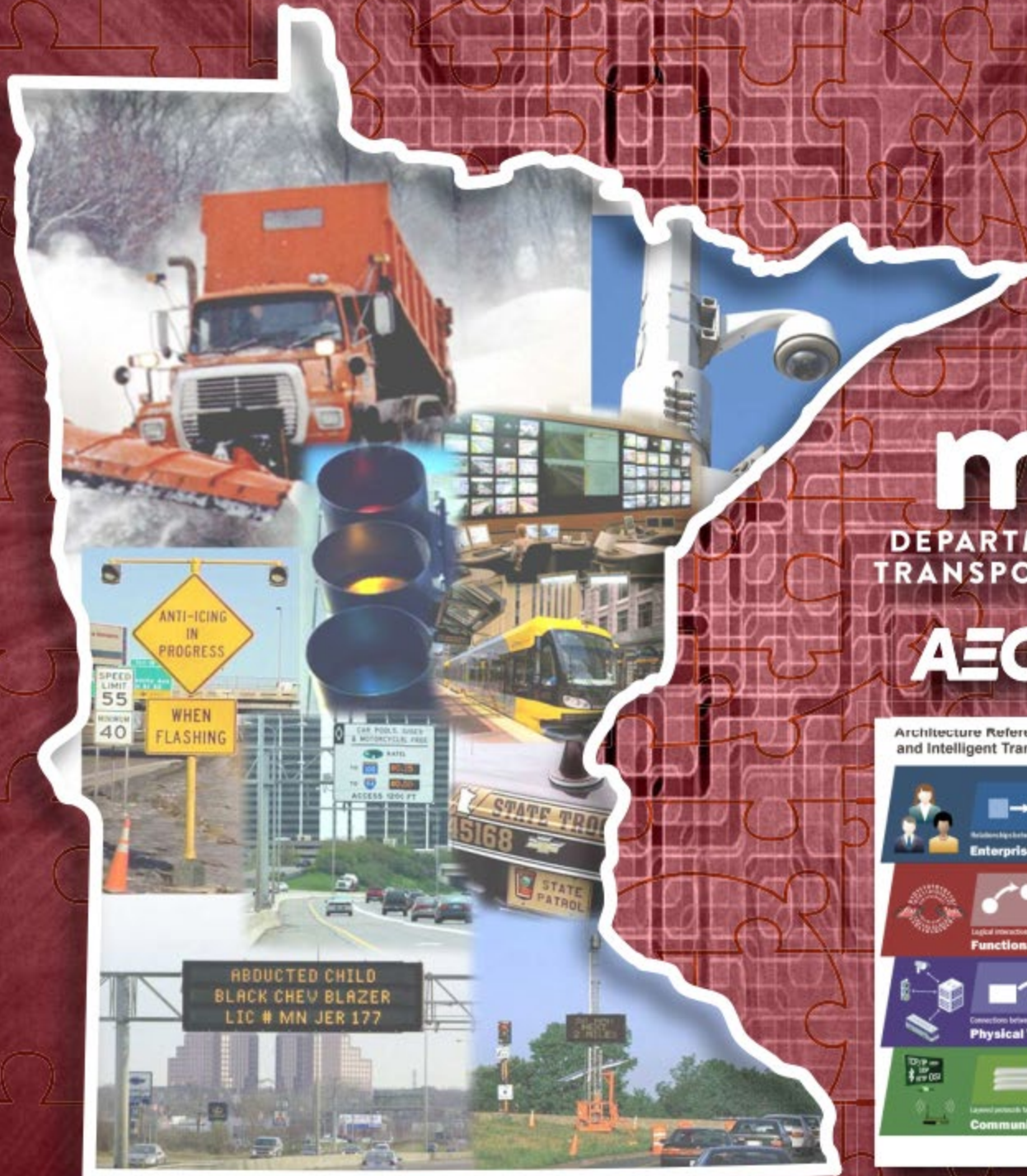


# Minnesota Statewide Regional ITS Architecture

Version 2018

Volume 2:  
Traveler Information Service Package Area

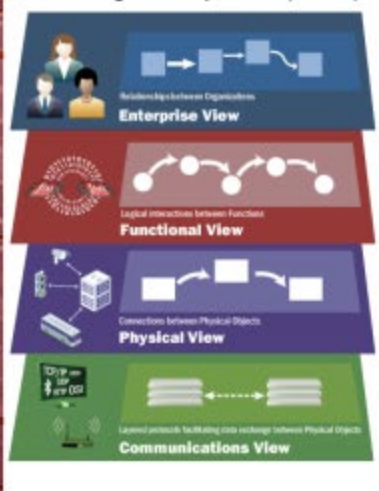


**mn**

DEPARTMENT OF  
TRANSPORTATION

**AECOM**

Architecture Reference for Cooperative  
and Intelligent Transportation (ARC-IT)



**Minnesota Statewide Regional ITS Architecture  
Version 2018**

**Volume 2: Traveler Information Service Package Area**



Prepared by

**AECOM**

December 2018

# TABLE OF CONTENTS

<b>1. Introduction</b> .....	<b>1</b>
1.1 Statewide Regional ITS Architecture Update .....	1
1.2 Volume 2 – Traveler Information Service Package Area .....	2
<b>2. Identification of Existing Traveler Information Systems</b> .....	<b>3</b>
<b>3. Development Objectives</b> .....	<b>4</b>
<b>4. Needs and Services</b> .....	<b>10</b>
<b>5. Detail of TI Needs and Services</b> .....	<b>13</b>
<b>6. TI Research and Development Needs</b> .....	<b>14</b>
<b>Appendix A: Existing/Planned TI Elements</b> .....	<b>15</b>
<b>Appendix B: Minnesota ITS Development Objectives</b> .....	<b>18</b>
<b>Appendix C: Needs and Services Detail</b> .....	<b>29</b>
<b>Appendix D: Traveler Information Service Packages and Descriptions</b> .....	<b>54</b>

## ACRONYMS

AMBER	America's Missing: Broadcast Emergency Response
APRS	Automated Permit Routing System
ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
ATIS	Advanced Traveler Information System
CAD	Computer Aided Dispatch
CARS	Condition Acquisition and Reporting System
CVO	Commercial Vehicle Operations
DM	Data Management
DMS	Dynamic Message Sign
DOT	Department of Transportation
DTN	Data Transmission Network
EOC	Emergency Operations Center
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GPS	Global Positioning System
HOV	High-Occupancy Vehicle
ICS	Incident Command Structure
IRIS	Intelligent Roadway Information System
ISP	Information Service Provider
ITS	Intelligent Transportation Systems
LOS	Level of Service
MC	Maintenance and Construction
MnDOT	Minnesota Department of Transportation
MSP	Minnesota State Patrol
NIMS	National Incident Management System
NOAA	National Oceanic and Atmospheric Administration
PM	Parking Management
PS	Public Safety
PT	Public Transportation
RAD-IT	Regional Architecture Development for Intelligent Transportation
RASAWI	Rest Area Sponsorship, Advertising, and Wireless Internet
RDS	Radio Data Service
RTMC	Regional Transportation Management Center
RWIS	Road Weather Information System
SPaT	Signal Phase and Timing
ST	Sustainable Travel
SU	Support
TI	Traveler Information
TM	Traffic Management
TMC	Transportation/Traffic Management Center
VMT	Vehicle-Miles Traveled
VS	Vehicle Safety
WX	Weather

# 1. Introduction

## 1.1 Statewide Regional ITS Architecture Update

The Minnesota Statewide Regional Intelligent Transportation Systems (ITS) Architecture Version 2018 is an update of the previous version that was developed in 2014. It conforms with the National ITS Architecture (the Architecture Reference for Cooperative and Intelligent Transportation, or ARC-IT, Version 8.2) and the Federal Highway Administration (FHWA) Final Rule 940 and Federal Transit Administration (FTA) Final Policy on ITS Architecture and Standards. The Final Rule and the Final Policy ensure that ITS projects carried out using funds from the Highway Trust Fund including the Mass Transit Account conform to the National ITS Architecture and applicable ITS standards.

The Minnesota Statewide Regional ITS Architecture represents a shared vision of how each agency's systems work together by sharing information and resources to enhance transportation safety, efficiency, capacity, mobility and security. The information exchange among the many transportation stakeholders helps illustrate various integration options, gain consensus on cost-effective ITS technologies and systems to be considered prior to investing in design, development and deployment of ITS.

The Minnesota Statewide Regional ITS Architecture is a living document and will evolve as needs, technology, stakeholders and funding change. ARC-IT is a resource to the Minnesota Statewide Regional Architecture providing framework for planning, defining and integrating ITS.

The Minnesota Statewide Regional ITS Architecture promotes deployment and integration of ITS systems and services that are compatible and interoperable with other ITS systems and services across jurisdictional boundaries. It facilitates coordination, cooperation, and information and resource sharing among State and local agencies. It guides systematic deployment and integration of regional ITS to improve the safety, efficiency, dependability, and cost effectiveness of the transportation system in Minnesota.

The Minnesota Statewide Regional ITS Architecture is organized as follows:

- **Overview:** The Overview document identifies the purpose/need, a general description of the region, development objectives, and performance measures for the Minnesota Statewide Regional ITS Architecture.
- **Implementation Volume – ITS Initiatives and Project Concepts for Implementation:** This volume serves as long-range guidance to systematically and cost-effectively implement the ITS initiatives and project concepts for the next 15 to 20 years in Minnesota based on funding availability. It lists specific ITS needs that are further prioritized into ITS initiatives and project concepts. It also provides the corresponding details for each initiative or project concept which include project concept descriptions, agency involved, champion, implementation timeframe, technology readiness, dependencies, benefits, service packages, estimated costs, and agreements needed.
- **Volumes 1 thru 12 – Development and Documentation of Service Package Areas:** Each volume is specific to the corresponding Service Package Area and includes: a description of the Service Package Area, ITS development objectives, a summary of

needs and services, and a detailed description of needs and services (consisting of the operational concept, inventory, specific service packages to address needs and services, interconnects and architecture flows, and research and development needs).

- **Volume 13 – RAD-IT Outputs of the Regional ITS Architecture:** Volume 13 consists of a report generated by the Regional Architecture Development for Intelligent Transportation (RAD-IT) software, formerly known as Turbo Architecture, for the Minnesota Statewide Regional ITS Architecture.

The purpose for developing Volumes 1 through 12 was to identify and prioritize stakeholder needs; gather information on existing infrastructure, components and technology; and define stakeholder roles and responsibilities in planning, deploying, operating and maintaining existing and future ITS systems.

Data collection activities were conducted early in the study process and focused on two primary tasks:

1. The assemblage of an inventory of existing and planned transportation infrastructure and, facilities and services.
2. The assessment of statewide needs and opportunities for further deployment of ITS.

Previously published transportation plans were the main source of data about characteristics of the existing transportation system, planned improvements, transportation system needs and goals. Strategic and long-range planning studies, ITS deployment and safety plans, transit studies and transportation planning and policy documents were reviewed.

## **1.2 Volume 2 – Traveler Information Service Package Area**

Traveler Information (TI) Service Package Area seeks to provide accurate and timely information to travelers, when and where they need it. TI systems are nearly universally assembled to provide travelers easy access to information that may affect the quality, duration or safety of their trip.

- *Roadside Systems:* Radio-based systems (these can be voice highway advisory type or Radio Data Service (RDS) FM sideband) data type
- *Vehicle/Personal Systems:* In-vehicle systems (OnStar type), mobile devices, navigational systems
- *Center Systems:* Telephone-based information systems (511 call supported by CARS: weather, trip times, incidents, construction, detours), Web-based systems, Dedicated television channels, E-mail based update systems

Development of Volume 2 - TI Service Package Area entailed the Project Consultant to work closely with MnDOT and stakeholders to identify and prioritize stakeholder needs; gather information on existing and future ITS infrastructure, components and technology; and define the stakeholders' roles and responsibilities in planning, deploying, operating and maintaining existing and future ITS systems.

Volume 2 summarizes the findings of data collection and analysis activities conducted to support development of the TI Service Package Area. Volume 2 is organized with the following sections:

- **Section 1: Introduction** provides a brief project overview and the purpose of this volume.
- **Section 2: Identification of Existing Traveler Information Systems** provides a brief overview of statewide TI system deployments with a detailed listing of existing/planned systems in *Appendix A*.
- **Section 3: Development Objectives** provides an overview of the Minnesota ITS Development Objectives specific to TI. This section summarizes the results of a TI stakeholder workshop conducted in 2017 to obtain feedback on the Minnesota ITS Deployment Objectives. These objectives are used to identify needs and gaps, which will then be used to identify services to address those needs.
- **Section 4: Identification of Needs and Services.** Based on the ITS Development Objectives, needs were identified and prioritized by the stakeholders. Services were identified to address those prioritized needs.
- **Section 5: Detail of TI Needs and Services** describes, for each identified Need/Service, the following information:
  - **Operational Concept** - who is currently using the service and how they are using it. Users include both managers of a system and other users, like the traveling public, who use an end service.
  - **Existing Capabilities** - what systems are currently in place that are used to provide this service and who operates these services.
  - **Gaps and Planned Enhancements** - enhancements that can be made to better provide the service and address needs, who will use these enhancements, and what they will be used for. These enhancements can include expanding systems to geographic areas that currently do not have access to the service, enhancing an existing service to provide greater functionality or use by more groups, or implementing a new system to address a gap.
  - **Roles and Responsibilities** - what roles stakeholders need to fulfill to make the service operate successfully throughout a system's lifecycle (planning, design, implementation, operations, and maintenance).
  - **Interconnects** - the communications linkages between subsystems or stakeholders to provide the service.
  - **Data Archive Needs** - what data is generated for the service that should be archived, who is responsible for archiving, and any special needs or requirements for such archiving.
  - **Associated Service Packages** - other Service Packages that the service falls under. This includes both Service Packages within the TI Service Package Area and those in other Service Package Areas.
- **Section 6: TI Research and Development Needs** describes general research that can be performed to help implement the identified services.

## 2. Identification of Existing Traveler Information Systems

Many TI systems are already in place in Minnesota. Traveler information such as travel times, current speeds, locations of incidents, construction, and congestion, and weather conditions can be obtained by a traveler either by pre-trip or en-route via the internet, telephone, kiosks, TV/radio, and/or in-vehicle devices. Examples are the 511 Telephone Information System and 511 Traveler Information Website. This information helps travelers either plan their routes in advance, or possibly change routes during a trip, based on the shortest travel times. Traveler

information can also help to improve safety. This system features an alert system that enables it to broadcast AMBER Alerts and Homeland Security/Emergency Management Alerts as needed. At incident locations and construction zones, alerted drivers may slow down or detour away from the location. At intersections and railroad crossings, in-vehicle or roadside equipment may warn drivers of dangerous situations.

An inventory of existing and planned TI (e.g. centers, devices and infrastructure) in Minnesota is described in *Appendix A*. This inventory summarizes a list of existing and programmed ITS systems in the state, their general description, associated stakeholders that are involved with their operations and management, and their current deployment. The systems described in *Appendix A* are Minnesota-specific implementations of subsystems from ARC-IT.

### 3. Development Objectives

Transportation needs identify the transportation problems that can be solved by ITS services. They also represent a link to transportation planning efforts that define the strategies and solutions to address various challenges. These strategies involve capital improvements as well as operational improvements. TI ITS solutions involve services that improve the effectiveness and safety of maintenance and construction operations.

TI seeks to provide accurate and timely information to travelers, when and where they need it. TI are nearly universally assembled to provide travelers easy access to information that may affect the quality, duration or safety of their trip. Major types of TI are roadside, vehicle/personal, and center systems. The goal of TI is to provide travelers in Minnesota with accurate and timely advanced traveler information they need to have a safe, efficient and reliable trip. The Minnesota ITS Development Objectives in Table 1, specific to TI, are steps to determine and/or measure whether or not TI goals are being achieved. A complete list of Minnesota ITS Development Objectives is included in *Appendix B*.

**Table 1. TI Specific Minnesota ITS Development Objectives**

#### **A. Improve the Safety of the State's Transportation System**

##### A-1 Reduce crash frequency

- A-1-01 Reduce number of vehicle crashes
- A-1-02 Reduce number of vehicle crashes per VMT
- A-1-03 Reduce number of crashes due to road weather conditions
- A-1-04 Reduce number of crashes due to unexpected congestion
- A-1-17 Reduce number of crashes due to roadway/geometric restrictions
- A-1-19 Reduce number of all secondary crashes

##### A-2 Reduce fatalities and life changing injuries

- A-2-01 Reduce number of roadway fatalities
- A-2-02 Reduce number of roadway fatalities per VMT
- A-2-03 Reduce number of fatalities due to road weather conditions
- A-2-04 Reduce number of fatalities due to unexpected congestion
- A-2-18 Reduce number of fatalities due to roadway/geometric restrictions
- A-2-22 Reduce number of roadway injuries
- A-2-23 Reduce number of roadway injuries per VMT
- A-2-24 Reduce number of injuries due to road weather conditions



- A-2-25 Reduce number of injuries due to unexpected congestion
- A-2-39 Reduce number of injuries due to roadway/geometric restrictions

A-3 Reduce crashes in work zones

- A-3-01 Reduce number of crashes in work zones
- A-3-02 Reduce number of fatalities in work zones
- A-3-03 Reduce number of motorist injuries in work zones
- A-3-04 Reduce number of workers injured by vehicles in work zones

**B. Increase Operational Efficiency and Reliability of the Transportation System**

B-1 Reduce overall delay associated with congestion

- B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
- B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- B-1-03 Reduce the share of major intersections operating at LOS F
- B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)
- B-1-05 Reduce the daily hours of recurring congestion on major freeways
- B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion
- B-1-07 Reduce the regional average travel time index
- B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- B-1-09 Improve average travel time during peak periods
- B-1-10 Reduce hours of delay per capita
- B-1-11 Reduce hours of delay per driver
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods

B-3 Reduce delays due to work zones

- B-3-01 Reduce total vehicle hours of delay by time period (peak, off-peak) caused by work zones
- B-3-02 Reduce the percentage of vehicles traveling through work zones that are queued
- B-3-03 Reduce the average and maximum length of queues, when present,
- B-3-04 Reduce the average time duration (in minutes) of queue length greater than some threshold (e.g., 0.5 mile)
- B-3-05 Reduce the variability of travel time in work zones during peak and off-peak periods

B-4 Reduce traffic delays during evacuation from homeland security and Hazmat incidents

- B-4-01 Reduce vehicle hours of delay per capita during evacuation from homeland security and Hazmat incidents

**C. Enhance Mobility, Convenience, and Comfort for Transportation System Users**

C-1 Reduce congestion and incident-related delay for travelers

- B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
- B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- B-1-03 Reduce the share of major intersections operating at LOS F
- B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)
- B-1-05 Reduce the daily hours of recurring congestion on major freeways
- B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion
- B-1-07 Reduce the regional average travel time index
- B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- B-1-09 Improve average travel time during peak periods
- B-1-10 Reduce hours of delay per capita
- B-1-11 Reduce hours of delay per driver
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- C-1-01 Reduce the vehicle hours of total delay associated with traffic incidents during peak and off-peak periods
- C-1-02 Increase percentage of incident management agencies in the region that participate in a multi-modal information exchange network
- C-1-03 Increase percentage of incident management agencies in the region that use interoperable voice communications
- C-1-04 Increase percentage of incident management agencies in the region that participate in a regional coordinated incident response team
- C-1-05 Increase the number of corridors in the region covered by regional coordinated incident response teams
- C-1-06 Maintain a percentage of transportation operating agencies have a plan in place for a representative to be at the local or State Emergency Operations Center (EOC) to coordinate strategic activities and response planning for transportation during emergencies
- C-1-07 Conduct joint training exercises among operators and emergency responders in the region
- C-1-08 Maintain a percentage of staff in region with incident management responsibilities who have completed the National Incident Management System (NIMS) Training and a percentage of transportation responders in the region are familiar with the incident command structure (ICS)
- C-1-09 Increase number of regional road miles covered by ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) in use for incident detection/response

C-2 Improve travel time reliability

- B-1-07 Reduce the regional average travel time index
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods

- C-2-01 Decrease the average buffer index for multiple routes or trips
- C-2-02 Reduce the average planning time index for specific routes in region

C-3 Increase choice of travel modes

- B-2-11 Reduce per capita single occupancy vehicle commute trip rate
- B-2-12 Increase the percentage of major employers actively participating in transportation demand management programs
- B-2-13 Reduce commuter vehicle miles traveled (VMT) per regional job
- B-2-14 Create a transportation access guide, which provides concise directions to reach destinations by alternative modes (transit, walking, bike, etc.)
- C-3-01 Increase active (bicycle/pedestrian) mode share
- C-3-02 Reduce single occupancy vehicle trips through travel demand management strategies (e.g., employer or residential rideshare)
- C-3-09 Increase the percent of the transportation system in which travel conditions can be detected remotely via video monitoring cameras, speed detectors, etc.
- C-3-10 Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region
- C-3-11 Increase number of 511 calls per year
- C-3-12 Increase number of visitors to traveler information website per year
- C-3-13 Increase number of users of notifications for traveler information (e.g., e-mail, text message)
- C-3-14 Increase the number of transit routes with information being provided by ATIS
- C-3-15 Increase the number of specifically tailored traveler information messages provided

C-4 Reduce stress caused by transportation

- A-2-44 Reduce number of traffic law violations
- B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
- B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- B-1-03 Reduce the share of major intersections operating at LOS F
- B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)
- B-1-05 Reduce the daily hours of recurring congestion on major freeways
- B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion
- B-1-07 Reduce the regional average travel time index
- B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- B-1-09 Improve average travel time during peak periods
- B-1-10 Reduce hours of delay per capita
- B-1-11 Reduce hours of delay per driver
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- C-3-11 Increase number of 511 calls per year
- C-3-12 Increase number of visitors to traveler information website per year

- C-3-13 Increase number of users of notifications for traveler information (e.g., e-mail, text message)
- C-3-14 Increase the number of transit routes with information being provided by ATIS
- C-3-15 Increase the number of specifically tailored traveler information messages provided
- C-4-02 Increase the number of users aware of park-and-ride lots in their region
- C-4-05 Increase the number of parking facilities with advanced parking information to customers
- C-4-07 Increase the number of parking facilities with coordinated availability information

#### **D. Improve the Security of the Transportation System**

##### D-2 Safeguard the motoring public from homeland security and/or Hazmat incidents

- C-3-09 Increase the percent of the transportation system in which travel conditions can be detected remotely via video monitoring cameras, speed detectors, etc.
- D-2-03 Increase the number of travelers routed around Hazmat incidents
- D-2-04 Increase the number of travelers routed around homeland security incidents

#### **E. Support Regional Economic Productivity and Development**

##### E-1 Reduce travel time for freight, transit and businesses

- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- E-1-03 Decrease the annual average travel time index for selected freight-significant highways
- E-1-04 Decrease point-to-point travel times on selected freight-significant highways
- E-1-05 Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways

##### E-2 Improve the efficiency of freight movement, permitting and credentials process

- E-2-06 Reduce the frequency of delays per month at intermodal facilities
- E-2-07 Reduce the average duration of delays per month at intermodal facilities

##### E-6 Enhance efficiency at borders

- E-3-11 Reduce average crossing times at international borders

#### **G. Enhance the Integration and Connectivity of the Transportation System**

##### G-1 Aid in transportation infrastructure and operations planning

- G-1-01 Increase the amount of data gathered from ITS enhancements used in infrastructure and operations planning
- G-1-02 Increase the number of planning activities using data from ITS systems
- G-1-03 Increase the number of years of data in database that is easily searchable and extractable

#### **H. Reduce Environmental Impacts**

##### H-1 Reduce emissions/energy impacts and use associated with congestion

- B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
- B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- B-1-03 Reduce the share of major intersections operating at LOS F

- B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)
- B-1-05 Reduce the daily hours of recurring congestion on major freeways
- B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion
- B-1-07 Reduce the regional average travel time index
- B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- B-1-09 Improve average travel time during peak periods
- B-1-10 Reduce hours of delay per capita
- B-1-11 Reduce hours of delay per driver
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- H-1-01 Reduce excess fuel consumed due to congestion
- H-1-02 Reduce total fuel consumed per capita for transportation
- H-1-03 Reduce vehicle miles traveled per capita
- H-1-04 Reduce MnDOT fleet gasoline use
- H-1-05 Reduce MnDOT fleet diesel use
- H-1-06 Reduce the amount of all emissions in the atmosphere
- H-1-07 Reduce the amount of carbon dioxide emissions measured

## 4. Needs and Services

Stakeholder outreach has been a key component for updating the Minnesota Statewide Regional ITS Architecture. A stakeholder survey was conducted in early 2017 to capture the following changes since the last update of the Architecture in 2014:

- Additional ITS needs and services have been identified and added
- New technologies have come on-line
- New technologies have replaced out-of-date technology.

The survey asked each survey participant to review and provide priority ranking to each of the ITS functional/informational needs as well as research and technology development needs that were identified previously in the 2009 Minnesota Statewide Regional ITS Architecture. Survey participants were also asked to identify additional needs and provide information on the status of current projects/initiatives and plans for future projects/initiatives.

Between July 2017 and April 2018, a series of stakeholder workshops were conducted. The purpose of those workshops was to obtain feedback on the Minnesota ITS Goals and Objectives, discuss the results of the stakeholder survey, and gather additional feedback on needs and priority rankings. Stakeholders reviewed the ITS functional/informational needs as well as discussed the research and technology development needs. Subsequently, the highest priority needs that would benefit the traveling public were identified.

Table 2 displays the Specific Functional/Informational Needs/Services as potential solutions and enhancements. Priority is indicated in the Priority Points column, with each point representing one vote from responders through the stakeholder survey. The ITS Development Objectives and ITS Architecture Service Packages corresponding with the potential solutions are also listed in Table 2. The potential solutions and enhancements identified in Table 2 will provide the required service(s) to fill the gaps summarized in *Appendix C*. This appendix will take the TI Needs and associated TI Solutions and define what and how the system will be used, who will use it and who is responsible for planning, design, implementation, operation and maintenance of the system.

**Table 2. TI Needs and Potential Solutions**

**Notes:**

<sup>a</sup> Priority point scoring system: 0 point for “no need”; 1 point for “low”; 2 points for “low to moderate”; 3 points for “moderate”; 4 points for “moderate to high”; and 5 points for “high”.

<sup>b</sup> Discussions on needs/solutions fall under other service package areas can be found in corresponding Service Package Area documents.

<sup>c</sup> Priority point is calculated based on limited votes (3 or less).

<b>ID</b>	<b>Need/Potential Solution</b>	<b>Priority Point<sup>a</sup></b>	<b>ITS Development Objective</b>	<b>ARC-IT Reference<sup>b</sup></b>
ATIS01	Provide incident information on freeways and major arterials	4.71	A-1-01, A-1-02, A-1-19, C-1-01, C-3-15	TI01, TI02, TM06
ATIS02	Provide traveler information across state borders	3.00	C-3-10, C-3-12, C-3-15	TI01, TM06, SU03
ATIS03	Provide traffic flow maps showing recurring freeway congestion levels	3.29	C-3-09, C-3-10, C-3-12	TI01
ATIS04	Provide current and forecast road and weather condition information	4.14	A-1-03, A-2-03, A-2-24, C-3-09, C-3-10, C-3-11, C-3-12, C-3-13, C-3-15	TI01, TI02, WX02
ATIS05	Provide information on roadway construction and maintenance activities	4.00	A-1-17, A-3-01, A-3-02, A-3-03, A-3-04, B-3-01, B-3-02, B-3-03, B-2-04, B-2-05, C-3-09, C-3-10, C-3-11, C-3-12, C-3-13, C-3-15	TI01, TI02, MC06
ATIS06	Conduct outreach and education activities to promote awareness of ATIS	2.17	C-3-11, C-3-12, C-3-13, C-3-15	n/a
ATIS07	Provide information on tollways	1.14	B-1-01, B-1-02, B-1-05, B-2-10, B-2-20, B-2-23, B-2-24, B-2-25, C-3-11, C-3-12, C-3-13, C-3-15	TI01
ATIS08	Provide information on seasonal road weight restrictions	3.38	C-3-11, C-3-12, C-3-13, C-3-15	TI01, TI02, TM06
ATIS09	Provide information on CVO permit restrictions	3.25	C-3-11, C-3-12, C-3-13, C-3-15	TI01, TI02, CVO01
ATIS10	Operate a statewide web-based and telephone 511 system	4.25	C-3-11, C-3-12, C-3-13, C-3-15	TI01, TI02
ATIS11	Provide traveler information at rest areas	3.88	C-3-12, C-3-13, C-3-15	TI01
ATIS12	Share/integrate public safety CAD data with CARS	3.25	C-1-01, C-1-02, C-3-10, D-2-03, D-2-04	SU03
ATIS13	Send e-mail alerts of major incidents to major employers	4.25	C-3-13, C-3-15	TI01
ATIS14	Expand traveler information coverage in Greater Minnesota	3.88	A-1-01, A-1-02, A-1-03, A-1-04, B-3-01, B-4-01, C-3-09, C-3-10, C-3-11, C-3-12, C-3-13, C-3-15	TI01
ATIS15	Make camera images available to travelers	3.83	C-3-10, C-3-12	TI01, TM01

ID	Need/Potential Solution	Priority Point <sup>a</sup>	ITS Development Objective	ARC-IT Reference <sup>b</sup>
ATIS16	Improve quality, consistency and thoroughness of traveler information	2.86	C-3-09, C-3-10, D-1-06, G-1-01	TI01, TI02
ATIS17	Determine travel time or traffic condition for major signalized arterials	4.00	C-3-09, D-1-06	TI01
ATIS18	Provide congestion information to travelers for seasonal or recreational traffic generators	3.57	C-3-09, C-3-10, C-3-11, C-3-12, C-3-13, C-3-15	TI01, TM06
ATIS19	Provide different alternatives to travelers for the most appropriate route/mode/time of travel	3.51	B-1-01, B-1-02, B-1-03, B-1-04, B-1-05, B-1-06, B-1-07, B-1-08, B-1-09, B-1-10, B-1-11, B-1-12, B-1-13, B-1-14, B-2-11, B-2-14, B-3-01, B-3-02, B-3-03, B-3-04, B-3-05, C-2-01, C-2-02, C-3-01, C-3-02, C-3-03, C-3-04, C-3-05, C-3-08	TI01, TI04, PT08
ATIS20	Provide traveler service information for reservations and advanced payment for traveler services	1.50	C-3-15	TI05
ATIS21	Make real-time transportation operations data available to other transportation system operators (i.e. interagency data sharing)	2.57	C-3-10	SU03
ATIS22	Include information on local roads in 511	2.88	C-3-09, C-3-10, C-3-11, C-3-12, C-3-13, C-3-15	TI01, TI02
ATIS23	Provide information on available public and private truck parking facilities	3.67	C-4-04, C-4-05, C-4-07	TI01, TI02, PM01, PM04, CVO09
ATIS24	Provide web traffic data	3.43	C-3-12	TI01
ATIS25	Provide turn-by-turn navigation using 511 app	5.00 <sup>c</sup>	B-1-01, B-1-02, B-1-07, B-1-10, B-1-11, C-3-13, C-3-15	TI03, TI04
ATIS26	Broadband access at rest area for customers, onsite staff and building energy management systems	3.00 <sup>c</sup>	C-3-12, C-3-13, C-3-15	TI01
ATMS15	Provide operating speed/travel time information to travelers	3.07	B-1-01, B-1-02, B-1-03, B-1-05, B-1-06, B-1-07, B-1-09, B-1-10, B-1-11, B-1-12, B-1-13, B-1-14, C-1-01, C-3-11, C-3-12, C-3-13, C-3-15	TM01, TM06, TI01



ID	Need/Potential Solution	Priority Point <sup>a</sup>	ITS Development Objective	ARC-IT Reference <sup>b</sup>
ATMS17	Provide travel information on special events	2.82	B-1-01, B-1-02, B-1-03, B-1-05, B-1-06, B-1-07, B-1-09, B-1-10, B-1-11, B-1-12, B-1-13, B-1-14, C-3-11, C-3-12, C-3-13, C-3-15	TM06, TI01
ATMS43	Notify travelers of snowplow operations and cleanup using DMS	2.91	A-1-03, A-2-03, A-2-24, C-3-15	TM06, MC04
ATMS54	Import of WAZE and other crowd sourced data to mine for incidents	5.00 <sup>c</sup>	G-1-01, G-1-03	TM08, SU03

## 5. Detail of TI Needs and Services

A detailed description of each TI Needs and Services for Minnesota is found in *Appendix C*. *Appendix C* contains a table, listing the services sorted by Service Package and details for the service. The details described in the table include:

- **Operational Concept:** Describes who is currently using the service and how they are using it. Users of the service include both managers and operators of a system and other users who may be impacted and/or benefit from such a service, such as other agencies and the traveling public.
- **Existing Capabilities:** Describes what systems are currently in place that are used to provide this service and who operates these systems and provides such services.
- **Gaps and Planned Enhancements:** Summarizes enhancements that can be made to better provide the service and address needs, who will use these enhancements, and what they will be used for. These enhancements include expanding current systems to geographic areas that presently do not have access to the service, enhancing an existing service to fill identified gaps or use by more groups, or implementing a new system to address a need.
- **Roles and Responsibilities:** Describes the roles and responsibilities of involved stakeholders to make the service operate successfully throughout a system's lifecycle (planning, design, implementation, operations, and maintenance).
- **Interconnects:** Presents the communications linkages between subsystems or stakeholders to provide the service.
- **Data Archive Needs:** Summarizes what data is generated for the service that should be archived, who is responsible for archiving, and any special needs or requirements for such archiving.
- **Associated Service Packages:** Describes other Service Package(s) required to deliver the desired service. This includes both Service Packages within the ATIS Service Package Area and those in other Service Package Areas.

## 6. TI Research and Development Needs

In order to fill gaps and meet the needs for technology advancement in TI services, some research must be performed to test solutions and gain a greater understanding of what can effectively address identified needs. Research and Technology development needs and opportunities for TI are as follows:

- Assess viability of partnerships between MnDOT and information service providers (ISPs) to provide mapping/routing information (i.e. MapQuest, Garmin, etc.) with traveler information details (i.e. road construction, incidents, etc.)
- Investigate methods and processes to improve data latency, quality and consistency
- Improve percentage and accuracy of incidents captured in CARS on statewide basis
- Test new methods for collecting travel time information for signalized arterials
- Investigate impact of traveler information on drivers when they receive it while driving (via in-vehicle systems, smartphones and apps, etc.)
- Develop more reliable methods for forecasting road conditions to share via traveler information (vs. forecasting done today for maintenance operations)
- Investigate new technologies for obtaining real-time traffic data primarily in rural areas where traditional detection methods are not feasible or economical
- Provide traffic flow maps showing predicted freeway congestion levels
- Investigate and develop means of communicating roadway and traffic information to connected and smart vehicles
- Develop travel time and traffic information smart systems for heavily traveled freeway and expressway corridors outside of the Metro area – to include I-94 to St. Cloud or beyond, I-35 to Duluth, and I-35 to Iowa, also TH 52 to Rochester, 169 to Mankato, etc.
- Develop improved means of using current and forecasted weather data to inform drivers of poor conditions or to recommend no travel or to provide travel times in poor roadway surface conditions

## Appendix A: Existing/Planned TI Elements

Element	Service Package	Description	Stakeholder	Status
511 Telephone Information Service	TI01, TI02	Minnesota launched its 511 telephone information service in July 2002. Callers can obtain the following information for all state maintained roadways: road conditions, construction, incidents, and urban area congestion among other information.	MnDOT	Existing
511 Traveler Information Website	TI01, TI02, TI04	The MnDOT 511 Traveler Information Website provides real time traveler information including road conditions, construction detours, road congestion, and travel weather information for all state maintained roadways. The 511 system features an alert system that enables it to broadcast AMBER Alerts and General Transportation and Homeland Security Alerts as needed. The website also provides a link to the MnDOT traffic flow map that provides travelers with traffic congestion information based on data from MnDOT loop detectors in the roadway.	MnDOT	Existing
Condition Acquisition and Reporting System (CARS)	TI01, TI02, SU03	This system represents a central source of roadway event information for both the management and dissemination of traffic-related information to the traveling public. The system is maintained by MnDOT and data is input throughout MnDOT at District Offices. Minnesota State Patrol users also enter information to CARS on road conditions and incidents each day. CARS also manages automated data entry for congestion in the Twin Cities metro area based on information from loop detector roadside equipment. Data entered into CARS is available to the public to use for traveler information services through an XML feed. In MnDOT District 7, data entry occurs via web-enabled cellular telephones with approximately 75 users, primarily snow plow operators. Similar deployment is planned for MnDOT District 6.	MnDOT Office of Maintenance	Existing
In Vehicle Signing Roadside Equipment	TI07	This represents roadside equipment as part of an operational test that emits a radio signal to In-Vehicle Signing Vehicle Equipment equipped with the proper receivers at railroad crossings and other intersections.	MnDOT	Existing

Element	Service Package	Description	Stakeholder	Status
In Vehicle Signing Vehicle Equipment	TI07	This represents an in-vehicle signing system that was installed in 29 school buses in the City of Glencoe as part of an operational test. The system is activated when a receiver on the school bus traveling toward the crossing comes within range of a radio signal emitted at the crossing. The system operates by providing the school bus driver with two types of information on rail crossings: the bus proximity to an at-grade railroad crossing (crossing alert) and whether or not a train is present at or near the crossing (train warning). Both visual and variable audio signals are given. The system was operational for the 1997/1998 school year. The system was initially installed at signalized railroad crossings but the test was later expanded to evaluate the technology for use at unsignalized or passive crossings.	MnDOT	Existing
Local Agency Traveler Information Website	TI01	This element represents websites that broadcast information on traveler services to the general public. This includes various county and city websites.	Local Agencies	Existing
Media Outlets	TI01, TI02	Represents the information systems that provide traffic reports, travel conditions, and other transportation-related news services to the traveling public through radio, TV, and other media.	Local Media	Existing
National Weather Service	TI01, TI02	The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas.	NOAA	Existing
Neighboring State CARS/ Roadway Information Systems	SU03	This element represents an existing Conditions Acquisition and Reporting System (CARS) for the state of Iowa and a planned CARS for the state of Wisconsin. This also represents a roadway information systems for North Dakota and South Dakota. MnDOT plans to coordinate its CARS with its neighboring states.	Neighboring States	Existing

Element	Service Package	Description	Stakeholder	Status
North/West Passage Corridor Traveler Information Website	TI01	The North/West Passage Corridor Traveler Information Website provide users with camera images and weather conditions along the corridor to serve as a comprehensive source for traveler information. The website also identified rest areas and provide links to each states commercial vehicle restriction information as well as truck stop information. Users can click on a state to receive a list of active event reports posted by member agencies. The North/West Passage Corridor encompasses eight states along the I-90/I-94 Corridor (WI, MN, ND, SD, MT, WY, ID, and WA).	MnDOT, Neighboring States	Existing
Rest Area Wi-Fi	TI01	RASAWI (Rest Area Sponsorship, Advertising, and Wireless Internet) Program aims to deploy wireless internet access at a number of rest areas throughout the state of Minnesota.	MnDOT District Offices	Planned
Surface Transportation Weather Service Providers	TI01	Providers of value-added sector specific meteorological services. These providers utilize National Weather Service data and predictions, road condition information and local environmental data to provide weather observations and forecasts. Examples include the Data Transmission Network (DTN).	Private Weather Service Providers	Existing
Traveler Information Kiosks	TI01	This element represents existing and planned information systems that provide traveler support at remote locations throughout Minnesota. Examples include: kiosks in rest areas and parking ramps.	MnDOT	Existing
User Personal Computing Devices	TI01, TI02, TI04, TI06	This element represents personal computers and other personal devices (such as PDA's and cell phones) used by travelers to obtain travel-related information. It is planned to obtain traffic data from cell phone usage on roads and highways.	Travelers	Existing

## Appendix B: Minnesota ITS Development Objectives

**General Purpose:** Create a system that enhances transportation through the safe and efficient movement of people, goods, and information, with greater mobility and fuel efficiency, less pollution, and increased operating efficiency in Minnesota.

DM:	Data Management	VS:	Vehicle Safety
PT:	Public Transportation	CVO:	Commercial Vehicle Operations
TI:	Traveler Information	PS:	Public Safety
TM:	Traffic Management	MC:	Maintenance and Construction
PM:	Parking Management	WX:	Weather
SU:	Support	ST:	Sustainable Travel

### A. Improve the Safety of the State's Transportation System

#### A-1 Reduce crash frequency (TI, TM, PT, CVO, PS, MC, VS & WX)

- A-1-01 Reduce number of vehicle crashes
- A-1-02 Reduce number of vehicle crashes per VMT
- A-1-03 Reduce number of crashes due to road weather conditions
- A-1-04 Reduce number of crashes due to unexpected congestion
- A-1-05 Reduce number of crashes due to red-light running
- A-1-06 Reduce number of crashes involving large trucks and buses
- A-1-07 Reduce number of crashes due to commercial vehicle safety violations
- A-1-08 Reduce number of crashes due to inappropriate lane departure, crossing and merging
- A-1-09 Reduce number of crashes at railroad crossings
- A-1-10 Reduce number of crashes at signalized intersections
- A-1-11 Reduce number of crashes at un-signalized intersections
- A-1-12 Reduce number of crashes due to excessive speeding
- A-1-13 Reduce number of crashes related to driving while intoxicated
- A-1-14 Reduce number of crashes related to driver inattention and distraction
- A-1-15 Reduce number of crashes involving pedestrians and non-motorized vehicles
- A-1-16 Reduce number of crashes at intersections due to inappropriate crossing
- A-1-17 Reduce number of crashes due to roadway/geometric restrictions
- A-1-18 Reduce number of crashes involving younger drivers (under 21)
- A-1-19 Reduce number of all secondary crashes

#### A-2 Reduce fatalities and life changing injuries (TI, TM, PT, CVO, PS, MC, VS & WX)

- A-2-01 Reduce number of roadway fatalities
- A-2-02 Reduce number of roadway fatalities per VMT
- A-2-03 Reduce number of fatalities due to road weather conditions
- A-2-04 Reduce number of fatalities due to unexpected congestion
- A-2-05 Reduce number of fatalities due to red-light running
- A-2-06 Reduce number of fatalities involving large trucks and buses
- A-2-07 Reduce number of fatalities due to commercial vehicle safety violations
- A-2-08 Reduce number of transit fatalities
- A-2-09 Reduce number of fatalities due to inappropriate lane departure, crossing and merging
- A-2-10 Reduce number of fatalities at railroad crossings
- A-2-11 Reduce number of fatalities at signalized intersections
- A-2-12 Reduce number of fatalities at un-signalized intersections
- A-2-13 Reduce number of fatalities due to excessive speeding
- A-2-14 Reduce number of fatalities related to driving while intoxicated

- A-2-15 Reduce number of fatalities related to driver inattention and distraction
- A-2-16 Reduce number of fatalities involving pedestrians and non-motorized vehicles
- A-2-17 Reduce number of fatalities at intersections due to inappropriate crossing
- A-2-18 Reduce number of fatalities due to roadway/geometric restrictions
- A-2-19 Reduce number of fatalities involving younger drivers (under 21)
- A-2-20 Reduce number of fatalities involving unbelted vehicle occupants
- A-2-21 Reduce number of hazardous materials transportation incidents involving fatalities
- A-2-22 Reduce number of roadway injuries
- A-2-23 Reduce number of roadway injuries per VMT
- A-2-24 Reduce number of injuries due to road weather conditions
- A-2-25 Reduce number of injuries due to unexpected congestion
- A-2-26 Reduce number of injuries due to red-light running
- A-2-27 Reduce number of injuries involving large trucks and buses
- A-2-28 Reduce number of injuries due to commercial vehicle safety violations
- A-2-29 Reduce number of transit injuries
- A-2-30 Reduce number of injuries due to inappropriate lane departure, crossing and merging
- A-2-31 Reduce number of injuries at railroad crossings
- A-2-32 Reduce number of injuries at signalized intersections
- A-2-33 Reduce number of injuries at un-signalized intersections
- A-2-34 Reduce number of injuries due to excessive speeding
- A-2-35 Reduce number of injuries related to driving while intoxicated
- A-2-36 Reduce number of injuries related to driver inattention and distraction
- A-2-37 Reduce number of injuries involving pedestrians and non-motorized vehicles
- A-2-38 Reduce number of injuries at intersections due to inappropriate crossing
- A-2-39 Reduce number of injuries due to roadway/geometric restrictions
- A-2-40 Reduce number of injuries involving younger drivers (under 21)
- A-2-41 Reduce number of injuries involving unbelted vehicle occupants
- A-2-42 Reduce number of hazardous materials transportation incidents involving injuries
- A-2-43 Reduce number of speed violations
- A-2-44 Reduce number of traffic law violations

A-3 Reduce crashes in work zones (TI, TM, PS, MC & VS)

- A-3-01 Reduce number of crashes in work zones
- A-3-02 Reduce number of fatalities in work zones
- A-3-03 Reduce number of motorist injuries in work zones
- A-3-04 Reduce number of workers injured by vehicles in work zones

**B. Increase Operational Efficiency and Reliability of the Transportation System**

B-1 Reduce overall delay associated with congestion (TI, TM, MC & VS)

- B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during peak periods
- B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- B-1-03 Reduce the share of major intersections operating at LOS F
- B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)
- B-1-05 Reduce the daily hours of recurring congestion on major freeways

- B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion
- B-1-07 Reduce the regional average travel time index
- B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- B-1-09 Improve average travel time during peak periods
- B-1-10 Reduce hours of delay per capita
- B-1-11 Reduce hours of delay per driver
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- B-1-15 Reduce mean incident notification time
- B-1-16 Reduce mean time for needed responders to arrive on-scene after notification
- B-1-17 Reduce mean incident clearance time per incident
- B-1-18 Reduce mean incident clearance time for Twin Cities urban freeway incidents

B-2 Increase average vehicle passenger occupancy and facility throughput (TM, PT & ST)

- B-2-01 Increase annual transit ridership
- B-2-02 Increase annual express bus ridership
- B-2-03 Increase annual light rail ridership
- B-2-04 Increase annual commuter rail ridership
- B-2-05 Maintain agency pre-defined performance targets for rides per hour of transit service
- B-2-06 Maintain transit passengers per capita rate for service types
- B-2-07 Maintain the cost efficiency of the statewide public transit network
- B-2-08 Maintain the service effectiveness of the statewide public transit network in terms of passengers/service hour and passengers/mile
- B-2-09 Maintain the cost effectiveness of the statewide public transit network in terms of cost per service hour, cost per passenger trip, and revenue recovery percentage
- B-2-10 Maintain the availability of the statewide public transit network in terms of hours (span) of service and frequency
- B-2-11 Reduce per capita single occupancy vehicle commute trip rate
- B-2-12 Increase the percentage of major employers actively participating in transportation demand management programs
- B-2-13 Reduce commuter vehicle miles traveled (VMT) per regional job
- B-2-14 Create a transportation access guide, which provides concise directions to reach destinations by alternative modes (transit, walking, bike, etc.)
- B-2-15 Improve average on-time performance for specified transit routes/facilities
- B-2-16 Increase use of automated fare collection system per year
- B-2-17 Increase the percent of transfers performed with automated fare cards
- B-2-18 Increase the miles of bus-only shoulder lanes in the metro area
- B-2-19 Increase the number of carpools
- B-2-20 Increase use of vanpools
- B-2-21 Provide carpool/vanpool matching and ridesharing information services
- B-2-22 Reduce trips per year in region through carpools/vanpools
- B-2-23 Increase vehicle throughput on specified routes
- B-2-24 Increase AM/PM peak hour vehicle throughput on specified routes
- B-2-25 Increase AM/PM peak hour person throughput on specified routes



**B-3 Reduce delays due to work zones (TI, TM, PS, MC & VS)**

- B-3-01 Reduce total vehicle hours of delay by time period (peak, off-peak) caused by work zones
- B-3-02 Reduce the percentage of vehicles traveling through work zones that are queued
- B-3-03 Reduce the average and maximum length of queues, when present,
- B-3-04 Reduce the average time duration (in minutes) of queue length greater than some threshold (e.g., 0.5 mile)
- B-3-05 Reduce the variability of travel time in work zones during peak and off-peak periods

**B-4 Reduce traffic delays during evacuation from homeland security and Hazmat incidents (TI, TM, PT, CVO, PS & VS)**

- B-4-01 Reduce vehicle hours of delay per capita during evacuation from homeland security and Hazmat incidents

**C. Enhance Mobility, Convenience, and Comfort for Transportation System Users****C-1 Reduce congestion and incident-related delay for travelers (TI, TM, PT, PS & VS)**

- B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during peak periods
- B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- B-1-03 Reduce the share of major intersections operating at LOS F
- B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)
- B-1-05 Reduce the daily hours of recurring congestion on major freeways
- B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion
- B-1-07 Reduce the regional average travel time index
- B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- B-1-09 Improve average travel time during peak periods
- B-1-10 Reduce hours of delay per capita
- B-1-11 Reduce hours of delay per driver
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- B-1-15 Reduce mean incident notification time
- B-1-16 Reduce mean time for needed responders to arrive on-scene after notification
- B-1-17 Reduce mean incident clearance time per incident
- B-1-18 Reduce mean incident clearance time for Twin Cities urban freeway incidents
- C-1-01 Reduce the vehicle hours of total delay associated with traffic incidents during peak and off-peak periods
- C-1-02 Increase percentage of incident management agencies in the region that participate in a multi-modal information exchange network
- C-1-03 Increase percentage of incident management agencies in the region that use interoperable voice communications

- C-1-04 Increase percentage of incident management agencies in the region that participate in a regional coordinated incident response team
- C-1-05 Increase the number of corridors in the region covered by regional coordinated incident response teams
- C-1-06 Maintain a percentage of transportation operating agencies have a plan in place for a representative to be at the local or State Emergency Operations Center (EOC) to coordinate strategic activities and response planning for transportation during emergencies
- C-1-07 Conduct joint training exercises among operators and emergency responders in the region
- C-1-08 Maintain a percentage of staff in region with incident management responsibilities who have completed the National Incident Management System (NIMS) Training and a percentage of transportation responders in the region are familiar with the incident command structure (ICS)
- C-1-09 Increase number of regional road miles covered by ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) in use for incident detection / response
- C-1-10 Increase number of traffic signals equipped with emergency vehicle preemption

C-2 Improve travel time reliability (TI, TM, PT & VS)

- B-1-07 Reduce the regional average travel time index
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- B-2-15 Improve average on-time performance for specified transit routes/facilities
- B-2-16 Increase use of automated fare collection system per year
- B-2-17 Increase the percent of transfers performed with automated fare cards
- C-2-01 Decrease the average buffer index for multiple routes or trips
- C-2-02 Reduce the average planning time index for specific routes in region
- C-2-03 Increase the miles of bus-only shoulder lanes in the metro area

C-3 Increase choice of travel modes (TI, TM, PT & ST)

- B-2-01 Increase annual transit ridership
- B-2-11 Reduce per capita single occupancy vehicle commute trip rate
- B-2-12 Increase the percentage of major employers actively participating in transportation demand management programs
- B-2-13 Reduce commuter vehicle miles traveled (VMT) per regional job
- B-2-14 Create a transportation access guide, which provides concise directions to reach destinations by alternative modes (transit, walking, bike, etc.)
- C-3-01 Increase active (bicycle/pedestrian) mode share
- C-3-02 Reduce single occupancy vehicle trips through travel demand management strategies (e.g., employer or residential rideshare)
- C-3-03 Increase the percent of alternative (non-single occupancy vehicle) mode share in transit station communities (or other areas)
- C-3-04 Increase transit mode share
- C-3-05 Increase transit mode share during peak periods
- C-3-06 Increase average transit load factor
- C-3-07 Increase passenger miles traveled per capita on transit

- C-3-08 Reduce the travel time differential between transit and auto during peak periods per year
- C-3-09 Increase the percent of the transportation system in which travel conditions can be detected remotely via video monitoring cameras, speed detectors, etc.
- C-3-10 Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region
- C-3-11 Increase number of 511 calls per year
- C-3-12 Increase number of visitors to traveler information website per year
- C-3-13 Increase number of users of notifications for traveler information (e.g., e-mail, text message)
- C-3-14 Increase the number of transit routes with information being provided by ATIS
- C-3-15 Increase the number of specifically tailored traveler information messages provided
- C-3-16 Increase annual transit ridership reported by urbanized area transit providers
- C-3-17 Increase annual transit ridership reported by rural area transit providers

C-4 Reduce stress caused by transportation (TI, TM, PT, PM, PS, MC & VS)

- A-2-43 Reduce number of speed violations
- A-2-44 Reduce number of traffic law violations
- B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during peak periods
- B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- B-1-03 Reduce the share of major intersections operating at LOS F
- B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)
- B-1-05 Reduce the daily hours of recurring congestion on major freeways
- B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion
- B-1-07 Reduce the regional average travel time index
- B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- B-1-09 Improve average travel time during peak periods
- B-1-10 Reduce hours of delay per capita
- B-1-11 Reduce hours of delay per driver
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- B-1-15 Reduce mean incident notification time
- B-1-16 Reduce mean time for needed responders to arrive on-scene after notification
- C-3-11 Increase number of 511 calls per year
- C-3-12 Increase number of visitors to traveler information website per year
- C-3-13 Increase number of users of notifications for traveler information (e.g., e-mail, text message)
- C-3-14 Increase the number of transit routes with information being provided by ATIS
- C-3-15 Increase the number of specifically tailored traveler information messages provided
- C-4-01 Reduce the speed differential between lanes of traffic on multi-lane highways
- C-4-02 Increase the number of users aware of park-and-ride lots in their region

- C-4-03 Increase the number parking facilities with electronic fee collection
- C-4-04 Increase the number of parking facilities with automated occupancy counting and space management
- C-4-05 Increase the number of parking facilities with advanced parking information to customers
- C-4-06 Increase the number of parking facilities with coordinated electronic payment systems
- C-4-07 Increase the number of parking facilities with coordinated availability information

#### **D. Improve the Security of the Transportation System**

##### D-1 Enhance traveler security (PT & PS)

- C-3-09 Increase the percent of the transportation system in which travel conditions can be detected remotely via video monitoring cameras, speed detectors, etc.
- D-1-01 Reduce on an annual basis the number of complaints per 1,000 boarding passengers
- D-1-02 Increase the number of video monitoring cameras installed on platforms, park-n-ride lots, vehicles, and other transit facilities
- D-1-03 Increase customer service and personal safety ratings
- D-1-04 Reduce the number of reported personal safety incidents
- D-1-05 Decrease the number of security incidents on roadways
- D-1-06 Increase the percent of major and minor arterials are equipped with and operating with video monitoring cameras
- D-1-07 Increase the number of critical sites with security monitoring
- D-1-08 Reduce the number of security incidents on transportation infrastructure
- D-1-09 Increase the number of critical sites with hardened security enhancements

##### D-2 Safeguard the motoring public from homeland security and/or Hazmat incidents (TI, TM, PT, CVO, PS, MC & VS)

- B-1-16 Reduce mean time for needed responders to arrive on-scene after notification
- C-3-09 Increase the percent of the transportation system in which travel conditions can be detected remotely via video monitoring cameras, speed detectors, etc.
- D-1-01 Reduce on an annual basis the number of complaints per 1,000 boarding passengers
- D-1-02 Increase the number of video monitoring cameras installed on platforms, park-n-ride lots, vehicles, and other transit facilities
- D-1-03 Increase customer service and personal safety ratings
- D-1-04 Reduce the number of reported personal safety incidents
- D-1-05 Decrease the number of security incidents on roadways
- D-1-06 Increase the percent of major and minor arterials are equipped with and operating with video monitoring cameras
- D-1-07 Increase the number of critical sites with security monitoring
- D-1-08 Reduce the number of security incidents on transportation infrastructure
- D-1-09 Increase the number of critical sites with hardened security enhancements
- D-2-01 Reduce the number of Hazmat incidents
- D-2-02 Reduce the number of homeland security incidents
- D-2-03 Increase the number of travelers routed around Hazmat incidents
- D-2-04 Increase the number of travelers routed around homeland security incidents
- D-2-05 Reduce the Hazmat incident response time
- D-2-06 Reduce the homeland security incident response time
- D-2-07 Increase the number of Hazmat shipments tracked in real-time

**E. Support Regional Economic Productivity and Development****E-1 Reduce travel time for freight, transit and businesses (TI, TM, PT, CVO & VS)**

- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- B-2-15 Improve average on-time performance for specified transit routes/facilities
- B-2-16 Increase use of automated fare collection system per year
- B-2-17 Increase the percent of transfers performed with automated fare cards
- C-2-09 Increase the miles of bus-only shoulder lanes in the metro area
- C-3-08 Reduce the travel time differential between transit and auto during peak periods per year
- E-1-01 Maintain a travel time differential between transit and auto during peak periods
- E-1-02 Improve average transit travel time compared to auto in major corridors
- E-1-03 Decrease the annual average travel time index for selected freight-significant highways
- E-1-04 Decrease point-to-point travel times on selected freight-significant highways
- E-1-05 Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways

**E-2 Improve the efficiency of freight movement, permitting and credentials process (TI & CVO)**

- E-2-01 Increase the percent (or number) of commercial vehicles tracked by trucking companies
- E-2-02 Increase the percent (or number) of freight shipment tracked
- E-2-03 Increase the percent of agencies involved in CVO inspection, administration, enforcement, and emergency management in the region with interoperable communications
- E-2-04 Increase the use of electronic credentialing at weigh stations and border crossings
- E-2-05 Increase the number of automated permits/credentials issued
- E-2-06 Reduce the frequency of delays per month at intermodal facilities
- E-2-07 Reduce the average duration of delays per month at intermodal facilities

**E-3 Improve travel time reliability for freight, transit and businesses (TM, PT, CVO & VS)**

- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- B-2-15 Improve average on-time performance for specified transit routes/facilities
- B-2-16 Increase use of automated fare collection system per year
- B-2-17 Increase the percent of transfers performed with automated fare cards
- C-1-06 Increase percentage of incident management agencies in the region that participate in a multi-modal information exchange network
- C-2-09 Increase the miles of bus-only shoulder lanes in the metro area
- C-3-09 Increase the percent of the transportation system in which travel conditions can be detected remotely via video monitoring cameras, speed detectors, etc.
- C-3-10 Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region
- C-3-13 Increase number of users of notifications for traveler information (e.g., e-mail, text message)
- E-1-08 Decrease the annual average travel time index for selected freight-significant highways

E-2-04 Increase the use of electronic credentialing at weigh stations and border crossings

E-3-01 Reduce average crossing times at international borders

E-4 Increase agency efficiency (DM, TM, PT, CVO, PS, MC & SU)

B-2-15 Improve average on-time performance for specified transit routes/facilities

B-2-16 Increase use of automated fare collection system per year

B-2-17 Increase the percent of transfers performed with automated fare cards

C-2-09 Increase the miles of bus-only shoulder lanes in the metro area

E-2-01 Increase the percent (or number) of commercial vehicles tracked by trucking companies

E-2-03 Increase the percent of agencies involved in CVO inspection, administration, enforcement, and emergency management in the region with interoperable communications

E-4-01 Increase the number of ITS-related assets tracked

E-4-02 Reduce the number of pavement miles damaged by commercial vehicles

E-4-03 Increase the rate of on-time completion of construction projects

E-4-04 Increase the rate at which equipment is utilized

E-4-05 Increase the percentage of fleet / equipment within its lifecycle

E-4-06 Increase the number of fleet vehicles with maintenance diagnostic equipment

E-4-07 Increase the number of vehicles operating under CAD

E-5 Reduce vehicle operating costs (TM, PT, CVO & VS)

B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during peak periods

B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods

B-1-03 Reduce the share of major intersections operating at LOS F

B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)

B-1-05 Reduce the daily hours of recurring congestion on major freeways

B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion

B-1-07 Reduce the regional average travel time index

B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth

B-1-09 Improve average travel time during peak periods

B-1-10 Reduce hours of delay per capita

B-1-11 Reduce hours of delay per driver

B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)

B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected

B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods

E-6 Enhance efficiency at borders (TI & CVO)

E-2-04 Increase the use of electronic credentialing at weigh stations and border crossings

E-3-11 Reduce average crossing times at international borders

**F. Preserve the Transportation System**

**F-1 Safeguard existing infrastructure (TM, CVO, PS & MC)**

- C-3-09 Increase the percent of the transportation system in which travel conditions can be detected remotely via video monitoring cameras, speed detectors, etc.
- D-1-06 Increase the percent of major and minor arterials are equipped with and operating with video monitoring cameras
- D-1-07 Increase the number of critical sites with security monitoring
- D-1-08 Reduce the number of security incidents on transportation infrastructure
- D-1-09 Increase the number of critical sites with hardened security enhancements
- E-2-03 Increase the percent of agencies involved in CVO inspection, administration, enforcement, and emergency management in the region with interoperable communications
- E-4-03 Increase the rate of on-time completion of construction projects
- F-1-01 Decrease the number of pavement miles damaged by commercial vehicles
- F-1-02 Decrease the number of size and weight violations

**G. Enhance the Integration and Connectivity of the Transportation System****G-1 Aid in transportation infrastructure and operations planning (ALL)**

- G-1-01 Increase the amount of data gathered from ITS enhancements used in infrastructure and operations planning
- G-1-02 Increase the number of planning activities using data from ITS systems
- G-1-03 Increase the number of years of data in database that is easily searchable and extractable
- G-1-04 Reduce project schedule deviation
- G-1-05 Reduce project cost deviation
- G-1-06 Reduce operations cost deviation
- G-1-07 Reduce administrative support rate (as part of overall project budget)

**G-2 Reduce need for new facilities (TM, CVO, MC & VS)**

- B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during peak periods
- B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- B-1-03 Reduce the share of major intersections operating at LOS F
- B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)
- B-1-05 Reduce the daily hours of recurring congestion on major freeways
- B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion
- B-1-07 Reduce the regional average travel time index
- B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- B-1-09 Improve average travel time during peak periods
- B-1-10 Reduce hours of delay per capita
- B-1-11 Reduce hours of delay per driver
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- E-2-04 Increase the use of electronic credentialing at weigh stations and border crossings

- E-2-05 Increase the number of automated permits/credentials issued
- E-3-11 Reduce average crossing times at international borders

**H. Reduce Environmental Impacts**

H-1 Reduce emissions/energy impacts and use associated with congestion (ST, TI, TM, CVO & VS)

- B-1-01 Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during peak periods
- B-1-02 Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- B-1-03 Reduce the share of major intersections operating at LOS F
- B-1-04 Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate)
- B-1-05 Reduce the daily hours of recurring congestion on major freeways
- B-1-06 Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion
- B-1-07 Reduce the regional average travel time index
- B-1-08 Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- B-1-09 Improve average travel time during peak periods
- B-1-10 Reduce hours of delay per capita
- B-1-11 Reduce hours of delay per driver
- B-1-12 Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region)
- B-1-13 Reduce the 90th (or 95th) percentile travel times for each route selected
- B-1-14 Reduce the variability of travel time on specified routes during peak and off-peak periods
- H-1-01 Reduce excess fuel consumed due to congestion
- H-1-02 Reduce total fuel consumed per capita for transportation
- H-1-03 Reduce vehicle miles traveled per capita
- H-1-04 Reduce MnDOT fleet gasoline use
- H-1-05 Reduce MnDOT fleet diesel use
- H-1-06 Reduce the amount of all emissions in the atmosphere
- H-1-07 Reduce the amount of carbon dioxide emissions measured

H-2 Reduce negative impacts of the transportation system on communities (TM, PT, PS, ST & MC)

- A-2-44 Reduce number of traffic law violations
- B-2-01 Increase annual transit ridership
- B-2-12 Increase the percentage of major employers actively participating in transportation demand management programs
- B-2-13 Reduce commuter vehicle miles traveled (VMT) per regional job
- B-2-14 Create a transportation access guide, which provides concise directions to reach destinations by alternative modes (transit, walking, bike, etc.)
- B-2-19 Increase the number of carpools
- B-2-20 Increase use of vanpools
- B-2-21 Provide carpool/vanpool matching and ridesharing information services
- B-2-22 Reduce trips per year in region through carpools/vanpools
- H-2-01 Increase the average vehicle passenger occupancy rate in HOV lanes
- H-2-02 Increase the amount of environmentally friendly de-icing material used



## Appendix C: Needs and Services Detail

### Service Package TI01 - Broadcast Traveler Information

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 01	Provide incident information on freeways and major arterials	<ul style="list-style-type: none"> <li>MSP and local incident responders collect and provide incident information on websites and to media, and/or send information to MnDOT and local agencies.</li> <li>MnDOT and local agencies provide incident information to travelers via DMS, websites, telephone information services, KBEM, and media.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT provides information on incidents occur on MnDOT maintained roadways through DMS, social media (e.g. Twitter), the 511 website, 511 phone service, and KBEM.</li> <li>MnDOT provides an incident list from the RTMC for the metro area.</li> <li>CARS/CAD integration allows for all incidents in state to be shown on 511 website.</li> <li>Personalized route feature for travelers to see updates only on certain routes.</li> <li>MnDOT provides a data feed that includes incident information through CARS.</li> </ul>	<ul style="list-style-type: none"> <li>Provide incident information (i.e. congestion, construction/maintenance, crashes) on major arterials to travelers.</li> <li>Capture a higher percentage of incidents on CARS and 511.</li> </ul>	<ul style="list-style-type: none"> <li>Each agency is responsible to plan, design, operate and maintain its own traveler information system.</li> <li>MSP, MnDOT, local agencies and local incident responders are responsible to coordinate with each other for information sharing and for planning, designing, operating and maintaining systems and interfaces for information sharing.</li> </ul>	<ul style="list-style-type: none"> <li>This service includes interconnects between incident responders/ 911 centers and CARS/TMCs/ maintenance dispatch centers.</li> <li>This service also includes interconnects between TMCs and roadside equipment (DMS).</li> <li>This service also includes interconnects between CARS and 511 system/ websites.</li> </ul>	<ul style="list-style-type: none"> <li>Incident information is archived through CAD for future analysis and planning efforts.</li> </ul>	<ul style="list-style-type: none"> <li>TI02</li> <li>TM06</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 02	Provide traveler information across state borders	<ul style="list-style-type: none"> <li>• MnDOT and neighboring state DOTs share regional traveler information across state borders.</li> <li>• MnDOT and neighboring state DOTs provide consistent and reliable traveler information via various traveler information delivery systems to travelers in the region.</li> </ul>	<ul style="list-style-type: none"> <li>• Minnesota's 511 website provides indirect links (through FHWA) to neighboring states' traffic information websites and intercity bus services.</li> <li>• North/West Passage traveler website provide traveler information for states participate in the study.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide a link on 511 website to North/West Passage traveler information website.</li> <li>• Provide direct links to neighboring states' traveler information systems.</li> <li>• Share regional traveler information data with neighboring states.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to maintain links to and provide relevant information to neighboring states' traveler information systems.</li> <li>• Neighboring states are responsible to maintain web page links and provide traveler information to MnDOT</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between MnDOT 511 and other regional 511/ traveler information systems.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• TM06</li> <li>• SU03</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 03	Provide traffic flow maps showing recurring freeway congestion levels	<ul style="list-style-type: none"> <li>• MnDOT uses sensors/detectors to collect traffic flow data (volume, speed and occupancy).</li> <li>• Data is processed through CARS and RTMC and provided for traffic flow maps that display freeway congestion information.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT RTMC provides a traffic flow map for the metro area indicating free flowing, slow or congested conditions, incidents and construction/maintenance activities.</li> <li>• MnDOT provides a statewide traffic map that includes driving condition information (good, fair, difficult) but not congestion information.</li> <li>• DMS displays travel times as a measure of congestion</li> <li>• KBEM provides real-time travel conditions on metro area freeways.</li> </ul>	<ul style="list-style-type: none"> <li>• Expand the coverage of the traffic flow map to include congestion information for key corridors outside of the metro area including, but not limited to, U.S. 10, I-94 and T.H. 52.</li> <li>• Expand coverage of the traffic flow map to arterial roadways within the Metro area as they are instrumented.</li> <li>• Provide a mobile-based version of the traffic flow map formatted for handhelds.</li> <li>• Next generation of 511 system will allow for customized maps and information for congestion and other travel information.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate and maintain the 511 system and websites.</li> <li>• MnDOT is responsible to plan, design, operate and maintain the loops/detection equipment, Intelligent Roadway Information System, and CARS that feeds information to the 511 system.</li> <li>• MSP is responsible to plan, design, operate and maintain the 511 system and websites in outstate areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between roadside equipment and TMCs and CARS.</li> <li>• Interconnects are needed between CARS and 511 system/websites.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 04	Provide current and forecast road and weather condition information	<ul style="list-style-type: none"> <li>• MnDOT and local agencies collect road and weather conditions information using observations from MSP troopers and field personnel or RWIS sensors.</li> <li>• MnDOT and local agencies receive current and forecast weather information from the National Weather Service and private weather information providers.</li> <li>• MnDOT and local agencies process and provide information to travelers via various traveler information systems.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT provides a statewide traffic map that includes driving condition information (good, fair, difficult)</li> <li>• The 511 website and phone services provide current conditions and forecasted weather information from the National Weather Service.</li> <li>• MDSS is also used for road and weather condition information.</li> <li>• Some roadways are segmented in the 511 system to identify road conditions more specifically.</li> <li>• Automated RWIS data entry into CARS and 511 systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Include road condition information for major arterials in urbanized areas.</li> <li>• Evolve from county-wide condition reports to route-specific reports.</li> <li>• Include forecasting roadway conditions is an area to evolve in improving condition reports and route-specific reports.</li> <li>• Use of data from bridge anti-icing systems.</li> <li>• Use of data from MDSS to let people know when specific roads have been plowed</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate and maintain the 511 and RWIS systems.</li> <li>• Local agencies are responsible to plan, design, operate and maintain their own traveler information systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between roadside equipment (RWIS) and CARS/central processing systems for road weather conditions information.</li> <li>• Interconnects are required between weather information providers and CARS/central processing systems.</li> <li>• Interconnects exist between CARS/ center processing systems and 511 traveler information system.</li> </ul>	<ul style="list-style-type: none"> <li>• Weather and road condition information is archived for future analysis and planning efforts.</li> </ul>	<ul style="list-style-type: none"> <li>• TI02</li> <li>• WX02</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 05	Provide information on roadway construction and maintenance activities	<ul style="list-style-type: none"> <li>• MnDOT and local agencies provide information on roadway construction and maintenance activities through the 511 Traveler Information website, local agency websites, telephone information services, and media outlets.</li> <li>• ISPs utilize the data feed provided by MnDOT via CARS to provide roadway construction and maintenance activity information to travelers.</li> </ul>	<ul style="list-style-type: none"> <li>• The 511 website, phone service, KBEM, local media outlets, and social media (e.g. Twitter and Facebook) provides information roadwork and maintenance activities.</li> <li>• Shoulder mounted DMS are used for longer term construction projects.</li> <li>• MnDOT provides a data feed to travelers through CARS that includes road construction and maintenance activity information.</li> <li>• MnDOT provides information on alternate routes and detours on the 511 telephone information service, website, DMS, and other services.</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance the provision of information on roadway construction and maintenance activities outside of the metro area in suburban areas.</li> <li>• Test the use of V2I communications to provide information on roadway construction and maintenance activities (as part of SPaT Challenge).</li> <li>• Develop tools to forecast traffic conditions during roadway construction and maintenance activities and provide information to travelers.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate and maintain the traveler information systems.</li> <li>• Local agencies are responsible to plan, design, operate and maintain systems providing information on closures, alternate routes and detours.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between CARS and the 511 system.</li> <li>• Interconnects are required between CARS and ISPs.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• TI02</li> <li>• MC06</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 07	Provide information on tollways	<ul style="list-style-type: none"> <li>• MnDOT's MnPASS Service Center collects and provides toll price information to travelers utilizing the 511 Traveler Information website and MnPASS website.</li> <li>• Promote use of MnPASS by integrating with other systems (i.e. TAD garage, MSP airport, Chicago toll system, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• General information about MnPASS toll pricing is currently provided on the MnPASS website.</li> <li>• DMS on mainline I-394 to provide real-time toll pricing</li> </ul>	<ul style="list-style-type: none"> <li>• Provide link from 511 to the MnPASS website for updated toll information.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate and maintain the interfaces between 511 and MnPASS systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between MnPASS Service Center and MnPASS website.</li> <li>• Interconnects are required between MnPASS Service Center and 511.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 08	Provide information on seasonal road weight restrictions	<ul style="list-style-type: none"> <li>MnDOT collects and provides information about seasonal road weight restrictions to travelers and commercial vehicle operators utilizing the 511 Traveler Information website and the CVO website.</li> </ul>	<ul style="list-style-type: none"> <li>Information about commercial vehicle restrictions due to construction is available on the 511 website.</li> <li>Seasonal load limit information is posted on the MnDOT Materials Engineering website.</li> </ul>	<ul style="list-style-type: none"> <li>Pilot project providing email alerts to major trucking companies/firms</li> <li>Provide link to information from wireless internet/kiosk at rest areas.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT is responsible to plan, design, operate and maintain the 511 systems.</li> <li>MnDOT Materials Engineering is responsible for providing seasonal load information.</li> <li>MnDOT will operate and maintain wireless internet at rest areas.</li> <li>MnDOT and other agencies to maintain email alert system</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>Historical winter load increase placement/removal dates is archived for reference by commercial vehicle operators.</li> </ul>	<ul style="list-style-type: none"> <li>TI02</li> <li>TM06</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 09	Provide information on CVO permit restrictions	<ul style="list-style-type: none"> <li>• MnDOT provides commercial vehicle operators and fleet managers with information on commercial vehicle permit restrictions utilizing the 511 Traveler Information website and the APRS.</li> <li>• ISPs utilize the data feed provided by MnDOT on 511 to provide permit restriction information to commercial vehicle operators and fleet managers.</li> </ul>	<ul style="list-style-type: none"> <li>• Permit restriction information is available on the 511 website and CVO website.</li> <li>• Automated Permit Routing System (APRS) is integrated with CARS database to allow for activated updating of roadway restriction information.</li> </ul>	<ul style="list-style-type: none"> <li>• Automate the data entry into APRS to allow for the provision of real time data.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate and maintain CARS and 511 systems.</li> <li>• MnDOT and local agencies are responsible for providing restrictions and road conditions information.</li> <li>• MnDOT is responsible to plan, design, and implement APRS enhancements.</li> <li>• MnDOT is responsible to operate and maintain APRS.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between CARS and the 511 system.</li> <li>• Interconnects are required between CARS and APRS.</li> <li>• Interconnects are required between MnDOT/local agencies and CARS.</li> <li>• Interconnects are required between 511/ APRS and private fleet and freight management centers.</li> </ul>	<ul style="list-style-type: none"> <li>• CV permit restriction information is archived for future analysis and planning efforts.</li> </ul>	<ul style="list-style-type: none"> <li>• TI02</li> <li>• CVO01</li> </ul>



ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 10	Operate a statewide web-based and telephone 511 system	<ul style="list-style-type: none"> <li>MnDOT collects traveler information about traffic congestion, camera images, incidents, road and weather conditions, construction, commercial vehicles, and transit. Information is automatically or manually entered into CARS.</li> <li>511 interfaces with CARS to disseminate information to users through the 511 website and telephone system.</li> </ul>	<ul style="list-style-type: none"> <li>The current 511 system includes information for state-maintained highways throughout Minnesota, with real-time freeway congestion traffic data available in the Twin Cities area.</li> <li>Images from some cameras in outstate Minnesota is available on the 511 website.</li> </ul>	<ul style="list-style-type: none"> <li>Expand 511 system to include information on major arterials.</li> <li>Improve the 511 telephone user interface by developing new, user friendly approaches to deliver real-time information.</li> <li>Expand 511 system to utilize new communications systems (i.e. vehicle GPS navigation systems, next-generation text messaging, etc.).</li> <li>Expand transit traveler information.</li> <li>Automate traffic flow entry into 511.</li> <li>Allow users of 511 phone system to say "Route 1" and receive voice information on incidents and traffic along that specific route.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT is responsible to plan, design, operate and maintain the 511 system.</li> <li>Transit providers are responsible to plan, design, operate and maintain their own traveler information system.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnects are required between CARS and 511 systems.</li> <li>Interconnects are required between 511 system and transit provider traveler information systems.</li> </ul>	<ul style="list-style-type: none"> <li>Consider archiving travel times and providing median travel times, as well as minimum and maximum travel times.</li> </ul>	<ul style="list-style-type: none"> <li>TI02</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 11	Provide traveler information at rest areas	<ul style="list-style-type: none"> <li>MnDOT provides traveler information at rest areas. Information may be provided via various traveler information delivery systems such as kiosks, displays, and others.</li> </ul>	<ul style="list-style-type: none"> <li>Electronic traveler information is not currently provided at rest areas.</li> </ul>	<ul style="list-style-type: none"> <li>Provide wireless internet access or other information delivery methods at a number of rest areas throughout Minnesota as part of the Rest Area Sponsorship, Advertising and Wireless Internet (RASAWI) program.</li> <li>Provide truck rest area parking availability to truckers on the roads.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT is responsible to plan, design, operate and maintain the traveler information delivery systems at rest areas.</li> <li>MnDOT is also responsible to plan, design, operate and maintain interfaces between information source(s) (e.g. CARS and 511) and information delivery systems.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnects are required between CARS/511 systems/other information service providers and information delivery systems.</li> </ul>	<ul style="list-style-type: none"> <li>Archive Log usage or track service usage to justify the program</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 13	Send e-mail alerts of major incidents to major employers	<ul style="list-style-type: none"> <li>MnDOT and other agencies send e-mails and/or text messages to key contacts at major employers to allow them to inform their employees of major incidents that could impact their travel.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT does not currently send e-mail alerts to employers.</li> <li>MnDOT has signup for email construction updates to individuals.</li> <li>City of Minneapolis does phone messaging</li> <li>City of Saint Paul sends emails in snow emergencies</li> </ul>	<ul style="list-style-type: none"> <li>Pilot project for providing e-mail alerts to major employers and government entities in the metro area.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT and other agencies are responsible to plan, design, operate and maintain the e-mail alerts notification system.</li> <li>Major employers are responsible for disseminating information to employees.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnect with 511 system and other automated telephone calling systems</li> </ul>	<ul style="list-style-type: none"> <li>Archive statistics of use to justify the system.</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 14	Expand traveler information coverage in Greater Minnesota	<ul style="list-style-type: none"> <li>• MnDOT and other agencies increase the information that is provided to travelers statewide on the 511 website and telephone information service.</li> <li>• MnDOT and other agencies enable increasing the coverage of its traffic flow map beyond the metro area by deploying sensors/detectors on additional freeway and major arterial segments and other state/county roads.</li> </ul>	<ul style="list-style-type: none"> <li>• Incidents, roadwork, road condition and weather related road information is available statewide on 511.</li> <li>• Congestion information is available statewide.</li> <li>• MnDOT RTMC, with supplemental information from Google data, provides a statewide traffic flow map indicating free flowing, slow or congested conditions.</li> <li>• Information on non-MnDOT roads has been entered into 511 if it has an impact on traffic.</li> </ul>	<ul style="list-style-type: none"> <li>• Expand the incident and congestion information that is available on roadways outside of the metro area.</li> <li>• Capture a higher percentage of incidents on CARS and 511.</li> <li>• Expand and explore enhancements on the use of maintenance vehicles and traveler vehicles as automated data sources.</li> <li>• Hire dedicated Greater Minnesota traveler information operators at RTMC.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate and maintain the 511 systems.</li> <li>• MnDOT and other agencies are responsible to plan, design, operate and maintain detectors and sensors.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between CARS, RTMC/SRCC and the 511 system.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 15	Make camera images available to travelers	<ul style="list-style-type: none"> <li>MnDOT and other agencies provide video monitoring camera images to travelers through the 511 website for pre-trip planning.</li> </ul>	<ul style="list-style-type: none"> <li>Camera images throughout the state are provided through the 511 website and RWIS website.</li> <li>Camera images are also made available on the 511 mobile app.</li> <li>Local media outlets present MnDOT camera images.</li> <li>Images from plow cameras are provided through the 511 website.</li> </ul>	<ul style="list-style-type: none"> <li>Install additional cameras in the Greater Minnesota and provide images to travelers.</li> <li>Camera images managed by cities and counties could be shared with the public and other agencies.</li> <li>Provide live streaming videos to travelers.</li> <li>Funding to switch from still images on the 511 website to streaming traffic camera videos.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT and other agencies are responsible to plan, design, operate and maintain video cameras and their interfaces with the 511 website.</li> <li>MnDOT is responsible to plan, design, operate and maintain the 511 website.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnects are required between central video camera servers receiving images and roadside equipment (video cameras).</li> <li>Interconnects are required between central servers and 511 website.</li> </ul>	<ul style="list-style-type: none"> <li>Archive camera images for future traveler analysis and road conditions.</li> </ul>	<ul style="list-style-type: none"> <li>TM01</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 16	Improve quality, consistency and thoroughness of traveler information	<ul style="list-style-type: none"> <li>• MnDOT and other agencies improve traveler information collection and processing practice.</li> <li>• MnDOT and other agencies improve the quality, consistency and thoroughness of traveler information provided to travelers.</li> </ul>	<ul style="list-style-type: none"> <li>• Incidents, roadwork, road condition and weather related road information is available statewide on 511.</li> <li>• Congestion information is available statewide.</li> <li>• Traveler information on the metro that originates from MnDOT is also available on third party websites.</li> <li>• MnDOT communicates with neighboring DOTs on potential incidents that may impact incoming and outgoing traffic.</li> </ul>	<ul style="list-style-type: none"> <li>• Implement uniform and unified data entry.</li> <li>• Implement data quality and consistency verification systems.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT and other agencies are responsible to collect and provide quality, consistent and thorough data.</li> <li>• MnDOT is responsible to plan, design, operate and maintain CARS, and to establish data consistency standards.</li> <li>• Each agency is responsible to implement data quality verification program/system.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between CARS and MnDOT and other agencies' traveler information collection systems.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• TI02</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 17	Determine travel time or traffic condition for major signalized arterials	<ul style="list-style-type: none"> <li>MnDOT coordinates with third part data services to include travel time or flow information for major signalized arterials on the traffic flow maps provided through 511.</li> </ul>	<ul style="list-style-type: none"> <li>Travel time is currently not provided for signalized arterials.</li> </ul>	<ul style="list-style-type: none"> <li>Test and implement methods to determine travel time information for signalized arterials.</li> <li>Research use of traveler information on signalized arterials.</li> <li>Use travel time data from third party services to improve arterial travel time determination.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT is responsible to plan, design, operate and maintain a travel time calculation/prediction system for arterials.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnects are required between roadside equipment and TMCs.</li> <li>Interconnects are required between TMCs and CARS/511 system.</li> </ul>	<ul style="list-style-type: none"> <li>Travel time information is archived for future analysis and planning efforts.</li> </ul>	
ATIS 18	Provide congestion information to travelers for seasonal or recreational traffic generators	<ul style="list-style-type: none"> <li>MnDOT and local agencies provide congestion information to travelers for seasonal or recreational traffic generators throughout Minnesota.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT currently provides statewide congestion information to travelers through 511.</li> </ul>	<ul style="list-style-type: none"> <li>Expand the 511 system to gather and disseminate congestion information for seasonal or recreational traffic generators.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT is responsible to plan, design, operate and maintain the 511 system in order to accommodate seasonal or recreational traffic information.</li> <li>MnDOT will coordinate with local agencies to collect and provide information to MnDOT.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnects are required between roadside equipment and TMCs.</li> <li>Interconnects are required between TMCs and CARS/511 system.</li> </ul>	<ul style="list-style-type: none"> <li>Seasonal and recreational traffic data is archived for future analysis and planning efforts.</li> </ul>	<ul style="list-style-type: none"> <li>TM06</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 19	Provide different alternatives to travelers for the most appropriate route/mode/time of travel	<ul style="list-style-type: none"> <li>• MnDOT and ISPs provide personalized traveler information to users to aid travelers in deciding the best route, mode, and/or time of travel.</li> <li>• MnDOT provides data feed to ISPs via 511 system.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT currently provides data feed via 511.</li> </ul>	<ul style="list-style-type: none"> <li>• Include information on transit and other modes of transportation in the data feed.</li> <li>• Implement personalized traveler information features in 511.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate, and maintain the 511 system.</li> <li>• ISPs are responsible to plan, design, operate, and maintain their systems.</li> <li>• Transit agencies are responsible to provide transit information to MnDOT.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between 511 system and ISPs/travelers.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• TI04</li> <li>• PT08</li> </ul>



ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 22	Include information on local roads in 511	<ul style="list-style-type: none"> <li>• Local agencies collect, process and share information on local roads with MnDOT.</li> <li>• MnDOT makes information on local roads available in 511.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT's 511 system currently includes traveler information for state-maintained roadways.</li> </ul>	<ul style="list-style-type: none"> <li>• Increase coverage of MnDOT 511 system to include local roads.</li> <li>• Expand coverage of the traffic flow map to additional roadways within the Metro area as they are instrumented.</li> <li>• Instrument local roads for automated data collection.</li> <li>• Establish real-time or near real-time data sharing between MnDOT and local agencies.</li> <li>• Local agencies collect, process, and share information on local roads with MnDOT.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate and maintain the 511 system to accommodate information on local roads.</li> <li>• MnDOT, in coordination with local agencies, is responsible for providing information on local roads.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between local agencies and MnDOT.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• TI02</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 23	Provide information on available public and private truck parking facilities	<ul style="list-style-type: none"> <li>• MnDOT provides rest area closure information to the 511 website and links to some other truck traveler information websites.</li> <li>• MnDOT provides truck parking availability information to fleet management, commercial vehicle operators, and private ISPs.</li> <li>• Commercial vehicle operators (truck drivers) obtain information from fleet management, or private ISPs.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT provides a website with an interactive map of safety rest areas and their amenities.</li> <li>• MnDOT is currently implementing a system to provide real-time truck parking availability information to commercial vehicle operators.</li> </ul>	<ul style="list-style-type: none"> <li>• Instrument truck parking areas at rest facility with cameras or sensors to gather parking availability information.</li> <li>• Provide information on available truck parking at rest facilities on the 511 website and other truck traveler information websites.</li> <li>• Provide truck parking availability information to fleet management, commercial vehicle operators, and private ISPs.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate and maintain the 511 system.</li> <li>• The North/West Passage states are responsible to plan, design, operate and maintain the North/West Passage website</li> <li>• Parking facility operators are responsible to plan, design, operate and maintain parking availability observation/detection systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between roadside equipment (cameras/sensors) and traveler information systems (websites).</li> <li>• Interconnects are also required between traveler information systems and fleet management/commercial vehicle operators/private ISPs.</li> </ul>	<ul style="list-style-type: none"> <li>• Utilization of truck parking facilities should be collected and archived.</li> </ul>	<ul style="list-style-type: none"> <li>• TI02</li> <li>• PM01</li> <li>• PM04</li> <li>• CVO09</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 24	Provide web traffic data	<ul style="list-style-type: none"> <li>• MnDOT and local agencies monitor and record the usage of traveler information websites by the public.</li> <li>• MnDOT and local agencies analyze the usage of the websites and identify trends and types of information frequently viewed by the public to gain a better understanding on the information needs by the public and to improve the web contents.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT operates and maintain the 511 website that provides road conditions, incident, congestion, closures, construction, and restrictions information on state-maintained roadways.</li> <li>• Many local agencies operates and maintain own websites to disseminate road conditions, construction, closures, special events, congestion, and incident information.</li> <li>• MnDOT and many local agencies track and analyze web traffic volumes to some extent.</li> </ul>	<ul style="list-style-type: none"> <li>• Gather detailed data on web traffic volume by types of information and events, time of day, day of week, seasons, etc.</li> <li>• Analyze web traffic data to gain a better understanding on public information needs.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT and local agencies are responsible to plan, design, implement, operation and maintain their own traveler information websites.</li> <li>• MnDOT and local agencies are responsible to collect and analyze traffic data on their websites.</li> </ul>	<ul style="list-style-type: none"> <li>• This service includes an interconnect between the MnDOT 511 website and MnDOT.</li> <li>• It also includes interconnect between local agencies and other traveler information websites.</li> </ul>	<ul style="list-style-type: none"> <li>• Web traffic and usage data.</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 26	Broadband access at rest area for customers, onsite staff and building energy management systems	<ul style="list-style-type: none"> <li>MnDOT provides broadband access to rest areas allowing travelers to access traveler information.</li> <li>MnDOT uses the broadband access to monitor and manage building energy management systems at rest areas.</li> </ul>	<ul style="list-style-type: none"> <li>Internet access is not currently provided at MnDOT rest areas.</li> <li>Electronic traveler information is not currently provided at rest areas.</li> </ul>	<ul style="list-style-type: none"> <li>Provide broadband internet access to rest areas throughout Minnesota.</li> <li>Connect energy management systems to internet access</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT is responsible to plan, design, operate and maintain the broadband internet connection at rest areas.</li> <li>Private internet service providers may assist with providing broadband internet access in some areas.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnects are required between 511 systems/other traveler information systems and travelers.</li> </ul>	<ul style="list-style-type: none"> <li>Log and track service usage to justify the services.</li> </ul>	

### Service Package TI02 - Personalized Traveler Information

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 01	Provide incident information on freeways and major arterials	See information under TI01.						
ATIS 04	Provide current and forecast road and weather condition information	See information under TI01.						

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 05	Provide information on roadway construction and maintenance activities	See information under TI01.						
ATIS 08	Provide information on seasonal road weight restrictions	See information under TI01.						
ATIS 09	Provide information on CVO permit restrictions	See information under TI01.						
ATIS 10	Operate a statewide web-based and telephone 511 system	See information under TI01.						
ATIS 16	Improve quality, consistency and thoroughness of traveler information	See information under TI01.						
ATIS 22	Include information on local roads in 511	See information under TI01.						

**Service Package TI03 - Dynamic Route Guidance**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 25	Provide turn-by-turn navigation using 511 app	<ul style="list-style-type: none"> <li>MnDOT provides turn-by-turn navigation guidance to motorists via the 511 app.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT's 511 app provides near real-time traveler information but does not have the turn-by-turn route guidance feature.</li> </ul>	<ul style="list-style-type: none"> <li>Enhance the 511 app to include turn-by-turn navigation guidance feature.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT is responsible to plan, design, operate and maintain the 511 system and app.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnects are required between CARS/511 systems and 511 app.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	TI04

**Service Package TI04 - Infrastructure-Provided Trip Planning and Route Guidance**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 19	Provide different alternatives to travelers for the most appropriate route/mode/time of travel	See information under TI01.						
ATIS 25	Provide turn-by-turn navigation using 511 app	See information under TI03.						

**Service Package TI05 - Travel Services Information and Reservation**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 20	Provide traveler service information for reservations and advanced payment for traveler services	<ul style="list-style-type: none"> <li>MnDOT, local agencies or third parties provide information on lodging, restaurants and service stations to travelers via various traveler information delivery systems.</li> <li>Travelers obtain service information for reservations and advanced payments through traveler information delivery systems.</li> </ul>	<ul style="list-style-type: none"> <li>The Minnesota Department of Commerce and Tourism maintains a website with lodging and attraction information for travelers. MnDOT 511 provides a link to this site.</li> <li>MnDOT maintains a website with maps and descriptions of the state's highway rest areas.</li> </ul>	<ul style="list-style-type: none"> <li>Provides links to ISPs that offer reservations and advanced payment for traveler services.</li> <li>Enhance traveler service information to include information on lodging, restaurants, and service stations.</li> <li>Include contact information on MnDOT 511 system for travel service information contacts.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT is responsible to plan, design, operate, and maintain the 511 system.</li> <li>Each agency is responsible to plan, design, operate, and maintain its own traveler information delivery system.</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	

**Service Package TI06 - Dynamic Ridesharing and Shared Use Transportation**

No needs or services under this service package were identified by stakeholders.

**Service Package TI07 - In Vehicle Signing**

No needs or services under this service package were identified by stakeholders.

**Service Package SU03 - Data Distribution<sup>1</sup>**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 02	Provide traveler information across state borders	See information under TI01.						
ATIS 12	Share/integrate public safety CAD data with CARS	<ul style="list-style-type: none"> <li>MnDOT CARS automatically incorporates data from the public safety agencies' CAD systems, increasing the timeliness and accuracy of information in CARS.</li> <li>General public uses 511 system to receive incident information.</li> </ul>	<ul style="list-style-type: none"> <li>MSP's CAD is integrated with MnDOT's CARS.</li> <li>Other public safety agencies' CAD systems and MnDOT's CARS systems currently operate independently of each other.</li> </ul>	<ul style="list-style-type: none"> <li>Continue Enhance the integration between CARS and MSP CAD system.</li> <li>Establish more frequent updates (such as every 30 seconds) than just every 5 minutes.</li> <li>Integrate more CAD systems with CARS beyond the state patrol.</li> </ul>	<ul style="list-style-type: none"> <li>MnDOT is responsible to plan, design, operate and maintain CARS</li> <li>MnDOT and each public safety agency are responsible to plan, design, operate, and maintain interfaces between its CAD systems and CARS.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnects are required between public safety CAD systems and CARS.</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	

<sup>1</sup> See Volume 11 – Support Service Package Area for the description of SU03 – Data Distribution.



ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATIS 21	Make real-time transportation operations data available to other transportation system operators (i.e. interagency data sharing)	<ul style="list-style-type: none"> <li>• MnDOT and local agencies collect real-time transportation operations data.</li> <li>• MnDOT and local agencies provides relevant real-time operations data to other transportation agencies upon request.</li> <li>• Transit vehicles collect real-time operations data and send to transit control center for dissemination to other agencies</li> </ul>	<ul style="list-style-type: none"> <li>• IRIS is a data distribution system used at the MnDOT RTMC from which data is shared with other agencies.</li> <li>• Third-party access to MnDOT CARS data is made available to outside vendors and universities</li> <li>• Camera feeds in District 4 are shared with other agencies.</li> <li>• MnDOT and Wisconsin DOT share control of DMS and camera images in Duluth, La Crosse and Metro regions.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide real-time transportation operations data outside the Twin Cities area to other transportation agencies.</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT is responsible to plan, design, operate, and maintain IRIS, RTMC, and CARS.</li> <li>• MnDOT and other transit/ transportation agencies are responsible to coordinate with each other to plan, design, operate and maintain interfaces necessary for real-time data sharing.</li> <li>• MnDOT and other transit/ transportation agencies are responsible to establish agreements for interagency data sharing.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects are required between RTMC and other TMCs.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	

## Appendix D: Traveler Information Service Packages and Descriptions

The descriptions of Traveler Information (TI) service packages are taken directly from the ARC-IT version 8.2.

### **TI01 Broadcast Traveler Information**

This service package provides a digital broadcast service that disseminates traveler information to all equipped travelers within range. It collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadcasts the information to travelers using technologies such as FM subcarrier, satellite radio, cellular data broadcasts, and Internet streaming technologies.

This service package also provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility service packages for connected vehicles. DSRC is used to deliver real-time traveler information including travel times, incident information, road conditions, and emergency traveler information to vehicles as they pass connected vehicle roadside equipment along their route. This service package provides public information that is available to all equipped vehicles in the vicinity of the roadside equipment.

### **TI02 Personalized Traveler Information**

This service package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information. Although the Internet is the predominate network used for traveler information dissemination, a range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications with the traveler. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal and web pages via smart phone, tablet, personal computer, and a variety of in-vehicle devices.

### **TI03 Dynamic Route Guidance**

This service package offers advanced route planning and guidance that is responsive to current conditions. The package augments a user's navigation system equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information, which is used by the user equipment to provide real-time route guidance that factors in current conditions.

### **TI04 Infrastructure-Provided Trip Planning and Route Guidance**

This service package offers the user trip planning and en-route guidance services. It generates a trip plan, including a multimodal route and associated service information (e.g., parking information), based on traveler preferences and constraints. Routes may be based on static information or reflect real time network conditions. Unlike TI03, where the user equipment determines the route, the route determination functions are performed by the center in this service package. The trip plan may be confirmed by the traveler and advanced payment and reservations for transit and alternate mode (e.g., airline, rail, and ferry) trip segments, and ancillary services are accepted and processed. The confirmed trip plan may include specific

routing information that can be supplied to the traveler as general directions or as turn-by-turn route guidance depending on the level of user equipment.

#### **TI05 Travel Services Information and Reservation**

This service package provides travel service information and reservation services to the traveler pre-trip and while en route. This includes information for tourist attractions, lodging, dining, service stations, parking, emergency services, and other services and businesses of interest to the traveler.

#### **TI06 Dynamic Ridesharing and Shared Use Transportation**

This service package addresses dynamic ridesharing/ride matching services to travelers and other forms of shared use transportation. Dynamic ridesharing allows travelers to arrange carpool trips through a personal device with a wireless connection to a ride matching system (e.g., a web-based application). It uses inputs from both passengers and drivers pre-trip, during the trip, and post-trip. These inputs are then translated into "optimal" pairings between passengers and drivers to provide both with a convenient route between their two origin and destination locations. After the trip, information is provided back to the service package to improve the user's experience for future trips.

The shared use aspect of the service package addresses three types of shared use that may be arranged using an internet connected personal device. In the first type, a traveler arranges for the temporary use of a vehicle. In the second type of shared use, a traveler arranges for a vehicle to pick them up at a specific location and take them to another location. The second type of shared use may be implemented as a ride matching or ridesharing service, including those provided by Uber and Lyft. The third type of shared use is a bikeshare capability.

#### **TI07 In-Vehicle Signage**

This service package augments regulatory, warning, and informational signs and signals by providing information directly to drivers through in-vehicle devices. The information provided would include static sign information (e.g., stop, curve warning, guide signs, service signs, and directional signs) and dynamic information (e.g., current signal states including highway intersection and highway-rail intersection status and local conditions warnings identified by local environmental sensors). This service package also includes the capability for maintenance and construction, emergency, and transit vehicles to transmit sign information to vehicles in the vicinity so that in vehicle signing can be used without fixed infrastructure in areas such as work zones, around incidents, and at bus stops.