DEPARTMENT OF TRANSPORTATION

MnDOT Transportation Systems Management and Operations (TSMO) Business Plan

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1.0 Introduction

This document represents one of three planning documents that comprise the Minnesota Department of Transportation (MnDOT) Transportation System Management and Operations (TSMO) Plan. As illustrated in Figure 1, the MnDOT TSMO Strategic Plan defines overall direction of the program and the MnDOT TSMO Implementation Plan provides a prioritized list of detailed TSMO strategies for implementing operational improvements. This Business Plan addresses the organizational structure and business processes needed to successfully deliver TSMO strategies in Minnesota. The Business Plan articulates how the MnDOT TSMO Program operates, identifies resources and workforce needs, and outlines business processes for implementing TSMO activities.

Figure 1: MnDOT TSMO Program Plan

TSMO strategies as defined by FHWA MAP-21 optimize the performance of existing infrastructure through the integrated implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system. Examples of TSMO strategies include traffic incident management, traffic signal coordination, transit signal priority, freight management, work zone management, special event management, road weather management, managed lanes, and ridesharing programs.

Examples of TSMO Strategies:

- Traffic incident management
- Traffic signal coordination
- Transit signal priority
- Freight management
- Work zone management
- Special event management
- Road weather management
- Managed lanes
- Ridesharing programs

2.0 TSMO in Minnesota

As described in the MnDOT TSMO Strategic Plan, TSMO is not new to MnDOT nor does it apply to only certain regions of the state. TSMO is a statewide program delivered by all districts and has enjoyed a long history of successful application within MnDOT, imparting significant benefits to its customers. While the overall structure of the three planning documents to describe MnDOT's TSMO activities is new and less familiar to stakeholders, the concepts and strategies are not. TSMO complements MnDOT's ongoing commitment to the state's transportation infrastructure and maximizes the return on investment by operating and managing the system as efficiently and effectively as possible. TSMO includes a host of operational strategies, system management approaches, and specific technical or business processes that:

- Optimize system performance
- Improve safety
- Anticipate and manage traffic congestion and impacts to system reliability

MnDOT has supported, deployed, and operated a variety of strategies for many years that are considered to be components of TSMO. Incident management, road weather management, ramp metering, bus on shoulder operations, traffic signal timing and coordination, and the Freeway Incident Response Safety Team (FIRST) are all longstanding examples of TSMO strategies in Minnesota. MnDOT's extensive experiences with TSMO strategies provides a strong foundation to further improve existing practices and readily expand into new strategy areas as outlined in the MnDOT TSMO Implementation Plan. Through implementation planning, MnDOT has become deliberate in assessing and selecting TSMO strategies considering the appropriate and cost-effective strategies to address goals and objectives.

From a program delivery perspective, TSMO-related activities are currently carried out in various functional offices and districts throughout MnDOT. MnDOT recognizes a need to develop a mature and robust TSMO program through more formal approaches to deployment, organization, staffing, and collaboration. These institutional improvements will drive proactive and efficient transportation operations and management, while fostering a culture that understands and supports TSMO at all levels of the organization.

3.0 Overview of Business Plan

The MnDOT TSMO Business Plan provides detailed recommendations for implementing institutional improvements to support TSMO as a core function within MnDOT. It outlines programmatic objectives and recommends actions to develop an agency structure that aligns day-to-day activities, staff, and resources to advance MnDOT's TSMO activities. This Business Plan provides the institutional "backbone" needed to achieve goals and objectives as outlined in the MnDOT TSMO Strategic Plan and to implement the tactical-level strategies defined in the MnDOT TSMO Implementation Plan.

MnDOT TSMO Goals

- Improve Reliability, Mobility, and Efficiency
- Increase Safety
- Carefully and Responsibly Manage Transportation Operations Assets

Several programmatic objectives guided the development of recommendations for this Business Plan. While strategic objectives are oriented toward the transportation system or customer, programmatic objectives are internal to the organization and oriented toward effectively delivering a TSMO program. Figure 2 shows the inter-relationships between the MnDOT TSMO Strategic Plan, Implementation Plan, and Business Plan.

Figure 2: Illustration of Inter-relationships of the Business, Implementation, and Strategic Plans

3.1 MnDOT's TSMO Programmatic Objectives

MnDOT's TSMO programmatic objectives were derived using previously developed materials including documentation from a MnDOT Capability Maturity Model workshop conducted in 2015; the FY18-19 Electrical Services Section/TSMO Business Plan; and the strategic objectives as defined in the MnDOT TSMO Strategic Plan. Table 1 shows MnDOT's TSMO programmatic objectives.

Table 1: MnDOT TSMO Programmatic Objectives

Business Planning Area	Programmatic Objectives
Business Processes	1. Ensure performance measures and practices are in place to manage and improve TSMO strategies without being burdensome. 2. Define and apply a TSMO implementation planning process that encourages grassroots identification of strategies that are proactive (ready to implement when the need arises), cost-effective, and consistent across the state where warranted, and that include identification of those who are responsible and accountable for their implementation. 3. Align applicable administrative, financial, and project delivery processes and policies to institutionalize the consideration and development of TSMO strategies.
Communication and Collaboration	4. Develop and maintain the necessary collaborative relationships and forums across divisions, offices, districts, and with external partners that support the TSMO program and effective operational strategies.
Resources	5. Identify, obtain, and manage the data needed to effectively perform TSMO strategies, manage operational performance, identify TSMO future needs, and effectively maintain TSMO assets. 6. Anticipate and provide the necessary staff, both quantity and their skills, to successfully and efficiently conduct all aspects of the TSMO program. 7. Identify and prioritize the appropriate financial resources to sustain the TSMO program at levels that achieve the TSMO strategic objectives and implementation plan priorities.
Organizational Structure and Integration	8. Develop and maintain an organizational model that institutionalizes and integrates TSMO into the department structure to support the execution of TSMO strategies and achievement of TSMO strategic objectives. 9. Articulate who is responsible and accountable for executing elements of the TSMO program.

3.2 Development of the MnDOT TSMO Business Plan

The bulk of this Business Plan defines recommendations for addressing MnDOT's TSMO programmatic objectives. The recommendations were initiated during a Business Planning workshop conducted on March 6, 2019. The workshop engaged leaders from MnDOT districts and central office functions including traffic operations, maintenance, ITS, planning, and program delivery in an interactive session to provide input for the business plan. Participants discussed strengths and weakness of current TSMO programmatic areas and generated recommendations in four key areas: Strategy deployment; staffing, organization, and business process. Following the Business Planning Workshop, the recommendations were further refined using input from MnDOT leaders and expert staff. Section 4 of this document contains the detailed TSMO Business Plan recommendations.

3.3 Process for Future Business Plan Updates

Throughout the initial business planning process, it has been recognized that this plan would require periodic updates. The Business Plan update cycle should correlate with updates to the Implementation Plan as well as updates to the MnDOT Family of Plans. The update process should include the following activities, as a minimum:

- Review of recommendations from the previous version of the Business Plan and the outcomes that resulted from the recommendations.
- Review the most recent version of the MnDOT TSMO Implementation Plan as input to understanding needs to continue existing Business Plan recommendations or to develop new recommendations.
- Identify the recommendations that are still valid and edit the descriptions appropriately (e.g. "continue" instead of "create").
- Identify the recommendations that are no longer needed, either because they are now institutionalized or because they are no longer needed or recommended.
- Determine new recommendations, reflecting updates to the Implementation Plan, as well as other related plans, such as the MnDOT Statewide ITS Plan, MnDOT CAV-X Strategic Plan, and the Minnesota State Highway Investment Plan (MnSHIP).
- Refresh the document, and ensure the document remains consistent with MnDOT's Family of Plans.

3.4 Relationship to the MnDOT Family of Plans

This Business Plan, as well as the TSMO Strategic Plan and TSMO Implementation Plan were developed to align with many MnDOT plans, including the Minnesota GO 50-Year Vision, Strategic Operating Plan, Statewide Multimodal Transportation Plan, Minnesota State Highway Investment Plan (MnSHIP), as well as supporting plans, policies and programs such as the Minnesota Statewide Regional ITS Architecture, MnDOT Project Selection Policy, and Corridors of Commerce. At the tactical level, TSMO strategies are consistent with and in some cases overlap implementations defined in the MnDOT Statewide ITS Plan, the MnDOT CAV-X Strategic Plan, and the Minnesota Statewide Regional ITS Architecture.

4.0 Business Plan Recommendations

4.1 Overview of Recommendations

A total of eight recommendations were developed through the business planning process. Table 2 lists each recommendation and groups each into one of four topic/area categories:

- ***Strategy Deployment Recommendations –*** Recommendations related to deploying the recommended strategies in the TSMO Implementation Plan;

- ***Staffing Recommendations*** - Recommendations related to staffing adjustments to support the implementation of the TSMO strategies;

- ***Organization Recommendations*** **-** Recommendations related to organizational models identified to benefit and support the TSMO strategies; and

- ***Business Process Recommendations*** – Recommendations related to business process related activities to support the TSMO strategies.

Table 2: TSMO Business Plan Recommendations

Topic/Area	Recommendation
Strategy Deployment	1. Fully fund TSMO
Staffing	2. Designate and fund a State TSMO Coordinator 3. Create staffing positions to support TSMO strategies
Organization	4. Continue and clarify the Minnesota TSMO Leadership Team 5. Continue and clarify the Minnesota TSMO Working Group 6. Establish a MnDOT TSMO organizational model
Business Process	7. Define TSMO Performance Measures and a Data Use Plan 8. Institutionalize the TSMO implementation planning process

4.2 Description of Recommendations

Tables 3-10 provide details for each of the ten TSMO business planning recommendations, including a description, summary of benefits, timing, in-progress products, cost estimate, and next steps.

Table 3: Recommendation #1 – Fully Fund TSMO

Recommendation #1: Fully Fund TSMO	
Description	Implement the full funding scenario that was developed during the implementation and business planning processes, to include dedicated TSMO funding for most of the 20 TSMO strategies indicated as short-term (ready to start in 1-2 years). Implement the $3 million scenario only in the situation where dedicated TSMO funding is not available to fully fund TSMO. (A full table of the strategies to be funded is included in Appendix A).
Benefits	• Coordinated deployment of TSMO strategies statewide. • Increased safety, mobility and efficiency of travel.
Timing	• Recommend initiating strategy activities as soon as dedicated TSMO funding is available. • Coordinate the initiation of strategy activities with other recommendations included in this plan.
In-Progress Products	The TSMO Implementation Plan defined 34 strategies, of which 20 were identified as short-term.

	The TSMO Working Group developed Funding Scenario #1 to initiate most of the 20 short-term strategies in the next two years. Highlights of the anticipated outcomes include: • Update timing on all MnDOT traffic signals on a frequent cycle (with a goal of every 4 to 5 years, recognizing that this frequency may be difficult to achieve throughout the state). • Continued availability of HERE real time probe data. • Traffic Incident Management Coordinator with consultant support. • 15 Miles of snow fence annually. • Expand freeway traffic management systems coverage initially by 1-2 corridors annually based on an overall plan that strategically identifies the number and location of corridors to ultimately be covered, based on needs. • Provide staff and repair parts for ITS and traffic signal field equipment • Four Additional innovative intersection (RCUTs) annually. • Build out the full Road Weather Information System. • Upgrade the majority of traffic signal control and communication equipment within a 5-year period. • Consultant plans for pre-signed alternate routes. • Expanded video sharing with the public and other agencies. An alternative approach, $3M Scenario, was developed to require reduced dedicated TSMO funding while still deploying some of the short-term strategies on a smaller scale and is recommended only if the Full Scenario funding is not available. The No Funding Scenario would continue TSMO activities only as opportunities allow, similar to current levels, and is the lowest recommended scenario. Significant impacts of the No Funding Scenario include cancellation of current probe data contract, no accelerated signal timing updates, very limited incident management resources, no expansion to freeway management systems, and lack of adequate ITS maintenance resources.
Cost Estimate	Full Scenario: $16.5M $3M Scenario: $3.3M No Funding Scenario: $0
Next Steps	1. Identify funding sources and conduct formal dedicated TSMO funding requests. 2. Initiate strategy deployments and organizational activities defined in other recommendations.

Table 4: Recommendation #2 – Designate and Fund a State TSMO Coordinator

Recommendation #2: Designate and Fund a State TSMO Coordinator	
Description	Designate and fund a full-time State TSMO Coordinator position located in the Operations Division. Through leadership and coordination with the individuals leading TSMO strategies, this position would lead a proactive, consistent, and deliberate statewide approach to TSMO that aligns with the goals and objectives in the TSMO Strategic Plan.
Benefits	• Ensure TSMO implementation strategies get done. • Support district traffic engineers in deploying and operating TSMO strategies and ensure the districts are involved in the TSMO prioritization process. • Provide consistency and efficiency in delivering TSMO strategies by coordinating efforts among the various offices and districts. • Ensure TSMO strategies reflect the Strategic Plan goals and objectives.
Timing	• Recommend position created and filled as soon as possible. • Anticipate that this is an ongoing position, with no defined end date.
In-Progress Products	The TSMO Working Group and Leadership Team developed the TSMO Coordinator's roles/responsibilities. These roles (for consideration in a Position Description) include: • Ensure execution of the TSMO Implementation Plan. • Serve as a champion, advocate, educator, and collaborator of TSMO activities. • Chair the TSMO Leadership Team and Working Group. • Monitor and identify further actions required to achieve the objectives of the TSMO Strategic Plan and Business Plan. • Organize and manage activities of the TSMO Leadership Team and Working Group (responsibility for meeting arrangement, agenda topics, assigning action items and responsibilities to the members). • Support the TSMO related functional areas by liaisons with Central Office specialty offices, functional area management groups, and District staff working in specific functional areas (or with dedicated District TSMO staff). • Monitor and engage in national TSMO activities to recommend applications/opportunities for MnDOT based on research and emerging practices/innovation. • Conduct outreach and education efforts, both internal and external to MnDOT. • Facilitate the sharing and use of TSMO best practices. • Understand the potential funding sources and their requirements for TSMO funding (e.g. federal funding), and vigorously pursue funding sources. • Coordinate the identification of, the need for, and assembly of TSMO Task Forces (i.e. temporary groups that meet to coordinate on strategy specific deployments). The TSMO Coordinator will not be expected to lead any specific Task Forces. • Lead activities to update the TSMO Implementation Plan.
Cost Estimate	Salary Position est. $100,000 (est) annually. In addition, consultant support will be needed for several of the TSMO Coordinators tasks, estimated at $50,000 to

	$100,000 annually. Costs for the State TSMO Coordinator are not included in any of the implementation strategies. Existing staff within Operations Division to provide support, no costs allocated. Actual availability of support staff will be critical to this position and must be confirmed.
Next Steps	1. Expand the draft roles and responsibilities into a MnDOT Position Description. 2. Perform the internal MnDOT steps required to consider/create a position. 3. Perform recruitment/hiring activities. 4. Integrate the new TSMO Coordinator into to existing Program.

Table 5: Recommendation #3 – Create Staffing Positions to Support TSMO Strategies

Recommendation #3: Create Staffing Positions to Support TSMO Strategies	
Description	Create staff positions within MnDOT or partnering agencies to support specific TSMO strategies or groups of strategies. The funding for these positions would be included in the strategy funding, and positions may be short-term, long-term, or permanent depending upon the strategy.
Benefits	• Ensure TSMO strategies are adequately staffed. • Increase the likelihood of success of the related strategy(ies).
Timing	• Recommend that positions are created and filled in a timely basis to support the strategies. • The nature and duration of the strategies will determine the longevity of the positions created.
In-Progress Products	The 2019 Implementation Plan identified two short-term TSMO strategies that need dedicated positions: ***Traffic Incident Management (TIM) Position:*** Support Strategy #3 "Develop Regional TIM Program". Staff would: • Develop TIM programs across Minnesota. • Facilitate discussions with partnering agencies such as State Patrol and emergency response agencies. • Identify TIM performance measures. • Coordinate TIM planning statewide. ***Electronic Maintenance Position.*** Support Strategy #12 "Increase TSMO Asset Life Cycle Understanding and Management" Staff would: • Increase maintenance activities for field devices. Improve life-cycle understanding and management through closer monitoring of field device status and maintenance/management needs.
Cost Estimate	Costs for initial staff positions are included in the strategy estimates.
Next Steps	1. Expand the draft roles and responsibilities for the positions supporting short-term TSMO strategies 2. Perform the internal MnDOT steps required to consider/create/fill each position 3. Integrate the new positions into the appropriate TSMO Strategy activity.

	4. Evaluate future TSMO strategies, as needed, and repeat the steps to add needed positions.

Table 6: Recommendation #4 - Continue and Clarify the Minnesota TSMO Leadership Team

Recommendation #4: Continue and Clarify the Minnesota TSMO Leadership Team	
Description	Continue the TSMO Leadership Team beyond the planning process to lead MnDOT's TSMO efforts. The TSMO Leadership Team will provide strong leadership, guidance, and support for and to the TSMO Coordinator. The TSMO Coordinator would chair this Leadership Team.
Benefits	• Provide management level direction to MnDOT TSMO efforts to ensure the Implementation Plan strategies are delivered effectively and efficiently. • Keep management well informed and involved in MnDOT TSMO efforts. • Management will be able to address support and resource requests for TSMO strategies.
Timing	• Recommend the Leadership Team continues meeting to finalize a Charter, refine membership, and redefine the meeting schedule. • Initially recommend Leadership Team meets every other month; meeting frequency to be re-visited as activities become streamlined.
In-Progress Products	**Leadership Team Charter:** The TSMO Leadership Team will adopt a Charter clarifying the purpose, membership, and activities of the team. Appendix B contains draft elements to support creation of the charter. The Leadership Team is encouraged to build upon these elements and draft and approve the Charter in 2019. **Anticipated Activities:** The TSMO Working Group identified activities for the Leadership Team that include: • Provide input on and review proposed TSMO performance measures. • Provide guidance on, and monitor progress of TSMO program activities. • Act as a sounding board for ideas and comments from the TSMO Coordinator and Working Group. • Consider funding requests to bring to appropriate funding approval committees. • Actively communicate management support for TSMO activities throughout MnDOT and encourage support for and staff participation in TSMO related tasks. • Share information about TSMO activities internal and external to MnDOT. **Membership Refinement:** The TSMO planning process identified benefits to refining Leadership Team membership, including adding related public agencies involved in Minnesota TSMO activities (included in charter material).
Cost Estimate	Additional dedicated staff time is not required. Support may be provided by the Operations Division or require contractor costs (to be discussed with Working Group).

Next Steps	1. Continue to convene the Leadership Team meetings every other month initially; frequency of meetings to be re-visited as activities become streamlined. 2. Formalize a support structure for the Leadership Team. 3. Craft and approve Leadership Team Charter with input material in this Business Plan.

Table 7: Recommendation #5 – Continue and Clarify the Minnesota TSMO Working Group

Recommendation #5: Continue and Clarify the Minnesota TSMO Working Group	
Description	Continue the MnDOT TSMO Working Group to provide input and management of the TSMO process, with refinement and clarification of roles, actions, and membership to broaden the reach of the group. The TSMO Coordinator would chair this working group.
Benefits	• Improve coordination across different functional areas of TSMO activities related to the Implementation Plan strategies. • Track and manage TSMO performance measures. • Support the identification and allocation of resources to implement TSMO strategies. • Provide leadership to ensure the strategies in the Implementation Plan are completed consistently and comprehensively.
Timing	• Recommend the TSMO Working Group continue meeting, without interruption. • Initially recommend meeting monthly.
In-Progress Products	**Working Group Description:** A draft description of the TSMO Working Group was drafted during the planning process. Appendix C to this business plan contains this description for the TSMO Working Group to review and finalize in 2019. **Anticipated Activities:** The Implementation Plan identified activities anticipated for the TSMO Working Group that include: • Carry out TSMO program activities • Assist and support the TSMO Coordinator in the various tasks and activities needed to pursue the TSMO Plan • Participate in the appropriate TSMO Task Forces • Define, collect and publish TSMO performance measures • Identify appropriate existing funding sources for TSMO strategies • Develop additional funding requests to bring to appropriate funding approval committees • Share information about TSMO activities internal and external to MnDOT • Update the TSMO Data Use Plan on an annual basis **Task Forces:** The Working Group will consider creating task forces, as needed, to approach selected strategies that merit input from various groups. Any task forces will include Working Group representatives, as well as any additional members.

Cost Estimate	Additional dedicated staff time is not required. Support may be provided by the Operations Division.
Next Steps	1. Continue to convene Working Group meetings on a monthly basis 2. Formalize support structure for the Working Group (expected to be the TSMO Coordinator support staff) 3. Edit the draft TSMO Working Group description and finalize it for reference as the Working group conducts activities 4. Add members as agreed in the Working Group description.

Table 8: Recommendation #6 – Establish a MnDOT TSMO Organizational Model

Recommendation #6: Establish a MnDOT TSMO Organizational Model	
Description	Establish an organizational model to execute the current and future TSMO Implementation Plans. The recommendation does not create a new TSMO structure in MnDOT, but rather defines an organizational approach to accomplishing TSMO strategies within the current MnDOT structure of districts, offices, management groups, and centers. A one-page suggested organizational model representation is included as Appendix D. The Leadership Team, Working Group and TSMO Coordinator will provide leadership. Through this model, TSMO activities will integrate with other MnDOT activities and plans. For example, TSMO would be included in the next Minnesota Statewide Highway Improvement Plan (MnSHIP). Similarly, linkages will be established with the CAV-X and Statewide ITS plans.
Benefits	• Defining the organizational approach and structure will support TSMO strategy deployments and operations. • Working within established MnDOT groups (and their inter-relationships) will streamline TSMO institutionalization.
Timing	• Finalization of the draft TSMO Organizational Model should proceed once the Business Plan is completed. • Outreach and education of the TSMO organization should begin as soon as the finalized model is completed.
In-Progress Products	**Draft Organizational Model:** Appendix D is a draft MnDOT TSMO Organizational Model. The model is briefly summarized as: ***MnDOT TSMO Coordinator*** will be part of the Operations Division and will serve as a link connecting the Leadership Team and Working Group with the offices, management groups and districts responsible for TSMO strategy implementation. ***District Engineers*** will full support TSMO goals and will strongly support the participation of District staff in TSMO tasks and activities. ***MnDOT Specialty Offices and the RTMC*** will be consulted by the TSMO Coordinator about TSMO strategies; will formulate policies and processes that are needed to support the TSMO strategies.

	Management Groups (MGs) (including CMG, PCMG, OMG/MBMT, PMG, TEO) will coordinate the policies, procedures, and TSMO strategy activities across the districts, engaging two-way interaction with district staff. ***Staff members in districts, specialty offices, and RTMC*** will implement the TSMO strategies, with support from others, including working on specific tasks or efforts, responding to requests for input or data, and volunteering time on task forces. Through TSMO Coordinator facilitation, will collaborate on topics such as performance measures, best practices, lessons learned.
Cost Estimate	Additional dedicated staff time or contractor costs are not required. Activities to finalize the organizational model will be performed by TSMO Working Group staff time allocations.
Next Steps	1. Finalize the organizational model and one-page summary, with input from the Leadership Team 2. Conduct outreach, explaining the Organizational Model prior to the onset of TSMO strategy activities.

Table 9: Recommendation #7 – Define TSMO Performance Measures and a Data Use Plan

Recommendation #7: Define TSMO Performance Measures and a Data Use Plan	
Description	Identify and formally adopt a small number of performance measures while establishing a data use plan that supports performance management as well as real-time operations. The performance measures and data management will document progress toward the TSMO Strategic goals and objectives, and ensure adequate data is available to support TSMO strategies.
Benefits	• Evaluate progress and impacts of individual TSMO strategies as well as the overall TSMO program. • Expanded utilization of data when deploying TSMO strategies. • Increased data utilization for real-time operations. • Increased data availability and use for performance management. • Better decision-making about future data needs.
Timing	• Task forces may form around priority TSMO strategies and will review existing performance measures and data and determine the need for additional incremental performance measures and data. • As performance measure needs are understood, strategy task forces may incrementally create performance measures and propose these as formal MnDOT performance measures, tied to supporting data.
In-Progress Products	Some existing MnDOT performance measures support TSMO strategies. Possible additional performance measures to support TSMO have been identified for consideration by strategy task forces that form. **Existing MnDOT performance measures related to TSMO strategies include:** • Average Incident Clearance Time • Metro Congestion • Interstate Reliability

	• Truck Travel Time Reliability • Number of Fatalities on Minnesota Roadways Resulting from Crashes Involving a Motor Vehicle • Number of Serious Injuries on Minnesota Roadways Resulting from Crashes Involving a Motor Vehicle **Possible additional performance measures to support TSMO metrics include:** • Travel time impacts of incident events; • Reliability of travel times through work zones; • Reliability of travel times on arterial routes; Number and severity of crashes involving work zones. Existing data sources have been identified and mapped to the TSMO strategies defined in the TSMO Implementation Plan. A summary of these data sources and their relationship to each TSMO strategy is included in Appendix E. Data gaps will be identified as new performance measures are clarified and will be included in the Data Management Plan.
Cost Estimate	Identification of new performance measure definitions and the creation of a Data Use Plan, based on Appendix E, will be performed by task forces that may form around strategy deployments, with input from contractors supporting TSMO strategy implementations.
Next Steps	1. Encourage TSMO task forces to consider existing performance measures and identify needs for additional measures. 2. Involve MnDOT Management Groups in TSMO strategies to help explore adding formal MnDOT performance measures. 3. MnDOT TSMO Working Group to leverage the preliminary mapping of data sources to TSMO strategies (Appendix E) within the TSMO Planning process, expanding additional details as needed and sharing with TSMO task forces as appropriate.

Table 10: Recommendation #8 – Institutionalize the TSMO Implementation Planning Process

Recommendation #8: Institutionalize the TSMO Implementation Planning Process	
Description	Institutionalize the TSMO implementation planning process to define prioritized TSMO strategies in a way that it can be replicated in the future.
Benefits	• Ensure that TSMO strategies deployed are still relevant and beneficial. • Consider new TSMO approaches and address new needs and challenges. • Select new TSMO strategies using agreed upon criteria and weightings.
Timing	• Immediately, the TSMO Working Group will review the TSMO implementation planning process to capture lessons learned and suggestions for the next process. • Just prior to the next implementation planning, review the process again to reflect any organizational changes.

	• Consider how the TSMO Implementation Plan relates to MnDOT's family of plans as well as MnDOT's business planning process and establish a schedule for updates that supports these other planning processes.
In-Progress Products	**Business Process Description:** Appendix F contains a brief business process, identifying a flow chart, roles, responsibilities and key activities to complete the TSMO implementation planning process on a regular basis. In addition to the description in the appendix, the following are overarching aspects of the process: **Timeframe:** Update the current Implementation Plan on a schedule that supports MnDOT's other planning processes, such as the family of plans. **Staffing:** Consider staffing demands and availability of existing staff during implementation planning activities. **Funding Opportunities:** Research TSMO funding options in conjunction with each implementation planning effort. **Progress**: Summarize progress towards each TSMO strategy when starting each implementation planning activity.
Cost Estimate	Some coordination and planning costs may be associated with performing the Implementation Plan updates (to be discussed with working group).
Next Steps	1. TSMO Working Group & Leadership Team to review and modify the business process definition. 2. Execute the Implementation Planning process at appropriate times.

Appendix A – TSMO Strategies and Annual Costs Included in Funding Scenarios

Score	Time Frame	ID	Strategy	No Funding Scenario - Annual Cost	$3M Scenario SRC - Annual Cost	$3M Scenario Non-SRC - Annual Cost	Full Scenario SRC - Annual Cost	Full Scenario Non-SRC - Annual Cost	No Funding Outcomes	$3M Scenario Outcomes	Full Scenario Outcomes
460	S	1	Update Signal Timing and Coordination	$0	$0	$550,000	$0	$1,100,000	Presently funding $100K GM, $100K Metro. Retiming about 65 signals every 1-3 years. Over 20 yr retiming cycle.	Retime about 165 signals every 1-3 years, including administra-tion. A moderate retiming cycle (8-12 years).	A frequent retiming cycle, retiming about 350 signals every 1-3 years.
440	S	2	Increase MnDOT Usage of 3rd Party Data and Increase Sharing with Traveler Information Disseminators (e.g. Google, WAZE, INRIX, HERE)	$0	$0	$300,000	$0	$300,000	Real-time 3rd party probe data ended	Real-time 3rd party probe data continued	Real-time 3rd party probe data continued
430	S	3	Develop Regional Traffic Incident Management (TIM) Programs	$0	$0	$100,000	$0	$200,000	No increased TIM service	TIM Coordinator no support	TIM Coordinator plus consultant support

Score	Time Frame	ID	Strategy	No Funding Scenario - Annual Cost	$3M Scenario SRC - Annual Cost	$3M Scenario Non-SRC - Annual Cost	Full Scenario SRC - Annual Cost	Full Scenario Non-SRC - Annual Cost	No Funding Outcomes	$3M Scenario Outcomes	Full Scenario Outcomes
410	M	4	Implement Low-Cost / High-Benefit Capital Improvements (CMSP)						Funded outside TSMO program	Funded outside TSMO program	Funded outside TSMO program
400	S	5	Coordinate Work Zones Across Jurisdictions and Routes	$0	$0	$0	$0	$0	Zero cost. Coordination between districts and agencies.	Zero cost. Coordination between districts and agencies.	Zero cost. Coordination between districts and agencies.
395	S	6	Expand Snow Fence Use through Research and Increased Use	$0	$0	$0	$4,000,000	$300,000	Funded outside TSMO program	Funded outside TSMO program	15 miles of snow fence annually plus staff
395	M	7	Expand the Coverage of Freeway and Expressway Traffic Management Systems	$0	$1,000,000	$0	$3,000,000	$0	No expansion	1 corridor annually	1-2 corridors annually
380	S	8	Develop Traffic Incident Management (TIM) Strategies for Work Zones	$0	$0	$0	$0	$0	Funded in TMP, ID during scoping. TIM in work zones	Funded in TMP, ID during scoping. TIM in work zones	Funded in TMP, ID during scoping. TIM in work zones

Score	Time Frame	ID	Strategy	No Funding Scenario - Annual Cost	$3M Scenario SRC - Annual Cost	$3M Scenario Non-SRC - Annual Cost	Full Scenario SRC - Annual Cost	Full Scenario Non-SRC - Annual Cost	No Funding Outcomes	$3M Scenario Outcomes	Full Scenario Outcomes
375	S	9	Utilize Intelligent Work Zone Systems Where Appropriate	$0	$0	$100,000	$0	$100,000	No increased focus on IWZ	Training and guidance for IWZ	Training and guidance for IWZ
370	M	10	Expand the Use of Ramp Metering	$0	$0	$0	$30,000	$0	No expanded ramp metering	No expanded ramp metering	2-3 ramp meters annually
370	M	11	Expand Use of Technology at Weigh Stations for Enforcement	$0	$0	$0	$250,000	$250,000	Currently funded approach	Currently funded approach	Add pre-screening at weigh stations
365	S	12	Increase TSMO Asset Life Cycle Understanding and Management	$0	$0	$550,000	$0	$1,100,000	Shortage of maintenance staff & parts	Better able to maintain electrical assets	Adequate maintenance staff & parts
360	S	13	Implement Signal Timing Updates for Construction Projects	$0	$0	$0	$0	$0	Funded in TMP, ID during scoping. Signal timing updated in work zones.	Funded in TMP, ID during scoping. Signal timing updated in work zones.	Funded in TMP, ID during scoping. Signal timing updated in work zones.
360	M	14	Provide Traveler Information on Alternative Modes and Routes						Analysis still needed	Analysis still needed	Analysis still needed

Score	Time Frame	ID	Strategy	No Funding Scenario - Annual Cost	$3M Scenario SRC - Annual Cost	$3M Scenario Non-SRC - Annual Cost	Full Scenario SRC - Annual Cost	Full Scenario Non-SRC - Annual Cost	No Funding Outcomes	$3M Scenario Outcomes	Full Scenario Outcomes
355	S	15	Expand and Enhance the Deployment of Road Weather Information Systems	$0	$60,000	$0	$120,000	$0	No RWIS expansion	10 new sites annually	20 new sites annually
355	S	16	Expand Consideration of Innovative Intersection Technology or Design (e.g. RICWS, roundabouts, RCIs, diverging diamonds, etc.)	$0	$0	$0	$4,000,000	$0	Currently funded approach	Currently funded approach	4 additional intersections annually
355	S	17	Expand Dynamic Message Sign (DMS) Use to Include Standard Weather Messages	$0	$0	$0	$0	$0	DMS uses standard weather messages	DMS uses standard weather messages	DMS uses standard weather messages
355	S	18	Improve Pedestrian and Bicycle Service at Signals	$0	$0	$0	$0	$0	Assess ped accom and update times	Assess ped accom and update times	Assess ped accom and update times
355	S	19	Increase Real-time Tracking of Work Zones and	$0	$0	$125,000	$0	$250,000	No new equipped arrow boards	Some new equipped arrow boards	More new equipped arrow boards

Score	Time Frame	ID	Strategy	No Funding Scenario - Annual Cost	$3M Scenario SRC - Annual Cost	$3M Scenario Non-SRC - Annual Cost	Full Scenario SRC - Annual Cost	Full Scenario Non-SRC - Annual Cost	No Funding Outcomes	$3M Scenario Outcomes	Full Scenario Outcomes
			Lane Closures for 511								
355	S	20	Upgrade Signal Controller and Communications Equipment for Communications to Central System	$0	$0	$550,000	$0	$1,120,000	Signal control equip lacks comm and is out of life cycle	Upgrade about 75 signals annually	Upgrade about 160 signals annually
350	S	21	Deploy Truck Parking Information for Rest Areas	$0	$0	$0	$0	$0	Evaluate existing deployments	Evaluate existing deployments	Evaluate existing deployments
350	M	22	Develop and Implement Pre-Planned Alternative Routes for Incidents	$0	$0	$0	$0	$150,000	No new alternate routes	No new alternate routes	Consultant plan for alternate routes
350	M	23	Ensure New Signals are Connected Automated Vehicle (CAV) Ready						Analysis still needed	Analysis still needed	Analysis still needed
340	M	24	Add Additional MnPASS Lanes in the Twin Cities Metro Area						Analysis still needed	Analysis still needed	Analysis still needed

Score	Time Frame	ID	Strategy	No Funding Scenario - Annual Cost	$3M Scenario SRC - Annual Cost	$3M Scenario Non-SRC - Annual Cost	Full Scenario SRC - Annual Cost	Full Scenario Non-SRC - Annual Cost	No Funding Outcomes	$3M Scenario Outcomes	Full Scenario Outcomes
340	M	25	Provide Enhanced Enforcement Technology (Speed Enforcement, Red Light Running, MnPASS, etc.)						Analysis still needed	Analysis still needed	Analysis still needed
325	S	26	Expand and Streamline Road Weather Data	$0	$0	$0	$0	$0	Complete current project MDSS - 511	Complete current project MDSS - 511	Complete current project MDSS - 511
320	L	27	Utilize Alternate Route Signing for Work Zones						Analysis still needed	Analysis still needed	Analysis still needed
315	M	28	Expand Dissemination of Travel Times (Work Zones and Geographic Expansion)						Analysis still needed	Analysis still needed	Analysis still needed
310	S	29	Expand Sharing of Video and Data Between Agencies (Integrated Corridor Management)	$0	$0	$0	$0	$150,000	No expanded video sharing	No expanded video sharing	Expanded video sharing with public & other agencies
305	M	30	Deploy Transit Signal Priority						Analysis still needed	Analysis still needed	Analysis still needed

Score	Time Frame	ID	Strategy	No Funding Scenario - Annual Cost	$3M Scenario SRC - Annual Cost	$3M Scenario Non-SRC - Annual Cost	Full Scenario SRC - Annual Cost	Full Scenario Non-SRC - Annual Cost	No Funding Outcomes	$3M Scenario Outcomes	Full Scenario Outcomes
290	S	31	Address Bikes and Pedestrians in Construction Detours						Analysis still needed	Analysis still needed	Analysis still needed
285	M	32	Improve Work Zone Data for CAV Readiness						Analysis still needed	Analysis still needed	Analysis still needed
240	L	33	Prepare Systems to Obtain/Use Data from CAVs						Analysis still needed	Analysis still needed	Analysis still needed
220	S	34	Encourage Work Flexibility for Travel Demand Management	$0	$0	$0	$0	$50,000	No new emphasis on TDM	No new emphasis on TDM	Outreach campaign on TDM
				$0	$1,060,000	$2,275,000	$11,400,000	$5,070,000			
			Total by scenario:	$0	$3,335,000		$16,470,000				

Appendix B – Draft Elements of the TSMO Leadership Team Charter

The TSMO Leadership Team will adopt a Charter clarifying the purpose, membership, and activities of the team. The following draft content was assembled during the business planning process and is referenced for use when developing the charter.

Purpose of the TSMO Leadership Team:

- To keep management informed and involved in MnDOT TSMO efforts
- For management to provide direction to MnDOT TSMO efforts as appropriate
- To address support and resource needs for TSMO

Leadership Team Primary Activities:

- Approve and review status of TSMO performance measures
- Approve and review progress of TSMO program activities
- Consider funding requests to bring to appropriate funding approval committees
- Communicate management support for TSMO activities throughout MnDOT
- Share information about TSMO activities internal and external to MnDOT

Leadership Team Meeting Logistics:

- Leadership Team to conduct in-person meetings every other month initially, with access available through Skype; meeting frequency to be revisited after activities become streamlined.
- Meetings to be chaired by the TSMO Coordinator
- Leadership Team to be supported by the TSMO Coordinator, the TSMO Working Group and the TSMO Coordinator's administrative support staff
- The support team will record and circulate decisions and action items of meetings

Leadership Team Membership Composition:

- Deputy commissioner
- Assistant Commissioner for Operations Division or Operations Division assistant division director
- State Traffic Engineer
- State Maintenance Engineer
- Chair of Maintenance Business Management Team (MBMT)
- Metro District Engineer or Operations & Maintenance Office Director
- 2 Non-metro District Engineers
- Office Director for Office of Construction and Innovative Contracting
- Office Director for Office of Freight and Commercial Vehicle Operations
- Office Director for Office of Transit and Active Transportation
- Office Director for Office of Transportation System Management
- Office Director for Office of Connected and Automated Vehicles-X
- TSMO Coordinator
- Additional external members (e.g. State Patrol, possibly cities and/or counties)

Appendix C – Draft TSMO Working Group Description

The TSMO Working Group has existed throughout the duration of the TSMO planning process. The following draft content was assembled during the business planning process and is referenced for use when formalizing activities of the working group.

Purpose of the TSMO Working Group:

- To coordinate the TSMO program across functional groups
- To collect and track TSMO performance measures
- Identify TSMO resource needs and sources
- Ensure implementation of the TSMO Implementation Plan strategies

Working Group Activities:

- Define, collect and publish TSMO performance measures
- Carry out TSMO program activities
- Identify appropriate existing funding sources for TSMO strategies
- Develop additional funding requests to bring to appropriate funding approval committees
- Connect the TSMO Champion with the appropriate coordinating group, such as the MG groups and TEO
- Share information about TSMO activities internal and external to MnDOT

Working Group Meeting Logistics:

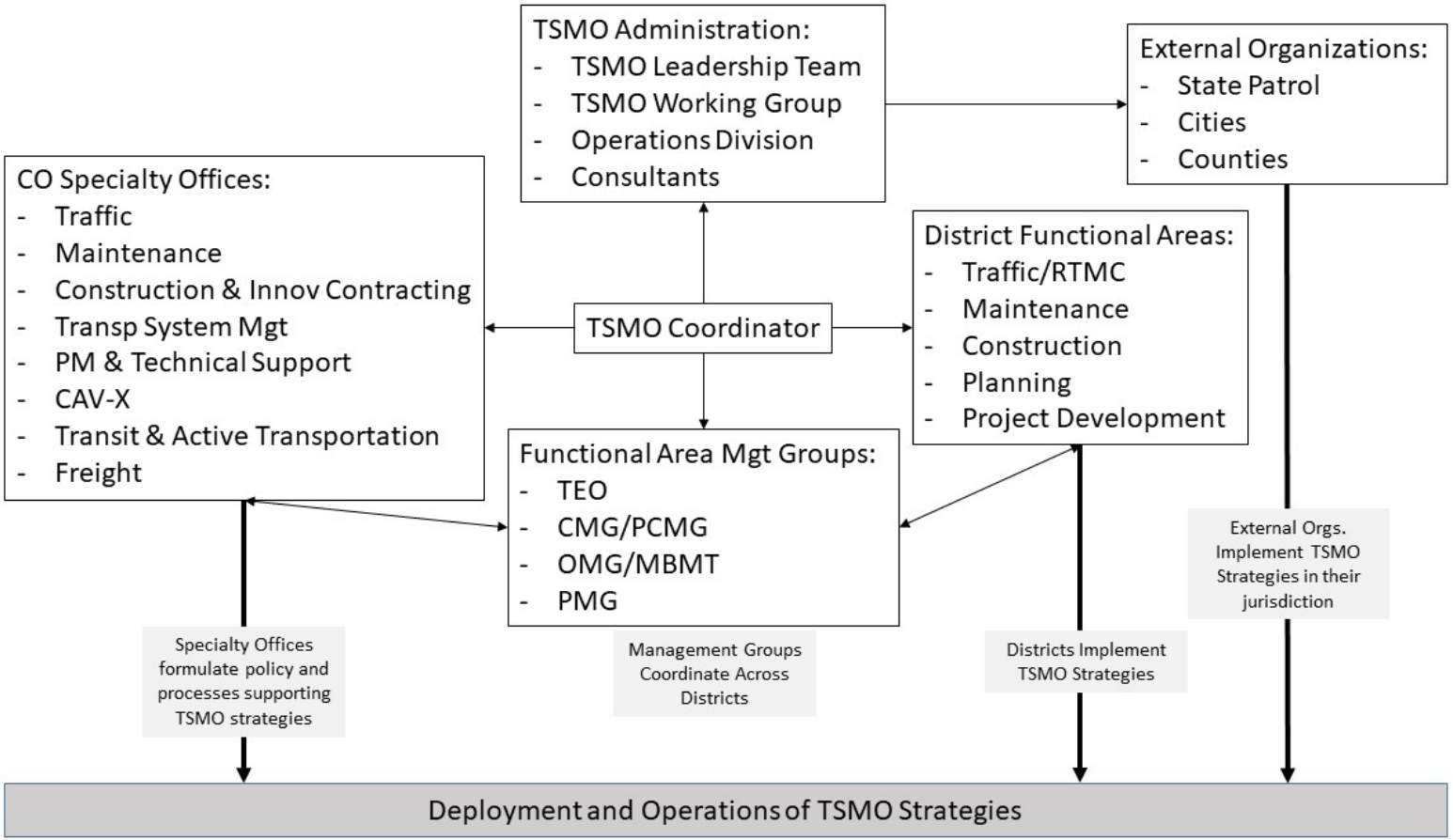
- Working Group to conduct standing monthly meetings with access available through Skype
- Meetings to be chaired by the TSMO Coordinator
- Working Group activities to be supported by the TSMO Coordinator, and the TSMO Coordinator's administrative support staff
- The support team will record and circulate decisions and action items of meetings

Working Group Membership Composition:

- Office of Traffic Engineering staff
- RTMC Director
- Metro Traffic Engineer
- 1 Non-metro District Traffic Engineer
- Office of Maintenance staff
- 1 Non-metro District Maintenance Engineer (AME)
- Metro District Freight Operations staff
- Office of Construction and Innovative Contracting staff
- Office of Freight and Commercial Vehicle Operations staff
- Office of Transit and Active Transportation staff
- Office of Transportation System Management staff
- Connected and Automated Vehicles-X staff
- Director of Electrical Services
- TSMO Coordinator
- Additional external members (e.g. State Patrol, possibly cities and/or counties)

Appendix D – Draft MnDOT TSMO Organizational Model

MnDOT TSMO Organizational Model



Appendix E – Existing Data Sources Mapped to TSMO Strategies

This appendix provides a listing of existing data sources and a description of the data source. See Table E-1. In addition, Table E-2 indicates which strategies from the TSMO Implementation Plan may use each data source.

Table E-1: Existing Data Sources

Data Source	Description
Data Source 1: MnDOT 2017 Congestion Report (Twin Cities)	• Specific to Twin Cities metro area • Annual report that indicates congestion (traffic flowing at speeds less than or equal to 45 mph) on metro interstates and trunk highways.
Data Source 2: MnDOT Data Tools (Twin Cities)	• Includes DataExtract (a tool for extracting detector data to a csv file) and DataPlot (a tool for graphing detector data) • All detector report is available to locate detectors and stations
Data Source 3: MnDOT PeMS (Twin Cities)	• Area of traffic data coverage is Twin Cities Metro and I-94 north to St. Cloud • Stores and processes traffic detector data and provides a web-based interface that can be used to view and analyze the performance of the freeway system at varying scales and time periods as defined by system users. • Displays traffic data on a map interface • Provides tools for historical data analysis
Data Source 4: Incident Reports (Southern Regional Communications Center) SRCC and Regional Transportation Management Center (RTMC) – by request)	• Reports completed by MnDOT describing details of incidents • Level of detail and content in reports may vary by incident type.
Data Source 5: Incident Reports: Minnesota State Patrol (as accessible by MnDOT)	• Reports completed by State Patrol describing details of incidents (e.g. location, nature of incident, time of incident, time of closure).
Data Source 6: Local knowledge of locations of recurring congestion	• Knowledge retained by staff and/or contractors about locations where congestion occurs regularly.
Data Source 7: Local knowledge of special events that cause congestion	• Knowledge retained by staff and/or contractors about locations where congestion occurs as a result of recurring planned events.
Data Source 8: Local knowledge of weather and related impacts	• Knowledge retained by staff and/or contractors about impacts of local weather on traffic and or safety of travel.
Data Source 9: Maintenance Decision Support System (MDSS)	• Includes data collected by maintenance vehicles that is reported to the central MDSS; • Includes forecast data for pavement conditions;

	• Includes pavement treatment applications, both recommended by the MDSS and executed by the maintenance vehicles.
Data Source 10: Local knowledge of areas with high occurrences of incidents that create delay	• Knowledge retained by staff and/or contractors about specific locations that have experienced higher than typical incidents in the past.
Data Source 11: Minnesota Crash Mapping Analysis Tool (MnCMAT)	• Program available only to authorized users • Select data within county, district, tribal government, state • Option to narrow results by city, intersection, crash number, or XY coordinate • Allows selected crash data to be exported • Provides 2 frequently used crash reports: 1. Top 100 Road Segments 2. Top 100 Intersections

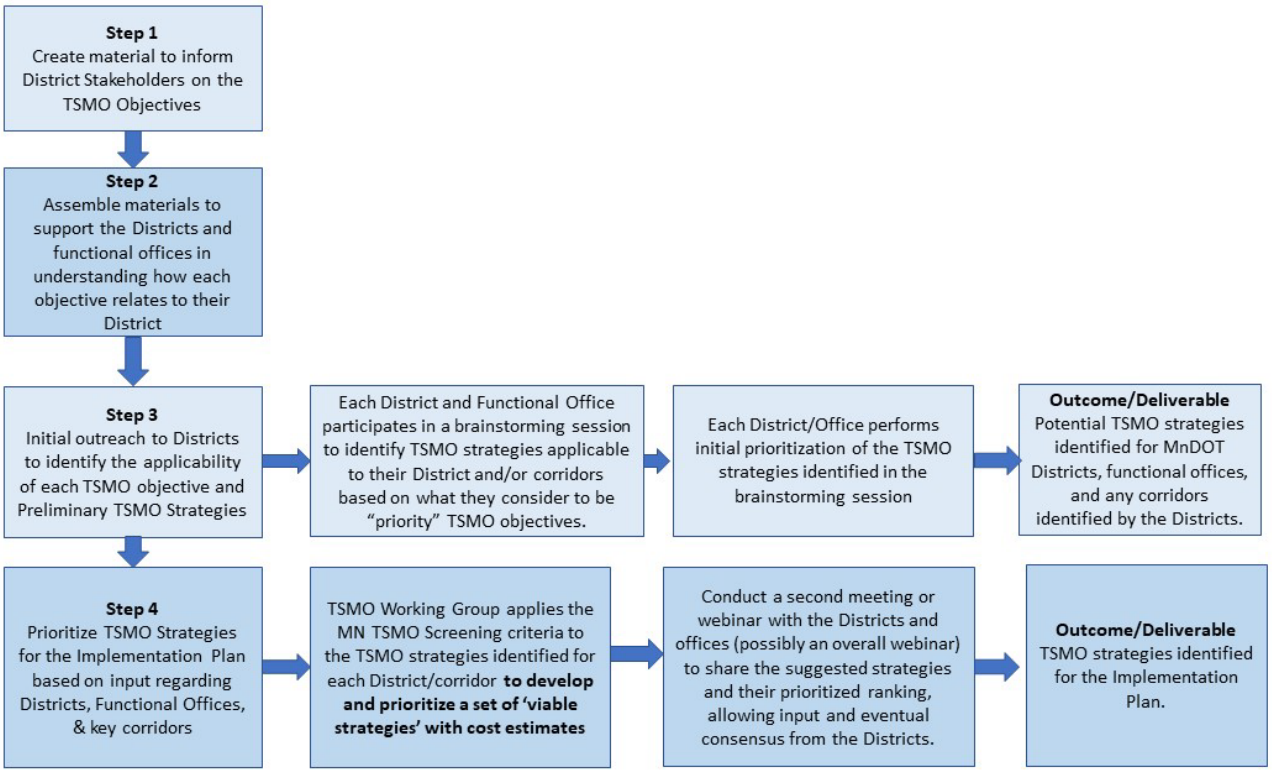
Table E-2: Existing Data Sources for each TSMO Implementation Strategies

TSMO Strategies	Existing Data Sources										
	1: Congestion Report	2: Data Tools	3: PeMS	4: RTMC and SRCC Incident Reports	5: State Patrol Incident Reports	6: Local Knowledge Recurring Congestion	7: Local Knowledge Special Events	8: Local Knowledge Weather	9: MDSS	10: Local Knowledge Incidents	11: MnCMAT
Strategy #1: Update Signal Timing and Coordination		■	■								
Strategy #2: Increase MnDOT Usage of 3rd Party Data and Increase Sharing with Traveler Information Disseminators (e.g. Google, WAZE, INRIX, HERE)		■									
Strategy #3: Develop Regional Traffic Incident Management (TIM) Programs				■	■					■	■
Strategy #4: Implement Low-Cost / High-Benefit Capital Improvements (CMSP)	■	■	■	■	■	■	■	■	■	■	■
Strategy #5: Coordinate Work Zones Across Jurisdictions and Routes											
Strategy #6: Expand Snow Fence Use through Research and Increased Use								■			

TSMO Strategies	Existing Data Sources										
	1: Congestion Report	2: Data Tools	3: PeMS	4: RTMC and SRCC Incident Reports	5: State Patrol Incident Reports	6: Local Knowledge Recurring Congestion	7: Local Knowledge Special Events	8: Local Knowledge Weather	9: MDSS	10: Local Knowledge Incidents	11: MnCMAT
Strategy #7: Expand the Coverage of Freeway and Expressway Traffic Management Systems	■	■	■	■	■	■	■	■	■	■	■
Strategy #8: Develop Traffic Incident Management (TIM) Strategies for Work Zones											
Strategy #9: Utilize Intelligent Work Zone Systems Where Appropriate											
Strategy #10: Expand the Use of Ramp Metering	■	■	■								
Strategy #11: Expand Use of Technology at Weigh Stations for Enforcement											
Strategy #12: Increase TSMO Asset Life Cycle Understanding and Management											
Strategy #13: Implement Signal Timing Updates for Construction Projects											
Strategy #14: Provide Traveler Information on Alternative Modes and Routes											
Strategy #15: Expand and Enhance the Deployment of Road Weather Information Systems								■			
Strategy #16: Expand Consideration of Innovative Intersection Technology or Design (e.g. RICWS, roundabouts, RCIs, diverging diamonds, etc.)	■	■									
Strategy #17: Expand Dynamic Message Sign (DMS) Use to Include Standard Weather Messages											
Strategy #18: Improve Pedestrian and Bicycle Service at Signals											

TSMO Strategies	Existing Data Sources										
	1: Congestion Report	2: Data Tools	3: PeMS	4: RTMC and SRCC Incident Reports	5: State Patrol Incident Reports	6: Local Knowledge Recurring Congestion	7: Local Knowledge Special Events	8: Local Knowledge Weather	9: MDSS	10: Local Knowledge Incidents	11: MnCMAT
Strategy #19: Increase Real-time Tracking of Work Zones and Lane Closures for 511											
Strategy #20: Upgrade Signal Controller and Communications Equipment for Communications to Central System											
Strategy #21: Deploy Truck Parking Information for Rest Areas											
Strategy #22: Develop and Implement Pre-planned Alternative Routes for Incidents				■	■					■	
Strategy #23: Ensure New Signals are Connected Automated Vehicle (CAV) Ready											
Strategy #24: Add Additional MnPASS Lanes in the Twin Cities Metro Area	■	■	■								
Strategy #25: Provide Enhanced Enforcement Technology (Speed Enforcement, Red Light Running, MnPASS, etc.)											
Strategy #26: Expand and Streamline Road Weather Data								■			
Strategy #27: Utilize Alternate Route Signing for Work Zones											
Strategy #28: Expand Dissemination of Travel Times (Work Zones and Geographic Expansion)											
Strategy #29: Expand Sharing of Video and Data Between Agencies (Integrated Corridor Management)											
Strategy #30: Deploy Transit Signal Priority											

TSMO Strategies	Existing Data Sources										
	1: Congestion Report	2: Data Tools	3: PeMS	4: RTMC and SRCC Incident Reports	5: State Patrol Incident Reports	6: Local Knowledge Recurring Congestion	7: Local Knowledge Special Events	8: Local Knowledge Weather	9: MDSS	10: Local Knowledge Incidents	11: MnCMAT
Strategy #31: Address Bikes and Pedestrians in Construction Detours											
Strategy #32: Improve Work Zone Data for CAV Readiness											
Strategy #33: Prepare Systems to Obtain/Use Data from CAVs											
Strategy #34: Encourage Work Flexibility for Travel Demand Management											

Appendix F – Business Process for the TSMO Implementation Planning Process

The diagram below illustrates the process followed to identify and prioritize TSMO strategies.