

MDT Traveler Information Reporting System Requirements Analysis

by

Sean Graham, Research Associate
Doug Galarus, Senior Research Associate
Jaime Eidswick, Research Engineer

Western Transportation Institute
College of Engineering
Montana State University

A report prepared for the
Montana Department of Transportation

April 20, 2007

DISCLAIMER

The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the Montana Department of Transportation or Montana State University.

Alternative accessible formats of this document will be provided upon request. Persons with disabilities who need an alternative accessible format of this information, or who require some other reasonable accommodation to participate, should contact Kate Heidkamp, Assistant Director for Communications and Information Systems, Western Transportation Institute, Montana State University-Bozeman, PO Box 174250, Bozeman, MT 59717-4250, telephone number 406-994-7018, e-mail: KateL@coe.montana.edu.

ACKNOWLEDGEMENTS

The authors would like to thank Brandi Hamilton and Mike Bousliman for their guidance in writing this document, particularly the background information and editorial review assistance that they provided. Thank you also to Suella Chapman for walking us through the existing road condition reporting system.

GLOSSARY OF ABBREVIATIONS

AP	Associated Press
AVL	Automated Vehicle Location
CAD	Computer Aided Dispatch
D of A	Department of Administration
DMS	Dynamic Message Signs
DOT	Department of Transportation
ETO	Emergency Travel Only
EVMS	Equipment Vehicle Management System
FHWA	Federal Highway Administration
GNP	Glacier National Park
GPS	Global Positioning System
I	Interstate
ISD	Information Services Division
ITSD	Information Technology Services Division
MCS	Motor Carrier Services
MDT	Montana Department of Transportation
MHP	Montana Highway Patrol
MMS	Maintenance Management System
MT	State Highway
MTBF	Mean Time Between Failure
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PDA	Personal Digital Assistant
RCRS	Road Condition Reporting System
RFP	Request for Proposal
RWIS	Road Weather Information System
SLA	Service Level Agreement
SRS	Software Requirements Specification
SSI	Surface Systems, Inc
TBD	To Be Decided
TIS	Transportation Information System

US Federal Non-Interstate Highway
YNP Yellowstone National Park

TABLE OF CONTENTS

1.	Introduction.....	1
2.	Methodology.....	2
2.1.	Current Reporting System Description.....	2
2.2.	Identify Stakeholder’ Challenges.....	2
2.3.	Identify Stakeholder Needs.....	2
2.4.	Vision and Scope	3
2.5.	Software Requirements Specification Background	3
2.6.	Data Definitions and Requirements	3
2.7.	Functional Requirements of the System Features.....	3
2.8.	Other Requirements	3
3.	Current Reporting System Description.....	4
3.1.	Reporting System Overview	4
3.2.	Winter Road Condition Information.....	6
3.3.	Construction / Maintenance Information	8
3.4.	Incident Information	9
3.5.	Spring Thaw Load and Speed Restriction Information	9
3.6.	Facility Information	10
3.7.	Information Dissemination	10
4.	Identify Stakeholder Challenges.....	17
4.1.	Separate Reporting Systems	17
4.2.	Montana Roadway System/TIS System.....	17
4.3.	Reporting System Speed/Volume	17
4.4.	Functions Available	18
4.5.	Notification	20
4.6.	Archiving	20
4.7.	Software/Hardware	21
4.8.	IT Maintenance	21
4.9.	Map Challenges	22
4.10.	Report Challenges.....	23
4.11.	Training Challenges.....	24
4.12.	Procedural Challenges	25

5.	Identify Stakeholder Needs.....	26
5.1.	Separate Systems	26
5.2.	Montana Roadway System/TIS System.....	26
5.3.	System Speed/Volume	27
5.4.	Functions Available	27
5.5.	Notification	30
5.6.	Archiving	30
5.7.	Software/Hardware	31
5.8.	IT Maintenance	31
5.9.	Map Needs	32
5.10.	Report Needs.....	33
5.11.	Training Needs.....	34
6.	Vision and Scope	36
6.1.	Vision Statement.....	36
6.2.	Scope.....	36
7.	Software Requirements Specification (SRS) Background	48
7.1.	SRS Purpose.....	48
7.2.	SRS Organization.....	48
8.	Data Definitions and Requirements	50
8.1.	DataDef.System	50
8.2.	DataDef.Lists	51
8.3.	DataDef.Contexts.....	58
8.4.	DataDef.Events	61
8.5.	DataDef.Facilities	65
8.6.	DataDef.Alerts	66
9.	Functional Requirements for system Features.....	68
9.1.	General Data Entry, Modification, and Deletion Interface Requirements.....	68
9.2.	Event, Facility, and Alert Data Entry, Modification, and Deletion Requirements.....	73
9.3.	Features.ReportGeneration	100
9.4.	Features.PublicInterface.....	116
9.5.	Features.PrivateInterface	120
9.6.	Features.Notification.....	126
9.7.	Features.UserAdministration	128

9.8.	Features.DataManagement.....	131
10.	Other Requirements	136
10.1.	Other.HostingRequirements.....	136
10.2.	Other.ExternalInterfaceRequirements	136
10.3.	Other.UserInterfaces	137
10.4.	Other.HardwareInterfaces	137
10.5.	Other.SoftwareInterfaces	137
10.6.	Other.CommunicationsInterfaces	138
10.7.	Other.PerformanceRequirements.....	138
10.8.	Other.UsabilityRequirements.....	140
10.9.	Other.InstitutionalRequirements.....	143
11.	Summary and Next Steps.....	144
11.1.	Summary	144
11.2.	Next Steps	154
12.	References.....	155

LIST OF TABLES

Table 1: Stakeholders for Traveler Requirements Reporting System Project 2

Table 2: Road Conditions Reporting System, Roles and Responsibilities 6

Table 3: MDT Local Phone Number (RACOM) Roles and Responsibilities 14

Table 4: 511 Traveler Information, Roles and Responsibilities 16

Table 5: Use Cases for New Reporting System..... 37

Table 6: User Class Descriptions..... 41

LIST OF FIGURES

Figure 1: Road Condition Reporting System, Operational Concept..... 5
Figure 2: MDT Local Phone Number (RACOM), Operational Concept 13
Figure 3: 511 Traveler Information Phone Number, Operational Concept..... 15

EXECUTIVE SUMMARY

Montana Department of Transportation's (MDT) Road Condition Reporting System (RCRS) is used to disseminate traveler information via reports, a website map, local phone numbers, and 511. The current RCRS uses separate Oracle-based systems for winter and summer reporting. The winter system is capable of storing information on road conditions, winter road closures, emergency travel only advisories, and chain requirements. The summer system stores construction and maintenance projects, incident information, load and speed restrictions for spring thaw, and facility information.

Over the years, many challenges have been identified with these two systems, including, but not limited to:

- the reporting systems are too complex and need to be simplified,
- there is an occasional need to use both systems at once in transitional seasonal periods,
- staff must know shortcuts and operations procedures for two systems, and
- The system lacks automation and sufficient functions.

It is envisioned that the solution to the identified challenges is to create a new RCRS to meet MDT's needs. MDT contracted with the Western Transportation Institute at Montana State University to conduct a requirements analysis for a new reporting system. Initially, WTI developed a detailed description of the existing systems, then conducted stakeholder meetings to document challenges with the existing systems and identify user needs.

From this information, WTI developed a vision and scope for a RCRS system. The vision describes one reporting system capable of storing all of the information in the current systems, as well expanding to meet the growing technology needs of a DOT. The new system should be easier for the inexperienced road reporter to operate, have more automated features such as notification and verification, and allow for more concise and user friendly displays of information to the public.

The scope for the new RCRS is a system that will:

- Facilitate the entry, storage, and reporting of road-related traveler information covering the MDT road network for the entire state of Montana.
- Integrate with other systems such as 511 and the MDT Web Server.
- Potentially integrate with field elements such as RWIS, cameras, and DMS.
- Potentially integrate with systems of other agencies.

Requirements for the new RCRS were also created. Requirements were developed to guide both data definitions and system features. Primary system features include:

- The system allows for the data entry and modification of construction and maintenance projects, road conditions, spring thaw load and speed restrictions, incidents, special events, rest areas, weigh stations, border crossings, and alerts.
- The system shall facilitate the generation of reports, both automatic (scheduled) and on-demand. The system shall allow authorized users to edit reports.

- The system shall facilitate a public interface to traveler information. This interface will consist of sub-interfaces focusing on interactive maps and on reports.
- The system shall facilitate a private interface to traveler information. These interfaces will display all information available to the public and also information that may not be intended for public viewing such as internal comments, fatalities, etc.
- The system shall facilitate notification of entities when certain events are entered within the system.

With the completion of Phase One, Phase Two will review the current options that exist for MDT to create this new database. Their options are to update the current RCRS, create a new RCRS from scratch, or purchase an “off-the-shelf” product with some modifications. Phase Two will examine the requirements and address which of the “off-the-shelf” products have the capabilities outlined in this requirements document, thereby providing MDT with a document comparing the capabilities of the current “off-the-shelf” products, as well as guidance for development of an RFP.

1. INTRODUCTION

The Montana Department of Transportation (MDT) has long recognized a need to update the current traveler information reporting systems that are used to feed data to the website, 511, and notifications to the public through fax and email.

Currently there are two traveler information reporting systems: one for winter road reporting (created in 1998) and one for summer road reporting (created in 2001). The winter system is capable of storing information regarding road conditions, winter road closures, emergency travel only advisories, and chain requirements. The summer system is capable of storing information regarding construction and maintenance; incident information; load and speed restrictions for spring thaw; and facility information.

Having two separate reporting systems for road reporting creates several challenges for MDT personnel, such as learning the operation procedures and shortcuts for two different systems. In addition, there are certain periods of the year when staff members may need to use both reporting systems at one time (e.g. in October when construction and winter weather can occur simultaneously in Montana). Along with challenges due to the separate reporting systems, there are also limitations within each reporting system due to insufficient functionality and automation.

In order to determine the next steps for a more efficient and integrated reporting system, MDT contracted with the Western Transportation Institute at Montana State University to conduct a requirements analysis for a new reporting system. This report documents Phase One, a requirements analysis that includes the determination of stakeholder needs and formalization of the requirements for a new reporting system. Phase Two will include the identification of off-the-shelf reporting system vendors that currently exist, a review of these reporting systems, a comparison of these reporting systems to MDT's requirements for a new reporting system from Phase One, and documentation of the benefits and drawbacks of each off-the-shelf reporting system, as well as those of a custom reporting system developed for MDT. The results of these two phases will allow MDT to create a Request For Proposal (RFP) to purchase a new reporting system.

2. METHODOLOGY

This section outlines the steps that were followed to document the requirements for the new reporting system. These steps correspond to subsequent chapters in this document.

2.1. Current Reporting System Description

This section describes the current MDT reporting systems including information collected by the winter system; information collected by the summer system; operational concept roles and responsibilities; and information dissemination.

The information described in this chapter was assembled by reviewing the Montana Statewide Architecture (1); the summer (2) and winter system (3) manuals; and minutes from meetings with the Traveler Information Coordinator and the Butte Road Reporting Staff.

2.2. Identify Stakeholder' Challenges

Prior to specifying a new reporting system, it is important to understand challenges with or limitations of the existing reporting system. This includes identifying functions in the current reporting system that do not work well, and also functions that do not exist in the current reporting system, but would be beneficial.

To identify stakeholder challenges with the current reporting system, WTI met with several groups of MDT staff members (listed in Table 1). Some discussions were conducted in conjunction with meetings regarding the Statewide Operations Center (i.e. Traffic Management Center) project.

Table 1: Stakeholders for Traveler Requirements Reporting System Project

Stakeholder	Meeting Date
Traveler Information Coordinator	November 22, 2004
IT and Maintenance Staff	December 17, 2004
Butte Road Reporting Staff	February 18, 2005
Miles City, and Wolf Point Maintenance Divisions and Glendive District	February 22, 2005
Butte and Bozeman Maintenance Divisions	February 23, 2005
Montana Highway Patrol	February 23, 2005
Missoula and Kalispell Maintenance Divisions	February 25, 2005
Great Falls and Havre Maintenance Division	February 24, 2005
MDT Headquarters Stakeholders	February 28, 2005
Billings and Lewistown Maintenance Division	March 8, 2005

2.3. Identify Stakeholder Needs

Based on stakeholder challenges, the research team compiled a list of user needs for the new reporting system. This list was used to create subsequent reporting system requirements. Further requirements were created by analyzing and documenting necessary and prospective functionality for this reporting system.

2.4. Vision and Scope

The research team, in consultation with MDT, developed a vision and scope for the reporting system to be eventually developed as a result of this project. The vision describes in a broad way the desired capabilities, and the scope describes in more detail anticipated or desired features of the system. The scope includes examples of use cases, potential user classes, business rules, business terms, and major features of the proposed Road Condition Reporting System (RCRS).

2.5. Software Requirements Specification Background

Researchers created a Software Requirements Specification (SRS) to organize and document requirements for the new reporting system. The SRS not only addresses the observed benefits and drawbacks of the current reporting system, but it documents in detail the necessary and prospective functions of a new reporting system. Sufficient detail was documented so that existing products could be evaluated and compared as possible solutions and so that necessary enhancements to these products could be identified. In the event that these products do not fulfill the expressed requirements, this specification will provide a framework for specifying the necessary features and functionality that must be added to the products or built from scratch to satisfy stakeholder' needs.

2.6. Data Definitions and Requirements

The team developed high level definitions for RCRS traits. These traits will be referenced by one or more of the subsequent requirements.

2.7. Functional Requirements of the System Features

Researchers developed functional requirements for each of the system features that are expected to be included in the new RCRS.

2.8. Other Requirements

The team identified additional requirements of the system other than those required by the primary features. These include hosting capabilities, external interfaces, user interfaces, hardware interfaces, software interfaces, communication interfaces, performance, usability, legal issues, and apportioned requirements.

3. CURRENT REPORTING SYSTEM DESCRIPTION

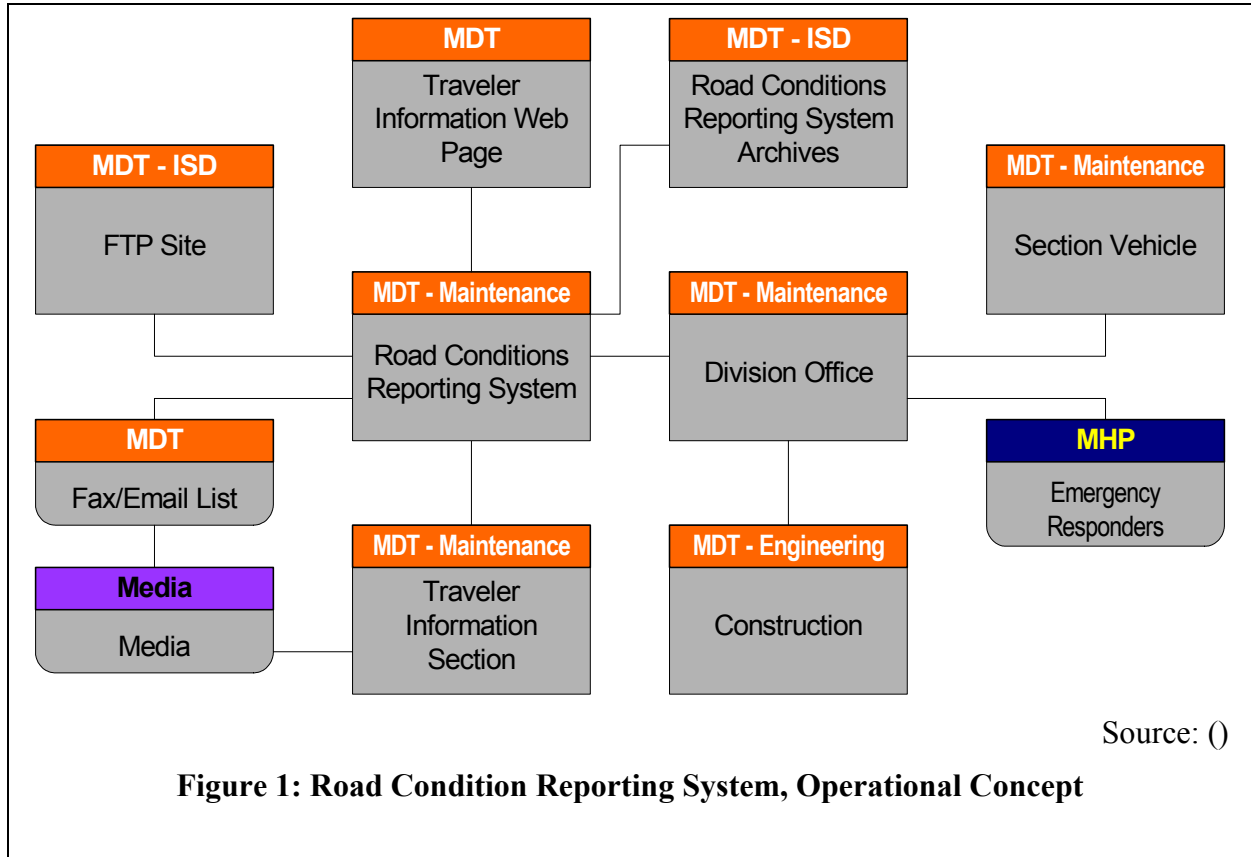
MDT currently has two traveler information reporting systems that provide information to devices such as 511, Montana's traveler information phone number; RACOM, MDT's local traveler information phone systems; the MDT website; and also to fax and email notifications that are distributed to the public and other agencies.

3.1. Reporting System Overview

MDT currently uses separate Oracle-based systems for winter and summer reporting. The winter system is capable of storing information regarding road conditions, winter road closures, emergency travel only advisories, and chain requirements. The summer system is capable of storing information regarding construction and maintenance; incident information; load and speed restrictions for spring thaw; and facility information. The general season for winter road condition reporting is October through April and the general season for construction reporting is April through October. However, this information is provided year round if applicable. (i.e., if there is a construction project in March it will be reported). These reporting seasons were established to correspond to daylight savings time. There are also separate testing/training systems that nearly replicate each of these reporting systems.

The winter and summer reporting systems are integrated with MDT's Transportation Information System (TIS). TIS is a system that contains information about roadbeds, segment lengths, coordinates, etc. It contains sign routes (the name that the public knows for routes); base routes (the old internal naming convention within MDT that labeled road as P-routes for primary and S-routes for secondary); and corridor routes (the new internal naming convention within MDT that labels roads with a C followed by a six digit number).

As defined in the Montana Statewide Architecture, the operational concept for the Road Conditions Reporting System (i.e. both the winter and summer systems) is shown in Figure 1.



The roles and responsibilities associated with this reporting system are shown in Table 2.

Table 2: Road Conditions Reporting System, Roles and Responsibilities

Stakeholder	Responsibility
Section Vehicle	<ul style="list-style-type: none"> • Collect road conditions information • Communicate road conditions information to division office • Make recommendations regarding chain requirements of emergency travel only (ETO) restrictions
Construction	<ul style="list-style-type: none"> • Provide construction information to road reporters
Emergency Responders	<ul style="list-style-type: none"> • Provide incident information to road reporters when applicable
Division Office	<ul style="list-style-type: none"> • Collect road conditions information from vehicles • Enter road conditions information, chain requirements, emergency travel only (ETO) restrictions, incidents, and load and speed restrictions.
Traveler Information Section	<ul style="list-style-type: none"> • [Status screen updates with a check mark as each division finishes reporting on all road condition segments in their division.]
Road Condition Reporting System	<ul style="list-style-type: none"> • Collect road conditions information, chain requirements, emergency travel only (ETO) restrictions, incidents, and load and speed restrictions from divisions. • Transmit information to FTP site, web page, and fax/email distribution list.
Road Condition Reporting System Archives	<ul style="list-style-type: none"> • Archive road condition reporting system information and reports.

Source ()

3.2. Winter Road Condition Information

The winter system is primarily weather-related, and reflects observations of road crews. It is capable of storing information regarding road conditions, winter road closures, Emergency Travel Only (ETO) advisories, and chain requirements.

The information for the reporting system is entered by road reporters in the division offices. This winter information is collected as follows:

- “Road condition information reflects observations of snow plow drivers. Scheduled, staggered polling is initiated at approximately 6 AM and 1 PM every day by the division road reporter. The division road reporter calls each section within their maintenance division and each snow plow driver within that division via two-way radio. ()” The road reporters first write down the information reported to them on a polling sheet. The polling sheet is a hard copy form used by each office and customized for each division. Each includes predefined segments and allows road reporters to record pre-defined condition numbers and descriptions for each segment. When staff members enter this information into the reporting system, they are asked to report only the worst condition that describes the segment.

- “ETO / closures and chain requirements are recommended by a plow driver within a section. The plow driver will call the Maintenance Chief (at the division level) and recommend that an ETO restriction, closure, or chain requirement be put into effect. The final decision as to whether this restriction is enacted is up to the Maintenance Chief. The Maintenance Chief then provides this information to the division road reporter. ()”

To input this information into the reporting system, road reporters must fill in the following fields:

- Division Number – One of the ten division numbers must be input.
- Temperature – Enter the current temperature.
- Current Weather – Enter the current weather (e.g. snowing).
- Rptd – This field is used to indicate that the segment has been reported on. A reporter must change the N (for no) to Y (for yes).
- Remarks - Used to input information useful to the motorist that is not part of the pre-defined conditions. This is an open field and anything can be written in here. Examples of use for the remarks section include “areas of slush” and “high profile vehicles not advised.” A checkbox is shown to indicate whether the remarks information should be displayed on the Internet map; it is not however included in 511 messages.
- Clear – This button is used to clear the previous conditions reported for a segment. This must occur before updated conditions can be entered. It should be noted that segments must always have a reported condition
- Road Condition Number – This is where road reporters enter the information collected from the field. Reporters may enter as many conditions as they feel necessary, and all of them will show up on the text report. One line condition (general weather condition along entire road segment) must be entered. Point conditions (isolated condition, i.e. rock slide) are indicated on the condition reference card by a dot. The associated description will be input accordingly (e.g. 18 = emergency travel only). Lastly, a new enhancement to the reporting system allows for the inclusion of travel direction (i.e. NB and SB for when only one travel direction is affected by chains, etc).
- Map – This is a manual toggle that must be used if reporters want the conditions to appear on the map. Reporters are only allowed to map two point conditions and one line condition regardless of how many were entered above for road conditions.
- Quality – This is currently not used.
- Quantity Min and Max - Allows for the entry of quantities, where appropriate (i.e. snow amounts).
- Check Segments – Prior to the information being saved in the reporting system, the road reporter must click this button which then allows the reporting system to verify that all segments in that division have been reported.

3.3. Construction/Maintenance Information

Construction project managers provide their project information to the road reporters on Wednesdays or as changes occur. To input this information into the reporting system, road reporters must fill in the following fields:

- Project Type - Either maintenance or construction
- Project ID - These numbers are pulled from the project status table for construction and from the Maintenance Management System (MMS) for maintenance.
- Division Number – One of the ten division numbers must be input. Note that this reporting system will not let construction or maintenance projects cross maintenance division boundaries.
- Project Start Date – The date that the project starts must be input.
- Sign Route – This is chosen from a list; then the corresponding corridor route and roadbed are filled in accordingly.
- Alternate Route Name – This is an open field that allows names that are better known to the public to be used (e.g. North Main Street rather than the route number). This also allows roads not in TIS to be reported on. If this field is used, a sign route can also be filled in, but is not required. A corridor route, however, is required regardless of whether the alternate route name is used.
- Maintenance Section Numbers – One of the 123 section numbers is then entered.
- Beginning and Ending Mileposts – Project beginning and ending mileposts must be entered. Note that these mileposts must fit within the corridor mileposts for that sign route and division.
- Project Status - Options include active, inactive, or completed. Only active projects are reported on 511. Others are disregarded when the vendor pulls the information from the ftp site. Active and inactive projects are both listed on the report; however, completed projects only show up on the report for one week after completion.
- Location Description – A description of the location should be input. This is a description that is easier for travelers to understand than mileposts. This information is used on the reports (e.g. 20 miles east of Bozeman).
- Start Reporting Date - This can either be the current date or a date in the future.
- End Reporting Date - The date the project was completed.
- Remarks - Additional information for the traveler can be put in this open field (e.g., “There is a signed truck detour in place”).
- Work Type - These are pre-defined work type descriptions/details. They can either pick them from a list or type in the number associated with the work type. More than one work type can be input. The work type list also includes the roadway restrictions (i.e. detours, width restrictions, speed reductions, etc).

3.4. Incident Information

“Incident information is collected via calls to the road reporters by Montana Highway Patrol or through section staff on the roadways. (1)” To input this information into the reporting system, road reporters must fill in the following fields:

- Incident ID - The ID number is automatically generated by the reporting system when an incident is saved.
- Incident Description – This is an open field for entering a description of the incident.
- From Date and To Date – The date the incident occurred and when it is expected to end are entered.
- From Time and To Time - The time the incident occurred and when it is expected to be cleared is entered.
- Division Number - One of the ten division numbers must be input.
- Sign Route - This is chosen from a list; then the corresponding corridor route and roadbed are filled in accordingly.
- Begin and End Milepost – Incident begin and end mileposts must be entered.
- Start and End Reporting Date - Start date is the current date. End date is when the incident is over.
- Location Description - A description of the location should be input. This is a description that is easier for travelers to understand than mileposts. This information is used on the reports (e.g. 20 miles east of Bozeman).
- Remarks - Additional information for the traveler can be put in this open field (e.g. “There is a signed detour in place”).
- Work Type – This includes details defining whether it is an accident (i.e. a car crash), an incident (e.g. fire, hazardous spill, etc), or a special event. Restrictions such as detours are also entered under this category. “Incident” currently is a catch-all. They do not appear on a map and are not shown on 511. The 511 vendor discouraged the presentation of incidents on 511, because of concerns that users would be frustrated unless MDT could provide more information than just the fact that an incident had occurred. The incident information, while not on 511 or the map, is in written report form on the website.

3.5. Spring Thaw Load and Speed Restriction Information

“Load and speed restrictions are decided by the Maintenance Chief or Superintendent. These load and speed restrictions are due to spring thaw (i.e. load and speed restrictions due to construction will show up only on the construction report.) This information is provided to road reporters on Wednesdays. (1)” To input this information into the reporting system, road reporters must fill in the following fields:

- Division Number - One of the ten division numbers must be input.
- Sign Route - This is chosen from a list; then the corresponding corridor route and roadbed will be filled in accordingly.

- Alternate Route Name - This is an open field that allows names that are better known to the public to be used (e.g. North Main Street rather than the route number). This also allows roads not in TIS to be reported on. If this field is used a sign route can also be filled in, but is not required. A corridor route, however, is required regardless of whether an alternate route name is used.
- Begin and End Milepost – Load and speed restriction begin and end mileposts must be entered.
- Location Description - A description of the location should be input. This is a description that is easier for travelers to understand than mileposts. This information is used on the reports (e.g. 20 miles east of Bozeman).
- Load Limits – Road reporters enter the reduced load size within each of the following categories: single-axle load limit, tandem-axle load limit, limit per inch tire width, max limit per single axle, and max limit per tandem axle. The standard restrictions are 8 and 16 tons.
- Speed Limit – The reduced speed due to the restriction.
- Effective Date – The following Monday’s date.
- Map Attribute – Theoretically, this will allow the route to show up on the map. Reporters must type in the number for either a load restriction, speed restriction, or both. However, they are currently not using this feature because there is no map built to show spring thaw load and speed restrictions.
- End Date – This is the date when the restriction is to be taken off the reporting system.
- Remarks - Additional information for the traveler can be put in this open field (e.g. “There is a signed truck detour in place”).

3.6. Facility Information

Facility information is currently not entered, but the following fields exist:

- Rest Area – A rest area is chosen from the list.
- From Date – The date the rest area will begin being opened or closed.
- To Date – The date the rest area will be closed or re-open.
- Remarks - Additional information for the traveler can be put in this open field (e.g. “This rest area will be closed until further notice due to drain field problems.”)

3.7. Information Dissemination

The information collected by the winter and summer systems is currently disseminated to the public via reports which are emailed and faxed and also placed on the website; the website map, RACOM; and 511.

3.7.1. Reports

The reports that are currently created include:

- **Statewide Concise Road Conditions Report** – This report includes road condition information, closures, emergency travel only advisories and chain requirements. The roads in this report include: Interstates, US Highways, and Montana State Routes. This report is automatically created and posted to the website and is also sent to the distribution list at 6:30 AM and 2:30 PM every day after polling is completed. The Associated Press (AP) and the National Oceanic and Atmospheric Administration (NOAA) are sent reports on a different time schedule. The AP receives this information at 6:30 AM, 6:50 AM, 7:30 AM, 10 AM, 3 PM, 4 PM, and 9 PM and NOAA receives this information once an hour starting at 6:50 AM. The report is updated on the website every half an hour; however, new reports are not sent to the distribution list.
- **Statewide Detailed Road Conditions Report** – This report includes road condition information, closures, emergency travel only advisories and chain requirements. The roads in this report include: Interstates, US Highways, Montana State Routes, Secondary Routes, and Seasonal Roads. This report is automatically generated and posted on the website every half an hour.
- **Area Road Conditions Reports** – There are eleven of these reports created, one for each of the ten maintenance divisions and one for the Helena area. These reports include road condition information, closures, emergency travel only advisories and chain requirements. The roads in this report include: Interstates, US Highways, Montana State Routes, Secondary Routes, and Seasonal Roads located within the area. This report is generated by the road reporters as needed, and then they are allowed to add additional information prior to saving it.
- **Construction/Maintenance Report** – This report is generated by the Traveler Information Section on Thursdays, posted to the website, and faxed/emailed to the construction report distribution list.
- **Incident Report** – This report is automatically created and posted to the website anytime an incident is added or deleted.
- **Road Closure and Emergency Travel Only (ETO) Report** – This report is automatically created and posted to the website anytime a closure or ETO is added or deleted. Currently only closures and ETOs due to road conditions are in this report (i.e. closures due to construction or incidents are not in this report).
- **Spring Thaw Load and Speed Restrictions Report** – This report is generated by the Traveler Information Section, posted to the website, and sent to the distribution list on Wednesdays. However, the information in this report does not go into effect until the following Monday, and is relevant for one week. When these restrictions are deleted/completed, they will be displayed on the report for one more week saying “return to statutory.”

All of the reports are archived every thirty minutes. The automation of reports and sending them to the website at one point could be overridden and done manually/forced in case of a failure.

For email/fax distribution, there is a distribution list/profile within the reporting system that indicates what reports to send, who the reports go to, what form they are sent in (e.g. email, fax, etc.), and the contact info (e.g. email address, fax number, etc.). These reports are emailed/faxed automatically as a text file with the exception of those sent to the Associated Press (AP). AP receives manual faxes from IT staff due to their specific formatting and time requirements. It was noted that there have been problems with these emails due to firewalls and origination points.

Automatic faxing is implemented using a product from a vendor named Omtools.

3.7.2. Notification

In addition to the dissemination of reports to public distribution lists, four other current types of notification exist.

First, when road reporters complete entry of polling information into the winter road condition reporting system, they verify that all of the segments have been reported. Once this information has been verified, a status screen update indicates that the information has been reported. This screen displays the time, date, and person who updated the information. This status screen is used by headquarters as a notification to verify that all of the divisions have updated their information before the road condition reports are created.

Secondly, when road reporters update winter road conditions between polling times, they must manually send an email to the road reporter distribution list stating that they have updated conditions, which segments have been updated, and what the corresponding conditions are.

Third, when road reporters enter the construction/maintenance information for the week or when they make updates, they manually email the construction reporter distribution list to notify them of information updates.

Lastly, each district has a list of local contacts who must be notified in the case of certain events. Currently this information is stored in a binder, and these people are contacted manually.

3.7.3. Website Map

The map that currently exists on MDT's website is comprised of a total of six maps and seven images, one being the legend. This map only provides road conditions information. There is no construction map and data such as rest area locations are listed in text format on a separate page, but not displayed on the map. The map allows the selection of each of the five MDT districts for individual, zoomed viewing.

Conditions are color coded and include line conditions such as icy and snow-packed and point conditions such as high winds and watch for fallen rock. The map is generated using information from the winter system.

Although the map is created in-house and managed by the IT staff, the Traveler Information Coordinator has the ability to change map segment attributes such as solid/dashed, color, thickness and to add road segments via the administrative menu.

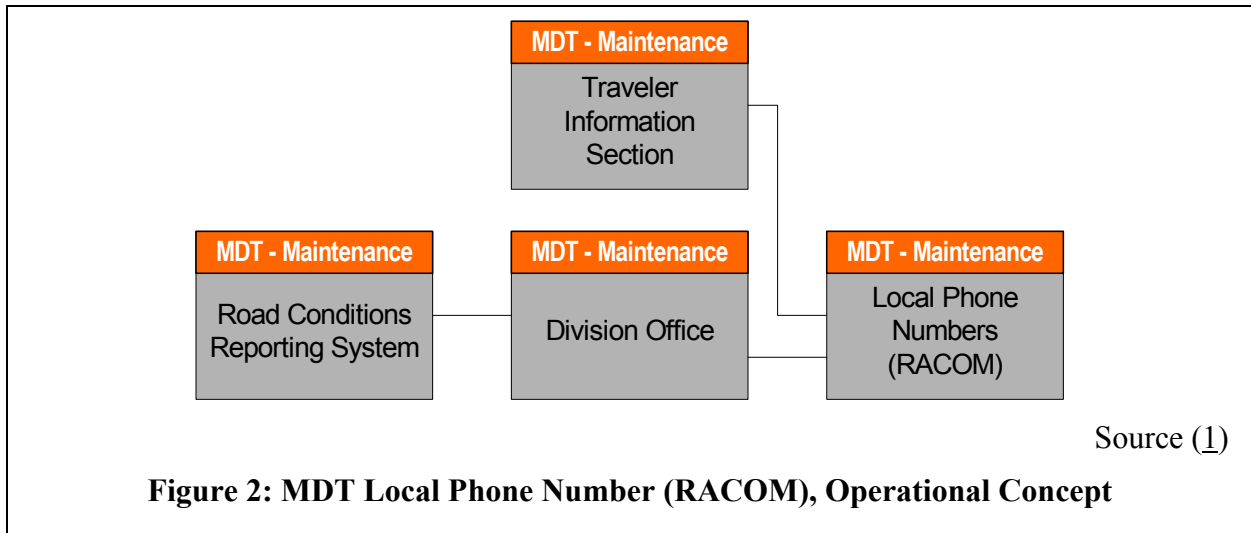
In addition to the in-house road condition map, there is also a map created by the 511 vendor that resides on their website, www.safetravelusa.com. This map contains all of the information that is currently being reported on 511 including road conditions, weather forecasts, construction, etc. To request further information on a road segment, users click on the segment, and a text description is displayed on the right hand side of the screen. This text is identical to the message on the 511 phone system.

3.7.4. RACOM

MDT currently has eleven local phone numbers, one for each maintenance division and one for Helena, that provide travelers with road conditions, closures, emergency travel only advisories, and chain requirements for that area. This information is taken from the area road reports

generated by the reporting system and is manually recorded by a road reporter in each division and the Traveler Information Section in Helena. The messages are recorded onto a RACOM unit which operates in a manner similar to a voice mail system.

As indicated in the Montana Statewide Architecture, the operational concept for the MDT local phone numbers (RACOM) is shown in Figure 2.



The roles and responsibilities associated with the MDT local phone numbers (RACOM) are shown in Table 3.

Table 3: MDT Local Phone Number (RACOM) Roles and Responsibilities

Stakeholder	Responsibility
Road Conditions Reporting System	<ul style="list-style-type: none"> ▪ Provide an area specific report that includes construction, road conditions, emergency travel only, closures, and chain requirements for roads in that area
Traveler Information Section	<ul style="list-style-type: none"> ▪ Record the Helena report on the local phone number based on the area report produced through the road condition reporting system
Division Office	<ul style="list-style-type: none"> ▪ Record the division reports on the local phone numbers based on the area reports produced through the road condition reporting system
Local Phone Numbers (RACOM)	<ul style="list-style-type: none"> ▪ Accept the recordings from the division offices and traveler information section ▪ Allow callers to receive the information

Source (1)

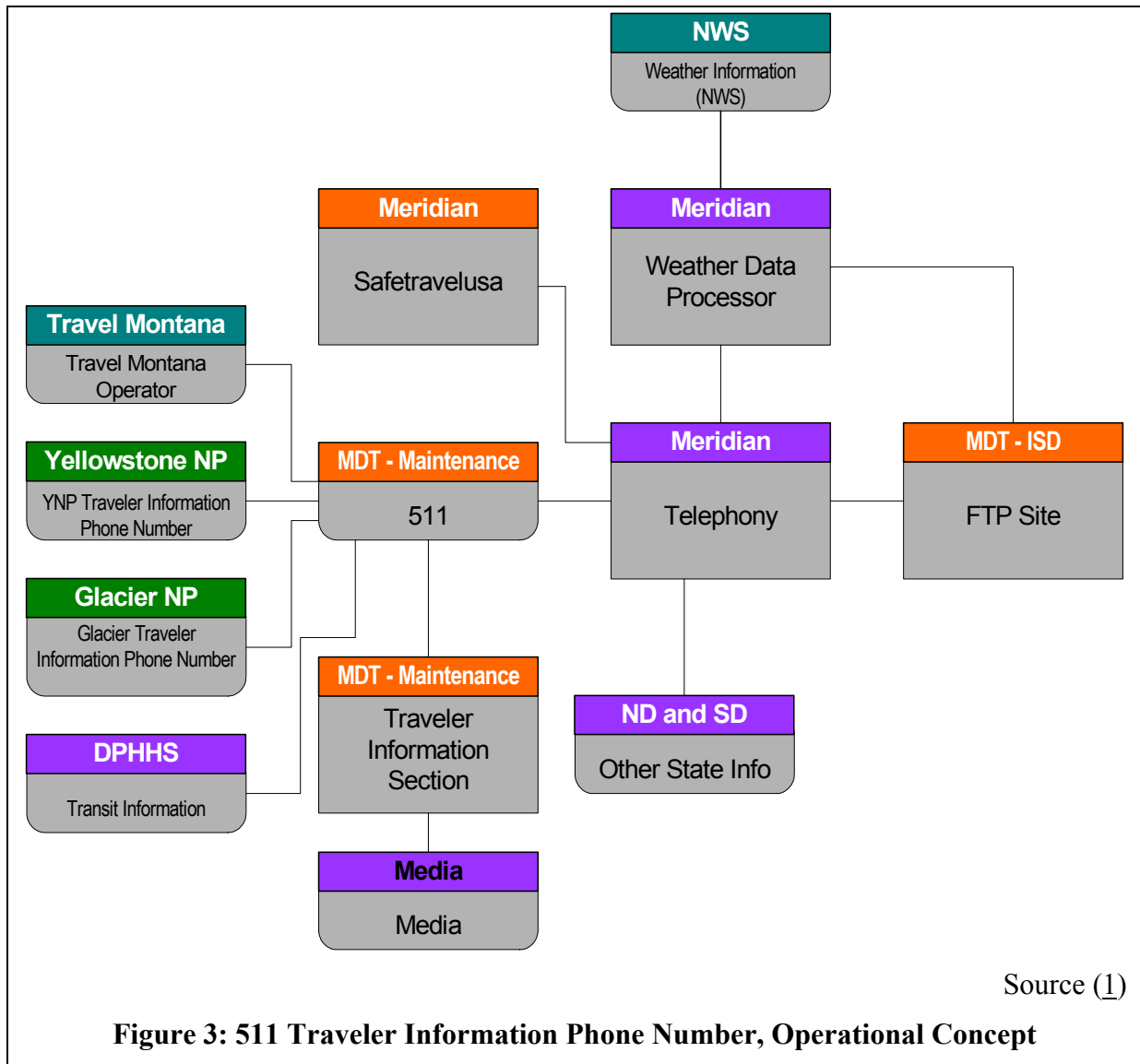
3.7.5. 511

The 511 system in Montana provides callers with information on road conditions, emergency travel only advisories, closures, chain requirements, construction/maintenance activities, information about surrounding states (information is available for North and South Dakota; however, only phone numbers are provided for Idaho and Wyoming), weather forecasts, Glacier National Park information and alerts (i.e. AMBER, homeland security, and general travel). The weather forecasts are provided by the 511 vendor and therefore are provided year-round.

The road conditions, emergency travel only advisories, closures, chain requirements, and construction/maintenance activities are extracted from the summer and winter systems. The reporting systems automatically post this information onto the MDT FTP site every ten minutes. The 511 vendor then downloads this information and updates the 511 system and the vendor website, www.safetravelusa.com.

Planned enhancements to the 511 system include adding regional reports which will replace the local RACOM phone numbers, information from the incident reports, information from Yellowstone National Park, the ability to transfer to a Travel Montana operator, and transit information.

This operational concept from the Montana Statewide Architecture for the 511 system is shown in Figure 3.



The roles and responsibilities associated with this 511 system are shown in Table 4.

Table 4: 511 Traveler Information, Roles and Responsibilities

Stakeholder	Responsibility
National Weather Service	<ul style="list-style-type: none"> ▪ Provide weather information and forecasts to Meridian
Meridian Weather Data Processor	<ul style="list-style-type: none"> ▪ Collect information from RWIS server and NWS ▪ Create segment based forecasts ▪ Send forecasts to telephony for inclusion on 511
MDT FTP Site	<ul style="list-style-type: none"> ▪ Poll construction, incident, statewide and detailed road conditions, road/pass closures emergency travel only, and load and speed restriction information from the database ▪ Allow Meridian telephony to access this information ▪ Poll Helena server for RWIS data ▪ Transfer RWIS data to Meridian
Other State Information	<ul style="list-style-type: none"> ▪ Allow Meridian to post ND and SD information on MT 511
Glacier and Yellowstone Traveler Information Phone Numbers	<ul style="list-style-type: none"> ▪ Receive transferred calls from 511
Meridian Telephony	<ul style="list-style-type: none"> ▪ Collect information from Meridian forecasts, MDT FTP site, other states, transit entities, and Glacier and Yellowstone National Parks ▪ Analyze data and send to 511 system as voice and SafeTravelUSA as text and maps
SafeTravelUSA	<ul style="list-style-type: none"> ▪ Receive information from Meridian telephony
511	<ul style="list-style-type: none"> ▪ Receive information from Meridian telephony ▪ Receive information from Traveler Information Section ▪ Transfer users to Travel Montana and Yellowstone and Glacier Traveler Information Phone Numbers
Traveler Information Section	<ul style="list-style-type: none"> ▪ Record/cancel alert messages ▪ Answer media's questions when requested
Travel Montana Operator	<ul style="list-style-type: none"> ▪ Receive transferred calls from 511
Transit Entities	<ul style="list-style-type: none"> ▪ Provide transit information to Meridian telephony
Media	<ul style="list-style-type: none"> ▪ Call traveler information section for information

Source (1)

4. IDENTIFY STAKEHOLDER CHALLENGES

This chapter identifies stakeholder challenges with the current reporting systems.

4.1. Separate Reporting Systems

Through the stakeholder meetings, participants identified that the reporting systems are too complex and should be simplified. Users felt it was challenging to continually close out of one reporting system in order to access another.

4.2. Montana Roadway System/TIS System

The Transportation Information System (TIS) is an Oracle-based system within MDT that defines the roadways. This system populates the roadways within the road reporting systems. Several challenges have occurred due to this. One challenge is that 511 was originally set up using base routes (the old route naming convention in TIS); however, MDT is now using the corridor route naming convention. Although the 511 vendor is attempting to translate their original model, this is not an easy job because base route and corridor mileposts do not match.

Another challenge is that there are anomalies such as multiple, identical mile markers on certain sign routes. For instance, there are four mile markers labeled #1 on Highway 12. There are also a number of concurrent routes. For instance, MT 3 near Great Falls coincides with US 87, US 89, and MT 200.

There are also discrepancies between TIS and some mileposts. For example, TIS may indicate that a road extends to milepost 300, but the project is occurring at an actual milepost numbered 302. In this case, the road reporting system will not accept the 302 entry, and only allow an entry up to 300 for milepost number. In this case, actual mileposts are put into the remarks section to make the public aware of the actual location of an event.

It was noted that although the roadway segments work well for winter reporting, the construction system (using mileposts) is more user-friendly. A challenge with using the pre-defined segments is that the conditions do not always fit well within a pre-defined segment. Some staff felt that condition reporting needs to be more dynamic.

Another challenge is that segment changes are requested several times a year due to name changes, personnel changes, or when different conditions are observed consistently on separate portions of a segment. This causes a problem with 511 because segment changes in the reporting system must be manually coordinated with the 511 vendor. Segment changes require reporting system and report updates at MDT, as well as model changes and the recording of new names on the 511 system. For instance, a recent segment change was on a segment near Shelby. When the border is closed, a particular portion of the segment, but not the entire segment, was closed. To accurately indicate this closure, the segment was subsequently subdivided.

4.3. Reporting System Speed/Volume

It was noted several times that when major events occur such as a winter storm, multiple road reporters enter information into the reporting system at the same time and find that the reporting system is slow and even tends to “lock up.”

4.4. Functions Available

A lot of time is spent learning and working with quirks in the software. The more experience that an operator acquires using the reporting system, the easier it becomes. Thus, temporary staff and others who do not use the reporting system frequently have difficulty learning or relearning how to use it.

There are challenges associated with the current remarks field, an open field available in both the winter and summer systems. Information entered in this field is also displayed in reports and the road reporters sometimes put duplicate or inconsistent information in this field. It was indicated that the remarks field is useful, but should have more structure associated with it. It was also mentioned that adding a 'single lane closure' and a 'high profile vehicle not advised' option in the winter and summer systems would eliminate some of the need for the remarks section.

Errors and error messages within the reporting systems present further challenges. It was noted that error messages often appear, but are cryptic, not meaningful, and do not indicate what needs to be done to fix the error. Knowing how to deal with the error messages comes with experience, and sometimes even having experience is not enough.

Knowing how to exit the reporting system is also a challenge. Currently for the winter system, a reporter must use the back arrow to exit when done polling, but must exit completely out of the program when updating conditions. There are also issues with exiting if the data is invalid.

Another challenge is the lack of shortcuts that would make data entry easier. Suggestions included:

- Provide an alternative to manually entering all of the data. For instance, a map could be utilized to choose a section/segment of roadway.
- Ensure that the reporting system continues to use the tab and up/down arrows for navigation rather than depending solely on the mouse for form navigation.
- Include the ability to enter information via point and click (i.e. mouse).
- Include back and undo buttons.
- Use the tab key to advance between the entry boxes rather than the enter key.
- Automatically obtain and display lists such as sign routes, corridor routes, mileposts rather than requiring the explicit execution of queries.

One of the challenges associated with reported winter road conditions is that there is sometimes a discrepancy between the Road Weather Information System (RWIS) and what the plow drivers report. It would be useful if there was a way to set up a comparison between road conditions provided by the plow drivers and the conditions reported by RWIS. Then, if a plow driver indicates "icy" and the RWIS indicates "bare and dry," an alert could be displayed to the road reporter.

Another challenge is that reporters can enter contradicting winter road conditions. For instance, they can enter both dry and icy for a segment. This can be done in both the road condition number field - enter 21 for dry and 27 for icy- and between the road condition number field and the remarks field - enter 21 for dry in the road condition number field and enter icy in the remarks field.

A further challenge is that both line conditions (road closed or snow-packed) and point conditions (fallen rock or ice on bridge) are available for entry. However, due to the pre-defined segments, the point locations are not exactly pinpointed, because there is no method in the reporting system to further define where on the segment they are located.

Because winter pre-defined road segments must always have a road condition associated with them, road reporters must delete or clear old conditions. If reporters just enter new data or try to type over previous data, they receive error messages that are not explanatory. This is time consuming and challenging.

Currently, for each winter pre-defined roadway segment, reporters must individually change the rptd field to Y from N. This is time consuming. A suggestion was made to enable changing this flag for all segments at once during polling rather than requiring that it be done individually.

Also, in the winter system, reporters must use the up and down arrows to move between sections and segments within those sections, but they feel there should be an easier way to do this.

Another challenge is recognizing whether a winter road condition has been updated. It was suggested that after updating a condition, a pop up box could appear indicating that “this road condition will be updated from dry to icy” and prompting the user to indicate “Is this correct: Yes or No?” Then after verification the update would be saved.

It was suggested that the fields Quality, Quantity min, and Quantity max in the winter system are rarely used and therefore clutter the screen and should be removed. Since the Quantity fields are sometimes used to enter snow, it was suggested that they should only appear if a reporter has entered the “inches of new snow (06)” condition.

Several challenges were also identified in the summer system. The first challenge is that there is no automatic entry or validation in the summer system. For instance, if a reporter forgets to input the end time/date, then the event will continue to be reported. If there is no end time, but there is an end date, the entry will clear at midnight. And, the end date and status (complete, inactive, etc.) of a construction/maintenance project may be inconsistent, with no associated indication of the inconsistency. If the status indicates complete but there is no end date, then the project will continue being reported.

Another challenge related to the construction/maintenance section is that a construction/maintenance event can only be entered into the reporting system within one division, i.e., a project cannot overlap into two divisions because routes and milepost lists are generated by division number. This is a challenge because many construction/maintenance projects extend past a division boundary. But due to the way the reporting system is set up, they must be input as two separate events. It would be easier if they could be input as one event, but they would also need to be displayed in reports under both divisions.

Another challenge is that there is no “no work in progress” option for the construction and maintenance projects; therefore, when a project is marked as inactive, all of the details of the work are still included in reports. This is confusing to the public.

Road reporters felt it would be useful to the public to provide information on border crossings including openings, closings, and delays. However, this is not an option in the current facility forms portion of the reporting system.

The current method of collecting and entering data can be inefficient and time consuming, so stakeholders suggested that an automated way of collecting road condition information may be useful. Suggestions included Automated Vehicle Location (AVL) systems or Global Positioning Systems (GPS) for location feeds and the use of Personal Digital Assistants (PDAs) for entering and automatically updating road conditions. Ease of use is important for such options because people are reluctant to learn and use new technology. It was also asked if time would really be saved if the plow driver has to pull over to use the device. Lastly, it was noted that Utah's 511 system can be updated directly from plows via phone. Automation of data collection may help resolve some of the timeliness and accuracy issues.

4.5. Notification

A current challenge with notifications is that every time a road condition is updated, an email must be sent to the road reporters' distribution list not only informing them that conditions have been updated, but also of what the update is. This also occurs with construction/maintenance project input/updates. However, in this case the information is sent to the construction reporters' distribution list. Currently this is done manually, making it time consuming. It can also be overwhelming to recipients, because they can receive hundreds of emails a day indicating changes. Suggestions were made to change this process to be automated.

Along with road reporters' and construction reporters' distribution lists, there are area distribution lists, used to notify local agencies and people within MDT about certain conditions such as bridge closures. It was suggested that to make this less time consuming, the reporting system could automatically indicate these people and their contact info, or perhaps even automate contacting them. Road reporters currently need to look this information up in a binder. The circumstances under which such notifications happen do not change, but the list of people who need to be contacted sometimes changes.

4.6. Archiving

There are several challenges regarding archiving data. For the Traveler Information Coordinator to look up past conditions upon request (this information is sometimes requested for accidents), it is necessary for her to request the information from the MDT IT staff because she does not have direct access to it.

Also, in order for information to be archived, the Traveler Information Coordinator must request that it be archived, which is also time consuming. Currently, construction information is saved as a "snap shot" at the end of each season. The road conditions are saved as a report every half hour, therefore not every change is archived as there may be changes in between the half hour report archives. The incidents have not been archived yet, and therefore are still all available via the database. Individual record archives might be a useful capability, allowing for automated retrieval and generation of statistics.

Along with reporting system information archival, all original documentation (polling sheets) must be archived. This is due to the fact that plow drivers may report several conditions (these are all documented on the polling sheet), but only some of the conditions are entered by road reporters into the reporting system. If multiple conditions could be entered into the reporting system and prioritized automatically for exclusion in reports and the map, the archival of this original documentation might not be necessary any longer.

4.7. Software/Hardware

A principal challenge related to software/hardware is that the road network system, TIS, is a closed, internal Oracle-based system. TIS must continue populating the new reporting system. It was also acknowledged that MDT is internally heavily dependent on Oracle Forms, but that Oracle is not necessary for the reporting/end user interfaces. Other end user interfaces that have been investigated include: VB.NET, Javascript, HTML, Dynamic HTML and ASP. Lastly, the end user interface must be 508 compliant (ADA compliant) for output and possibly for input.

Road Reporters mentioned that they do not find the current user-interface (Oracle Forms) intuitive; therefore their involvement in the creation of the new user-interface will be key.

4.8. IT Maintenance

IT maintenance is conducted both within MDT and by the State Department of Administration (D of A) Information Technology Services Division (ITSD). When maintenance occurs, the system (i.e. reporting system, web reports and maps, distribution lists, and 511) becomes unavailable and information is not updated until the maintenance is complete. Moreover, users have noted inconsistent behavior when the reporting system is brought back up. Maintenance is often conducted during periods when there may be major weather events and these reporting systems are needed. When this occurs an alert is recorded on 511 notifying travelers that information is unavailable at that time; however, it is unclear as to whether a similar message appears on the website or whether old data is still available. MDT IT staff mentioned that they are working with D of A on agreements for procedures when the network goes down. It was also mentioned that when D of A is going to take the network down, there is an option of “mirroring” the reporting system, but it has never been requested by MDT. This would allow the reporting system, ftp site, and 511 to continue to work, but it might still inhibit condition entry.

Another challenge is ensuring that IT Staff within ITSD as well as within Information Services Division (ISD) of MDT are apprised of the process and purchase of the new reporting system from the beginning, because they will be impacted by its deployment. All IT projects must have a project charter and a business case developed that will be reviewed by ITSD for approval. A Service Level Agreement (SLA) will be needed to explain what the Maintenance Division and ISD require of each other (for instance, 24 hour help, guaranteed uptime, etc.).

Tasks that ISD staff may be involved with include reporting system implementation, maintenance of the reporting system, and archival of data. When it is time to implement the reporting system, it may require significant staff resources. Therefore the reporting system will need to be well documented and include timetables and requirements for implementation. Staff will need information to prepare them to load, run and test the reporting system (i.e. how many MDT employees, what type of equipment, etc). Maintenance of systems and data archival is traditionally done at MDT by IT staff and therefore the maintenance of the reporting system and archival of data will need to be well understood so it does not cause unnecessary challenges. A main question is whether the reporting system will be maintained externally, like the Equipment Vehicle Management System (EVMS), or in-house like the current reporting system. Even with off-the-shelf products, the Operation and System Administration group within ISD can be impacted.

4.9. Map Challenges

Stakeholders identified several challenges related to the map. The first challenge is that the map currently only displays road condition information (i.e. events in the winter system). Staff felt that everything should be mapped (i.e. construction, weather, facilities, spring thaw load and speed restrictions, RWIS, and cameras). It was suggested that an “interactive” map with associated icons, pop-up windows to obtain more information on the event, zoom capability, and multiple layers would be ideal. Other suggestions included color-coding the construction map similar to the road condition map to identify major projects and incorporating a pop-up window containing construction and roadway information that would appear when the user clicked on a section of roadway on the map.

MDT has considered creating a construction map; however, there is confusion internally as to what should be on a construction map (i.e. road closures, just construction, delays, etc). The reporting metrics have never been defined. Also, because information is gathered only before a project starts and subsequently once a week, MDT would have to decide how and when to display construction that is not yet in progress. Also, there is a lot of construction on secondary roads and if all of these are mapped, the map will be too cluttered. Lastly, the customer base is different for construction information versus winter information. Commercial vehicle drivers need to know load limits before traveling, and the maps should display this information for them.

Another consideration for maps is that multiple versions of maps may be needed to fulfill different dissemination or viewing purposes. For instance, a black and white map is needed for fax dissemination and a color map is needed for the internet/email.

Within the winter system, multiple conditions can be entered into the reporting system. However, only one line condition and two point conditions can be mapped per segment. Therefore, the road reporter must decide which of the conditions are highest priorities and manually select them for display on the map. This results in a great deal of inconsistency across the state, and it would be more helpful to automate the decision for condition priorities and mapping.

A related issue is that both line conditions, such as road closed or snow-packed, and point conditions, such as fallen rock or ice on bridge, are available for entry. However, due to reporting based on pre-defined segments, the point condition locations can not be specified to a specific location within the segment. This causes challenges when these conditions are mapped. Although they are displayed on the map as points, the points do not actually correspond to a specific location. Instead, they are placed arbitrarily along the segment.

Currently, the Internet map provides a time stamp to let the public know when the conditions were last updated. The associated challenge, however, is that only one segment may have been updated at that time. Possible solutions include having an expiration time/date on data, adding the ability to post “unknown” as a condition, having a condition turn black when it is outdated, showing the original conditions with a separate part that shows updated conditions (as was previously done), or putting a note on the website that explains how the conditions/map are updated.

MDT receives many comments on the accuracy of the data and most are negative. The public has increased expectations for information, perhaps due to increased access to and improvements in reporting systems in general. Currently the map only updates every thirty minutes; staff attending

the stakeholder meetings were not aware of why thirty minute updates were selected over real-time updates when the system was initially deployed.

When creating the maps, MDT places a high priority on minimum download time and user friendliness. For this reason, MDT did not select ArcIMS for mapping six years ago even though it has more functionality, because it takes longer to load. Some MDT customers still use dial-up connections as well as broadband, and may even use WebTV so MDT supports them all.

Lastly, to ensure continuity MDT wants to host the map and associated data in-house, in case vendors are changed.

4.10. Report Challenges

The total number of reports and the way the information is separated is a significant challenge. It was suggested that the reports be streamlined. For instance, the road closure report only has winter road closures in it and not incident or spring thaw load and speed closures.

Report distribution is also complex. Currently, reports are sent to National Oceanic and Atmospheric Administration (NOAA) and to the Associated Press (AP), and are manually sent due to the times they are needed (for wiring deadlines) as well as the required format. A specific format for AP was created to follow their specifications on text size, line feeds, heading codes, and ending codes. AP would like further changes to the document. Because AP distributes the document to media across Montana, they would like a “more polished” version of the report than they currently receive, including having segments with identical conditions combined to shorten the report, having a summary of the segments (i.e. bare and dry all the way across I-90), and having filler words to make the report more readable. Creating a new format specifically for AP and an automatic distribution for NOAA and AP would be more efficient.

Stakeholders have concerns about the quality and accuracy of the information in the reports. Currently there is no approval step between the entry of road condition information into the reporting system and its presentation in the condition reports. This means that information may be incorrect, contradictory, or even excessive (because road reporters can enter as many conditions as they like). A suggestion is to allow the Traveler Information Coordinator to preview the report before it is posted to the web and sent to the distribution list. Ideally, this would provide the Traveler Information Coordinator with the opportunity to talk to plow drivers for clarification; however, this is not yet possible due to limitations in statewide radio communications.

Another issue is assigning “report indicators” for the construction/maintenance projects which indicate where on the report the construction will be displayed. The report is divided by region and then alphanumerically. Duplicate report indicators cannot be used and there are a lot of projects, so it is a challenge to assign and update numbers so that entries remain in alphanumerical order. One thing that helped was adding the ability to use decimals in the report indicator. Another challenge with the construction report is that all construction/maintenance projects are displayed on the report regardless of their status being active or inactive. This is confusing to readers because the entry first indicates “no work in progress” then continues to detail the type of work that is being done on that project. It was suggested that the report not be broken into regions anymore, but that it be separated into active, inactive, and completed projects (which show up on the report for one week after they have been completed).

MDT would like to improve report coordination and information sharing with the Montana Highway Patrol (MHP). MHP currently receives the road condition report via a distribution list and then retypes it into their Computer Aided Dispatch (CAD) System. MHP must also call MDT to alert them of conditions. To make this more efficient, it was suggested that the road reporting systems could be integrated with the MHP CAD system to allow MDT and MHP to share the information they are entering. This could also facilitate MHP sharing road condition and incident information from their CAD system with MDT.

It was noted that Motor Carrier Services (MCS) uses the information from the reports for issuing trip permits to commercial vehicles. Information for particular routes is very important to them, but their experience has been that the reports are often not up-to-date. They also find it hard to find the specific information they need as they have to sift through a lot of text to determine which roads they can permit commercial vehicles to travel on.

Lastly, it is difficult to have the road closure report display information about road closures due to incidents or spring thaw load and speed restrictions. Currently, they must be input into the winter system under the “Road Closed” condition. In the remarks, the details of the road closure are then described.

4.11. Training Challenges

One of the primary challenges related to training is that plow drivers are not receiving formal instruction for identifying conditions. This results in accuracy issues and consistency problems across the state. For instance, there is a great deal of variation in how to define “snow-packed.” For guidance, plow drivers must currently rely on pictures of the road conditions on the web site. Training updates are also provided via periodic memorandums, but these do not appear to be effective. For example, memos have been sent to plow drivers indicating that they should only report the worst condition, yet they still report multiple conditions.

Staff believes that, having trained staff to report road conditions year-round (rather than temporary winter employees) would be extremely beneficial and would most likely improve efficiency. If MDT implemented a traffic management center option, then personnel would be trained and available to report conditions full-time, for all seasons. Training temporary staff for winter has been difficult for some divisions.

Road reporters cited difficulties with polling procedures. When reporters poll, they write the information down on paper and then transcribe it into the reporting system. Each division creates its own polling sheets; this can cause confusion, errors, and inconsistencies, because some polling sheets are not arranged in the same order as the reporting system. It is also possible to be “off by one segment” when entering the data from the polling sheet into the reporting system.

It was also noted that the original user manual was not as useful as it could have been. The challenge was that the manual did not instruct the operator on helpful techniques, such as shortcuts, troubleshooting, and system overrides. This manual has been updated since the original deployment.

Lastly, several divisions mentioned that their biggest challenge with entering construction data is getting the reports in from the field. They felt that project managers and superintendents should be reminded at their next meeting of how important this information is to the traveling public.

4.12. Procedural Challenges

The primary procedural challenge is accuracy of information due to the map and report not reflecting updated conditions on nights and weekends. Many times, unless conditions worsen, conditions will not be updated until the next work day. For instance, if the report indicates “snow packed and icy” Friday night, this condition would not be changed to dry Saturday morning. This will be an even more significant challenge if 511, road reports, and maps play a greater role, because then it may be necessary to have staff available to perform the updates seven days a week.

5. IDENTIFY STAKEHOLDER NEEDS

Based on the challenges identified with the current reporting systems, the research team developed the following recommendations for features to be included in the new system. For each recommendation, a requirements treatment is included. The requirements treatment details whether this need has been addressed in the subsequent requirements or why it has not been addressed at this time. Specific requirements are cited using the “dot notation” naming system (i.e. “BusinessTerms.TIS”) described in greater detail in Chapter 7 (page 48).

5.1. Separate Systems

- The winter and summer systems should be combined.

Requirements Treatment: While this is not explicitly stated in the requirements, it is implied that there is only one system. In fact there is no distinction between summer and winter; the system merely recognizes events and facilities.

5.2. Montana Roadway System/TIS System

- The system should use corridor routes and sign routes as the naming conventions for the roadways.

Requirements Treatment: This is addressed in BusinessTerms.TIS.

- The system should be able to handle multiple mile markers on one roadway and concurrent routes.

Requirements Treatment: This is implied by BusinessRules.TISInteroperability.

- There should be a way to handle differences in mileposts in TIS versus construction/maintenance projects (currently this is done via an open-ended field called remarks).

Requirements Treatment: This is a complicated requirement since a primary objective is to have the system be consistent with TIS. Requiring the system to compensate for TIS inconsistencies in a coherent manner is no easy task, which leaves free-typed mileposts. Free-typed mileposts are impossible to verify since the verifier (TIS) is inconsistent with actual locations. The system is required be able to translate between TIS locations and other locations as per BusinessRules.TISInteroperability.

- MDT should consider making the pre-defined road condition reporting segments more dynamic.

Requirements Treatment: In its current wording, this statement does not apply to the requirements since it is something that MDT should consider. If the system is required to handle segments more dynamically, researchers would need to ascertain how often and by how much segments can change. For example, if segments can be dynamically changed anytime anywhere, then perhaps mileposts should be used. This requirement would need further research.

- The system vendor should identify an easier way to change segments while not affecting 511.

Requirements Treatment: This is required of the 511 vendor's software system, which is not addressed by this document.

5.3. System Speed/Volume

- The system should be able to effectively process the volume of data statewide typically input during a winter storm.

Requirements Treatment: Peak usage is handled in PerformanceRequirements.Robustness.

- The speed of the system should not degrade during high volume periods.

Requirements Treatment: Numbers of concurrent users are specified in Other.PerformanceRequirements.Robustness. The time it takes to do common tasks is specified in Other.UsabilityRequirements.EaseOfUse.

5.4. Functions Available

- The system should have as few "quirks" in it as possible.

Requirements Treatment: This is implied in the requirements.

- The system should be simple to use for both new and experienced users.

Requirements Treatment: This is handled in UsabilityRequirements.EaseOfUse.

- A "single lane closure" option and a "high profile vehicles not advised" option should be added to the road condition, construction/maintenance, incident, and spring thaw load and speed events.

Requirements Treatment: This is addressed in DataDef.Contexts.Restrictions.Lands and DataDef.Contexts.Restrictions.HighProfile.

- The open-ended remarks field should be kept to be a catchall for information that cannot be entered elsewhere, although more structure should be associated with this field.

Requirements Treatment: It can be required that a remarks field exist. In fact there is a requirement for a section for public notes and private notes. However, the requirement for "more structure" needs greater definition. If the remarks field is used consistently for a single purpose, a specification for that purpose could be added. It is difficult, if not impossible, to verify free-form data, so care should be taken about what can be entered into this field.

- The error messages should be detailed and describe where in the system the error is and how to fix it.

Requirements Treatment: Throughout the document there are system requirements for user messages that state why and where an error occurred and how to fix it.

- The user should be able to exit the system using the same procedure regardless of what type of information they are entering; therefore data verification methods will need to be changed accordingly.

Requirements Treatment: A single method of terminating an instance of the application is required in Other.UsabilityRequirements.EaseOfUse. Further information is needed to address the last part of the statement about other means of verifying the data. In several

sections of the requirements, it is stated that data is not saved until the user explicitly chooses to save the data and it passes validation, implying that termination of the application will not save the data.

- The system should provide shortcuts for the following:
 - Provide an alternative to manually entering all of the data. For instance, a map could be utilized to choose a section/segment of roadway.

Requirements Treatment: This is addressed throughout the document.

- Ensure that the reporting system continues to use the tab and up/down arrows for navigation rather than depending solely on the mouse for form navigation.

Requirements Treatment: This is not in the document. Stating that certain keys must be used for certain functions may force design decisions while precluding possibly more efficient means of navigation. Instead the general idea will be addressed in the Ease of Use requirements.

- Include the ability to enter information via point and click (i.e. mouse).

Requirements Treatment: This is not in the document. Stating that certain actions must be used for certain functions may force design decisions while precluding possibly more efficient means of navigation. Instead the general idea will be addressed in the Ease of Use requirements.

- Include back and undo buttons.

Requirements Treatment: This is not in the document. Stating that certain buttons must be present may force design decisions while precluding possibly more efficient means of navigation. Instead the general idea will be addressed in the Ease of Use requirements.

- Use the tab key to advance between the entry boxes rather than the enter key.

Requirements Treatment: *Requirements Treatment:* This is not in the document. Stating that certain keys must be used for certain functions may force design decisions while precluding possibly more efficient means of navigation. Instead the general idea will be addressed in the Ease of Use requirements.

- Automatically obtain and display lists such as sign routes, corridor routes, mileposts rather than requiring the explicit execution of queries.

Requirements Treatment: This is stated throughout the requirements.

- The system should be able to compare RWIS data with reported road conditions and flag any conditions where there are discrepancies.

Requirements Treatment: This is addressed in Features.RoadConditionEntry.

- The system should not allow users to report contradicting road conditions.

Requirements Treatment: Validation by way of applicable RWIS readings is one method of preventing contradictions. This is addressed in Features.RoadConditionEntry. However, further requirements may be needed to further address this issue.

- The system should allow point conditions to be defined in more detail for easier understanding on reports and maps.

Requirements Treatment: Entry of all road conditions, including point conditions, is defined in Features.RoadConditionEntry. DataDef.Events.RoadConditions allows for location as a point or a segment.

- The system should allow for easier and less time consuming entry of updated road conditions.

Requirements Treatment: Time quantification of conditions entry is covered in UsabilityRequirements.EaseOfUse.

- The system should have a more efficient way of determining if a segment has been reported on than the current system (i.e. change N to Y in the “rptd” field).

Requirements Treatment: Determining if all segments in a section are reported and identifying which ones are not is addressed in Features.RoadConditionEntry and Features.RoadConditionModification.

- The system should allow for movement between sections and segments in an easier way than just via up and down arrows.

Requirements Treatment: The ease of use for entering conditions is addressed in UsabilityRequirements.EaseOfUse.

- The system should ask the reporter to verify that the current condition should be changed.

Requirements Treatment: This is addressed in Features.RoadConditionModification.

- The system should not have the Quality field.

Requirements Treatment: Quality field is not defined.

- The system should only ask for Quantity min and Quantity max if the condition entered is “inches of new snow.”

Requirements Treatment: This is addressed in DataDef.Events.RoadConditions.

- The summer portion of the system should have more error checks for the construction/maintenance, spring thaw load and speed restrictions, and incident events than currently exist.

Requirements Treatment: More information is needed concerning the types of specific error checks needed. In general it is required that data is complete and valid before being committed to the database, which may satisfy this need.

- There should be a verification/error check for the end date versus status of a construction/maintenance project (i.e. if status is completed there should be an end date).

Requirements Treatment: This is explicitly stated in DataDef.Contexts.Project and therefore implied in Features.DataSaveOptions.

- A construction/maintenance project should be allowed to cross maintenance division boundaries.

Requirements Treatment: This is implicitly required by having no restrictions on mileposts for projects. However it may be worth mentioning in an introductory paragraph.

- A construction/maintenance project crossing maintenance division boundaries should show up when queried under either division.

Requirements Treatment: This is implied in the requirements, although the details of queries are not stated explicitly. Consideration should be given to strengthening associated requirements if this is not sufficient.

- The construction/maintenance events should have a “no work in progress” option.

Requirements Treatment: This option was added to the DataDef.Lists.WorkTypes.

- The new system should have the capability to input information about border crossings.

Requirements Treatment: This capability is addressed under facilities requirements, as well as with weigh stations.

- The new system should allow for automated data collection (i.e. via AVL, GPS, etc)

Requirements Treatment: These are mentioned in Other.ExternalInterface.ExternalSystems.

5.5. Notification

- The notifications to the road reporters’ distribution list and construction reporters’ distribution list should be automated.

Requirements Treatment: This is addressed where applicable.

- Area profiles should be set-up indicating who to contact in case of a specific event.

Requirements Treatment: This is addressed where applicable.

- Contact with the people in the area profiles should be automated.

Requirements Treatment: This is addressed in the case of electronic communication, but, of course, not in the case of phone communication.

5.6. Archiving

- The Traveler Information Coordinator should have access to all data archives.

Requirements Treatment: This is addressed in Features.ArchivedDataInterface.

- Archiving should be an automated process, not one to be requested.

Requirements Treatment: This is required in Other.UsabilityRequirements.EaseOfUse. Consideration should be given to making archiving an explicit feature to strengthen associated requirements.

- Individual archives that can be queried should be saved, not just report archives.

Requirements Treatment: Other.UsabilityRequirements.Robustness requires that all events and facilities are archived. Other.UsabilityRequirements.Security requires that all changes are logged.

- The system should allow all road conditions to be entered into the system, but should prioritize which road conditions appear in both the report and on the map.

Requirements Treatment: This is addressed in DataDef.Lists.Conditions, which requires priorities. All reports dealing with conditions require that only the highest priority condition is shown. Also, Other.UsabilityRequirements.EaseOfUse requires that public and private map users be able to instantly identify the highest priority condition of a particular segment.

5.7. Software/Hardware

- The system back-end should support Oracle 8i to 10g.

Requirements Treatment: This is not explicitly in the document; however it is implied that the system must be able to query a database.

- The end user interface of the system should be 508 compliant.

Requirements Treatment: This compliance issue is addressed in the Other.UsabilityRequirements.Accessibility.

- The new user interface should be more intuitive and easier to use than the current one (i.e. Oracle forms).

Requirements Treatment: Intuitive interface issues are addressed by Other.UsabilityRequirements.EaseOfUse.

5.8. IT Maintenance

- MDT should set up an agreement with the Department of Administration on times that the network or oracle can be shut down for maintenance.

Requirements Treatment: There is nothing required of the system to satisfy this need; therefore, this is not in the requirements.

- MDT should request “mirroring” of the system and the ftp site so that 511 can continue to function when the network or Oracle are shut down.

Requirements Treatment: There is nothing required of the system to satisfy this need. However, robustness topics are covered in Other.PerformanceRequirements.Robustness.

- MDT should keep the Information Services Division (ISD) at MDT apprised of the process to purchase a new system.

Requirements Treatment: There is nothing required of the system to satisfy this need.

- MDT should create a project charter and business case for the Information Technology Services Division (ITSD) at the Department of Administration (D of A).

Requirements Treatment: There is nothing required of the system to satisfy this need.

- MDT maintenance should set up a service level agreement (SLA) with ISD to explain what maintenance and ISD require of each other with respect to the system.

Requirements Treatment: There is nothing required of the system to satisfy this need.

- The system vendor should document the implementation of the system with timetables (i.e. to load, run, and test the system) and identify which resources they will require of MDT including number of employees and type of equipment.

Requirements Treatment: An implementation and test plan must be included in subsequent requirements and/or contracts with prospective vendors.

- The system vendor should provide detailed documentation on system maintenance and data archival processes and what will be required of MDT.

Requirements Treatment: This is addressed in Other.UsabilityRequirements.UserSupport.

5.9. Map Needs

- The system should allow all inputs as well as RWIS and cameras locations and data to be mapped.

Requirements Treatment: This is covered in Features.PublicInteractiveMapInterface and Features.PrivateInteractiveMapInterface.

- The system should be interactive with zoom capabilities and multiple layers.

Requirements Treatment: This is covered in Features.PublicInteractiveMapInterface and Features.PrivateInteractiveMapInterface.

- The system should have icons or color coding depicting events and facilities.

Requirements Treatment: The manner of display is a design decision. This is covered in Features.PublicInteractiveMapInterface and Features.PrivateInteractiveMapInterface requirements, both of which specify that some sort of graphic is needed.

- The system should have a method for obtaining more information about an event or facility (i.e. pop-up boxes.)

Requirements Treatment: This is covered in Features.PublicInteractiveMapInterface and Features.PrivateInteractiveMapInterface, which require a method for obtaining more information. However, a specific method is excluded.

- The system should depict the difference between active, inactive, and completed construction/maintenance projects.

Requirements Treatment: Other.UsabilityRequirements.EaseOfUse requires the system to allow map users to instantly make this determination.

- The system should allow for a color map (for internet/email) and a black-and-white map (for fax).

Requirements Treatment: Features.PublicInterface.MapInterface requires the system to allow users to choose color or black-and-white maps.

- The system should automatically prioritize winter road conditions and only display those with highest priority on the map.

Requirements Treatment: Other.UsabilityRequirements.EaseOfUse requires that public and private map users be able to instantly identify the highest priority condition of a particular segment.

- The system should have a method to pinpoint specific locations for point conditions on the map.

Requirements Treatment: Other.UsabilityRequirements.EaseOfUse requires that public and private map users be able to instantly identify the approximate location of point conditions.

- The system should identify which road conditions were updated, when they were updated, and possibly display an unknown condition when applicable.

Requirements Treatment: Further investigation is required to determine how to best state a requirement for this without specifying design and precluding options.

- The system should allow the internet map to update more frequently than every half an hour.

Requirements Treatment: This feature is not yet required, but can easily be placed in document. There are two choices: the map can be dynamically created upon request or updated at a set time.

- The system should consider user friendliness and minimum download time when choosing an application for the internet map.

Requirements Treatment: This is not in requirements, but is implicit in Other.UsabilityRequirements.EaseOfUse.

- The system should design the internet map to work with dial-up, broadband, and webtv.

Requirements Treatment: Conformance to industry-standard communications protocols is required in Communications Interfaces.

- The system vendor should allow MDT to host the internet map.

Requirements Treatment: This is mentioned as an option in Hosting Requirements.

5.10. Report Needs

- MDT should streamline the number of reports that are created by the system.

Requirements Treatment: These requirements only remove the old concise report, and in fact, add more reports for the different facilities.

- Report distribution to the National Oceanic and Atmospheric Administration (NOAA) and the Associated Press (AP) should be automated.

Requirements Treatment: The distribution methods for reports are addressed in Features.ReportDistribution. However, the AP and NOAA are not specifically mentioned.

- A new report format should be created specifically for AP.

Requirements Treatment: This is addressed in Features.APRoadConditionReport.

- The system should allow for the Traveler Information Coordinator to select either automated distribution of reports or preview of reports prior to distribution.

Requirements Treatment: The distribution methods for reports, including an option for a preview prior to distribution, are addressed in Features.ReportDistribution.

- The system should not include report indicators for construction/maintenance projects.

Requirements Treatment: More information is required to satisfy this need. There is no mention of report indicators in requirements; however the order of report items is specified.

- The construction/maintenance project report should no longer be divided into regions.

Requirements Treatment: This is addressed by requirements.

- The construction/maintenance project should be divided by project status (i.e. active, inactive, and completed).

Requirements Treatment: This is addressed by requirements.

- The new system should allow for exchange of information between the new system and the Montana Highway Patrol Computer Aided Dispatch (CAD) system.

Requirements Treatment: This is addressed in External Interface Requirements.

- MDT should create a report that is more useful to Motor Carrier Services (MCS).

Requirements Treatment: This requires more information about exactly what is needed. A different report or map may be needed to satisfy this requirement.

- The system should identify road closures in the road condition, construction/maintenance, load and speed, and incident events (i.e. not just in the road condition event) and put all of these into the road closure report and on the map.

Requirements Treatment: This is addressed by requirements.

5.11. Training Needs

Please note that many of the needs in this section fall outside the scope of the application.

- MDT should create a training program for snow plow drivers on identifying winter conditions.

Requirements Treatment: There is nothing required of the system to satisfy this need.

- MDT should consider hiring year-round road reporters.

Requirements Treatment: There is nothing required of the system to satisfy this need.

- MDT should consider having reporters enter information directly into the system without using polling sheets.

Requirements Treatment: There is nothing required of the system to satisfy this need.

- MDT should ensure that the training manual indicates tips and shortcuts for operating the system.

Requirements Treatment: There is nothing required of the system to satisfy this need.

- Procedural ChallengesMDT should create a policy that conditions be updated on a regular basis (i.e. not just when conditions worsen) in order to improve accuracy.

Requirements Treatment: There is nothing required of the system to satisfy this need.

6. VISION AND SCOPE

This chapter describes in general a vision and scope for the new traveler information reporting system. The system requirements are defined in subsequent chapters. However, some terms from the requirements are cited here using the “dot notation” naming system (i.e. “UserClasses”) described in greater detail in Chapter 7 (page 48).

6.1. Vision Statement

It is envisioned that the overall solution to the challenges mentioned in Chapter 4 is a new traveler information reporting system designed to meet MDT’s growing needs. The new traveler information reporting system will be one system that meets all of MDT’s reporting needs (i.e. winter and summer).

The new reporting system will be expandable to meet the growing technology needs of a Department of Transportation (DOT). This means that while the reporting system may not be needed for certain functions currently, it will facilitate updates or expansions as new technologies are identified and become main stream in DOT use.

It is envisioned that the new traveler information reporting system will be easier for the inexperienced road reporter to operate, have more automated features such as notification and verification, and allow for more concise and user friendly displays of information to the public.

6.2. Scope

The new reporting system will continue to be utilized as the major information source for the state’s 511 traveler information phone number, the local phone systems (i.e. RACOM), the MDT traveler information webpage, and fax/email notifications to the public. In addition to these current processes, the new reporting system will allow for automatic notification of agencies in certain circumstances.

The scope and features of this road condition reporting system include:

- Facilitating the entry, storage and reporting of road-related traveler information covering the MDT road network for the entire state of Montana.
- Integrating with other systems such as 511 and the MDT Web Server.
- Potentially integrating with field elements such as RWIS, cameras and DMS.
- Potentially integrating with other agencies’ systems.

This section describes in more detail the use cases, possible user classes, business rules, and business terms for the reporting system and the major features it will contain.

6.2.1. Use Cases

Table 5 describes in detail the cases in which the reporting system will be used and the primary actors who will be using the reporting system for each purpose.

Table 5: Use Cases for New Reporting System

Primary Actor	Use Cases
Road Reporter in Each Division Office	<ul style="list-style-type: none"> • Specify event location • Collect and enter construction information • Collect and enter incident information • Collect and enter spring thaw load and speed restrictions information • Collect and enter ETO/closures/chain requirements • Contact each division section and plow driver and collect and enter road condition information • Record division reports on local phone numbers based on area reports from the Road Condition Reporting System (RCRS)
Traveler Information Section	<ul style="list-style-type: none"> • Receive alerts when new information is entered into reporting system • Provide static information for web page such as rest area locations • Record/cancel 511 Alert messages • Satisfy media inquiries • Record Helena report on local phone number based on area report from RCRS • Receive information from division road reporters • Oversee system report generation and distribution lists
Section Staff/Plow Driver	<ul style="list-style-type: none"> • Provide incident information to road reporters • Provide road condition information to road reporters • Provide recommendations to maintenance chief about closures/ETO/ chain requirements
Maintenance Chief	<ul style="list-style-type: none"> • Decide spring thaw load and speed restrictions • Receive recommendations from plow drivers about closures/ETO/chain requirements and provide the decision to road reporter.
Construction Project Managers	<ul style="list-style-type: none"> • Provide construction information to road reporters

Primary Actor	Use Cases
IT and Maintenance Staff	<ul style="list-style-type: none"> • Design web site, write scripts • Send manual reports to specified media entities • Administer website maps • Administer internal/external user interfaces • Manage RWIS • Maintain all aspects of system • Provide training and user support for system users
Road Conditions Reporting System (RCRS)	<ul style="list-style-type: none"> • Collect road conditions information, chain requirements, emergency travel only restrictions, incidents, construction, and spring thaw load and speed restrictions from all divisions • Transmit this information to FTP site, web page, and distribution lists via fax/email • Provide area specific report that includes construction, road conditions, ETO, closures, and chain requirements for roads in the area for RACOM
RACOM (Local Phone #'s)	<ul style="list-style-type: none"> • Accept recordings from division offices and Traveler Information Section • Allow callers to receive information
Media	<ul style="list-style-type: none"> • Receive automatically generated reports • Query Traveler Information Section
Montana Highway Patrol (MHP)	<ul style="list-style-type: none"> • Receive automatically generated reports • Potential to provide incident information to road reporters • Potential to provide road condition information
Helena Server	<ul style="list-style-type: none"> • Provide a server for RWIS and Camera data • Satisfy requests for RWIS and camera data
MDT FTP Site	<ul style="list-style-type: none"> • Poll RWIS data and cameras on Helena Server • Allow Surface Systems, Inc (SSI) to poll RWIS and cameras for ScanWeb • Poll construction, incident, statewide and detailed road

Primary Actor	Use Cases
	<p>conditions, road/pass closures, ETO, and spring thaw load and speed restrictions from reporting system</p> <ul style="list-style-type: none"> • Allow 511 vendor telephony to access above information • Transfer RWIS data to 511 Vendor
511 Vendor Weather Processor	<ul style="list-style-type: none"> • Collect RWIS from MDT ftp site and National Weather Service (NWS) data • Create segment-based forecasts • Send forecasts to telephony for 511 and safetravelusa web page
Surrounding States and Provinces	<ul style="list-style-type: none"> • Receive web traffic linked from traveler information page • Allow 511 vendor to post information on Montana 511
511 Vendor Telephony	<ul style="list-style-type: none"> • Collect and analyze data from forecasts, MDT FTP, and other states. • Send data via telephony as voice to 511 system and maps and text to 511 web page
Glacier National Park (GNP)	<ul style="list-style-type: none"> • Record/cancel Glacier messages on 511 via alert system
511	<ul style="list-style-type: none"> • Receive information from 511 vendor telephony • Receive information from Traveler Information Section via Alert system • Receive information from Glacier National Park via Alert system • Potential to transfer users to Travel Montana, Yellowstone National Park (YNP), and GNP traveler information phone numbers
511 Web Page (Safetravelusa)	<ul style="list-style-type: none"> • Receive web traffic linked from traveler information page for replicated 511 system represented in map and text format via the web • Receive information from 511 vendor telephony
Internet Traveler Information	<ul style="list-style-type: none"> • Provide public interface for viewing static and

Primary Actor	Use Cases
Web page	dynamic travel information from a variety of sources <ul style="list-style-type: none"> • Provide project information map for const/maintenance projects, incidents, spring thaw load and speed limit restrictions, etc to the general public
Department of Justice	<ul style="list-style-type: none"> • Receive web traffic linked from traveler information page for driver licensing and AMBER Alert information
Glacier and Yellowstone National Parks	<ul style="list-style-type: none"> • Receive web traffic linked from traveler information page for web cameras • Allow users to view their camera images • Potential to receive transferred calls to their traveler information phone numbers
Montana Cities	<ul style="list-style-type: none"> • Provide construction information for urban web pages
Motor Carrier Services	<ul style="list-style-type: none"> • Receive web traffic linked from traveler information page for driver licensing and restriction information
National Weather Service	<ul style="list-style-type: none"> • Receive web traffic linked from traveler information page for state weather, forecast, winter storm warning information, and cameras • Provide weather information and forecasts to 511 vendor
Other Entities' cameras	<ul style="list-style-type: none"> • Receive web traffic linked from traveler information page • Allow users to use their cameras
Surface Systems, Inc (SSI)	<ul style="list-style-type: none"> • Provide RWIS/camera information through ScanWeb to traveler information page • Receive information from MDT FTP site
The Weather Channel	<ul style="list-style-type: none"> • Provide major city temperatures to traveler information page
Travel Montana	<ul style="list-style-type: none"> • Receive web traffic linked from traveler information page for tourism information and trip planning • Potential to receive transferred calls from 511

Primary Actor	Use Cases
Public	<ul style="list-style-type: none"> • View weather / reports on web site • View RWIS/camera information on website • View maps on web site • Use 511 system via telephone

6.2.2. User Classes

There are many different capabilities and prospective uses for the road condition reporting system. The user classes define a particular set of attributes available to different users. There are a number of identified necessary and prospective user classes and these are defined in Table 6.

Table 6: User Class Descriptions

User Class	Description
.UserClasses	The system shall facilitate user classes and related characteristics.
.StatewideTravelerInformation Coordinator	Has ability to enter, modify, or delete any event, facility, or alert. Can modify, add, or delete facility amenities. These operations apply to all MDT Divisions. Can perform user administration operations. Can perform all functions of UserClasses.Reporter. Notified of all event and facility entries, modifications, and deletions.
.Reporter	Can add, modify, or delete events. Can change facility status from “Open” to “Closed”. Reporters can perform these operations for all Divisions across the state.
.AlertReporter	Used for allowing alerts to be created and for notification of alert entry, modification, and deletion.
.ConditionReporter	Used for notification of condition data entry, modification, deletion, and all segments in a division reported on.
.ConstructionReporter	Used for notification of construction data entry, modification, deletion
.SpringThawLoadandSpeed RestrictionReporter	Used for notification of spring thaw load and speed restriction data entry, modification, deletion.
.IncidentReporter	Used for notification of incident data entry, modification, deletion.
.SpecialEventReporter	Used for notification of special event data entry, modification, deletion.
.RestAreaReporter	Used for notification of rest area data entry, modification, deletion.

User Class	Description
.BorderCrossingReporter	Used for notification of border crossing data entry, modification, deletion.
.WeighStationReporter	Used for notification of weigh station data entry, modification, deletion.
.SystemAdministrator	It may be necessary to include a system administrator class. This depends on whether MDT hosts the system or not.
.SystemDeveloper	It may be necessary to include a system developer class. This depends on whether MDT hosts the system or not.
.MDTStaff	It may be necessary to include a user class for other MDT staff.
.Public	This class will represent the general public.
.ExternalAgency	It may be necessary to represent users from external agencies. To Be Decided (TBD)
.ExternalSystem	It may be necessary to represent external systems as users. TBD

6.2.3. Business Terms

The following terms are specific to the Montana Department of Transportation and of relevance to this project. An understanding of these terms is necessary for subsequent requirements.

Business Terms.MDTRoadNetwork: The Montana Department of Transportation (MDT) road network is described in a variety of ways:

.RoadTypes: Roads are classified according to their Federal, State or Local designation as follows:

.InterState: Roads designated as Interstate in the National Highway System.

.US: National Highway System roads that are not designated as Interstate.

.Montana: Non-Federal, State highways.

.Secondary: Non-Federal, major collector.

.NonMaintained: Roads within the state but falling outside the responsibility of the Montana Department of Transportation. Examples include city and county roads.

.Maintained: Interstate, US, Montana and Secondary roads shall be considered “on system”.

.Seasonal: Roads may also be classified as seasonal. Such roads include Skalkaho Pass (MT 38), the Beartooth Highway (US 212), and the Going-to-the-Sun Road.

.MDT Organization: The Montana Department of Transportation organizes the State and its roadways into Districts, Divisions, Sections and Segments.

.MDT Districts: The State is divided into five MDT Districts. The District offices are located in Missoula, Great Falls, Glendive, Billings and Butte. Districts are responsible for overseeing and performing the day-to-day operations, maintenance, and construction on Montana Highways. A District Administrator oversees an MDT District, which includes two MDT Divisions.

.MDT Divisions: The State is divided into ten MDT Divisions, two per MDT District. The Division offices are located in Missoula, Kalispell, Great Falls, Havre, Wolf Point, Miles City, Billings, Lewistown, Butte and Bozeman. Divisions are responsible for the day-to-day maintenance on Montana Highways. A Maintenance Chief oversees a maintenance division.

.MDT Sections: State roadways are divided into MDT Maintenance Sections. Sections fall within divisions and there are approximately 10 to 20 Sections per Division. Sections correspond to routes driven by snow plow drivers.

.MDT Segments: MDT Sections are divided into Segments. Typically, there are less than ten Segments per Section. In addition to numeric IDs, Segments are given descriptions to indicate their location (example: "Flint Creek Hill"). Segments divide sections into smaller portions so that road conditions can be reported on a finer scale. MDT typically implements between three and six segment changes each year, due to extreme weather on certain portions of segments or administrative boundary changes.

Business Terms. TIS: The Montana Department of Transportation stores an electronic representation of the State road network in a database system called the Transportation Information System (TIS). TIS is integrated with a number of other systems including the current condition reporting and construction reporting systems. Within TIS, the State road network is classified by a number of route systems.

.Sign Routes: Sign routes correspond to the physical signs and mileposts that identify roads and locations to the public.

.Multiple Milepost Anomaly: Some sign routes may have multiple instances of the same milepost number. For instance, there are 4 mileposts #1s on U.S. Highway 12.

.Milepost Interdistance Anomaly: Sign route mileposts are not necessarily one mile apart.

.Concurrent Routes: A given location may fall on multiple sign routes. For instance, MT 3 near Great Falls is also U.S. 87, U.S. 89 and MT 200.

.Corridor Routes: Internal MDT route identification scheme used to identify portions of roads and locations on roads. Corridor routes have "mileposts," but the mileposts do not correspond to physical, posted signs. Corridor routes do not have the milepost anomalies of sign routes and do not overlap. Corridor route names begin with a 'C' and are followed by six digits.

.Translation: MDT has developed code to translate between corridor routes and sign routes.

.AlternateRoutes: The term Alternate Route is used referring to alternate, common names for portions of roads. For instance, “Main Street” and “Huffine” are alternate, common names for US-191 in Bozeman. TIS does not include Alternate Routes.

.OtherRoutes: Other route naming systems such as Base Routes are used to classify the State road network within TIS. These routes shall not be used within the new condition reporting system.

6.2.4. Business Rules

The following rules are specific to the Montana Department of Transportation and of relevance to this project. An understanding of these rules is necessary for subsequent requirements.

BusinessRules.Notification: Certain communication must occur in response to events including:

.Incidents: Certain communications must occur in response to incidents involving:

.Fatalities: If an incident has five or more fatalities, involves a school bus, loss of life of a public figure, hazardous materials spill, or natural disaster, then certain department personnel must be contacted by phone (after hours) and email (business hours).

.Damage: If major damage occurs to facilities requiring significant repairs and/or affecting facility usability, then certain department personnel must be contacted by phone (after hours) and email (business hours).

.RoadClosures: If any road closure occurs, then certain department personnel must be contacted by phone (after hours) and email (business hours).

.DeptAccident: If an incident occurs involving the injury or death of a department employee, then certain department personnel must be contacted by phone (after hours) and email (business hours).

.OracleDown: If Oracle goes down, then certain department personnel must be contacted by phone (after hours) and email (business hours).

.EventInfo: The Traveler Information Section, Road Reporters, and some area agencies must be notified in light of new or updated events or facilities.

BusinessRules.Legal: MDT must abide by the following legal requirements:

.Archives: Road Reports and all original supporting materials must be stored on paper or disk for a period of eight fiscal years.

BusinessRules.TISInteroperability: Certain operations must occur to properly interface with MDT’s TIS database.

.Translation: All on-system locations must be translatable to positions relative to mile posts on both TIS corridor and sign routes and vice versa.

.Consistency: Changes to TIS must be reflected in other systems.

BusinessRules.ReportingProcess

.Construction: Construction project managers provide their project information to the road reporters on Wednesdays or as changes occur.

.Polling: Every day at 6 AM and 1 PM, the division road reporters call each snow plow driver within each section of their division via two-way radio. The snow plow drivers report the conditions, and the road reporters write this information onto a polling sheet. When they have completed polling their entire division, they enter this information into the RCRS database.

.SpringThawLoadAndSpeedRestrictions: Load and speed restrictions due to spring thaw are provided to the road reporters on Wednesdays by the Maintenance Chief or Superintendent.

.Incident: Incident information is collected via calls to the road reporters by Montana Highway Patrol or through section staff on the roadways.

.ETOAndClosuresAndChainRequirements: A plow driver will recommend an ETO advisory, closure, or chain requirement to the Maintenance Chief. The Maintenance Chief decides if the restriction is warranted and then provides this information to the division road reporter.

6.2.5. Major Features

The traveler information reporting system specified in the following chapters supports the following major features.

Data Entry and Storage

The reporting system will allow for the entry, modification, and deletion of the following types of data:

- Construction/maintenance projects,
- Road conditions,
- Spring thaw load and speed restrictions,
- Incidents,
- Special events,
- Rest areas,
- Weigh stations,
- Border crossings, and
- Alerts.

Report Generation

The reporting system will allow for the following types of reports to be generated:

- Construction/maintenance report,

- Statewide conditions report,
- Area conditions report,
- Associated Press (AP) conditions report,
- Incident report,
- Road closure & Emergency Travel Only (ETO) report,
- Spring thaw load and speed restrictions report,
- Rest area report,
- Border crossing report, and
- Weigh station report.

Public Interface

The public interface of the reporting system will allow the public to do the following:

- View appropriate data on a map, and
- View appropriate data through reports.

Private Interface

The private interface will allow internal users to do the following:

- View appropriate data on a map based on user class,
- View appropriate data through event and facility listings, and
- View archived data.

Notification

Notification will allow for the following functionalities:

- Automatic notification of users due to reporting system updates, and
- Automatic notification of users due to incident characteristics.

User Administration

User administration allows for the following administrative functionalities:

- Entering new users to the system,
- Editing existing user information,
- Establishing groups of users, and
- Assigning privileges to individual users or groups

Data Management

Data management allows for the following functionalities:

- Data list management (i.e. road conditions, incident types, etc),
- External device list management (i.e. locations of road weather information systems, dynamic message signs (DMS), and cameras to populate the map), and
- Ability to change segments/parameters.

7. SOFTWARE REQUIREMENTS SPECIFICATION (SRS) BACKGROUND

This chapter provides an overview of the requirements organization as well as their purpose. In order to create a new Road Condition Reporting System (RCRS) for MDT, their requirements for a new system must be specified. Chapters eight through ten accomplish this task.

7.1. SRS Purpose

The purpose of this SRS is to:

- document system requirements.
- establish a benchmark for evaluation of prospective solutions.
- provide a conceptual framework for subsequent build or buy solution.

The intended audience is:

- MDT and other stakeholders, to decide how to proceed in obtaining a new system.
- WTI, to use as a tool to evaluate existing solutions and recommend a course of action for MDT.
- Vendors and prospective contractors, to understand the requirements of the system.

7.2. SRS Organization

Building on the current reporting system description (chapter 3), identified stakeholder challenges (chapter 4), identified stakeholder needs (chapter 5), and the vision for a new system (chapter 6), detailed requirements for a new RCRS must be organized and documented. The SRS in chapters eight through ten accomplish this.

This SRS includes the requirements necessary to evaluate other systems and options as planned for in Phase Two. For the subsequent Request for Proposals (RFP), further refinement and detail may be required. To create these requirements, standards and formats from “IEEE Recommended Practice for Software Requirements Specifications,” (4) “Software Requirements,” (5) and “Mastering the Requirements Process” (6) were reviewed.

A best effort has been made to capture MDT requirements while not precluding viable alternatives. At the same time, an effort has been made to capture the best parts of the existing system, while trying to remedy those components that are lacking.

Requirements are organized under the following major sections:

- Data Definitions and Requirements
- Systems Features and Functional Requirements
- Other Requirements

The Data Definitions and Requirements section includes a high-level listing of major data elements that will be used and possibly stored within the system. In some cases, data definitions are specific, indicating a number of attributes that will be requirements. In other cases, data definitions are more general, indicating general properties of the data. In no case is it assumed or

required that a specific reporting system product or structure be used to implement these elements. In fact, some (the road network) may be implemented via links to other systems (TIS), or others may be implemented via the operating system or network (users, for instance). The Data Definitions and Requirements section precedes other sections, and defines data elements that are subsequently referenced.

The System Features and Functional Requirements section defines not only major features of the system, but also the associated functional requirements. Features are used as major headings, and requirements are associated with features to provide logical grouping and context.

The Other Requirements section includes non-functional requirements.

In choosing these sections and their contents, the research team has attempted to use the best and most relevant sections and content from the requirements analysis references listed above. As is well known in conducting software requirements analysis, there is no “Silver Bullet.” In other words, there is no known specific method or template that covers the requirements specification for every system. Thus, researchers have chosen to adapt elements from these references to best represent this proposed system.

The authors have adopted a modified “dot notation” to name and reference requirements and other elements within this document. As opposed to other methods such as sequential, numeric referencing of requirements, this approach gives each element a meaningful name that immediately places that element in context. The fully-qualified dot notation representation of certain requirements can be cumbersome, but it increases readability. For instance, DataDef.Lists.MDTRoadNetwork.SignRoutes.Mileposts.Number refers to an element in the Data Definitions and Requirements section that specifically describes Milepost Numbers on Sign Routes. This information can be gathered readily from the name, albeit a long name. Similarly, Features.RoadConditionEntry.BySection.Accuracy represents a requirement concerning the accuracy of the Road Condition Entry feature when conducted by section.

Where possible, indentation and sub headings are used to implicitly indicate dot notation relations between expressed elements. Each indentation should be combined with the previous one and the subheading to form a complete notation. Refer to the examples from the previous paragraph and their expression in the corresponding sections for examples. This convention helps to increase document readability while minimizing repetition.

8. DATA DEFINITIONS AND REQUIREMENTS

This chapter characterizes the data created, stored and used by the system. Data definitions are stated at a high level, allowing for a variety of possible implementations. It is not implied that this data will be entirely stored in or correspond to a single relational database.

8.1. DataDef.System

There shall be certain information stored for general system operation. This information may be implemented in a variety of ways and includes:

- Users and user information.
- Logs used to log system activity.
- Archives used to store certain information.

8.1.1. DataDef.System.Users

The system will have a number of users and several classifications of users, as defined in other sections. This information is presented here in a generic manner, since users, roles, permissions, etc. can be implemented in a variety of ways. For instance, it might be beneficial to integrate existing MDT logons with the system, providing “single sign-on.” However, implementing this functionality might not be possible for certain existing products that would rely on their integrated user accounts.

There shall be “accounts” for individual users so that each user is uniquely identified when using the system.

Individual user information will consist of:

.UserName: The name by which the system will recognize the user.

.Password: The password used by the user to logon to the system.

.ContactInformation: Contact information including email, phone, physical address, etc.

.MDTOrganizationInformation: Identifies the Districts, Divisions, etc. to which the user belongs.

.UserType: Indicates the type of user, which in turn identifies the privileges of the user and which notifications they should receive.

.Profile: It may be desirable to associate a profile with each user that retains preferences to reduce repetition, etc. For instance, map views and preferences might be tailored and saved for individual users.

8.1.2. DataDef.System.Logs

The system shall include logs for a variety of purposes. These logs can be implemented at a number of different levels. Included shall be logs for:

.Security: Indicates access to the system and subsystems. Included will be logs of logons and logoffs.

.Change: Indicates who entered, modified or deleted information in the system; what action they took; and what date and time the change occurred.

.Usage: Indicates access to publicly-visible information, most likely that was displayed via the web. Logs may be used to determine frequency of use, etc.

8.1.3. DataDef.System.Archives

The system shall facilitate the electronic archiving and associated retrieval of certain information including reports.

.ReportArchive: Archives of all reports produced by the system. Includes:

.Text: The text of the report. (Note: reports might include more than just text in the future system. Maps could possibly be included.)

.DateTime: The dates and times in which the report was created and is in effect.

.Type: The type of the report.

.CoverageArea: The coverage area of the report.

.EventArchive: Archives of all events and facilities in the system. Includes:

.EventInfo: All specific event or facility attributes.

8.2. DataDef.Lists

There are a number of lists/lookups that need to be maintained within the system. These lists are used primarily to provide information to entry fields and to assure consistency.

8.2.1. DataDef.Lists.WorkTypes

Project work types describe the nature of a construction or maintenance project. The items in this list are currently-used MDT terms and are subject to change. All work types shall be prioritized, meaning if multiple work types are selected, the project work type shall be characterized first by the work type with the highest priority. (Note that MDT may be currently using numeric codes for such items. These codes are not listed below.)

Includes the following:

- Chip Seal
- Overlay
- Guardrail
- Reconstruction
- Milling
- Bridge
- Sign Installation
- Striping
- Shoulder
- Patching
- Sweeping
- Rumble Strips
- Seeding
- Fencing
- Crack Sealing
- Grading
- Landscaping
- Topsoil
- Miscellaneous
- Pulverizing
- Sidewalk
- Surveying
- Culvert Installation
- Clearing and Grubbing
- Rut Filling
- Paving
- Signal Installation
- No Work In Progress

8.2.2. DataDef.Lists.Conditions

At present, conditions describe the weather conditions along an MDT segment. It is anticipated that conditions will continue to be reported corresponding to segments, but also in a more flexible or granular manner, such as point conditions for specified locations. Point conditions are used to indicate certain conditions such as fallen rock that occur somewhere on the segment, but not necessarily along the entire segment. By displaying point conditions on the map, it is visible the user that this condition does not exist for the entire segment, but only a point within that segment.

Under current practice, MDT plow drivers are polled and report the conditions of their segments using one or more of these terms. The system should allow for multiple condition inputs. The items in this list are prioritized and should be in the system, meaning if a driver reports more than one set of conditions, the instance will be categorized by the entry with the highest priority value. (Prioritization values are not indicated in the list below.) Prioritization will allow the correct conditions to be displayed on the map and reports. The entries in this list reflect current MDT terms and may be subject to change. Condition descriptions from national standards are being investigated for inclusion.

Includes the following:

- Fog
- Heavy Fog
- Black Ice
- Frost On Bridges
- High Wind
- High Wind Warning
- Blowing and Drifting
- Poor Visibility
- Fallen Rock
- Rain
- Freezing Rain
- Snowing
- Light Snow
- # Inches of New Snow
- Heavy Snow
- Mostly dry; scattered snowpack and ice
- Dry
- Wet
- Slushy
- Intermittently Snowpacked
- Snowpacked
- Intermittent Ice
- Icy
- Intermittently Snowpacked and Icy
- Snowpacked and Icy
- Frost on Road
- Snowcovered
- Snowcovered with Ice

8.2.3. DataDef.Lists.VehicleTypes

Restrictions may apply to certain vehicle types. This list contains various vehicle types.

- Towing: Vehicles which are towing units.
- Passenger: Passenger vehicles.
- Commercial Vehicles: Vehicles which are registered as commercial including semis.
- All: All vehicles on the highway.

8.2.4. DataDef.Lists.FieldElements

Field element locations and their current readings and/or displays may be indicated on maps and in reports from this system. The following elements are anticipated.

.RWIS

.SiteName: The display name of the site. For example, “Bozeman Pass.”

.URL: The URL associated with further information for the site. For RWIS, this URL might be the ScanWeb URL.

.Location: Specification of the site location including sign route and milepost.

.Cameras

.SiteName: The display name of the site. For example, “Bozeman Pass.”

.URL: The URL associated with further information for the site. For Cameras, this URL might be that of a current MDT page showing the camera display.

.Location: Specification of the site location including sign route and milepost.

.DMS

.SiteName: The display name of the site. For example, “Bozeman.”

.URL: The URL associated with further information for the site. For DMS, this URL might point to a URL in the DMS central software.

.Location: Specification of the site location including sign route and milepost.

8.2.5. DataDef.Lists.Contacts

To facilitate notification, a list of contacts may be maintained separate from the user list. These contacts might include internal (MDT) and external (non-MDT) contacts. The contact list might also include a listing of regular contacts that provide information used in the system such as snow plow drivers.

Contacts will consist of:

.Name: The name of the contact.

.Information: Contact information including email, phone and physical address.

.Organization: Information about the organization to which the contact belongs.

.Groups: Used to organize contacts.

.NotificationLists: Used specifically to associate contacts with notifications.

8.2.6. DataDef.Lists.Notification

Contacts (as per DataDef.Lists.Contacts) will be assigned to notification lists for a variety of purposes. The following are anticipated notification lists. For each of these notifications, there will be a list of contacts to be provided after a proposal for a new road condition reporting system has been chosen.

.DeptAccident: The persons appearing on this list must be notified in response to the injury or death of a department employee.

.MajorIncident: The persons appearing on this list must be notified in response to an accident involving five or more fatalities, involving a school bus, loss of life of a public figure, hazardous materials spill, or natural disaster (i.e. slides, earthquakes, and fires).

.FacilityMajorDamage: The persons appearing on this list must be notified in response to major facility damage requiring significant repairs and/or affecting the usability of a building such as fires, collapses, tornadoes, hail, etc.

.RoadClosures: The persons appearing on this list must be notified due to any and all road closures that occur.

.DatabaseUpdate: The persons appearing on this list must be notified in response to the entry, modification, or deletion of any event or facility as per UserClasses.Reporter and UserClasses.StatewideTravelerInformationCoordinator.

.Area: The area notification list contains local agencies and other people within MDT about certain conditions such as bridge closures.

8.2.7. DataDef.Lists.MDTRoadNetwork

The Montana Department of Transportation represents the state road network in its TIS database using multiple route identification systems. Elements from this database shall be imported or linked into the road condition reporting system to provide the necessary information to describe the road network for internal and public purposes. This information is used and/or referenced in location specifications for events, facilities, and alerts. It may also be used for reporting, mapping, identifying, querying and grouping of data. The road condition reporting system shall maintain consistency with the TIS database. It is assumed that coordinates will be stored to facilitate graphical representation and identification of all road network elements and related entities.

Elements consist of:

.MDTDistricts: Multiple MDT Districts, with each MDT District consisting of:

.Name: The District name, which is the name of the town in which the District is headquartered.

.DistrictID: The numeric ID of the District.

.Coordinates: Coordinates defining the District boundaries, primarily used for plotting purposes.

.MDTDivisions: Multiple MDT Divisions, with each MDT Division consisting of:

.Name: The Division name, which is the name of the town in which the Division is headquartered.

.DivisionID: The numeric ID of the Division.

.DistrictID: The numeric ID of the District to which the Division belongs.

.Coordinates: Coordinates defining the Division boundaries, primarily used for plotting purposes.

.MDTSections: Multiple MDT Sections, with each MDT Section consisting of:

.Name: The name of the Section, which is generally the name of the town in which the section is located.

.SectionID: The numeric ID of the Section.

.DivisionID: The numeric ID of the Division to which the Section belongs.

.DistrictID: The numeric ID of the District to which the Section belongs.

.CorridorRouteLocation: Consists of one or more of the following:

CorridorRoute Name and Start and End Mileposts.

.Coordinates: Coordinates defining the Section. (This could be derived from Corridor Route coordinates.)

.MDTSegments: Multiple MDT Segments, with each MDT Segment consisting of:

.Name: The name of the Segment. Example: "Flint Creek Hill."

.SegmentID: The numeric ID of the Segment.

.DivisionID: The numeric ID of the Division to which the Segment belongs.

.DistrictID: The numeric ID of the District to which the Segment belongs.

.SectionID: The numeric ID of the Section to which the Segment belongs

.CorridorRouteLocation: Consists of one or more of the following:

CorridorRoute Name and Start and End Mileposts.

.Coordinates: Coordinates defining the Segment. (Could be derived from Corridor Route coordinates.)

.CorridorRoutes: Note that Corridor routes may consist of several segments per corridor; therefore there is no one-to-one correlation between segments and Corridor routes. Also it is not always possible to assign entire Corridor routes to single Districts, Divisions, and Sections. Corridor routes are also non-overlapping.

Consists of multiple CorridorRoutes, each consisting of:

.CorridorRouteID: A unique six digit identification number starting with the letter 'C'.

.Roadbed: Indicates direction(s) of road:

North "N", South "S", East "E", West "W".

.Seasonal: Indicates if the corridor route is seasonal. (Should indicate only seasonal portions.)

.Mileposts: Indicates the mileposts and their locations. Each milepost includes the following:

.Number: The number of the milepost. These will occur in sequence along the corridor route, with no duplicates.

.Coordinates: The coordinates of the milepost. (If necessary, coordinates of points between mileposts, accurate to the nearest tenth of a milepost could be included.)

.DivisionID: The numeric ID of the Division to which the milepost belongs.

.DistrictID: The numeric ID of the District to which the milepost belongs.

.SectionID: The numeric ID of the Section to which the milepost belongs.

.SegmentID: The numeric ID of the Segment to which the milepost belongs.

.SignRouteCorrespondance: A correspondence shall be established so that locations specified by Corridor Route and milepost can be translated to a corresponding Sign Route and milepost.

.SignRoutes: Note that Sign routes may consist of several segments per route; therefore there is no one-to-one correlation between segments and Sign routes. Also it is not always possible to assign an entire Sign route to single Districts, Divisions, and Sections. Sign routes may overlap/coincide, i.e., there may be multiple sign routes identifying the same portion of road.

Multiple SignRoutes are included here, each consisting of:

.Type: Indicates if the sign route corresponds to one of the following:

- Interstate (I)
- Federal Non-Interstate (US)
- State (MT)
- Secondary (S)

.Number: The identifying number of the road such as “90” for Interstate 90.

.Roadbed: Indicates direction(s) of road:

North “N”, South “S”, East “E”, West “W”.

.Seasonal: Indicates if the sign route is seasonal. (Should indicate only seasonal portions.)

.Mileposts: Indicates the mileposts and their locations. Each milepost includes the following:

.Number: The number of the milepost. Note: A sign route may contain redundant milepost numbers. Mileposts with identical numbers should be distinguished from each other in some other manner.

.Coordinates: The coordinates of the milepost. (If necessary, coordinates of points between mileposts, accurate to the nearest tenth of a milepost could be included.)

.DivisionID: The numeric ID of the Division to which the milepost belongs.

.DistrictID: The numeric ID of the District to which the milepost belongs.

.SectionID: The numeric ID of the Section to which the milepost belongs.

.SegmentID: The numeric ID of the Segment to which the milepost belongs.

.AlternateRoutes: Certain portions of sign routes, particularly in urban areas are referred to by alternate names. For instance, U.S. 191 is known as “Main Street” and “Huffine” in the Bozeman area. Alternate routes identify the names and locations of alternate names for a sign route. (At present, these are not specified in TIS and are manually entered for each instance. It would be more efficient if a list of these were available.)

.CorridorRouteCorrespondance: A correspondence shall be established so that locations specified by Sign Route and milepost can be translated to correspond to Corridor Route and milepost.

.Landmarks: Landmarks, towns, passes, intersections, junctions and exits of sign routes are identified by name and location within each sign and corridor route. (At present, this information is not stored in TIS. Formalizing this practice would make the system more

consistent and easier to use.) These would facilitate automating such “location description” entries as “10 miles East of Bozeman,” “2 miles West of Homestake Pass,” etc.

Consists of:

.Name: The name of a landmark. Example “Homestake Pass.”

.Type: If this structure is implemented, it may be desirable to distinguish different types such as landmarks, towns, passes, intersections, junctions, and exits.

.CorridorRouteLocation: Consists of one or more of the following:

Corridor Route Name and Start and End Mileposts.

8.3. DataDef.Contexts

Contexts characterize incidents in terms of their location, the times in which they impact travel, the impact they have on travel (restrictions), and the source of the information provided for them.

8.3.1. DataDef.Contexts.Location

These entries indicate the physical location of an event, facility, or alert on the road network as well as the specification of the location in terms of MDT geographic entities, including Districts, Divisions, Sections, Segments, Sign Routes and Corridor Routes.

.PhysicalLocation: A Location will be one of the following types:

.Point: A point on the road network.

.GeneralSegment: A segment with a start and end point on the road network.

.MDTSegment: A pre-defined MDT Segment.

.Organization: A Location will indicate the following, where appropriate and possible:

.MDTDivision: Division ID of the Division containing the Location.

.MDTDistrict: District ID of the District containing the Location.

.MDTSection: Section ID of the Section containing the Location.

.MDTSegment: Segment ID of the Segment containing the Location.

.RoadNetwork: A Location will be assigned on the road network according to:

.CorridorRouteLocation: Its location, accurate to the nearest tenth of a milepost, on a corridor route.

.SignRouteLocation: Its location, accurate to the nearest tenth of a milepost, on a sign route.

.Description: The ability to enter/automate a text description of the location should be allowed, as is currently the case. Example: “10 miles East of Bozeman.” This process could be automated using Landmarks (specified in DataDef.Lists.MDTRoadNetwork).

.OffNetwork: In certain cases, events at off-network locations will be specified. This designation shall only be used for off-network events. Off-network locations should indicate Division and District.

.LocationDescription: A text description of the off-network location shall be included.

.Coordinates: Coordinates of the off-network location shall be specified so the event can be represented on maps. (Note: It may be necessary to allow these to be specified via the map, which will result in lack of precision.)

8.3.2. DataDef.Contexts.EffectivePeriod

These entries indicate the period (dates and times) during which an event affects travel, a facility is open, etc. They consist of:

.StartDateTime: May be one of the following:

- Time and Date
- “Effective Immediately”
- “Unknown”

.EndDateTime: May be one of the following:

- Time and Date
- “Until Further Notice”
- “Unknown”

.WeeklySchedule: Indicates days of the week and times during those days, between start and end times, in which travel is affected. For instance, might indicate that activity on a construction project occurs between 8AM and 5PM, Monday through Friday.

.Exceptions: Indicates exceptions to stated schedules. For instance, activity might not take place on a holiday.

.Recurrence: Indicates recurrences. For instance, a facility or roadway might open and close at pre-planned, recurring times each year.

8.3.3. DataDef.Contexts.Restrictions

This information indicates the restrictions on normal travel due to an event. Includes:

.Dimensions: These consist of restrictions on the dimensions of a vehicle due to an event.

.Height: A limitation on the height (inches) of a vehicle.

.Length: A limitation on the length (inches) of a vehicle.

.Width: A limitation on the width (inches) of a vehicle.

.Load: These consist of restrictions on the weight of the vehicle due to an event.

.Single-Axle: A limitation of a single-axle vehicle load (tons).

.Tandem-Axle: A limitation of a tandem-axle vehicle load (tons).

.PerSingle: A maximum limit per single axle (lbs).

.PerTandem: A maximum limit per tandem axle (lbs).

.TireWidth: A limit per inch tire width (lbs).

.WinterEquip: These consist of requirements for winter equipment on vehicles due to an event.

.Chains: Includes:

.Required: Chains are required on vehicles.

.Advisory: Chains are advised on vehicles.

.VehicleTypes: The vehicle types affected by the chain requirements/advisories.

.Direction: The direction of travel lanes for which chains are required.

.Payload: These consist of restrictions on types of payload a vehicle can carry.

.HazMat: A restriction on vehicles carrying hazardous materials.

.Speed: These include limits and advisories for all vehicles and for commercial vehicles.

.Advisory: A speed in miles per hour that is advised.

.Limit: A speed in mile per hour that is not to be exceeded.

.VehicleTypes: The vehicle types affected by the speed limits.

.Pilot: Indicates that travelers must follow a pilot car.

.Passing: Indicates that passing is prohibited.

.ETO: Indicates that emergency travel only (ETO) is advised.

.Lanes: Describes lane closures including the number of closed lanes, the position of closed lanes on the highway, and the re-routing of traffic flow to opposing lanes.

.Unspecified: Indicates that one or more lanes are closed.

.SpecificLanesClosed: Indicates the number and position of lanes that are closed.

.Delay: Indicates an associated delay.

.Unspecified: Denotes that a delay of unspecified length exists.

.Duration: Indicates the amount of time of the delay.

.Closure: Indicates a closure and its nature:

.AllVehicles: Closed to all vehicles.

.SpecificVehicleTypes: Indicates specific types of vehicles for which the closure applies.

.Avalanche: Indicates a road closure due to an avalanche.

.Season: Indicates that the road is closed for the season.

.Detour: Indicates the presence and nature of a detour. Includes:

.Description: A text description of the detour route. Note that most detours are “off-network” as per DataDef.Contexts.Location.OffNetwork. Thus, the system includes the description of the detour rather than the selection of the component segments of the detour.

.Length: The length in miles of the detour.

.EstimatedTime: The estimated time length of the detour.

.VehicleTypes: Indicates specific types of vehicles for which the detour applies.

.PassGrade: Indicates the grade of the slope in degrees of inclination of a mountain pass.

.BridgeHeight: Indicates the height of a bridge.

.HighProfile: Indicates that high profile vehicles are not advised.

8.3.4. DataDef.Contexts.InfoSource

These entries indicate the source of information entered into the system.

.Contact: Contact information, as defined previously, for the information source.

.DateTime: The Date and time at which the information was reported.

8.4. DataDef.Events

For the purpose of this document, event is a generic term used to represent:

- Projects (Construction or Maintenance)
- Road Conditions
- Spring Thaw Load and Speed Restrictions
- Incidents
- Special Events

All of these are considered types of events. Other types of events may be considered for addition to the system in the future.

All events include contexts, which describe the events in terms of location, time and impact on travel. Implicit is the inclusion of the corresponding MDT District, Division, and Section.

8.4.1. DataDef.Events.Project

These entries describe a construction or maintenance project and consist of:

.Type: Must be one of the following:

“Construction.”

“Maintenance.”

.ID: A unique identifier, dependent on project type.

If “Construction”: An alphanumeric project ID contained in the comprehensive listing of project IDs from an internal system table (i.e. `espr_alpha_id` of the `dp.eis_project_status_report` or from the `atce_project_id` of the `acct.acct_tc_edits`).

If “Maintenance”: A seven-digit cost center number contained in the comprehensive list of cost center numbers from the Maintenance Management System (MMS).

.InformationSource: Must be a:

DataDef.Contexts.InfoSource as previously defined.

.Status: Indicates the status of the project. Must be one of the following:

“Completed.”

“Active.”

“Inactive.”

.WorkTypes: Must be one or more:

DataDef.Lists.WorkType as previously defined.

.Location: Must be exactly one of:

DataDef.Contexts.Location.PhysicalLocation.GeneralSegment.

DataDef.Contexts.Location.PhysicalLocation.Point.

DataDef.Contexts.Location.OffNetwork.

.EffectivePeriod: Must be a:

DataDef.Contexts.EffectivePeriod instance.

.CompletionDateTime: Indicates the date and time when the project was completed. This is required if the status of a project is “Completed”.

.Restrictions: Must be zero or more:

DataDef.Contexts.Restrictions as previously defined.

.InternalRemarks: Remarks describing the event for internal purposes. These will only be displayed to internal users of the system.

.ExternalRemarks: Remarks describing the event for external purposes. These will be displayed to the public via reports and other output.

8.4.2. DataDef.Events.RoadConditions

These entries describe Road Conditions and consist of:

.InformationSource: Must be a:

DataDef.Contexts.InfoSource instance.

.ConditionTypes: Must be one or more:

DataDef.Lists.Conditions as previously defined.

.Location must be:

DataDef.Contexts.Location.PhysicalLocation.MDTSegment.

DataDef.Contexts.Location.PhysicalLocation.Point.

.EffectivePeriod: Consists of:

DataDef.Contexts.EffectivePeriod.

.Restrictions: Must be zero or more:

DataDef.Contexts.Restrictions as previously defined. These include road closures, chain requirements, and ETOs.

.InternalRemarks: Remarks describing the event for internal purposes. These will only be displayed to internal users of the system.

.ExternalRemarks: Remarks describing the event for external purposes. These will be displayed to the public via reports and other output.

.Quantity: Numbers denoting maximum and minimum values further qualifying the condition type only when the condition type is “# Inches of New Snow”.

8.4.3. DataDef.Events.SpringThawLoadAndSpeedRestrictions

These entries describe Spring Thaw related Load and Speed Restrictions and consists of:

.InformationSource: Must be a:

DataDef.Contexts.InfoSource instance.

.Location: Must be a:

DataDef.Contexts.Location.PhysicalLocation.GeneralSegment.

.EffectivePeriod: Consists of:

DataDef.Contexts.EffectivePeriod.

.Restrictions: Consists of:

DataDef.Contexts.Restrictions as previously defined.

.InternalRemarks: Remarks describing the event for internal purposes. These will only be displayed to internal users of the system.

.ExternalRemarks: Remarks describing the event for external purposes. These will be displayed to the public via reports and other output.

8.4.4. DataDef.Events.Incident

These entries describes an Incident and consist of:

.ID: Must be a:

Unique incident identifier, automatically generated by the system.

.InformationSource: Must be a:

DataDef.Contexts.InfoSource instance.

.Location: Must be one or more:

DataDef.Contexts.Location.PhysicalLocation.Point.

DataDef.Contexts.Location.PhysicalLocation.GeneralSegment.

.EffectivePeriod: Consists of:

DataDef.Contexts.EffectivePeriod.

.Restrictions: Consists of:

DataDef.Contexts.Restrictions as previously defined.

.Description: Consists of:

A text description of the incident.

.VehicleTypes: Consists of:

DataDef.Lists.VehicleTypes as previously defined.

.Fatalities: Consists of:

Number of fatalities. This field shall not be viewable by the public.

.Injuries: Consists of:

Number of injuries. This field shall not be viewable by the public.

.IncidentClearedTime: Consists of:

The Date and time when the incident was cleared.

.LaneClosureTime: Consists of:

The Date and time when lanes were closed due to the incident.

.InternalRemarks: Remarks describing the event for internal purposes. These will only be displayed to internal users of the system.

.ExternalRemarks: Remarks describing the event for external purposes. These will be displayed to the public via reports and other output.

8.4.5. DataDef.Events.SpecialEvent

These entries describe a Special Event and consist of:

.ID: Must be a:

Unique special event identifier, automatically generated by the system.

.InformationSource: Must be a:

DataDef.Contexts.InfoSource instance.

.Location Must be one or more:

DataDef.Contexts.Location.PhysicalLocation.Point.

DataDef.Contexts.Location.PhysicalLocation.GeneralSegment.

.EffectivePeriod: Consists of:

DataDef.Contexts.EffectivePeriod.

.Restrictions: Consists of zero or more:

DataDef.Contexts.Restrictions as previously defined.

.Description: Consists of:

A text description of the special event.

8.5. DataDef.Facilities

For the purpose of this document, facility is a generic term used to represent:

- Rest Areas.
- Border Crossings.
- Weigh Stations.

All of these are considered types of facilities. Other types of facilities may be considered for addition to the system in the future.

All facilities include contexts, which describe the facilities in terms of location, time and impact on travel. Implicit is the inclusion of the corresponding MDT District, Division, and Section.

8.5.1. DataDef.Facilities.RestArea

These entries describe a Rest Area and consist of:

.ID: An ID used to uniquely identify the Rest Area.

.Location: Must be a:

DataDef.Contexts.Location.PhysicalLocation.Point.

.EffectivePeriod: Indicates the dates and times in which the Rest Area is closed and consists of:

DataDef.Contexts.EffectivePeriod.

.Description: A text description of the rest area or the reason for the closure

.Amenities: Indicates which of the following are available at the Rest Area:

- Seasonal availability of rest area (if applicable)
- Phone
- Picnic Area
- RV Dump Station
- Pet Exercise Area
- Baby Changing Station
- Truck Parking
- Road Condition and Weather Information

8.5.2. DataDef.Facilities.BorderCrossing

This information describes a Border Crossing and consists of:

.ID: An ID used to uniquely identify the Border Crossing.

.Location must be:

DataDef.Contexts.Location.PhysicalLocation.Point.

.EffectivePeriod: Indicates the dates and times at which the Border Crossing is closed and consists of:

DataDef.Contexts.EffectivePeriod.

.Description: A text description of the Border Crossing and the reason for the closure.

8.5.3. DataDef.Facilities.WeighStation

Describes a Weigh Station and consists of:

.ID: An ID used to uniquely identify the Weigh Station.

.Location must be:

DataDef.Contexts.Location.PhysicalLocation.Point.

.EffectivePeriod: Indicates the dates and times in which the Weigh Station is closed and consists of:

DataDef.Contexts.EffectivePeriod.

.Description: A text description of the Weigh Station and a reason for the closure.

.Amenities: Indicates which of the following are available at the Weigh Station:

- Weigh in Motion
- PrePass

8.6. DataDef.Alerts

For the purpose of this document, alert is a generic term used to represent:

- AMBER Alerts
- Homeland Security Alerts
- General Transportation Alerts

More alerts may be added to the system in the future. All alerts consist of the following:

.ID: an ID used to uniquely identify an alert.

.AlertType: Indicates the type of alert and must be one of the following:

- AMBER Alert
- Homeland Security
- General Transportation

.Description: A text description of the alert.

.Expiration: The time at which the alert expires.

.InterruptType: Must be one of the following:

- Interruptible
- Non-interruptible

.PhoneContext: Must be one of the following:

- Call Greeting
- Sub-Menu

9. FUNCTIONAL REQUIREMENTS FOR SYSTEM FEATURES

Functional requirements for features include general data, event, facility and alert entry, modification and deletion; report generation; public interface; private interface; notification; user administration; and data management.

9.1. General Data Entry, Modification, and Deletion Interface Requirements

The system provides users with options to enter, modify and delete information for which they have associated privileges. In general, the interfaces for doing so will include the features that follow.

9.1.1. Features.DataEntryInterfaces

The system provides users with the option to enter information for which they have associated privileges.

Description

When a user chooses to enter new data such as an event, a facility or a list entry, the system provides an interface through which the user can specify the data attributes.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) chooses to enter new data.	System provides user with an interface to specify data attributes.

Functional Requirements

Requirement ID	Statement
.DataEntryInterfaces	The system shall allow authorized users to choose to enter new data and shall provide the user with an interface to specify corresponding data attributes.
.PrepopulateDataChoices	The system shall automatically pre-populate lists and other fields, where appropriate, for data selection and consistency. Certain fields may also be pre-populated with times, locations and other information where appropriate.
.ModifiableFields	The system shall restrict modification of fields dependent on rules associated with the users' privileges and the data that users are editing.
.DatabaseCommit	The system shall not commit changes to the database until the user explicitly chooses to save entries.

9.1.2. Features.DataModificationInterfaces

The system provides users with the option to modify information for which they have associated privileges.

Description

When the user requests to modify an existing event, facility, or alert, the system must display all stored fields and allow users to modify appropriate fields.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) chooses to modify existing data.	System provides user with an interface to specify and modify data attributes.

Functional Requirements

Requirement ID	Statement
.DataModificationInterfaces	The system shall allow authorized users to choose to modify existing data and shall provide the user with an interface to specify and change associated data attributes.
.Select	The system shall allow authorized users to select an existing data item for modification.
.AutoPopulateExistingData	Upon selection of a data element for modification by the user, the system shall automatically display field names and values corresponding to those stored in the database at the time of the request.
.PrepopulateDataChoices	The system shall automatically pre-populate lists and other fields, where appropriate, for data selection and consistency. Certain fields may also be pre-populated with times, locations and other information where appropriate.
.ModifiableFields	The system shall restrict modification of fields dependent on rules associated with users' privileges and the data they are editing.
.DatabaseCommit	The system shall not commit changes to the database until the user explicitly chooses to save modifications.

9.1.3. Features.DataSaveOptions

The system provides users with the option to save information for which they have associated privileges for entry and/or modification.

Description

When modifying data, the user can choose to save the new information. The system checks for errant/missing information and takes the appropriate actions.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) chooses to save data entries /modifications.	System checks the entries for validity and either updates the database or displays an error message to the user.

Functional Requirements

Requirement ID	Statement
.DataSaveOptions	The system shall allow authorized users to save data entries/modifications.
.Confirmation	Prior to saving data entries/modifications, the system shall ask users to confirm that they want to save changes. If a user chooses not to confirm, no action will be taken.
.Validation	Prior to saving data entries/modifications, the system shall check entries for validity.
.NoChanges	Prior to saving, the system shall check to see if data was entered/modified. If not, the system will inform the user that no changes have been made.
.MissingValues	The system shall check that all required fields are filled. If there are missing values for required fields, the system shall display a message to the user stating which missing values must be supplied.
.ValidValues	The system shall check that all values are valid. If one or more values are not valid, the system shall display a message stating which field values are not valid and the reasons that the values are not valid.
.DatabaseCommit	If all values are valid and all required fields are present, the system shall update database tables with the new modifications.
.Success	The system shall indicate to the user if changes were committed to the database.
.Failure	The system shall indicate to the user if changes were not committed to the database and state a reason why they were not committed.
.Logging	The system shall log all saved modifications with user identification, date and time of the saved modifications, and the modifications made.

Features.DataCancelOptions

The system provides users with the option to cancel entry/modification of information without committing data to the database.

Description

Users can choose to cancel the entry/modification of existing events, facilities or alerts. The system will then halt the modification process and remove the display of modified values where applicable.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests to cancel the modification of data.	System prompts user to confirm cancel decision.
User chooses to confirm cancel.	System removes the entry/modification interface.
User chooses not to confirm cancel.	System does nothing.

Functional Requirements

Requirement ID	Statement
.DataCancelOptions	The system shall allow authorized users to cancel data entries/modifications that have not yet been saved to the database.
.Confirm	In response to a user’s cancel request, the system shall prompt the user to confirm the cancel. If the user confirms the cancel, the system shall disregard any unsaved entries / modifications made to the data. If the user does not confirm the cancel, the system shall do nothing.

9.1.4. Features.DataDeletionOptions

The system provides users with the option to delete information from the database for which they have associated privileges.

Description

When users choose to delete existing data, the system prompts them for confirmation. If the user confirms the delete, the system removes the event, facility, or alert information from the database. If the user does not confirm the delete, the system does nothing. Users delete data which were entered with wrong information. Deletion will permanently remove the information from the database. This action should not be confused with changing the status of an event or facility. For example, deleting a construction project permanently removes all traces of the project from the system whereas changing the project's status from 'Active' to 'Complete' merely changes an attribute of the project, while preserving the record of the project.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests to delete a data element.	System prompts the user for delete confirmation.
User confirms delete.	System removes the data item from the database permanently.
User does not confirm delete.	System does nothing.

Functional Requirements

Requirement ID	Statement
.DataDeletionOptions	The system shall allow authorized users to choose to delete existing events, facilities, or alerts.
.Confirm	Upon user delete request, the system shall prompt the user to confirm the delete. If the user confirms the delete, an attempt will be made to commit the deletion to the database. If the user does not confirm the delete, the system shall do nothing.
.DatabaseCommit	If the user confirms the request to delete, an attempt will be made to commit the deletion to the database.
.Success	The system shall indicate to the user if deletion was committed to the database.
.Failure	The system shall indicate to the user if deletion was not committed to the database and a reason why it was not deleted.
.Logging	The system shall log all deletions with user identification, date and time of the deletion, and the deletion made.

9.2. Event, Facility, and Alert Data Entry, Modification, and Deletion Requirements

The system provides users with the ability to enter, modify, and delete event, facility, and alert information including construction/maintenance projects, road conditions, spring thaw load and speed restrictions, incidents, special events, rest areas, border crossings, and weigh stations.

9.2.1. Features.ProjectEntry

The system allows data entry and storage of construction/maintenance project information.

Description

The system shall allow entry and storage of roadway construction and maintenance project information, including temporal properties, location, the nature of the project, and its effects on travel.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) enters new project information.	System stores a new database record containing input for the new project information.

Functional Requirements

Requirement ID	Statement
.ProjectEntry	The system shall allow an authorized user to enter a new project as a DataDef.Events.Project according to Features.DataEntryInterfaces.
.IDList	The system shall automatically populate a project ID list when the user specifies the project as construction or maintenance as per DataDef.Events.Project.ID.
.LocationMethod	The system shall allow the user to specify project location using a map interface, a form interface, or a combination of the two.
.WorkTypeList	The system shall automatically populate a list of possible work types from DataDef.Lists.WorkTypes.
.Save	The system shall allow the user to save the project entry according to Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel the project entry according to Features.DataCancelOptions.

9.2.2. Features.ProjectModification

The system allows modification of construction/maintenance project information.

Description

The system shall allow authorized users to modify existing construction or maintenance projects. The user must be able to select which project to modify. Users can modify all fields except the project ID. If the location is modified, mileposts must still be consistent with corridor routes. After modification the user may save or cancel the changes.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) modifies existing project information.	System updates database records to reflect the modifications.

Functional Requirements

Requirement ID	Statement
.ProjectModification	The system shall allow an authorized user to modify an existing project as a DataDef.Events.Project according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all project fields except DataDef.Events.Project.ID.
.Save	The system shall allow the user to save project modifications as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel project modifications as per Features.DataCancelOptions.

9.2.3. Features.ProjectDeletion

The system allows users to delete an existing construction/maintenance project.

Description

The system shall allow users to delete construction or maintenance projects. Deleted projects are permanently removed from the system, so deletion should not be confused with changing the status of the project to 'Completed'. Therefore the delete feature shall be used primarily in cases where incorrect information was entered.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) deletes project information.	System updates database tables to account for the project removal.

Functional Requirements

Requirement ID	Statement
.ProjectDeletion	The system shall allow an authorized user to delete a project as a DataDef.Events.Project according to Features.DataDeletionOptions.

9.2.4. Features.RoadConditionEntry

The system allows data entry and storage of road condition information. Note that seasonal road closures shall be entered here as well.

Description

The system shall allow entry and storage of road condition information. Such information includes location, timing, conditions, and effects on travel.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) enters new road condition information.	System stores a new database record containing input for the new road condition information.

Functional Requirements

Requirement ID	Statement
.RoadConditionEntry	The system shall allow an authorized user to enter new road conditions as a DataDef.Events.RoadConditions instance according to Features.DataEntryInterfaces.
.LocationMethod	The system shall allow the user to specify road condition location using a map interface, a form interface, or a combination of the two.
.ByDivision	The system shall allow, as one of multiple means for entry of conditions, the rapid entry of segment conditions within a selected division. (This corresponds to the current method in which conditions for all segments in a division are entered on the same form.)
.Proficiency	The system shall facilitate, as part of the Features.RoadConditionEntry.ByDivision method, entry with proficiency equal to that in the current system as specified in the Section 10.8.1, Other.UsabilityRequirements.EaseOfUse.
.Accuracy	The system shall facilitate, as part of the Features.RoadConditionEntry.ByDivision method, entry with accuracy exceeding that of the current system as specified in the Section 10.8.1, Other.UsabilityRequirements.EaseOfUse .
.ConditionList	The system shall populate a list of possible road conditions corresponding with the list defined in DataDef.Lists.Conditions.
.Save	The system shall allow the user to save a new condition entry according to Features.DataSaveOptions.
.Check	Prior to saving, the system shall check that every segment has a condition. If there is a segment without a condition, the system will not save and will tell the reporter which segment needs a condition assigned.

Requirement ID	Statement
.Resolve	After the user assigns conditions to missing segments, the system shall allow the user to save entries according to Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel conditions entry according to Features.DataCancelOptions.
.RWIS	The system shall verify that road condition entries are consistent with associated RWIS readings where applicable.
.Discrepancy	The system shall notify the user if there is a significant discrepancy between the reported condition and the associated RWIS reading.

9.2.5. Features.RoadConditionModification

The system allows modification of road condition information.

Description

The system shall allow authorized users to modify data regarding existing conditions. The user must be able to select which conditions to modify. Users can modify all condition attributes except location, which is a pre-defined segment. After modification the user may save or cancel the changes. Road condition deletion will not exist as all segments must always have a condition. If multiple conditions are listed for a segment and several are to be deleted or changed, this will occur under condition modification.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) modifies existing conditions.	System updates database records to reflect the modifications. Each modification will result in a new change log being created.

Functional Requirements

Requirement ID	Statement
.RoadConditionModification	The system shall allow an authorized user to modify existing conditions as a DataDef.Events.RoadConditions according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all condition fields except DataDef.Events.RoadConditions.Location.
.Save	The system shall allow the user to save condition modifications as per Features.DataSaveOptions.
.Prompt	The system shall display a message prompt asking the user to confirm that the condition be modified.
.Check	Prior to saving, the system shall check that every segment has a condition. If there is a segment without a condition, the system will not save and will tell the reporter which segment needs a condition added.
.Resolve	After the user assigns conditions to missing segments, the system shall allow the user to save entries according to Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel modifications to conditions as per Features.DataCancelOptions.

9.2.6. Features.SpringThawLoadAndSpeedRestrictionEntry

The system allows data entry and storage of spring thaw load and speed restriction information.

Description

The system shall allow entry and storage of load and speed restrictions due to spring thaw. These are entered separately from load and speed restrictions imposed due to construction/maintenance projects and other events.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) enters new spring thaw load and speed restrictions information.	System stores a new database record containing input for the new spring thaw load and speed restrictions information.

Functional Requirements

Requirement ID	Statement
.SpringThawLoadAndSpeedRestrictionEntry	The system shall allow an authorized user to enter new spring thaw load and speed restriction information as a DataDef.Events.SpringThawLoadAndSpeedRestrictions instance as per Features.DataEntryInterfaces.
.LocationMethod	The system shall allow the user to enter spring thaw load and speed restriction locations using a map interface, a form interface, or the combination of the two.
.Save	The system shall allow users to save spring thaw load and speed restrictions entries according to Features.DataSaveOptions.
.Cancel	The system shall allow users to cancel the entry of spring thaw load and speed restrictions as per Features.DataCancelOptions.

9.2.7. Features.SpringThawLoadAndSpeedRestrictionModification

The system allows data modification of spring thaw load and speed restriction information.

Description

The system shall allow authorized users to modify existing spring thaw load and speed restrictions. The user must be able to select which spring thaw load and speed restrictions to modify. If the location is modified, mileposts must still be consistent with corridor routes. After modification the user may save or cancel the changes.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) modifies existing spring thaw load and speed restrictions.	System updates database records to reflect the modifications.

Functional Requirements

Requirement ID	Statement
.SpringThawLoadAndSpeedRestrictionModification	The system shall allow an authorized user to modify an existing spring thaw load and speed restrictions as a DataDef.Events.SpringThawLoadAndSpeedRest instance according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all spring thaw load and speed restriction fields.
.Save	The system shall allow the user to save spring thaw load and speed restriction modifications as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel spring thaw load and speed modifications as per Features.DataCancelOptions.

9.2.8. Features.SpringThawLoadAndSpeedRestrictionDeletion

The system allows users to delete an existing spring thaw load and speed restriction.

Description

The system must allow users to delete load and speed restrictions. Deleted spring thaw load and speed restrictions are permanently removed from the system. Therefore, the delete feature is used primarily in cases where incorrect information was entered.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) deletes spring thaw load and speed restrictions.	System updates database tables to account for the spring thaw load and speed restriction removal.

Functional Requirements

Requirement ID	Statement
.SpringThawLoadAndSpeedRestrictionDeletion	The system shall allow an authorized user to delete a spring thaw load and speed restriction as a DataDef.Events.SpringThawLoadAndSpeedRestrictions according to Features.DataDeletionOptions.

9.2.9. Features.IncidentEntry

The system allows data entry and storage of incident information.

Description

The system shall allow entry and storage of incident information. Such information includes location, timing, details, effects on travel, reporting and source information.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) enters new incident information.	System stores a new database record containing input for the new incident information.

Functional Requirements

Requirement ID	Statement
.IncidentEntry	The system shall allow an authorized user to enter new incident information as a DataDef.Events.Incident instance as per Features.DataEntryInterfaces.
.IDGeneration	The system shall generate a unique incident ID as a DataDef.Events.Incident.ID.
.LocationMethod	The system shall allow the user to enter incident location using a map interface, a form interface, or a combination of the two.
.Save	The system shall allow the user to save incident entry information as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel incident entry as per Features.DataCancelOptions.

9.2.10. Features.IncidentModification

The system allows data modification of incident information.

Description

The system shall allow authorized users to modify existing incidents. The user must be able to select which incident to modify. If the location is modified, mileposts must still be consistent with corridor routes. After modification the user may save or cancel the changes.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) modifies existing incident.	System updates database records to reflect the modifications.

Functional Requirements

Requirement ID	Statement
.IncidentModification	The system shall allow an authorized user to modify an existing incident as a DataDef.Events.Incident according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all project fields except DataDef.Events.Incident.ID.
.Save	The system shall allow the user to save incident modifications as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel incident modifications as per Features.DataCancelOptions.

9.2.11. Features.IncidentDeletion

The system allows users to delete an existing incident.

Description

The system shall allow users to delete incidents. Deleted incidents are permanently removed from the system. Therefore the delete feature is used primarily in cases where incorrect information was entered.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) deletes an incident.	System updates database tables to account for the incident removal.

Functional Requirements

Requirement ID	Statement
.IncidentDeletion	The system shall allow an authorized user to delete an incident as a DataDef.Events.Incident according to Features.DataDeletionOptions.

9.2.12. Features.SpecialEventEntry

The system allows data entry and storage of special event information.

Description

The system shall allow entry and storage of special event information. Such information includes location, times, details, effects on travel, reporting and source information.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) enters new special event information.	System stores a new database record containing input for the new special event information.

Functional Requirements

Requirement ID	Statement
.SpecialEventEntry	The system shall allow an authorized user to enter new special event information as a DataDef.Events.SpecialEvent instance as per Features.DataEntryInterfaces.
.LocationMethod	The system shall allow the user to enter special event location using a map interface, a form interface, or a combination of the two.
.Save	The system shall allow users to save special event entries according to Features.DataSaveOptions.
.Cancel	The system shall allow users to cancel special event entry as per Features.DataCancelOptions.

9.2.13. Features.SpecialEventModification

The system allows data modification of special event information.

Description

The system shall allow authorized users to modify existing special events. The user must be able to select which special events to modify. If the location is modified, mileposts must still be consistent with corridor routes. After modification the user may save or cancel the changes.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) modifies an existing special event.	System updates database records to reflect the modifications.

Functional Requirements

Requirement ID	Statement
.SpecialEventModification	The system shall allow an authorized user to modify an existing special event as a DataDef.Events.SpecialEvent according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all special event fields except DataDef.Events.SpecialEvent.ID.
.Save	The system shall allow the user to save special event modifications as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel special event modifications as per Features.DataCancelOptions.

9.2.14. Features.SpecialEventDeletion

The system allows users to delete an existing special event.

Description

The system shall allow users to delete special events. Deleted special events are permanently removed from the system. Therefore the delete feature is used primarily in cases where incorrect information was entered.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) deletes a special event.	System updates database tables to account for the special event removal.

Functional Requirements

Requirement ID	Statement
.SpecialEventDeletion	The system shall allow an authorized user to delete a special event as a DataDef.Events.SpecialEvent according to Features.DataDeletionOptions.

9.2.15. Features.RestAreaEntry

The system allows data entry and storage of rest area information.

Description

The system shall allow entry and storage of rest area information. Such information includes location, operating schedule, and details (i.e. amenities).

Stimulus / Response Sequences

Stimulus	Response
User (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator) enters new rest area information.	System stores a new database record containing input for the new rest area information.

Functional Requirements

Requirement ID	Statement
.RestAreaEntry	The system shall allow an authorized user to enter new rest area information as a DataDef.Facilities.RestArea.
.LocationMethod	The system shall allow the user to enter a rest area location using a map interface, a data form interface, or a combination of the two.
.Save	The system shall allow the user to save a rest area entry according to Features.DataSaveOptions.

9.2.16. Features.RestAreaModification

The system allows data modification of rest area information.

Description

The system shall allow authorized users to modify existing rest areas. The user must be able to select which rest areas to modify. After modification the user may save or cancel the changes.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator for modifying amenities and UserClasses.Reporter for modifying status) modifies existing rest area information.	System updates database records to reflect the modifications.

Functional Requirements

Requirement ID	Statement
.RestAreaModification	The system shall allow an authorized user to modify an existing rest area as a DataDef.Facilities.RestArea according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow user to modify all rest area fields based on his or her user class.
.Save	The system shall allow the user to save rest area modifications as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel rest area modifications as per Features.DataCancelOptions.

9.2.17. Features.RestAreaDeletion

The system allows users to delete an existing rest area.

Description

The system shall allow users to delete a rest area. Deleted rest areas are permanently removed from the system. Therefore the delete feature is used primarily in cases where incorrect information was entered.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator) deletes rest area.	System updates database tables to account for the rest area removal.

Functional Requirements

Requirement ID	Statement
.RestAreaDeletion	The system shall allow an authorized user to delete a rest area as a DataDef.Facilities.RestArea according to Features.DataDeletionOptions.

9.2.18. Features.BorderCrossingEntry

The system allows data entry and storage of border crossing information.

Description

The system shall allow entry and storage of border crossing information. Such information includes location, times of operation, and details.

Stimulus / Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator) enters new border crossing information.	System stores a new database record containing input for the new border crossing information.

Functional Requirements

Requirement ID	Statement
.BorderCrossingEntry	The system shall allow an authorized user to enter new border crossing information as a DataDef.Facilities.BorderCrossing.
.LocationMethod	The system shall allow the user to enter border crossing location using a map interface, a data form interface, or a combination of the two.
.Save	The system shall allow the user to save a border crossing entry according to Features.DataSaveOptions.

9.2.19. Features.BorderCrossingModification

The system allows data modification of border crossing information.

Description

The system shall allow authorized users to modify existing border crossings. The user must be able to select which border crossings to modify. After modification the user may save or cancel the changes.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator for modifying amenities and UserClasses.Reporter for modifying status) modifies existing border crossing.	System updates database records to reflect the modifications.

Functional Requirements

Requirement ID	Statement
.BorderCrossingModification	The system shall allow an authorized user to modify an existing border crossing as a DataDef.Facilities.BorderCrossing according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all border crossing fields based on his or her user class.
.Save	The system shall allow the user to save border crossing modifications as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel border crossing modifications as per Features.DataCancelOptions.

9.2.20. Features.BorderCrossingDeletion

The system allows users to delete an existing border crossing.

Description

The system shall allow users to delete a border crossing. Deleted border crossings are permanently removed from the system. Therefore the delete feature is used primarily in cases where incorrect information was entered.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator) deletes a border crossing.	System updates database tables to account for the border crossing removal.

Functional Requirements

Requirement ID	Statement
.BorderCrossingDeletion	The system shall allow an authorized user to delete a border crossing as a DataDef.Facilities.BorderCrossing according to Features.DataDeletionOptions.

9.2.21. Features.WeighStationEntry

The system allows data entry and storage of weigh station information.

Description

The system shall allow entry and storage of weigh station information. Such information includes location, times of operation, and details.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator) enters new weigh station information.	System stores a new database record containing input for the new weigh station information.

Functional Requirements

Requirement ID	Statement
.WeighStationEntry	The system shall allow an authorized user to enter new weigh station information as a DataDef.Facilities.WeighStation.
.LocationMethod	The system shall allow the user to enter weigh station location using a map interface, a data form interface, or a combination of the two.
.Save	The system shall allow the user to save a weigh station entry according to Features.DataSaveOptions.

9.2.22. Features.WeighStationModification

The system allows data modification of weigh station information.

Description

The system shall allow authorized users to modify existing weigh stations. The user must be able to select which weigh stations to modify. After modification the user may save or cancel the changes.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator for modifying amenities and UserClasses.Reporter for modifying status) modifies an existing weigh station.	System updates database records to reflect the modifications.

Functional Requirements

Requirement ID	Statement
.WeighStationModification	The system shall allow an authorized user to modify an existing weigh station as a DataDef.Facilities.WeighStation according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all weigh station fields based on his or her user class.
.Save	The system shall allow the user to save weigh station modifications as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel weigh station modifications as per Features.DataCancelOptions.

9.2.23. Features.WeighStationDeletion

The system allows users to delete an existing weigh station entry.

Description and Priority

The system shall allow users to delete a weigh station. Deleted weigh stations are permanently removed from the system. Therefore the delete feature is used primarily in cases where incorrect information was entered.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator) deletes a weigh station.	System updates database tables to account for the weigh station removal.

Functional Requirements

Requirement ID	Statement
.WeighStationDeletion	The system shall allow an authorized user to delete a weigh station as a DataDef.Facilities.WeighStation according to Features.DataDeletionOptions.

9.2.24. Features.AlertEntry

The system allows data entry and storage of alerts.

Description

The system shall allow entry and storage of alert information. Such information includes the type of alert, expiration time, description of alert, and specification of how the alert is employed.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.AlertReporter) enters new alert information.	System stores a new database record containing input for the new alert information.

Functional Requirements

Requirement ID	Statement
.AlertEntry	The system shall allow an authorized user to enter a new alert as a DataDef.Alerts according to Features.DataEntryInterfaces.
.Save	The system shall allow the user to save the alert entry according to Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel the alert entry according to Features.DataCancelOptions.

9.2.25. Features.AlertModification

The system allows data modification of alert information.

Description

The system shall allow authorized users to modify existing alerts. The user must be able to select which alert to modify. Users can modify all fields except the alert ID. After modification the user may save or cancel the changes.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.AlertReporter) modifies existing alert information.	System updates database records to reflect the modifications.

Functional Requirements

Requirement ID	Statement
.AlertModification	The system shall allow an authorized user to modify an existing alert as a DataDef.Alerts according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all alert fields except DataDef.Alerts.ID.
.Save	The system shall allow the user to save alert modifications as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel alert modifications as per Features.DataCancelOptions.

9.2.26. Features.AlertDeletion

The system allows users to delete an existing alert.

Description

The system shall allow users to delete alerts. Deleted alerts are permanently removed from the system. Therefore the delete feature shall be used primarily in cases where incorrect information was entered.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.AlertReporter) deletes alert information.	System updates database tables to account for the alert removal.

Functional Requirements

Requirement ID	Statement
.AlertDeletion	The system shall allow an authorized user to delete an alert as a DataDef.Alerts according to Features.DataDeletionOptions.

9.3. Features.ReportGeneration

The system includes features to facilitate report generation.

Description

The system shall facilitate the generation of reports, both automatic (scheduled) and on-demand. The system shall allow authorized users to edit reports.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.
User requests to edit a report.	System allows user to edit report.

Functional Requirements

Requirement ID	Statement
.ReportGeneration	The system shall generate reports.
.AutomaticReports	The system shall automatically generate reports, at pre-defined intervals specific to each report type.
.OnDemandReports	The system shall generate reports on demand when requested by authorized users.
.EditReports	The system shall allow authorized users to edit the contents of reports.
.Save	The system shall allow authorized users to save edited reports.
.Cancel	The system shall allow users to cancel editing of reports.
.Archive	The system shall archive report versions each time a report is edited and saved according to DataDef.System.Archives.

9.3.1. Features.ReportGeneration.ConstructionReport

The system allows generation of Construction Reports.

Description

The system shall generate reports concerning construction events in the system.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.ConstructionReport	The system shall generate construction/maintenance project reports.
.Name	The Construction Report shall be named using an alphanumeric code automatically determined by the database.
.DateTime	The Construction Report shall include a date and time corresponding to the date and time of report generation.
.IntroInfo	The Construction Report shall have an introductory informational section providing a telephone number for additional information, a description of the report, legal reminders, and general delay information.
.Status	The Construction Report shall have status headings corresponding to DataDef.Events.Project.Status
.Routes	The Construction Report status headings shall contain sign route name headings (as per DataDef.Lists.MDTRoadNetwork.SignRoutes.Type and DataDef.Lists.MDTRoadNetwork.SignRoutes.Number) listed in alphanumeric order.
.Order	The route headings shall be in alphanumeric order.
.List	Each route heading shall have a list of Construction Report entries (as Features.ReportGeneration.ConstructionReport.Entry) corresponding to project events (as per DataDef.Events.Project) along the sign route specified by the route heading whose status corresponds to the status heading.
.Order	Entries in the list under each route heading shall be geographically ordered.
.Entry	Each Construction Report entry, pertaining to a project in the database, shall contain a work type, weekly status, general location information, project details, and travel effects (as per

Requirement ID	Statement
	DataDef.Events.Project).
.Local	The Construction Report shall provide a list of telephone numbers for information on Montana's lesser traveled roads.

9.3.2. Features.ReportGeneration.StatewideRoadConditionReport

The system allows generation of Statewide Road Condition Reports.

Description

The system shall be able to generate a statewide report containing conditions (other than dry) for all interstate, state, federal, seasonal, and secondary roadways.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.StatewideRoadConditionReport	The system shall generate a statewide road conditions report.
.DateTime	The Statewide Road Condition Report shall have a date and time corresponding to the date and time of report generation.
.Routes	The Statewide Road Condition Report shall contain route headings corresponding to sign routes which contain conditions other than dry. The names of each route heading correspond to the sign route name (as per a DataDef.Lists.MDTRoadNetwork.SignRoutes.Type and DataDef.Lists.MDTRoadNetwork.SignRoutes.Number).
.Order	The route headings shall be in alphanumeric order.
.List	Each route name heading shall have a list of condition entries (as per Features.ReportGeneration.StatewideRoadConditionReport.Entry) corresponding to conditions (as per DataDef.Events.RoadConditions) located along the route specified in the route heading.
.Order	List entries shall be geographically ordered by segment location.
.Entry	Statewide Road Condition Report entries shall have a location description and a conditions phrase (as per DataDef.Events.RoadConditions). The condition in the entry pertains to the highest priority condition for the particular event if more than one condition is specified.

9.3.3. Features.ReportGeneration.AreaRoadConditionReport

The system generates Area Road Condition Reports.

Description

The system shall be able to generate an area report describing conditions (other than wet or dry) for all interstate, state, federal, seasonal, and secondary roadways in a specified area. Currently, the system creates area reports for each division and an additional area report for Helena, for a total of 11 area reports. Area reports are generated automatically and by demand. Prior to distribution, the reporter should have the ability to make modifications or additions to the report. Automatic distribution shall occur after the reporter saves the modifications and additions.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.AreaRoadConditionReport	The system shall generate area road condition reports.
.Method	Area reports shall be generated automatically and on demand.
.AreaTitle	The Area Road Conditions Report shall contain a title with the name of the area, corresponding to an MDT division or “Helena”, for which all conditions pertain.
.DateTime	The Area Road Conditions Report shall have a date and time corresponding to the date and time of report generation.
.List	The Area Road Conditions Report shall have a list of line-separated entries (as per Features.ReportGeneration.AreaRoadConditionReport.Entry) pertaining to all conditions found on a single route within or partially within the area.
.Order	List entries are ordered alphanumerically by sign route name.
.Entry	Area Road Conditions Report list entries include a sign route name followed by a series of location description/conditions combinations (in paragraph form) in geographic order (as per DataDef.Events.RoadConditions). The conditions in the description/conditions combination pertains to the highest priority condition for the particular event if more than one condition is specified.
.Edit	After the report has been generated, the UserClasses.Reporter

Requirement ID	Statement
	shall be able to edit and make additions to this report prior to its distribution.
.Distribute	The system shall only allow report distribution after the UserClasses.Reporter completes and saves edits/additions if they are necessary. If the user chooses not to edit the report, the distribution shall occur as is.

9.3.4. Features.ReportGeneration.PassReport

The system generates Mountain Pass Road Conditions Reports.

Description

The system shall be able to generate a mountain pass report containing all information relevant to the pass such as road conditions, construction/maintenance, spring thaw load and speed restrictions, incidents, and special events.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.PassReport	The system shall generate a mountain pass report.
.DateTime	The Pass Report shall have a date and time corresponding to the date and time of report generation.
.List	The Pass Report shall have a list of line-separated entries (as per Features.ReportGeneration.PassReport.Entry) pertaining to all events found on a single mountain pass.
.Order	List entries are ordered alphanumerically by pass name.
.Entry	Pass Report list entries include a pass name followed by a series of descriptions of all conditions, projects, incidents, special events, and load and speed restrictions.

9.3.5. Features.ReportGeneration.APRoadConditionReport

The system generates Associated Press (AP) Road Condition Reports.

Description

The system shall be able to generate an Associated Press (AP) conditions report exclusively for AP distribution. There is no significant difference between the types of information contained in the AP report and the statewide and area reports. However, there is a difference in how the information is presented, the goal being a format which can be easily read by general audiences without modification. Contiguous road segments sharing the same conditions are combined into one entry instead of separated into a series of segments.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.APRoadConditionReport	The system shall generate an AP conditions report.
.DateTime	The AP Road Condition Report shall have a date and time corresponding to the date and time of report generation.
.Routes	The AP Road Condition Report shall contain route headings corresponding to sign routes which contain conditions other than dry. The names of each route heading correspond to the sign route name (as per a DataDef.Lists.MDTRoadNetwork.SignRoutes.Type and DataDef.Lists.MDTRoadNetwork.SignRoutes.Number).
.Order	The route headings shall be in alphanumeric order.
.List	Each route heading shall contain a list of condition entries (as per Features.ReportGeneration.APRoadConditionReport.Entry) corresponding to conditions (as per DataDef.Events.RoadConditions) located along the route specified in the route heading.
.Order	Entries on the list are geographically ordered by segment location.
.Entry	Each AP Road Condition Report entry contains a location description and one or more location/condition phrase combinations (as per DataDef.Events.RoadConditions). The conditions in the description/conditions combination pertains to

Requirement ID	Statement
	the highest priority condition for the particular event if more than one condition is specified.
.Readability	<p>The language used in each AP Road Condition Report entry shall conform to English language standards and shall be readable and comprehensible to English-speaking persons, without modification. (i.e. instead of a listing of locations and conditions such as:</p> <p>“I 90 SALTESE TO ST. REGIS RAIN, WET ST. REGIS TO TARKIO SLUSHY”).</p> <p>An AP-style example of the same conditions is as follows: “I 90, from Saltese to St. Regis, is rainy and wet. From St. Regis to Tariko, I-90 is slushy.”</p>
.Continuity	<p>Within each entry, location/condition combinations whose locations are contiguous and whose condition phrases are the same shall be combined into a single location/phrase combination. (i.e. if conditions on I-15 from Vaughn to Dutton are icy and from Dutton to Brady are also icy, a corresponding entry reads: “I 15, from Vaughn to Brady, is icy”.)</p>
.Closed	<p>The AP Road Condition Report shall contain a heading “Closed roads” which contains a listing of all sign routes and segments which are closed due to weather.</p>

9.3.6. Features.ReportGeneration.RoadClosureETOReport

The system generates Road Closure/Emergency Travel Only (ETO) Reports.

Description

The system shall be able to generate reports concerning road closures or Emergency Travel Only (ETO) advisories. This information is extrapolated from events in the database and not entered separately. Closure/ETO reports include the sign route and description of the area closed or subject to ETO.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.RoadClosureETOReport	The system shall generate Road Closed/Emergency Travel Only reports.
.DateTime	The Road Closure/ETO Report shall contain a date and time corresponding to the date and time of report generation.
.Name	The Road Closure/ETO Report shall have a name.
.List	The Road Closure/ETO Report shall contain a list of entries (as per Features.ReportGeneration.RoadClosureETOReport.Entry) detailing those roads that are closed or are under an ETO advisory.
.Order	The Road Closure/ETO Report list shall be organized in alphanumeric order according to sign route and then by location.
.Entry	Each Road Closure/ETO Report entry shall contain a sign route, a location description, a phrase denoting whether the specified location is closed or under ETO, and the cause of the closure or ETO (one of the following: “Construction”, “Adverse Conditions”, “Incident”, or “Special Event” (as per DataDef.Events.RoadConditions)).

9.3.7. Features.ReportGeneration.SpringThawLoadAndSpeedRestrictionsReport

The system generates Spring Thaw Load and Speed Restrictions Reports.

Description

The system shall be able to generate reports concerning load and speed restrictions for commercial vehicles due to spring thaw. These restrictions are not to be confused with load and speed restrictions resulting from other events such as projects or incidents. Therefore, the Spring Thaw Load and Speed Restrictions Report does not include the restrictions for other events.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.SpringThawLoadAndSpeedRestrictionsReport	The system shall generate Spring Thaw Load and Speed Restriction reports.
.DateTime	The Spring Thaw Load and Speed Restrictions Report shall contain a date and time corresponding to the date and time of report generation.
.Intro	The Spring Thaw Load and Speed Restrictions Report shall contain an introductory section explaining the meaning of the restrictions.
.Restrictions	The Spring Thaw Load and Speed Restrictions Report shall contain restriction headings specifying spring thaw load and speed restrictions.
.List	Each restrictions heading shall contain a list of entries (as per Features.ReportGeneration.SpringThawLoadAndSpeedRestrictionsReport.Entry) describing locations, ordered alphanumerically by sign route, that all share the restrictions specified by the heading (as per DataDef.Events.SpringThawLoadAndSpeedRestrictions).
.Entry	Each entry shall consist of a sign route name, a location description, and a corridor milepost range.
.MoreInfo	The Spring Thaw Load and Speed Restrictions Report shall contain a closing paragraph containing additional information concerning the ramifications of the restrictions for permitting of commercial vehicles.

9.3.8. Features.ReportGeneration.IncidentReport

The system generates Incident Reports.

Description

The system shall be able to generate reports concerning incidents or special events that have been entered in the database.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.IncidentReport	The system shall generate incident reports.
.Name	The Incident Report shall have a name.
.Intro	The Incident Report shall have an introductory section showing the date and time for which the incidents are valid and indicating that authorities are responding to the incidents.
.Date	The Incident Report shall have a date corresponding to the date of report generation.
.List	The Incident Report shall contain a list of incident entries (as per Features.ReportGeneration.IncidentReport.Entry) corresponding to the region's incidents (as per DataDef.Events.Incident) in the database at the time of report generation.
.Order	The Incident Report list shall be organized in alphanumeric order according to sign route and then geographically by location.
.Entry	Each Incident Report entry shall have a location description, an incident description, and details concerning the incident's travel effects (as per DataDef.Events.Incident).

9.3.9. Features.ReportGeneration.RestAreaReport

The system generates Rest Area Reports.

Description

The system shall be able to generate reports concerning rest areas in the system.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.RestAreaReport	The system shall generate rest area reports.
.DateTime	The Rest Area Report shall have a date and time corresponding to the date and time of report generation.
.Routes	The rest area report shall contain route headings. The name of each route heading corresponds to a sign route name (as per a DataDef.Lists.MDTRoadNetwork.SignRoutes.Type and DataDef.Lists.MDTRoadNetwork.SignRoutes.Number).
.Order	Route headings shall be in alphanumeric order.
.List	Each rest area report route heading shall contain a list of rest area entries (as per Features.ReportGeneration.RestAreaReport.Entry) corresponding to the rest areas (as per DataDef.Facilities.RestArea) in the database at the time of report generation, whose locations are along the route named in the heading.
.Order	Each list shall be geographically ordered by the location of the entries.
.Entry	Each Rest Area Report entry shall have a sign route name, location description (milepost and direction), name, and details concerning the rest area’s amenities (as per DataDef.Facilities.RestArea).

9.3.10. Features.ReportGeneration.BorderCrossingReport

The system generates Border Crossing Reports.

Description

The system shall be able to generate reports concerning border crossings entered in the database.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.BorderCrossingReport	The system shall generate border crossing reports.
.DateTime	The Border Crossing Report shall have a date and time corresponding to the date and time of report generation.
.Routes	The Border Crossing Report shall contain route headings. The name of each route heading corresponds to a sign route name (as per a DataDef.Lists.MDTRoadNetwork.SignRoutes.Type and DataDef.Lists.MDTRoadNetwork.SignRoutes.Number).
.Order	Route headings shall be in alphanumeric order.
.List	Each Border Crossing Report route heading shall contain a list of border crossings (as per Features.ReportGeneration.BorderCrossingReport.Entry) corresponding to the border crossings (as per DataDef.Facilities.BorderCrossing) in the database at the time of report generation, whose locations are along the route named in the route heading.
.Order	Each list shall be geographically ordered by the location of the entries.
.Entry	Each Border Crossing Report entry shall have a location description (milepost and direction), name and details (as per DataDef.Facilities.BorderCrossing).

9.3.11. Features.ReportGeneration.WeighStationReport

The system generates Weigh Station Reports.

Description

The system shall be able to generate reports concerning weigh stations in the system.

Stimulus/Response Sequences

Stimulus	Response
Current time coincides with scheduled time for report generation.	System generates the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests generation of report.	System generates the report.

Functional Requirements

Requirement ID	Statement
.WeighStationReport	The system shall generate weigh station reports.
.DateTime	The Weigh Station Report shall have a date and time corresponding to the date and time of report generation.
.Routes	The Weigh Station Report shall contain route headings. The name of each route heading corresponds to a sign route name (as per a DataDef.Lists.MDTRoadNetwork.SignRoutes.Type and DataDef.Lists.MDTRoadNetwork.SignRoutes.Number).
.Order	Route headings shall be in alphanumeric order.
.List	Each Weigh Station Report route heading shall contain a list of weigh stations (as per Features.ReportGeneration.WeighStationReport.Entry) corresponding to the weigh stations (as per DataDef.Facilities.WeighStation) in the database at the time of report generation, whose locations are along the route named in the route heading.
.Order	Each list shall be geographically ordered by the location of the entries.
.Entry	Each Weigh Station Report entry shall have a location description (milepost and direction), name and details (as per DataDef.Facilities.WeighStation).

9.3.12. Features.ReportGeneration.Distribution

The system allows more than one method for disseminating reports.

Description

The system shall automatically or manually disseminate reports to other agencies, as designated.

Stimulus/Response Sequences

Stimulus	Response
A user requests to manually send a report.	System sends the report.
Current time coincides with scheduled time for report distribution.	System automatically sends the report.
A user (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.Reporter) requests to change the method of dissemination of a particular report.	System changes the method of dissemination of a report.

Functional Requirements

Requirement ID	Statement
.Distribution	The system shall distribute reports to users and/or other agencies.
.Methods	The system shall distribute reports according to specified methods of dissemination.
.Manual	The system shall allow reports to be distributed manually.
.Automatic	The system shall allow reports to be distributed automatically.
.Preview	The system shall allow users to preview the report immediately prior to distribution.

9.4. Features.PublicInterface

The system shall facilitate a public interface to traveler information. This interface will consist of sub-interfaces focusing on interactive maps and reports. There will also be an overall interface or multiple interfaces that link to these sub-interfaces.

Description

The system shall facilitate access to maps and reports via a public interface.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.Public) requests to view traveler information.	System displays an interface allowing the user to select traveler information to view, both in terms of form and content.
User requests to view information via an interactive map interface.	System displays an interactive map interface allowing the user to select types of traveler information to view.
User requests to view information via reports.	System provides a selection of reports and allows the user to choose and view selected reports.

Functional Requirements

Requirement ID	Statement
.PublicInterface	The system shall provide a public interface for traveler information.
.MapSelection	The system shall allow the user to select traveler information to be viewed via an interactive map interface; then the system will display the corresponding interactive map interface.
.ReportSelection	The system shall allow the user to select traveler information to view via reports; then the system will display the corresponding reports.

9.4.1. Features.PublicInterface.MapInterface

The system allows the public to select and view data on an interactive map.

Description

The system shall allow the public to view event, facility, alert and other data on a web-based map interface. Users can select which data element types should be displayed, navigate different areas of the map, and view the map at different zoom levels. The map should allow for the display of other “layers” including cities, county boundaries, cameras, Dynamic Message Signs (DMS) and weather stations.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.Public) navigates to the public web page to view traveler information map.	The system displays a map showing all relevant (in terms of time, location, etc.) events, facilities and alerts, with their locations overlaid upon a map of the MDT road network and including other “layers.”
User selects and deselects event types and facilities to display.	The system redisplay the map showing only those events, facilities and alerts specified by the user.
User selects a specific region for the map to display.	The system redisplay the map showing only the region specified by the user.
User changes the map zoom level.	The system redisplay the map at the specified zoom level.
User re-centers the map.	The system redisplay the map centered at the specified location.
User requests more information about an event or facility.	The system displays additional information about the specified event, facility, alert, or other entity.

Functional Requirements

Requirement ID	Statement
.MapInterface	The system shall allow the public to view appropriate system data on a map interface via the world wide web.
.Default	The system shall initially display a map of the state of Montana, a graphical representation of MDT’s road network, and graphics showing the type and location of events, facilities, alerts, and other entities.
.Entities	The system shall display a graphical representation of geographical features such as cities, counties, mountain passes, and other entities.
.Types	The system shall display event, facility, alerts, RWIS, Cameras, DMS, and other entity types specified by the public user (as per DataDef.Events, DataDef.Facilities, and DataDef.Lists.FieldElements).
.Region	The system shall display regions of the state of Montana as

Requirement ID	Statement
	specified by the public user. Included as a region will be the entire state.
.Zoom	The system shall display the map at a level of zoom specified by the user, and allow the user to zoom in and zoom out on the map.
.Center	The system shall allow the user to center the map at a user-specified point on the map.
.Pan	The system shall allow users to navigate the map by allowing them to pan the current map position including the ability to pan in the following directions: North, South, East, West, NorthEast, NorthWest, SouthEast, and SouthWest.
.RequestItemInformation	The system shall allow the user to select and request more information about a specific event, facility, or alert. Information shall subsequently be displayed.
.ColorOptions	The system shall allow the user to select color or black-and-white versions of the map for display.

9.4.2. Features.PublicInterface.ReportsInterface

The system allows the public to view data through reports.

Description

The system shall allow the public to view data in system reports via a public web page. Users can specify the types of reports and, for the Area Road Conditions Report, the areas for the report they are requesting.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.Public) navigates to the public web page to view traveler information reports.	The system displays a selection of public reports.
User selects a specific report.	The system displays the selected report.

Functional Requirements

Requirement ID	Statement
.ReportsInterface	The system shall allow the public to view event reports via the world wide web.
.Region	The system shall display the area road condition report corresponding to a region specified by the user (as per Features.ReportGeneration.AreaRoadConditionReport). There are 11 area reports, one for each Division plus Helena, for the users to choose from.
.ReportType	The system shall display reports corresponding to a report type (as listed in Features.ReportGeneration) specified by the user.

9.5. Features.PrivateInterface

The system shall facilitate access to maps and reports via a private interface intended for MDT staff.

Description

The system shall facilitate a private interface for traveler information. This interface will consist of sub-interfaces focusing on interactive maps, reports, and report-like listings with embedded, enhanced options. There would also be an overall interface or multiple interfaces that link to these sub-interfaces. These interfaces will display all information available to the public and also information that may not be intended for public viewing such as internal comments, fatalities, etc. In addition, authorized users may also be given the option to add, modify and delete data.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator, UserClasses.Reporter, and UserClasses.MDTStaff) requests to view traveler information.	System displays an interface allowing the user to select the content and format of traveler information to be viewed.
User requests to view information via a private interactive map interface.	System displays an interactive map interface allowing the user to select traveler information to view.
User requests to view information via private reports.	System provides a selection of reports and allows the user to choose and view selected reports.
User requests to view information via private listing.	System provides a form corresponding to the selected item and an option for entering, modifying or deleting.

Functional Requirements

Requirement ID	Statement
.PrivateInterface	The system shall provide a private interface to traveler information.
.MapSelection	The system shall allow the user to select traveler information to view via an interactive map interface and will display the corresponding interactive map interface.
.ReportSelection	The system shall allow the user to select traveler information to view via reports and will display the corresponding reports (as per Features.ReportGeneration).
.PrivateListingSelection	The system shall allow the user to select traveler information to view via private listings with embedded enhanced options for entering, modifying and deleting items.

9.5.1. Features.PrivateInterface.MapInterface

The system allows internal users to view data on a map.

Description

The system shall allow authorized users to view public and private data on an interactive map interface. Users can select which events should be displayed, navigate different areas of the map, and view the map at different zoom levels.

Stimulus/Response Sequences

Stimulus	Response
A user (as per UserClasses.StatewideTravelerInformationCoordinator, UserClasses.Reporter, and UserClasses.MDTStaff) navigates to the interface to view the traveler information map.	The system displays a map showing all appropriate events, facilities, and alerts, and their locations overlaid upon a map of the MDT road network.
User selects and deselects event types and facilities to display.	The system redisplay the map showing only those events, facilities, and alerts specified by the user.
User selects a specific region for the map to display.	The system redisplay the map showing only the region specified by the user.
User changes the map zoom level.	The system redisplay the map at the specified zoom level.
User re-centers the map.	The system redisplay the map centered at the specified location.
User requests more information about an event or facility.	The system displays additional information about the specified event, facility or alert.
A user (as per UserClasses.StatewideTravelerInformationCoordinator for modifying amenities and entering and deleting facilities and UserClasses.Reporter for modifying facility status) chooses to enter, modify, or delete an event or facility.	The system displays the appropriate entry, modification or deletion options.

Functional Requirements

Requirement ID	Statement
.MapInterface	The system shall allow internal users to view appropriate system data on a map interface.
.PublicData	The system shall initially display a map of the state of Montana, a graphical representation of MDT's road network, and graphics showing the type and location of events, facilities and alerts. All public data shall be viewable as described in the Features.PublicInterface.MapInterface.
.PrivateData	The system shall display additional private data and allow the user to toggle the display of such data.
.DataEditingOptions	The system shall provide options for selecting data from the map interface for editing.

9.5.2. Features.PrivateInterface.EventFacilityAndAlertListings

The system allows authorized users to view data through listings with enhanced options for adding, modifying and deleting data.

Description

The system shall allow authorized users to view listings of data via a private interface. Users can specify the types of data for which the listings will appear.

Stimulus/Response Sequences

Stimulus	Response
User (as per UserClasses.StatewideTravelerInformationCoordinator, UserClasses.RoadReporter, and UserClasses.MDTStaff) navigates to the private listing to view event and facility data.	The system displays a selection of public and private reports
User selects an option within the private listing.	The system displays a form corresponding to the selected item and option for entering, modifying or deleting.

Functional Requirements

Requirement ID	Statement
.EventAndFacilityListings	The system shall allow authorized users to view events, facilities, and alerts through a private interface, accompanied by options to enter, modify or delete information.
.Contents	Each data list entry shall contain information regarding the corresponding event or facility, including but not limited to: a description, author, creation date, and modification date (as per DataDef.System.Logs).
.Region	The system shall display listings corresponding to a region specified by the user.
.ReportType	The system shall display listings corresponding to a report type specified by the user (as per Features.ReportGeneration).
.DetailLevel	The system shall display listings corresponding to a detail level specified by the user.
.RequestDetail	The system shall allow users to request and display more information about a particular list entry.
.Enter	The system shall provide an option for the user to enter new information (as per Features.DataEntryInterfaces).
.Modify	The system shall provide an option for the user to modify existing information (as per

Requirement ID	Statement
	Features.DataModificationInterfaces).
.Delete	The system shall provide an option for the user to delete existing information (as per Features.DataDeletionOptions).
.Save	The system shall allow the user to save new information or modifications as per Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel new information or modifications as per Features.DataCancelOptions.
.Sort	The system shall display list entries sorted by the event, facility, alert type, author, creation date, modification date, etc. associated with each entry.
.Search	The system shall display items to be searched and retrieved by the event, facility, alert type, author, creation date, modification date, etc. associated with each entry.

9.5.3. Features.PrivateInterface.ArchivedDataInterface

The system allows authorized users to access archived data.

Description

The system shall allow an authorized user to access archived event and facility data.

Stimulus/Response Sequences

Stimulus	Response
Authorized users (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator) request to access archived data.	System provides access to archived data.

Functional Requirements

Requirement ID	Statement
.ArchivedDataInterface	The system shall allow users to access archived event, facility, and alert data.
.Date	The system shall allow users to select the date of the desired archived data.
.ByEvent	The system shall allow users to select the desired archived data by a specific event and date combination.
.ByFacility	The system shall allow users to select the desired archived data by a specific facility and date combination.

9.6. Features.Notification

The system shall facilitate notification of entities when certain events are entered within the system. Ideally such notification will be electronic, with email as a possible means. However, implementation is not specified. (Note the drawbacks of using email that were cited by current users.)

9.6.1. Features.Notification.DatabaseUpdate

The system provides automatic notification due to database updates.

Description

The system must notify specified users if events, facilities or alerts are entered, modified, or deleted, resulting in an updated database.

Stimulus/Response Sequences

Stimulus	Response
New event, facility, or alert is entered.	System notifies appropriate users.
Existing event, facility, or alert is modified.	System notifies appropriate users.
Existing event, facility, or alert is deleted.	System notifies appropriate users.

Functional Requirements

Requirement ID	Statement
.DatabaseUpdate	The system shall notify contacts as per DataDef.Lists.Notification.DatabaseUpdate
.NotificationTypes	The system shall notify users using emails or other means in response to database updates or other reporting events.
.NotificationContents	The notifications shall contain identifying event information and the reason for notification (i.e. location description and change description).

9.6.2. Features.Notification.Event

The system provides automatic notification due to event characteristics.

Description

The system shall notify specified users if new events or changes made to existing events satisfy certain criteria such as involvement of departmental employees, a major accident, damage to a facility, or a road closure.

Stimulus/Response Sequences

Stimulus	Response
New event involving injury or death of a department employee, a major accident, damage to a facility, or a road closure is entered.	System notifies appropriate users.
Existing event is modified, and new status involves departmental employees, a major accident, damage to a facility, or a road closure.	System notifies appropriate users.

Functional Requirements

Requirement ID	Statement
.Event	The system shall notify appropriate users when an event is entered within the system, dependent on the nature of the event.
.DeptAccident	The system shall notify the DataDef.Lists.Notification.DeptAccident list if a new or modified event involves a department employee and/or vehicle that will require drug and/or alcohol testing of a department employee.
.MajorIncident	The system shall notify the DataDef.Lists.Notification.MajorIncident list if a new or modified event involves five or more fatalities, a school bus, loss of life of a public figure, hazardous materials spill, or a natural disaster.
.FacilityMajorDamage	The system shall notify the DataDef.Lists.Notification.FacilityMajorDamage list if a new or existing event involves major facility damage requiring significant repairs and/or affecting the usability of a building.
.RoadClosures	The system shall notify the DataDef.Lists.Notification.RoadClosures list if a new or existing event involves a road closure.

9.7. Features.UserAdministration

The system shall facilitate the administration of system users. User administration includes adding new users, editing existing users, and deleting user accounts.

9.7.1. Features.UserAdministration.UserEntry

The system allows authorized users to create new user accounts as DataDef.System.Users

Description

The system shall allow an authorized user to enter information about a new user and create an account with the information.

Stimulus/Response Sequences

Stimulus	Response
Authorized users (as per UserClasses.StatewideTravelerInformationCoordinator) enter new user information.	System updates the database to include new user information.

Functional Requirements

Requirement ID	Statement
.UserEntry	The system shall allow an authorized user to enter a new user as a DataDef.System.Users according to Features.DataEntryInterfaces.
.MDTOrganizationInfo	The system shall populate a list of possible MDT organization types including MDT District and MDT Division.
.UserType	The system shall populate a list of possible user types as per user classes.
.Save	The system shall allow the user to save the user entry according to Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel the user entry according to Features.DataCancelOptions.

9.7.2. Features.UserAdministration.UserModification

The system allows authorized users to modify existing user accounts as DataDef.System.Users.

Description

The system shall allow an authorized user to modify information about an existing user.

Stimulus/Response Sequences

Stimulus	Response
Authorized users (as per UserClasses.StatewideTravelerInformationCoordinator) modify existing user information.	System updates the database to include modified user information.

Functional Requirements

Requirement ID	Statement
.UserModification	The system shall allow an authorized user to modify an existing user as a DataDef.System.Users according to Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all user account fields.
.Save	The system shall allow the user to save the user modification according to Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel the user modification according to Features.DataCancelOptions.

9.7.3. Features.UserAdministration.UserDeletion

The system allows authorized users to delete existing user accounts as DataDef.Users

Description

The system shall allow an authorized user to delete an existing user.

Stimulus/Response Sequences

Stimulus	Response
Authorized users (as per UserClasses.StatewideTravelerInformationCoordinator) delete existing user information.	System removes the user from the database.

Functional Requirements

Requirement ID	Statement
.UserDeletion	The system shall allow an authorized user to delete an existing user as a DataDef.System.Users according to Features.DataDeletionOptions.
.Save	The system shall allow the user to save the user deletion according to Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel the user deletion according to Features.DataCancelOptions.

9.8. Features.DataManagement

The system shall contain several key information lists used throughout system operation. Lists are used for convenience and to ensure consistency. The system shall facilitate management of the lists by authorized users. The types of lists are as follows:

Data Lists

The system uses lists to populate forms. For instance, a conditions input form may include a list of conditions consisting of phrases as defined by DataDef.Lists.Conditions. Over time the terms in these lists may need to be modified. Similarly, new terms may need to be added or old terms deleted. The priority of items in the lists may need to be changed as well. As a result, the system must allow a user to select a list, and perform operations on it. Operations on lists should maintain data integrity. Therefore the system shall prevent users from modifying or deleting a list term that is currently in use.

RWIS/Camera/DMS Lists

The system shall provide links to external RWIS/Camera/DMS information pages. In order to provide these links, the location of the external device and the hyperlink to its corresponding information page must be stored. The system must allow a user to add entries to, delete entries from, and modify existing entries of an external device list.

Contact Lists

The system uses contact lists as per DataDef.Lists.Contacts to facilitate communication to persons or agencies. Entries in the contact lists can be assigned to notification lists. The system must allow a user to add entries to, delete entries from, and modify entries of a contact list. The system must ensure referential integrity for contact lists. For example, the system must prevent users from deleting items on a contact list if the item is referenced in another list, particularly a notification list.

9.8.1. Features.DataManagement.ListItemAdd

The system allows users to enter new items to a list.

Description

The system shall allow an authorized user to add new items to a list. The system shall immediately reflect the changes to the list throughout all system interfaces.

Stimulus/Response Sequences

Stimulus	Response
Authorized users (as per UserClasses.StatewideTravelerInformationCoordinator) modify an existing list item.	System updates the database to reflect the modification to the existing item on the specified list.

Functional Requirements

Requirement ID	Statement
.ListItemAdd	The system shall allow authorized users to add items to lists as per Features.DataEntryInterfaces.
.Lists	The system shall populate a list of possible lists to which the user may add a new item.
.ListItems	The system shall populate a list with existing items when the user selects a list to which to add a new item (as per DataDef.Lists).
.Save	The system shall allow the user to save the list item addition according to Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel the list item addition according to Features.DataCancelOptions.

9.8.2. Features.DataManagement.ListItemModification

The system allows users to modify items in a list.

Description

The system shall allow an authorized user to modify an existing list item. The system shall immediately reflect the changes to the list throughout all system interfaces. The system shall maintain referential integrity for list item modifications. Referential integrity ensures that modifications of the list items from a list will not affect previous references to the list items.

Stimulus/Response Sequences

Stimulus	Response
Authorized users (as per UserClasses.StatewideTravelerInformationCoordinator) modify list item.	System updates the database to reflect the modified item on the specified list.

Functional Requirements

Requirement ID	Statement
.ListItemModification	The system shall allow authorized uses to modify items on an existing list as per Features.DataModificationInterfaces.
.ModifiableFields	The system shall allow the user to modify all list item fields.
.ReferentialIntegrity	The system shall ensure that referential integrity is preserved. For instance, modifying a road condition from “Snowpacked and Icy” to “Snowpacked” will not affect archived conditions that were recorded as “Snowpacked and Icy”. The condition listed for the archived event would remain “Snowpacked and Icy”.
.Save	The system shall allow the user to save the user modification according to Features.DataSaveOptions.
.Cancel	The system shall allow the user to cancel the user modification according to Features.DataCancelOptions.

9.8.3. Features.DataManagement.ListItemDeletion

The system allows users to delete items from a list.

Description

The system shall allow an authorized user to delete an existing list item. The system shall immediately reflect the changes to the list throughout all system interfaces. The system shall maintain referential integrity for list item deletions. Referential integrity ensures that deletions of the list items from a list will not affect previous references to the list items.

Stimulus/Response Sequences

Stimulus	Response
Authorized users (as per UserClasses.StatewideTravelerInformationCoordinator) delete list item.	System updates the database to reflect the deleted item on the specified list.

Functional Requirements

Requirement ID	Statement
.ListItemDeletion	The system shall allow authorized users to delete items on an existing list as per Features.DataDeletionOptions.
.ReferentialIntegrity	The system shall ensure that referential integrity is preserved. For instance, deleting a road condition “Snowpacked and Icy” will not affect archived conditions that were recorded as “Snowpacked and Icy”. The condition listed for the archived event would remain “Snowpacked and Icy”.

9.8.4. Features.DataManagement.SegmentChange

The system allows authorized users to change road condition segments and parameters.

Description

The system shall allow an authorized user to change the road condition segments and parameters.

Stimulus / Response Sequences

Stimulus	Response
Authorized users (as per UserClasses.StatewideTravelerInformationCoordinator and UserClasses.SystemAdministrator) request a segment or parameter change.	System changes the segment or parameter.

Functional Requirements

Requirement ID	Statement
.ChangeSegment	The system shall allow the users to modify predefined MDT segments.
.Existing	The system shall allow users to modify the mileposts of existing MDT segments.
.New	The system shall allow users to add new MDT segments.
.Delete	The system shall allow users to delete existing MDT segments.

10. OTHER REQUIREMENTS

This section provides more detail on other requirements that are needed, but do not directly involve system features. These include hosting capabilities, external interfaces, user interfaces, hardware interfaces, software interfaces, communication interfaces, performance, usability, legal, and apportioned requirements.

10.1. Other.HostingRequirements

Two options for RCRS hosting exist:

- Internally hosted at MDT and
- Externally hosted by the RCRS vendor.

As there are some RCRS vendors that can accommodate both options, this decision will be left open for proposers to recommend when responding to the RFP.

Two things should be noted:

- If MDT hosts the system locally, it will be necessary to have a system administrator and system developer included in the user classes.
- If a vendor externally hosts the system, MDT shall own all of the data and shall be able to archive the RCRS data on the MDT network.

10.2. Other.ExternalInterfaceRequirements

The system shall interact with external systems through an interface. Therefore, the system must be able to exchange data, both automatically and generally, with other systems. In particular, the system must be able to exchange data with 511 systems, internal MDT systems, and external agency systems.

10.2.1. Other.ExternalInterfaceRequirements.ExternalSystems

The system shall exchange data with the following external systems (as per UserClasses.ExternalSystem):

- Montana 511 System
- Neighboring States' 511 Systems
- Montana Highway Patrol CAD System (optional)
- Neighboring States' Condition Reporting Systems
- MDT TIS
- MDT MMS (optional)
- MDT RWIS (optional)
- SnowPlow AVL System (optional)
- Field-Based PDA System (optional)

10.2.2. Other.ExternalInterfaceRequirements.ExchangeTypes

The system shall take the following roles in data exchange with external systems:

- External systems shall retrieve data from the system.
- The system shall send data to external systems.
- The system shall retrieve data from external systems.
- The system shall receive data sent from external systems.

10.2.3. Other.ExternalInterface.ExchangeMethods

The system shall exchange data with external systems in the following manners:

- The system shall automatically exchange data with external systems.
- The system shall allow users to manually exchange data with external systems.

10.3. Other.UserInterfaces

The system shall interface to users through a graphical user interface. The system user interface shall conform to industry-standard design principles and contain but not be limited to the following graphical components:

- Buttons
- Forms
- Text Boxes
- List Boxes
- Labels
- Message Boxes
- Image Boxes
- Windows

The system HTML code shall conform to Federal Highway Administration (FHWA) standards for HTML coding (<http://www.tfhr.gov/qkref/qrg08.htm>).

10.4. Other.HardwareInterfaces

The system shall operate on hardware conforming to MDT, ITSD, and other applicable agency and industry standards if internally hosted.

10.5. Other.SoftwareInterfaces

The system shall interface with a variety of specific software products depending on whether the application is web-based or standalone. These software products shall be identified by the proposers during their MDT data flow analysis, because product selection is dependent on system set-up and design.

10.6. Other.CommunicationsInterfaces

The system shall conform to industry-standard communication protocols, particularly TCPIP. In addition, the system shall operate on the local MDT intranet.

10.7. Other.PerformanceRequirements

Performance requirements for the RCRS include reliability, availability, security, maintainability, portability, robustness, safety, precision, scalability, deployment, extensibility, and reactivity.

NOTE: There are several placeholders in the following requirements. Placeholders are represented by a “___” and indicate that a number should be inserted. These numbers should be filled in by the MDT RFP committee prior to releasing the RFP.

10.7.1. Other.PerformanceRequirements.Reliability

- If vendor hosted, the system shall be redundant and therefore achieve ___ hours Mean Time Between Failure (MTBF).
- The system shall be implemented on proven, enterprise-level hardware and software systems.

10.7.2. Other.PerformanceRequirements.Availability

- If the system is vendor hosted, it shall be redundant and therefore not have downtime.

10.7.3. Other.PerformanceRequirements.Security

- The MDT security policy shall prevail.
- The system shall record logs of all logons; logoffs; event, facility or alert entries; deletions; and modifications.
- The system shall record all logs of public access to events, facilities and alerts.
- The system shall provide user authentication.
- The system shall use industry-standard encryption techniques for all information sent over the network.
- The system shall display user passwords with asterisks on login screens or in emails.
- The system shall differentiate between publicly available and privately available data.
- The system shall differentiate between user classes and their authority for viewing and changing (i.e. entering, modifying, and deleting) data.

10.7.4. Other.PerformanceRequirements.Maintainability

- The system shall automatically incorporate new or reassigned MDT road segments or corridor routes from TIS.
- If the system is vendor hosted, downtime for software maintenance shall be less than _ hours per year and _ hours per instance.

- If the software is to be down for maintenance, a notification shall be sent to UserClasses.StatewideTravelerInformationCoordinator.

10.7.5. Other.PerformanceRequirements.Robustness

If the system is vendor hosted, then:

- The system shall support ___ user accounts
- The system shall support ___ concurrent private users.
- The system shall support ___ concurrent public users.
- The system shall allow ___ concurrent public or private users to request event, facility and alert information.
- The system shall allow ___ concurrent private users to modify or delete the same existing event, facility and alert.
- The system shall allow ___ concurrent private users to enter new events, facilities and alerts.
- The system shall operate on a non-interruptible power supply.
- The system shall preserve data integrity during network outages or errors.
- The system shall preserve data integrity during interrupted transactions.
- The system shall preserve data integrity during system maintenance.
- The system shall store ___ concurrent, unique events, facilities and alerts.
- The system shall archive all events, facilities, and alerts.

10.7.6. Other.PerformanceRequirements.Precision

- The system shall be consistent in the precision of TIS regarding milepost locations.

10.7.7. Other.PerformanceRequirements.Scalability

- The system shall allow additional capacity for user accounts.
- The system shall allow additional capacity for concurrent private users.
- The system shall allow additional capacity for concurrent public users.
- The system shall allow additional capacity for event, facility, and alert storage.
- The system shall allow additional capacity for report storage.
- The system shall allow additional capacity for archive storage.

10.7.8. Other.PerformanceRequirements.Deployment

- The system shall provide a separate, but fully-functional, test environment.
- The system shall be deployed on the MDT network (i.e. internet and intranet).

10.7.9. Other.PerformanceRequirements.Extensibility

- The system shall allow users to add new types of events, facilities and alerts.
- The system shall allow users to add new types of reports.
- The system shall allow users to add new types of maps or other interfaces.
- The system shall be able to interface with new external systems.
- The system shall be able to interface with new MDT systems.

10.7.10. Other.PerformanceRequirements.Reactivity

- The system shall display events, facilities and alerts on public and private maps and reports ___ minutes after their initial entry and subsequent submittal to the database.
- The system shall display updated events, facilities and alerts on public and private maps and reports ___ minutes after modifications or deletions were committed to the database.
- The system shall update the database ___ minutes after a user has entered, modified, or deleted events, facilities or alerts.
- The system shall display new list entries _ minutes after their initial entry and subsequent submittal to the database.
- The system shall display new notification contacts _ minutes after their initial entry and subsequent submittal to the database.

10.8. Other.UsabilityRequirements

Usability requirements include ease of use, ease of learning, accessibility, and user support.

10.8.1. Other.UsabilityRequirements.EaseOfUse

- The system shall allow users to navigate to a data entry interface within ___ minutes of logging into the system.
- The system shall allow users to enter new events in ___ minutes after reaching a data entry interface.
- The system shall allow users to enter conditions for all segments in a division in ___ minutes after reaching a data entry interface.
- The system shall allow users to modify or delete events in ___ minutes.
- The system shall allow users to add new facilities in ___ minutes after reaching a data entry interface.
- The system shall allow users to modify or delete facilities in ___ minutes.
- The system shall allow users to add new alerts in ___ minutes after reaching a data entry interface.
- The system shall allow users to modify or delete alerts in ___ minutes.
- The system shall allow users to select a specific report in ___ minutes.

- The system shall provide users with a desired report ___ minutes after a user report request.
- The system shall allow users to add new user accounts in ___ minutes.
- The system shall allow users to modify or delete user accounts in ___ minutes.
- The system shall allow users to add new list items in ___ minutes.
- The system shall allow users to delete or modify list items in ___ minutes.
- The system shall allow public users to encounter the public map within ___ minutes after first coming to the public web page.
- The system shall allow public users to navigate to the desired map area in ___ minutes after they first encounter the public map.
- The system shall allow the user to request more information about a particular event, facility or alert in ___ minutes after first coming to the public web page.
- The system shall allow the user to request public reports within ___ minutes after first coming to the public web page.
- The system shall provide the user with the requested public report (i.e. open the document that has already been run and is saved) ___ minutes after the report request.
- The system shall provide mouse-based navigation and key-based navigation, using tabs and up and down arrows) where possible.
- The system shall allow public and private users to instantly differentiate between different types of events, facilities, and alerts on the public and private map interface.
- The system shall allow public and private users to instantly identify the highest priority road condition of a particular segment, even if there is more than one condition associated with the segment.
- The system shall allow public and private users to instantly differentiate between different instances of the same type of event or facility on the public and private map interface.
- The system shall allow public and private users to instantly determine when two or more events, facilities or alerts occur, and which types are involved, in the same physical location on the public and private map interface.
- The system shall allow public and private map users to instantly determine the highest priority condition or work type when viewing event information for events which have two or more prioritized conditions or work types.
- The system shall send notification to contact lists _ minutes after notification warrants are met.
- The system shall provide feedback or a “why” if a submittal fails to save or cannot be added, modified, or deleted.

- The system shall provide a single method of terminating a user interface, regardless of the current activity of the user.
- The system shall automate the process of archiving events, facilities and alerts.
- The system shall allow public and private map users to instantly determine the status of a construction/maintenance project.
- The system shall allow public and private map users to instantly determine the approximate location of point conditions.

10.8.2. Other.UsabilityRequirements.EaseOfLearning

- The system shall allow reporters with ___ months previous experience at MDT to learn to enter, modify, and delete events with ___ hours of training.
- The system shall allow reporters with zero previous experience to learn to enter, modify, and delete events with ___ hours of training.
- The system shall allow the statewide coordinator to learn to perform user administration tasks with ___ hours of training.
- The system shall allow the statewide coordinator to learn to enter new facilities with ___ hours of training.
- The system shall allow the statewide coordinator and reporters to learn to enter new alerts with ___ hours of training.
- The system shall allow the statewide coordinator to learn to perform data management tasks with ___ hours or training.
- The system shall allow users with no experience to learn to request reports with ___ hours of training.
- The system shall allow first-time public users to learn to navigate the public events and reports interfaces.

10.8.3. Other.UsabilityRequirements.Accessibility

- The system shall be Section 508 compliant.

10.8.4. Other.UsabilityRequirements.UserSupport

- The system developers shall provide user documentation regarding all aspects of system maintenance and use.
- The system developers shall provide training to ___ system users covering all aspects of system maintenance and use.
- The system developers shall provide continuous technical support for all aspects of system maintenance and use.
- The system developers shall provide user manuals.
- The system developers shall provide training on the system and on the test environment.

10.9. Other.InstitutionalRequirements

Institutional requirements include those for cultural, political, legal, or apportioned reasons.

10.9.1. Other.InstitutionalRequirements.Legal

- The system shall archive reports as per DataDef.System.Archives.
- The system shall archive change logs as per DataDef.System.Logs.

10.9.2. Other.InstitutionalRequirements.Apportioned

- The system shall allow people from designated external agencies to add data as per UserClasses.ExternalAgency. Examples may include Yellowstone and Glacier National Parks and Montana Highway Patrol.
- The system shall allow for automated entry and modification of events, facilities and alerts via phone or handheld device from the field.

11. SUMMARY AND NEXT STEPS

This chapter provides a summary of the document as well as a list of next steps to be taken for this project prior to creating a request for proposal.

11.1. Summary

Montana Department of Transportation's (MDT) Road Condition Reporting System (RCRS) is used to disseminate traveler information via reports, a website map, local phone numbers, and 511. The current RCRS uses separate Oracle-based systems for winter and summer reporting. The winter system is capable of storing information on road conditions, winter road closures, emergency travel only advisories, and chain requirements. The summer system stores construction and maintenance projects, incident information, load and speed restrictions for spring thaw, and facility information.

Over the years, many challenges have been identified with these two systems, including, but not limited to:

- the reporting systems are too complex and need to be simplified,
- there is an occasional need to use both systems at once in transitional seasonal periods,
- staff must know shortcuts and operations procedures for two systems, and
- The system lacks automation and sufficient functions.

It is envisioned that the solution to the identified challenges is to create a new RCRS to meet MDT's needs. The vision for this new system is one reporting system capable of storing all of the information in the current systems, as well expanding to meet the growing technology needs of a DOT. The new system should be easier for the inexperienced road reporter to operate, have more automated features such as notification and verification, and allow for more concise and user friendly displays of information to the public.

The scope for the new RCRS is a system that will:

- Facilitate the entry, storage, and reporting of road-related traveler information covering the MDT road network for the entire state of Montana.
- Integrate with other systems such as 511 and the MDT Web Server.
- Potentially integrate with field elements such as RWIS, cameras, and DMS.
- Potentially integrate with systems of other agencies.

Requirements for the new RCRS were also created. The requirements were broken into two pieces: data definitions and system features. A high level review of these requirements is described next.

11.1.1. Data Definitions

This section characterizes the data created, stored and used by the system. Data definitions are stated at a high level, allowing for a variety of possible implementations. It is not implied that this data will be entirely stored in or correspond to a single relational database.

System Data

There shall be certain information stored for general system operation.

- The system shall support user accounts, containing identifying information, for all system users.
- The system shall provide a means of user authentication.
- The system shall maintain profiles for each user account, containing user preferences and user types.
- The system shall maintain logs of system access, changes, and public access.
- Each log shall contain user information, a timestamp, and information about the action which caused the log to occur.
- The system shall support electronic archiving of reports.
- The system shall support retrieval of archived reports.

Lists

There are a number of lists/lookups that need to be maintained within the system. These lists are used primarily to provide information to lists and to assure consistency.

- The system shall store lists of items for lookups, list population, and to maintain consistency.
- The system shall store a list of construction and maintenance work types.
- The system shall store a list of road conditions, including both point conditions and line conditions.
- The system shall store a list of vehicle types for which restrictions or certain conditions apply.
- The system shall store a list of external field elements, including the location and current readings or status of each element.
- The system shall store a list of RWIS sensors.
- The system shall store a list of road cameras.
- The system shall store a list of dynamic message signs (DMS).
- The system shall store a list of contacts, including identifying information and preferred method of contact.
- The system shall store lists of contacts requiring notification of certain events being input into the system or the database being updated.

Road Network

The Montana Department of Transportation represents the state road network in its TIS database using multiple route identification systems. Elements from this database shall be imported or linked into the road condition reporting system to provide the necessary information to describe

the road network for internal and public purposes. This information is used and/or referenced in location specifications for events, facilities and alerts. It may also be used for reporting, mapping, identifying, querying and grouping of data. The road condition reporting system shall maintain consistency with the TIS database. It is assumed that coordinates will be stored to facilitate graphical representation and identification of all road network elements and related entities.

The system shall store the coordinates of the MDT road network and maintain consistency with TIS.

- The system shall support the specification of MDT District locations.
- The system shall support the specification of MDT Division locations.
- The system shall support the specification of MDT Section locations.
- The system shall support the specification of MDT segment locations.
- The system shall support the specification of corridor route locations.
- The system shall maintain a correspondence between corridor route locations and sign route locations.
- The system shall support the specification of sign route locations.
- The system shall maintain a correspondence between sign route locations and corridor route locations.
- The system shall support the specification of landmark locations such as towns, intersections, and mountain passes.

Contexts

Contexts characterize events in terms of their location, the times in which they impact travel, the impact they have on travel (restrictions), and the source of the information provided for them.

- The system shall support locations of events, facilities and alerts.
- The system shall represent locations as points, general segments, or pre-defined segments.
- The system shall represent locations in terms of sign and corridor route location on the road network.
- The system shall determine road network information based on a location, such as divisions, districts, segments, corridor routes, and sign routes.
- The system shall support text-based location descriptions.
- The system shall support locations that are not on the road network.
- The system shall support effective periods for all events (i.e. when an event affects travel), facilities (i.e. when a facility is open) and alerts.
- The system shall support restrictions on normal travel due to an event.
- The system shall support restrictions on vehicle dimensions due to an event.

- The system shall support restrictions on vehicle loads due to an event.
- The system shall support restrictions for vehicles concerning winter equipment due to an event.
- The system shall support restrictions on a vehicle's payload due to an event.
- The system shall support restrictions on a vehicle's speed due to an event.
- The system shall support restrictions concerning the use of pilot vehicles due to an event.
- The system shall support restrictions on passing due to an event.
- The system shall support Emergency Travel Only (ETO) restrictions due to an event.
- The system shall support lane restrictions due to an event.
- The system shall support delay restrictions due to an event.
- The system shall support closure restrictions due to an event.
- The system shall support detours due to an event.
- The system shall support an information source containing data about the person who submitted the event, facility or alert information.

Events

For the purpose of this document, "Event" is a generic term used to represent projects (construction or maintenance), conditions, spring thaw load and speed restrictions, incidents, and special events.

All of these are considered types of events. Other types of events may be considered for addition to the system in the future.

All events include "Contexts," which describe the events in terms of location, time and impact on travel. Implicit is the inclusion of the corresponding MDT District, etc. (MDT requires that all events be associated with their division.)

- The system shall support events.
- The system shall support construction or maintenance project events.
- In addition to the context items above, each project shall contain a Project ID (consistent with that of internal MDT database tables for construction or MMS, Maintenance Management System, for maintenance), a project type, a work type, a project status, and a project completed time.
- The system shall support road condition events.
- In addition to the context items above, each condition event shall contain a condition type.
- Road condition locations shall be in terms of pre-defined MDT segments.
- The system shall support load and speed restrictions due to spring thaw.
- The system shall support incident events.

- In addition to the context items above, each incident shall contain vehicle types, a description, the number of fatalities or injuries, and information concerning the time of lane closures and openings due to the incident.
- The system shall support special events.
- In addition to the context items above, each special event shall contain a description.

Facilities

For the purpose of this document, “Facility” is a generic term used to represent rest areas, border crossings, and weigh stations.

All of these are considered types of facilities. Other types of facilities may be considered for addition to the system in the future.

All facilities include “Contexts,” which describe the facilities in terms of location, time and impact on travel. Implicit is the inclusion of the corresponding MDT District, etc. (MDT requires that all events be associated with their division.)

- The system shall support facilities.
- The system shall support rest area facilities.
- The system shall support border crossing facilities.
- The system shall support weigh station facilities.

Alerts

For the purpose of this document, “Alert” is a generic term used to represent AMBER alerts, homeland security alerts, and general transportation alerts.

All of these are considered alerts, although more alerts may be added to the system in the future.

- The system shall support AMBER, homeland security, and general transportation alerts.

11.1.2. System Features

This section characterizes the requirements in a high level for the RCRS system features.

General Data Entry and Data Modification Interfaces

The system provides users with the options to enter, modify and delete information for which they have associated privileges. In general, the interfaces for doing so will have the following features:

- The system shall provide a data entry interface when the user requests to enter new events, facilities, or alerts.
- The system shall provide a data modification interface when the user requests to modify existing events, facilities, or alerts.
- The system shall allow the user to save new entries or modifications to existing entries.
- The system shall allow users to cancel data entry or modifications.

- The system shall allow authorized users to choose to delete events, facilities, and alerts.

Event, Facility, and Alert Data Entry and Modification Interfaces

This allows for the data entry and modification of construction and maintenance projects, road conditions, spring thaw load and speed restrictions, incidents, special events, rest areas, weigh stations, border crossings, and alerts.

- The system shall allow an authorized user to enter a new construction or maintenance project.
- The system shall automatically populate an ID List of project IDs consistent with MMS (for maintenance) or internal MDT database tables (for construction).
- The system shall allow an authorized user to modify existing construction or maintenance projects.
- The system shall allow an authorized user to delete an existing project.
- The system shall allow an authorized user to enter road conditions.
- The system shall allow, as one of multiple means for entry of conditions, the rapid entry of segment conditions within a selected section. (This corresponds to the current method in which conditions for all segments in a section are entered on the same form.)
- The system shall facilitate, as part of the BySection entry method, entry with proficiency equal to or exceeding that in the current system. (This will need to be clarified.)
- The system shall facilitate, as part of the BySection entry method, entry with accuracy exceeding that of the current system. (This will need to be clarified. At present, there is a common error of entering conditions in the wrong row/segment.)
- The system shall allow an authorized user to modify existing road conditions.
- The system shall allow an authorized user to delete existing road conditions.
- The system shall allow an authorized user to enter a new incident.
- The system shall allow an authorized user to modify existing incidents.
- The system shall allow an authorized user to delete existing incidents.
- The system shall allow an authorized user to enter a new special event.
- The system shall allow an authorized user to modify existing special events.
- The system shall allow an authorized user to delete existing special events.
- The system shall allow an authorized user to enter spring thaw load and speed restrictions.
- The system shall allow an authorized user to enter new rest areas.
- The system shall allow an authorized user to modify existing rest areas.
- The system shall allow an authorized user to delete existing rest areas.
- The system shall allow an authorized user to enter new weigh stations.

- The system shall allow an authorized user to modify existing weigh stations.
- The system shall allow an authorized user to delete existing weigh stations.
- The system shall allow an authorized user to enter new border crossings.
- The system shall allow an authorized user to modify existing border crossings.
- The system shall allow an authorized user to delete existing border crossings.
- The system shall allow an authorized user to enter new alerts.
- The system shall allow an authorized user to modify existing alerts.
- The system shall allow an authorized user to delete existing alerts.

Report Generation

The system shall facilitate the generation of reports, both automatic (scheduled) and on-demand. The system shall allow authorized users to edit reports.

- The system shall generate reports on demand or automatically.
- The system shall allow users to edit existing reports and save the modified report.
- The system shall generate the following reports:
 - Construction Report
 - Statewide Road Condition Report
 - Area Road Condition Report
 - Pass Report
 - AP Road Condition Report
 - Spring Thaw Load and Speed Restrictions Report
 - Road Closure/Emergency Travel Only Report
 - Incident Report
 - Rest Area Report
 - Border Crossing Report
 - Weigh Station Report
- The system shall distribute reports automatically and manually.
- The system shall allow users to preview reports prior to distribution.

Public Interface

The system shall facilitate a public interface to traveler information. This interface will consist of sub-interfaces focusing on interactive maps and on reports. There would also be an overall interface or multiple interfaces that link to these sub-interfaces.

- The system shall provide a public interface to publicly available traveler information.

- The system shall provide a public map interface to publicly available traveler information.
- The system shall provide a public report interface to publicly available traveler information reports.

Private Interface

The system shall facilitate a private interface to traveler information. This interface will consist of sub-interfaces focusing on interactive maps, reports, and report-like listings with embedded, enhanced options. There would also be an overall interface or multiple interfaces that link to these sub-interfaces. These interfaces will display all information available to the public and also information that may not be intended for public viewing such as internal comments, fatalities, etc. In addition, authorized users may also be given the option to add, modify and delete data.

- The system shall provide a private interface to both publicly available and private traveler information.
- The system shall provide a private map interface to public and private traveler information.
- The system shall allow users to select events, facilities and alerts for editing using the private map.
- The system shall provide a private listing to public and private traveler information.
- The system shall provide an option for users to enter new events, facilities or alerts using the private listing.
- The system shall provide an option for users to modify existing events, facilities or alerts using the private listing.
- The system shall provide an option for users to delete existing events, facilities or alerts using the private listing.

Notification

The system shall facilitate notification of entities when certain events are entered within the system. Ideally such notification will be electronic, with email as a possible means. However, implementation is left open. (Note the drawbacks of using email that were cited by current users.)

- The system shall provide automatic notification to members of notification lists when appropriate.
- The system shall notify specified users if new events, facilities or alerts are entered into the system, existing events, facilities or alerts are modified or deleted, or when all segments of a section contain updated road conditions.
- The system shall notify specified users if an incident meeting certain criteria (such as major facility damage) is entered into the system.

User Administration

The system shall facilitate the administration of system users. User administration includes adding new users, editing existing users, and deleting user accounts.

- The system shall allow authorized users to perform user administration tasks.
- The system shall allow authorized users to enter new users into the system.
- The system shall allow authorized users to modify existing user accounts.
- The system shall allow authorized users to delete existing user accounts from the system.

Data Management

The system shall contain several lists used throughout system operation. Lists are used for convenience and to ensure consistency. The system shall facilitate management of the lists by authorized users.

- The system shall allow users to perform management tasks to stored lists, including data lists, contact lists, and external device lists.
- The system shall allow users to add items to lists.
- The system shall allow users to modify existing list items.
- The system shall allow users to delete existing list items.

11.1.3. Other Requirements**Hosting**

- If the system is hosted by the vendor, MDT shall own the data.
- If the system is hosted by the vendor, MDT shall be able to archive the data on MDT networks.

External Interface

- The system shall be able to exchange information with other systems such as Montana's 511 system, other states' 511 systems, and other states' RCRS.
- The system shall allow both automatic and manual data exchange with other systems.

User Interfaces

- The system shall interface to users through a graphical user interface.
- The system user interface shall conform to industry-standard design principles.

Hardware Interfaces

- The system shall operate on hardware conforming to MDT, ITSD, and other applicable agency and industry standards if internally hosted.

Software Interfaces

- The system shall interface with a variety of specific software products depending on whether the application is web-based or standalone. These software products shall be identified by proposers during their MDT data flow analysis, because these products are dependent on system set-up and design.

Communication Interfaces

- The system shall conform to industry-standard communication protocols, particularly TCP/IP. In addition, the system shall operate on the local MDT intranet.

Performance Requirements

- The system shall implement redundancy to achieve reliability.
- The system shall not have downtime.
- The system shall maintain security by limiting access to data to authorized users and encrypting data when necessary.
- The system shall allow users to add or reassign MDT road network components with little or no downtime.
- The system shall support many private and public users viewing or adding data without significant performance decreases.
- The system shall preserve data integrity despite interruptions to normal operation.
- The system shall be consistent in the precision of TIS regarding milepost locations.
- The system shall allow additional capacity for events, facilities, alerts, reports, archives, and user accounts.
- The system shall deploy a separate, fully-functional test environment.
- The system shall allow users to add new types of events, facilities, alerts, reports, external systems, or other components beyond those provided at the time of deployment.
- The system shall react quickly to requests for data or database updates.

Usability Requirements

- The system shall allow users to efficiently and consistently enter, edit, and view RCRS data through map or text interfaces.
- The system shall support the user by providing meaningful error messages.
- The system shall allow users to learn to perform all system tasks in a reasonable amount of time.
- The system shall be Section 508 compliant.
- The system developers shall provide adequate user support in the form of user documentation, training and technical support.

11.2. Next Steps

With the completion of Phase One, Phase Two will review the current options that exist for MDT to create this new database. Their options are to update the current RCRS, create a new RCRS from scratch, or purchase an “off-the-shelf” product with some modifications. Phase Two will examine the requirements and address which of the “off-the-shelf” products have the capabilities outlined in this requirements document, thereby providing MDT with a document comparing the capabilities of the current “off-the-shelf” products.

After Phase Two is completed, MDT will need to consider in more detail the requirements for the RCRS set forth in this document. This document’s requirements were created to encompass all of the options desired by MDT in an RCRS. If this document were to be used in its entirety as the request for proposals (RFP), it may

- preclude some vendors if they are not be able to meet all of the requirements,
- lead to a system that is too costly for MDT, or
- lead to a system that is too difficult to implement.

It is recommended that the MDT RFP committee use the Phase Two comparison document as the basis for an in-depth discussion of which of the detailed requirements are the highest priority for the Department and most feasible from a fiscal and institutional perspective. From this discussion, an RFP could then be created with requirements that are a balance between the high-level requirements outlined in this summary and the detailed requirements outlined in the body of this document.

12. REFERENCES

- 1 C. Strong and Eidswick, J. "Montana Regional Architecture," March 2005.
- 2 Montana Department of Transportation, "Summer Road Reporting Programs Procedures Manual," April 2002.
- 3 Montana Department of Transportation, "General Road Reporting Information," 2004.
- 4 IEEE Std 830-1998, "IEEE Recommended practice for Software Requirements Specifications", 1998.
- 5 K. Wiegers, "Software Requirements," Microsoft Press, 2003.
- 6 S. Robertson and Robertson J. "Mastering the Requirements Process," Addison-Wesley, 1999.