

IMPROVING TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSM&O)

Capability Maturity Model Workshop White Paper

Organization and Staffing



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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 Organization and Staffing as one of the central dimensions of capability needed to support effective TSM&O – including program status, organizational structure and staff development, and recruitment and retention. 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 Organization and Staffing dimension.
- A discussion of the state-of-the-practice regarding Organization and Staffing in terms of its key elements including capability levels self-assessed at the workshops.
- A description of key synergies between Organization and Staffing 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 Organization and Staffing needs on a national level.
- An Appendix presenting common implementation plan priority actions for the Organization and Staffing dimension.

State of the Practice Findings for TSM&O Organization and Staffing

Key findings from the workshops included:

General

TSM&O activity managers are typically two to three levels down in headquarters and in regions, often stovepiped in engineering vs. operational units, and typically report to senior managers who have divided programmatic responsibilities. Program initiatives are therefore heavily dependent on middle management champions, rather than formal organization. A few states are developing more consolidated organizational structures with clear lines of authority/reporting but vary widely in the degree of centralization vs. decentralization. TSM&O staffs are very small and trained on-the-job, as formal training opportunities are not generally available (FHWA traffic incident management and SHRP 2 training are notable exceptions). Some core technical capacities are difficult to recruit and retain, which appears to be leading to increased outsourcing of more technical functions to private entities.

Program Status

- **TSM&O organized as a program.** In states/regions, TSM&O typically has not yet been accorded formal program status equivalent to legacy programs (construction, project development, maintenance, safety). This subsidiary status is reflected in agency organizational structure at both the central office and district/regional level, as well as in agency policy, planning, and budgeting. While TSM&O ultimately needs to be integrated into a wide range of agency activities, the consensus from most workshops has been that given its early stage of development, TSM&O should be established as a program with a separate and more visible identity.

Organizational Structure

- **TSM&O in the State DOT hierarchy.** At the central office level, the highest level of TSM&O program management is typically at a branch level – three to four levels down from top leadership – and part of one of the conventional legacy programs. A similar situation exists at the district and regional level, where TSM&O activity managers typically report to the district managers of operations or maintenance. Workshop participants noted that this subsidiary status limits the representation of TSM&O in overall agency staffing and budgeting considerations.
- **Centralization/decentralization.** Most TSM&O applications are real-time and delivered with or by traffic management centers (TMCs) at the regional level and reporting to district management, while TSM&O program development and administrative functions are typically handled in central offices. As a result – especially in larger states – local operations managers report some communication problems and confusion in chain of command regarding TSM&O program development and operations.
- **Siloing and responsibility versus authority.** In many State DOTs, TSM&O duties are often siloed between engineering/project development units and system operations/management units (including TMCs). This structure separates systems and

technology development from real-time systems management, with no single senior manager with full time responsibility for all aspects.

- **Reorganization.** In several States, pressures for agency-wide efficiency combined with increasing understanding of TSM&O synergies have led to considerable consolidation of TSM&O-related units and clarified reporting relationships, although they have stopped short of creating a new top-level division.

Staff Development

- **Staffing levels.** The overwhelming reality in most State DOTs is staff hiring freezes or even reductions in force. Workshop participants indicated that staffing constraints undercut the ability and initiative for expanding and/or improving TSM&O programs because they require additional staff resources.
- **Champion dependency.** TSM&O activities are typically reliant on a small, dedicated, hard-working staff, often energized by one or more highly committed individuals who are able to overcome lack of formal authority or dedicated resources through knowledge of the agency, strong personal relationships and personal persuasiveness. However, such informal leadership is fragile and subject to retirements or reassignments that can significantly undercut the momentum and priority of TSM&O initiatives.
- **Core capacities, mentoring and succession.** Most TSM&O staff has come from other parts of an agency, especially from traffic engineering, maintenance, and safety. Few staff have significant systems engineering, information systems, or performance management backgrounds – or capabilities relevant to newer technology applications such as connected vehicles. Workshop discussion reflected an increasing recognition of the need for specialized technical and managerial staff capacities to sustain an effective TSM&O program, including formal development of relevant knowledge, skills, and abilities (KSAs). In addition, there is rarely a formal approach to mentoring or succession planning. There were several instances where departure of key staff left major holes in agency capacity.
- **Training.** Formal in-house training with a TSM&O focus is limited, supplied largely through SHRP 2 and FHWA-based programs that have provided important onsite training, as well as through related association activities. Many of the relevant KSAs are acquired via on-the-job training. While most State DOTs offer support for technical training and coursework, this opportunity has limited impact due to the lack of training curricula or university courses specifically focused on TSM&O.
- **Outsourcing.** The lack of specialized staff capacity and slot limitations encourage the outsourcing of activities that require special technical expertise, such as planning, systems engineering, data management, and device maintenance, to private technology and service suppliers, especially where the need for expertise is episodic. Most workshop States outsource two or more activities and several outsource five or six, sometimes managed by different units within the agency. Uniform performance management of outsourced activities is becoming a challenge.

Recruitment and Retention

- **Recruitment and retention.** Most State DOT TSM&O staff comes from within agencies, transferring from other units. The hiring processes, internal staff job preferences, relative compensation, and union constraints appear to discourage external hires. Hiring staff with backgrounds in key technical specialties is especially difficult. At the same time, some States report retention challenges as younger staff (Millennials) value career flexibility and varied opportunities over long-term institutional career commitments, especially if they have developed technical skills of value in the private sector.
- **Career attractiveness.** With very few exceptions, TSM&O is not seen as part of the traditional career track to senior State DOT management, where senior roles historically have been rooted in engineering and planning, and district or division management. Furthermore, TSM&O brings with it a lifestyle at odds with the 9-to-5 office culture, including 24x7 availability, rapid response, improvising solutions, and working extensively with outside collaborators – all without any special recognition in grade level or compensation. State DOTs report entry level staff with relevant technical backgrounds often use department employment as a stepping stone to more lucrative and mobile career options, especially in the private sector.

Synergism

The Organization and Staffing dimension is synergistic with other dimensions of capability. The agency Culture dimension is extremely influential in terms of top management support for organization and staffing improvements and the need for external Collaboration. At the same time, the process dimensions (Business Processes, Systems and Technology, and Performance Measurement) are all dependent on both efficient organizational structure and staff capabilities.

State DOT and Regional Implementation Plan Priorities

Most states/regions included some aspect of Organization and Staffing in their implementation plans to improve agency capability. The two highest priorities were organizational consolidation of related units and the development of TSM&O staffing plans, potentially including identification of core staff capacities, position descriptions, and succession plans. Several agencies had undertaken some degree of recent reorganization.

Best Practices and National Needs

This white paper describes example best practices and references material related to the identified implementation plan priority needs. The paper also suggests supportive national actions to improve TSM&O Organization and Staffing – development of a TSM&O organization and staffing gap analysis tool, polling State DOT senior TSM&O managers on needed staff core capacities and identifying related training and educational resources, and reviewing secondary and graduate school curricula for TSM&O best practices and gaps – 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 Organization and Staffing 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 Organization and Staffing 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.

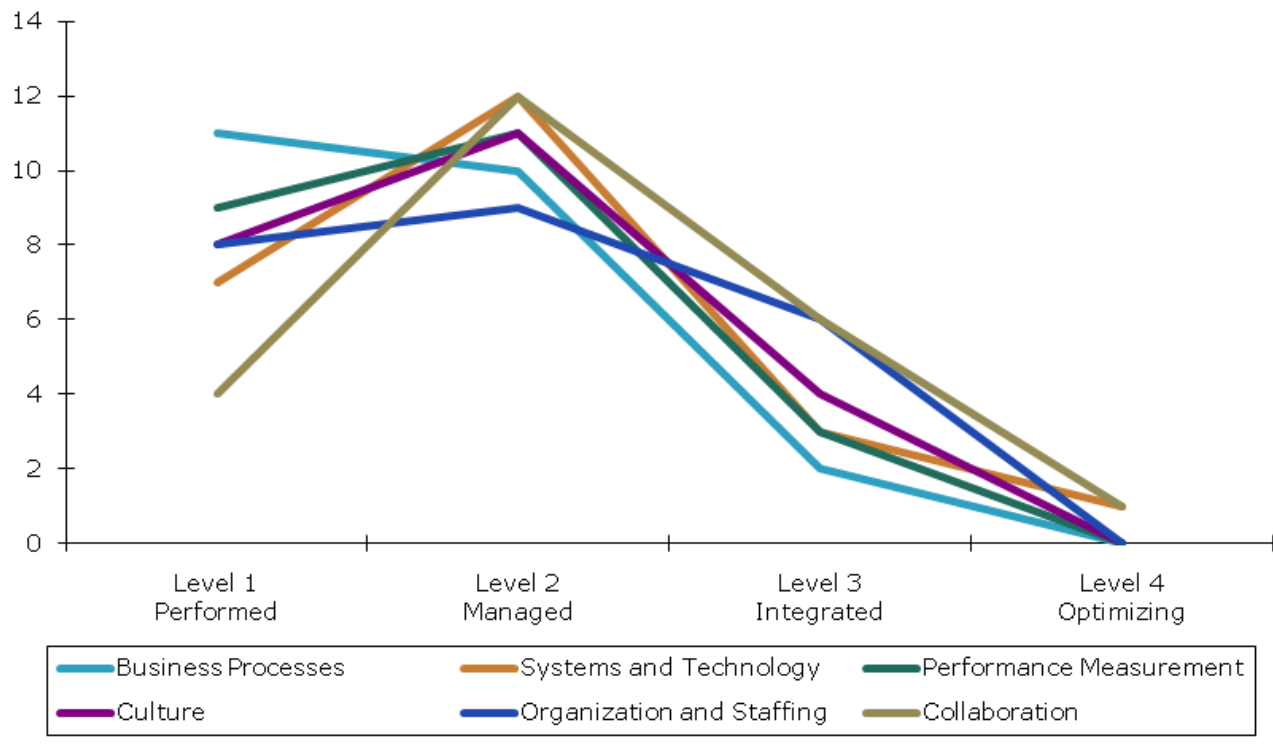


Figure 2.1 Graph. Distribution of Self-Assessments (23 Workshops)

(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 Organization and Staffing Dimension

3.1 The Organization and Staffing Dimension

Organization and Staffing is a critical institutional dimension of TSM&O capability. It incorporates development of an appropriate TSM&O-related organizational structure within and between State DOT headquarters and districts. It also includes the identification, development, and maintenance of essential staff capabilities. 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 Organization and Staffing

Organization and Staffing Criteria for Level Achievement	
Capability Level 1	TSM&O added on to units within existing structure and staffing; dependent on technical champions
Capability Level 2	TSM&O-specific organizational concept developed within/among jurisdictions with core capacity needs identified, collaboration takes place
Capability Level 3	TSM&O managers report directly to top management; job specifications, certification, and training in place for core positions
Capability Level 4	TSM&O senior managers at equivalent level with other jurisdiction services and staff professionalized

Among the 23 workshops, the average self-assessed capability for Organization and Staffing is 2.02, with eight sites at Level 1, nine sites at Level 2, and six sites at Level 3. Figure 3.1 depicts the scoring distribution relative to the other dimensions. Across all workshop locations, Organization and Staffing was included in implementation plans about as often as Performance Measurement and Collaboration, but behind Business Processes, Systems and Technology, and Culture.

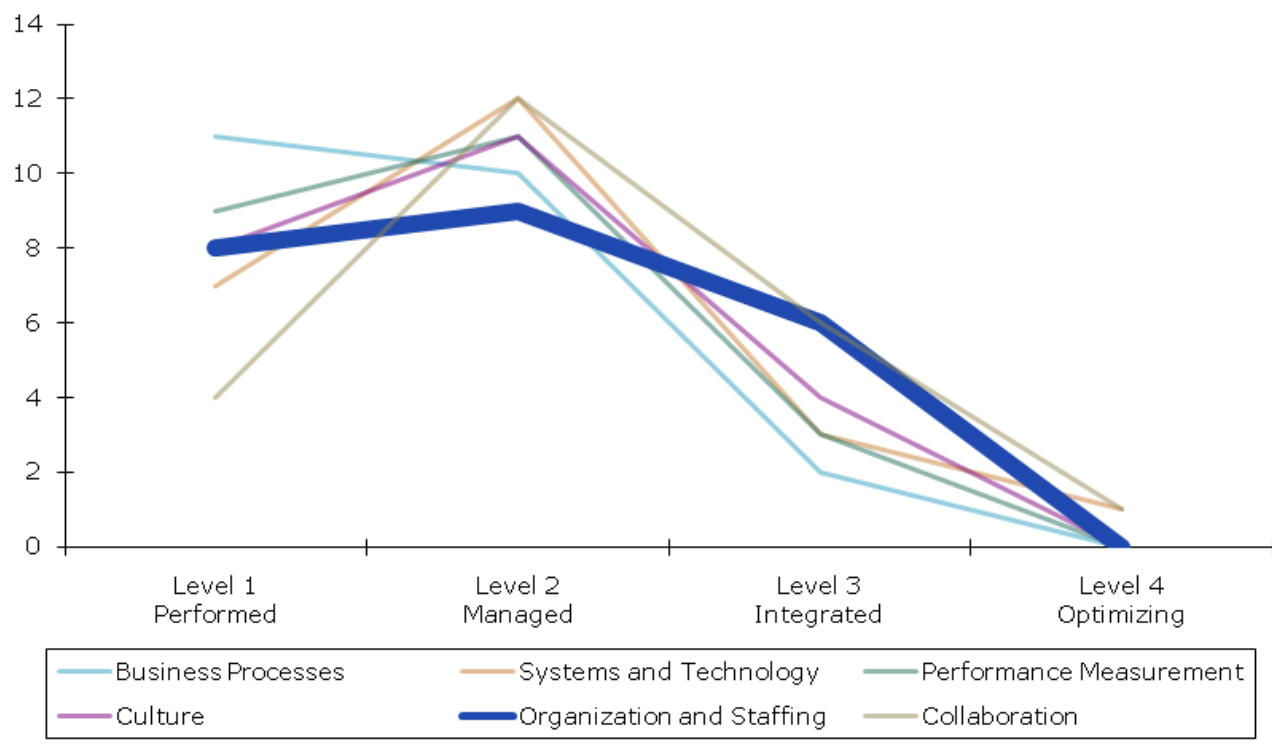


Figure 3.1 Graph. Organization and Staffing Compared to Other Dimensions of Capability

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

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

- Program Status
- Organizational Structure
- Staff Development
- Recruitment and Retention

The material that follows discusses the current state of play in each key element.

3.2 Program Status

The role of TSM&O in transportation agency activities – as measured by the importance placed on implementing TSM&O strategies as a key part of the agency mission; the priority given in a sequence of programming; and the level of funding and staffing – is determined substantially

by whether TSM&O is seen as a set of unrelated activities, a coordinated group of activities, a subpart of another program, or a program in its own right.

- **TSM&O organized as a program.** In State DOTs, TSM&O typically has not yet been accorded formal program status equivalent to construction, project development, maintenance, or safety. This is reflected in agency organizational structure at both the headquarters and district/regional level (in addition to agency policy, planning, and programs). In the workshops there has been discussion within a few States as to whether TSM&O should be a stand-alone activity with a separate program with its own management, and organizational structure, or whether TSM&O functions should remain part of other functional units with coordination from a central office unit. In the latter case, a heightened understanding of TSM&O's relevance to other functions would allow for TSM&O considerations to be integrated into routines associated with capacity project development, maintenance, and safety, especially at the district/regional project delivery level. The consensus from most workshops, however, has been that given its early state of development as a set of coordinated activities, TSM&O should be established with a separate and more visible identity, with leadership at an appropriate level of influence and with dedicated funding to support TSM&O program initiatives.

3.3 Organizational Structure

Organizational structure is closely related to the stature and visibility of TSM&O in the program, including the flow of accountability for achievement of relevant objectives and the consolidation of authority over activities that may be essential to strategy effectiveness. Key issues include where the senior manager with TSM&O responsibilities is located in the central office hierarchy (division, branch, unit, etc.), where the TSM&O responsibility is within districts (first, second, or third level), and the reporting/accountability for TSM&O between the central office and districts. This distribution of responsibility and authority within an agency headquarters, between headquarters and field (in districts or transportation management centers), and within districts has a major impact on an agency's ability to produce effective strategies.

- **TSM&O in the DOT hierarchy.** At the central office level, TSM&O top program management is usually a branch of one or more divisions, most often a subpart of an "Operations" division that can also include right-of-way, safety, traffic engineering, design, equipment, management, etc.; in other cases, TSM&O is part of a maintenance division. As a result, managers responsible for various TSM&O-related statewide activities are distributed at a level three to four levels down from top leadership, which inhibits both a comprehensive view of TSM&O as an activity and limits the representation of TSM&O in agency decision making. The same situation exists at the district and regional level, where TSM&O activity managers typically report to the district managers of operations or maintenance. In larger metropolitan districts, TSM&O is sometimes organized around transportation management centers (TMCs), which may have a matrix reporting relationship to both headquarters and district levels. This lack of separate program status means that TSM&O program needs are considered a subpart of some other activity without

separate programmatic or budgetary presence. Workshop participants noted that this subsidiary status in organization, management, and budgeting impairs their ability to obtain needed resources.

- **Centralization/decentralization.** TSM&O functions include both real-time service delivery activities and administrative functions such as planning and programming. In almost all states, service delivery takes place at the district level where there is often a district senior manager with TSM&O responsibility (often coupled with maintenance responsibility in smaller states). This person works closely with other district staff related to traffic engineering, safety, and other disciplines, as well as a TMC manager with a focus on much of the real-time activities and potentially co-located public safety and local government partners. In all but the largest states with significant metro areas, most of the administrative functions are located in a central office unit, although a few of the larger states also have administrative, systems engineering, and planning responsibilities at the district level. In a few small states where the capital city is also a metro area, the central office may also oversee the local TMC and related TSM&O programs. There are a few states with a start-up program that have a single TMC serving multiple metro areas or rural regions. In rural districts (usually without TMCs) TSM&O functions are likely to be the responsibility of a traffic or maintenance group without a separate staff. At the district/regional level, TSM&O responsibility – especially TMCs – are not always coincident with districts and may encompass more than one or be located to account for special corridor needs.
- **Siloing and responsibility versus authority.** In many cases, TSM&O duties are split between groups in engineering/project development units and system operations/management units, each with separate upward reporting relationships. This “siloing” often hampers cooperation when real-time cooperation is required, such as for incident management, traveler information, and safety service patrol. Upward reporting requirements often separate engineering functions (such as systems engineering) from the actual users of the systems. In most State DOTs, there is no one manager with regular involvement in aspects of TSM&O who has responsibility for all functions as part of a single program. Individual activity managers (TMC, incident management, ITS systems) thus have a limited authority regarding activities in other branches that may be critical to their success or advancement. There also are cases in which there are different roles/titles for district/region level staff versus headquarters level staff, as well as inconsistent role definition among or between districts or regions.
- **Reorganization.** Some workshop participants noted that the combination of the pressure for agency-wide increased staff efficiency and an improved understanding of potential synergies have been leading to considerable reorganization and consolidation. These reorganization efforts often have focused on adjusting the reporting relationships among headquarters and larger district units responsible for both real-time operational activities (TMC, safety service patrol, incident management, traveler information/511) and the engineering functions (systems engineering, design, ITS device procurement, and maintenance). During the course of the CMM workshop program, several State DOTs have

undertaken some consolidation of TSM&O-related units and clarified reporting relationships, although stopping short of creating a new top-level division.

3.4 Staff Development

Since TSM&O is not yet a formal “discipline” with a distinct educational and training focus, TSM&O staff typically come from other backgrounds from within DOTs, such as planning, maintenance, and traffic engineering and learn by on-the-job training and informal mentoring. Workshop participants indicated that minimal program expansion, largely static staffing, and the absence of strategic planning for TSM&O have provided little impetus or resources for formal training activities beyond those sponsored by FHWA.

- **Staffing levels.** The overwhelming staffing reality in most State DOTs is that they are operating with a staff freeze in place or even a reduction in force. Within the TSM&O arena, exceptions are found where a few State DOTs who had experienced major external events, such as a major weather incident, a national sports event, or new leadership. These events sometimes call special attention to TSM&O program needs or shortcomings and therefore top-down directives for program improvement, often with additional resources. Workshop participants indicated that staffing constraints made initiatives focused on expanding and improving programs unrealistic because they would require additional staff resources. As a result of staffing constraints, the few states with significant program expansion were relying on contractors or consultants. The prevailing lack of resource availability was clearly a major influence on the overall tenor of workshops, undercutting any presumption that activities requiring additional staffing (planning, systems engineering, and performance measurement) could be undertaken.
- **Champion dependency.** Without formal programming and budgeting status and given the reliance on on-the-job training, the effectiveness of agency TSM&O activities is typically reliant on a small, dedicated, hard-working staff. Often these efforts are energized by a highly committed individual who is able to overcome lack of formal authority or dedicated resources through knowledge of the agency, strong personal relationships, and personal persuasiveness. These “champions” appear to be able to cut deals on an ad hoc basis with other program and project managers to access resources and initiate project development. The effectiveness with which key TSM&O functions are developed and conducted often relies as much on informal “dotted line” connections as formal organization charts. However, such informal leadership is fragile: workshop participants noted that retirement or relocation of these key staff can significantly undercut the momentum and priority of TSM&O initiatives and program development within an agency.
- **Core capacities, mentoring and succession.** Workshop discussion reflected an increasing recognition of the need for specialized technical and managerial staff capacities to sustain an effective TSM&O program. This is reflected in the job specifications for TSM&O positions developed by several states, including TSM&O-specific knowledge, skills, and abilities (KSAs). At present however, most of the staff has come from other parts of the agency, especially from traffic engineering, maintenance, and safety. New hires or

transfers are limited, reflecting the lack of available staffing slots and the difficulty in competing for needed skills among other agencies and the private sector. Given the relatively small staffs who themselves have developed their KSAs on the job, there is rarely a formal approach to mentoring or succession planning. Furthermore, in some States, civil service and union practices inhibit the ability to develop succession plans and targeted training and constrain the hiring of staff with special technical qualifications. There were several instances when departure of key staff left major holes in agency capacity.

- **Training.** As new technology emerges in TSM&O, lack of staff development is becoming a more serious challenge, especially in areas requiring special technical expertise (systems engineering, communication, data management, and automation) as well as in general knowledge of TSM&O applications. Formal in-house training with a TSM&O focus is limited, supplied largely through SHRP 2-based programs that have provided important onsite training in incident management, planning and programming, performance management, data, and freight planning. FHWA, AASHTO, ITE, and CITE courses are also providing information about specialized topics via webinars. In addition, some workshop participants have attended the National Operations Academy™ and Regional Operations Forums, which provide a wide range of professional capacity building support. Nevertheless, most of the relevant KSAs are acquired via on-the-job training or trial-and-error. While most State DOTs offer support for technical coursework, this opportunity has limited impact due to the lack of university-based training curricula in TSM&O, which by and large remain focused on traditional civil engineering skills.
- **Outsourcing.** The lack of specialized staff capacity and staff slot limitations encourage the outsourcing of technical services such as planning, systems engineering, and data management to private technology and service suppliers where the need for expertise is episodic. In addition to consultants, some of the outsourcing is to research and academic entities which have close supporting relationships with State DOTs. In addition, hiring constraints, costs, and recruiting requirements and timeframes also lead to outsourcing in nonprofessional support areas like TMC staff and device maintenance. Most State DOTs that participated in the workshops outsource two or more activities and several outsource five or six. In many cases, the outsourcing is managed by different units within the agency. Uniform performance management of outsourced activities is becoming a new challenge.

3.5 Recruitment and Retention

TSM&O is a new activity area and, in some cases, does not provide career options with clear potential. At the same time, the relatively static or declining staffing levels in State DOTs overall, and the reliance on consultants for special expertise or functions, has not made recruitment a major issue.

- **Recruitment and retention.** As noted under the staffing discussion above, given generally static or declining staff levels among State DOTs, there is limited recruitment experience. Most of the existing State DOT TSM&O staff comes from within the agencies

transferring from other units. As a result, special technical capacity needs are substantially met through the use of consultants, contract employees, or academic support. Permanent staff recruitment from outside appears rare. In part this appears to reflect the fact that some of the needed skills (systems engineering, information and communications) are generated in educational institutions with little contact with the transportation sector. The hiring processes, internal staff job preferences, relative compensation, and union constraints appear to discourage external hires. At the same time, some States report retention challenges as younger staff (Millennials) value career flexibility and varied opportunities over long term institutional career commitments, especially if they have developed technical skills of value in the private sector.

- **Career attractiveness.** State DOT careers have traditionally been built on civil engineering and project development backgrounds. These types of expertise are easily recognizable by top management, as reflected in career opportunities. The upward career vector is typically unclear for staff specializing in operations and usually lacking PE qualifications. With very few exceptions, TSM&O is not seen as part of the traditional career track to senior DOT management at either the central office or district level, where senior roles historically have been rooted in engineering and planning and district or division management. Furthermore, the real-time nature of TSM&O brings with it a lifestyle at odds with the 9-to-5 civil engineering office culture and one that requires reacting to events, improvising solutions, and working closely with outside collaborators, all without any special recognition in compensation. State DOTs report entry level staff with relevant technical backgrounds often use department employment as a stepping stone to more lucrative and mobile career options such as in the private sector. Lack of a defined TSM&O career path within an agency was noted as a challenge.

4.0 Relationships to Other Capability Dimensions

The workshops illuminated interdependencies among the Organization and Staffing 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.

It was apparent from the workshops that agencies' organization and staffing was synergistic with other dimensions of capability, both process oriented and institutional. Agency culture is extremely influential in terms of top management support for elevating TSM&O program status, undertaking the reorganization needed for improved internal collaboration, and prioritizing TSM&O for increased staff slots. The inability to add staff was a widely acknowledged assumption in the discussion of the process dimensions (business processes, system and technology, and performance measurement) and clearly undercut staff ambitions to improve the effectiveness of their current activities or to expand them. Without strong staff capabilities, technical improvements are difficult. At the same time, it also was apparent that the ability to develop and conduct appropriate business processes was dependent on both efficient organizational structure and staff since many of the essential business processes (e.g., development of a TSM&O program plan or architecture) require special staff capabilities. These relationships expressed in the workshops are diagrammed in Figure 4.1.

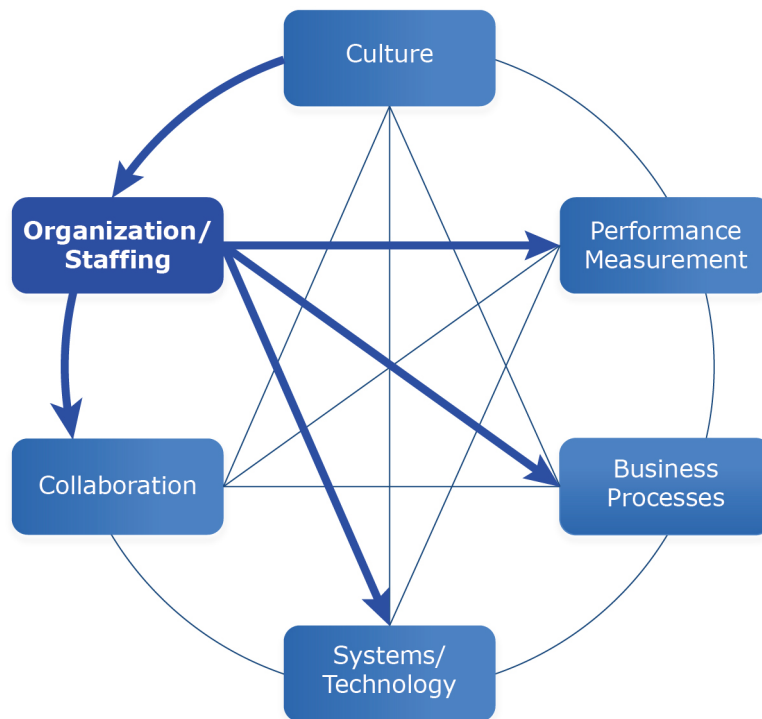


Figure 4.1 Graph. Key Synergisms between Organization and Staffing and Other Dimensions

(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 on a day-to-day basis in real time. These individuals appear to be well aware of existing organizational challenges and staffing problems; however, they are limited in their span of control over organizational change and constrained by staffing limitations. They facilitate many of the key process and organizational changes associated with increasing TSM&O capabilities that rest with second or first-level managers to whom they report. Therefore, TSM&O middle managers exert their influence over organization and staffing through their personal initiative, agency knowledge, and long-standing relationships. They make the case for change on a “middle-up” rather than top-down basis. Workshop participants’ discussions about TSM&O improvement and their implementation plans reflect a consciousness of organizational and staffing issues and recognition that implementation plan actions necessarily require upper management buy-in and initiative.

5.0 Implementation Plan Capability Improvement Actions

Most States included some aspect of Organization and Staffing in their implementation plans to improve agency capability. Within these States, the two highest priorities were consideration of a dedicated TSM&O section or other modifications to existing organizational structures and the development of TSM&O staffing plans, potentially including identification of core staff capacities, position descriptions, and succession plans. Only five States focused on the need for some kind of structural reorganization, which may reflect participants' acceptance of their span of control as middle managers. As noted previously, several agencies had experienced some degree of recent reorganization. Typical participant-suggested actions for advancement to the next level of capability in Organization and Staffing are presented below in order of frequency of inclusion:

- Review/define organizational structure for TSM&O/develop business case for TSM&O section
- Develop TSM&O staffing plans
- Develop succession plans
- Create career maps/paths and position descriptions
- Provide technical training and mentoring and encourage staff participation in national forums
- Provide TSM&O point of contact for each region to advance TSM&O concepts and projects
- Reorganize existing headquarters division/district to emphasize TSM&O/corridor performance
- Develop new program framework to accommodate TSM&O
- At management level, focus on performance management plans and accountability to optimize staff utilization and efficiency
- Hold TSM&O summit
- Conduct additional CMM assessments

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

5.1 Review/Define Organizational Structure for TSM&O

The priority actions of agencies dealing with organizational structure related to two issues:

- From an implementation point of view, it was seen as essential to develop an organizational configuration that was consistent with a proposed TSM&O program focus. The proposal would outline the roles and responsibilities of staff implementing other proposed strategies to improve TSM&O, the implications of their concepts of operations, and the consequent relationships among internal units (within and between headquarters and districts) and with external partners.
- From a program point of view, there was an emphasis on clarifying the chain of responsibility, especially between the day-to-day operating managers and those senior staff responsible for resource allocation.

5.2 Develop TSM&O Staffing and Succession Plans

Most workshop participants agreed that they were significantly staff-constrained. Implementation plans with an organizational focus typically included actions focused on staffing, including the following:

- Defining staffing needs for the agreed-upon TSM&O activity functions, including core capacities and related job descriptions, as well as allocation and balancing of responsibilities and identification of key gaps; and
- Determining which functions could best be addressed in-house or outsourced.

Closely related to these two priorities was discussion of staff development, including career vectors and succession plans for making TSM&O an attractive professional development opportunity.

6.0 Best Practice Examples

As noted above, several workshop States have undertaken some degree of reorganization typically involving consolidation of multiple TSM&O-related branches within headquarters (e.g., ITS, traffic operations, TMCs, safety service patrol, and safety). These functions typically remain at the branch level but consolidated reporting to a single division is introduced. In some cases, the reporting relationships to headquarters from the larger metropolitan districts, often organized around TMCs, also have been modified. Very few States have a top-level TSM&O division or program.

Colorado DOT: Division of Transportation System Management and Operations

Reorganization. The most complete reorganization for TSM&O has taken place at Colorado DOT (CDOT), which has formed a new top-level unit – the Division of TSM&O – to provide focus for the agency’s commitment to TSM&O. This division was formed by consolidating previously separate branches, the Intelligent Transportation Systems (ITS), Traffic Engineering, and Safety Branches, from the Division of Staff Branches to the Division of TSM&O. In addition, a wide range of programs that were previously separate (some at the regional level) were brought under the new division, including ramp metering, HOV/HOT operations, and integration of previously separate TMCs. These changes are described in a reorganization report that also identified the need for new technical staff to fill out the needed core staff capabilities. In addition, the reorganization brought with it the introduction of a formal “operations clearance review” process to ensure that TSM&O was appropriately considered where relevant to new capital projects. The *CDOT Transportation System Management and Operations Reorganization Report* currently is unavailable online but is a useful reference that can be obtained by contacting the department.

Colorado DOT University. The Corporate University for the Colorado Department of Transportation (CDOTU) is a system of training programs that delivers both general and specialized curricula to CDOT staff. It operates on a federation model that is organized by four clusters of business units related to CDOT’s principal program areas. These “colleges” are unified by a common set of policies, standards, operating practices, and core administrative services and delivers curriculum material in response to identified program-related needs defined by staff and management. The training uses available instructional materials, original material as appropriate, and a full range of instructional methods. CDOT is currently in the process of building a TSM&O-related curriculum. Contact CDOT directly to learn more.

Maryland State Highway Administration: CHART Program. The CHART (Coordinated Highways Action Response Team) program is the Maryland State Highway Administration’s (SHA) long-standing freeway operations and management program. The CHART program maintains division status within the agency and its director reports directly to the Deputy Administrator/Chief Engineer for Operations. One of the most notable aspects of CHART is the composition and role of the CHART Board, consisting of senior technical and operational personnel from SHA, the Maryland Transportation Authority, Maryland State Police, Federal Highway Administration, University of Maryland Center For Advanced Transportation

Technology, and various local governments. The Board is chaired by the Deputy Administrator/Chief Engineer for Operations.

<http://www.chart.state.md.us/>

New Jersey DOT: Creation of Transportation Systems Management Office. Another example of reorganization from a workshop State is New Jersey DOT (NJDOT), which in 2011 created a new Office of Transportation Systems Management headed by an Executive Director. It consolidated the Division of Traffic Operations and its regional bureaus and the Bureau of Mobility and Systems Engineering (ITS). Close cooperation with the State's toll road, transit, and law enforcement entities is emphasized. The office reports directly to the Deputy Commissioner (NJDOT's COO) and was given clear responsibility for all activities related to statewide traffic management, including resource allocation, program evaluation, and budget requests. In 2013, the Executive Director position was elevated to the Assistant Commissioner level.

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 constitutes 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, by AASHTO, FHWA, or other entities. Overall there is very little support material targeting organization and staffing needs. Suggestions are presented in Table 7.1.

Table 7.1 Suggested National Activities to Support Improvements in Organization and Staffing

Activity	Organization and Staffing Element	Sponsor(s)	Comments
Compile examples of reorganizations, including organization charts, functions, and underlying policies as examples for other States and use for technology transfer	Program Status Organizational Structure	Operations Academy™, NOCoE	Material could be circulated among interested peer States
Develop basic webinar and/or training module focused on organization and staffing	Organizational Structure	FHWA/ITS PCB Program, CITE	Requires modest technical study using CMM workshop materials and limited peer interviews
Develop a TSM&O organization and staffing gap analysis tool for agencies to compare current operations with those needed to fulfill all desired functions	Organizational Structure	FHWA, AASHTO, NCHRP	Existing model is FHWA's Traffic Signal Operations and Maintenance Staffing Guidelines
Establish electronic dialogue among DOT TSM&O managers for general peer-to-peer discussion of organization, staffing, and other management issues	Organizational Structure	Operations Academy™, NOCoE	Dialogue would have to be structured and managed
Strengthen NOCoE Knowledge Transfer System database (developed for SHRP 2 L17)	Organizational Structure	NOCoE	Organization and staffing are existing search items; further material could be added

Activity	Organization and Staffing		Comments
	Element	Sponsor(s)	
Poll State DOT senior TSM&O managers on key staff capacities needed and unmet; compare identified needs with training and educational opportunities and consider remediation actions to fill gaps	Staff Development	AASHTO and/or FHWA via peer-to-peer interchange or polling	No State has systematically identified core capacities; Use emerging TSM&O applications as guide to specific technical staffing needs (ATM, ICM, CV, arterial operations)
Develop a suite of core competencies with lists of helpful training, experiences, and resources for TSM&O managers	Staff Development	AASHTO and/or FHWA via peer-to-peer interchange or polling, NOCoE	Alternative or complementary to the above
Review critical training deficiencies across all levels of TSM&O employees and develop permanent classes to address these deficiencies (for example, CITE or NHI courses)	Staff Development	FHWA/ITS PCB Program, CITE	May extend beyond organization and staffing or be conducted in conjunction with other dimensions
Adjust curricula of National Operations Academy™ and Regional Operations Forums (ROF) to include material supporting managers' needs to improve processes and organization	Staff Development	Operations Academy™, ROFs	Specific tasks developed in workshop implementation plans constitute a starting point
Identify State DOT functions typically outsourced and associated agency rationales	Staff Development	AASHTO, ITE, ITS-A	Workshop experience shows substantial outsourcing of ITS-related functions in many states
Investigate existing State DOT experience regarding TSM&O as a career option, including education and training, conditions of employment, and career track options	Staff Development Recruitment and Retention	FHWA, AASHTO, NCHRP	Increasingly technical staff positions are hard to compete for; special training will be essential. Establish some best practices of agencies that have developed TSM&O job descriptions, career paths, etc.

Activity	Organization and Staffing		Comments
	Element	Sponsor(s)	
Review curricula of secondary and graduate schools related to TSM&O to identify key gaps and best practices to produce "TSM&O-ready" entry level employees	Staff Development Recruitment and Retention	FHWA/ITS PCB Program, AASHTO, NCHRP	Entry-level TSM&O employees generally are not well served by current academic offerings
NOCoE	National Operations Center of Excellence		
ITS PCB Program	Office of the Assistant Secretary for Research and Technology Capacity Building Program		ITS Professional
CITE	Consortium for ITS Training and Education		
ITE	Institute of Transportation Engineers		
ITS-A	Intelligent Transportation Society of America		

8.0 References

AASHTO TSM&O Guidance: Organization and Staffing Dimension. AASHTO's web-based *TSM&O Guidance* follows the six dimensions of TSM&O capability described in this white paper, including organization and staffing. 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 structures key 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 organization and staffing 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/OW_L2.pdf).

http://www.aashtotsmoguidance.org/guides/OW_L2.pdf

A Transportation Executive's Guide to Organizational Improvement, NCHRP 20-24(42), 2006. This report is a guide to State DOT best practice in organizational improvement programs and performance. It provides guidance on determining where and how to start improving organizational effectiveness. Actual State program examples, tips, and data are included among detail on these nine success factors that contribute to organizational improvement effectiveness.

[http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/20-24\(42\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/20-24(42)_FR.pdf)

Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management, NCHRP Report 693, 2012. This report considers the supply and demand of both the current and future TSM&O workforce – the actions transportation agencies may take to attract, recruit, develop, and retain skilled staff with needed capabilities; and the tools that are available or may be developed to assist agencies in their efforts to ensure the availability of skilled professionals to meet the growing demand. Five critical issues are identified which currently are affecting TSM&O workforce attraction, recruitment, training, and retention: 1) baby boomer retirement; 2) demographic changes in the workforce; 3) availability of training; 4) new technologies; and 5) demand on transportation agencies.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_693.pdf

Supplemental information is available in *NCHRP Web-Only Document 182*, which includes a set of tables compiling TSM&O job categories, number of positions, and educational requirements for all 50 States.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_W182.pdf

An *Executive Workbook* provides a summary of the project results and recommendations for senior management personnel.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_693Workbook.pdf

CDOT Transportation Systems Management and Operations Reorganization Report, CDOT, 2014. See discussion in Section 8.0.

Available upon request from CDOT.

Developing Transportation Agency Leaders, NCHRP Synthesis 349, 2005. This report examines leadership development programs in 25 States and 7 private-sector firms to address succession management among transportation agency leaders at a time when many experienced leaders are retiring or moving on to other opportunities. The report states that its findings and examples of private sector programs have much to offer in application to public sector transportation agencies. The report also contains a current examination of State DOT workforce challenges, a literature review synthesis of successful practices in developing agency leaders, and existing state practices on recruitment and retention of current and future leaders.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_349.pdf

Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management, NCHRP 693, 2012. The purpose of this project was to provide transportation agencies with strategies and resources to meet their needs for attracting, recruiting, and retaining transportation system operations and management (SOM) staff. The research considers the potential supply and demand for SOM skills and staffing; the actions transportation agencies may take to attract, recruit, develop, and retain skilled staff with SOM capabilities; and the tools that are available or may be developed to assist agencies in attracting and recruiting skilled staff in this area.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_693.pdf

Appendix: Steps to Implement Common Implementation Plan Priority Action for Organization and Staffing 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 organization and staffing 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.

Program Status:

1. Establish a TSM&O program development group.
2. Develop and communicate the business case for TSM&O as a key program activity of the agency, including the need for clear objectives, strategies, and related performance measures; clarify the nature of agency activities and their resource requirements, including staffing, to implement the strategies.
3. Make the case for TSM&O as a top level formal agency program with appropriate explicit identification in agency documents related to mission, vision, policy, goals and objectives.
4. Make the case for explicit inclusion of TSM&O as a program in planning and budgeting activities.
5. Propose modifications to the existing agency standard project development process that add coordination with and reference to TSM&O facility deployment as part of other projects.

Organizational Structure:

1. Examine current division/group mission descriptions, roles, job descriptions, and staff resource allocation (headquarters and district) and identify gaps that are inhibiting effective implementation or expansion of priority TSM&O strategies or programs.
2. Based on concepts of operations for key strategy applications, identify appropriate organizational relationships, and clarify chain of command; consider vertical and horizontal scope and span of control of TSM&O relevant offices compared to legacy organization.
3. Consider staffing needs to support the full range of identified TSM&O requirements and priorities, including project planning and development, performance management and reporting, system operations and management, maintenance, etc.

4. Identify the need and instances for the senior full-time TSM&O staff manager's direct participation in decision making required for effective coordination and for representation in tradeoff decisions affecting access to needed resources.
5. Identify specific staff manager responsibilities, performance metrics, and reporting responsibilities and compare responsibilities with authority and resources.
6. Develop a strategy to address TSM&O staff and resource priorities, considering any constraints on FTEs department-wide, including defining those functions that could potentially be addressed by outsourcing and reprioritizing internal staffing allocation.
7. Review appropriate distribution of roles and responsibilities between headquarters and districts and/or TMCs to determine efficient allocation of staff and other resources to minimize duplication and maximum field-level program delivery effectiveness.
8. Initiate internal discussions to address priority TSM&O staffing needs, including reprioritizing staffing allocations, redefining job descriptions, or contracting needs for functions identified for outsourcing; leverage TSM&O business case and program plan.
9. Update division/unit missions and staff job descriptions to reflect TSM&O needs and functions.

Staff Development:

1. Establish TSM&O policy group of key internal and external stakeholders to review program functions and needed relationships.
2. Identify the range of needed core capabilities to carry out a TSM&O plan relative to development, acquisition, and implementation, as well as strategy-specific procedures and protocols that are essential to building and managing TSM&O activities as defined in a TSM&O plan.
3. Compare position descriptions within agency for equivalency based on experience and job-relevant technical skills, including consideration of new positions' specification relevant to special TSM&O skills.
4. Identify dependency on staff champions and determine characteristics that can be built into formalized standard operating procedures that are not champion dependent.
5. Evaluate job description credentials/experience requirements for current applicability and develop position descriptions that satisfy needed TSM&O core capabilities (potentially using national best practice).
6. Conduct comparative study on salaries (peer States, agencies, regions, private sector), including differences in cost of living across a State.
7. Identify opportunities to use staff with nontraditional degrees.

8. Prepare a TSM&O Staffing Plan that addresses, at a minimum:
 - a. TSM&O position qualifications, job descriptions, and core competencies;
 - b. Career paths that align with current/expected department needs/activities;
 - c. Strategies for recruiting/retaining young staff, including intern recruitment;
 - d. Training and experience resources to help fulfill core competencies of TSM&O position requirements; and
 - e. Compensation requirements relative to peer organizations and geographic locale.
9. Support the business case for increased staffing by indicating benefits and payoffs; illustrate the consequences of staffing shortfalls.
10. Develop specific training needs based on core competencies versus existing staff background; identify training resources from Federal, State, and association level, including consideration of peer State activities.
11. Identify existing training courses/materials that will meet identified training needs (SHRP 2 products, AASHTO, FHWA, ITE, etc.) and identify gaps in available training materials and resources; develop materials/methods for addressing needs unmet by existing courses/materials.
12. Establish a mentoring program for junior staff to support professional development and clarify paths of career advancement.
13. Support staff participation in national forums and associations such as AASHTO, TRB, ITE, and others; support staff participation in local forums to leverage potential training and capacity building opportunities.
14. Participate in technical interchanges with peer agencies and professional organizations.

Recruitment and Retention:

1. Identify existing non-TSM&O staff for qualifications and interests in new or backfilling positions.
2. Review and compare position descriptions, working conditions, training, career opportunities, and competing opportunities to improve attractiveness of TSM&O staff positions.
3. Develop strategies and requirements for acquiring skills through appropriate means/sources (reassign, hire, outsource), supported by appropriate cost-benefit analysis or justification of staffing levels/paths.
4. Consider pros and cons of outsourcing functions requiring special expertise versus retaining those functions in-house.

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