Enhancement of Statewide Operations

Concept of Operations Study

Technical Memorandum #4: Concept of Operations and Implementation Plan

by

Suzanne Lassacher, Research Associate
Jaime Eidswick, P.E., Research Engineer
Steve Albert, Director

Western Transportation Institute
College of Engineering
Montana State University

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LIST OF ABBREVIATIONS

A	Aeronautics
ADOT	Arizona Department of Transportation
AHP	Arizona Highway Patrol
AIAA	American Institute of Astronautics and Aeronautics
ANSI	American Nationals Standards Institute
ATR	Automated Traffic Recorder
CAD	Computer Aided Dispatch
Caltrans	California Department of Transportation
CB	Communications Bureau
CHP	California Highway Patrol
CCTV	Closed Circuit Television
CVO	Commercial Vehicle Operator
DNRC	Department of Natural Resources and Conservation
DMS	Dynamic Message Sign
EVMS	Equipment Vehicle Management System
ETO	Emergency Travel Only
FTE	Full-Time Employee
HAR	Highway Advisory Radio
HCRS	Highway Closure and Restrictions System
ISD	Information Services Division
ITS	Intelligent Transportation Systems
MCS	Motor Carrier Services
MD	Maintenance Division
MDSS	Maintenance Decision Support System
MDT	Montana Department of Transportation

MH	Maintenance Headquarters
MHP	Montana Highway Patrol
MMS	Maintenance Management System
MOU	Memorandum of Understanding
ODOT	Oregon Department of Transportation
P	Planning
PIO	Public Information Office
RACOM	Local phone number recording device
RWIS	Road & Weather Information Systems
SOC	Statewide Operations Center
TMC	Transportation Management Center
TMOC	Traffic Management Operations Center
TOC	Transportation Operations Center
V	Vendor
WIM	Weigh in Motion
WTI	Western Transportation Institute
YNP	Yellowstone National Park

EXECUTIVE SUMMARY

The Montana Department of Transportation (MDT) has decided to explore the possibility of establishing a Statewide Operations Center (SOC) to more effectively utilize and manage their ITS devices, and improve operational efficiency. The concept of using a transportation management center (TMC) or transportation operations center (TOC) to more efficiently use and manage roadways and Intelligent Transportation System (ITS) devices is not new. Several large urban areas such as San Antonio, Texas, use TMCs to effectively manage their roadways. A rural application of a TMC is, however, a less common approach in managing roadways and ITS technologies in rural areas/states.

The objective of this research project is to prepare a concept of operations for the enhancement of statewide operations in Montana. To accomplish this, a set of technical memorandum have been completed. This document is the fourth in the series, and documents in broad terms the proposed SOC concept of operations and implementation plan.

A concept of operations is a document that describes the high-level capabilities of a specific system to a broad audience. Traditionally, the document answers six questions: who, what, when, where, why, and how. Below are details of these questions and the answers that this report has provided.

- Who: *The response to this question identifies the internal and external stakeholders that will be impacted by and might potentially benefit from the implementation of a statewide operations center and/or partnership with MDT.*

  The SOC will benefit MDT as a whole by providing accurate, timely, reliable, and comprehensive traveler information services 24 hours a day, seven days a week thereby enhancing road safety and promoting safer travel. The SOC will also enhance MDT's overall operations and public image and serve as a central point of contact for the public and external agencies.

  The internal MDT stakeholders that would benefit most from an SOC are the District and the Maintenance Divisions as it is proposed that the SOC would take over night, weekend, and holiday responsibilities and provide back-up for these two entities during the normal business hours.

  In the future, the SOC would also benefit the Maintenance Headquarters, Planning Division, ITS Coordinator, Aeronautics Division, Information Service Division, and Public Information Officer by assuming some of their ITS responsibilities.

  The SOC will benefit external agencies such as Montana Highway Patrol and Department of Disaster Services by providing a 24 hour 7 day a week year round contact resource for coordination.

- What: *The response to this question defines the high-level functionality of the system. It also pinpoints issues that need to be addressed and details current MDT operations.*

  Current MDT Operations were outlined in Technical Memorandum #1 and 3 as well as in Chapter 3 of this document. The current functions were then reviewed to determine which of these the SOC could assume. These tables are shown in Chapter 4.

In order to start small and ensure success, it was recommended that the SOC begin by assuming Maintenance Headquarters, Maintenance Division, and District tasks described in Chapter 4, and save the other entity functions for future phases of the SOC.

- When: *This question details the timeline involved for deploying the statewide operations center.*

  This answer will depend soley on MDT. The actual schedule for deployment will be determined by MDT and depend heavily on funding and space constraints/availability.

- Where: *This question addresses the question of the location for the SOC.*

  The proposed location is in the MDT Headquarters in the current Facility Bureau location behind the Customer Service desk. The Facilities Bureau will be moving out of this location in the near future, making it available to the SOC.

  The benefits of this location include the proximity to the Customer Service desk. This would enable the Customer Service staff to assist the SOC with answering phone calls as needed. Additional attributes of the space that make it appealing for the SOC location include the following:

  - The close proximity to the MDT Headquarters' main entrance would facilitate visitor access;
  - Windows would afford the SOC operators to view changing weather conditions; and
  - Room for future expansion.

- Why: *This question addresses the reasons why an SOC is needed and describes how MDT would benefit from having an SOC. It provides some justification for the SOC itself.*

  The SOC is needed to help manage, operate, and maintain the growing number of ITS devices that MDT owns. The SOC would efficiently run night, weekend, and holiday maintenance operations. This centralization for after-hours activities and coordination efforts will relieve some of the responsibilities from the District and Division offices that have a hard time finding, retaining, and training temporary staff.

  Benefits to MDT associated with establishing an SOC include:

  - Providing accurate, timely, reliable, and comprehensive traveler information to the traveling public 24 hours a day, seven days a week. This would enable the traveling public to make informed decisions regarding travel and enhance roadway safety;
  - Designating a central point of contact for the public and external agencies; and
  - Enhancing overall MDT operations and MDT's public image.

- How: *This question helps identify the resources needed to successfully deploy an SOC – particularly funding, personnel issues, resources, transition plans, etc.*

  The proposed MDT Statewide Operations Center (SOC)'s vision is to act as a "clearinghouse or single-point-of-contact for roadway information/needs" while the

mission is “to serve the public by providing a higher level of service, accuracy, and safety.”

Along with the vision and mission of the SOC, this report addresses the staffing and hours, equipment, software, hardware, operational procedures, media coordination, training, remote access, institutional arrangements, and security that will be needed by the SOC. Each of these topics is discussed in Chapter 5 of this document.

The next steps for the MDT SOC include securing the location for the SOC, purchasing the needed equipment, creating a training program, creating process and procedure manuals, creating contact list binders, and hiring additional staff.

INTRODUCTION

This chapter describes the purpose of this document and defines a concept of operations.

1.1. Purpose

The purpose of this document is to present the Montana Department of Transportation (MDT) with an initial concept of operations for their proposed statewide operations center (SOC) based on comments and selections made from previous technical memoranda, and stakeholder meetings.

1.2. What is a Concept of Operations?

A concept of operations is a document that describes the high-level capabilities of a specific system to a broad audience. Traditionally, the document answers six questions: who, what, when, where, why, and how.

In MDT's case:

- Who:

  The response to this question identifies the internal and external stakeholders that will be impacted by, and might potentially benefit from, the implementation of a statewide operations center and/or partnership with MDT.

- What:

  The response to this question defines the high-level functionality of the system. It also pinpoints issues that need to be addressed and details current MDT operations.

- When:

  This question details the timeline involved for deploying the statewide operations center.

- Where:

  This question addresses the question of the location for the SOC.

- Why

  This question addresses the reasons why an SOC is needed and describes how MDT would benefit from having an SOC. It provides some justification for the SOC itself.

- How

  This question helps identify the resources needed to successfully deploy an SOC – particularly funding, personnel issues, resources, transition plans, etc.

Figure 1 provides a graphical flow of the information and questions that the concept of operations addresses.

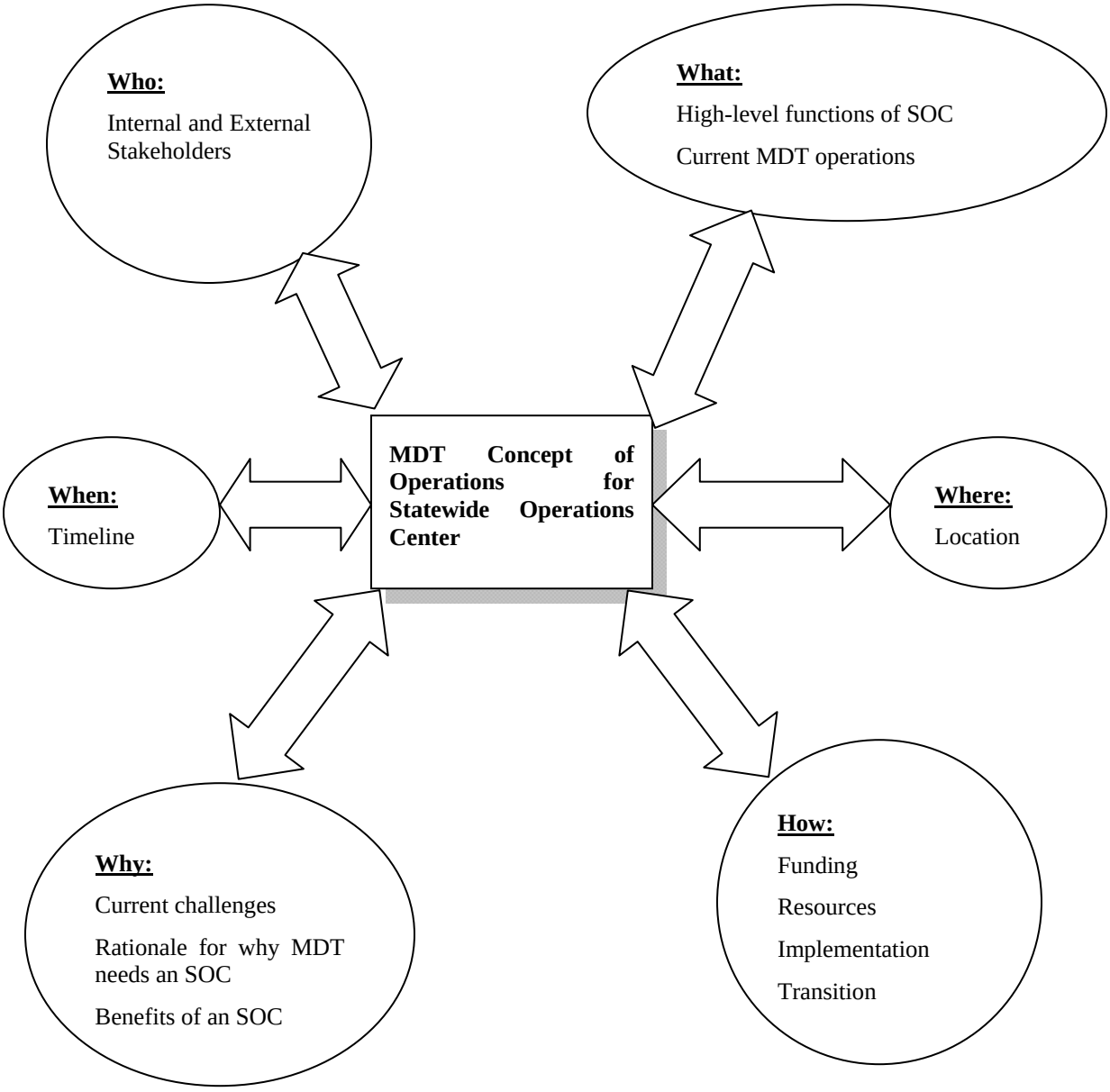

Figure 1: Questions Addressed by the Concept of Operations

The concept of operations is a customized document that addresses the individual needs of the system/organization in very broad terms [1]. It should outline the scope of system functionality in very general terms as opposed to providing specific details about system functionality. The process of developing a concept of operations is often iterative. Each new iteration pinpoints functions performed by the system and helps refine the scope of what the system will do. This iterative process has been illustrated in Technical Memoranda 1 through 3.

1.3. What a Concept of Operations is Not

A concept of operations is not a document that details the specifics of how a system will work. It is not a requirements analysis, operations manual, or a one size fits all approach to defining system functionality [1]. The document will not provide low-level technical detail about how the overall system will work. It should not be mistaken for any one of the above-mentioned documents.

1.4. Major Goals of a Concept of Operations

There are four major goals associated with a concept of operations [1]:

- Stakeholder identification and communication: One of the primary goals of a concept of operations is to identify and initiate communications with the stakeholders. The concept of operations should provide a non-technical, high-level definition of the system and its abilities. The document should enable the stakeholders to understand what the system is capable of doing, and the issues that the system is intended to address. It should provide the foundation for a lower-level technical system description such as a requirements document.
- High-level system definition: The purpose of the concept of operation is to outline the capabilities of the system in high-level, non-technical terms so that the stakeholders understand the basic functionality of the system. It will outline basic operations as well as the information flow that needs to occur.
- Foundation for Lower-level System Description: It should be possible to use the concept of operations as the basis for a requirements document and the lower-level definition of system functionality.
- Definition of Major User Classes and User Activities: The concept of operations should determine for the stakeholders exactly who would be using the system and identify the activities to be performed by the end users of the system. It basically outlines who is doing what and in what context. This is useful for traceability purposes.

1.5. Core Elements

According to the American Nationals Standards Institute (ANSI)/American Institute of Astronautics and Aeronautics (AIAA) standard, there are eight core elements to a concept of operations [1]:

- Scope;
- Referenced documents;
- User-oriented operational description;
- Identification of operational needs;
- System overview;
- Operational environment description;
- Support environment description; and

- Operational scenario development.

These core elements will be incorporated into the following sections and discussed as they pertain to MDT.

1.6. Document Overview

The concept of using a transportation management center (TMC) or transportation operations center (TOC) to more efficiently use and manage roadways and Intelligent Transportation System (ITS) devices is not new. Several large urban areas such as San Antonio, Texas, use TMCs to effectively manage their roadways. A rural application of a TMC is, however, a less common approach in managing roadways and ITS technologies in rural areas/states. MDT has decided to explore the possibility of establishing a Statewide Operations Center to more effectively utilize and manage their ITS devices, and improve operational efficiency.

The objective of this research project is to prepare a concept of operations report for the enhancement of statewide operations in Montana. The purpose of this document is to carefully plan and define in broad terms the proposed functions and operations of the statewide operations center, and to provide some insight as to potential locations and configuration(s) for the SOC.

2. REFERENCED DOCUMENTS

The background documents that were referenced and used as a basis for this report include the Montana Statewide ITS Architecture, the Stakeholder Outreach Summary (Technical Memorandum 1), the Scanning Tour Summary (Technical Memorandum 2A), the Literature Review (Technical Memorandum 2B), and the Statewide Operations (Technical Memorandum 3). These documents are all described in more detail below.

2.1. Montana Statewide ITS Architecture

The Montana Statewide ITS Architecture provides an overview for MDT's current ITS program. The document details MDT's current and planned ITS devices, how they are operated and managed, along with which entities own these devices in Montana. This document serves as a starting point for determining the functions of the SOC and which ITS devices the SOC should operate and manage [2].

This document also provides a listing of agreements between different stakeholders that are currently used by MDT. This information is important as the SOC may require the creation of additional agreements. Three different types of agreements used by MDT include:

- Memorandum of Understanding (MOU). A written document that is signed by MDT and the partner agency(ies) and does not require an exchange of money, but is legally binding.
- Understanding. Similar to a "handshake agreement", this is an agreement that is known by both parties, but is not written down and therefore not legally binding.
- Contract. A legally binding written document where one agency is hiring another to do work and an exchange of money will occur.

2.2. Stakeholder Outreach Summary

Technical Memorandum #1 documented the findings from the internal stakeholder meetings conducted to discuss the strengths and weaknesses of current operations, and the means by which operations might be improved.

The Western Transportation Institute (WTI) interviewed maintenance division staff and headquarters staff within MDT. At each of the meetings, WTI staff discussed the feasibility of implementing a statewide operations center with MDT personnel. Additional discussion topics included the operational characteristics and functions of a statewide operations center, and issues/concerns that staff had. Current ITS and related issues (communications, additional needs, etc.) were discussed at length. WTI and MDT also conducted an interview and tour of the new Montana Highway Patrol (MHP) facility. Discussion topics included MHP's current operations, lessons learned from centralizing, and the possibility of partnering with MDT.

2.3. Scanning Tour Summary

Technical Memorandum #2A documented the findings from the scanning tour. Representatives from MDT and the Western Transportation Institute (WTI) selected seven traffic management centers to visit in the Western United States. The selected TMCs in California, Oregon, and Arizona represented a broad sampling of business models and configurations for MDT and WTI

to examine. This technical memorandum documents the findings from the scanning tours made to the California Department of Transportation (Caltrans) District 2, the Oregon Department of Transportation (ODOT), the Arizona Department of Transportation (ADOT), the City of Mesa, the City of Phoenix, the City of Glendale, and the Maricopa County TMCs. Literature Review

A comprehensive Literature Review was prepared and submitted to MDT in the form of Technical Memorandum #2B. This document explored and documented the current state of the practice with regards to TMCs.

2.4. Statewide Operations

Technical memorandum #3 documented the four possible organizational options, four possible locations/configurations, and the proposed set of functions for the proposed MDT Statewide Operations Center (SOC). After their review of the options, MDT selected the after-hours added value approach as the option for further research. This option permits the Division offices and the SOC to split responsibilities during the day. All operations will then roll-over to the SOC on weekends, nights, and holidays with backup support from the Division offices as needed. The Division offices will operate 8 hours a day, five days a week. The SOC will operate 24 hours a day, seven days a week. This option will provide additional support to the District/Division offices. As for the location/configuration option, MDT selected the one or more rooms in MDT headquarters as the option for further research.

3. RATIONALE FOR TRANSPORTATION MANAGEMENT & OPERATIONS CENTER

3.1. Current Systems and Operations

Each of the five districts is staffed twenty-four hours a day, seven days a week in the winter with the exception of the Glendive district which is staffed from 6 am to midnight. Each division office is staffed weekdays from 7 or 8 am to 5 pm with the exception of Butte which is staffed until midnight.

In the wintertime, there are approximately thirty-three staff members statewide (seven permanent, twenty-two temporary, and four existing staff) that do road reporting. There are approximately eleven staff members statewide (four permanent and seven existing) that do road reporting in the summer.

When this project began, there was a total of two hundred and thirty-six ITS devices including portable and permanent dynamic message signs (DMS), highway advisory radios (HAR), road and weather information systems (RWIS), cameras, automated traffic recorders (ATR), weigh in motion detectors (WIM), and RACOM)s for recording the local road report across the state of Montana. Each of the divisions has at least one ITS device. Wolf Point has twelve ITS devices, which is the lowest number of ITS devices in the state, while Bozeman has thirty-four ITS devices, the highest number in the state.

The MDT Maintenance Division staff identified the following tasks as functions that they currently perform:

- Provide traveler information;
- Operate and maintain ITS devices;
- Road reporting;
- Winter operations;
- Summer maintenance;
- Information dispersal, communication with public;
- Radio dispatch for division operations and maintenance activities; and
- Incident management.

To better identify current operations, tables were created to describe the roles and responsibilities of MDT staff within these functions. As some of the above listed functions are related, they were combined into the following functions to facilitate table creation:

- Winter operations;
- Traveler information;
- Maintenance operations;
- Incident management;
- Device management; and

- Archive data and reporting.

Table 1 illustrates the relationship between the functions identified by MDT Maintenance staff and the corresponding function in the tables provided in this document.

Table 1: MDT Identified Functions versus Table Functions

MDT Staff Functions	Table Functions
Provide traveler information	Traveler Information Archive Data and Reporting
Operate and maintain ITS devices	Device Management Archive Data and Reporting
Road reporting	Traveler Information Archive Data and reporting
Winter operations	Winter Operations
Summer maintenance	Maintenance Operations
Information dispersal, communication with public	Traveler Information
Radio dispatch for division operations and maintenance activities	Winter Operations Maintenance Operations
Incident management	Incident Management

Each of the tables included in this document subdivide and categorize the current MDT staff functions into smaller sub-functions which, for the purpose of this report, will be referred to as categories. Categories are listed as the row headings in the tables provided. Each box in the matrix contains a description of the task(s) associated with each category. The responsible party for each task is identified in the column headings of the tables which include the following groups:

- Maintenance Division;
- Maintenance Headquarters;
- District;
- Public Information Officer (PIO);
- Information Services Division (ISD);
- ITS Coordinator (Traffic & Safety Bureau);
- Aeronautics;
- Communications Bureau;
- Planning;
- Motor Carrier Services (MCS); and
- Vendor.

The tables were constructed to incorporate the additional functionality requested by the stakeholders. Although the MDT Maintenance staff is responsible for the majority of the functions discussed, some of the responsibility for certain functions such as the Public

Information Officer and the Automated Traffic Recorders (ATR) is the responsibility of other MDT departments and/or external vendors.

3.1.1. Winter Operations

According to the MDT, winter operations "involve snow and ice control on all state-maintained roadways, [and] is by far the Maintenance Division's highest priority activity. Providing a safe roadway for the traveling public and helping ensure commerce are the primary justifications for this effort (3)."

The Winter Operations function encompasses the current categories listed below:

- Weather Tracking and Monitoring;
- Chain Restrictions;
- Closures and Emergency Travel Only (ETO) Advisories;
- Resource Tracking;
- Winter Operations Response Plan;
- Division Phone Calls;
- Dispatch;
- Coordination with other agencies; and
- Weather Forecasting.

Table 2 provides a full description of these categories, lists the tasks associated with each category, and identifies the responsible MDT party.

Table 2: Current MDT Winter Operations

Winter Operations				
Category	**Maintenance Division**	**Maintenance Headquarters**	**District**	**Public Information Officer (PIO)**
Weather Tracking/Monitoring	Monitor weather Monitor RWIS and cameras Dispatch crews Post warnings on DMS Update information in road condition database Update HAR and RACOM as needed		Assume division duties on nights, weekends, and holidays in the winter	Create press releases prior to and after big storm events as needed
Chain Restrictions	Decide when to enact a chain restriction Input chain restriction information into road condition database Record chain restriction information onto DMS, RACOM and HAR Notify MCS and MHP of chain restrictions		Assume division duties on nights, weekends, and holidays in the winter	
Closures and Emergency Travel Only (ETO) Advisories	Decide when to enact a closure or ETO Input closure/ETO information into road condition database Record closure/ETO information onto DMS, RACOM, and HAR Notify MHP of closure/ETO		Assume division duties on nights, weekends, and holidays in the winter	
Resource Tracking	Input weekly resource reports into the maintenance management system (MMS) Inputs daily information into the equipment vehicle management system (EVMS) Creates and maintains staff shifts and on-call responsibilities	Compiles MMS reports Compiles EVMS reports		
Winter Operations Response Plan	Implement winter operations response plan	Develop and modify winter operations response plan	Implement winter operations response plan	
Division Phone Calls	Answer phone calls from the public and other agencies		Assume division duties on nights, weekends, and holidays in the winter	
Dispatch	Dispatch crews as needed		Assume division duties on nights, weekends, and holidays in the winter	
Coordination with Other Agencies	Answer phone calls from other agencies Call other agencies to coordinate Notify MHP of closures/ETO/chain restrictions Notify MCS of chain restrictions Notify media and other agencies via local reports for all winter updates that occur and incidents	Answer phone calls from other agencies Call other agencies to coordinate Road condition database automatically sends out updates at least twice a day to other agencies		
Weather Forecasting	Call National Weather Service (NWS) for forecast if needed			

3.1.2. Traveler Information

Traveler information encompasses any condition that might impact the traveling public. "MDT's Traveler Information System was developed and is used to provide the traveling public with timely, accurate information on roadway conditions. This includes winter road conditions, summer construction and maintenance project information, load and speed limit restriction reports for the trucking industry, and rest area locations and amenities (4)."

The Traveler Information function encompasses the following categories:

- Road reporting (i.e. road conditions, chain requirements, road closures, emergency travel only (ETO) advisories, incident data, maintenance activities, construction activities, email/fax notifications, and height, weight, load, and speed restrictions);
- 511;
- Website;
- Dynamic message signs (DMS);
- Highway advisory radio (HAR);
- Cameras;
- Public information;
- Media notification;
- Point of contact; and
- RACOM.

Table 3 provides a full description of the current MDT Traveler Information categories, lists the tasks associated with each category, and identifies the group at MDT responsible for each task.

Table 3: Current MDT Traveler Information Functions

Traveler Information						
Category		**Maintenance Division**	**Maintenance Headquarters**	**District**	**Information Services Division (ISD)**	**Public Information Officer (PIO)**
Road Reporting	**Road Conditions**	Poll plow drivers twice a day for current road conditions Plow drivers call in more frequently with road condition updates Create local area report and distribute as conditions change	Run and review statewide reports for accuracy Automatically distribute to listserv twice a day Run and review Helena area report and distribute as conditions change Post report to web First line of support for software maintenance	Assume division duties on nights, weekends, and holidays in the winter	Distribute reports to National Oceanic and Atmospheric Administration (NOAA) and Associated Press (AP) Set-up automatic report distribution 24/7 system maintenance support	
	Chain Requirements	Maintenance chief decides when to require chains based on superintendent's recommendation Input chain restriction into road condition database	First line of support for software maintenance	Assume division duties on nights, weekends, and holidays in the winter	24/7 system maintenance support	
	Road Closures and Emergency Travel Only (ETO) Advisories	Maintenance chief decides when to require closure/ETO based on recommendation Input closure/ETO into road condition database	First line of support for software maintenance	Assume division duties on nights, weekends, and holidays in the winter	24/7 system maintenance support	
	Incident Data	Input incident data into the road condition database based on information provided by MDT staff or MHP	First line of support for software maintenance	Assume division duties on nights, weekends, and holidays in the winter	24/7 system maintenance support	
	Construction Activity	Receive information from project managers and input into road condition database Create local area report and distribute	Run and review construction /maintenance activity report for accuracy Automatically distribute to listserv once a week Post report to web First line of support for software maintenance	Project managers provide construction information to division offices weekly	24/7 system maintenance support	
	Maintenance Activity	Superintendents provide information to road reporters once a week Input maintenance activity information into the road condition database once a week	Run and review construction /maintenance activity report for accuracy Automatically distribute to listserv once a week Post report to web First line of support for software maintenance		24/7 system maintenance support	
	Height & Weight Restrictions	Receive information from project managers and input into road condition database	Run and review construction /maintenance activity report for accuracy Automatically distribute to listserv once a week Post report to web First line of support for software maintenance	Project managers provide construction information to division offices weekly	24/7 system maintenance support	

Traveler Information						
Category		**Maintenance Division**	**Maintenance Headquarters**	**District**	**Information Services Division (ISD)**	**Public Information Officer (PIO)**
	Load & Speed Restrictions	Maintenance Chiefs provide load and speed restrictions to road reporting staff once a week Input information into the road condition database	Run and review load and speed restriction report Post report to web First line of support for software maintenance Compile report and distribute to listserv		24/7 system maintenance support	
	Email/Fax Notifications		Distribute road condition reports twice a day to listserv Distribute construction reports and load and speed restrictions once a week to listserv First line of support for software maintenance		24/7 system maintenance support Distribute reports to NOAA and AP Set-up automatic report distribution	
511			Record alert messages onto system		Maintain, manage, and monitor the FTP site	
Website			Post road condition report on web Post construction report on web Post load and speed restriction report to web		Ensure RWIS information posts to web	
Dynamic Message Signs (DMS)		Post messages on signs	Develop and approve messages Develop and approve procedures and protocols First line of support for software maintenance		Software and network support	
Highway Advisory Radio (HAR)		Record message on machine	Record message on machine for AMBER Alerts		Software and network support	
Cameras			Monitor camera images		Ensure camera images post to web	
Public Information						Create press releases
Media Notification		Notify media via local reports for all winter updates Notify media of incidents	Distribute road condition reports twice a day to listserv Distribute construction reports once a week to listserv			
Point of Contact		Answer calls/questions from public	Answer calls/questions from public			
RACOM		Record message on machine	Record message on machine			

3.1.3. Maintenance Operations

MDT's Maintenance Operations Manager states that maintenance operations are "the activities associated with keeping the transportation infrastructure in proper working order. Activities such as pavement work, sign repair, pavement marking, etc. Operations will be the aspects associated with keeping traffic moving (5)."

Maintenance operations currently performed by MDT include:

- Call down lists with contact information;
- Damage reports;
- Maintenance activity;
- Resource availability and assignments;
- Dispatch;
- Coordination with other agencies;
- Training; and
- Policies, procedures, and statewide guidelines.

Table 4 provides a full description of the current MDT Maintenance Operations categories, lists the tasks associated with each category, and identifies the group at MDT responsible for each task.

Table 4: Current MDT Maintenance Operations

Maintenance Operations			
Category	**Maintenance Division**	**Maintenance Headquarters**	**District**
Call Down Lists with Contact Information	Maintain current call-down lists of contact information	Maintain current call-down lists of contact information	Maintain current call-down lists of contact information
Damage Reports	Act as central contact point for damage reporting from outside parties Determine prioritization of repairs Maintain database of reported damage incidents, severity, location, and repair status/priority Enter information regarding location and extent of damage Assess damage Repairs		
Maintenance Activity	Track maintenance activities and locations Prioritize maintenance activities Schedule maintenance activities and resource needs Enter maintenance resources weekly into MMS and EVMS Monitor status of maintenance activities Notify road reporters of maintenance activities and potential impacts Enter maintenance activities and impacts into road condition database	Run EVMS and MMS reports Run and review construction/maintenance reports and post to web and send to listserv	
Resource Availability & Assignments	Coordinate and assign resources Monitor maintenance activities		
Dispatch	Dispatch crews		
Coordination with Other Agencies	Coordinate with other agencies	Coordinate with other agencies	Coordinate with other agencies
Training	Train all personnel	Train all personnel	Train all personnel
Policies, Procedures, and Statewide Guidelines		Develop any policies, procedures, or guidelines that are used in-house	

3.1.4. Incident Management

In this case, incidents are defined as traffic, special events, construction, and accidents. Management of these incidents allows traffic to resume normal speeds and flow in a timely manner.

Current MDT incident management categories include:

- Response plan;
- Accident detection and reporting;
- Accident notification;
- Accident management;
- Homeland security;
- AMBER Alert;
- Search and rescue;
- Special events;
- Signal operations;
- Construction reporting;
- Coordination with other agencies; and
- Resource tracking.

Table 5 provides a full description of the current MDT Incident Management categories, lists the tasks associated with each category, and identifies the group at MDT responsible for each task.

Table 5: Current MDT Incident Management Practices

Incident (traffic, special event, construction, accident) Management					
Category	**Maintenance Division**	**Maintenance Headquarters**	**District**	**ITS Coordinator (Traffic & Safety Bureau)**	**Aeronautics**
Response Plan	Implement MDT Emergency Operations and Disaster Plan	Update MDT Emergency Operations and Disaster Plan Coordinate response plans with other agencies (state, multi-state, and federal) Implement MDT Emergency Operations and Disaster Plan	Implement MDT Emergency Operations and Disaster Plan		
Accident Detection & Reporting	Field staff and MHP notify/report incidents (status, severity, and location) to office staff Verify and enter information into databases Office staff notify headquarters if warranted	Activate alert system on 511	Report special event and construction information to divisions Assume division duties on nights, weekends, and holidays in the winter		
Accident Notification	Coordination with other agencies Notify maintenance crews and incident responders Manage call down lists Notify people on call down list Notify PIO		Assume division duties on nights, weekends, and holidays in the winter		
Accident Management	Track status and severity Input into database Facilitate incident support Onsite coordination Create an emergency operations center if necessary Follow the MDT Emergency Operations and Disaster Plan	Incident management/coordination Coordination with other agencies Onsite coordination Create a statewide emergency operations center if necessary Follow the MDT Emergency Operations and Disaster Plan Update the Emergency Operations and Disaster Plan as needed	Incident management/coordination Coordination with other agencies Onsite coordination Create an emergency operations center if necessary Follow the MDT Emergency Operations and Disaster Plan		
Homeland Security	Create an emergency operations center if necessary Coordinate with other state agencies as needed Report to the department of Homeland security Follow the MDT Emergency Operations and Disaster Plan	Create a statewide emergency operations center if necessary Coordinate with other state agencies as needed Report to the department of Homeland Security Follow the MDT Emergency Operations and Disaster Plan	Create an emergency operations center if necessary Coordinate with other state agencies as needed Report to the department of Homeland Security Follow the MDT Emergency Operations and Disaster Plan		
AMBER Alert	Implement MDT AMBER Alert policies and procedures Activate messages on DMS Alert field staff via radio Update as changes occur	Coordinate with Department of Justice Update MDT AMBER Alert policies and procedures as needed Implement MDT AMBER Alert policies and procedures Receive AMBER Alert notification Notify Divisions of AMBER Alert Monitor status and report changes to divisions Activate alert system on 511 Activate HAR systems Update 511 and HAR as changes occur			

Incident (traffic, special event, construction, accident) Management					
Category	**Maintenance Division**	**Maintenance Headquarters**	**District**	**ITS Coordinator (Traffic & Safety Bureau)**	**Aeronautics**
Search & Rescue					Coordinate activities with appropriate state and federal agencies
Special Event	Enter information into incident reporting system Report special events to road reporters Implement special event permitting guidelines	Create special event permitting guidelines Implement special event permitting guidelines	Report special events to division Implement special event permitting guidelines		
Signal Operations			Work with cities and ITS coordinator to identify special events requiring signal changes	Work with districts and cities to identify special events requiring signal changes Make appropriate signal changes	
Construction Reporting	Receive information from project managers and input into road condition database – this task may also be performed by construction staff	Run/review construction /maintenance activity report for accuracy Automatically distribute to listserv once a week Post report on web	Project managers provide construction information to division offices weekly		
Coordination with Other Agencies			Coordinate with other agencies		
Resource Tracking	Queue management Alternate routing/detours Input crew assignments Track status and severity of incidents Track portable DMS locations		Report status and location of construction and special events to division Log information into database		

3.1.5. Device Management

Device management is a fairly widespread, complex task. It covers all aspects of device usage, maintenance, deployment, installation, support, monitoring, and repair.

Current MDT device management categories include:

- ITS deployment and prioritization;
- Cameras;
- Road weather information systems (RWIS);
- Dynamic message signs (DMS);
- 511;
- RACOM;
- Highway advisory radio (HAR);
- Kiosks;
- Signals;
- Large animal detection systems;
- Automated traffic recorders (ATR); and
- Weigh in motion (WIM).

Table 6 provides a full description of the current MDT Device Management categories, lists the tasks associated with each category, and identifies the group at MDT responsible for each task.

Table 6: Current MDT Device Management Practices

Device Management								
Category	**Maintenance Division**	**Maintenance Headquarters**	**Communications Bureau**	**Information Services Division (ISD)**	**ITS Coordinator (Traffic Safety Bureau)**	**Planning**	**Motor Carrier Services (MCS)**	**Vendor**
ITS Deployment & Prioritization	Suggest locations for field devices	Prioritize deployment of new field devices		Update website to incorporate data from new devices if appropriate	Suggest locations for field devices Prioritize deployment of new field devices Include new device locations into the STIP and construction projects Log locations of all new field devices and include in Montana architecture			Assist in deployment
Camera	Use device as verification tool for crew dispatch Monitor conditions	Scheduled monitoring of equipment for failures Coordinate support and repairs	Device installation Provide tech support for equipment Device maintenance and repair Maintain failure and equipment status logs	Provide tech support for equipment Display equipment location and status on web Data management				Device installation Provide tech support for equipment Updates and patches Provide equipment location and status for MDT to link to for web
Road Weather Information System (RWIS)	Use device information for staff dispatching Identify conditions to warrant automatic notification Receive automatic notification of certain conditions	Scheduled monitoring of equipment for failures Implement notification procedures (Info Systems Specifications and front desk) Establish alert thresholds Arrange for support and repairs	Device installation Provide tech support for equipment Device maintenance and repair	Provide tech support for equipment Log/archive data Display equipment location and status on web Enable automatic notification of certain conditions to maintenance division/section staff Data management				Device installation Provide tech support for equipment Updates and patches Display equipment location and status on web

Device Management								
Category	**Maintenance Division**	**Maintenance Headquarters**	**Communications Bureau**	**Information Services Division (ISD)**	**ITS Coordinator (Traffic Safety Bureau)**	**Planning**	**Motor Carrier Services (MCS)**	**Vendor**
Dynamic Message Signs (DMS) - portable & permanent	Coordinate repairs Post messages on signs Scheduled monitoring of equipment for failures Implement notification procedures Establish alert thresholds Maintain failure and equipment status logs Log/archive messages posted Transport and store portable DMS	Develop and approve messages Develop and approve procedures and protocols	Provide tech support for equipment Device maintenance and repair	Provide tech support for equipment Data management	Provide tech support for equipment Device maintenance and repair		Develop and approve messages Develop and approve procedures and protocols	Install equipment Provide tech support for equipment Updates and patches
511	Update road reporting database	Record alert messages onto system Scheduled monitoring of equipment for failures Implement notification procedures Establish alert thresholds Retrieve and respond to public comments on system System management and oversight		Push information from road reporting database to FTP site for vendor Push RWIS information to FTP site for vendor				Device maintenance and repair Updates and patches Receive database and RWIS information and create forecast and telephone information Scheduled monitoring of equipment for failures Implement notification procedures Establish alert thresholds Log/archive comments and call volume information
RACOM	Record message on machine	Record message on machine	Provide tech support for equipment Device maintenance and repair Updates and patches					
Highway Advisory Radio (HAR)	Record message on machine Device installation Monitor for failures	Record message on machine for AMBER Alerts	Provide tech support for equipment Device maintenance and repair Updates and patches					

Device Management								
Category	**Maintenance Division**	**Maintenance Headquarters**	**Communications Bureau**	**Information Services Division (ISD)**	**ITS Coordinator (Traffic Safety Bureau)**	**Planning**	**Motor Carrier Services (MCS)**	**Vendor**
Kiosks	Monitor for failures Determine deployment locations			Network support Provide connection to road reporting database				Provide tech support for equipment Device installation Device maintenance and repair Updates and patches Scheduled monitoring of equipment for failures Implement notification procedures Establish alert thresholds
Signals			Maintain devices		Device installation Provide tech support for equipment Device maintenance and repair Set/update device timings (some of these may also be performed by individual cities)			
Large Animal Detection Systems	Device maintenance and repair		Device maintenance and repair Provide tech support for equipment					Device installation Updates and patches Device maintenance and repair Provide tech support for equipment
Automated Traffic Recorders (ATR)						Device installation Provide tech support for equipment Device maintenance and repair Analyze data Log/archive data		
Weigh In Motion (WIM)							Operate and monitor device	Device installation Updates and patches Device maintenance and repair Provide tech support for equipment

3.1.6. Data Archiving and Reporting

Data archiving and reporting is a critical component of MDT Maintenance operations. Data archives of device logs, databases, weather and resource tracking data provide MDT with historical and current data which can be used to assist MDT in decision making capacities. Reporting is one of the fundamental tasks supported by MDT Maintenance operations and provides the basis for several other MDT Maintenance operations. Archived, historical data is also important to address any liability and legal issues that might arise.

Current MDT data archiving and reporting categories include:

- Monitoring device reliability and failures;
- Road reporting database;
- Dynamic message signs (DMS);
- Equipment vehicle management system (EVMS);
- Maintenance management system (MMS); and
- Automated traffic recorders (ATR).

Table 7 provides a full description of the current MDT Data Archiving and Reporting categories, lists the tasks associated with each category, and identifies the group at MDT responsible for each task.

Table 7: Current MDT Data Archival and Reporting Practices

Archive Data and Reporting				
Category	**Maintenance Division**	**Maintenance Headquarters**	**Information Services Division (ISD)**	**Planning**
Monitoring Device Reliability/Failures	Archive device failures and maintenance	Archive device failures and maintenance		
Road Reporting Database		Archive databases Create summary reports Distribute reports Retrieve Data	Set up system for database backup Store archived data in safe location Provide support for backup functions	
Dynamic Message Signs (DMS)	Archive message logs		Set up system for database backup Store archived data in safe location Provide support for backup functions	
Equipment Vehicle Management System (EVMS)		Archive databases Create summary reports Distribute reports	Set up system for database backup Store archived data in safe location Provide support for backup functions	
Maintenance Management System (MMS)		Archive databases Create summary reports Distribute reports	Set up system for database backup Store archived data in safe location Provide support for backup functions	
Automated Traffic Recorders (ATR)			Set up system for database backup Store archived data in safe location Provide support for backup functions	Archive databases Create summary reports Distribute reports

3.2. Justification for Change

MDT's needs and functional responsibilities have greatly increased over the years and continue to grow. As the population within the state continues to increase, demands on the roadway and MDT will also increase. Currently, the District and Division offices have a great deal of responsibility, so much so that staffing can be an issue at times. Finding, training, and retaining temporary staff for District/Division offices is challenging and sometimes not possible which creates problems for the District/Division offices. Additionally, temporary employees are expected to work the least desirable shifts and receive the lower wages, and yet are given a great deal of responsibility for ensuring that critical traveler information is provided to the traveling public.

One of the primary objectives of the SOC will be to work with the District and Division offices to provide comprehensive traveler information services 24 hours a day, seven days a week. This would go a long way in improving MDT's public image and enhancing overall MDT operations.

Benefits of incorporating an SOC into MDT's organizational structure include the following:

- Relieve some of the responsibility from the district/division offices;
- Provide backup to overworked or understaffed Division/District offices;
- Remove the responsibility from district/division offices for finding, training, and retaining temporary staff which is challenging;
- Provide comprehensive traveler information services 24 hours a day, seven days a week;
- Provide accurate, timely and reliable information to the traveling public;
- Enhance road safety and promote safe travel through information dissemination so that the traveling public may make informed decisions;
- Enhance overall MDT operations and improve public image; and
- Designate a central point of contact for external agencies and the public thereby eliminating some of the current confusion.

3.3. Proposed SOC Vision, Mission, and Goals

This section will discuss the incorporation of the SOC into MDT's overall vision, mission, and goals. It will also address the SOC's specific vision, mission, and goals.

3.3.1. Montana Department of Transportation

MDT's vision statement is "Serving You with Pride (6).", and their mission statement is "to serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality and sensitivity to the environment (7)." Given that the SOC will be a part of MDT, it should strive to meet the vision, mission, and goals established by MDT.

Each division and program of MDT submits goals and objectives for each biennium [8]. For the 2007 biennium, there are several of these goals which an SOC could help facilitate or meet. These include:

- Maximize external customer satisfaction;
- Provide total commitment to continuous process improvement;
- Manage information technology as an investment;
- Approach information technology as a strategic partnership with all internal and external customers;
- Evaluate and consolidate IT resources to maximize the use of computing resources, reduce cost, and utilize IT staff efficiently;
- Maintain a stable and well-trained workforce;
- Maintain safe winter driving conditions through snow removal and application of abrasive materials and anti-icing chemicals to reduce roadway hazards and slippery surface conditions;
- Continue to research new equipment, materials, and processes to improve winter driving conditions of roadways;
- Maintain or improve existing customer satisfaction index; and
- Increase public and internal utilization of the Maintenance Program's electronic information systems.

3.3.2. SOC

The vision proposed for the SOC is for the SOC to act as a "clearinghouse or single-point-of-contact for roadway information/needs." The mission statement that has been proposed for the SOC is "to serve the public by providing a higher level of service, accuracy, and safety."

The goals of the SOC will be to:

- Provide year-round, twenty-four hour a day, seven day a week service to the public;
- Provide a higher level of after-hours service to the public;
- Streamline the road reporting process to make it more cost effective;
- Act as a clearinghouse for roadway information;
- Increase the accuracy and timeliness of traveler information for consumption by the public and the media;
- As a secondary benefit, serve as a marketing tool for MDT;
- Monitor weather and incidents to facilitate faster dispatch and response times;
- Maintain safe winter driving conditions; and

- Increase public and internal utilization of the Maintenance Program's electronic information systems.

4. PROPOSED SOC FUNCTIONS

4.1. Introduction

The implementation of the SOC with full functionality will take time. The SOC should take a phased approach to deployment. As the SOC establishes itself, more functionality will most likely be requested of it. Statewide coverage will not be able to be offered immediately given communications, staffing, and field element placement constraints.

4.1.1. Purpose

The initial objective of Phase I will be to provide coverage for District/Division offices for the nights, weekends and holidays thereby extending MDT's operations to 24 hours a day, seven days a week. The SOC will also be available to assist District/Division offices upon request during normal business hours. Subsequent phases will incorporate additional functionality and operations to be determined by MDT Headquarters.

4.1.2. Concept Contents

4.1.2.1. Activities

The SOC option that MDT Headquarters has opted to pursue is the After-Hours Added Value approach which enables the District/Division offices and the SOC to split responsibilities during the weekdays. The SOC will provide backup support to the District/Division offices on an as needed basis during regular business hours. All operations will roll-over to the SOC on weekends, nights, and holidays rather than to the District offices. The SOC will operate year-round, 24 hours a day, seven days a week.

4.1.2.2. Business Impacts and Considerations

This option will provide the additional support needed by the District/Division offices and enhance operations and overall efficiency. This operational model enables the SOC to assume the District/Division offices' duties and responsibilities for nights, weekends, and holidays. The SOC and District/Division offices might also elect to split their responsibilities during the weekdays. Additional support to the District/Division offices will be provided by the SOC in the event of a major storm or other emergency. Using the SOC to provide coverage for the District/Division offices has several advantages:

- Workload for District/Division personnel will be reduced;
- Staffing and training issues at the District/Division offices will be eliminated;
- Reports, maps, and databases will be current at all times;
- Coordination efforts between District/Division offices and Headquarters will be improved as the direct result of the SOC being designated the central point of contact for external stakeholders and the public;
- Shifts in operation will be facilitated should MDT elect to have the SOC assume full/independent operations in the future;
- Development of statewide procedures, guidelines, and standards will be facilitated; and

- The SOC could take the lead for MDT in the event of a major incident.

For this option to succeed, several considerations need to be taken into account. One such consideration is training. Extensive training will be required for the SOC operators to become familiar with the local area roadways for each District/Division. This will take some time. Another issue has to do with points of contact. External stakeholders and the public may be confused about the appropriate office to call. It will be beneficial to have the SOC act as the single point of contact. Also, to ensure overall efficiency, a clear plan needs to be created that will outline each task and office (Division/District or SOC) responsible for that task. Tentative tables detailing known tasks have been developed and are presented later in this document.

4.1.2.3. Partnerships

Stakeholders identified a need to establish partnerships with the following agencies. The stakeholders felt that MDT would benefit from working together and sharing information with these agencies.

- MHP;
- Forest Service;
- Ports of Entry/Borders;
- Department of Natural Resources;
- Cities/Counties;
- Burlington Northern Railroad;
- Disaster and Emergency Services;
- Department of Homeland Security;
- Montana Fish Wildlife and Parks;
- Tribal Agencies;
- National Parks;
- Fire Departments;
- Department of Justice; and
- Canadian Transportation Department.

4.1.2.4. Functional/ Organizational Unit Responsibilities

Several functions that could be performed by the SOC were identified at the stakeholder meetings. Seventeen key functions were taken from those meetings and are listed below as potential functions that could be performed by the SOC:

1. Traveler Information including road reporting, website administration, and ITS device operations;
2. Maintenance operations (summer and winter);
3. Maintenance dispatch (summer and winter);

4. Construction operations;
5. Weather tracking/forecasting;
6. Communications;
7. Serve as a single point of contact;
8. Coordination with state agencies as well as District/Division offices;
9. Answering Division phones during events;
10. Planning/Administration/Support including quality control, staffing, hours of operation, archived data, ITS deployments and prioritization, training, policies and procedures, and statewide guidelines;
11. ITS device maintenance;
12. Traffic/special event/incident/construction management (including AMBER alert, Homeland Security, etc.);
13. Public Information Office (PIO);
14. Search and Rescue (Aeronautics);
15. Data archive;
16. Signal Control; and
17. Automated Traffic Recorder (ATR)/Planning.

Each of these functions is described in more detail below.

4.2. Winter Operations

Winter Operations are the main duty of the MDT Maintenance Division. Duties include weather tracking and monitoring, crew dispatch, determining and enacting restrictions and closures for roadways, inter/intra-agency coordination, and resource tracking. The impacts of an SOC on Winter Operations activities are discussed in sections 4.2.1 through 4.2.10. Table 8 in section 4.2.10 summarizes the shifts in responsibility for these tasks.

4.2.1. Weather Tracking and Monitoring

The Maintenance Division offices and the SOC will share responsibility for the following list of tasks:

- Weather monitoring;
- Monitoring the RWIS and cameras;
- Dispatching crews;
- Posting warning messages on the DMS;
- Updating road condition information in the road condition database; and
- Updating the HARs and RACOMs as needed.

Maintenance Division offices will perform the tasks during normal hours of operation with some help from the SOC. The SOC will then assume responsibility for the tasks after-hours, weekends, and holidays.

The SOC will assume District duties on nights, weekends, and holidays. This will eliminate the need to have the District assume Division duties for these time periods. The SOC will also work with the PIO to create press releases before, during, and after storm events as needed.

4.2.2. Chain Restrictions

During normal hours of operation, the Maintenance Division offices will continue to perform the following tasks:

- Enter and update the chain restriction information in the road condition database; and
- Record chain restriction information on the DMS', RACOMs, and HARs.

The SOC will assume responsibility for these tasks after-hours, weekends, and holidays, rather than the District. The Maintenance Division Chief will retain sole responsibility for determining when to enact a chain restriction.

As the SOC will be operating as the single point of contact with the public and external agencies, the SOC will be responsible for notifying MHP of road closures and emergency travel only (ETO) advisories.

4.2.3. Closures/Emergency Travel Only

During normal hours of operation, the Maintenance Division offices will continue to perform the following tasks:

- Enter and update the road closure/ETO information in the road condition database; and
- Record road closure/ETO information on the DMS, RACOMs, and HARs.

The SOC will assume responsibility for these tasks after-hours, weekends, and holidays. The Maintenance Division Chief will retain sole responsibility for determining when to enact a road closure or ETO. As the SOC will be operating as the single point of contact with the public and external agencies, the SOC will be responsible for notifying MHP of road closures and ETO advisories.

4.2.4. Resource Tracking

The Maintenance Division offices will continue to perform the following resource tracking functions without help from the SOC:

- Input weekly resource reports into the Maintenance Management System (MMS);
- Input daily information into the Equipment Vehicle Management System (EVMS);
- Compile MMS reports; and
- Compile EVMS reports.

Maintenance Headquarters will also be responsible for compiling the MMS and EVMS reports. Maintenance Division office staff and SOC staff will be responsible for working together to schedule and maintain staff shifts and on-call responsibilities.

4.2.5. Winter Operations Response Plan

The SOC and Maintenance Headquarters will collaborate to develop and modify a winter operations response plan. Once this has been accomplished, the SOC, Maintenance Division offices and District offices will work together to implement the winter operations response plan.

4.2.6. Division Phone Calls

The SOC will be the main point of contact at all times, especially for outgoing communications. The SOC phone number will be made available and advertised to the public and external agencies as the primary number to call for information. The Maintenance Division offices will still be required to answer any questions from the public or external agencies that they may receive during normal hours of operation. The SOC will be the sole entity answering phone calls after-hours, weekends, and holidays.

4.2.7. Dispatch

The Maintenance Division offices will dispatch crews as needed during normal hours of operation. The SOC will assume responsibility for this task after-hours, weekends, and holidays and will be available to assist the Maintenance Division during normal business hours if needed.

4.2.8. Coordination with other Agencies

The SOC will be regarded as a single point of contact with the public and external agencies. During the time it takes to transition to this approach, outside entities my elect to contact Maintenance Headquarters instead. Therefore, the SOC and Maintenance Headquarters will collaborate to perform the following tasks:

- Answer phone calls from other agencies;
- Place calls to external agencies for coordination purposes; and
- Ensure that the road condition database automatically forwards updates to external agencies twice a day.

The SOC will act as the sole point of contact for MDT Maintenance for outgoing communications and as such will be solely responsible for:

- Notifying MHP of chain restrictions, road closures, and ETO restrictions;
- Notifying MCS of chain restrictions; and
- Utilizing local reports to notify the media and other agencies of winter road condition/restriction updates and incidents.

4.2.9. Weather Forecasting

This function is an addition to the list of current MDT functions and is not part of current MDT operations. The SOC will place calls to National Weather Service (NWS) for the weather

forecast when necessary. The SOC may also have a meteorologist on staff for forecasting purposes.

4.2.10. Summary Table of Proposed Winter Operations

Table 8 provides a summary of the proposed Winter Operations functions. The responsible office is indicated by the marked box. The following abbreviations are used in the table:

- SOC – Statewide Operations Center
- MD – Maintenance Division
- MH – Maintenance Headquarters
- D – District
- PIO – Public Information Office

Table 8: Proposed Incorporation of SOC into Winter Operations

Winter Operations	
Category	**Functions**
Weather Tracking/Monitoring	Monitor weather ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Monitor RWIS and cameras ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Dispatch crew ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Post warnings on DMS ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Update information in road condition database ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Update HAR and RACOM as needed ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO Create press releases prior to and after big storm events as needed ☒ SOC ☐ MD ☐ MH ☐ D ☒ PIO
Chain Restrictions	Decide when to enact a chain restriction ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO

Winter Operations	
Category	**Functions**
	Input chain restriction information into road condition database ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Record chain restriction information onto DMS, RACOM and HAR ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Notify MCS and MHP of chain restriction ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO
Closures/Emergency Travel Only (ETO)	Decide when to enact a closure or ETO ☐ SOC ☒ MD ☐ MH ☐ D ☐ PIO Input closure/ETO information into road condition database ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Record closure/ETO information onto DMS, RACOM, and HAR ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Notify MHP of closure/ETO ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO
Resource Tracking	Input weekly resource reports into the Maintenance Management System (MMS) ☐ SOC ☒ MD ☐ MH ☐ D ☐ PIO Input daily information into the Equipment Vehicle Management System (EVMS) ☐ SOC ☒ MD ☐ MH ☐ D ☐ PIO Create and maintain staff shifts and on-call responsibilities ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Compiles MMS reports ☐ SOC ☒ MD ☐ MH ☐ D ☐ PIO Compiles EVMS reports ☐ SOC ☒ MD ☐ MH ☐ D ☐ PIO

Winter Operations	
Category	**Functions**
Winter Operations Response Plan	Implement winter operations response plan ☒ SOC ☒ MD ☐ MH ☒ D ☐ PIO Develop and modify winter operations response plan ☒ SOC ☐ MD ☒ MH ☐ D ☐ PIO
Division Phone Calls	Answer phone calls from the public and other agencies ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO
Dispatch	Dispatch crews as needed ☒ SOC ☒ MD ☐ MH ☐ D ☐ PIO Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO
Coordination with Other Agencies	Answer phone calls from other agencies ☒ SOC ☐ MD ☒ MH ☐ D ☐ PIO Call other agencies to coordinate ☒ SOC ☐ MD ☒ MH ☐ D ☐ PIO Notify MHP of closures/ETO/chain restrictions ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO Notify MCS of chain restrictions ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO Notify media and other agencies via local reports for all winter updates that occur and incidents ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO Road condition database automatically sends out updates at least twice a day to other agencies ☒ SOC ☐ MD ☒ MH ☐ D ☐ PIO
Weather Forecasting	Call NWS for forecast if needed ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO Hire an on staff meteorologist for forecasting ☒ SOC ☐ MD ☐ MH ☐ D ☐ PIO

4.3. Traveler Information

Traveler information encompasses any condition that might impact the traveling public. Systems, functions, and applications include all aspects of road reporting, 511, the website, DMS, HAR, cameras, public information, media notification, point of contact, RACOM, and transit. Table 9 provides a full description of the proposed MDT Traveler Information categories, lists the tasks associated with each category, and identifies the group(s) at MDT that could accomplish the task if an SOC were created. In addition to the functions (i.e. categories) that MDT currently performs, "transit information" was added as a new piece of traveler information for the SOC to provide.

4.3.1. Road Reporting

Road reporting includes collecting and distributing information such as road conditions, chain requirements, road closures and Emergency Travel Only (ETO) advisories, incident data, maintenance and construction activities, height, weight, load, and speed restrictions, as well as email/fax notifications. These are described in more detail below.

4.3.1.1. Road Conditions

The SOC and Maintenance Division offices will share responsibility for the following tasks:

- Polling the snow plow drivers twice a day for road condition information;
- Increasing the frequency of contact with plow drivers to acquire road condition updates; and
- Creating and distributing local area reports as conditions change.

The Maintenance Division offices will be responsible for the above-mentioned tasks during normal business hours and will receive help from the SOC when needed. The SOC will assume responsibility for the tasks after-hours, weekends, and holidays.

The SOC will collaborate with Maintenance Headquarters to perform the following tasks:

- Prepare and review statewide reports for accuracy;
- Automatically post reports to the listserv twice a day;
- Prepare, review, and distribute the Helena area report as road conditions change;
- Post reports to the web site; and
- Act as the first line of support for software maintenance.

The SOC will assume District road reporting duties evenings, weekends, and holidays. The SOC will work with ISD to distribute road reports to the National Oceanic and Atmospheric Association (NOAA) and the Associated Press (AP). ISD will be responsible for setting up automatic report distribution to the listserv, and for providing 24 hour a day, seven days a week system maintenance support for the road reporting system.

4.3.1.2. Chain Requirements

Maintenance Chiefs at the Maintenance Division offices will be solely responsible for determining when to require chains on vehicles based on the recommendations of the

Superintendents. The Maintenance Division Offices will then enter and update the chain restriction information in the road condition database during normal business hours. The SOC will assume responsibility for the data entry into the road condition database after-hours, weekends, and holidays. Maintenance Headquarters and the SOC will work together to act as the first line of support for software maintenance. The SOC will assume District duties after-hours, weekends, and holidays. ISD will be responsible for providing 24 hour a day, seven days a week system maintenance support for road reporting.

4.3.1.3. Closures/ETOs

The Maintenance Chief at the Maintenance Division office will be solely responsible for deciding to enact a road closure or ETO. The Maintenance Division offices will continue to enter road closures and ETO advisories into the road condition database during normal hours of operation. The SOC will assist the Division with this task during normal business hours if needed and as requested by the Division. Maintenance Headquarters and the SOC will work together to act as the first line of support for software maintenance. The SOC will assume District duties after-hours, weekends, and holidays. ISD will be responsible for providing 24 hour a day, seven days a week system maintenance support for road reporting.

4.3.1.4. Incident Data

The Maintenance Division offices will enter incident data and updates provided by MDT staff or MHP into the road condition databases during business hours. The SOC will assist the Division with this task during the day if requested by the Division. Maintenance Headquarters and the SOC will work together to act as the first line of support for software maintenance. The SOC will assume District duties after-hours, weekends, and holidays. ISD will be responsible for providing 24 hour a day, seven days a week system maintenance support for road reporting.

4.3.1.5. Construction Activity

The Maintenance Division offices will continue to receive construction activity information from project managers and enter it into the road condition database during normal hours of operation. Local area report creation and distribution will also be handled by the Division offices during normal hours of operation. The SOC will assume these responsibilities after-hours, weekends, and holidays or as requested by the Division during business hours.

The SOC and Maintenance Headquarters will collaborate on the following:

- Prepare and review construction/maintenance activity reports for accuracy;
- Automatically distribute the construction/maintenance activity reports via the listserv weekly;
- Post the construction/maintenance activity reports to the web; and
- Act as the first line of support for software maintenance.

District offices will coordinate with project managers to collect weekly construction information to provide to the Maintenance Division offices. ISD will be responsible for providing 24 hour a day, seven days a week system maintenance support for road reporting.

4.3.1.6. Maintenance Activity

Maintenance Division Superintendents will continue to provide the road reporters maintenance activity updates and information on a weekly basis exclusively.

The Maintenance Division offices will enter the weekly maintenance activity information and updates into the road condition database during normal business hours. The SOC will assume this responsibility after-hours, weekends, and holidays and as requested during business hours by the Division.

The SOC will work with Maintenance Headquarters to perform the following functions:

- Prepare and review construction/maintenance activity reports for accuracy;
- Automatically distribute the construction/maintenance activity reports via the listserv weekly;
- Post the construction/maintenance activity reports to the web; and
- Act as the first line of support for software maintenance.

ISD will be responsible for providing 24 hour a day, seven days a week system maintenance support for road reporting.

4.3.1.7. Height and Weight Restrictions

The Maintenance Division offices will continue to receive height and weight restriction information from project managers and enter it into the road condition database. The SOC will receive this information after hours, weekends, and holidays.

The SOC will work with Maintenance Headquarters to perform the following functions:

- Prepare and review construction/maintenance activity reports for accuracy;
- Automatically distribute the construction/maintenance activity reports via the listserv weekly;
- Post the construction/maintenance activity reports to the web; and
- Act as the first line of support for software maintenance.

District offices will collect construction information and updates including height and weight restrictions if applicable, from project managers on a weekly basis. ISD will be responsible for providing 24 hour a day, seven days a week system maintenance support for road reporting.

4.3.1.8. Load and Speed Restrictions

The Maintenance Division offices Maintenance Chiefs will retain responsibility for providing weekly load and speed restriction information and updates to road reporting staff. The Maintenance Division offices will also continue to input information into the road condition database during normal hours of operation, while the SOC will assume this responsibility after-hours, weekends, and holidays, and as requested during business hours by the SOC.

The SOC will work with Maintenance Headquarters to perform the following functions:

- Prepare and review load and speed restriction reports;

- Post reports to the web;
- Act as the first line of support for software maintenance; and
- Compile and distribute reports via the listserv.

ISD will be responsible for providing 24 hour a day, seven days a week system maintenance support for road reporting.

4.3.1.9. Email/Fax Notifications

The SOC will work with Maintenance Headquarters to perform the following functions:

- Post road conditions report to the listserv twice a day;
- Post construction reports, as well as load and speed restrictions to the listserv weekly; and
- Act as the primary support contact for software maintenance issues.

ISD will collaborate with the SOC to ensure that reports were distributed to NOAA and the AP. ISD will retain sole responsibility for 24 hour a day, seven days a week system maintenance support and automatic report distribution.

4.3.2. 511

The SOC and Maintenance Headquarters will work together to record alert messages on the 511 system. ISD will be responsible for the maintenance, management, and monitoring of the 511 FTP site.

4.3.3. Website

The SOC and Maintenance Headquarters will be responsible for collaborating on the following functions as they pertain to the website:

- Posting road conditions;
- Posting construction reports; and
- Posting load and speed restriction reports.

The SOC will collaborate with ISD to ensure that the RWIS information/data were posted to the web.

4.3.4. DMS

The Maintenance Division offices will post messages on signs during normal business hours. The SOC will assume this responsibility after-hours, weekends, holidays, and as requested by the Division during business hours.

The SOC and Maintenance Headquarters will collaborate on the following functions:

- Development and approval of message sets;
- Development and approval of procedures and protocols; and
- Act as the first point of contact for software support for the DMS.

ISD will be responsible for software and network support.

4.3.5. HAR

Given the proposed hours of operation and functionality of the SOC, both the SOC and Maintenance Divisions will record messages on the HAR radios. The Maintenance Division will do this during normal business hours, and the SOC will assume this responsibility after-hours, weekends, holidays, and during normal business hours as requested by the Division.

Maintenance Headquarters will coordinate with the SOC in the event of an AMBER alert. One of these two entities will be designated to record the AMBER alert message on the radios for broadcast. Software and network support for the HAR equipment will be the responsibility of ISD.

4.3.6. Cameras

Cameras will be monitored by the SOC and Maintenance Headquarters. The SOC will work with ISD to ensure that updated camera imagery was posted to the web in a timely fashion.

4.3.7. Public Information

The PIO and SOC will collaborate on the creation and distribution of press releases.

4.3.8. Media Notification

The SOC will act as the primary point of contact for the media. It will be responsible for the following functions:

- Notifying the media with winter updates; and
- Notifying the media of incidents.

Maintenance Headquarters and the SOC will share the responsibility for the following functions:

- Posting road condition reports to the listserv twice daily; and
- Posting construction reports to the listserv weekly.

4.3.9. Point of Contact

The SOC will be the primary point of contact to answer all calls and inquiries from the public. Maintenance Headquarters will also be kept apprised of any and all relevant calls and respond accordingly should the need arise.

4.3.10. RACOM

The Maintenance Division Offices and Maintenance Headquarters will be responsible for recording the outgoing message onto the machine during normal hours of operation. The SOC will assume this responsibility after-hours, weekend, and holidays and as requested by the Division or Headquarters during business hours. There is a potential that the Helena report recorded by Maintenance Headquarters might also be done by the SOC.

4.3.11. Transit

This is a proposed function that is not part of current MDT operations, but could be done by the SOC. The SOC will be the primary source of information for transit operations. The SOC will be responsible for the following:

- Fielding calls and questions from the public;
- Updating transit information on the web site;
- Updating transit information on the 511 system; and
- Providing weather and incident information and updates to transit providers.

4.3.12. Summary Table of Proposed Traveler Information Functions

Table 9 provides a summary of the proposed Traveler Information functions. The responsible office is indicated by the marked box. The following abbreviations are used in the table:

- SOC – Statewide Operations Center
- MD – Maintenance Division
- MH – Maintenance Headquarters
- D – District
- ISD – Information Services Division
- PIO – Public Information Office

Table 9: Proposed SOC Incorporation into Traveler Information

Traveler Information		
Category		**Functions**
Road Reporting	**Road Conditions**	Poll plow drivers twice a day for current road conditions ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Plow drivers call in more frequently with road condition updates ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Create local area report and distribute as conditions change ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Run and review statewide reports for accuracy ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Automatically distribute to listserv twice a day ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO

Traveler Information		
Category		**Functions**
		Run and review Helena area report and distribute as conditions change ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Post report to web ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO First line of support for software maintenance ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO Distribute reports to NOAA and AP ☒ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO Set-up automatic report distribution ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO 24/7 system maintenance support ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO
	Chain Requirements	Maintenance chief decides when to require chains based on superintendent's recommendation ☐ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Input chain restriction information into road condition database ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO First line of support for software maintenance ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO 24/7 system maintenance support ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO

Traveler Information		
Category		**Functions**
	Road Closures and Emergency Travel Only (ETO) Advisories	Maintenance chief decides when to require closure/ETO based on recommendation ☐ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Input closure/ETO into road condition database ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO First line of support for software maintenance ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO 24/7 system maintenance support ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO
	Incident Data	Input incident data into the road condition database based on information provided by MDT staff or MHP ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO First line of support for software maintenance ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO 24/7 system maintenance support ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO
	Construction Activity	Receive information from project managers and input into road condition database ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Create local area report and distribute ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Run and review construction /maintenance activity report for accuracy ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO

Traveler Information		
Category		**Functions**
		Automatically distribute to listserv once a week ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Post report to web ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO First line of support for software maintenance ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Project managers provide construction information to division offices weekly ☐ SOC ☐ MD ☐ MH ☒ D ☐ ISD ☐ PIO 24/7 system maintenance support ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO
	Maintenance Activity	Superintendents provide information to road reporters once a week ☐ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Input maintenance activity information into the road condition database once a week ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Run and review construction /maintenance activity report for accuracy ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Automatically distribute to listserv once a week ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Post report to web ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO First line of support for software maintenance ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO 24/7 system maintenance support ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO

Traveler Information		
Category		**Functions**
	Height & Weight Restrictions	Receive information from project managers and input into road condition database ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Run and review construction /maintenance activity report for accuracy ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Automatically distribute to listserv once a week ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Post report to web ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO First line of support for software maintenance ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Project managers provide construction information to division offices weekly ☐ SOC ☐ MD ☐ MH ☒ D ☐ ISD ☐ PIO 24/7 system maintenance support ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO
	Load & Speed Restrictions	Maintenance Chiefs provide load and speed restrictions to road reporting staff once a week ☐ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Input information into the road condition database ☒ SOC ☒ MD ☐ MH ☐ D ☐ ISD ☐ PIO Run and review load and speed restriction report ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Post report to web ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO First line of support for software maintenance ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Compile report and distribute to listserv ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO

Traveler Information		
Category		**Functions**
		24/7 system maintenance support ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO
	Email / Fax Notifications	Distribute road condition reports twice a day to listserv ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Distribute construction and load and speed restriction reports once a week to listserv ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO First line of support for software maintenance ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO 24/7 system maintenance support ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO Distribute reports to NOAA and AP ☒ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO Set-up automatic report distribution ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO
511		Record alert messages onto system ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Maintain, manage, and monitor the FTP site ☐ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO
Website		Post road condition report on web ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Post construction report on web ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Post load and speed restriction report to web ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Ensure RWIS information posts to web ☒ SOC ☐ MD ☐ MH ☐ D ☒ ISD ☐ PIO

Traveler Information		
Category		**Functions**
Dynamic Message Signs (DMS)		Post messages on signs ☒ ☒ ☐ ☐ ☐ ☐ SOC MD MH D ISD PIO Develop and approve messages ☒ ☐ ☒ ☐ ☐ ☐ SOC MD MH D ISD PIO Develop and approve procedures and protocols ☒ ☐ ☒ ☐ ☐ ☐ SOC MD MH D ISD PIO First line of support for software maintenance ☒ ☐ ☒ ☐ ☐ ☐ SOC MD MH D ISD PIO Software and network support ☐ ☐ ☐ ☐ ☒ ☐ SOC MD MH D ISD PIO
Highway Advisory Radio (HAR)		Record message on machine ☒ ☒ ☐ ☐ ☐ ☐ SOC MD MH D ISD PIO Record message on machine for AMBER alerts ☒ ☐ ☒ ☐ ☐ ☐ SOC MD MH D ISD PIO Software and network support ☐ ☐ ☐ ☐ ☒ ☐ SOC MD MH D ISD PIO
Cameras		Monitor camera images ☒ ☐ ☒ ☐ ☐ ☐ SOC MD MH D ISD PIO Ensure camera images post to web ☒ ☐ ☐ ☐ ☒ ☐ SOC MD MH D ISD PIO
Public Information		Create press releases ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH D ISD PIO

Traveler Information		
Category		**Functions**
Media Notification		Notify media via local reports for all winter updates ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO Notify media of incidents ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO Distribute road condition reports twice a day to listserv ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO Distribute construction reports once a week to listserv ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO
Point of Contact		Answer calls/questions from public ☒ SOC ☐ MD ☒ MH ☐ D ☐ ISD ☐ PIO
RACOM		Record message on machine ☒ SOC ☒ MD ☒ MH ☐ D ☐ ISD ☐ PIO
Transit		Answer calls/questions from public ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO Update transit information on web ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO Update transit information on 511 ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO Provide weather and incident notifications to transit providers ☒ SOC ☐ MD ☐ MH ☐ D ☐ ISD ☐ PIO

4.4. Maintenance Operations

MDT's Maintenance Operations Manager states that maintenance operations are "the activities associated with keeping the transportation infrastructure in proper working order. Activities such as pavement work, sign repair, pavement marking, etc. Operations will be the aspects associated with keeping traffic moving (5)." Table 10 provides a full description of the proposed MDT Traveler Information categories, lists the tasks associated with each category, and identifies the group(s) at MDT that could accomplish the task if an SOC were created.

4.4.1. Call Down Lists with Contact Information

The SOC, Maintenance Division offices, District offices, and Maintenance Headquarters will all work together to update and maintain current call-down lists of contact information to ensure that all MDT entities and external agencies have the same information.

4.4.2. Damage Reports

During normal hours of operation, the Maintenance Division offices will continue to perform the following tasks:

- Act as the central point of contact for damage reports from outside parties;
- Determine the prioritization of repairs; and
- Maintain a damage report database detailing incidents, severity, location, extent of damage, repair status, and scheduled priority for repair.

The SOC will assume responsibility for these tasks after-hours, weekends, and holidays and as requested by the Divisions during normal hours of operation. There is a potential that the central point of contact for damage reports from outside parties could fall solely on the SOC as they serve as the central point of contact for the public and external agencies. The SOC will then need to coordinate with the Divisions so that the Divisions can accomplish the remainder of the tasks.

The Maintenance Division offices will retain sole responsibility for assessing damage and making the necessary repairs.

4.4.3. Maintenance Activity

During normal hours of operation, the Maintenance Division offices will continue to perform the following tasks:

- Tracking maintenance activities and locations;
- Prioritizing maintenance activities;
- Scheduling maintenance activities and resource needs;
- Entering maintenance resources into MMS and EVMS on a weekly basis;
- Monitoring the status of maintenance activities;
- Entering maintenance activities and potential impacts into the road condition database; and
- Notifying road reporters of maintenance activities and potential impacts.

The SOC will assume responsibility for these tasks (other than entering resources into the Maintenance Management System (MMS) and Equipment Vehicle Management System (EVMS)) after-hours, weekends, holidays, and as requested by the Division during business hours. Maintenance Headquarters will run the MMS and EVMS reports and will work with the SOC to prepare and review the construction and maintenance reports, post them to the web, and distribute them via the listserv.

4.4.4. Resource Availability and Assignments

During normal hours of operation, the Maintenance Division offices will continue to perform the following tasks:

- Coordinate and assign resources; and
- Monitor maintenance activities.

The SOC will assume responsibility for these tasks after-hours, weekends, holidays, and during business hours as requested by the Division.

4.4.5. Dispatch

During normal hours of operation, the Maintenance Division offices will continue to dispatch maintenance crews. The SOC will assume responsibility for these tasks after-hours, weekends, holidays, and as requested by the Division during business hours.

4.4.6. Coordination with Other Agencies

The SOC and Maintenance Headquarters will collaborate on the task of inter-agency coordination.

4.4.7. Training

Personnel training will be the responsibility of each individual group (SOC, Maintenance Headquarters, Maintenance Division Offices, and District offices). The need for some cross training may be necessary for certain personnel associated with the SOC.

4.4.8. Policies, Procedures, and Guidelines

The SOC and Maintenance Headquarters will work together to develop statewide guideline, policies, and procedures for use by the MDT Maintenance Division.

4.4.9. Summary Table of Proposed Maintenance Operations

Table 10 provides a summary of the proposed Maintenance Operations functions. The responsible office is indicated by the marked box. The following abbreviations are used in the table:

- SOC – Statewide Operations Center
- MD – Maintenance Division
- MH – Maintenance Headquarters
- D – District

Table 10: Proposed Incorporation of SOC into Maintenance Operations

Maintenance Operations	
Category	**Functions**
Down Lists with Call Contact Information	Maintain current call-down lists of contact information ☒ SOC ☒ MD ☒ MH ☒ D
Damage Reports	Act as central contact point for damage reporting from outside parties ☒ SOC ☒ MD ☐ MH ☐ D Determine prioritization of repairs ☒ SOC ☒ MD ☐ MH ☐ D Maintain database of reported damage incidents, severity, location, and repair status/priority ☒ SOC ☒ MD ☐ MH ☐ D Enter information regarding location and extent of damage ☒ SOC ☒ MD ☐ MH ☐ D Assess damage ☐ SOC ☒ MD ☐ MH ☐ D Repairs ☐ SOC ☒ MD ☐ MH ☐ D
Maintenance Activity	Track maintenance activities and locations ☒ SOC ☒ MD ☐ MH ☐ D Prioritize maintenance activities ☒ SOC ☒ MD ☐ MH ☐ D Schedule maintenance activities and resource needs ☒ SOC ☒ MD ☐ MH ☐ D Enter maintenance resources weekly into MMS and EVMS ☐ SOC ☒ MD ☐ MH ☐ D Monitor status of maintenance activities ☒ SOC ☒ MD ☐ MH ☐ D Notify road reporters of maintenance activities and potential impacts ☒ ☒ ☐ ☐

Maintenance Operations	
Category	**Functions**
	SOC MD MH D Enter maintenance activities and impacts into road condition database ☒ ☒ ☐ ☐ SOC MD MH D Run EVMS and MMS reports ☐ ☐ ☒ ☐ SOC MD MH D Run and review construction/maintenance reports and post to web and send to listserv ☒ ☐ ☒ ☐ SOC MD MH D
Resource Availability & Assignments	Coordinate and assign resources ☒ ☒ ☐ ☐ SOC MD MH D Monitor maintenance activities ☒ ☒ ☐ ☐ SOC MD MH D
Dispatch	Dispatch crews ☒ ☒ ☐ ☐ SOC MD MH D
Coordination with Other Agencies	Coordinate with other agencies ☒ ☐ ☒ ☐ SOC MD MH D
Training	Train all personnel ☒ ☒ ☒ ☒ SOC MD MH D
Policies, Procedures, and Guidelines	Develop any policies, procedures, or guidelines that are used in-house ☒ ☐ ☒ ☐ SOC MD MH D

4.5. Incident Management (Traffic/ Special Events/ Incident/ Construction Management)

Incidents are defined as traffic, special events, construction, and accidents. Management of these incidents allows traffic to resume normal speeds and flow in a timely manner. Table 11 provides a full description of the proposed MDT Incident Management categories, lists the tasks associated with each category, and identifies the group(s) at MDT that could accomplish the task if an SOC were created.

4.5.1. Response Plan

The SOC, Maintenance Headquarters, Maintenance Division offices, and District offices will all be responsible for implementing the MDT Emergency Operations and Disaster Plan should the need arise. The SOC and Maintenance Headquarters are responsible for ensuring that the MDT Emergency Operations and Disaster Plan is updated and coordinating response plans with state, multi-state, and federal agencies.

4.5.2. Accident Detection and Reporting

During normal hours of operation, the Maintenance Division offices will continue to perform the following tasks:

- Receiving incident notification and reports (status, severity, and location) from MDT field staff and MHP;
- Verifying and entering the incident information into the appropriate databases; and
- Notifying MDT Headquarters if warranted.

The SOC will assume responsibility for these tasks after-hours, weekends, holidays, and upon request by the Division during business hours. The SOC will share responsibility for activating the alert system on 511 with Maintenance Headquarters. District offices will continue to be responsible for reporting special event and construction information to Divisions.

4.5.3. Accident Notification

The SOC will be solely responsible for coordinating with other agencies in the event of an accident. During normal hours of operation, the Maintenance Division offices will continue to perform the following tasks:

- Notification of maintenance crews and incident responders;
- Management of call down lists;
- Notification of people on call down list; and
- Notification of the PIO.

The SOC will assume responsibility for these tasks after-hours, weekends, and holidays and during business hours as requested by the Division.

4.5.4. Accident Management

During normal hours of operation, the Maintenance Division offices will continue to perform the following tasks:

- Tracking incident status and severity;
- Entering relevant information into the incident database; and
- Facilitating incident support.

The SOC will assume responsibility for these tasks after-hours, weekends, and holidays and as requested by the Division during business hours.

Maintenance Headquarters, Maintenance Division offices, and District Offices will work together to provide onsite coordination for incidents. The SOC, Maintenance Headquarters, Maintenance Division offices, and District Offices will work together to perform the following tasks:

- Create a statewide emergency operations center; and
- Implement the MDT Emergency Operations and Disaster Plan.

The SOC, Maintenance Headquarters, and District offices will collaborate on incident management and coordination operations. The SOC and Maintenance Headquarters will work together to:

- Coordinate incident management with external agencies; and
- Update the MDT Emergency Operations and Disaster Plan as needed.

4.5.5. Homeland Security

The SOC, Maintenance Headquarters, Maintenance Division offices, and District Offices will work together to perform the following tasks:

- Create a statewide emergency operations center;
- Coordinate with other state and federal agencies as needed;
- Report to the Department of Homeland Security; and
- Comply with the MDT Emergency Operations and Disaster Plan.

4.5.6. AMBER Alert

The SOC, Maintenance Headquarters, and Maintenance Division offices will work together to implement MDT AMBER Alert policies and procedures.

During normal hours of operation, the Maintenance Division offices will continue to perform the following tasks:

- Activating messages on DMS;
- Alerting filed staff via radio; and
- Update equipment and personnel as changes occur.

The SOC will assume responsibility for these tasks after-hours, weekends, and holidays and as requested by the Division during business hours. Once the DMS central software is functional and statewide communications has been established, the SOC will be able to consistently handle these tasks.

The SOC and Maintenance Headquarters will collaborate on the following tasks as they pertain to AMBER Alerts:

- Coordination with the Department of Justice (DOJ);
- Update the MDT AMBER Alert policies and procedures as needed;
- Receive AMBER Alert notifications;

- Provide notification to Divisions of AMBER Alerts;
- Monitor AMBER Alert status and apprise Divisions of updates/changes in status;
- Activate the AMBER Alert on the 511 system;
- Activate the HAR system broadcasting the AMBER Alert information; and
- Update the 511 system and HARs as changes occur.

4.5.7. Search and Rescue

The SOC will collaborate with the MDT Aeronautics Division to coordinate with the appropriate state and federal agencies for search and rescue operations.

4.5.8. Special Events

The Maintenance Division offices will be solely responsible for notifying road reporters of special events. District offices will be solely responsible for notifying Maintenance Division offices of special events.

During normal hours of operation, the Maintenance Division offices will continue to input special event information into the incident reporting system. The SOC will assume responsibility for this task after-hours, weekends, and holidays and as requested by the Division during business hours.

The SOC, Maintenance Headquarters, Maintenance Division offices, and District offices will collaborate on the implementation of special event permitting guidelines. The SOC will work with MDT Headquarters to create the above-mentioned special event permitting guidelines.

4.5.9. Signal Operations

The SOC will coordinate with District offices to assist cities and the ITS coordinator to identify special events which will require changes in normal signal operations.

The SOC and ITS coordinator will work together to assist Districts and cities to identify special events which will require changes in normal signal operations, and to implement the signal changes for the special event.

4.5.10. Construction Reporting

District offices will be solely responsible for obtaining construction information from project managers and providing it to Maintenance Division offices on a weekly basis. During normal hours of operation, the Maintenance Division offices will continue to receive construction information and updates from District project managers and enter the information into the road condition database. Construction staff may also perform this task. The SOC will assume responsibility for this task after-hours, weekends, and holidays and as requested by the Division during business hours.

The SOC and Maintenance Headquarters will collaborate on the preparation and review of the construction/maintenance report(s) for accuracy. They will work together to ensure that the reports are automatically distributed to the listserv once a week and are subsequently posted to the web.

4.5.11. Resource Tracking

During normal hours of operation, the Maintenance Division offices will continue to perform the following functions:

- Queue management;
- Alternate routing/detours;
- Input crew assignments into the database;
- Track incident status and severity;
- Track portable DMS locations; and
- Enter information into the MMS database.

The SOC will assume responsibility for these tasks after-hours, weekends, and holidays and as requested by the Division during business hours. Maintenance Division offices will be solely responsible for reporting the status and locations of special events and construction tasks to the Division.

4.5.12. Coordination with Other Agencies

The SOC will be solely responsible for coordinating with other agencies for incident management purposes.

4.5.13. Traffic Management

This function was added to the list of SOC operations tables. The SOC will be responsible for the following traffic management functions:

- Monitoring sensors;
- Monitoring ITS equipment;
- Verifying and entering relevant information into the road condition database; and
- Traffic management coordination with other agencies.

4.5.14. Summary Table of Proposed Incident Management Operations

Table 11 provides a summary of the proposed Traveler Information functions. The responsible office is indicated by the marked box. The following abbreviations are used in the table:

- SOC – Statewide Operations Center
- MD – Maintenance Division
- MH – Maintenance Headquarters
- D – District
- ITS – ITS Coordinator
- A – Aeronautics

Table 11: Proposed Incorporation of SOC into Incident Management

Incident (traffic, special event, construction, accident) Management	
Category	**Functions**
Response Plan	Implement MDT Emergency Operations and Disaster Plan ☒ SOC ☒ MD ☒ MH ☒ D ☐ ITS ☐ A Update MDT Emergency Operations and Disaster Plan ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Coordinate response plans with other agencies (state, multi-state, and federal) ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A
Accident Detection & Reporting	Field staff and MHP notify/report incidents (status, severity, and location) to o staff ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Verify and enter information into databases ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Office staff notify headquarters if warranted ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Activate alert system on 511 ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Report special event and construction information to divisions ☐ SOC ☐ MD ☐ MH ☒ D ☐ ITS ☐ A Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ ITS ☐ A
Accident Notification	Coordination with other agencies ☒ SOC ☐ MD ☐ MH ☐ D ☐ ITS ☐ A Notify maintenance crews and incident responders ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Manage call down lists ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Notify people on call down list ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Notify PIO ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A

Incident (traffic, special event, construction, accident) Management	
Category	**Functions**
	Assume division duties on nights, weekends, and holidays in the winter ☒ SOC ☐ MD ☐ MH ☐ D ☐ ITS ☐ A
Accident Management	Track status and severity ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Input into database ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Facilitate incident support ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Onsite coordination ☐ SOC ☒ MD ☒ MH ☒ D ☐ ITS ☐ A Create a statewide emergency operations center if necessary ☒ SOC ☒ MD ☒ MH ☒ D ☐ ITS ☐ A Follow the MDT Emergency Operations and Disaster Plan ☒ SOC ☒ MD ☒ MH ☒ D ☐ ITS ☐ A Incident management/coordination ☒ SOC ☐ MD ☒ MH ☒ D ☐ ITS ☐ A Coordination with other agencies ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Update the MDT Emergency Operations and Disaster Plan as needed ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A
Homeland Security	Create a statewide emergency operations center if necessary ☒ SOC ☒ MD ☒ MH ☒ D ☐ ITS ☐ A Coordinate with other state and federal agencies as needed ☒ SOC ☒ MD ☒ MH ☒ D ☐ ITS ☐ A Report to the department of Homeland Security ☒ SOC ☒ MD ☒ MH ☒ D ☐ ITS ☐ A Follow the MDT Emergency Operations and Disaster Plan ☒ SOC ☒ MD ☒ MH ☒ D ☐ ITS ☐ A

Incident (traffic, special event, construction, accident) Management	
Category	**Functions**
AMBER Alert	Implement MDT AMBER Alert policies and procedures ☒ SOC ☒ MD ☒ MH ☐ D ☐ ITS ☐ A Activate messages on DMS ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Alert field staff via radio ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Update as changes occur ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Coordinate with Department of Justice ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Update MDT AMBER Alert policies and procedures as needed ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Receive AMBER Alert notification ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Notify Divisions of AMBER Alert ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Monitor status and report changes to divisions ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Activate alert system on 511 ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Activate HAR systems ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Update 511 and HAR as changes occur ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A
Search & Rescue	Coordinate activities with appropriate state and federal agencies ☒ SOC ☐ MD ☐ MH ☐ D ☐ ITS ☒ A

Incident (traffic, special event, construction, accident) Management	
Category	**Functions**
Special Event	Enter information into incident reporting system ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Report special events to road reporters ☐ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Implement special event permitting guidelines ☒ SOC ☒ MD ☒ MH ☒ D ☐ ITS ☐ A Create special event permitting guidelines ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Report special events to division ☐ SOC ☐ MD ☐ MH ☒ D ☐ ITS ☐ A
Signal Operations	Work with cities and ITS coordinator to identify special events requiring signa changes ☒ SOC ☐ MD ☐ MH ☒ D ☐ ITS ☐ A Work with districts and cities to identify special events requiring signal change ☒ SOC ☐ MD ☐ MH ☐ D ☒ ITS ☐ A Make appropriate signal changes ☒ SOC ☐ MD ☐ MH ☐ D ☒ ITS ☐ A
Construction Reporting	Receive information from project managers and input into road condition data this task may also be performed by construction staff ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Run/review construction /maintenance activity report for accuracy ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Automatically distribute to listserv once a week ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Post report on web ☒ SOC ☐ MD ☒ MH ☐ D ☐ ITS ☐ A Project managers provide construction information to division offices weekly ☐ SOC ☐ MD ☐ MH ☒ D ☐ ITS ☐ A

Incident (traffic, special event, construction, accident) Management	
Category	**Functions**
Resource Tracking	Queue management ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Alternate routing/detours ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Input crew assignments ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Track status and severity of incidents ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Track portable DMS locations ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Report status and location of construction and special events to division ☐ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A Log information into database ☒ SOC ☒ MD ☐ MH ☐ D ☐ ITS ☐ A
Coordination with Other Agencies	Coordinate with other agencies ☒ SOC ☐ MD ☐ MH ☐ D ☐ ITS ☐ A
Traffic Management	Monitor sensors ☒ SOC ☐ MD ☐ MH ☐ D ☐ ITS ☐ A Monitor ITS equipment ☒ SOC ☐ MD ☐ MH ☐ D ☐ ITS ☐ A Verify and enter information into road condition databases ☒ SOC ☐ MD ☐ MH ☐ D ☐ ITS ☐ A Traffic management coordination with other agencies ☒ SOC ☐ MD ☐ MH ☐ D ☐ ITS ☐ A

4.6. Device Management

Device management is a fairly widespread, complex task. It covers all aspects of device usage, maintenance, deployment, installation, support, monitoring, and repair. Table 12 provides a full description of the proposed MDT Traveler Information categories, lists the tasks associated with each category, and identifies the group(s) at MDT that could accomplish the task if an SOC were created.

4.6.1. ITS Deployment and Prioritization

The SOC will work with the Maintenance Division offices and the ITS Coordinator to determine locations for field devices. Prioritization for the deployment of new field devices will be determined by the SOC, Maintenance Headquarters, and the ITS Coordinator. The SOC will work with the Information Services Department to update the website to incorporate the data from new field devices. It will be the ITS Coordinator's responsibility to include new device locations into the STIP and construction projects, log the locations of all new field devices, and ensure that these devices are included in the Montana Architecture. The Vendor(s) will assist with the device deployment.

4.6.2. Cameras

The cameras may be used by the SOC and Maintenance Division offices to verify the need to dispatch crews to a particular location and to monitor conditions at a remote location. The SOC and Maintenance Headquarters (MH) will establish a schedule that will monitor the camera equipment for failures. MH and the SOC will also coordinate camera support and repairs. The Communications Bureau (CB) will be responsible for camera installation. Technical support for the cameras will be provided by the CB, Information Services Division (ISD), the Vendor (V), and the SOC. The SOC and CB will coordinate camera maintenance and repair, and will maintain failure and equipment status logs. The SOC will work with ISD to ensure that equipment status and location is displayed on the web, and will collaborate on data management. The Vendor will be responsible for camera updates and patches, and will provide MDT with equipment location and status for web link purposes.

4.6.3. RWIS

The SOC and Maintenance Division (MD) offices will use RWIS information for dispatching purposes. They will also collaborate to identify road conditions which would warrant the RWIS automatically notifying Maintenance staff (e.g. temperature reaches a certain lavel on a mountain pass indicating the roads will be icy) for use in crew dispatching.

The SOC and Maintenance Headquarters (MH) will perform the following functions:

- Monitor equipment for failures;
- Implement equipment failure notification procedures;
- Establish alert thresholds; and
- Coordinate equipment support and repairs.

The Communications Bureau (CB) will be responsible for RWIS installation. They will work with the SOC and the Information Services Division (ISD) to provide technical support for the RWIS equipment. The CB and SOC will coordinate RWIS maintenance and repair operations.

The SOC and the ISD will collaborate on the following functions:

- Log and archive the RWIS data;
- Display RWIS location and status on the web;
- Enable automatic notification of certain road weather conditions to the Maintenance Division/Section staff; and
- Data management.

The RWIS vendor will provide upgrades and patches for the RWIS systems.

4.6.4. DMS (Portable and Permanent)

The SOC and the Maintenance Division (MD) offices will collaborate on the following functions:

- Coordinate repairs for the DMS;
- Post messages on the DMS;
- Monitor DMS for failure;
- Implement notification procedures;
- Establish alert thresholds;
- Maintain DMS failure and status logs; and
- Log/archive messages posted to the DMS.

The MD offices will be responsible for transporting and storing the portable DMS equipment. The SOC, Motor Carrier Services (MCS), and Maintenance Headquarters (MH) will develop and approve procedures and protocols as well as messages to be posted on the DMS. The SOC will coordinate with the ITS Coordinator (ITS), Communications Bureau (CB) and the Vendor (V) to provide technical support for the DMS equipment. The SOC, CB, V, and ITS coordinator will work with the CB, ITS Coordinator, and the Information Services Department (ISD) to maintain and repair the DMS equipment. The SOC and ISD will collaborate on data management protocols. The Vendor will perform DMS installation and provide updates and patches for the equipment.

4.6.5. 511

The SOC will work with the Maintenance Division (MD) offices to update the road reporting database. The SOC will assume responsibility for this task after-hours, weekends, holidays, and upon request from the MD offices during normal business hours.

The SOC will coordinate with Maintenance Headquarters (MH) to perform the following functions:

- Record alert messages onto the 511 system;
- Monitor the 511 equipment for failures on a regularly scheduled basis;
- Implement notification procedures;
- Establish alert thresholds;
- Retrieve and respond to public comments about the 511 system; and
- Manage the 511 system.

The Information Services Department (ISD) will assume responsibility for ensuring that the information from the RWIS and road reporting databases is pushed to the FTP site for the vendor to access and download. The vendor will be responsible for the following tasks with regards to the 511 system:

- Maintenance and repair of the 511 equipment;
- Provide necessary updates and patches for the system;
- Prepare the forecast and telephone information for 511 based on the RWIS and road reporting information pulled from MDT's FTP site; and
- Log and archive 511 system user comments and call volume information.

4.6.6. RACOM

The SOC will jointly collaborate with the Maintenance Division (MD) offices and Maintenance Headquarters to record messages on the RACOMs. The SOC will assume responsibility for this task after-hours, weekends, holidays and as requested by the Division during business hours. The SOC and Communications Bureau will be responsible for the following device management tasks:

- RACOM device maintenance and repair;
- Provision of technical support for the RACOMs; and
- Update and patch the RACOM equipment.

4.6.7. HAR

The SOC will jointly collaborate with the Maintenance Division (MD) to record messages on the HARs. The SOC will assume responsibility for this tasks after-hours, weekends, holidays and as requested by the Division during business hours. MD offices and the SOC will share responsibility for monitoring the HAR equipment for failures. The MD offices will coordinate installation of the HAR equipment. The SOC will work with Maintenance Headquarters (MH) to record AMBER Alert messages to the HARs. The SOC will collaborate with the Communications Bureau to perform the following device management tasks:

- HAR device maintenance and repair;
- Provision of technical support for the HARs; and
- Update and patch the HAR equipment.

4.6.8. Kiosks

The SOC will work with the Maintenance Division (MD) offices to monitor the kiosks for failures and to determine locations at which to deploy kiosks. The Information Services Division (ISD) will ensure that the kiosks are connected to the road reporting database and have network support. The Vendor (V) will be responsible for the following tasks:

- Providing technical support for kiosk equipment;
- Installation of the kiosks;
- Maintenance and repair of the kiosks;
- Ensuring that the kiosks are updated and patched;
- Monitoring the equipment for failures;
- Implementing notification procedures; and
- Establishing alert thresholds.

4.6.9. Signals

The SOC and Communications Bureau (CB) will share responsibility for signal device maintenance. The ITS Coordinator (ITS) will install signal equipment. He will share responsibility with the SOC for the following tasks:

- Providing technical support for the equipment;
- Maintenance and repair of the signal equipment; and
- Setting/Updating device timing schemes.

4.6.10. Large Animal Detection Systems

The SOC will coordinate with the Maintenance Division (MD) offices, the Vendor (V) and the Communications Bureau (CB) to support, maintain and repair the animal detection system devices and equipment. The Vendor will assume responsibility for the installation of the animal detection system equipment, and ensuring that the system is updated and patched.

4.6.11. Automated Traffic Recorders (ATR)

The Planning Department (P) will coordinate installation of ATR devices. The SOC will work with P to provide technical support for the equipment, coordinate maintenance and repair of the equipment, analyze the data collected by the equipment, and log/archive the data.

4.6.12. Weigh in Motion (WIM)

The SOC will coordinate with Motor Carrier Services (MCS) to operate and maintain the WIM equipment. The Vendor (V) will install the WIM devices, ensure that the devices are updated and patched, maintain and repair the devices as needed, and provide technical support for the WIM equipment.

4.6.13. Bridge Spray Systems

The Maintenance Division (MD) offices will be responsible for installation of the bridge spray system devices. The MD offices will manually activate the spray system when needed. The SOC will assume responsibility for this task after-hours, weekends, holidays and as requested by the Division during business hours.

The SOC and Communications Bureau (CB) will work together to support, maintain, and repair the bridge spray equipment. The Vendor (V) will ensure that the system is updated and patched.

4.6.14. AVL

The Maintenance Division (MD), Maintenance Headquarters, and the SOC offices will be responsible for utilizing the tracking devices to inform/answer questions from the public. The MD offices will utilize the tracking devices for staff dispatching purposes. The SOC will assume responsibility for this task after-hours, weekends, holidays and as requested by the Division during business hours. The SOC will also monitor the AVL to determine the locations of plows. Operators will take this information and compare it to road condition data to ensure that the plows are dispatched to the areas where they are most needed. The SOC and Communications Bureau (CB) will maintain, and repair the AVL devices. The SOC will coordinate with the CB and the Vendor to provide technical support for the AVL equipment. The Vendor will install, update, and patch the AVL equipment.

4.6.15. Automatic Gates

The Maintenance Division (MD) offices will be responsible for the installation of the automatic gates and related equipment. In the event of a closure, the MD offices will activate and utilize the automatic gates. The SOC will coordinate with the MD offices and the CB to maintain and repair the devices. The SOC will assume responsibility for this activation and utilization of the automatic gates after-hours, weekends, holidays and as requested by the Division during business hours. The SOC will coordinate with the CB and the Vendor to provide technical support for the devices.

4.6.16. Rollover Warning Systems

The Maintenance Division (MD) offices will be responsible for the installation of the rollover warning systems. The SOC will coordinate with the CB to maintain and repair the devices. The SOC will coordinate with the CB and the Vendor to provide technical support for the devices. The Vendor will be responsible for keeping the system patched and updated.

4.6.17. Speed Trailers

The Maintenance Division (MD) offices will be responsible for the transport to locations and storage of the speed trailers when not in use. The SOC will coordinate with the MD offices to decide where the speed trailers are to be deployed. The SOC will work with the CB to maintain and repair the speed trailers equipment. The SOC, CB, and the Vendor will be responsible for providing technical support for the speed trailer equipment. The Vendor will assume responsibility for updating and patching the speed trailer equipment.

4.6.18. Summary Table of Proposed Device Management Operations

Table 12 provides a summary of the proposed Traveler Information functions. The responsible office is indicated by the marked box. The following abbreviations are used in the table:

- SOC – Statewide Operations Center
- MD – Maintenance Division
- MH – Maintenance Headquarters
- CB – Communications Bureau
- ISD – Information Services Division
- ITS – ITS Coordinator
- P - Planning
- MCS – Motor Carrier Services
- V - Vendor

Table 12: Proposed Incorporation of SOC into Device Management

Device Management	
Category	**Functions**
ITS Deployment & Prioritization	Suggest locations for field devices ☒ ☒ ☐ ☐ ☐ ☒ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Prioritize deployment of new field devices ☒ ☐ ☒ ☐ ☐ ☒ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Update website to incorporate data from new devices if appropriate ☒ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Include new device locations into the STIP and construction projects ☐ ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Log locations of all new field devices and include in Montana architecture ☐ ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Assist in deployment ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
Camera	Use device as verification tool for crew dispatch ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Monitor conditions ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V e ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Coordinate support and repairs ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device installation ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☒ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V

Device Management	
Category	**Functions**
	Maintain failure and equipment status logs ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS Ve Display equipment location and status on web ☒ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Data management ☒ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Provide equipment location and status for MDT to link to for web ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
Road Weather Information Systems (RWIS)	Use device information for staff dispatching ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Identify conditions to warrant automatic notification ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Receive automatic notification of certain conditions ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Scheduled monitoring of equipment for failures ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Implement notification procedures (Info Sys. Spec. and front desk) ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Establish alert thresholds ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Arrange for support and repairs ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device installation ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☒ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V

Device Management	
Category	**Functions**
	Device maintenance and repair ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Log/archive data ☒ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Display equipment location and status on web ☒ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Enable automatic notification of certain conditions to maintenance division/section staff ☒ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Data management ☒ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
Dynamic Message Signs (DMS) - portable & permanent	Coordinate repairs ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Post messages on signs ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Scheduled monitoring of equipment for failures ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Implement notification procedures ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Establish alert thresholds ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Maintain failure and equipment status logs ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Log/archive messages posted ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Transport and store portable DMS ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V

Device Management	
Category	**Functions**
	Develop and approve messages ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☒ ☐ SOC MD MH CB ISD ITS P MCS V Develop and approve procedures and protocols ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☒ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☐ ☒ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☐ ☐ ☒ ☒ ☒ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Data management ☒ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Install equipment ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
511	Update road reporting database ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Record alert messages onto system ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Scheduled monitoring of equipment for failures ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Implement notification procedures ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Establish alert thresholds ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Retrieve and respond to public comments on system ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V System management and oversight ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V

Device Management	
Category	**Functions**
	Push information from road reporting database to FTP site for vendor ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Push RWIS information to FTP site for vendor ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Receive database and RWIS information and create forecast and telephone information ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Log/archive comments and call volume information ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
RACOM	Record message on machine ☒ ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Updates and patches ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V
Highway Advisory Radio (HAR)	Record message on machine ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device installation ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Monitor for failures ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Record message on machine for AMBER Alerts ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V

Device Management	
Category	**Functions**
	Provide tech support for equipment ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Updates and patches ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V
Kiosks	Monitor for failures ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Determine deployment locations ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Network support ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide connection to road reporting database ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Device installation ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Monitor equipment for failures ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Implement notification procedures ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Establish alert thresholds ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V

Device Management	
Category	**Functions**
Signals	Maintain devices ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device installation ☐ ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Set/update device timings ☒ ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V
Large Animal Detection Systems	Device maintenance and repair ☒ ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Device installation ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
Automated Traffic Recorders (ATR)	Device installation ☐ ☐ ☐ ☐ ☐ ☐ ☒ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☐ ☐ ☐ ☒ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☐ ☐ ☐ ☐ ☐ ☒ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Analyze data ☒ ☐ ☐ ☐ ☐ ☐ ☒ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Log/archive data ☒ ☐ ☐ ☐ ☐ ☐ ☒ ☐ ☐ SOC MD MH CB ISD ITS P MCS V

Device Management	
Category	**Functions**
Weigh in Motion (WIM)	Operate and monitor device ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☒ ☐ SOC MD MH CB ISD ITS P MCS V Device installation ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
Bridge Spray System	Device installation ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Manually activate spray system ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
Automated Vehicle Location (AVL)	Utilize tracking device to inform/answer the public's questions ☒ ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Utilize tracking devices for staff dispatching ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V

Device Management	
Category	**Functions**
	Device installation ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
Automatic Gates	Device installation ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Utilize device in the event of a road closure ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
Rollover Warning System	Device installation ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☒ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V
Speed Trailers	Transport and store devices ☐ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Decide where to utilize device ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Device maintenance and repair ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☐ SOC MD MH CB ISD ITS P MCS V Provide tech support for equipment ☒ ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V

Device Management	
Category	**Functions**
	Updates and patches ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ SOC MD MH CB ISD ITS P MCS V

4.7. Archive Data and Reporting

Data archiving and reporting is a critical component of MDT Maintenance operations. Data archives of device logs, databases, weather and resource tracking data provide MDT with historical and current data which can be used to assist MDT in decision making capacities. Reporting is one of the fundamental tasks supported by MDT Maintenance operations and provides the basis for several other MDT Maintenance operations. Archived, historical data is also important to address any liability and legal issues that might arise. Table 13 provides a full description of the proposed MDT Traveler Information categories, lists the tasks associated with each category, and identifies the group(s) at MDT that could accomplish the task if an SOC were created.

4.7.1. Monitoring Device Reliability/Failures

The SOC will work with the Maintenance Division (MD) offices and Maintenance Headquarters (MH) to archive documentation on device failures and maintenance operations.

4.7.2. Road Reporting Database

The SOC will work with Maintenance Headquarters to perform the following data archiving and reporting tasks associated with the road reporting database:

- Archive the road reporting database(s);
- Create summary reports;
- Distribute reports; and
- Retrieve data.

The Information Services Division (ISD) will assume responsibility for the following:

- Ensuring that a system is in place for database backup;
- Storing the data in a safe location; and
- Providing support for the backup functions.

4.7.3. DMS

The SOC will work with the Maintenance Division (MD) offices to archive the message logs from the DMS. The Information Services Division (ISD) will assume responsibility for the following:

- Ensuring that a system is in place for database backup;
- Storing the data in a safe location; and

- Providing support for the backup functions.

4.7.4. EVMS

Maintenance Headquarters (MH) will be tasked with archiving the message logs from the EVMS, creating, and distributing summary reports. The Information Services Division (ISD) will assume responsibility for the following:

- Ensuring that a system is in place for database backup;
- Storing the data in a safe location; and
- Providing support for the backup functions.

4.7.5. MMS

Maintenance Headquarters (MH) will be tasked with archiving the message logs from the MMS, creating, and distributing summary reports. The Information Services Division (ISD) will assume responsibility for the following:

- Ensuring that a system is in place for database backup;
- Storing the data in a safe location; and
- Providing support for the backup functions.

4.7.6. ATR

The Information Services Division (ISD) will assume responsibility for the following:

- Ensuring that a system is in place for database backup;
- Storing the data in a safe location; and
- Providing support for the backup functions.

The SOC will be responsible for archiving the databases, creating summary reports of the database contents, and distributing the reports.

4.7.7. Historical Weather Data

The SOC will archive the historical weather data and employ the data to anticipate the current year's resource needs.

4.7.8. Resource Tracking Data

The SOC will be responsible for tracking resources.

4.7.9. Summary Table of Proposed Archive Data and Reporting Operations

Table 13 provides a summary of the proposed Traveler Information functions. The responsible office is indicated by the marked box. The following abbreviations are used in the table:

- SOC – Statewide Operations Center

- MD – Maintenance Division
- MH – Maintenance Headquarters
- ISD – Information Services Division
- P - Planning

Table 13: Proposed Incorporation of SOC into Data Archiving and Reporting

Data and Archiving	
Category	**Functions**
Monitoring Device Reliability/Failures	Archive device failures and maintenance ☒ SOC ☒ MD ☒ MH ☐ ISD ☐ P
Road Reporting Database	Archive databases ☒ SOC ☐ MD ☒ MH ☐ ISD ☐ P Create summary reports ☒ SOC ☐ MD ☒ MH ☐ ISD ☐ P Distribute reports ☒ SOC ☐ MD ☒ MH ☐ ISD ☐ P Retrieve data ☒ SOC ☐ MD ☒ MH ☐ ISD ☐ P Set up system for database backup ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Store archived data in safe location ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Provide support for backup functions ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P
DMS	Archive message logs ☒ SOC ☒ MD ☐ MH ☐ ISD ☐ P Set up system for database backup ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Store archived data in safe location ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Provide support for backup functions ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P

Data and Archiving	
Category	**Functions**
EVMS	Archive databases ☐ SOC ☐ MD ☒ MH ☐ ISD ☐ P Create summary reports ☐ SOC ☐ MD ☒ MH ☐ ISD ☐ P Distribute reports ☐ SOC ☐ MD ☒ MH ☐ ISD ☐ P Set up system for database backup ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Store archived data in safe location ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Provide support for backup functions ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P
MMS	Archive databases ☐ SOC ☐ MD ☒ MH ☐ ISD ☐ P Create summary reports ☐ SOC ☐ MD ☒ MH ☐ ISD ☐ P Distribute reports ☐ SOC ☐ MD ☒ MH ☐ ISD ☐ P Set up system for database backup ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Store archived data in safe location ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Provide support for backup functions ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P

Data and Archiving	
Category	**Functions**
ATR	Set up system for database backup ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Store archived data in safe location ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Provide support for backup functions ☐ SOC ☐ MD ☐ MH ☒ ISD ☐ P Archive databases ☒ SOC ☐ MD ☐ MH ☐ ISD ☒ P Create summary reports ☒ SOC ☐ MD ☐ MH ☐ ISD ☒ P Distribute reports ☒ SOC ☐ MD ☐ MH ☐ ISD ☒ P
Historical Weather Data	Archive historical weather data ☒ SOC ☐ MD ☐ MH ☐ ISD ☐ P Use to predict current year's weather and needed resources ☒ SOC ☐ MD ☐ MH ☐ ISD ☐ P
Resource Tracking Data	Track resources ☒ SOC ☐ MD ☐ MH ☐ ISD ☐ P

5. ADMINISTRATION, OPERATIONAL AND SUPPORT ENVIRONMENT

5.1. Facilities

5.1.1. Potential Candidates for SOC Location

The SOC will be located inside MDT Headquarters in Helena, MT. Four potential locations within the building were identified by the Maintenance Division Administrator:

1. Current location of the Facility Bureau behind the Customer Service desk. This location is optimal as there are two offices and a larger open space. The SOC would be set up in the larger space. The offices might potentially be used to house the SOC manager and a communications technician, or could be set up as an area from which live broadcasts could be done.

   This space is next to the MDT Customer Service desk. MDT Customer Service staff would be able to assist the SOC with answering phone calls as needed. The proposed location also has the added benefit of being situated adjacent to the building's front doors. This will make it very easy for visitors to find and access for tours or meetings with SOC staff. The fact that the proposed area has windows is also beneficial to SOC operators as they can see changing weather and take the appropriate steps with regards to checking field equipment to assess current roadway/travel conditions. Additional benefits of the proposed location include the option for future expansion. This space would be available for the SOC as the Facilities staff has plans to vacate the space in the near future.

Figure 2: MDT Facilities Bureau Offices

2. Current location of the MDT Auditing Division. Much like the first option, this space is located close to the main MDT building entrance, has windows, and has room for expansion. This space is also larger than the Facility Bureau space. The space will be available in the very near future as the Auditing Division is scheduled to move to the newly renovated Salvation Army building across the street from MDT Headquarters.

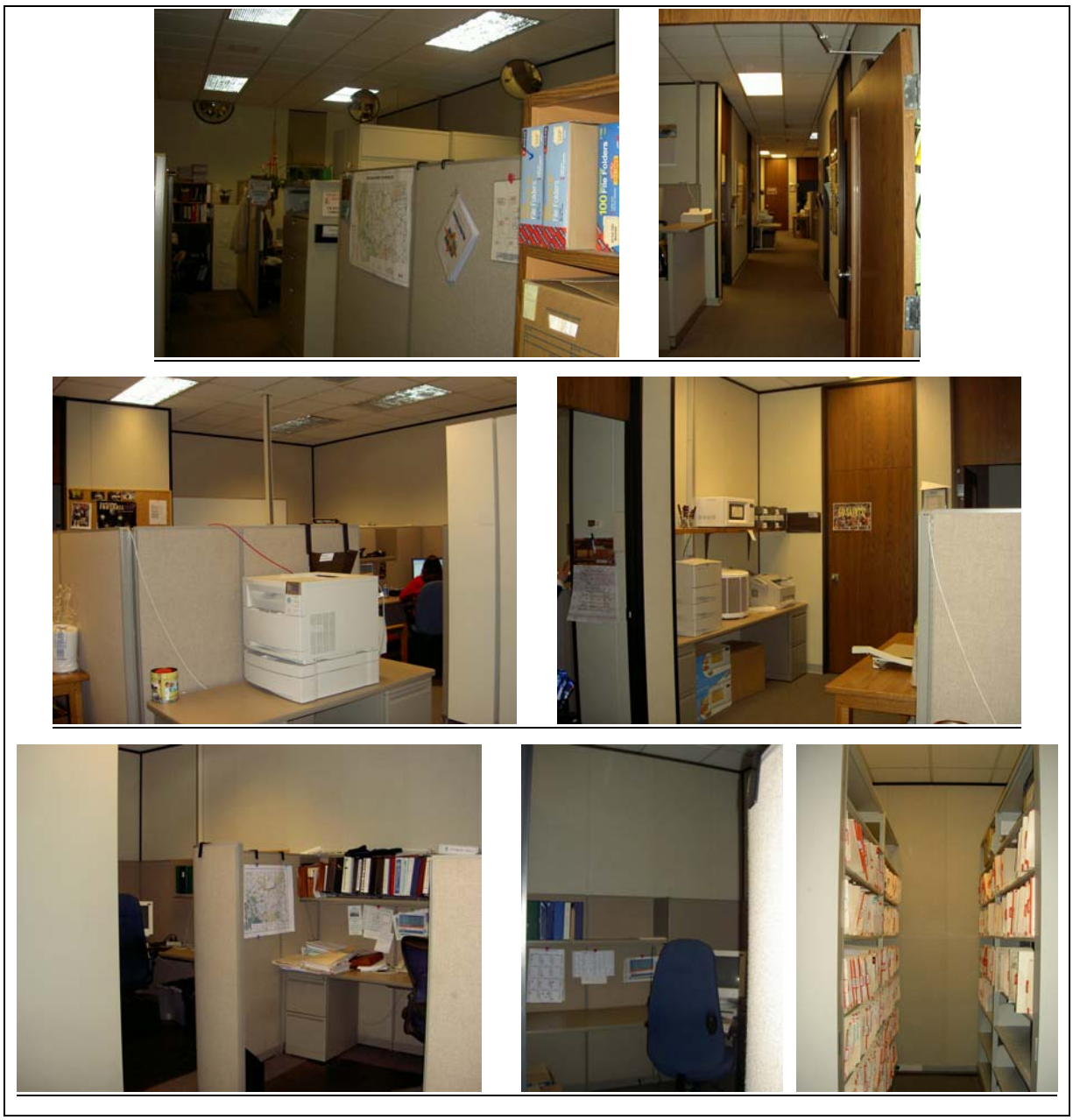

Figure 3: MDT Auditing Division Offices

3. Current Motor Carrier Services (MCS) space. The Motor Carrier's Service space is a very large space located on the back side of the first floor of the MDT Headquarters building. Windows are available in this space as well, yet it is not as conveniently located as are the first two spaces mentioned. This space was not ranked as one of the top locations for the SOC after viewing the space and comparing it to the Auditing Division and the Facility Bureau spaces. This location would also be available in the near future as Motor Carrier Services is scheduled to move to the newly renovated Salvation Army building across the street from MDT Headquarters.


Figure 4: MDT Motor Carrier Services Offices

4. Current Motor Carrier Safety and Assistance Program (MCSAP) location. This space is located in the center of the first floor of the MDT Headquarters building. It is a very small space, and has limited opportunities for expansion. This space will also be vacated soon. Photos were not available of these offices.

5.1.2. Proposed SOC Location

The Maintenance Division Administrator has stated that the Facility Bureau location is the best option for the location of the proposed SOC. Floor plans of the proposed space were not available for inclusion in this document at the time of writing.

5.2. Staffing and Hours of Operations

The Statewide Operations Center (SOC) will operate 24 hours a day, 7 days a week. Its primary role will be to provide after-hours, weekend, and holiday coverage for the District/Division offices. The SOC could also provide backup to the District/Division offices on an as needed basis.

To provide 24 hour a day, seven day a week coverage, the SOC will need staff in addition to the Traveler Information Coordinator. Number of SOC staff will vary depending on the time of year. Fewer staff will be needed during the summer as opposed to winter. A minimum of three to four full-time employees (FTE) will be needed to staff the SOC. Additional staff over and above the three to four FTE may be needed during the winter or in the case of a weather-related or incident driven event. The additional staff at the SOC will alleviate the need for temporary staff at the District/Division offices and greatly facilitate coordination efforts as SOC staff will be fully trained.

5.3. Organizational Structure

Initially, the SOC will reside in the current MDT organizational structure under the Maintenance Division Administrator's supervision. This will enable the Maintenance Division Administrator to be fully involved with all aspects of the SOC from its inception. It might make sense to transfer SOC operations to the Maintenance Division's Operations Manager for supervision in the MDT organizational structure once the SOC has been fully functional for a period of time.

The following figures illustrate the MDT Maintenance Division's organizational architecture as of January 4, 2007. Information was supplied by MDT.

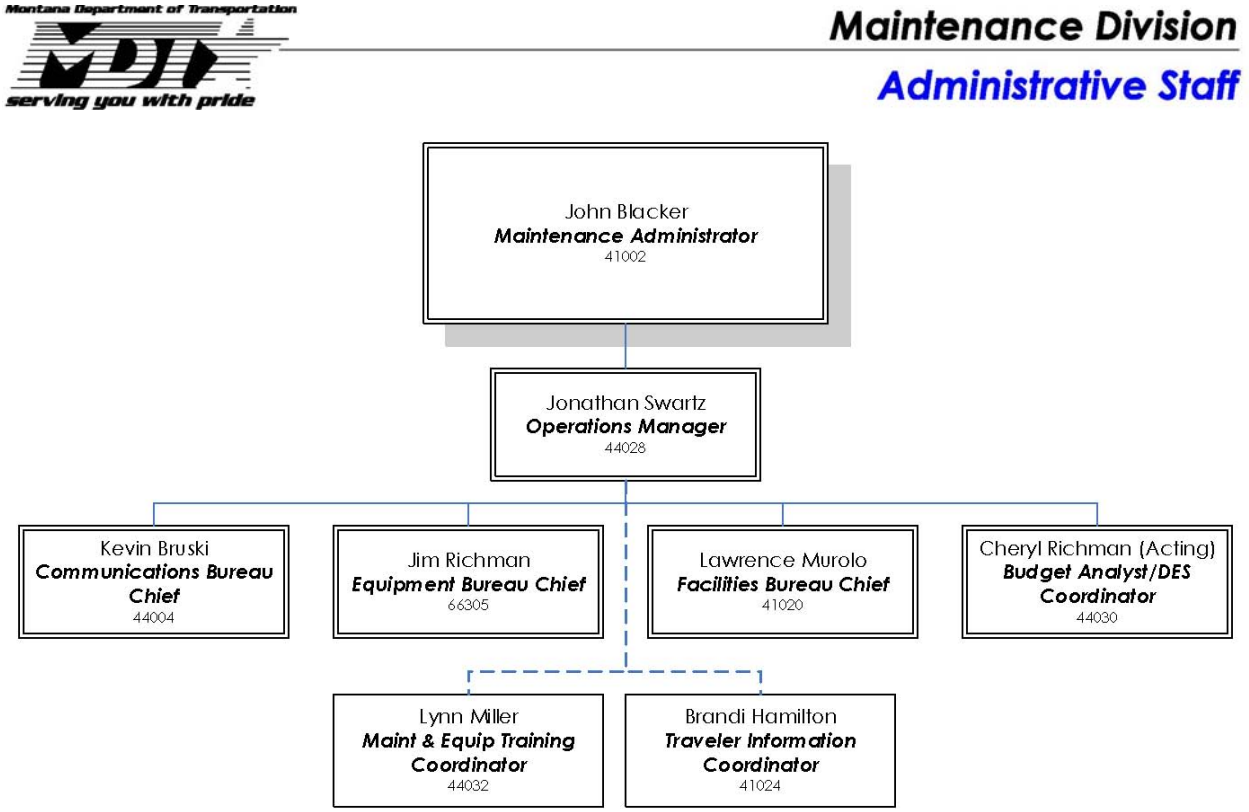

Figure 5: MDT Maintenance Division Administrative Staff

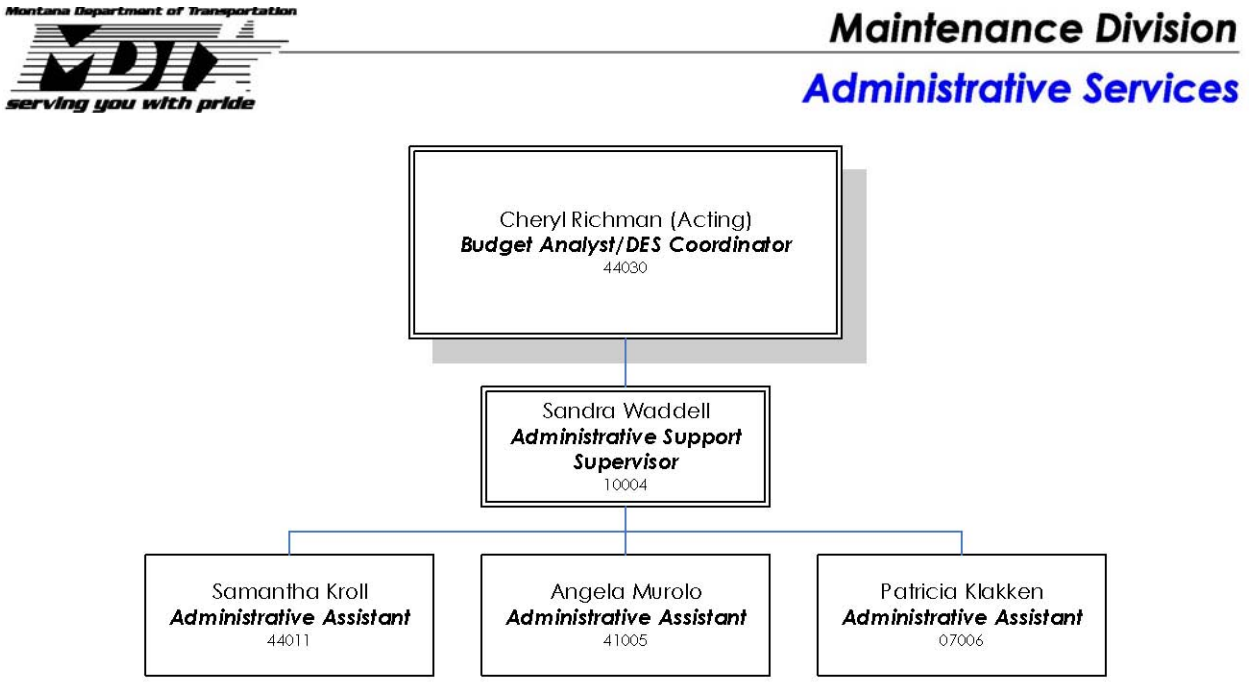

Figure 6: MDT Maintenance Division Administrative Services

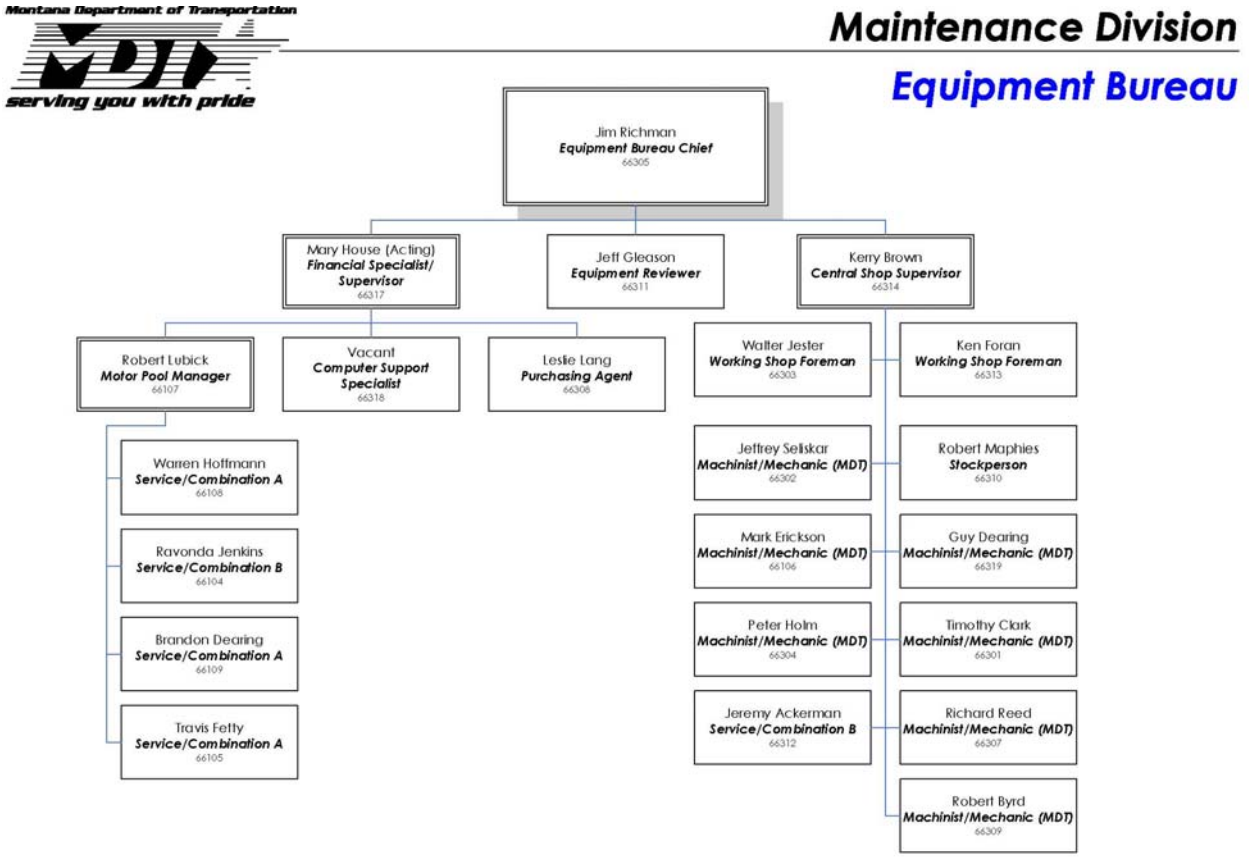

Figure 7: MDT Maintenance Division Equipment Bureau

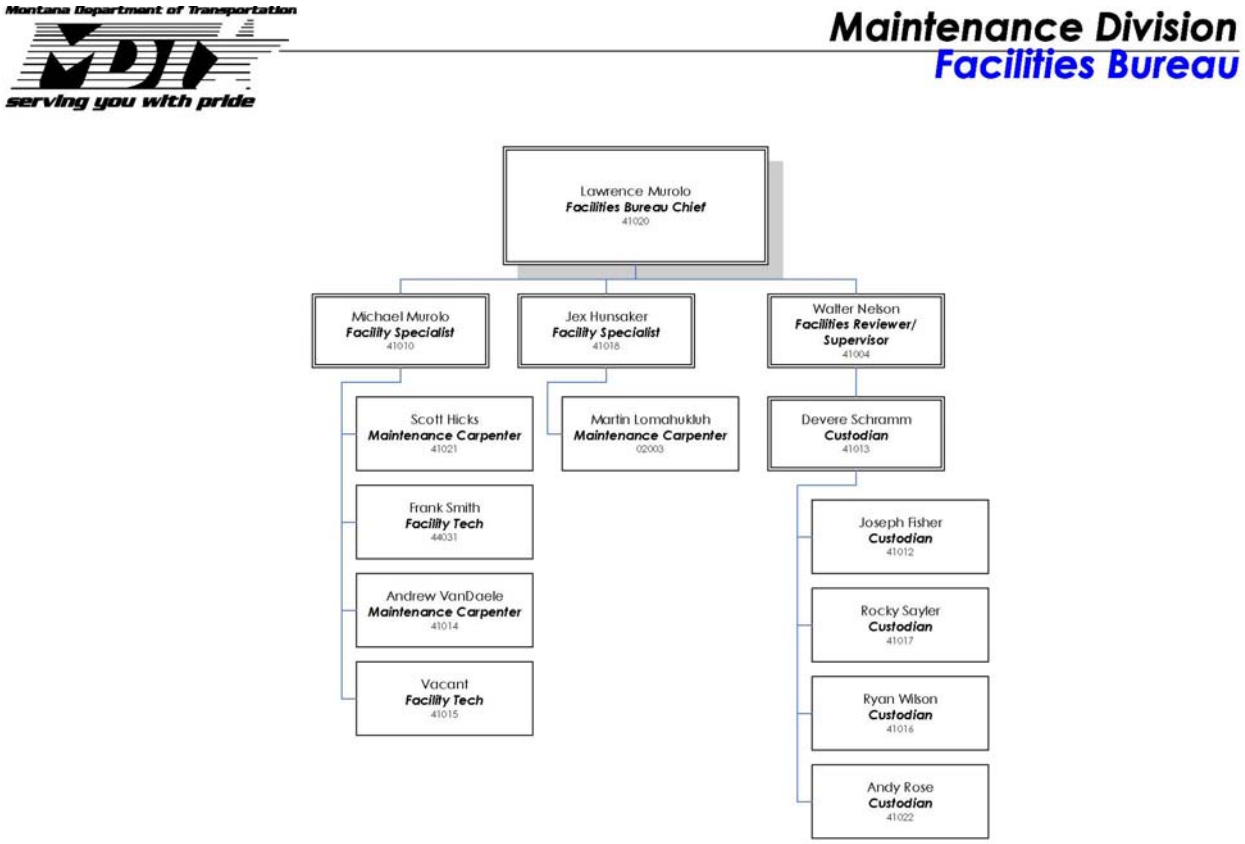

Figure 8: MDT Maintenance Division Facilities Bureau

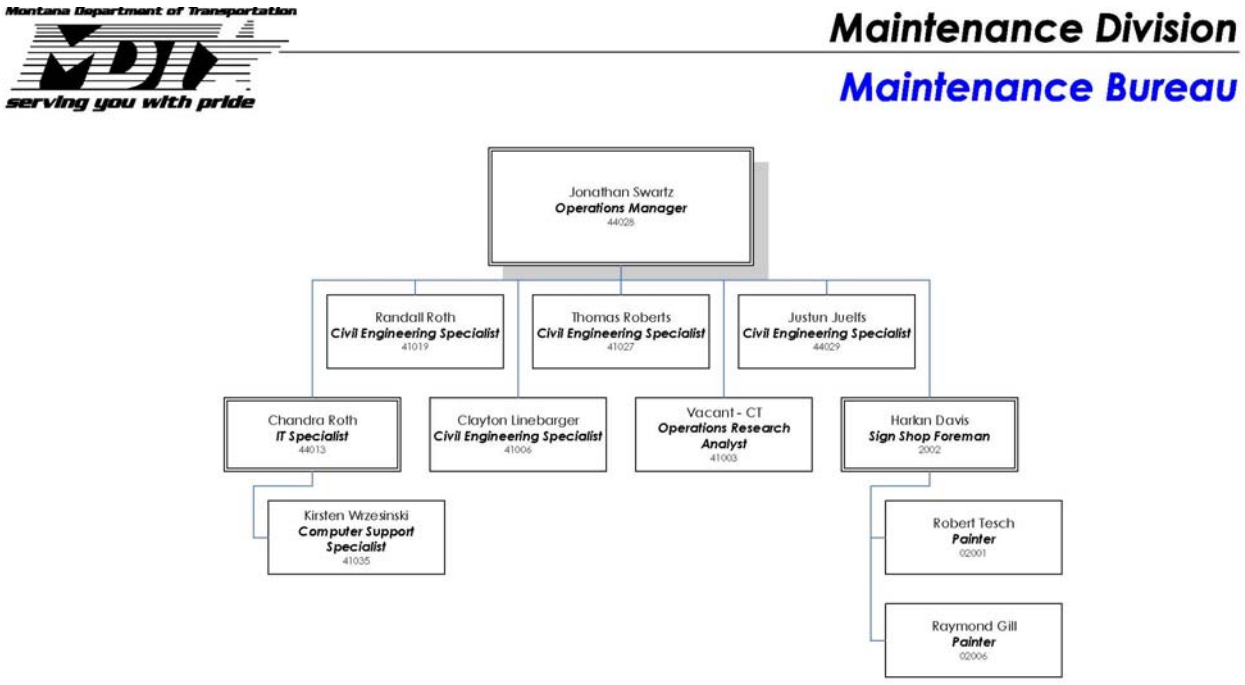

Figure 9: MDT Maintenance Division Maintenance Bureau

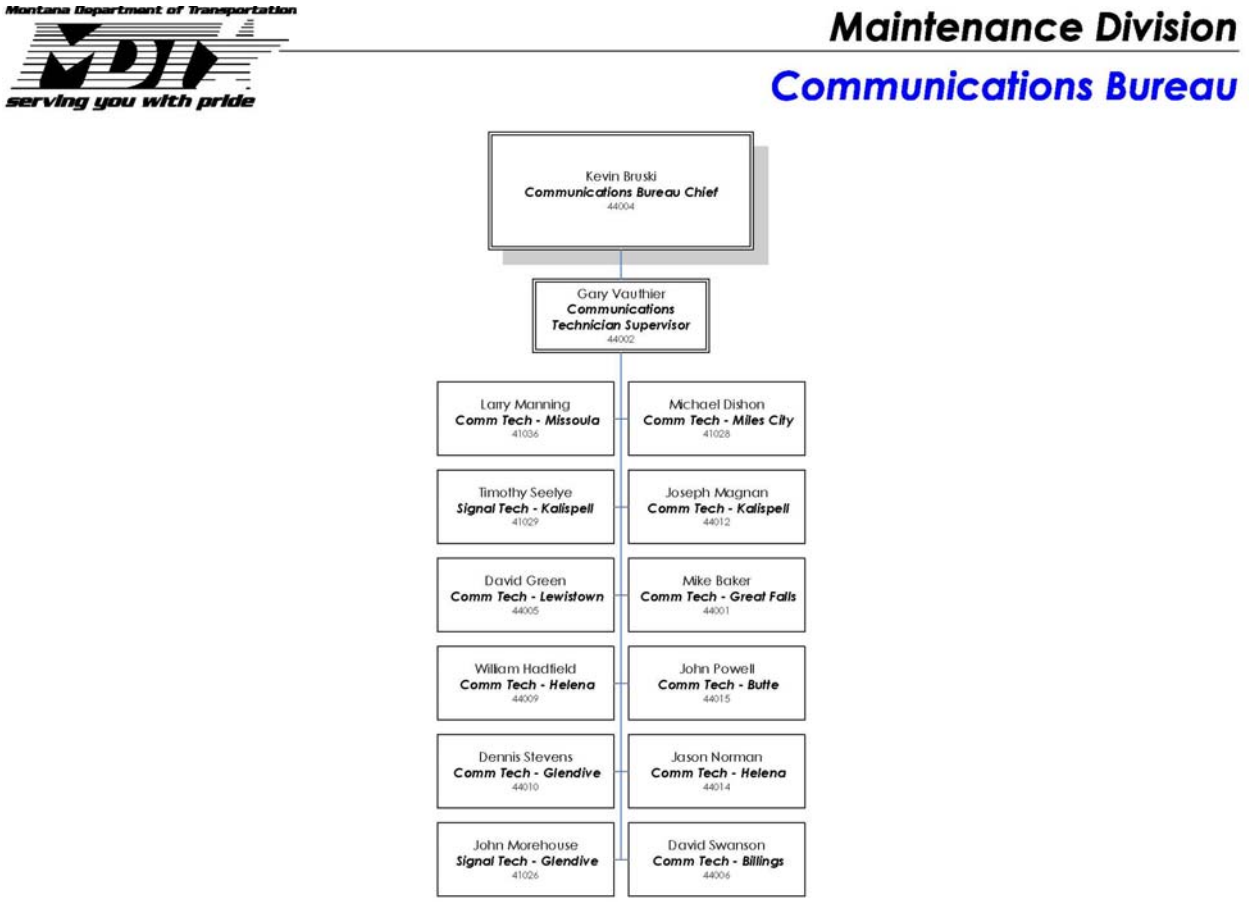

Figure 10: MDT Maintenance Division Communications Bureau

5.4. Implementation Prioritization

In order to facilitate and transition operations to an SOC, a phased approach to adding functionality to the SOC is strongly recommended. An incremental approach would be the best approach to SOC deployment. The first phase would involve the actual implementation of the SOC – i.e. occupying a space, setting up the equipment, and establishing basic functionality and operations. Future phases would include the incorporation of additional functionality and responsibility incrementally, adding more organizational options to the SOC, centralization of certain operations, expansion, and coordination with external agencies.

5.4.1. Organizational Options

Technical Memorandum #3 outlined four organizational options for the MDT SOC: the change nothing approach, the hybrid approach, the after-hours added value approach, and the centralized approach [9].

MDT opted to partially adopt the after-hours value approach. The SOC will assume District/Division responsibilities nights, weekends, and holidays. The SOC will not duplicate or assume District/Division duties during normal business hours unless specifically asked to

provide support by a District/Division office. In the future, the SOC may fully incorporate the proposed tasks in the after-hours added value approach and/or centralize operations.

5.4.2. Statewide Centralization

Centralization of the Maintenance Operations to the SOC should also occur in phases. It is recommended that the SOC assume District functions, roles, and responsibilities for one MDT district at a time rather than trying to incorporate everything at once. An incremental approach to functional and operational deployment of the SOC will facilitate the transition, and allow the Districts to see and enjoy the benefits of the SOC. The centralization of the state of Montana microwave communications network is still a work in progress. For this reason, it is suggested that Districts with existing microwave communications infrastructure be the first to be centralized into SOC operations.

5.4.3. Functions

Chapter 4 of this document outlines the means by which the SOC can help different MDT Divisions with their operations, roles, and responsibilities. This chapter takes into consideration efficiency and centralizing roles associated with ITS and maintenance operations. While the functions in this chapter may not be an exhaustive list, they represent a majority of the functions that the SOC may assume over time. It is strongly recommended that the assumption and incorporation of responsibilities and functionality by the SOC take a phased approach to ensure reliability and success. Given that the SOC will fall under the jurisdiction of the Maintenance Division, it is suggested that functions listed in Chapter 4 that are associated with Maintenance Headquarters, District, and Division offices be incorporated into SOC operations first. In the future, the SOC might assume certain operations and functionality currently associated with other MDT Divisions and Bureaus such as the Information Services Division, the Public Information Office, the ITS Coordinator, the Aeronautics Division, and the Planning Division.

5.4.4. Location Size

A lesson learned from other TMCs is that expansion was inevitable. It is therefore extremely important to ensure that any space allocated has room to incorporate future expansion and functionality. Deployment of a bare bones SOC would require a location with enough open space to accommodate desks, a wall for video displays, and the appropriate networking and communications infrastructure. However, as the SOC grows and incorporates additional functionality into its operations, additional physical and computing/networking infrastructure needs may be required. A conference room could accommodate multi-agency coordination efforts during an event, a space that could be used by the media for broadcast purposes might be considered, a network and equipment room to house the field element network and communications components will be needed, as will individual offices for the SOC Manager and the Communications Technician.

5.4.5. Agencies Involved

Previous Technical Memoranda for this project suggested collocation with other agencies. MDT opted for an initial in-house SOC deployment. MDT is willing to consider providing workspace for other agencies within the SOC in future iterations of the SOC to facilitate interagency

communications and coordination efforts. The eventual addition of a conference room in the SOC would also facilitate inter/intra-agency coordination efforts during events and emergencies.

5.5. General Equipment

Equipment needed for Phase I of the SOC consists of the following:

- **Workstation Desks and Chairs:** Desks for SOC Operators – the type of desks needed will be determined by the configuration of the SOC. The desks must be able to hold two flat screen monitors, a phone, and provide the SOC operator with ample space to work. Some TMCs have purchased ergonomic adjustable height desks. This type of desk enables the operator to stand and work if he/she chooses. Caltans District 2 Redding TMC has found this type of desk to be greatly beneficial as operators work 12 hour shifts during an event. (See Figure 11). The Oregon Department of Transportation's (ODOT) TOC in Medford, OR, also uses smaller, shaped desks for their operators. These desks are not adjustable, however.

Figure 11: Left: TMC Operator Ergonomic Desk - Redding TMC – Right: Medford TOC Operator Workstation

Arizona Department of Transportation (ADOT) (Figure 12) stations their TMC operators in U-shaped cubicles facing the video wall. The ADOT TMC is a much larger operation that the planned MDT operation, and therefore cubicles will not be necessary.

Figure 12: ADOT TMC Operator Workstation

The City of Glendale, AZ, TMC uses tiered rows of semicircular desks facing the video wall to house TMC operators (Figure 7).

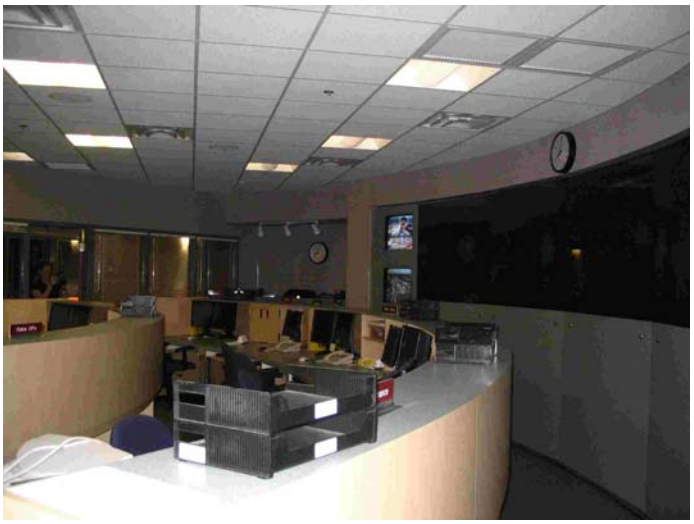

Figure 13: City of Glendale TMC Operator Workstations

WTI has also set up a simulated traffic management lab which has a large, semicircular desk for two operators positioned in front of the video displays. A third desk is located in the lab as well. All desks may easily view the video displays.

Additional Equipment

- Copy machine;
- Fax machine;
- 3 – 4 anti-static floor mats;
- Multi-line telephone system at each workstation;
- MHP radio(s);

- MDT radio(s);
- Cellular phone;
- Whiteboards and Magnetic boards;
- Maps; and
- AM/FM radio.

Phase II Deployment will incorporate a conference room and related resources, a network equipment room and related resources, and media broadcasting resources into the SOC. This phase may also involve setting up individual spaces/offices for the SOC Manager and the Communications Technician.

Note – these may not be comprehensive lists. Additional equipment may be needed.

5.6. Technical Equipment and Computer Hardware

Necessary technical equipment and computer hardware for Phase I implementation of the SOC includes the following:

- 6 to 8 computer systems with 19 inch or larger monitors. The number of computer systems purchases depends upon the number of SOC personnel hired. Two computers and monitors will be allocated to each operator workstation;
- 10 to 12 surge suppressors for the computer systems, copier, printers, and fax;
- Color LaserJet printer;
- Black and white LaserJet printer (networked);
- Four 50 inch LCD or plasma displays for video wall with necessary hardware for mounting;
- 32 – 40 inch LCD television with mounting hardware;
- Cable or satellite television service;
- Appropriate surge suppression for the 4 displays and television set;
- Network and Internet access;
- Uninterruptible Power Supply (UPS); and
- Backup generator.

Equipment Back-up

Given that the SOC might be called upon to perform critical functions during emergency situations, it is suggested that consideration is give to having back-up equipment and power supplies at some point in the future. For example, if staff use wireless communications and wireless components on a regular basis, the following items should be kept readily available:

- Large supply of replacement batteries for all equipment;
- Standard wired computer keyboards and mice, to replace wireless components if necessary; and

- Phones that do not require power.

5.7. Software

The SOC will use the software packages currently owned by MDT including the AVL, Road Condition Reporting Software (RCRS) and the DMS Central Software. MDT may choose to have copies of each software package installed on one computer at each workstation, or may opt to restrict specific software packages to certain computers. The first option might mean that MDT would have to purchase additional licenses. Individual licensing agreements will determine if MDT needs to purchase additional licenses for the software installation on multiple computers. Additionally, if the SOC takes over responsibilities for traffic signal control, MDT may want to incorporate traffic signal control servers into the SOC.

The SOC may want to consider purchasing the incident management control module that is available for the DMS Central software package or RCRS software package. This module will enable SOC operators to enter action plans for incidents into the software. In the event of an emergency, operators would know exactly who to call, and what procedures to follow, as the information/action plan would be in the computer system. This automated application would eliminate guess work for operators, facilitate incident response operations, and remove the need to manually locate and research information stored in binders. However, the binder should be done away with; up-to-date information should be maintained in a documented format for a variety of reasons, including allowing the SOC Manager to take the current binder with him/her in the event of an emergency that required MDT to vacate the premises.

Currently, MDT accesses its cameras using the web interface provided by SSI. If MDT should make the shift towards using cameras with more pan, tilt, zoom and real-time video streaming capabilities, MDT may consider specialized software for camera control. The DMS Central Software might have a module that would be appropriate for this task.

MDT might find that software utilized by other TMCs useful – particularly software that incorporated a mapping feature (state, county, District, Division, local, city, etc.) which permits the SOC operator to pinpoint the exact location of the incident on the map, and provide the operator with information such as who to contact, section and division location, etc.

MDT might also consider coordinating with the Montana Highway Patrol (MHP) to obtain a copy of their CAD software. The SOC would also need to purchase a backup system for archiving data and logs.

5.8. Operational Procedures

Statewide guidelines and procedures will be important for the SOC. Access to this type of documentation will allow the SOC to understand what actions are expected of them in certain situations and will allow them to confidently answer questions about MDT's guidelines, policies, and procedures for the public and external agencies. Document accessibility in both electronic and printed format will be important, especially during incidents or other major events. Documents should be comprehensive in nature and easy to understand. The SOC should also prepare a manual of guidelines, resources, and procedures for SOC operations. This manual should also contain call down lists and all necessary contact information.

Current MDT guidelines and procedures that the SOC will need to be able to access include, but are not limited to: AMBER Alert procedures, ITS deployment and implementation plans, MT ITS regional architecture, winter operations response plan, road condition reporting system manual and policies, call down lists, MDT emergency operations and disaster plan, special event permitting guidelines, DMS policies and procedures, and DMS messages. In the functions, roles, and responsibilities chapter of this document, it was proposed that the SOC work in conjunction with Maintenance Headquarters to create and update the statewide guidelines, policies, and procedures.

Research suggests that many TMCs rely on a program for updating their procedures, while other have dedicated staff responsible for procedure updating, maintenance, and training [10].

In addition to statewide policies and guidelines, SOC operators must be provided with reference materials such as manuals and detailed handbooks about TMC/SOC operations. The Institute of Transportation Engineers (ITE) has created a report outlining what a TMC operations manual should resemble [11]. This may serve as a good reference for the MDT SOC manual creation. The TMC Pooled Fund Study has also completed research on operations manuals that may be of use to MDT [12].

5.9. Media Coordination

In a future phase of the SOC, MDT is interested in improving communications with the media and the traveling public. There are several ways to accomplish this including having a dedicated space for media in the SOC, allowing for media broadcasts from the SOC, allowing interviews with SOC operators, and providing the media with MDT camera images/video feeds for use during broadcast.

One lesson learned from other TMCs, is to ensure that the media provides the proper acknowledgements to MDT, the SOC, and the 511 traveler information phone number during live broadcasts or when using camera images/video feeds,. This has helped tremendously in some states with marketing and creating a brand in the public eye [10].

5.10. Training

Having highly skilled and trained personnel will be key for the SOC to run properly, especially when centralizing operations. Staff will need to understand ITS as a whole, ITS operations and maintenance, key software application operation, the entire state's road network, and MDT's policies and procedures. The research for the TMC state of the practice also indicated that TMCs generally provide training in the following areas for their staff [10]:

- Emergency management;
- Computer training;
- Network certification;
- Incident management;
- Radio operations and telecommunications;
- Traffic analysis; as well as
- Partnership and team building.

MDT currently has dedicated training staff through the Maintenance Division located at MDT Headquarters. Available training programs include a maintenance academy used to train new field staff, and a maintenance mentor's program used to train maintenance staff that would like to advance organizationally to a management position. Other trainings that are available include road condition reporting system training, Dynamic Message Sign (DMS) central software training, and Maintenance Management System (MMS) training. Any combination of these trainings would be appropriate for SOC operators; however, these trainings are not comprehensive for SOC purposes. Additional training will be necessary. This may involve the creation of new in-house training programs, or contracting with an outside source.

Due to the lack of an available TMC operator training course at the national level that can be used by all states, TMCs generally create their own in-house training courses. These in-house training courses are supplemented with on-the-job training; simulation and mock-training (some with simulated workstations); certification through seminars and/or workshops; computer-based training; and contracting with outside entities such as private consultants, contractors, manufacturers, installers, and equipment and software vendors for training [10].

The Western Transportation Institute at Montana State University Bozeman's TRAIL laboratory was designed to be used as a TMC simulation and mock-training laboratory and is available to MDT for that purpose.

When the Montana Highway Patrol (MHP) centralized operations, a training program was created. MHP stated that one of the most challenging aspects of operation centralization was the training program. MHP found that having a staff member from each section train the central staff on attributes associated with their section such as roadways, local naming conventions, landmarks, and maps, was very beneficial. Another step taken to facilitate the transition to centralized operations was to incorporate centralization operations for one section of the state at a time, rather than trying to take over operations for the entire state all at once.

SOC personnel (operators, manager, and the communications technician) will also require in-depth, job-specific training relevant to the individual's role and level of responsibility in the SOC. The National Highway Institute (NHI) and Consortium for ITS Training and Education (CITE) offer online or onsite training that may be beneficial for these positions. These courses range in price from $950 for a full semester course to between $75 and $400 for an individual course per person.

The ITS Professional Capacity Building Program offers courses in conjunction with CITE, but also has catalogs on their website that list ITS education and training opportunities from U.S. Universities, ITS Training Opportunities from U.S. Vendors & Private Sector Firms, and Distance Learning Courses and Programs [13].

Courses that are relevant to the proposed job duties of the SOC Manager include:

- Rural ITS Toolbox (FHWA-NHI-137007);
- ITS Software Acquisition (FHWA-NHI-137019);
- Intelligent Transportation System Procurement (FHWA-NHI-137020);
- Managing High Technology Projects in Transportation (FHWA-NHI-137026);
- Introduction to National ITS Architecture (FHWA-NHI-137015);

- Deploying the National Intelligent Transportation System Architecture (FHWA-NHI-137013);
- Turbo Architecture Software Training (FHWA-NHI-137029A);
- Principles and Tools for Road Weather Management (FHWA-NHI-137030);
- Integrated Transportation Management for Small- and Medium-Sized Communities (FHWA-NHI-137043);
- Improving Highway Safety with Intelligent Transportation Systems (FHWA-NHI-137044);
- Computerized Traffic Signal Systems (FHWA-NHI-133010);
- Traffic Signal Design and Operation (FHWA-NHI-133028);
- Managing Traffic Incident and Roadway Emergencies (FHWA-NHI-133048: 1-Day and FHWA-NHI-133048A: 2 Day);
- Advancing Transportation Systems Management and Operations (FHWA-NHI-133098);
- Managing Travel for Planned Special Events (FHWA-NHI-133099A: 1-day and FHWA-NHI-133099: 2-Day);
- Fundamentals of ITS and Traffic Management - full semester course (CITE Course);
- ITS Applications and Management - full semester course (CITE Course);
- Advanced Signal Systems (CITE Course);
- Deploying ITS: Strategic Planning and Implementation (CITE Course);
- Fundamentals of Database Management Systems (CITE Course);
- Improving Highway Safety with ITS (CITE Course);
- Incident Management and Emergency Management (CITE Course);
- Interoperability: ITS System Architecture and Standards (CITE Course);
- Introduction to the National ITS Architecture (CITE Course);
- Managing High Technology Projects in Transportation (CITE Course);
- Transportation Management (CITE Course);
- Rural ITS (CITE Course);
- The Tools of ATMS (CITE Course); and
- Traffic Signal Timing (CITE Course).

Courses that are relevant to the job duties of the SOC Communications Technician include:

- ITS Telecommunications Overview (FHWA-NHI-137005);

- Configuration Management (CM) for Traffic Management Systems (FHWA-NHI-137042);
- Advanced Telecommunications Technology (CITE Course); and
- Introduction to Telecommunications Technology (CITE Course).

Both NHI and CITE also offer certificate programs. Currently, NHI only has two available certificate programs, neither of which would be relevant for SOC personnel. CITE has three programs available that are relevant. These include ITS Project Management, Traffic Engineering and Operations, and ITS Systems. To complete these certificate programs, three core courses, two elective courses, and a bonus course must be completed. Most of these courses are ones that are references above as relevant for these two positions.

ADOT requires their operators to participate in extensive on-the-job training, ride with construction and maintenance personnel, and work with Highway Patrol dispatchers. All operators must also be certified prior to staffing the control room on their own. Training takes approximately six months. The ADOT TOC also has a four level career path which provides TOC staff an opportunity for advancement within the organization.

The Florida Department of Transportation (FDOT) District 4 offers a two-week training program for TMC operators called SMART. The training program provides both hands-on and text-book learning opportunities. Operators progress from theory and observation to practical, to hands-on learning modules [14]. Operator trainees use training consoles to learn the various software applications employed by the TMC. ITS system functionality is fully explained. Daily tests are administered to gauge a trainee's comfort level with equipment and software. Trainees are observed and must pass written and practical tests. At the end of the second week, trainees are assigned a mentor with whom they work in the TMC. All operators are provided regular training opportunities. Operators are required to participate in exercises and watch presentations twice a year. The cross-training is attended by TMC operators and Road Rangers to allow the two groups an opportunity to gain insight into the unique challenges and responsibilities of each group. Additional training for operators includes a day spent as an observer with a Florida Highway Patrol (FHP) trooper, and another day spent in the field with FDOT Maintenance personnel [14]. Additionally, operators visit other TMCs in the region and the FHP Communications Center. There is also an established career path which assists with operational efficiency and aids with operator retention [15].

The California Polytechnic (Cal Poly) University at San Luis Obispo offers a thirty-six hour training course for TMC operators through a unique partnership between the California Highway Patrol (CHP), the California Department of Transportation (Caltrans), and Cal Poly. This program exposes TMC operators and CHP troopers to TMC operations and equipment in a simulated environment and allows the two agencies to interact and gain a better understanding of each agency's roles and responsibilities [16]. However, this training is geared more towards metropolitan applications and traffic management schemes.

The Federal Highway Administration in conjunction with the Georgia Institute of Technology has prepared resources in the form of documentation entitled "*Guidelines for TMC TMOT Staff Development*" and "*TMC Operator Requirements and Position Descriptions*". These documents are available at http://tmcops.gtri.gatech.edu/background_home.php.

Although a single, all encompassing training program for rural TMC operations does not exist, there are training options, documentation, and resources available for reference to MDT. MDT might wish to develop an in-house training course for SOC operators.

5.11. Remote Access

Remote access to field element devices will be an important tool for the SOC. The ability to access devices remotely enables SOC operators to check for failures, ascertain communications, and ensure accuracy and reliability. It is strongly recommended that the SOC utilize an IP based communications network approach with their field elements. There are several advantages to having directly accessible IP field elements, including:

- Diagnostic capabilities;
- The ability to quickly add elements or features to elements;
- Remote configuration upgrade capabilities;
- The ability to access devices from any location;
- The relative stability of the IP infrastructure and Ethernet connections; and
- Remote access, testing, and troubleshooting capabilities.

An IP based network would enable the SOC to run an asynchronous parallel process such as querying an RWIS station without affecting the operation of any other device on the network. Adding another low bandwidth element by connecting it via Ethernet would be simple and powerful. The California Department of Transportation District 2 ITS Engineer employed IP to obtain the imagery from cameras and export it to the web. One of the primary benefits of IP is maintaining connections. Connections are made on an as needed basis, controlling communications costs.

An IP based network would enable the SOC to remotely connect to the device and perform maintenance, upgrades, and troubleshooting. This saves a great deal of time and money given the remoteness of some ITS node locations [17].

5.12. Institutional Arrangements

Many of the Traffic Management Centers that were interviewed for this project indicated that even though institutional coordination with other agencies can be challenging, it is crucial to the success and operation of the TMC. In some cases, as a means to facilitate coordination, external agencies share space in TMC with the Department of Transportation.

Collocation of the MDT SOC in the Montana Highway Patrol building was one of the options provided to MDT in the previous document that was not selected; however, MDT is not adverse to the idea of collocation; rather, it is not the best option for MDT for the first phase of the SOC deployment. It has been noted by MDT that they would like to propose collocation at their facility in the future.

Other institutional arrangements may exist in addition to collocation. One role that the SOC will be tasked with will be to act as the single point of contact for outside agencies and communications requests. Traveler information and incident coordination efforts will be provided to external agencies through the SOC. Additionally, should external agencies need to

contact an individual at the DOT, the request will be routed through the SOC who will then provide the requested information or contact information.

The SOC will also be responsible for partnering with other agencies to provide traveler information to the public. Examples include MDT's current partnership with the Department of Justice on AMBER Alerts, the partnership with Disaster and Emergency Services, and transit agencies.

Future phases of the MDT SOC include expanded resources and functionality such as a conference room facility equipped with additional phones and network jacks to facilitate interagency coordination efforts during emergencies. Utilizing the SOC for emergency or incident coordination efforts will provide collaborating external agencies with access to camera imagery and information from ITS devices for public notifications.

An additional institutional function of the SOC will be to coordinate the operation and maintenance of the ITS devices. The SOC will act as the point of contact for coordination with external agencies requesting the use of MDT ITS devices. One such example of a coordination effort would be Glacier National Park (GNP) requesting that certain messages be posted to the DMS located near the park.

The SOC will also coordinate ITS deployment by external agencies on MDT roadways. Glacier and Yellowstone National Parks have both proposed deploying ITS devices such as DMS and Highway Advisory Radio (HAR) on MDT roadways. The SOC will be responsible for coordinating the paperwork that the agencies need to fill out and will serve as the point of contact for questions or issues as they arise.

5.13. Security

Security is a very important issue that should be carefully considered. Material being displayed on the computers and/or displays, or discussed among the operators and outside agencies, may be legally sensitive and could raise liability issues for MDT without appropriate security and privacy measures for the SOC. Security considerations for the SOC should include both building security and information (computer) security.

The potential SOC location within MDT Headquarters will allow for controlled access to the SOC computers, desks, and any displays that might be used by the SOC. Visitors should be required to sign in at the front desk at the entrance and be escorted to the SOC by one of the SOC staff. To access the SOC rooms, MDT might consider having personnel use an identity card that is swiped over a reader mounted outside of the door(s). Computer access must be restricted to SOC personnel. The SOC might consider operating on a separate subnet of the MDT computer network.

Securing communications and access to field elements is also a key consideration. Using an IP based communications network will facilitate securing the field element network and devices. Each element would be assigned a unique IP address and communications restricted to authorized users. A strong encryption method should also be employed for certain types of communications.

6. SUMMARY AND NEXT STEPS

This concept of operations document has described the high-level capabilities of the proposed MDT Statewide Operations Center. The report addressed the six questions of a concept of operations as detailed below:

- Who: The SOC will benefit MDT as a whole by providing accurate, timely, reliable, and comprehensive traveler information services 24 hours a day, seven days a week thereby enhancing road safety and promoting safer travel. The SOC will also enhance MDT's overall operations and public image and serve as a central point of contact for the public and external agencies.

  The internal MDT stakeholders that would benefit most from an SOC are the District and the Maintenance Divisions as it is proposed that the SOC would take over night, weekend, and holiday responsibilities and provide back-up for these two entities during normal business hours.

  In the future, the SOC would also benefit the Maintenance Headquarters, Planning Division, ITS Coordinator, Aeronautics Division, Information Service Division, and Public Information Officer by assuming some of their ITS responsibilities.

  The SOC will benefit external agencies such as Montana Highway Patrol and the Department of Disaster Services by providing a 24 hour 7 day a week year round source of contact for coordination efforts.

- What: Current MDT Operations were outlined in Technical Memorandum #1 and 3 as well as in Chapter 3 of this document. The current functions were then reviewed to determine which of these the SOC could feasibly assume. These tables are shown in Chapter 4.

  In order to start small and ensure success it was recommended that the SOC start by assuming those tasks in the Maintenance Headquarters, Maintenance Division, and District described in Chapter 4, and save the other entity functions for future phases of the SOC.

- When: This answer will be depend solely on MDT. The actual schedule for deployment will be determined by MDT and depend heavily on funding and space constraints.

- Where: The proposed location for the SOC is at MDT Headquarters in the current Facility Bureau location behind the Customer Service desk. The Facilities Bureau will be moving out of this location in the near future, making it available to the SOC.

  The benefits of this location include the proximity to the Customer Service desk. This would enable the Customer Service staff to assist the SOC with answering phone calls as needed. Additional appealing attributes of the space for the SOC location include the following:

  - The close proximity to the MDT Headquarters' main entrance would facilitate visitor access;
  - Windows would afford the SOC operators to view changing weather conditions; and

- Room for future expansion.

- Why: The SOC is needed to help manage, operate, and maintain the growing number of ITS devices that MDT owns. It is also needed to more efficiently run night, weekend, and holiday maintenance operations. This centralization for after-hours activities and coordination efforts will relieve some responsibilities from the District and Division offices that have a hard time finding, retaining, and training temporary staff.

  Benefits to MDT associated with establishing an SOC include:

  - Accurate, timely, reliable, and comprehensive traveler information to the traveling public 24 hours a day, seven days a week. This would enable the traveling public to make informed decisions regarding travel and enhance roadway safety;
  - Designating a central point of contact for the public and external agencies; and enhancing overall MDT operations and MDT's public image.

- How: The proposed MDT Statewide Operations Center (SOC)'s vision is to act as a "clearinghouse or single-point-of-contact for roadway information/needs" while the mission is "to serve the public by providing a higher level of service, accuracy, and safety."

  Along with the vision and mission of the SOC, this report addresses the staffing and hours, equipment, software, hardware, operational procedures, media coordination, training, remote access, institutional arrangements, and security that will be needed by the SOC in order to successfully deploy. These are addressed in Chapter 5 of this document.

The next steps for the MDT SOC include securing the location for the SOC, purchasing the needed equipment, creating a training program, creating process and procedure manuals, creating contact list binders, and hiring additional staff.

APPENDIX A

This appendix is provided as a convenience for MDT when purchasing equipment for the SOC.

Phase	Equipment	Check When Purchased
Phase I	Workstation desk	
	Workstation chair	
	Fax machine	
	3 – 4 anti-static floor mats	
	Copy machine	
	Multi-line telephone system at each workstation	
	MHP radio(s)	
	MDT radio(s)	
	Cellular phone	
	Whiteboards and Magnetic boards	
	Maps	
	AM/FM radio	
	2 computer systems with 19 inch or larger monitors per SOC operator	
	10 to 12 surge suppressors	
	Color LaserJet printer	
	Black and white LaserJet printer (networked)	
	Four 50 inch LCD or plasma displays for video wall with	

	necessary hardware for mounting	
	32 – 40 inch LCD television with mounting hardware	
	cable or satellite television service	
	Appropriate surge suppression for the 4 displays and television set	
	Network and Internet access	
	Uninterruptible Power Supply (UPS)	
	Generator	
Future Phases	Conference room	
	Network and Equipment room	
	Media Broadcasting room	
	Individual rooms for SOC Manager and Communications Technician	

8. REFERENCES

1 Developing and Using a Concept of Operations in Transportation Management Systems – May 2004

2 Strong, C. and J. Eidswick, *Montana Regional Architecture*. Western Transportation Institute at Montana State University Bozeman. March 2005.

3 http://mdtinfo.mdt.state.mt.us/maint/programs/winter-mtc.shtml

4 http://mdtinfo.mdt.state.mt.us/maint/programs/trav_info.shtml

5 Email from Mike Bousliman on 8/29/05 "RE Quick question"

6 http://mdtinfo.mdt.state.mt.us/dir/

7 http://www.mdt.state.mt.us/misc/mission.shtml

8 http://www.mdt.state.mt.us/general/2007goals_objectives.shtml#directory

9 Lassacher, Suzanne and Eidswick, Jaime. Statewide Operations, June 2006.

10 Fox, Leann, Lassacher, Suzanne, Eidswick, Jaime. TMC State of the Practice. April 13, 2006.

11 An Annotated Outline for a TMC Operations Manual: An Informational Report. [www.ite.org/m&o/tmc.asp]

12 Transportation Pooled Fund Study [www.pooledfund.org]

13 ITS Professional Capacity Building Program [www.pcb.its.dot.gov]

14 http://www.smartsunguide.com/Tr_Training.aspx

15 http://www.smartsunguide.com/ppt/SMARTOperator.ppt#300

16 http://www.chp.ca.gov/programs/perspectives/per02-21.html

17 Lassacher, Suzanne, Graham, Sean, and Hayden, Larry. Caltrans District 2 Redding Traffic Management Center Documentation. September 2006.