO Plan Maintenance Workshop" aimed to re-engage the MDOT stakeholders who helped institutionalize MDOT's TSMO program in order to (1) discuss challenges and identify near-term priorities for sustaining momentum, (2) update the BA/CA action matrices and TSMO Plan as needed, and (3) come together to discuss advances in the rapidly evolving TSMO field as a means of continuing education. The workshop facilitated such peer exchange, plan maintenance, and education following the agenda shown below.

MORNING SESSIONS

MDOT TSMO Progress To-Date: An overview of MDOT's TSMO efforts and accomplishments to-date.

MDOT TSMO BA and CA Progress Updates: A series of short presentations on the progress of each of the 10 TSMO BAs and 5 TSMO CAs. BA/CA presenters highlighted: accomplishments to-date, challenges, and priorities for the near term (up to 18 months from October 2018).

AFTERNOON SESSIONS

National TSMO Updates: A plenary session on new TSMO research and advancements at the national level as well as the evolution of select peer state TSMO programs.

2018 MDOT Capability Maturity Model (CMM) Reassessment: An interactive session where participants discussed and assessed MDOT's 2018 levels of capability/maturity

(levels 1-4) across the six CMM dimensions, as compared to the levels assessed by the MDOT CMM Workshop in 2013.

Breakout Working Sessions on BA and CA Matrices: Participants divided into small breakout groups for working sessions on the BA and CA action matrices (one action matrix per group) based on their involvement to-date in these areas and relevancy to their roles. Each breakout group discussed near-term priorities and challenges for the actions identified their group's matrix as well as any modifications that should be made to improve, realign, refocus, etc. the action matrix.

MEMO OVERVIEW

Given the nature of the two morning sessions and the first afternoon session ("National TSMO Update") as primarily presentations of which the workshop team has full documentation in the workshop presentation slides, this memo focuses on the last two afternoon sessions—the 2018 MDOT CMM Reassessment and the Breakout Working Sessions on BA and CA Action Matrices. This memo provides summary notes and significant insights from these last two sessions for use in MDOT's TSMO efforts moving forward. Following the memo, the full presentation slides from the three earlier sessions not covered in this memo are included as summaries of these session. In addition, the presentation slides from the CMM Reassessment session are also included to provide additional insights into the CMM process.

MDOT 2018 CMM REASSESSMENT

MDOT conducted a statewide, FHWA-sponsored CMM Assessment Workshop in 2013. MDOT's self-assessed 2013 capability scores are shown in Table 13 below. This 2013 workshop was held at the onset on MDOT's concerted TSMO program planning efforts, but shows the relatively high level of TSMO maturity occurring throughout several offices, programs, and projects that MDOT had going into its TSMO program planning efforts.

2013 MDOT CMM				
Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimizing
Business Processes		2+		
Systems and Technology		Arterials: 2+	Freeways: 3	
Performance Measurement		Remainder: 2	I-94: 3+	
Culture		2		
Organization and Staffing		2+		
Collaboration		2+		

Table 13. MDOT 2013 CMM Results.

Given MDOT's significant progress over the past five years, the 2018 TSMO Plan Maintenance Workshop included an expedited "lightening round" CMM Reassessment to allow TSMO staff to briefly revisit and reconsider their strengths, weaknesses, and capability levels across the six CMM dimensions. A standard CMM workshop is a full-day event while the lightening round CMM was conducted over the course of just one hour and considered only the "criteria" of each dimensions maturity level. The lightening round built on the morning sessions' presentations of MDOT's TSMO state-of-the-practice as an alternative for the longer conversations of strengths, weaknesses, accomplishments, and challenges that are part of the standard CMM. The results of the 2018 MDOT CMM lightening round reassessment exercise are shown below in Table 14. It should be noted that the relative stability of scores between 2013 and 2018 does not indicate that MDOT has not advanced significantly, because the presentations of progress in each MDOT BA and CA demonstrate notable progress and achievements across a range of TSMO activities and aspects. Rather, scores staying the same—or even going down—in agencies that have invested considerable time and energy in advancing TSMO is a trend that has been seen across the country in FHWA CMM **re**assessments. These agencies generally attest to the fact that they simply "didn't know what they didn't know" or didn't understand the full scope of TSMO needs and potential benefits to their agency at the time of their initial CMM assessment. Given the expedited nature of the "lightening round" the scores for 2013 to 2018 should not be considered as apples to apples comparisons. Taken in full, MDOT is another good example of this trend, and participants at the 2018 workshop expressed sentiments that they now better understand and appreciate the work needed to optimize the reliability, mobility, and safety of Michigan's transportation systems.

2018 MDOT CMM				
Dimensions	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimizing
Business Processes		2.75		
Systems and Technology		2.3		
Performance Measurement		2.1		
Culture		2.2		
Organization and Staffing		2		
Collaboration		2.1		

Table 14. MDOT 2018 CMM Results.

BREAKOUT WORKING SESSIONS ON BA AND CA ACTION MATRICES

Following the CMM lightening round reassessment, participants divided into small breakout groups for working sessions on the individual BA and CA action matrices that have been in development since September 2016. In these working sessions, participants were encouraged to discuss any needed modifications to the actions laid out in these matrices, such as: revisions to implementation details (MDOT leads, resources, timelines, performance measures, etc.), improved approaches to accomplishing actions, and any actions that needed to be added or deleted based on progress to-date. Notes on each working session's report out to the whole group are shown below.

Modal Interaction and Integration BA

- Decided on two performance measures – personal delay (delay experienced by an individual regardless of the mode) and quality of service. Not going to precisely define these measures though, since they expect they will be constantly changing. Will let the regions define over time.
- Want to do different levels of analysis for the multimodal performance measures. They are going to meet soon to discuss.

Congestion (Recurring) Management BA

- Planning to hold a meeting in February 2019, before the next CFP, to discuss the group's first experience, lessons learned, etc. with the CFP. Specifically, they plan to look at lessons learned from the projects submitted.
- Considering combining action 3 (staffing levels) and action 4 (increasing communications), since they are pretty interrelated.

Data BA/CA (Data BA and CA discussions were presented together)

- Don't have anything in the current action matrix related to data collection and storage. These are key to the rest of the data efforts, will be addressed moving forward.
- Updated team members.

Work Zones BA

- Maintenance of Traffic (MOT) – measures to associated engineers.
- SME – Trying to put together what is currently taking place in terms of how each region is set-up right now.
- Boiler plate – How to make sure current efforts stay relevant, how to come up with a process to track the changes that are taking place.

Road Weather BA

- Confirmed that they are moving in the right direction, no major changes to the action matrix.
- Defined some near-term communications priorities.

Safety BA

- Determined that the steps to complete each action in general are appropriate, and that the timelines are appropriate.
- Action 3 – Added another step to the beginning: Develop a sub-team comprised of regional representation. May not make sense for every part of the agency, but want to have a more diverse team.

Traffic Incident Management (TIM) BA

- Added steps on how to move forward after identifying TIM champions – want to create a network of these champions that would meet to convene next steps.
- Want to expand beyond trainers to other responders.

Funding Integration CA

- Now need to focus on funding for operations and maintenance, building in more flexibility. How are we going to pay for what we've built already? Focus on O&M future year expenses.

IT/Michigan Department of Technology, Management, and Budget (DTMB) CA

- Changed the lead on all actions and steps, and will revise deadlines, mostly to be completed within the next year.
- Going to reword the steps to make them more detailed and more actionable. The Signals Management System will be a pilot for some steps.

Connected and Automated Vehicles (CAV) BA

- Education and communications initiative have gathered good momentum, now turning to CAV technology assessment and implementation. This is not well defined within the current matrix, but will be important.
- SME for implementing.
- Updated team members.

Field Equipment Asset and Functionality Management BA

- How can we best administer the maintenance of signals?
- How can we determine the optimal number of FTEs required to maintain signals?

Transportation Operations Centers (TOCs) BA

- Much of the organizational TSMO structure has been worked out, but need to figure out the TOC reporting issues and systems/software.
- Will coordinate with IT/DTMB CA on some common actions – likely that CA is taking the TOCs BA's steps further than defined in the TOC matrix.
- Updated team members.
- Establishing operations costs for projects in project selection phase.

Function Integration CA

- Central office TSMO organizational structure completed, but originally the task also covered diving into the TSCs and regions. So far this hasn't been tackled by the BA, and this may not be the best avenue, but the CA will discuss and consider this further.

Outreach and Business Cases CA

- MDOT's five TSMO business cases have been completed and published, need to continue progress and momentum going forward. Promote the business case as an outreach and communications tool for TSMO.

15. Appendix F: Ongoing Road Weather Management (RWM) Efforts

In support of the MDOT TSMO Implementation and Strategic Planning

Summer 2019
Summary "TSMO365" RWM Peer Exchange Outputs for Michigan

Peer Exchange Overview

MDOT partnered with the AASHTO Committee of Transportation System Operations (CTSO) Community of Practice on Road Weather Management (CoP on RWM), the National Operations Center of Excellence (NOCoE), and FHWA to lead a TSMO-focused RWM Peer Exchange from June 25th to 26th 2019 in Salt Lake City, Utah. The overall theme for the Peer Exchange was building a strong Transportation Systems Management and Operations (TSMO) foundation for weather responsive management strategies and solutions. By delving into RWM within the greater context of TSMO, the Peer Exchange sought to promote an awareness of how RWM, like TSMO, is something that needs to be considered in all aspects of the transportation system, every day of the year, rain or shine. This led to the coining of the term "**TSMO365**" to capture this emerging mindset on RWM and operations.

The Peer Exchange focused on four topics within RWM that a AASHTO CTSO CoP on RWM survey identified as priority areas (listed below). The Peer Exchange, however, worked with the understanding that there are many other RWM topics beyond these areas that are also critical.

1. **IMO**: Integrating Mobile Observations about road weather for decision-making
2. **VSL**: Variable Speed Limits driven by road weather
3. **Real-Time Warnings**: Active real-time motorist warning systems for road weather hazards (road ice, wind, visibility, flooding, etc.)
4. **Predictive Traffic Models**: Predictive traffic condition models integrating road weather forecasts

Workshop Activities

During the Peer Exchange, participants from state and regional agencies across the country collaboratively discussed ways to better integrate the above four RWM topics across the spectrum of TSMO activities advanced by the AASHTO CTSO. Participants also worked to identify priority actions for advancing these four RWM topics across the six dimensions of the Capability Maturity Model (CMM). The result was a series of potential actions for improving these four priority RWM topics that reflects a wide range of agency experiences and perspectives.

At the Exchange, presentations were made on the national state of the practice. Presentations included:

- Weather Responsive Management Strategies and Solutions
    - Steve Cook, Michigan DOT

- Snow and Ice Cooperative Program (SICoP) Winter Maintenance/ Technical Service Program
    - Steve Cook, Michigan DOT
- Utah DOT Weather Program Traffic Operations Center
    - Jeff Williams, Utah DOT
- FHWA Road Weather Program and TSMO365
    - Roemer Alfelor, FHWA Office of Operations
- Integrating Mobile Observations about Road Weather Conditions for Decision-Making
    - Rod Schilling, Nevada DOT
- Road Weather Management Strategies
    - Joe Huneke, MnDOT
- Active Traffic & Safety Management System for Interstate 77 in Virginia
    - Mike McPherson, VDOT
- Weather Responsive Variable Speed Limit Systems in Oregon
    - Galen McGill, Oregon DOT
- Road Hazard Motorist Warning Systems
    - Nicolaas P. Swart, P.E., Maricopa County Department of Transportation
- TDOT Low Visibility Warning System
    - Said El Said, Tennessee DOT
- Integrated Modeling for Road Condition Prediction (IMRCP)
    - Nancy Powell, KC Scout
- Integrating Traffic and Weather Prediction Models on I-80 Corridor
    - Vince Garcia, Wyoming DOT

Tabletop exercises of small teams allowed MDOT staff to discuss each of the four RWM topics with their peers. Within each exercise, teams developed matrixes to define actions to advance the state of the practice. The larger group then came back together to discuss the findings of each team. This exchange of ideas helped bring a large set of actions into focus through facilitated discussions.

Implications for MDOT

MDOT is a national leader in RWM as well as in TSMO, so it was natural for MDOT to play a leading role in this Peer Exchange. However, MDOT also gained important insights and information as a participant in this Peer Exchange. RWM is one of the 10 original TSMO Business Areas in the MDOT TSMO Implementation and Strategic Plan – and it plays a core role in MDOT's TSMO program and in the safety, reliability, and mobility of Michigan's transportation system. The latest version of the action matrix for the RWM Business Area details three priority actions that MDOT is actively working on as part of its TSMO advancement efforts. These three priority actions are:

1. **Re-evaluate weather data/system needs** and accessibility with internal and external partners; incorporate into ConOps (statewide ConOps per priority action items).
2. Continuously **update policies** to match evolving practices (such as 25 MPH salting and wings in live lanes of traffic).

3. **Improve two-way communications** between the TOCs and internal and external field staff about weather events.

To advance these priority actions, MDOT gained the following insights and information from the RWM Peer Exchange:

- In support of Actions 1 and 3: There is a need to illustrate benefits of Integrating Mobile Observations (IMO) through case studies and best practices analysis. MDOT can help advance the practice by documenting experiences with IMO in Michigan.
- In support of Action 2: Discussions with peer agencies brought forward the need for de facto data standards on fixed and mobile environmental sensor stations (ESS). MDOT will need to stay tuned into the national conversation as these de facto standards take shape.
- In support of Action 1: Use of variable speed limit (VSL) strategies and real-time warning (RTW) systems for weather applications are still advancing nationally. There is a need for additional research (at the national level) on the benefits as well as systems engineering processes to advance VSL and RTW for road weather. MDOT should continue to monitor the national conversation.
- In support of Action 2: Discussions with peer agencies made clear that the success of VSL implementation can be dependent on the regulatory and enforcement authority of DOTs and their partners. MDOT may benefit from a brief, internal review of VSL regulations to shape future planning with this option for addressing road weather issues.

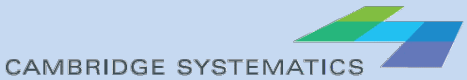
In addition to these insights, MDOT gained significant value in deepening and building the following connections and partnerships:

- Understanding and communicating predictive traffic models (PTM) for advancing road weather through learning about the current state of the practice and pilot projects. Presentations from KC Scout (Kansas DOT and Missouri DOT) and from Wyoming DOT presented research programs they are involved with in modeling impacts of weather in operating the system.

Summary

The peer exchange occurred prior to a number of national AASHTO meetings and events. The actions identified will help form the agendas of various committees in moving forward. In addition agencies such as NOCoE and FHWA were able to gather information on the needs and gaps in the industry to assist as they develop future programs.


TSMO
TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS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