

ADVANCING TSMO:

Making the Business Case for Institutional, Organizational, and Procedural Changes



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INTRODUCTION



Transportation Systems Management and Operations (TSMO) presents a key opportunity for transportation agencies today and many agencies have recently been making a significant effort to better leverage TSMO to improve system performance in a cost effective way. This guide explores how a transportation agency's established Institutional, Organizational, and Procedural (IOP) "way of doing business" can be changed to reduce barriers and increase capabilities for effective TSMO.

The Need for Transportation Systems Management and Operations

Transportation agencies are dedicated to improving the safety, mobility, and reliability of transportation systems to more effectively move people and goods. Agencies also work to support other objectives that serve their customers, including improving quality of life, increasing economic efficiencies, and reducing emissions. Responsibility and accountability to the public to wisely invest resources and achieve optimal performance are key drivers across the public sector, and transportation agencies are no exception. Within highway transportation, financial and right-of-way constraints on adding new lanes have restricted agencies' ability to add enough new capacity to relieve congestion through traditional road building approaches. Many

causes of congestion only affect the roadway at certain times, such as nonrecurring congestion from events like crashes and bad weather that take some of the available capacity temporarily out-of-service due to lane blockages or deteriorated road conditions that reduce traffic flow. These events are not directly addressed by building new capacity, though the added capacity does indirectly mitigate these issues in the short- to medium-term.

Making the most effective use of *existing* highway capacity and coupling new road building projects with strategies that directly address nonrecurring congestion are important to meeting current transportation needs and will continue to be moving forward. In meeting these needs, a set of specific strategies has evolved to support improved transportation systems management and operations—known by the shorthand acronym, TSMO—with the goal of maintaining, and even increasing, the effective capacity and service of transportation networks. TSMO is an emerging term used to describe an integrated program of projects, strategies, services, technologies, and processes to plan for, manage, and operate whole transportation networks to optimize systemwide performance. TSMO can also be applied in combination with projects to expand transportation facilities, such as adding lanes, to enhance the effectiveness of these projects, especially when it comes to managing nonrecurring congestion. Most agencies have been conducting some TSMO activities for years (although not necessarily under the name of TSMO), such as managing crashes and work zones. Many educational efforts to increase TSMO awareness and understanding at agencies across the country have resulted in participants’ realization that TSMO is simply what they do on a day-to-day basis and the need for increased efficiency and collaboration is essentially a need to view these existing TSMO activities through a system- and agency-wide lens. On the other end of the TSMO spectrum, some strategies, such as preparing Transportation Management Centers (TMC) for big data from connected vehicles, are working to take advantage of still-evolving technologies. Some specific examples of the strategies that make up TSMO include:

Why TSMO Matters

“TSMO matters because it deals directly with the root causes of congestion, offers the potential to improve safety and efficiency, and offers the potential to maximize existing infrastructure capacity through cost effective strategies.

Ultimately, this will improve the safety and mobility of the transportation system and help Iowans travel to their destinations safely, efficiently, and conveniently”.

—Iowa TSMO Program Plan

(Source: <https://www.iowadot.gov/tsmo/>)

- ▶ Managing traffic in and around construction work zones.
- ▶ Upgrading traffic signals for increased traffic-responsiveness.
- ▶ Clearing traffic incidents, like crashes and breakdowns, more quickly and thereby improving clearance safety.
- ▶ Anticipating and treating the effects of bad weather, such as snow and ice, and adjusting traffic control to help with traffic flow.
- ▶ Metering ramps to improve throughput.
- ▶ Improving traffic signal coordination for improved flow.
- ▶ Providing driver warnings and advisories in advance of crashes or congestion.
- ▶ Coordinating and integrating systems, services, and partnerships.
- ▶ Capitalizing on new technology to detect and communicate traffic information.

Most of these strategies, compared to capacity improvements, are relatively low in cost and can be accomplished in the short term. Improving the system's operational management has the potential to offer a wide range of benefits, both directly to customers in terms of improved service through application of the above strategies, and to the agency itself.

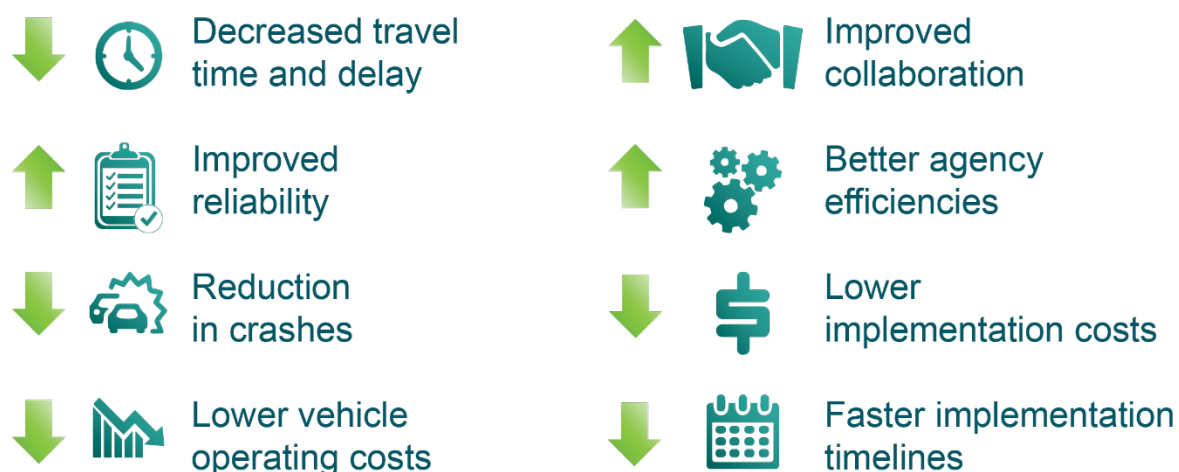


Figure 1. Graph. Benefits associated with Transportation Systems Management and Operations (TSMO) strategies.

(Source: Federal Highway Administration.)

Extensive educational efforts to increase TSMO awareness and understanding at agencies across the country have resulted in participants' realization that viewing TSMO activities through a system- and agency-wide lens provides a useful framework for advancing their efforts to reduce both recurring and nonrecurring congestion on a more efficient and cost effective basis. Conversion of TSMO efforts from a set of ad hoc activities to a formal, organized, and sustained program establishes TSMO as one of the agency's key objectives and activities and establishes appropriate standard approaches and arrangements with other functions in the agency, like construction and maintenance, thereby moving towards "institutionalizing" TSMO on a sustainable basis.

The breadth of related TSMO strategies is both a potential strength and a challenge. Many agencies find that TSMO touches the entire agency. This presents a collaboration challenge in terms of coordinating across agency units. It also offers an opportunity to use the advancement of TSMO as an avenue for improving communication and integration across the agency, which provides benefits for both TSMO and other agency activities.

Experience has shown that integrating TSMO strategies can have a significant impact on measurable highway performance both by reducing travel time delay and providing for more predictable travel times. In addition, integrating TSMO elements into new construction, safety projects, and maintenance programs can provide important enhancements to their effectiveness. TSMO not only provides public agencies with a growing toolbox of individual solutions and a growing ability to use these solutions proactively through technology, but also encourages agencies to combine them to achieve greater performance throughout the entire system. Integration can happen at multiple levels: among a set of strategies; across multiple State Department of Transportation (DOT) units, jurisdictions, and agencies; and across different modes. Together this integration ensures that the entire transportation systems performs optimally.

Overcoming these challenges and leveraging these opportunities through the lens of IOP are a major focus of this guide. TSMO presents a key opportunity for transportation agencies today and many agencies have recently been making a significant effort to better leverage TSMO to improve system performance in a cost effective way. This Guide explores how a transportation agency's established Institutional, Organizational, and Procedural "way of doing business" can be changed to reduce barriers and increase capabilities for effective TSMO.

The Need for Institutional, Organizational, and Procedural Changes

Over the last decade as highway capacity improvements became more constrained, concern grew over the impacts of rising congestion in normal peak periods. To this issue was added increasing unpredictable delay, especially problematic in an economic context with a rising importance of “just in time” service. In response, “Reliability” became one of the four research and solution development focuses of the Transportation Research Board (TRB) second Strategic Highway Research Program (SHRP 2) program. One of the early products (2012) of that research focused on *Institutional Architecture to Improve Systems Operations and Management*¹. The findings of this research focused on identifying the procedural and institutional characteristic of agencies with the most effective TSMO programs. This research was used to develop a framework, called the TSMO Capability Maturity Model (CMM), that identified the key dimensions and levels of agency capability associated with effective TSMO. The six key dimensions are: business processes, systems and technology, performance measurement, culture, organization and staffing, and collaboration. Criteria were developed characterizing incremental levels observed in best practice based on the goal of continuous improvement.

The TSMO CMM framework was subsequently utilized to establish an agency self-evaluation process in which agency TSMO management and staff identified current strengths and weakness regarding each dimension to identify the current level of capability—and used the level criteria as a target against which to develop specific actions for incremental improvement in each dimension. Since 2009, over 30 States, most with significant TSMO activities, have conducted Federal Highway Administration (FHWA) sponsored CMM self-assessment workshops at the statewide or regional level.² In these workshops, TSMO program managers and staff assess the current agency status regarding their TSMO efforts in terms of the CMM's

¹ National Academies of Sciences, Engineering, and Medicine. 2012. *Institutional Architectures to Improve Systems Operations and Management*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/14512>.

² <https://ops.fhwa.dot.gov/publications/fhwahop16031/index.htm>.

six key dimensions of capability. The assessment provides the participants with a starting place to develop agency actions to improve the effectiveness of the agency's TSMO efforts, often in incremental steps that advance operations. Many of these actions to advance TSMO require actions on the part of agency leadership.

These workshops confirmed that effective TSMO implementation requires the development of a set of specific arrangements within State DOTs that differ somewhat from those that have been used to support traditional highway construction and maintenance. Some of these changes are largely “technical”—such as systems engineering and ITS device deployment—and largely within the span-of-control of agency units directly responsible for TSMO activities. However, improving TSMO effectiveness goes beyond changes in systems and technology to include the needed TSMO-specific procedures and arrangements that may be at odds with legacy arrangements. These changes, or actions, generally fall into three categories:

- ▶ **Institutional.** Actions that are focused on growing an agency culture that values TSMO, including mission and objectives, technical understanding, leadership, outreach, and program legal authorities.

“ Increasing Recognition of the Importance of IOP Changes to Advance TSMO

The following insights from agencies were collected during a 2017 peer exchange involving leading TSMO practitioners:

“Situational awareness is an important part of TSMO; we are trying to be aware of private sector resources and opportunities.”

“There is a continual need to educate top management on the importance of TSMO.”

“To garner support of top managers, applied cost/benefit analyses are needed—meaning localized, practical analyses, not just general, nation-wide research.”

“TSMO is becoming fairly well mainstreamed in the agency.”

“Coordinating with DOT districts to get “buy in” is important to advance TSMO in the State.”

“It is important to establish a set of criteria to select TSMO projects.”

“Our approach focuses on integrating TSMO into programming processes.”

“A large negative event propelled the agency to advance TSMO.”

“Making the business case for IOP changes, especially in light of staff turnover, is key to mainstreaming TSMO in the long-run.”

- ▶ **Organizational.** Actions that adjust the structure of responsibilities including reorganization, staff training and development, recruitment and retention, and collaboration to better support TSMO functions.
- ▶ **Procedural.** Actions that improve business and technical processes to better incorporate TSMO, including adjustments in planning, programming and budgeting, systems engineering, and performance measurement.

Nationwide experience and research points to the fact that these kinds of changes may not be easy, but are essential to unlocking the full potential of TSMO strategies towards “mainstreaming” TSMO as an effective, formal first line agency program.

Changes in Institutional, Organizational, and Procedural (IOP) arrangements are generally not expensive. However, they can be challenging since, in varying degrees, they may involve some reorganization, introduce new reporting requirements, involve competition for resources or staffing, or require changes that impact the agency more broadly such as new policies or objectives. Moreover, these changes can be incremental in nature, consistent with staff resources and the need to learn new approaches. As one State DOT report puts it:

“Operational improvements can be “advanced through better integration, coordination, and systematic and strategic implementation. At the same time, and equally important, this also requires a cultural change within the department to transform operations from how it has been historically viewed and delivered to an integrated statewide program. Cultural change is difficult and time consuming to implement due to institutional barriers and issues associated with the particular program.”³

A Note on Terminology

In the emerging field of TSMO, agencies use different terms to describe the intent of making IOP changes to support more effective TSMO on a continuous basis. The terms “mainstreaming TSMO” and “institutionalizing TSMO” are sometimes used: however, these terms should not be taken to imply that there is any single recipe for making systematic IOP changes. The general intent is for agencies to make *incremental IOP changes* to support the continuous enhancement

³ Colorado Department of Transportation.

of their TSMO activities, which, when fully integrated, should enhance agencies' services and functions as a whole. IOP changes to advance TSMO should be identified and implemented with consideration for each agency's unique context, culture, and nomenclature. DOTs at different levels of implementing TSMO should and do take different approaches to the types and extent of the changes.

Purpose of the Guide

This guide provides a process for the development and communication of the business case for making IOP changes to advance TSMO. The business case is a **well-formed argument** that is based on compelling **qualitative and anecdotal information** as well as **technical analyses** that rationalize and justify the need for the IOP changes to advance TSMO. It involves identifying the transportation problem to be addressed; relating the problem to effective TSMO; showing how effective TSMO requires certain IOP changes; and, illustrating the payoffs versus the costs.

In most cases the need for making the business case will occur when an agency already conducts a range of TSMO activities and realizes the need to evolve its TSMO activities from a collection of "ad hoc" activities to a set of integrated practices that are efficient and effective for a complete range of current and future strategies. Formalizing TSMO processes within an agency will likely to involve IOP changes that may introduce challenges in the agency's approach to legacy programs and will require a strong IOP business case.

Overview of the Guide

This guide provides supporting concepts, actions, and tips to transportation agencies working to create and document the business case for an effective TSMO program: a discussion of the general context for business case preparation; descriptions of alternative strategies for communicating the business case; an outline of business case content; and a discussion of the types and forms of business case presentations and related media that may be appropriate for varying contexts. The guide is organized as follows:

- ▶ **Part I. Getting Started on Making the Business Case.** Introduces the objectives for this guide while covering some assumptions about the business case preparer, and details seven characteristics of a successful business case.
- ▶ **Part II. Preparing the Business Case for Institutional, Organizational, and Procedural Changes.** Provides steps for developing the business case, broken down into seven essential sections of an effective business case.
- ▶ **Part III. Agency Leadership Support for Key Institutional, Organizational, and Procedural Changes.** Discusses the significance of actions and resource expenditures related to agency leadership and provides insights for navigating this critical area.
- ▶ **Part IV. Tailoring the Business Case to Specific Audiences.** Discusses and provides recommendations on preparing the business case for a variety of key stakeholder audiences in a variety of formats to best suit the target audience.

PART I

GETTING STARTED ON MAKING THE BUSINESS CASE



Why Make the Business Case?

Most agencies or jurisdictions have developed a set of Transportation Systems Management and Operations (TSMO) strategies and solutions that are providing important benefits to their transportation systems users in terms of reduced congestion and delay and improved reliability and safety. However, continued improvement is often hampered by reliance on legacy Institutional, Organizational, and Procedural (IOP) arrangements that were developed for traditional highway “build and maintain” program approaches. Continuous improvement in TSMO requires IOP arrangements that are suitable for the distinct characteristics of TSMO strategies, including their high-tech systems engineering and decision-support systems, 24/7 situational awareness, and performance-driven real-time collaborative management. Often legacy technical and business processes associated with highway capital project development are not well suited to the characteristics of such TSMO strategies.

Research indicated that traditional IOP arrangements are not oriented to real time operations or supportive of continuous improvement. Since many of the needed IOP changes are beyond the span of control of TSMO managers on their own, this situation has often led to a “plateauing” of

TSMO effectiveness—highlighting the need to make the business case to **senior managers** and **agency leadership** for a greater commitment to continuous advancement.

There are many events—both positive and negative—that have been associated with triggering a focus on the need for improving TSMO including:

- ▶ A major disruptive traffic incident or event (such as a major weather disruption, crash with considerable backup, or planned special event) highlighting the importance of effective system operations and suggesting the need for improving TSMO.
- ▶ Recognition of the need for specific improvement actions resulting from a TSMO self-assessment.
- ▶ A change in top-level policy priorities to include advancing TSMO as a formal strategic management and agency activity.
- ▶ Public concern about increased traffic congestion, especially nonrecurring congestion.
- ▶ The implications of more effective utilization of new technologies, such as advanced Intelligent Transportation Systems (ITS) or automated driving systems.

Making the Business Case for TSMO is a Growing Need Across the Nation

As documented in National Cooperative Highway Research Program (NCHRP) 20-07 Task 365, Transportation Systems Management and Operations Program Planning: Experiences from the Second Strategic Highway Research Program (SHRP 2) Implementation Assistance Program, making the business case for TSMO has emerged as an important need and tool as agencies develop and implement TSMO program plans. Business cases can be tailored to specific audiences as an effective method to engage, educate, and gain support from various partners. NCHRP 20-07(365) conducted a national survey of TSMO agency leaders and champions. As an element within a larger TSMO program plan, the survey indicated a fair amount of importance to business cases. Sixty-eight percent indicated that their agency included a business case in their TSMO program plan and viewed it as a very or somewhat important element. When ranked among twenty elements of a program plan, developing a business case ranked as the fourth most important element—highlighting its key role in TSMO program planning.

- ▶ Anticipation of major construction or maintenance projects that may cause major traffic disruptions.
- ▶ A shortfall in agency resources, making it more challenging to pursue expensive new capacity projects.

Both negative events and positive opportunities can highlight the need to formalize an agency's direction for TSMO-related IOP changes in terms of making the business case.

Business Case Formats

The range of motivations for making the business case is paralleled by a range of approaches to making the case. In some cases, an extensive technical report may be appropriate for full documentation. In other cases, a concise technical memo to senior management or decisionmakers may be more effective. However, a business case need not be confined to technical documents. The need for immediate responses to events and opportunities suggests the utility of other formats that use varying lengths, styles, and media including:

- ▶ Informal conversations with agency colleagues.
- ▶ Interactive media presentations to either internal audiences or external stakeholders.
- ▶ Visual aids such as infographics that can quickly communicate key points to a variety of audiences.
- ▶ A Web page or document posted on the agency's website.

The material in this guide is designed to support all these contexts and approaches. Further, it should be noted that making the TSMO business case is not a one-time activity nor is it confined to preparing a technical document. The availability and willingness to employ a wide range of strategies to foster a greater understanding of the IOP aspects needed to advance TSMO is a continual process. Experience suggests that several reinforcing and continual communication strategies are essential, with multiple audiences, in order to generate continuing support for the IOP changes essential to more effective TSMO.

Who Should Make the Business Case?

The ambition to improve TSMO effectiveness through IOP changes may be found in a range of agencies, from those with only an emerging interest in TSMO (e.g., a few ad hoc TSMO strategy applications) to those with a significant TSMO orientation and interest in upgrading and transforming TSMO activities into a formal part of the agency's programs.

Regardless of the context and initiative, the business case should be prepared by staff (internal or external) with a good understanding of the agency's TSMO activities and IOP challenges as well as a reasonable knowledge of the state-of-the-practice of IOP arrangements for TSMO. The individuals driving this change may be TSMO "champions" within the agency staff, agency leadership (both veteran leaders and new leaders), staff involved with implementing TSMO who have struggled with specific IOP barriers, part of a government-wide performance initiative, or any combination of these. In all cases, extensive experience indicates that improving TSMO effectiveness requires a deliberate managed change approach if it is to address key IOP dimensions. Champions should be willing to advocate for TSMO in-person or on paper—even when the cultural and institutional setting

State-of-the-Practice Resources on IOP Changes for TSMO

Over 60 State DOT TSMO Capability Maturity Model (CMM) self-evaluation workshops have been conducted throughout the country with FHWA support. These workshops include a focus on IOP dimensions and include criteria for agency evaluation of maturity level. These workshops have generated a set of typical strategies to improve agency performance relative to IOP dimensions. This material is presented in the 2015 Federal Highway Administration (FHWA) report: "Organizing for Reliability—Capability Maturity Model Assessment and Implementation Plans, Executive Summary"¹ and in the 2017 FHWA report "Developing and Sustaining a Transportation Systems Management & Operations Mission for Your Organization: A Primer for Program Planning."²

For preparers not familiar with the TSMO CMM process, it will prove valuable to complete the online CMM self-assessment for their agency at the following website: <http://www.aashtotsmoguidance.org>.

1. <https://ops.fhwa.dot.gov/docs/cmmexesum/index.htm>.

2. <https://ops.fhwa.dot.gov/publications/fhwahop17017/index.htm>.

may offer some level of push-back. Key tenets of effective TSMO advocacy include good communication and the ability to generate confidence, understanding, and excitement towards the benefits that improved TSMO offers the agency. Experience indicates that these champions play a key role in promoting TSMO and raising the profile of TSMO in an agency.

Characteristics of an Effective Business Case

Achieving the most effective and efficient TSMO program is the key objective of making the business case. Ultimately, TSMO effectiveness will depend on the degree to which it becomes an integral part of agency culture and a formal program, like capacity development or maintenance. The essential characteristics of making an effective business case include:

- A.** Tailoring the IOP business case to local priorities.
- B.** Illustrating how current experience and events indicate how TSMO can augment the effectiveness and benefits of the full range of current agency programs.
- C.** Specifying the strategic IOP changes needed, including the specific actions that need to be made and the desired outcomes, and relating the changes to the appropriate decisionmaking level accounting for individual and unit's span-of-control and responsibilities.
- D.** Including both external and internal benefits and payoffs at the program level.
- E.** Describing the required levels of effort and resources associated with the needed changes.
- F.** Identifying relationships between costs, benefits, and risks.
- G.** Targeting the IOP business case to specific audiences.

These characteristics are discussed in greater detail below.

A. Tailoring the Institutional, Organizational, and Procedural Business Case to Local Priorities

The IOP business case should be tailored to the local transportation context with a consideration of improvements needed in the existing TSMO program or activities. Tailoring the IOP business case to local priorities in terms of local challenges, needs, and appropriateness to the jurisdiction's current system performance and TSMO applications ensure the relevance of IOP changes and help build support for these changes from key stakeholders. Disruptive events, new TSMO applications and technology, resource issues, or new leadership may suggest the need for a systematic review of current agency challenges related to TSMO IOP arrangements and the need for making improvements. Agency experiences to date indicate that typical IOP challenges include:

- ▶ Specific congestion issue with a potential TSMO strategy not in place (for example incidents not detected by ITS or other systems currently in place).
- ▶ Transportation and public safety incident management responsibilities not well coordinated.
- ▶ Agency protocols or decision support systems for ramp metering or other real-time responses lacking.
- ▶ ITS technologies under maintained.
- ▶ Agency TSMO performance is unknown and not tracked/measured.
- ▶ No forward plan or program for TSMO improvement in place leading to potential future staffing or budget shortfalls.
- ▶ Lack of specific staff technical capability to conduct key activities such as systems engineering or ITS architecture updates.
- ▶ ITS system development unit uncoordinated with Traffic Management Center (TMC)-based operational issues.
- ▶ Absence of clear responsibility or authority to improve some aspects of TSMO programs.

B. Illustrating How Transportation Systems Management and Operations Can Augment the Effectiveness and Benefits of Agency Programs

TSMO does not compete with, or displace, the important agency functions regarding the development and maintenance of roadway capacity. TSMO can improve the potential benefits from those programs. For example, TSMO components and strategies applied to existing and new capacity can improve its throughput, with only a marginal increase in cost, and in some cases will heighten the justification for capacity improvement through the use of ramp meters, variable message signs, and other advisory systems that increase the benefits of the new capacity. TSMO also can minimize delay related to maintenance and reconstruction by ensuring safe and smooth traffic flow in work zones. Therefore, the business case can frame TSMO improvements as a cost effective way to complement more traditional transportation agency activities, such as roadway expansion and pavement condition maintenance, and highlight that adding TSMO projects to such transportation improvement projects enhances the impacts and cost effectiveness of both.

C. Specifying Strategic Institutional, Organizational, and Procedural Changes Needed and Relating Actions to the Appropriate Decisionmaking Level

The challenges noted above are interrelated. Effective deployment and operation of TSMO strategies and solutions requires updating legacy business and technical processes to accommodate the special characteristics of TSMO project development and implementation. The development and execution of these important processes depends on the development of appropriate staff capabilities and an organizational structure capable of executing the needed IOP adjustments. Finally, the creation of an appropriate organizational structure and securing needed staff resources may be dependent on new institutional arrangements that elevate TSMO to the program level alongside legacy programs related to planning, design, construction, maintenance, and safety.

Evolution from “TSMO as a set of ad hoc activities” to “mainstreamed TSMO” has been shown to be dependent on agency commitment to a set of related significant IOP changes, including:

- ▶ Identifying TSMO applications that are providing effective response to disruptions, events, and mobility challenges.
- ▶ Developing TSMO application-specific plans, programs, and processes.
- ▶ Providing predictable resources for a sustainable TSMO program.
- ▶ Increasing utilization of systems engineering processes and updated technologies.
- ▶ Incorporating operational performance measurement in agency-wide processes.
- ▶ Clarifying leadership commitment regarding TSMO mission and resources.
- ▶ Improving agency TSMO effectiveness through reorganization or reassignments.
- ▶ Improving staff capabilities and organizational efficiency.
- ▶ Increasing training on TSMO systems, processes, and partnerships.
- ▶ Enhancing alignment with collaborators, stakeholders, and partners.

For agencies that have at least a few TSMO strategies in place, the benefits and payoffs of these program level changes have been shown to be significant in terms of the impact on agency effectiveness in dealing with transportation challenges and, at the same time, on agency efficiency. The TSMO business case is designed to present the arguments for the importance of these changes. However, agencies will first have to identify and prioritize the needed IOP changes for their unique context. There are various approaches for identifying a range of appropriate IOP changes for a given agency, including: CMM workshops/self-assessments, specialized Capability Maturity Framework (CMF) workshops/self-assessments that focus on particular TSMO applications such as work zone management, process reviews, peer exchanges, or benchmarking the agency's IOP arrangements against the arrangements of a peer State that has been advancing TSMO. Once a range of potential IOP changes are identified, agencies have a similar range of approaches or strategies for prioritizing these changes, such as prioritizing actions based on which actions are seen as "low hanging fruit," more likely to garner leadership support, or well-timed with other initiatives such as ITS architecture updates, long range plan updates, or major events. In identifying and prioritizing

these changes, there are a set of additional considerations, detailed below, that agencies should bear in mind.

The authority and capacity within an agency to make key IOP changes varies with the type of change. Changes in technical and business process may be within the span of control of a TSMO unit manager or may require coordination with other units/functions. Authority for staffing and certain organizational changes may reside at the division level of which TSMO is a part of.

Improvements related to institutional commitment, reorganization, staffing, or processes are often outside the span of control of staff managing TSMO functions. Such changes typically require support and authorization on the part of top management in the agency, such as other division managers, agency leadership, or policymakers. Understanding the structure, support, and authorization needed to advance IOP actions within the control of various levels of management is often needed to make the IOP changes. Given the many demands on agency leadership, the arguments for including TSMO as a high priority must be carefully structured in terms of the logic of the relationship between specific IOP changes and the presumed benefits to the agency overall mission and vision.

D. Including Both External and Internal Benefits/Payoffs at the Program Level

The types of IOP changes described above can provide two types of payoffs, external and internal. *External* payoffs to customers flow from the enhanced ability of an organized program. However it is often difficult to trace a one-to-one relationship between a specific action and the payoff in terms of its specific impact on improving the effectiveness of a given TSMO strategy application. The payoffs from IOP changes typically leverage improvements in the entire range of TSMO strategies at any given point in the future, such as:

- ▶ More precise matching of strategy applications to causes of nonrecurring congestion by type and location.
- ▶ Aggressive application of each strategy to capitalize on its full potential.
- ▶ New strategies which capitalize on new data and procedures that respond to more complex problems.

- ▶ Direct impacts on improving mobility and safety.
- ▶ Lower costs and quicker implementation.

Estimating *internal* payoffs from these benefits maybe approached in several ways. One payoff relates to “staff efficiency”. This may be estimated in terms of increases in the quantities of ITS devices, route miles of coverage, and incidents responded to, as compared to staff levels. Improvements in TSMO strategy application performance, as impacted by improved applications deployment and management, may be measured on a year-to-year basis (such as incident clearance times, number of information messages, significant work zone delay, intersection delay, etc.). In addition, incorporation (and in some cases funding) of ITS devices in construction or maintenance project budgets may represent a cost saving reflecting a payoff from of integrated planning and project development.

Other internal benefits may include:

- ▶ Use of a single set of agency objective related performance measures to manage and improve TSMO strategy applications on an incremental basis.
- ▶ Integrated TSMO planning to assure that priority TSMO-responsive service targets are being addressed.
- ▶ Sustainable funding for TSMO permitting logical multi-year deployment sequences.
- ▶ Improved inter-unit coordination to minimize staff activity overlap or gaps and to clarify responsibilities.
- ▶ Measurement supported by top management commitment and leadership.
- ▶ Identification of key staff capabilities needed and associated training needs.
- ▶ Formalization of partnership arrangements to support aligned objectives, roles, and procedures.
- ▶ Positive customer perception feedback regarding improved service (as in the case of service patrol mail-back postcards).
- ▶ Increased staff retention in response to experiencing a challenging and rewarding work place that helps make a difference.

E. Describing the Required Levels of Effort and Resources Associated with the Needed Changes

The IOP business case should include a description of the type of IOP changes proposed as well as the potential levels of effort and/or resources required. The “costs” of needed IOP changes include efforts involved to bring them about. Costs are not necessarily related to financial expenditure; indeed few IOP changes involve significant investment. However, all changes involve the expenditure of some type of resources, though they may be more intangible. The range of costs may include:

- ▶ *Dollar costs*—where staffing is involved or consultant studies employed for products such as a plan or systems engineering.
- ▶ *Levels of effort*—the proportion of staff or unit time needed to develop new business and technical processes; develop new procedures; plan, program, and budget; make adjustments in accountability and reporting relationship; and conduct communications activities to gain buy-in and support from agency leadership.
- ▶ *Top management initiatives*—making the key decisions to authorize and support the necessary changes that are unquantifiable but have extremely high value and can be described in qualitative terms.

Even where costs or levels of effort are not quantifiable, a description of the proposed action and its intended outcome that highlights cause and effect relationships, in terms of the logical relationships between specific IOP changes and the expected benefits, may be effective.

F. Identifying Relationships between Costs, Benefits, and Risks

Fundamental to the business case is a positive relationship between benefits and costs. However, making the business case for IOP changes is not a conventional cost-benefit exercise. Characteristics of important TSMO improvements are changes in procedures and protocols where “costs” are difficult to measure or express. Furthermore, important benefits across a range of TSMO strategies and applications are often achieved by a set of interrelated,

mutually reinforcing arrangements in programming, staffing, and organization that support improvements. Associating specific benefits with a specific change may not be possible.

Often the relationships between costs and benefits may be self-evident, especially where costs are minimal against obvious and logical (if unmeasurable) benefits such as in reduced clearance time for incidents. In some cases either or both costs and benefits may be quantifiable or even monetizable, especially in instances where performance is being tracked. In other cases, data may be available from current performance tracking. References to peer experiences or case studies may also be relevant.

Risk issues are associated both with investments made and not made. The need for the most quantified benefits is likely to be in association with improvements that involve any measurable costs such as increase in staffing, or additional outsourced technical support. However, by definition, most IOP improvements do not involve significant investments or budget impacts. Yet, at the same time, they may support improved effectiveness across one or several TSMO strategies. This underlines the substantial benefits versus cost of leveraging IOP changes. There are also risks associated with actions not taken, the opportunity costs associated with failing to address a problem, such as improving or extending a well-understood strategy such as traveler information or ramp metering.

G. Targeting the Institutional, Organizational, and Procedural Business Case to Specific Audiences

Cross-cutting all of the above essential characteristics is the need to make the business case for the target audience. Key audiences for the TSMO business case include:

- ▶ Agency TSMO staff and management.
- ▶ Other agency units and divisions whose involvement is essential.
- ▶ Agency top management and leadership.
- ▶ Local transportation partners.
- ▶ The general public.

Each audience may have different levels of background knowledge, stakes, and varying levels of interest and attention span. While these audiences have common concerns regarding improvement in agency programs, they have different interests and “stakes” with regard to their interest in specific internal and external issues such as agency efficiency versus customer impact. Therefore, the business case should be organized, articulated, and communicated considering the issues and concerns of the specific key audiences and their interests and stakes which may be relevant to their roles in authorizing, implementing, cooperating and maintaining the proposed IOP changes and actions.

Business case arguments should be tailored to the specific characteristics of each audience in terms of the key issues and effective arguments, the mode of business case presentation (in person, memos, or examples) as well as the use of technical jargon, document length, and style of presentation. In some cases, audiences will be most responsive to a business case made with respect to an event (disruption) or opportunity (generate visibility/credibility).

PART II

PREPARING THE BUSINESS CASE FOR INSTITUTIONAL, ORGANIZATION, AND PROCEDURAL CHANGES



Preparing a Business Case

A business case for mainstreaming Transportation Systems Management and Operations (TSMO), structured to advocate for essential Institutional, Organizational, and Procedural (IOP) changes, is a **well-formed argument** that is based on compelling **qualitative** and **anecdotal information** as well as technical analysis. The compelling logic, or persuasive argument, is generally supported by the **positive payoffs** from improvements in system operational performance, safety, and customer service compared to the **modest level-of-effort** associated with making the well-understood modifications to IOP arrangements—a clear “win-win.”

The business case should be tailored to key audiences in terms of their expected TSMO-related interests, technical background, and media orientation (this issue is discussed in further detail in part IV). It should clearly and concisely articulate the business case and address the payoffs and level-of-effort required.

Business Case Organization

Making the business case involves combining a sequence of evidence-based “arguments” that rationalize and justify the need for the IOP changes. The sequence consists of: identifying the transportation problem to be addressed; relating the problem to effective TSMO; showing how effective TSMO requires certain IOP changes; and illustrating the payoffs versus the costs. The guidance below sets forth a structured framework for the business case in terms of a logical sequence of arguments, which are organized as seven “sections” in the framework. Each section represents one part of a sequence of logical argument that together make up a complete business case.

The term “section” does not imply that the business case needs to be an onerous and lengthy technical report. Depending on the audience and circumstances, an effective business case may be made in any one of several formats: a detailed technical study, brief memo, presentation, a series of illustrative infographics, or an “elevator speech” (a short and complete verbal statement of the business case presented in person). Therefore, each section of a business case, as detailed below, may be a paragraph, a page, a single PowerPoint slide, or any format that works for the writer. Regardless of length or level of detail, the most effective case will address the key issues in each of the sections.

The material below sets forth the suggested issues to address for each section and it relates to the sections preceding and following to make the most compelling business case. The seven sections, consistent with the characteristics of a successful business case presented in part I, are:

- ▶ **Section 1**—Describe the jurisdiction’s current system performance and TSMO activities as a baseline for change.
- ▶ **Section 2**—Describe how current problems or events suggest that an effective TSMO response requires IOP changes that integrate TSMO into agency activities on a more formal (rather than ad hoc) basis.
- ▶ **Section 3**—Specify the recommended or required IOP actions.

- ▶ **Section 4**—Identify the external and internal benefits and payoffs from the proposed IOP changes.
- ▶ **Section 5**—Identify/quantify IOP improvement costs and resource requirements.
- ▶ **Section 6**—Discuss the overall balance between rate of return and risks.
- ▶ **Section 7**—Identify the responsibilities for change management at the unit and agency level.

Within each section, the discussion is organized by:

- ▶ **Purpose.** Describing the role and position of the section to orient the preparer to how the section fits into the logical sequence of business case argument.
- ▶ **General Content.** Outlining the substantive coverage of the section.
- ▶ **Persuasive Arguments/Approach.** Presenting the key arguments/points to be made in short bullet form, allowing for further tailoring to the preparers' context.
- ▶ **References and Examples.** Providing additional background on key evidentiary points.

Seven Sections in an Effective Business Case

Section 1. Describe the Jurisdiction's Current System Performance and Transportation Systems Management and Operations Activities as a Baseline for Change

The Purpose of This Section of the Business Case:

The purpose of this section is to orient the intended audience through a description of the seriousness of the system operational disruptions and challenges facing the agency. It can refer to the progress made with the agency's TSMO activities to date, and what is needed to improve TSMO on a continuous basis. This section allows the audience to fully understand how responding to the jurisdiction's transportation needs requires a change and/or improvement in the overall approach to TSMO through IOP changes.

General Content to Consider for This Section of the Business Case:

- ▶ Current system performance and how that matches desired performance goals.
- ▶ Current TSMO-related challenges.
- ▶ Existing TSMO activities and historical context, as needed.
- ▶ Indicators of the need for new or improved strategies.
- ▶ Major advantages of TSMO in a financially constrained context.
- ▶ How TSMO can complement, or address the constraints to, major capacity additions.

Persuasive Arguments/Approaches to Consider for This Section of the Business Case:

- ▶ Describe how congestion, delay, crashes, and unreliability are growing transportation and economic challenges in the region as reflected in trends and events related to congestion, delay, and safety.

- » Cite local statistics regarding congestion and incidents.
 - » Use national average statistics from resources such as the Urban Mobility Scorecard⁴ for metro areas or statewide values.
 - » Cite statistics on how congestion and unreliability can affect business productivity and corporate decisions.
- ▶ Note that nonrecurring congestion, which generally causes a significant portion of total delay and most of travel unreliability in most urban areas and greatly impacts rural areas, is a significant concern to travel in the region.
 - ▶ Highlight that nonrecurring congestion for commuters and shipping are not addressed by conventional capacity additions.
 - ▶ Characterize the jurisdiction's current TSMO activities in terms of strategy applications being applied and identify/illustrate their impacts to date.
 - ▶ Emphasize that these applications to date have been proven as low cost, quick-to-implement, and an effective means of addressing the principal causes of congestion (nonrecurring congestion).
 - ▶ Call out how TSMO supports or links to the overall agency mission, vision, and objectives.
 - ▶ Identify current trends or recent visible events that indicate the need to consider additional TSMO improvements—including TSMO as a response to major disruptions (crashes, weather, and special events).

Helpful References and Examples for Topics in This Section:

- ▶ 2015 Urban Mobility Scorecard Published jointly by The Texas A&M Transportation Institute and INRIX (<https://static.tti.tamu.edu/tti.tamu.edu/documents/mobility-scorecard-2015.pdf>) August 2015.

⁴ 2015 Urban Mobility Scorecard Published jointly by The Texas A&M Transportation Institute and INRIX (<https://static.tti.tamu.edu/tti.tamu.edu/documents/mobility-scorecard-2015.pdf>) August 2015.

- ▶ Developing and Sustaining a Transportation Systems Management and Operations Mission for Your Organization: A Primer for Program Planning (FHWA-HOP-17-017).
- ▶ National Cooperative Highway Research Program (NCHRP) 20-07 Task 365 Transportation Systems Management and Operations Program Planning—Experiences from the Second Strategic Highway Research Program (SHRP 2) Implementation Assistance Program (August 2016).
- ▶ Transportation Systems Management and Operations in Action (FHWA-HOP-17-025).
- ▶ Improving Business Processes for More Effective Transportation Systems Management and Operations (FHWA-HOP-16-018).
- ▶ Making the Business Case for Traffic Incident Management (FHWA-HOP-16-084).

National Cooperative Highway Research Program (NCHRP) 20-07 Task 365: Transportation Systems Management and Operations Program Planning: Experiences from the Second Strategic Highway Research Program (SHRP 2) Implementation Assistance Program

This 2016 study conducted a national survey of TSMO agency leaders and champions, collecting responses from 48 TSMO leaders and champion across 31 different State Departments of Transportation (DOT) and eight different regional agencies. Their responses provide helpful insights that agencies can use in understanding their own baseline and articulating it in a national context. For instance, the study shows that while the large majority of respondents hailed from agencies that were implementing or developing TSMO plans (36 out of 48) most of them felt that this progress was largely champion driven (23 out of 36) and, therefore, TSMO was in need of further institutionalization and mainstreaming.

To view the full study visit: [http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-07\(365\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-07(365)_FR.pdf).

Collaboration for Incident and Emergency Management in Washington State

A business case for IOP changes to advance TSMO needs to provide the persuasive argument as to why these changes matter. One successful example of how TSMO collaboration—a key IOP capability—has advanced operations can be found in a recent highway closure in Washington State. In December of 2017 an Amtrak train derailed, toppling onto I-5 in DuPont, Washington and resulting in the closure of all lanes of I-5 in the area during the immediate response. Later, the Washington State Department of Transportation (WSDOT) asked drivers to avoid both northbound and southbound I-5 lanes near DuPont and find alternate routes. The affected section of I-5 parallels approximately two miles of grounds at the Joint Base Lewis-McChord (JBLM) military installation south of Tacoma. The section normally carries 60,000 vehicles a day. Civilian traffic, which is generally not allowed on base, was able to reroute and travel on the military site roadways.

Southbound traffic was detoured at Center Drive north of Mounts Road and, after exiting, drivers went through military site JBLM to State Route 510, and then back to I-5. WSDOT's ability to work with the military base to divert traffic through the base provided a much shorter diversion route and facilitated a shorter drive for many travelers. The partners were able to implement innovative solutions for improved results—such as the use of drones and sensing technologies to assess traffic levels—for enhanced situational awareness.

WSDOT attributes the success of this response directly to their efforts to advance IOP arrangements for TSMO. Monica Harwood of WSDOT stated that “Through our TSMO activities, we had established communications and relationships with the leaders at JBLM and were able to quickly work with them to determine the best way to address traffic flow in the region due to the I-5 closure.” Key activities prior to the incident included formal chartering by the State Secretary of Transportation, the Chief of the Washington State Patrol, and the Commanding Officer of JBLM of a regional multi-agency joint operations group (JOG), which facilitated sharing of multi-agency experience and training, integrating innovative technology, and joint planning and policy development. In the TSMO framework for advancing operations, optimizing collaboration involves the highest levels of TSMO coordination among an agency and its partners, and this example shows a successful example of a DOT working hand-in-hand with their partners to provide customers with optimal service during a challenging incident.

Section 2. Describe how Current Experiences or Events Suggest that an Effective Transportation Systems Management and Operations Response Requires Institutional, Organizational, and Procedural Changes

The Purpose of This Section of the Business Case:

The purpose of this section is to describe how further improvements in the agency's TSMO effectiveness will require improvements in current business and technical procedures, organization and staffing, and institutional structures tailored to TSMO—all essential to supporting improved TSMO effectiveness and especially essential to advanced strategy applications.

General Content to Consider for This Section of the Business Case:

- ▶ Recognition of systems management and operations of the transportation network as consistent with agency mission.
- ▶ Opportunities for improving agency effectiveness through implementing TSMO strategies.
- ▶ Constraints of legacy IOP arrangements to advancing TSMO strategies.
- ▶ Dependence of TSMO program improvement on supportive IOP context.

Persuasive Arguments/Approaches to Consider for This Section of the Business Case:

- ▶ Cite/refer to the agency's current commitment to TSMO (as embodied in agency materials).
- ▶ Describe desired next steps for the evolution and improvement in the jurisdiction's TSMO applications (existing and new) to increase effectiveness.
- ▶ Indicate that TSMO effectiveness is often "plateaued" in that it is constrained by an agency's current legacy IOP structure that was established for capacity oriented improvements, including:

- » Perceived limited understanding of TSMO at the executive management level and among key decisionmakers.
 - » TSMO treated as an activity or disparate projects rather than as a formal program.
 - » A lack of planned and sustainable funding for TSMO advancement.
 - » In some cases, fragmented TSMO units may be uncoordinated, inefficient, and/or redundant.
 - » Absence of TSMO-oriented training for staff.
 - » Minimal alignments with other key partners essential to effective TSMO such as public safety community and the private sector.
- ▶ Refer to the concept of “continuous improvement” in terms of establishing an IOP framework that will establish the mechanisms and staff capability to capitalize on evaluation of current practices to identify logical incremental improvements on a regular basis.
 - ▶ Cite the ample body of Federal-level research that demonstrates that improved TSMO effectiveness is dependent on overcoming the above constraints. Improved TSMO advancement requires changes in the agency’s business and technical processes in order to effectively conduct the full range of TSMO strategies and applications; and, that these processes in turn depend on capable staff and an efficient organizational structure. These are at the core of IOP improvements.
 - ▶ Structure the needed IOP changes to support transitioning from a set of ad hoc activities to a more systematic, integrated, cooperative, strategic approach capable of continuous improvement.
 - ▶ Highlight that the development of these processes in turn depends on capable staff and an efficient organizational structure to carry them out. The creation of the appropriate organization and staffing will depend on key changes in institutional arrangements that integrate TSMO into the agency’s mission and policies as a formal program.
 - ▶ Note that improving the capabilities in each of the IOP areas must be done on an incremental basis and requires a managed stepwise approach.

Helpful References and Examples for Topics in This Section:

- ▶ SHRP 2 L17 (6) Business Case Primer: Communicating the Value of Transportation System Management and Operations.

Colorado DOT Reorganization for TSMO

In early 2012, the Colorado Department of Transportation (CDOT) began to discuss the importance of providing improved operations in an integrated and systematic manner and committed to place a much higher emphasis on improving the operations of the transportation network. By January 2013, CDOT created the Division of TSMO and hired a Director for the Division. The Director was then charged by the CDOT Executive Director to collaborate with staff directly involved in operations and recommend an organization structure that would facilitate improved systematic and integrated delivery of statewide operations in Colorado. The changes resulted in a long-term sustainable organization structure that enabled improved cooperation and collaboration within CDOT and the ability to deliver integrated and systematic statewide operations with regards to TSMO. CDOT's reorganization for TSMO helped facilitate changes such as the establishment of a TSMO Evaluation, which was launched in 2016 and requires all projects with a design scoping review to complete a TSMO Evaluation that consists of a safety, operations, and Intelligent Transportation Systems (ITS) analysis.

More information on CDOT's TSMO efforts can be found in part III, A Case Study of TSMO Leadership: Colorado Department of Transportation

(Source: Colorado Department of Transportation. Transportation System Management and Operations Reorganization Report May 2013.)

Section 3. Specify the Institutional, Organizational, and Procedural Actions Needed to Advance Transportation Systems Management and Operations

The Purpose of This Section of the Business Case:

The purpose of this section of the business case is to identify and document the specific IOP actions that are proposed to support evolution from the current state of “TSMO as a set of ad hoc activities” to the desired status of “mainstreamed TSMO.”

General Content to Consider for This Section of the Business Case:

Results from a TSMO Capability Maturity Model (CMM) self-assessment will indicate the key IOP dimensions needing attention. Research provides evidence that the lowest CMM dimensions should be the focus for improvement.

- ▶ Actions identified for advancing in the IOP categories needing attention in the region.
- ▶ Discussion of the appropriate level of detail needed in describing the recommended IOP actions (e.g., do the recommendations need to detail resource needs, timelines to accomplish, staff leads, etc.?).

Persuasive Arguments/Approaches to Consider for This Section of the Business Case:

- ▶ Explain that while the agency has made some important first steps, advancing TSMO for maximum effectiveness requires key changes relating to each IOP dimension in order of current capability, and includes proposed actions to address the needed improvements.
- ▶ Use the agency’s own CMM self-assessment, or the CMM literature, to identify the current state of play and needed strategic management actions to advance TSMO. The CMM literature can be used as a basic reference regarding the types of actions that have proven to be most important across a wide range of agencies. Consider the most often identified actions in agency self-evaluations and adjust as appropriate for jurisdiction. The most often identified actions include:

1. Adjust key business and technical process, including:
 - Integrating TSMO into the legacy business and technical processes, such as planning, programming, and budgeting.
 - Accommodating TSMO in the project development process.
 - Providing predictable resources for a sustainable TSMO program.
 - Institutionalizing systems engineering including effective concepts of operations.
 - Establishing a TSMO performance measurement and management framework.
2. Build staff capabilities (hire or train), including:
 - Supporting education and familiarity regarding “what TSMO is” and its unique payoff potential in supporting the agency’s mission.
 - Developing training to improve staff capabilities.
3. Target key organizational and institutional changes, including:
 - Adjusting agency policy and objectives to incorporate TSMO commitments.
 - Aggressive top management authorization and support for making the key IOP changes that transition TSMO into a formal top-level agency program.

Common Actions to Make IOP Changes for TSMO

The current research and agency TSMO CMM Workshop experience to date has identified a set of generally accepted actions on the part of TSMO managers, other non-TSMO units, and agency leadership. They include identified actions to improve the level of capabilities relating to TSMO planning, programming, and budgeting; systems engineering and technology; performance management; staffing and organization; agency culture; and collaboration, as well as in agency policy and resource allocation. The criteria for each of these IOP capabilities are well defined from CMM research and workshop experiences. These actions are included in a summary of the IOP actions that agencies from over 20 regions determined were necessary when they assessed their IOP maturity.

(Source: FHWA, Organizing for Reliability—Capability Maturity Model Assessment and Implementation Plans, Executive Summary, 2015, available at: <https://ops.fhwa.dot.gov/docs/cmmexesum/index.htm>.)

- Consolidating fragmented TSMO-related business units, or creating better mechanisms for coordination among those units and identifying a lead point of contact for TSMO overall.
 - Elevating TSMO to an organizational status on par with other major functions such as design, construction, and maintenance.
- ▶ Enhance alignment with collaborators, stakeholders, and partners.
 - ▶ Note that the actions are at the “program” level—designed to support improving the effectiveness of the complete array of TSMO strategies, both current and future—and structured to support improvement on a continuous basis.
 - ▶ Highlight that where TSMO is not well-understood and accepted and part of the agency culture, improvements in TSMO effectiveness are unlikely.
 - ▶ Provide well-formed arguments that are based on compelling qualitative and anecdotal information as well as technical analysis.

Executive Direction Spurs IOP Changes to Advance TSMO in Texas

The Texas Department of Transportation developed a TSMO Statewide Strategic Plan (August 2017). As part of this plan the Chief Engineer issued a memo (dated April 7, 2017) establishing a common set of TSMO objectives. Specifically the memo stated:

“The Traffic Operations Division has outlined a common set of objectives for the Districts...Each district will be expected to ensure (1) Traffic Management Systems (TMS) is included in each project’s planning, development, design, construction, maintenance and operation, and (2) provide specific TMS projects where gaps exist between typical road and bridge projects. Funding for these efforts is expected to be included as an element of each project...”

(Source:<http://ftp.dot.state.tx.us/pub/txdot-info/trf/tsmo/statewide-strategic-plan.pdf> page 30.)

Key Actions Identified by State DOTs to Date

Based on over 40 State DOT TSMO self-assessment workshops sponsored by FHWA, a core set of common actions have emerged from the individual State assessments. While every State context is different, this set of actions constitutes a useful point of departure and reference tool. Tables 1 through 6 below present these common actions for the six dimensions of TSMO

capability. In the table, the action items are presented along with the responsible party for the action in reference to an agency’s program staff or top management as to who might “own” the action. Further exploration of the specific role of top management is addressed in section 4.

Table 1. Business processes priority actions.

Actions Items	Responsibility	
	Program	Top Management Involvement
Analyze recurring and nonrecurring delay problems for TSMO applicability.	●	
Create regional/statewide TSMO plan/program/TSMO Program Plan.	●	
Insert TSMO into Transportation Improvement Program (TIP)/ Long-Range Transportation Plan (LRTP)/ and other statewide/regional plans.	●	●
Develop a formal TSMO budget line item and Integrate TSMO into the programming processes.	●	●
Integrate TSMO into the standard project development process.	●	
Develop TSMO business case for various key stakeholders.	●	
Establish methods to evaluate TSMO vs. capacity options, including B/C.	●	
Identify institutional mechanism to shorten planning horizons to facilitate TSMO solutions.	●	
Pilot FHWA INVEST model for operations and maintenance sustainability assessment.	●	
Include consideration of advanced, proactive TSMO strategies (Integrated Corridor Management, Active Transportation and Demand Management, etc.).	●	

Table 2. Systems and technology priority actions.

Actions Items	Responsibility	
	Program	Top Management Involvement
Require Systems Engineering utilization to develop and manage TSMO applications.	●	●
Assess/update regional/statewide ITS architecture/deployment plan.	●	
Encourage use of emerging technologies.	●	●
Improve Information Technology (IT)/ITS procurement (including applying best practice).	●	
Develop coordination between DOT IT and State IT entities.	●	
Review/develop data sharing practices/policies (Traffic Incident Management (TIM), Computed-Aided Design (CAD), traffic control, etc.).	●	
Investigate standard communications protocol to facilitate interoperability.	●	
Develop TSMO asset management system/performance guidelines.	●	
Increase participation in TMC and software systems discussions/ decisionmaking.	●	

Table 3. Performance measurement priority actions.

Actions Items	Responsibility	
	Program	Top Management
Modify performance objectives and measures to accommodate TSMO.	●	●
Update TSMO performance measurement plan/program/policy/data business plan.	●	
Agree upon and leverage performance measures for TSMO deployments—include before and after.	●	
Identify performance measures and data development/analysis procedures.	●	
Incorporate TSMO into performance-based planning documents and guidance.	●	
Share/disseminate performance data/info with partners.	●	
Evaluate sources of data (internal vs. third party).	●	
Identify/develop performance measures (PMs) for dashboard (freeway and arterial).	●	
Create modeling plan and tools for supporting TSMO analysis.	●	

Table 4. Culture priority actions.

Actions Items	Responsibility	
	Program	Top Management
Develop top manager and staff TSMO familiarization/ justification program.	●	●
Adjust agency policy to place TSMO in the top tier of policy program and related objectives.	●	●
Introduce executive policy/directives in support of TSMO/ITS/total system management.	●	●
Use personal influence and contacts to persuade key players both internally and externally of value.	●	●
Direct TSMO staff capability development.	●	●
Prepare TSMO outreach/communications material; document lessons learned/success stories.	●	
Develop TSMO business case/marketing plan/campaign.	●	
Institute TSMO knowledge sharing (e.g., though identified experts and peer exchanges).	●	
Establish TSMO executive steering committee to set vision and strategic priorities.	●	●
Identify team of TSMO champions at senior management, division and district level levels.	●	●

Table 5. Organization and staffing priority actions.

Actions Items	Responsibility	
	Program	Top Management
Review/define organizational structure for TSMO.	●	
Reorganize to elevate TSMO activities to appropriate and effective chain of command and organizational level.	●	●
Identify and support a TSMO change manager champion.	●	●
Develop business case for TSMO unit.	●	
Identify core management and technical positions needed.	●	●
Design succession plans.	●	
Create career maps/paths and position descriptions.	●	
Provide technical training, mentoring, encourage staff participation in national forums.	●	
Provide TSMO point of contact for each region to advance development of TSMO concepts and projects.	●	
At management level, focus on performance management plans and accountability to optimize staff utilization and efficiency.	●	●

Table 6. Collaboration priority actions.

Actions Items	Responsibility	
	Program	Top Management
Negotiate objectives realignment with other agencies (public safety, local government.).	●	●
Develop new relationships with private service and technology providers.	●	●
Participate in/advance traffic incident management (TIM) training.	●	
Establish a forum to build better interagency relationships and improve TIM practices.	●	
Institute corridor platforms/forums for improved collaboration/ops strategies/TIM.	●	
Execute Memorandums of Understanding (MOU) with first responders for TIM practices.	●	
Perform overall assessment of stakeholder groups' ability to advance TSMO.	●	
Conduct outreach to partners for improved transportation management procedures.	●	
Disseminate Incident Management best practice to local jurisdictions.	●	
Leverage university relationships.	●	

Helpful References and Examples for Topics in this Section:

FHWA has published six reports based on the findings of the initial 27 State DOT CMM self-assessment reports that include typical actions identified by the States,

<https://ops.fhwa.dot.gov/docs/cmmexesum/cmmexesum.pdf>.

Texas Department of Transportation. Transportation Systems Management and Operations Statewide Strategic Plan (August 15, 2017) Version 1.1: <http://ftp.dot.state.tx.us/pub/txdot-info/trf/tsmo/statewide-strategic-plan.pdf>.

Washington State Guide to TSMO: <http://fratis.trac.washington.edu/TSMO/>.

Section 4. Identify the Benefits and Payoffs from the Advancement Supported by Proposed Institutional, Organizational, and Procedural Changes

The Purpose of This Section of the Business Case:

The purpose of this section is to identify the benefits and payoffs that may be expected as TSMO activities move from an ad hoc approach to a mainstreamed program. As there are a wide range of positive impacts anticipated on areas such as customer mobility, investment options, and agency efficiency, it is important to identify the full range of potential benefits. Anticipated payoffs from the proposed IOP improvement actions should be documented including both those with external payoffs (to customers and stakeholders) and internal payoffs (agency efficiency and effectiveness).

General Content to Consider for This Section of the Business Case:

Categories of payoffs and benefits in two categories—internal (agency efficiency/effectiveness) and external (benefits to customers in mobility and safety).

- ▶ TSMO approaches as a complement or an alternative to more expensive new capacity projects.
- ▶ Tailored examples of internal and external payoffs from pilot programs or peer experiences.
- ▶ Recognition of which payoffs/benefits are quantifiable versus descriptive.
- ▶ Table 7 below categorizes some of the external and internal payoffs that may be gained from making IOP changes to advance and mainstream TSMO.

Persuasive Arguments/Approaches to Consider for This Section of the Business Case:

- ▶ Identify the categories of benefits and payoffs that result from actions, such as those presented in section 3. Include both those that can only be described as well as those with quantifiable measures.

- ▶ Highlight the fact that the actions described in section 3 leverage IOP improvements supporting a range of future TSMO strategies.
- ▶ Detail how many benefits and payoffs expected from improved TSMO in the future cannot easily be quantified, absent a specific implementation plan and relevant precedents.
- ▶ Identify external benefits—in particular, those directly impacting customers from improved and broadened TSMO strategy applications that flow from:
 - » More precise matching of TSMO strategy applications that address causes of nonrecurring congestion (by type and location).
 - » More aggressive implementation of each TSMO strategy to capitalize on its full potential.
 - » Ability to capitalize on new data and analytics for interagency cooperative actions and decision support systems.
- ▶ Note that the research shows improving the effectiveness of TSMO strategy applications will help address more than half of an average region's delay - that associated with nonrecurring congestion - while at the same time uniquely targeting improvement of travel time reliability. Many conventional capacity improvements (adding lanes) may have little or a modest impact on the causes of nonrecurring congestion such as weather or major crashes.
- ▶ Highlight the relatively low cost, quick to implement nature of TSMO improvements as a demonstration of customer focus and improved agency credibility.
- ▶ Provide examples of expected benefits as illustrated by best practice examples of peers and/or from comparison with previous practices, including those associated with a more rapid clearance of incidents, improved signal timing, better coordination of freeway and arterial traffic, more accurate and timely customer information regarding traffic and weather conditions, and the use of new technology.
- ▶ Identify internal benefits that support the improved efficient and effective use of scarce financial and staff resources, including:
 - » The ability of the agency to support and target improved service at low costs and in short timeframes.

- » Making the most cost effective use of agency financial and staff resources.
 - » Describing the opportunities to capitalize on new technologies, systems, and service delivery concepts, such as active traffic management; integrated corridor management; and automated driving systems.
- Describe improved potential to use TSMO to enhance or substitute for capital investment in terms of the increased effectiveness of TSMO applications that can reduce the demand for, and public perception of the need for, new capacity.

Table 7 below illustrates the range of payoffs—external and internal—related to the capabilities within procedural, organizational, and institutional arrangements.

Table 7. External and internal payoffs of advancing institutional, organizational, and procedural capabilities.

IOP	Capability Improved	Payoffs	
		External (Customers)	Internal (Agency)
Processes	<ul style="list-style-type: none"> ► TSMO integrated into agency planning and programming. ► TSMO part of agency project development process. ► TSMO-oriented performance measures specified. ► Measures used for real-time operational management. ► Systems engineering utilized. ► Best available technology standardized. 	<ul style="list-style-type: none"> ► Better targeting on causes. ► Focus on more complex settings. ► Improved response time and strategy effectiveness. ► Providing continuous improvement. ► Effective detection and solution arrangements. ► Decision-support systems incorporated. 	<ul style="list-style-type: none"> ► Cost effective use of limited funds. ► Ability to use best available technology for efficiency. ► Assurance that funds are being used cost effectively. ► Public accountability. ► Improved detection and response to disruption, and real time management of the system.
Organization	<ul style="list-style-type: none"> ► Stove piping reduced. ► Staff capabilities improved. ► Improved coordination. 	<ul style="list-style-type: none"> ► More accurate and timely responses to nonrecurring events. 	<ul style="list-style-type: none"> ► Improved staff efficiency. ► Ability to capitalize on new concepts.
Institutional	<ul style="list-style-type: none"> ► TSMO embedded in formal agency mission and policy. ► Improved partner collaboration. ► Visible agency TSMO leadership and support. 	<ul style="list-style-type: none"> ► Clarifies expectations. ► Quicker/more effective response. ► Public accountability. 	<ul style="list-style-type: none"> ► Includes TSMO considerations in project prioritization. ► Reliable support for TSMO units. ► Efficient integration.

Helpful References and Examples for Topics in This Section:

- ▶ Federal Highway Administration. Transportation Systems Management and Operations Benefit-Cost Analysis Compendium (FHWA-HOP-14-032), July 2015.
- ▶ As an example of an estimation of the benefits of IOP changes to advance TSMO—the Colorado DOT TSMO website estimates that advancing its TSMO program (which has included IOP changes such as reorganization for TSMO and procedural improvements in addition to application-specific advancements) has enabled the DOT to pursue high return-on-investment projects with benefit-cost ratios that typically fall around 10:1 and go as high as 40:1. These changes have also resulted in quantifiable reductions in delay and improvements in travel time reliability and safety⁵.
- ▶ Similarly, the Tennessee Department of Transportation (TDOT) made organizational changes to better support TSMO in 2013 and has documented the following benefits associated with this IOP change⁶:
 - » Prior to reorganizing to create the Traffic Operations Division, TDOT has cited the following issues and challenges in its former TSMO capabilities:
 - Fragmented legacy organization with TSMO-related responsibilities spread across multiple TDOT divisions and work units.
 - TSMO initiatives led by champions who were working outside of their traditional job responsibilities.
 - A collection of disparate TSMO-focused programs separated by geographic TDOT regions with no standard guidelines or procedures.
 - Lack of strategic direction for TSMO deployments and practices.
 - » After reorganizing to create the Traffic Operations Division, TDOT has observed the following advantages:
 - Commitment to develop a TSMO program plan.
 - IT Division engagement in TSMO.

⁵ CDOT TSMO website, <https://www.codot.gov/programs/operations>, accessed February 27, 2018.

⁶ Tennessee DOT presentation during 2017 roundtable, presented by Paul Degges, P.E., Tennessee Deputy Commissioner, Chief Engineer.

- Standardized TMC and TIM guidelines adopted.
- Pathway established for the incorporating of TSMO performance measures into overall agency objectives.

► Figure 2 below provides a helpful jumping off point for thinking about the differences in benefit-to-cost ratios between TSMO projects (i.e., every investment shown in figure 2 except for “Traditional” road capacity) and traditional solutions. It should be noted, however, that TSMO projects can often be combined with traditional solutions to enhance effectiveness.

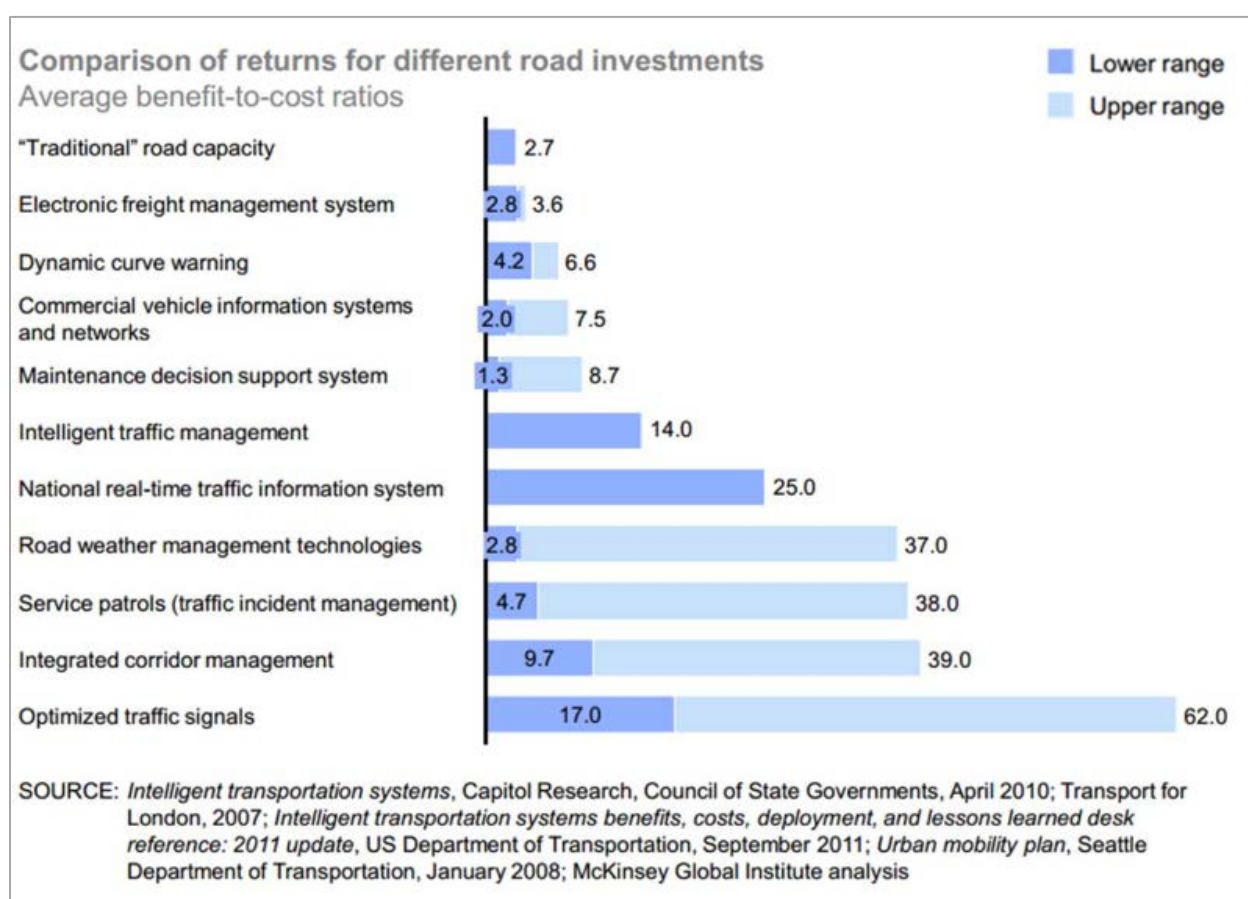


Figure 2. Graph. Benefit-to-cost ratios of different road investments.

(Source: *The National Academies of Sciences, Engineering, and Medicine*, https://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_083856.pdf.)

IOP Arrangements Enhance Hurricane Responses in Florida

From June through November each year, the Florida Department of Transportation (FDOT) Traffic Engineering and Operations Office (TEOO) is prepared to address the special transportation problems brought on by hurricane season. Whether a tropical storm is due to strike Florida or a much stronger hurricane threatens, the FDOT is responsible for seeing that preparations are made and procedures carried out to safeguard critical transportation infrastructure. Another important function is keeping roads open for the thousands of coastal residents who may have to evacuate their communities (from: http://www.fdot.gov/traffic/traf_incident/Hurricane_Response.shtm).



Figure 3. Photo. The Florida State Emergency Operations Center in Tallahassee.

*(Source: Federal Highway Administration,
<https://www.fhwa.dot.gov/publications/publicroads/05nov/05.cfm>.)*

During a hurricane the Governor and media outlets will visit a traffic operations center to assess FDOT's response and see the DOT team in action. Showcasing the Transportation Operations Center (TOC) to the Governor and media outlets inform the traveling public and offer tremendous good will in supporting the system.

The Florida State Emergency Operations Center in Tallahassee (shown here) served as the coordination hub when State Emergency Response Team members from key State and Federal agencies, the military, and volunteer organizations were activated for an expected hurricane.

The Benefits and Costs of Individual TSMO Applications: Variable Speed Limits

Variable speed limits (VSL) are a low cost TSMO application. VSLs are implemented by signs that can be changed to alert drivers when traffic congestion is imminent.

Benefits: Variable speed limits can improve safety by helping to reduce primary and secondary crashes during adverse weather conditions, congestion, or work zones where temporary speed reductions may be warranted. By establishing speed limits appropriate for conditions and encouraging driver compliance through education, VSL helps reduce erratic driving and, therefore, the likelihood of crashes. The reduced speeds can also reduce the severity of incidents that might occur.

Cost: The cost of installing variable speed limits within a corridor varies considerably depending on the existing infrastructure and the selection and spacing of overhead gantries, dynamic message sign (DMS), and other related signage.

(Source: mobility.tamu.edu/mip/strategies-pdfs/active-traffic/technical-summary/Variable-Speed-Limit-4-Pg.pdf.)

Section 5. Identify/Quantify Institutional, Organizational, and Procedural Improvement Costs and Resource Requirements

The Purpose of This Section of the Business Case:

The purpose of this section is to identify and describe the staff and other resource commitments associated with implementing the IOP actions described in section 3.

Many of the IOP actions identified in section 3 associated with making the IOP changes to support advancing TSMO require staff resources related to changes in procedures and supporting organizational adjustments—and the key challenges involve the costs in management and staff time associated with actions required to overcome the natural inertia with regard to making changes in legacy processes or organization. Overcoming these obstacles must be weighed against the payoffs as described in section 4. In developing the business case for the IOP changes, compelling arguments must be made for the management and leadership decisions required to support the necessary level-of-effort and related costs as well as the related organization and institutional adjustments.

General Content to Consider for This Section of the Business Case:

- ▶ Identification of the full range of change management activities requiring resources, both quantifiable and nonquantifiable.
- ▶ Quantifiable costs where specified initiatives or projects can be distinctly identified.
- ▶ Nonquantifiable costs and related resource requirements.
- ▶ Do not neglect including descriptions of impacts perceived as negative by specific managers or staff related to disruptions regarding staff roles and responsibilities, uncertainty, and change in access to resources.
- ▶ Table 8 below illustrates potential types of resources and how the level-of-effort may be measured.

Table 8. Needed resources.

Level-of-Effort Type	Measured
Staff effort in development of new processes, arrangements, and collaborations.	Percent of an agency's full time equivalent (FTE) staff resource multiplied by the time period needed for that staff person (and/or costs to hire consultant).
Staff effort on public and stakeholder outreach, education, and information exchanges.	Percent of an agency's full time equivalent (FTE) staff resource multiplied by the time period needed for that staff person (and/or costs to hire consultant).
Agency champion's efforts to overcome staff skepticism.	Included in day-to-day position responsibilities.
Leadership time and attention to support IOP changes and actions.	Leader's expenditure of leadership and peer capital and the leader's perception of importance of accomplishing the objective.
Acceptance of organization and staff disruption.	Described and highly dependent on leadership support, sponsorship, clarity, and engagement.

Persuasive Arguments/Approaches to Consider for This Section of the Business Case:

- ▶ Categorize the resources and potential payoffs associated with the IOP actions set forth in section 3.
- ▶ Highlight that most of the benefits can be captured without substantial increase in staff or financial resources and rather through adjusting existing priorities, processes, and organizational structure to accommodate the specific requirements of TSMO. In doing this, TSMO accomplishments are converted from a set of ad hoc activities to an integrated and accepted agency program.
- ▶ Recognize that costs are generally of two types: the level-of-effort of key TSMO managers and staff in developing the needed business and technical processes; and, the time, attention, and costs of persuasion that top management expends in authorizing and supporting key IOP changes to other agency unit leaders.
- ▶ Include the potential need for new technical activities, planning, and systems engineering with estimated costs and explain how such costs insure cost effective use of resources.
- ▶ Acknowledge that some IOP changes may be viewed as disruptive, such as modifications to the existing organizational structure or realignment of certain key reporting and responsibility relationships, but present that with the longer term success that result from IOP changes.

Helpful References and Examples for Topics in This Section:

- ▶ Federal Highway Administration. Transportation Systems Management and Operations Benefit-Cost Analysis Compendium (FHWA-HOP-14-032), July 2015.
- ▶ FHWA Operation Benefit/Cost Analysis Desk Reference (2012): <https://ops.fhwa.dot.gov/publications/fhwahop12028/fhwahop12028.pdf>.

Identifying Resource Requirements to Advance TSMO in Michigan

The Michigan DOT is currently implementing their TSMO Implementation and Strategic Plan, which was published in February 2018 and is available online at www.michigan.gov/tsmo. To guide and track progress, the plan developed a series of action matrices for the full spectrum of TSMO-related functions in Michigan (e.g., safety, field equipment, data, etc.). While these action matrices are internal documents that Michigan DOT staff are continually updating to track progress, In this matrix, Michigan DOT TSMO staff outline the resource requirements necessary for each action and sub-step—as the matrix asks them to list the staff lead, staff support, resources, timeline, etc.

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 4. Photo. Sample action matrix from the Michigan Department of Transportation’s Transportation Systems Management and Operations (TSMO) Plan.

(Source: Michigan Department of Transportation, www.michigan.gov/tsmo.)

Section 6. Discuss the Overall Balance between Rate of Return and Risks

The Purpose of This Section of the Business Case:

The purpose of this section is to present potential payoffs and benefits in comparison to the level-of-effort and other resource expenditures required to capture them—as well as the risk of action versus no action to make the IOP improvements.

General Content to Consider for This Section of the Business Case:

- ▶ Contrast between the potential broad ranges of benefits and payoffs as set forth in section 4 with the potential levels-of-effort (costs) of section 5.
- ▶ Acknowledge that many payoffs are anecdotal in nature without hard costs values and returns on investments.
- ▶ TSMO costs and related efforts compared with other mobility improvement options.
- ▶ Risks and opportunity costs associated with the choice to not mainstream TSMO.

Persuasive Arguments/Approaches to Consider for This Section of the Business Case:

- ▶ Present research and empirical experience, learned through observation of differences in the effectiveness of conventional ad hoc TSMO applications versus best practice in IOP actions that mainstream TSMO.
- ▶ Highlight that the risk of failure of TSMO investments in providing improved service is relatively low and largely reversible as service is directly related to the level of operational management.
- ▶ Note that the new and more complex TSMO strategies such as Integrated Corridor Management (ICM), Active Transportation Management (ATM), and Automated Driving Systems (ADS) must be supported by key IOP changes.
- ▶ Point out that compared to improving customer service through construction of new capacity improvements, TSMO provides important customer benefits in the short term at low cost.

- ▶ Outline the opportunity cost associated with lack of a TSMO supportive IOP framework that would enable capitalizing on new technology-driven strategies related to data management, performance management, and corridor-wide systems management.

Address Risks and Opportunity Costs:

Risk issues are associated both with investments made and not made. The need for the most quantified benefits is likely to be in association with IOP improvements that involve any measurable costs such as increase in staffing to support the new approaches, or additional outsourced technical support in areas such as planning and systems engineering. However, by definition, most IOP improvements do not involve significant investments or budget impacts. Yet, at the same time, they may support improved effectiveness across one or several TSMO strategies. For example, a commitment to performance management can support improvements across a broad range of TSMO strategies. This underlines the substantial benefits versus cost leverage of IOP changes.

There are also risks associated with actions not taken—the opportunity costs associated with failing to address a problem—such as improving or extending a well-understood strategy such as ramp metering to improve freeway throughput. In many cases, the effectiveness of certain TSMO strategies reaches a “plateau, where further improvements in effectiveness are not possible without specific changes in IOP arrangements—such as improving staff coordination, or upgrades to decision-support systems and other processes.

Helpful References and Examples for Topics in This Section:

As a key component of TSMO, Intelligent Transportation Systems (ITS) can be used as a model for evaluating the balance between costs/risks and benefits of IOP changes to advance TSMO. For example, ITS benefits typically include costs of delay and fuel savings. Costs of improvements in reliability are measurable—but difficult to monetize. Benefits may be allocated by network component and/or strategy. Figure 5 below illustrates the cost to benefit relationships typical of ITS investments, which is a relationship that is similarly important to understand for IOP changes. There are range of techniques to display cost versus benefits, as suggested below in the two graphics.

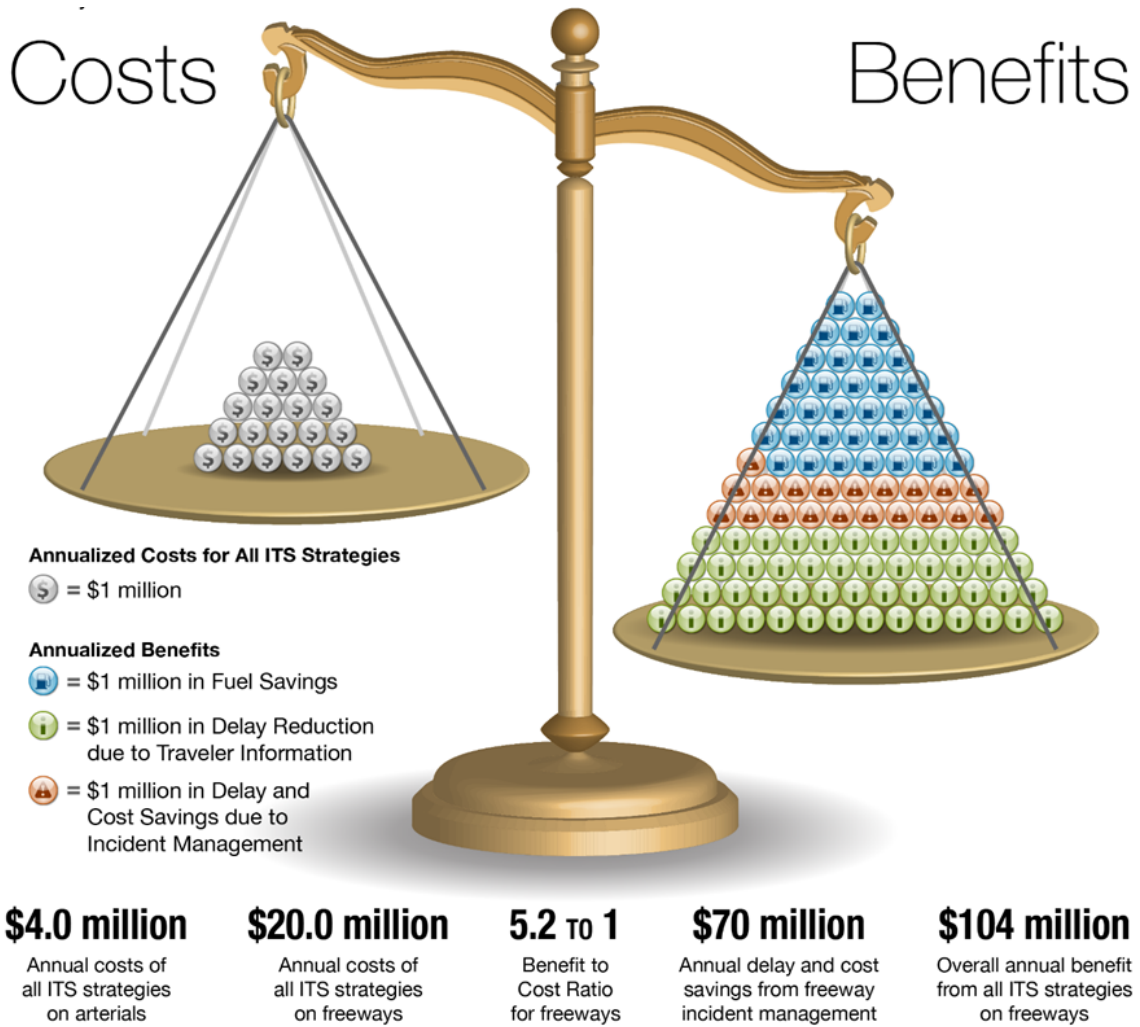


Figure 5. Graph. Comparison of the costs and benefits of Intelligent Transportation Systems (ITS) strategies.

(Source: Federal Highway Administration.)

Choose the active strategies:		Benefit/Cost Summary		
		Generic Link Analysis		Signal Coordination: Central Control
<input checked="" type="checkbox"/>	Generic Link Analysis			
<input checked="" type="checkbox"/>	Signal Coordination: Central Control			
<input checked="" type="checkbox"/>	Ramp Metering: Preset Timing			
<input checked="" type="checkbox"/>	Traffic Incident Management			
<input checked="" type="checkbox"/>	Dynamic Message Sign			
<input checked="" type="checkbox"/>	Highway Advisory Radio			
<input checked="" type="checkbox"/>	Pre-Trip Traveler Information			
<input checked="" type="checkbox"/>	HOT Lanes			
<input checked="" type="checkbox"/>	Hard Shoulder Running			
<input checked="" type="checkbox"/>	Speed Harmonization			
<input checked="" type="checkbox"/>	Road Weather Management			
<input checked="" type="checkbox"/>	Work Zone Systems			
<input checked="" type="checkbox"/>	Traffic Management Center			
<input checked="" type="checkbox"/>	Loop Detection			
<input checked="" type="checkbox"/>	CCTV			
		Annual Benefits		
	Travel Time	\$	36,561	121,654
	Travel Time Reliability	\$	31,023	106,602
	Energy	\$	21,004	23,412
	Safety	\$	19,200	98,464
	Other	\$	0	0
	User Entered	\$	0	0
	Total Annual Benefits	\$	107,788	350,132
		Annual Costs	\$	62,521
		Benefit/Cost Comparison		
	Net Benefit	\$	45,267	183,552
	Benefit Cost Ratio		1.72	2.10
		Stream of Net Benefits		

Figure 6. Photo. Partial tabular presentation of ITS benefit/cost results from the tool for operations benefit/cost analysis.

(Source: FHWA TOPS-BC, <https://ops.fhwa.dot.gov/publications/fhwahop14032/ch2.htm>.)

Literature on change management in organizations (in general, not limited to the transportation sector) also offers insight in understanding the relationship between the costs, risks of doing nothing, and benefits of IOP changes for TSMO. The old adage that change is the only constant in life is particularly true in today's transportation sector with the emergence of new technologies such as connected and automated vehicles and with the applications of big data. The social science of change management acknowledges that change is always difficult and provides a number of models for approaching institutional change to help make these transitions easier. A recent model from McKinsey recommends "four building blocks of change" that help companies adapt to new situations and with the benefits of more successfully achieving the objectives that are the driving force behind their change. For transportation agencies advancing TSMO, the overall goal would be to adapt to new transportation landscapes, constraints, and technologies with the objectives of improving mobility, reliability, and safety. To do this, McKinsey's four building blocks essentially recommend IOP changes, as shown in figure 7 below. For example, changes in training, formalization/institutionalization, and communications/awareness are large features of this model to improve the effectiveness of an organization's adaptation.



Figure 7. Graph. The Four Building Blocks of Change Management from McKinsey & Company.

(Source: McKinsey & Company, <https://www.mckinsey.com/business-functions/organization/our-insights/the-four-building-blocks--of-change>.)

Section 7 Identify the Responsibilities for Change Management at the Unit and Agency Level

The Purpose of This Section of the Business Case:

The purpose of this section is to identify the responsibilities for the IOP changes needed to advance TSMO in order to understand what management and leadership efforts are needed. Many of the needed organizational, policy, and funding changes require converting TSMO concepts into mainstreamed program components. These components will cut across agency procedures and organizational structure and require support and cooperation from other parts of the agency, including top management.

IOP changes don't just "happen." As they are likely to involve modifications or additions to policies and/or procedures or changes in reporting relationships, established conventions may be affected along with those involved. Therefore, IOP changes need to be managed. This includes: obtaining authorization, securing necessary resources (if needed), establishing a cooperative framework for actions with key players, defining actions, communicating why changes are needed, and tracking progress. In most cases, the business case will be needed to persuade key decisionmakers or unit managers to support, authorize, or direct the necessary changes needed to improve TSMO effectiveness.

Some IOP change actions are typically the responsibility of TSMO unit managers, while others may be beyond their span-of-control. These types of IOP changes will require the commitment, time, and attention of senior managers (e.g., Chief Executive Officers (CEOs), chief engineers, division heads) which, in itself, represents a form of "cost". These costs can be categories as time and attention which represent a scarce resource of these managers in the face of competing claims for attention. This cost and the need for attention may initially be better understood than the arguments for IOP changes.

In addition, to manage the change initiatives, a tracking process will be necessary to ensure that key actions, responsibilities, time frames, and desired outcomes are widely understood.

General Content to Consider for This Section of the Business Case:

- ▶ Focus on the roles and responsibilities for key IOP improvement actions needed to mainstream TSMO.
- ▶ Recognition that certain needed changes, especially as related to organization and institutional commitment, are outside the span of control of TSMO managers and require actions on the part of top management.

Persuasive Arguments/Approaches to Consider for This Section of the Business Case:

- ▶ Identify the logical sponsor and manager of key IOP changes. Tables 1 through 6 in section 3 provide some visibility to the potential responsibilities by various roles in an agency.
- ▶ Identify the critical changes that require support and authorization, or cross-cutting initiatives on the part of top management in the agency (including other division managers, agency leadership, or policymakers).
- ▶ Explain that agency culture that supports TSMO requires investments of time, attention, and authority on the part of executive leadership including:
 - » Legitimizing through visible communication that TSMO aligns with the agency's mission and objectives.
 - » Elevating TSMO as a formal top level program.
 - » Identifying and committing to sustainable funding sources for TSMO.
 - » Authorizing appropriate organization structure changes and identifying staff leadership as necessary.
 - » Describing the level of commitment needed from executive leadership in the form of time, attention, and persuasion efforts across agency top management to direct and support the needed changes.

Helpful References and Examples for Topics in This Section:

Improving Transportation Systems Management and Operations—Capability Maturity Model Workshop White Paper—Culture, (FHWA, 2015)

<https://ops.fhwa.dot.gov/docs/cmmwhitepapers/culture/index.htm>.

Michigan Department of Transportation TSMO Strategic Plan. Appendix D.

<https://www.michigan.gov/tsmo>.

PART III

AGENCY LEADERSHIP SUPPORT FOR KEY INSTITUTIONAL, ORGANIZATIONAL, AND PROCEDURAL CHANGES



The Role of Leadership

Most Departments of Transportation (DOT) have made many improvements in their Transportation Systems Management and Operations (TSMO) activities that can be carried out by TSMO staff (i.e., activities not requiring Institutional, Organizational, and Procedural (IOP) changes beyond TSMO staff span of control) without the need for preparing and communicating a formal business case. However, as described above, the nature of IOP changes is that they often involve actions requiring top management support or initiative; therefore, many require making the business case in terms related to concerns of top management.

Even in the few cases where formal business cases have been prepared (as part of formal TSMO Program Plans), TSMO IOP changes may still have difficulty gaining traction. This is especially true if the case to advance TSMO has not been developed in terms sufficiently compelling to overcome a DOT Chief Executive Officer's (CEO) reluctance to expend their in-demand time and attention that is required to understand the needs of TSMO, to support the necessary changes in policy, and to authorize and support specific actions needed to facilitate certain IOP changes.

Given the limited tenure of the CEO position at most DOTs and the accompanying effort to address a wide range of agency-related priorities over a short amount of time, it is not surprising that TSMO must compete with other agency activities for CEO attention and support. Leaders may question if the efforts, disruptions, and associated risks of departing from long-standing conventions are worthwhile, especially given the often less visible nature of TSMO projects and limited awareness of the potential payoffs. This section addresses these challenges, providing insights into how to tailor a business case for IOP in terms related to the leadership audience.

Tailoring the Business Case to Leadership

The changes in DOT institutional orientation, culture, and arrangements required to develop and support more efficient and effective TSMO necessarily involve top management—those agency leaders with the authority to make the types of key adjustments as noted in part II, section 7.

Increasingly, agency directors or CEOs include both highway agency career professionals who have risen up in the organization, as well as externally-appointed officials coming from outside the agency and, in many cases, from outside transportation. In both cases, there are challenges in making the business case for the needed top-down changes.

- ▶ For career CEOs, it is likely that their success has been built on their effectiveness in managing the legacy agency programs (project development, construction, and maintenance) and fully understanding every aspect of agency structure and management.
- ▶ For externally-appointed CEOs, their appointment typically reflects management experience and understanding of overall State government which may or may not have included experience with the State DOT program—much less TSMO.

In either case, many CEOs may lack a clear understanding of TSMO—its importance, the justification for it, and the substance of TSMO programs and approaches. The business case therefore must serve the roles of supporting increased familiarization, understanding, and commitment on the part of leaders as the basis for top management-led change towards

implementing more effective TSMO—by justifying the proposed changes to both elected officials and agency senior management in terms relevant to their interests and priorities.

It should be noted that the lack of familiarity with, or commitment to, TSMO is not a reflection on a CEO's capabilities. Agency leadership must grapple with a wide range of both immediate and long-term policy, funding, management, and political priorities that can consume available CEO time and attention. Any given set of top management priorities reflects the reality of finite leadership time and relative perceived risks and benefits. In many cases, TSMO is, or will be, perceived as an unfamiliar new enterprise with a limited track record that provides modest payoffs with low public and political visibility and the risk associated with introducing changes that may not be justified. In addition, given that (on average) State DOT CEO turnover is between two and three years, it is not surprising that there is a tendency for leadership to focus on issues that maintain continuity and reflect well-accepted priorities. TSMO champions may, therefore, need to explain the benefits of TSMO and how it helps a DOT manage risks and mitigate congestion and safety challenges. The business case is an opportunity to do that.

Insights for Working with Leaders to Make IOP Changes to Advance TSMO

A DOT director's timeline should be considered as a sequence of actions that build on one another. Generally they may have four years to accomplish what they set out to do, so taking preparations to get TSMO on their radar early on, and capturing the initial energy of their term, may be very beneficial in building progress. Strategies for exposing directors to TSMO include: using case studies of or peer exchanges with high achieving TSMO States to learn from and apply what those States are doing (this could also infuse the TSMO discussion with some extra energy), or to frame TSMO as a strategy for pursuing low-cost, easy, and early (quick turnaround) wins for their term (i.e., fix a bottleneck). From there, the focus should turn to institutionalizing the easy fixes by establishing performance monitoring to show how the easy fix has long term impacts on safety and travel time. A third step is then to protect the program or staff from CEO changes by not associating the program as something owned by the CEO, but rather the right thing to do for the DOT. This step reinforces the institutionalization of the approach and TSMO.

Understanding “Leadership Capital”

Making the business case to top management involves special challenges. By definition, senior decisionmakers, such as DOT chief executives, have responsibility for broad policy and program issues. TSMO is only one of many concerns and one that may not initially appear to be significant to the agency mission and credibility. In addition, the type of IOP changes essential to more effective TSMO may require a special focus not easy to obtain. It is important to understand top management orientation and tailor the business case to it.

Public administration literature sometimes uses the concept of “political capital” to define, as a scarce resource, the credibility that is either accumulated from seniority or endowed by position and is an important component of their authority. Similarly, “leadership capital” can be used to understand the store of time, attention, and capability that can be brought to bear by a leader on any particular issue to foster change. For DOTs, leadership capital can be usefully subdivided into “reputational” and “representative” capital. In addition, “intellectual” capital can be considered. For each type, a range of payoffs, risks, and rewards is involved:

- ▶ **Leader Reputational Capital.** Agency leaders achieve and maintain their institutional positions and authority (both formal and informal) by maintaining the overall external image of an agency in terms of reliable and stable execution of the agency’s understood mission. This reputation is based, in part, on the legacy and promise of institutional achievement within the context of political and stakeholder support. These two aspects are important to both supporting a leaders’ career success and in maintaining agency external support. It is, therefore, natural that the time and attention of a leader is focused on activities and investments that support the agency’s reputation with minimal risk.
- ▶ **Leader Representative Capital.** Agency leaders establish and maintain their authority (formal and informal) and credibility within the agency based not just on experience and seniority, but also on supporting a stable and effective organization in terms of its structure of hierarchy and authority. This authority is based, in part, on respect for the established positions and roles of the other key players within the organization and the tacit support of key managers (and their direct reports), within the organization. It is natural that leaders are

extremely cautious about making changes that may suggest instability and or disturb existing relationships.

- ▶ **Leader Intellectual Capital.** DOTs are professional organizations built around a legacy culture of technical expertise—typically, expertise in civil engineering. The introduction of new technology and concepts, such as TSMO, may involve the challenge of the unfamiliar. The inherent degree of uncertainty surrounding these new technologies and concepts, as well as the effort required to collect reliable information and gain confidence for informed decisionmaking, may cause top management to hesitate in making the needed IOP changes.

Each of the above forms of leadership capital is a scarce resource. In making the business case to leadership it is important to understand how the payoffs and risks may be perceived from a **top management point of view** and what type of **leadership capital expenditure** is involved as a framework for targeting supportive arguments as appropriate.

Leadership Actions to Support Institutional, Organizational Change

In light of top leaders' orientation as described above, it is important to focus on key IOP changes that may be dependent on supportive leadership, or, in other words, that are in the span of control of leadership. This section provides some general considerations for leadership actions in each of the three IOP areas. **Procedural changes**, many of which are within the span of control of middle management, require only modest support from top management. **Organizational changes**, which may disrupt other agency units, suggest the importance of leadership persuasiveness in the ability to build a top management consensus supportive of TSMO. **Institutional changes** make the greatest demand on leadership capital, as it involves being able to articulate the payoffs from some significant changes in policies and programs, both internally and externally. A general discussion is followed by a table describing key leadership actions and the nature and level of leadership capital involved to advance TSMO IOP.

Institutional: Building a Culture that Values and Supports TSMO

The needed organizational and procedural adjustments (as discussed in part II, section 5) may require adjustments in institutional orientation that require strong and informed leadership. In this the business case can play a critical role. This is especially important as a unique role of top management is to develop an internal consensus and external support for the changes and resources required for effective TSMO.

Top-down change management support, to be effective, must be rooted in a clear understanding on the part of leadership of the TSMO mission and objectives as being an agency priority. This is further emphasized in today's safety and reliability challenges and in the opportunities for new combinations of technology and processes to deal with them. Key focus areas for leadership include:

- *Explicitly including TSMO in the Agency's Mission*—Fundamental to ensuring a long-term

Leadership Levels

The importance of leadership—CEOs, chief engineers, division heads—relates to the reality that IOP changes involve the fundamental rethinking of the agency's mission and objectives, and together changes how TSMO gets done on day-to-day basis. Some of these may seem at odds with the agency's legacy culture with its civil engineering and capacity project focus, even though TSMO can contribute to more effective targeting of new capacity and more efficient maintenance procedures.

Leading and managing changes usually requires a combination of staff champions and top management support. The CMM workshops indicated the range of levels in leadership and its importance as a key ingredient in making the important IOP changes:

Level 1: Individual staff champions promote TSMO.

Level 2: Jurisdiction's senior management understands the TSMO business case and educates decisionmakers/the public.

Level 3: Jurisdiction's mission identifies TSMO and its benefits with a formal program and achieves wide public visibility/understanding.

Level 4: Customer mobility, reliability, and safety services accepted as a formal, top level core program of all jurisdictions with agency commitment and accountability.

A key challenge is that both champions and leaders turn over. Therefore integrating TSMO into policy as well as related procedures and organizational changes can formalize these changes to institutionalize TSMO into the agency.

commitment to, and the continuing improvement of TSMO is embedding it in agency *policy*, along with appropriate objectives and performance measures. Agency strategies and resource allocations are presumed to be policy responsive, and effective TSMO must be part of explicitly stated agency priorities, along with development and maintenance of the infrastructure, if it is to play its appropriate cost effective role. Changes in policy must be sponsored by top management and include extensive buy-in by leadership throughout the agency.

- ▶ *Marketing TSMO*, both internally and externally, is an important use of the unique influence and leverage of top management. It also clearly demonstrates that the commitment to TSMO is truly at the agency level.
- ▶ *Facilitating Collaboration* often requires top management support through heading up inter-agency *collaboration* initiatives, at the agency head peer-to peer level, to align transportation-related public agencies (law enforcement, emergency response, etc.) with the DOT TSMO objectives.
- ▶ *Public-private partnerships*, which are in some cases needed to access key technical resources, also involve clear policy decisions regarding outsourcing and the level of external dependence.

Organizational: Reorganizing and Staffing to Support the Needed Transportation Systems Management and Operations Business and Technical Processes

The organizational and staff adjustments required to effectively execute may require important organizational structure and staffing changes as detailed in part II. Advancing TSMO as a program requires a clear allocation of responsibility to ensure that there is effective coordination, responsibility, and accountability. Thereby a chain of command that silos engineering from operations is a considerable handicap to continuous and coordinated improvement of a TSMO program that promotes technology development as the basis for operational management.

Key focus areas for leadership include:

- ▶ *Revising Organizational Structure*—The development of the appropriate organizational structure may require adjustments in roles, responsibilities, allocations of resources, and even policy priorities that cut across all agency programs. There are alternative models for allocating responsibility, but they have a common need for continuous coordination in both program development and program operations. The identification of the single point of responsibility and chain of command at the overall agency (or district/region) level of who has been endowed with the appropriate mix of responsibility and authority is needed to clearly place TSMO in the organization. The nature of these changes requires initiative and support at the top management level.
- ▶ *Allocating Needed Staff Resources* —“Staffing up” for TSMO may require reallocation of existing positions, an increase in Full-Time Equivalents (FTEs), or a redefinition of certain positions, especially where specific technical capabilities are required. In addition, top management attention may also be important to develop or expand existing training programs with the appropriate resource allocation. Top management attention may also be important in making adjustments regarding existing position descriptions and job classifications or adding new ones, to support hiring and retaining the necessary skillsets for advancing TSMO.
- ▶ *Supporting TSMO Champions*—Experience indicates that staff champions play a key role in promoting TSMO, raising the profile of TSMO in the agency and with leadership, identifying issues and opportunities, and facilitating and maintaining formal and informal collaboration. This is especially critical in the earlier stages of TSMO program development where IOP changes are important. Effective TSMO programs are often dependent on middle management leadership that have been identified, authorized, encouraged, and supported by leadership.

Insights from Interviews with State DOT CEOs on IOP Arrangements for TSMO

The following insights for increasing the traction of TSMO among agency executives were collected during discussions with current and former DOT executives.

- ▶ The American Association of State Highway and Transportation Officials (AASHTO) New CEO program offers a potential point of intervention. This program uses presentations/discussions with existing CEO veterans as a device to sensitize new CEOs to key perspective to increase their prospects for success.
- ▶ Consider branding issues related both to how TSMO is described and the confusing jargon that seems disconnected to typical CEO priorities.
- ▶ Have tools “on the ready” for incoming CEOs—most likely provided by AASHTO at the new CEOs orientation. Ideas include:
 - » TSMO needs to be rebranded, not necessarily a shiny new acronym or advertising campaign, more so a core definition and understanding of what TSMO is. “We don’t build the system out anymore, we operate and manage it.”
 - » Present TSMO in terms of an operational management evolution—this should address from what to what to show evolution.
 - » Have a very short handout for new CEOs to explain what TSMO is and how it will make a CEO a “hero,” by effective response to transportation events such as major incidents and storms and through deployment of low cost, quickly implemented, strategies with proven benefits, and working with your essential partners in unison.
 - » Recognize the discussion of key IOP changes is not the leading point—and is appropriate as it may emerge from peer discussions/examples and follow-up activities that show it is needed.
 - » Package TSMO for what it is for the forward thinking CEO: big data, as a predecessor to connected and autonomous vehicles requiring many of the same policy and program commitments, and capabilities, etc.

Procedural: Changes to Business and Technical Processes

Business and technical processes associated with TSMO are substantially different than those developed to support capital construction and maintenance, and are often not a natural fit with traditional agency IOP arrangements. Some changes to traditional processes, or development of some new processes, are often needed to support effective TSMO. Oversight from leadership is typically an important component to making these adjustments to legacy processes where TSMO involves real-time management of operational strategies. Since TSMO strategies often address causes of congestion and delay that are not addressed by capacity improvements, they need to be considered in both the *planning and project development* processes to ensure simultaneous consideration for the most cost effective combined application of both capacity and operational measures.

Developing, maintaining, and updating TSMO strategies requires the development of concepts of operation and ITS architectures based on *systems engineering* that must be understood and applied by staff experts to ensure system interoperability and appropriate technology.

Other processes, especially situational awareness and *performance measurement*, are critical to TSMO to determine its effectiveness at any given point in time, and over time. The function of transportation management centers (TMC) that operate the network in real-time symbolizes the distinct features of TSMO, compared to a project development-oriented engineering organization. Unlike conventional capacity improvements, effective TSMO strategies require “tuning up” in real-time and periodic check-ups to ensure that the various procedures and protocols are being combined and applied at their greatest effectiveness in response to changing conditions.

Many of these IOP interdependencies are not intuitively obvious, and an important role of the business case—from a senior leadership perspective—is to clarify the need for the appropriate directions of managed change.

Key Leadership Actions related to IOP Changes

Tables 9 to 11 identify key leadership actions in each of the IOP dimensions together with the demands they place on the expenditure of leadership capital. The action items on this table are consistent with the table of actions by CMM dimension (part II, tables 1 through 6).

The columns in the tables below are organized by the principal categories of needed top leadership action. They present the potential payoffs from each as well as the leadership commitment level (the requirements on top management attention and authority) and the likely time frame for accomplishment. Finally, the table summarizes what kind of leadership “capital” expenditure may be involved in the action.

Table 9. Key leadership actions related to institutional changes.

	Leadership Actions to Mainstream TSMO	Benefits/ Payoffs	Leadership Commitment Level	Commitment Time Frame	Leadership “Capital” Expenditure
Institutional	<u>Familiarization</u> Develop top manager and staff TSMO familiarization/ justification program.	Essential as basis/framework for actions below.	Use of valuable time.	Short—at leader’s initiative.	<i>Intellectual:</i> High—requires self-education.
	<u>Policy support</u> Adjust agency policy to place TSMO in the top tier of policy program and related objectives.	Required to support adjustments in program and organization.	Endowing TSMO with status that is not perceived as merited by established legacy (civil engineering) constituency and is perceived as diminishing their professional status/value.	Long and continuous.	<i>Intellectual:</i> Moderate—requires continues communication with payoff examples <i>Representative:</i> High—requires justification to other senior managers.
	<u>Marketing TSMO</u> Use personal influence and contacts to persuade key players both internally and externally of value.	Important to securing voluntary cooperation from key players.	Importance of demonstrating agency-level commitment.	Both short and long.	<i>Representative:</i> High—requires justification to internal staff and management and external partners.
	<u>Agency Collaboration</u> Negotiate objectives realignment with other agencies (public safety, local government).	Need for partner program and TSMO activities alignment to deliver program.	Time consuming—requires persuasive face-to face interactions.	Long—continuous reinforcement.	<i>Reputational:</i> High—requires education/ collaboration with partner leaders.
	<u>Private Partnerships</u> Develop new relationships with private service and technology providers.	Improved applications effectiveness.	Perceived changes in conventional arms-length relationships.	Medium—may require senior management intervention.	<i>Intellectual:</i> Low—may improve agency image.

Table 10. Key leadership actions related to organizational changes.

	Leadership Actions to Mainstream TSMO	Benefits/ Payoffs	Leadership Commitment Level	Commitment Time Frame	Leadership “Capital” Expenditure
Organizational	<u>Chain of Command</u> Reorganize to elevate TSMO activities to appropriate and effective chain of command and organizational level.	Improvement of efficiency.	Reducing reports to specific manager as loss of status, control (change in role).	Medium—must be sold. Long—in order to persist.	<i>Representative:</i> High—requires justification to other senior managers.
	<u>Championship</u> Identify and support a TSMO change manager champion.	Achieve momentum for change management.	Mentorship.	Short—but individual must be supported.	<i>Representative:</i> Moderate—involves some specific delegation of authority.
	<u>Staff Capabilities</u> Identify needed management and technical positions.	More effective program development and execution and agency self-reliance. Clearer defined career paths for staff.	May involve pay scale changes and new position descriptions and levels.	Short—staff needed for program development.	<i>Representative:</i> Moderate—involves supporting needed administrative changes.
	<u>Training</u> Direct TSMO staff capability development.	Ability to stay on top of emerging technologies and research.	Use of staff resources.	Long—continuous reinforcement.	<i>Representative:</i> Low—may require justification to other senior managers. <i>Intellectual:</i> Direct TSMO staff capability development.

Table 11. Key leadership actions related to procedural changes.

	Leadership Actions to Mainstream TSMO	Benefits/ Payoffs	Leadership Commitment Level	Commitment Time Frame	Leadership “Capital” Expenditure
Procedural	<u>Planning/ Programming</u> Insert TSMO into the legacy planning, programming, and project development process.	Development of appropriate sequence of improvements with needed resources.	Understanding the technical capability in planning staff.	Short (can be initiated as staff effort).	<i>Reputational:</i> Moderate—requires continuous communication with payoff examples. <i>Representative:</i> High—requires justification to other senior managers.
	<u>Systems Engineering</u> Require Systems Engineering utilization to develop and manage TSMO applications and use of emerging technologies.	Assurance of effective operations.	Understanding the technical capacity in systems engineering.	Short—must become standard procedure for projects.	<i>Reputational:</i> Moderate—requires continued communication with payoff examples. <i>Representative:</i> High—requires justification to other senior managers.
	<u>Budgeting</u> Develop a formal TSMO budget line item.	Sustainable funding to support program development.	Need to reallocate existing resources.	Medium—related to budget cycles and repetition.	<i>Representative:</i> High—requires justification to other senior managers.
	<u>Performance Measurement</u> Modify performance objectives and measures to accommodate TSMO.	TSMO management entirely performance-based outcome.	Change of traditional program output focus towards outcomes.	Short (can be initiated as staff effort).	<i>Reputational:</i> Low—should be easy to explain <i>Representative:</i> Low—May be part of larger performance focus initiative. <i>Intellectual:</i> Moderate—Can be authorized/ delegated.

A Case Study of TSMO Leadership: Colorado Department of Transportation

In 2012 the Colorado Department of Transportation (CDOT) began taking serious actions to reassess and improve how it approaches TSMO. These actions were in large part spurred by TSMO champions at the executive level—in particular CDOT’s executive director—from 2011-2015. To jump start its formal TSMO program, CDOT established the Division of TSMO in 2013 with a new TSMO Director position on par with legacy division directors. The new TSMO Director was then charged with defining CDOT’s TSMO goals, evaluating its current TSMO activities, and recommending the organizational changes, investments, and immediate actions needed to improve TSMO.

While there are many potential motivations and justifications for improving TSMO activities, CDOT created a TSMO business case that reflected the unique context of its agency, its customers, and the State of Colorado. For CDOT, a key selling point was that the state can no longer build its way out of pressing congestion and safety issues due to time and cost constraints. By investing in TSMO, CDOT is therefore “buying the most mobility at the lowest possible cost” and offering real solutions in the near term, rather than years to decades down the road. For CDOT it was also important to communicate that approximately 55 percent of urban congestion and virtually all rural congestion is due to nonrecurring congestion—and that TSMO solutions are ideally suited to solve exactly this type of congestion.

A key element in CDOT’s initial transition was the visible and active support of the executive director. At the first Steering Committee meeting, the actions of CDOT’s then Executive Director were described as follows in a CDOT report:

“[The Executive Director] opened the workshop by reiterating his support for improved operations and the benefits that can be gained by operating the transportation system more efficiently and effectively. He stated that CDOT created the Division of TSMO in order to provide the organizational structure and support to strategically deliver operations in a more integrated and effective manner and that the Transportation Commission strongly supports this goal and has allocated \$75 million over the next five years to support the program. He stated that the

Chief Engineer also supports this project. Finally, he extended his appreciation to the Steering Committee for taking time to be involved in this very important project.”

The Steering Committee established by the executive director undertook a systematic stepwise program to install the essential IOP elements. To focus the planning and recommendations of the new TSMO Division, CDOT first created its own definition of TSMO and delineated the 12 most important “core operational areas” for Colorado: (1) Freeway Management, (2) Arterial Management, (3) Travel Demand Management, (4) Maintenance Management, (5) Work Zone Management, (6) Law Enforcement Coordination, (7) Traffic Incident Management, (8) Commercial Vehicle Operations, (9) Communications Infrastructure Management, (10) Data Management, (11) Asset Management, and (12) Transportation Planning Coordination. To establish a baseline, CDOT graded the current activities within each of the core operational areas. All areas received a grade in the “C” or “D” range, with the exception of Maintenance Management and Traffic Incident Management, which both received a B-minus. From here, CDOT found it necessary to either implement new responsibilities within the Division of TSMO or implement changes within the larger CDOT organizational structure in order to improve their grade in each core operational area. (No change in organizational structure was also considered, but ultimately dismissed, for each core operational area.)

This led to the creation of detailed recommendations for each core operational area at the individual program level—as well as a list of recommended investments and intermediate goals for the near future (Fiscal Year 2014).

A key feature supporting these TSMO-supportive improvements was the formal incorporation of TSMO evaluation into the agency’s formal project development process. The purpose of the directive from the executive director was to ensure that:

- ▶ The TSMO Evaluation consists of three parts; Safety, Operations, and ITS analyses.
- ▶ The TSMO Evaluation Process is aligned with the CDOT Project Development Process and will be included in the manual.
- ▶ The TSMO Evaluation will evaluate the project area and make recommendations to the project team for improvements related to Safety, Operations, and ITS.

Beginning January 1, 2016 all projects with a Design Scoping Review on or after February 1, 2016 will require a TSMO Evaluation.

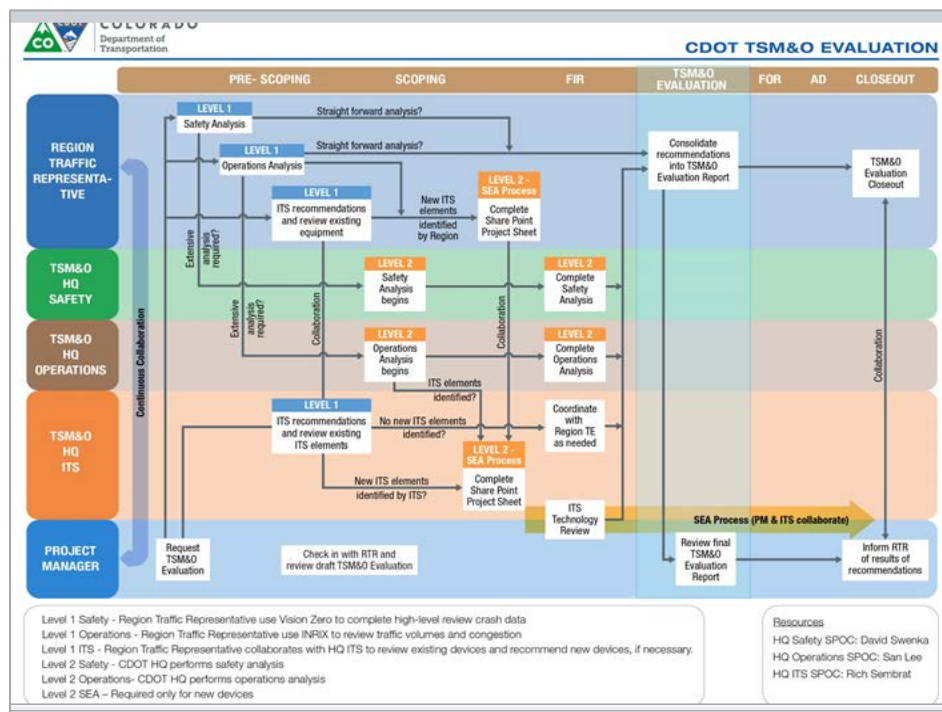


Figure 8. Graph. Schematic of the Colorado Department of Transportation (CDOT) Transportation Systems Management and Operations (TSMO) Evaluation.

(Source: CDOT, https://www.codot.gov/business/designsupport/bulletins_manuals/adg/tsmo.)

As early as fall 2015, CDOT was already seeing the fruits of its labor. In this time, the reorganization helped the amount of dedicated TSMO funding surge from around \$8 million/year to over \$60 million/year. This early success has been attributed to both the executive level champions and newly offered TSMO training programs, which created a culture much more conducive to effective TSMO activities. In the following years, CDOT continued to build on this success. The agency has found that its IOP changes to support TSMO have helped facilitate the implementation of a series of high return-on-investment TSMO projects, with benefit-cost ratios typically around 10:1 and as high as 40:1. Overall, CDOT’s reorganization and associated IOP changes have helped—and continue to help—the department make great strides in advancing TSMO as an integrated, systematic part of transportation planning in Colorado.

PART IV

TAILORING THE BUSINESS CASE TO SPECIFIC AUDIENCES



In making the business case for Institutional, Organizational, and Procedural (IOP) changes for Transportation Systems Management and Operations (TSMO), it will be important to gain the support of a variety of stakeholders. This will require tailoring the business case to a variety of audiences throughout the agency and beyond the agency. Opportunities exist to make the case for advancing operations with several classes of stakeholders, each with their own understanding and influence in the process. This part provides key considerations for tailoring the business case to four critical audiences: agency leaders, management and staff, transportation partners, and the general public. These considerations include best practices and lessons learned from existing TSMO business cases in terms of tailoring the language, content, and format to these audiences.

Agency Leaders and Management

Given the critical role of top management leadership as described in part III, the TSMO business case for agency leaders and management should provide a clear rationale for TSMO and the role it plays as a complement to the existing capacity development, safety, and maintenance programs. Supporters have made it clear that TSMO does not substitute for capacity projects in its function to improve service, but that it can substantially improve the cost

effectiveness and performance of existing and new capacity, often with only a marginal increase in cost. Moreover, this heightened cost effectiveness can improve the justification for capacity improvements. TSMO can increase the potential benefits from other programs as well. For example, TSMO can have substantial impacts on safety through strategies such as the use of variable message signing and other warning systems in providing real time information to the traveler. TSMO also can minimize the negative impacts of maintenance and reconstruction by ensuring safe and smooth traffic flow in and around work zones.

Given this, agencies might want to frame TSMO improvements as a cost effective way to complement more traditional transportation agency activities—such as roadway expansion and pavement condition maintenance—and highlight that adding TSMO projects to other transportation improvement projects enhances the impacts and cost effectiveness of both.

Technical detail and examples can be provided that allow agency leadership to feel confident in lending support to TSMO and that offer defensible arguments to move forward with IOP actions. The content of the business case for agency leaders and management may include several sections as described in this document. The business case provides the background for the changes and the objectives and changes needed to integrate TSMO, as well as discussions of proposed IOP actions, benefits, resources needed, and expected returns. It may also include a discussion of the risks associated with not making the recommended changes. A business case for agency leaders is tailored to the specific needs and culture of the organization and cannot be viewed as a one-size-fits-all document.

A business case for this audience is short and concise (two to four pages), and links to the overall agency mission, goals, and objectives. It includes examples of best practices and cost benefit justification tailored to the agency, with local examples if possible. The business case for agency management is simple, clear, and concisely presented providing specific direction on how and why the IOP changes to advance TSMO should occur. If possible, a link to an agency Web page or TSMO plan with more information is useful for those who pick up the business case and would like to know more.

Agency Staff

Many of the same considerations in regarding the interests and concerns noted above for leaders and management apply to the workforce as a whole, especially professional staff. Effective execution of whatever IOP changes may occur depends on the buy-in and cooperation of all of those involved at the staff level, since the day-to-day actions, communication, and cooperation occurs at the staff level. For professional staff, in particular, it is important to establish the value of their professional commitment to TSMO as a key component of job satisfaction. For this audience, a more extensive technical discussion is likely to be helpful. One potential action to build professional staff understanding is to involve them in the development of the business case—especially since they may possess technical insight that may be important in developing the case for other audiences. In addition, group staff discussions of the business case may be as valuable as written documents.

Transportation Agency Partners

A business case for transportation agency partners will provide information on how and why increased cooperation/collaboration and increased alignment will enhance their own program effectiveness through delivering a well-functioning transportation system for the region and its customers and the State/regional economy. It illustrates how collaboration with other levels of government, modes, and public safety entities can advance both mutual and individual agendas. The business case is compact and uses terms related to the partners' own interests—for instance, two to four pages, depending on how familiar the partners are with TSMO and how much detail the agencies might expect. The use of acronyms in this business case is also a sliding scale—depending on the partner's familiarity with TSMO. Defining all acronyms may be sufficient for some partners, while others may require a definition and short explanatory description.

The content of the business case for transportation partners will hinge on the agency's goal for the business case. Some common goals may include: improving collaboration around traffic incident management or work zone management, aligning project development and funding processes among key partners, and establishing inter-agency committees or working groups. The preparer of the business case should first clearly define its goals for this business case and

then identify and focus on select examples, projects, and benefit-cost information that can show partners the value of these goals. A business case for transportation agency partners, in general, will provide more technical detail and examples than business cases for the general public. If possible, a link to an agency Web page or TSMO plan with more information is useful for those who pick up the business case and would like to know more.

General Public

A business case tailored to the general public is a concise, high-level version of the business case. Agencies may aim to limit the business case to a single page, with a maximum length of two pages (or one double-side printed page). The objective of a business case for the general public is generally focused on educating the reader on the work of the agency. The content should be as light on text as possible. The use of infographics, simple charts, and images helps to engage as many people as possible. If possible, a link to an agency Web page or TSMO plan with more information is useful for those who pick up the business case and would like to know more.

Acronyms and industry jargon are avoided whenever possible (especially “TSMO”) and TSMO improvements discussed in terms of services (e.g., traveler information or freeway service patrol services) and outcomes (e.g., improved traffic conditions) rather than in terms of projects and programs (e.g., a new Road Weather Information System (RWIS) or Integrated Corridor Management (ICM) project). In general, monetary benefit-cost information is avoided as it is expected that, more often than not, the general public does not have a good benchmark for the costs of comparable transportation and infrastructure projects. Discussing benefit-cost ratios, on the other hand, is an effective way to demonstrate the cost effectiveness of TSMO to the general public.

Agencies may want to frame TSMO improvements as a cost effective way to complement more traditional transportation agency activities—such as roadway expansion and pavement condition maintenance—and highlight that adding TSMO projects to other transportation improvement projects enhances the impacts and cost effectiveness of both. Contrasting the cost effectiveness of TSMO against other, more traditional approaches without highlighting this

synergy may unintentionally lead stakeholders to the conclusion that the agency has misspent its funds in the past.

Reference: SHRP 2 L17 (6) Business Case Primer: Communicating the Value of Transportation System Management and Operations.

The Elevator Speech

Preparing and practicing an “elevator speech” has been shown to be effective in how an agency’s TSMO unit can improve the efficacy of its business case for IOP changes. Typically, an elevator speech is delivered verbally in about one minute (although it can be longer, if desired). In general, key talking points in an overall business case can be shortened to an elevator speech for IOP changes for TSMO. These can include the following components:

- ▶ **The overall objective of the business case for IOP changes.**
- ▶ **The top priority IOP change that the agency wants to accomplish.**
- ▶ **The basic argument/rationale for making this IOP change.**
- ▶ **A reference to the agency’s business case along with an offer to send an electronic or hard copy, or set-up a follow up meeting.**

An elevator speech would typically work differently under a variety of contexts. For example—a TSMO champion may come across the opportunity to speak briefly with the State’s transportation secretary, a senior manager in another division, a key partner, or an elected official. Another example of contexts would be if situations arise that impact the position of TSMO (e.g., a new governor/ or a bad storm or crash).

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