

APPENDIX H – STAKEHOLDER USER REQUIREMENTS DOCUMENT

JOC Project Background and History

The Nebraska Joint Operations Center (JOC) project began with the initiation of the Phase 1 contract between NDOR and Kimley-Horn and Associates, Inc. The Joint Operations Center was envisioned to be a multi-agency operations center, with the primary agency partners being NDOR, NSP, NEMA and the Army National Guard. The JOC was envisioned to be constructed on the ARNG base in Lincoln, concurrent with the ARNG construction of the STARC building. Phase 1 of the Nebraska JOC project was intended to conduct the ITS planning for this project and included a number of ITS planning tasks including conducting stakeholder workshops, determining user requirements, determining functional requirements, developing an architecture for the Statewide JOC and DOC system, preparing a communications report and recommendations, developing an implementation plan for Nebraska's ITS program and summarizing all of these items in the High Level System Design Report.

With this goal in mind, Kimley-Horn and Associates, Inc. began the JOC project by conducting stakeholder workshops in each of the eight districts of NDOR, along with a ninth workshop in Lincoln focused on the features and functions of the JOC. The purpose of the stakeholder workshops were to conduct a comprehensive inventory of the ITS and non-ITS equipment and processes that were in use throughout the State of Nebraska by the stakeholders, to solicit specific input as to the issues that stakeholders frequently encounter in carrying out their day to day functions, to identify the needs (user needs) for ITS that the stakeholders have, and to prioritize their needs. The results of the Stakeholder workshops are summarized in the *Stakeholder Workshop Summary* document.

The *Stakeholder User Requirements* document was developed by Kimley-Horn and Associates, Inc. utilizing the information that was collected in the Stakeholder workshops and in subsequent follow-up conversations with various stakeholders. The *Stakeholder User Requirements* document forms the foundation for developing subsequent aspects of the planning process including developing the functional requirements for the JOC project and developing the Architecture for the JOC project. The *Stakeholder Workshop Summary* document and the *Stakeholder User Requirements* document were both finalized in November 2002. Building upon these documents, the *Draft Functional Requirements* document and the *Draft Statewide JOC/DOC System Architecture* document were submitted to NDOR in November 2002 and December 2002, respectively.

In January 2003, as the State of Nebraska governor and legislature were going through an important process of establishing budgets for the upcoming fiscal year, the Governor pulled the state's portion of the funding for the Joint Operations Center out of the capital facilities portion of the state budget. This action meant that the soonest that funding for the JOC could be included in the capital facilities budget would be in approximately two years, for Fiscal Year 2006, and the window of opportunity for constructing the JOC along with the ARNG's STARC building closed.

However, it is important to understand that the entire ITS planning process that had been going on during the previous nine months is still entirely valid, in that the needs of the users have been identified, and the resulting functional requirements and architecture under development are for the most part still valid. The primary aspect that changed was that the opportunity for co-locating NDOR, NSP, NEMA and ARNG in the same physical building could not occur, but the agency relationships and responsibilities by and large are still the

same and will continue whether the agencies are co-located in the same physical building, or whether they are linked virtually.

Hence, the planning efforts continued, appropriate modifications were made to the Functional Requirements, Architecture, and Communications documents to address the change in course that had occurred, and to reflect the new concept of having a Statewide Operations Center in the Omaha metropolitan area that will serve the same NDOR functions as the JOC in Lincoln was originally envisioned to serve.

In the interest of forging ahead with the project planning process, and not significantly delaying the project by restarting the planning process, it was decided by NDOR and Kimley-Horn and Associates, Inc. that the *Stakeholder Workshop Summary* and the *Stakeholder User Requirements* documents would not be “revised” to reflect the deletion of JOC terminology and replacement by Statewide Operations Center (SOC) terminology, but rather that this JOC project background and history write-up would be included at the front of these two documents to explain how the project transitioned from a “Joint Operations Center” focus to a “Statewide Operations Center” focus.

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1. INTRODUCTION

1.1 Purpose

In 1998, the State of Nebraska completed a statewide intelligent transportation system (ITS) strategic plan identifying projects for the purpose of improving the safety, mobility, security, and the economic well being of the people of Nebraska. The plan presented a long-term vision for ITS projects and identified the need for a near-term implementation of a statewide joint operations center (JOC). It was envisioned that this JOC would provide the foundation for an integrated deployment of ITS throughout Nebraska and serve as the central hub in the data collection, processing, aggregation, monitoring, storage and dissemination of data and information necessary to achieve effective and coordinated statewide management of transportation facilities.

In the fall of 2001, the Nebraska Department of Roads (NDOR) embarked on the development of the JOC. The JOC concept would implement a facility shared by NDOR, Nebraska State Patrol (NSP), and Nebraska Emergency Management Agency (NEMA). The statewide NDOR-JOC High Level System Design (HLSD) report is the first step in the JOC development process. The primary objective of the HLSD is to establish the conceptual design of the statewide JOC. The purpose of this report is to document the comprehensive set of user requirements that have been defined from the user needs assessment process based on the JOC partners specific needs. User service bundles and user service requirements have been included in support of the JOC partners, NDOR District Operation Center's (DOC), and local entity operational needs.

1.2 Goals of Joint Operation Center

The JOC is being implemented to facilitate the integrated management of incidents, events, emergencies and provide traveler information services on a statewide basis throughout the state of Nebraska.

The primary JOC goals are as follows:

- Provide a facility to support NDOR statewide and district operations;
- Provide NSP a communications center for the Headquarters Troop-Area/State Headquarters and offices for the Headquarters Troop-Area-Traffic Services Division;
- Provide a facility to support NEMA's statewide emergency response coordination and management role;
- Provide the Army National Guard (ARNG) access to real-time transportation system information and facilitate data exchange between agencies;
- Establish communication links to the NDOR district operations centers, NSP troop area operations centers, and county emergency management centers;
- Provide the foundation for integrated deployment of ITS throughout the state and serve as the focal point for data collection, synthesis, analysis, dissemination, and archiving;
- Coordinate and facilitate the activities of agencies responding to incidents and emergencies to minimize the negative impact on the safety and efficiency of Nebraska's transportation system;
- Facilitate coordination among NDOR district operations centers, NSP troop area operations centers, and county emergency management officials; and

- Provide operational coverage of Nebraska's ITS elements statewide 24 hours a day, 7 days a week. Using remote workstations and in close coordination with district field personnel, the JOC would serve as a secondary control point via primary control systems implemented in the districts.

2. NEEDS ASSESSMENT

During the strategic plan project completed in 1998, a needs assessment was completed and documented. The first major task of this project was to develop an updated needs assessment. To accomplish this task, meetings and stakeholder workshops were conducted in each NDOR District, a Joint Operations Center Workshop was conducted in Lincoln, Nebraska and individual meetings were held with staff from NEMA, NSP, ARNG, and the Department of Administrative Services-Division of Communications (DAS-DOC). During the meetings and workshops, stakeholders provided input on currently deployed ITS, communication and systems elements, ITS and operational needs and ITS and operational implementation issues. The expressed purpose of the workshops was to hear from the operations center stakeholders statewide. Results of the workshops were incorporated into the *Stakeholder Workshop Summary* report that summarizes the stakeholders' view of the statewide needs of Nebraska as well as their view of the high-level JOC functions. The needs identified during these stakeholder workshops serve as the primary input to this user requirement development task. The needs identified by NEMA, NSP, ARNG, and DAS-DOC have been combined with the NDOR identified needs where appropriate, or incorporated separately into Section 6 – JOC Operational Concepts, when not specifically related to user services as defined in the National ITS Architecture.

3. NATIONAL ITS ARCHITECTURE

Nebraska's traffic and transportation problems and needs, in the broad scheme of things, are not entirely unique. Other states and their partner agencies (local and/or regional) are faced with similar problems and similar potential solutions. Many of the potential solutions involve computing, electronic sensing and communications technologies, commonly referred to as ITS technologies that are being applied nationally to effectively mitigate the negative effects of operational transportation problems.

In order to maximize the potential of the available ITS technologies, system design solutions must be compatible at the system interface level. Compatible interfaces are needed specifically to support coordinated area-wide integrated operations, effective data sharing, and where appropriate interoperable/interchangeable equipment. ITS technologies have therefore been assembled into a comprehensive collection of system element descriptions in an attempt to promote the uniform application of these technologies throughout the transportation industry.

As a collective work, this codification effort is referred to as the National ITS Architecture. Its purpose is to provide a common structure for and comprehensive guidance to transportation system owners, operators and designers during the conceptual design of ITS system elements so as to promote system, product, and service compatibility/interoperability without limiting the design options of stakeholders.

It is extremely important to note that the National ITS Architecture in and of itself is not a system design concept, nor is it a system design; however, it is the framework around which a design concept can be developed, specifically tailored to meet the individual needs of a user, while maintaining the benefits of a common architecture noted above.

The architecture defines:

- The functions (e.g., gather traffic information or request a route) that must be performed to implement a given user service;
- The physical entities or subsystems where these functions reside (e.g., the roadside or the vehicle), the interfaces/information flows between the physical subsystems; and
- The communication requirements for the information flows (e.g., wire -line or wireless).

Much of the content of this document is taken from or based on the National ITS Architecture. It draws heavily upon the User Service and User Service Requirements as defined therein.

4. HIGH LEVEL SYSTEM DESIGN

This compilation of user requirements represents one chapter of the HLSD report that will ultimately comprise the JOC conceptual design. In addition to this report and the Workshop Summary report that preceded it, the HLSD will include the following reports:

- Functional Requirements;
- System Architecture;
- Communication Report; and
- Implementation Plan.

This HLSD report will serve as a summary of these reports, and as such, provide a succinct description of the JOC High Level System Design. The HLSD report will serve as the foundation for the System Design and Plans, Specifications, and Estimates (PS&E) efforts that will be conducted as the next major steps of the JOC implementation process.

5. CONTENTS OF REPORT

This report takes the comprehensive set of needs assessed during the stakeholder meetings and workshop process, when appropriate, and maps them to user requirements that must be met in support of Nebraska's ITS and JOC needs. Within the Stakeholder Workshop Summary Report, user needs were organized into ten (10) categories as identified by stakeholders. The process completed within this report is to further relate and categorize the needs to the specific user services and user service requirements of the National ITS Architecture. **Table 1** provides an outline of the user service bundles and the corresponding user services defined by the National ITS Architecture. This report discusses the resultant requirements using National ITS Architecture terminology and numbers them using National ITS Architecture numbering schemes for easy reference.

The following User Service categories and user services (US) from the National ITS Architecture have been identified in support of the stakeholder identified needs for deployment of the Nebraska JOC and NDOR District Operations Centers:

- Pre-trip Travel Information (US 1.1);
- En-route Driver Information (US 1.2);
- Traveler Services Information (US 1.5);
- Traffic Control (US 1.6);

- Incident Management (US 1.7);
- Travel Demand Management (US 1.8);
- Highway Rail Intersection (US 1.10);
- Public Transportation Management (US 2.1);
- En-Route Transit Information (US 2.2);
- Personalized Public Transit (US 2.3);
- Commercial Vehicle Operations (US 4.1);
- Commercial Vehicle Administrative Processes (US 4.4);
- Hazardous Material Incident Response (US 4.5);
- Emergency Vehicle Management (US 5.2);
- Longitudinal Collision Avoidance (US 6.1);
- Archived Data Function (US 7.1); and
- Maintenance and Construction Operations (US 8.1).

Within the National ITS Architecture, numerous user service requirements (USRs) are associated with each of these User Service categories. During this task, USRs have been gleaned from the National ITS Architecture and included as applicable. USRs, as defined in the National ITS Architecture, are intended to be basic building blocks of a system, defining *the things* the system should do to meet the defined user needs, but not how or where they should be done.

Table 1 – User Service Bundles

User Services Bundle	User Services
1.0 Travel and Transportation Management	<ul style="list-style-type: none"> ▪ Pre-trip Travel Information* ▪ 1.2 En-route Driver Information* ▪ 1.3 Route Guidance ▪ 1.4 Ride Matching and Reservation ▪ 1.5 Traveler Services Information* ▪ 1.6 Traffic Control* ▪ 1.7 Incident Management* ▪ 1.8 Travel Demand Management* ▪ 1.9 Emissions Testing and Mitigation ▪ 1.10 Highway Rail Intersection*
2.0 Public Transportation Operations	<ul style="list-style-type: none"> ▪ 2.1 Public Transportation Management* ▪ 2.2 En-route Transit Information* ▪ 2.3 Personalized Public Transit* ▪ 2.4 Public Travel Security
3.0 Electronic Payment	<ul style="list-style-type: none"> ▪ 3.1 Electronic Payment Services
4.0 Commercial Vehicle Operations	<ul style="list-style-type: none"> ▪ 4.1 Commercial Vehicle Electronic Clearance* ▪ 4.2 Automated Roadside Safety Inspection ▪ 4.3 On-board Safety Monitoring ▪ 4.4 Commercial Vehicle Administration Processes* ▪ 4.5 Hazardous Materials Incident Response* ▪ 4.6 Commercial Fleet Management

Table 1 – User Service Bundles (continued)

User Services Bundle	User Services
5.0 Emergency Management	<ul style="list-style-type: none"> 5.1 Emergency Notification and Personal Security 5.2 Emergency Vehicle Management*
6.0 Advanced Vehicle Control and Safety Systems	<ul style="list-style-type: none"> 6.1 Longitudinal Collision Avoidance* 6.2 Lateral Collision Avoidance 6.3 Intersection Collision Avoidance 6.4 Vision Enhancement for Crash Avoidance 6.5 Safety Readiness 6.6 Pre-crash Restraint Deployment 6.7 Automated Vehicle Operation
7.0 Information Management	<ul style="list-style-type: none"> 7.1 Archived Data Function*
8.0 Maintenance and Construction Management	<ul style="list-style-type: none"> 8.1 Maintenance and Construction Operations*

**Indicates User Service that supports Nebraska Stakeholder Needs*

5.1 Analysis Methodology

For each user service requirement, a recommended implementation phase is denoted. This implementation phase was derived from information gathered during the Stakeholder Workshops and is based on (1) the number of districts and (2) the number of stakeholders that identified a specific need. A weighted value was calculated based on the following formula:

$$\text{Weighted Value} = (\# \text{ of Stakeholder Responses}) * \frac{(\# \text{ of Districts Responded})}{8 \text{ Districts}}$$

The results of this calculation were then sorted to determine the implementation phasing based on the following logic:

- Phase 1 Deployment – weighted value is greater than/equal to 13;
- Phase 2 Deployment – weighted value is less than 13 or greater than/equal to 4; and
- Phase 3 Deployment – weighted need is less than 4.

The deployment phasing has been assigned from the perspective of the JOC. Ultimately, the deployment phasing recommendations were based on a combination of the above numerical analysis and a degree of subjectivity. Phase 1 deployment will be implemented initially and is intended to provide the highly desired needs and functions as identified by Stakeholders and include basic functions that will provide the foundation for a statewide system. Phase 2 and 3 deployment packages are expected to provide expanded system functions and enhancements to the system. The user need prioritization spreadsheets used in the numerical analysis are provided in **Attachment A**. The final deployment phases are outlined in Section 6 with an element of subjectivity.

5.2 Acronyms

The following list outlines the acronyms used throughout the document and is provided for reference.

ADA	Americans with Disabilities Act
ADHA	Automatic Data Historical Archive
AICC	Autonomous Intelligence Cruise Control
AMS	Arterial Management System
ARNG	Army National Guard
ATIS	Advanced Travel Information System
ATMS	Advanced Traffic Management System
AVI	Automatic Vehicle Identity
AVL	Automatic Vehicle Location
CC	Command and Control
CCTV	Closed Circuit Television
CMS	Changeable Message Sign
CVAP	Commercial Vehicle Administrative Process
CVEC	Commercial Vehicle Electronic Clearance
DAS-DOC	Department of Administrative Services-Division of Communications
DI	Driver Information
DIV	Data Import and Verification
DMS	Dynamic Message Sign
DOC	District Operations Center
DWD	Data Warehouse Distribution
EOC	Emergency Operations Center
EPC	Electronic Purchase of Credentials
EVM	Emergency Vehicle Management
FMS	Freeway Management System
GIS	Geographic Information System
HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
HDA	Historical Data Archive



HIN	HAZMAT Incident Notification
HIR	HAZMAT Incident Response
HLSD	High Level System Design
HRI	Highway Rail Intersection
ICI	ITS Community Interface
IIC	Intelligent Intersection Control
IM	Incident Management
ITS	Intelligent Transportation System
JOC	Joint Operations Center
MCO	Maintenance and Construction Operations
MPH	Miles Per Hour
MPO	Metropolitan Planning Organization
MVFM	Maintenance Vehicle Fleet Management
NDOR	Nebraska Department of Roads
NEMA	Nebraska Emergency Management Agency
NSP	Nebraska State Patrol
OVF	Operation of Vehicles and Facilities
PPT	Personalized Public Transit
PS&E	Plans, Specifications, and Estimates
PSS	Planning and Scheduling Services
PTM	Public Transportation Management
PTTI	Pre-Trip Travel Information
RMCWPD	Roadway Maintenance Conditions and Work Plan Dissemination
RWIS	Road Weather Information System
RWM	Roadway Management
SSR	Standard Speed Rail
TC	Traffic Control
TDM	Travel Demand Management
TI	Transit Information
TMC	Transportation Management Center

TSI	Traveler Services Information
US	User Services
USR	User Service Requirements
VCC	Vehicle Command and Control
WZMS	Work Zone Management and Safety
XML	Extensible Markup Language

6. JOC OPERATIONAL CONCEPTS

Creation of the centralized JOC will involve the collocation of four State Agencies with local, regional and statewide responsibilities. The JOC partners have a history of interagency cooperation and coordination involving response to emergency, security, and public safety incidents. The interaction will be enhanced, for example, through the close proximity of operational staff developing a better understanding of each agencies' roles and responsibilities but also from an ability to share in real-time data and information being collected. Communication of information to the public also will be enhanced due to the single point of contact. The collocation offers the partners an ability to share field and operations center equipment, computer hardware, and software systems, including databases and staff resources. These efficiencies will be identified through the HLSD report and implementation through the design and deployment of systems and development of operational procedures. Within the JOC complex the partners will each perform two roles, one internal to the organization and one supporting the JOC operational concept.

6.1 Nebraska Department of Roads

NDOR will relocate the Transportation Technology Division to offices within the JOC from which the Division will support ITS implementation and Traffic Operations statewide. The Division has the primary role in the provision and dissemination of advance travel information (ATIS) and 511, and will house those functions within the JOC. In an operational role, the primary responsibility will be in providing statewide, regional, and local support for state highway system operations, secondary traffic control, and assist with the coordination of statewide and regional activities. In the traffic control support role, the NDOR JOC will assist through the 24/7 operation, supporting the DOC's after-hours operations. NDOR will support the JOC concept through statewide deployment of ITS field transportation monitoring and control devices, collecting real-time traffic and weather data, providing staff and equipment for incident response, and providing the means for dissemination of information to the public.

6.2 Nebraska Emergency Management Agency

NEMA will relocate administrative and staff of four departments (Planning, Mitigation, Training, and Geographic Information Systems [GIS]) to offices within the JOC. The current day-to-day mission of the Agency will not change; however, the Agency's mission of managing statewide emergency response activities and the ability to operationally respond to emergencies will improve through the physically closer proximity of the JOC partner agencies, enhanced

information availability/exchange, resources sharing, and through the improved facilities available within the JOC.

6.3 Nebraska State Patrol

NSP will relocate the communications center for the Headquarters Troop Area/State Headquarters and the Headquarters Troop Area-Traffic Services Division to the JOC. The relocation of staff and functions from two separate locations will facilitate better internal coordination between Troop Area communications and field operations. In addition, the current responsibility as the State call center for operations associated with public safety and law enforcement will be relocated to the JOC. Additionally, operational support for the JOC will be through the statewide communications capability, staff, and resources. Coordination and cooperation in response to statewide incidents will be enhanced through the physical proximity of management staff and sharing of the same data in real-time. The State Patrol has staff located statewide trained and equipped to respond immediately to emergency, public safety, and security incidents.

6.4 Nebraska Army National Guard

The Army National Guard will relocate headquarters staff to a new facility connected to the JOC. The ARNG's presence within the JOC will be limited to workstations periodically used by movement control staff and video feeds from site security cameras monitoring armories statewide. Monitoring of the security cameras can be a function performed by the JOC operations center staff. The ARNG presence within the JOC supports a similar role as the other partners such as providing statewide resources and capabilities, and the ability to share real-time information. Again, the JOC concept offers an opportunity for closer cooperation and coordination, and in the case of the ARNG, the availability of the real-time information necessary to request immediate deployment of the Guards' statewide resources offers tremendous benefits.

7. USER SERVICE REQUIREMENTS

This section of the report provides an outline of the user needs with the recommended deployment phasing per US categories. User needs could be classified under various US categories, as several US categories might be necessary to fully implement a defined user need. The section reflects user needs identified by each of the JOC partners. How this project accommodates each agency's needs will be addressed during the design phase of the project. In many cases, needs are repetitive thus identifying a real opportunity to share deployed resources including field and hardware/software systems. This section also outlines those USR needed to implement the user needs.

7.1 Pre-trip Travel Information (US 1.1)

The Stakeholders identified fourteen- (14) specific needs categorized under the Pre-Trip Travel Information US. Primary function of Pre-Trip Travel Information is to provide communication between the central system that processes field data and end users such as transportation management center (TMC) operators, transportation professionals, and commuters. It provides information such as roadway conditions, location and information on incidents for trip planning, route selection, time of departure, and travel time estimation through telephone systems, Internet access, kiosks, etc. The primary goal of this US is to provide information prior to travel in order for travelers to make informed decisions.

7.1.1 Pre-Trip Travel Information Prioritized Needs

During the Stakeholder workshop process, it became evident that traveler information is a priority in Nebraska. Collection, fusion, storage, access, and dissemination have been identified as an initial priority.

Phase 1 Deployment

- Statewide coverage of a fully functional 511 system.
- Access to adjacent region/states data/information.
- Timely/reliable statewide ATIS dissemination.
- Centralized ATIS data/information collection, fusion and dissemination, accessible through a common protocol, e.g., extensible markup language (XML).
- Format and availability of ATIS data/information to public agencies.
- Access to ATIS data/information by public and agencies.
- Implement an ATIS fully supported by the freeway management system (FMS).
- Deploy additional data/information collection devices/systems.

Phase 2 Deployment

- Implement an infrastructure inventory and status reporting system (i.e., ITS devices).
- Road Weather Information System (RWIS), deploy additional sites, implement data control/access, develop winter roadway maintenance program.
- Implement real-time DOC/field condition reporting capability.
- Mobile/portable RWIS system, emergency condition reporting.

Phase 3 Deployment

- Implement a parking management system.
- Deploy web based real-time transit schedules/status.
- Access to yellow pages, tourist attractions/information emergency services.

7.1.2 Pre-Trip Travel Information User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

USR 1.1.0 ITS shall include a Pre-Trip Travel Information (PTTI) capability to assist travelers in making mode choices, travel time estimates, and route decisions prior to trip departure. It consists of four major functions, which are, (1) Available Services Information, (2) Current Situation Information, (3) Trip Planning Service, and (4) User Access. Information is integrated from various transportation modes and presented to the user for decision making.

USR 1.1.1 PTTI shall provide travelers with Available Services Information on travel, for their use.

<i>USR 1.1.1.1</i>	PTTI shall provide users with available services information that is timely.
<i>USR 1.1.1.1.1</i>	PTTI shall provide users the latest available information on transit routes.
<i>USR 1.1.1.1.2</i>	PTTI shall provide users the latest available information on transit schedules.
<i>USR 1.1.1.1.3</i>	PTTI shall provide users with the latest available schedule adherence information.
<i>USR 1.1.2</i>	PTTI shall provide the capability for users to access the Current Situation Information on transportation systems.
<i>USR 1.1.2.1</i>	PTTI shall provide the latest available information on the current status of transportation services.
<i>USR 1.1.2.1.1</i>	Real-time information provided by PTTI shall include the current condition of any incidents, including rural incidents such as high winds, extreme temperature, and falling rocks.
<i>USR 1.1.2.1.2</i>	Real-time information provided by PTTI shall include the current status of any accidents or incidents.
<i>USR 1.1.2.1.3</i>	Real-time information provided by PTTI shall include the current condition of any road construction.
<i>USR 1.1.2.1.5</i>	Real-time information provided by PTTI shall include the current speeds on specific routes.
<i>USR 1.1.2.1.6</i>	Real-time information provided by PTTI shall include current parking conditions in key areas.
<i>USR 1.1.2.1.7</i>	Real-time information provided by PTTI shall include the schedules for any current or soon to start events.
<i>USR 1.1.2.1.8</i>	Real-time information provided by PTTI shall include the current weather situation.
<i>USR 1.1.4</i>	PTTI shall provide the capability for User Access.
<i>USR 1.1.4.1</i>	PTTI shall provide the capability for users to access the system from multiple distributed locations.
<i>USR 1.1.4.1.1</i>	PTTI shall provide the capability for users to access the system from their homes.
<i>USR 1.1.4.1.2</i>	PTTI shall provide the capability for users to access the system from their place of work.

- USR 1.1.4.1.3* PTTI shall provide the capability for users to access the system from major trip generation sites.
- USR 1.1.4.1.4* PTTI shall provide the capability for users to access the system from personal portable devices.
- USR 1.1.4.2* PTTI shall provide the capability for users to access the system over multiple types of electronic media.
- USR 1.1.4.2.1* Access media shall comply with the Americans with Disabilities Act (ADA) legislation.

7.2 En-route Driver Information (US 1.2)

Thirteen- (13) needs identified by stakeholders have been categorized under the En-Route Driver Information US. Its primary function is dissemination of information to users concerning current roadway, weather, and transit conditions while en-route via DMS, HAR, etc. Benefits include increased mobility resulting in the ability of commuters to make informed decisions regarding their travel path and thus resulting in reduction of driver frustration.

7.2.1 En-route Driver Information Prioritized Needs

The needs identified by the stakeholders were focused on providing information to travelers in a real-time fashion in order to make informed decisions while en-route. A summary of the needs categorized by deployment phasing is provided below.

Phase 1 Deployment

- Timely/reliable statewide ATIS dissemination.
- Strategic ITS device (closed-circuit television [CCTV]/dynamic message sign [DMS]) deployment, shared use control.
- Statewide coverage of a fully functional 511 system.
- Implement an ATIS fully supported by the FMS.
- Implement an advanced traffic management system (ATMS), freeway and expressways.
- Deploy additional data/information collection devices/systems.

Phase 2 Deployment

- Implement a fully functional arterial management system (AMS), support incident, special event management and smart corridor deployment.
- Deploy HAR at strategic locations.
- Implement real-time DOC/field condition reporting capability.
- RWIS, deploy additional sites, implement data control/access, develop winter roadway maintenance program.
- Mobile/portable RWIS systems, emergency condition reporting.

Phase 3 Deployment

- Implement arterial en-route traveler information system.
- Implement a parking management system.
- Access to yellow pages, tourist attractions/information, emergency services.

7.2.2 En-route Driver Information User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 1.2.0* ITS shall include an En-Route Driver Information (DI) function. Driver Information provides vehicle drivers with information, while en-route, which will allow alternative routes to be chosen for their destination. Driver Information consists of two major functions, which are (1) Driver Advisory and (2) In-vehicle Signing. The potential decrease in traffic may also provide benefits in highway safety, reduced air pollution, and decreased congestion.
- USR 1.2.1* DI shall be implemented in a manner that is beneficial to the transportation system and the public.
- USR 1.2.1.1* DI shall be implemented in a manner that helps improve highway safety.
- USR 1.2.1.3* DI shall be implemented in a manner that helps decrease congestion.
- USR 1.2.1.4* DI shall be designed in a manner that permits a two-phase implementation.
- USR 1.2.1.4.1* The DI two-phase implementation shall include a short-term capability to address those features that can be implemented in the present time frame.
- USR 1.2.1.4.2* The DI two-phase implementation shall include a long-term capability to address those features that can be implemented when the remainder of the ITS system is deployed.
- USR 1.2.2* DI shall include a Driver Advisory function, which shall be implemented in two phases with first a short-term capability and later a long term capability.
- USR 1.2.2.1* The short term DI driver information capability shall include the ability to provide information to travelers within the limited area of deployment.
- USR 1.2.2.1.1* DI shall include the capability to provide travelers with accurate information concerning available travel options and their state of operational availability.
- USR 1.2.2.1.2* DI shall provide information to travelers required for them to avoid areas of congestion.

USR 1.2.2.2 The long term DI driver information capability shall include the ability to provide information to travelers within all geographic areas of the ITS deployment.

7.3 Traveler Services Information (US 1.5)

Eleven- (11) stakeholder needs have been classified under the Traveler Services Information US with the focus on providing travelers with information regarding weather, tourist areas, parking, emergency services, etc. This US focuses on maintaining a database of information on area services both real-time and historical.

7.3.1 Traveler Services Information Prioritized Needs

The needs identified by the stakeholders were focused on providing information to travelers in a real-time fashion in order to make informed decision while en-route. A summary of the needs categorized by deployment phasing is provided below.

Phase 1 Deployment

- Centralized ATIS data/information collection, fusion and dissemination, accessible through a common protocol, e.g., XML.
- Statewide coverage of a fully functional 511 system.
- Access to ATIS data/information by public and agencies.
- Format and availability of ATIS data/information to public and agencies.

Phase 2 Deployment

- RWIS, deploy additional sites, implement data control/access, develop winter roadway maintenance program.
- Implement real-time DOC/field condition reporting capability.
- Deploy HAR at strategic locations.
- Include tourist information at rest areas.
- Mobile/portable RWIS system, emergency condition reporting.

Phase 3 Deployment

- Implement a parking management system.
- Improve dissemination during National Emergencies.
- Access to yellow pages, tourist attractions/information emergency services.

7.3.2 Traveler Services Information User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 1.5.0 ITS shall include a Traveler Services Information (TSI) function. Traveler Services Information provides travelers with service and facility data for the purpose of assisting prior to embarking on a trip or after the traveler is underway. The functions which are included in this capability are Information Receipt and Information Access. This will provide the traveler with a "yellow pages" type of capability.
- USR 1.5.1 TSI shall include an Information Receipt function for the collection of information to be provided to travelers.
 - USR 1.5.1.1 Information Receipt shall provide and maintain a database of local area services available to travelers.
 - USR 1.5.1.2 Information Receipt provides the capability to acquire current information relating to traveler services available in the local area.
 - USR 1.5.1.2.3 Information Receipt shall acquire information on the availability of local traveler services.
 - USR 1.5.1.2.5 Information Receipt shall acquire information on the availability of local tourist services.
 - USR 1.5.1.5 Information Receipt shall include the capability to have interactive connectivity between users, sponsors and providers of services.
- USR 1.5.2 TSI shall include an Information Access function that allows travelers to access the available information.
 - USR 1.5.2.1 Information Access shall provide the capability for travelers to request and receive general information about the local area.
 - USR 1.5.2.2 Information Access shall provide the capability for travelers and centers to request and receive information about the location of facilities and the quality of specific services provided in an area to include but, not be limited to, the following:
 - USR 1.5.2.2(a) Lodging information.
 - USR 1.5.2.2(c) Parking information.
 - USR 1.5.2.2(e) Tourist activities information.
 - USR 1.5.2.2(f) Daily or special events information.

- USR 1.5.2.2(g)* Local shelter/medical facility availability information including level of service provided.
- USR 1.5.2.4* Information Access shall provide the capability for all travelers to access information regardless of their particular mode of travel.
- USR 1.5.2.5* Information Access shall provide the capability for travelers to access the TSI information via any of, but not limited to, the following methods:
 - USR 1.5.2.5(a)* Highway advisory radio.
 - USR 1.5.2.5(b)* Dial-up telephone lines.
 - USR 1.5.2.5(c)* Computers at home.
 - USR 1.5.2.5(d)* Computers in the office.
 - USR 1.5.2.5(e)* In-vehicle computers.
 - USR 1.5.2.5(f)* Public area kiosks.
 - USR 1.5.2.5(g)* Personal portable devices.
- USR 1.5.2.6* Information Access shall provide the capability for travelers to access TSI information from public kiosk locations which include, but are not limited to:
 - USR 1.5.2.6(a)* Rest areas.
 - USR 1.5.2.6(b)* Activity centers.
 - USR 1.5.2.6(c)* Tourist attractions.
 - USR 1.5.2.6(e)* Airports.

7.4 Traffic Control (US 1.6)

Twenty- (20) user needs have been categorized under Traffic Control. A primary desire expressed by stakeholders was to have automated and remote control of field devices to react and control conditions resulting from roadway congestion, the environment, or incidents. This US outlines functions to promote communication between field devices and management centers under real-time conditions. Data from field devices would be collected and processed to determine field conditions. Processing of data allows for identification of potential incidents. Traffic surveillance via CCTV cameras provides for verification of conditions. Ultimately, traffic control measures would be implemented to manage the situation. Requirements established under US 1.6 satisfies many of the stakeholder needs.

7.4.1 Traffic Control Prioritized Needs

A summary of the needs categorized by deployment phase is provided below.

Phase 1 Deployment

- Centralized ATIS data/information collection, fusion and dissemination, accessible through a common protocol, e.g. XML.
- Strategic ITS device (CCTV/DMS) deployment, shared use control.
- Implement an ATMS, freeway and expressways.
- Pre-emption on emergency vehicles.
- Historical data archive system.
- Deploy additional data/information collection devices/systems.
- Joint use/control of ITS devices.
- Deploy vehicle speed warning systems.
- Pre-emption on emergency vehicles.

Phase 2 Deployment

- Implement a fully functional AMS, support incident, special event management and smart corridor deployment.
- RWIS, deploy additional sites, implement data control/access, develop winter roadway maintenance program.
- Automated ramp closure system with status verification.
- Implement real-time DOC/field condition reporting capability.
- Deploy CCTV at RWIS and anti-icing system locations.
- Notification of train location, crossing gates status, implement intersection warning systems.
- Implement multi-agency traffic operations plans.
- Deploy CCTV at DMS locations.
- Mobile/portable RWIS system, emergency condition reporting.

Phase 3 Deployment

- Ability to control traffic signals on site.
- Deploy road closure systems on state routes.
- Deploy rest area closure system.
- Implement a parking management system.

7.4.2 Traffic Control User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 1.6.0* ITS shall include a Traffic Control (TC) function. Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. Four functions are provided, which are (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control, and (4) Provide Information. This will also include control of network signal systems with eventual integration of freeway control.
- USR 1.6.1* TC shall include a Traffic Flow Optimization function to provide the capability to optimize traffic flow.
- USR 1.6.1.1* Traffic Flow Optimization shall employ control strategies that seek to maximize traffic-movement efficiency.
- USR 1.6.1.1.1* Traffic-movement control shall manage movement of traffic on streets.
- USR 1.6.1.1.2* Traffic-movement control shall manage movement of traffic on highways.
- USR 1.6.1.1.3* Traffic-movement control shall include the goal of minimizing delay times.
- USR 1.6.1.2* Traffic Flow Optimization shall include a wide area optimization capability, to include several jurisdictions.
- USR 1.6.1.2.1* Wide area optimization shall integrate the control of network signal systems with the control of freeways.
- USR 1.6.1.3* Traffic Flow Optimization shall be implemented in a manner that seeks to optimize traffic movement over a large geographic area.
- USR 1.6.1.4* Traffic Flow Optimization shall include a Control function that is responsive to both the current demand as well as the expected demand.
- USR 1.6.1.6* The Control function shall include the use of data acquired from traffic surveillance as feedback to the control strategies.
- USR 1.6.2* TC shall include a Traffic Surveillance function.
- USR 1.6.2.1* Traffic Surveillance shall include a vehicle detection function with the capability of accurately detecting vehicles in a real-time fashion.
- USR 1.6.2.2* Traffic Surveillance shall include a data collect function to provide the capability to collect data for determining traffic flow and prediction.

- USR 1.6.2.2.1* The data collect function shall provide the capability to quickly feedback traffic data to the control processes.
- USR 1.6.2.3* Traffic Surveillance shall include a wide-area surveillance capability to include several jurisdictions.
- USR 1.6.2.3.1* The wide-area surveillance shall gather speed and flow information.
- USR 1.6.2.3.2* The wide-area surveillance shall cover a large number of roadway segments.
- USR 1.6.2.4* TC shall provide the capability to acquire detailed traffic measurements at specific locations.
- USR 1.6.2.4.1* Traffic Surveillance shall include a data process function to process the traffic data, which are acquired.
- USR 1.6.2.5* The wide area surveillance shall acquire sufficient data to provide the system with the knowledge of the existing conditions.
- USR 1.6.3* TC shall include a Device Control function.
- USR 1.6.3.1* The Device Control function shall include a "real-time" traffic-adaptive control capability.
- USR 1.6.3.2* The real-time traffic-adaptive control portion of the Device Control function shall be an area wide control to include several jurisdictions.
- USR 1.6.3.2.1* The area wide control shall be implemented in an integrated and consistent manner that avoids the issuance of conflicting controls.
- USR 1.6.3.2.2* The area wide control shall be implemented in a manner that permits the following types of vehicles to have preference over other vehicles being controlled.
- USR 1.6.3.2.2(c)* Emergency Medical Service Vehicles.
- USR 1.6.3.3* The Device Control function shall provide the capability to exercise control over those devices utilized for traffic control.
- USR 1.6.3.3.1* Device Control shall include the capability to control traffic signalization, including rapid modification of signalization parameters to respond to traffic requirements.
- USR 1.6.3.3.2* Device Control shall include the capability to dynamically control traffic signing.
- USR 1.6.3.3.3* Device Control shall include the capability to control freeway ramp metering.

- USR 1.6.3.3.4* Device Control shall include the capability to exercise dynamic control over the infrastructure (such as reversible-lanes, turning restrictions, etc.).
- USR 1.6.3.4* Device Control shall communicate control data to the following devices.
- USR 1.6.3.4(a)* Traffic signals.
- USR 1.6.3.4(c)* Information signs.
- USR 1.6.3.4(e)* Human operator support.
- USR 1.6.3.4.1* Traffic Surveillance shall include a data process function to process the traffic data, which are acquired.
- USR 1.6.3.5* Device Control shall provide the operator with the capability to manually override the system's automatic controls.
- USR 1.6.3.6* Device Control shall provide the operator the capability to adaptively change system response in order to provide a response that is coordinated with other TMCs responding to incidents.
- USR 1.6.4* Device Control shall provide traffic control information to other elements of the ITS, including but not limited to the following:
- USR 1.6.4(d)* Fleet management systems.

7.5 Incident Management (US 1.7)

Nine- (9) user needs have been categorized under Incident Management for mostly later deployment and are focused on coordination between entities. Incident Management focuses on increasing the detection accuracy of incidents in order to provide response formulation and dispatch in a timely fashion. This requires coordination between responding entities (i.e. medical services, highway patrol, maintenance services, towing services, etc.)

7.5.1 Incident Management Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- Implement an ATMS, freeway and expressways.
- Deploy additional data/information collection devices/systems.

Phase 2 Deployment

- Implement a fully functional AMS, support incident, special event management and smart corridor deployment.
- Local Emergency Operations Plan web accessible.
- Coordinated incident response, multi-jurisdictional/agency teams.
- Implement multi-agency traffic operations plans.
- Establish/maintain a state/local agency contact list.
- Access to multi-agency GIS base map information.

Phase 3 Deployment

- Ability to control traffic signals on site.

7.5.2 Incident Management User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 1.7.0* ITS shall include an Incident Management (IM) function. Incident Management will identify incidents, formulate response actions, and support initiation and ongoing coordination of those response actions. Four major functions are provided, which are, (1) Incidents Identification, (2) Response Formulation, (3) Response Implementation, and (4) Predict Hazardous Conditions.
- USR 1.7.1* Incident Management shall provide an Incident Identification function to identify incidents.
- USR 1.7.1.2* The Incident Identification function shall include the capability to identify existing (both planned and unplanned) incidents.
- USR 1.7.1.2.1* The Incident Identification function shall use information from the following types of sources, where available, to identify existing incidents:
- USR 1.7.1.2.1(a)* Traffic flow sensors.
- USR 1.7.1.2.1(b)* Environmental sensors.
- USR 1.7.1.2.1(c)* Public safety sources.
- USR 1.7.1.2.1(d)* Media sources.
- USR 1.7.1.2.1(e)* Weather information sources.
- USR 1.7.1.2.1(f)* Transportation providers.
- USR 1.7.1.2.1(g)* Travelers.

- USR 1.7.1.2.2* The Incident Identification function shall determine and continuously monitor at least the following characteristics of each existing incident:
- USR 1.7.1.2.2(a)* Type (including Terrain Hazards).
- USR 1.7.1.2.2(b)* Extent.
- USR 1.7.1.2.2(c)* Severity.
- USR 1.7.1.2.2(d)* Location.
- USR 1.7.1.2.2(e)* Expected duration.
- USR 1.7.1.2.3* The Incident Identification function shall determine and continuously monitor the current and expected traffic flow impact of each existing incident.
- USR 1.7.2* IM shall provide a Response Formulation function to formulate appropriate response actions to each identified incident and revise those actions when necessary.
- USR 1.7.2.2* The Response Formulation function shall propose and facilitate the appropriate dispatch of emergency response vehicles to an incident.
- USR 1.7.2.3* The Response Formulation function shall propose and facilitate the appropriate dispatch of service vehicles to an incident.
- USR 1.7.2.4* The Response Formulation function shall propose and facilitate the appropriate dissemination of incident related information to travelers and potential travelers.
- USR 1.7.3* IM shall include a Response Implementation function to provide the services to implement a response coordinated with all appropriate agencies.
- USR 1.7.3.1* The Response Implementation function shall provide at least the following decision support capabilities needed to implement coordinated incident response actions by all participating institutions:
- USR 1.7.3.1(a)* Response Implementation shall allow coordinated selection/determination of the procedures, including alternate routes, needed for resolution of each incident and provide the procedures to those agencies responding to the incident.
- USR 1.7.3.1(b)* Response Implementation shall provide the status of all resources needed for incident resolution to those agencies responding to the incident.
- USR 1.7.3.2* The Response Implementation function shall provide a link between Incident Management and all other user services necessary to implement incident response actions.

USR 1.7.3.3 The Response Implementation function shall provide the capability to disseminate information relating to response status to other agencies and user services.

7.6 Travel Demand Management (US 1.8)

Six- (6) user needs have been categorized under Travel Demand Management. The primary focus of Travel Demand Management is to develop management and control strategies that will promote the creation and implementation of travel demand programs.

7.6.1 Travel Demand Management Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- Implement an ATMS, freeway and expressways.
- Historical data archive system.
- Deploy additional data/information collection devices/systems.

Phase 2 Deployment

- Implement a fully functional AMS, support incident, special event management and smart corridor deployment.
- RWIS, deploy additional sites, implement data control/access, develop winter roadway maintenance program.

Phase 3 Deployment

- Implement a parking management system.

7.6.2 Travel Demand Management User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

USR 1.8.0 ITS shall include a Travel Demand Management (TDM) function. Travel Demand Management will generate and communicate management and control strategies that will support and facilitate the implementation of TDM programs, policies and regulations. It consists of two major functions, which are, (1) Increase Efficiency of Transportation System and (2) Provide Wide Variety of Mobility Options.

USR 1.8.1 TDM shall include a communications function.

USR 1.8.1.4 The communications function shall provide the capability to send information and data as needed to implement management and control strategies that respond to changing environments, conditions, and policy needs to include, but not limited to, the following:

- USR 1.8.1.4(c)* Parking availability.
- USR 1.8.2* TDM shall include a processing function.
- USR 1.8.2.1* The processing function shall provide the capability to generate management and control strategies that facilitate the implementation of policies and regulations designed to address the following:
- USR 1.8.2.1(c)* Parking management and control.
- USR 1.8.2.11* The processing function's dynamically generated management and control strategies for parking management and controls shall be based on factors that include, but are not limited to, the following:
- USR 1.8.2.11(a)* Parking availability.
- USR 1.8.2.11(b)* Usage data.
- USR 1.8.3* TDM shall include a sensors/control function.
- USR 1.8.3.1* The sensors/control function shall provide the capability to gather information needed for the generation of management and control strategies to include, but not be limited to, the following:
- USR 1.8.3.1(a)* Parking availability.
- USR 1.8.3.1(b)* Usage levels.
- USR 1.8.3.1(c)* Vehicle occupancy.

7.7 Highway Rail Intersection (US 1.10)

Four- (4) user needs have been identified that specifically pertains to highway rail intersection requirements. Highway rail intersection functions include traffic control, driver advisory, and collision avoidance. Control room operators utilize field devices at highway-rail intersections to monitor conditions. It could include equipping vehicles with monitoring devices and in-vehicle alert systems.

7.7.1 Highway Rail Intersection Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- Strategic ITS device (CCTV/DMS) deployment, shared use control.
- Deploy additional data/information collection devices/systems.
- Joint use/control of ITS devices.

Phase 2 Deployment

- Notification of train location, crossing gates status, and implement intersection warning systems.

Phase 3 Deployment

- None.

7.7.2 Highway Rail Intersection User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 1.10.0* ITS shall include a Highway-Rail Intersection (HRI) function to control highway and rail traffic in at-grade HRIs. Two sub-services are supported: Standard Speed Rail Subservice which is applicable to light rail transit, commuter rail and heavy rail trains with operational speeds up to 79 miles per hour (MPH); and High Speed Rail Subservice which is applicable to all passenger and freight trains with operational speeds from 80 to 125 MPH.
- USR 1.10.1* The HRI function shall be applicable to operational, at-grade highway-rail intersections with train operational speeds up to 125 MPH.
- USR 1.10.1.3* HRI users shall include freight and intercity passenger trains approaching and crossing HRIs.
- USR 1.10.1.4* HRI users shall include highway vehicles approaching and crossing HRIs.
- USR 1.10.1.5* HRI users shall include motor vehicle operators, bicyclists and pedestrians approaching and crossing HRIs.
- USR 1.10.2* HRI shall provide interfaces between highway and rail management functions.
- USR 1.10.2.1* HRI shall provide information management interfaces between highway and rail to coordinate traffic, demand and schedules.
- USR 1.10.2.1.1* HRI shall be capable of acquiring current train schedules from rail operations functions, and shall determine projected HRI closure times and duration.
- USR 1.10.2.1.2* HRI shall be capable of interacting with traffic management functions.
- USR 1.10.2.2* HRI shall provide the capability for interactive real-time interfaces.
- USR 1.10.2.2.2* HRI shall provide the capability to interface with traffic management functions for highway traffic coordination.

- USR 1.10.2.2.3* HRI shall provide the capability to interface with trains approaching and crossing the HRI for traffic coordination.
- USR 1.10.3* At all HRIs with active railroad warning systems, HRI shall manage the traffic in the intersection.
- USR 1.10.3.3* HRI shall provide an Intelligent Intersection Controller (IIC) function to manage highway and rail traffic in the intersection.
- USR 1.10.3.3.1* IIC shall control active highway traffic signal devices at HRIs to manage highway traffic.
- USR 1.10.3.3.2* IIC function shall control active railway warning devices, including flashing lights and physical barriers for highway and walkway lanes at HRIs.
- USR 1.10.3.3.3* IIC function shall provide an intersection surveillance system to derive the real-time status of traffic in the intersection.
- USR 1.10.3.3.4* IIC function shall report real-time HRI equipment status.
- USR 1.10.3.3.5* IIC function shall report real-time HRI traffic status as advisories or alerts.
- USR 1.10.4* HRI shall include a Standard Speed Rail (SSR) Subservice to manage highway and rail traffic at HRIs for rail lines with operational speeds less than 80 MPH.
- USR 1.10.4.1* SSR shall include active railroad warning systems at designated HRIs.
- USR 1.10.4.2* SSR shall include passive HRIs with non-active warning systems.
- USR 1.10.4.2.1* SSR shall augment passive warning signs with additional highway traffic control devices at passive HRIs.
- USR 1.10.6* At HRIs with active railroad warning systems, HRI shall provide the capability for automatic collision notification to rail operations and traffic management.

7.8 Public Transportation Management (US 2.1)

Two- (2) user needs were classified under Public Transportation Management to enhance the transit operations by providing web-based transit schedules, and automated tracking systems of the transit fleet. Public Transportation Management US supports these needs by establishing functions to provide real-time data exchange between the appropriately equipped transit vehicles and transit operators. This data exchange would provide information regarding the vehicle such as location. This information allows the operator to update transit schedules, suggest alternate routes due to roadway conditions, or initiate signal priority to enhance transit operations.

7.8.1 *Public Transportation Management Prioritized Needs*

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- None.

Phase 2 Deployment

- None.

Phase 3 Deployment

- Implement transit tracking, automatic vehicle identity (AVI) and automatic vehicle location (AVL) (bus stop arrivals).
- Deploy web-based real-time transit schedules/status.

7.8.2 *Public Transportation Management User Service Requirements*

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- | | |
|---------------------------|--|
| <i>USR 2.1.0</i> | ITS shall include a Public Transportation Management (PTM) function. |
| <i>USR 2.1.1</i> | PTM shall include an Operation of Vehicles and Facilities (OVF) function that provides computer assisted control of the operation of vehicles and their associated facilities. |
| <i>USR 2.1.1.1</i> | To enable the automation of the vehicle and facilities operations OVF shall provide the capability to gather the needed data to include, but not be limited to, the following: |
| <i>USR 2.1.1.1(b)</i> | Bus running times between time points. |
| <i>USR 2.1.1.1(f)</i> | Real-time vehicle location reports. |
| <i>USR 2.1.1.2</i> | OVF shall include a Command and Control (CC) capability. |
| <i>USR 2.1.1.2.1</i> | CC shall provide the capability for real-time Vehicle Command and Control (VCC). |
| <i>USR 2.1.1.2.1.4</i> | VCC shall provide the capability to automatically issue corrective instructions to the driver including, but not limited to, the following: |
| <i>USR 2.1.1.2.1.4(a)</i> | Route corrections. |
| <i>USR 2.1.1.2.1.4(b)</i> | Changes in stops. |

- USR 2.1.1.2.3* CC shall include an integrated traffic control capability that provides traffic signal preemption when required for schedule adjustment to Transit Vehicles at traffic signals (i.e., centralized or distributed).
- USR 2.1.2* PTM shall include a Planning and Scheduling Services (PSS) function to automate the planning and scheduling of public transit operations.
- USR 2.1.2.2* The PSS shall include a Schedule Generation capability.
- USR 2.1.2.2.1* The PSS Schedule Generation function shall collect data for schedule generation including, but not limited to, the following:
- USR 2.1.2.2.1(a)* Route segment running time.
- USR 2.1.2.2.4* The PSS Schedule Generation function shall provide the capability to disseminate schedules to, but not be limited to, the following:
- USR 2.1.2.2.4(a)* Kiosks.
- USR 2.1.2.2.4(b)* Transportation Management Centers.
- USR 2.1.2.2.5* The PSS Schedule Generation function shall provide the capability to automatically update the customer service operator system with the most current schedule and schedule adherence information.

7.9 En-Route Transit Information (US 2.2)

Two- (2) user need was classified under En-Route Transit Information to enhance the transit operations by providing transit schedules to commuters. En-Route Transit Information US supports these needs by disseminating real-time transit data to commuters for trip planning purposes.

7.9.1 En-Route Transit Information Prioritized Needs

Below is a summary of the needs categorized by deployment phase:

Phase 1 Deployment

- None.

Phase 2 Deployment

- None.

Phase 3 Deployment

- Implement transit tracking, AVI and AVL.
- Deploy web based real-time transit schedules/status.

7.9.2 *En-Route Transit Information User Service Requirements*

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 2.2.0* ITS shall include an En-Route Transit Information (TI) function. En-Route Transit Information provides travelers with real-time transit and high-occupancy vehicle information allowing travel alternatives to be chosen once the traveler is en-route. It consists of three major functions, which are, (1) Information Distribution, (2) Information Receipt, and (3) Information Processing. This capability integrates information from different transit modes and presents it to travelers for decision making.
- USR 2.2.1* TI shall include an Information Distribution function that disseminates information to travelers.
- USR 2.2.1.1* Information Distribution shall include an Information Network capability.
- USR 2.2.1.1.1* The Information Network shall provide the capability to furnish users with real-time travel related information while they are traveling.
- USR 2.2.1.1.2* The Information Network shall provide the capability to disseminate information to travelers that will assist them in making decisions about transfers.
- USR 2.2.1.1.3* The Information Network shall provide the capability to disseminate information to travelers that will assist them in making decisions in the modification (includes both intermode and intramode) of their trips.
- USR 2.2.1.1.4* The Information Network shall provide all users with information that is from a single source in order to ensure consistency across all users.
- USR 2.2.1.2* Information Distribution shall include a User Interface feature.
- USR 2.2.1.2.1* User Interface shall provide the capability for users to access travel related information at fixed locations.
- USR 2.2.1.2.1.1* Fixed location user interfaces shall be provided at transit stops.
- USR 2.2.1.2.1.1.1* Transit stop user interfaces shall have interactive visual displays.
- USR 2.2.1.2.1.1.2* Transit stop user interfaces shall provide audio messages containing the following:
- USR 2.2.1.2.1.1.2(a)* Notification of imminent transit arrival.
- USR 2.2.1.2.1.1.2(b)* Identification of route of arriving transit vehicles.

- USR 2.2.1.2.1.1.3* Transit stop user interfaces shall provide the capability to provide information to individuals who are physically impaired.
- USR 2.2.1.2.1.2* Fixed location user interface shall provide interactive video (e.g., cable TV) interfaces in kiosks at the following:
- USR 2.2.1.2.1.2(a)* Travel information centers.
- USR 2.2.1.2.1.2(b)* Transfer points.
- USR 2.2.1.2.1.2(c)* Wayside stops.

7.10 Personalized Public Transit (US 2.3)

One- (1) user need was identified by stakeholders that may be classified under Personalized Public Transit. US 2.3 supports this need by outlining requirements to provide real time data exchange between equipped vehicles and transit operators for vehicle location for route determination. These functions would benefit users by providing optimized service for the unique demands of a paratransit service.

7.10.1 Personalized Public Transit Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- None.

Phase 2 Deployment

- None.

Phase 3 Deployment

- Implement a paratransit central system route/scheduler system.

7.10.2 Personalized Public Transit User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 2.3.0* ITS shall include a Personalized Public Transit (PPT) function.
- USR 2.3.1* The PPT shall include a Rider Request function.
- USR 2.3.1.1* Rider Request shall provide the capability for an individual rider to request a trip by specifying the trip origin and destination, time and date.

- USR 2.3.1.2* Rider Request shall provide the capability for an individual to specify a rider's special equipment or handling requirements.
- USR 2.3.1.3* Rider Request shall provide the capability to notify a requester of the fact that a trip assignment has been made including the time at which the vehicle is expected at the point of departure.
- USR 2.3.1.4* Rider Request shall include the capability to notify the requester that the transit vehicle's arrival is imminent.
- USR 2.3.2* The PPT shall include a Vehicle Assignment function.
- USR 2.3.2.1* Vehicle Assignment shall utilize vehicle availability, special requirements and rides requested information to determine vehicle assignments and routing.
- USR 2.3.2.2* For random route operations Vehicle Assignment shall assign trip origin and destination.
- USR 2.3.2.4* For reservation based random-route operations Vehicle Assignment shall provide the capability to plan routes that optimize vehicle schedules while considering passengers' needs.
- USR 2.3.2.5* Vehicle Assignment shall provide the capability to select the best match between riders' needs and the available vehicles.
- USR 2.3.2.6* Vehicle Assignment shall provide services to both publicly owned and privately owned, publicly licensed vehicles.
- USR 2.3.2.9* Vehicle Assignment shall be a real-time system.
- USR 2.3.2.10* Vehicle Assignment shall provide the capability to accommodate immediate trip requests when enough capacity is available for the added rider pickup and delivery.
- USR 2.3.3* The PPT shall include a Data Collection function.
- USR 2.3.3.1* Data Collection shall include on-board sensors to monitor, but not be limited to, the following:
 - USR 2.3.3.1(a)* Vehicle location.
 - USR 2.3.3.1(b)* Passenger loading.
- USR 2.3.3.2* Data Collection shall process and store collected data so that it is available for:
 - USR 2.3.3.2(a)* Real-time schedule adjustments.
 - USR 2.3.3.2(b)* Off-line analysis and planning.

7.11 Commercial Vehicle Electronic Clearance (US 4.1)

Two- (2) needs have been identified to implement an automated truck permitting process and additional WIM locations. The primary function of US 4.1 is communication between inspection stations and appropriately equipped vehicles for determination of vehicle credentials, weight, safety information, etc. This information provides the operator the ability to determine the status of vehicles and the need for inspection. The benefit of a commercial vehicle electronic clearance system is automation of the inspection process.

7.11.1 Commercial Vehicle Electronic Clearance Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- None.

Phase 2 Deployment

- Additional deployment of WIM and fixed location scales.

Phase 3 Deployment

- Implement automated truck permitting process.

7.11.2 Commercial Vehicle Electronic Clearance User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 4.1.0* ITS shall include a Commercial Vehicle Electronic Clearance (CVEC) capability.
- USR 4.1.1* CVEC shall include a Fixed Facility consisting of those structures and equipment to include Ports Of Entry, Inspection Stations, Weigh Stations and Toll Booths.
- USR 4.1.1.2* Fixed Facility shall provide the capability to support the enrollment of vehicles/carriers in the CVEC program.
- USR 4.1.1.3* Fixed Facility shall provide the capability to accommodate both interstate and intrastate vehicles/carriers.
- USR 4.1.1.4* Fixed Facility shall include processing to issue pull-in for safety inspection signals of the following type:
- USR 4.1.1.4(a)* Automatically generated from Pass/Need To Stop tests.
- USR 4.1.1.4(b)* Randomly generated.
- USR 4.1.1.4(c)* Manually generated.

- USR 4.1.1.5* Fixed Facility shall provide the facility operator the capability to manually override the issuance of automatically and randomly generated Pull-In requests.
- USR 4.1.1.6* When making the "Pass/Need To Stop" determination the Fixed Facility shall perform checks on the following:
- USR 4.1.1.6(a)* Vehicle/Carrier Safety Information.
- USR 4.1.1.6(b)* Vehicle Credentials.
- USR 4.1.1.6(d)* Vehicle Weight Information.
- USR 4.1.1.6(e)* Tax Payment Account.

7.12 Commercial Vehicle Administrative Processes (US 4.4)

One- (1) need to automate the truck permitting process has been categorized under US 4.4. US 4.4 support this need by allowing communication between appropriately equipped vehicles and electronic check stations to verify information for automated clearance.

7.12.1 Commercial Vehicle Administrative Processes Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- None.

Phase 2 Deployment

- None.

Phase 3 Deployment

- Implement automated truck permitting process.

7.12.2 Commercial Vehicle Administrative Processes User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 4.4.0* ITS shall include a Commercial Vehicle Administrative Process (CVAP) function consisting of 3 subservices to include Electronic Purchase Of Credentials, Automated Mileage and Fuel Reporting and Auditing, and International Border Electronic Clearance.
- USR 4.4.1* CVAP shall include an Electronic Purchase Of Credentials (EPC) function with capabilities that include but are not limited to the following:
- USR 4.4.1(a)* Annual Electronic Credentials.

USR 4.4.1(b) Temporary Electronic Credentials.

USR 4.4.1(d) Multiple Permits.

USR 4.4.1(e) Specific Situation Permits.

USR 4.4.1(f) Electronic Payment.

USR 4.4.1(g) Automated Processing of Applications.

7.13 Hazardous Material Incident Response (US 4.5)

One-(1) need was identified to implement an HAZMAT tracking system. Based on the stakeholder responses, this need is anticipated to be deployed in later phases to provide additional system functions. The HAZMAT tracking system has been categorized under Hazardous Material Incident Response due to the requirements to provide vehicle tracking and management of the fleet.

7.13.1 Hazardous Material Incident Response Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- None.

Phase 2 Deployment

- None.

Phase 3 Deployment

- HAZMAT tracking systems.

7.13.2 Hazardous Material Incident Response User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

USR 4.5.0 ITS shall include a Hazardous Materials (HAZMAT) Incident Response (HIR) service.

USR 4.5.1 HIR shall include a HAZMAT Incident Notification (HIN) function.

USR 4.5.1.1 HIN shall include the capability to provide enforcement and HAZMAT response teams with timely and accurate information on cargo contents when the vehicle is involved in an incident.

USR 4.5.1.2 HIN shall be capable of providing the following Information :

- USR 4.5.1.2(a)* Time of incident.
- USR 4.5.1.2(b)* Location of the incident.
- USR 4.5.1.2(c)* The material(s) involved.
- USR 4.5.2* HIR shall provide an Operation Focal Point (OFP) for initiating appropriate responses.
- USR 4.5.2.1* OFP shall be capable of being implemented as either a centralized dispatch or several de-centralized dispatch units or vehicles.
- USR 4.5.2.2* OFP shall provide the capability for existing dispatch centers to receive the calls, determine response requirements, and route distress calls to predesignated responding agencies.
- USR 4.5.2.3* OFP shall provide the capability for operators to coordinate with other agencies and response services to include, but not be limited to, the following:
 - USR 4.5.2.3(a)* State and/or local transportation officials.
 - USR 4.5.2.3(b)* Police departments.
 - USR 4.5.2.3(c)* Highway patrol.
 - USR 4.5.2.3(e)* Emergency medical services.
 - USR 4.5.2.3(f)* Environmental protection agencies.
 - USR 4.5.2.3(g)* HAZMAT teams.
- USR 4.5.3* HIR shall include a Communications (COMM) function.
- USR 4.5.3.1* COMM shall provide the capability for distress signals to be sent to a focal point.

7.14 Emergency Vehicle Management (US 5.2)

Four- (4) needs have been identified for Emergency Vehicle Management. Based on the stakeholder responses, these needs are anticipated to be deployed in later phases to provide additional system functions. The needs have been categorized under the Emergency Vehicle Management User Service since it identifies requirements for real-time communication between appropriately equipped vehicles and dispatchers. The real-time data exchange provides fleet management, vehicle identification, and vehicle location.

7.14.1 *Emergency Vehicle Management Prioritized Needs*

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- Pre-emption on emergency vehicles.
- Access to ATIS data/information by public and agencies.
- Format and availability of ATIS data/information to public and agencies.

Phase 2 Deployment

- Deploy AVI and AVL on enforcement/emergency vehicles.
- Coordinated incident response, multi-jurisdictional/agency teams.
- Access to multi-agency GIS base map information.

Phase 3 Deployment

- None.

7.14.2 *Emergency Vehicle Management User Service Requirements*

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

USR 5.2.0 ITS shall include an Emergency Vehicle Management (EVM) Service.

USR 5.2.2 EVM Service shall include a Route Guidance System.

USR 5.2.3 EVM Service shall include a Signal Priority System.

USR 5.2.3.2 Signal Priority System shall determine signal prioritize timing sequences for relevant signals.

7.15 Longitudinal Collision Avoidance (US 6.1)

One- (1) user need has been categorized under the Longitudinal Collision Avoidance US. The Longitudinal Collision Avoidance User Service allows properly equipped vehicles to sense a potential collision and alert the driver. This user service supports the need to deploy snow plow safety systems to detect stalled vehicles during adverse weather conditions. The longitudinal collision avoidance system is primarily in-vehicle communication for driver information.

7.15.1 Longitudinal Collision Avoidance Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- None.

Phase 2 Deployment

- Deploy snow plow safety systems, driver and approaching vehicle.

Phase 3 Deployment

- None.

7.15.2 Longitudinal Collision Avoidance User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

<i>USR 6.1.0</i>	ITS shall include a Longitudinal Collision Avoidance Service.
<i>USR 6.1.1</i>	Longitudinal Collision Avoidance Service shall include a Rear-End Sub-service.
<i>USR 6.1.1.1</i>	Rear-End Sub-service shall include a Headway Maintenance System which assists in maintaining a safe relative longitudinal separation between vehicles.
<i>USR 6.1.1.1.1</i>	Headway Maintenance System shall include a Manual Operations Subsystem.
<i>USR 6.1.1.1.1.1</i>	Manual Operations Subsystem shall determine impending situations that are inconsistent with safe headway.
<i>USR 6.1.1.1.1.2</i>	Manual Operations Subsystem shall alert the vehicle's driver of the need for speed control to maintain a safe headway.
<i>USR 6.1.1.1.2</i>	Headway Maintenance System shall include an Autonomous Intelligence Cruise Control (AICC) Subsystem.

- USR 6.1.1.1.2.1* Autonomous Intelligence Cruise Control Subsystem shall determine actions necessary to maintain the vehicle at a safe distance behind a lead vehicle.
- USR 6.1.1.1.2.2* Autonomous Intelligence Cruise Control Subsystem shall implement necessary vehicle speed control.
- USR 6.1.1.2* Rear-End Sub-service shall include a Driver Action System
- USR 6.1.1.2.1* Driver Action System shall inform the driver of the need for immediate collision avoidance action.
- USR 6.1.3* Longitudinal Collision Avoidance Service shall include a Head-On/Passing Sub-service.
- USR 6.1.3.1* Head-On/Passing Sub-service shall include an Advisory System.
- USR 6.1.3.1.1* Advisory System shall notify the driver of the presence of potentially hazardous situations.

7.16 Archived Data Function (US 7.1)

Archived Data Function focuses on the archival of ITS data and “requires ITS-related systems to have the capability to receive, collect and archive ITS-generated data for historical, secondary, and non-real time users.” Five- (5) needs have been identified and categorized under Archived Data Functions. Needs expressed by Stakeholders aim to improve storage of accidents and infrastructure data. These needs are anticipated for later deployment for enhancement of the statewide system.

7.16.1 Archived Data Function Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- Historical data archive system.
- Deploy additional data/information collection devices/systems.
- Format and availability of ATIS data/information to public and agencies.

Phase 2 Deployment

- Enhance accident records data entry/submittal process, access.
- Implement an infrastructure inventory and status reporting system (i.e., ITS devices).
- Access to multi-agency GIS base map information.
- Develop GIS-based relational databases.

Phase 3 Deployment

- None.

7.16.2 Archived Data Function User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 7.1.0* ITS shall provide an Archived Data Function to control the archiving and distribution of ITS data. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data with five major functions: 1) the Operational Data Control function to manage operations data integrity; 2) the Data Import and Verification function to acquire historical data from the Operational Data Control function; 3) the Automatic Data Historical Archive function for permanently archiving the data; 4) the Data Warehouse Distribution function, which integrates the planning, safety, operations, and research communities into ITS and processes data products for these communities; and 5) the ITS Community Interface which provides the ITS common interface to all ITS users for data products specification and retrieval. ADUS helps achieve the ITS information goal of unambiguous interchange and reuse of data and information throughout all functional areas.
- USR 7.1.1* The Archived Data Function shall provide a Historical Data Archive (HDA) system for ITS data.
- USR 7.1.1.2* HDA shall provide permanent historical data repositories.
- USR 7.1.1.3* HDA repositories shall include meta data and meta-attributes repositories.
- USR 7.1.1.4* HDA shall provide ITS data system security.
- USR 7.1.1.4.1* HDA shall be capable of employing security solutions.
- USR 7.1.1.4.2* HDA shall be capable of preventing data loss.
- USR 7.1.1.4.3* HDA shall be capable of preventing unauthorized access to ITS data repositories
- USR 7.1.1.4.4* HDA shall be capable of providing a secure interface for online support of the ITS user interface.
- USR 7.1.3* The Archived Data Function shall include a Data Import and Verification (DIV) function to acquire historical data from the Operational Data Control function.
- USR 7.1.3.1* DIV shall be capable of importing selected ITS Operational data from the ITS Operational Repositories.
- USR 7.1.3.1.1* DIV shall be capable of importing ITS Freeway Operations data to include:

- USR 7.1.3.1.1(a)* Freeway traffic flow surveillance data.
- USR 7.1.3.1.1(b)* Ramp meter preemptions.
- USR 7.1.3.1.1(c)* Ramp meter operational data.
- USR 7.1.3.1.1(e)* Traffic Management Center generated freeway flow metrics.
- USR 7.1.3.1.3* DIV shall be capable of importing ITS Arterial data to include:
 - USR 7.1.3.1.3(a)* Traffic signal preemptions.
 - USR 7.1.3.1.3(b)* Traffic signal operational data.
 - USR 7.1.3.1.3(d)* Traffic Management Center generated arterial flow metrics.
 - USR 7.1.3.1.3(e)* Arterial traffic flow surveillance data.
- USR 7.1.3.1.5* DIV shall be capable of importing ITS Incident Management data to include:
 - USR 7.1.3.1.5(a)* Incident characteristics.
 - USR 7.1.3.1.5(e)* Construction and work zone identification.
- USR 7.1.3.1.7* DIV shall be capable of importing ITS Environmental data to include:
 - USR 7.1.3.1.7(b)* Weather data.
- USR 7.1.3.1.8* DIV shall be capable of importing ITS Vehicle and Traveler data to include:
 - USR 7.1.3.1.8(a)* Commercial and non-commercial vehicle probe data.
 - USR 7.1.3.1.8(b)* VMS message set data.
- USR 7.1.3.1.9* DIV shall be capable of importing data on ITS Physical Characteristics of Transportation Infrastructure to include:
 - USR 7.1.3.1.9(a)* Roadway network attributes.
 - USR 7.1.3.1.9(b)* Transit network attributes.
 - USR 7.1.3.1.9(c)* Equipment maintenance status
 - USR 7.1.3.1.9(d)* Transportation facilities.
 - USR 7.1.3.1.9(e)* GIS map of network.

- USR 7.1.3.1.9(f)* Infrastructure maintenance data
- USR 7.1.3.2* DIV shall be capable of accepting pre-defined data inputs from transportation or other sources.
- USR 7.1.3.3* DIV shall be capable of applying pre-defined quality control verification on the imported ITS data and annotating results in the appropriate meta files.
- USR 7.1.3.4* DIV shall be capable of formatting the data to conform to the archive schema.
- USR 7.1.3.5* DIV shall be capable of cleansing imported data
- USR 7.1.3.5.1* Cleansing shall include the removal of source privacy attributes.
- USR 7.1.3.5.2* Cleansing shall be capable of assigning unique system-developed anonymous identifiers to data during archiving.
- USR 7.1.3.6* DIV shall be capable of performing pre-defined data mining functions to import data.
- USR 7.1.3.7* DIV shall be capable of performing pre-defined data fusion on imported data near real-time.
- USR 7.1.3.8* DIV shall be capable of assigning meta attributes to ITS operational data if data modification is required during the historical archive process.
- USR 7.1.3.9* DIV shall be capable of notifying source system owners of potential data or equipment errors.
- USR 7.1.4* The Archived Data function shall provide the Automatic Data Historical Archive (ADHA) function for permanently archiving the data.
- USR 7.1.4.1* ADHA shall provide an archive schema for all ITS data entering the archives.
- USR 7.1.4.1.1* The archive schema shall preclude the possibility of identifying or tracking either individual citizens or private firms.
- USR 7.1.4.1.2* ADHA shall strip all identifiers of individual citizens or private firms from all data before archiving.
- USR 7.1.4.1.3* ADHA shall be capable of assigning unique system-developed anonymous identifiers to data during archiving.

- USR 7.1.4.2* ADHA shall manage the ITS historical data archiving processes for all functional areas as follows:
 - USR 7.1.4.2(a)* Format data to archive schema conformance.
 - USR 7.1.4.2(b)* Maintain a centralized meta schema to specify how data is archived.
 - USR 7.1.4.2(c)* Maintain data quality meta attributes.
 - USR 7.1.4.2(d)* Schedule archiving of data.
- USR 7.1.4.3* ADHA shall permanently store historical archives and only provide data replicates to users.
- USR 7.1.5* The Archived Data Function shall provide a Data Warehouse Distribution (DWD) function as the ITS data source to support the ITS community user functions.
 - USR 7.1.5.1* DWD shall be capable of supporting the generation of data products for the following transportation agencies:
 - USR 7.1.5.1(a)* Planning
 - USR 7.1.5.1(b)* Operations
 - USR 7.1.5.1(c)* Safety
 - USR 7.1.5.1(d)* Research
 - USR 7.1.5.3* DWD shall have the single point of administration for the archived data system.
- USR 7.1.6* The Archived Data Function shall provide users with an ITS Community Interface (ICI) including all ITS users for the specification and retrieval of data products.
 - USR 7.1.6.1* ICI shall be the common data interface for all ITS users to access the ITS Data Archives.
 - USR 7.1.6.1.1* ICI shall provide users' systems with the data interface functionality.
 - USR 7.1.6.2* ICI shall manage user access and security across the interface.
 - USR 7.1.6.3* ICI shall provide a user-interface functionality to existing data warehouse data schema for users to define their data products.
 - USR 7.1.6.3.3* The user-interface shall permit the user to view sample data products.
 - USR 7.1.6.4* ICI shall provide the user interface for ITS Transportation Agencies.

- USR 7.1.6.4.1* Transportation agencies shall include the following planning functions:
 - USR 7.1.6.4.1(a)* Metropolitan Planning Organizations (MPO) and State Transportation Planning
 - USR 7.1.6.4.1(c)* Air Quality Analysis
 - USR 7.1.6.4.1(d)* MPO/State Freight and Intermodal Planning
 - USR 7.1.6.4.1(e)* Land Use Regulation and Growth Management
 - USR 7.1.6.4.1(f)* Transportation Administration and Policy Analysis.
 - USR 7.1.6.4.1(g)* Transit Planning
- USR 7.1.6.4.2* Transportation agencies shall include the following ITS Operations functions:
 - USR 7.1.6.4.2(a)* Traffic Management.
 - USR 7.1.6.4.2(b)* Transit Management.
 - USR 7.1.6.4.2(c)* Construction and Maintenance.
 - USR 7.1.6.4.2(d)* The Private Sector.
- USR 7.1.6.4.3* Transportation functions shall include the following safety agencies:
 - USR 7.1.6.4.3(a)* Safety Planning and Administration.
 - USR 7.1.6.4.3(b)* Commercial Vehicle Operations.
 - USR 7.1.6.4.3(c)* Emergency Management.
- USR 7.1.6.4.4* Transportation agencies shall include research agencies.

7.17 Maintenance and Construction Operations (US 8.1)

Sixteen- (16) user needs have been categorized under the Maintenance and Construction Operations US. Maintenance and Construction Operations focuses on providing operational support to monitor, operate, maintain, improve and manage the physical condition of roadways, the associated infrastructure equipment and the required resources. The user service focuses on four major functions: the Maintenance Vehicle Fleet Management function to monitor and track locations and conditions of fleets of maintenance, construction and specialized service vehicles; the Roadway Management function to monitor and forecast conditions and manage treatment of roadways during various travel conditions; the Work Zone Management and Safety function to support effective and efficient roadway operations during work zone activities; and the Roadway Maintenance Conditions and Work Plan Dissemination function to coordinate work plans and to

communicate conditions. This user service will utilize ITS systems and processes to support interchange of information among diverse groups of users, to improve efficiency and effectiveness of operational, maintenance and managerial activities.

7.17.1 Maintenance and Construction Operations Prioritized Needs

Below is a summary of the needs categorized by deployment phase.

Phase 1 Deployment

- Access to ATIS data/information by public and agencies.
- Deploy vehicle speed warning systems.
- Increased portable changeable message sign (CMS) deployment.

Phase 2 Deployment

- Implement an infrastructure inventory and status reporting system (i.e., ITS devices).
- Deploy snow plow safety systems, driver and approaching vehicle.
- Deploy bridge anti-icing system.
- Deploy AVI and AVL on enforcement/emergency vehicles.
- Implement real-time DOC/field condition reporting capability.
- Implement a maintenance and construction smart work zone management program, include contractors.
- RWIS, deploy additional sites, implement data control/access, develop winter roadway maintenance program.
- AVL deployed on maintenance and construction vehicles/equipment.
- Deploy CCTV at RWIS and anti-icing system locations.
- Develop coordinated construction/maintenance traffic management plans including incident management plans, involve all affected parties.
- Implement multi-agency traffic operations plans.

Phase 3 Deployment

- Deploy roadway anti-icing systems.
- Deploy smart snow plow roadway location systems.

7.17.2 Maintenance and Construction Operations User Service Requirements

This section outlines the specific USR that are essential to satisfy the needs identified by Stakeholders.

- USR 8.1.0* ITS shall provide MCO functions to support monitoring, operating, maintaining, improving and managing the physical condition of roadways, the associated infrastructure equipment, and the required resources. MCO shall focus on four major functions: 1) the Maintenance Vehicle Fleet Management function, to monitor and track locations and conditions of fleets of maintenance, construction, and specialized service vehicles; 2) the Roadway Management function, to monitor and forecast conditions and manage treatment of roadways during various travel conditions; 3) the Work Zone Management and Safety function, to support effective and efficient roadway operations during work zone activities; and 4) the Roadway Maintenance Conditions and Work Plan Dissemination function, to coordinate work plans and to communicate conditions. This User Service will utilize ITS systems and processes to support interchange of information among diverse groups of users, to improve efficiency and effectiveness of operational, maintenance, and managerial activities.
- USR 8.1.1* Maintenance and Construction Operations shall provide a Maintenance Vehicle Fleet Management (MVFM) function to schedule and dispatch, monitor and track location, and monitor operational condition and maintenance requirements of public and contracted fleets of maintenance, construction, and specialized service vehicles. This function includes interactions among Traffic Managers, Supervisors, Dispatchers, Field Crews, Construction Crews, Vehicle Maintenance Crews, Equipment Maintenance Crews, Weather Services Organizations, and Information Service Providers.
- USR 8.1.1.1* MVFM shall be capable of monitoring and tracking the locations of public and contracted fleets of maintenance, construction, and specialized service vehicles to provide current location and status information.
- USR 8.1.1.1.1* MVFM shall be capable of monitoring and tracking the locations of fleets of maintenance, construction, and specialized service vehicles, including but not limited to:
- USR 8.1.1.1.1(a)* Roadway maintenance trucks
- USR 8.1.1.1.1(b)* Other motorized roadway maintenance equipment
- USR 8.1.1.1.1(e)* Roadway service patrols
- USR 8.1.1.1.1(f)* Snow plows

<i>USR 8.1.1.1.1(j)</i>	Traffic control vehicles
<i>USR 8.1.1.1.2</i>	MVFM shall be capable of monitoring information regarding fleets of maintenance, construction, and specialized service vehicles, including but not limited to:
<i>USR 8.1.1.1.2(a)</i>	Location
<i>USR 8.1.1.3</i>	MVFM shall be capable of supporting interactive data communications between dispatchers and operators of public and contracted maintenance, construction, and specialized service vehicles.
<i>USR 8.1.1.3.1</i>	MVFM shall be capable of communicating information to vehicle operators, including but not limited to:
<i>USR 8.1.1.3.1(c)</i>	Dispatch instructions
<i>USR 8.1.1.3.1(e)</i>	Environmental information (road and weather conditions)
<i>USR 8.1.1.5</i>	MVFM shall be capable of using on-board vehicle sensors to monitor roadway conditions and vehicle functions, including but not limited to:
<i>USR 8.1.1.5(a)</i>	Environmental conditions
<i>USR 8.1.1.5(b)</i>	Operating status (e.g. materials stored, materials usage, plow blade up/down, etc.)
<i>USR 8.1.1.6</i>	MVFM shall be capable of providing dispatchers and operators of maintenance, construction, and specialized service vehicles with information regarding potential and actual roadway problems.
<i>USR 8.1.1.6.1</i>	MVFM shall provide information to dispatchers and vehicle operators, including but not limited to:
<i>USR 8.1.1.6.1(a)</i>	Congestion
<i>USR 8.1.1.6.1(b)</i>	Incidents
<i>USR 8.1.1.6.1(c)</i>	Roadway restrictions
<i>USR 8.1.1.6.1(d)</i>	Environmental conditions
<i>USR 8.1.1.6.2</i>	MVFM shall be capable of filtering, fusing, processing, and presenting data from multiple weather and environmental sources.

- USR 8.1.1.6.3* MVFM shall be capable of receiving fused weather and roadway information from external sources, including but not limited to:
 - USR 8.1.1.6.3(a)* Surface transportation sources
 - USR 8.1.1.6.3(b)* Weather service organizations
- USR 8.1.1.6.4* MVFM shall be capable of using fused weather and roadway information from external sources to aid in scheduling roadway maintenance and construction activities.
- USR 8.1.1.6.6* MVFM shall support transmission of fleet operations data to other Operations centers.
- USR 8.1.2* Maintenance and Construction Operations shall provide a Roadway Management (RWM) function to monitor traffic, road surface, and environmental conditions and forecast traffic and road surface conditions to support management of routine and hazardous road condition remediation and to communicate changes in conditions. This function includes interactions among Traffic Managers, Supervisors, Dispatchers, Field Crews, Construction Crews, Asset Managers, Planning Agencies, and Weather Services Organizations.
- USR 8.1.2.1* RWM shall support a number of different services, including but not limited to:
 - USR 8.1.2.1(a)* Winter maintenance (plowing, treating, anti-icing, de-icing, etc.)
 - USR 8.1.2.1(c)* Emergency activities (incident response, planning, alternate routing, etc.)
 - USR 8.1.2.1(f)* Other weather related activities (fog dispersion, etc.)
- USR 8.1.2.2* RWM shall support provision of efficient and effective roadway operations during normal and severe weather or adverse travel conditions.
- USR 8.1.2.4* RWM shall determine the need for forecasted and scheduled roadway treatment.
- USR 8.1.2.4.3* RWM shall make use of information on current and forecast weather.
- USR 8.1.2.4.5* RWM shall support short-term weather prediction for winter maintenance.
- USR 8.1.2.9* RWM shall monitor, manage, and control remotely located, automated systems, that affect the roadway surface (e.g. de-icing/anti-icing applications).

- USR 8.1.3* Maintenance and Construction Operations shall provide a Work Zone Management and Safety (WZMS) function, which provides support for the effectiveness, safety, and efficiency of roadway operations during all work zone activities. This function includes interactions among Traffic Managers, Supervisors, Dispatchers, Field Crews, Construction Crews, Public Safety Organizations, Information Service Providers, and Travelers.
- USR 8.1.3.1* WZMS shall monitor, control, and direct activity in the vicinity of work zones.
- USR 8.1.3.1.1* WZMS shall provide information about work zones, including but not limited to:
- USR 8.1.3.1.1(a)* Anticipated delays
 - USR 8.1.3.1.1(b)* Alternate routes
 - USR 8.1.3.1.1(c)* Suggested speed limit
- USR 8.1.3.1.2* WZMS shall provide support for automated speed enforcement around work zones.
- USR 8.1.3.2* WZMS shall support the management of data about work zones.
- USR 8.1.3.2.4* WZMS shall provide information on work zone activities to other agencies, including but not limited to:
- USR 8.1.3.2.4(a)* Other maintenance and construction operations systems
 - USR 8.1.3.2.4(b)* Commercial vehicle fleets
 - USR 8.1.3.2.4(c)* Emergency vehicle fleets
 - USR 8.1.3.2.4(d)* Traveler information systems
 - USR 8.1.3.2.4(e)* Traffic management systems
- USR 8.1.3.3* WZMS shall provide systems that communicate reliable, accurate, and timely traveler information, including but not limited to:
- USR 8.1.3.3(a)* Location, including lane closure information
 - USR 8.1.3.3(b)* Alternate route / detour
 - USR 8.1.3.3(c)* Work zone speed limit
 - USR 8.1.3.3(d)* Delay
- USR 8.1.3.4* WZMS shall support the provision of vehicle intrusion warnings.

- USR 8.1.4* Maintenance and Construction Operations shall provide a Roadway Maintenance Conditions and Work Plan Dissemination (RMCWPD) function to provide Intra- and Inter-agency coordination of work plans. This function includes interactions among Traffic Managers, Supervisors, Planning Agencies, Public Safety Organizations, and Information Service Providers.
- USR 8.1.4.1* RMCWPD shall coordinate information on planned maintenance and construction activities, including work zone information, and unplanned remediation activities, such as inclement weather responses, so that routing, scheduling, and resource allocation can be accomplished.
- USR 8.1.4.2* RMCWP shall support inter-agency coordination of response and scheduling of resources for significant events with broad impact, like natural disasters, major incidents, and large planned or seasonal events.
- USR 8.1.4.3* RMCWPD shall coordinate information with other transportation agencies, including but not limited to:
- USR 8.1.4.3(a)* Public Safety
 - USR 8.1.4.3(b)* Emergency Medical Management
 - USR 8.1.4.3(c)* Transit
 - USR 8.1.4.3(d)* Traffic Management
 - USR 8.1.4.3(e)* Railroads
 - USR 8.1.4.3(f)* Airports
 - USR 8.1.4.3(g)* Information Service Providers

8. DESIGN CONSIDERATIONS

Through separate meetings with the JOC partners, other State Agencies and Stakeholder Workshops, several needs were identified that are not specifically addressed by User Service Requirements. Instead, they can be addressed through project design, specifications and/or through the development of state agency, statewide, regional, or local agreements and/or institutional policies that should be considered during the design process to achieve desired functionality. The following outline provides a summary of the needs that should be addressed during the design stage:

Phase 1 Deployment

- Improve multi-agency wireless communications system.
- Include a NEMA radio communications support room adjacent to the JOC/Emergency Operations Center (EOC), incorporate existing capability (include the FEMA radio system)*.
- Include within the JOC/EOC an NSP dispatch function, state hotline call center and general information center*.
- Incorporate into the JOC/EOC the required agency workstations and audio-visual systems (the JOC operations room will serve both the day-to-day functions and as the statewide EOC)*.
- Include within the JOC the capability to monitor the ARNG statewide armory security system, provide workstations for the Movement Control Officer*.
- Construct on-site JOC agency radio towers, satellite receivers and antennas*.
- Deploy regional center to center communications network consider statewide requirements of each JOC partner, include voice and data capability*.
- Include within the JOC a large conference room for management personnel from State Agency Departments, duplicate the JOC/Emergency Operations Room audio-visual capability*.
- Include the JOC design areas for staff and operational equipment that meet the functional requirements for NEMA, NDOR, and NSP – Headquarters Troop Area Traffic Services Division and Communications Center that will be located on-site*.
- Provide for public and media access to the JOC*.
- Enhance NDOR internal, voice/data, communication capabilities.
- Incorporate ITS design into all construction projects.
- Develop ITS deployment standard design and specifications.

Phase 2 Deployment

- Deploy redundant communication interconnects, central system hardware and software for disaster recovery purposes*.
- Develop alternative freeway emergency response access points/plans.

Phase 3 Deployment

- Emergency response in-vehicle voice/data communications technology, Mobile Data Terminals.
- Implement LifeLink Systems.
- First responder remote transmission of video images.
- Incorporate ITS into bikeway system.

*Needs identified by the JOC partners.

9. SUMMARY

This User Requirements Document outlines stakeholder needs, the corresponding US bundle, and the National ITS Architecture defined USR. Due to the broad nature of the defined needs, several US categories and requirements may have been identified as being required to satisfy a particular need. In addition, this document outlines only those National ITS Architecture defined USR needed to support Nebraska's needs.

User service bundles and user service requirements have been included in this report in support of all operations center needs defined by Nebraska stakeholders; however, in order to satisfy many of the needs identified, ITS system elements will have to be deployed at the local or district/DOC level prior to (or at least in conjunction with) their being deployed at the JOC level. The Functional Requirements document will separate the user service requirements that are appropriate for implementation at the local, district, or state level. The user requirements that are anticipated for the JOC partner and NDOR DOC functions will be the primary focus of the Functional Requirements document and specific process specifications will be identified. The functions anticipated to be the primary responsibility of local operations centers will be outlined for informational purposes and recommended for implementation to support statewide JOC operations.



ATTACHMENT A – USER NEED PRIORITIZATION SPREADSHEETS

Need	# of Stakeholders Responded	Districts that Responded	# of Districts Responded	Ranking	Numerical Phasing	Final Phasing
Centralized ATIS data/information collection, fusion and dissemination, accessible through a common protocol, e.g. XML	55	1,2,3,4,5,6,7,8	8	55	1	1
Implement real-time DOC/field condition reporting capability	51	2,3,4,5,6,7,8	7	44.625	1	2, 3
Timely/reliable statewide ATIS dissemination including HAR at strategic locations	56	1,4,5,6,7,8	6	42	1	1
Enhance NDOR internal, voice/data, communication capabilities	53	1,3,4,5,6,7	6	39.75	1	1
Implement a maintenance/construction smart work zone management program, include contractors	50	1,3,4,5,7,8	6	37.5	1	2
RWIS, deploy additional sites, implement data control/access, develop winter roadway maintenance program	42	1,2,3,5,6,8	6	31.5	1	2, 3
Improve multi-agency wireless communications system	40	1, 3, 4, 5, 7	5	25	1	2, 3
Statewide coverage of a fully functional 511 system, access to yellow pages, tourist attractions/information, emergency services	39	3,4,5,6,8	5	24.375	1	1
Strategic ITS device (CCTV/DMS) deployment, shared use control	44	1,4,5,6	4	22	1	A
Access to adjacent region/states data/information	30	1,2,3,5,7	5	18.75	1	1
Automated ramp closure system with status verification	27	2,4,5,6	4	13.5	1	2, 3
Deploy regional center to center communications network	26	1,3,6,7	4	13	1	1
Local Emergency Operations Plan web accessible	24	5,6,7	3	9	2	2
AVL deployed on maintenance/construction vehicles/equipment	23	2,5,6	3	8.625	2	2, 3
Deploy CCTV at RWIS and anti-icing system locations	21	4,5,6	3	7.875	2	2, 3
Enhance accident records data entry/submittal process, access	16	1,4,5	3	6	2	2
Joint use/control of ITS devices	23	1,2	2	5.75	2	1
Deploy AVI and AVL on enforcement/emergency vehicles	23	4, 5	2	5.75	2	2
Deploy snow plow safety systems, driver and approaching vehicle	20	4,5	2	5	2	2, 3
Deploy additional data/information collection devices/systems	20	1,2	2	5	2	A
Notification of train location, crossing gates status, implement intersection warning systems	13	1,3,6	3	4.875	2	2, 3

Need	# of Stakeholders Responded	Districts that Responded	# of Districts Responded	Ranking	Numerical Phasing	Final Phasing
Deploy bridge anti-icing system	13	1,3,5	3	4.875	2	2, 3
Implement a fully functional AMS, support incident, special event management and smart corridor deployment	19	1,2	2	4.75	2	2, 3
Deploy CCTV at DMS locations	17	5,6	2	4.25	2	2
Implement a ATMS, freeway and expressways	16	1,2	2	4	2	1, 2, 3
Implement an infrastructure inventory and status reporting system (i.e. ITS Devices)	16	6,7	2	4	2	2
Establish/maintain a state/local agency contact list	10	1, 3, 5	3	3.75	3	2
Incorporate ITS design into all construction projects	14	2,6	2	3.5	3	1
Access to ATIS data/information by public and agencies	12	1, 5	2	3	3	1
Develop coordinated construction/maintenance traffic management plans including incident management plans, involve all effected parties	11	1,3	2	2.75	3	2
Coordinated incident response, multi-jurisdictional/agency teams	10	1, 8	2	2.5	3	2
First responder remote transmission of video images	7	6, 7	2	1.75	3	3
Implement arterial en-route traveler information system	13	2	1	1.625	3	3
Emergency response in-vehicle voice/data communications technology, Mobile Data Terminals	13	5	1	1.625	3	3
Deploy road closure systems on state routes	12	6	1	1.5	3	3
Deploy roadway anti-icing systems	12	5	1	1.5	3	3
Implement an ATIS fully supported by the FMS	11	2	1	1.375	3	1, 2, 3
HAZMAT tracking systems	11	6	1	1.375	3	3
Increased portable CMS deployment	11	5	1	1.375	3	A
Implement multi-agency traffic operations plans	10	1	1	1.25	3	2
Implement a parking management system	9	2	1	1.125	3	3
Implement automated truck permitting process	9	4	1	1.125	3	3
Develop alt. freeway emergency response access points/plans	9	2	1	1.125	3	2, 3

Need	# of Stakeholders Responded	Districts that Responded	# of Districts Responded	Ranking	Numerical Phasing	Final Phasing
Deploy smart snow plow roadway location systems	9	5	1	1.125	3	3
Access to multi-agency GIS base map information	8	2	1	1	3	2
Develop ITS deployment standard design and specifications	7	2	1	0.875	3	1
Implement transit tracking, AVI and AVL (bus stop arrivals)	3	1, 2	2	0.75	3	3
Ability to control traffic signals on site	5	2	1	0.625	3	3
Deploy rest area closure system	5	5	1	0.625	3	3
Deploy vehicle speed warning systems	5	6	1	0.625	3	A
Historical data archive system	5	6	1	0.625	3	1
Develop GIS based relational data bases	4	2	1	0.5	3	2
Incorporate ITS into bikeway system	3	1	1	0.375	3	3
Additional deployment of WIM and fixed location scales	3	5	1	0.375	3	2
Implement Lifelink systems	2	7	1	0.25	3	3
Improve dissemination during National Emergencies	2	1	1	0.25	3	3
Include tourist information at rest areas	2	4	1	0.25	3	2
Format and availability of ATIS data/information to public and agencies	2	1	1	0.25	3	1
Deploy web based real-time transit schedules/status	1	2	1	0.125	3	3
Implement a paratransit central system route/scheduler system	1	2	1	0.125	3	3
Mobile/portable RWIS system, emergency condition reporting	1	5	1	0.125	3	2
Pre-emption on emergency vehicles	1	7	1	0.125	3	1, 2, 3