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SDDOT Transportation Systems Management & Operations Program Plan Study SD2014-06

Prepared by:
WSP | Parsons Brinckerhoff
One Penn Plaza
New York, NY

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This work was performed under the direction of the SD2014-06 Technical Panel:

Capt. John Broers	SD Highway Patrol	Chad Huwe.....	City of Sioux Falls
Patrick Brueggeman	Office of Research	Ben Orsbon	Office of the Secretary
Joel Jundt.....	Division of Planning & Engineering	Todd Seaman	Rapid City Region
Greg Fuller	Division of Operations	Craig Smith.....	Mitchell Region
David Huft.....	Office of Research	Maj. Dana Svendsen	SD Highway Patrol
Bruce Hunt.....	Federal Highway Administration	Kristi Turman	SD Office of Emergency Mgt.

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16. Abstract The objective of this project is the development of a comprehensive Transportation Systems Management and Operations (TSM&O) Program Plan for the South Dakota Department of Transportation. This plan guides business planning and strategic decision-making to advance SDDOT's currently informal TSM&O program to one with a more effective and formalized approach to incorporating TSM&O into the department's mission, goals and objectives, future planning initiatives at all timescales, and day-to-day activities. It presents a series of recommendations in the form of actions, tasks, and implementation steps. It also provides the rationale or "Business Case" for committing to its recommended actions, additional background on SDDOT's current TSM&O capabilities, and an implementation strategy for executing the plan's recommendations that summarizes each action's feasibility, priority and schedule, and roles for identified SDDOT and partner agency staff.			
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TABLE OF CONTENTS

DISCLAIMER	II
ACKNOWLEDGEMENTS.....	II
TECHNICAL REPORT STANDARD TITLE PAGE	III
TABLE OF CONTENTS	V
LIST OF TABLES.....	VII
LIST OF FIGURES.....	VIII
TABLE OF ACRONYMS.....	IX
CHAPTER 1 RESEARCH SUMMARY	1-1
1.1 EXECUTIVE SUMMARY	1-1
1.2 PROBLEM DESCRIPTION	1-5
1.3 RESEARCH OBJECTIVES	1-5
1.4 TASK DESCRIPTIONS.....	1-6
1.5 FINDINGS, RECOMMENDATIONS AND BENEFITS.....	1-9
CHAPTER 2 INTRODUCTION & THE CASE FOR A TSM&O PROGRAM.....	2-1
2.1 DEFINING A TSM&O PROGRAM AND PLAN	2-1
2.1.1 What is TSM&O?	2-1
2.1.2 What is a TSM&O Program?.....	2-1
2.1.3 What is the TSM&O Program Plan?	2-2
2.2 THE CASE FOR A SOUTH DAKOTA TSM&O PROGRAM	2-3
2.2.1 Why Is TSM&O Important in South Dakota?.....	2-3
2.2.2 Current South Dakota TSM&O Program Activities and Benefits.....	2-5
2.2.3 Why Should South Dakota Invest in Advancing Its TSM&O Program?.....	2-6
2.3 SDDOT TSM&O CAPABILITY IMPROVEMENT BACKGROUND	2-12
2.3.1 TSM&O Program Plan Foundation – Evaluative Concepts	2-12
2.3.2 TSM&O Program Plan Foundation – Tools and SDDOT Results	2-13
2.3.3 TSM&O Program Plan Foundation – State of the Practice.....	2-14
CHAPTER 3 SUMMARY OF ACTIONS AND TASKS	3-1
3.1 OVERVIEW	3-1
3.2 ORGANIZATION & STAFFING.....	3-1
3.2.1 Action O&S-1: Establish a TSM&O Structure within SDDOT	3-2
3.2.2 Action O&S-2: Develop Staff Capabilities for TSM&O	3-3
3.3 CULTURE	3-4
3.3.1 Action CUL-1: Establish the Business Case for TSM&O	3-5
3.3.2 Action CUL-2: Articulate and Establish the Appropriate Level of TSM&O Program Status.....	3-6
3.3.3 Action CUL-3: Adjust SDDOT Mission, Vision, Strategic Objectives, and Performance Goals to Align with TSM&O.....	3-6
3.3.4 Action CUL-4: Implement an Outreach Strategy to Customers in Support of TSM&O	3-7
3.4 COLLABORATION	3-7
3.4.1 Action COL-1: Establish TSM&O Functions at the Regional Level	3-8
3.4.2 Action COL-2: Expand TSM&O Capabilities among Partners.....	3-9
3.5 BUSINESS PROCESSES.....	3-9
3.5.1 Action BP-1: Establish a Planning and Project Development Process for TSM&O/ITS Projects.....	3-10
3.6 SYSTEMS & TECHNOLOGY	3-12
3.6.1 Action S&T-1: Update the Statewide ITS Architecture.....	3-12

3.6.2	Action S&T-2: Develop Guidance on Using the Systems Engineering Process.....	3-13
3.6.3	Action S&T-3: Determine the Most Appropriate Ways to Carry Out Typical TOC-Related Activities	3-14
3.6.4	Action S&T-4: Develop and Apply Operations Guidance	3-14
3.7	PERFORMANCE MEASUREMENT	3-15
3.7.1	Action PM-1: Develop a Pilot Performance Measurement Program	3-16
3.7.2	Action PM-2: Develop a Performance Measurement Plan	3-16
CHAPTER 4	IMPLEMENTATION STRATEGY.....	4-1
4.1	PRIORITIES AND SCHEDULE.....	4-1
4.2	FEASIBILITY AND RESOURCE IMPLICATIONS	4-2
4.3	STAFF ROLES	4-2
4.4	IMMEDIATE IMPLEMENTATION STRATEGY	4-2
4.4.1	Task O&S-1a: TSM&O Implementation Team	4-5
4.4.2	Task CUL-1a: Business Case Preparation.....	4-5
4.4.3	Task CUL-2a: Leadership Commitment to TSM&O.....	4-5
CHAPTER 5	RECOMMENDATIONS: ACTIONS, TASKS AND IMPLEMENTATION STEPS	5-1
5.1	OVERVIEW	5-1
5.2	ORGANIZATION & STAFFING.....	5-1
5.2.1	Introduction to Organization & Staffing.....	5-1
5.2.2	Action O&S-1: Establish a TSM&O Structure within SDDOT	5-2
5.2.3	Action O&S-2: Develop Staff Capabilities for TSM&O	5-7
5.3	CULTURE	5-10
5.3.1	Introduction to Culture	5-10
5.3.2	Action CUL-1: Establish the Business Case for TSM&O	5-11
5.3.3	Action CUL-2: Articulate and Establish the Appropriate Level of TSM&O Program Status.....	5-14
5.3.4	Action CUL-3: Adjust SDDOT Mission, Vision, Strategic Objectives, and Performance Goals to Align with TSM&O.....	5-17
5.3.5	Action CUL-4: Implement an Outreach Strategy to Customers in Support of TSM&O	5-20
5.4	COLLABORATION	5-24
5.4.1	Introduction to Collaboration	5-24
5.4.2	Action COL-1: Establish TSM&O Functions at the Regional Level	5-25
5.4.3	Action COL-2: Expand TSM&O Capabilities among Partners.....	5-29
5.5	BUSINESS PROCESSES.....	5-32
5.5.1	Introduction to Business Processes.....	5-32
5.5.2	Action BP-1: Establish a Planning and Project Development Process for TSM&O/ITS Projects.....	5-32
5.6	SYSTEMS & TECHNOLOGY	5-43
5.6.1	Introduction to Systems & Technology	5-43
5.6.2	Action S&T-1: Update the Statewide ITS Architecture.....	5-43
5.6.3	Action S&T-2: Develop Guidance on Using the Systems Engineering Process.....	5-45
5.6.4	Action S&T-3: Determine the Most Appropriate Ways to Carry Out Typical TOC-Related Activities	5-49
5.6.5	Action S&T-4: Develop and Apply Operations Guidance	5-51
5.7	PERFORMANCE MEASUREMENT	5-54
5.7.1	Introduction to Performance Measurement.....	5-54
5.7.2	Action PM-1: Develop a Pilot Performance Measurement Program	5-55
5.7.3	Action PM-2: Develop a Performance Measurement Plan	5-61
APPENDIX A:	STATE DOT WEBSITES WITH TSM&O EMPHASIS.....	A-1
APPENDIX B:	STATE DOT TSM&O ORGANIZATIONAL STRUCTURE REFERENCES.....	B-1

LIST OF TABLES

TABLE 1-1: SUMMARY OF THE SDDOT TSM&O PROGRAM PLAN’S RECOMMENDED ACTIONS.....	1-3
TABLE 2-1: SOUTH DAKOTA DOT TSM&O ACTIVITIES	2-5
TABLE 2-2: STATUS OF TSM&O ACTIVITIES, OPPORTUNITIES AND BENEFITS	2-7
TABLE 2-3: 2013 TSM&O CAPABILITY IMPROVEMENT WORKSHOP RESULTS (SHADED) ^A	2-15
TABLE 2-4: 2014 TSM&O CAPABILITY MATURITY IMPLEMENTATION PLAN ACTIONS AND STATUS	2-16
TABLE 5-1: TASK O&S-1A – IMPLEMENTATION STEPS.....	5-5
TABLE 5-2: TASK O&S-1B – IMPLEMENTATION STEPS.....	5-6
TABLE 5-3: TASK O&S-1C – IMPLEMENTATION STEPS.....	5-7
TABLE 5-4: TASK O&S-2A – IMPLEMENTATION STEPS.....	5-9
TABLE 5-5: TASK O&S-2B – IMPLEMENTATION STEPS.....	5-10
TABLE 5-6: TASK CUL-1A – IMPLEMENTATION STEPS	5-12
TABLE 5-7: TASK CUL-1B – IMPLEMENTATION STEPS.....	5-13
TABLE 5-8: TASK CUL-2A – IMPLEMENTATION STEPS	5-15
TABLE 5-9: TASK CUL-2B – IMPLEMENTATION STEPS.....	5-16
TABLE 5-10: EXAMPLE STATE DOT MISSIONS, VISIONS AND STRATEGIC OBJECTIVES	5-18
TABLE 5-11: TASK CUL-3A – IMPLEMENTATION STEPS	5-19
TABLE 5-12: TASK CUL-3B – IMPLEMENTATION STEPS.....	5-20
TABLE 5-13: EXAMPLE SDDOT CUSTOMER SEGMENTS	5-21
TABLE 5-14: TASK CUL-4A – IMPLEMENTATION STEPS	5-23
TABLE 5-15: TASK CUL-4B – IMPLEMENTATION STEPS.....	5-24
TABLE 5-16: TASK COL-1A – IMPLEMENTATION STEPS	5-27
TABLE 5-17: TASK COL-1B – IMPLEMENTATION STEPS	5-28
TABLE 5-18: TASK COL-2A – IMPLEMENTATION STEPS	5-30
TABLE 5-19: TASK COL-2B – IMPLEMENTATION STEPS	5-31
TABLE 5-20: IOWA DOT ICE-OPS CONSTRUCTION PROJECT CRITERIA AND WEIGHTING	5-35
TABLE 5-21: TASK BP-1A – IMPLEMENTATION STEPS.....	5-38
TABLE 5-22: TASK BP-1B – IMPLEMENTATION STEPS.....	5-39
TABLE 5-23: TASK BP-1C – IMPLEMENTATION STEPS.....	5-40
TABLE 5-24: TASK BP-1D – IMPLEMENTATION STEPS	5-41
TABLE 5-25: TASK BP-1E – IMPLEMENTATION STEPS.....	5-42
TABLE 5-26: TASK S&T-1A – IMPLEMENTATION STEPS	5-45
TABLE 5-27: TASK S&T-1B – IMPLEMENTATION STEPS	5-45
TABLE 5-28: TASK S&T-2A – IMPLEMENTATION STEPS	5-47
TABLE 5-29: TASK S&T-2B – IMPLEMENTATION STEPS	5-48
TABLE 5-30: TASK S&T-3A – IMPLEMENTATION STEPS	5-51
TABLE 5-31: TASK S&T-4A – IMPLEMENTATION STEPS	5-53
TABLE 5-32: TASK S&T-4B – IMPLEMENTATION STEPS	5-54
TABLE 5-33: TASK PM-1A – IMPLEMENTATION STEPS	5-59
TABLE 5-34: TASK PM-1B – IMPLEMENTATION STEPS	5-60
TABLE 5-35: TASK PM-2A – IMPLEMENTATION STEPS	5-62
TABLE 5-36: TASK PM-2B – IMPLEMENTATION STEPS	5-63

LIST OF FIGURES

FIGURE 2-1: SOURCES OF NON-RECURRING CONGESTION	2-4
FIGURE 4-1: IMPLEMENTATION SCHEDULE	4-3
FIGURE 5-1: SDDOT ORGANIZATION CHART.....	5-3
FIGURE 5-2: EXAMPLE WEB-BASED CUSTOMER FEEDBACK	ERROR! BOOKMARK NOT DEFINED.
FIGURE 5-3: SDDOT STIP PROCESS.....	5-33
FIGURE 5-4: NEVADA DOT TSM&O STRATEGY PRIORITIZATION MATRIX.....	5-37
FIGURE 5-5: CAUSES OF CONGESTION IN RURAL AREAS	5-57

TABLE OF ACRONYMS

Acronym	Definition
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ATDM	Active Transportation and Demand Management
BIT	Bureau of Information and Telecommunications
CAD	Computer-Aided Dispatch
CAV	Connected and Automated Vehicles
CHART	Coordinated Highways Action Response Team
CITE	Consortium for ITS Training and Education
CMM	Capability Maturity Model
CVISN	Commercial Vehicle Information Systems and Networks
DMS	Dynamic Message Sign
EOC	Emergency Operations Center
ESS	Environmental Sensor Station
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
HP	Highway Patrol
ICE	Interstate Condition Evaluation
ICE-OPS	Interstate Condition Evaluation-Operations
ITRP	Integrated Transportation Reliability Program
ITS	Intelligent Transportation Systems
LOS	Level of Service
LOTTR	Level of Travel Time Reliability
LTAP	Local Technical Assistance Program
MDSS	Maintenance Decision Support System
MIS	Major Investment Study
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
RWIS	Road Weather Information System
SDDOT	South Dakota Department of Transportation
SHRP2	Second Strategic Highway Research Program
STIP	State Transportation Improvement Program
STRAHNET	Strategic Highway Network
TIM	Traffic Incident Management
TMC	Transportation Management Center
TOC	Traffic Operations Center
TSM&O	Transportation Systems Management and Operations
TTAP	Tribal Technical Assistance Program
USDOT	United States Department of Transportation
VSL	Variable Speed Limits
WZ	Work Zone

CHAPTER 1 RESEARCH SUMMARY

This Research Summary identifies the research project’s problem description, objectives, approach, and task descriptions. It begins with an Executive Summary suitable for an audience that wants to understand the project from an outside perspective, i.e. for those not involved with the development of the Transportation Systems Management & Operations Program Plan or that will be using it to guide internal decision-making.

1.1 Executive Summary

This project developed a Transportation Systems Management and Operations (TSM&O) Program Plan for the South Dakota Department of Transportation (SDDOT).

TSM&O is a set of activities and strategies to manage transportation systems and resources in order to optimize system operation, improve safety, and anticipate and manage traffic congestion and impacts to system reliability. TSM&O is used to directly manage the causes of non-recurring and recurring congestion in real time and take actions to respond to events that affect the operation of the transportation system. TSM&O strategies and activities help to ensure that the roadway network is used to its optimal extent, ensuring trips are efficient, reliable and safe, and agency operations are cost-effective. One example is systems and programs that provide traveler information to users of the transportation network so they can make informed decisions on when and where to travel—to avoid a traffic incident or bad weather, for example. Another example is the use of computer information systems to optimally and efficiently manage the treatment and clearance of roadways during winter weather events.

Agencies that successfully apply TSM&O strategies do not do so simply with ample budgets and strong technical skills. Rather, critical business processes and institutional arrangements must be in place to support activities that typically require several groups of people, often from different agencies, to collaborate, communicate, and execute.

To help organize this desired structure, the concept of a “TSM&O Program” is introduced. A TSM&O Program is a set of goals, actions, and priorities that establishes TSM&O as a formal, critical activity in the state. It sets out what TSM&O is in South Dakota, what it is meant to accomplish, and with what levels of agency capability. These capabilities include appropriate institutional, organizational, collaborative, and technical capacities. A TSM&O Program should include setting objectives, planning, executing, managing, sustaining, and improving TSM&O strategies in a clear and deliberate manner.

Today, South Dakota’s TSM&O Program is informal, with strategies applied on an as-needed basis, generally without comprehensive consideration of the supporting processes and institutional arrangements cited above. This approach to TSM&O has generally sufficed to implement a number of critical TSM&O activities across the state. Important examples include managing winter weather events, traffic incidents, work zones, special events such as the Sturgis Motorcycle Rally, and urban arterial traffic signal operations.

SDDOT recognizes that it could continue with business as usual—planning, deploying, and managing TSM&O strategies and technology applications in a relatively informal manner—and continue to see successful outcomes and incremental progress. However, many managers and staff also recognize that there is significant room for improvement and compelling reasons to invest—even just modestly—in advancing SDDOT’s TSM&O program. Improvements and investment will help sustain and enhance existing TSM&O strategy benefits, allow the department to make better investment decisions under tightening fiscal constraints, address future system safety and reliability issues, and accommodate evolving technology applications and system demands.

To identify, prioritize, and track the requirements of advancing SDDOT’s TSM&O program, a TSM&O program plan has been prepared primarily through 1) a review of background documentation on SDDOT TSM&O activities, related plans, and relevant regional and national experience and research; and 2) in-person and phone interviews with staff from SDDOT, South Dakota Department of Public Safety, Bureau of Information and Telecommunications, City of Sioux Falls, City of Rapid City, Sisseton Wahpeton Oyate, local law enforcement, South Dakota Trucking Association, Federal Highway Administration, and Federal Motor Carrier Safety Association.

The plan presents a series of recommendations in the form of actions, tasks, and implementation steps. It also provides the rationale or “Business Case” for committing to its recommendations, additional background on SDDOT’s current TSM&O capabilities, and an implementation strategy for plan execution that summarizes each action’s feasibility, priority and schedule, and roles for identified SDDOT and partner agency staff. The plan does not identify specific TSM&O or Intelligent Transportation Systems (ITS) capital and non-capital projects but rather focuses on the key business process and institutional capabilities that research has shown are critical to effective TSM&O programs. These are:

- **Organization & Staffing** including organizational structure, staff development, and recruitment and retention
- **Culture** including technical understanding, leadership, outreach, and program legal authority
- **Collaboration** including relationships with public safety agencies, local governments, metropolitan planning organizations and the private sector
- **Business Processes** including formal project planning, programming, budgeting, and development
- **Systems & Technology** including use of systems engineering, systems architecture standards, interoperability, and standardization

Performance Measurement including measures definition, data acquisition, and use **Table 1-1** summarizes the plan’s recommended actions organized by TSM&O capability dimension.

Table 1-1: Summary of the SDDOT TSM&O Program Plan's Recommended Actions

Action	Outcome Summary and Component Tasks
Organization & Staffing (O&S)	
O&S-1: Establish a TSM&O Structure within SDDOT	Provides a TSM&O focus throughout the department, sets expectations, manages the program, and introduces consistency into TSM&O strategy and system development and execution. Includes establishing a TSM&O Implementation Team, TSM&O Managerial Level Focus, and TSM&O Senior Leadership Position.
O&S-2: Develop Staff Capabilities for TSM&O	Improves TSM&O training for staff and recruitment and retention of staff knowledgeable in TSM&O strategies and systems. Consists of Division of Operations staff training and department-wide staff TSM&O training.
Culture (CUL)	
CUL-1: Establish the Business Case for TSM&O	Provides methods and means to articulate purpose and benefits for making investments in TSM&O capabilities and strategies—internally to staff and leadership, externally to decision makers, and to the public and stakeholders. Comprises business case preparation and applying the business case in a variety of contexts.
CUL-2: Articulate and Establish the Appropriate Level of TSM&O Program Status	Affirms that TSM&O is a department priority and cultivates broader staff understanding of TSM&O. Includes leadership commitment to TSM&O and TSM&O awareness and focus among staff.
CUL-3: Adjust SDDOT Mission, Vision, Strategic Objectives, and Performance Goals to Align with TSM&O	Affirms that TSM&O is a department priority and sets targets to guide and communicate the department's decision making on TSM&O investments and methods to measure success. Consists of setting TSM&O strategic objectives and aligning the SDDOT mission and vision with TSM&O.
CUL-4: Implement an Outreach Strategy to Customers in Support of TSM&O	Provides greater ability to make investments that directly respond to the needs of system users as well as awareness and enhanced use of SDDOT TSM&O tools. Involves meeting customer segments' needs with TSM&O and developing TSM&O outreach strategy components.
Collaboration (COL)	
COL-1: Establish TSM&O Functions at the Regional Level	Permits increased effectiveness and efficiencies when working with partners on TSM&O strategy execution, avoids loss of institutional knowledge, increases TSM&O awareness through collaboration, and improves incident management and response. Includes creation of regional traffic incident management support groups and regional TSM&O review meetings.
COL-2: Expand TSM&O Capabilities among Partners	Accomplishes the same outcomes as above through creation of TSM&O planning guidance for local partners and department-provided TSM&O support for local partners.
Business Processes (BP)	
BP-1: Establish a Planning and Project Development Process for TSM&O/ITS Projects	Yields a structured method for identifying and implementing cost-effective alternatives to traditional capital improvements, an ability to document and communicate future TSM&O needs, and coordinated, more efficient capital project implementation that combines TSM&O or ITS improvements or upgrades with traditional capital projects. Includes an interim process for TSM&O planning, a standard process for TSM&O planning, a standard TSM&O deployment plan, TSM&O integration into the capital programming process, and TSM&O integration into the project development process.

Table 1-1: Summary of the SDDOT TSM&O Program Plan's Recommended Actions

Action	Outcome Summary and Component Tasks
Systems & Technology (S&T)	
S&T-1: Update the Statewide ITS Architecture	Results in an updated roadmap for ITS system integration, which will ensure cost-effective technology deployment and that systems are deployed to get the most out of each one and will be able to fulfill the needs of stakeholders. Consists of ITS architecture software training and an update to the statewide ITS architecture.
S&T-2: Develop Guidance on Using the Systems Engineering Process	Provides cost-effective implementation of ITS elements and systems and engagement of stakeholders (local partner agencies) in the process. Consists of systems engineering process training and development of systems engineering process guidance.
S&T-3: Determine the Most Appropriate Ways to Carry Out Typical Traffic Operations Center-Related Activities	Allows for a central focal point in identifying internal and partner agency staff communication needs and mechanisms related to TSM&O, more consistent responses to incidents and emergencies, and enhanced and facilitated debriefings and after-action reviews. Requires the development of traffic operations center roles, responsibilities, and protocols.
S&T-4: Develop and Apply Operations Guidance	Provides clear expectations on operational roles and actions across the department to increase consistency and efficiency. Comprises establishing the priority and form for operations guidance and developing selected guidance.
Performance Measurement (PM)	
PM-1: Develop a Pilot Performance Measurement Program	Focuses attention on activities that affect performance the most, provides a mechanism to effectively meet federal performance measurement requirements, and yields quantifiable information to stakeholders and decision-makers about SDDOT performance improvements. Requires defining a performance measurement process and pilot.
PM-2: Develop a Performance Measurement Plan	Accomplishes the same outcomes as above by building on the pilot process outcomes. Consists of conducting a performance measurement process update and preparing a performance measurement implementation plan.

The TSM&O Program Plan can be used in several ways: as a business plan for near-term decision making, initiative planning and prioritization; as a strategic plan for longer-term decision making, initiative guidance and target setting; and as a stepwise implementation manual for executing selected initiatives (actions).

To start with, SDDOT's demonstrated commitment to the TSM&O Program Plan and a clear path to beginning its implementation necessitate the plan's formal adoption. Project panel members have agreed that adoption of the plan is defined by concurrence with the business case and the overarching vision and goals of the plan. In addition, three tasks are selected for immediate implementation. They are critical for taking the next steps beyond completion of the plan and advancing toward feasible and sustained implementation in the immediate, near, mid, and long-term. The three immediate tasks are:

- **Creating a TSM&O Implementation Team (Task O&S-1a)** – An interim TSM&O Implementation Team must be established to begin considering and carrying out the plan's next steps. It should be responsible for selecting and prioritizing the plan's actions and tasks. A team approach is recommended for further plan implementation decision-making, with membership representing a cross section of the functional areas throughout the department.
- **Preparing the TSM&O Business Case (Task CUL-1a)** – Completion of the business case for TSM&O and the TSM&O Program is an immediate need to obtain as great a level of participant buy-in and understanding as possible for plan adoption and initial execution. Business case

material presented in the plan can be refined, organized, formatted, and branded in ways that most effectively suit intended audiences. They include internal SDDOT staff not familiar with TSM&O, leadership, decision makers, and peer staff among SDDOT state and local agency partners, members of the state legislature, and the public. Goals and outcomes of the TSM&O program and plan must be highlighted so that further actions and tasks can successfully be implemented.

- **Obtaining Leadership Commitment to TSM&O (Task CUL-2a)** – Commitment to SDDOT’s TSM&O Program and the plan’s vision and goals must start with department leadership. They are the driving force behind supplying the necessary resource commitment, fostering implementation momentum and staff buy-in, and cultivating external recognition (e.g. from the legislature and public) of TSM&O as an SDDOT priority. The SDDOT Executive Team should endorse the plan and its implementation strategy and approve the plan’s formal adoption. Subsequently, leadership should be actively involved in supporting the program plan’s actions and tasks and promoting its goals and accomplishments, both within the department and to external decision makers and stakeholders.

1.2 Problem Description

Like many states, South Dakota recognizes the need to advance its transportation systems management and operations (TSM&O) capabilities to better address agency efficiency and a number of sources of non-recurring (and in some cases, recurring) congestion and impacts to system reliability and safety.

Agencies that successfully apply TSM&O strategies do not do so simply with ample budgets and strong technical skills. Rather, critical business processes and institutional arrangements must be in place to support activities that typically require several groups of people, often from different agencies, to collaborate, communicate, and execute.

Achieving this desired structure requires having a more formal “TSM&O Program” in place. A TSM&O Program is a set of goals, actions, and priorities that establishes TSM&O as a formal, critical activity in the state. It sets out what TSM&O is in South Dakota, what it is meant to accomplish, and with what levels of agency capability. These capabilities include appropriate institutional, organizational, collaborative, and technical capacities. A TSM&O Program should include setting objectives, planning, executing, managing, sustaining, and improving TSM&O strategies in a clear and deliberate manner.

In order to identify, prioritize, and track the requirements of advancing SDDOT’s TSM&O Program, a plan should be in place—a TSM&O Program Plan.

1.3 Research Objectives

Project SD2014-06 had a single objective: *Develop a comprehensive Transportation Systems Management and Operations (TSM&O) Program Plan for the South Dakota Department of Transportation.*

This plan guides business planning and strategic decision-making to advance SDDOT's currently informal TSM&O program to one with a more effective and formalized approach to incorporating TSM&O into the department's mission, goals and objectives, future planning initiatives at all timescales, and day-to-day activities.

The plan does not identify specific TSM&O or Intelligent Transportation Systems (ITS) capital and non-capital projects (respectively, for example, Dynamic Message Signs (DMS) installations or traffic operations center services). As recommended by this plan, these TSM&O project, or "deployments," can be identified as part of a more formal TSM&O planning process and ultimately augment the program plan.

The plan can be used in several ways:

- as a **business plan** for near-term decision making, initiative planning and prioritization
- as a **strategic plan** for longer-term decision making, initiative guidance and target setting
- as a stepwise **implementation manual** for executing selected initiatives (actions)

1.4 Task Descriptions

The research project comprised eight tasks.

- **Task 1 - Meet with panel to review scope and work plan** – The project began with a kick-off meeting with the Project Panel via web conference. Discussion took place about the project's goals, work plan, and approach. The Project Panel provided direction on desired project outcomes. The FHWA-sponsored TSM&O Capability Maturity Assessment workshop's outcomes held in November 2013 were reviewed. The group provided the status of that workshop's 10 Implementation Plan action items, including the preparation of a TSM&O program plan. The group also discussed recommended stakeholder interviews for Task 2.
- **Task 2 - Review SDDOT maturity plan and other documents** – The project team reviewed background documentation on SDDOT TSM&O activities, related plans, and relevant regional and national experience and research. Three documents served as the primary inputs to the focus area discussions by virtue of being the precursor work to the decision to develop a TSM&O Program Plan (Nos. 1 and 2 below) and by providing a proposed framework for developing the program plan (No. 3):
 - SDDOT TSM&O Capability Workshop Output (Nov. 2013)
 - SDDOT TSM&O Capability Implementation Plan (Mar. 2014)
 - Program Planning and Development for TSM&O for State Departments of Transportation, NCHRP 20-07 Task 345 (Jun. 2014)

We also reviewed the following documents (some of which were made available later in the project after Task 2 was complete):

- SDDOT Organization Chart

- SD Department of Public Safety Organization Chart
 - “National Traffic Incident Management Responder Training Program Training Status Report” (Apr. 18, 2016)
 - SDDOT 2015 Statewide Customer Satisfaction Assessment DRAFT Final Report, Project SD2015-07 (Mar. 2016)
 - “South Dakota Department of Transportation (SDDOT) Regional Traveler Information System for Weather Responsive Traffic Management,” FHWA-JPO-16-325
 - 2016–2019 SDDOT Statewide Transportation Improvement Program (STIP)
 - SDDOT 2015 Strategic Plan (Jul. 2015 – Jun. 2016)
 - I-229 Major Investment Study (meeting minutes)
 - Traffic Control Plan Sturgis Rally – 2015
 - North/West Passage Regional Operations Forum Summary (May 2015)
 - SDDOT 2014 Annual Report
 - North/West Passage Project 8.2: Concepts for Rural TMC/TOC Operations (Aug. 2014)
 - South Dakota Strategic Highway Safety Plan (Feb. 2014)
 - SDDOT 2011 Statewide Customer Satisfaction Assessment Executive Briefing
 - “Research & Implementation Process Summary,” SDDOT Office of Research (Jan. 2011)
 - South Dakota Statewide Long Range Transportation Plan (Sep. 2010)
 - Draft Traffic Incident Management Plan, Project SD2008-02 (Aug. 2009)
 - Traffic Operations Center Concepts for South Dakota Final Report, Project SD2005-04 (Jun. 2006)
- **Task 3 - Conduct interviews with SDDOT stakeholders and partners** – The project team conducted in-person interviews (66 participants) and phone interviews (14 participants) with staff from SDDOT, South Dakota Department of Public Safety, Bureau of Information and Telecommunications, City of Sioux Falls, City of Rapid City, Sisseton Wahpeton Oyate, local law enforcement, South Dakota Trucking Association, Federal Highway Administration, and Federal Motor Carrier Safety Association. Most interviews were conducted in groups of two to six people; several were with just one individual.

Interviews ascertained participants’ role and/or awareness of others’ roles in carrying out TSM&O activities as well as thoughts on the need for a formal program of activities, strengths and weaknesses of the existing TSM&O program, and recent progress made or obstacles encountered in advancing TSM&O plans, procedures, and activities. Depending on the group, the interviews explored specific processes, organizational relationships, and investment strategies related to TSM&O activities, such as traffic incident management (TIM), special event management, winter maintenance, traveler information, ITS deployments, and others.

- **Task 4 - Summarize Task 1–3 findings and work plan refinements** – The project team organized the information extracted from the Task 2 document review and the Task 3 interview notes, as well as insights from the Task 1 Project Panel meeting, into eight “focus areas”:
 - Customer Communication
 - Communicating Practice Internally
 - Staffing
 - ITS Knowledge and Responsibility
 - Project Development Process
 - Formality of TSM&O Program Roles and Responsibilities among SDDOT and Other State Agencies
 - Relationship with Local Entities
 - Agriculture and Rural Freight Movement Issues

The focus areas allowed the most prominent issues uncovered during the interviews (and supported with evidence from the documentation review) to be presented in a logical manner and to facilitate incorporation into a proposed structure and content for the TSM&O Program Plan. Each of the eight focus areas includes evidence and discussion of:

- progress to date and what works well
- opportunities and what needs improvement
- findings’ implications on the TSM&O program plan, including potential outcomes or targets for improvement and leveraging activities or recommendations suggested during the course of the interviews or already planned

The focus area discussion and a refined explanation of the TSM&O Program Plan’s purpose, use, and proposed structure, including a plan outline were presented in a Task 4 Technical Memorandum and via web conference with the Project Panel.

- **Task 5 - Develop and present draft TSM&O program plan** – Using the material compiled in the prior tasks and summarized in the Task 4 memo, the project team prepared a draft TSM&O program plan. The structure and content of the plan evolved some since the Task 4 memo and includes the following components:
 - *Chapter 2: Introduction and the Case for a TSM&O Program* – presents background information and definitions and the “business case” for investing in TSM&O and a TSM&O Program
 - *Chapter 3: Summary of Actions and Tasks* – provides a summary version of the plan’s recommendations intended for a management audience
 - *Chapter 4: Implementation Strategy* – outlines the implementation strategy for executing the plan, including priorities and schedule, feasibility and resource implications, and staff roles

- *Chapter 5: Recommendations: Actions, Tasks and Implementation Steps* – provides detailed descriptions of the plan’s recommendations organized around actions, tasks, and specific implementation steps

Prior to finalizing the draft program plan, three web conference presentations to the Project Panel were held to solicit feedback on the proposed recommendations.

- **Task 6 - Refine plan and propose implementation strategy** – The project team revised the draft plan based on feedback from the Project Panel. An implementation strategy was included in the Task 5 draft plan and refined as well.
- **Task 7 - Prepare final report in accordance with SDDOT guidelines** – With agreement from the SDDOT project manager, Chapter 1 of this document constitutes the project’s final report when combined with the findings and conclusions, implementation recommendations, and research benefits documented in the TSM&O Program Plan (Chapters 2–5) itself.
- **Task 8 - Prepare and present an executive presentation to board** – A final presentation was delivered to the SDDOT Research Review Board on June 14, 2016. This was immediately preceded by a final meeting with the Project Panel to discuss plan implementation and next steps for the department now that the plan is complete.

1.5 Findings, Recommendations and Benefits

The remaining components of an SDDOT research project final report are embodied in the TSM&O Program Plan itself:

- **Findings and Conclusions** – The Chapter 5 Recommendations: Actions, Tasks and Implementation Steps includes background material constituting the findings from examining SDDOT’s current approach to and capability for TSM&O activities. Results presented in the Task 4 memo and compiled from additional examination of peer agency practice during the course of plan development are incorporated into these sections of Chapter 5. Some findings and conclusions are also embedded in the Chapter 2 TSM&O business case.
- **Implementation Recommendations** – Chapter 5 also constitutes the project’s recommendations in detailed form. Chapter 3 presents them in a management audience summary. An implementation strategy and schedule is mapped out in Chapter 4.
- **Research Benefits** – The benefits of the research performed and the recommendations are inherent throughout the detailed discussion of actions, tasks, and implementation steps. They are also presented in the Chapter 2 TSM&O business case.

CHAPTER 2 INTRODUCTION & THE CASE FOR A TSM&O PROGRAM

2.1 Defining a TSM&O Program and Plan

2.1.1 What is TSM&O?

Transportation Systems Management and Operations (TSM&O) is a set of activities and strategies to manage transportation systems and resources in order to optimize system operation, improve safety, and anticipate and manage traffic congestion and impacts to system reliability. TSM&O is used to directly manage the causes of non-recurring and recurring congestion in real time and take actions to respond to events that affect the operation of the transportation system. TSM&O strategies and activities help to ensure that the roadway network is used to its optimal extent, ensuring trips are efficient, reliable and safe, and agency operations are cost-effective.

TSM&O is defined formally in federal law (as shown to the right) and includes a comprehensive list of strategies. Traditionally, TSM&O calls to mind applications in heavily congested urban regions or corridors, and certainly a number of the strategies apply primarily to those situations—for example, active transportation and demand management, arterial management strategies or congestion pricing. But many apply broadly to all contexts, including rural environments, corridors with low traffic, and regions with little recurring (peak period) congestion or bottlenecks.

2.1.2 What is a TSM&O Program?

Agencies that successfully apply TSM&O strategies do not do so simply with ample budgets and strong technical skills. Rather, critical business processes and institutional arrangements must be in place to support activities that typically require several groups of people, often from different agencies, to

TSM&O Defined in Federal Law

Federal legislation enacted in 2012—the Moving Ahead for Progress in the 21st Century (MAP-21)—defines TSM&O as “*integrated strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system.*” These strategies include:

- Traffic detection and surveillance
- Corridor management
- Freeway management
- Arterial management
- Active transportation and demand management (ATDM)
- Work zone management
- Emergency management
- Traveler information services
- Congestion pricing
- Parking management
- Automated enforcement
- Traffic control
- Commercial vehicle operations
- Freight management
- Coordination of highway, rail, transit, bicycle, and pedestrian operations

TSM&O also includes coordination of the implementation of regional transportation system management and operations investments that require agreements, integration, and interoperability to achieve targeted system performance, reliability, safety, and customer service levels. These include:

- Traffic incident management
- Traveler information services
- Emergency management
- Roadway weather management
- Intelligent transportation systems (ITS)
- Communication networks

collaborate, communicate, and execute.

To help organize this desired structure, the concept of a “TSM&O Program” is introduced. A TSM&O Program is a set of goals, actions, and priorities that establishes TSM&O as a formal, critical activity in the state. It sets out what TSM&O is in South Dakota, what it is meant to accomplish, and with what levels of agency capability. These capabilities include appropriate institutional, organizational, collaborative, and technical capacities. A TSM&O Program should include setting objectives, planning, executing, managing, sustaining, and improving TSM&O strategies in a clear and deliberate manner.

A TSM&O Program—one that is afforded comparable attention and priority to longstanding state DOT programs such as capital construction and bridge or pavement management—requires a broad set of department capabilities. A TSM&O Program is supported by:

- agency leadership commitment
- formal planning and programming processes
- appropriate systems and technology
- sufficient organization and staffing resources, including appropriate positions, technical skills, and communication
- collaboration internally and externally with public and private partners
- performance measurement to inform progress and results against established goals and objectives

2.1.3 What is the TSM&O Program Plan?

In order to identify, prioritize, and track the requirements of advancing SDDOT’s TSM&O Program, this “TSM&O Program Plan” has been developed. The plan contains:

- Part 1 – A Research Summary that identifies the research project’s problem description, objectives, approach, and task descriptions. It includes an Executive Summary suitable for an audience that wants to understand the project from an outside perspective, i.e. for those not involved with the development of the TSM&O Program Plan or that will be using it to guide internal decision-making.
- Part 2 – This Introduction defining what a TSM&O Program Plan is, presents the rationale or “Business Case” for committing to its recommended actions, and provides additional background on SDDOT’s current TSM&O capabilities.
- Part 3 – A Summary of the recommended actions suitable for an executive or leadership audience.
- Part 4 – The plan’s Implementation Strategy.
- Part 5 – A detailed presentation of the plan’s recommended **Actions, Tasks and Implementation Steps**, organized around six dimensions of TSM&O capability.

The plan does not identify specific TSM&O or ITS capital and non-capital projects (respectively, for example, Dynamic Message Sign [DMS] installations or traffic operations center services). As recommended by this plan, these TSM&O projects or “deployments” can be identified as part of a more formal TSM&O planning process and ultimately augment the program plan.

The plan can be used in several ways:

- as a business plan for near-term decision making, initiative planning and prioritization
- as a strategic plan for longer-term decision making, initiative guidance and target setting
- as a stepwise implementation manual for executing selected initiatives (actions)

The plan has two key audiences:

- **Executive Leadership** – The SDDOT Executive Team (department secretary, deputy secretary, division directors, and region engineers) as well as key partner agency (e.g. Department of Public Safety) leadership can use this plan as a guide for key decision making to advance the state’s TSM&O Program. These decisions can have a number of important implications—staff and financial resources, policy, and customer service outcomes—that require the authorization and support of leadership.
- **Implementation Team and other DOT and partner agency staff** – This plan recommends the creation of an Implementation Team to direct the execution of the recommended actions. Members of that team and other DOT and partner agency staff involved in carrying out or participating in the actions’ objectives should be familiar with the plan’s detailed tasks and implementation steps, as well as elements of the overall Implementation Strategy.

The plan’s recommended actions offer some flexibility for SDDOT leadership to commit to those actions that they view as priorities and the most feasible given an applicable set of resource constraints. This process is facilitated by the plan’s Implementation Strategy and recommended actions’ detail that identify which tasks are dependent on others before them.

2.2 The Case for a South Dakota TSM&O Program

2.2.1 Why Is TSM&O Important in South Dakota?

TSM&O strategies are an important part of SDDOT’s responsibilities. They are a necessity to address agency efficiency and a number of sources of non-recurring (and in some cases, recurring) congestion and impacts to system reliability and safety.

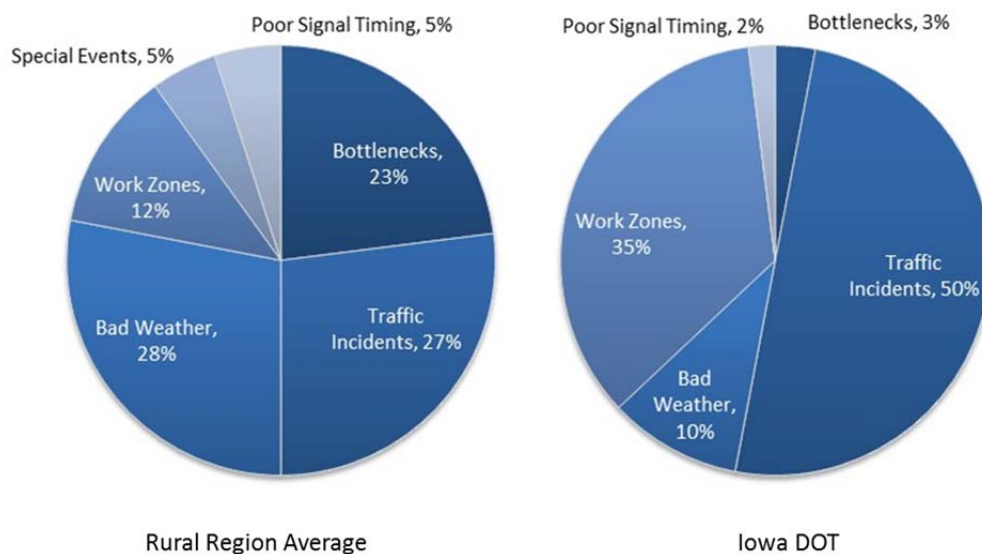
Agency efficiencies mean making better use of finite resources, both staff and physical resources. For example, when responding to a winter storm, greater efficiency can lead to spending less time plowing or treating certain roadways, which permits greater response with the same number of staff. Similarly, it can mean using less roadway treatment product, increasing coverage for the same cost and reducing localized environmental impacts.

South Dakota is a rural state characterized by long travel distances and very heavy reliance on highway transportation. General mobility, the economy, and quality of life are all closely tied to reliable travel on the state’s roadways. Disruptions from non-recurring sources such as traffic incidents, winter storms, and work zones lead to lost time to commuters, tourists, shippers, or other travelers visiting friends and family, going to school, or running errands. These sources of delay also negatively impact system reliability. That is, if delay from non-recurring or recurring congestion is likely during your trip, getting to your destination on time is less reliable. You may choose to build in extra time for your travel whether or not you ultimately experience delay. Delay also contributes to wasted fuel and increased emissions.

And finally, these sources of congestion, if not mitigated properly, typically make travel more hazardous. For example, for every minute a lane is blocked from a traffic incident, four to five minutes of delay is created and the risk of a secondary crash increases by 2.8 percent.¹ In South Dakota, secondary crashes may carry an even greater risk, as slowed or stopped traffic is not a common occurrence and consequently is generally unanticipated by drivers.

The contribution of each source of delay is shown in the Figure 2-1 pie charts. For rural states like South Dakota, sources of non-recurring congestion represent the vast majority of delay, as compared to urbanized regions and states, where bottlenecks (or a lack of roadway capacity) are a significant part—on average 40 percent. This observation strengthens the rationale for applying TSM&O solutions to reduce or eliminate the causes of non-recurring congestion. The first pie chart shown represents a national average for rural regions, while for peer comparison, the same pie chart is shown for Iowa (2013–2015), a South Dakota neighbor and relatively rural state. The actual distribution in South Dakota may look more like the rural average with fewer delays from bottlenecks and more related to bad weather and traffic incidents.

Figure 2-1: Sources of Non-Recurring Congestion



Source (Rural Region): FHWA

Source (Iowa DOT): *TSM&O Program Plan*, Iowa DOT, February 2016 <http://www.iowadot.gov/TSMO/TSMO-Program-Plan.pdf>

¹ Karlaftis, Latoski and Sinha Richards. “ITS Impacts on Safety and Traffic Management: An Investigation of Secondary Crash Causes,” *ITS Journal*, 1999, Vol. 5, pp.39-52.

2.2.2 Current South Dakota TSM&O Program Activities and Benefits

Today, South Dakota’s TSM&O Program is informal, with strategies applied on an as-needed basis, generally without comprehensive consideration of the supporting processes and institutional arrangements cited above. This approach to TSM&O has generally sufficed to implement a number of critical TSM&O activities across the state—urban and rural, corridor and network, and intrastate and interstate. Important examples include managing winter weather events, traffic incidents, work zones, special events such as the Sturgis Motorcycle Rally, and urban arterial traffic signal operations. These activities are summarized in Table 2-1.

Table 2-1: South Dakota DOT TSM&O Activities

	Traveler Information Services	Traffic Incident Management	Road Weather Mgt. / Winter Operations ^c	Special Event Management	Work Zone Management	Com. Vehicle Ops. / CVISN	Urban Traffic Control ^d	Agricultural Vehicle Mgt. ^e
Statewide	X	X	X		X	X		
I-90 Corridor	X	X	X		X	X		
I-29 Corridor	X	X	X		X	X		
Sioux Falls Region	X	X	X	X	X		X	
Rapid City Region	X	X	X	X	X			
Rural ^a	X	X	X		X			X
Multistate ^b			X			X		

^a Generally off the I-90 and I-29 corridors and outside the Sioux Falls, Rapid City, and other urban regions

^b Incorporates collaboration with neighboring states

^c Includes all severe weather events and disaster response

^d Includes application of adaptive signal controllers, traffic signal timing plans, and surveillance and detection

^e Agricultural Vehicle Mgt. refers to operational strategies and treatments to safely manage the movement of agricultural vehicles and equipment on high-speed, two-lane roadways

These activities have:

- Reduced delay and unreliability from non-recurring events (incidents, weather, special events)
- Increased efficiency in use of agency resources (more efficient use of maintenance personnel, especially during winter storms, and more efficient use of resources, especially salt and brine when fighting snow and ice conditions)
- Increased efficiency where the potential for delay causes economic loss or resulting in unmet customer expectations (Ports of Entry commercial vehicle screening, optimized traffic signal timing)
- Improved safety (incident scene management, clearance, and restoration; winter maintenance, special events, work zone management)
- Improved customer service, especially through traveler information services that advise motorists on road conditions to help them decide when and where to travel

2.2.2.1 TSM&O Baseline and Opportunity

SDDOT estimated its own capability to carry out its informal TSM&O program and evaluated the program's effectiveness in a facilitated workshop held in late 2013. (Section 2.3.2 below summarizes the outcomes of this workshop.) Subsequently, a series of stakeholder interviews of SDDOT and partner agency staff held in late summer 2015 generally confirmed and elaborated upon the workshop findings.

Table 2-2 provides a brief summary of TSM&O activities' current status, existing best practice in the state, further detail on their benefits, and opportunities to sustain or improve those activities and their benefits.

2.2.3 Why Should South Dakota Invest in Advancing Its TSM&O Program?

SDDOT has a choice to make. It can continue with business as usual: planning, deploying, and managing TSM&O strategies and technology applications in a relatively informal manner. Even under this scenario, it can continue to see successful outcomes and incremental progress. But as the workshop and interview results show, there is significant room for improvement and compelling reasons to invest—even just modestly—in advancing SDDOT's TSM&O program.

SDDOT staff at various levels, from leadership to the field, as well as key partner agency staff, acknowledge that greater consideration of TSM&O strategies and ITS solutions is worthwhile and essential. In addition to sustaining and enhancing the benefits of TSM&O summarized in Table 2-2, they will be critical to:

- making better investment decisions under tightening fiscal constraints
- proactively serving travelers in the state
- addressing future system safety and reliability issues
- accommodating evolving technology applications and system demands

TSM&O strategies help agencies operate more efficiently internally, stretching budgets farther and getting more done. For example, road weather management strategies, including the use of a winter Maintenance Decisions Support System (MDSS), which is an information technology that allows winter maintenance staff to more optimally allocate their resources. This includes time spent plowing and treating roadways and the amount and location of treatment used. Desired road conditions can be achieved more quickly or over a greater extent with the same amount of resources. As a second example, electronic credentialing, screening, and permit issuance through collaborative and technology-driven commercial vehicle operation programs like CVISN not only save truckers time but more efficiently allow public agencies to perform their duties.

Table 2-2: Status of TSM&O Activities, Opportunities and Benefits

TSM&O Activity	Current Status	SD Best Practice and Recent Progress	Benefit ^a	Opportunity	Existing Partner Collaboration or Opportunity
Traveler Information Services (road conditions, closures, work zones, incidents)	Multiple sources of information generally perceived as beneficial: 511 (phone), ClearPath 511 (email, text), SafeTravelUSA.com, social media, DMS High customer satisfaction with SDDOT information and road conditions (82% in 2011, 84% in 2015)	Sturgis – coordinated traffic management and communication through SDDOT-HP temporary TMC; direct access to HP Computer-Aided Dispatch; recent incorporation of weather info into ClearPath 511 and SafeTravelUSA.com (24-hour road condition threat forecasts)	Provides effective information to motorists on a daily basis to plan and adjust travel decisions. For example, assists nearly 500,000 visitors coming to Sturgis each year Manages traffic and travel when many times the normal number of vehicles are traveling in the Sturgis area	Greater coordination among communication platforms and defined communication protocols would improve service (e.g. establishing incident thresholds for contacting SDDOT and posting information to DMS or 511); need to more responsively update work zone information; some non-state highway gaps in coverage worth filling	HP – no direct access to 511 or DMS, no single point of contact at SDDOT for emergency managers; incident reporting based on local relationships
Traffic Incident Management	Flexibility afforded to Regions’ staff to deploy resources, manage traffic, and disseminate information that best fits the local context and participants’ relationships; consistency and momentum from National TIM Responder Training	Tri-State and Sioux Falls TIM groups facilitate relationship-building, detour route planning, debriefs Nearly 1/3 (1,600) of identified first responders in SD trained as of 4/2016	Reduction in incident duration of 15-65% nationally when applying an organized program and ITS tools. Improved safety from reduction in secondary crashes	Performance expectations and targets not communicated clearly from Central Office to achieve defined objectives, consistency, and efficiency; no Quick Clearance laws in place	HP – good relationships with Region counterparts Emergency response/ local law enforcement and governments – take lead on response off the state system, responsibilities and relationships with SDDOT staff vary geographically
Commercial Vehicle Operations / CVISN	Highly collaborative relationships sustain program successes including linking of participant agencies’ systems, automated permitting and routing, and electronic screening site implementation	SD Trucking Association praise for intrastate traveler information and tools, and CVISN	Trucking/ freight movement (enforcement, security) efficiencies; safety enforcement; reduced administrative costs for freight movement National electronic credentialing B/C: 2.6 National electronic screening B/C: 1.9-7.5	Limited capacity to monitor freight (only a few license plate readers/cameras at ports of entry); need to ensure interstate truckers outside SD are accessing available traveler info; prepare for future truck platooning	HP, Dept. of Revenue, FMCSA – CVISN partners Neighboring states – communicating and sharing travel conditions and restrictions
Special Event Management	SDDOT/HP-led comprehensive plan to manage Sturgis; other special events (e.g. Lifelight) are not led by SDDOT or planned to such an extent	Sturgis planning, management (temporary TOC, ITS deployments, stationing of field maintenance staff), and debriefing processes	Reduction in event-related congestion and delay; reduction in crashes	Disseminate and institute special event planning and management planning best practices; define appropriate role for SDDOT in non-Sturgis events	Sturgis (all aspects) – HP, local law enforcement, City of Rapid City, other municipalities

Table 2-2: Status of TSM&O Activities, Opportunities and Benefits

TSM&O Activity	Current Status	SD Best Practice and Recent Progress	Benefit ^a	Opportunity	Existing Partner Collaboration or Opportunity
Road Weather Management & Winter Operations	Flexibility afforded Regions staff to deploy resources, manage response, and disseminate information that best fits the local context; annual winter maintenance plan and winter Maintenance Decision Support System (MDSS) used; snow plow operations generally consistent General public satisfaction with plowing/salting roads (74% in 2011, 70% in 2015)	Explicit Central Office direction on winter maintenance performance measures and use of MDSS Effective road clearance and conditions reporting Recent plow driver road condition mobile data collection capability	Minimized lost productivity (inability to commute, lost business sales, freight delays, increased travel time) Reduction in safety risk and weather-related crashes Reduced operations and maintenance costs; increased staff and resource efficiency (plowing, treatment, road condition data collection). Reduced environmental impacts Peer state B/C from RWIS: 2.8-7.0 (MI) Peer state B/C from MDSS: 1.34-8.67 (CO, MN, NH)	Encourage adoption and consistent use of MDSS; explore feasibility of variable speed limits (VSL); communication challenges from lack of 24/7 operation or TOC capabilities	HP – manage winter road closures Office of Emergency Management – manage severe storm response (EOC or “mini-EOC” within SDDPS building)
Work Zone Management	Work zones (WZ) generally managed well with contractor training and management for MUTCD compliance underway	Application of Sturgis experience with temporary traffic control devices and queue detection systems, and seeking input from field maintenance staff for adjusting WZ operation based on conditions; WZ issues considered by Traffic Engineering Panel	ITS applications to WZs can reduce traveler delay and crashes, increase worker safety	WZ management can benefit from application of ITS enhancements (e.g. queue detection) and better traveler information (e.g. use and no. of DMS); examine benefits/trade-offs of shorter work zones (customer satisfaction vs. contractor preference); I-229 work zones can capitalize on ITS	HP/local law enforcement – work zone management (e.g. head-to-head traffic) Neighboring states – coordination, especially for traveler information
Urban Traffic Control	Urban ITS applications limited to Sioux Falls; signal operations and maintenance handed off to cities after SDDOT performs initial timings	Adaptive signal controllers, special event signal timing plans, and surveillance and detection in Sioux Falls	Reduced intersection delay, improved arterial travel time and travel time reliability.	Need for more consistent ITS consideration in project scoping process; insufficient staff to explore new ITS opportunities; adaptive signal deployment at other urban intersections	Municipalities – planning and communication coordination essential for project identification and capitalizing on network efficiencies across state and local systems BIT – collaborate with municipal IT (Sioux Falls)

^a National statistics taken from *Intelligent Transportation Systems Benefits, Costs, and Lessons Learned*, USDOT ITS JPO, June 2014

TSM&O solutions that address system performance deficiencies also are substantially more cost-effective investments than traditional capital improvements, which often involve disruptive capital construction, new pavement or structures, land acquisition, greater environmental impacts, longer implementation timeframes, and potentially greater lifecycle maintenance costs. The costs and benefits of specific TSM&O strategies are well documented by the USDOT ITS Joint Program Office in *Intelligent Transportation Systems Benefits, Costs, and Lessons Learned: 2014 Update Report*² and relevant applications in South Dakota are noted in Table 2-2. Investing in the necessary institutional, business process, and collaborative capacities to support TSM&O strategies, and collectively, a TSM&O program will permit SDDOT to plan, make, and sustain TSM&O investments that yield strong payoffs.

2.2.3.1 TSM&O Allows SDDOT to Proactively Serve Travelers in the State

SDDOT exists to serve its customers. Achieving excellence at meeting the needs of the public is embedded in its vision statement and characterizes success at executing its mission. To “Improve Customer and Stakeholder Service” is also one of its 2015 Strategic Plan’s five objectives.

TSM&O is rooted in an agency customer-service orientation. TSM&O strategies by their nature require active consideration of how and when travelers use the system. To do this well, it is necessary to be attuned to customers’ perspectives and needs and to be proactive in addressing them. This can mean, for example, that procedures are in place to clear incidents quickly and safely, minimizing delay and reducing the risk of secondary crashes or harm to emergency responders. Work zones are managed efficiently for the same reasons, and do not create the impression that road closures or detours are needlessly in place. During a winter storm, information on road closures is timely and accessible.

These examples illustrate how on a day-to-day basis, the operation and management of the transportation system is significant to serving customers as they *use* the system. Certainly, smooth roads, good signage, and clear striping are important and appreciated by travelers, but applying strategies and services that help those travelers navigate the system safely, reliably, and informed goes a long way to achieving excellence in meeting customer needs. Effective TSM&O execution can help predict and minimize impacts from these on-the-road scenarios.

Feedback from SDDOT’s 2015 Customer Satisfaction Survey³ supports the case for improving TSM&O capability to better address customer needs:

- Among identified maintenance issues, plowing and salting of roads is an opportunity for improvement. Given SDDOT’s longstanding commitment to executing winter maintenance strategies and recent applications of advanced technology (e.g. MDSS), further improvement will require greater attention to organizational and process-oriented changes and formalizing a consistent approach.
- Among safety problems, winter conditions continue to rank the highest, reinforcing the finding above. Across the board, however, all areas of safety concern drew a greater response from survey takers in 2015 than in 2011. Concern about safety problems from traffic congestion increased 13 percentage points and from construction zones, 6 percentage points. TSM&O

² http://www.itsknowledgeresources.its.dot.gov/its/bcllupdate/pdf/BCLL_2014_Combined_JPO-FINAL.pdf

³ *SDDOT 2015 Statewide Customer Satisfaction Assessment*, SD2015-07 Final Report, ETC Institute, Olathe, KS for the South Dakota Department of Transportation Office of Research, June 2016.

strategies fundamentally address these concerns by directly targeting sources of congestion or minimizing work zone delay and safety risk.

- The desire for information from SDDOT has increased from 2011 to 2015 among nearly all forms of dissemination, ranging from traditional sources like TV and radio, to more recent advances such as text message and social networks. This observation suggests an increased customer desire to be aware of what the department is doing on its behalf, and to be knowledgeable of system availability and performance—i.e. travel conditions—to ensure a reliable and trouble-free trip.
- The use of traveler information services is dominated by access to road conditions during winter, along with construction project and road closure information. A vast majority (84 percent) feel that SDDOT does a good job of keeping travelers informed about road conditions. Maintaining or increasing this level of satisfaction in an environment of growing information consumption will require SDDOT to be responsive to ensuring and improving traveler information dissemination practices, information accuracy, and accessibility.
- Capital intensive projects, like adding lanes to increase capacity, do not rank in the top five of survey respondents' priorities for the next five years. Rather, small capital projects such as routine repairs and maintenance and the addition of turning, passing, or shoulder lanes are the identified priorities. Although these focus areas are not explicit TSM&O activities, they suggest a customer focus on more operationally oriented improvements compared to building more roads. Recurring congestion, often addressed by capital capacity solutions, is not a priority concern. SDDOT should focus attention on issues of a more operational nature.

2.2.3.2 TSM&O Addresses Future System Safety and Reliability Issues

SDDOT, like all state DOTs, prioritizes safety in its mission and responsibilities. If the goals of the department continue to target incremental reductions in fatal and serious injury crash rates (currently a 15% reduction in 2015–2020 according to the 2014 Strategic Highway Safety Plan), effective TSM&O has to play a role. A sharpened focus on safety will call for best practice management of traffic incidents, weather events and other emergencies, work zones, and system impacts from special events to better protect and preserve lives. Safe and quick clearance of incidents protects first responders and reduces the likelihood of secondary crashes. Timely and accurate traveler information, effective winter maintenance protocols, and proper road closures guard against the risks of driving in poor conditions. Effective work zone management strategies protect workers and motorists navigating through construction zones. Greater system demands, and often travelers with less route familiarity, increase the risk of crashes during special events. In all, as agencies idealistically target a “vision zero” approach to safety—that is, all traffic fatalities are considered inherently preventable—TSM&O strategies will play a critical role. This conclusion will only become more pronounced with the continued application of advanced technologies, including connected and automated vehicles that promise to reduce and even eliminate human error during driving.

Although South Dakota is an overwhelmingly rural state, it will not be immune to the pressures of population and traffic growth. Even though delay from capacity constraints and bottlenecks is minimal

today, in the long-term, SDDOT should be prepared to apply cost-effective TSM&O strategies to address this growth to complement or even preclude the need for expensive capital expansion improvements.

TSM&O also permits SDDOT to be better positioned to comply with forthcoming federal requirements for measuring system performance and congestion on the Interstate and National Highway Systems.

2.2.3.3 TSM&O Accommodates Evolving Technology and System Demands

Like with all facets of life, technological advancement is permeating how we use our transportation systems. The state DOT role in accommodating, providing, and using technology is in a state of flux and hotly being debated. Key examples include:

- advanced traveler information technologies such as probe-based traveler information, location-based technology and services, and the public agency role in providing traveler information services
- harnessing access to real-time or big data to enhance mobility and safety
- integrated corridor management strategies that coordinate real-time transportation network use along a corridor to optimize capacity and maximize reliability, and other and automated traffic management technologies
- preparing for a future filled with connected and automated vehicles (CAV)

In this environment, agencies that will be well positioned to meet their customer service missions and fulfill their roles as stewards of the public transportation system will embrace technological advancement, innovation, and potentially profound changes to our transportation infrastructure—both in how it functions and how we use it. Because technology and agency capability to apply it are at the heart of TSM&O and ITS, those agencies actively engaged in a TSM&O program are best positioned to meet these challenges.

Probably the most significant departure from the traditional state DOT role is managing the advent of connected and automated vehicles. CAV technologies have the potential to profoundly affect our highway infrastructure, not only operationally, but from many other perspectives: land use, safety, roadway geometric design, pavements, and others. Regulatory action is anticipated as early as late 2016, which could mandate vehicle-to-vehicle technology in new production vehicles. However, the uncertainty of this timing and generally constrained transportation funding nationally has to date limited business models for significant CAV deployment. Even so, automobile manufacturers are leading significant change in this arena, rapidly introducing technologies that automate certain aspects of driving to enhance safety and reduce the burden of driving in congested conditions. Truck platooning on significant long-haul freight corridors such as I-90 is a serious consideration for the mid-term.

Federal support is encouraging CAV pilot activities among early adopter states who are partnering with the private sector and assessing applications' feasibility and value. Wyoming is one example. The state is seeking to reduce the number of weather-related incidents on its critical, freight-intensive I-80 corridor to improve safety and reduce delay. Vehicle-to-vehicle and vehicle-to-infrastructure connectivity will provide travel advisories, roadside alerts including weather-responsive variable speed limits, freight-specific dynamic travel planning, and parking information. Planning is underway, deployment will begin

in October 2016, and an 18-month demonstration will follow in October 2017. These activities are the next-tier advancement of today's TSM&O applications.

There is no doubt state DOTs will play an expanding, critical role in this transformation, one that is quickly evolving and not clearly defined. What is clear, though, is that state DOTs must be prepared to accommodate this changing reality and the impacts it will have on how its infrastructure is used, what features and technologies should be supported, and what relationships it must cultivate with private sector technology providers.

2.3 SDDOT TSM&O Capability Improvement Background

Several foundational background elements to the TSM&O Program Plan help frame its methodology and structure: evaluative concepts for TSM&O capability developed through national research; the application of those concepts to SDDOT, and additional background on the state of the practice.

2.3.1 TSM&O Program Plan Foundation – Evaluative Concepts

The foundation of the TSM&O Program Plan development and its content is the application of the Capability Maturity Model (CMM)⁴ to TSM&O, originally developed through the Transportation Research Board's Second Strategic Highway Research Program (SHRP2).⁵ That research found that the more effective TSM&O programs were those that approached TSM&O most like traditional construction and maintenance activities—evolving formal “programs” with improvements in key dimensions related to missions, strategies, objectives, sustainable funding, performance measurement, documented procedures and protocols, clear organizational structures, reporting, and accountability.

Institutionalizing or formalizing these programs, including the development of known “best practice,” took place over many years. Each of these key dimensions passed through a set of distinct and definable levels of maturity that together led to increased efficiency and effectiveness of construction and maintenance activities. The SHRP2 research suggested this same type of process was essential for the continuous improvement toward more effective and efficient TSM&O.

The research identified six key dimensions of capability, which provide the primary organizational construct for the TSM&O Program Plan. Short descriptions are shown below, while more detailed discussion is included in the Part 3 Summary and Part 5 Recommendations.

- **Organization & Staffing** including organizational structure, staff development, and recruitment and retention
- **Culture** including technical understanding, leadership, outreach, and program legal authority
- **Collaboration** including relationships with public safety agencies, local governments, metropolitan planning organizations (MPOs) and the private sector
- **Business Processes** including formal project planning, programming, budgeting, and development

⁴ FHWA now refers to application of the CMM to TSM&O and its specific strategy applications as a Capability Maturity Framework.

⁵ *Institutional Architectures to Improve Transportation Systems Operations and Management*, SHRP2 Report S2-L06-RR-1, Transportation Research Board, 2012, <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2180>

- **Systems & Technology** including use of systems engineering, systems architecture standards, interoperability, and standardization
- **Performance Measurement** including measures definition, data acquisition, and use

There are four distinct levels of capability for each of the six dimensions. The four levels reflect current or potential level of capability in support of effective TSM&O. They start with a level reflecting a start-up situation consisting of *ad hoc*, inconsistent, fragmented, undocumented, and informal approaches, with little management and over-reliance on committed champions. Successive levels embody increasing capability from development of processes and organizational structure characterized by improving integration, structure, formality, and collaboration.

Specific criteria characterize each of the levels for all six dimensions. The levels generally can be described as follows:

- **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 a full, sustainable core DOT program priority, established on the basis of continuous improvement with top level management status and formal partnerships

Advancing through the levels of capability provides greater efficiency and improved outcomes while establishing the foundation and point of departure for further advancement.

2.3.2 TSM&O Program Plan Foundation – Tools and SDDOT Results

Two primary products of the SHRP2 research are relevant to the TSM&O Program Plan: formal guidance published by AASHTO on TSM&O capability improvement, which can be accessed at <http://www.aashtotsmoguidance.org/> and a self-assessment workshop sponsored by FHWA and AASHTO used during the implementation of the SHRP2 research. Both of these tools feature prominently in the development of the TSM&O Program Plan.

The AASHTO guidance provides detailed, recommended targets, actions, steps, and resources for advancing among the levels of TSM&O capability maturity. It has been used as a primary resource to characterize the current state of SDDOT TSM&O capability (along with extensive staff discussions) and to develop the recommended actions in the TSM&O Program Plan.

SDDOT began the process of critically examining its current TSM&O activities and capabilities in a Capability Improvement Workshop held in November 2013. The purpose of the workshop was to develop a consensus evaluation of the state of practice and promising next steps in advancing the effectiveness of statewide TSM&O efforts in South Dakota. Using the SHRP2 research approach,

workshop participants identified the current levels of TSM&O capability among the six dimensions and suggested ways in which to begin making improvements. These outcomes were formalized into a South Dakota TSM&O Capability Maturity Implementation Plan endorsed by the secretaries of SDDOT and the Department of Public Safety in March 2014. The workshop self-assessment results are presented in Table 2-3. (Note these are the generalized capability criteria used in the AASHTO guidance and are not specifically worded for South Dakota.) A summary of the Implementation Plan's actions and their status as of April 2016 is shown in Table 2-4.

2.3.3 TSM&O Program Plan Foundation – State of the Practice

Many state DOTs are facing the same decisions as South Dakota or more generally are looking to organize and document plans for advancing their own capabilities in TSM&O and increasing the effectiveness of its program outcomes. As South Dakota did, a number of state DOTs that assessed their capabilities through an FHWA-sponsored TSM&O capability improvement workshop (or otherwise) have identified the preparation of a TSM&O program plan as a priority. Several plans are currently under development, and at least one has been made available publically as of early 2016 (Iowa DOT). The growing peer contingent seeking to organize their TSM&O activities and future efforts to improve capability through this exercise is serving to strengthen both the impetus for other states to develop a TSM&O program plan and the support network for a plan's preparation and implementation. A TSM&O program planning module is included in Regional Operations Forums and is planned to be offered as a CITE (Consortium for ITS Training and Education) course in the near future.

Some states, such as Iowa, have organized their program plan around the recommendations of a recent National Cooperative Highway Research Program (NCHRP) project: *Program Planning and Development for TSM&O in State Departments of Transportation*⁶, which focused on redefining what kind of a "plan" was appropriate to establish the basis for broad improvement in capabilities for any TSM&O program. The project recommended a framework for TSM&O program planning and development. Although it was not adopted for South Dakota, the basic considerations and components were considered and incorporated where appropriate. A follow-up NCHRP project⁷ is examining the current national state of TSM&O program planning and refining the proposed framework.

⁶ *Program Planning and Development for Transportation System Management and Operations (TSM&O) in State Departments of Transportation*, Project 20-07(345), National Cooperative Highway Research Program, Transportation Research Board, June 2014, <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3501>

⁷ *Strategic Transportation Systems Management & Operations Program Planning Lead States Initiative Development & Evaluation*, Project 20-07(365), National Cooperative Highway Research Program, Transportation Research Board, <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3811>

Table 2-3: 2013 TSM&O Capability Improvement Workshop Results (*shaded*)^a

DIMENSIONS	LEVEL 1 PERFORMED	LEVEL 2 MANAGED	LEVEL 3 INTEGRATED	LEVEL 4 OPTIMIZING
Organization & Staffing	TSM&O added on to units within existing structure and staffing—dependent on technical champions	TSM&O-specific organizational concept developed within/among jurisdictions with core capacity needs identified, collaboration takes place	TSM&O Managers have direct report to top management; Job specs, certification and training for core positions	TSM&O senior managers at equivalent level with other jurisdiction services and staff professionalized
Culture	Individual staff champions promote TSM&O – varying among jurisdictions	Jurisdictions’ senior management understands TSM&O business case and educates decision makers/public	Jurisdictions’ mission identifies TSM&O and benefits with formal program and achieves wide public visibility/ understanding	Customer mobility service commitment accountability accepted as formal, top level core program of all jurisdictions
Collaboration	Relationships <i>ad hoc</i> , and on personal basis (public-public, public-private)	Objectives, strategies and performance measures aligned among organized key players (transportation and public safety agencies) with after-action debriefing	Rationalization/ sharing/ formalization of responsibilities among key players through co-training, formal agreements and incentives	High level of TSM&O coordination among owner/operators (state, local, private)
Business Processes	Each jurisdiction doing its own thing according to individual priorities and capabilities	Consensus regional approach developed regarding TSM&O goals, deficiencies, B/C, networks, strategies and common priorities	Regional program integrated into jurisdictions’ overall multimodal transportation plans with related staged program	TSM&O integrated into jurisdictions’ plans and programs, based on formal continuing planning processes
Systems & Technology	<i>Ad hoc</i> approaches to system implementation without consideration of systems engineering and appropriate procurement processes	Regional conops and architectures developed and documented with costs included; appropriate procurement process employed	Systems & technology standardized and integrated on a regional basis (including arterial focus) with other related processes and training as appropriate	Architectures and technology routinely upgraded to improve performance; systems integration/interoperability maintained on continuing basis
Performance Measurement	Some outputs measured and reported by some jurisdictions	Output data used directly for after-action debriefings and improvements; data easily available and dashboarded	Outcome measures identified (networks, modes, impacts) and routinely used for objective-based program improvements	Performance measures reported internally for use and externally for accountability and program justification

^a Business Processes and Organization & Staffing were assessed at Level 1.5; both levels’ criteria are shaded.

Table 2-4: 2014 TSM&O Capability Maturity Implementation Plan Actions and Status

Action	Status
1. Develop a Statewide TSM&O Plan .	The TSM&O Program Plan completes this action.
2. Update and adopt the Statewide Traffic Incident Management Plan , which will include statewide participation in National Traffic Incident Management Responder Training program.	This action has not been addressed aside from participation in National TIM Responder Training (Action No. 10). Concerns exist over the staffing time and level of effort necessary to carry out the recommendations made in prior research that prepared a proposed Statewide TIM Plan.
3. Leverage outcomes of the North/West Passage study with respect to Traffic Operations Center (TOC) functions in rural applications in terms of staffing, collaboration, and communication protocols.	SDDOT participated in the North/West Passage project that examined rural TOC Operations (Project 8.2), a peer exchange workshop on this topic, and a visit to the Wyoming TOC. The topic was also discussed at the North/West Passage Regional Operations Forum. As with executing the proposed Statewide Traffic Incident Management Plan, there is concern that application of a TOC in SDDOT would result in significant staff commitments with potentially considerable downtime to manage since the state generally experiences low traffic volumes and low numbers of incidents. Could other productive work be performed by TOC staff during these periods?
4. Develop and deploy weather responsive travel management enhancements to SD traveler information services.	This action is 75–80 percent complete. Enhancements to incorporate weather information into 511 (website and app) were launched in spring 2015. Information is provided on threatening future weather conditions based on SDDOT’s Road Weather Information System program forecasts. Public feedback has been favorable.
5. Develop and deploy traffic incident related enhancements to SD traveler information services.	This action is still in its early phases. Some discussion has been held with SDDOT’s travel information contractor (Iteris) and SDHP’s Computer-Aided Dispatch (CAD) contractor (Zuercher Technology). Exploring the feasibility of integrating CAD data into traveler information is the next step.
6. Develop guidance for deployment and use of Dynamic Message Signs and deploy additional signs.	No progress to date.
7. Update South Dakota’s Statewide ITS Architecture.	SDDOT has identified ITS architecture training in conjunction with FHWA. No one in the department has experience entering an architecture into TurboArchitecture software. Encouragement is needed for Sioux Falls and Rapid City to update their architectures as well.
8. Develop a TSM&O Performance Measurement Plan.	This action was put on hold pending outcomes from FHWA’s proposed MAP-21 rulemaking (Notice of Proposed Rulemaking released April 2016).
9. Examine and define how the Department’s organizational structure can be improved to advance TSM&O.	This action is included in development of the TSM&O Program Plan.
10. Provide statewide incident management training through participation in the FHWA-sponsored National Traffic Incident Management Responder Training program.	Three train-the-trainer sessions have also been held with 103 individuals trained. Fifty-five responder training sessions have been held as of April 2016 with nearly 1,500 individuals trained. The target for the state is 4,930.

CHAPTER 3 SUMMARY OF ACTIONS AND TASKS

3.1 Overview

This TSM&O Program Plan's recommendations are organized around the six dimensions of TSM&O capability identified through SHRP2 research and used in AASHTO's guidance on improving agency TSM&O capability. The TSM&O Capability Improvement Workshop in which SDDOT and its partner agencies participated also used these dimensions to evaluate the department and to identify targets for improvement and implementation actions to get there. The TSM&O Program Plan is one outcome of that exercise and builds on the self-assessment findings.

Among the six dimensions, the plan's recommendations include actions, tasks, and implementation steps, characterized as follows:

- **Actions** – Top-level recommendations that can involve several discrete activities, extending from the near-term through to the longer-term, resulting in significant implications or outcomes for SDDOT TSM&O capability.
- **Tasks** – Discrete activities that can be individually prioritized, typically can be accomplished within a set timeframe (near, mid, or long-term), and result in a certain identifiable outcome—for example development of a new product or process, use of a product (one-time or ongoing) or process, completion of training, or key decision.
- **Implementation Steps** – The specific steps needed to incrementally carry out a task, along with guidance on the task's priority, feasibility (resource implications), and staff roles within SDDOT and among partner agencies.

In this summary, details of Implementation Steps are incorporated into the Task discussions as necessary.

3.2 Organization & Staffing

Organization refers to the structure of and relationships among the functional units and individual managers and technical staff within SDDOT. As agencies look toward advancing TSM&O capability and instituting a more formal TSM&O program, it may be necessary to apply organizational changes to better support TSM&O outcomes. It is often necessary to develop an organizational concept or reporting structure with identified responsibility for TSM&O planning, design, implementation, and management. This can be consolidated within a distinct division or office or dispersed among staff within an existing structure.

Staffing refers to the availability of needed technical and managerial capabilities among SDDOT employees. Sufficient, qualified staff resources directly correlate an agency's ability to effectively manage and perform TSM&O activities, because TSM&O requires both adequate staff availability, often 24 hours per day, and special capability to conduct the necessary research, design, implementation and maintenance of technologically intensive applications. Finding, retaining, training, and planning for eventual succession in staff changes are all challenges that must be addressed when building a more formal TSM&O program.

Agency capabilities in this dimension can range from fragmented roles based on legacy organization and available skills to professionalization and certification of operations core capacity positions, including performance incentives. The recommended actions for SDDOT in this dimension include the establishment of a TSM&O structure within the organization and the development of staff capabilities to both focus and support the implementation and ongoing evolution of TSM&O.

3.2.1 Action O&S-1: Establish a TSM&O Structure within SDDOT

Establishing a TSM&O structure within SDDOT will provide the following benefits:

- more focused roles for TSM&O throughout the department, allowing expectations to be set and accountability to be managed within the TSM&O program, resulting in more efficient TSM&O activities and ultimately to improved performance
- a more consistent approach for transitioning TSM&O projects from development in Research to implementation in Operations, which will lead to more effective operations and cross-functional communication as more systems are implemented

3.2.1.1 Task O&S-1a: TSM&O Implementation Team

Establish an interim TSM&O Implementation Team within the department to serve as the internal focal point for near-term policy development, change management, education, and accountability. Members of the team should represent a cross section of the functional areas throughout the department. The team can consist of Division Directors, Region Engineers, and Program Managers and technical experts as necessary. This approach is akin to the successful structure of standing training groups and in the execution of the department's asset management plan. Additionally, many activities addressed by the team (e.g. incident management, work zone management) will involve the Highway Patrol, and as such, it should also be included as a member of the team. The team will address near-term roles for leadership, management, and staff level positions.

The TSM&O Implementation Team will direct activities to:

- communicate the business case for TSM&O across the department
- communicate expectations for TSM&O strategy execution
- establish Area Engineers as TSM&O champions within the Regions to serve as local conduits for sharing information
- document best practices from throughout the department
- consistently apply and lead improvements to the implementation process for transitioning TSM&O related projects and activities from Research to Operations

Additional tasks and corresponding implementation steps in other dimensions are also assigned to the TSM&O Implementation Team as a staff lead or support.

3.2.1.2 Task O&S-1b: TSM&O Managerial Level Focus

Assign a managerial level focus to TSM&O within the department to serve as an ongoing focal point and resource for TSM&O—internally and externally. This may be accomplished by creating a new position,

modifying an existing position, or assigning responsibilities across multiple positions. Ideally, this managerial focus would be assigned immediately so the individual(s) could actively participate in the interim TSM&O Implementation Team (Task O&S-1a). This assignment should initially focus on efforts to support internal TSM&O development of staff and business processes in partnership with Area Engineers in the regions.

The managerial level focus to TSM&O will:

- support the work of the TSM&O Implementation Team
- keep abreast of national TSM&O policy developments and training opportunities
- monitor the department's ongoing TSM&O activities to identify challenges and opportunities for future development
- serve as a TSM&O subject matter expert for leadership and staff level positions
- identify further organizational structure modifications to support TSM&O program development

3.2.1.3 Task O&S-1c: TSM&O Senior Leadership Position

Assign one existing senior leadership position within the department to be responsible for holding the TSM&O Implementation Team and Managerial Focus accountable for near-term tasks described in Task O&S-1a and Task O&S-1b. This oversight role may be expanded as the department further develops TSM&O, particularly as development migrates to external transportation partners. This focused leadership position will serve as a sounding board and conduit to the full department leadership that includes all divisions, the secretary, and deputy secretary.

The senior leadership position will:

- provide high-level direction for TSM&O development in alignment with department-wide goals and activities
- review and approve the tasks associated with other near-term actions
- secure resources to carry out actions and tasks associated with TSM&O development
- hold periodic status meetings with the TSM&O Implementation Team and Managerial Focus
- provide status reports against established performance outcomes to other department leadership

3.2.2 Action O&S-2: Develop Staff Capabilities for TSM&O

Developing SDDOT staff capabilities for TSM&O will result in the following benefits:

- improved training for staff, which will result in improved competency in operation and maintenance of TSM&O program elements, leading to improved performance
- improved recruitment and retention by providing opportunities in this emerging field

3.2.2.1 Task O&S-2a: Division of Operations Staff TSM&O Training

Assess the Division of Operations staff capabilities, training needs and succession plans for TSM&O, and develop recommendations for gradually addressing them at Central Office first, then in the Regions. Initial priority should be given to work zone management training, staff development and succession planning. Based on the experience gained from TIM and then work zone management, staff capabilities, training needs and succession plans can then be developed for other TSM&O areas and applied to other functional areas within SDDOT.

3.2.2.2 Task O&S-2b: Department-wide Staff TSM&O Training

Assess department-wide staff capabilities, training needs and succession plans for TSM&O, similar to what is recommended in Task O&S-2a for the Division of Operations and work zone management in the near-term. The assessment should identify where current capabilities lie, how knowledge is being (or could be) transferred to others, and what additional expertise is needed. Although completion of this task may be mid- to long-term to support the continued development of TSM&O throughout other department functions, there may be more immediate training and development needs that arise and need to be addressed separately (e.g. ITS device design and maintenance). National and peer-to-peer resources should be identified to support the training needs. Standing training groups should be formed for select TSM&O service areas or one such group could be established for TSM&O overall.

3.3 Culture

Culture broadly encompasses the department's focus, understanding, and support for TSM&O. It characterizes how well TSM&O is understood technically among staff and leadership and how extensively it receives support and is championed by leadership as a department priority. Functionally, TSM&O's status as a formal program with supporting policies and authorizations to carry out its activities is also incorporated in this dimension. Culture represents the extent to which TSM&O is embodied in an agency's mission, vision, and strategic objectives. Finally, culture includes agency outreach to communicate to its customers and partners the significance of TSM&O and to build awareness and technical understanding of its activities.

An essential goal of the TSM&O Program Plan is to advance SDDOT's currently informal set of TSM&O activities to one with more "formal" consideration. This may entail establishing a "formal program," i.e. one that is accorded status on par with legacy activities or "programs" such as capital construction, maintenance, or safety—in terms of supporting policy, planning, budgeting, organization, and staff capabilities. Often, agencies looking to establish the rationale and momentum for a more formal TSM&O program—in effect marking a shift in culture—begin with making the "business case" to provide explicit recognition and examples of the value and role of TSM&O to internal and external stakeholders, decision makers, and the public.

Agency capabilities in this dimension can range from individual staff champions promoting TSM&O in an *ad hoc* fashion, without concepts being widely understood beyond them, to a customer mobility service commitment accepted as a formal, top-level program. The recommended actions for SDDOT in this dimension include preparation and application of the TSM&O business case to communicate benefits and justify investments in its improvement, further leadership and staff commitment to TSM&O,

aligning department strategic objectives with TSM&O outcomes, and improving TSM&O outreach to customers.

3.3.1 Action CUL-1: Establish the Business Case for TSM&O

Developing and communicating the business case for TSM&O will provide the following benefits:

- methods and means for the department to articulate purpose and benefits for making investments in TSM&O capabilities and strategies—internally to staff and leadership, externally to decision makers, and to the public and stakeholders
- clear identification of information and data with which to make more cost-effective decisions on the use of department resources
- a platform for which SDDOT agency partners can begin to achieve similar outcomes by identifying their own benefits from investing in TSM&O

3.3.1.1 Task CUL-1a: Business Case Preparation

Prepare simple TSM&O business case document(s) tailored to certain audiences that:

- clearly defines TSM&O in terms of activities the department performs or manages and in terms of how partner agencies do or can participate
- presents the rationale for continuing to advance these activities and investing in TSM&O
- illustrates the benefits to the state and the public, using TSM&O payoff examples augmented with national best practice and outcomes as necessary

The business case material presented in the introduction can be refined, organized, formatted, and branded in ways that most effectively suit the intended audience. Audiences include internal SDDOT staff not familiar with TSM&O, leadership, decision makers, and peer staff among SDDOT state and local agency partners, members of the state legislature, and the public.

3.3.1.2 Task CUL-1b: Business Case Applications

Present or provide the business case to inform stakeholders and decision-makers.

With the business case material organized, SDDOT can identify opportunities and audiences for its presentation. Application of the business case can advance the goals for TSM&O laid out in the program plan and help support the plan's actions and tasks. Audiences and forums should align with opportunities to provide:

- explanatory background on TSM&O information and outcomes—internal and external
- resource allocation justification
- justification for programmatic, policy, or organizational changes
- a basis for new or strengthened cooperative relationships and activities with partner agencies

3.3.2 Action CUL-2: Articulate and Establish the Appropriate Level of TSM&O Program Status

Elevating the program status of TSM&O through leadership commitment and improved awareness and consideration of TSM&O in all department functions will provide the following benefits:

- affirmation that TSM&O is a department priority to help facilitate other actions and tasks and derive their benefits
- broader staff understanding of TSM&O in order to more effectively implement and execute the strategies

3.3.2.1 Task CUL-2a: Leadership Commitment to TSM&O

Obtain a commitment from SDDOT leadership to elevate TSM&O as a department priority by endorsing the TSM&O Program Plan and committing to its Implementation Strategy. Leadership should be actively involved in supporting the program plan's actions and tasks and promoting its goals and accomplishments, both within the department and to external decision makers and stakeholders. SDDOT leadership is considered to be the SDDOT Executive Team, which comprises the Secretary, Deputy Secretary, the three Division Directors, and the four Region Engineers.

3.3.2.2 Task CUL-2b: TSM&O Awareness and Focus among Staff

Incorporate TSM&O awareness and consideration into all department offices and functions and support the development of appropriate capabilities. This more deliberate acknowledgment of TSM&O would increase its visibility and understanding, and advance SDDOT's capability to perform TSM&O activities and their supporting processes.

3.3.3 Action CUL-3: Adjust SDDOT Mission, Vision, Strategic Objectives, and Performance Goals to Align with TSM&O

Aligning SDDOT's strategic objectives, performance goals, mission, and vision with TSM&O will provide the following benefits:

- affirmation that TSM&O is a department priority to help facilitate other actions and tasks and derive their benefits
- targets to guide and communicate the department's decision making on TSM&O investments and methods to measure success

3.3.3.1 Task CUL-3a: TSM&O Strategic Objectives

Develop new or modified department strategic objectives and performance goals that include TSM&O activities and outcomes. Use the business case for TSM&O to align them with the prioritized near-term actions of this plan. Partner agency input can be sought relative to strategic objectives that suggest collaboration or coordination with an external agency (e.g. the Department of Public Safety and their involvement in managing traffic incidents).

3.3.3.2 Task CUL-3b: Mission and Vision Alignment with TSM&O

Identify and consider modifications to SDDOT's mission and vision that further support and align with the goals of this plan and commitment to TSM&O.

3.3.4 Action CUL-4: Implement an Outreach Strategy to Customers in Support of TSM&O

Gaining a better understanding of customer segments' needs and effectively applying outreach for TSM&O will provide the following benefits:

- greater ability to make investments that directly respond to the needs of system users, yielding greater customer satisfaction and more effective allocation of resources
- greater awareness and enhanced use of SDDOT TSM&O tools, such as traveler information, improving the quality, reliability, or safety of the trips they take on the system

3.3.4.1 Task CUL-4a: Meeting Customer Segments' Needs with TSM&O

Develop an improved awareness of customer segments' expectations with respect to system use and how TSM&O can help meet those expectations. The current Customer Satisfaction Assessment can help inform this understanding. Partner agency input is essential, including from the Department of Public Safety; counties, municipalities, and tribes familiar with their constituent customer expectations; and representatives from large interest groups such as agriculture and freight. The product of this task can be referenced during execution of the program plan's actions and tasks to help define better outcomes.

3.3.4.2 Task CUL-4b: TSM&O Outreach Strategy Components

Improve customer outreach for TSM&O and document priority activities in an outreach strategy. Improved communication to support TSM&O should use all forms of media (press releases, periodic publications, website, social media feeds) and can leverage content developed for the TSM&O business case. Greater prominence of TSM&O communication and information on the SDDOT website, including a focus on traveler information or other operational announcements, should be considered.

3.4 Collaboration

Collaboration includes partnerships among local, state and federal levels of government, public safety agencies and, sometimes, private sector companies whose cooperation is essential to the execution of key TSM&O strategies. A key SDDOT partner is the Department of Public Safety. The Highway Patrol plays a central role in incident management and the CVISN program.

SDDOT's relationships with the FHWA Division Office, Department of Public Safety, Sioux Falls and Rapid City MPOs, and other local and tribal partners appear to be strong overall. However, a uniform interest in creating a more formal TSM&O program is expressed by both SDDOT and local agency partners, with a recognition that enhanced collaboration would benefit multiple functional areas, including incident management, emergency response, local event planning, design and operations and maintenance, and coordination of shared ITS resources.

Agency capabilities in this dimension can range from informal, infrequent relationships to a high level of operations coordination institutionalized among key partners. The actions recommended for SDDOT in

this dimension focus on the establishment of TSM&O functions at the regional level to further develop collaboration throughout the department, and the expansion of TSM&O capabilities among SDDOT partners to encourage a statewide approach to TSM&O in managing transportation throughout South Dakota.

3.4.1 Action COL-1: Establish TSM&O Functions at the Regional Level

Establishing TSM&O functions at the Regional level will result in the following benefits:

- increased effectiveness and efficiencies when working with other groups within SDDOT and with partner agencies
- avoiding the loss of institutional knowledge when collaborators move on from their current roles
- increased awareness of TSM&O through collaboration to facilitate identification of effective operational improvements
- improved incident management and response through the creation of regional TIM support groups

3.4.1.1 Task COL-1a: Regional TIM Support Groups

Establish three additional regional TIM support groups similar to the well-established Tri-State TIM group and the newly formed Sioux Falls TIM group. These regional groups in the Rapid City, Pierre, and Aberdeen regions would become a focal point for the incident management aspects of TSM&O. They would provide ongoing TIM support, relationship building, special event planning, after-action reviews, and policy and procedure development. Regional TIM functions would also be supported by TIM operational guidelines (as suggested in Task S&T-4b) and an annual debriefing meeting among the regional TIM groups. Formation of these groups and TIM collaboration at the statewide level would be further strengthened and sustained through a new memorandum of understanding between SDDOT and Highway Patrol.

3.4.1.2 Task COL-1b: Regional TSM&O Review Meetings

Establish regional TSM&O review meetings among transportation partners to discuss collaboration opportunities across TSM&O areas of service (e.g. traveler information, work zone management, winter maintenance, etc.). These meetings would be geared toward managers and staff of transportation agencies (e.g. initially DOT regions and eventually MPOs, tribes, counties and cities, etc.). The meetings would allow participants to learn about current and new TSM&O best practices, discuss plans for installing new equipment and systems in support of TSM&O, exchange ideas for sharing equipment or services associated with TSM&O, and identify needs for future equipment or services. Hosting the meetings at the regional level will also encourage broader peer exchange among areas within each region. The meetings will also allow practices in one region to be identified for their potential application across the regions.

3.4.2 Action COL-2: Expand TSM&O Capabilities among Partners

Greater agency partner capabilities at TSM&O through support from SDDOT will result in the following benefits:

- increased effectiveness and efficiencies when working with other groups within SDDOT and with partner agencies
- avoiding the loss of institutional knowledge when collaborators move on from their current roles
- increased partner agency understanding and ability to plan and implement potentially less expensive and more effective TSM&O alternatives to address transportation challenges
- improved overall transportation system performance with more collaborative management and operations among agencies

3.4.2.1 Task COL-2a: TSM&O Planning Guidance for Local Partners

Introduce SDDOT's TSM&O activities to the Transportation Advisory Council, LTAP, TTAP, and SDDOT MPO Coordinator to determine how they can be used as conduits for TSM&O planning guidance that local transportation partners can use.

3.4.2.2 Task COL-2b: TSM&O Support for Local Partners

Provide TSM&O support for local agency partners in the areas of planning, project development, operations and maintenance.

Once SDDOT has established TSM&O guidance and processes as described in Action BP-1, Task S&T-2a, and Task S&T-4b, they will be in a good position to share their approaches with local agencies for consideration and adaptation into local efforts. Support can also be offered through shared training and master agreements for access to contractor expertise.

3.5 Business Processes

Business processes are the set of structured activities or tasks and related decision points required to efficiently produce TSM&O systems and services (capital and non-capital projects) and to integrate them into overall agency activities as standard processes. Business processes include formal planning, budgeting, programming, and project development. A more formalized TSM&O program requires that these processes—traditionally structured around capital construction and preservation projects—consider TSM&O strategies and ITS projects in a manner consistent with SDDOT's strategic objectives, performance goals, and priorities for addressing system reliability, safety, and capacity preservation or optimization. A project planning and development process that supports an appropriate level of TSM&O consideration must have in place proper analytical procedures for project identification, evaluation tools, knowledgeable staff, and processes that support input from agency partners (cities, MPOs, and tribal governments).

First, though, it is important to recognize that the TSM&O program plan addresses SDDOT *capabilities* to carry out and sustain an effective TSM&O program. This TSM&O program plan does not explicitly identify TSM&O and ITS capital projects (such as DMS deployments) or non-capital projects (such as the

delivery of TOC-type services). Nonetheless, the identification and planning (as well as programming and implementation) of these projects are critical, and the results of which should complement the TSM&O program plan.

Agency capabilities in this dimension range from *ad hoc* and unintegrated processes to plan and implement TSM&O activities—absent a cohesive statewide TSM&O deployment plan—to the presence of a fully integrated, formal TSM&O program supported by coordinated, documented planning and project implementation processes. The recommended business processes action will, over time, develop the necessary planning, programming, and project development processes to help formalize an approach for TSM&O deployments (capital and non-capital) and document them in a TSM&O Deployment Plan that can augment the TSM&O Program Plan.

3.5.1 Action BP-1: Establish a Planning and Project Development Process for TSM&O/ITS Projects

Putting in place processes that fully consider TSM&O alternatives during planning, programming, and project development will offer the following benefits:

- a structured method for identifying and implementing cost-effective alternatives to traditional capital improvements, delivering user benefits faster and less expensively
- an ability to document and communicate future TSM&O needs to make better decisions on the appropriate time to implement them and secure the necessary resources
- coordinated, more efficient capital project implementation that combines TSM&O or ITS improvements or upgrades with traditional capital projects

3.5.1.1 Task BP-1a: Interim Process for TSM&O Planning

Develop a near-term, interim process for TSM&O planning and develop an Interim TSM&O Deployment Plan. The interim plan would complement the TSM&O Program Plan and be added as a separate section.

The Interim TSM&O Deployment Plan is not intended to be a formal product but rather an exercise that jump-starts the identification of TSM&O projects to accompany the capability improvements in the TSM&O program plan and to generate discussion and broader consideration of TSM&O expansions. Subsequent tasks under this action would systematically formalize the process. TSM&O projects would be identified through existing TSM&O-related efforts and forums (e.g. TIM group meetings or Area Engineers meetings). The interim deployment plan would be used in the next round of State Transportation Improvement Program (STIP) programming or amendment process.

3.5.1.2 Task BP-1b: Standard Process for TSM&O Planning

Develop a longer-term, standard strategy and process for TSM&O planning. The process would be designed to produce a plan to serve both as a guide to TSM&O capital and non-capital projects (complementing the TSM&O program plan capability improvements) as well as an input to the SDDOT Statewide Long Range Transportation Plan and STIP. This task builds on and formalizes the process in Task BP-1a.

The process undertaken to produce a TSM&O Deployment Plan would be distinct from the standard planning process, but once complete, that plan would feed into the standard STIP programming process

(with some potential modifications to project selection criteria to accommodate TSM&O) and long-range transportation planning process. Additionally, however, TSM&O opportunities should always be encouraged for consideration during existing project development processes, as suggested in Task BP-1e.

A proposed, multiagency Planning and Programming Working Group would lead the development of the process and plan. Candidate participants in the group include SDDOT staff—Research (ITS), Project Development, Operations Support, Regions—and agency partners—Department of Public Safety (Highway Patrol), BIT, local governments, and MPOs. The planning process would identify candidate TSM&O capital improvements for their inclusion in broader highway improvement projects (“piggybacking”) or as standalone TSM&O/ITS deployments. Non-capital improvements to existing TSM&O activities’ field procedures and protocols (such as crash and weather related incidents and special events) and establishment of TOC capabilities would also be considered. Ultimately, agreement would be reached among SDDOT offices and key external partners on the general objective, scope, and schedule for the longer-term standard planning process.

3.5.1.3 Task BP-1c: Standard TSM&O Deployment Plan

Apply the standard TSM&O planning process developed in Task BP-1b to prepare and update a standard TSM&O Deployment Plan and to integrate TSM&O into the SDDOT Statewide Long Range Transportation Plan and STIP. Cost estimates for identified projects would be developed from peer state experience and national sources. The TSM&O Deployment Plan should also be appended to the TSM&O Program Plan.

3.5.1.4 Task BP-1d: TSM&O Integration into the Capital Programming Process

Assess TSM&O project priorities and resource availability and integrate the TSM&O Deployment Plan into the capital programming process. Projects in the plan should be reviewed for a logical sequence of investments. Appropriate adjustments to the existing project prioritization methodology and tool used to develop the STIP should be implemented to better accommodate TSM&O. These adjustments would be aligned to modifications to the Strategic Plan’s goals and objectives made under Task CUL-3a.

Beyond the incorporation of the TSM&O Deployment Plan into the capital programming process, opportunities to include the upgrade or replacement of TSM&O or ITS components affected by “standard” highway improvement projects should be sought to achieve overall preventative maintenance and replacement cost efficiencies.

3.5.1.5 Task BP-1e: TSM&O Integration into the Project Development Process

Integrate TSM&O projects—standalone and integrated with other capital projects—into the overall project development (post-programming project scoping and preliminary engineering, environmental review, final design, and bid letting) and construction management processes. This task also includes ensuring that acceptable and appropriate systems engineering procedures are used throughout the project lifecycle and establishing a regular checkpoint for consulting with the Bureau of Information and Telecommunications (BIT) on technology purchases.

3.6 Systems & Technology

Systems and technology are the backbone of TSM&O in many ways. They provide the “face” of TSM&O to the traveling public and to many within the transportation community. In order to effectively implement systems and technology, a technical framework must be in place. The actions in this dimension are geared toward making sure that technical framework is in place to support and encourage the implementation of systems and technologies that are critical to the efficient operation of the transportation network. Tools that facilitate the implementation of systems and technology include:

- **Developing and using ITS architectures (statewide and regional)** – an ITS architecture provides a blueprint of the ITS systems and technologies that stakeholders envision in a region or state and facilitates their incremental implementation
- **Following the systems engineering process** – systems engineering is the methodology by which complex systems should be designed, updated, and managed and is used as an analytic and project development framework for ITS projects (and is a requirement for ITS projects using federal funds)
- **Providing the tools needed to operate the systems and technologies that are in place, such as the tools and functions that are often housed in a transportation operations center (TOC)** – a TOC is the focal point of ITS and TSM&O operations where staff monitor the transportation network in real-time, either during peak periods, during incidents and emergencies, or 24 hours a day and make decisions regarding system operations, information dissemination, and coordination with partner agencies; a TOC can be a physical location (building or room), a virtual network, or some combination of both
- **Providing guidance on how to most effectively operate implemented systems and technologies**

The actions below represent the next logical steps for SDDOT to take to improve this technical framework, based on stakeholder interviews and national experience in the TSM&O field. These actions include:

- updating South Dakota’s ITS architectures
- developing guidance on using the systems engineering process
- determining the most appropriate ways to carry out typical TOC functions
- developing needed operations guidance

3.6.1 **Action S&T-1: Update the Statewide ITS Architecture**

Updating the statewide ITS architecture will provide SDDOT the following benefits:

- an updated roadmap for ITS system integration, which will ensure systems are deployed to get the most out of each one and they will be able to fulfill the needs of stakeholders
- cost-effective technology deployment
- stakeholders (local partner agencies) engaged in the update process, leading to a better understanding of the goals and objectives, requirements, and benefits of TSM&O systems

3.6.1.1 Task S&T-1a: Turbo Architecture Training

Train staff on use of Turbo Architecture. Turbo Architecture is a software application that supports development of regional and project ITS architectures using the National ITS Architecture as a starting point. It provides a structured way to develop, use, maintain, and update ITS architectures. The National Architecture website⁸ includes web-based training on both the National ITS Architecture and Turbo Architecture.

3.6.1.2 Task S&T-1b: Statewide Architecture Update

Either using in-house or consultant staff, update the statewide architecture using the latest versions of the National Architecture and Turbo Architecture.

3.6.2 Action S&T-2: Develop Guidance on Using the Systems Engineering Process

Developing guidance on using the systems engineering process will provide SDDOT the following benefits:

- cost-effective implementation of ITS elements and systems (Systems engineering provides linkages from stakeholders needs, to the concept of ITS systems, to the design and implementation process. By following the systems engineering process, SDDOT will be able verify that what is actually implemented meets stakeholder needs and is what was intended to be implemented.)
- engagement of stakeholders (local partner agencies) in the systems engineering process, especially the development of the concept of operations, which will lead to a better understanding of the goals and objectives, requirements, and benefits of TSM&O systems
- the development of ITS projects that meet the requirements for federal funding

3.6.2.1 Task S&T-2a: Systems Engineering Process Training

A systems engineering analysis is required for all intelligent transportation systems projects using federal funds according to the Final Rule on ITS Architecture and Standards Conformity⁹. It is important for internal staff to understand the process. Web-based and blended training (including discussions with instructor and classmates using conference calls) is available through the Consortium for ITS Training and Education CITE¹⁰. FHWA maintains a handbook¹¹ on systems engineering for ITS projects.

3.6.2.2 Task S&T-2b: Systems Engineering Process Guidance

The Final Rule on ITS Architecture and Standards Conformity requires that ITS projects carried out using funds from the federal Highway Trust Fund, including the Mass Transit Account, conform to the National ITS Architecture and applicable ITS standards. Section 940.11 of the Final Rule also requires that a

⁸ National ITS Architecture, United States Department of Transportation, Office of the Assistant Secretary for Research and Technology, Intelligent Transportation Systems Joint Programs Office, <http://www.iteris.com/itsarch/>

⁹ 23 CFR 940 - INTELLIGENT TRANSPORTATION SYSTEM ARCHITECTURE AND STANDARDS, <https://www.gpo.gov/fdsys/pkg/CFR-2008-title23-vol1/pdf/CFR-2008-title23-vol1-part940.pdf>

¹⁰ <http://www.citeconsortium.org/>

¹¹ *Systems Engineering for Intelligent Transportation Systems*, United States Department of Transportation, Federal Highway Administration, Office of Operations, January 2007. <http://ops.fhwa.dot.gov/publications/seitsguide/seguide.pdf>

systems engineering analysis be conducted. This action will determine how to apply the systems engineering process for SDDOT. The guidance on applying systems engineering should be tailored to SDDOT while meeting federal requirements.

3.6.3 Action S&T-3: Determine the Most Appropriate Ways to Carry Out Typical TOC-Related Activities

Determining the most appropriate ways to carry out typical TOC-related tasks will provide SDDOT the following benefits:

- a central focal point in identifying internal and partner agency staff communication needs and mechanisms, which will lead to improved communication and subsequent actions, especially during incident and emergency conditions
- more consistent responses to incidents and emergencies
- enhanced and facilitated debriefings and after-action reviews, which will further improve response actions

3.6.3.1 Task S&T-3a: TOC Roles, Responsibilities and Protocols

Similar to an approach taken by the Municipality of Anchorage, Alaska, identify roles, responsibilities, and protocols needed by SDDOT that are often housed in a TOC. Determine effective ways to provide the roles and responsibilities and implement the protocols. Work with partner agencies in this task to include their perspectives, experience, and ideas. A stakeholder workshop is key to obtaining this input. The result will be a recommendation of how to deliver these TOC features most effectively and to identify potential “triggers” that could guide when a brick-and-mortar TOC would be needed.

3.6.4 Action S&T-4: Develop and Apply Operations Guidance

Determining operational guidance will provide SDDOT the following benefit:

- provide clear expectations on operational roles and actions, which will result in more consistent and more efficient operations

3.6.4.1 Task S&T-4a: Operations Guidance Priority and Form

Determine the priority for and form of operations guidance. Many potential areas of operational guidance came up through staff discussions. Not all of those areas can be undertaken at the same time. It is important that these potential areas of operations guidance be prioritized. It is also necessary to determine what form that “guidance” might take, from simple best practice sharing, to policy that encourages specific activities or common practice, to the development of more formalized guidance documents.

Potential TSM&O areas in which guidance may be needed include:

- DMS operation, specifically which staff members should have the authority to post a message, when the message should be posted, and what agencies need to be consulted with or communicated with
- traveler information dissemination

- inclusion of work zone traffic control or maintenance of traffic considerations in the project development process
- special event planning
- use of the MDSS
- environmental sensor stations, particularly guidance on maintenance
- on-scene roles for traffic incident management
- road closures, detour routing, and traffic control standards
- future TSM&O actions, such as variable speed limits and traffic queue detection

3.6.4.2 Task S&T-4b: Operations Guidance Development

Develop operations guidance by priority and level of effort. Based on the priority from Task S&T-4a and the available resources, determine how best to develop and implement the needed guidance. The guidance should include troubleshooting approaches and who is responsible for carrying out the guidance. The staff responsible need to be familiar with the area and the form of the guidance.

3.7 Performance Measurement

Performance measurement encompasses the definition of measures, the data collection and analysis of the measures, and the use of the information for adjusting TSM&O systems and activities to improve performance. Performance measurement is therefore the means of determining the effectiveness of agency TSM&O activity based on measures that reflect their impact.

Recent federal rule-making processes and final rules are currently establishing the framework for state DOT and MPO performance reporting and related planning, as required of federal MAP-21 legislation. These rules will pertain to the Interstate System and other National Highway System elements. However, performance measurement is important for more reasons than meeting the federally required reporting requirements of MAP-21 and the proposed rule. It is fundamental to all other capability dimensions in that it identifies how well an organization is delivering operations services and identifies areas that need improvement.

A full-scale TSM&O performance program involves key collaborators, especially the Department of Public Safety and law enforcement. Therefore, it is essential that the approach to performance measurement (the value, use, roles in data development, and reporting) be developed on a consensus basis, recognizing the differences in priorities among partners.

The actions presented below represent the next logical steps for SDDOT to take to improve their performance measurement, based on stakeholder interviews and the national experience in the TSM&O field. Two actions are proposed:

- developing a pilot performance measurement program
- developing a performance measurement plan

These actions correspond to Action 8 in the 2014 TSM&O Capability Maturity Implementation Plan (see Table 2-4), which was placed on hold pending the outcome of FHWA's proposed MAP-21 rulemaking. The proposed actions would be suitable for a research project.

3.7.1 Action PM-1: Develop a Pilot Performance Measurement Program

Developing a pilot performance measurement program will benefit SDDOT by:

- focus on the activities that affect performance the most, which will in turn lead to effective performance improvements
- a mechanism to effectively meet federal performance measurement requirements
- quantifiable information to stakeholders and decision-makers about SDDOT performance improvements

3.7.1.1 Task PM-1a: Performance Measurement Process

The first step in developing a performance measurement program is to define performance measures and develop a measurement process. This task will propose a set of measures and determine the best measurement process based on the review of background material on DOT performance measurement experience, SDDOT needs, and federal requirements and rulemaking.

3.7.1.2 Task PM-1b: Performance Measurement Process Pilot

Develop a pilot implementation of the performance measurement process. Identify a candidate set of performance measures and supporting practices relevant to satisfying proposed federal requirements and to meeting the goals of essential TSM&O activities. A reasonable pilot implementation would be the performance measures required by the proposed Federal Rule, those critically important to SDDOT, and the measures already used by SDDOT.

3.7.2 Action PM-2: Develop a Performance Measurement Plan

As with Action PM-1, developing a performance measurement plan (building on the Action PM-1 pilot) will benefit SDDOT by:

- providing focus on the activities that affect performance the most, which will in turn lead to effective performance improvements
- providing a mechanism to effectively meet federal performance measurement requirements
- providing quantifiable information to stakeholders and decision-makers about the SDDOT performance improvements

3.7.2.1 Task PM-2a: Performance Measurement Process Update

Evaluate the performance measurement pilot and update the performance measurement process. This task will evaluate the effectiveness of the performance measurement process developed in Task PM-1a and implemented in a pilot effort in Task PM-1b. This task will adjust the process as needed before it is more fully implemented, recognizing that the performance measurement program will be implemented in incremental stages over time.

3.7.2.2 Task PM-2b: Performance Measurement Implementation Plan

Develop a staged performance measurement implementation plan and implement initial stage. This task will implement the recommendations that result from the evaluation of the performance measurement pilot project in Task PM-2a. The value of performance measurement is directly proportional to how it is used in improving applications as well as in planning future applications. Developing a coherent, staged implementation plan will allow SDDOT to implement portions of the overall performance measurement program in a way that will enable focus on improvements related to the new performance measures. It will also allow it to adjust the program accordingly.

CHAPTER 4 IMPLEMENTATION STRATEGY

The TSM&O Program Plan is intended to be used for both near-term business planning purposes and long-term strategic planning. Over the next 18 to 24 months, this plan can be used to select, prioritize, and guide the implementation of a host of significant improvements to SDDOT's capability to perform TSM&O functions more effectively. Looking out 2 to 5 years and beyond, SDDOT can continue to plan for continuous improvements to its TSM&O program.

The program plan is structured around the capability maturity model and its six dimensions of TSM&O capability improvement. All six dimensions are important and many linkages among them imply certain sequences to the recommended actions and tasks, as well as necessary dependencies or supporting relationships among them. Nonetheless, the recommendations are intended to offer flexibility to the department in terms of selection and prioritization, depending on available resources, leadership's perceived priorities, and other circumstances that may lie outside the department's control.

4.1 Priorities and Schedule

The recommended actions and tasks summarized in Part 3 and detailed further in Part 5 with extensive background information and specific implementation steps are arrayed in a proposed implementation schedule shown in Figure 4-1. The figure indicates priorities of the actions and tasks by their relative timing and a logical sequence to their execution. Further detail on priorities and timeframes is included in Part 5.

The timeline assumes starting implementation in the third quarter of 2016. The schedule, however, is suggestive. It is possible that some time may be needed to further, internally plan an implementation strategy, prioritize those tasks selected for near-term implementation, and begin to resolve issues of staff resource availability and participation—essentially a ramp-up period. In addition, the suggested schedule is not truly resource constrained. Some thought went into how much staff time the tasks would take, but staff availability was not known. The schedule is dependency constrained, however. In addition, without finalizing the department's priorities on the early tasks, the schedule could not truly take into account staffing constraints.

Generally, the plan uses the following timeframes (with some overlap) to schedule and prioritize the tasks:

- **Immediate** – within 3 months
- **Mid-term** – 18 months to 5 years
- **Near-term** – 3 to 18 months
- **Long-term** – 5+ years

Task timeframes are approximate and could justifiably shift by 3 to 6 months or more depending on selected or preferred priorities, scheduling constraints, and resource constraints. While all recommended tasks are presented in the figure, and collectively many overlap or take place concurrently, realistically not all can occur as shown. Rather than sequence the tasks further out into the future to accommodate all resource constraints, the schedule assumes that SDDOT will select its own priorities and not tackle all tasks at once. Revisions to the schedule should be incorporated once these decisions are made. In addition, for the sake of clarity, not all dependencies and task linkages are shown, only key ones.

4.2 Feasibility and Resource Implications

Each task presented in Part 5 includes discussion of its feasibility and resource implications. All tasks must be weighed in the context of existing SDDOT responsibilities, work efforts, and projects. The program plan's business case, however, is designed to build the necessary momentum and impetus for adjusting or creating resources for pursuing many of the recommended actions and tasks.

Unlike building more system infrastructure or maintaining what already exists, investments in improving TSM&O capability are largely driven by staff availability rather than funding. To be sure, investments will have to be made, but generally, the success of executing the program plan will largely rest on commitments from staff, principally the designated TSM&O Implementation Team, Managerial Focus, and staff already involved in TSM&O planning and strategy applications. Equally important, managers and leadership must reinforce the priority of advancing a more formal TSM&O program and provide those performing the tasks the opportunity to make room for them among their existing responsibilities.

The Part 5 feasibility discussions include references to minimal, modest, moderate, and significant resource implications to help guide decision-making on prioritizing and carrying out the recommended actions and tasks.

4.3 Staff Roles

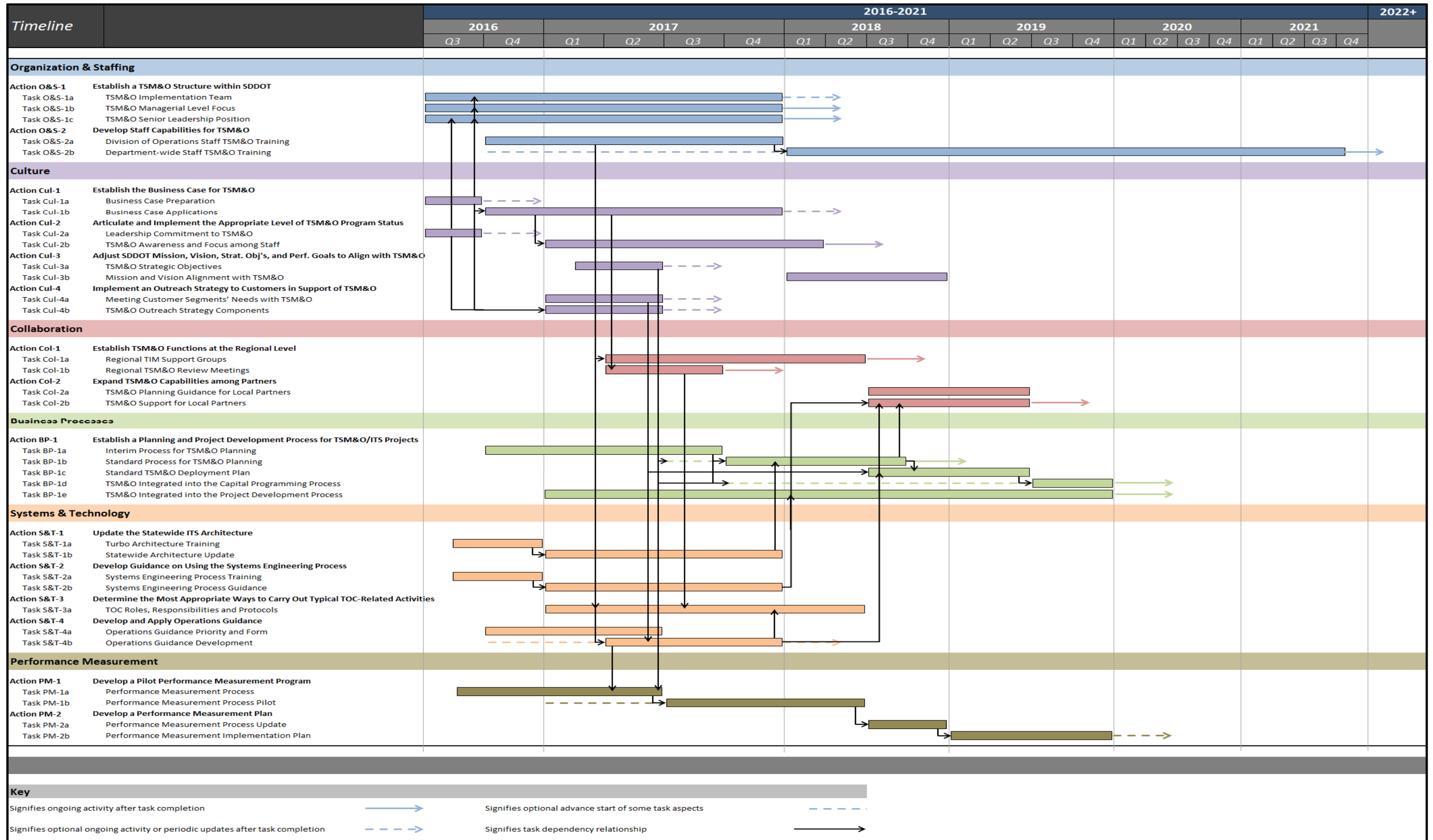
Each task in Part 5 also highlights how the task should be accomplished in terms of staff participation, including where leadership approvals are necessary and when partner agency staff are involved. The proposed TSM&O Implementation Team and Managerial Focus will be key to guiding, and in many cases, performing the work. In addition to SDDOT staff, participation from the Department of Public Safety is critical to the success of the plan. Where appropriate consultant support is also suggested.

4.4 Immediate Implementation Strategy

SDDOT's demonstrated commitment to the TSM&O Program Plan and a clear path to beginning its implementation begins with the plan's formal adoption. Project panel members agreed that adoption of the plan is defined by concurrence with the business case and the overarching vision and goals of the plan. In addition, three tasks are selected for immediate implementation. They are critical for taking the next steps beyond completion of the plan and advancing toward feasible and sustained implementation in the immediate, near, mid, and long-term. The three immediate tasks are:

- **Task O&S-1a:** TSM&O Implementation Team
- **Task CUL-1a:** Business Case Preparation
- **Task CUL-2a:** Leadership Commitment to TSM&O

Figure 4-1: Implementation Schedule



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4.4.1 Task O&S-1a: TSM&O Implementation Team

Plan championship, execution, and communication cannot take place without committed staff. As a very first step, the interim TSM&O Implementation Team must be established to begin considering and carrying out the plan's next steps. Beyond the three immediate tasks described here, the Implementation Team should be responsible for selecting and prioritizing the plan's remaining actions and tasks. A team approach is recommended for further plan implementation decision-making, with membership representing a cross section of the functional areas throughout the department, as has been applied successfully for standing training groups and in the execution of the department's asset management plan. The team can consist of Division Directors, Region Engineers, and Program Managers and technical experts as necessary. Partner agency representatives, especially the Highway Patrol, should also be included. Team members can begin regularly communicating the plan's goals, implementation process, and progress throughout the department, down to the level of field and frontline staff.

4.4.2 Task CUL-1a: Business Case Preparation

Plan adoption and initial execution is dependent on as great a level of participant buy-in and understanding as possible. Completion of the business case for TSM&O and the TSM&O Program is therefore an immediate need. As described earlier, the business case material presented in the introduction can be refined, organized, formatted, and branded in ways that most effectively suit intended audiences. They include internal SDDOT staff not familiar with TSM&O, leadership, decision makers, and peer staff among SDDOT state and local agency partners, members of the state legislature, and the public. Goals and outcomes of the program and plan must be highlighted so that further actions and tasks can successfully be implemented.

4.4.3 Task CUL-2a: Leadership Commitment to TSM&O

Commitment to SDDOT's TSM&O Program and the plan's vision and goals must start with department leadership. The plan and its implementation strategy should be endorsed by the SDDOT Executive Team. They should approve the plan's formal adoption. Subsequently, leadership should be actively involved in supporting the program plan's actions and tasks and promoting its goals and accomplishments, both within the department and to external decision makers and stakeholders. Without this, there stands little chance of sustained success, because leadership is the driving force behind supplying the necessary resource commitment, fostering implementation momentum and staff buy-in, and cultivating external recognition (e.g. from the legislature and public) of TSM&O as an SDDOT priority.

CHAPTER 5 RECOMMENDATIONS: ACTIONS, TASKS AND IMPLEMENTATION STEPS

5.1 Overview

This TSM&O Program Plan's recommendations are organized around the six dimensions of TSM&O capability identified through SHRP2 research and used in AASHTO's guidance on improving agency TSM&O capability. The TSM&O Capability Improvement Workshop in which SDDOT and its partner agencies participated used these dimensions to evaluate the department and identify targets for improvement and implementation actions to get there. The TSM&O Program Plan is one outcome of that exercise and builds on the self-assessment findings.

Among the six dimensions, the plan's recommendations include actions, tasks, and implementation steps, characterized as follows:

- **Actions** – Top-level recommendations that can involve several discrete activities, extending from the near-term through to the longer-term, resulting in significant implications or outcomes for SDDOT TSM&O capability.
- **Tasks** – Discrete activities that can be individually prioritized, typically can be accomplished within a set timeframe (near, mid, or long-term), and result in a certain identifiable outcome—for example, development of a new product or process, use of a product (one time or ongoing) or process, completion of training, or key decision.
- **Implementation Steps** – The specific steps needed to incrementally carry out a task, along with guidance on the task's priority, feasibility (resource implications), and staff roles within SDDOT and among partner agencies.

5.2 Organization & Staffing

5.2.1 Introduction to Organization & Staffing

Organization refers to the structure of and relationships among the functional units and individual managers and technical staff within SDDOT. Staffing refers to the availability of needed technical and managerial capabilities among SDDOT employees. Agency capabilities in this dimension can range from fragmented roles based on legacy organization and available skills to professionalization and certification of operations core capacity positions including performance incentives.

Overall, SDDOT assessed itself for this dimension at Level 1.5 in the Capability Improvement Workshop (see Table 2-3). An appropriate target of Level 2 would be achieved by having in place a TSM&O-specific organizational concept with the relationship among divisions and offices more clearly delineated. The recommended actions for SDDOT in this dimension include the establishment of a TSM&O structure within the organization and the development of staff capabilities to both focus and support the implementation and ongoing evolution of TSM&O.

5.2.2 Action O&S-1: Establish a TSM&O Structure within SDDOT

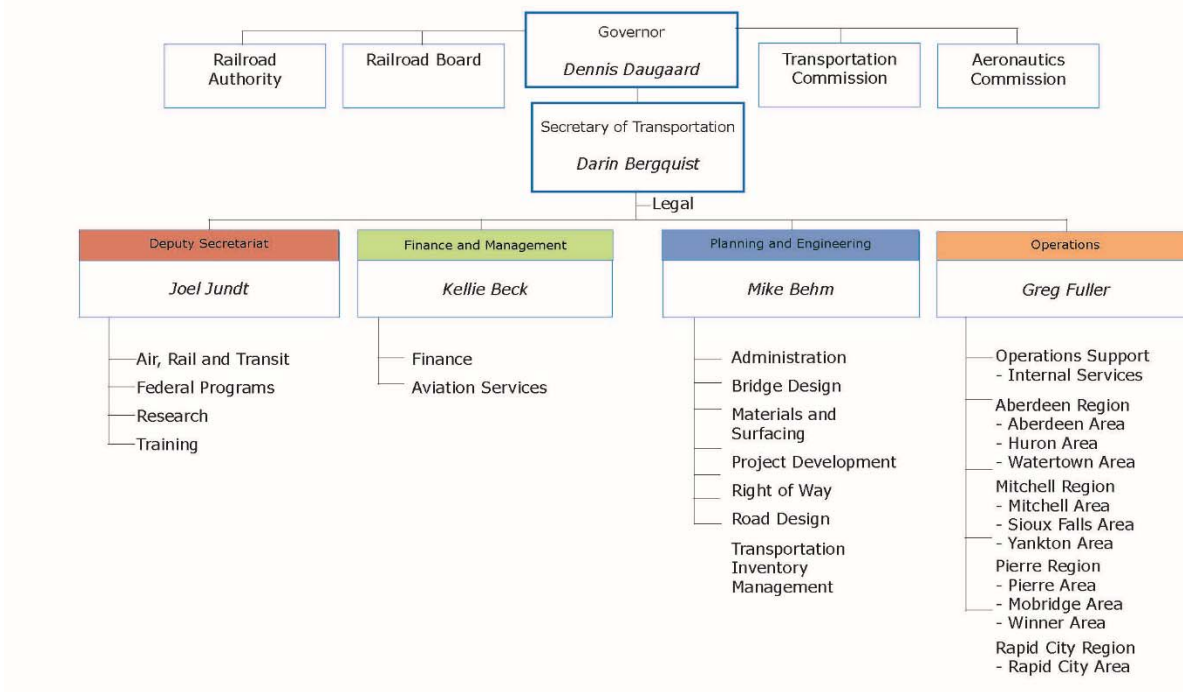
5.2.2.1 Background and Rationale

As illustrated in Figure 5-1, SDDOT's organizational structure is relatively traditional and oriented toward constructing and maintaining roadway infrastructure. There is no consolidated division or office responsible for TSM&O activities or systems, and consequently no organizational concept or reporting structure with primary responsibility for TSM&O planning, design, implementation, or management. While this structure has been consistent with SDDOT's primary mission to date, as it looks toward advancing TSM&O capability and instituting a more formal TSM&O program, it may be necessary to apply organizational changes to better support TSM&O outcomes. The fragmentation of ITS knowledge and responsibility within the organizational structure, in particular, requires specific attention.

Responsibility for existing TSM&O-oriented activities is currently fragmented across the department depending on the specific strategy. Division of Operations staff within Region and Area offices and in the field are responsible for managing day-to-day TSM&O activities such as traffic incident response, weather event response and winter maintenance, planned special event management, and work zone management. Some local traffic engineering such as work zone traffic control design is performed at the Region level. Traffic signal design and most initial timing (except the City of Sioux Falls) are performed in the Office of Road Design. Signal operations and retiming become the responsibility of municipalities. Operations Support within Central Office provides statewide coordination and management of these activities through traffic engineering and maintenance support. ITS project development and some ITS device maintenance, however, is housed in the Office of Research.

There is a near-term need to evaluate and rationalize the existing organizational structure with respect to ITS knowledge and responsibility fragmentation. ITS expertise lies within the Office of Research and is applied to ITS project development. Project handoff and knowledge transfer to appropriate staff in the Division of Operations, especially maintenance staff within Operations Support, need improvement to clarify roles and responsibilities for post-research project implementation and appropriate longer-term ITS device maintenance.

Figure 5-1: SDDOT Organization Chart



No formal ITS education program or process exists within the department. Once the Office of Research completes an ITS project, assuming formal responsibility for ITS project implementation and upkeep and gaining a technical understanding of the projects’ systems by the Division of Operations take place on a project-by-project basis, generally following a project’s implementation plan. Management agreements are designed to facilitate handoff but tend to lack a committed champion or sufficient follow-through. The appropriate level of project implementation plans’ operational guidance is not well defined. Occasionally projects are completed in multiple phases over several years, making handoff delineation even less clear. Interim implementation milestones for handoff may warrant consideration. In one instance, environmental sensor stations (ESS), part of the department’s road weather information system (RWIS) program, are still maintained by Research staff several years after development and implementation. Conversely, DMS responsibility now lies with Operations but the office does not possess the same level of technical expertise as Research. Involving Operations Support staff earlier in ITS project development should be encouraged.

Many staff recognize—to varying degrees—the growing significance of TSM&O application strategies and ITS solutions to address future system safety and reliability issues, accommodate evolving system demands and technology, proactively serve travelers in the state, and respond to the reality of reduced federal funding that supports traditional capital improvements. The informal nature of TSM&O and the need to better define operational expectations affects ITS project handoff clarity as well. An example is the development of the winter MDSS, which has not been supported by Central Office guidance on its implementation and use. This weakness is reflected in a need for Operations to assume responsibility for making timely updates to system users and routes and providing user training.

Further highlighting a lack of clarity on ITS responsibilities, not all ITS projects are initiated within Research. The installation of surveillance cameras at rest areas and implementation of snow gates for

the snowplowing fleet are two examples. Input from Research, development of an ITS plan, and the application of systems engineering were absent from these initiatives. There is no clear division of responsibility between Research and Operations for ITS-related assistance inquiries from the Regions.

Overall, familiarity with ITS concepts and technology is not sufficient throughout the department (and among partner agencies) and should extend beyond the Office of Research. Keeping pace with rapidly evolving technology change and being able to use that knowledge to make sound investment decisions is a staff resource challenge. Local and especially rural municipalities' capability to manage and maintain ITS equipment—notably traffic signals designed by SDDOT—is minimal. If not assisted by SDDOT, local signal retiming needs often go unaddressed.

It is important to note that the near-term organizational modifications recommended in the following tasks are focused on establishing leadership and key expertise within the department to continue leading TSM&O implementation. The tasks are also initially focused on further clarifying the transition of TSM&O activities from development in Research to implementation in Operations. For example, Task O&S-1b references further organizational structure modifications that may occur after the TSM&O Implementation Team described in Task O&S-1a completes their initial work and input from Action O&S-2 is available.

The tasks in this action will also help SDDOT think through the pros and cons of ultimately implementing a dedicated TSM&O office or unit, compared with distributing TSM&O responsibilities among existing office and staff or applying some intermediate solution. Appendix B provides a tabular summary of four state DOTs that recently underwent significant reorganizations to create a dedicated TSM&O office or division. Two counterexamples are also provided of state DOTs known for effective TSM&O capabilities, but have done so without a dedicated unit, instead distributing responsibilities among several units. Current organization charts for all six state DOTs are included in the appendix.

Establishing a TSM&O structure within SDDOT will provide the following benefits:

- more focused roles for TSM&O throughout the department allowing expectations to be set and accountability to be managed within the TSM&O, resulting in more efficient TSM&O activities and ultimately to improved performance
- a more consistent approach for transitioning TSM&O projects from development in Research to implementation in Operations, which will lead to more effective operations and cross-functional communication as more systems are implemented

5.2.2.2 Task O&S-1a: TSM&O Implementation Team

Establish an interim TSM&O Implementation Team within the department to serve as the internal focal point for near-term policy development, change management, education, and accountability. Members of the team should represent a cross section of the functional areas throughout the department. The team can consist of Division Directors, Region Engineers, and Program Managers and technical experts as necessary. This approach is akin to the successful structure of standing training groups and in the execution of the department's asset management plan. Additionally, many activities addressed by the team (e.g. incident management, work zone management) will involve the Highway Patrol, and as such, it should also be included as a member of the team. The team will address near-term roles for

leadership, management, and staff level positions. The implementation steps below represent those most needed to establish the TSM&O Implementation Team and generate momentum for continued TSM&O implementation. Additional tasks and corresponding implementation steps in other dimensions are also assigned to the TSM&O Implementation Team as a staff lead or support.

Table 5-1: Task O&S-1a – Implementation Steps

Implementation Steps	
1.	Communicate to the full department the business case for TSM&O (developed in Action CUL-1) and expectations for TSM&O strategy execution or ITS use as articulated through operations guidance (developed in Action S&T-4).
2.	Establish Area Engineers as TSM&O champions within the Regions to serve as local conduits for sharing information. Initially, the Area Engineers may communicate the business case and expectations regarding TSM&O, introduce the new regional TIM support groups described in Task COL-1a, arrange and participate in the regional TSM&O review meetings noted in Task COL-1b, and share best practices within their area.
3.	Document best practices from throughout the department to share as examples of existing TSM&O work that can be replicated in other areas. These best practices may be used during the regional TSM&O review meetings described in Task COL-1b.
4.	Consistently apply the existing implementation process for transitioning TSM&O related projects and activities from Research to Operations. The process requires the development of a plan that describes an implementation approach with recommended roles and responsibilities, schedule and resources, as well as criteria for evaluating progress. The Managerial Focus and Senior Leadership Position should be responsible for evaluating and ensuring progress through periodic status meeting and reports identified in Task O&S-1c. This process is also consistent with the operations and maintenance step in the systems engineering process noted in Task S&T-2b.
5.	Using the existing implementation process, carry out the SDDOT Research Review Board-authorized development of an implementation plan for MDSS and consider transferring MDSS and RWIS from Research to Operations. These TSM&O services are developed and used in daily operations, and as such they should be formally transitioned into Operations. This step will encourage Research and Operations staff to formally establish an implementation plan that delineates roles and responsibilities, identifies resources and establishes a schedule for making the transition happen.
6.	Evaluate the implementation process used for MDSS and RWIS to determine if modifications are needed to support the transition of additional TSM&O projects and activities from Research to Operations.
7.	Encourage active participation from Operations in the identification of future Research efforts associated with TSM&O. This could occur through regional TSM&O review meetings described in Task COL-1 and through Research solicitations for new research needs.

- **Priority** – This is an immediate and near-term task to initiate within the first three months and upon which much of the remainder of the plan depends.
- **Feasibility** – This task has significant staff resource implications, as the proposed Implementation Team will require several individuals from Central Office and the Regions to participate and commit their time.
- **Staff Roles** – The proposed Managerial Focus and Senior Leadership Position also included in Action O&S-1 will work with the Implementation Team in several of the Implementation Steps. Leadership approval is needed to pursue this approach. No partner agencies are directly involved.

5.2.2.3 Task O&S-1b: TSM&O Managerial Level Focus

Assign a managerial level focus to TSM&O within the department to serve as an ongoing focal point and resource for TSM&O—internally and externally. This may be accomplished by creating a new position, modifying an existing position, or assigning responsibilities across multiple positions. Ideally, this

managerial focus would be assigned immediately so the individual(s) could actively participate in the interim TSM&O Implementation Team (as described in Task O&S-1a). This assignment should initially focus on efforts to support internal TSM&O staff and business process development in partnership with Area Engineers in the regions. The implementation steps below represent those most needed to establish the managerial focus for TSM&O and sustain momentum for continued TSM&O implementation. There are additional tasks and corresponding implementation steps in other dimensions that are also assigned to this role as a staff lead or support.

Table 5-2: Task O&S-1b – Implementation Steps

Implementation Steps	
1.	Determine if managerial level focus is best accomplished by creating a new position, modifying an existing position, or assigning responsibilities across multiple positions.
2.	Support near-term implementation steps described in Task O&S-1a.
3.	Keep abreast of national TSM&O policy developments and training opportunities to identify those that could support SDDOT’s TSM&O program development. Key national sources include the FHWA Office of Operations, National Operations Center of Excellence, and AASHTO Subcommittee on TSM&O.
4.	Monitor the department’s ongoing TSM&O activities to identify challenges and opportunities for future development.
5.	Serve as a TSM&O subject matter expert for leadership and staff level positions.
6.	Identify further organizational structure modifications to support continued TSM&O program development (e.g. establishing regional TIM support groups as described in Task COL-1a; performing TOC-related tasks as described in Task S&T-3a). The Iowa DOT TSM&O Program Plan provides examples of typical TSM&O staffing roles and needs that could also be referenced for potential changes to organizational structure.

- **Priority** – This is an immediate and near-term task to initiate within the first three months that will help strengthen the effectiveness and accountability of much of the rest of the plan.
- **Feasibility** – This task has significant staff resource implications, whether a new role is created or if existing staff fulfill the role. This focus fills a longstanding gap in SDDOT TSM&O capability from a staff resource perspective.
- **Staff Roles** – Leadership approval is needed to pursue this approach. No partner agencies are directly involved.

5.2.2.4 Task O&S-1c: TSM&O Senior Leadership Position

Assign one existing senior leadership position within the department to be responsible for holding the TSM&O Implementation Team and Managerial Focus accountable for near-term tasks described in Task O&S-1a and Task O&S-1b. This oversight role may be expanded as the department further develops TSM&O, particularly as development migrates to external transportation partners. The implementation steps below represent those most needed to establish the senior leadership focal point for TSM&O and support momentum for continued TSM&O implementation. This focused leadership position will serve as a sounding board and conduit to the full department leadership that includes all divisions, the secretary, and deputy secretary.

Table 5-3: Task O&S-1c – Implementation Steps

Implementation Steps	
1.	Provide high-level direction for TSM&O development in alignment with department-wide goals and activities.
2.	Review and approve the tasks associated with other near-term actions.
3.	Secure resources to carry out actions and tasks associated with TSM&O development.
4.	Hold periodic status meetings with the TSM&O Implementation Team and Managerial Focus.
5.	Provide status reports against established performance outcomes to other department leadership, including the Governor and Transportation Commission.

- **Priority** – This is an immediate and near-term task to initiate within the first three months that will help strengthen the effectiveness and accountability of much of the rest of the plan.
- **Feasibility** – This task has modest staff resource implications, with the suggested implementation activities being incorporated into the proposed individual’s existing day-to-day responsibilities.
- **Staff Roles** – Leadership approval is needed to pursue this approach. No partner agencies are directly involved.

5.2.3 Action O&S-2: Develop Staff Capabilities for TSM&O

5.2.3.1 Background and Rationale

Sufficient, qualified staff resources directly correlate to the department’s ability to effectively manage and perform TSM&O activities, because TSM&O requires both adequate staff availability, often 24 hours per day, and special capability to conduct the necessary research, design, implementation and maintenance of technologically intensive applications. Finding, retaining, training, and planning for eventual succession in staff changes are all challenges that must be addressed as SDDOT seeks to build a more formal TSM&O program.

SDDOT is challenged to find and cultivate staff with appropriate qualifications to perform the functions necessary to support a TSM&O program. Specialized skills include traffic engineering, systems engineering, ITS device maintenance, information and communications management, and keeping abreast of rapid changes in technology. Employees knowledgeable in these disciplines are at a premium across the country. South Dakota’s small population and limited number of engineering and technical sources of higher education amplifies this problem. Additionally, hiring and advancement opportunities strongly favor those who hold civil engineering degrees, even though SDDOT is not limited to recruiting candidates with only those qualifications.

For positions that require TSM&O or ITS skills and expertise, typically a new employee does not enter the job with all necessary knowledge. On-the-job training is common. A more formal, structured approach to staff development and training is desired, however. In general, staff availability and skills to perform ITS device maintenance is a particular challenge.

The need for sufficient staff resources and availability often affects other aspects of the department’s capability to support TSM&O. Demand for traffic design and signal timing project needs exceeds staff availability. Insufficient staff resources also impact an ability to consider all operational and safety issues for the approximately 150 projects per year that go through the project development process. This

inhibits properly considering TSM&O or ITS solutions through the course of project development. There are also little to no staff resources to research new technology applications (e.g. adaptive signal controllers) and to stay out in front of ITS advances and industry trends that may affect SDDOT's customer service mission and performance.

No succession plans are in place to provide continuity, transfer knowledge, and communicate roles and expectations during staff turnover among key positions—especially when knowledge of certain procedures are grounded in informal relationships.

Another area related to staffing that was not directly explored during this project involves the South Dakota contractor community which often serves as a temporary extension of SDDOT staff in various capacities. Similar to SDDOT, it is recognized that local contractor staff may also be limited in their knowledge and experience with TSM&O strategies, and this could present challenges for SDDOT when external resources are needed to support select TSM&O efforts. In the spirit of nurturing a TSM&O culture throughout the state, SDDOT is also encouraged to include contractors in training and developmental opportunities when appropriate.

Winter maintenance is one area with some success in addressing the challenge of TSM&O staff expertise. Operations Support recently added a winter maintenance specialist position to encourage adoption of MDSS, instruct Regions on its use, and develop consistent procedures statewide. Although the precise job functions of the winter maintenance specialist are still being determined, the intent of developing key expertise for an important TSM&O resource is an excellent example of how the department can continue to build expertise in other areas.

There has been additional success with the recent and ongoing TSM&O-related training. The National Traffic Incident Management Responder Training Program sponsored by FHWA is being applied in South Dakota to improve awareness and consistency with national TIM goals for responder safety, quick clearance, and improved agency collaboration (e.g. prompt, reliable, and interoperable communications). Train-the-trainer sessions have been held in Pierre, Rapid City, and Mitchell. There is also recognition that the training needs to be multidisciplinary. Partner agency participation is taking place including county emergency managers and the Highway Patrol. The Highway Patrol, in turn, intends to have all troopers take the training. Towing and recovery personnel in Sioux Falls were also trained.

Additionally, each Region has identified SDDOT staff responsible for TIM training coordination. Training opportunities are sometimes held on weekends when local emergency service personnel—typically volunteers with other jobs during the work week—are available. The training has been very well received in the Sioux Falls region, although Rapid City staff report that the content could be more specific to the local context. The approach to TIM training is another example of how the department has addressed staffing for one specific TSM&O area that could be emulated for other areas.

Work zone traffic control training (MUTCD regulations) for SDDOT staff and contractors is a specific area of training that the department should pursue in the near-term. There is recognition that an understanding of the basics must come before being able to apply ITS enhancements to work zone traffic management—for which opportunities for improvement exist, especially building on the

experience with temporary devices and systems (e.g. queue detection) deployed during the Sturgis Rally.

The SDDOT mentoring program may provide further workforce development opportunities. This program, scheduled on an 18-month cycle, pairs 25 to 50 staff with mentors to expose participants to new aspects of the department. A mentee defines his or her own goals that can relate to job function, leadership, a special skill, etc. Improvements such as breaking down organizational silos and helping to streamline certain business processes can be attributed to the program. A volunteer committee runs the program on a modest budget with consultant assistance.

Developing SDDOT staff capabilities for TSM&O will result in the following benefits:

- improved training for staff, which will result in improved competency in operation and maintenance of TSM&O program elements, leading to improved performance
- improved recruitment and retention by providing opportunities in this emerging field

5.2.3.2 Task O&S-2a: Division of Operations Staff TSM&O Training

Assess Division of Operations staff capabilities, training needs and succession plans for TSM&O, and develop recommendations for gradually addressing them at Central Office first, then in the Regions. Initial priority should be given to work zone management training, staff development, and succession planning. Based on the experience gained from TIM and then work zone management, staff capabilities, training needs and succession plans can then be developed for other TSM&O areas and applied to other functional areas within SDDOT.

Table 5-4: Task O&S-2a – Implementation Steps

Implementation Steps	
1.	Conduct an assessment of staff capabilities and succession opportunities within the Division of Operations related to work zone management, including the application of technology. The assessment should identify where current capabilities lie, how knowledge is being (or could be) transferred to others, and what additional expertise is needed.
2.	Evaluate the National Highway Institute Certificate in Work Zone Safety as an existing national resource (similar to the TIM training) that could be used within the department to support work zone management training, especially with addressing safety and establishing consistency of practice across the state. This is instructor-led training that could be especially useful as it has a module specifically focused on advanced work zone management. The NHI training should be evaluated in context with the American Traffic Safety Services Association-sponsored training that SDDOT has previously used to determine which combination best addresses the needs identified within Operations.
3.	Host work zone management training for staff identified through the assessment of Operations' needs. Training invitations may also be extended to other SDDOT functions (e.g. Road Design) and contractors as appropriate to expand their work zone management knowledge.
4.	Following classroom training, attendees should be identified and paired with experienced staff for additional in-field, on-the-job training that will allow them to apply the knowledge gained regarding work zone management. The Traffic Engineering Panel could potentially be a resource for supporting this additional field training.

- **Priority** – This is a near-term task to carry out within the first 3–18 months of the plan. The Division of Operations should begin addressing their staff capabilities, training needs, and succession plans first before these activities expand throughout the rest of the department.
- **Feasibility** – This task has moderate staff resource implications to conduct the necessary assessments and participate in training and knowledge sharing.

- **Staff Roles** – The TSM&O Implementation Team and Managerial Focus will have primary responsibility for leading the task with support from the Operations Traffic Engineer. Leadership approval is needed to pursue this approach. Select partner agency staff (e.g. Highway Patrol) and members of the contractor community may participate in the work zone management classroom training and in-field training.

5.2.3.3 Task O&S-2b: Department-wide Staff TSM&O Training

Assess department-wide staff capabilities, training needs and succession plans for TSM&O, similar to what is recommended in Task O&S-2a for the Division of Operations and work zone management in the near-term. This task will likely identify ITS device design and maintenance as the most immediate training needs.

Table 5-5: Task O&S-2b – Implementation Steps

Implementation Steps	
1.	Assess staff capabilities and succession opportunities in Operations and Planning and Engineering for remaining TSM&O service areas, excluding TIM and work zone management. The assessment should identify where current capabilities lie, how knowledge is being (or could be) transferred to others, and what additional expertise is needed.
2.	Review evaluation feedback from work zone management and TIM training participants to confirm its effectiveness, and identify strengths and weaknesses for planning additional TSM&O training.
3.	Identify national resources that may be used to support additional TSM&O training and development needs. Resources may include the National Operations Center of Excellence, FHWA Office of Operations, FHWA Resource Center, the Consortium for ITS Training and Education (CITE), and additional Regional Operations Forums like the one sponsored by the North/West Passage in May 2015. It may also be possible to organize training with DOT staff in other states through the FHWA Peer-to-Peer Program.
4.	Based on experiences with TIM and work zone management, develop training, staff development and succession plans for other TSM&O service areas associated with planning, design, construction and maintenance. As with work zone management, training should be followed by in-field, on the job training when possible.
5.	Standing training groups should be established for select TSM&O service areas (e.g. TIM and work zone management) or TSM&O overall to support training and development.

- **Priority** – Although completion of this task may be mid- to long-term (18 months to 5-year+ range) to support the continued development of TSM&O throughout other department functions, there may be more immediate training and development needs that arise and need to be addressed separately (e.g. ITS device design and maintenance).
- **Feasibility** – This task has moderate staff resource implications to conduct the necessary assessments and participate in training and knowledge sharing.
- **Staff Roles** – The Managerial Focus will have primary responsibility for leading the task. Leadership approval is needed to pursue this approach. Select partner agency staff can provide input on relevant experience with work zone management and TIM training.

5.3 Culture

5.3.1 Introduction to Culture

Culture broadly encompasses the department’s focus, understanding, and support for TSM&O. It characterizes how well TSM&O is understood technically among staff and leadership and how extensively it receives support and is championed by leadership as a department priority. Functionally,

TSM&O's status as a formal program with supporting policies and authorizations to carry out its activities is also incorporated in this dimension. Culture represents the extent to which TSM&O is embodied in an agency's mission, vision, and strategic objectives. Finally, culture includes agency outreach to communicate to its customers and partners the significance of TSM&O and to build awareness and technical understanding of its activities.

Agency capabilities in this dimension can range from individual staff champions promoting TSM&O in an *ad hoc* fashion, without concepts being widely understood beyond them, to a customer mobility service commitment accepted as a formal, top-level program. The recommended actions for SDDOT in this dimension include preparation and application of the TSM&O business case to communicate benefits and justify investments in its improvement, further leadership and staff commitment to TSM&O, aligning department strategic objectives with TSM&O outcomes, and improving TSM&O outreach to customers.

5.3.2 Action CUL-1: Establish the Business Case for TSM&O

5.3.2.1 Background and Rationale

Often the public perception of SDDOT's mission is that it "build roads." "Operations," if considered at all, usually means an activity such as snowplowing. There is a need to better articulate and communicate to customers the business case for investing in and deploying TSM&O activities, technology, and tools.

Likewise, local partner agencies' understanding of TSM&O is often limited, and essential educational material would help them appreciate and consider TSM&O among their areas of responsibility (e.g. transportation planning).

The business case for TSM&O would provide explicit recognition and examples of the value and role of TSM&O. This technical justification would allow SDDOT to solidify an agency-wide appreciation for TSM&O, building on its growing recognition across department offices, and allow the department to communicate this to appropriate stakeholder groups including the public. Reciprocally, an appreciation of the business case would allow SDDOT to become more attuned to customer needs from an operational perspective—i.e. being aware of and applying appropriate strategies to the various sources of non-recurring congestion that generally characterize South Dakota's TSM&O needs.

Developing and communicating the business case for TSM&O will provide the following benefits:

- methods and means for the department to articulate purpose and benefits for making investments in TSM&O capabilities and strategies—internally to staff and leadership, externally to decision makers, and to the public and stakeholders
- clear identification of information and data with which to make more cost-effective decisions on the use of department resources
- a platform for which SDDOT agency partners can begin to achieve similar outcomes by identifying their own benefits from investing in TSM&O

SDDOT assessed itself as a Level 2 for Culture in the Capability Improvement Workshop (see Table 2-3). The results of discussions with SDDOT staff suggest that Level 2–3 is an appropriate target for next-step achievement. The recommended tasks would help the department achieve and enhance an agency-wide

appreciation of the value and role of TSM&O (Level 2) by providing technical justification of TSM&O from a customer service related perspective. It would also begin to achieve TSM&O as an accepted, formal function of SDDOT (Level 3). An agency-wide understanding of TSM&O’s implications on the department’s mission, strategic objectives, and programs should be cultivated.

5.3.2.2 Task CUL-1a: Business Case Preparation

Prepare simple TSM&O business case document(s) tailored to certain audiences that:

- clearly defines TSM&O in terms of activities the department performs or manages and in terms of how partner agencies do or can participate
- presents the rationale for continuing to advance these activities and investing in TSM&O
- illustrates the benefits to the state and the public, using TSM&O payoff examples augmented with national best practice and outcomes as necessary

Table 5-6: Task CUL-1a – Implementation Steps

Implementation Steps	
1.	Confirm and articulate the rationale for why TSM&O is important in South Dakota and why the state should commit to a TSM&O Program.
2.	Compile information on existing TSM&O activities including their current state, where opportunities may lie as articulated through this plan’s development (i.e. staff interviews), partner agency roles, existing South Dakota best practices, and benefits.
3.	Organize information into a concise business case geared toward target audiences and opportunities identified through this TSM&O Program Plan (see Task CUL-1b and Task CUL-1c): internal SDDOT staff not familiar with TSM&O, leadership, decision makers, and peer staff among SDDOT state and local agency partners, members of the state legislature, and the public.
4.	Discuss and refine draft business case material contained within this plan’s introduction.
5.	Finalize business case material by developing formatted and branded standalone documents.
6.	Update the material as necessary, especially as new applications, best practice examples, and benefits develop (see Task BP-1a).

- **Priority** – This is an immediate task to complete within the plan’s first three months. The development of the TSM&O business case is critical to other tasks as it will help communicate the purpose and benefits of TSM&O, the program plan itself, and justification for making TSM&O investments.
- **Feasibility** – The essential material to develop business case document(s) tailored for various audiences is contained within the program plan’s Part 1 Introduction. Implementation Steps 1, 2, and the majority of 3 are effectively complete. The business case can be finalized, organized, and formatted with minimal resource implications.
- **Staff Roles** – The TSM&O Implementation Team should lead the final development of the TSM&O business case. Finalizing the business case products and the branding and incorporation of the material into an outreach or communication strategy should be done in collaboration with the DOT Public Information Officer (see Task CUL-4b on outreach). Leadership review and approval of the business case material is required. Partner agency input, especially from the Department of Public Safety, could be sought to enhance the business case material content itself or effectively tailoring it to appropriate applications, as proposed in Task CUL-1b.

5.3.2.3 Task CUL-1b: Business Case Applications

Present or provide the business case to inform stakeholders and decision-makers.

With the business case material organized, SDDOT can identify opportunities and audiences for its presentation. Application of the business case can advance the goals for TSM&O laid out in the program plan and help support the plan’s actions and tasks. As suggested in the implementation table below, audiences and forums should align with opportunities to provide:

- explanatory background on TSM&O information and outcomes
- resource allocation justification
- justification for programmatic, policy, or organizational changes
- a basis for new or strengthened cooperative relationships and activities with partner agencies

The timing and execution of the implementation steps are not sequential and are dependent upon when SDDOT carries out certain other the specific actions and tasks that require support from the TSM&O business case.

Table 5-7: Task CUL-1b – Implementation Steps

Implementation Steps	
1.	Use existing meetings and forums as opportunities to conduct internal education briefings among SDDOT staff to: <ol style="list-style-type: none"> a. Summarize what is TSM&O, what SDDOT TSM&O activities are taking place, and what their benefits are b. Demonstrate how existing SDDOT job functions can play a role in the delivery of TSM&O activities c. Demonstrate how existing SDDOT job functions already do play a role in the delivery of TSM&O (without explicit recognition) and can be further enhanced
2.	Use the business case to help identify adjustments to department strategic objectives and performance goals (Task CUL-3a).
3.	Communicate the case internally for making TSM&O investments in capital and non-capital projects, equipment, and staff resources.
4.	Communicate the case internally for building staff TSM&O capabilities and knowledge, including organizational adjustments (Task O&S-1), training and development (Task O&S-2), promulgation of operations guidance (Task S&T-4), and adjustments to existing processes such as planning (Task BP-1b, Task BP-1c), programming (Task BP-1d), and project development (Task BP-1e).
5.	Communicate the case externally for making TSM&O investments and potential adjustments to supporting policies, including: capital and non-capital projects, resources (funding), and changes to laws or regulations. Potential audiences include the Governor, the Transportation Commission, secretaries and directors at other state agencies, state legislators, and local decision makers.
6.	Communicate the case externally when meeting with partner agencies to plan for TSM&O, improve execution of existing activities, and provide education as necessary. Audiences include the Transportation Advisory Council, LTAP, and SDDOT MPO Coordinator (Task COL-2a); local agency partners (Task COL-2b) including municipalities, tribal governments, local law enforcement agencies, and MPOs; and key customer segments such as freight and agricultural interests.

- **Priority** – This is a near-term task to carry out primarily within the 3–18 month timeframe, once the Task CUL-1a business case is ready. Beyond that timeframe, the business case can still be applied to facilitate TSM&O communication and justification, and should be kept up-to-date. Using the business case in ways suggested in the Implementation Steps will be critical to obtaining internal and external buy-in for committing to the program plan’s recommendations.

- **Feasibility** – With the business case material finalized and packaged in ways that are most effective for the intended audiences, communicating its content has minimal resource implications.
- **Staff Roles** – The TSM&O Implementation Team should lead the identification of opportunities to use the business case and help ensure that it is deployed to its fullest extent. Users of the business case can include:
 - SDDOT leadership
 - TSM&O champions (including TSM&O Implementation Team members) at Central Office and in the Regions with active participation in appropriate meetings or forums
 - TSM&O project or initiative lead(s) during the project planning and development processes

In cases where leadership is not the direct user of the business case, leadership should endorse its use by others. Partner agency staff may participate to lend credibility and information to certain aspects of the business case presentation—for example, members of the Highway Patrol involved in TIM.

5.3.3 Action CUL-2: Articulate and Establish the Appropriate Level of TSM&O Program Status

5.3.3.1 Background and Rationale

Extensive interviewing of SDDOT and partner agency staff indicates near-universal recognition that TSM&O deserves more formal consideration as a department activity. An essential goal of the TSM&O Program Plan is to advance SDDOT’s currently informal set of TSM&O activities to one with more “formal” consideration. This may entail establishing a “formal program,” i.e. one that is accorded status on par with legacy activities or “programs” such as capital construction, maintenance, or safety—in terms of supporting policy, planning, budgeting, organization, and staff capabilities. A formal TSM&O Program would have to be supported by appropriate business processes, organizational arrangements, and technical knowledge—as advanced through the program plan’s other actions.

This goal could also be realized by building TSM&O consideration into all department functions or offices. TSM&O would be appropriately taken into account as a regular part of an office’s function with an understanding of how it contributes to the elevated status of TSM&O department-wide. This shift in considering and treating TSM&O means that TSM&O is more clearly understood, a more ingrained part of everyone’s day-to-day job, and more clearly integrated into the department’s functions and interactions with its state and local partners.

By identifying and committing to actions in this plan, SDDOT lays out an explicit path for advancing TSM&O as a department priority and program, and documents the ways in which the program status of TSM&O can be elevated. However, visible affirmation from SDDOT leadership is also required to guide and sustain progress. The extent to which existing SDDOT business processes and organizational attributes are formalized or adjusted to support this progress should be clearly embraced by SDDOT leadership.

Elevating the program status of TSM&O through leadership commitment and improved awareness and consideration of TSM&O in all department functions will provide the following benefits:

- Affirmation that TSM&O is a department priority to help facilitate other actions and tasks and derive their benefits.
- Broader staff understanding of TSM&O in order to more effectively implement and execute the strategies.

SDDOT assessed itself as a Level 2 for Culture in the Capability Improvement Workshop (see Table 2-3). The results of discussions with SDDOT staff suggest that Level 2–3 is an appropriate target for next-step achievement. The recommended tasks in this action would help establish visible top management commitment to TSM&O to help lead in the definition and establishment of a “formal” TSM&O program (Level 3). They would also promote an agency-wide understanding of TSM&O implications on the department’s activities and establish a formal level of TSM&O consideration in all major department functions (Level 2–3).

5.3.3.2 Task CUL-2a: Leadership Commitment to TSM&O

Obtain a commitment from SDDOT leadership to elevate TSM&O as a department priority by endorsing the TSM&O Program Plan and committing to its Implementation Strategy. SDDOT leadership is considered to be the SDDOT Executive Team, which comprises the Secretary, Deputy Secretary, the three Division Directors and the four Region Engineers.

Table 5-8: Task CUL-2a – Implementation Steps

Implementation Steps	
1.	Upon acceptance of this plan and presentation to the SDDOT Research Review Board (Executive Presentation), obtain leadership endorsement of the plan and have leadership authorize and charge the TSM&O Implementation Team (Task O&S-1a) with carrying out its actions.
2.	Obtain additional leadership support as necessary for the TSM&O Implementation Team to execute this plan’s actions <ul style="list-style-type: none"> a. Use business case material when explaining the plan’s rationale b. Monitor and participate in the work of the Implementation Team as necessary c. Assume the role of the senior leadership position (Task O&S-1c) when established
3.	Build awareness for and incorporate promotion of the plan and its goals into communication from leadership, consistent with the outreach strategy (Action CUL-4) as applicable through: <ul style="list-style-type: none"> a. Memos b. Meetings c. Publications d. Website content
4.	Encourage leadership to externally communicate the plan’s goals and progress as appropriate to the Transportation Commission, secretaries and directors at other state agencies, state legislators, and local decision makers.

- **Priority** – This is an immediate task to carry out within the plan’s first three months, as it is critical that subsequent actions and tasks are supported by leadership’s commitment to TSM&O and the program plan.
- **Feasibility** – This task can be implemented with minimal resource implications. However, commitment to TSM&O and execution of the program plan’s recommendations must compete with other department priorities, and diligence in maintaining focus must be exercised.

- **Staff Roles** – This task primarily involves the actions of leadership, although the TSM&O Implementation Team should encourage and support their endorsement and promotion of the department’s commitment to TSM&O.

5.3.3.3 Task CUL-2b: TSM&O Awareness and Focus among Staff

Incorporate TSM&O awareness and consideration into all department offices and functions and support the development of appropriate capabilities. This more deliberate acknowledgment of TSM&O would increase its visibility and understanding, and advance SDDOT’s capability to perform TSM&O activities and their supporting processes.

The implementation steps outlined below suggest how certain SDDOT offices and their functions can contribute to advancing TSM&O outcomes. This would complement and continue to build on the exposure to TSM&O and internal education suggested in Task CUL-1b (Implementation Step No. 1) and roles and responsibilities suggested by other actions and tasks in the program plan.

For those offices not explicitly identified here, a simpler approach to awareness building can be accomplished through traditional knowledge sharing channels, such as using the business case material as the basis for “brown bag-style” presentations on TSM&O, the TSM&O Program Plan, and the department’s commitment to advancing its capabilities.

Table 5-9: Task CUL-2b – Implementation Steps

Implementation Steps	
1.	Transportation Inventory Management – Develop an understanding of how traffic monitoring equipment and data could be used for operational purposes, such as work zone management, and actively consider application opportunities (e.g. within the I-229 project); keep abreast of what existing data and analytics (and what existing gaps) pertain to selected Performance Measurement activities.
2.	Road Design – Participate as appropriate in systems engineering training (Task S&T-2a); establish as a practice consideration of opportunities for incorporating TSM&O into existing road and traffic design engineering project scopes.
3.	Project Development – Participate as appropriate in systems engineering training (Task S&T-2a); help develop and execute the standard process for TSM&O planning (Task BP-1b), integration of TSM&O into the capital programming process (Task BP-1d), and project development process (Task BP-1e); have the MPO Coordinator act as a conduit for TSM&O planning guidance and coordination with MPOs (Task COL-2a).
4.	Research – Existing job functions already support TSM&O outcomes, therefore: sustain and continue to build capabilities in ITS research and design and participate as appropriate in nearly all actions and tasks, especially Business Processes, Systems & Technology, Performance Measurement, and Organization & Staffing.
5.	Administration (Division of Planning & Engineering) – Consider the role of TSM&O when managing the qualification process of design consultant capabilities.
6.	Operations Support and Regional Offices – Existing job functions already support TSM&O outcomes, therefore: sustain and continue to build capabilities in TSM&O activity execution, as identified in Task O&S-2a; gain a greater understanding of contractor capability to support TSM&O including smart work zone management and ITS device maintenance.

- **Priority** – This is an ongoing task that can begin in the near-term and be sustained over the life of the program plan.
- **Feasibility** – Generally, this tasks needs oversight and guidance from the TSM&O Implementation Team. The resource implications of staff participation in other referenced tasks are discussed within those tasks. This task does require some reorienting of existing job

responsibilities and performance or at least an improved understanding of how existing responsibilities can facilitate greater appreciation and knowledge of TSM&O's elevated focus.

- **Staff Roles** – All staff can benefit from TSM&O awareness building. Specific offices are explicitly identified. Office Program Managers should lead those respective efforts with support from the Implementation Team. The Implementation Team should also lead basic knowledge sharing and brown-bag presentations to other department staff.

5.3.4 Action CUL-3: Adjust SDDOT Mission, Vision, Strategic Objectives, and Performance Goals to Align with TSM&O

5.3.4.1 Background and Rationale

Setting direction for how SDDOT conducts business and serves its customers is established through its mission, vision, strategic objectives, and performance goals. These agency attributes communicate and guide the department's purpose. At a high level, SDDOT's mission ("why we exist") and vision ("what success looks like") capture the agency's essential direction. At a more operational level, strategic objectives are used by leadership and managers to establish priorities and targets for achieving the mission and vision, as well as determining "where we must focus our strengths and resources to overcome challenges." Importantly, they have a direct impact on the annual programming of projects in the State Transportation Improvement Program (STIP) (see Figure 5-3). These objectives can change annually and are typically formulated in the spring and rolled out by July 1. Strategic objectives are supported by measurable performance goals, which recently have been established for 1 and 4-year intervals and represent "the future condition or performance level we intend to attain."

SDDOT's mission and vision and 2015 Strategic Plan do not explicitly address TSM&O or set clear operational performance goals. The 2015 strategic objectives could be modified or augmented to strengthen the connection to TSM&O. Even so, existing strategic objectives such as "improve customer and stakeholder service" could be further achieved through TSM&O strategies and capabilities, but the objective's specific performance goals do not generally suggest a prime role for TSM&O.

For example, minimizing delay from work zones by completing projects on time suggests a TSM&O focus on work zone management, but performance goals for minimizing delay could also be set for traffic incident management or winter operations. In a second example, another 2015 strategic objective is to "sustain and manage the state transportation system and assets." The related performance goals include pavement, bridges, equipment and vehicle fleet, and signing—but not ITS devices.

A few of states maintain both a department-wide mission and vision, and a mission and vision for TSM&O. Agencies that set specific objectives or performance goals for TSM&O are not numerous. Several examples are shown in Table 5-10.

Table 5-10: Example State DOT Missions, Visions and Strategic Objectives

State	Mission	Vision	Sample TSM&O-Related Goals or Objectives
Iowa	[TSM&O-specific] To get you there safely and reliably by proactively managing the transportation system.	[TSM&O-specific] Iowa's transportation system is safe, efficient and reliable, supporting the state's environmental and economic health as a result of TSMO.	<ul style="list-style-type: none"> ▪ Safety – Reduce crash frequency and severity ▪ Reliability – Improve transportation system reliability, increase system resiliency, and add highway capacity in critical corridors ▪ Efficiency – Minimize traffic delay and maximize transportation system efficiency to keep traffic moving ▪ Convenience – Provide ease of access and mobility choices to customers ▪ Coordination – Engage all DOT disciplines, and external agencies and jurisdictions to proactively manage and operate the transportation system ▪ Integration – Incorporate TSMO strategies throughout DOT's transportation planning, design, construction, maintenance, and operations activities <p>Reference: Iowa DOT TSM&O Strategic Plan, February 2016 http://www.iowadot.gov/TSMO/TSMO-Strategic-Plan.pdf</p>
Virginia	[Department-wide] Our mission is to plan, deliver, operate and maintain a transportation system that is safe, enables easy movement of people and goods, enhances the economy and improves our quality of life.	n/a	<ul style="list-style-type: none"> ▪ Ensure multimodal travel opportunities are considered in the commonwealth's transportation network and improve travel time and travel time reliability on key transportation corridors. <p>Reference: VDOT Business Plan Update – FY2016 http://www.virginia.gov/about/resources/FY2016_Business_Plan.pdf</p>
Washington	[Department-wide] The Washington State Department of Transportation provides and supports safe, reliable and cost-effective transportation options to improve livable communities and economic vitality for people and businesses.	[Department-wide] The Washington State Department of Transportation's vision is to be the best in providing a sustainable and integrated multimodal transportation system.	<ul style="list-style-type: none"> ▪ Goal: Modal Integration – Align the operation of all modes in corridors to optimize throughput capacity to move people and freight. Strategy: Operations and Demand Management – Improve WSDOT processes to integrate operations and demand management. ▪ Goal: Smart Technology – Improve organizational effectiveness to expand the timely evaluation, adoption, application and deployment of new technologies used to manage demand and/or enhance system operations to improve system performance. Strategy: Innovative Technology – Assess innovative technologies to identify tools to support operational and demand management strategies. <p>Reference: <i>Results WSDOT</i> – Strategic Plan 2014–2017 http://www.wsdot.wa.gov/publications/fulltext/secretary/WSDOTStrategicPlan.pdf</p>

Aligning SDDOT’s strategic objectives, performance goals, mission, and vision with TSM&O will provide the following benefits:

- affirmation that TSM&O is a department priority to help facilitate other actions and tasks and derive their benefits
- targets to guide and communicate the department’s decision making on TSM&O investments and methods to measure success

SDDOT assessed itself as a Level 2 for Culture in the Capability Improvement Workshop (see Table 2-3). The results of discussions with SDDOT staff suggest that Level 2–3 is an appropriate target for next-step achievement. As with Action CUL-2, the recommended tasks in this action would further help establish visible top management and overall department commitment to TSM&O (Level 3). Embedding TSM&O considerations into its strategic objectives and performance goals would communicate and lend credibility to such a commitment.

5.3.4.2 Task CUL-3a: TSM&O Strategic Objectives

Develop new or modified department strategic objectives and performance goals that include TSM&O activities and outcomes. Use the business case for TSM&O to align them with the prioritized near-term actions of this plan.

Table 5-11: Task CUL-3a – Implementation Steps

Implementation Steps	
1.	During the annual strategic planning process, evaluate current department strategic objectives in the context of the TSM&O Program Plan’s goals and prioritized actions and tasks. Include consideration of peer state strategic objectives for comparison. Identify any modifications or additions to strategic objectives.
2.	Systematically identify how TSM&O activities and projects can help achieve department strategic objectives (as potentially modified above) using TSM&O business case information on existing practices and other background information throughout this plan.
3.	Incorporate the findings above into the annual strategic planning process’s short- and long-term goal setting. Establish goals and performance objectives that take into account TSM&O and align with the anticipated progress and milestones set in this plan.
4.	Document key processes and findings from Steps 1–3 to formally establish TSM&O consideration as an integrated part of the annual strategic planning process.
5.	Incorporate consideration of the following during the strategic planning process when they are available: <ul style="list-style-type: none"> a. TSM&O Deployment Plan developed under Task BP-1a and Task BP-1c b. Operations guidance developed under Task S&T-4b c. Performance measurement process under Task PM-1a and update under Task PM-2a d. Relevant Customer Satisfaction Assessment input that directly reflects TSM&O activities and outcomes

- **Priority** – This is a near-term task to be started in time to incorporate TSM&O into the 2016 strategic planning process. Subsequent annual iterations of the strategic plan can then reflect the TSM&O consideration process established by this task and the products and milestones of completing other actions and tasks in the program plan.
- **Feasibility** – This task has minimal resource implications, as it only requires procedural changes to an existing process.
- **Staff Roles** – The same staff involved in the existing strategic planning process should lead this task with support as necessary from the Implementation Team and TSM&O Managerial Level

Focus, which should make those setting goals and objectives fully aware of their relation to the recommendations and progress of program plan execution. Leadership support should be provided, including from a future TSM&O Senior Leadership Position (suggested in Task O&S-1c). Partner agency input could be sought relative to potential strategic objectives that suggest collaboration or coordination with an external agency (e.g. the Department of Public Safety and their involvement in managing traffic incidents).

5.3.4.3 Task CUL-3b: Mission and Vision Alignment with TSM&O

Identify and consider modifications to SDDOT’s mission and vision that further support and align with the goals of this plan and commitment to TSM&O.

Table 5-12: Task CUL-3b – Implementation Steps

Implementation Steps	
1.	In the mid- to longer-term, determine the value and importance of making adjustments to SDDOT’s mission and vision to reflect TSM&O’s elevated status and consideration as a formal program.
2.	Identify and implement adjustments to the SDDOT mission and vision if Step 1 suggests to do so. Look at missions and visions of peer states with a strong TSM&O focus as examples, including missions and visions focused on TSM&O that are separate from an overall DOT mission and vision.

- **Priority** – This task can be undertaken as deemed appropriate, potentially in the mid to long-term (18+ months) and likely as some of the initial program plan tasks are underway or complete, the commitment to TSM&O is apparent, and a need to reflect that progress and commitment in the department’s mission and vision is clear.
- **Feasibility** – This task has minimal resource implications.
- **Staff Roles** – Suggested revisions to mission and vision can originate from those involved in the strategic planning process or the TSM&O Implementation Team. Leadership approval is necessary.

5.3.5 Action CUL-4: Implement an Outreach Strategy to Customers in Support of TSM&O

5.3.5.1 Background and Rationale

Customer communication is embedded in TSM&O capability. SDDOT communication to its customers—through its website, publications, media coverage, direct communications from leadership, etc.—is an ongoing opportunity to articulate what the department’s purpose and responsibilities are to the traveling public. This type of communication frames the public’s perception and understanding of SDDOT and the services it provides for their tax dollars. It includes the extent to which TSM&O is a priority for the department.

SDDOT’s website and publications do not place significant emphasis on the importance of TSM&O, SDDOT’s current TSM&O initiatives and achievements, or future plans and needs. The SDDOT Annual Report has traditionally focused on capital projects and maintenance (along with safety) and included performance measures to support these activities (e.g. pavement condition and bridge sufficiency).

A more formal TSM&O program and emphasis as a department priority should be apparent to the public. Evidence of this is established in the TSM&O Business Case (Action CUL-1) and supported by the department’s mission, vision, strategic objectives, and performance goals (Action CUL-3). These products should be readily shared with and communicated to the public.

Adequately soliciting and acting upon communication *from* customers is also an area for improvement. SDDOT conducts periodic Customer Satisfaction Assessments “to gather statistically valid data from residents and persons who impact transportation decisions in the [state] to help identify short-term and long-term transportation priorities for the Department”¹² and feed into the ongoing strategic planning process. SDDOT has conducted seven assessments since 1997, but the application of TSM&O strategies, both new and existing, would benefit from more regular user feedback.

Both communicating to customers and soliciting their feedback requires knowledge of key customer segments and an essential understanding of how they use the system and their expectations for service. Sometimes, it may be challenging to fully address the irregular, yet critical events around the state that are known to require active operational management or solutions. These events, which can cause temporary congestion, delay, or safety issues, are far more prevalent than recurring congestion found in more urbanized states. Nonetheless, SDDOT should strive to accommodate all customer needs with respect to when and how they use the transportation system.

An initial compilation of customer segments is provided in Table 5-13. It closely mirrors those used in past SDDOT Customer Satisfaction Assessments. It should be noted that customer communication strategy and improvement extends beyond TSM&O, and this task should be considered in the context of other initiatives to improve SDDOT customer outreach.

Table 5-13: Example SDDOT Customer Segments

Customer Segment	Priority Operational Considerations	Potential TSM&O Enhancements
Regular Commuters	Reliable and safe home-work journey	Improved urban traffic signal timing
Tourists	Clear, safe routes among destinations	Greater DMS coverage with timely and accurate traveler information
Freight Carriers - Intrastate	Reliable, safe routing with delay minimized or known in advance to plan accordingly – interstates and local state routes Routing restrictions identified in advance	Smart work zone management to minimize work zone delay and enhance safety
Freight Carriers - Interstate	Reliable, safe routing with delay minimized or known in advance (including prior to entering the state) to plan accordingly – primarily interstates Efficient port of entry operations Routing restrictions identified in advance	Improved dissemination of SD interstate travel conditions – known prior to decision to enter state when selection of alternative(s) still an option
Rural Agriculture Businesses	Safe entry and exit movements to and from high-speed rural roads	Collaborative solutions to high-speed rural roads’ traffic operations to protect or facilitate turning movements
Employers	Reliable and safe access for employees and customers	Continued advancements in winter operations and traffic incident management

¹² SDDOT 2015 Statewide Customer Satisfaction Assessment, SD2015-07 Final Report, ETC Institute, Olathe, KS for the South Dakota Department of Transportation Office of Research, June 2016.

Like South Dakota, many peer state DOTs actively seek input on customer satisfaction, DOT services they would like to see improved, or feedback on specific projects or initiatives. Some have capitalized on the potentially cost-effective and on-demand solicitation of feedback through their websites. This approach is an option for SDDOT since it would capture a substantial majority of its customer base; nearly three-quarters of South Dakota’s population are internet users.¹³

Email surveys can be used at little cost to garner feedback on specific topics such as satisfaction with work zones or 511 services. These can be sent to existing email lists, purchased through media buyers or an online survey service, and can be made available through social media, the website and other sources. Social media sites like Facebook and Twitter, particularly when used in combination, provide a nearly real-time opportunity to disseminate information and obtain feedback. Facebook ads can be effective and low cost. They could be used, for example, to direct people to an online survey.¹⁴

In one example, the Missouri Department of Transportation (MoDOT) maintains a “Rate Our Work Zones” survey on its website. A partial snapshot is shown in **Error! Reference source not found.** (see: <http://www.modot.org/workzones/Comments.htm>). Questions pertain to understandability, safety, delays, etc. MoDOT directed users who traveled through the work zone to the survey via DMS. A similar approach could be taken for 511.

Overall, gaining a better understanding of customer segments’ needs and effectively applying outreach for TSM&O will provide the following benefits:

- greater ability to make investments that directly respond to the needs of system users, yielding greater customer satisfaction and more effective allocation of resources
- greater awareness and enhanced use of SDDOT TSM&O tools, such as traveler information, improving the quality, reliability, or safety of the trips they take on the system

Figure 5-2 Example Web-based Customer Feedback

¹³ <http://www.internetworldstats.com/unitedstates.htm#SD>

¹⁴ South Dakota had more than 325,000 people on Facebook as of 2014: <http://www.internetworldstats.com/unitedstates.htm#SD>.

SDDOT assessed itself as a Level 2 for Culture in the Capability Improvement Workshop (see Table 2-3). The results of discussions with SDDOT staff suggest that Level 2–3 is an appropriate target for next-step achievement. This action’s recommended tasks would further help establish an appreciation of TSM&O’s value and concepts among stakeholders and the general public (Level 2) and achieve TSM&O acceptance as a formal program with publically visible linkages of performance with TSM&O (Level 3).

5.3.5.2 Task CUL-4a: Meet Customer Segments’ Needs with TSM&O

Develop an improved awareness of customer segments’ expectations with respect to system use and how TSM&O can help meet those expectations.

Table 5-14: Task CUL-4a – Implementation Steps

Implementation Steps	
1.	Identify key customer segments and their priority needs or services expected from SDDOT (relative to TSM&O) starting with those used for the Customer Satisfaction Assessment and suggested in Table 5-13.
2.	Extract relevant information from the current Customer Satisfaction Assessment (see Section 2.2.3.1).
3.	Evaluate and document the extent to which customer segment expectations are being met by current SDDOT services and practices. This can be accomplished in part from interpreting current Customer Satisfaction Assessment results but also will need to be augmented with additional TSM&O-strategy-specific data compiled throughout this plan and potentially new analysis.
4.	Use the results from Steps 1–3 as a reference during execution of the program plan’s actions and tasks as an input that helps define better outcomes. For example, this knowledge can be applied to development of the TSM&O Deployment Plan (Task BP-1c) or development of prioritized Operations Guidance (Task S&T-4b).
5.	To make this a continuous process, implement a regular platform for soliciting customer input and comments related to TSM&O activity performance. This would likely go beyond the current periodic application of the Customer Satisfaction Assessment and incorporate real-time, ongoing feedback via a web-based platform.

- **Priority** – This task should start in the near-term as a solid understanding of customer segment requirements and expectations from SDDOT and its partners is critical to effectively carrying out many of the program plan’s recommendations to improve TSM&O capability. Beyond obtaining this improved initial comprehension, regularly or continuously soliciting customer feedback should be instituted on an ongoing basis.
- **Feasibility** – Identifying and characterizing the needs of customer segments will involve a modest time commitment to build on the information provided in the program plan. Implementing a new, ongoing method or platform to solicit customer feedback may require consultant support.
- **Staff Roles** – The TSM&O Implementation Team should guide this task with input from other staff and partners familiar with particular customer segments. Project panel members who oversaw the 2015 Customer Satisfaction Assessment or staff who are otherwise familiar with its results should be involved. The SDDOT Public Information Officer should advise on this exercise and help lead improvements to customer feedback solicitation. Leadership approval is necessary to implement a new feedback platform. Partner agency input is essential, including from the Department of Public Safety; counties, municipalities, and tribes familiar with their constituent customer expectations; and representatives from large interest groups such as agriculture and freight.

5.3.5.3 Task CUL-4b: TSM&O Outreach Strategy Components

Improve customer outreach for TSM&O and document priority activities in an outreach strategy.

Table 5-15: Task CUL-4b – Implementation Steps

Implementation Steps	
1.	Communicate the traveler benefits of TSM&O applications through routine and special department communications using all forms of media (press releases, periodic publications, website, social media feeds). Consider content from the TSM&O business case and highlights from recent critical events (e.g. weather emergencies, Sturgis). This outreach demonstrates the department’s commitment and accomplishments with respect to TSM&O to customers and supports the case for TSM&O externally.
2.	Consider including select highlights in the SDDOT Annual Report to elevate the significance of TSM&O. Also consider highlighting the TSM&O Program Plan itself.
3.	Elevate the prominence of TSM&O communication and information on the SDDOT website, including a focus on traveler information or other operational announcements. See Appendix A for examples of DOT websites: <ol style="list-style-type: none"> Colorado DOT – clean, modern look with an equal emphasis on its homepage placed on travel information and other operations information (e.g., express lanes, winter driving) as on other areas of the website (e.g., programs and projects, safety) Caltrans – uncluttered homepage with prominent travel information and travel conditions features Maryland State Highway Administration – extensive information on its TSM&O program (Coordinated Highways Action Response Team, or CHART) on a dedicated webpage
4.	Consider creating a TSM&O “brand” (logo, tagline, style for communication) to apply to the steps above and other relevant customer-facing products.
5.	Memorialize identified priority outreach steps in an Outreach Strategy.

- **Priority** – This task should start in the near-term to build external awareness and support for a greater department focus on TSM&O. Communication opportunities are an ongoing activity. Specific applications should be addressed as they arise—for example during the next iteration of annual report preparation. An initial outreach strategy should be established within the near-term (approximately 12 months).
- **Feasibility** – The resource implications of communication and outreach efforts varies. Development of TSM&O content for existing communication products and channels is a modest investment. Modifications to the SDDOT website may be incorporated into larger updates or communication strategies. Consultant support may be required for certain outreach initiatives, such as TSM&O brand development.
- **Staff Roles** – The TSM&O Implementation Team should lead this task in conjunction with the SDDOT Public Information Officer. Website modifications may involve the Bureau of Information Technology. Other SDDOT and partner staff may be engaged as necessary to help develop TSM&O outreach content. Leadership approval is necessary to approve the outreach strategy and final communication products.

5.4 Collaboration

5.4.1 Introduction to Collaboration

Collaboration includes partnerships among local, state and federal levels of government, public safety agencies and, sometimes, private sector companies whose cooperation is essential to the execution of key TSM&O strategies. Agency capabilities in this dimension can range from informal, infrequent relationships to a high level of operations coordination institutionalized among key partners. The actions

recommended for SDDOT in this dimension focus on the establishment of TSM&O functions at the regional level to further develop collaboration throughout the department, and the expansion of TSM&O capabilities among SDDOT partners to encourage a statewide approach to TSM&O in managing transportation throughout South Dakota.

5.4.2 Action COL-1: Establish TSM&O Functions at the Regional Level

5.4.2.1 Background and Rationale

Culturally, personal relationships are a significant component of the state's way of "doing business" with its partners. Building a more formal TSM&O program and improving the capability of SDDOT's TSM&O activities potentially requires formalizing roles and responsibilities among department staff and their partners, while continuing to build the personal and professional relationships that are necessary for any program to be effective. The success and sustainability of existing programs and activities are questionable without mechanisms to formalize participant roles, procedures, and protocols. Current TSM&O activities illustrating this issue include incident management and the CVISN program.

Much success and recent improvements to specific TSM&O activities are credited to strong personal relationships among SDDOT staff and its partners, especially with the Department of Public Safety and Highway Patrol. In general, both SDDOT and the Highway Patrol view their relationships with one another as highly positive and attribute success in various incident management activities, winter operations, and work zone management to their ability to work with one another on a personal basis. Collocation or occupying adjacent property in Sioux Falls, Rapid City, and Aberdeen is beneficial. Direct communication between Highway Patrol and the Area maintenance supervisors facilitates appropriate SDDOT assistance at incident locations, use of DMS, adjustment to work zone configurations when necessary, and decision making on interstate closures due to winter weather conditions. Highway Patrol notes that SDDOT has become more "public safety" focused in recent years, helping to align with Highway Patrol on a shared vision of how to respond to incidents and operate the state highways. The agencies are now working together to explore options for sharing incident information between the Highway Patrol computer-aided dispatch system and the SDDOT traveler information system.

Both SDDOT and Highway Patrol acknowledge certain drawbacks to the informal relationships under which they collaborate. It is not always clear what SDDOT's appropriate role is at an incident and varies by region around the state. Without more formalized policies or procedures, communication protocols, accountability, and on-scene expectations may not always be clear. Informal relationships may also be placing institutional knowledge and existing understanding at risk from staff turnover, as well as making it difficult for new staff to comprehend without some level of documentation. Existing relationships may also be stronger at the senior manager level and may not be carried down respective chains of command. Protocols that rely on personal relationships may be unclear to those not directly involved.

Similar to SDDOT's loosely defined role in responding to incidents in support of Highway Patrol on the state system, its role in incident management on local roads is not well defined. The local system is the responsibility of numerous county and local law enforcement agencies, and SDDOT has no ordinary responsibility for incidents on local roads. The department's involvement depends on its local relationship with each of these entities and typically takes place during emergency response. Local law

enforcement agencies also may be the first to respond to incidents on the state highway system, and the same question of SDDOT's role applies.

Previous efforts have been made to better articulate roles and responsibilities related to incident management. In 2009, a baseline statewide TIM Plan was developed to present general, multidisciplinary procedural guidelines for achieving SDDOT's primary objectives for management of traffic incidents: responder and public safety; safe and efficient incident clearance; and prompt, reliable incident communications.¹⁵ It defined incident severity levels, outlined traffic incident responder roles by incident severity type and road class, and presented procedural guidelines for various types of incidents. Although the plan was not officially adopted, it contained many essential elements to further establish TIM practices in South Dakota, and an update of the TIM Plan is expected in the near future (see Table 2-4, Item No. 2).

Outside incident management, the CVISN program, initiated in the late 1990s, is seen as a successful, multiagency program with participation from the Department of Revenue, Highway Patrol, and the Federal Motor Carrier Safety Administration (FMCSA). A memorandum of understanding (MOU) among the agencies was signed in 1999 but is perceived of as out-of-date and not actively referenced. Program successes that have benefited from a highly collaborative relationship include linking participant agency systems, automating permitting and routing processes, and launching four electronic screening sites. It is expected that this aspect of the relationship between SDDOT and Highway Patrol will continue to evolve as freight laws change. For example, the agencies will likely collaborate closely to change long combination vehicle routes as authorized under the FAST Act.

Finally, SDDOT also is responsible for maintenance at the Highway Patrol Motor Carrier Division's facilities, such as commercial vehicle enforcement pull-outs, weigh stations, and ports of entry. An MOU between the two agencies addressing maintenance responsibilities is old and vague and does not define responsibilities sufficiently. Highway Patrol generally handles relatively small issues, but not all SDDOT staff may be aware of each facility's established expectations, leaving it unclear who should perform the maintenance.

Establishing TSM&O functions at the Regional level will result in the following benefits:

- increased effectiveness and efficiencies when working with other groups within SDDOT and with partner agencies
- avoiding the loss of institutional knowledge when collaborators move on from their current roles
- increased awareness of TSM&O through collaboration to facilitate identification of effective operational improvements
- improved incident management and response through the creation of regional TIM support groups

The Capability Improvement Workshop determined SDDOT to be at Level 2 for the Collaboration dimension and the results of stakeholder interviews would generally support this assessment. The tasks

¹⁵ *Development of a Baseline Statewide Traffic Incident Management Plan*, Study SD2008-02, August 4, 2009.

and implementation steps identified for SDDOT under this action would target Level 3 for capability improvement, characterized by formalization of roles, responsibilities, and planning and implementation efforts.

5.4.2.2 Task COL-1a: Regional TIM Support Groups

Establish three additional regional TIM support groups similar to the well-established Tri-State TIM group and the newly formed Sioux Falls TIM group. These regional groups would become a focal point for the incident management aspects of TSM&O. They would provide ongoing TIM support, relationship building, special event planning, after-action reviews, and policy and procedure development.

Table 5-16: Task COL-1a – Implementation Steps

Implementation Steps	
1.	Develop case studies of the Tri-State and Sioux Falls regional TIM support groups to share with the Rapid City, Pierre, and Aberdeen regions as examples of structure, participation, management, etc.
2.	Establish regional TIM support groups in the Rapid City, Pierre, and Aberdeen regions. These groups will generally consist of representation from SDDOT regional and area offices, the Highway Patrol District, applicable MPOs, state and local law enforcement, and county emergency response dispatchers. Specific representation will vary from region to region depending on the nature of incidents.
3.	Develop a new memorandum of understanding between SDDOT and Highway Patrol regarding TIM collaboration statewide. The MOU should contain a high-level understanding of how the agencies will collaborate during the execution of TSM&O activities like incident management. The MOU will not provide detailed guidance on executing activities at regional levels. Rather, it will articulate expectations and encourage collaboration among the agencies.
4.	Develop TIM operational guidelines for staff to reference during incidents as described in Task S&T-4b. New guidelines should also reference those initially developed in the Draft Traffic Incident Management Plan from August 4, 2009. Development of new guidelines could happen in conjunction with the effort to update the TIM Plan.
5.	Engage regional groups in an annual incident debriefing meeting to address broader TIM challenges and opportunities. As recommended in the FHWA Traffic Incident Management Handbook (2010), periodic TIM meetings familiarize response agencies with each other’s roles and procedures, and provide opportunities for incident debriefings to identify what worked and what could be improved in future incidents. This meeting would also provide a near-term opportunity to discuss the development of an updated TIM Plan.
6.	Identify and address localized TIM issues noted during the review of TIM training evaluations as described in Task O&S-2a and during the annual incident debriefing. The training and annual debriefing represent opportunities to determine if there are specific improvements or projects that should be recommended to address TIM issues.

- **Priority** – This is a near to mid-term task to begin within the plan’s first 12 months. Establishment of TIM groups and an update to the TIM Plan will extend at least another 12 months beyond the initial startup period. Once begun, the activities of new groups and other regional collaborative efforts are designed to become permanent.
- **Feasibility** – This task has staff resource challenges because of the commitment required of launching and participating in new TIM support groups. A strong case has to be made to secure consistent participation from all partners. Development of TIM operational guidelines also requires SDDOT staff resources from Central Office and the Regions, potentially along with partner agencies’ input.
- **Staff Roles** – This task would likely be carried out by the proposed Managerial Focus dedicated to TSM&O or the TSM&O Implementation Team, in partnership with the Region Engineers, Region Operations Engineers, and Area Engineers in each region. Leadership approval would be

necessary. Although other actions and tasks are primarily internally focused in the near-term, this task immediately involves external partners because of the strong successes already observed throughout SDDOT and Highway Patrol. The formation of these groups would also be supported by the development of a new MOU between SDDOT and Highway Patrol to articulate the agencies' commitment to collaboration. Highway Patrol and the Department of Public Safety leadership must approve the MOU. Additional partner agency input is need to develop the case studies of the existing TIM support groups and to develop the TIM operational guidelines. This participation in the task can be coordinated through the Implementation Team.

5.4.2.3 Task COL-1b: Regional TSM&O Review Meetings

Establish regional TSM&O review meetings among transportation partners to discuss collaboration opportunities across TSM&O areas of service (e.g. traveler information, work zone management, winter maintenance, etc.). These meetings would be geared toward managers and staff of transportation agencies (e.g. initially DOT regions and eventually MPOs, tribes, counties and cities, etc.). The meetings would allow participants to learn about current and new TSM&O best practices, discuss plans for installing new equipment and systems in support of TSM&O, exchange ideas for sharing equipment or services associated with TSM&O, and identify needs for future equipment or services. Hosting the meetings at the regional level will also encourage broader peer exchange among areas within each region. The meetings will also allow practices in one region to be identified for their potential application across the regions.

Table 5-17: Task COL-1b – Implementation Steps

Implementation Steps	
1.	Conduct a pilot meeting in one region to develop the structure, frequency, format and participation for future meetings. It is suggested that the pilot meeting be held in Sioux Falls metropolitan region, due to the level of current TSM&O activity there, and in conjunction with pre-winter preparation meetings. The department may wish to reference the format and content of the Regional Operations Forums held through the SHRP 2 program. The forums are structured around the TSM&O service areas and could be a model for the review meetings suggested here.
2.	Evaluate the pilot meeting to develop a proposal for holding additional meetings in other regions.
3.	Schedule and host additional regional TSM&O review meetings. Continue to evaluate meeting format, frequency, content and participant response to adjust for future meetings.

- **Priority** – This is a near to mid-term task. The pilot meeting should be initiated within the plan's first 12 months. Additional meetings can be held regularly once a successful precedent is set.
- **Feasibility** – This task has staff resource challenges because of the commitment required of launching and participating in new TSM&O review meetings. A strong case has to be made to secure consistent participation from all partners.
- **Staff Roles** – This task should be led by the TSM&O Implementation Team with support from the Managerial Focus. Leadership must approve of the approach. Partner agency participation is necessary for the task's success. Potential partner agency leadership approval is also necessary to secure their participation.

5.4.3 Action COL-2: Expand TSM&O Capabilities among Partners

5.4.3.1 Background and Rationale

Personal relationships are acknowledged as a critical component when SDDOT works with its local, state, and federal partners. Building a more formal TSM&O program and improving the capability of SDDOT's TSM&O activities potentially requires more formal approaches to develop and sustain collaborative activities among partners. Benefits could be realized from more formal interactions, increased staff resource allocation to TSM&O coordination, and guidelines for roles, procedures, and protocols. Some of the TSM&O activities illustrating this issue include local emergency response, planning and design, and ITS resource sharing.

SDDOT's relationships with the FHWA Division Office, Department of Public Safety, Sioux Falls and Rapid City MPOs, and other local and tribal partners appear to be strong overall. However, a uniform interest in creating a more formal TSM&O program is expressed by both SDDOT and local agency partners, with a recognition that enhanced collaboration would benefit multiple functional areas, including emergency response, local event planning, design and operations and maintenance, and coordination of shared ITS resources.

Local emergency response coordination efforts appear to be improving around the state, with local personnel engaged in area-specific TIM groups such as the Tri-State TIM group (Iowa, Nebraska, South Dakota) and the recently formed Sioux Falls Area TIM group. City of Sioux Falls personnel and local emergency response representatives (Lincoln County Sheriff's Office, Minnehaha County Sheriff's Office, Sioux Falls Fire and Rescue, and Sioux Falls-District Two for the Highway Patrol) have noted the significant benefits of regular interaction for relationship-building, discussion, detour route planning, and debriefing after major incidents.

Lessons learned could serve as useful best practices for local event planning and emergency response efforts (e.g. development of detour routes for incident planning, inclusion of ITS considerations in the I-229 corridor plan, Sturgis Motorcycle Rally traffic management approaches, Party in the Pasture in Groton, Tri-State TIM Group, Sioux Falls TIM Group) to share among SDDOT personnel and with local partners as TSM&O expands.

The City of Sioux Falls also recognizes its in-place fiber network as a major strength to support deployment of new ITS devices. SDDOT and city personnel acknowledge that the relationship is currently very informal, but that opportunities for additional collaboration are ripe for advancement (e.g. shared use of cameras, overcoming technical or security barriers in cooperation with the Bureau of Information and Telecommunications (BIT), joint ITS-TSM&O master planning, promotion of TSM&O to decision-makers, etc.).

The Transportation Advisory Council was highlighted by the Rapid City MPO as a new and helpful resource that could potentially be leveraged for sharing TSM&O practices and establishing expectations among state and local agencies. The Council was established nearly two years ago through the Every Day Counts Program to support counties, in particular, with the development of local transportation plans. The group has covered a variety of issues ranging from planning to design to consultant selection and could continue to serve as a point of information exchange for TSM&O in the future.

One area of collaboration that was not directly explored during this project involves the contractor community in South Dakota. Similar to SDDOT, it is recognized that local contractor staff may also be limited in their knowledge and experience with TSM&O strategies and this could present challenges for SDDOT when external resources are needed to support select TSM&O efforts. In the spirit of nurturing a TSM&O culture throughout the state, SDDOT is also encouraged to include contractors in training and educational opportunities when appropriate.

Greater agency partner capabilities at TSM&O through support from SDDOT will result in the following benefits:

- increased effectiveness and efficiencies when working with other groups within SDDOT and with partner agencies
- avoiding the loss of institutional knowledge when collaborators move on from their current roles
- increased partner agency understanding and ability to plan and implement potentially less expensive and more effective TSM&O alternatives to address transportation challenges
- improved overall transportation system performance with more collaborative management and operations among agencies

The Capability Improvement Workshop determined SDDOT to be at Level 2 for the Collaboration dimension and the results of stakeholder interviews would generally support this assessment. The tasks and implementation steps identified for SDDOT under this action would target Level 3 for capability improvement, characterized by formalization of roles, responsibilities, and planning and implementation efforts.

5.4.3.2 Task COL-2a: TSM&O Planning Guidance for Local Partners

Introduce SDDOT’s TSM&O activities to the Transportation Advisory Council, Local Technical Assistance Program (LTAP), Tribal Technical Assistance Program (TTAP), and SDDOT MPO Coordinator to determine how they can be used as conduits for TSM&O planning guidance that local transportation partners can use. Planning guidance can address local transportation issues and TSM&O projects, as well as local involvement in state projects.

Table 5-18: Task COL-2a – Implementation Steps

Implementation Steps	
1.	Educate the Transportation Advisory Council, LTAP, TTAP, and SDDOT MPO Coordinator on the basics of TSM&O and how it is envisioned by SDDOT to support transportation needs in the future.
2.	Identify resources to support planning-level evaluation of TSM&O alternatives to address transportation problems.
3.	Provide guidance—based on federal direction and state vision—for transportation plan development that includes, where appropriate, TSM&O-oriented projects.

- **Priority** – This task is a mid- to long-term activity (24 months+) after TSM&O is further developed within SDDOT, allowing the department to serve as a strong advocate and example.
- **Feasibility** – This task has significant staff resource implications depending on the volume and level of engagement with local agency partners. As TSM&O planning considerations increase in

number, assistance from SDDOT may grow. In the longer run, however, greater local partner agency competence will decrease the necessary level of support.

- **Staff Roles** – This task should be led by the TSM&O Implementation Team with support from the Managerial Focus. Leadership must approve of the approach. Participation from identified groups and staff (Transportation Advisory Council, LTAP, TTAP, and MPO Coordinator) are necessary for successful local partner engagement and support. Partner agreement on the approach is necessary for acceptance and success.

5.4.3.3 Task COL-2b: TSM&O Support for Local Partners

Provide TSM&O support for local agency partners in the areas of planning, project development, operations and maintenance.

Once SDDOT has established TSM&O guidance and processes as described in Action BP-1, Task S&T-2a, and Task S&T-4b, they will be in a good position to share their approaches with local agencies for consideration and adaptation into local efforts. Support can also be offered through shared training and master agreements for access to contractor expertise.

Table 5-19: Task COL-2b – Implementation Steps

Implementation Steps	
1.	Share SDDOT’s TSM&O operating guidance, planning process, project development process including design practices, and maintenance guidance with local agency partners for use in their own TSM&O activities. Sharing could be done through the local conduit options suggested in Task COL-2a and through the regional TSM&O review meetings described in Task COL-1b.
2.	Invite local agency partners to participate in TSM&O training when available. When appropriate, local contractor staff may also be invited to participate in training to support their ability to serve as external resources for SDDOT and local transportation partners.
3.	Consider establishing master agreements with contractors for TSM&O-oriented professional services (e.g. systems engineering, design, maintenance) that SDDOT and local agency partners can access when needed. These agreements may be similar to those already in place for design services and equipment purchases.

- **Priority** – This task is a mid- to long-term activity (24 months+) after TSM&O is further developed within SDDOT, allowing the department to serve as a strong advocate and example.
- **Feasibility** – This task has modest staff resource implications depending on the level of engagement SDDOT staff provide to local agency partners in support of shared guidance and processes.
- **Staff Roles** – This task should be led by the TSM&O Implementation Team with support from the Managerial Focus. The Task COL-2a local agency conduits (Transportation Advisory Council, LTAP, TTAP, and MPO Coordinator) can help share guidance and practices. Reciprocal participation from local agency partners and the contracting community (adopting guidance, participating in training) is necessary to raise the level of TSM&O capability outside SDDOT and to achieve success. Leadership must approve of the approach for establishing master agreements with contractors.

5.5 Business Processes

5.5.1 Introduction to Business Processes

Business processes are the set of structured activities or tasks and related decision points required to efficiently produce TSM&O systems and services (capital and non-capital projects) and to integrate them into overall agency activities as standard processes. Business processes include formal planning, budgeting, programming, and project development. Several business processes, such as TSM&O planning may be new to the department, but generally these processes must integrate into existing agency procedures. Formal business processes also must be designed to accommodate informal and real-time inputs from TSM&O activity management staff.

Agency capabilities in this dimension range from *ad hoc* and unintegrated processes to plan and implement TSM&O activities—absent a cohesive statewide TSM&O deployment plan—to the presence of a fully integrated, formal TSM&O program supported by coordinated, documented planning and project implementation processes. The recommended business processes action will, over time, develop the necessary planning, programming, and project development processes to help formalize an approach for TSM&O deployments (capital and non-capital) and document them in a TSM&O Deployment Plan that can augment the TSM&O Program Plan.

5.5.2 **Action BP-1: Establish a Planning and Project Development Process for TSM&O/ITS Projects**

5.5.2.1 Background and Rationale

A more formalized TSM&O program requires that the project planning, budgeting, programming, and development processes—traditionally structured around capital construction and preservation projects—consider TSM&O strategies and ITS projects in a manner consistent with SDDOT’s strategic objectives, performance goals, and priorities for addressing system reliability, safety, and capacity preservation or optimization. A project planning and development process that supports an appropriate level of TSM&O consideration must have in place proper analytical procedures for project identification, evaluation tools, knowledgeable staff, and processes that support input from agency partners (cities, MPOs, and tribal governments). An understanding of available financial resources is also necessary.

First, though, it is important to recognize that the TSM&O program plan addresses SDDOT *capabilities* to carry out and sustain an effective TSM&O program. This TSM&O program plan does not explicitly identify TSM&O and ITS capital projects (such as DMS deployments) or non-capital projects (such as the delivery of TOC-type services). Nonetheless, the identification and planning (as well as programming and implementation) of these projects are critical, and the results of which should complement the TSM&O program plan.

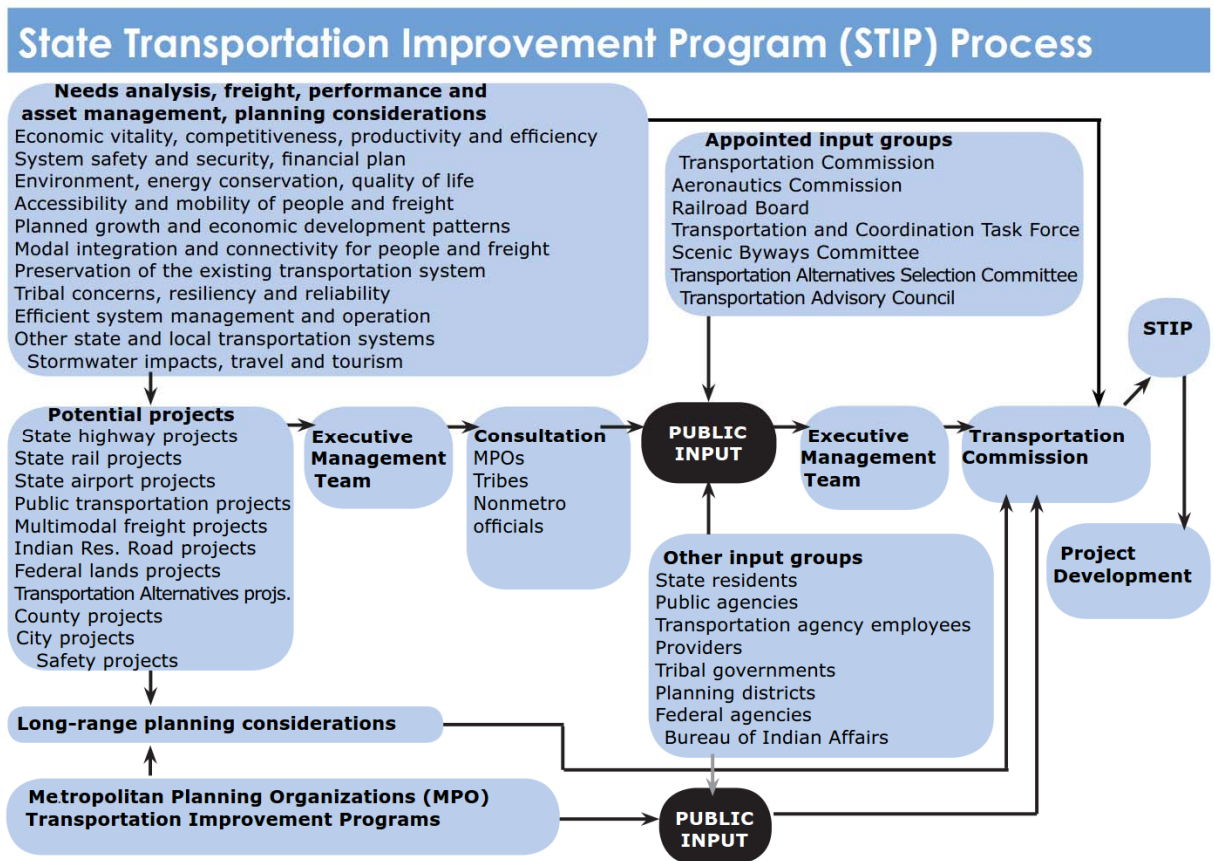
SDDOT Observations

Overall, there is an observed need to formalize and facilitate the consideration of TSM&O/ITS solutions at a strategic systems level. Projects should be planned and programmed beyond simply being a product of Office of Research initiatives or a simple “checkbox” for ITS on a project scoping document. SDDOT staff acknowledge the difficulty in evaluating approximately 150 projects per year for all operational and

safety issues. There is insufficient staff availability to always participate in initial project scoping and programming and a lack of processes and procedures in place that allow the right department staff to weigh in, especially for obtaining appropriate involvement from the Office of Research, which typically champions ITS projects. Ideally, appropriate staff from Central Office and the Regions should participate, including input from the Office of Research and Maintenance Supervisor and field staff in the Regions.

It is also a challenge to advance ITS projects into the STIP and near-term work plans. The current STIP process is shown in Figure 5-3. The box in the upper left of the flow diagram lists the project identification criteria that are tied directly to SDDOT’s annual goals and objectives in its Strategic Plan. A project scoring methodology, which can be adjusted for each programming cycle, is then applied to proposed projects. A points system ranks projects using input from pavement management, bridge management, safety benefit-cost module, and subjective input from the Region Engineers. Also incorporated into the ranking system are priority needs by functional classification, Strategic Highway Network (STRAHNET, a federal designation of roadways that provide defense and emergency access), preferential truck network, and current and future level of service (LOS). This methodology is geared toward traditional highway capital projects and does not accommodate specialized project types (e.g., lighting projects, culvert repair, or slope flattening to improve safety) very well. Similarly, it does not handle TSM&O projects very well, either.

Figure 5-3: SDDOT STIP Process



Further, project investment decisions are not facilitated by and consistent with a statewide ITS architecture, in part because it is only descriptive in nature and in need of updating. During project

development, the systems engineering process—which is used as an analytic and project development framework for ITS projects, and is a requirement for ITS projects using federal funds—is not necessarily applied to all projects regardless of funding source.

Appropriate Scale and Rationale

Business processes must also be tailored to the scale and complexity of the TSM&O program to avoid costly, unnecessary features. For instance, a TSM&O “deployment plan” and set of programmed projects need not be complicated. These outcomes, combined with the TSM&O program plan, will help achieve a clear agency-wide understanding of the business case and logic behind proposed TSM&O/ITS improvements, and of the necessary next steps and implied resource commitments. These features cannot be confined to champions but instead must be communicated among all the key players necessary for project development.

- Given the range of players involved (Central Office, Regions, Department of Public Safety, and others) formal documentation is an important communications device to ensure consensus that will support effective implementation.
- That agency resources (staff, capital investment) must be identified and committed within the existing programming, budgeting, and project development process, suggests the importance of a formal consensus document that identifies intended TSM&O activities to legitimize the “claim” of TSM&O/ITS using scarce resources. This becomes especially important given that TSM&O improvements often “piggy-back” on other capital projects, as currently planned, for example in the I-229 MIS.
- Recognizing that TSM&O by its nature represents an ongoing commitment to staff resources (as well as potential technology improvements) and is not simply composed of “set-and-forget” projects, a widely understood document improves the likelihood of a sustainable commitment.

In view of the above and complementing the capability improvements of the TSM&O program plan, SDDOT can adopt a suitably modest approach to planning, programming and project implementation, avoiding overly elaborate processes and documents. Limitations on the number of key operational issues statewide, data, and staff availability should also be recognized.

It should be noted that such a “formal-but-right-sized” process represents an innovation in the TSM&O arena, as presently TSM&O planning has been largely confined to large urban states. Two relevant examples with some rural region focus include Iowa’s TSM&O Program Plan and Nevada’s Integrated Transportation Reliability Program.

Peer Example: Iowa DOT

Iowa DOT’s recently completed TSM&O program plan contained a “5-Year TSM&O Program” that, in addition to recommended improvements to organizational, staffing, systems and technology, collaboration, communication and outreach capabilities (collectively activities, policies, and procedures), includes both capital and non-capital projects as well. The former set of capabilities is the focus of SDDOT’s TSM&O program plan.

Iowa’s 5-Year Program includes an annualized list and budget for:

- non-construction projects and services required to deliver the TSM&O program:
 - systems and technical services
 - traffic incident and emergency management
 - traffic operations research and decision support
 - traffic management center services
- construction projects:
 - targeted highway improvement projects – ITS devices, intelligent work zones (a major focus), and communications integrated into highway improvement projects (including upgrades of existing systems)
 - independent ITS Deployments – standalone projects that help meet TSM&O needs around the state, not necessarily associated with a highway improvement project and listed separately in the 5-Year Program; collectively the “ITS Program”

Iowa DOT identified its proposed construction projects by applying a newly developed screening and prioritization tool. It modified an existing methodology and tool called the Interstate Condition Evaluation (ICE), which uses condition data and spatial analytics to determine which Interstate corridors should be considered priorities for infrastructure renewal, to evaluate the same corridors to address operational challenges. This Interstate Condition Evaluation-Operations (ICE-OPS) tool uses the criteria and weighting shown in Table 5-20 to score and rank TSM&O projects.

Table 5-20: Iowa DOT ICE-OPS Construction Project Criteria and Weighting

Criteria	Weighting
All Bottleneck Occurrences Per Mile	10%
Freight Bottleneck Occurrences Per Mile	10%
Traffic Incident Frequency	15%
Crash Rate	15%
Planning Time Index	10%
Event Center Buffer Mileage	5%
Weather Sensitive Corridor Mileage	10%
Total AADT	20%
ICE Rating	5%
TOTAL	100%

Peer Example: Nevada DOT

A second example of TSM&O planning and improvement project selection comes from Nevada DOT’s Integrated Transportation Reliability Program (ITRP). This program is not strictly a TSM&O deployment program, as it includes a mix of processes, policies, and projects (collectively “strategies”), not unlike Iowa DOT’s TSM&O Program Plan that combines capability improvement strategies and capital and non-capital projects.

Nevada DOT’s program is organized around reliability focus areas: incident management, infrastructure, sharing resources, transportation policy, traveler information, and work zone management. The program includes 51 strategies prioritized through an effort-impact matrix, where effort represents the

resources required to complete the task and impact is the effect the task has on transportation reliability (reduction in non-recurring or recurring congestion). The four quadrants of the matrix provide a relative prioritization of the strategies as shown in Figure 5-4. The definitions of the quadrants are as follows (see source for figure):

- Proceed (low effort, high impact) – These strategies are generally recommended for the near-term or mid-term timeframe because of the quickness and low effort involved in their actual implementation.
- Investigate (high effort, high impact) – These strategies are generally recommended for the late mid-term or long-term timeframe because of the large amount of effort required to implement the strategy. Where there is an opportunity for fast tracking effort such as funding or staffing, these strategies should be considered first on the list to bring forward into more current fiscal year implementations.
- Consider (low effort, low impact) – These strategies are typically recommended for the late near-term or mid-term timeframe because of their relative minimal effort to implement but also should not necessarily be prioritized over a “Proceed” strategy or an “Investigate” strategy because of its relatively low impact to transportation reliability.
- Keep as reference (high effort, low impact) – These strategies would not be feasible to recommend because the benefits received from the effort expended would not justify implementation at the current time.

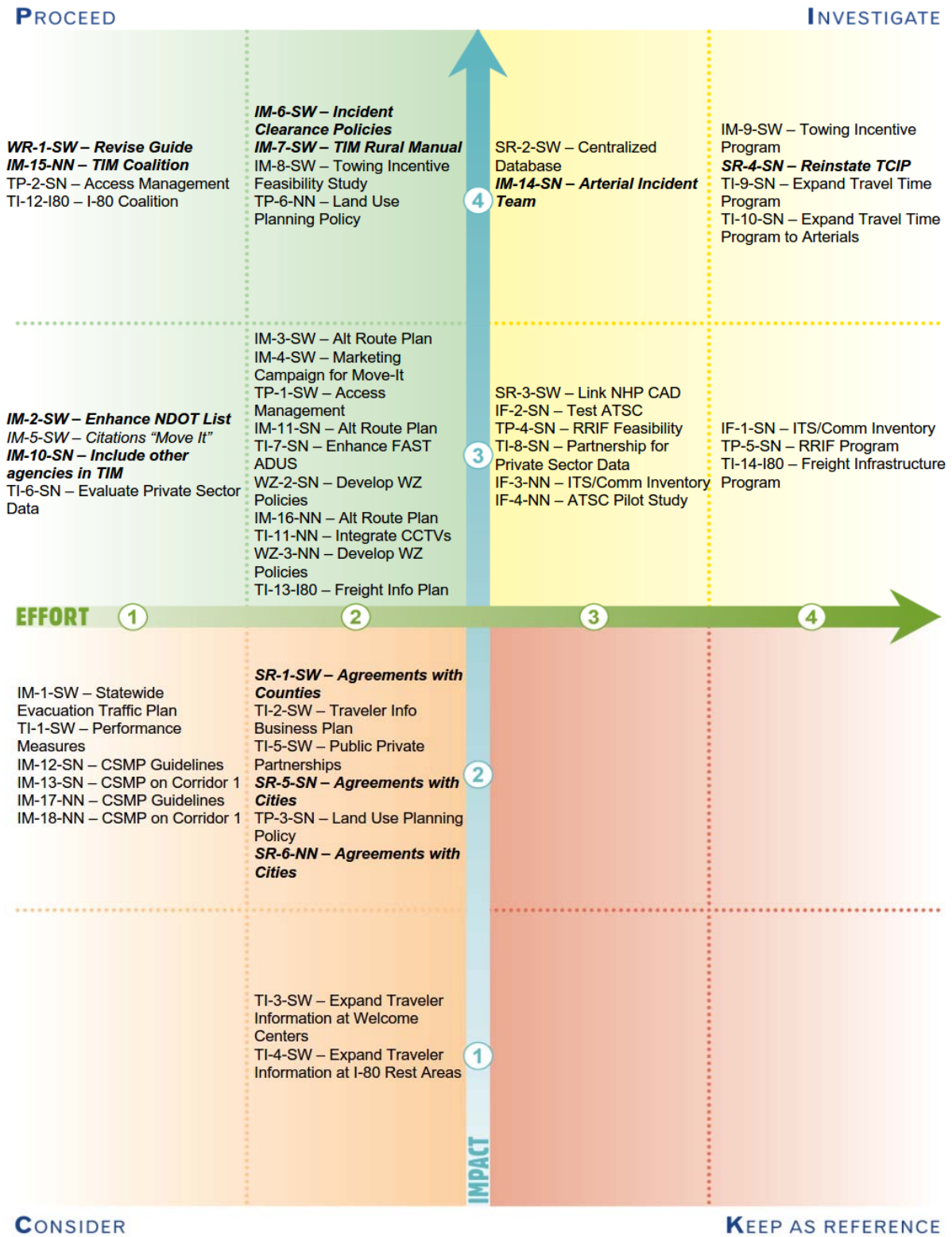
Benefits and Capability Improvement

Putting in place processes that fully consider TSM&O alternatives during planning, programming, and project development will offer the following benefits:

- a structured method for identifying and implementing cost-effective alternatives to traditional capital improvements, delivering user benefits faster and less expensively
- an ability to document and communicate future TSM&O needs to make better decisions on the appropriate time to implement them and secure the necessary resources
- coordinated, more efficient capital project implementation that combines TSM&O or ITS improvements or upgrades with traditional capital projects

SDDOT assessed itself at Level 1.5 for business processes in the Capability Improvement Workshop (see Table 2-3). The results of discussions with SDDOT staff suggest that Level 2 is an appropriate target for next-step achievement, characterized by a consensus statewide approach on TSM&O goals, deficiencies, benefit-costs, strategies, and common priorities. The recommended tasks would help the department develop a multiyear statewide TSM&O deployment plan (complementing the TSM&O program plan) by establishing a framework for suitable TSM&O-related planning and programming activities and facilitating any special needs and requirements for efficient TSM&O project development (Level 2). To an extent the set of recommended tasks also will begin to help SDDOT achieve Level 3, indicated by standardized and documented programming, budgeting, and project development processes for TSM&O.

Figure 5-4: Nevada DOT TSM&O Strategy Prioritization Matrix



Source: Nevada DOT Integrated Transportation Reliability Program, Technical Memorandum #7 – Implementation Plan, April 2010.

http://www.kimley-horn.com/projects/NevadaITRP/images/pdfs/Technical%20Memo7_Implementation%20Plan-04-10.pdf

5.5.2.2 Task BP-1a: Interim Process for TSM&O Planning

Develop a near-term, interim process for TSM&O planning and develop an Interim TSM&O Deployment Plan. The interim plan would complement the TSM&O Program Plan and be added as a separate section.

The Interim TSM&O Deployment Plan is not intended to be a formal product but rather an exercise that jump-starts the identification of TSM&O projects to accompany the capability improvements in the TSM&O program plan and to generate discussion and broader consideration of TSM&O expansions. Subsequent tasks under this action would systematically formalize the process. TSM&O projects would be identified through existing TSM&O-related efforts and forums (e.g. TIM group meetings or Area Engineers meetings). The interim deployment plan would be used in the next round of STIP programming and/or amendment process.

Table 5-21: Task BP-1a – Implementation Steps

Implementation Steps	
1.	Agree on an approach for a start-up Interim TSM&O Deployment Plan development. The Interim TSM&O Deployment Plan is not intended to be a formal product but rather an exercise that jump-starts the identification of TSM&O projects to accompany the capability improvements in the TSM&O program plan and to generate discussion and broader consideration of TSM&O expansions. Subsequent tasks under this action would systematically formalize the process. The suggested approach would systematically but expediently identify next-step TSM&O capital and non-capital project improvements in the following areas: <ol style="list-style-type: none"> a. Immediate “on-the-shelf” expansions or improvements of existing TSM&O applications or improvements based on “piggy-backing” opportunities on existing design or construction projects (as with the current I-229 study) b. Non-capital improvements to existing TSM&O activities’ field procedures and protocols (such as crash and weather related incidents and special events) and establishment of TOC capabilities (see Action S&T-3 and Action S&T-4) c. Other low-cost statewide improvements to existing TSM&O applications as suggested in Table 2-2
2.	Execute the agreed-to plan approach by systematically applying a process to solicit, compile, organize, and confirm opportunities suggested from the following products or forums (past or upcoming): <ol style="list-style-type: none"> a. Activities referenced in the Office of Research’s “SDDOT ITS Activities” tracking summary b. Results of the post-event Sturgis Rally debriefing process c. TIM group meetings d. Traffic Engineering Panel meetings e. Area Engineers meetings f. Annual winter maintenance preparation meetings g. Project Development STIP programming meetings h. Outcomes from implementation of the SHSP and collaboration between Project Development and Region operations and maintenance staff i. Outcomes from TSM&O program plan tasks underway
3.	Document results of Step 3 above in a simple Interim TSM&O Deployment Plan with projects supported by needs analysis, planning considerations, and costs—as feasible. Incorporate the Interim TSM&O Deployment Plan into the TSM&O Program Plan as a separate section.
4.	Use the plan as an input into the next round of STIP programming and/or amendment process.
5.	Extract highlights of the Interim TSM&O Deployment Plan for inclusion in updates to the TSM&O Business Case (Task CUL-1a) to demonstrate desired potential improvements to existing TSM&O activities and applications, and to characterize their benefits.

- **Priority** – This is a near-term task to complete within the TSM&O program plan’s first 12 months while the implementation of this action’s remaining tasks begins. The Interim TSM&O Deployment Plan could be used as an input into the FY 2018–2021 STIP.

- **Feasibility** – This task has modest staff resource implications but requires broad participation to capture and organize input into the interim deployment plan.
- **Staff Roles** – This task should be led by the TSM&O Implementation Team with assistance from the Managerial Focus. A task lead should be assigned to manage the process. Broad SDDOT staff participation is necessary. Coordination of the approach is also necessary with the Office of Project Development and the STIP Coordinator.

5.5.2.3 Task BP-1b: Standard Process for TSM&O Planning

Develop a longer-term, standard strategy and process for TSM&O planning. The process would be designed to produce a plan to serve both as a guide to TSM&O capital and non-capital projects (complementing the TSM&O program plan capability improvements) as well as an input to the SDDOT Statewide Long Range Transportation Plan and STIP. The process undertaken to produce a TSM&O Deployment Plan would be distinct from the standard planning process, but once complete, that plan would feed into the standard STIP programming process (with some potential modifications to project selection criteria to accommodate TSM&O) and long-range transportation planning process. Additionally, however, TSM&O opportunities should always be encouraged for consideration during existing project development processes, as suggested in Task BP-1e.

Table 5-22: Task BP-1b – Implementation Steps

Implementation Steps	
1.	Review the strategic objectives and department mission and vision, as potentially revised to better reflect a TSM&O focus in Task CUL-3a and Task CUL-3b, respectively. Ensure that this task’s TSM&O planning process aligns with them.
2.	Depending on the timing of initiating this task, consider and incorporate lessons learned and successful practices (as available) from the Task BP-1a interim process for TSM&O planning.
3.	Confirm key participants who should be involved in TSM&O planning and programming. This includes SDDOT staff—Research (ITS), Project Development, Operations Support, Regions—and agency partners—Department of Public Safety (Highway Patrol), BIT, local governments, and MPOs. Form a multiagency Planning and Programming Working Group to consider key scope, process, roles, focus and schedule for a formal TSM&O planning and programming process. Identify appropriate staff functions and roles and participants (internal and external) likely to be involved in the planning and programming process on a continuing basis. Review development of the SDDOT Strategic Highway Safety Plan as a persuasive example.
4.	Develop and agree on the approach for a “standard” TSM&O Deployment Plan, recommended to include: <ul style="list-style-type: none"> a. Identifying projects for inclusion as either incorporated into broader highway improvement projects (“piggybacking”) or as a standalone TSM&O/ITS deployment b. Identifying non-capital improvements to existing TSM&O activities’ field procedures and protocols (such as crash and weather related incidents and special events) and establishment of TOC capabilities (see Action S&T-4 and Action S&T-3, respectively) c. Capturing updates to TSM&O program capabilities to be reflected in revisions to the TSM&O program plan Ensure consistency with statewide and regional architectures.
5.	Develop consensus on a framework for TSM&O planning process and plan format. Establish approaches to project identification and prioritization methodologies (e.g. gap analysis and use of performance data), complexity of plan development, and timescale (e.g. 5 years). Consider practices of peer states. Potentially applicable peers include: <ul style="list-style-type: none"> a. Iowa: A predominantly rural state that developed a 5-Year TSM&O Program as part of its TSM&O Program Plan (February 2016) b. Nevada: Focused on “reliability” over “congestion” in its Statewide Integrated Transportation Reliability Program (April 2010) c. Arizona: A state with considerable rural highway mileage outside major metro areas, currently developing a TSM&O Program Plan (forthcoming)
6.	Identify appropriate procedures to ensure a transparent continuing planning process that accommodates inputs

and adjustments from the Planning and Programming Working Group as well as from key project management and field personnel.
7. Incorporate review and coordination with planning activities of other agencies within the state and adjacent states for coordination and incorporation of any longer-term projects under consideration.
8. Include updates to the statewide architecture and concepts of operations (as/if necessary) for compatibility with new applications and/or technology. Identify and document related field and center procedures and protocols and decision-support systems, including those recommended or developed under the Action S&T-4 Operations Guidance.
9. Develop a memorandum of understanding incorporating participation from SDDOT offices or units and key external partners documenting the general objective, scope, and schedule for the longer-term standard planning process.

- **Priority** – This is a mid-term task (potentially starting in the near-term and within the program plan’s first 12 months) to carry out as resources permit. The task can start and overlap with Task BP-1a or take place sequentially.
- **Feasibility** – This task has significant staff resource implications to develop the strategy and process, and requires new or potentially substantial adjustments to existing business processes.
- **Staff Roles** – This task can be initiated by the TSM&O Implementation Team but should be led by the suggested Planning and Programming Working Group that draws from SDDOT and partner agencies. Leadership approval is needed for implementing the new planning process.

5.5.2.4 Task BP-1c: Standard TSM&O Deployment Plan

Apply the standard TSM&O planning process developed in Task BP-1b to prepare and update a standard TSM&O Deployment Plan and to integrate TSM&O into the SDDOT Statewide Long Range Transportation Plan and STIP.

Table 5-23: Task BP-1c – Implementation Steps

Implementation Steps	
1.	Apply the TSM&O planning process and approach developed in Task BP-1b to develop the first version of the standard TSM&O Deployment Plan.
2.	Review implications to SDDOT legal, regulatory, and standard operating procedures that may occur by implementing the planned projects.
3.	Consider activities needed to improve the next round of planning including additional data, improved methodologies, collaboration with partners, etc. for the next incremental round of planning.
4.	Estimate costs (capital, operating, technology upgrade, maintenance) for each project using information from peer state experience and national sources (e.g. ITS JPO Costs Database: http://www.itscosts.its.dot.gov/).
5.	Append the TSM&O Deployment Plan to the TSM&O Program Plan as a separate section. Schedule a periodic review of the TSM&O Deployment Plan for incorporation of proposed projects into the STIP (see Task BP-1d) and incorporation into future iterations of the Statewide Long Range Transportation Plan, Strategic Highway Safety Plan, and others plans as applicable.

- **Priority** – This is a mid-term task to carry out once the Task BP-1b standard TSM&O planning process is established. The task can build on the Interim TSM&O Deployment Plan prepared under Task BP-1a. Once prepared, updates to the deployment plan and incorporation into other SDDOT planning documents should be an ongoing exercise.
- **Feasibility** – This task has significant staff resource implications, especially among Project Development staff and others from the TSM&O Implementation Team or Planning and Programming Working Group. Advancements in data availability, understanding of TSM&O

projects costs, and collaboration with partner agencies are directly tied to a more successful product from this task.

- **Staff Roles** – Project Development should lead this task with input as necessary from members of the TSM&O Implementation Team, Planning and Programming Working Group, and Managerial Focus. It is also possible to engage consultant support to develop the TSM&O Deployment Plan.

5.5.2.5 Task BP-1d: TSM&O Integration into the Capital Programming Process

Assess TSM&O project priorities and resource availability and integrate the TSM&O Deployment Plan into the capital programming process.

Table 5-24: Task BP-1d – Implementation Steps

Implementation Steps	
1.	Review resource availability (both financial and staff resources for development, deployment, operations and maintenance) and identify funding sources and potential allocations such as federal funds for NHPP, STP, CMAQ, grant programs, and state capital and maintenance funds. Determine federal funding eligibility and identify which projects may need to be included in the operations budget if not eligible.
2.	Classify current projects in the TSM&O Deployment Plan in terms of cost/level of effort vs. benefits/impacts and use ranking to identify logical, cost-effective sequence of investments in 4–5 year increments. Iowa DOT and Nevada DOT provide peer examples.
3.	Identify appropriate adjustments as necessary to the existing project prioritization methodology and tool (described in Section 5.5.2.1) to accommodate TSM&O projects in STIP project selection. Align adjustments to methodology with modifications to the Strategic Plan’s goals and objectives made under Task CUL-3a.
4.	Based on prioritization, identify TSM&O projects for insertion into the next logical iteration of the capital programming and budgeting process.
5.	When programming “standard” highway improvement projects: <ol style="list-style-type: none"> a. Look for opportunities to include the upgrade or replacement of TSM&O or ITS components affected by the larger highway project to achieve overall preventative maintenance and replacement cost efficiencies b. Incorporate sufficient consideration of delay or reliability considerations into construction and maintenance-of-traffic planning and costing, ensuring appropriate levels of work zone traffic management

- **Priority** – This is a mid-term task to carry out once the Task BP-1b standard TSM&O planning process is established and the Task BP-1c TSM&O Deployment Plan is developed. Accordingly, it may take 2–3 years before the capital programming process can begin to fully integrate TSM&O projects. However, this timeframe should not preclude earlier consideration of adjustments to the project prioritization and programming processes to better accommodate TSM&O in general, even prior to the availability of a standard TSM&O Deployment Plan. The Task BP-1a Interim TSM&O Deployment Plan can be used to drive initial changes to the process; that task’s Implementation Step No. 4 recommends that the interim plan be used in the next applicable round of STIP programming.
- **Feasibility** – Moderate staff resources will be necessary to analyze and prioritize TSM&O investments for consideration in the capital programming process. Similarly, adjustments to the prioritization process used during STIP programming will need to be developed and approved. Advancements in characterizing potential TSM&O project benefits and impacts will influence successful outcomes of this task.

- **Staff Roles** – Project Development should lead this task with input as necessary from members of the TSM&O Implementation Team, Planning and Programming Working Group, and Managerial Focus. Leadership approval is needed for adjustments to the capital programming prioritization methodology.

5.5.2.6 Task BP-1e: TSM&O Integration into the Project Development Process

Integrate TSM&O projects—standalone and integrated with other capital projects—into the overall project development (post-programming project scoping and preliminary engineering, environmental review, final design, and bid letting) and construction management processes.

Table 5-25: Task BP-1e – Implementation Steps

Implementation Steps	
1.	Review the existing SDDOT project initiation process and recommend revisions to require TSM&O/ITS considerations at key points in the project development process, including: <ol style="list-style-type: none"> Alternatives analysis and evaluation Preliminary engineering, environmental clearance, and cost updates Final design Construction management process including work zone traffic management Opportunities to combine maintenance, upgrade, or replacement of TSM&O or ITS devices with the broader scope of a traditional highway improvement project (e.g. preservation, renewal, replacement, or expansion) should be actively sought.
2.	Ensure that acceptable and appropriate systems engineering procedures are used throughout the project lifecycle, including development of concepts of operation and consistency with systems architecture.
3.	Review the existing SDDOT procurement process related to TSM&O projects that involve communications and other technology with existing BIT engagement. Establish a regular checkpoint for consulting with BIT on technology purchases to assess issues related to vendor selection, compatibility, security, obsolescence, future reliability, and cost-effectiveness. Ensure staff involved in the project development process understand the value and process for engaging with BIT.
4.	Investigate opportunities to combine programmed, standard capital projects with TSM&O projects to achieve efficiencies and synergies.
5.	Document proposed modifications to the project development process in an annotated flowchart for discussion with affected offices and staff, and secure formal approval for changes.

- **Priority** – This is a near to mid-term task that can be initiated in parallel with other tasks under this action. Refinement and completion of this task’s implementation steps can occur as progress on other tasks are made (Task BP-1b [planning] and Task BP-1d [programming]).
- **Feasibility** – Moderate staff resources will be necessary to lead and oversee the suggested changes to existing processes outlined in this task. For the most part, the level of effort may be nominally greater than already expended on project development, and as TSM&O consideration becomes more standardized, resource implications will diminish.
- **Staff Roles** – Project Development should lead this task with input as necessary from members of the TSM&O Implementation Team, Planning and Programming Working Group, and Managerial Focus. Coordination with the BIT SDDOT Point of Contact is necessary to develop and confirm the standard process and checkpoint for interfacing with BIT on technology procurements. Leadership approval is needed for adjustments to the existing project development and procurement processes.

5.6 Systems & Technology

5.6.1 Introduction to Systems & Technology

Systems and technology are the backbone of TSM&O in many ways. They provide the “face” of TSM&O to the traveling public and to many within the transportation community. In order to effectively implement systems and technology, a technical framework must be in place. The actions in this dimension are geared toward making sure that technical framework is in place to support and encourage the implementation of systems and technologies that are critical to the efficient operation of the transportation network. Tools that facilitate the implementation of systems and technology include developing and using ITS architectures (statewide and regional); following the systems engineering process; providing the tools needed to operate the systems and technologies that are in place, such as the tools and functions that are often housed in a transportation operations center; and providing guidance on how to most effectively operate implemented systems and technologies.

The actions presented below represent the next logical steps for SDDOT to take to improve this technical framework, based on stakeholder interviews and national experience in the TSM&O field. These actions include:

- updating South Dakota’s ITS architectures
- developing guidance on using the systems engineering process
- determining the most appropriate ways to carry out typical TOC functions
- developing needed operations guidance

5.6.2 Action S&T-1: Update the Statewide ITS Architecture

5.6.2.1 Background and Rationale

ITS architectures provide a blueprint of the ITS systems and technologies that stakeholders envision in a region or state. The ITS architecture identifies the functions and services that are needed by stakeholders and the ITS elements that will enable those functions and services. It identifies information or data that needs to flow between ITS elements and the standards that are needed to ensure that those elements will be able interoperate. An ITS architecture facilitates the incremental implementation of the entire intelligent transportation system for a region or state. It also provides the framework for institutional agreement and technical integration for the implementation of ITS projects or groups of projects. It is required to obtain federal funding for the implementation of an Intelligent Transportation System and must be periodically updated as the TSM&O program develops.

The Federal Highway Administration requires the development and use of ITS architectures for all projects that include ITS elements that use federal funds. The specific rule is the Final Rule on ITS Architecture and Standards Conformity (23 CFR Part 940). ITS architectures are used in project planning, programming, and design. As projects are identified in transportation planning efforts, planners should refer to the applicable ITS architecture to make sure the ITS components in the proposed project are included in the architecture. The architecture also identifies stakeholders who should be coordinated with during the planning process. Similarly, when projects with ITS elements are incorporated in a funding program, the architecture should be checked again to verify the ITS elements are included in the

architecture. Perhaps the most important use of the architecture comes during preliminary design. At this stage, the architecture provides insight into the other ITS elements that should be planned for in the project being designed. This helps to assure interoperability. The architecture identifies stakeholders to be included in the design process and can be used to identify high-level requirements. Finally, the architecture should again be used during the detailed design of the project, especially to identify needed standards that should be specified in contracts and procurement documents.

In South Dakota, there is a statewide architecture and regional architectures for Sioux Falls and Rapid City. The statewide architecture was completed about 10 years ago and has not been updated since. New technologies have developed over the intervening timeframe and the needs of stakeholders have evolved as well. An up-to-date ITS architecture is needed to fully support technology deployment that supports and enables effective TSM&O.

The existing statewide ITS architecture (and the regional ones in Sioux Falls and Rapid City) needs updating, as identified among the Capability Maturity Implementation Plan actions shown in Table 2-4. Its application in practice also needs improvement since it is only used in a descriptive manner and not as a planning or project implementation tool. That is, project investment decisions should be facilitated by and consistent with the architecture.

Updating the statewide ITS architecture will provide SDDOT the following benefits:

- an updated roadmap for ITS system integration, which will ensure systems are deployed to get the most out of each one and they will be able to fulfill the needs of stakeholders
- cost-effective technology deployment
- stakeholders (local partner agencies) engaged in the update process, leading to a better understanding of the goals and objectives, requirements, and benefits of TSM&O systems

The results of the Capability Improvement Workshop included a self-assessment of Level 2 for Systems & Technology, which include supporting project development tools and processes such as the application of an ITS architecture. Level 2 may still be an appropriate target for the Systems & Technology dimension, despite the self-assessment at the workshop. Updated statewide and regional ITS architectures used for guiding project development characterize this target.

5.6.2.2 Task S&T-1a: Turbo Architecture Training

Train staff on use of Turbo Architecture. Turbo Architecture is a software application that supports development of regional and project ITS architectures using the National ITS Architecture as a starting point. It provides a structured way to develop, use, maintain, and update ITS architectures. The National Architecture website¹⁶ includes web-based training on both the National ITS Architecture and Turbo Architecture¹⁷.

¹⁶ National ITS Architecture, United States Department of Transportation, Office of the Assistant Secretary for Research and Technology, Intelligent Transportation Systems Joint Programs Office, <http://www.iteris.com/itsarch/>

¹⁷ <http://www.iteris.com/itsarch/html/training/training.htm>

Table 5-26: Task S&T-1a – Implementation Steps

Implementation Steps	
1.	Identify staff who will lead ITS architecture efforts within SDDOT.
2.	Participate in web-based training on Turbo Architecture.

- **Priority** – This is an immediate task recommended to start within 3 months.
- **Feasibility** – The web-based training is free and can be found on the National Architecture website.
- **Staff Roles** – Identify staff assigned to take the training. These staff members will lead the architecture update process. Partner agency staff should also be encouraged to take the training, especially those staff who may lead architecture updates to the Sioux Falls and Rapid City regional architectures.

5.6.2.3 Task S&T-1b: Statewide Architecture Update

Either using in-house or consultant staff, update the statewide architecture using the latest versions of the National Architecture and Turbo Architecture.

Table 5-27: Task S&T-1b – Implementation Steps

Implementation Steps	
1.	Determine personnel to update architecture. This could be in-house or consultant staff.
2.	Review existing architecture and ITS-related plans, based on knowledge gained from training in Task S&T-1a.
3.	Identify needs, starting with those identified in the existing architecture. Then conduct stakeholder meetings or interviews to determine additional needs. Review the needs with the TSM&O Implementation Team that is managing and understands the status of other actions and tasks in the program plan.
4.	Update ITS concepts of operation if needed and conduct a concept of operations workshop. Include stakeholders.
5.	Update ITS architecture in Turbo based on the training received in Task S&T-1a.
6.	Update the architecture documentation. Include guidance on how to use and maintain the architecture.
7.	Provide outreach and training on the new architecture so appropriate people know how to use and maintain the architecture.

- **Priority** – This is a near-term task to complete within 18 months, after the Task S&T-1a training is complete.
- **Feasibility** – The architecture update can be done in-house or by consultants.
- **Staff Roles** – The staff who took the training in S&T-1a will lead the architecture update. Interface with the TSM&O Implementation Team is necessary. Partner agency staff and other stakeholders should be engaged in the update process through stakeholder interviews and workshops to identify needs and the ITS vision, identify needed ITS elements, and refine the structure of the architecture. The Implementation Team should review the updates to the architecture.

5.6.3 Action S&T-2: Develop Guidance on Using the Systems Engineering Process

5.6.3.1 Background and Rationale

Systems engineering is the methodology by which complex systems should be designed, updated, and managed. Systems engineering is an interdisciplinary process that from concept to design to operations

focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, and then proceeding with design synthesis and system validation.

The systems engineering process, which is used as an analytic and project development framework for ITS projects (and is a requirement for ITS projects using federal funds) is not necessarily applied to all SDDOT ITS projects, regardless of funding source. Greater staff capability and education is needed in order to ensure consistency of application of the systems engineering process. Some SDDOT staff should have the capability to apply the systems engineering process.

FHWA requires the use of a systems engineering process for projects including significant ITS elements that use federal funds. The FHWA requirements are set forth in 23 CFR 940.11. It requires seven steps:

1. **Identification of portion of the regional architecture being implemented.** The specific portion of the architecture that will be addressed by the project needs to be identified. This includes the architecture elements, architecture flows, and service packages that may be affected by the project.
2. **Identification of participating agencies.** Stakeholder agencies should be identified, oftentimes through previous planning efforts and documents. Their roles and responsibilities should also be identified.
3. **Definition of requirements.** The concept of operations often is used to derive high-level requirements for the ITS elements.
4. **Analysis of alternatives.** The concept of operations also includes a discussion of alternatives. Alternative analysis may also be a standalone effort.
5. **Selection and definition of applicable standards and testing procedures.** Needed standards can be derived from the ITS architecture. The requirements identified in step 3 need to be tested and a high-level description of each test should be defined.
6. **Identification or selection of procurement options.** Procurement options can be identified in a standalone memo or effort, or can be included in other documents, such as the concept of operations.
7. **Identification of resources for operations and maintenance.** The concept of operations address the needed operations and maintenance resources.

There are examples of planning to better use the system engineering process. The I-229 Major Investment Study is an ongoing corridor study in the Sioux Falls Region to examine future capacity needs, geometric and accessibility improvements, and operational improvements enabled by ITS solutions. This study is a benchmark exercise for SDDOT that considers ITS from the very beginning of the project development process, for application both during anticipated construction and on a permanent basis. The I-229 study is currently at the master planning stage with all ITS solutions under consideration for potential application to identified needs (summarized in an "ITS Solutions Memo"). Those advanced further will be subject to a systems engineering process and incorporation into a concept of operations and systems requirements development process. Recent work on the study has identified the challenge of figuring out how ITS solutions will align with proposed capital improvements.

SDDOT is challenged to find and cultivate staff with specialized skills, including systems engineering. Employees knowledgeable in systems engineering and transportation are at a premium across the country, especially in the public sector, which must compete with potentially more lucrative private-sector job opportunities. South Dakota’s small population and limited number of engineering and technical sources of higher education amplifies this problem. Training existing staff is a critical component in using the systems engineering process.

Developing guidance on using the systems engineering process will provide SDDOT the following benefits:

- cost-effective implementation of ITS elements and systems (Systems engineering provides linkages from stakeholders needs, to the concept of ITS systems, to the design and implementation process. By following the systems engineering process, SDDOT will be able verify that what is actually implemented meets stakeholder needs and is what was intended to be implemented.)
- engagement of stakeholders (local partner agencies) in the systems engineering process, especially the development of the concept of operations, which will lead to a better understanding of the goals and objectives, requirements, and benefits of TSM&O systems
- the development of ITS projects that meet the requirements for federal funding

The results of the Capability Improvement Workshop resulted in a self-assessment Level 2 for Systems & Technology, which include supporting project development tools and processes such as the application of the systems engineering process. Level 2 is an appropriate target for the Systems & Technology dimension, despite the self-assessment at the workshop. Building systems engineering capability and consistently applying it to system development would be a next-step outcome.

5.6.3.2 Task S&T-2a: Systems Engineering Process Training

A systems engineering analysis is required for all intelligent transportation systems projects using federal funds according to the Final Rule on ITS Architecture and Standards Conformity. It is important for internal staff to understand the process. Web-based and blended training (including discussions with instructor and classmates using conference calls) is available through the Consortium for ITS Training and Education (CITE)¹⁸. FHWA maintains a handbook on systems engineering for ITS projects¹⁹.

Table 5-28: Task S&T-2a – Implementation Steps

Implementation Steps	
1.	Identify staff to be responsible for developing systems engineering guidance and to be trained in systems engineering.
2.	Review systems engineering guidance and participate in available training.

¹⁸ <http://www.citeconsortium.org/courses/syseng.html>

¹⁹ *Systems Engineering for Intelligent Transportation Systems*, United States Department of Transportation, Federal Highway Administration, Office of Operations, January 2007. <http://ops.fhwa.dot.gov/publications/seitsguide/seguide.pdf>

- **Priority** – This is an immediate task recommended to start within 3 months.
- **Feasibility** – Web-based, blended introduction to systems engineering and advanced systems engineering training is available through CITE. CITE courses are free of charge to public agencies. The introductory course takes 8 to 10 hours to complete and the advanced course takes 10 to 12 hours to complete.
- **Staff Roles** – The TSM&O Implementation Team should identify staff with an interest in technology who would be assigned to take the training. These staff members will lead the development of systems engineering guidance. Partner agency staff should also be encouraged to take the training, especially those staff who may be assigned to oversee the systems engineering process in their agencies—specifically MPO staff, municipal staff, and any other operating agencies who may need to use or understand the architecture.

5.6.3.3 Task S&T-2b: Systems Engineering Process Guidance

The Final Rule on ITS Architecture and Standards Conformity²⁰ requires that ITS projects carried out using funds from the federal Highway Trust Fund, including the Mass Transit Account, conform to the National ITS Architecture and applicable ITS standards:

Section 940.11 of the Final Rule also requires that a systems engineering analysis be conducted. This action will determine how to apply the systems engineering process for SDDOT. The guidance on applying systems engineering should be tailored to SDDOT while meeting federal requirements.

Table 5-29: Task S&T-2b – Implementation Steps

Implementation Steps	
1.	Identify a team to recommend a SDDOT systems engineering process. This could be in-house or consultant-led.
2.	Review guidance from others states. Many states (examples include California, Florida, and Washington) have developed guidance on applying the systems engineering process. Investigate the available guidance from those states and identify aspects that would apply well to SDDOT.
3.	Develop draft guidance, including the projects and actions that need to be covered by the systems engineering process.
4.	Conduct a workshop to gather comments and further develop the guidance.
5.	Revise the guidance and distribute for comment.
6.	Present to the guidance to leadership.
7.	Incorporate the guidance into SDDOT processes.

- **Priority** – This task should be carried out in the near-term (3–18 months).
- **Feasibility** – The preferred approach would be to find guidance from another state that has guidance that fits South Dakota. If guidance needs to be developed, the staffing required to develop the guidance internally may strain department resources. If the personnel or skill set is not available, a consultant or research effort would be needed to develop the guidance.
- **Staff Roles** – The staff trained in systems engineering should lead the development of the systems engineering guidance.

²⁰ 23 CFR 940 - INTELLIGENT TRANSPORTATION SYSTEM ARCHITECTURE AND STANDARDS, <https://www.gpo.gov/fdsys/pkg/CFR-2008-title23-vol1/pdf/CFR-2008-title23-vol1-part940.pdf>

5.6.4 Action S&T-3: Determine the Most Appropriate Ways to Carry Out Typical TOC-Related Activities

5.6.4.1 Background and Rationale

In many states and regions, the focal point of ITS and TSM&O operations is a transportation operations center (TOC) or transportation management center (TMC). Staff at these centers monitor the transportation network in real-time, either during peak periods, during incidents and emergencies, or 24 hours a day. Based on the conditions they observe, staff make decisions regarding system operations, information dissemination, and coordination with partner agencies. TOCs have considerable value when and where central coordination is needed. TOCs can also reduce duplication in efforts because of the central coordination role.

TOC concepts have been considered and studied in the state for over a decade. In 2005, SDDOT “undertook a research project to help define traffic operations needs, functions, projects, programs and procedures applicable to South Dakota.”²¹ This project examined TOC concepts, including primary functions a TOC would serve, a proposed TOC concept that would provide those functions, and a phased deployment plan. The concept recommended included a hybrid, distributed approach with the central, statewide center located in Pierre and regional centers in Sioux Falls and Rapid City. The three centers would have broadband connections to facilitate coordination of efforts. Although the recommendations of this project have not been implemented due to cost and resource considerations, the study has advanced the conversation and understanding of what the right level of TOC capability may be for the state.

The coordinated use of DMS, 511, and other tools among SDDOT and Highway Patrol during the Sturgis Motorcycle Rally is seen as successful practice for communicating traveler information. Traffic management and public communication are facilitated by SDDOT-HP colocation in a temporary Sturgis TOC and by SDDOT’s direct access to Highway Patrol Computer-aided Dispatch information. These reflect some potential benefits of incorporating TOC functions more formally in SDDOT.

By contrast, staff note that it is challenging to communicate and coordinate during major traffic incident and weather events without a TOC, as SDDOT is not organized for 24-hour operation, and responding managers and supervisors often communicate from disparate, *ad hoc* locations, including their own homes. There is also no central clearinghouse for decision making and execution on road closures, while guidance on how to close and reopen interstates by section is lacking.

South Dakota’s participation in the North/West Passage has most recently advanced the understanding of TOC concepts further in the state. The group has conducted recent research on the unique needs of a rural TOC operational concept and what existing guidance or models could be used to support the enhancement of TOC operations among North/West Passage states. The project included a peer exchange workshop on this topic and a visit to the Wyoming TOC. The topic was also discussed at the North/West Passage Regional Operations Forum. Building upon this, SDDOT’s Capability Maturity Implementation Plan includes an action to develop a TOC concept of operations that would guide what functions and systems, as well as staffing, resources, and procedures are most suitable for South Dakota’s context (see Table 2-4).

²¹ *Traffic Operations Center Concepts for South Dakota*, Study SD2005-04, June 2006.

There is concern that application of a TOC in SDDOT would result in significant staff commitments with potentially a lot of downtime to manage, since the state generally experiences low traffic volumes and low numbers of incidents. The TOC staff downtime would have to be filled with other productive work. The continued consideration of TOC concepts plays a central role in identifying internal (and external) communication needs and mechanisms. A key question is: can we find ways to address the centralized needs without a “brick-and-mortar” building? This may be an evolutionary step until such time that a TOC can be funded.

In Alaska, similar considerations led the Municipality of Anchorage to conduct a workshop on TOC options. The goal of the workshop was to explore the purpose of and need for a TOC. Workshop objectives were to solicit comment on regional and statewide needs, discuss how a TOC might function in support of those needs, and then to use this information to explore various configurations for “housing” (locating or configuring) those needed functions. The workshop identified a variety of configurations, from large multi-agency buildings to centers that were primarily virtual in nature. Participants decided that the first step would be to investigate how to accomplish as many of the TOC functions as possible through a virtual configuration with the vision of a statewide brick-and-mortar TOC in the long-run.

Determining the most appropriate ways to carry out typical TOC-related tasks will provide SDDOT the following benefits:

- a central focal point in identifying internal and partner agency staff communication needs and mechanisms, which will lead to improved communication and subsequent actions, especially during incident and emergency conditions
- more consistent responses to incidents and emergencies
- enhanced and facilitated debriefings and after-action reviews, which will further improve response actions

The results of the Capability Improvement Workshop included a self-assessment Level 2 for Systems & Technology, which include supporting project development tools and processes. Level 2 is an appropriate target for the Systems & Technology dimension, despite the self-assessment at the workshop. Much of the deployment of TSM&O systems are focused on a TOC and identifying how best to fulfill the TOC functions will move SDDOT forward in the Systems & Technology dimension.

5.6.4.2 Task S&T-3a: TOC Roles, Responsibilities and Protocols

Similar to what the Municipality of Anchorage did, identify roles, responsibilities, and protocols needed by SDDOT that are often housed in a TOC. Determine effective ways to provide the roles and responsibilities and implement the protocols. Work with partner agencies in this task to include their perspectives, experience, and ideas. The result will be a recommendation of how to deliver these TOC features most effectively and to identify potential “triggers” that could guide when a brick-and-mortar TOC would be needed.

Table 5-30: Task S&T-3a – Implementation Steps

Implementation Steps	
1.	Identify staff familiar with or interested in TOC operations to identify TOC functions and lead this task. It could be in-house or consultant.
2.	Identify the range of operational needs in SDDOT that could benefit from the centralized communication and control characteristics of a TOC. Include partner agency staff in identifying needs.
3.	Identify the operational needs that are being effectively met currently. Reach out to partner agencies, especially Highway Patrol, to solicit their input.
4.	For the needs that are not effectively being met, identify those that are often met in TOCs in other jurisdictions. Identify typical TOC functions that meet these needs. Reach out to partner agencies, especially Highway Patrol, to solicit their input.
5.	Identify the range of TOC configurations that could meet the operational needs and offer the identified functions. The range of potential TOC configurations should include totally virtual concepts, small control rooms that could fit in an existing building with virtual connections, and a standalone building sized to the needs of the department.
6.	Conduct a workshop to gather stakeholder input on effective ways to meet operational needs and provide typical TOC functions. Include identifying a set of performance goals that can be used to evaluate the effectiveness of meeting the operational needs. These performance goals can be used as triggers to determine when SDDOT may want to migrate from the initial TOC configuration to the next more sophisticated. Order of magnitude cost estimates for the candidate configurations could be gathered from the most recent national experience for similar configurations.
7.	Document the results of the workshop and present to executive management to determine which recommendations are carried out.
8.	Implement decisions from meeting with executive management.

- **Priority** – This task should be carried out in the near-term (6–18 months).
- **Feasibility** – This task has significant resource implications. An initial effort can be done in-house, however it will require expertise that may not be available within SDDOT. It may be a good topic for a research project, however. The focus of the research project should be on how best to meet the operational needs initially with a plan to migrate to more advanced configurations of the TOC as conditions change.
- **Staff Roles** – The TSM&O Implementation Team should identify staff to lead this effort. Leadership approval is required to implement any recommendations on establishing TOC functions. Partner agency staff should also be invited to provide input into the needed TOC functions and the best methods to accomplish those functions.

5.6.5 Action S&T-4: Develop and Apply Operations Guidance

5.6.5.1 Background and Rationale

SDDOT’s TSM&O program capability relies on internal communication effectiveness. Internal communication comprises two primary channels: 1) from leadership to staff and 2) among staff when carrying out TSM&O strategies in the field and when sharing day-to-day practices or debriefing on post-event or post-incident outcomes. Leadership’s communication to staff includes expectations and performance targets in the form of guidance or policy. Clear guidance on operational roles and priorities is critical the effectiveness of TSM&O.

Consistency of practice has made recent progress. Traffic engineering staff, with FHWA participation, coordinate and meet quarterly through a Traffic Engineering Panel. The panel reviews and makes recommendations on traffic engineering concepts and design issues such as traffic signals, pavement

markings, signs, and work zone management. Recommendations may result in guidance or policy outcomes approved by Operations Support, the Division of Operations director, or implemented through a formal department policy-making process. Another area with progress is the more consistent use of a winter MDSS coordinated through a recently added staff position within Operations Support.

Leadership in Central Office recognizes a need to communicate clearer expectations to staff, especially in the Regions. Expectations for ITS use and support also need to be communicated to the Office of Research where their consideration and design originate. Overall, there is a need to better define expectations or performance targets for carrying out TSM&O goals and objectives, executing TSM&O strategies, and applying TSM&O tools and technology. Properly accounting for public feedback (as addressed in Action CUL-4) would help clarify what performance targets are most appropriate.

In general, communication from Central Office to Regions is characterized as taking place “on a case-by-case basis,” but the outcomes of these instances are not necessarily shared more broadly or translated into defined performance targets. Neither is the approach taken where guidance or direction is established on a more proactive basis and communicated to all relevant staff. Instituting clearer guidance would help maintain knowledge continuity when dealing with staff turnover. Staff do not wish for formal step-by-step procedures, as local autonomy is valued, but common goals or guidelines shared among Regions would be beneficial.

The best example of Central Office providing explicit activity direction is for performance of winter maintenance, but otherwise little direction typically is given. Examples where sufficient guidelines or procedures are lacking—even ones that would preserve the desired environment of regional flexibility—include defining SDDOT on-scene roles and responsibilities during traffic incidents, responding to weather events and emergencies, and using and managing traveler information tools, such as posting messages to DMS. A recent flooding event near the North Dakota border highlighted a lack of guidance on road closures, detour routing, traffic control standards, and cross-border procedures agreed to with the North Dakota Department of Transportation.

As noted in the previous section, staff note that without a TOC, it is challenging to communicate and coordinate during major traffic incident and weather events. There is no common guidance for road closures including how to close and reopen interstates by section.

Determining operational guidance will provide SDDOT the following benefit:

- provide clear expectations on operational roles and actions, which will result in more consistent and more efficient operations

The results of the Capability Improvement Workshop included a self-assessment Level 2 for Systems & Technology, which include supporting project development tools and processes such as providing clear operations guidance. Level 2 is an appropriate target for the Systems & Technology dimension, despite the self-assessment at the workshop. Much of the effectiveness of TSM&O systems depends on clear and consistent knowledge of appropriate actions. Developing operational guidance will move SDDOT forward in the Systems & Technology dimension.

5.6.5.2 Task S&T-4a: Operations Guidance Priority and Form

Determine the priority for and form of operations guidance. Many potential areas of operational guidance came up through staff discussions. Not all of those areas can be undertaken at the same time. It is important that these potential areas of operations guidance be prioritized. It is also necessary to determine what form that “guidance” might take, from simple best practice sharing, to policy that encourages specific activities or common practice, to the development of more formalized guidance documents. Potential TSM&O areas in which guidance may be needed include:

- DMS operation, specifically which staff members should have the authority to post a message, when the message should be posted, and what agencies need to be consulted with or communicated with
- traveler information dissemination
- inclusion of work zone traffic control or maintenance of traffic considerations in the project development process
- special event planning
- use of the MDSS
- environmental sensor stations, particularly guidance on maintenance
- on-scene roles for traffic incident management
- road closures, detour routing, and traffic control standards
- future TSM&O actions, such as variable speed limits and traffic queue detection

Table 5-31: Task S&T-4a – Implementation Steps

Implementation Steps	
1.	Identify staff to lead the effort to determine priority for developing operations guidance. This could be in-house or consultant-led.
2.	Review the possible areas of guidance. Review existing guidance. Develop the form of guidance that would be most effective in each area.
3.	Prioritize the guidance areas. Include stakeholder input in the prioritization process. Priority should include consideration of not only what is most important, but the level of effort required and the immediacy of implementing the guidance.
4.	Present recommendations for guidance areas that include the results of the prioritization and the recommended form for the guidance in each area.
5.	Specify when the guidance should be reviewed to determine if they need to be updated.

- **Priority** – This task should be carried out in the near-term (6–18 months).
- **Feasibility** – This task has should be carried out by the TSM&O Implementation Team or staff assigned by the Implementation Team. The guidance should be addressed based on priority and staff availability. This task does not lend itself to consultant support.
- **Staff Roles** – The TSM&O Implementation Team should identify staff to lead this effort. Leadership approval is required to implement most of the guidance.

5.6.5.3 Task S&T-4b: Operations Guidance Development

Develop operations guidance by priority and level of effort. Based on the priority from Task S&T-4a and the available resources, determine how best to develop and implement the needed guidance. The guidance should include troubleshooting approaches and who is responsible for carrying out the guidance. The staff responsible need to be familiar with the area of guidance and familiar with the form of the guidance.

Table 5-32: Task S&T-4b – Implementation Steps

Implementation Steps	
1.	Identify staff best positioned to draft guidance. Staff developing guidance need first-hand familiarity with SDDOT's processes specific to the TSM&O function, an understanding of leadership's vision on executing that function, and ideally knowledge of applicable best practices.
2.	Work with stakeholders, especially internal stakeholders, to determine specific guidance that is needed.
3.	Research the best approaches that should be reflected in the guidance. Very often, this will simply entail discussions within SDDOT to see what has worked well in a variety of situations.
4.	Work with stakeholders to develop the specific guidance. This may be as simple as sharing best practice.
5.	Distribute the guidance for review and comment.
6.	Finalize the guidance.

- **Priority** – This is a near-term to mid-term set of tasks, the first of which could start within a 3–18 month timeframe.
- **Feasibility** – This task should be undertaken by in-house staff. The number of guidance elements to initiate will depend on staff availability.
- **Staff Roles** – The TSM&O Implementation Team should coordinate and track these efforts. Staff familiar with the guidance area should be assigned to lead each effort. Partner agency staff should be consulted and coordinated with as appropriate to the guidance area.

5.7 Performance Measurement

5.7.1 Introduction to Performance Measurement

Performance measurement encompasses the definition of measures, the data collection and analysis of the measures and the use of the information for adjusting TSM&O systems and activities to improve performance. Performance measurement is therefore the means of determining the effectiveness of agency TSM&O activity based on measures that reflect their impact.

The actions presented below represent the next logical steps for SDDOT to take to improve their performance measurement, based on stakeholder interviews and the national experience in the TSM&O field. Two actions are proposed:

- developing a pilot performance measurement program
- developing a performance measurement plan

These actions correspond to Action 8 in the 2014 TSM&O Capability Maturity Implementation Plan (see Table 2-4), which was placed on hold pending the outcome of FHWA's proposed MAP-21 rulemaking. The proposed actions would be suitable for a research project.

5.7.2 Action PM-1: Develop a Pilot Performance Measurement Program

5.7.2.1 Background and Rationale

SDDOT is already involved in performance measurement both in the federally required Strategic Highway Safety Plan and for infrastructure asset management, as reported in SDDOT Annual Reports. TSM&O reporting may be considered a natural extension of the department's commitment to measuring and reporting performance.

Federal Requirements

The federal MAP-21 legislation introduced new requirements for performance management on the federal-aid highway systems to ensure the most effective use of federal-aid funds. Some of the general requirements associated with all MAP-21 performance reporting requirements include a focus on:

- establishment of a formal performance measurement process
- identifying measures and sample size
- coordination between state DOTs and MPOs in selecting congestion-related performance targets
- reporting performance and sample size
- performance thresholds that indicate significant progress
- integration of performance measurement into statewide and MPO plans
- integration of performance plans into the planning process through demonstrated consideration of the anticipated effect of the congestion-related improvement and linkage of investment priorities to performance achievement
- federal approvals of proposed state processes and target date for first report

An additional consideration was introduced by the FAST Act: states that fail to achieve their self-imposed targets during two consecutive planning cycles must document to FHWA steps to be taken to achieve the target.

The proposed rules related to system performance and congestion were published on April 22, 2016 (23 CFR Part 490: National Performance Management Measures; Assessing Performance of the National Highway System (NHS), Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program). The rule applies to the Interstate System and other National Highway System elements. The rule introduces new requirements at the core of the TSM&O program planning process.

Three performance areas are addressed by the proposed rule as noted in its title:

- performance on the NHS
- freight movement on the Interstate System
- Congestion Mitigation and Air Quality Improvement Program

Because South Dakota has no metropolitan areas with a population of over 1 million, the third performance area does not apply.

For performance of the NHS, the proposed rule states:

There are four performance measures to assess the performance of the Interstate System and the performance of the non-Interstate NHS for the purpose of carrying out the National Highway Performance Program. Two measures are used to assess Reliability. They are:

(1) Percent of the Interstate System providing for Reliable Travel Times; and

(2) Percent of the non-Interstate NHS providing for Reliable Travel Times.

Two measures are used to assess Peak Hour Travel Time in urbanized areas over 1,000,000 in population. They are:

(1) Percent of the Interstate System where Peak Hour Travel Times meet expectations; and

(2) Percent of the non-Interstate NHS where Peak Hour Travel Times meet expectations.

Only the first 2 apply to South Dakota.

For freight movement on the Interstate System, the proposed rule states:

There are two performance measures to assess freight movement on the Interstate System. They are:

(a) Percent of the Interstate System Mileage providing for Reliable Truck Travel Times; and

(b) Percent of the Interstate System Mileage Uncongested.

All four of the measures applicable to South Dakota are based on segment travel times on the NHS (including the Interstate System). FHWA suggests that states use the National Performance Management Research Data Set for their travel time data set. This data set is derived from vehicle-based probe data that includes average travel times representative of all segments of the NHS for all traffic and for freight traffic. The benefit to South Dakota of using this data set is that it already exists and it is clearly acceptable for use by FHWA.

The rule proposes that the measure for reliable travel time be “Level of Travel Time Reliability” (LOTTR). Specifically, the rule proposes that the ratio of the 80th percentile travel time to the 50th percentile travel time be used. The target value for this ratio is 1.5; for results lower than that, performance is considered acceptable. This measure is proposed for both the Interstate System and the NHS.

For freight movement, the rule proposes that the measure for reliable truck travel times be somewhat different than that for the general fleet. They reference standard trucking industry practice and propose using a comparison of the 95th percentile truck travel time to the 50th percentile truck travel time. Again, the rule proposes a threshold value for reliable truck travel time ratio of 1.5.

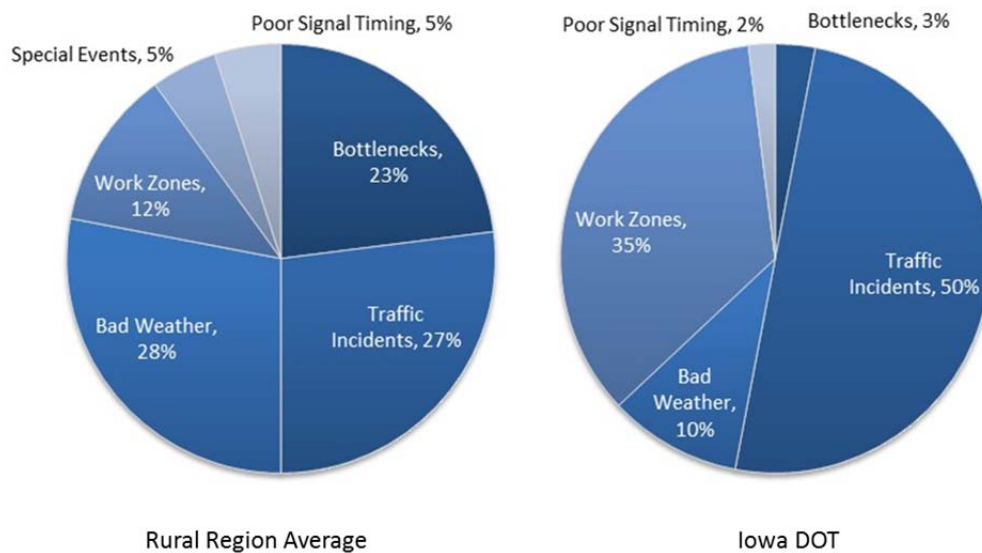
The second freight movement measure (percentage of the Interstate System mileage uncongested) uses average truck speeds on Interstate segments. They define uncongested conditions as average truck speeds greater than “50.00 mph.” The rule proposes that average truck speed be calculated by dividing segment length by the segment travel time.

Although the final rule may differ from the proposed rule based on comments, the likelihood is that the measures will continue to be based on travel time and focus on reliability.

SDDOT Observations

Performance measurement is important for more reasons than meeting the federally required reporting requirements of MAP-21 and the proposed rule. Nationally over one-half of systems delay and most unreliability is a function of non-recurring congestion, the target of TSM&O, including weather, traffic incidents, construction work zones and special events. This share is much greater, 75–95 percent, in rural areas as shown in Figure 5-5. Performance measurement is especially critical to TSM&O because current real-time “performance” is the basis for systems operational management, including both the deployment of systems and technology and their use in terms of standardized real-time procedures and protocols. In effect, performance measurement is fundamental to all other capability dimensions in that it identifies how well an organization is delivering operations services and identifies areas that need improvement.

Figure 5-5: Causes of Congestion in Rural Areas



Source (Rural Region): FHWA

Source (Iowa DOT): *TSM&O Program Plan*, Iowa DOT, February 2016 <http://www.iowadot.gov/TSMO/TSMO-Program-Plan.pdf>

Discussion with SDDOT staff identified the importance of performance measurement to the improvement of the effectiveness of SDDOT’s future SDDOT TSM&O activities. SDDOT already reports performance measures related to capital projects, including safety, pavement condition, and bridge sufficiency. In addition, leadership’s current communications to staff includes expectations and performance targets in the form of guidance or policy for existing activities such as winter maintenance and the Sturgis rally. Additional reliability measures will be required by the FHWA MAP-21 performance measurement regulations. The discussion recognized that an appropriate set of performance targets, measures, and expectations will need to be communicated to the Office of Research and to offices

involved in project delivery. In some form, these measures and related performance should be communicated to the public.

Federal requirements have introduced a new impetus for developing a performance measurement program. A key issue regarding performance measurement is defining a useful but achievable approach, one that targets key areas of concern, but at the same time is practical in terms of data development and use in actual day-to-day systems management. In this regard, the use of output measures and the value and level of effort to develop outcome measures is a central consideration.

Especially for a start-up performance measurement program, it is important to consider the trade-off between level of effort involved in measurement and analysis vs. the payoff in use as part of performance improvement actions. The ultimate objective of performance measurement is to support improvement in system performance, in customer terms, such as reduced travel time delay or improved reliability of work trip travel time. However, direct measurements of outcomes regarding travel times outside those included in the National Performance Management Research Data Set may require significant data collection and analysis costs. Three options are available for measures outside the Federal Rule:

- output measures that measure the level and type of activities that contribute to desired outcomes, as in the case of TSM&O: number of incidents responded to, secondary crash incidence, incident clearance time, snow and ice-related bare pavement achieved, etc.
- “synthetic” outcome measures that can be constructed by combining available data and known parameter values—such as using traffic volumes and facility capacities to calculate average segment speeds and derived travel times—correlated with the estimated impact of incident delay on travel times
- outcome measurements based on direct customer-based service improvements, such as actual travel time on key highway segments and reliability

For each case, data requirements are very different. For example, desirable input data could include incident clearance times, segmented by time-stamped phase (time from notification to first arrival, time to clearance, time to flow restoration), so that data could be used to analyze trends over time and improve procedures. A similar approach could be applied to snow and ice control related to timing and quality of micro-weather data, use in determination of treatment and other actions, and mobilization of equipment to analyze trends and impacts of procedural improvements. However, SDDOT faces the challenge of very little data, even input data such as incident lifecycle events and timestamps.

This type of consideration will be central to the development of a practical performance measurement program for SDDOT.

Benefits and Capability Improvement

Overall, this performance measurement action and its related tasks will benefit SDDOT by:

- focus on the activities that affect performance the most, which will in turn lead to effective performance improvements
- a mechanism to effectively meet federal performance measurement requirements

- quantifiable information to stakeholders and decision-makers about SDDOT performance improvements

SDDOT assessed itself as a Level 1 for Performance Measurement in the Capability Improvement Workshop (see Table 2-3). The results of discussions with SDDOT staff suggest that Level 1–2 is an appropriate target for next-step achievement. This action’s recommended tasks would help establish data collection that could be used for after-action debriefings (primarily for special events, winter weather, and incidents) and for identifying overall improvements. This data could also be made available and presented on performance dashboards (Level 2).

5.7.2.2 Task PM-1a: Performance Measurement Process

The first step in developing a performance measurement program is to define performance measures and develop a measurement process. This task will propose a set of measures and determine the best measurement process based on the review of background material on DOT performance measurement experience, SDDOT needs, and federal requirements and rulemaking.

Table 5-33: Task PM-1a – Implementation Steps

Implementation Steps	
1.	Review appropriate sections of federal regulations in MAP-21 and the proposed Federal Rule (23 CFR Part 490) to understand federal requirements.
2.	Identify requirements that apply to South Dakota. If the final rule remains the same as the proposed rule, the required measures relate to travel time reliability for the general fleet and for freight.
3.	Review SDDOT experience with performance measurement, including: <ul style="list-style-type: none"> a. Federal asset management and safety reporting requirements b. Winter maintenance Determine if there are lessons that may be applied.
4.	Identify existing data available to be used in performance measurement. The proposed rule proposes the use of the National Performance Management Research Data Set as the data source for the federal requirements.
5.	Identify any additional potential “desired” performance measures that reflect SDDOT TSM&O concepts (include freight, agriculture, special events or tourism, as well as conventional delay, reliability, traffic incident management, winter maintenance, and safety) and take into account data availability. Coordinate with relevant SDDOT offices.
6.	Identify reasonable performance targets for performance on the Interstate and other National Highway System elements. The Federal Rule proposes a target threshold of 1.5 for LOTTR.
7.	Review experience and activities of peer agencies especially regarding the relationship among key performance measures and goals, strategy applications, and data availability. Review related analytical methods for any measures to be included other than those in the Federal Rule.
8.	Compile a practical candidate set of start-up performance measures and their requirements for collection, analytical method, and application. Identify staging for collection and analysis of data. A reasonable initial set would be the measures required by the Federal Rule added to those critically important to SDDOT, alongside the measures already used by SDDOT.
9.	Identify SDDOT and partners’ current data availability related to TSM&O that are relevant to the identified performance measures. For the measures included in the Federal Rule, the National Performance Management Research Data Set will likely be the best data set to use.
10.	Document the performance measures process, including the method of collection, analytical methods, and application.
11.	Review the proposed approach with the FHWA Division Office regarding compliance.

- **Priority** – This is an immediate task recommended to start within 3 months because of the importance of performance measurement to TSM&O overall. For complying with the Federal Rule, this task could be more in the near-term (3–18 months).

- **Feasibility** – Generally, this task needs oversight and guidance from the TSM&O Implementation Team. There are resource implications of staff participation in developing the performance measurement program. However, the effort can be scaled to personnel availability by starting with a core set of measures, perhaps only those required by the Federal Rule.
- **Staff Roles** – The Implementation Team will need to identify a lead in the development of the performance measurement process. The process development itself could be done in-house, but may be better suited to a research project.

5.7.2.3 Task PM-1b: Performance Measurement Process Pilot

Develop a pilot implementation of the performance measurement process. Identify a candidate set of performance measures and supporting practices relevant to satisfying proposed federal requirements and to meeting the goals of essential TSM&O activities. A reasonable pilot implementation would be the performance measures required by the proposed Federal Rule, those critically important to SDDOT, and the measures already used by SDDOT, as identified in Task PM-1a.

Table 5-34: Task PM-1b – Implementation Steps

Implementation Steps	
1.	Review the TSM&O performance measurement process developed in PM-1a with relevant offices. Gather input on scope of the proposed pilot implementation (performance measures and geographic and functional areas to be included in the pilot).
2.	Using the TSM&O Implementation Team, work with key partners to identify specific performance-related goals and objectives.
3.	Secure agreement among leadership and staff affected by the pilot regarding the use of performance data in improving performance for each key TSM&O application selected.
4.	Based on the input received in Steps 1 through 3, outline the proposed scope of the pilot performance measurement implementation.
5.	Distribute the pilot scope for review and comment. Update the scope of the pilot scope based on comments. Estimate resources needed to conduct the pilot.
6.	Present the proposed pilot scope and required resources to leadership. Adjust pilot scope based on comments from leadership. Update required resources to reflect revision.
7.	Develop a pilot implementation plan. The plan will document the pilot scope and resources and add a schedule of activities. The plan will also provide implementation steps to conduct the pilot. Depending on the size of the pilot, consideration should be given to a staged implementation.
8.	Assign pilot implementation responsibilities.
9.	Conduct the pilot implementation, following the implementation plan.
10.	Provide periodic updates on the progress of the implementation to leadership. Adjust the pilot as needed, based on lessons learned. Document changes needed to the TSM&O performance measurement process based on the results of the pilot.
11.	Document the results of the pilot.

- **Priority** – This is near-term task recommended to start in the 3 – 18 month timeframe.
- **Feasibility** – Generally, this tasks needs oversight and guidance from the TSM&O Implementation Team. There are resource implications of staff participation in developing the pilot performance measurement program. However, the effort can be scaled to personnel availability by limiting the set of measures, perhaps to only those required by the Federal Rule.

- **Staff Roles** – The Implementation Team will need to identify a lead in the development of the performance measurement pilot. The pilot could be undertaken in-house, or as a phase of the research project suggested in PM-1a.

5.7.3 Action PM-2: Develop a Performance Measurement Plan

5.7.3.1 Background and Rationale

Transitioning from a pilot performance measurement program to an established performance measurement and reporting program could involve a significant investment in data collection, ongoing consensus and collaboration with partners, data analysis, and report development. There also needs to be a commitment to use the results of the performance measurement program to improve performance and report results, especially to external stakeholders through mechanisms such as dashboarding.

A full-scale TSM&O performance program involves key collaborators, especially the Department of Public Safety and law enforcement. Therefore, it is essential that the approach to performance measurement (the value, use, roles in data development, and reporting) be developed on a consensus basis, recognizing the differences in priorities among partners.

Given the current state of performance data availability within SDDOT, it is important to identify an incremental approach, starting with a “doable” first stage, as recommended in Action PM-1 with the pilot. For the continuing program, it is equally, or even more important, to use available data to the extent possible for measures such as trends in traffic congestion, inventory and characteristics of crash and weather incidents. Anecdotal information may also be important, but it must be captured and shared and made part of the performance measurement “record.” In addition, special attention should be focused on crash and weather related response and restoration measurement as the principal sources of non-recurring congestion and the biggest threat to reliability in South Dakota.

This action essentially implements the findings of Action PM-1 and establishes a TSM&O performance measurement program within the department. A principle incorporated in this task is that even after the completion of the performance measurement pilot, consideration should be given to a staged implementation of the full performance measurement program. This allows the program to grow and develop at the level of resourcing available, adapt to the experience gained in early stages, and evolve as TSM&O evolves.

As with Action PM-1, this action and its related tasks will benefit SDDOT by:

- providing focus on the activities that affect performance the most, which will in turn lead to effective performance improvements
- providing a mechanism to effectively meet federal performance measurement requirements
- providing quantifiable information to stakeholders and decision-makers about the SDDOT performance improvements

SDDOT assessed itself as a Level 1 for Performance Measurement in the Capability Improvement Workshop (see Table 2-3). The results of discussions with SDDOT staff suggest that Level 1–2 is an appropriate target for next-step achievement. This action’s recommended tasks would further establish data collection that could be used for after-action debriefings (primarily for special events, winter

weather, and incidents) and for identifying overall improvements. This data could also be made available and presented on performance dashboards (Level 2).

5.7.3.2 Task PM-2a: Performance Measurement Process Update

Evaluate the performance measurement pilot and update the performance measurement process. This task will evaluate the effectiveness of the performance measurement process developed in Task PM-1a and implemented in a pilot effort in Task PM-1b. This task will adjust the process as needed before it is more fully implemented, recognizing that the performance measurement program will be implemented in incremental stages over time.

Table 5-35: Task PM-2a – Implementation Steps

Implementation Steps	
1.	Review the results of the pilot implementation. Interview key resources involved with the pilot. Specifically, look for lessons learned, issues encountered, and successes in the pilot.
2.	Document the actual steps that were needed to gather and analyze data for determining the performance measures during the pilot. Pay particular attention to any issues encountered using the National Performance Management Research Data Set and the perceived accuracy of that data.
3.	Identify and document recommended improvements needed in the performance measurement process.
4.	Present the revised process to the managers and key staff involved in the pilot. Solicit feedback on the revisions to the process.
5.	Update the revised process on the basis of the feedback received in Step 4.
6.	Present the revised process to leadership.
7.	Update the process according to feedback from leadership.

- **Priority** – This is a mid-term task recommended to start after the completion of the pilot (Task PM-1b), most likely starting in the in the 18 to 24-month timeframe.
- **Feasibility** – Generally, this task needs oversight and guidance from the TSM&O Implementation Team. This will be a key activity that will affect the performance measurement program and, therefore, the entire TSM&O program.
- **Staff Roles** – The Implementation Team will need to identify a lead in the oversight of the evaluation effort. Because this is essentially an assessment of the pilot project, it lends itself to being a third phase of the research project suggested in PM-1a.

5.7.3.3 Task PM-2b: Performance Measurement Implementation Plan

Develop a staged performance measurement implementation plan and implement initial stage. This task will implement the recommendations that result from the evaluation of the performance measurement pilot project in Task PM-2a. The value of performance measurement is directly proportional to how it is used in improving applications as well as in planning future applications. Developing a coherent, staged implementation plan will allow SDDOT to implement portions of the overall performance measurement program in a way that will enable focus on improvements related to the new performance measures. It will also allow it to adjust the program accordingly.

Table 5-36: Task PM-2b – Implementation Steps

Implementation Steps	
1.	Identify key stakeholders within SDDOT in each of the relevant agency activity programs or areas.
2.	Reach out to managers responsible for the programs that will be included in the performance measurement implementation plan. Present the performance measurement process. Secure agreement among management and staff regarding the use of performance data for each key TSM&O application selected.
3.	Identify key external stakeholders in SDDOT performance measurement with special attention to TSM&O partners such as the Department of Public Safety, other local public safety agencies, and local transportation agencies. Present the performance measurement process.
4.	Identify the types of reporting and accountability implied—internal and external—and ensure an understanding and acceptability to leadership, management, and staff involved.
5.	Identify a practical approach, potential process activity level-of-effort, and staffing burdens and resource requirements. Ensure understanding and acceptability.
6.	Identify specific capabilities needed and availability in-house vs. outsourced.
7.	Develop a staged approach to performance measurement, analysis, reporting, and use focused on safety and reliability.
8.	Document findings in a performance measurement implementation plan.
9.	Specify activities and responsibilities for collection, analysis, and reporting/communicating.
10.	Identify policy and procedures regarding liaison with other agency performance groups and support of the Public Information Officer.

- **Priority** – This is a longer-term task recommended to start after the pilot evaluation (Task PM-2a).
- **Feasibility** – This task is the logical outcome of all the previous tasks. It is important to have the performance measurement activity to migrate into standard SDDOT practice. This task needs oversight and guidance from the TSM&O Implementation Team but also requires integration into the rest of the department. The plan will need to be cognizant of resource needs and adjust accordingly if it is to be feasible. The plan needs to be scaled to personnel availability and must acknowledge the importance of measurement and reporting requirements of the Federal Rule.
- **Staff Roles** – The Implementation Team will need to identify a lead in the development of the performance measurement plan. It is recommended that the plan be developed in-house to maximize ownership of the plan, but it could be developed by consultants or as a research project.

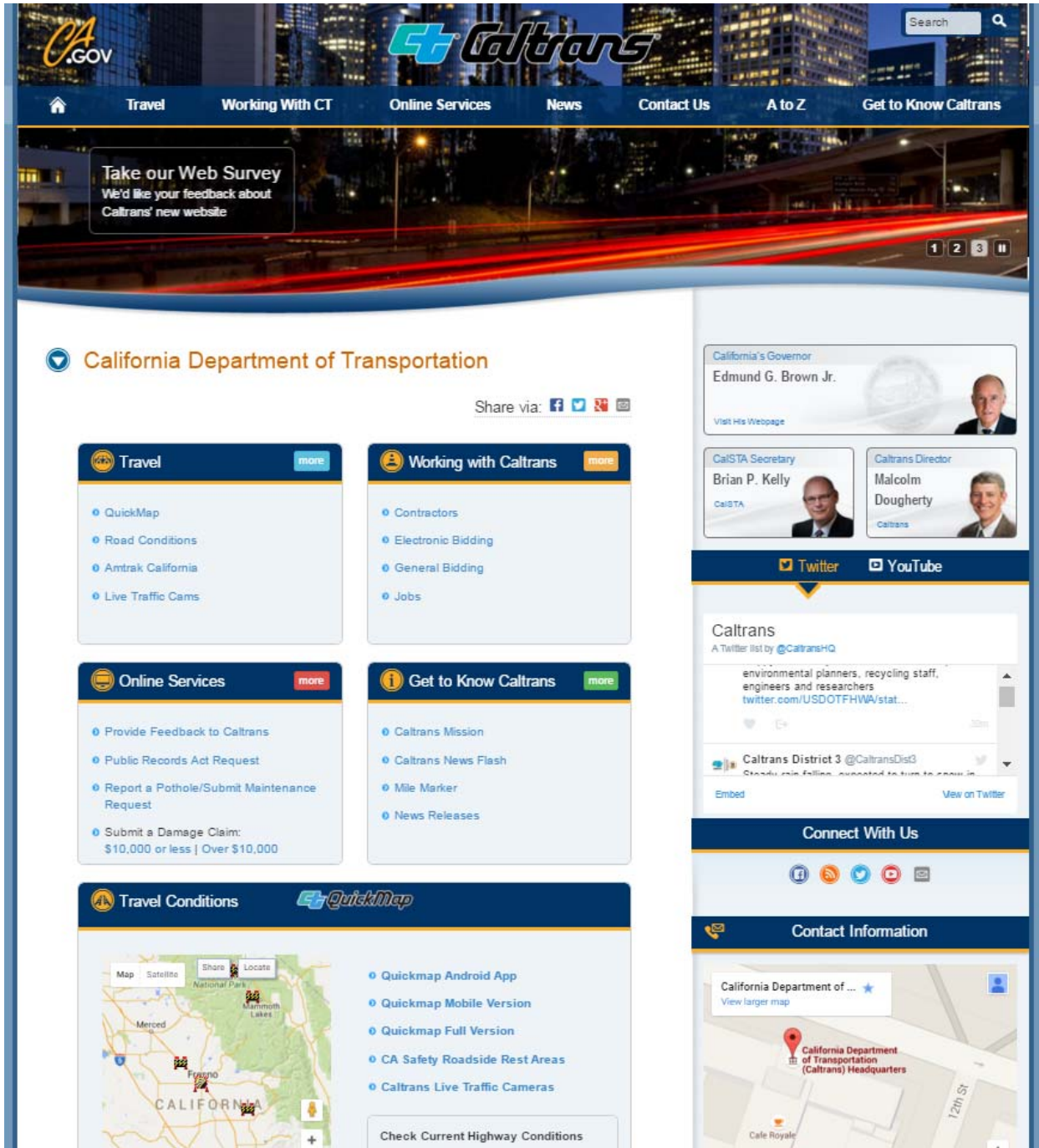
APPENDIX A: STATE DOT WEBSITES WITH TSM&O EMPHASIS

The following screenshots illustrate state DOT websites with a focus on TSM&O strategies or information.

- **Colorado DOT** – clean, modern look with an equal emphasis on its homepage placed on travel information and other operations information (e.g., express lanes, winter driving) as on other areas of the website (e.g., programs and projects, safety)



- **Caltrans** – uncluttered homepage with prominent travel information and travel conditions features



- **Maryland State Highway Administration** – extensive information on its TSM&O program (Coordinated Highways Action Response Team, or CHART) on a dedicated webpage

Maryland.gov Phone Directory State Agencies Online Services

DEPARTMENT OF TRANSPORTATION
COORDINATED HIGHWAYS ACTION RESPONSE TEAM

[HOME](#)
[LOCAL INFO](#)
[INTERACTIVE MAP](#)
[SEVERE WEATHER](#)
[TRAFFIC CAMERAS](#)
[LANE CLOSURES](#)

Notice: The CHARTWeb web site will be undergoing maintenance on Monday, April 25th, between 10AM and 2PM. Some brief interruptions to our web site and data feeds are possible during this time.

LOCAL TRAVELER INFORMATION

- Live Traffic Cameras
- Interactive Map
- Maryland Highway & Traffic Information
- Lane Closures
- Route Restrictions
- Speed Sensor Data
- Highway Message Signs
- RSS and XML Feeds

WEATHER INFORMATION

- Severe Weather Information
- Local Weather Station Data
- Current Weather Conditions
- Tropical Weather
- Satellite Images

ABOUT CHART

Allegany County Southbound Shoulder closed I-77 US 220			
Type	Location	Direction	Details
Roadwork	Allegany County (MD 956 EAST PAST US 220)	East	1 of 1 Westbound traffic lanes bidirectional. 1 of 1 Eastbound traffic lanes closed. Created: 6/18/2013 7:18:49 AM by SOC.

Lane Configuration Data

Maryland Highway & Traffic Information

Coordinated Highways Action Response Team (CHART) is a joint effort of the Maryland Department of Transportation, Maryland Transportation Authority and the Maryland State Police, in cooperation with other federal, state and local agencies.

CHART's mission is to improve "real-time" operations of Maryland's highway system through teamwork and technology.

APPENDIX B: STATE DOT TSM&O ORGANIZATIONAL STRUCTURE REFERENCES

State DOTs with recent reorganizations establishing a dedicated TSM&O division or office are summarized in the table below. Current organization charts for each state DOT follow.

	Date	Name	Reports up to	Comprises	Responsibilities	Other
TN ^a	2012	Traffic Operations Division	Asst. Chiefs: Engineer of Operations, Engineer of Design	Transportation Management Office	TMC TIM traveler information	4 Regional TMCs managed by Regions
				ITS Design and Deployments	Technology design and implementation	
				Traffic Engineering	Highway safety and operations improvements	
AZ ^b	2016	TSMO Division	Deputy Dir. Transportation/ State Engineer	Traffic Maintenance	Signal operations Striping and signing	
				Systems Maintenance	ITS maintenance	
				Traffic Management	TOC Emergency management TIM	
				Systems Management	Maintenance admin Contracts Pavement management	
				Operational Traffic and Safety	Signal systems Regional traffic engineering Safety	
IA ^c	2013	Office of Traffic Operations	Bureau of Systems Operations Division of Highways	Traffic Operations Systems and Technical Services	ATMS software ITS planning Traveler information ITS maintenance	Bureau also includes: Maintenance, Traffic and Safety Districts also responsible for traffic operations
				Traffic Incident and Emergency Management	TIM Emergency management	
				Traffic Management Center Services	TMC	
				Traffic Operations Research and Decision Support	CTRE coordination Performance measurement Applications development	
CO ^d	2013	Division of TSM&O	Deputy Executive Director	Traffic, Safety and Engineering	Safety	Regions, Maintenance, Office of Emergency Management
				ITS/Technology	ITS design ITS asset	

Date	Name	Reports up to	Comprises	Responsibilities	Other
				management	
			Active Traffic Management and Operations	Real-time traffic monitoring Manage event congestion Manage 511 and weather information	
			Corridor Management and Incident Command Branch	Incident command dispatch Manage key corridors Traveler information Courtesy Patrol and Heavy Tow programs	
			Planning, Performance and Transportation Demand Management	TSM&O planning	

^a Tennessee DOT Draft TSM&O Program Plan

^b Press release, TSM&O Presentation 9/16/2015

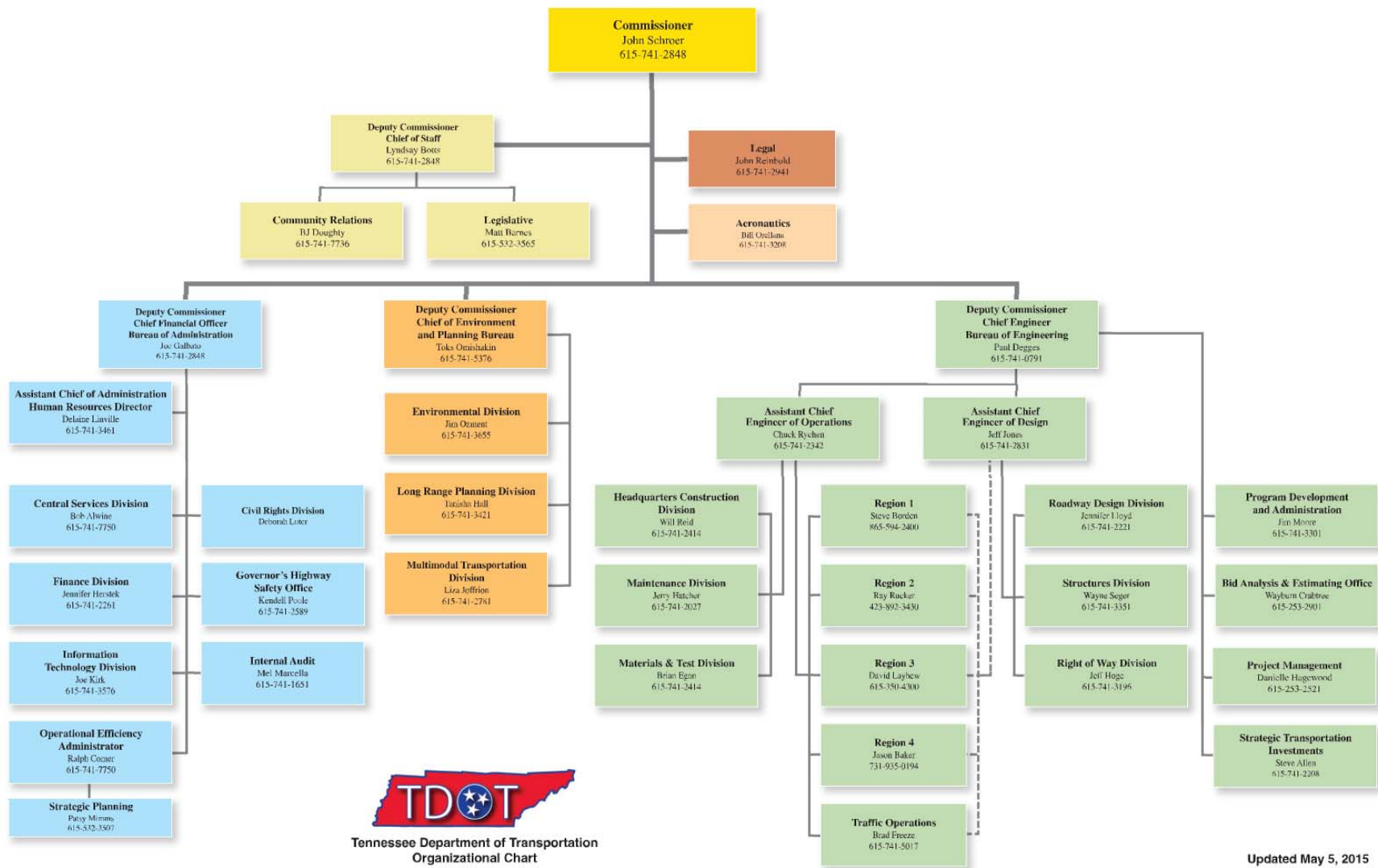
^c Iowa DOT TSM&O Program Plan, February 2016 <http://www.iowadot.gov/TSMO/TSMO-Program-Plan.pdf>

^d Colorado DOT TSM&O Reorganization Report, May 2013 <https://www.codot.gov/programs/operations>

Two state DOTs that are known for effective TSM&O capabilities but without a dedicated TSM&O division or office are Washington State DOT and Utah DOT. Their current organization charts also follow.

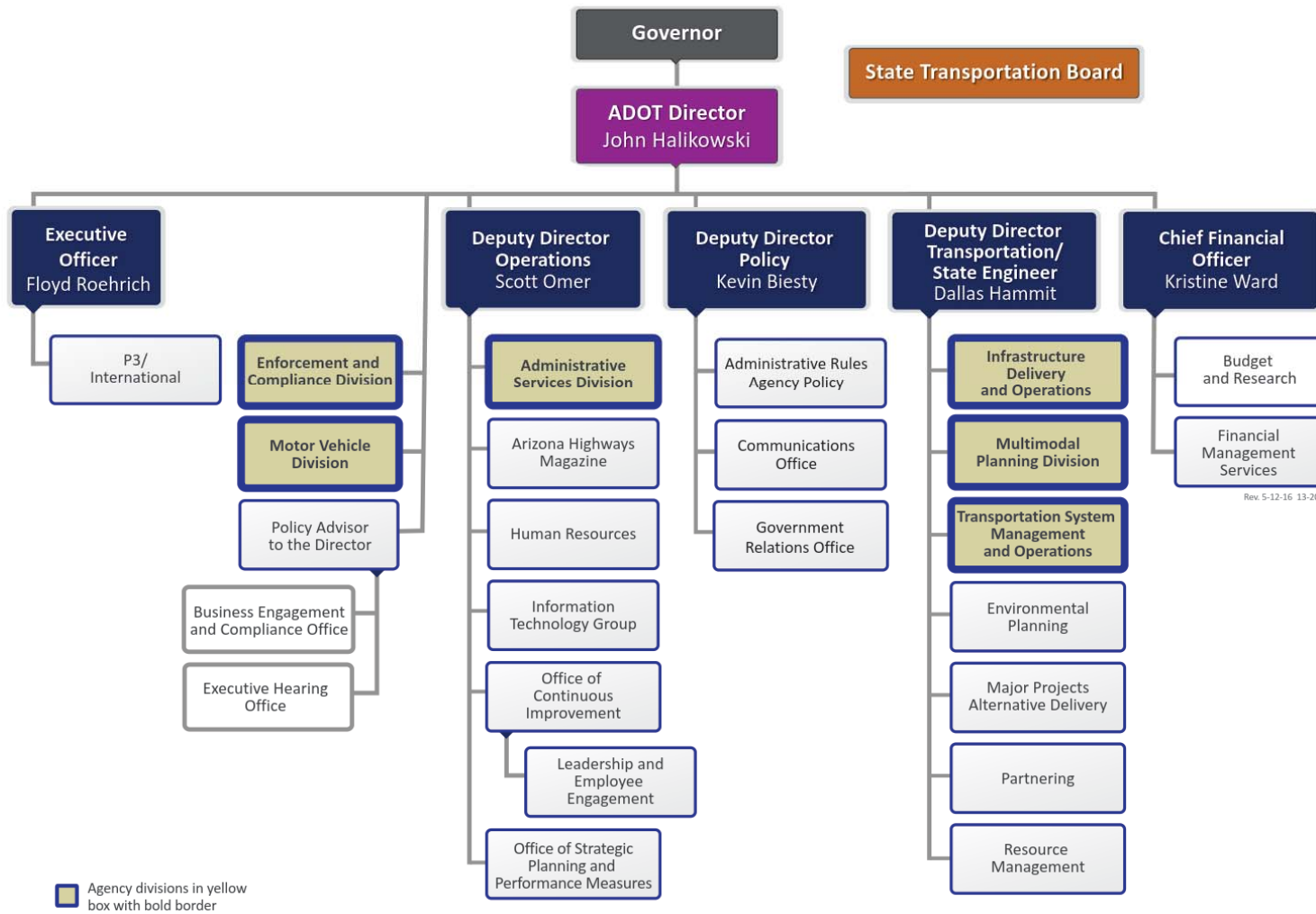
Washington State DOT made no organizational changes to account for the emergence of TSM&O. In most ways, the organizational structure, except in the executive structure of the department, is unchanged over the last 20 years. TSM&O responsibilities are spread across existing organizational units. Overall, TSM&O program management rests in the Traffic organization and operational responsibilities for traffic management, ITS, and the TMCs rests in the Region Traffic offices. Traffic and ITS design in the larger regions is the responsibility of the Traffic office, but in the smaller regions is the responsibility of the Design office. At the headquarters level, managing the maintenance program, including maintenance of traffic management and ITS devices, is the responsibility of the Maintenance Office. Programming Capital projects needed by TSM&O is the responsibility of the Program Management Office. The Traffic Office, as part of the Operations (TSMO) program has responsibility over the low cost improvement funds. Both the Traffic Office and Maintenance have responsibility in traffic incident management.

Utah DOT's organizational structure is similar to Washington State DOT and implies a similar distributed responsibility for TSM&O among several offices.




Tennessee Department of Transportation
Organizational Chart

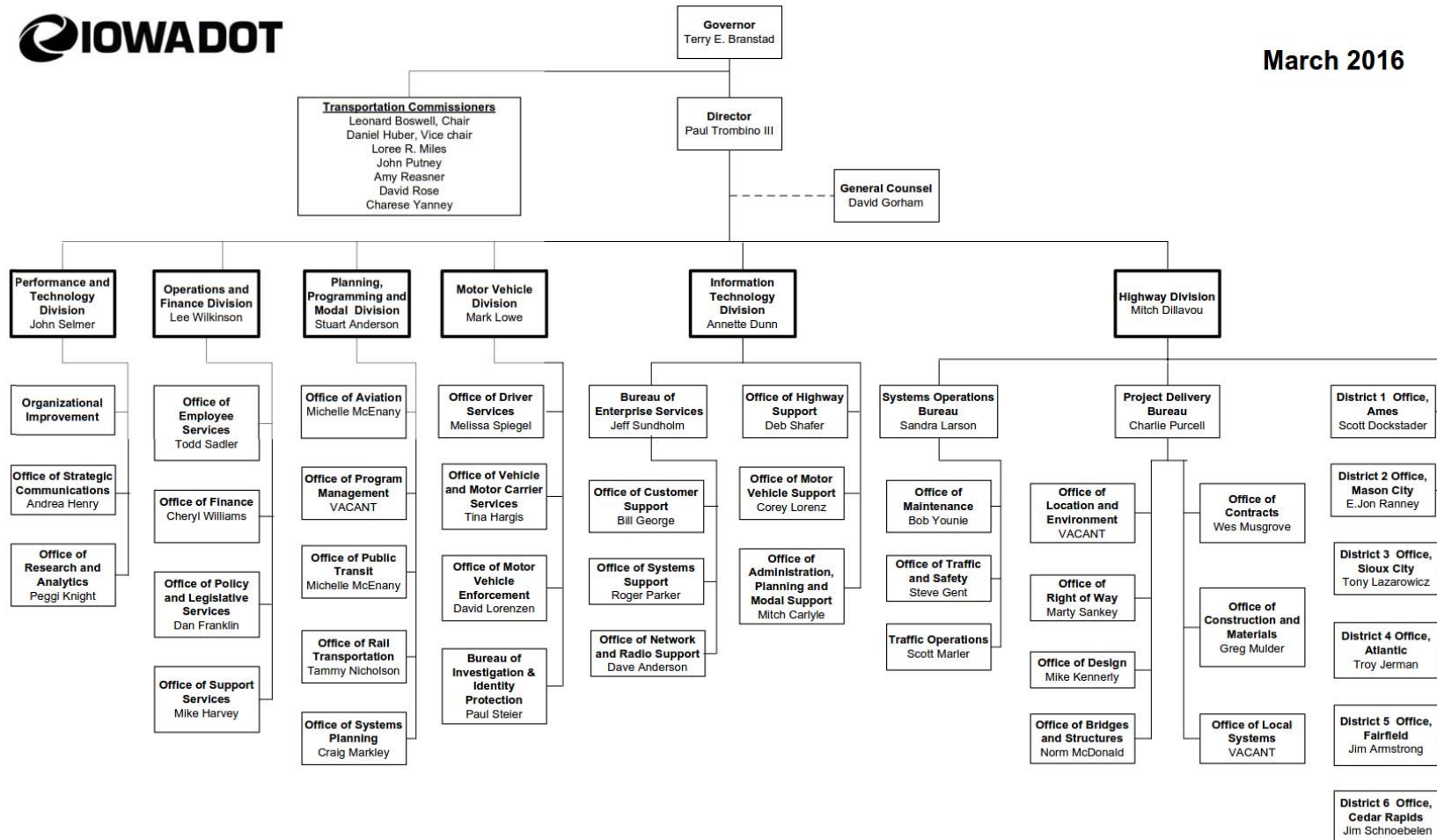
Updated May 5, 2015



Rev 5-12-16 13-201

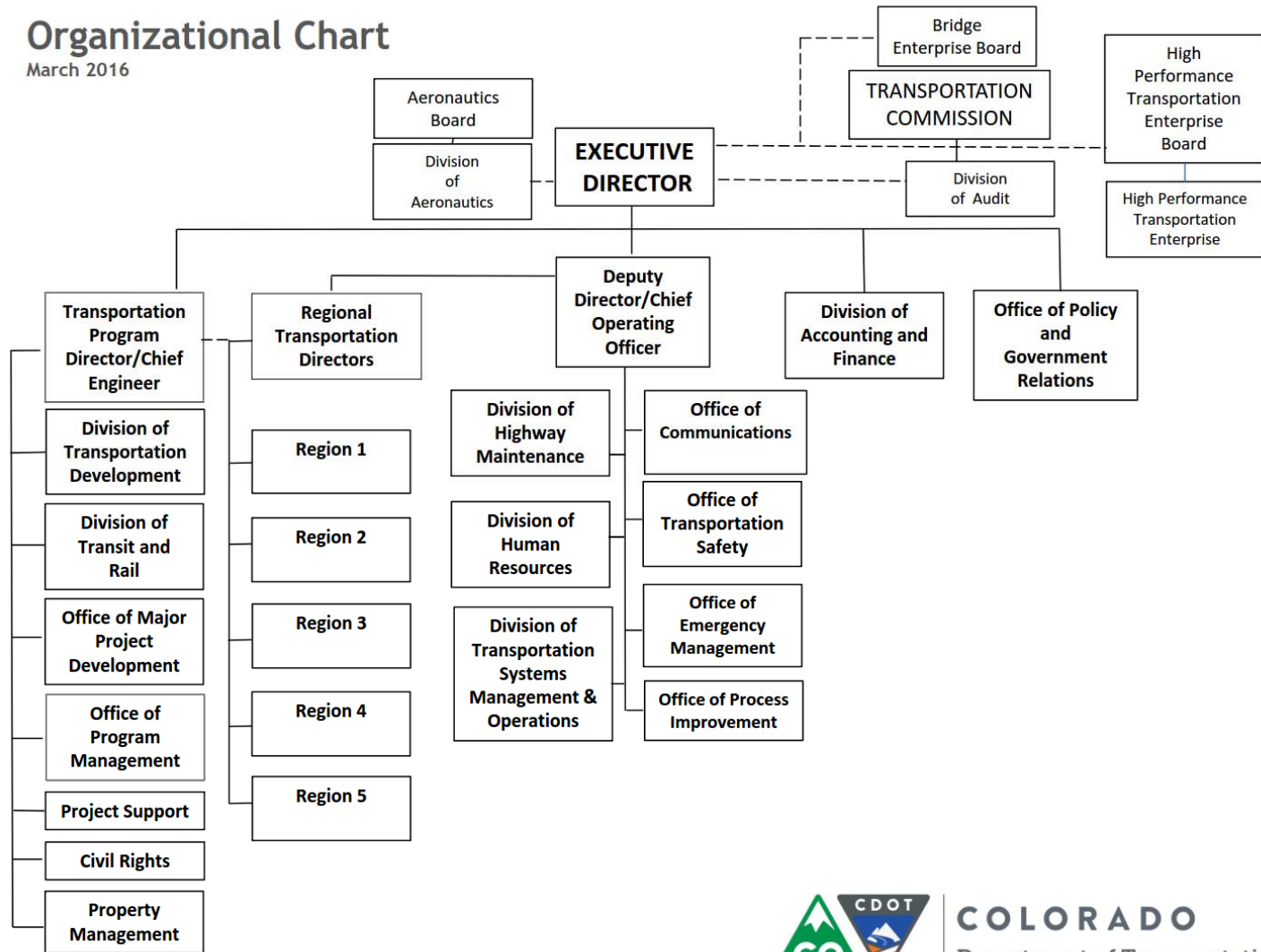


March 2016

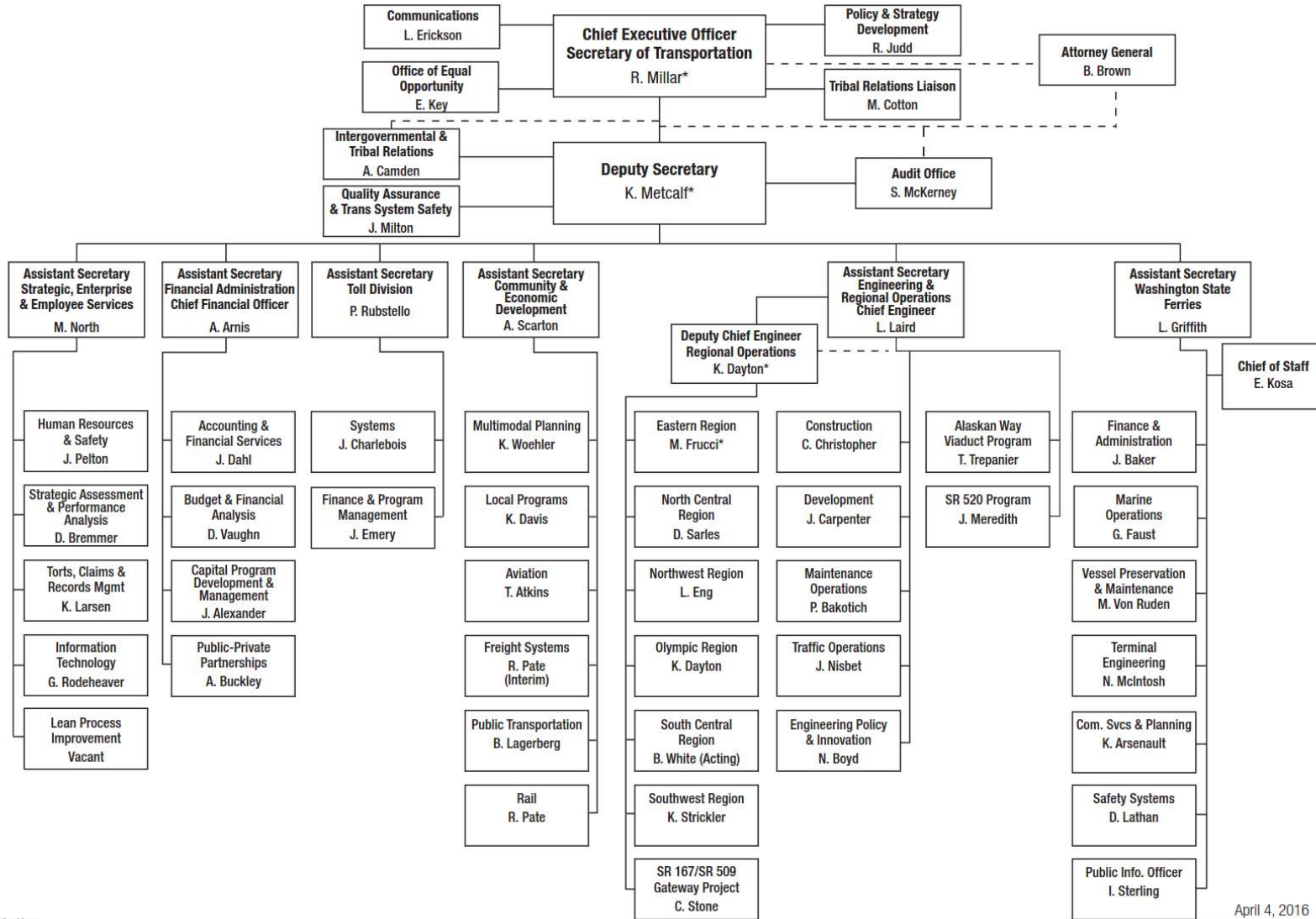


Organizational Chart

March 2016



COLORADO
Department of Transportation

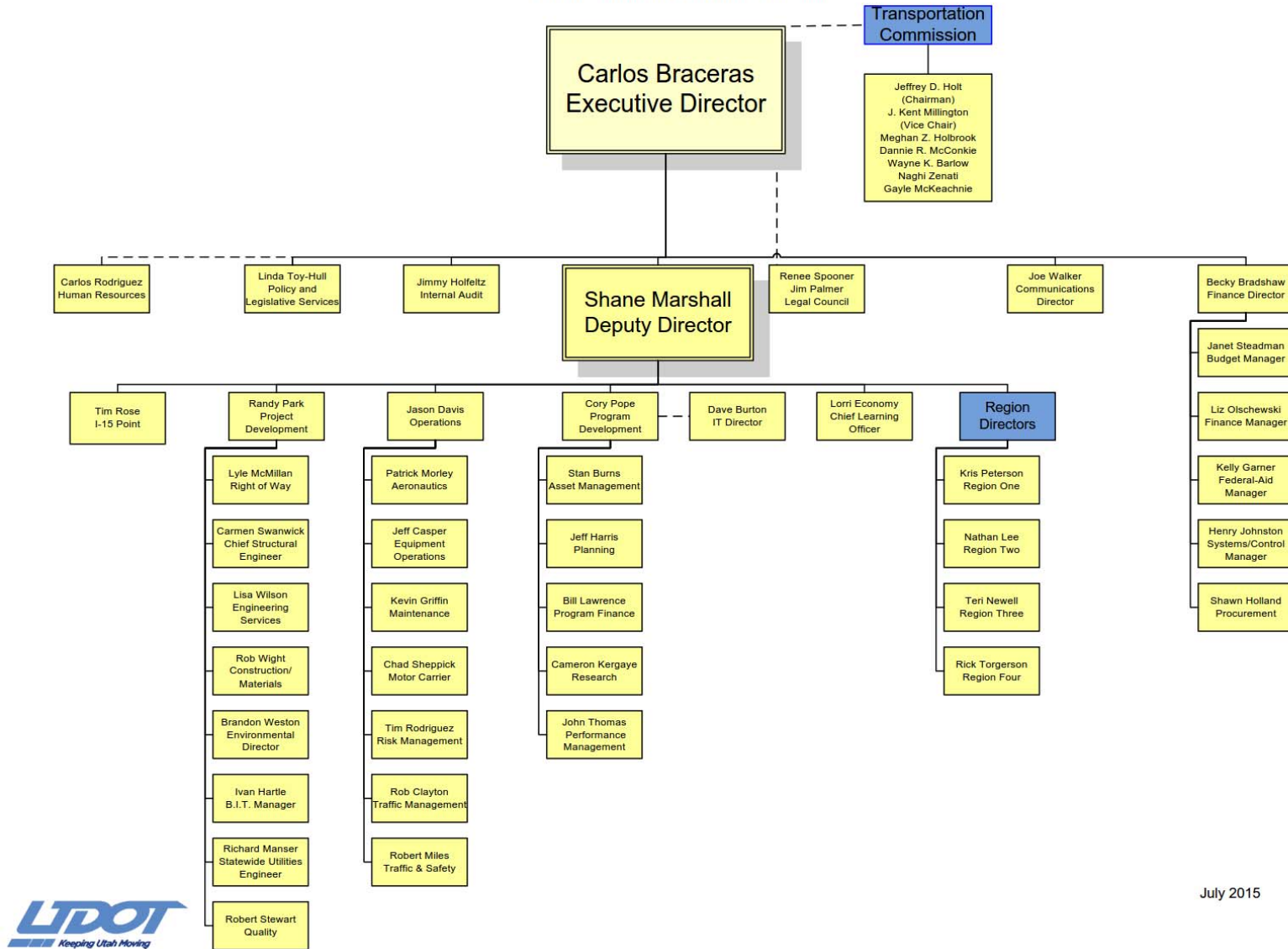


* Acting

April 4, 2016
Date

Utah Department of Transportation

Office of the Executive Director



July 2015

