SHRP 2

STRATEGIC HIGHWAY RESEARCH PROGRAM

Accelerating solutions for highway safety, renewal, reliability, and capacity

Guide to Improving Capability for Systems Operations and Management

S2-L06-RR-2

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THE SECOND STRATEGIC HIGHWAY RESEARCH PROGRAM

Guide to Improving Capability for Systems Operations and Management

SHRP 2 Report S2-L06-RR-2

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THE SECOND STRATEGIC HIGHWAY RESEARCH PROGRAM

America's highway system is critical to meeting the mobility and economic needs of local communities, regions, and the nation. Developments in research and technology—such as advanced materials, communications technology, new data collection technologies, and human factors science—offer a new opportunity to improve the safety and reliability of this important national resource. Breakthrough resolution of significant transportation problems, however, requires concentrated resources over a short time frame. Reflecting this need, the second Strategic Highway Research Program (SHRP 2) has an intense, large-scale focus, integrates multiple fields of research and technology, and is fundamentally different from the broad, mission-oriented, discipline-based research programs that have been the mainstay of the highway research industry for half a century.

The need for SHRP 2 was identified in *TRB Special Report 260: Strategic Highway Research: Saving Lives, Reducing Congestion, Improving Quality of Life*, published in 2001 and based on a study sponsored by Congress through the Transportation Equity Act for the 21st Century (TEA-21). SHRP 2, modeled after the first Strategic Highway Research Program, is a focused, time-constrained, management-driven program designed to complement existing highway research programs. SHRP 2 focuses on applied research in four areas: Safety, to prevent or reduce the severity of highway crashes by understanding driver behavior; Renewal, to address the aging infrastructure through rapid design and construction methods that cause minimal disruptions and produce lasting facilities; Reliability, to reduce congestion through incident reduction, management, response, and mitigation; and Capacity, to integrate mobility, economic, environmental, and community needs in the planning and designing of new transportation capacity.

SHRP 2 was authorized in August 2005 as part of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). The program is managed by the Transportation Research Board (TRB) on behalf of the National Research Council (NRC). SHRP 2 is conducted under a memorandum of understanding among the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), and the National Academy of Sciences, parent organization of TRB and NRC. The program provides for competitive, merit-based selection of research contractors; independent research project oversight; and dissemination of research results.

SHRP 2 Report S2-L06-RR-2
ISBN: 978-0-309-12906-0
Library of Congress Control Number: 2011939553
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ACKNOWLEDGMENTS

This work was sponsored by the Federal Highway Administration (FHWA) in cooperation with the American Association of State Highway and Transportation Officials (AASHTO). It was conducted in the second Strategic Highway Research Program (SHRP 2), which is administered by the Transportation Research Board of the National Academies. The project was managed by William Hyman, Senior Program Officer for SHRP 2 Reliability.

The principal author of the report was Steve Lockwood of Parsons Brinckerhoff, with significant contributions from the project team: Phil Tarnoff, John O'Laughlin of Delcan, and Tojo Thatchenkery of George Mason University. Housman and Associates also contributed to this project. Alan Lubliner and Amy Zwas of Parsons Brinckerhoff provided important editorial and administrative support throughout.

Researchers in related SHRP 2 projects, FHWA Operations Division staff, Institute of Transportation Engineers staff, and AASHTO staff were an important source of consultation throughout. The AASHTO Subcommittee on Systems Operations and Management provided an essential sounding board at key points in the project.

FOREWORD

William Hyman
SHRP 2 Senior Program Officer, Reliability

A large number of strategies aimed at improving travel time reliability focus on highway operations. To be successful, operational strategies often require a collaborative and coordinated effort among many transportation organizations and within their key units. For example, effective work zone management within a transportation agency cuts across organizational boundaries and involves construction, maintenance, safety, and operations personnel. More significantly, many operational strategies, particularly traffic incident management, require strong cooperation from many different organizations, such as transportation departments, police, fire, emergency medical services, and towing and recovery.

The objective of this research was to undertake a comprehensive and systematic examination of the way agencies should be organized to successfully execute operations programs that improve travel time reliability. The following types of questions were examined at the outset of this research: How does operations fit into a transportation agency's overall program? What changes can be made in agency culture and training to promote operations? Which local and regional public agencies and private-sector organizations are essential to the various aspects of operations? Are there emerging technologies, systems, or organizational structures that can be used to advance intra-agency and interagency communications and therefore operations?

The research addressed a large number of topics concerning organizational and institutional approaches that could enhance highway operations and travel time reliability. The most fruitful investigation was identification of the Capability Maturity Model, used extensively in the information technology field for organizational self-assessment and continuous improvement of quality and reliability. The researchers recognized that a version of the Capability Maturity Model could be developed and applied to highway operations and in turn travel time reliability. Elements defining different levels of maturity include culture/leadership, organization and staffing, resource

allocation, and partnerships. As a part of the research, two companion publications—this guide and a research report—were produced and refined through workshops involving operations managers, executives, and others.

After this guide was submitted for publication, the American Association of State Highway and Transportation Officials (AASHTO) decided to support the conversion of the SHRP 2 Reliability Project L06 research into a web-based tool that would be user friendly, easy to access, and updatable. This work was done under the Transportation Research Board's NCHRP Project 03-94, Transportation Systems Operations and Management Guide. The web tool, Systems Operations and Management Guidance, is available on the AASHTO website at www.aashtosomguidance.org. At the same time, under Phase 2 of the SHRP 2 L06 project, workshops with state DOTs and metropolitan areas are being conducted to validate the research, and the findings will be incorporated into the web material.

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1 THE INSTITUTIONAL CAPABILITY MATURITY MODEL

The purpose of this guide is to support transportation agencies in developing institutional arrangements suitable to the special demands of congestion management, now emerging as a new transportation agency priority. In particular, the strategy conventions appropriate to effective management of nonrecurring congestion (NRC) present new challenges for agency policy, organization and staffing, resources, and partnerships, as well as for basic agency culture and leadership. This guide focuses on these special institutional challenges in the form of a change management tool called the Institutional Capability Maturity Model.

The background to the development of the guide is presented in the accompanying SHRP 2 research report, *Institutional Architectures to Improve Systems Operations and Management* (*1*). The guide is based on real-world experiences of transportation agencies, especially state departments of transportation (DOTs), across a range of levels of application of the conventional strategies that focus on NRC, which is responsible, on average, for about 50% of delays in metropolitan areas. The research included a review of key features of the typical congestion management program activities and the technical and business processes that characterize the more effective programs. From this analysis, the institutional preconditions most supportive of the more effective programs were identified and incorporated into the guide.

The guide structure is based on an adaptation of the Capability Maturity Model widely used in the information technology industry to improve product quality and reliability. The basic concepts were adapted to provide transportation agency management with a tool to improve congestion management capabilities. The model starts with agency self-evaluation to determine the current state of play and provides related appropriate incremental strategies for evolving toward institutional arrangements most supportive of congestion management. The rationale and structure of the Institutional Capability Maturity Model used in this guide are described briefly below.

FOCUS ON INSTITUTIONAL SUPPORT FOR NONRECURRING CONGESTION STRATEGY APPLICATIONS

To minimize the impacts of NRC, the key congestion management strategy applications involve active systems operations and management (SO&M). The guide emphasizes that SO&M strategies present special challenges owing to their real-time, event-responsive nature and the need to combine technology, adopted procedures, and organized interagency roles. The strategies include the following:

- **Incident management** in response to crashes, breakdowns, hazardous material spills, and other emergencies, including multijurisdictional integrated corridor management;
- **Road weather management** in response to heavy rain, wind, snow, and ice;
- **Work zone traffic management** focused on traffic control plans to minimize the impacts of reduced capacity;
- **Special events planning and management** to accommodate event patrons with minimal traffic disruption; and
- **Active traffic management** employing lane-use and speed control, as well as the management of diversions, to minimize flow disruption and incidents.

ELEMENTS OF INSTITUTIONAL CAPABILITY MATURITY

Research conducted as part of *Institutional Architectures to Improve Systems Operations and Management* (*1*) indicates that key institutional features are important determinants of a transportation agency's ability to improve the outcomes associated with these strategy applications. It indicated that agencies with more comprehensive strategy applications—increasingly integrated and standardized—are distinguished from agencies with less well-developed SO&M activities in terms of the following four elements of institutional capability maturity:

- **Culture/leadership** related to the level of understanding and potential leverage of SO&M, as reflected in values, mission, leadership, and related legal arrangements and strategy applications, and as demonstrated by leadership;
- **Organization and staffing** related to how structure aligns responsibilities and accountabilities vertically and horizontally, consistent with capabilities and incentives at the staff level;
- **Resource allocation** for operations and capital, and the degree of transparency and sustainability in relationship to program improvement; and
- **Partnerships** in terms of degree of alignment and stability in objectives, procedures, roles, and relationships.

The guide focuses on these substantial (nontechnical) institutional elements that describe whether, how, and with whom an agency pursues SO&M. Therefore, it is important to distinguish between business and technical processes (such as planning, programming, systems and technology, performance measurement) and the program (consisting of strategies to address NRC, as listed above).

RELATIONSHIP BETWEEN TECHNICAL AND BUSINESS PROCESSES AND INSTITUTIONAL ARCHITECTURE

The guide is based on the premise that the effectiveness of SO&M strategy applications is dependent on business and technical processes that are, in turn, substantially dependent on the degree of support provided by the institutional elements listed above. The configurations, relationships, and arrangements that relate the four elements are called the "institutional architecture." As determined in the research, there are some architectures that appear to be supportive of a higher level of institutional capability maturity. Figure 1.1 diagrams this basic concept of the model, showing the relationships between process and institutional characteristics. The figure also illustrates increasing levels of institutional capability maturity in support of SO&M programs of increasing comprehensiveness and effectiveness.

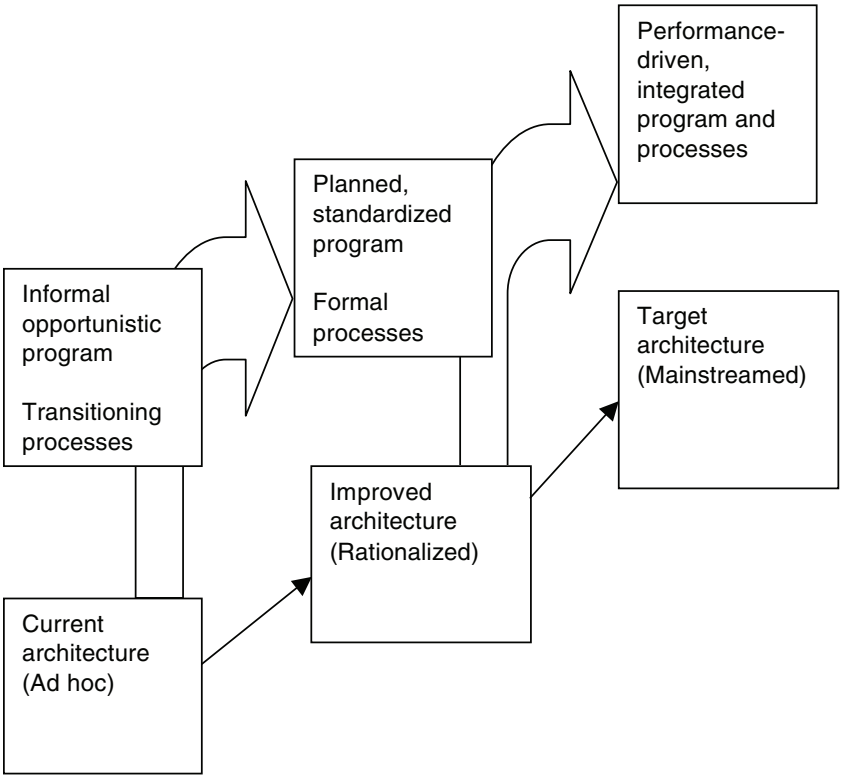

Figure 1.1. *Relationship between more effective processes and supportive institutional architecture.*

LEVELS OF INSTITUTIONAL CAPABILITY MATURITY

An examination of the experience of transportation agencies (particularly state DOTs) indicates that the four elements of institutional architecture tend to evolve together toward institutional frameworks increasingly supportive of SO&M. The following three distinct combinations of features, in levels of increasing capability to support effective SO&M, have been identified (see also Table 1.1):

- **Level 1: Ad Hoc.** An architecture reflecting a legacy civil engineering culture in which SO&M activities are accommodated on an ad hoc and informal basis, typically as a subsidiary part of maintenance or capital project arrangements, as reflected in the transitioning states. This state of play is reflected in a legacy organizational structure and informal resource allocation, fragmented SO&M activities, ad hoc project-oriented business processes, and a narrow SO&M program with no clear sense of performance.
- **Level 2: Rationalized.** An architecture reflecting an appreciation of SO&M as a distinct activity with related adjustments in arrangements, resources, and roles to accommodate the distinct demands of SO&M, as reflected in the mature states.
- **Level 3: Mainstreamed.** An architecture (hypothetical) in which SO&M is considered a core mission, with appropriate formal and standardized arrangements (equivalent to other core programs) configured to support continuous improvement as an ideal target.

The point of departure for this spectrum of levels is Level 1, reflected by the many state DOTs that are transitioning into SO&M as an identifiable managed activity. At the other end of the maturity scale is Level 3—an ideal agency culture, fully staffed within an efficient organizational structure, a transparent resource allocation process for SO&M, and formal relationships with partners. Between the transitioning situation and the ideal is Level 2, already evident in state DOTs committed to formalizing SO&M as a core program and who are undertaking changes to rationalize organization, staffing, resource allocation, and partner relationships toward that end.

TABLE 1.1. BASIC INSTITUTIONAL CAPABILITY MATURITY ELEMENTS AND LEVELS

Institutional Elements	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
Culture/ leadership	Mixed, hero driven	Championed/ internalized across disciplines	Commitment to customer mobility
Organization and staffing	Fragmented, understaffed	Aligned, trained	Integrated
Resource allocation	Project level	Criteria-based program	Sustainable budget line item
Partnerships	Informal, unaligned	Formal, aligned	Consolidated

Criteria for the Levels

For purposes of guidance to change to a more process-supportive institutional architecture, additional specification is necessary. Table 1.2 presents the criteria that define the institutional capability maturity levels for each of the four elements in greater detail. Each cell represents either a point of departure or a target for improving architecture to the next level. The table provides criteria for each element at each level, but it does not provide guidance on the strategies for moving to the next level. Transportation agencies can plot their current position and targets for improvement.

Capability Improvement Strategies at Each Level

For each of the four elements of institutional architecture, there is a set of generic strategies that has been, and can be, used to make the required adjustments. The generic strategies have their own related tactics associated with each level of maturity. The interpretation of strategies changes with successive levels. The differences reflect the increasingly managed, formalized, and mainstreamed status achieved in the movement from one level to the next. There is a logical sequence to the focus of each element of institutional architecture to reach the next level of capability. For example, regarding resource allocation, moving from Level 1 to 2 may involve a systematic determination of needs, whereas moving from Level 2 to 3 may involve formal budgeting. There is a parallel progression for all the strategies. Key strategies associated with each institutional architecture category are shown in Table 1.3.

Within the model framework, four standard rules of maturity models have been developed:

- Each incremental level of maturity within a given element of institutional architecture establishes the basis for the agency's ability to progress to the next higher level of effectiveness.
- Levels cannot be skipped.
- Each level of technical and business processes needs specific institutional support.
- The overall level of maturity for an organization is defined by the lowest level of institutional maturity of any element.

MANAGING IMPROVEMENTS IN INSTITUTIONAL MATURITY

This guide, through the templates on the following pages, indicates *what* needs to be done institutionally to provide a supportive basis for more effective SO&M programs and processes. However, *how* these changes will be implemented is an additional challenge that will vary from context to context and be highly dependent on circumstances and leadership. Changes in institutional architecture that are supportive of the improved SO&M process and programs are not likely to happen without a deliberate change in management strategy.

TABLE 1.2. CRITERIA FOR INSTITUTIONAL CAPABILITY MATURITY

	Levels of Capability Maturity		
Elements	**Level 1** **Ad Hoc**	**Level 2** **Rationalized**	**Level 3** **Mainstreamed**
Culture/ leadership	**Mixed, hero driven** • Operations value not widely appreciated (lack of message). • Middle management heroes promote program. • Full legal authority not established.	**Championed/internalized across disciplines** • Visible agency leadership citing operations leverage, cost-effectiveness, and risks. • Customer outreach and feedback.	**Commitment to customer mobility** • Customer mobility service commitment accepted as formal core program. • Clear legal authority for operations roles; actions among transportation agency, public safety agencies (PSAs), local government clarified.
Organization and staffing	**Fragmented, understaffed** • Legacy roles: Some fragmentation of key functions and boundaries, both horizontally and vertically. • Hero driven: Reliance on key individual for technical knowledge and champions for leadership.	**Aligned, trained** • Transportation Management Center (TMC) focus with vertical and horizontal authority or responsibility alignment for operations for the life of a project. • Accountability to top management. • Core capacities established with knowledge, skill, ability specifications, training, and performance incentives in clear career paths.	**Integrated** • Top-level management position with operations orientation established in central office and districts. • Professionalization and certification of operations core capacity positions including performance incentives.
Resource allocation	**Project level** • Resource allocation at project level, ad hoc, unpredictable, buried, invisible. • Apparent limited eligibility of existing funds for operations.	**Criteria-based program** • Budget allocation for operations driven by transparent criteria on effectiveness and life-cycle needs basis. • Funding levels based on relationship to identified needs.	**Sustainable budget line item** • Operations is a formal, visible, and sustainable line item in agency's budget—capital, operating, and maintenance. • Trade-offs between operations and capital expenditures considered as part of the planning process.
Partnerships	**Informal, unaligned** • Nontransportation entities unaligned with transportation objectives, procedures relying on informal personal basis. • Outsourcing to private sector used for isolated functions.	**Formal, aligned** • Rationalization of responsibilities by formal agreements across institutions (transportation agency, PSAs, private). • Outsourcing revised to meet agency technical, staffing, and management objectives.	**Consolidated** • High level of operations coordination (memorandums of understanding) among owner/operators with TMC consolidation. • Outsourcing performance managed while maintaining agency's core capacities.

TABLE 1.3. BASIC MATURITY STRATEGIES FOR INSTITUTIONAL ELEMENTS

Strategies for Elements	Criteria for Levels		
	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
Culture/leadership • Undertake educational program on SO&M as customer service. • Exert visible senior leadership. • Establish formal core program. • Rationalize state DOT authority. • Internalize customer service performance as ethic. • Commit to continuous improvement as agency mode.	Mixed, hero driven	Championed/ internalized across disciplines	Commitment to customer mobility
Organization and staffing • Establish top-level SO&M executive structure. • Establish appropriate organizational structure. • Identify core capacities. • Determine and allocate responsibility, accountability, and incentives.	Fragmented, understaffed	Aligned, trained	Integrated
Resource allocation • Develop program-level budget estimate. • Introduce SO&M as a top-level agency budget line item. • Develop acceptance of sustainable resourcing from state funds. • Use performance and life-cycle costs as resource allocation tool. • Develop methodology for trade-offs.	Project level	Criteria-based program	Sustainable budget line item
Partnerships • Agree on operational roles and procedures with PSAs. • Identify opportunities for joint operations activities with local government/metropolitan planning organizations (MPOs). • Develop procedures that accommodate partners' goals and maximize mobility (minimum disruption). • Rationalize staff versus outsourcing activities, responsibilities, and oversight.	Informal, unaligned	Formal, aligned	Consolidated

As discussed in *Institutional Architectures to Improve Systems Operations and Management* (*1*), change may happen in an evolutionary way without a significant change in management initiative. However, it is important to recognize the barriers and constraints that inhibit change; the principal ones are indicated in Table 1.4.

There are two main types of change: managed change, which stems from internal agency management, and externally driven change.

TABLE 1.4. BARRIERS TO INSTITUTIONAL CHANGE

Change Elements	Barriers
Culture/leadership	• Limited public and elected-leader support. • Significant capacity construction program. • Limited internal middle management support. • Fuzzy legislative authority.
Organization and staffing	• Absence of experienced SO&M manager(s). • Shortfall or turnover in qualified staff. • Staffing-level constraints.
Resource allocation	• State funding ineligible for SO&M. • Competition for resources from other program backlogs. • No performance outcome measures.
Partnerships	• Conflicting partner priorities.

Managed Change

Managed change, in which leadership within an organization makes deliberate changes in program, process, or institutional arrangements, represents a departure from the existing legacy arrangements and is openly acknowledged as such. The drivers to these more discrete changes tend to be a combination of professional predisposition and agency leadership who articulate the need for change in a way that makes the need more widely apparent. They also tend to oversee a program of appropriate changes (as specified in the transition to a higher level). The following briefly describes the types of managed change:

- **Middle management–led change.** Committed professionals can have a significant impact from the inside out and up.

- **Top management–led change.** In a few instances, SO&M has been encouraged by new CEO leadership mandating or authorizing a department-wide process to improve SO&M. This can involve consolidating and strengthening the systems operations functions at a statewide program level, in central offices as well as key regions.

Externally Driven Change

Events outside the control of management have been the key drivers of change in SO&M. The following types of change have been observed among state DOTs regarding significant increments in attention to SO&M: event driven, incident driven, constraint driven, federal program incentives, and new regional institutional configurations.

Event-driven change occurs when anticipated major traffic impacts in response to major external events stimulate significant change. Major one-time or annual sports events (e.g., Olympics or auto races) and conferences are the two most prevalent types of events for which extensive planning is undertaken to preserve general mobility and minimize disruption while accommodating the event. These anticipated events have required significant improvements in operational capacity, including new infrastructure, new special procedures, and new relationships.

Incident-driven change happens when major unplanned events causing major disruptions bring about across-the-board improvements in SO&M. These incidents include natural disasters, major weather events such as snowstorms, and major traffic incidents ranging from crashes to extensive seasonal recreation congestion. With the disruption, delay, and loss of system reliability associated with such major NRC events—especially those with high public and policy visibility—the need for specific changes in one or more operations activities becomes compelling, with strong public and policy support or imperatives. Immediate action is usually required as a matter of agency credibility, including the need to demonstrate visible change and positive outcomes. Although the response is often limited to a specific activity, there are a few cases in which the response to a particular event and location has been extended by management to the statewide program level and is often accompanied by changes in process and institutional arrangements.

In the face of constraints such as financial or environmental limitations, expensive capital projects to increase highway capacity are often infeasible. SO&M then gains credibility as a relatively inexpensive way to improve the efficiency of the existing roadway. This driver of change becomes most apparent where congestion levels are extremely high and capacity improvement opportunity limitations are openly acknowledged by the transportation agency and accepted by traditional highway stakeholders.

Federal funds from program incentives have been used to introduce planning and systems architecture requirements and are increasingly focused on performance measurement. FHWA has also promoted research, technical exchange, and definitions of current best practice. FHWA also provides dedicated funding. These actions have increased the visibility and legitimacy of intelligent transportation systems (ITS) and SO&M within transportation policy and encouraged state and local involvement.

New regional institutional configurations can also drive change. There are a number of substate entities (e.g., local governments, MPOs) that have taken the initiative to develop cooperative regional efforts for interagency collaboration in improving SO&M, with state DOTs as one of several cooperative entities.

It should be noted that there are often multiple drivers of change—or a sequence of drivers—that provide impetus for increased focus on SO&M.

BUILDING ON CHANGE-DRIVEN MOMENTUM

In response to some of the major external events, key external stakeholders, policy makers, and the public have developed expectations that a specific transportation agency response will minimize the potential impact of similar events in the future. It is no surprise, therefore, that major external events have been associated with enabling, if not forcing, change associated with nearly all of the significant progress made by several of the state DOTs with the more mature programs. The events reduce the barriers to otherwise difficult or expensive organizational changes, increased funding, and changed relationships with external partners (such as law enforcement). Transportation change managers—middle or top management—can capitalize on the opportunity to institute such important changes that otherwise might not be possible.

However, effectively capitalizing on such events requires that the agency have a general strategy in place to seize these windows of opportunity to standardize and extend the specific event-driven program and organizational changes into improved day-to-day SO&M across the agency as a whole. Even in constrained contexts, it can be extremely valuable to have an improvement program on the shelf to use when circumstances permit focusing on the key elements most directly implicated, as well as to use to seize the momentum for more general improvements.

CHANGE MANAGEMENT TACTICS

The Institutional Capability Maturity Model is not the complete recipe for change management; it provides a framework for determining what needs to be done and the strategies for making institutional changes in a direction that is more supportive to aggressive congestion management. However, the strategies themselves must be managed and carried out by appropriate staff. The guide is not intended to provide general change management tactics. There is substantial existing strategic management literature, including approaches such as process engineering, balanced scorecards, and Baldrige criteria. Each of these approaches includes a version of the standard, generic steps of change management that would be generally applicable to all the components of the guide. They typically include the following:

- Joint (consensus) identification of the problem, opportunity, or challenge within the change manager's span of control or influence to create a sense of urgency. This activity is clearly relevant to institutional maturity in congestion management; the focus of an agency culture shifts toward operations—based on both the constraints facing alternative service improvement options and the potential of congestion management opportunities. An understanding of these technical issues is an essential point of departure.

- Developing a vision and defining the general changes needed and the specifics for priority components, which may be limited by the change manager's span of control (see below). This activity corresponds to the adoption of the Institutional Capability Maturity Model as the template for managed change and the development of a commitment to use it on a continuing basis as a component of formal strategic planning.

- Creating or building a team of change agents. This may be specific individuals with specified responsibilities or a task force. Application of the maturity model requires the formation of a team or unit with the responsibility of applying the method with the appropriate units within the agency.
- Sharing the vision and creating buy-in among the widest possible group of staff members that are needed to understand and support the changes. The Institutional Capability Maturity Model is applied in a self-evaluation context, in which key management and staff evaluate their current situation with regard to the level criteria and develop their own custom-tailored version of the next steps and strategies to get there, which results in an internalized understanding of and buy-in to the changes required.
- Empowering the change agents with the necessary support, resources, and authority to make the necessary changes. Installing the maturity model as a continuing strategic change process requires both a broad, shared understanding of the objectives and staff capability to manage and monitor the change commitments made for each element in the maturity framework. Each of the level transition strategies is a task to be managed.
- Using an incremental approach to create visible, early wins to generate momentum and wider support. This is focused on results, not activities.

REFERENCE

1. Parsons Brinckerhoff, Delcan, George Mason University School of Public Policy, and Housman and Associates. *SHRP 2 Report S2-L06-RW-1: Institutional Architectures to Improve Systems Operations and Management*. Transportation Research Board of the National Academies, Washington, D.C., forthcoming.

Note

After this guide was submitted for publication, the American Association of State Highway and Transportation Officials (AASHTO) decided to support the conversion of this project's research into a web-based tool that would be user friendly, easy to access, and updatable. This work was done under the Transportation Research Board's NCHRP Project 03-94, Transportation Systems Operations and Management Guide. The web tool, Systems Operations and Management Guidance, is available on the AASHTO website at www.aashtosomguidance.org.

2 GUIDANCE TEMPLATES

BASIC GUIDANCE STEPS

For use as guidance in improving the effectiveness of systems operations and management (SO&M), the Institutional Capability Maturity Model is presented in a series of steps and strategy matrices, one for each element (culture/leadership, organization and staffing, resource allocation, partnerships). The use of the model is a four-step process.

Step 1

Identify the element of interest (e.g., see Table 2.1: Operations Maturity Framework). Note that all elements are necessary, but the agency may be at a higher level of maturity in certain elements. Priority focus should be on the element at the lowest level of maturity.

Step 2

Self-evaluate the agency's current level of maturity to determine the point of departure (current level). Use the model criteria for each element to determine the agency's current level of maturity (e.g., see Table 2.1: Operations Maturity Framework).

Step 3

Identify the target level and inspect the numbered strategies for each element to move up to the next level (e.g., see Table 2.2: Levels and Objectives for Improvement). Each element has several associated maturity improvement strategies. Determine the priority strategy based on the current circumstances and the amount of change needed to get to the next level.

Step 4

Review each general strategy table for guidance to move to the next level: Level 1 to Level 2, or Level 2 to Level 3. Following each general strategy table are separate numbered detailed strategies in a standard format. The strategies include the following:

- Relationship to program and process;
- Identification of how the institutional change supports improved SO&M business processes and more effective strategy applications;
- Points of departure (levels of capability);
- Additional criteria or descriptions for the user to determine the current level;
- Description of the ultimate target level (Level 3);
- Capability improvement strategies;
- Strategies for moving from Level 1 to Level 2, or Level 2 to Level 3; and
- Responsibilities.

CULTURE/LEADERSHIP TEMPLATE

This section discusses the culture/leadership element of institutional architecture (Table 2.1). Table 2.2 illustrates the levels and the objectives for the next steps to improvement.

TABLE 2.1. CULTURE/LEADERSHIP: OPERATIONS MATURITY FRAMEWORK

Institutional Architecture Elements	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
Culture/ leadership	**Mixed, hero driven**	**Championed/ internalized across disciplines**	**Commitment to customer mobility**
Organization and staffing	Fragmented, understaffed	Aligned, trained	Integrated
Resource allocation	Project level	Criteria-based program	Sustainable budget line item
Partnerships	Informal, unaligned	Formal, aligned	Consolidated

TABLE 2.2. CULTURE/LEADERSHIP: LEVELS AND OBJECTIVES FOR IMPROVEMENT

Strategies to Advance Level	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
1. Undertake educational program	**Value of SO&M not yet widely appreciated.**	**Role of SO&M in providing service improvements widely understood.**	**SO&M fully appreciated.**
	From L1 to L2: Role of SO&M in providing service improvements widely understood. Drill down regarding the relevance of operational performance to the DOT customer service mission.		*From L2 to L3: SO&M fully appreciated.* Undertake persuasive "road show" to communicate new DOT focus to customers—policy makers and the public.
2. Exert senior leadership	**Lack of management priority.**	**Visible senior support agencywide.**	**Stable SO&M leadership.**
	From L1 to L2: Visible senior support agencywide. Exert senior management leadership visibly throughout organization and across disciplines regarding SO&M leverage and cost-effectiveness.		*From L2 to L3: Stable SO&M leadership.* Identify and accept risks associated with expanding and intensifying new mission.
3. Establish formal core program	**SO&M is a set of ad hoc activities.**	**SO&M is a formal mission and program with supporting policy.**	**New state DOT business model.**
	From L1 to L2: SO&M is a formal mission and program with supporting policy. Update mission in light of SO&M business case for mobility in light of minimum new capacity.		*From L2 to L3: New state DOT business model.* Introduce SO&M as formal core DOT program, at the same level as project development and maintenance.
4. Rationalize transportation agency authority	**SO&M ambitions limited by legacy assumptions.**	**Effective span-of-control needs identified.**	**Effective span of control negotiated.**
	From L1 to L2: Effective span-of-control needs identified. Identify and describe opportunities to rationalize current presumed legal or regulatory constraints regarding DOT's activities.		*From L2 to L3: Effective span of control negotiated.* Legitimize SO&M and partner role rationalization via policy and legislative initiatives.
5. Internalize continuous improvement as agency mode or ethic	**Limited progress orientation.**	**Adoption of continuous progress concept.**	**Continuous improvement approach internalized.**
	From L1 to L2: Adoption of continuous progress concept. Develop concepts of continuous improvement with examples toward achieving performance-driven best practice.		*From L2 to L3: Continuous improvement approach internalized.* Support culture of continuous improvement with clear targets and incentives for individuals and units.

Culture/Leadership Strategy 1: Undertake Educational Program

Relationship to Program and Process

Often, stakeholders and transportation professionals have little knowledge of the potential service impact of SO&M. Significant changes in program or process that require resources, special authority, or custom-tailored approaches cannot be implemented without gaining support both internally or externally. Internally, leadership and other staff may have limited exposure to the strategies and are therefore unaware of their customer service potential (compared with other ongoing agency investments) or are not prepared to modify existing priorities, programs, and actions. Externally, policy makers may also have limited exposure. Therefore, it is important to undertake an educational program to create a broad understanding of SO&M and its potential impact on congestion, as well as its cost-effectiveness.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Value of SO&M Not Yet Widely Appreciated

In a Level 1 organization, the impacts and benefits of SO&M strategies are not well understood or quantified by agency staff or leadership. Therefore, there is limited support for devoting staffing and funding resources to SO&M, especially in competition with other presumed state DOT priorities. Because the DOT or operating agency itself is not aware of the impacts, there is not likely to have been an effort to expose policy decision makers to them.

The following strategies can help raise a Level 1 organization to Level 2:

- Drill down via discussions and formal meetings within the agency regarding programmatic response to the importance of operational performance to the DOT mission and the role of SO&M and its potential to improve performance and customer responsiveness. Build on the broad momentum regarding performance reporting and accountability.
- Prepare and circulate existing technical and peer materials explaining roles and benefits.
- Prepare illustrative analyses from examples within the state for external circulation to policy and stakeholder groups.

Level 2: Role of SO&M in Providing Service Improvements Widely Understood

A Level 2 organization has a technical appreciation of potential performance leverage on recurring and nonrecurring congestion relative to other programs within the agency. The role of SO&M is appreciated by policy makers and key stakeholders (commission, governor's office, and legislative committees), including both expectations and willingness to support it at the level where there is active cooperation in fostering improved SO&M.

The following strategies can help raise a Level 2 organization to Level 3:

- Undertake a persuasive road show to communicate the importance of an SO&M focus to customers (both public and specific stakeholder groups)—to demonstrate their stakes in improved SO&M—by participating in meetings and conferences.
- Develop policy-maker briefings using understandable examples of the limitations of capacity and the opportunities with SO&M.
- Develop regular aggressive public outreach programs (media) focused on benefits, accomplishments, and issues.

Level 3: SO&M Fully Appreciated

In a Level 3 organization, SO&M is fully appreciated in terms of value and potential within the agency and understood at policy, professional, and public levels. DOT focus on SO&M becomes part of normal expectations in a Level 3 organization.

Culture/Leadership Strategy 2: Exert Senior Leadership

Relationship to Program and Process

Middle management champions have limited leverage and span of control over institutional change. Furthermore, their position and career longevity are often limited. Therefore, significant changes in program or process (see Strategy 3) are not possible without continuous and aggressive senior management support and direction.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Lack of Management Priority

In a Level 1 organization, existing senior and middle management staffs are often preoccupied with competing priorities (or lack technical knowledge regarding SO&M [see Strategy 1]). At the same time, CEOs often come from an outside sector with little understanding of the program. There is no visible leadership at the agency level to mainstream SO&M.

The following strategies can help raise a Level 1 organization to Level 2:

- Develop and articulate support for operations and take visible steps to clarify SO&M in statements of mission, vision, and values throughout the organization via discussion and task forces at both the field and central-office levels.
- Indicate the relevance and role of SO&M with regard to capacity, safety, and maintenance activities across internal divisions via targeted meetings and briefings.
- Select middle managers with SO&M background for program development.

Level 2: Visible Senior Support Agencywide

In a Level 2 organization, top management is visible in supporting and articulating SO&M leverage, cost-effectiveness, and risks across disciplines in the DOT. Top management also supports strategic SO&M program development.

The following strategies can raise a Level 2 organization to Level 3:

- Take action at the top management level to include SO&M staff leadership in all program discussions.
- Make a commitment to SO&M at the agency level in policy documents with explicit (internal and external) acknowledgment of risks of expanding and intensifying a new mission (despite the lack of total control over outcomes because of partner differences and variations in demand).
- Establish a succession plan for SO&M leadership at the central-office and regional levels.

Level 3: Stable SO&M Leadership

In a Level 3 organization, SO&M is understood and supported by stable career leadership as a key mission.

Responsibility

The CEO and immediate headquarters executive staff (division heads), as well as district leadership, can undertake this strategy within their span of influence over staff.

Culture/Leadership Strategy 3: Establish Formal Core Program

Relationship to Program and Process

If SO&M is not a program, improvements in capabilities are uncertain, management responsibilities are unclear, the organization framework is subsidiary to other programs, and key processes are outside the conventional framework. Resource competition is informal, and internal and external performances are not judged. The role of the DOT in relation to other partners in service delivery is unclear.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Vague Mission and SO&M Subsidiary to Other Programs

In a Level 1 organization, SO&M is a set of activities conducted by certain districts, based on district leadership priorities and inclination. The mission is vague regarding SO&M, and SO&M activities are parts of other programs. There is no DOT-wide strategy, budget, or accountability.

The following strategies can help raise a Level 1 organization to Level 2:

- Update the mission in light of the SO&M business case for mobility; current capacity expansion limitations; and increased congestion, incidents, and emergencies.
- Consider development of an SO&M policy board to legitimize and guide the program and to budget with policy, with the board being composed of agency division heads and external industry and other stakeholder members.
- Articulate a formal SO&M policy and develop a strategic plan for SO&M, including all standard features of a formal program (e.g., management, budget, objectives, authorities).

Level 2: SO&M as a Formal Mission and Program with Supporting Policy

In a Level 2 organization, SO&M activities are established as a formal program with all program attributes of capital and maintenance tailored to the special needs of operations.

The following strategies can raise a Level 2 organization to Level 3:

- Articulate a business model regarding the roles and relationships of the DOT, its partners, users, and other stakeholders and the value proposition regarding the state DOT role in discussions at the agency level and with external partners and policy makers.
- Introduce SO&M as a formal core DOT program with remaining key features of a core program: mission and policy, strategic plan and program, eligible funding, budget, and transparent criteria.
- Expand the program to all regions—urban and rural.

Level 3: New Transportation Agency Business Model

In a Level 3 organization, the new state DOT business model accepts maintaining the operational level of service as a program objective and is fully mobilized, programmatically, for continuous improvement.

Responsibility

CEO action is required to lead these changes, most of which are top down.

Culture/Leadership Strategy 4: Rationalize Transportation Agency Authority

Relationship to Program and Process

Effective SO&M requires highly coordinated real-time actions among several partners (public safety, other state agencies, local governments, and private service providers) if on-the-road activities are to be conducted in a manner that minimizes disruption and maximizes customer service. In many cases, the DOT's highway service management role is unclear or unnecessarily confined to legacy roles that limit leverage on operations because of presumed legal constraints or the lack of necessary authorities (such as quick incident access and clearance).

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: SO&M Ambitions Limited by Legacy Assumptions

In a Level 1 organization, the DOT role, especially in the field, is based on accepting existing or presumed legal constraints or traditions regarding roles of partners in areas relating to incident response and traffic management, such that the full benefits of SO&M strategies cannot be realized. Issues are left to resolution on a personal basis in the field.

The following strategies can help raise a Level 1 organization to Level 2:

- Identify and describe opportunities to generate support for changes in state law and regulations regarding the roles of the state DOT in traffic and incident management in relation to other state agencies and private-sector players to improve effective traffic management.
- Review and publicize national best practice regarding interagency roles and their advantages.
- Seek partner consensus—at the agency and association top-management level—for procedural improvements or legislative reform initiative, if necessary.

Level 2: Effective Span-of-Control Needs Identified

In a Level 2 organization, the DOT works with partners to identify common interests and means of rationalizing roles that meet a range of interests.

The following strategies can raise a Level 2 organization to Level 3:

- Legitimize SO&M and partner role rationalization via policy development initiatives with policy makers.
- Seek legislation or regulatory clarification—including reallocation of authority that may improve operations.
- Develop new formal agreements and contracts as appropriate with external agency partners.

Level 3: Effective Span of Control Negotiated

In a Level 3 organization, the roles of public- and private-sector players are rationalized through legislation, regulation, and new contractual agreements.

Responsibility

Top management works with policy makers in cooperation with other service providers, public (PSAs) and private (e.g., contracted Transportation Management Center [TMC] operators, safety service patrol providers, asset managers, towing and recovery entities).

Culture/Leadership Strategy 5: Internalize Continuous Improvement as Agency Mode or Ethic

Relationship to Program and Process

With an objective of building toward best practices, cost-effective process and program improvements are necessarily incremental. Continuing improvement to and beyond the state of best practice requires development and management of a continuous improvement process built around performance measurement, analysis, and procedural improvement.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Limited Progress Orientation

In a Level 1 organization, activities are started (set and forget) without regard to the potential for improving effectiveness through learning and are likely to plateau at modest levels, given the lack of performance feedback and improvement. Lack of ideal performance measurement often is used as an excuse for business-as-usual approaches.

The following strategies can help raise a Level 1 organization to Level 2:

- Identify long-range ideal practice concepts as targets for improvement.
- Identify basic performance measures, both activity based (to start) and outcome based (ultimately).
- Establish a standardized performance-based continuous improvement process, including documentation, performance monitoring and measurement, postevent briefing, and process adjustments.

Level 2: Adoption of Continuous Progress Concept

In a Level 2 organization, the DOT is broadly committed to improving SO&M in terms of both technologies and procedures on a continuous incremental basis.

The following strategies can raise a Level 2 organization to Level 3:

- Support a culture of continuous improvement with clear policy and incentives for an individual's and unit's performance or innovation.
- Set incremental performance improvement targets, measure effectiveness, and improve approaches to all services, both in office and in field.
- Use performance to determine program modifications and resource allocation.

Level 3: Continuous Improvement Approach Internalized

In a Level 3 organization, the presumption is that continuous improvement is desirable and sustainable.

Responsibility

This strategy must be initiated in a top-down manner and be a shared approach involving all staff.

ORGANIZATION AND STAFFING TEMPLATE

This section discusses the organization and staffing element of institutional architecture (Table 2.3). Table 2.4 illustrates the levels and the objectives for the next steps to improvement.

TABLE 2.3. ORGANIZATION AND STAFFING: OPERATIONS MATURITY FRAMEWORK

Institutional Architecture Elements	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
Culture/leadership	Mixed, hero driven	Championed/ internalized across disciplines	Commitment to customer mobility
Organization and staffing	**Fragmented, understaffed**	**Aligned, trained**	**Integrated**
Resource allocation	Project level	Criteria-based program	Sustainable budget line item
Partnerships	Informal, unaligned	Formal, aligned	Consolidated

TABLE 2.4. ORGANIZATION AND STAFFING: LEVELS AND OBJECTIVES FOR IMPROVEMENT

Strategies to Advance Level	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
1. Establish top-level SO&M executive structure	**Leadership subordinate and top-level accountability absent.**	**SO&M at top level of program management.**	**Integrated, with organizational equivalency.**
	From L1 to L2: SO&M with top management position. Establish first-tier executive in central office and districts with program responsibility, reporting directly to CEO.		*From L2 to L3: SO&M at organizational equivalency of other core programs.* Establish appropriate and parallel relationships and positions regarding reporting relationships, chain of command, unit levels, authorities, and responsibility.
2. Establish appropriate organizational structure	**Functions fragmented and unclear.**	**Functions consolidated and aligned.**	**Integrated.**
	From L1 to L2: SO&M organizational issues identified. Develop organizational concept of operations, rationalizing roles and relationships to key functions.		*From L2 to L3: Efficient and appropriate organizational structure established.* Implement appropriate structure of units (custom tailored).
3. Determine core competencies and training needs	**Needed core capabilities unknown.**	**Aligned, trained.**	**Key positions filled.**
	From L1 to L2: SO&M core capacities identified. Analyze program and organizational needs to develop appropriate knowledge, skill, and ability needs and position descriptions.		*From L2 to L3: SO&M core capacities staffed.* Develop recruitment, retention, training, and succession program to fill needed positions.
4. Establish accountability system	**Accountability vague and conflicting.**	**Responsibilities clarified within SO&M.**	**SO&M responsibilities clarified within all DOT units.**
	From L1 to L2: Clarified responsibilities. Use organizational structure and concept of operations to identify nature of accountability in chain of command for units and individuals.		*From L2 to L3: Organizational units and staff objectives clear.* Develop an approach to accountability-related process and measures between top management and program managers in central office and districts.

Organization and Staffing Strategy 1: Establish Top-Level SO&M Executive Structure

Relationship to Program and Process

Executive leadership at the central office and in the field needs to be equivalent to other programs' (capacity, maintenance) leadership for appropriate representation in policy, resource, staffing, and related decisions.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Leadership Subordinate and Top-Level Accountability Absent

In a Level 1 organization, all core programs, by definition, require equivalent status and level of influence in statewide and district program development, including participation in policy and program development and resource allocation. This implies that SO&M management should be at the first tier of both headquarters and district management.

The following strategies can help raise a Level 1 organization to Level 2:

- Establish first-tier executive responsibility in the central office for the SO&M program, reporting directly to the CEO (this executive may also have responsibility for other programs).
- Establish an assistant to district executives with appropriate reporting to both district executives and statewide program leadership (this executive may also have responsibility for other programs).

Level 2: SO&M at Top Level of Program Management

In a Level 2 organization, the status of the operations organization is equivalent in reporting relationships and chain of command, organizational unit levels, authorities, and responsibility at both the central office and districts.

The following strategy can raise a Level 2 organization to Level 3:

- Establish appropriate reporting and chain-of-command relationships and full-time position status (parallel to construction and maintenance), organizational unit levels, authorities, and responsibility in both the central office and districts.

Level 3: Integrated, with Organizational Equivalency

In a Level 3 organization, a top-level management position with SO&M orientation is established in the central office and districts.

Responsibility

Reorganization at the top level may be a prerogative of the CEO within the central office, although state administration or legislative committee support or both may be necessary.

Organization and Staffing Strategy 2: Establish Appropriate Organizational Structure

Relationship to Program and Process

Organizational structure supports efficient and effective program delivery in the field through clear and efficient disposition of responsibilities and capabilities, with appropriate authority at district and central-office levels and between them.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Functions Fragmented and Unclear

In a Level 1 organization, SO&M units are fragmented and responsibilities are unclear at the central-office, division, or branch level and at the district level, with unclear division of authority, responsibility, and support. Coordination and provision of service to districts is difficult.

The following strategies can help raise a Level 1 organization to Level 2:

- Develop an organizational concept of operations for key processes, roles, key functions, and geography within and between levels (central office, districts, TMCs) regarding responsibilities, scope, chain of command, span of control, and vertical and horizontal relationships. (Note: There is no standard model—organizational structures can vary in how they mediate between function and turf.)
- Clarify boundaries between central-office and district responsibilities and identify central-office support functions needed from a district point of view.

Level 2: Functions Consolidated and Aligned

In a Level 2 organization, the functions and related responsibilities and authorities have been clarified and established (e.g., ITS, systems operations, traffic engineering, TMC management, contracting, asset management).

The following strategies can raise a Level 2 organization to Level 3:

- To achieve management control and accountability, consolidate central-office divisions or units and reporting relationships that are directly responsible for real-time performance.
- Document roles with related procedures within the central office and districts and between them.

Level 3: Integrated

In a Level 3 organization, an efficient and appropriate organizational structure has been established.

Responsibility

CEO and senior SO&M management are in consultation.

Organization and Staffing Strategy 3: Determine Core Competencies and Training Needs

Relationship to Program and Process

SO&M requires technical specialties regarding planning, engineering, TMC, field operations, and contract management. The management of SO&M is also a specialty requiring a broad acquaintance with both the state of the practice and with state DOT administration.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Needed Core Capabilities Unknown

In a Level 1 organization, there is no identification of needed core capabilities; staffing plan or job specifications and key capacities may be missing or their need simply not recognized.

The following strategies can help raise a Level 1 organization to Level 2:

- Determine essential core technical, SO&M (TMC or field), and management capabilities needed in the central office and districts.
- Consider options of internal staffing versus outsourcing for key functions on the basis of a clear business model regarding interagency/partner roles.
- Assess training resource potential (internal and external) and establish formal activity related to position requirements.

Level 2: Aligned, Trained

In a Level 2 organization, SO&M has been professionalized via identification of needed core capabilities, a program to develop and retain the needed capabilities, and a clear succession path.

The following strategies can raise a Level 2 organization to Level 3:

- Develop a clear plan regarding recruitment and training versus outsourcing.
- Establish a succession path, certification, and performance incentives for technical and management staff that are parallel and equivalent to those of other core program areas.
- Develop a human resources dimension for SO&M, including career options and conditions of employment that will attract and retain technical specialties.

Level 3: Key Positions Filled

In a Level 3 organization, SO&M has been professionalized.

Responsibility

This strategy requires task forces of senior staff from headquarters and district management with possible support from industry associations and training entities.

Organization and Staffing Strategy 4: Establish Accountability System

Relationship to Program and Process

As a service focused on system performance—much of it in real time—the SO&M program must justify its claim on resources through performance accountability, at the scale of the entire DOT and its component units.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Accountability Vague and Conflicting

In a Level 1 organization, there is little if any accountability for the service impacts of SO&M activities within TMCs and districts or between districts and central-office management.

The following strategies can help raise a Level 1 organization to Level 2:

- Use organizational structure and concept of operations to identify the nature of performance accountability in the chain of command for units and individuals.
- Scan (survey) internal customers to determine the clarity of responsibility among stakeholders.
- Identify reasonable performance measures (beyond project development measures) for staff and units.

Level 2: Responsibilities Clarified Within SO&M

A Level 2 organization has clarified performance accountability in the chain of command based on program, unit, and individual responsibilities related to SO&M effectiveness. Both units and the DOT, overall, are prepared to report performance publicly.

The following strategies can raise a Level 2 organization to Level 3:

- Develop reporting systems within districts and with top management and program managers in the central office and districts.
- Use performance measures and incentives to improve measurable performance of both key unit activities and strategic applications.
- Report performance to the public in a manner that displays status over time and report current DOT improvement activities in response.

Level 3: SO&M Responsibilities Clarified Within All DOT Units

A Level 3 organization accepts accountability for its SO&M activities (recognizing that the DOT does not control all the variables that affect performance).

Responsibility

Responsibility falls to senior management and unit leaders in cooperation.

RESOURCE ALLOCATION TEMPLATE

This section discusses the resource allocation element of institutional architecture (Table 2.5). Table 2.6 illustrates the levels and the objectives for the next steps to improvement.

TABLE 2.5. RESOURCE ALLOCATION: OPERATIONS MATURITY FRAMEWORK

Institutional Architecture Elements	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
Culture/leadership	Mixed, hero driven	Championed/ internalized across disciplines	Commitment to customer mobility
Organization and staffing	Fragmented, understaffed	Aligned, trained	Integrated
Resource allocation	**Project level**	**Criteria-based program**	**Sustainable budget line item**
Partnerships	Informal, unaligned	Formal, aligned	Consolidated

TABLE 2.6. RESOURCE ALLOCATION: LEVELS AND OBJECTIVES FOR IMPROVEMENT

Strategies to Advance Level	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
1. Develop program-level budget estimate	**Ad hoc project funding.**	**Criteria-based program-level needs estimated.**	**Sustainable budget line item.**
	From L1 to L2: Program-level needs estimates. Conduct analysis of staged needs-based implementation costs, based on priority problem locations, network or corridor applications, infrastructure, and staff costs.	*From L2 to L3: Staged, needs-based program cost estimates.* Develop program plan and related resource requirements to upgrade program by stages, including systems, staffing, and maintenance.	
2. Introduce SO&M as a top-level agency budget line item	**Outside of standard budgeting process.**	**Consolidated program budget developed.**	**Sustainable budget line item.**
	From L1 to L2: Sustainable SO&M budget development. Incorporate SO&M budget as part of annual and multiyear budgeting process.	*From L2 to L3: SO&M as first-tier budget item.* Treat SO&M budget on a parallel basis with other core programs.	
3. Develop acceptance of sustainable resourcing from state funds	**SO&M lacks clear position in state funding.**	**SO&M costs as eligible use of state funding categories.**	**State budget for operations.**
	From L1 to L2: SO&M costs as eligible use of state funding categories. Consider SO&M to be an eligible use of state funds (with or without separate dedicated category).	*From L2 to L3: Sustainable resource provision.* Incorporate into state funding.	
4. Develop methodology for trade-offs	**SO&M cost-effectiveness ignored across programs.**	**Criteria-based program.**	**Rational performance-based investment.**
	From L1 to L2: Rational performance-based investment trade-offs. Make cost–benefit material available to support investment needs via transparent process.	*From L2 to L3: Efficient resource allocation across programs.* Consider SO&M in rational process of performance-based resource allocation.	

Resource Allocation Strategy 1: Develop Program-Level Budget Estimate

Relationship to Program and Process

The development of a continuing and sustainable program involving multiyear capital and operating costs requires a rational and transparent budget process equivalent to those used in other core programs.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Ad Hoc Project Funding

In a Level 1 organization, SO&M strategy applications are often at the project level and funded on an ad hoc, unpredictable basis, or are buried in other projects (capital or maintenance) and subject to other priorities. There is often no knowledge of how much (or how little) is being spent on SO&M.

The following strategies can help raise a Level 1 organization to Level 2:

- As a start, identify a priority, immediate action plan budget with the most visible short-run payoffs, prioritized in response to varying overall agency resources.
- Develop a formal planning process for SO&M, working within the DOT planning and budgeting framework. Analyze costs associated with a long-term strategic program, responding to customer needs at the state-of-practice level, to establish a needs-related baseline for a continuing program.
- Determine regional and strategy-specific investment implications.

Level 2: Criteria-Based Program-Level Needs Estimated

In a Level 2 organization, there are cost estimates for a staged statewide program, including capital, operating, and life-cycle maintenance costs with clear priorities.

The following strategies can raise a Level 2 organization to Level 3:

- Develop a staging plan and budget based on priority problem locations and network or corridor applications, including infrastructure and staff costs.
- Develop a program plan and related resource requirements to upgrade the program by stages, including systems, staffing, and maintenance.

Level 3: Sustainable Budget Line Item

At Level 3, the agency has a needs-related and prioritized, staged program.

Responsibility

Strategy 1 requires a combination of headquarters planning and SO&M program staff, working with districts and MPOs.

Resource Allocation Strategy 2: Introduce SO&M as a Top-Level Agency Budget Line Item

Relationship to Program and Process

SO&M cannot be established as a mainstreamed, long-term, sustainable, continuously improving activity—a program—unless it is part of the formal budgeting process for capital, operations, and staff resources.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Outside of Standard Budgeting Process

In a Level 1 organization, funding levels for SO&M are unpredictable—and typically not known in the aggregate—because funding is from multiple sources at the project levels. There is often no knowledge of the level of funding for comparison with potential benefits—or in comparison with other programs.

The following strategies can help raise a Level 1 organization to Level 2:

- Develop a budgeting process for SO&M resources that is consistent with general agency practice and involves key players.
- Incorporate the SO&M budget in the annual and multiyear budgeting process.

Level 2: Consolidated Program Budget Developed

In a Level 2 organization, SO&M-related costs are aggregated for full accounting—capital, operating, and staffing.

The following strategies can raise a Level 2 organization to Level 3:

- Show the relative level of investment in SO&M in the published budget.
- In the budget cycle, report the cost-effectiveness of past and current investments.

Level 3: Sustainable Budget Line Item

At Level 3, SO&M becomes a first-tier budget item.

Responsibility

The CEO and senior staff are responsible for this strategy.

Resource Allocation Strategy 3: Develop Acceptance of Sustainable Resourcing from State Funds

Relationship to Program and Process

There are often categorical constraints on the use of state funds (capital and maintenance) that restrict use for SO&M directly. The lack of a viable source of funding leads to ad hoc and nontransparent approaches and limits the ability to plan. Furthermore, it is an indication that there is no public policy about, or accountability for, SO&M expenditures.

- Predictable resource flow is essential to rational program planning.
- Transitioning from ad hoc funding (from capital and maintenance programs) requires development of dedicated funding.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: SO&M Lacks Clear Position in State Funding

In a Level 1 organization, resources are suballocated from other program categories.

The following strategies can help raise a Level 1 organization to Level 2:

- Develop a clear DOT position on SO&M (mission, vision, strategy, long- and short-range needs estimates). (Note: It may be necessary to develop an outside stakeholder support entity.)
- Explain the value of sustainable resources to policy makers and seek adjustment in state practice and law, as appropriate, regarding the eligible use of funds or the creation of a separate budget category.

Level 2: SO&M Costs as Eligible Use of State Funding Categories

In a Level 2 organization, SO&M is included in state transportation budgeting procedures as a stand-alone category.

The following strategy can raise a Level 2 organization to Level 3:

- Develop and submit SO&M budget needs to the legislative committee as part of the routine planning and budgeting process.

Level 3: State Budget for Operations

At Level 3, SO&M becomes a separate budget category for state funding.

Responsibility

Responsibility in this strategy is with the highest state policy-making entity (e.g., commission, secretary), with recommendations and staffing from DOT top management.

Resource Allocation Strategy 4: Develop Methodology for Trade-offs

Relationship to Program and Process

In the competition for scarce resources, certain missions related to congestion and safety are most cost-effectively achieved by SO&M—compared with other capital investments. However, this fact is not made explicit in the resource allocation process—internally or externally.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: SO&M Cost-Effectiveness Ignored Across Programs

In a Level 1 organization, there is no rational analysis that relates performance to type of investment. SO&M is not consistently considered in the conventional highway project development process for both budget and investment trade-offs.

The following strategies can help raise a Level 1 organization to Level 2:

- Develop the policy case for the need for more explicit allocation of scarce DOT resources for each major DOT objective (performance-based allocation).
- Develop criteria to evaluate the payoffs from varying investment types (capital, maintenance, operations, etc.) and levels across an array of appropriate objectives, and accounting for the time stream of benefits.
- Develop cost-effectiveness material for key agency performance objectives and demonstrate relative payoffs of different investment mixes.

Level 2: Criteria-Based Program

In a Level 2 organization, performance-related cost-effectiveness is a major factor in resource allocation.

The following strategy can raise a Level 2 organization to Level 3:

- Use performance-related criteria in a rational process of performance-based resource allocation.

Level 3: Rational Performance-Based Investment

At Level 3, the trade-offs between SO&M and capital expenditure are considered as part of the planning process.

Responsibility

The CEO is responsible for this strategy, supported by planning and program staff.

PARTNERSHIPS TEMPLATE

This section discusses the partnership element of institutional architecture (Table 2.7). Table 2.8 illustrates the levels and the objectives for the next steps to improvement.

TABLE 2.7. PARTNERSHIPS: OPERATIONS MATURITY FRAMEWORK

Institutional Architecture Elements	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
Culture/leadership	Mixed, hero driven	Championed/ internalized across disciplines	Commitment to customer mobility
Organization and staffing	Fragmented, understaffed	Aligned, trained	Integrated
Resource allocation	Project level	Criteria-based program	Sustainable budget line item
Partnerships	**Informal, unaligned**	**Formal, aligned**	**Consolidated**

TABLE 2.8. PARTNERSHIPS: LEVELS AND OBJECTIVES FOR IMPROVEMENT

Strategies to Advance Level	Level 1 Ad Hoc	Level 2 Rationalized	Level 3 Mainstreamed
1. Agreement on operational roles and procedures with PSAs	**Informal unaligned relationships.**	**Aligned objectives and roles.**	**Rationalized roles.**
	From L1 to L2: Agreements on DOT/PSA roles and responsibilities. Rationalized roles and responsibilities in light of agency priorities, resources, and effectiveness.		*From L2 to L3: Rationalized state DOT/PSA roles and responsibilities.* Formal interagency-level agreement to develop cooperative approach respecting the objectives of all parties.
2. Identify opportunities for joint operations activities with local government and MPOs	**Limited interactions with local government.**	**Cooperative planning, programming, and operations.**	**Regional cooperative mechanisms in place.**
	From L1 to L2: Cooperative planning, programming, and operations. Cooperative interagency plan for operations (short and long range).		*From L2 to L3: Regional cooperative mechanisms in place.* Integrated strategies with role adjustments for efficiency.
3. Develop procedures that accommodate partners' goals and maximize mobility (minimum disruption)	**Inconsistent application of nominal procedures.**	**Traffic impact-oriented procedures.**	**Aggressive procedures to maximize mobility-based performance measurement activity or outcome measurement.**
	From L1 to L2: Traffic impact-oriented procedures. Development of (new) concepts of operations and related procedures that minimize delay and disruption, irrespective of conventional approaches.		*From L2 to L3: Aggressive procedures to maximize mobility.* Consistent applications of traffic-optimized approaches.
4. Rationalize staff versus outsourcing activities, responsibilities, and oversight	**Inconsistent approach to outsourcing.**	**Basic business model for service delivery.**	**Clarified, rationalized business model for public–private partnerships.**
	From L1 to L2: Basic business model for service delivery. Policy on in-house staff roles in service delivery versus outsourcing or devolved roles.		*From L2 to L3: Clarified, rationalized business model for public–private partnerships.* Consistent approach to outsourcing regarding contracting procedures, performance management, time frame of contracts.

Partnerships Strategy 1: Agreement on Operational Roles and Procedures with Public Safety Agencies

Relationship to Program and Process

Effective delivery of key SO&M strategy applications requires close cooperation between DOTs and public safety agencies (PSAs). Cooperation involves shared priorities, clear roles, and consensus practices that can substantially resolve issues with changes in conventional procedures that may support DOT objectives without compromising those of the partners.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Informal Unaligned Relationships

In a Level 1 organization, there is a modest level of SO&M cooperation and coordination between the state DOT and PSAs. Roles and procedures are informal, personal, and subject to uncertainty with turnover.

The following strategies can help raise a Level 1 organization to Level 2:

- Conduct regional-level joint workshops to develop consensus on goals, best practices, and general procedures.
- Conduct co-training in field procedures and protocols.
- Establish regular debriefings related to major events.

Level 2: Aligned Objectives and Roles

In a Level 2 organization, there are formal, agency-level agreements regarding roles and procedures.

The following strategies can raise a Level 2 organization to Level 3:

- Develop a formal interagency-level agreement (MOU) for the cooperative approach respecting the objectives of all parties and build it into agency policies and plans (especially incident management, work zone traffic control).
- Establish policy evolving toward operations centers and possibly co-location of partners.
- Cooperate with PSAs in support of necessary changes in state law to support improved effectiveness of roles and procedures related to congestion and safety.
- Develop a joint formal commitment to procedural improvement based on performance (such as application timeline targets).

Level 3: Rationalized Roles

At Level 3, roles of agencies are organized for maximum strategy effectiveness.

Responsibility

Some issues can be resolved at the regional level. Major changes in procedures (e.g., Incident Command System or towing) require top management peer-to-peer dialogue supported by examples from other state contexts.

Partnerships Strategy 2: Identify Opportunities for Joint Operations Activities with Local Government and MPOs

Relationship to Program and Process

At the state-of-the-art level, most SO&M strategies involve both state and local government. An essential component of developing a program in a multijurisdictional environment is a strong and institutionalized working relationship among state, local, and regional entities (MPOs) that supports effective regional SO&M planning, programming, and implementation.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Limited Interactions with Local Government

In a Level 1 organization, there is a modest level of SO&M cooperation and coordination between state and local governments (uneven, informal) in terms of developing regional operations solutions and in terms of the capacity (fiscal, technical) of local jurisdictions to play a significant role.

The following strategies can help raise a Level 1 organization to Level 2:

- Develop an interagency task force on SO&M at appropriate geographic levels (region, corridor).
- Prepare a cooperative interagency plan for phased improvement of operations (short and long range).
- Execute agency-level formal agreements with local governments and MPOs regarding rationalized roles and responsibilities in cooperative delivery of SO&M-related services.
- Standardize cooperation mechanisms on a statewide basis.

Level 2: Cooperative Planning, Programming, and Operations

In a Level 2 organization, SO&M is included in the MPO regional plan and programs. Active regional task forces focus on operations issues.

The following strategies can raise a Level 2 organization to Level 3:

- Pursue reorganization of federal and state funding categories and responsibilities at the regional level to include operations.
- Develop multijurisdictional programs (interlocal) for funding and operating non-state facilities and for integrated corridors.
- Consider use of state funds, cost sharing, and technology transfer to incentivize regional cooperation.
- Share or consolidate real-time operational coordination and oversight via TMC, co-location, and staffing.

Level 3: Regional Cooperative Mechanisms in Place

At Level 3, there is an integrated SO&M program at the regional level.

Responsibility

The district level has the lead responsibility for planning and programming, with support from headquarters.

Partnerships Strategy 3: Develop Procedures That Accommodate Partners' Goals and Maximize Mobility (Minimum Disruption)

Relationship to Program and Process

Nominal applications of SO&M strategies—based on narrow roles, mixed priorities, traditional roles, limited ITS—are likely to have little impact on performance.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Inconsistent Application of Nominal Procedures

In a Level 1 organization, there is a lack of agreed-on concepts of operations for all strategy applications and no consistent effort to measure and improve effectiveness.

The following strategies can help raise a Level 1 organization to Level 2:

- Develop external stakeholder (system users) support for substantial improvements in congestion-related procedures and protocols.
- Develop (new) concepts of operations and related procedures that minimize delay and disruption and are beyond conventional roles and practices.
- Agree with partners (e.g., PSAs, local governments) to commit to continuous improvement.

Level 2: Traffic Impact-Oriented Procedures

In a Level 2 organization, there is agreement among partners (public and private) on improved procedures, with performance-based benchmarking against best practice.

The following strategies can raise a Level 2 organization to Level 3:

- Identify and analyze state-of-practice procedures for strategy applications and commit to apply traffic-optimized approaches.
- Develop a mechanism to maintain awareness of industry best practice and new developments beyond existing conventions.
- Cultivate DOT partners' willingness to modify traditional approaches to achieve minimal disruption via demonstrated payoffs in cost, safety, and mobility.

Level 3: Aggressive Procedures to Maximize Mobility-Based Performance Measurement Activity or Outcome Measurement

At Level 3 there is acceptance of a performance-driven process of refinement and upgrading of procedures.

Responsibility

The responsibility should be developed on a statewide basis, although individual districts can take the lead.

Partnerships Strategy 4: Rationalize Staff Versus Outsourcing Activities, Responsibilities, and Oversight

Relationship to Program and Process

Efficient organizational planning is dependent on a clear business model regarding the role of the public and private sectors—including the roles in relation to in-house staff and the approach to managing outsourced activities to meet DOT objectives.

Outsourcing may be considered as a strategy to increase or maintain SO&M in light of staffing or hiring constraints. The private sector may possess unique technology, cost advantages, or management capabilities.

Points of Departure (Levels of Capability) and Related Improvement Strategy

Level 1: Inconsistent Approach to Outsourcing

In a Level 1 organization, the DOT uses outsourcing without clear policy or strategic context regarding the impact on retention of core competencies and without the special skills or procedures needed to manage outsourcing. The existing outsourcing arrangements may lack consistency, performance orientation, and clear interagency understanding.

The following strategies can help raise a Level 1 organization to Level 2:

- Identify issues and options regarding outsourcing (TMC, service safety patrol, towing and recovery, asset management, private data) to meet overall agency technical, staffing, and management objectives and core capacity retention.
- Develop policy on in-house staff roles in service delivery versus outsourcing or devolving roles.

Level 2: Basic Business Model for Service Delivery

In a Level 2 organization, essential core agency capabilities have been identified and a consistent statewide performance management approach to outsourced services has been developed.

The following strategies can raise a Level 2 organization to Level 3:

- Establish a consistent statewide approach to outsourcing with regard to procurement, contracting procedures, performance management, and time frame of contracts.
- Identify and develop a sustainable business model regarding field activity roles (state personnel versus external) that considers all factors of cost, core capacity, accountability, and so forth.

Level 3: Clarified, Rationalized Business Model for Public–Private Partnerships

At Level 3, the DOT has a clear and sustainable business model regarding in-house versus outsourced roles and how they are managed.

Responsibility

The central office is responsible for this strategy.

RELATED RESEARCH

Integrating Business Processes to Improve Travel Time Reliability (L01)
Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes (L05)
Evaluating Alternative Operations Strategies to Improve Travel Time Reliability (L11)
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