U.S. Department of Transportation
Federal Highway Administration

Mainstreaming TSMO Throughout the Project Lifecycle Phases

INTRODUCTION

This case study highlights examples from departments of transportation (DOTs) that have incorporated transportation systems management and operations (TSMO) policies and processes into all phases of the project lifecycle. The examples focus on the integration of TSMO strategies and considerations into project development, design, construction, and maintenance manuals or formal processes.

TSMO applies operational improvements to maximize system performance on existing transportation facilities and stretch limited funding. TMSO is a set of strategies that enable transportation agencies to implement low-cost solutions, balance supply and demand, provide flexible solutions to meet changing conditions, and benefit more areas and customers. TSMO benefits may include improved safety and reliable traffic flow, which results in reduced congestion, better quality of life, less wasted fuel, cleaner air, and economic advantages.

This case study focuses on DOTs that have used policies and processes to mainstream TSMO across project lifecycle phases. The examples in this case study illustrate techniques for mainstreaming and advancing TSMO in DOTs.

DEFINITION OF MAINSTREAMING TSMO

Mainstreaming TSMO within an organization makes management and operations strategies readily understood, considered, attractive, and available to relevant agency leadership and staff, regardless of where they sit in the organization. Mainstreaming formalizes a TSMO program through comprehensive collaboration among a broad group of transportation management stakeholders (e.g., State and local DOTs, cities, counties, metropolitan planning organizations [MPOs], transit authorities, first responders, law enforcement, and legislators). This allows input based on knowledge, skills, and techniques from individuals in all programs that have a stake in improving the multimodal transportation system. Success in TSMO is not dependent on just one champion.

RATIONALE FOR MAINSTREAMING

Mainstreaming TSMO helps transportation agencies align, rather than compete, across programs to accomplish long-term system performance goals for the transportation system. Mainstreaming TSMO integrates a broader range of strategies throughout transportation departments and related agencies and organizations. It engages planners, designers, operators, and construction and maintenance staff, and it touches all aspects of mobility, including congestion, air quality, sustainability, safety, security, reliability, and related quality-of-life concerns. The goal of mainstreaming is to routinely include TSMO strategies as an equal player to address transportation needs within a community or region, along with other options to improve transportation system performance.

INCORPORATING TSMO IN PROJECT PLANNING AND DEVELOPMENT

Several DOTs have incorporated TSMO considerations and strategies into project planning and development policies and processes. These DOTs include the Ohio Department of Transportation (ODOT), Washington State Department of Transportation (WSDOT), Maryland Department of Transportation State Highway Administration (MDOT SHA), Pennsylvania Department of Transportation (PennDOT), and Colorado Department of Transportation (CDOT). Although each DOT uses different approaches, they each offer an illustration of how to incorporate TSMO into project development.

OHIO DEPARTMENT OF TRANSPORTATION

Traffic Operations Assessment Systems Tool (TOAST): ODOT developed TOAST as recommended in its 2018 TSMO Early Action Implementation Plan. The tool uses an interactive spreadsheet to identify system hotspots and prioritize projects. TOAST data calculations are run on route segments, and a total score is calculated for each route to identify those that can benefit from TSMO strategies. TOAST reports are generated statewide and by district and indicate the top 25 segments or hotspots by using data in the following categories: travel time performance, bottlenecks, TSMO safety, incident clearance, secondary crashes, volume per lane, and freight corridors. ODOT created an interactive online TOAST ratings map to allow stakeholders to zoom in and identify ratings on roads of interest.

TOAST is an example of how a DOT can mainstream TSMO into existing processes—in this case, project prioritization and initiation. ODOT staff apply TOAST at the programming and project initiation phases as follows:

- ODOT districts can apply for TSMO funding to address issues identified with TOAST through a $5 million annual budget dedicated to TSMO projects.
- ODOT's Project Initiation Package requires that project managers for major capital projects address specific TSMO considerations at the start of their projects. As part of the Project Initiation Package, project managers must indicate whether a project area is a hotspot in TOAST.

Additional information on TOAST is available on the ODOT TOAST website.[1] ODOT's TSMO website includes TSMO case studies featuring projects with goals of improving safety, reducing congestion, and improving travel time on I–90, I–670, and I–480.[2]

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

Corridor Sketch Initiative: The 2017 Corridor Sketch Initiative included a set of planning activities to engage WSDOT partners in determining the context and performance of corridors throughout the State and identifying strategies to improve gaps in performance. WSDOT captured information for every State route and presented it in a Corridor Sketch Summary that includes current and future function, data on what is

1 Ohio DOT. n.d. "Traffic Operation Assessment Systems Tool (TOAST)" (website). https://www.transportation.ohio.gov/wps/portal/gov/odot/working/data-tools/resources/toast, last accessed February 23, 2023.

2 Ohio DOT. n.d. "Transportation Systems Management & Operations" (website). https://www.transportation.ohio.gov/wps/portal/gov/odot/programs/tsmo/tsmo-landing-page, last accessed January 12, 2023.

working well and what needs to change, and recommended strategies and near-term actions to improve corridor function. The focus was to identify near-term operations and demand management strategies to address traffic congestion. The initial results help support both regional planning processes around the State and project scoping activities to identify investments for a corridor. State and local planners and project staff use the corridor information provided in the summary to mainstream operational considerations and TSMO strategies into planning and project development processes.[3]

COLORADO DEPARTMENT OF TRANSPORTATION

Project Development Manuals and Evaluation Tool: In 2015, CDOT developed an operations evaluation process to support TSMO considerations in projects using "a holistic approach to project development that encourages stakeholders to consider safety, operations, and technology elements early in the project life-cycle."[4] The TSMO evaluation provides a framework to support recommendations for improvement. Beginning in 2016, CDOT required all projects to include a TSMO evaluation—consisting of a safety assessment, an operations assessment, and an intelligent transportation systems (ITS) assessment—that recommends improvements to safety and mobility on the project. Using the evaluation on every project integrated the consideration of TSMO as a regular part of project development. The evaluation form is an online tool that takes input on crash data, current and proposed ITS infrastructure, operations data, and existing geometric conditions. The tool helps document current conditions and TSMO recommendations and identify projects for in-depth operational and safety analyses.[5]

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

TSMO Guidebook Series: PennDOT's TSMO Program Plan recommended developing a TSMO guidebook to integrate TSMO into planning, design, construction, maintenance, and operations processes. The guidebook has five parts addressing various project lifecycle phases. To date, several parts in the series have been completed to strengthen and connect planning and other agency processes with TSMO.[6] The *TSMO Guidebook Part 1: Planning* is intended to provide a clear connection between planning processes. It identifies areas for collaboration between TSMO and capital program development, including transportation program financial guidance, transportation program general and procedural guidance, regional congestion management processes, long-range plan guidance, and regional operations plans. Figure 1 from *TSMO Guidebook, Part 1: Planning* shows the TSMO relationship with the planning process.

The audience for the guidebook includes transportation planners and operations professionals at PennDOT and Pennsylvania metropolitan planning organizations, rural planning organizations, and local governments. The guidebook provides recommendations in the development and implementation of transportation operations plans and programs.[7]

3 More information is available at https://wsdot.wa.gov/engineering-standards/planning-guidance/corridor-sketch-initiative.

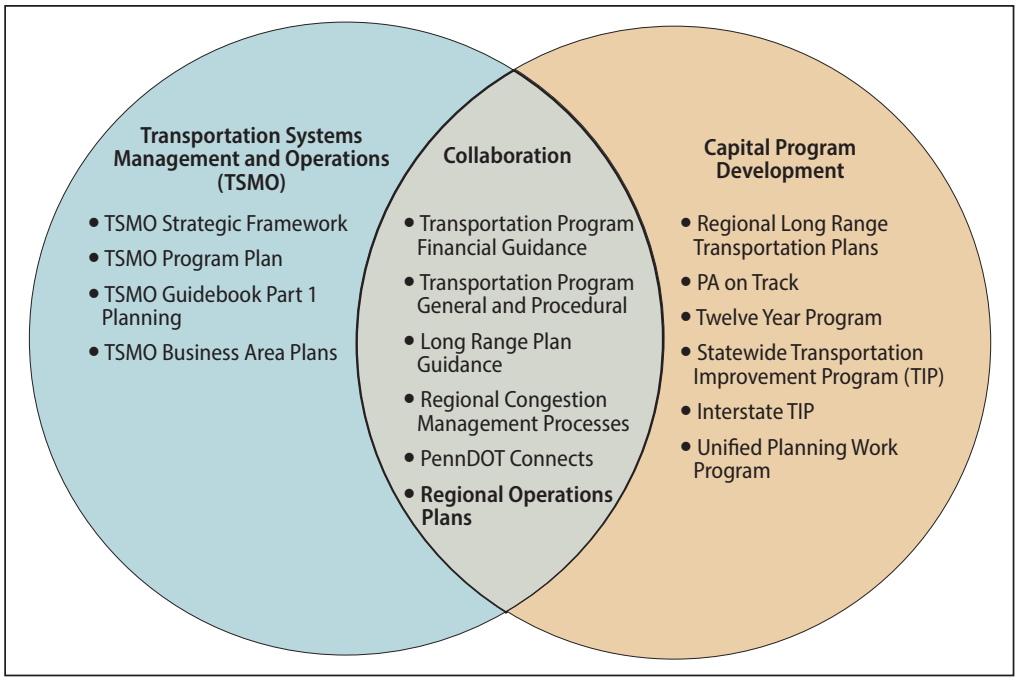
4 Colorado DOT. "Project Operations Evaluation." (web page). https://www.codot.gov/safety/traffic-safety/tsmo-evaluation, last accessed January 12, 2023.

5 More information is available at https://www.codot.gov/safety/traffic-safety/tsmo-evaluation.

6 The TSMO Guidebook series publications are posted to the PennDOT TSMO website as they are completed: https://www.penndot.pa.gov/ProjectAndPrograms/operations/Pages/default.aspx, last accessed January 31, 2023.

7 More information is available at https://www.penndot.gov/ProjectAndPrograms/operations/Documents/PA%20TSMO%20Program%20Plan.pdf and http://www.dot.state.pa.us/public/PubsForms/Publications/PUB%20851.pdf.

Source: Getty Images.



PennDOT = Pennsylvania Department of Transportation, PA = Pennsylvania.

Source: Pennsylvania DOT.

Figure 1. Diagram. Pennsylvania Department of Transportation (DOT) TSMO relationship with planning process.[8]

MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION

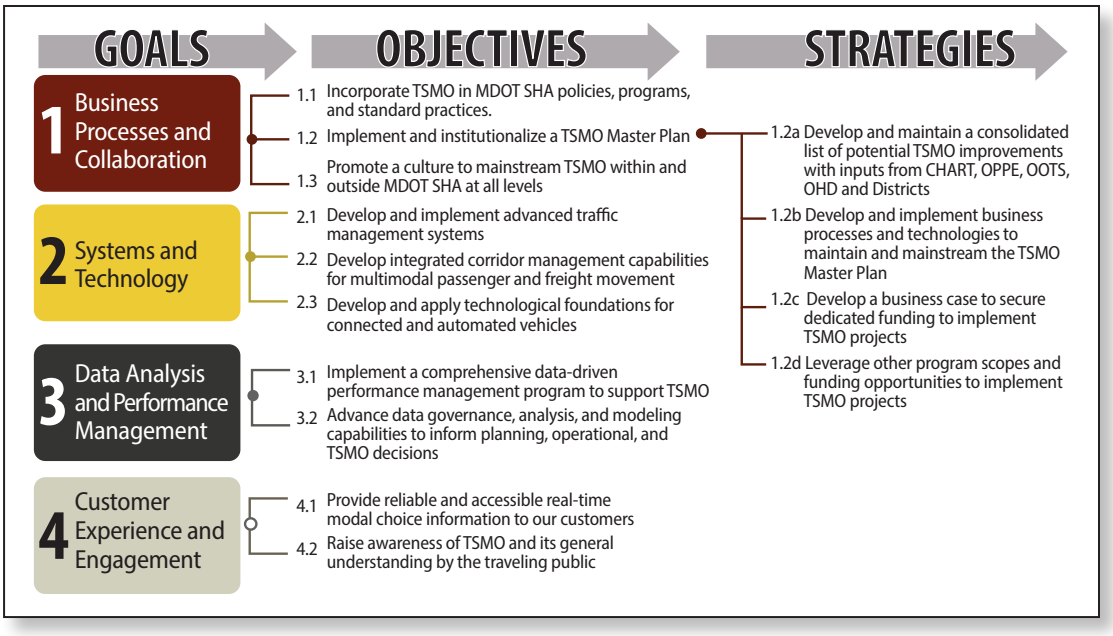
TSMO Directive and TSMO Program Objectives: MDOT SHA published a TSMO directive in July 2020 that directed MDOT SHA employees to mainstream TSMO across the agency. The purpose of the directive is to mainstream TSMO across the agency to achieve the following objectives:

- Establish an integrated approach to implementing multimodal systems and services
- Maximize efficiency of facilities
- Address capacity limitations through collaboration
- Promote TSMO integration
- Provide a method to incorporate principles into all activities

MDOT SHA's TSMO Master Plan identifies TSMO goals, objectives, and strategies (figure 2).[9] The first goal, business processes and collaboration, focuses specifically on mainstreaming TSMO with the objectives to incorporate TSMO across policies, programs, and practices; institutionalize a TSMO plan; and promote TSMO mainstreaming across all levels within and outside MDOT SHA. The commitment to mainstreaming TSMO is clearly articulated through MDOT SHA's plans, policies, processes, and program documents.

8 Pennsylvania DOT. 2018. Transportation Systems Management and Operations (TSMO) Guidebook Part I: Planning, PUB 851. http://www.dot.state.pa.us/public/PubsForms/Publications/PUB%20851.pdf, last accessed January 12, 2023.

9 Maryland DOT State Highway Administration. 2020. 2020 TSMO Master Plan. Baltimore, MD: Maryland DOT SHA. https://roads.maryland.gov/OPPEN/TSMO_Master_Plan.pdf, last accessed January 12, 2023.



TSMO = transportation systems management and operations, MDOT SHA = Maryland Department of Transportation State Highway Administration, CHART = Coordinated Highways Action Response Team, OPPE = Office of Planning and Preliminary Engineering, OOTS = Office of Traffic and Safety, OHD = Office of Highway Development.

Source: Maryland DOT State Highway Administration.

Figure 2. Maryland Department of Transportation (DOT) State Highway Administration strategic TSMO goals, objectives, and strategies.[10]

INTEGRATING TSMO INTO DESIGN AND CONSTRUCTION

This section highlights DOTs that have integrated TSMO into design and construction manuals. These DOTs include the Florida Department of Transportation (FDOT), New Hampshire Department of Transportation (NHDOT), Iowa Department of Transportation (Iowa DOT), and Texas Department of Transportation (TxDOT).

FLORIDA DEPARTMENT OF TRANSPORTATION

Review of Guidelines to Include TSMO: In 2016 and 2017, FDOT comprehensively reviewed its guidelines to identify where TSMO strategies had been included and what would be required to mainstream TSMO throughout the project development process. The agency also reviewed TSMO best practices across other State DOTs. Areas of focus included business processes, such as procurement, budgeting, and software development in ITS and TSMO projects. During the review of FDOT publications for TSMO language, FDOT revised a couple of its manuals such as the *Florida Intersection Design Guide* and *Florida Design Manual* to incorporate TSMO. The review also found that multiple manuals such as the *Efficient Transportation Decision-Making Manual* did not contain TSMO language.

Several recommendations came out of the study, including providing TSMO education throughout all disciplines, requiring communication coordination with TSMO staff in all project phases, and formalizing processes and procedures for inclusion of TSMO in FDOT guidelines. These recommendations would make it possible for TSMO staff to provide more input during project development and construction. The goal of these changes was to facilitate TSMO mainstreaming throughout FDOT project development practices and incorporate TSMO and ITS best practices into FDOT's contract templates and project development processes.[11]

10 Ibid.

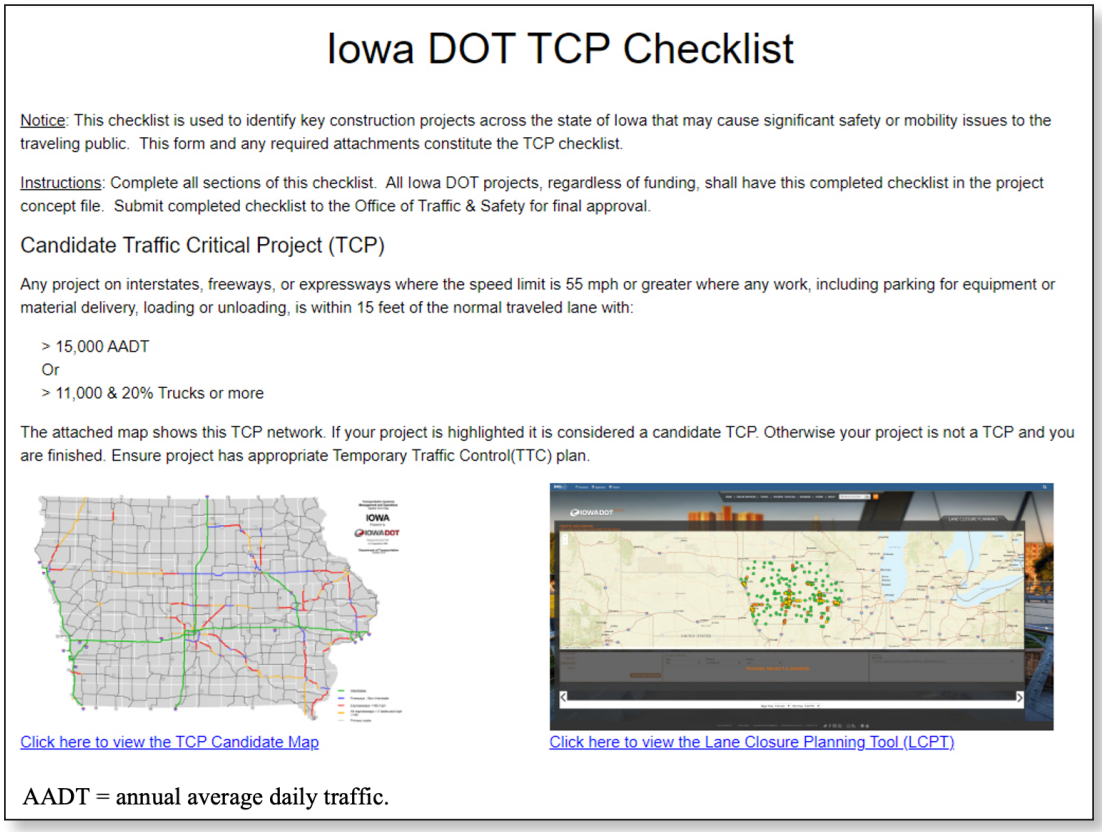
11 Sando, T., P. Alluri, L. Hagen, M. Angel, and D. Saha. 2018. Evaluation of Project Processes in Relation to Transportation Systems Management and Operations (TSM&O). https://transops.s3.amazonaws.com/uploaded_files/FDOT-BDV34-977-07-rpt.pdf, last accessed February 23, 2023.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Project Design Review by TSMO Bureau: In 2015, NHDOT's TSMO administrator and the director of project development outlined a project design review process for the TSMO Bureau. The Bureau reviews project designs for potential inclusion of ITS, and if it determines ITS should be included, up to 1.5 percent of the project cost can fund ITS without additional approval. Any value greater than 1.5 percent of the project cost requires approval from the director of project development. The NHDOT review process mainstreams the consideration of ITS in projects so that it no longer relies on individual staff connections, and only larger efforts require special budget requests.

IOWA DEPARTMENT OF TRANSPORTATION

Traffic Critical Project (TCP) Program: The TCP program facilitates safety and mobility at construction work zones by identifying projects that have the potential for significant safety or mobility impacts and applying mitigation strategies to address those impacts. The TCP program supports Iowa DOT's TSMO strategic goals of safety, reliability, efficiency, convenience, and coordination and draws on TSMO strategies and applications to enhance work zone safety and mobility. The program is included in the "Traffic Control" chapter of Iowa DOT's *Design Manual*. This ensures traffic-critical projects are routinely identified during planning and design, and various mitigation strategies are applied. The *Design Manual* includes a TCP checklist for projects on interstate and primary highways (figure 3).[12]



Iowa DOT TCP Checklist

Notice: This checklist is used to identify key construction projects across the state of Iowa that may cause significant safety or mobility issues to the traveling public. This form and any required attachments constitute the TCP checklist.

Instructions: Complete all sections of this checklist. All Iowa DOT projects, regardless of funding, shall have this completed checklist in the project concept file. Submit completed checklist to the Office of Traffic & Safety for final approval.

Candidate Traffic Critical Project (TCP)

Any project on interstates, freeways, or expressways where the speed limit is 55 mph or greater where any work, including parking for equipment or material delivery, loading or unloading, is within 15 feet of the normal traveled lane with:

> 15,000 AADT
Or
> 11,000 & 20% Trucks or more

The attached map shows this TCP network. If your project is highlighted it is considered a candidate TCP. Otherwise your project is not a TCP and you are finished. Ensure project has appropriate Temporary Traffic Control(TTC) plan.

Click here to view the TCP Candidate Map

Click here to view the Lane Closure Planning Tool (LCPT)

AADT = annual average daily traffic.

Source: Iowa DOT.

Figure 3. Image. First section of online Iowa Department of Transportation (DOT) Traffic Critical Projects Checklist.[13]

12 Iowa DOT. Design Manual. 2019. https://iowadot.gov/design/design-manual, last accessed January 12, 2023.

13 Ibid.

TEXAS DEPARTMENT OF TRANSPORTATION

Statewide Traffic Management Systems Policy:[14] In a 2022 policy notice to TxDOT district engineers, the chief engineer outlined statewide policies for incorporating traffic management systems throughout the project lifecycle—from inception through construction. By formalizing traffic management at each of these phases, the memo supported mainstreaming TSMO in project planning, design, and construction. In support of operations, the memo stated that fiber-optic cable for the district's traffic network, closed-circuit television cameras, and dynamic message signs are expected to be installed (if not already present) during construction projects on priority roads as defined by the maintenance division. It also stated that districts are responsible for ensuring that greater than 90 percent of equipment is operational even during construction, and for implementing asset and network management. The 2016 version of this memo is an appendix to the TxDOT TSMO Statewide Strategic Plan.[15]

BRINGING TSMO INTO MAINTENANCE

The Oregon and Minnesota DOTs are examples of agencies that have integrated TSMO into maintenance procedures or systems.

OREGON DEPARTMENT OF TRANSPORTATION

The Oregon DOT (ODOT) encourages the use of TSMO strategies during maintenance to minimize traffic impacts, which supports the mainstreaming of TSMO in maintenance activities. A reference document to support transportation planning, ODOT's Analysis Procedures Manual, Transportation Systems Management & Operations, guides the State in the integration of TSMO into planning processes and project development. It includes specific TSMO strategies and calls out applications to be considered in work zones. Strategies include smart work zones, integrated corridor management, automated speed enforcement, dynamic lane-use control, work zone incident management, traveler information, and dynamic warning systems.[16]

MINNESOTA DEPARTMENT OF TRANSPORTATION

The Minnesota Department of Transportation (MnDOT) mainstreamed TSMO into routine winter maintenance by deploying a system that automatically posts messages on variable message signs to alert drivers to snowplows or maintenance vehicles when an equipped vehicle enters a predefined area. MnDOT uses the system statewide, using more than 100 existing dynamic message signs, and it is intended to improve safety for snow and ice removal as well as other maintenance operations. The system can also alert drivers to maintenance activities and work zones.[17]

14 Texas DOT. Stateside Traffic Management Systems Policy, June 29, 2022. Policy Notice P-TRF-001.

15 Texas DOT. 2018. Transportation Systems Management and Operations (TSMO) Statewide Strategic Plan. http://ftp.dot.state.tx.us/pub/txdot-info/trf/tsmo/tsmo-statewide-strategic-plan.pdf, last accessed February 23, 2023.

16 Oregon Department of Transportation. 2020. Analysis Procedures Manual Version 2: Planning & Technical Guidance. Salem, OR: ODOT. https://www.oregon.gov/odot/Planning/Documents/APMv2.pdf, last accessed June 29, 2021.

17 More information is at https://www.dot.state.mn.us/its/projects/2016-2020/wzarde.html.

SUMMARY

State DOTs are taking key steps to mainstream TSMO across functional areas and project lifecycle phases through a variety of methods.

These methods include:

- Policy directives and formal planning documents, as in the case of MDOT SHA
- Focused applications and processes that guide consideration of TSMO-first strategies, as seen in WSDOT and MDOT SHA
- Guidance documents that raise awareness of TMSO strategies, such as CDOT's TSMO evaluation and PennDOT's TSMO guidebook series
- Initiatives that bring TSMO into construction and maintenance, as in Iowa DOT's TCP program and MnDOT's maintenance activities notification project statewide

Each example illustrates the range of opportunities to advance the process of mainstreaming TSMO—from agencywide policies to project-specific applications. These opportunities can be considered for applicability to different DOTs and their ability to advance and mainstream TSMO.

NON-BINDING CONTENTS

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