

IMPROVING TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSM&O)

Capability Maturity Model Workshop White Paper

Business Processes



U.S. Department of Transportation
Federal Highway Administration

April 2015

Notice

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The U.S. Government is not endorsing any manufacturers, products, or services cited herein and any trade name that may appear in the work has been included only because it is essential to the contents of the work.

Quality Assurance Statement

The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and processes for continuous quality improvement.

Table of Contents

Executive Summary.....	ES-1
Background	ES-1
Scope	ES-1
State of the Practice Findings for TSM&O Business Processes	ES-1
General.....	ES-1
TSM&O Planning Process	ES-2
Programming/Budgeting	ES-2
Project Development/Procurement	ES-3
Metropolitan/Regional Planning Organization Roles	ES-3
Synergism.....	ES-3
State DOT and Regional Implementation Plan Priorities	ES-3
Best Practices and National Needs	ES-4
1.0 TSM&O Capability Maturity Self-Assessment Program: General Background..	1-1
1.1 TSM&O and the Capability Maturity Model	1-1
1.2 CMM Self-Assessment Workshops.....	1-1
1.3 The Capability Maturity Self-Assessment Framework	1-2
1.4 CMM Self-Assessment Workshops Analyzed	1-3
2.0 Summary of All Capability Dimensions	2-1
2.1 Synergies among Dimensions of Capability	2-2
2.2 General Implementation Plan Priorities for All Six Dimensions	2-3
Business Processes.....	2-3
Systems and Technology	2-4
Performance Measurement	2-4
Culture	2-4
Organization and Staffing	2-4
Collaboration	2-4
3.0 State of the Practice for the Business Processes Dimension.....	3-1
3.1 The Business Processes Dimension	3-1
3.2 TSM&O Planning Process	3-2
3.3 Programming/Budgeting	3-5
3.4 Project Development/Procurement	3-6
3.5 Metropolitan Planning Organizations, Other Regional Entities and TSM&O Planning.....	3-6

4.0 Relationships to Other Capability Dimensions	4-1
4.1 Synergy	4-1
4.2 Span of Control.....	4-2
5.0 Implementation Plan Capability Improvement Actions	5-1
5.1 Development of a TSM&O Program Plan	5-2
5.2 Focus on a Specific Corridor Plan.....	5-2
5.3 Develop TSM&O Business Case and Related Communications Strategy.....	5-3
6.0 Best Practice Examples	6-1
7.0 Addressing Needs on the National Level	7-1
8.0 References	8-1
Appendix: Steps to Implement Common Implementation Plan Priority Actions for Business Processes Dimension	A-1

List of Tables

Table 1.1	Self-Assessment CMM Workshop Locations Analyzed in this White Paper	1-3
Table 2.1	Workshop Self-Assessment Levels Distribution by Dimension (23 Workshops)	2-1
Table 3.1	Self-Assessment Workshop Levels of Capability Maturity for Business Processes	3-1
Table 7.1	Suggested National Activities to Support Improvements in Business Processes	7-1

List of Figures

Figure 2.1	Graph. Distribution of Self-Assessments (23 Workshops)	2-2
Figure 2.2	Graph. Synergy among Dimensions of Capability.....	2-3
Figure 3.1	Graph. Business Processes Compared to Other Dimensions of Capability	3-2
Figure 4.1	Graph. Key Synergisms between Business Processes and Other Dimensions ...	4-2

Executive Summary

Background

Research done through the Second Strategic Highway Research Program (SHRP 2) determined that agencies with the most effective transportation systems management and operations (TSM&O) activities were differentiated not by budgets or technical skills alone, but by the existence of critical processes and institutional arrangements tailored to the unique features of TSM&O applications. The significance of this finding has been validated in 40 State and regional self-assessment workshops using the Capability Maturity Model (CMM) and its six dimensions of organizational capabilities. This white paper focuses on Business Processes as one of the central dimensions of capability needed to support effective TSM&O, including planning, programming, and project development. It summarizes the TSM&O state-of-the-practice based on the workshops and subsequent implementation plans developed at 23 sites selected by FHWA and the American Association of State Highway and Transportation Officials (AASHTO) as part of the SHRP 2 Implementation Assistance Program.

Scope

This white paper includes the following material:

- A description of the SHRP 2 research and workshop process related to the institutional and process aspects of TSM&O including a description of the CMM self-assessment framework and its application to the Business Process dimension.
- A discussion of the state-of-the-practice regarding Business Processes in terms of its key elements including capability levels self-assessed at the workshops.
- A description of key synergies between Business Processes and the other dimensions of capability and evaluation of managers' spans of control to effect improvement.
- Best practice examples and references.
- Suggested actions to address Business Process needs on a national level.
- An Appendix presenting common implementation plan priority actions for the Business Processes dimension.

State of the Practice Findings for TSM&O Business Processes

Key findings from the workshops included:

General

There are very few statewide TSM&O-specific plans that go beyond ITS and an equally limited number of included MPOs with a TSM&O-related plan or budget element. TSM&O planning and

budgeting have been largely limited to specific projects or initiatives. In addition, TSM&O as a program has very limited visibility in statewide and MPO comprehensive plans and programs – although valuable guidance is available. Planning initiatives are discouraged by lack of sustainable funding and lack of program status. TSM&O funding is rarely over 2–3 percent of agency total on a multiyear basis. However, newly emerging multijurisdictional applications and new technology applications (integrated corridors, active traffic management, connected vehicles) appear to highlight the need for a systematic planning approach. Consensus indicates that a start-up TSM&O “program plan” is needed with several components, including the basic business case and strategies for dealing with all the CMM dimensions as well as system investment strategies. Workshop participants noted lack of relevant methodologies and the lack of technical capacities.

TSM&O Planning Process

- **Plateauing.** Many of the states/regions have “plateaued.” They have completed implementation of conventional freeway management applications and now realize that expanding beyond these conventional applications requires new planning and programming, especially for strategies that need greater involvement with other stakeholders.
- **Types of current TSM&O-related planning efforts.** Very few states/regions have incorporated TSM&O as a distinct category of expenditure in their agency comprehensive plans and programs. However, some states/regions have developed separate “plans” for specific applications such as incident management and integrated corridor management.
- **Need for a “TSM&O Program Plan.”** A TSM&O-specific plan is not required either by Federal regulations or as a matter of standard agency procedure. However, there are a set of specific issues that can be addressed in a start-up TSM&O Program Plan including the business case, performance measures, concepts of operations, procedures/protocols, and organizational, staffing and collaboration needs.
- **TSM&O element in statewide planning.** TSM&O has not achieved the status of a formal “program” in the statewide planning process, either as an investment or as an alternative to certain capacity improvements. However, a few MPOs have distinct TSM&O plan elements and have included them in their metropolitan plans.
- **Key capabilities and methodologies needed.** Agency TSM&O staff lack both a planning background and relevant planning tools and methods. In several workshops, Strategic Highway Safety Plans were identified as a relevant model.

Programming/Budgeting

- **TSM&O programming and budgeting.** Most TSM&O funding for specific projects is ad hoc and intermittent. Funding is inhibited by TSM&O’s lack of program status and agency resource constraints and leads to fragmented implementation, difficulty addressing lifecycle costs, and vulnerability (elimination from programs when cost reductions are necessary).

- **Level of investment.** Few State DOT managers know what resources are being invested in TSM&O or how current investments might relate to more cost-effective use of scarce DOT resources. The absence of a plan-based TSM&O program and related multiyear budget reduces the ability of TSM&O to compete for these resources.

Project Development/Procurement

- **Accommodating the project development process.** TSM&O projects have special development requirements – systems engineering, concepts of operations, types of procurement, systems integration/deployment needs, and special contracting requirements – and a different benefit-cost structure, making them difficult to accommodate in the conventional project development process. Procurement of advanced technology systems (non-low-bid) is presenting a special challenge.

Metropolitan/Regional Planning Organization Roles

- Workshop locations did not include any of the few regions that have prepared TSM&O-related plans. However, the larger MPOs involved in the workshops conduct a Congestion Management Process and several have allocated CMAQ funds under their control for signal upgrades and coordination, and sponsored/managed incident management training for their local transportation and public safety members.

Synergism

TSM&O Business Processes are especially dependent on capabilities in other dimensions: on systems engineering to identify concepts of operations required for planning and programming, on organization and staffing for relationships between planning and TSM&O staff, on performance measurement for the setting of objectives and progress measurement. All these relationships are often collaborative in nature.

State DOT and Regional Implementation Plan Priorities

The leading participant-suggested actions included in TSM&O implementation plans for advancement to the next level of capability in Business Processes include:

- Developing a regional/statewide “TSM&O Program Plan” that includes the full range of CMM related components.
- Integrating TSM&O into statewide long-range plans and transportation improvement programs.
- Preparing and communicating the TSM&O business case for various key stakeholder audiences.
- Developing methods to evaluate TSM&O against capacity options, including benefit-cost comparisons.

- Modifying the project development process to include TSM&O considerations and needs.
- Preparing a statewide TIM plan/program as a standalone activity.

Best Practices and National Needs

This white paper describes example best practices and reference material related to the identified implementation plan priority needs. The paper also suggests supportive national actions to improve TSM&O Business Processes – development of a program of webinars, guidelines, and lessons-learned to disseminate best practice – but also the need to develop new custom-tailored approaches to the issues raised by workshop participants in their implementation plan priorities. Important roles are seen for FHWA, AASHTO, and the National Operations Center of Excellence in supporting these efforts.

1.0 TSM&O Capability Maturity Self-Assessment Program: General Background

Many State DOTs and regions have recognized the importance of more effective TSM&O to improving customer service and system performance. Best practice TSM&O is being developed as an integrated program to optimize the performance of existing multimodal infrastructure through implementation of systems, services, and projects to optimize capacity and improve the security, safety, and reliability of the transportation system.

1.1 TSM&O and the Capability Maturity Model

The Second Strategic Highway Research Program (SHRP 2) included a Reliability Focus Area that produced research and products on many important data, analytic, and design issues, as well as process and applications improvements. One project identified the institutional characteristics of the agencies with the more effective TSM&O activities.¹ This research determined that agencies with the most effective TSM&O activities were differentiated not by budgets or technical skills alone, but by the existence of critical processes and institutional arrangements tailored to the unique features of TSM&O applications. These processes and institutional arrangements are defined by six critical dimensions: business processes; systems and technology; performance measurement; agency culture; organization and staffing; and collaboration.

Using these critical dimensions, the research project adapted concepts from the Capability Maturity Model (CMM) – widely used in the Information Technology industry – to develop a self-assessment framework designed to help transportation agencies identify their current strengths and weaknesses and related actions needed to improve their capabilities for effective TSM&O – in effect, a roadmap for “getting better at getting better.”

1.2 CMM Self-Assessment Workshops

The TSM&O CMM framework has been used as the basis for the development of a facilitated one-day self-assessment workshop process for State DOTs and regions. The CMM workshops are intended to improve the effectiveness of TSM&O applications and activities by assisting the unit managers and key technical staff with day-to-day oversight of TSM&O-related activities, as well as DOT partners, including public safety agencies, MPOs, local governments, and the private sector.

The workshop framework provides a structured focus on the six dimensions of capability, together with a facilitated self-assessment process in which participants evaluate their current activities and arrangements according to criteria from the CMM framework defining levels of

¹ *Institutional Architectures to Improve Systems Operations and Management*, SHRP 2 L06, 2012.

capability. The current challenges and problems identified by workshop participants are used to identify actions needed to improve capability, which are subsequently embodied in an implementation plan to improve the effectiveness of TSM&O.

Senior agency leadership is involved in a pre-workshop briefing and their approval of the implementation plan is required as a precondition of Federal financial assistance for the SHRP2 Implementation Assistance program sites.

1.3 The Capability Maturity Self-Assessment Framework

The CMM self-assessment framework is structured in terms of six dimensions of capability. Three dimensions are process oriented:

- **Business Processes**, including planning, programming, and budgeting (resources);
- **Systems and Technology**, including use of systems engineering, systems architecture standards, interoperability, and standardization; and
- **Performance Measurement**, including measures definition, data acquisition, and utilization.

Three dimensions are institutional:

- **Culture**, including technical understanding, leadership, outreach, and program legal authority;
- **Organization and Staffing**, including programmatic status, organizational structure, staff development, and recruitment and retention; and
- **Collaboration**, including relationships with public safety agencies, local governments, MPOs, and the private sector.

For each of these six dimensions, the self-assessment utilizes four criteria-based “levels” of capability maturity that indicate the direction of managed changes required to improve TSM&O effectiveness:

- **Level 1 – “Performed.”** Activities and relationships largely ad hoc, informal, and champion driven, substantially outside the mainstream of other DOT activities.
- **Level 2 – “Managed.”** Basic strategy applications understood; key processes’ support requirements identified and key technology and core capacities under development, but limited internal accountability and uneven alignment with external partners.
- **Level 3 – “Integrated.”** Standardized strategy applications implemented in priority contexts and managed for performance; TSM&O technical and business processes developed, documented, and integrated into DOT; partnerships aligned.

- **Level 4 – “Optimizing.”** TSM&O as full, sustainable core DOT program priority, established on the basis of continuous improvement with top-level management status and formal partnerships.

This structure of critical key dimensions of capabilities and their levels as self-assessed was used as the basis for the determination of the current state of the practice in the Business Processes dimension as discussed in the sections that follow.

1.4 CMM Self-Assessment Workshops Analyzed

This white paper synthesizes findings, as of December 2014, from 23 of 27 sites selected by FHWA and AASHTO in 2013 as part of the SHRP 2 Implementation Assistance Program. These 23, listed in Table 1.1, include 19 State DOTs (statewide or district focus) and four regional entities (including two MPOs).²

Table 1.1 Self-Assessment CMM Workshop Locations Analyzed in this White Paper

Arizona	NOACA (Cleveland, OH)
California	Ohio
Colorado	Oregon
Florida District 5 (Orlando)	Pennsylvania
Georgia	Rhode Island
Iowa	South Dakota
Kansas District 5 (Wichita)	Tennessee
Maryland	Utah
New Jersey	Washington, D.C.
Michigan	Washington State
Missouri	Whatcom (Whatcom County, Washington)
NITTEC (Buffalo, NY)	

² For a detailed discussion of prior workshops and those selected for the SHRP 2 Implementation Assistance Program, see the Organizing for Reliability – Assessment and Implementation Plan Development Final Report.

2.0 Summary of All Capability Dimensions

As background to this discussion of the Business Processes dimension in this white paper, it is useful to understand all the CMM dimensions in terms of the comparative capability levels and related initiatives. Table 2.1 presents the range of self-assessment levels by CMM dimension and capability level for the 23 workshop locations analyzed in this white paper.

Table 2.1 Workshop Self-Assessment Levels Distribution by Dimension (23 Workshops)

Dimension	Capability Self-Assessment			
	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimizing
Business Processes	11	10	2	0
Systems and Technology	7	12	3	1
Performance Measurement	9	11	3	0
Culture	8	11	4	0
Organization and Staffing	8	9	6	0
Collaboration	4	12	6	1

Note: Workshop self-assessment scores were often augmented with a “plus” or “minus” or given as a fraction (e.g., 1.5). For the purpose of the exhibit, “pluses” and “minuses” were ignored and all fractions were rounded to a whole number (with one-halves rounded down).

Self-assessment “scoring” is subjective, is specific to each state/region, and represents the consensus of workshop participants. The scores cannot be used for cross-site comparison, as some states/regions were tougher self-graders than others were. Nevertheless, within a given state/region, the scores for each dimension appear to reflect the relative level of capability among the dimensions. However, certain general conclusions can be drawn:

- Most locations assessed themselves at the “performed” or “managed” level (often somewhere in between) for most dimensions.
- Only two locations rated themselves as Level 4 in specific dimensions.
- Only a few agencies indicated reaching the level of “integrated” on more than two dimensions.
- While the aggregate distributions among several dimensions were similar (see Figure 2.1), this result masks very different distributions within individual agencies; that is, strengths and weakness differed among agencies responding to varying conditions.

- Collaboration and Systems and Technology are the strongest dimensions; for Collaboration, this reflects in part the impact of recent FHWA incident management training and other collaboration outreach; for Systems and Technology, this reflects an advancement in technology deployment over the past 10–15 years.

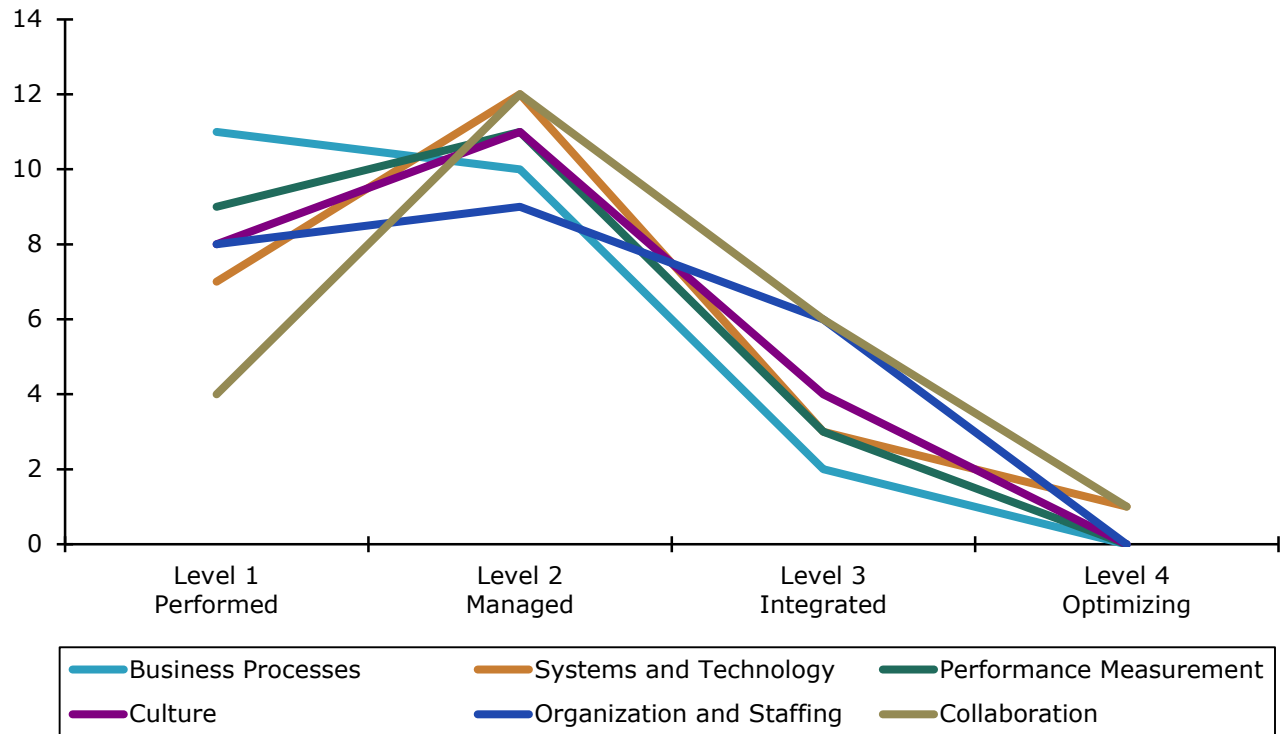


Figure 2.1 Graph. Distribution of Self-Assessments (23 Workshops)

(Source: Cambridge Systematics, Inc. and Parsons Brinckerhoff.)

Within a given dimension, there is often a significant gap between best practice and average practice among States. Even within individual States, progress in improving capabilities across the six dimensions is uneven. In many cases, however, there is visible change and strong staff leaders that are fully aware of what best practice is and are working within their institutions to develop essential capabilities.

2.1 Synergies among Dimensions of Capability

One of the most important findings of the SHRP 2 research, clearly validated in the workshops, was the apparent synergy among technical and institutional dimensions, as suggested in Figure 2.2. The dimensions of capability appear to be highly interdependent, such that it is difficult to improve a current level of capability in one dimension without simultaneously improving other dimensions that support it. This is reflected by the narrow spread in capabilities found among all workshops. As examples, workshop participants noted that

strategic planning is hampered by lack of performance data; business processes were hampered by lack of staff capabilities; and reorganization was impossible without top management buy-in (Culture).

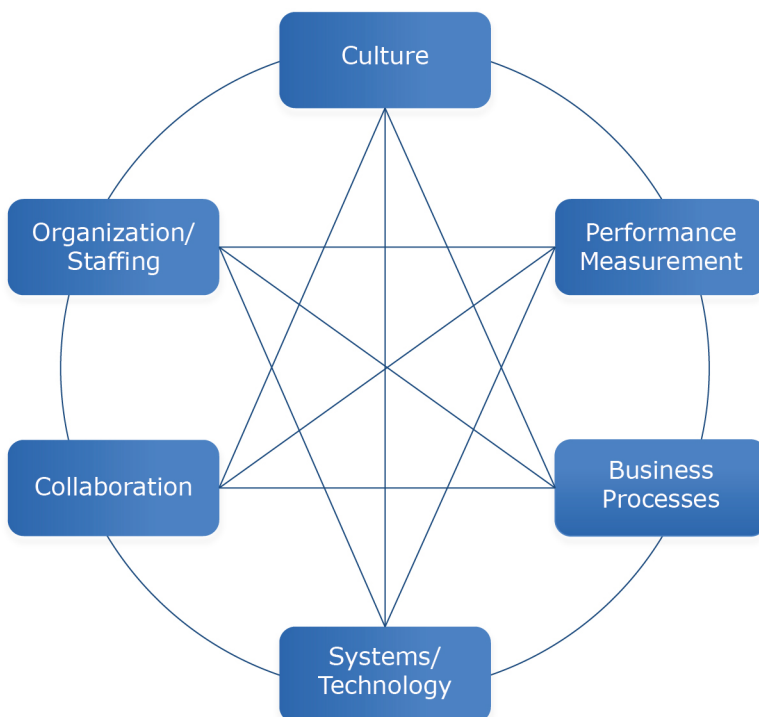


Figure 2.2 Graph. Synergy among Dimensions of Capability

(Source: Cambridge Systematics, Inc. and Parsons Brinckerhoff.)

2.2 General Implementation Plan Priorities for All Six Dimensions

Essential actions and products identified through the workshop and implementation plan process are presented below to establish some context regarding consideration of implementation plan recommendations for all six dimensions from the 23 workshops. A wide variety of actions are recommended across the six dimensions, including plans, processes, agreements, business cases, and organizational and staffing recommendations, each of which has a mutually reinforcing effect on overall capability.

Business Processes

- Develop a statewide/regional TSM&O program plan
- Integrate TSM&O into the conventional State and metropolitan planning process

Systems and Technology

- Update both regional and statewide system architectures for new/emerging TSM&O applications
- Improve ITS systems procurement process and/or relationships with agency IT unit

Performance Measurement

- Develop a plan for performance measures, data, and analytics
- Secure agreement from the public safety community on measures for incident management

Culture

- Develop a persuasive business case for TSM&O
- Develop a communications/outreach plan/branding for stakeholders

Organization and Staffing

- Define an appropriate organizational structure for the TSM&O program
- Identify core capabilities needed and develop related staffing and training plan

Collaboration

- Improve collaboration related to TIM including participating in TIM training and establishing a forum for building interagency relationships
- Align partners' TSM&O objectives and interact on a regular basis

3.0 State of the Practice for the Business Processes Dimension

3.1 The Business Processes Dimension

Business Processes are the set of specific, structured activities or tasks and related decision points required to efficiently produce TSM&O systems and services. Business Processes include formal planning, programming, scoping, budgeting, and project development. The capability-level criteria used in the self-assessments for this dimension are shown in Table 3.1.

Table 3.1 Self-Assessment Workshop Levels of Capability Maturity for Business Processes

Business Processes Criteria for Level Achievement	
Capability Level 1	Each jurisdiction doing its own thing according to individual priorities and capabilities
Capability Level 2	Consensus regional or statewide approach developed regarding TSM&O goals, deficiencies, B/C, networks, strategies and common priorities
Capability Level 3	Regional or statewide program integrated into jurisdictions' overall multimodal transportation plans with related staged program
Capability Level 4	TSM&O integrated into jurisdictions' multi-sectoral plans and programs, based on a formal, continuing planning processes

Among the 23 workshops, the average self-assessed capability level for Business Processes was 1.83, with 11 sites at Level 1, 10 sites at Level 2, and two at Level 3. Figure 3.1 depicts the scoring distribution relative to the other dimensions. Across all workshop locations, Business Processes was the dimension most frequently cited for inclusion in implementation plans.

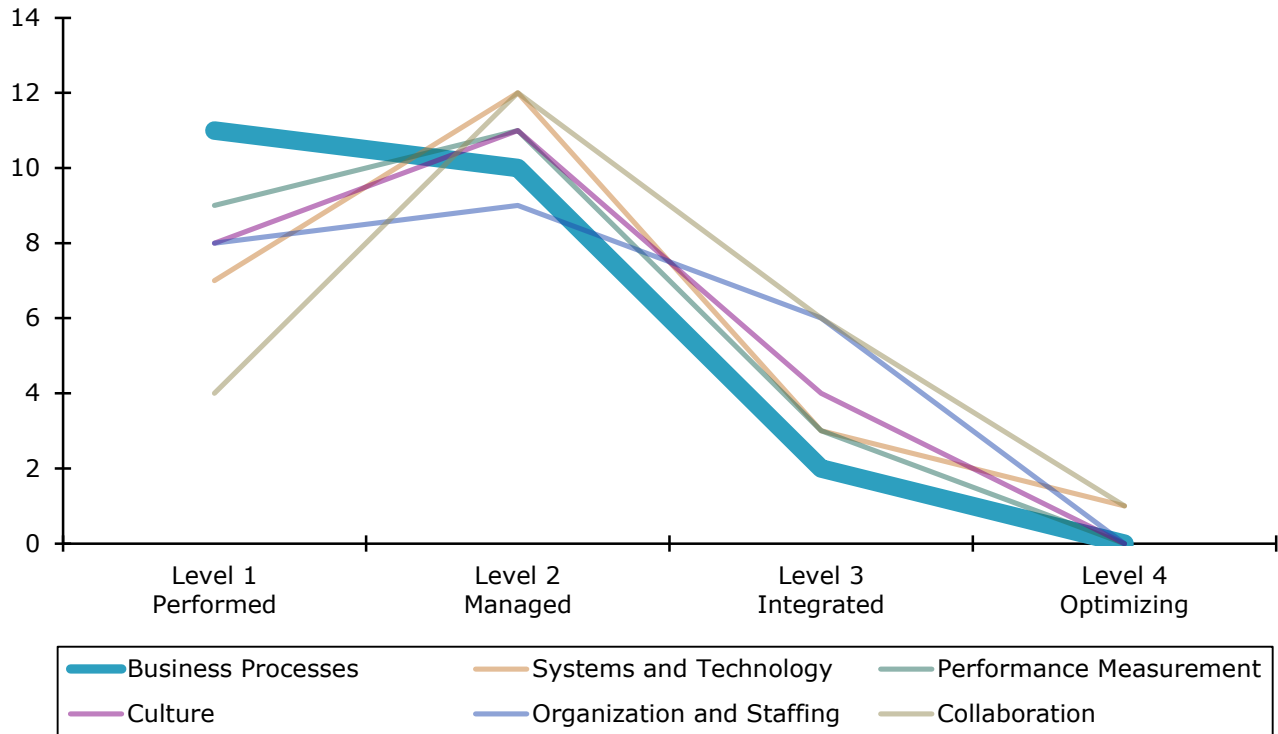


Figure 3.1 Graph. Business Processes Compared to Other Dimensions of Capability

(Source: Cambridge Systematics, Inc. and Parsons Brinckerhoff.)

The discussion of the state of the practice regarding the Business Processes dimension is divided into key elements based on the approach used in the *AASHTO Guide to Transportation Systems Management and Operations*:

- TSM&O Planning Process
- Programming/Budgeting
- Project Development/Procurement

In addition, there is a special discussion for this dimension related to metropolitan planning organization (MPO) involvement and MPOs' role in TSM&O planning and programming.

The following sections discuss observations regarding the current state of play in each element.

3.2 TSM&O Planning Process

- **“Plateauing” and the need for a roadmap.** The DOT TSM&O staff who participated in the workshops have been, until recently, largely focused on implementing conventional TSM&O strategies, such as incident and freeway management, which has fully consumed

both available staff and financial resources. As a result, there has been very little perceived need for “planning” beyond the immediate horizon or planning beyond traditional freeway management system approaches. Now that many areas have foundation systems in place, many States appear to have reached a “plateau”, and the next steps involve several challenges: improving effectiveness of existing applications, determining a course of action associated with new (and more expensive/intensive) strategies (such as active traffic management), and/or developing strategies that involve greater involvement with other stakeholders (such as arterial operations and integrated corridor management (ICM) staff). Charting the next steps requires systematic consideration of strategies and resources, currently hindered by the absence of TSM&O planning and programming.

- **Various scales and types of current TSM&O-related planning efforts.** Very few states have incorporated TSM&O as a distinct category of expenditure in their agency comprehensive plans and programs, although some include individual TSM&O components (such as TMC development) within other standard categories such as “operations,” “maintenance,” or “mobility.” However some states have developed separate “plans” at various levels and scales that address TSM&O including:
 1. A few State DOTs have “policy plans” for TSM&O (which they may be call an “ITS Plan” or “ITS Strategic Plan”) that focus on high-level considerations of statewide or regional needs, policy, and strategies but without specific project or resource commitments.
 2. Only one State has both a short- and long-range plan (and budget) for TSM&O, although this plan focuses on freeway operations.
 3. Several States have plans for specific services, projects, and activities, such as ITS Plans, Traffic Incident Management Plans, Emergency Response Plans, Special Event Plans, and others, but these are not inclusive of all related TSM&O activities.
 4. Several States have focused planning on specific high visibility corridors based on congestion, in the context of major maintenance or interstate traffic challenges, or as part of new ICM activities. Some workshop participants felt that initiating a new program planning process on a statewide basis was too complex, and their agencies are considering starting the development of TSM&O planning on a corridor basis.
 5. There are several comprehensive TSM&O planning efforts where an MPO or other regional planning entity has taken the lead in the absence of State DOT action, although they do not appear to have a significant impact on State DOT resource allocation. The workshops also included one example of State DOT-prepared, district-level short- and long-range plans.
- **TSM&O planning scope and need for a “TSM&O Program Plan.”** Many participants indicated that a specific planning activity is needed for TSM&O in order to address the features and demands unique to effective TSM&O. This activity is also driven by the need to plan at a level of detail that is not found within the focus and format of most statewide

plans and is not easy to accommodate within a conventional agency-wide planning process. The workshops identified specific issues to be addressed in TSM&O planning:

- Development of a business case for TSM&O.
 - Application of performance measures for real time transportation system management.
 - Updating concepts of operations, architectures, and field procedures/protocols.
 - Identification of organizational change and staffing needs.
 - Collaborative training with partners.
 - Other resource needs not normally addressed in conventional agency comprehensive planning and programming processes, which are typically preoccupied with capital needs.
- **TSM&O incorporation into the statewide planning process.** The existing State DOT and MPO planning and programming conventions for formal agency capital programs includes a defined long-range investment strategy by program area, a short-range plan with a program of specific projects, and an agency line-item capital budget (sometimes with operating and maintenance costs included). A planning unit within a State DOT central office or an MPO typically undertakes these activities. Sometimes specific TSM&O strategies are subsidiary components of planning elements such as “congestion management,” demand management, or “mobility,” and are budgeted – if at all – as subcategories of capital, maintenance, or operations expenditures. Although conducted at various levels of detail, short- and long-range statewide plans and related programs follow the well-understood “continuous, cooperative, and comprehensive” process outlined in Federal guidelines. By this measure, TSM&O has not achieved the status of a formal State DOT program such that it is included in the statewide planning process. Central office planning units (some of which were represented among the workshops) do not often appear to work regularly with TSM&O staff in the central office or regions. Only three workshop states systematically address TSM&O as a distinct program and resource category in comprehensive statewide strategic plans, although several have separate TSM&O program plans.
 - **Key capabilities and methodologies needed.** The limited planning for TSM&O relates, in part, to staff background limitations. Few TSM&O managers have planning backgrounds and few statewide planners have TSM&O backgrounds. This knowledge gap creates special challenges in developing appropriate planning approaches for both TSM&O-specific program plans and for incorporating TSM&O into statewide plans. In addition, there are other factors that inhibit planning for TSM&O:
 - The lack of prospective funding discourages a forward-looking approach.

- A TSM&O-specific plan is not required either by Federal regulations or as a matter of standard agency procedure. In several workshops, Strategic Highway Safety Plans were identified as relevant models as they include safety goal performance measures and related data support, involvement of stakeholders, strategies, and a continuous cycle of updating.
- TSM&O staff often secure funds on an informal opportunistic basis for projects rather than having dedicated “programs” with their own budgets.
- TSM&O staff shortfalls result in staff focusing on immediate problems.
- Life cycle costing methodologies, to include operational cost as well as capital cost are not widely applied or are not suited to capturing the lower cost and quicker return on investment experienced with TSM&O.
- Given the lack of planning skills among TSM&O staff and the lack of good examples, many states have outsourced TSM&O planning-related activities such as functional plans and systems architectures.

3.3 Programming/Budgeting

- **Programming and budgeting.** Few workshop States have an explicit statewide program and budget line item devoted to TSM&O. Most TSM&O funding for specific projects is ad hoc and intermittent. Project costs are sometimes implicitly included (by prior agreement) in one or more general maintenance, capital, or operations budget categories and tend to vary widely from year to year. Programming and budgeting appear to be substantially inhibited by TSM&O’s lack of program status, emphasized by a prevailing sense of resource shortfalls. In addition, TSM&O staff is not typically represented at an organizational level in budget discussions, and in most cases, TSM&O is not systematically included in top-level, agency-wide resource allocation processes. In fact, facing a competition for funds, some staffs find it advantageous to bury TSM&O costs within other projects so that they are not conspicuous and consequently at risk for potential cuts. ITS or “operations-like” improvements are often added onto major capital improvements, making an expenditure determination difficult but also leading to uncoordinated or fragmented ITS implementation, a lack of consideration for future maintenance needs and costs, and vulnerability to being the first cut from an overall capital project when cost reductions are necessary. These expedient solutions are not conducive to effective decision-making or to effective financial planning. Even though it was acknowledged in workshops that TSM&O-specific processes are needed for budgeting and accounting, managers do not appear to have the time and/or authority to pursue such changes.
- **Level of investment.** Annual and multiyear programs and related budgets are a convention of State DOT and MPO activities. However, the absence of a defined TSM&O program and related budget means that few State DOT managers know what resources are being invested in TSM&O or how current investments might relate to more cost-effective

use of scarce DOT resources. In fact, most workshop participants acknowledged that it is difficult to state with certainty the level of agency expenditure on TSM&O strategies or applications. Where available, the information suggested that TSM&O expenditures were typically in the two-to-three-percent range of a department's overall capital budget. One DOT TSM&O manager noted that if over 50 percent of delay and most of the system's unreliability was most effectively addressed by TSM&O rather than new capacity, that three percent of DOT investment may be significantly out of proportion with this observation. Workshop comments suggest that staff effort towards systematic development of a TSM&O program appears to be discouraged by generally static State DOT budgets and competition for resources with core programs. Budget cuts have hit some TSM&O programs, and staffing levels in most participating States have been static or declining, and turnover is significant. While some staff needs may be addressed through outsourcing, this can lead to lack of continuity and the loss of key staff capabilities. The absence of a plan-based TSM&O "program" and related multiyear budget clearly reduces the ability of TSM&O to compete for its appropriate share of scarce State DOT resources.

3.4 Project Development/Procurement

- **A project development process tailored to TSM&O.** State DOTs have formal project development processes for conventional capital development, maintenance, and safety projects with well-defined steps, roles, and responsibilities. TSM&O projects have special development requirements, however, including systems engineering, concepts of operations, types of procurement, systems integration/deployment needs, and special contracting requirements. Even when TSM&O projects can benefit from integration with other capital or maintenance projects, TSM&O staff report difficulty in inserting projects into the process because the conventional project development process may not have a specific step for consideration of TSM&O or because tight budgets eliminate the TSM&O element. Workshop participants indicated inclusion of TSM&O is often dependent on champions "making a deal." In a few State DOTs, the project development process has now been adjusted to incorporate operational considerations with standards steps that include interaction with TSM&O managers .

3.5 Metropolitan Planning Organizations, Other Regional Entities and TSM&O Planning

Of the 23 workshops included in this white paper, almost all States included at least one MPO. (The larger States selected a "representative MPO.") Six of the workshops had a regional focus, including two hosted by State DOT districts (Florida DOT District 5 (Orlando) and Kansas DOT District 5 (Wichita) and four hosted by MPOs or regional consortiums: NITTEC (Buffalo, New York); NOACA (Cleveland, Ohio); Washington DC DOT; and Whatcom (Whatcom County, Washington). Workshop participants indicated that MPO involvement in TSM&O is essential in the areas of regional planning, programming, and performance measurement, not only for Federal planning and congestion management process requirements, but as a practical matter, given local governments' involvement in arterial and transit operations. All the larger MPOs

conduct a Congestion Management Process (CMP) per Federal regulations (23 CFR 450.320), but few use the data gathered as the basis for developing a regional TSM&O plan and program. Several of the larger MPOs have allocated CMAQ funds for signal upgrades and a few MPOs have assumed a major role in signalization coordination. In addition, several MPOs have sponsored and managed incident management training for their local transportation and public safety members. These MPOs evidence a broad range of organizational arrangements focused on TSM&O, typically under a technical committee with various names that relate to operations (e.g., “ITS,” “Operations,” and “Congestion Management”).

A handful of MPOs have developed TSM&O plan elements and included TSM&O in their overall comprehensive plans. In fact, their efforts have provided the most systematic approaches to TSM&O planning and programming, including capitalizing on CMP data, reviewing and evaluating strategic options, and developing a program.

4.0 Relationships to Other Capability Dimensions

The workshops illuminated interdependencies among the Business Processes dimension and other dimensions of capability.

4.1 Synergy

As noted in Section 3.1, the synergies among the six TSM&O CMM dimensions are key defining characteristics of their critically. Each dimension is directly dependent on other specific dimensions to support improving capabilities. The three process dimensions are interdependent, but they, in turn, are also dependent on supportive institutional dimensions.

Through all workshops it was observed that TSM&O Business Processes (planning, programming, and project development) are especially dependent on systems engineering (the Systems and Technology dimension) to identify the aspects of TSM&O applications and their concepts of operations required for planning and programming. Support from the Organization and Staffing dimension was noted because of the close organizational relationship between agency planning staff and TSM&O staff and the required staff technical capabilities of both. In addition, the planning and programming components of the Business Processes dimension are also dependent on Performance Measurement for setting objectives and measuring progress. In addition, since much of TSM&O is regional and multi-partner in nature, many of the business processes are necessarily collaborative (Collaboration dimension). These synergistic relationships expressed in the workshops are shown in Figure 4.1.

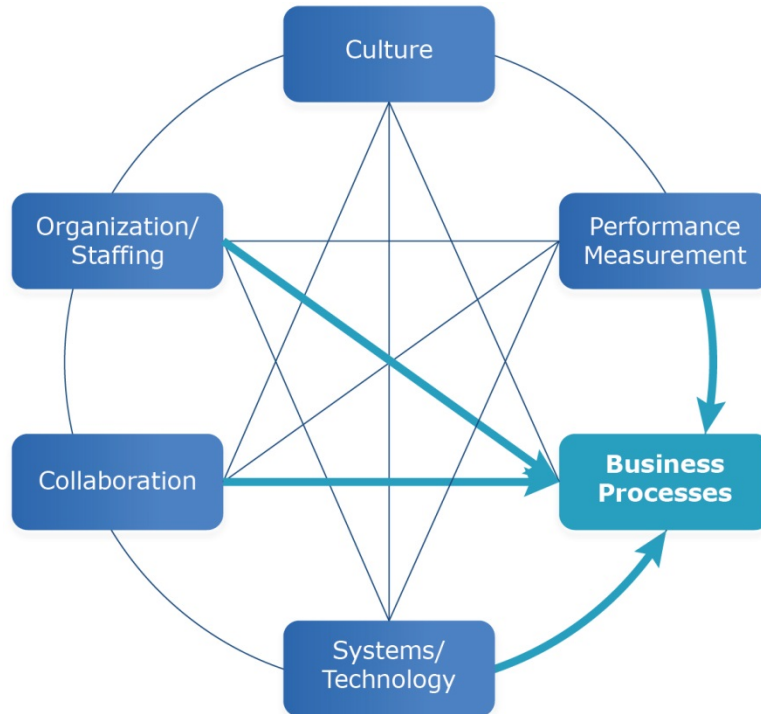


Figure 4.1 Graph. Key Synergisms between Business Processes and Other Dimensions

(Source: Cambridge Systematics, Inc. and Parsons Brinckerhoff.)

4.2 Span of Control

The workshops focused on middle management involved with TSM&O. This kind of staff is typically positioned at the third or fourth level within a State DOT central office, at the second or third level in DOT districts/regions, and is specialized staff in MPOs. These individuals have direct responsibility for visible TSM&O functions such as TMC operations, incident management, ITS device maintenance, or snow and ice control. Even though they lack formal authority, they often exert important influence as “champions” through energy, experience, agency knowledge, and long-standing relationships.

Business and technical processes is an area that, in concept, is substantially within the span of control of middle management, especially if supported by agency leadership that facilitates converting plan and program concepts into budgetary commitments. TSM&O staff have the hands-on knowledge to support planning for TSM&O even though they may lack a “planning” background. In addition, planning and programming for TSM&O receives important validation and support from FHWA policy and outreach, since planning and programming (at least for Federal aid) is a requirement. An important challenge remains the lack of established precedents or templates for effective Business Processes.

5.0 Implementation Plan Capability Improvement Actions

More than one-half of workshop sites identified the development of some kind of plan (or “program plan”) at one scale or another as an implementation plan action to improve capability in Business Processes. Among these sites, approximately one-third are also integrating TSM&O into the State standard project development process. Many workshop locations also included development of a business case as part of – or closely related to – plan development, or as an action within the Culture dimension.

Typical participant-suggested actions for advancement to the next level of capability are presented below in order of frequency of inclusion:

- Develop regional/statewide “TSM&O Program Plan” that includes TSM&O business case, concepts of operation and architecture, specific business and field process for TMCs and in the field, organizational and staffing needs, operations and maintenance costs – in addition to the capital costs that are normally the focus of statewide plans
- Integrate TSM&O into TIP/LRTP and other statewide or regional plans and related planning processes
- Develop TSM&O business case for various key stakeholder audiences
- Develop methods to evaluate TSM&O versus capacity options, including B/C
- Modify project development process to include TSM&O considerations or needs
- Develop statewide TIM plan/program as standalone activity
- Establish forum to discuss/evaluate/recommend promising technologies, processes, and policies
- Identify institutional mechanism to shorten planning horizons to facilitate TSM&O solutions
- Develop corridor performance-based improvement projects
- Develop internal and external communications plans (leveraging TSM&O business case to explain TSM&O strategies and benefits)
- Develop/update existing ITS Strategic Plan (incorporate districts)
- Develop process to integrate signal/ITS maintenance and upgrades into asset management
- Seek opportunities for greater involvement with planning partners
- Establish a pool of funding for TSM&O

- Apply FHWA INVEST model for operations and maintenance sustainability assessment (<https://www.sustainablehighways.org/>)

The appendix presents the key implementation plan work tasks commonly identified for these priorities. The highlights of the most commonly identified actions are discussed below.

5.1 Development of a TSM&O Program Plan

The term “TSM&O Program Plan” emerged during the course of the workshops as a term that inclusively captures the appropriate content of a specific activity and product to support improved TSM&O. Thirteen of the workshop locations identified development of a Program Plan as a key priority for their implementation plans. It would include the following: TSM&O mission and policy statements; objectives and related performance measures; key related business process specifications for planning and project development; strategies/projects/services required to improve TSM&O alongside their capital, maintenance, technology upgrades and operating costs; related (non-capital) resources; and identification of leadership and needed organizational changes. These features distinguish a “program plan” from conventional “plans” that are typically limited to project capital investments. In addition, these components should be addressed as part of an ongoing, iterative process that is mutually supported by other departmental plans and initiatives, builds on established relationships with other TSM&O stakeholders, and is adapted to the unique characteristics and circumstances of each DOT.³

5.2 Focus on a Specific Corridor Plan

Several States, especially those with larger multi-metro regions, focused on development of a “corridor” plan as an initial effort, rather than grappling with the complexities implied by the program plan concept at a statewide level. The concept seemed to be that corridor planning – typically multi-jurisdictional – provided a “test bed” for the various components involved in the program plan concept noted above, but in a context that was more concrete, focused on one or two strategy applications to address some specific needs and issues, and involving a well-defined group of stakeholders with some common objectives. The corridor approach also coincided with staff recognition that, having focused largely on State freeway network strategies, the next logical step would be tackling a more complicated environment involving integrated corridor management and coordination with local governments and MPOs. This approach would involve making the business case, developing common performance measures, and communicating with stakeholders – steps that would be “hard enough” even when confined to a single corridor.

³ This concept was further elaborated in a special workshop, NCHRP 20-07, Task 345, Program Planning and Development for Transportation System Management and Operations in State Departments of Transportation, [http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-07\(345\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-07(345)_FR.pdf).

5.3 Develop TSM&O Business Case and Related Communications Strategy

The lack of a persuasive business case to justify TSM&O as a program (staffing, organization, and resource needs) was an issue that arose under Business Processes as well as the Culture and Collaboration dimensions. Development of a business case was typically conceived of as a distinct work effort, requiring collaboration among those involved and those who needed persuasion. The common implementation plan work tasks typically had education, evidence, and persuasion components. Workshop participants recognized that custom-tailored cases had to be made for specific stakeholder audiences – in particular, senior management, policy makers, and key partners in TSM&O execution. There was concern that as a new program, TSM&O had to meet a higher standard of justification than a legacy program and that development of persuasive performance data, B/C data, payoffs, and anecdotal experience (nationally and locally) was an important task yielding peer exchange and lessons learned. As a result, implementation plans related to business case development typically included an effort to identify and document cases where the payoffs could be described, especially in comparison to conventional improvements. Several workshops raised the need for compelling data on benefits.

6.0 Best Practice Examples

As indicated in Table 2.1, only two workshop sites among those analyzed in this white paper have reached Level 3 at this time (“regional or statewide program integrated into jurisdictions’ overall multimodal transportation plans with related staged program”) while all other workshop sites assessed themselves as Level 1 or 2.

Best practice examples include some state that conducted CMM workshops but did not develop FHWA-supported implementation plans.

Two examples illustrate best practices at the local and regional level for business processes.

Regional Transportation System Management and Operations 2010-2020, Portland Metro, 2010. This plan, while generated by climate change and economic development concerns, adopted a systematic approach to dealing with non-recurring congestion. A strong outcome-based performance measurement approach was employed. The TSM&O Plan was based on strong staff championship and used a collaborative approach to evolve a more efficient and equitable transportation system for the traveling public. The MPO worked with several advisory committees involving the complete array of transportation related agencies and held workshops to identify and prioritize projects for the TSM&O Plan. A full range of TSM&O strategies targeted improving operations of the existing infrastructure and managing demand on the transportation system, including the following:

- Multimodal traffic management;
- Traveler information;
- Traffic incident management; and
- Transportation demand management (TDM).

For each category, the TSM&O plan developers identified regional investments combined in the form of a TSM&O action plan. The action plan identifies specific projects and the associated objectives, priority level, timeframe, cost, and potential lead agency for each project. It also includes tactics for enhancing and expanding data collection for monitoring system performance.

http://www.oregonmetro.gov/sites/default/files/062010_regional_transportation_system_management_operations_plan_executive_summary.pdf

Transportation Operations Master Plan, DVRPC, 2009. The TSM&O plan for Greater Philadelphia was based on a series of previous efforts, including a regional architecture, the congestion management process, an ITS master plan, and regional operations plans done for Pennsylvania DOT districts. Strong championship working through a Transportation Operations Task Force (TOTF) was the vehicle for the TSM&O plan intended as a component of the DVRPC long-range plan. The TSM&O plan has four principal components. The first component

presents TSM&O themes and crosscutting goals with related objectives for key strategies. The second component consists of a series of visions, each with related plans and maps, including for ITS infrastructure, emergency services patrol, incident management, integrated corridor management, and communications network. The third component presents major projects, program categories, and priorities, along with an associated action plan for each. The fourth component is a financial plan that summarizes the investment requirements for implementation, maintenance, and operations, including methodology and assumptions to determine cost projections, transportation operations financing needs, and funding allocation.

<http://www.dvrpc.org/operations/Masterplan.htm>

Approaches used at the State level are varied, ranging from policy plans to strategies that are more detailed.

Colorado DOT Operations Clearance (OC) Process. CDOT has modified its project development process to include steps designed to ensure that operational considerations are identified and evaluated via a multidisciplinary project review. This Operational Assessment is required for all CDOT projects. The Division of TSM&O developed a web application platform used to input project information into the existing CDOT workflow process. It includes notifications to the project engineer/project manager and the project review team. When the OC review and approval process is complete, the Operations Clearance is automatically generated and sent to the project engineer/project manager and the Region's Business Office. As this is a new process, the Division of TSM&O has conducted training sessions in each Region and produced a related communications plan and training materials.

Florida Transportation Systems Management and Operations Strategic Plan, updated 2013. This Florida DOT (FDOT) strategic plan is a high level policy/strategic plan that establishes both the strategic and functional framework for formal TSM&O planning and development at the Central and District Office levels. The plan includes definition, mission, and vision statements and describes its relationship to FDOT and Federal policy. It identifies typical strategies and the activities needed to improve at each level of implementation, from planning to construction to maintenance, including staff, process, and tools, needed policies and procedures, and key project development steps. The plan is accompanied by an updatable functional plan, which includes objectives, activities, performance indicators, targets, responsibility, and status for a wide range of key activities designed to develop and maintain the TSM&O program as well as to maximize the efficient use of existing infrastructure. This functional plan has been updated and expanded consistent with the CMM dimensions.

<http://floridait.com/01ITSGC/doc-TSMO/TSMO-Strategic-Plan-2013-v2.pdf>

Washington State DOT Statewide Intelligent Systems Plan. This statewide plan provides the vision and goals for what Washington State DOT calls ITS (although it addresses broader TSM&O strategies) as related to the existing Statewide Plan and policy. It describes the current state of deployment of crucial TSM&O activities: plans and architecture, centers, field devices, communications, and data collection approaches. It then presents plans pursuant to four general strategies:

- Provide an integrated network of transportation information;
- Improve safety and crash avoidance;
- Improve the detection of incident occurrence and severity, notification, and response; and
- Provide advanced transportation management.

For each of these areas the plan describes corresponding opportunities, benefits, challenges, actions, research, and policy. The plan concludes with a “long view” regarding funding and policy implications.

The plan is available upon request from the Washington State DOT Headquarters Traffic Operations Office.

7.0 Addressing Needs on the National Level

The weakness and related implementation plan actions identified in common by many State DOTs and their partners creates an agenda of needs for research, guidance, and training. Consistent with the capability dimensions, this agenda is focused on process and institutional improvements that are not substantially addressed by existing support materials developed among peers or by AASHTO, FHWA, or other entities. There is very little support material targeting Business Process-related issues (see Best Practices above and References below). Suggestions are presented in Table 7.1.

Table 7.1 Suggested National Activities to Support Improvements in Business Processes

Activity	Business Processes Element	Sponsor(s)	Comments
Conduct webinar on TSM&O program planning as defined in this report and drawing on participants in NCHRP 20-07/345	<ul style="list-style-type: none"> • TSM&O Planning Process • Programming/Budgeting 	<p>NOCoE</p> <p>TRB RTSMO</p>	Definition of “program planning” as in this report. See Strategic Highway Safety Plan as useful precedent
Develop guidance and best practice examples related to TSM&O program planning, including example plans	<ul style="list-style-type: none"> • TSM&O Planning Process • Programming/Budgeting 	<p>FHWA</p> <p>NOCoE</p>	Definition of “program planning” as in this report. Highlight DOT and MPO best practices
Compile lessons learned from ICM planning and programming to date	<ul style="list-style-type: none"> • TSM&O Planning Process • Programming/Budgeting • Project Development/Procurement 	<p>FHWA</p> <p>NOCoE</p>	Would be developed from interviews of State DOT and regional staff
Develop resources and collect examples of TSM&O business cases	<ul style="list-style-type: none"> • TSM&O Planning Process • Programming/Budgeting • Project Development/Procurement 	<p>FHWA,</p> <p>AASHTO,</p> <p>NOCoE</p>	Build on material already included in the NOCoE web site and incorporate case studies and B/C material from ITS Joint Program Office and FHWA web sites
Apply FHWA INVEST model for operations and maintenance sustainability assessment	<ul style="list-style-type: none"> • TSM&O Planning Process • Programming/Budgeting 	<p>FHWA</p> <p>NOCoE</p>	INVEST provides a life-cycle cost model

Activity	Business Processes Element	Sponsor(s)	Comments
Identify, collect, and circulate best practices on integrated TSM&O in standard DOT project development processes. Establish a group of peers that could provide lessons learned to other States/regions	<ul style="list-style-type: none"> Project Development/ Procurement 	FHWA AASHTO NOCoE	Primer or synthesis of best practices; include non-TSM&O perspectives to show depth of collaboration and process change

NOCoE National Operations Center of Excellence

TRB Transportation Research Board

RTSMO Regional Transportation Systems Management and Operations (AHB10)

8.0 References

AASHTO TSM&O Guidance: Business Processes Dimension. AASHTO’s web-based TSM&O Guidance follows the six dimensions of TSM&O capability described in this white paper, including Business Processes. It is designed for transportation agency managers whose span of control relates to the operations and management of the roadway system, including policy makers and program managers for ITS and TSM&O at both the State and regional level. It incorporates insights from a review of the state of the practice in TSM&O among transportation agencies into a well-accepted change management framework that identifies doable steps toward mainstreaming TSM&O on a continuously improving basis. Specific guidance for business processes is cited here for advancing an agency currently at Level 1 to Level 2 within the CMM framework. Other level changes within the framework can be found on the [AASHTO TSM&O Guidance web site](http://www.aashtotsmoguidance.org/guides/BP_L2.pdf).

http://www.aashtotsmoguidance.org/guides/BP_L2.pdf

Best Practices for TSM&O Program and Budget Development, SHRP 2 L17 Gap Filling Project 3. This SHRP 2 Reliability Program “Gap Filling” project presents case studies and lessons learned from successful TSM&O programs. The focus is on appropriate Business Processes, including planning, programming/budget, performance measurement, procurement, and project development. Through detailed case studies, information is presented that covers the following:

- The structure and unique characteristics of an agency’s and region’s TSM&O program;
- Information about current TSM&O programming and financing practices, including technical processes used; and
- Lessons learned and recommendations for other agencies working on mainstreaming TSM&O programs.

http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_L17_Gap-Filling_Project_3_BestPracticesFor_TSM&O_ProgramAndBudgetDevelopment.pdf

Deployment Guidance for TSM&O Strategies, SHRP 2 L17 Gap Filling Project 2. This SHRP 2 Reliability Program “Gap Filling” project provides guidance to practitioners in short term deployment planning. The project interviewed eight agencies to identify short-term deployment planning methods and classified them according to the following:

- General technical strategies
- Desired outcome driving the strategy
- Conditions and context
- Decision to implement

- What to implement
- Where to implement
- Tools or guidance
- Tools or guidance needed
- Strategies not implemented
- Stability of funding over multiple years
- Other partners involved in deployment decisions
- Use of performance measures in either project planning or program direction
- Contact

Finally, the project offers a set of recommendations for developing a formalized and structured approach to short term deployment planning. Both technical and institutional issues are addressed by the syntheses.

http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_L17_Gap-Filling_Project_2_DeploymentGuidanceFor_TSM&O_Strategies.pdf

Designing for Transportation Management and Operations: A Primer. This primer focuses on designing for operations; i.e., the collaborative and systematic consideration of TSM&O during transportation project design and development. Effectively designing for operations involves the development and application of design policies, procedures, and strategies that support transportation management and operations. The primer offers a toolbox of specific design considerations to support TSM&O strategies and examples of effective strategies in practice.

<http://www.ops.fhwa.dot.gov/publications/fhwahop13013/>

Program Planning and Development for Transportation System Management and Operations (TSM&O) In State Departments of Transportation, NCHRP 20-07, Task 345. This report summarizes a national review of State DOT state of the practice in “program planning,” including a workshop of State DOT managers focusing on common experience in developing State TSM&O program plans. Participants included substantial representation for State staff involved in the FHWA TSM&O CMM workshops. It also contains extensive appendix material, including references to State and regional plans and documents related to TSM&O.

[http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-07\(345\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-07(345)_FR.pdf)

SHRP 2 Reliability Solutions. In addition to SHRP 2 L06, which lead directly to the CMM framework and workshop concept discussed in this white paper, many of the other SHRP 2 Reliability products relate to improving TSM&O effectiveness. Information on these products and the status of their availability through the SHRP 2 Implementation Assistance Program is available on FHWA’s SHRP 2 Solutions website.

<http://www.fhwa.dot.gov/goshrp2/Solutions/Reliability/List>

Transportation Planning for Operations: Quick Guide to Practitioner Resources, FHWA. This guide provides a listing and description of “knowledge resources to help provide answers to planners, operators, public safety professionals, and transportation decision makers” and includes “guidebooks, case studies, and workshops” relative to TSM&O.

<http://www.ops.fhwa.dot.gov/publications/fhwahop13049/index.htm>

Notable resources included in the above guide are:

- **Advancing Metropolitan Planning for Operations: An Objectives-Driven, Performance-Based Approach - A Guidebook**
<http://www.ops.fhwa.dot.gov/publications/fhwahop10026/>
- **Advancing Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations - A Desk Reference**
<http://www.ops.fhwa.dot.gov/publications/fhwahop10027/>
- **Creating an Effective Program to Advance Transportation System Management and Operations Primer**
<http://www.ops.fhwa.dot.gov/publications/fhwahop12003/fhwahop12003.pdf>
- **Operations Benefit/Cost Analysis Desk Reference**
<http://www.ops.fhwa.dot.gov/publications/fhwahop12028/index.htm>
- **Statewide Opportunities for Integrating Operations, Safety, and Multimodal Planning: A Reference Manual**
<http://www.fhwa.dot.gov/planning/processes/statewide/practices/manual/manual.pdf>

Appendix: Steps to Implement Common Implementation Plan Priority Actions for Business Processes Dimension

The steps listed below implement the most common priority actions identified by workshop participants when developing their implementation plans. Although the actions themselves are not stated, they generally address improvement in each of the business process elements. The steps for each action were developed by the workshop site core team, assisted by a template of facilitator-supplied suggested steps based on workshop outputs, and structured consistent with the basic CMM guidance presented in the AASHTO TSM&O Guidance.

TSM&O Planning Process

1. Convene or utilize an integrated/inclusive working group/planning committee (including representatives from local jurisdictions, public safety community, other modes, etc., as appropriate) to undertake planning activities (setting a vision, policies, strategies, work program, etc.)
2. Consider the merits of a statewide plan compared to building off a high-priority corridor or region to accommodate staff resources and the need to develop new process, data, and relationships
3. Develop of a broad strategic TSM&O “program plan” framework that goes beyond projects and budgets to address other more general features of TSM&O as a program that also need to be “planned”, given the lack of a legacy TSM&O program status or planning framework. The Strategic Highway Safety Plan model provides some important lessons regarding key components. These TSM&O program plan components should include:
 - a. Business Case. Given that TSM&O plans may be unprecedented, they must include a persuasive element in the form of a well-supported business case for TSM&O.
 - b. Mission, Vision, Goals, Objectives, and Performance Measures. These components establish an agency approach, are used as a device to communicate internally and externally, and serve as a basis for other planning components (strategies, projects). They also make a distinction between the DOT’s vision and a statewide vision, which requires involvement of all the stakeholder agencies.
 - c. Organization and Staffing. Planning, budgeting, and implementation of plans and projects may also require identification of an organizational and staffing strategy, not only for the conduct of Business Processes but for program implementation in general. Key issues include central office versus regional/district responsibilities, internal responsibilities, and reporting.

- d. Business Processes. Business Processes include identification of the essential processes, procedures, and protocols, including staff responsibilities for developing TSM&O Plans and integration of TSM&O into the TIP/STIP and Long Range Plans.
 - e. Resources Requirements (Financial, Human, Infrastructure, and Technology). There is a need for a well documented, staged program of resources. Identification of long-, medium-, and short- resource requirements, including justification, is necessary.
 - f. Packages of Services, Projects, and Activities. This component is not a deployment plan. Rather, it includes warrants and guidelines for broad packages of TSM&O services, projects, and activities. This also includes a screening process that leads to deployment planning.
4. Identify the key steps in the development of a TSM&O plan, including the following:
- a. Convene multi-jurisdictional planning group to guide TSM&O planning activities, including central office division and district/regional staff and MPO and local government personnel as appropriate.
 - b. Secure support of key policy groups to consider integration of plan results into DOT, MPO, and other relevant plans and programs.
 - c. Identify planning focus in terms of network focus (district-wide or selected corridors within district as a pilot program), including both freeways and arterials. Consider the use of one or more freeway/arterial corridors as a pilot for the development of a comprehensive program planning process.
 - d. Identify mission, goals, and objectives with corresponding available performance measures information, and identify small robust set of user-related performance measures for use in evaluating proposed strategies.
 - e. Using the goals and objectives, identify specific needs and deficiencies related to capacity constraints, reliability issues and important sources of non-recurring congestion in the selected geographic context and identify logical generic TSM&O strategy applications addressing those issues.
 - f. Update statewide or regional ITS architecture as appropriate by building on existing architectures/concepts of operations/systems and current state of practice, including accommodation of potential TSM&O strategy applications.
 - g. Build on the existing deployments and current plans for the identified network by identifying specific sets of incremental, cost-effective improvements for key strategies, existing and new, including systems, technology, and related actions (center and field procedures), timeframes, and participants. Identify opportunities for program components to be embodied in other projects and identify critical roles in implementation.

Programming/Budgeting

1. Review long- and short-term investment options (including capital, maintenance, and staffing) in the context of alternative levels of expenditure and resource availability from DOT, MPO, and local sources to develop programs and schedules for improvement actions, linking them to updated architectures.
2. Evaluate and rank proposed strategies in terms of likely performance effectiveness (using available measures identified above) and feasibility of implementation, and prepare a phased program of improvements.
3. Prepare a phased implementation plan, budget, schedule, and performance-tracking strategy, and present to relevant policy groups.

Project Development/Procurement

1. Develop an appropriate project development process based on the current agency approach for other types of projects, including the following steps:
 - a. Identify specific gaps in the current planning process that limit or exclude TSM&O attributes from being included in project development process.
 - b. Map out a project development workflow that identifies critical steps in the project planning and development processes where specific TSM&O considerations could be included.
 - c. Identify specific TSM&O requirements for the various stages, including planning-level TSM&O cost/resource requirements, implementation considerations, and potential benefits.
 - d. Prepare guidance on TSM&O strategies (“toolkits” or checklists) that can be used by project development staff.
 - e. Review options for procurement for system integration projects.
 - f. Identify specific TSM&O department staff members who can be involved in project development/planning, as well as serve as liaisons during specific project development activities.
 - g. Establish a process with a planning group that will allow for periodic coordination to identify opportunities for advancing TSM&O recommended projects or initiatives, which might be ahead of typical planning cycles. Include a review of the findings of MPOs’ congestion management process.
 - h. Develop a recommended process for mainstreaming TSM&O in the project planning and development process, and develop specific policy language to include in workflows and development process documentation.

U.S. Department of Transportation
Federal Highway Administration
Office of Operations
1200 New Jersey Avenue, SE
Washington, DC 20590

www.ops.fhwa.dot.gov

April 2015