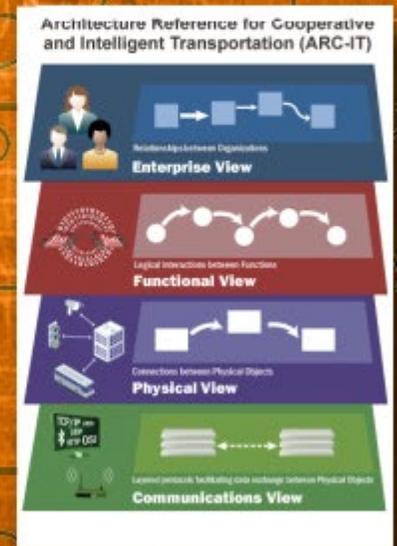
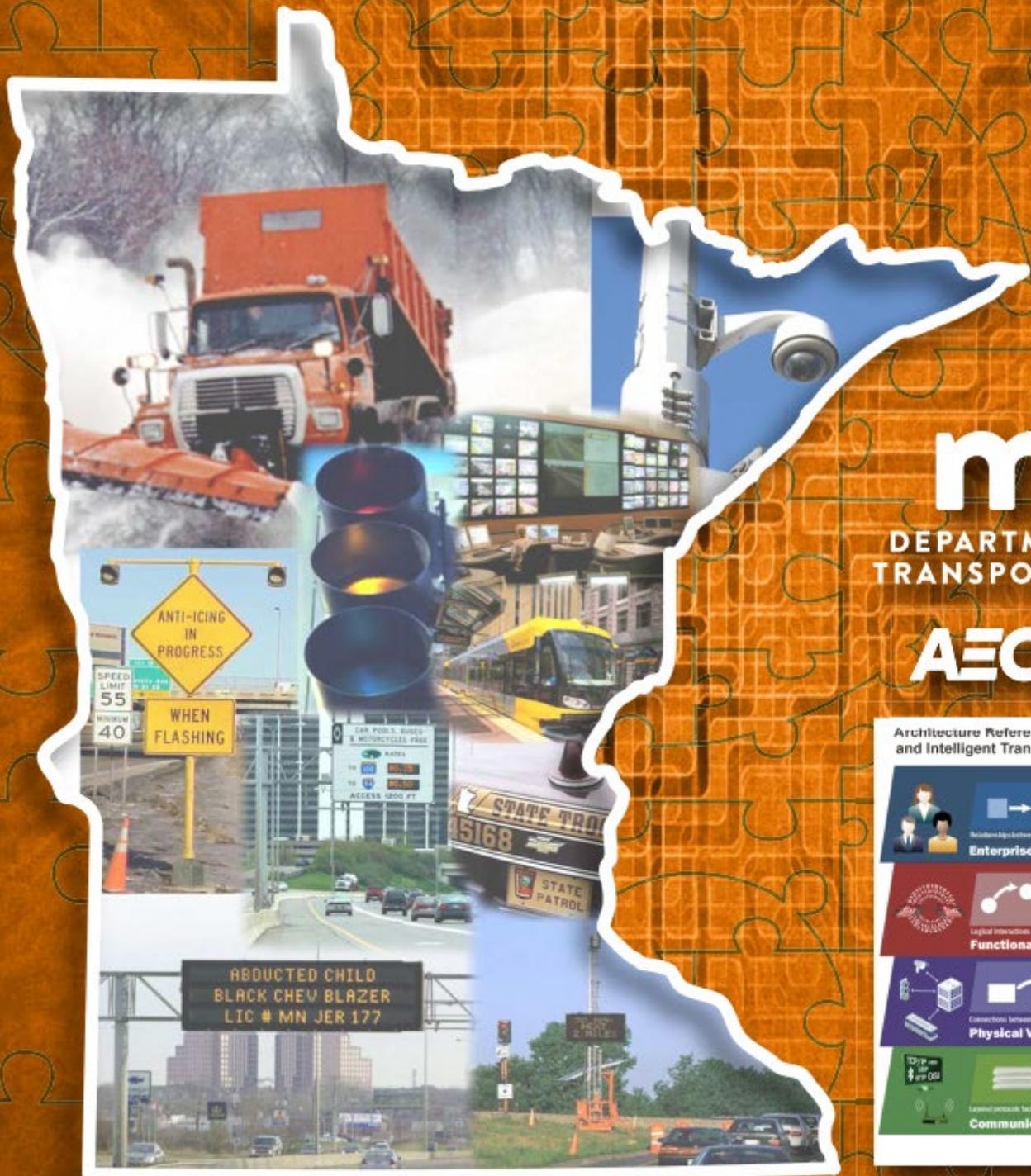


# Minnesota Statewide Regional ITS Architecture

Version 2018

Volume 4:  
Public Transportation Service Package Area



**Minnesota Statewide Regional ITS Architecture  
Version 2018**

**Volume 4: Public Transportation  
Service Package Area**



Prepared by

**AECOM**

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## ACRONYMS

ADA	Americans with Disabilities Act
APTS	Advanced Public Transportation System
ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVL	Automatic Vehicle Location
BRT	Bus Rapid Transit
CAD	Computer Aided Dispatch
CAT	Cities Area Transit (East Grand Forks)
CVO	Commercial Vehicle Operations
DARTS	Dakota Area Resources and Transportation for Seniors
DM	Data Management
DMS	Dynamic Message Sign
DOT	Department of Transportation
DTA	Duluth Transit Authority
EOC	Emergency Operations Center
EVP	Emergency Vehicle Preemption
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GIS	Geographic Information System
GPS	Global Positioning System
HOV	High-Occupancy Vehicle
ICS	Incident Command Structure
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
LCD	Liquid-Crystal Display
LED	Light-Emitting Diode
LOS	Level of Service
MAT	Metro Area Transit (Moorhead)
MC	Maintenance and Construction
MDT	Mobile Data Terminal
MnDOT	Minnesota Department of Transportation
MTC	Metropolitan Transit Commission (St. Cloud)
MVTA	Minnesota Valley Transit Authority
NIMS	National Incident Management System
PD	Police Department
PM	Parking Management
PS	Public Safety
PT	Public Transportation
RAD-IT	Regional Architecture Development for Intelligent Transportation
RTMC	Regional Transportation Management Center
ST	Sustainable Travel
SU	Support
TI	Traveler Information
TM	Traffic Management
TMC	Transportation/Traffic Management Center
TSP	Transit Signal Priority
U of M	University of Minnesota
VMT	Vehicle-Miles Traveled

VS            Vehicle Safety  
WX            Weather

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# 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 Bundle 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 needs.

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 4 – Public Transportation Service Package Area

Public Transportation (PT) Service Package Area is intended to enhance public transportation choices, safety and efficiency with a goal towards increased transit ridership.

Development of Volume 4 – PT Service Package Area entailed the Project Consultant working 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 4 summarizes the findings of data collection and analysis activities conducted to support development of the PT Service Package Area. Volume 4 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 Public Transportation Systems** provides a brief overview of statewide PT system deployments with a detailed listing of existing and planned systems in *Appendix A*.
- **Section 3: Development Objectives** provides an overview of the Minnesota ITS Development Objectives specific to PT. 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 APTS 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 PT Service Package Area and those in other Service Package Areas.
- **Section 6: PT Research and Development Needs** describes general research that can be performed to help implement the identified services.

## 2. Identification of Existing Public Transportation Systems

PT systems are utilized throughout Minnesota to assist in transit operations and enhance services to transit users. Using those systems has improved schedule adherence, transit security, backroom operations, and availability of information about modal choices.

PT systems can be used to assist in the operations, security, and fleet management, of a transit system as well as coordinate services provided by different transit providers. Transit users can access schedule information through telephone systems, Internet sites or electronic displays, quickly pay with electronic payment cards, and easily transfer to another transit vehicle or mode of travel. PT systems also allow transit vehicles to operate more efficiently and stay on schedule through implementations such as scheduling software, bus signal priority, computer-aided dispatch (CAD), automated vehicle location (AVL), and mobile data terminals (MDT).

Operations managers can use services such as automated passenger counting, vehicle tracking, fare management, and dispatch and response logs to enhance operational planning and make back-office activities more efficient. Security enhancements such as transit platform monitoring, in-vehicle surveillance and driver alert systems are used to improve the safety of passengers as well as vehicle operators.

An inventory of existing and planned PT systems (e.g. control centers, vehicles, 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 stakeholder that are involved with their operations and management, and their current deployment. The PT 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. PT solutions involve services that improve the schedule adherence, safety, and operations of the transit system as well as the safety and experience of the transit user.

PT systems are intended to enhance public transportation choices, safety and efficiency with a goal towards increased transit ridership. The vision for PT systems is that it will enable travelers in Minnesota to have reliable public transportation choices for a safe, efficient and satisfying trip. The Minnesota ITS Development Objectives in Table 1, specific to PT, are steps to determine and/or measure whether or not PT goals are being achieved. A complete list of Minnesota ITS Development Objectives is included in *Appendix B*.

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

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

##### A-1 Reduce crash frequency

- A-1-06 Reduce number of crashes involving large trucks and buses
- A-1-15 Reduce number of crashes involving pedestrians and non-motorized vehicles

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

- A-2-06 Reduce number of fatalities involving large trucks and buses
- A-2-08 Reduce number of transit fatalities
- A-2-16 Reduce number of fatalities involving pedestrians and non-motorized vehicles
- A-2-27 Reduce number of injuries involving large trucks and buses
- A-2-29 Reduce number of transit injuries
- A-2-37 Reduce number of injuries involving pedestrians and non-motorized vehicles

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

##### B-2 Increase average vehicle passenger occupancy and facility throughput

- 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-2-14 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-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-2 Improve travel time reliability**

- 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-2-03 Increase the miles of bus-only shoulder lanes in the metro area

**C-3 Increase choice of travel modes**

- B-2-14 Create a transportation access guide, which provides concise directions to reach destinations by alternative modes (transit, walking, bike, etc.)
- 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-3-14 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
- C-3-17 Increase annual transit ridership reported by urbanized area transit providers
- C-3-18 Increase annual transit ridership reported by rural area transit providers

**C-4 Reduce stress caused by transportation**

- C-3-15 Increase the number of transit routes with information being provided by ATIS
- C-3-16 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-4-04 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-4-07 Increase the number of parking facilities with coordinated availability information

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

##### D-1 Enhance traveler security

- 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-1-07 Increase the number of critical sites with security monitoring
- 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

- 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-1-06 Increase the percent of major and minor arterials are equipped with and operating with video monitoring cameras
- D-1-08 Increase the number of critical sites with security monitoring
- D-1-10 Increase the number of critical sites with hardened security enhancements

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

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

- 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-3 Improve travel time reliability for freight, transit and businesses

- 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-4 Increase agency efficiency

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

## **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-2 Reduce negative impacts of the transportation system on communities

- B-2-14 Create a transportation access guide, which provides concise directions to reach destinations by alternative modes (transit, walking, bike, etc.)
- C-3-17 Increase annual transit ridership

## **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 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 2014 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.

A workshop with PT stakeholders was conducted in November 2017. The purpose of the workshop 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 Needs and associated PT 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. PT 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).

ID	Need/Potential Solution	Priority Point <sup>a</sup>	ITS Development Objective	ARC-IT Reference <sup>b</sup>
APTS 01	Provide transit route and schedule information	4.75	B-2-01, B-2-02, B-2-03, B-2-04, C-3-04, C-3-05, C-3-06, C-3-07, C-3-14, C-3-16, C-3-17	PT08
APTS 02	Provide real-time transit vehicle arrival/departure and load information	4.63	B-2-01, B-2-02, B-2-03, B-2-04, C-3-04, C-3-05, C-3-06, C-3-07, C-3-14, C-3-16, C-3-17	PT01, PT08
APTS 03	Provide simple and flexible fare payment systems	4.88	B-2-16, B-2-17	PT04
APTS 04	Coordinate timed transfers between route segments, providers & modes	4.13	B-2-01, B-2-08, C-3-10	PT14, PT17
APTS 05	Manage transit assets, fleet and personnel operations	4.00	B-2-15, E-4-01, E-4-04, E-4-05, E-4-06, E-4-07	PT01, PT02, PT06
APTS 06	Provide surveillance and enforcement on transit vehicles and transit facilities	4.25	D-1-02, D-1-03, D-1-04, D-1-07, D-1-08, D-1-09	PT05
APTS 07	Provide electronic fare payment card	4.00	B-2-16, B-2-17	PT04
APTS 08	Support vehicle diagnostics and maintenance	3.63	E-4-05, E-4-06	PT06, SU11
APTS 09	Measure historical transit route performance	3.50	B-2-05, B-2-06, B-2-07, B-2-08, B-2-09, B-2-10, G-1-01, G-1-02, G-1-03	PT01, DM01, DM02
APTS 10	Provide on-board automated annunciators and information displays	4.00	C-3-14, C-3-15	PT08
APTS 11	Provide information to the ADA community	4.38	C-3-14, C-3-15	PT08, PT16
APTS 12	Optimize garage operations	3.50	E-4-04, E-4-05, E-4-06	PT06
APTS 13	Provide collision avoidance assistance for transit vehicles	3.23	A-1-06, A-2-06, A-2-08, A-2-27, A-2-29	PT11, PT12, PT13, VS01, VS12, VS13
APTS 14	Provide security at park and ride lots	3.38	D-1-02, D-1-03, D-1-04	PT05
APTS 15	Optimize schedule efficiency and schedule coordination	3.38	B-2-15, E-4-01, E-4-07	PT02, PT14, PT17

ID	Need/Potential Solution	Priority Point <sup>a</sup>	ITS Development Objective	ARC-IT Reference <sup>b</sup>
APTS 16	Provide information on ridesharing opportunities	3.00	B-2-11, B-2-12, B-2-19, B-2-20, B-2-21, B-2-22, B-2-23, B-2-23, B-2-25, C-3-02, C-3-03	PT08, TI06
APTS 17	Coordinate transit vehicle movements with traffic control devices	3.44	B-2-15, C-3-08, E-1-01, E-1-02	PT09
APTS 18	Install pedestrian and bike detection/warning system to reduce incidents	3.69	A-1-06, A-1-15, A-2-06, A-2-08, A-2-16, A-2-27, A-2-29, A-2-37	PT11, VS12
APTS 19	Provide queue jumping	2.75	B-2-15, B-2-18, C-3-08, E-1-01, E-1-02	PT09
APTS 20	Provide real-time transfer information to travelers en route	3.63	B-2-01, B-2-08, C-3-14	PT08
APTS 21	Provide on-line reservation system for demand-responsive transit	4.57	B-2-01, B-2-06, B-2-07, B-2-08, B-2-09, B-2-10	PT03
APTS 22	IT support consistently with mission critical operations systems	4.38	B-2-01, B-2-06, B-2-07	PT06
APTS 23	Provide multi-communication mode hub/ infrastructure on buses to transmit/ receive high speed data in the most efficient and cost-effective manner	3.71	B-2-01, B-2-06, B-2-07	PT06
APTS 24	Metro Transit Police records integration with other PD's	4.00	B-1-16, G-1-01, G-1-02, G-1-03	DM01
APTS 25	Wireless access for transit customers	3.63	C-3-04, C-3-05	PT08
APTS 26	Additional GIS systems integration	3.25	G-1-01, G-1-02, G-1-03	PT02, PT03, DM01
APTS 27	Integrated and coordinated GIS and transit AVL system for the region	5.00 <sup>c</sup>	B-2-15, C-3-04, C-3-05, C-3-06, C-3-07	PT01
APTS 28	Develop integration among fixed route, demand-responsive transit services and other modes	4.67 <sup>c</sup>	C-3-04, C-3-05, C-3-06, C-3-07	PT02, PT03, PT14, PT17
APTS 29	Improve transit service quality, including speed, reliability, convenience and safety	3.67 <sup>c</sup>	A-2-09, A-2-29, B-2-01, B-2-10, B-2-15, B-2-18, C-3-08, C-3-14, C-4-02, D-1-01, D-1-02, D-1-03, D-1-04, D-1-05, E-1-02	PT02, PT03, PT05, PT08, PT09, PT14, PT17
APTS 30	Provide tools for the public to report transit-related public safety and personal security concerns	4.33 <sup>c</sup>	D-1-02, D-1-03, D-1-04, D-1-05	PT05
APTS 31	Improve access to real-time and historical transit data and improve quality of data	4.33 <sup>c</sup>	E-4-01, G-1-01, G-1-02, G-1-03	DM01, DM02
APTS 32	Create connections with other public agencies and third parties to share real-time and historical transit data both ways	2.67 <sup>c</sup>	C-3-10, G-1-01, G-1-02	SU03, DM01, DM02
APTS 33	Improve seamless customer services across all modes	4.33 <sup>c</sup>	B-2-14, B-2-16, B-2-17, C-3-12, C-3-13, X-3-14	PT08, PT14, PT17

ID	Need/Potential Solution	Priority Point <sup>a</sup>	ITS Development Objective	ARC-IT Reference <sup>b</sup>
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	TI04, PT08
ATMS30	Provide simple and integrated electronic payment systems	1.25	B-2-16, C-4-03, C-4-06	TM10, PM03, PT04, PT18

## 5. Detail of PT Needs and Services

A detailed description of each PT 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 responsibility of involving 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 APTS Service Package Area and those in other Service Package Area.

## 6. PT Research and Development Needs

In order to fill gaps and meet the needs for technology advancement in PT 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 PT are as follows:

### Communications

- Analyze technologies and policies to transmit and record real-time operations data
- Research, develop, and test new methods to integrate existing systems to gain operational efficiencies and leverage agency investment in technology systems

### Data

- Enhance route performance analysis tools
- Refine/enhance transit scheduling software
- Enhance transit archived data search tools
- Test coordination of different agency scheduling software for mixed mode/provider schedule coordination
- Test use of transit vehicles as traffic probes

### Operations

- Test smart/electronic fare cards
- Enhance carpool rideshare finding systems
- Test transit signal priority technologies and systems
- Develop bus stop occupancy alert system for drivers
- Develop, test and enhance mobile tickets
- Develop and test fare media and fare payment integration with other transportation modes
- Develop and test open fare card systems and account-based fare card systems for transit and other modes

### Maintenance

- Enhance vehicle performance monitoring/diagnostic equipment
- Test in-garage transit vehicle bus finder system

### Transit Information

- Enhance trip planning systems
- Test transit information distribution to mobile devices
- Enhance interactive transit information systems
- Develop and test next bus arrival time systems
- Test bus arrival announcement systems at bus stops
- Test traveler information distribution methods for ADA and elderly communities
- Develop/enhance on-line transit reservation systems
- Develop and test onboard customer information systems

### Safety

- Test collision avoidance systems
- Test pedestrian warning systems
- Test lane departure warning/shoulder driving assistance systems

## Security

- Enhance automated surveillance monitoring/alert systems

## Appendix A: Existing/Planned PT Elements

Element	Service Package	Description	Stakeholder	Status
Commuter Rail Operations Center	PT02, PT04, PT05, PT14, PT17	This element represents the Northstar Commuter Rail operations center that operates and maintains commuter rail vehicles between downtown Minneapolis and Big Lake. Commuter rail vehicle maintenance facility is located in Big Lake. Stations are located in Minneapolis, Fridley, Coon Rapids, Anoka, Elk River, and Big Lake. Future plans are to expand the commuter rail line northwest to downtown Saint Cloud and the VA Medical Center.	Metro Transit, Northstar Corridor Development Authority	Existing
Commuter Rail Vehicle Maintenance Facility	PT06, SU11	This element represents the Northstar Commuter Rail vehicle maintenance facility located in Big Lake.	Metro Transit, Northstar Corridor Development Authority	Existing
Intercity Transit Management Centers	PT02, PT04	This element represents transit management centers that operate intercity fixed routes traveling long distances. These centers include Greyhound and Jefferson Lines buses traveling throughout the state.	Intercity Transit Providers	Existing
Light Rail Operations Center	PT02, PT05, PT06, PT09, PT17	This element represents the Metro Transit light rail transit management center. This center dispatches and maintains all light rail transit vehicles running between downtown Minneapolis and the Mall of America (Blue Line) and along University Avenue between Minneapolis and Saint Paul (Green Line). Other light rail transit lines connecting suburbs with Minneapolis and Saint Paul are in planning stages.	Metro Transit	Existing

Element	Service Package	Description	Stakeholder	Status
Local Transit Management Centers	PT01, PT02, PT03, PT04, PT05, PT06, PT07, PT08, PT09, PT14, PT17	<p>This element represents local transit management centers operating outside of the Twin Cities metropolitan area that operate fixed route and demand responsive public transit services. These centers include the St. Cloud Metropolitan Transit Commission (MTC), Duluth Transit Authority (DTA), City of Rochester Public Transit, Metro Area Transit (MAT - serving Moorhead), Cities Area Transit (CAT - serving East Grand Forks), and various county and city-level transit management centers. St. Cloud MTC uses ITS applications such as transit signal priority (TSP), electronic fare collection, on-board monitoring systems, and automated transit fleet management system. DTA disseminates real-time bus arrival information at bus stops, via the internet, and via on-board annunciators. DTA manages electronic fare collection with smart “touch” cards that are integrated with student ID cards with 4 colleges – University of Minnesota Duluth, Lake Superior College, College of St Scholastica and University of Wisconsin Superior. TSP has been implemented at 23 signals. DTA has TSP equipment on all its buses. DTA also operates monitoring systems on-board all buses and at transit centers/garages. City of Rochester manages electronic fare collection and plans to operate TSP at all signalized intersections that serve emergency vehicles with traffic signal preemption within the City. MAT currently operates electronic fare collection and plans to operate TSP at intersections where traffic signals are operated by MnDOT. CAT currently operates TSP at intersections where traffic signals are operated by MnDOT. Various other counties and cities throughout the state are in the process of deploying AVL equipment.</p>	Local Transit Providers	Existing

Element	Service Package	Description	Stakeholder	Status
Metro Area Transit Management Centers	PT01, PT02, PT03, PT04, PT05, PT06, PT07, PT08, PT09, PT14, PT17, SU03	This element represents transit management centers operating within the Twin Cities metropolitan area that operate fixed route and demand responsive public transit services. This includes the Metro Transit Control Center and Suburban Transit Provider Operations Centers, independent of Metro Transit, that connect outer-ring metro-area suburbs with Minneapolis and St. Paul metro areas. Metro Transit Control Center utilizes Global Position System (GPS) technology to identify the location of all transit vehicles and also uses an 800-megahertz regional radio system, which allows Metro Transit to interact with police and fire departments and emergency response teams. Metro Transit also utilizes an automated transit fleet maintenance system (TxBase). Within the metro area, door-to-door demand response transit service is provided by Metro Mobility (serving Minneapolis, St. Paul and many surrounding suburbs), Anoka County Traveler (serving Anoka County), DARTS (serving Dakota County), Scott County (Scott County) and H.S.I. (serving Washington County). Transit fare coordination exists between Metro Transit and all Suburban Transit Providers. As a suburban transit provider, Minnesota Valley Transit Authority plans to implement Bus Rapid Transit components, such as transit signal priority and transit kiosks at transit stations along the Cedar Avenue/I-35W Corridor. Other Suburban Transit Providers include Maple Grove Transit, Southwest Metro Transit Commission, Prior Lake Laker Lines, Plymouth Transit, and Scott County Transit.	Metro Area Transit Providers	Existing
Park-and-Ride Parking Information System Roadside Equipment	PM02	Real-time information on availability of parking spaces at transit park-and-ride facilities is provided to drivers via electronic message signs at selected park-and-ride locations in the Twin Cities metro area.	Metro Transit	Existing

Element	Service Package	Description	Stakeholder	Status
Real-Time Bus Arrival Time Display Roadside Equipment	PT08	Real-time information on bus and light rail arrival/departure times is provided to passengers via electronic message signs at bus stops and light rail stations in the Twin Cities metro area. Signs are installed at key decision points for drivers along arterial roads and freeways prior to entrances to park-and-ride facilities. Commuter rail arrival/departure times could also be displayed to travelers in the future. DTA has 25 OnStreet signs installed in various locations for passenger amenities as well as a mobile solution for real time departure and bus location information.	Metro Transit, Local Transit Providers	Existing
Real-Time Transit Travel Time Display Roadside Equipment	PT08, TM06	Real-time information on transit travel times as compared passenger-vehicle travel times is displayed to passengers via dynamic message signs prior to arriving at selected park-and-ride locations in the Twin Cities metro area.	MnDOT, Metro Transit	Existing
Traffic Signal Roadside Equipment	PT09	This element represents traffic signals on all Minnesota roads and highways that are controlled by Traffic Signal Central Control and monitored by Traffic Signal Central Monitoring. Transit Signal Priority (TSP) capability has been implemented in the Twin Cities metro area for Metro Transit.	MnDOT, Local Agencies	Existing
Transit Center and Station Surveillance System Roadside Equipment	PT05	These systems represent surveillance and security monitoring at transit centers, garages, stations, and park and ride lots. The systems have been implemented at centers and garages for the Saint Cloud Metropolitan Transit Commission, Duluth Transit Authority, and Metro Transit. Park and ride surveillance system and BRT/light rail boarding area surveillance systems are deployed by Metro Transit.	Metro Area Transit Providers, Local Transit Providers	Existing
Transit Information Telephone Systems	PT08	This element represents telephone systems that allows users to utilize a touchtone phone to access transit schedule information. Metro Transit currently operates a phone system that gives transit related information such as routes, schedule, State Fair transit information, and Snow Reroute information when applicable. It provides real-time information for trips departing in the next 20 minutes. It also provides visually impaired customers with equal access to schedules.	Metro Transit	Existing

Element	Service Package	Description	Stakeholder	Status
Transit Information Websites	PT08, TI01, TI05, TI06	This element represents websites that provide general route and schedule information to travelers. Metro Transit, DTA, and Twin Cities Area Transit websites support transit trip planner functions. Metro Transit website also provides real-time bus arrival information and supports trip planning and dynamic ridesharing functions. DARTS has an on-line ride reservation request system. DTA has a real-time bus arrival information section, as well as bus location and departure in real-time. DTA has approved a GTFS-RT solution and plan to implement the solution by 2018.	Metro Area Transit Providers, Local Transit Providers	Existing
Transit Kiosks	PT04, PT08	This element represents transit kiosks that manage electronic fare payment and provide real-time stop arrival notifications. Kiosks are currently in operation along the Metro Transit Light Rail lines. Kiosks are also deployed as part of the Minnesota Valley Transit Authority Bus Rapid Transit project along Cedar Avenue and I-35W and the A Line route on Snelling Avenue. DTA has ticket vending machines (TVM) for fare purchase and recharge.	Metro Area Transit Providers, Local Transit Providers	Existing

Element	Service Package	Description	Stakeholder	Status
Transit Vehicle Equipment	PT01, PT02, PT03, PT04, PT05, PT06, PT07, PT08, PT09, PT11, PT12, PT13, PT16, VS01, VS12, SU01, SU08, SU11	<p>This element represents transit vehicles and on-board ITS equipment operated by transit service providers. On-board ITS equipment may include AVL, MDT, radio communications, TSP, passenger counter, electronic fare collection equipment, customer information systems, surveillance and security monitoring devices, and traveler information annunciation. TSP exists on vehicles serving St. Cloud and East Grand Forks. TSP is planned for vehicles serving Minneapolis, Rochester, Duluth, and Moorhead. Transit vehicles for Metro Transit, MTC, and DTA are equipped with on-board surveillance cameras. Transit vehicles for Metro Transit, MTC, and DTA have Automated Vehicle Location (AVL) devices installed. Transit vehicles for Metro Transit, MTC, DTA, MAT, CAT, and Rochester support electronic fare collection devices. Transit vehicles for Metro Transit and DTA support automated passenger counting. Light Rail transit vehicles support automated next stop annunciation. MVTA and Metro Transit plan to deploy transit vehicle lateral and longitudinal vehicle safety warning systems as well as advanced vehicle lateral control for shoulder-running buses to improve transit travel safety. Future plans include installation of pedestrian and bicyclist detection/warning systems to provide warnings to transit operators.</p>	Metro Area Transit Providers, Local Transit Providers, Intercity Transit Providers, NCDA	Existing
Transit Vehicle Maintenance Facilities	PT06, SU11	<p>This element represents maintenance facilities for transit vehicles (including buses for fixed-route, BRT and demand-responsive services, and LRT vehicles). These facilities support transit maintenance scheduling and monitoring. On-board condition sensors monitor system status and transmit critical status information to these maintenance facilities. The maintenance facilities process the data and schedule preventative and corrective maintenance. The maintenance facilities may collect vehicle diagnostic information from vehicles and provide service options for vehicle drivers.</p>	Metro Area Transit Providers, Local Transit Providers, Intercity Transit Providers	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 PT01-Transit Vehicle Tracking

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 02	Provide real-time transit vehicle arrival/departure and load information	<ul style="list-style-type: none"> <li>Transit agencies provide real-time vehicle arrival/departure and load information to customers via travel information systems to assist with their travel decisions.</li> <li>Customers use real-time arrival/departure and load information to make mode and route choices.</li> <li>Third parties (e.g. Google) also provide real-time arrival/departure information to customers.</li> </ul>	<ul style="list-style-type: none"> <li>Metro Transit provides real-time information on LED signs and LCD monitors at more than 70 locations. Information is also provided via phone, internet, and mobile phone text as well as through the NexTrip.</li> <li>Metro Transit also provides arrival information for the LRT system.</li> <li>DTA provides real-time arrival information at selected locations with dynamic message signs. More locations will be added in the coming years.</li> </ul>	<ul style="list-style-type: none"> <li>Expand real-time transit arrival time and transit travel-time information.</li> <li>Integrate Metro Transit CAD/AVL system and RTMC to improve data accuracy and share data usage.</li> <li>Expand the capabilities of providing real-time transit information via mobile devices.</li> <li>Make information systems more interactive and customer-driven.</li> <li>Display real-time information consistently between agencies and systems.</li> <li>Integrate real-time transit information into a Transit Trip Planning System.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to plan, design, construct, operate, maintain and evaluate their information systems.</li> </ul>	<ul style="list-style-type: none"> <li>Real-time vehicle arrival systems include interconnects between in-vehicle GPS/AVL equipment and transit management centers.</li> <li>Interconnects between transit management centers and traveler information systems.</li> </ul>	<ul style="list-style-type: none"> <li>Vehicle travel time and schedule adherence data should be archived for performance evaluation and analysis.</li> </ul>	<ul style="list-style-type: none"> <li>PT08</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 02 (continued)	Provide real-time transit vehicle arrival/ departure and load information (continued from previous page)	<ul style="list-style-type: none"> <li>• (See previous page)</li> </ul>	<ul style="list-style-type: none"> <li>• (See previous page)</li> </ul>	<ul style="list-style-type: none"> <li>• Display real-time transit arrival/ departure information via DMS, web service and mobile applications.</li> <li>• Provide real-time information of transit transfer connections and connections to other modes on board of transit vehicles.</li> <li>• Address data latency issues with real-time information.</li> <li>• Collect and provide bus load information in real-time.</li> <li>• Collect bike rack and wheelchair load information.</li> <li>• Assess current systems and improve accuracy of predictions.</li> </ul>	<ul style="list-style-type: none"> <li>• (See previous page)</li> </ul>	<ul style="list-style-type: none"> <li>• (See previous page)</li> </ul>	<ul style="list-style-type: none"> <li>• (See previous page)</li> </ul>	<ul style="list-style-type: none"> <li>• (See previous page)</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 05	Manage transit fleet and personnel operations	<ul style="list-style-type: none"> <li>Transit agencies monitor vehicle locations to manage operations and schedule adherence and to optimize future operations.</li> </ul>	<ul style="list-style-type: none"> <li>Most transit agencies use automated vehicle location (AVL) systems on transit fleet vehicles and computer aided dispatch (CAD) to manage resources.</li> </ul>	<ul style="list-style-type: none"> <li>Expand AVL deployments.</li> <li>Integrate transit resources and/or information between agencies.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to plan, design, construct, operate and maintain their AVL systems.</li> </ul>	<ul style="list-style-type: none"> <li>AVL systems include interconnects between in-vehicle equipment, transit operational devices, and transit management centers.</li> </ul>	<ul style="list-style-type: none"> <li>AVL data is archived for future analysis to improve operations.</li> </ul>	<ul style="list-style-type: none"> <li>PT02</li> <li>PT06</li> </ul>
APTS 09	Measure historical transit route performance	<ul style="list-style-type: none"> <li>Transit agencies measure and analyze route performance to identify areas to enhance service and improve operations.</li> </ul>	<ul style="list-style-type: none"> <li>Many metro area and local transit agencies already track route performance and use in analysis of transit operations.</li> </ul>	<ul style="list-style-type: none"> <li>Refine data analysis tools to evaluate route performance based on archived data.</li> <li>Refine tools to manage archived transit performance data.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to gather, manage, archive, and analyze route performance for their system.</li> </ul>	<ul style="list-style-type: none"> <li>This service includes interconnects between in-vehicle equipment and transit management centers.</li> <li>Interconnects between transit management centers and transit data archives.</li> </ul>	<ul style="list-style-type: none"> <li>Key measures of route performance have already been archived for future analysis and comparison.</li> </ul>	<ul style="list-style-type: none"> <li>DM01</li> <li>DM02</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 27	Integrated and coordinated GIS and transit AVL system for the region	<ul style="list-style-type: none"> <li>Transit agencies coordinate the deployment of GIS systems and AVL systems to ensure compatibility and interoperability.</li> <li>Transit agencies integrated GIS and AVL systems to allow for seamless information sharing.</li> </ul>	<ul style="list-style-type: none"> <li>Many transit agencies use AVL systems and CAD to manage resources and improve operations.</li> <li>Many transit agencies integrated AVL systems with GIS.</li> <li>Most transit agencies in the Metro Area have a common AVL system that allows for seamless data sharing.</li> </ul>	<ul style="list-style-type: none"> <li>Integration and coordination of different AVL and CAD systems used by different transit agencies.</li> <li>Display real-time information consistently between agencies and systems.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to plan, design, deploy, operate and maintain their own GIS and AVL systems.</li> <li>Transit agencies are responsible to coordinate the deployment and integration of AVL and GIS systems.</li> </ul>	<ul style="list-style-type: none"> <li>This service includes interconnects between transit management centers and other transit management centers.</li> </ul>	<ul style="list-style-type: none"> <li>AVL data is archived for future analysis to improve operations.</li> </ul>	

**Service Package PT02-Transit Fixed-Route Operations**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 05	Manage transit fleet and personnel operations	See information under PT01.						

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 15	Optimize schedule efficiency and schedule coordination	<ul style="list-style-type: none"> <li>Transit agencies track route performance and analyze schedule efficiency.</li> <li>Transit agencies use performance analysis results and scheduling software to improve schedule efficiency and coordination to provide better service at a lower cost.</li> <li>Transit agencies optimize schedule coordination to improve connection protection.</li> </ul>	<ul style="list-style-type: none"> <li>Many agencies already use scheduling software to improve operations efficiency and connection protection.</li> <li>Other services that support schedule adherence also have a secondary effect of improving schedule efficiency.</li> </ul>	<ul style="list-style-type: none"> <li>Enhance scheduling software.</li> <li>Coordinate implementation of related services such as TR02 – provide real-time transit vehicle arrival/departure information, TR04 – coordinate time transfer, TR09 – measure historical route performance, and TR17 – coordinate transit vehicle movements with traffic control devices.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to plan, design, construct, integrate, operate and maintain their systems to optimize schedules.</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling optimization systems includes interconnects between historic route databases and scheduling software systems.</li> </ul>	<ul style="list-style-type: none"> <li>None. This service uses key historic travel information already archived.</li> </ul>	<ul style="list-style-type: none"> <li>PT14</li> <li>PT17</li> </ul>
APTS 26	Additional GIS systems integration	<ul style="list-style-type: none"> <li>Transit police and transit agencies use GIS systems for collecting incident data and performing incident investigation.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies use GIS for operations and management.</li> <li>Transit police uses GIS to an extent for incident data collection.</li> </ul>	<ul style="list-style-type: none"> <li>Integrate transit agencies GIS systems with city/county law enforcement systems for enhanced data collection and investigation capabilities.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to coordinate with law enforcement agencies and to plan, procure, integrate, operate and maintain their systems.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>Transit service data and incident data are already archived.</li> </ul>	<ul style="list-style-type: none"> <li>PT03</li> <li>DM01</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 28	Develop integration among fixed route, demand-responsive transit services and other modes	<ul style="list-style-type: none"> <li>Transit agencies coordinate internally and with other transit agencies to develop and integrate fixed route and demand response transit services and other modes to improve transit service coordination and increase traveler convenience.</li> </ul>	<ul style="list-style-type: none"> <li>Many transit agencies use AVL systems and CAD to manage resources and improve operations efficiency.</li> </ul>	<ul style="list-style-type: none"> <li>Coordinate and integrate fix route and demand-responsive services within an agency and a region.</li> <li>Coordinate transit services with other modes.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to develop plans and implement integrated and coordinated transit services.</li> </ul>	<ul style="list-style-type: none"> <li>This service includes interconnects between transit management centers and other transit management centers</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>PT03</li> <li>PT14</li> <li>PT17</li> </ul>
APTS 29	Improve transit service quality, including speed, reliability, convenience and safety	<ul style="list-style-type: none"> <li>Transit agencies uses a variety of ITS technology to improve traveler information delivery and accuracy, fleet management, service quality and reliability, and safety and security of transit users and operators.</li> </ul>	<ul style="list-style-type: none"> <li>Many transit agencies implemented various transit customer information systems, fleet management systems, vehicle systems, control and operations systems, and safety and security systems to improve service quality, reliability, convenience and safety.</li> </ul>	<ul style="list-style-type: none"> <li>Expand the capabilities of providing real-time transit information.</li> <li>Integrate real-time transit information into Trip Planning Systems.</li> <li>Expand TSP deployment.</li> <li>Expand transit safety and security systems.</li> <li>Coordinate with traffic agencies to improve transit travel speed.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to implement systems and operations to improve transit services.</li> </ul>	<ul style="list-style-type: none"> <li>This service includes interconnects between transit management centers and various on-board and roadside equipment/ systems.</li> <li>This service also includes interconnects between transit vehicles and traffic signal roadside equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Data archive needs for specific transit ITS applications are discussed in relevant needs/ services .</li> </ul>	<ul style="list-style-type: none"> <li>PT03</li> <li>PT08</li> <li>PT09</li> <li>PT14</li> <li>PT17</li> </ul>

**Service Package PT03-Dynamic Transit Operations**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 21	Provide on-line reservation system for demand-responsive transit	<ul style="list-style-type: none"> <li>• Demand-responsive transit agencies provide on-line services to allow customers to schedule pick-up and drop-off.</li> <li>• Demand-response transit riders use on-line services to schedule pick-ups and drop-offs.</li> </ul>	<ul style="list-style-type: none"> <li>• Many demand-responsive transit agencies schedule services via phone, mobile applications and web.</li> <li>• SouthWest Transit uses web, mobile application, and phone for scheduling SW Prime services.</li> <li>• Dakota Area Resources and Transportation for Seniors (DARTS) has an on-line reservation request system.</li> </ul>	<ul style="list-style-type: none"> <li>• Implement on-line reservation systems on agency web-sites and integrate them with fleet scheduling systems.</li> <li>• Integrate with fixed route trip planning system.</li> <li>• Provide first and last mile connections, including Transportation Network Company (TNC).</li> </ul>	<ul style="list-style-type: none"> <li>• Demand-responsive transit agencies are responsible to plan, design, construct, integrate, operate and maintain on-line reservation systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Interconnects between on-line reservation web sites and scheduling systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Service requests will be archived for schedule analysis and request tracking.</li> </ul>	
APTS 26	Additional GIS systems integration	See information under PT02.						
APTS 28	Develop integration among fixed route, demand-responsive transit services and other modes	See information under PT02.						

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 29	Improve transit service quality, including speed, reliability, convenience and safety	See information under PT02.						

**Service Package PT04-Transit Fare Collection Management**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 03	Provide simple and flexible fare payment systems	<ul style="list-style-type: none"> <li>• Transit agencies use simple electronic fare payment systems to make it easier for customers to pay.</li> <li>• Transit agencies in the same region integrate their fare payment systems to allow customers to use a single fare card to ride on transit services provided by different agencies.</li> <li>• Transit customers pay fare using electronic fare cards or mobile devices.</li> </ul>	<ul style="list-style-type: none"> <li>• Metro Transit coordinates fare payment between bus and rail services and with Suburban Transit Providers.</li> <li>• U of M, Metro Transit, and DTA have integrated transit smart cards and Student ID cards students and faculty.</li> <li>• DTA also integrates smart cards with student ID cards with 3 other colleges.</li> <li>• Businesses and Metro Transit have integrated transit smart card and MetroPass.</li> <li>• Metro Transit has implemented Go-To Card customer check balance and add value capability.</li> <li>• Metro Transit has implemented using mobile app to pay fares.</li> </ul>	<ul style="list-style-type: none"> <li>• Coordinate payment integration between transit systems.</li> <li>• Met Council is developing a policy to simplify fare structure across agencies.</li> <li>• St. Cloud MTC is examining using the smart card capability.</li> <li>• Allow credit card and account-based payment to simplify payment system and allow recharging.</li> <li>• Integrate dial-a-ride fare payment service with bus and rail payment systems in the Twin Cities area.</li> <li>• Implement new technology for fare payment and maintain simplicity.</li> <li>• Implement multimodal fare payment systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, integrate, operate and maintain their payment systems.</li> </ul>	<ul style="list-style-type: none"> <li>• This service includes interconnects between transit traveler cards and in-vehicle electronic fare boxes.</li> <li>• Interconnects between in-vehicle electronic fare boxes and transit operations centers.</li> <li>• Interconnects between fare payment system and credit card processing center.</li> <li>• Interconnects between fare payment system and IVR phone system.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit customer account transactions should be archived for back-office account management.</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 07	Provide electronic fare payment card	<ul style="list-style-type: none"> <li>• Transit agencies provide electronic fare card to simplify fare collection and reduce boarding time.</li> <li>• Customers use electronic fare system to quickly pay and board vehicle.</li> <li>• Transit agencies use electronic fare card as employee security cards/timecards.</li> </ul>	<ul style="list-style-type: none"> <li>• Metro Transit has implemented Go-To Card for electronic fare payment.</li> <li>• St. Cloud MTC is examining using the smart card capability.</li> <li>• Metro Transit and DTA uses transit smart card for employee security and door access in addition to transit usage.</li> </ul>	<ul style="list-style-type: none"> <li>• DTA is planning to use transit smart card for employee time clock management.</li> <li>• Investigate the use of electronic fare card to pay for parking</li> <li>• Investigate the use of electronic fare card for paratransit.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, integrate, operate and maintain their fare payment system.</li> </ul>	<ul style="list-style-type: none"> <li>• This service includes interconnects between transit traveler cards and in-vehicle electronic fare boxes.</li> <li>• Interconnects between in-vehicle electronic fare boxes and transit operations centers.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit customer account transactions should be archived for back-office account management.</li> <li>• Archive electronic fare card usage and bad list data.</li> <li>• Need central database to allow fare management across regional providers.</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATM S30	Provide simple and integrated electronic payment systems	<ul style="list-style-type: none"> <li>• Parking garage operators, toll operators, and transit operators integrate their payment systems into a single electronic payment system.</li> <li>• Travelers use a single payment card/device to pay parking, toll, and transit fare electronically.</li> </ul>	<ul style="list-style-type: none"> <li>• MnPASS is currently used on I-394 for pay tolls.</li> <li>• City of Minneapolis parking ramps use a separate automated payment system.</li> </ul>	<ul style="list-style-type: none"> <li>• Integrate MnPASS with City of Minneapolis parking payment systems.</li> <li>• Integrate various payment systems for transit, parking, and MnPASS to a single system.</li> <li>• Integration of MnPASS with other toll systems (part of MAP-21 legislation).</li> </ul>	<ul style="list-style-type: none"> <li>• MnDOT, City of Minneapolis, parking operators and transit operators are responsible to coordinate and integrate MnPASS into the parking fee payment systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Electronic payment systems include interconnects between in-vehicle transponders and roadside readers.</li> <li>• Systems also include interconnects between roadside equipment and parking management systems.</li> <li>• Interconnects between parking management systems and the MnPASS customer center are also needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Account transactions and parking utilization data should also be archived for back-office account management.</li> </ul>	<ul style="list-style-type: none"> <li>• PM03</li> <li>• PT18</li> <li>• TM10</li> </ul>

**Service Package PT05-Transit Security**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 06	Provide surveillance and enforcement on transit vehicles and transit facilities	<ul style="list-style-type: none"> <li>• Transit agencies use surveillance to monitor and/or detect suspicious activities, threats or incidents on transit vehicles, outside transit vehicles, and in and around transit facilities.</li> <li>• Transit agencies share surveillance and information of suspicious activities, threats, and incidents with enforcement agencies.</li> </ul>	<ul style="list-style-type: none"> <li>• St. Cloud MTC, Metro Transit, and DTA have video surveillance on their buses.</li> <li>• St. Cloud MTC is planning an operational test to enhance its security features.</li> <li>• Metro Transit has surveillance systems installed at transit centers and garages.</li> <li>• Metro Transit has intrusion detection at BRT stations.</li> <li>• DTA operates surveillance systems at transit centers and garages.</li> <li>• Silent, driver activated security alert buttons in vehicles.</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance automated surveillance monitoring with alarms.</li> <li>• Install secure, high capacity, wireless communications between surveillance equipment and operations centers (video download to garage, center, and supervisor personnel)</li> <li>• Multi-agency integration of surveillance video (police, DOT, etc.).</li> <li>• Upgrade analog cameras to digital cameras.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their surveillance systems.</li> </ul>	<ul style="list-style-type: none"> <li>• This service includes interconnects between in-vehicle surveillance equipment/ roadside surveillance equipment and transit management center/ enforcement agency (DOT, other transit agencies).</li> <li>• Interconnects between transit management center and enforcement agency (DOT, other transit agencies).</li> </ul>	<ul style="list-style-type: none"> <li>• Live video should be "buffered" for a period of time to allow saving video of interest after the fact.</li> <li>• Video of interest should be permanently saved and cataloged for training, post incident briefing, and tort cases.</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 14	Provide security at park and ride lots	<ul style="list-style-type: none"> <li>• Transit agencies use surveillance to monitor and record suspicious activity at park-and-ride lots to improve the safety and security of customers and vehicle operators.</li> </ul>	<ul style="list-style-type: none"> <li>• Some transit agencies already use cameras for surveillance at park-and-ride lots.</li> <li>• Panic buttons and emergency phones also exist at select park-and-ride facilities.</li> </ul>	<ul style="list-style-type: none"> <li>• Deploy surveillance cameras at more park-and-ride lots.</li> <li>• Integrate monitoring alert systems with surveillance systems to automatically alert agencies of suspicious activities.</li> <li>• Upgrade analog cameras to digital cameras.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their surveillance systems.</li> </ul>	<ul style="list-style-type: none"> <li>• This service includes interconnects between roadside surveillance equipment and transit management centers.</li> </ul>	<ul style="list-style-type: none"> <li>• Live video should be "buffered" for a period of time to allow saving video of interest after the fact.</li> <li>• Video of interest should be permanently saved and cataloged for training, post incident briefing, and tort cases.</li> </ul>	
APTS 29	Improve transit service quality, including speed, reliability, convenience and safety	See information under PT02.						

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 30	Provide tools for the public to report transit-related public safety and personal security concerns	<ul style="list-style-type: none"> <li>Transit agencies install tools on transit vehicles, at stops/stations, and enable remote communications channels (e.g. text messaging) to allow the public to report transit-related safety and security concerns in a timely, convenient and safe manner.</li> </ul>	<ul style="list-style-type: none"> <li>Many transit agencies have surveillance systems installed on transit vehicles, at transit centers and garages.</li> <li>Metro Transit has pushbuttons at selected transit stops/stations allowing passengers to contact transit personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Implement tools to allow passengers to report safety and security incidents/concern to transit agency personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to plan, design, construct, operate and maintain safety/security reporting tools.</li> </ul>	<ul style="list-style-type: none"> <li>This service includes interconnects between security monitoring field equipment and transit management center, as well as personal communications devices and transit management centers.</li> </ul>	<ul style="list-style-type: none"> <li>Records of reported safety and personal security incidents and concerns should be archived.</li> </ul>	

**Service Package PT06-Transit Fleet Management**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 05	Manage transit fleet and personnel operations	See information under PT01.						

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 08	Support vehicle diagnostics and maintenance	<ul style="list-style-type: none"> <li>• Transit agencies use sensors to monitor vehicle usage and conditions and transmit data to fleet management systems to issue diagnostic reports and maintenance requests.</li> <li>• Fleet management systems process data and schedule preventative and corrective maintenance.</li> <li>• The systems also provide personnel with vehicle diagnostic and historical maintenance data for use during preventative maintenance and for roadside assistance calls.</li> </ul>	<ul style="list-style-type: none"> <li>• Metro Transit uses TxBase interface to generate work orders when some error codes are received.</li> <li>• Metro Transit is updating its AVL system to gather vehicle diagnostics through the AVL system.</li> <li>• St. Cloud enters all diagnostic data into its fleet management system.</li> <li>• (DTA uses AVL system for diagnostic data reporting and on-board sensors for preventative maintenance.</li> <li>• Transit agencies have integrated vehicle monitoring equipment with automated diagnostic systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Expand implementation of fleet management systems with automated diagnostic and scheduling capabilities to other transit agencies.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, integrate, operate and maintain their vehicle monitoring and diagnostic systems.</li> </ul>	<ul style="list-style-type: none"> <li>• This service includes interconnects between in-vehicle monitoring equipment and fleet management/ diagnostic systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Diagnostic and maintenance history will be archived for use in future vehicle maintenance and fleet maintenance analysis.</li> </ul>	<ul style="list-style-type: none"> <li>• SU11</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 12	Optimize garage operations	<ul style="list-style-type: none"> <li>Transit agencies use fleet/garage management systems to improve efficiency in vehicle storage, finding, and maintenance.</li> </ul>	<ul style="list-style-type: none"> <li>Metro Transit employees perform bus “markup” by walking the aisles in bus garages and recording the position of each bus in the garage area.</li> <li>(DTA staff assigns transit vehicles to drivers. DTA is setting up a parking grid and notification system that will inform drivers where their buses are parked.</li> <li>Metro Transit has a garage bus locator system to locate buses while they are parked in garages. Upgrade is underway to install LED signage to direct information to bus drivers on where to park when they enter the garage.</li> </ul>	<ul style="list-style-type: none"> <li>Some transit agencies plan to deploy a garage bus locator system to locate buses primarily while they are parked on transit agency property.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to plan, design, deploy, integrate, operate and maintain their fleet/garage management systems.</li> </ul>	<ul style="list-style-type: none"> <li>The fleet management systems and garage bus locator systems include interconnects between in-vehicles equipment and garage operations centers</li> <li>Interconnects between garage operations centers and transit management centers.</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
APTS 22	IT support consistently with mission critical operations systems	<ul style="list-style-type: none"> <li>Transit agencies' IT departments support real-time operations and mission-critical operations consistently</li> </ul>	<ul style="list-style-type: none"> <li>IT support in general is focused on administrative support and cannot support real-time and mission-critical operations in the same fashion.</li> </ul>	<ul style="list-style-type: none"> <li>IT departments provide needed support for real-time and mission-critical operations at a level that is consistent with the administrative support.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible for identifying IT support needed for real-time and mission critical operations and coordinating with their IT departments for the support.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	
APTS 23	Provide multi-communication mode hub/ infrastructure on buses to transmit/ receive high speed data in the most efficient and cost-effective manner	<ul style="list-style-type: none"> <li>Transit agencies use a high speed communications network for transit control staff to send and receive data to/from data systems on-board transit vehicles to improve safety and operations.</li> <li>On-board equipment and data systems include Automated Vehicle Locator technology, Security Cameras, Transit Signal Priority, and Automated Passenger Counter equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Metro Transit vehicles are equipped with multiple on-board data systems, such as Automated Vehicle Locator technology, Security Cameras, Transit Signal Priority, and Automated Passenger Counter equipment.</li> <li>Metro Transit is improving current radio communications and implementing software upgrades.</li> </ul>	<ul style="list-style-type: none"> <li>Implement a communications system that provides high speed, accuracy, reliability and capacity to increase the ability of transit vehicles to send and receive data.</li> <li>Upgrade hardware on vehicles and investigate hardware options to allow high speed data communications between buses and the Metro Transit Control Center.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to plan, design, deploy, integrate, operate and maintain their communications systems.</li> </ul>	<ul style="list-style-type: none"> <li>This service includes interconnects between transit vehicles, their on-board equipment, transit management centers, and agencies.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	

**Service Package PT07-Transit Passenger Counting**

Many transit agencies have automated passenger counters installed in their transit vehicles. No additional needs or services in this area were identified by stakeholders.

**Service Package PT08-Transit Traveler Information**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 01	Provide transit route and schedule information	<ul style="list-style-type: none"> <li>• Transit agencies use various travel information systems to provide route, schedule, and fare information to the public.</li> <li>• Transit customers use route, schedule, and fare information to make time/route/mode travel decisions.</li> <li>• Third parties (e.g. Google) also provide transit route and schedule information.</li> </ul>	<ul style="list-style-type: none"> <li>• Many transit agencies provide route, schedule and fare information via websites, mobile apps, phone systems as well as printed schedules at stops.</li> <li>• Metro Transit provides a trip planner service on its website.</li> <li>• DTA uses WebWatch software that informs customers via the Internet of real-time transit departures from bus stops.</li> <li>• Several transit agencies use Google Transit to disseminate route information.</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance voice recognition for automated trip planning.</li> <li>• Implement route planning systems for regional transit and county providers.</li> <li>• Provide Wi-Fi Internet access points on trains.</li> <li>• Install kiosks at key transit stops/centers to provide information and for trip planning.</li> <li>• Understand third-party data and how transit agencies can use it.</li> <li>• Disseminate adjusted schedule due to service disruption and reflect changes in trip planning.</li> <li>• Provide additional fare information.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their travel information systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit traveler information systems include interconnects between transit scheduling systems and websites, phone systems, kiosks and other information distribution equipment.</li> </ul>	<ul style="list-style-type: none"> <li>• Service usage should be tracked and archived.</li> </ul>	

<b>ID</b>	<b>Need/Service</b>	<b>Operational Concept</b>	<b>Existing Capability</b>	<b>Gap/Planned Enhancement</b>	<b>Role/Responsibility</b>	<b>Interconnect</b>	<b>Data Archive Need</b>	<b>Associated Service Package</b>
APTS 02	Provide real-time transit vehicle arrival/ departure information	See information under PT01.						

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 10	Provide on-board automated annunciators	<ul style="list-style-type: none"> <li>• Transit agencies use on-board annunciators to automatically announce stops based on vehicle locations.</li> <li>• Customer use annunciators to determine what stop the vehicle is at and whether they should get off.</li> </ul>	<ul style="list-style-type: none"> <li>• Metro Transit's light rail system uses on-board automated annunciators to announce next stops/routes and safety messages. Annunciators at LRT stations also provide safety messages. Metro Transit will have 75% of its bus fleet equipped with annunciators by the spring of 2014.</li> <li>• (DTA utilizes on-board annunciators to announce next stops/routes and safety messages on the interior and exterior of transit vehicles. Drivers can also activate a set of pre-defined messages to address transit customers.</li> <li>• St. Cloud MTC has on-board annunciators on all its fixed route fleet.</li> </ul>	<ul style="list-style-type: none"> <li>• Deploy on-board annunciators/visual display systems and integrate them with AVL systems. Southwest Transit is planning on deploying the technology in a few years.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their automated enunciator systems/visual display systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Enunciator systems include interconnects between in vehicle annunciators and in-vehicle AVL equipment.</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
APTS 11	Provide information to the ADA community	<ul style="list-style-type: none"> <li>• Transit agencies use websites, telephone services, printed materials, media, and other means to provide transit service and fare information to ADA communities.</li> <li>• The traveler information systems provided by transit agencies shall meet Section 508 of the U.S. Rehabilitation Act of 1973.</li> <li>• ADA communities obtain information on transit availability, routes, schedule, fare, vehicle types, and accessibility options.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies currently provide vehicle wheelchair accessibility information via public websites and brochures.</li> <li>• Provision of on-board annunciators by Metro Transit and DTA provide automated information to ADA community.</li> <li>• Metro Transit has push-button annunciators at stops equipped with LED real-time signs and LCD monitors.</li> <li>• Metro Transit announces route, branch and destinations outside the front door of a bus at every bus stop.</li> <li>• Provision of screen reading capabilities on Metro Transit website.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop/update transit agency websites to meet accessibility requirements as required by Section 508.</li> <li>• Coordinate with solutions to address needs/services of APTS01 – provide transit route, schedule and fare information and APTS10 – provide on-board automated annunciators.</li> <li>• Provide mobile customer information systems such as on-board monitors.</li> <li>• Develop wayfinding systems for the ADA community.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their travel information systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit travel information systems include interconnects between transit management centers and websites, phone systems, kiosks and other information distribution equipment.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	<ul style="list-style-type: none"> <li>• PT16</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 16	Provide information on ridesharing opportunities	<ul style="list-style-type: none"> <li>• Transit agencies provide transit and ridesharing information to customers to assist them with travel decisions and interagency trip coordination.</li> <li>• Customers use this information to obtain rideshare information and form carpools.</li> </ul>	<ul style="list-style-type: none"> <li>• Agencies provide information on transit and carpooling opportunities on their websites or phone information systems.</li> <li>• Metro Transit provides rideshare information on its web site and has on-line carpool and vanpool matching capabilities.</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance carpool and vanpool ridematching system.</li> <li>• Opportunities for coordination of existing transit services in greater Minnesota with city/county/ regional transit providers.</li> <li>• Implement first/last mile alternatives.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their carpool/vanpool ridematching systems.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	<ul style="list-style-type: none"> <li>• TI06</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 20	Provide real-time transfer information to travelers en route	<ul style="list-style-type: none"> <li>• Transit agencies provide real-time transfer information to customers “en route” to assist with their travel decisions, regardless of travel mode.</li> <li>• Customers use real-time arrival information to make transfer decisions.</li> </ul>	<ul style="list-style-type: none"> <li>• Metro Transit provides real-time information on LED signs and LCD monitors at more than 290 locations. Information is also provided via phone, internet, onboard real-time displays, mobile app and mobile phone text as well as through the NexTrip.</li> <li>• Metro Transit also provides arrival information for the LRT system.</li> <li>• DTA provides real-time arrival information at selected locations with dynamic message signs. More locations will be added in the coming year.</li> <li>• DTA also has an email notification/text message system that notified riders 15 minutes prior to departure for selected stops.</li> </ul>	<ul style="list-style-type: none"> <li>• Integrate Metro Transit CAD/AVL system with RTMC to generate real-time information.</li> <li>• Provide real-time next bus arrival and transfer information at transit centers and transfer points.</li> <li>• Provide next bus arrival time at decision points on freeways and major arterials.</li> <li>• Provide real-time information to customers en route.</li> <li>• Add rail mode information to NexTrip.</li> <li>• Integrate St. Cloud transit information into NexTrip.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their AVL and real-time information systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Transfer information systems include interconnects between in-vehicle AVL systems and transit management centers.</li> <li>• Interconnects between operations centers and roadside and portable traveler information equipment.</li> </ul>	<ul style="list-style-type: none"> <li>• None. Transit arrival archive data is archived as part of the CAD/AVL service.</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 25	Wireless access for transit customers	<ul style="list-style-type: none"> <li>• Transit agencies provide wireless access at transit stations and on transit vehicles.</li> </ul>	<ul style="list-style-type: none"> <li>• Many transit agencies provides wireless access to customers at major transit centers/stations and on many of its buses.</li> <li>• Metro Transit also provides wireless access to customers on LRT, BRT and Northstar trains.</li> </ul>	<ul style="list-style-type: none"> <li>• Expand wireless access coverage.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their systems.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	
APTS 29	Improve transit service quality, including speed, reliability, convenience and safety	See information under PT02.						

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 33	Improve seamless customer services across all modes	<ul style="list-style-type: none"> <li>• Transit agencies coordinate service routes and schedule to improve convenience to customers.</li> <li>• Transit agencies provide service information, including connections with services provided by other transit agencies.</li> <li>• Travelers can easily access and obtain route, schedule, connections, fare and additional information across transit and transportation service providers to allow them for better trip planning.</li> </ul>	<ul style="list-style-type: none"> <li>• Metro Transit provides route, schedule and fare information for all transit providers in the Twin Cities area via website and mobile app.</li> <li>• Metro Transit has implemented Go-To Cards that can be used for fare payment on bus, BRT, LRT and Northstar commuter train. Go-To Cards can be used for fare payment on suburban transit provider buses too.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide real-time next bus arrival and transfer information at transit centers and transfer points.</li> <li>• Provide real-time information to customers en route.</li> <li>• Add rail mode information to NexTrip.</li> <li>• Improve service coordination among transit agencies to expand services and improve transfer/ connection convenience and efficiency.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to coordinate among other transit agencies to enhance services and connections across agencies and modes.</li> </ul>	<ul style="list-style-type: none"> <li>• This service includes interconnects between transit information centers and other transit information centers; and between transit information centers and transit management centers.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• PT17</li> </ul>

**Service Package PT09-Transit Signal Priority**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 17	Coordinate transit vehicle movements with traffic control devices	<ul style="list-style-type: none"> <li>• Transit agencies will use transit signal priority (TSP) to increase schedule adherence and improve transit speed and trip time reliability for customers.</li> </ul>	<ul style="list-style-type: none"> <li>• Many signalized intersections in many cities are equipped with emergency vehicle preemption (EVP)</li> <li>• St. Cloud MTC currently operates TSP at all intersections where MTC buses travel through.</li> <li>• Metro Transit deployed TSP along two north-south arterial corridors and near park-and-ride locations along I-35W corridor.</li> <li>• DTA has implemented TSP on its full fleet with 23 intersections and plans to expand TSP to additional intersections.</li> </ul>	<ul style="list-style-type: none"> <li>• Expand TSP along other key transit corridors.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their TSP systems.</li> <li>• Local traffic control agencies are responsible to operate and maintain traffic signals.</li> <li>• Transit agencies are responsible to coordinate with local traffic control and law enforcement agencies.</li> </ul>	<ul style="list-style-type: none"> <li>• TSP systems includes interconnects between transit vehicles, roadside signal control equipment, and a transit management center.</li> </ul>	<ul style="list-style-type: none"> <li>• Vehicle travel time and schedule adherence data should be archived as part of CAD/AVL service for performance evaluation and analysis.</li> </ul>	

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 19	Provide queue jumping	<ul style="list-style-type: none"> <li>• Transit agencies use queue jumping to allow transit vehicles preferred access to reduce travel time and enhance schedule adherence.</li> </ul>	<ul style="list-style-type: none"> <li>• Buses currently have access to HOV bypass lanes at some ramp locations in the metro area and have an exception for turn lanes.</li> </ul>	<ul style="list-style-type: none"> <li>• Investigate queue jumping for future BRT projects.</li> <li>• Test and implement queue jump systems at selected bottle necked areas.</li> <li>• Implement queue jumps along with TSP to improve operations efficiency.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to coordinate with MnDOT and local agencies to plan, design, construct, operate and maintain their queue jump systems.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	
APTS 29	Improve transit service quality, including speed, reliability, convenience and safety	See information under PT02.						

**Service Package PT10-Intermittent Bus Lanes**

No needs or services in this area were identified by stakeholders.

**Service Package PT11-Transit Pedestrian Indication**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 13	Provide collision avoidance assistance for transit vehicles	<ul style="list-style-type: none"> <li>• Transit vehicle drivers use collision avoidance systems to monitor the areas around the vehicles, detect potential hazards, and receive warnings when hazardous conditions are present.</li> <li>• Transit drivers use on-board safety sensors and collision sensors to monitor the areas to the sides of vehicles as buses are merging into and out of shoulder lanes and bus stops.</li> <li>• Warnings about potential hazards are presented to transit drivers.</li> </ul>	<ul style="list-style-type: none"> <li>• Vehicle collision warning systems have been tested in several states, including Minnesota.</li> <li>• MVTA has an avoidance system installed on selected vehicles and will expand the system to more vehicles in the near future.</li> </ul>	<ul style="list-style-type: none"> <li>• Test and deploy GPS system for bus-only shoulder lane use driver assistance.</li> <li>• Test and deploy lateral safety detection and warning systems to improve safety of buses merging.</li> <li>• Test and deploy collision warning/avoidance systems on buses.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their collision warning/avoidance systems on their fleet vehicles.</li> <li>• Transit agencies are responsible to plan, design, construct, operate and maintain their lateral safety detection and warning systems on their fleet vehicles.</li> </ul>	<ul style="list-style-type: none"> <li>• Lateral safety detection and warning systems as well as collision warning/avoidance systems include interconnects between in-vehicle safety and collision detection equipment and in-vehicle warning equipment.</li> <li>• Interconnects between in-vehicle detection equipment and in-vehicle driver feedback equipment.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	<ul style="list-style-type: none"> <li>• PT12</li> <li>• PT13</li> <li>• VS01</li> <li>• VS12</li> <li>• VS13</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 18	Install pedestrian and bike detection/warning system to reduce incidents	<ul style="list-style-type: none"> <li>The detection and warning system detects pedestrians and cyclists in obstructed view area.</li> <li>Transit drivers receive alerts of pedestrians and cyclists in obstructed view areas.</li> <li>Pedestrians and cyclists receive warning from transit vehicles.</li> </ul>	<ul style="list-style-type: none"> <li>Some garage and transit station entry/exit ways have static and dynamic pedestrian warning systems.</li> <li>No current systems provide in-vehicle warnings to drivers.</li> <li></li> </ul>	<ul style="list-style-type: none"> <li>Test and deploy on-board pedestrian and bike detection/warning systems.</li> <li>Test and deploy roadside pedestrian and bike warning systems at areas with high pedestrian/cyclist accident rates.</li> <li>Provide warning to pedestrians and cyclists.</li> <li>Use detection and warning data for analysis to identify high risk areas for potential enhancements.</li> </ul>	<ul style="list-style-type: none"> <li>Transit agencies are responsible to plan, design, construct, operate and maintain their on-board pedestrian detection and warning systems.</li> <li>Local traffic agencies are responsible to plan, design, construct, operate and maintain roadside signage.</li> </ul>	<ul style="list-style-type: none"> <li>Pedestrian detection and warning systems include interconnects between in-vehicle detection equipment and in-vehicle warning equipment.</li> <li>Interconnects between roadside detection and warning equipment and in-vehicle warning equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Warnings activation data will be archived for future system analysis and tort claims.</li> </ul>	<ul style="list-style-type: none"> <li>VS01</li> <li>VS12</li> </ul>

**Service Package PT12-Transit Vehicle at Station/Stop Warnings**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 13	Provide collision avoidance assistance for transit vehicles	See information under PT11.						

**Service Package PT13-Vehicle Turning Right in Front of a Transit Vehicle**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 13	Provide collision avoidance assistance for transit vehicles	See information under PT11.						

**Service Package PT14-Multi-modal Coordination**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 04	Coordinate timed transfers between route segments, providers & modes	<ul style="list-style-type: none"> <li>• Transit agencies share and coordinate vehicle routes and schedules to minimize wait times and missed transfers at transfer points.</li> <li>• Transit agencies coordinate with providers of other modes to improve service coordination and operating efficiency.</li> </ul>	<ul style="list-style-type: none"> <li>• Metro Transit uses software to provide internal timed transfers.</li> <li>• Three transit agencies are coordinating services in common regional centers in southwest and west central Minnesota</li> <li>• (DTA uses AVL system to coordinate transfers between DTA routes.</li> <li>• DTA uses Google Transit Trip Planning. Metro Transit and Regional Transit Providers also use Google.</li> </ul>	<ul style="list-style-type: none"> <li>• Improve automated coordination among transit providers to expand service and prevent duplicating trips</li> <li>• Alert transit drivers/dispatchers whether passengers are waiting at a bus stop.</li> <li>• Reduce duplication of routes between fixed route and demand-response</li> <li>• Deploy GPS/AVL technology for transit agencies in greater MN transit.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to communicate and coordinate with each other to improve service coordination.</li> <li>• Coordination between regional transit providers, county, and transit planning stakeholders for greater MN.</li> </ul>	<ul style="list-style-type: none"> <li>• This service includes interconnects between transit vehicles, transit management centers, and agencies.</li> <li>• Interconnects between different transit management centers.</li> </ul>	<ul style="list-style-type: none"> <li>• Historic route performance and schedule adherence data should be archived to assist in analyzing vehicles arrive/depart times at transfer points and trip patterns/trends.</li> </ul>	<ul style="list-style-type: none"> <li>• PT17</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 28	Develop integration among fixed route, demand-responsive transit services and other modes	See information under PT02.						
APTS 29	Improve transit service quality, including speed, reliability, convenience and safety	See information under PT02.						
APTS 33	Improve seamless customer services across all modes	See information under PT08.						

**Service Package PT15-Transit Stop Request**

No needs or services in this area were identified by stakeholders.

**Service Package PT16-Route ID for the Visually Impaired**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 11	Provide information to the ADA community	See information under PT08.						

**Service Package PT17-Transit Connection Protection**

<b>ID</b>	<b>Need/Service</b>	<b>Operational Concept</b>	<b>Existing Capability</b>	<b>Gap/Planned Enhancement</b>	<b>Role/Responsibility</b>	<b>Interconnect</b>	<b>Data Archive Need</b>	<b>Associated Service Package</b>
APTS 04	Coordinate timed transfers between route segments, providers & modes	See information under PT14.						
APTS 28	Develop integration among fixed route, demand-responsive transit services and other modes	See information under PT02.						
APTS 29	Improve transit service quality, including speed, reliability, convenience and safety	See information under PT02.						
APTS 33	Improve seamless customer services across all modes	See information under PT08.						

**Service Package PT18-Integrated Multi-Modal Electronic Payment**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/ Responsibility	Interconnect	Data Archive Need	Associated Service Package
ATM S30	Provide simple and integrated electronic payment systems	See information under PT04.						

**Service Package DM01-ITS Data Warehouse<sup>1</sup>**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/ Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 09	Measure historical transit route performance	See information under PT01.						
APTS 24	Metro Transit Police records integration with other PD's	<ul style="list-style-type: none"> <li>Local public safety agencies and Metro Transit Police integrate their records for better data sharing and coordination in incident/emergency responses.</li> </ul>	<ul style="list-style-type: none"> <li>Metro Transit Police currently have a separate, non-integrated police record system.</li> <li>Coordination between Metro Transit Police and local PD's is conducted by calling each other during an incident.</li> </ul>	<ul style="list-style-type: none"> <li>Define standards for data record integration.</li> <li>Integrate Metro Transit Police system with that of other PD's in the metro area.</li> </ul>	<ul style="list-style-type: none"> <li>Metro Transit Police and local public safety agencies are responsible to develop common standards and integrate and maintain their systems.</li> </ul>	<ul style="list-style-type: none"> <li>Data integration includes interconnects between Metro Transit Police and other PD's.</li> </ul>	<ul style="list-style-type: none"> <li>None for data/record integration. Separate systems already have archiving guidelines and storage protocols for police records.</li> </ul>	
APTS 26	Additional GIS systems integration	See information under PT02.						

<sup>1</sup> See Volume 1 – Data Management Service Package Area for the description of DM01 – ITS Data Warehouse.

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 31	Improve access to real-time and historical transit data and improve quality of data	<ul style="list-style-type: none"> <li>• Transit agencies use database and tools to store real-time and historical transit data.</li> <li>• Transit agencies use tools to verify and improve data quality.</li> <li>• Non-operations transit personnel is provided with improved access to retrieve real-time and historical data.</li> <li>• Transit agencies uses real-time and historical data for performance monitoring, planning, analysis and research.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit data is typically stored in transit agencies' operation systems and is challenging to retrieve or extract the data for non-operations uses.</li> </ul>	<ul style="list-style-type: none"> <li>• DTA plans to have a GTFS-RT (Google Transit Feed Specification – Real Time) for third party applications in 2018.</li> <li>• Develop new or enhance existing tools to improve access to operations data.</li> <li>• Develop tools and methods to improve transit data quality.</li> </ul>	<ul style="list-style-type: none"> <li>• Transit agencies are responsible to plan, design, deploy, integrate, operate and maintain transit databases to data access tools.</li> </ul>	<ul style="list-style-type: none"> <li>• This service includes interconnects between transit databases, transit management centers, and other transit personnel.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	<ul style="list-style-type: none"> <li>• DM02</li> </ul>

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 32	Create connections with other public agencies and third parties to share real-time and historical transit data both ways	<ul style="list-style-type: none"> <li>Transit agencies work with other transit, traffic and public safety agencies to share real-time and historical data.</li> <li>Transit agencies work with third party data/information providers to share information to improve services and customer satisfaction.</li> <li>Transit agencies uses real-time and historical data for performance monitoring, planning, analysis and research.</li> </ul>	<ul style="list-style-type: none"> <li>Information sharing among transit, traffic and public safety agencies occurs on limited basis.</li> <li>MnDOT shares Metro area congestion, detour and incident information with transit providers in the Metro area.</li> <li>Minneapolis and St. Paul shares roadway closures with transit providers in the Metro area.</li> </ul>	<ul style="list-style-type: none"> <li>Coordinate with traffic and public safety agencies and third party providers to identify data sharing needs.</li> <li>Develop and implement plans for establishing connects with traffic and public safety agencies and third parties to share data both ways.</li> </ul>	<ul style="list-style-type: none"> <li>Public agencies are responsible to coordinate with each other to plan and implement two-way data sharing.</li> <li>Transit agencies are responsible to coordinate with third party data providers to enable two-way data sharing.</li> </ul>	<ul style="list-style-type: none"> <li>Interconnects between transit management centers, other transit management centers, traffic management centers, public safety agencies and third party providers.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>DM02</li> <li>SU03</li> </ul>

**Service Package DM02-Performance Monitoring<sup>2</sup>**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 09	Measure historical transit route performance	See information under PT01.						

<sup>2</sup> See Volume 1 – Data Management Service Package Area for the description of DM02 – Performance Monitoring.

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 31	Improve access to real-time and historical transit data and improve quality of data	See information under DM01.						
APTS 32	Create connections with other public agencies and third parties to share real-time and historical transit data both ways	See information under DM01.						

**Service Package VS01-Autonomous Vehicle Safety Systems<sup>3</sup>**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 13	Provide collision avoidance assistance for transit vehicles	See information under PT11.						

<sup>3</sup> See Volume 8 – Vehicle Safety Service Package Area for the description of VS01 – Autonomous Vehicle Safety Systems.

**Service Package VS12-Pedestrian and Cyclist Safety<sup>4</sup>**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 13	Provide collision avoidance assistance for transit vehicles	See information under PT11.						
APTS 18	Install pedestrian detection/warning system to reduce incidents	See information under PT11.						

**Service Package VS13-Intersection Safety Warning and Collision Avoidance<sup>5</sup>**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 13	Provide collision avoidance assistance for transit vehicles	See information under PT11.						

<sup>4</sup> See Volume 8 – Vehicle Safety Service Package Area for the description of VS12 – Pedestrian and Cyclist Safety.

<sup>5</sup> See Volume 8 – Vehicle Safety Service Package Area for the description of VS13 – Intersection Safety Warning and Collision Avoidance.

**Service Package SU03-Data Distribution<sup>6</sup>**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 32	Create connections with other public agencies and third parties to share real-time and historical transit data both ways	See information under DM01.						

**Service Package SU11-Vehicle Maintenance<sup>7</sup>**

ID	Need/Service	Operational Concept	Existing Capability	Gap/Planned Enhancement	Role/Responsibility	Interconnect	Data Archive Need	Associated Service Package
APTS 08	Support vehicle diagnostics and maintenance	See information under PT06.						

<sup>6</sup> See Volume 11 – Support Service Package Area for the description of SU03 – Data Distribution.

<sup>7</sup> See Volume 11 – Support Service Package Area for the description of SU11 – Vehicle Maintenance.

## Appendix D: Public Transportation Service Packages and Descriptions

The descriptions of Public Transportation (PT) service packages are taken directly from ARC-IT version 8.2.

### **PT01 Transit Vehicle Tracking**

This service package monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real time schedule adherence and update the transit system's schedule in real-time.

### **PT02 Transit Fixed-Route Operations**

This service package performs automated dispatch and system monitoring for fixed-route and flexible-route transit services. This service performs scheduling activities including the creation of schedules, blocks and runs, as well as operator assignment. This service monitors the transit vehicle trip performance against the schedule and provides information displays at the Transit Management Center.

### **PT03 Demand Transit Operations**

The Dynamic Transit Operations service package allows travelers to request trips and obtain itineraries using a personal device such as a smart phone, tablet, or personal computer. The trips and itineraries cover multiple transportation services (public transportation modes, private transportation services, shared-ride, walking and biking). This service package builds on existing technology systems such as computer-aided dispatch/ automated vehicle location (CAD/AVL) systems and automated scheduling software, providing a coordination function within and between transit providers that would dynamically schedule and dispatch or modify the route of an in-service vehicle by matching compatible trips together. TI06 covers other shared use transportation options.

### **PT04 Transit Fare Collection Management**

This service package manages transit fare collection on-board transit vehicles and at transit stops using electronic means. It allows transit users to use a traveler card or other electronic payment device such as a smart phone. Readers located either in the infrastructure or on-board the transit vehicles enable electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Center.

### **PT05 Transit Security**

This service package provides for the physical security of transit passengers and transit vehicle operators. On-board equipment performs surveillance and sensor monitoring in order to identify potentially hazardous situations. The surveillance equipment includes video (e.g., CCTV cameras), audio systems and/or event recorder systems. The sensor equipment includes threat sensors (e.g., chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g., metal detectors). Transit user or transit vehicle operator activated alarms are provided on-board. Public areas (e.g., transit stops, park and ride lots, stations) are also monitored with similar surveillance and sensor equipment and provided with transit user activated alarms. In addition this service package provides surveillance and sensor monitoring of non-public areas of transit facilities (e.g., transit yards) and transit infrastructure such as bridges, tunnels, and transit railways or bus rapid transit (BRT) guideways. The surveillance equipment includes video and/or audio systems. The sensor equipment includes threat sensors and object detection sensors as described above as well as,

intrusion or motion detection sensors and infrastructure integrity monitoring (e.g., rail track continuity checking or bridge structural integrity monitoring).

Most of the surveillance and sensor data that is collected by this service package may be monitored by either the Emergency Management Center or the Transit Management Center, providing two possible approaches to implementing this service package. This service package also supports remote transit vehicle disabling and transit vehicle operator authentication by the Transit Management Center.

#### **PT06 Transit Fleet Management**

This service package supports automatic transit maintenance scheduling and monitoring. On-board condition sensors monitor system status and transmit critical status information to the Transit Management Center. The Transit Management Center processes this data and schedules preventative and corrective maintenance. The service package also supports the day to day management of the transit fleet inventory, including the assignment of specific transit vehicles to blocks and the assignment of transit vehicle operators to runs.

#### **PT07 Transit Passenger Counting**

This service package counts the number of passengers entering and exiting a transit vehicle using sensors mounted on the vehicle and communicates the collected passenger data back to the management center. The collected data can be used to calculate reliable ridership figures and measure passenger load information at particular stops.

#### **PT08 Transit Traveler Information**

This service package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this service package.

#### **PT09 Transit Signal Priority**

The Transit Signal Priority service package uses transit vehicle to infrastructure communications to allow a transit vehicle to request priority at one or a series of intersections. The service package provides feedback to the transit driver indicating whether the signal priority has been granted or not. This service package can contribute to improved operating performance of the transit vehicles by reducing the time spent stopped at a red light.

#### **PT10 Intermittent Bus Lanes**

This service package provides dedicated bus lanes during peak demand times to enhance transit operations mobility. An intermittent bus lane is a lane that can change its status from regular lane (accessible for all vehicles) to bus lane, for the time strictly necessary for a bus or set of buses to pass. The status of the IBL is communicated to drivers using roadside message signs and through in-vehicle signage. The creation and removal of dedicated bus lanes is managed through coordination between traffic and transit centers.

#### **PT11 Transit Pedestrian Indication**

The Transit Pedestrian Indication service package provides vehicle to device communications to inform pedestrians at a station or stop about the presence of a transit vehicle. In addition, this service package would inform the transit vehicle operator about the presence of pedestrians nearby and those waiting for the bus. It would help prevent collisions between transit vehicles and pedestrians.

**PT12 Transit Vehicle at Station/Stop Warnings**

The Transit Vehicle at Station/Stop Warnings service package inform nearby vehicles of the presence of a transit vehicle at a station or stop. The service package also indicates the intention of the transit vehicle in terms of pulling into or out of a station/stop.

**PT13 Vehicle Turning Right in Front of a Transit Vehicle**

The Vehicle Turning Right in Front of a Transit Vehicle (VTRFTV) service package determines the movement of vehicles near to a transit vehicle stopped at a transit stop and provides an indication to the transit vehicle operator that a nearby vehicle is pulling in front of the transit vehicle to make a right turn. This service package will help the transit vehicle determine if the area in front of it will not be occupied as it begins to pull away from a transit stop.

**PT14 Multi-modal Coordination**

This service package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.

**PT15 Transit Stop Request**

This service package allows a transit passenger to send a stop request to an approaching transit vehicle. The transit vehicle receives the request and notifies the vehicle operator of the stop request.

**PT16 Route ID for the Visually Impaired**

This service package assists visually impaired travelers to identify the appropriate bus and route to their intended destination. It provides information from bus stop infrastructure to visually impaired travelers portable devices that can be converted to audible information regarding the appropriate bus and route. It also allows the visually impaired traveler to query the portable device to identify route options.

**PT17 Transit Connection Protection**

This service package allows travelers to initiate a request for connection protection anytime during the trip using a personal device or on-board equipment and receive a confirmation indicating whether the request is accepted. Connection protection uses real time data to examine the arrival status of a transit vehicle and to transmit a hold message to a vehicle or other mode of transportation (e.g. rail) in order for the traveler to make a successful transfer from one vehicle to another. Connection protection can be performed within a single agency, across multiple agencies, and across multiple modes. In an intermodal, multimodal or interagency environment, a transfer request brokerage system, represented by the Transit Management System, can be used to determine the feasibility of a connection protection request and support schedule coordination between agencies.

**PT18 Integrated Multi-Modal Electronic Payment**

The Integrated Multi-Modal Electronic Payment service package provides electronic payment capability for transit fares, tolls, road use, parking, and other areas requiring electronic payments.