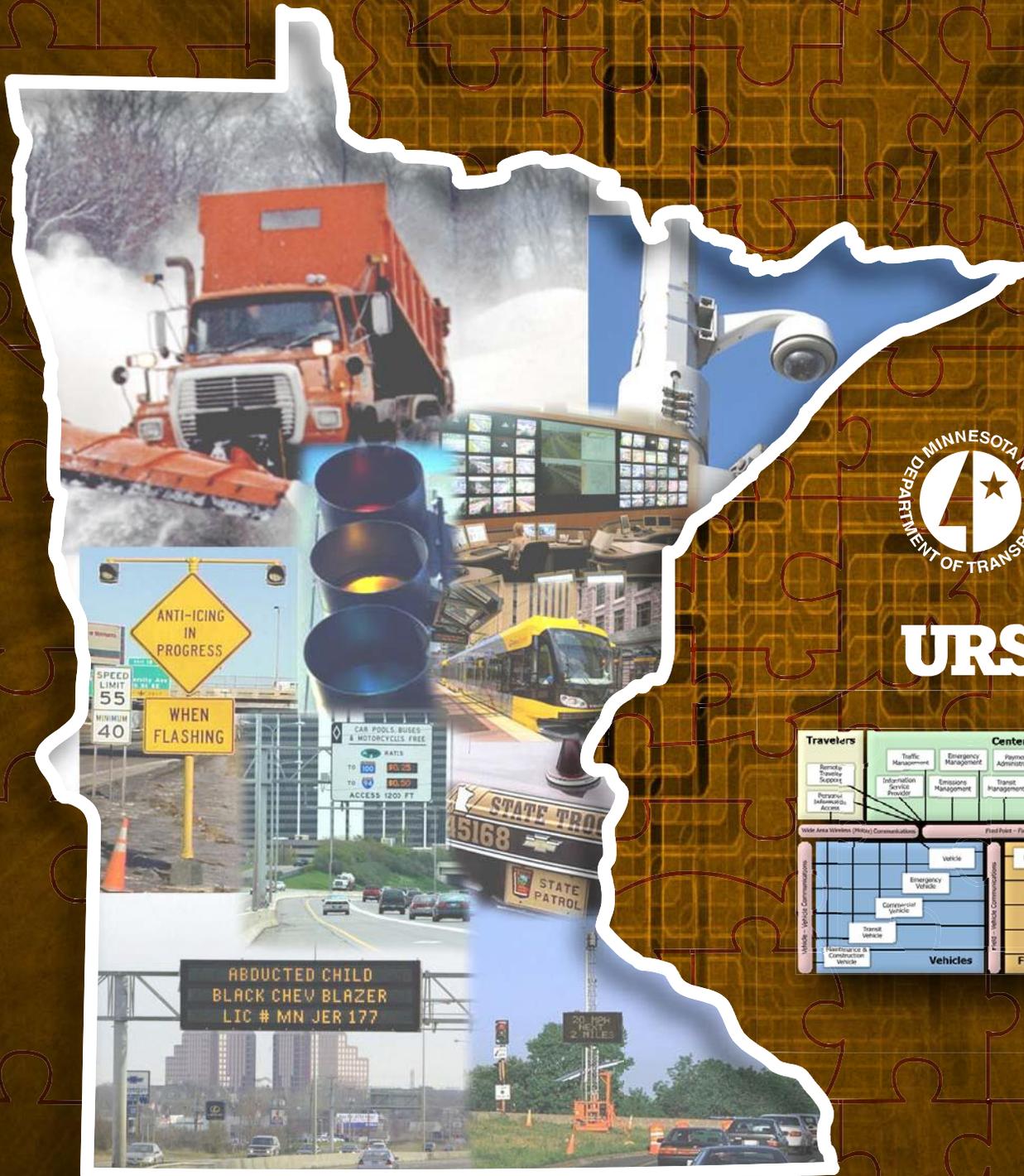


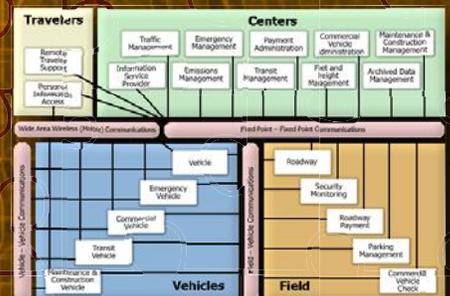
# MINNESOTA STATEWIDE REGIONAL ITS ARCHITECTURE

Version 2014

Volume 9:  
ITS Initiatives and Project Concepts for Implementation



**URS**



**Minnesota Statewide Regional ITS Architecture  
Version 2014**

**Volume 9: ITS Initiatives and Project Concepts for  
Implementation**



Prepared by

**URS Corporation**

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## Acronyms

|         |  |
|---------|--|
| ACS     | Adaptive Control Software                            |
| AD      | Archived Data Management                             |
| AMBER   | America's Missing: Broadcast Emergency Response      |
| APTS    | Advanced Public Transportation System                |
| ATIP    | Area Transportation Improvement Program              |
| ATIS    | Advanced Traveler Information System                 |
| ATMS    | Advanced Traffic Management System                   |
| ATP     | Area Transportation Partnership                      |
| AVL     | Automatic Vehicle Location                           |
| AVSS    | Advanced Vehicle Safety System                       |
| AWOS    | Automated Weather Observation System                 |
| BRT     | Bus Rapid Transit                                    |
| CAD     | Computer Aided Dispatch                              |
| CARS    | Condition Acquisition and Reporting System           |
| CCTV    | Closed Circuit Television                            |
| CEA     | Critical Emphasis Area                               |
| CMAQ    | Congestion Mitigation and Air Quality                |
| CSAH    | County State Aid Highway                             |
| CVO     | Commercial Vehicle Operations                        |
| DARTS   | Dakota Area Resources and Transportation for Seniors |
| DMS     | Dynamic Message Sign                                 |
| DOT     | Department of Transportation                         |
| DPS     | Department of Public Safety                          |
| DTA     | Duluth Transit Authority                             |
| DVR     | Digital Video Recorder                               |
| EM      | Emergency Management                                 |
| EMS     | Emergency Medical Services                           |
| EVP     | Emergency Vehicle Preemption                         |
| FHWA    | Federal Highway Administration                       |
| FIRST   | Freeway Incident Response Safety Team                |
| FTA     | Federal Transit Administration                       |
| GIS     | Geographic Information System                        |
| GPS     | Global Positioning System                            |
| HAR     | Highway Advisory Radio                               |
| HAZMAT  | Hazardous Materials                                  |
| HiSPARC | High-Speed, Accuracy Reliability, and Capacity       |
| HOT     | High-Occupancy Toll                                  |
| HOV     | High-Occupancy Vehicle                               |
| HPDP    | Highway Project Development Process                  |
| HRI     | Highway Rail Intersection                            |
| HSIP    | Highway Safety Improvement Program                   |
| HUTD    | Highway User Tax Distribution                        |
| ICM     | Integrated Corridor Management                       |
| IEEE    | Institute of Electrical and Electronics Engineers    |
| ISP     | Information Service Provider                         |
| ITS     | Intelligent Transportation Systems                   |
| IWZ     | Intelligent Work Zone                                |
| LED     | Light Emitting Diode                                 |
| LRT     | Light Rail Transit                                   |

|            |   |
|------------|---|
| MAP-21     | Moving Ahead for Progress in the 21 <sup>st</sup> Century Act                         |
| MCM        | Maintenance and Construction Management   |
| MCMIS      | Motor Carrier Management Information System   |
| MDSS       | Maintenance Decision Support System   |
| MDT        | Mobile Data Terminal  |
| MnDOT      | Minnesota Department of Transportation  |
| MnPASS     | An electronic toll collection system operated by MnDOT                                |
| MnSHIP     | Minnesota State Highway Investment Plan   |
| MPCA       | Minnesota Pollution Control Agency  |
| MPO        | Metropolitan Planning Organization  |
| MSAS       | Municipal State Aid Streets   |
| MSP        | Minnesota State Patrol  |
| MTC        | Metropolitan Transit Commission (St. Cloud)   |
| MVLST      | Motor Vehicle Leased Sales Tax  |
| MVST       | Motor Vehicle Sales Tax   |
| MVTA       | Minnesota Valley Transit Authority  |
| NHPP       | National Highway Performance Program  |
| NHS        | National Highway System   |
| NTCIP      | National Transportation Communications for Intelligent Transportation System Protocol |
| OFCVO      | Office of Freight and Commercial Vehicle Operations (MnDOT)                           |
| OS/OW      | Oversize/Overweight   |
| OTST       | Office of Traffic, Safety, and Technology (MnDOT)                                     |
| PCMS       | Portable Changeable Message Sign  |
| PDA        | Personal Digital Assistant  |
| PDSL       | Priced Dynamic Shoulder Lane  |
| PPMS       | Program and Project Management System   |
| PRISM      | Performance and Registration information Systems Management                           |
| PSAP       | Public Safety Answering Point   |
| RDC        | Regional Development Commission   |
| RFID       | Radio-Frequency Identification  |
| RICWS      | Rural Intersection Conflict Warning System  |
| RTMC       | Regional Transportation Management Center   |
| RWIS       | Road Weather Information System   |
| SAFER      | Safety and Fitness Electronic Records   |
| SAFETEA-LU | Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users  |
| SALT       | State Aid for Local Transportation  |
| SEOC       | State Emergency Operations Center   |
| SHSP       | Strategic Highway Safety Plan   |
| SOV        | Single Occupancy Vehicle  |
| STIP       | State Transportation Improvement Program  |
| STP        | Surface Transportation Program  |
| STRAHNET   | Strategic Highway Network   |
| TEA-21     | Transportation Equity Act for the 21st Century  |
| TH         | Trunk Highway   |
| TIGER      | Traveler Information, Guidance, and Evacuation Routing                                |
| TIFIA      | Transportation Infrastructure Finance and Innovation Act                              |
| TMC        | Transportation/Traffic Management Center  |
| TOCC       | Transportation Operation and Communications Center                                    |
| TSP        | Transit Signal Priority   |

|     |                             |
|-----|-----------------------------|
| TZD | Toward Zero Deaths          |
| UPA | Urban Partnership Agreement |
| VMT | Vehicle Miles Traveled      |
| VSL | Variable Speed Limit        |
| WIM | Weigh-in-Motion             |

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# 1. Overview

## 1.1 Background

The Minnesota Statewide Regional Intelligent Transportation Systems (ITS) Architecture Version 2014 is an update of the previous version that was developed in 2009. It conforms with the National ITS Architecture 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.

Volume 9 is one of a series of 11 reports that have been developed as part of the Minnesota Statewide Regional ITS Architecture Update effort. Volume 9 investigates and identifies opportunities to further integrate various ITS systems, and provide guidance for Minnesota state, regional and local agencies, and other involved transportation entities, to effectively apply the Minnesota Statewide Regional ITS Architecture in the planning, design, implementation, and operation stages of ITS systems and projects.

Ten other documents were developed as part of this architecture update effort and are listed below:

- **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.
- **Volumes 1 thru 8 – Development and Documentation of Service Package Bundles:** Each volume is specific to the corresponding Service Package Bundle and includes: a description of the Service Package Bundle, 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 10 – Regional ITS Architecture:** Volume 10 consists of a Turbo Architecture generated report for the Minnesota Statewide Regional ITS Architecture.

Volumes 1 through 8 were developed 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. The Volume 9 was developed based on the information collected and summarized in these volumes.

## 1.2 Purpose

This document serves as long-range guidance to help affected agencies and stakeholders 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 and defines specific ITS needs that are further defined and prioritized into ITS initiatives and project concepts. Based on stakeholders' input on transportation issues and needs, the long-range project implementation document provides the corresponding details for each project concept or initiative which include

project concept descriptions, agency involved, champion, implementation timeframe, technology readiness, dependencies, benefits, service packages, estimated costs, and agreements needed. The document identifies the approach for mainstreaming ITS into the Minnesota Transportation Investment Process and recommends the sequence and strategy for future project implementation.

### **1.3 Document Development Approach**

The process for developing this document includes identification of stakeholder needs, investigation of existing capabilities and gaps related to the needs, development of appropriate ITS concept and initiatives to address needs, analysis of project dependencies, identification of implementation sequencing, investigation of technology and ITS standards maturity and readiness, and consideration of agency agreements and project funding requirements. Initiatives and project concepts identified in this document will accomplish the needs and services documented in the Statewide Regional ITS Architecture. Due to the complexity of the ITS systems and their dependencies, it is critical to develop a proper sequence to guide the deployment of all proposed ITS initiatives over time. Priority, desired timeframe and duration are examined and assigned to each ITS initiative, and an overall deployment schedule is compiled to ensure successful implementation.

The key in this planning process is to identify initiative definition and sequencing. An initiative definition outlines project concepts and the associated details including initiative title, stakeholder, scope, costs, benefits and the service packages defined in the ITS architecture. Implementation sequencing gives an approximate timeframe in which an ITS initiative should be implemented based on the understanding of the initiatives and the dependencies of the initiatives on other existing or planned ITS systems. Project dependencies show how successive ITS initiatives can build on one another. Typically, the first initiatives in the implementation sequence are already programmed and will simply be extracted from existing transportation plans. Successive initiatives will then be added to the sequence based on the project dependencies as well as technical, institutional and financial considerations.

An implementation sequence defines the order in which ITS initiatives may be implemented. A good sequence is based on a combination of two factors:

- Prioritization of initiatives based on existing conditions and stakeholder needs. The ITS initiatives were prioritized to reflect a deployment path (sequence) on stakeholder needs. Although the information collected through stakeholder surveys and meetings was the basis of the ITS architecture; technology, funding opportunities and requirements continue to evolve.
- Project dependencies, based on how successive ITS initiatives can build upon one another. Project dependencies influence the implementation sequencing. It is beneficial to identify the information and functional dependencies between initiatives.

### **1.4 Document Organization**

This document is organized into four sections:

- Section 1 provides a brief introduction to the document.
- Section 2 describes the approach and key process for ITS program development focusing on stakeholder needs, initiatives and project concepts identification, ITS

architecture development, timeframe and sequencing. This section also identifies the role of ITS in the Minnesota Transportation Investment Process, which is the State's planning and programming process, funding needs and identification process.

- Section 3 describes the ITS project development process for generating specific ITS projects for incorporating into the Minnesota Transportation Investment Process. This section also provides an overview of the Systems Engineering Checklists for ITS Projects which are approval documents required to be completed prior to appropriating federal funding for ITS projects or projects with ITS components.
- Section 4 identifies the important implementation considerations including costs and short, medium and long term ITS initiatives and project concepts that may affect ITS implementation and integration.

In summary, Volume 9 describes the general approach and key process used to develop this document and how Minnesota ITS Goals, Objectives, and overall Statewide transportation strategic directions, goals and objectives are related to ITS project identification, selection and prioritization.

## 2. ITS Program Development

### 2.1 Overview

This section provides an overview of the ITS project identification, selection and development process and the relationships of ITS projects with the transportation planning processes of transportation agencies and associated stakeholders throughout Minnesota

The Minnesota Statewide Regional ITS Architecture provides Minnesota state, regional and local agencies, and other involved transportation entities with a framework for planning, defining, and integrating the ITS systems in Minnesota. As part of the Architecture, Volume 9 identifies and defines specific ITS initiatives and project concepts planned to be implemented statewide and needed enhancements to existing ITS systems. Volume 9 documents the necessary information that will facilitate and prioritize the funding resources for future ITS deployments and enhancements statewide. The general approach for developing this document includes the following:

- Based on stakeholder needs, identify, categorize and prioritize ITS initiatives for implementation considerations for the next 15 to 20 years.
- Develop and utilize a process and a method for identifying, evaluating and prioritizing ITS initiatives based on needs, goals and objectives, investment priorities and benefits.
- Develop *project architectures* consistent with the Minnesota Statewide Regional ITS Architecture and in conformance with the National ITS Architecture.
- Define criteria, considerations and process for determining implementation timeline and sequences for future ITS initiative and project concepts.
- Describe Minnesota Department of Transportation's planning process and where the ITS project development process fits into the planning and programming process; defines the approach for mainstreaming ITS into the Minnesota Transportation Investment Process.
- Provide an overview of funding needs and sources to implement, operate, maintain and integrate ITS elements in Minnesota.

- Defines and illustrates a schedule summary for implementing ITS short, medium and long term initiatives and project concepts:
  - Short term initiatives (0-4 years) including a summary of: category; description; agency/stakeholder involved; champion; elements and interconnects; estimated costs; dependencies, and service packages.
  - Medium (5-8 years) and long term (>8 years) initiatives providing a high level summary for each initiative, including: category; description; agency/stakeholder, champion; dependencies and service packages.

Planned initiatives will accomplish the user services and system functions defined in Volume 10: Regional ITS Architecture. Due to the complexity of ITS systems and their dependencies, it is critical to develop a proper sequence to guide the deployment of proposed ITS initiatives over time. Priority, desired timeframe and duration are examined and assigned to each ITS initiative, and an overall deployment schedule is compiled to ensure successful implementation.

The key to the ITS planning process is to define the project/initiative definition and implementation sequencing process. The project/initiative definition outlines the initiatives and project concepts and the associated details including initiative title, stakeholder, scope, costs, benefits and service packages defined in Volume 10: Regional ITS Architecture. The implementation sequencing provides an approximate timeframe in which an ITS initiative may be implemented based on the understanding of the initiative and dependencies of the initiative with other existing or planned ITS systems.

## **2.2 Stakeholder Needs Identification and Prioritization**

Stakeholder outreach has been a key component for updating the Minnesota Statewide Regional ITS Architecture. Because additional ITS needs and services have been identified and added since 2009, new technologies have come on-line, and new technologies have replaced out-of-date technology, a stakeholder survey was conducted in early 2013. The survey asked each survey participant to review and provide priority ranking to each of the ITS functional/informational needs as well as research and technology development needs that were identified previously in the 2009 Minnesota Statewide Regional ITS Architecture. Survey participants were also asked to identify additional needs and provide information on the status of current projects/initiatives and plans for future projects/initiatives.

Between March and May 2013, a series of stakeholder workshops were conducted. The purpose of those workshops was to obtain feedback on the Minnesota ITS Goals and Objectives, discuss the results of the stakeholder survey, and gather additional feedback on needs and priority rankings. Based on those goals and objectives, stakeholders reviewed the ITS functional/informational needs and research and technology development needs and participated in discussion to identify the highest priority needs that would benefit the traveling public.

Stakeholders also reviewed and updated the needs and services identified in the 2009 architecture update for each of the eight Service Package Bundles (Volumes 1 through 8). The stakeholders accomplished this by providing detailed feedback from Appendix C – Needs and Service Detail, in each Service Package Bundle document on the following categories:

- Need/Service
- Operational Concept

- Existing Capabilities
- Gaps/Planned Enhancements
- Roles/Responsibilities
- Interconnect
- Data Archive Needs
- Associated Service Package Bundles

The stakeholder outreach and engagement resulted in an up-to-date list of ITS initiatives and project concepts to determine short (0-4 years), medium (5-8 years) and long term (>8 years) initiatives identified in this volume.

### 2.3 ITS Initiative Identification, Evaluation and Selection

As part of the Volume 9 development process the Project Team worked closely with participating stakeholders to identify, evaluate, select and prioritize ITS initiatives. Based on the previously identified needs and services, stakeholders identified and prioritized, in each of the service package bundles, a list of initiatives and project concepts to address those needs and services. Specifically, detailed descriptions of operational concepts; existing capabilities; gaps and/or planned enhancements; stakeholder roles and responsibilities; interconnects; archive needs; specific and associated service packages were developed. ITS initiative selection included a detailed review of those needs and service details, keying in on operational concepts and gaps and/or planned enhancements to establish the list of initiatives.

Additional safety related initiatives with ITS components were identified in coordination and collaboration with the 2014 Minnesota Strategic Highway Safety Plan (SHSP) Update effort. Those ITS safety initiatives along with other ITS initiatives identified through the stakeholder outreach process are detailed in Section 4.

### 2.4 Implementation Timeframe and Sequencing

Implementation timeframe and sequencing explains the general criteria and process of defining the implementation sequence for future ITS initiatives and project concepts. Initiative timeframe represents the initiative status and defines the time window to implement the ITS initiative and associated services. Three timeframe categories are used and their definitions are described below:

**Table 2-1. Initiative Implementation Timeframes**

| Category    | Timeframe      | Year of Deployment |
|-------------|----------------|--------------------|
| Short Term  | 0 – 4 years    | 2015 - 2019        |
| Medium Term | 5 – 8 years    | 2020 – 2024        |
| Long Term   | Beyond 8 years | 2024 and beyond    |

Defining the timeframe and sequencing for initiative implementation is based on, stakeholder input; specific needs of the region (e.g. statewide, rural area, metropolitan planning organization [MPO], etc.) or local area (e.g. municipal or county jurisdiction etc.); and the readiness of each initiative. Other factors that will need to be considered in the implementation timeframe and sequencing process are:

- Funding availability
- Interdependency with current ITS capabilities and other initiatives
- Technology assessment
- Identification of estimated capital, operations and maintenance costs
- Agreements required for implementation and operations of ITS systems

## 2.5 Statewide Transportation Investment Process

### 2.5.1 Transportation Planning and Program Process

The Statewide Transportation Investment Process provides an interrelationship between elected officials and transportation agencies, and relies on the transportation planning activities of Minnesota Department of Transportation (MnDOT), cities, counties, MPOs, Regional Development Commissions (RDCs), and other transportation agencies. This transportation investment process is driven by statewide goals and transportation directions via the Minnesota Strategic Plan and Statewide Transportation Plan, which are supported by statewide, district, regional and local plans.

The Statewide Transportation Investment Process encompasses planning, programming and project development. The following summarizes the planning framework which guides program and development process:

#### Transportation Planning Process

1. **Minnesota GO 50-Year Vision:** The Minnesota GO 50-year vision was adopted in November 2011 and is the first long-range transportation vision adopted for Minnesota. It establishes long-term objectives for the Statewide Multimodal Transportation Plan as well as for all modes and transportation partners. The vision is structured around a vision for a multimodal transportation system for Minnesota that maximizes the health of people, the environment, and economy, and includes eight guiding principles to help inform future policy and investment decisions for all forms of transportation throughout Minnesota.
2. **MnDOT 20-Year Statewide Multimodal Transportation Plan:** The Statewide Multimodal Transportation Plan is used to shape subsequent MnDOT plans and investment decisions while serving as a framework and providing guidance for transportation partners moving forward. It is based on the Minnesota GO 50-year vision and includes broader multimodal objectives and strategies that directly affect the direction of modal investment plans. Additionally, the plan was developed to align with state legislative goals and federal guidance.
3. **MnDOT 20-Year Modal Investment Plans:** MnDOT currently has four 20-year modal investment plans: State Aviation System Plan, State Highway Investment Plan (MnSHIP), Greater Minnesota Transit Investment Plan, and Minnesota Comprehensive Statewide Freight and Passenger Rail Plan. Minnesota Statewide Bicycle System Plan is current being updated. Updates to MnDOT's modal investment plans will use the Minnesota GO vision and guiding principles and the objectives and strategies identified in the Statewide Multimodal Transportation Plan as their framework for development. These plans draw on a broad array of other plans and studies to set out mode-specific strategies, performance measures, performance-based needs over upcoming years, risk-based investment trade-offs and recommended priorities.

4. **“Local” Plans:** Local plans are described, in this case, as MPOs; RDCs; Tribal governments; city; county; etc., located within the MnDOT District boundaries. MnDOT district representatives take into consideration developed local plans that address transportation issues and needs, as well receive input and feedback from local agencies, interested transportation groups and the public.

### **Transportation Programming Process**

1. **Area Transportation Partnerships (ATPs):** ATPs generally follow MnDOT District boundaries and are represented, but not limited to, MPOs, RDCs, Tribal Governments, local governments, the general public and other transportation interests. The primary role of the ATPs is to bring together transportation improvement recommendations into a list of transportation investments – Area Transportation Improvement Program (ATIP).
2. **Area Transportation Improvement Program (ATIP):** The ATP develops an ATIP that covers a minimum of a four-year period. ATIPs include all projects seeking federal-aid highway, state trunk highway, and federal transit sources of funding. Each of the eight ATPs receives one or many prioritized lists of transportation projects through their solicitation process. The ATPs are responsible for integrating these priority lists into the ATIP. The ATIP prepared by each of the eight ATPs is submitted for inclusion in the draft State Transportation Improvement Program (STIP).
3. **State Transportation Improvement Program (STIP):** The ATIPs are analyzed and compared to statewide goals and objectives, and unique transportation needs. The ATIPs are also analyzed for completeness and fiscal constraint. From this process the draft STIP is developed. The draft STIP is circulated for review and comment before final adjustments are made. The STIP covers four state fiscal years and includes all state and local projects financed with federal highway or transit assistance. The STIP also includes other regionally significant projects, all projects on the state highway system and illustrative projects (i.e. projects that will be programmed should funding become available).

In summary, the project selection process is the identification of the projects to be implemented in the first year of the four year duration of the STIP. Projects in the remaining years of the STIP are eligible for selection for implementation without a formal amendment to the STIP. Project selection includes two iterative processes.

- Determining the program from the list of projects within the draft ATIP. This includes analysis of preferred sources of funding and where fiscal constraint is maintained.
- Review of the STIP. The draft STIP is circulated back to the District/ATP for review and comment. After revisions are made the STIP is forwarded to the Commissioner’s staff for review and approval prior to being sent to the US Department of Transportation (DOT).

### **2.5.2 ITS Roles in STIP**

ITS from a statewide perspective supports the Minnesota Transportation Investment Process in several ways:

- The subject of this most recent document, Minnesota Statewide Regional ITS Architecture helps to set up the next step to integrate ITS into the Minnesota Transportation Investment Process. The Minnesota Statewide Regional ITS Architecture, incorporated with the MnDOT

Statewide Multimodal Transportation Plan, aligns projects with the State or region's goals and flow into the STIP.

- The FHWA's, "Use of Regional ITS Architecture" manual lists several additional ways that a regional ITS architecture can support the transportation planning process:
  - The services described in the ITS architecture can provide the basis for operational strategies to improve the transportation system and meet the state's or region's vision and goals.
  - The ITS architecture can be used to support the evaluation and prioritization of strategies in two ways: 1) through the architecture's definition of archiving and data collection systems that support collecting the data needed for evaluation; and 2) through the detailed definition of ITS projects and their sequencing that can be used to support prioritization.
  - The definition of an integrated transportation system described by the ITS architecture can support a key element of the transportation plan.
  - The process of developing and maintaining a regional ITS architecture can help to enhance the linkage between operations and planning.

In summary, it is essential that overarching policies from statewide, regional and local plans provide direction to the architecture by establishing the state's/region's ITS needs and priorities to incorporate and plan improvements to address those identified needs and priorities. The Minnesota Statewide Regional ITS Architecture and associated ITS planning and deployment documents, were built upon a foundation provided by previous MnDOT transportation planning documents. These planning documents outline the agency's vision, goals, and priorities for the overall transportation system. These documents form the foundation for the ITS Architecture Update and guide the development of future ITS enhancements.

The basis for all MnDOT transportation planning documents is the Minnesota GO vision. This high-level plan defines MnDOT's principles to guide future policy and investment decisions for all forms of transportation throughout Minnesota. The 20-Year Statewide Multimodal Transportation Plan further clarifies these principles and lays out objectives and strategies to be used to implement the directions identified in the 50-year vision. These objectives and strategies are further developed in several different types of planning documents: Modal Investment Plans, Highway Systems Operations Plan, SHSP, other investment plans, and local agency plans. These plans develop strategies, concepts, and projects to implement higher level policies. This Minnesota Statewide Regional ITS Architecture falls into this category. Projects from this level of planning are selected for inclusion into 10-year programs of capital and service improvements and then a limited number are included into the 4-year STIP.

## **2.6 ITS Funding Sources**

### **2.6.1 Federal Funding**

Moving Ahead for Progress in the 21st Century Act (MAP-21) starts the transition to a performance-driven and outcome-based program. This transition is represented in many areas of MAP-21: formula highway programs, new performance management provisions, and planning provisions. It requires States and MPOs to establish and use a performance-based approach as part of the statewide and metropolitan transportation planning process. Potential funding programs for ITS activities are summarized below:

- National Highway Performance Program (NHPP)

- NHPP funds an enhanced National Highway System, combining the functions of the existing National Highway System (NHS), Interstate Maintenance (IM) and Bridge Programs.
- The enhanced NHS includes existing NHS, all principal arterials, STRAHNET, and intermodal connectors.
- NHPP provides support for the condition and performance of the NHS, for the construction of new facilities on the NHS, and to ensure that Federal-aid investments in highway construction are directed to support progress toward achieving performance targets established in a State's asset management plan for the NHS.
- NHPP funds capital and operating costs for traffic management and traveler information monitoring, management, and control facilities and programs.
- NHPP also covers infrastructure-based ITS capital improvements.
- Surface Transportation Program (STP)
  - STP provides flexible funding that may be used for projects to preserve and improve conditions and performance on any Federal-aid highway, bridge and tunnel project on any public road, pedestrian or bicycle infrastructure, and on a capital transit project.
  - Apportionment sub-allocation change: 50% available for statewide use; 50% available based on population.
  - It adds funding for projects and strategies designed to support congestion pricing, including electronic toll collection and travel demand management strategies.
- Highway Safety Improvement Program (HSIP)
  - Level of funding is doubled and eligibility is expanded to include priority control system for emergency vehicles at signalized intersections, traffic control or other warning device at a location with high crash potential.
  - SAFETEA-LU (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users) focus on reducing fatal and serious injury crashes on all public roads is retained.
  - Performance targets for safety will be set by states one year after the USDOT completes their rulemaking process to establish performance measures and standards with the goal of achieving a significant reduction in traffic fatalities and serious injuries on all public roads.
- Congestion Mitigation and Air Quality (CMAQ)
  - CMAQ program existed in SAFETEA-LU is largely retained. The program funds projects that help reduce emissions and traffic congestion in areas designated as nonattainment or maintenance areas for carbon monoxide, ozone or particulate matter.
  - Eligible projects include projects to improve mobility such as through real-time traffic, transit and multimodal traveler information, or otherwise reduce demand for roads through means such as telecommuting, ridesharing, carsharing, and pricing.
- Transit Program
  - MAP-21 furthers several important goals, including safety, state of good repair, performance, and program efficiency.
  - It establishes performance-based planning requirements that align Federal funding with key goals and tracks progress towards these goals.
  - It grants FTA the authority to establish and enforce a new comprehensive framework to overs the safety of public transportation.
  - It broadens the definition of Bus Rapid Transit (BRT) projects. BRT projects are now classified and funded as either Corridor-Based or Fixed Guideway.
  - It funds BRT projects in defined corridors that demonstrate substantial investment in fixed transit facilities including transit stations, ITS technology, traffic signal priority, and off-bard fare collection.

- Capital project definitions are expanded to include transit-related ITS, safety and security equipment and facilities, and the introduction of new technology through innovative and improved products.
- It includes new funding for technology demonstration and deployment projects, including mobility management and improvements in vehicle technology.
- Highway Research and ITS
  - MAP-21 establishes a flexible, nationally-coordinated research and technology program. All research activities are to include a component of performance measurement and evaluation, should be outcome-based, and must be consistent with the USDOT Research, Development, and Technology Strategic Plan.
  - The Technology and Innovation Deployment Program funds efforts to accelerate the implementation and delivery of new innovations and technologies that result from highway research and development to benefit all aspects of highway transportation.
  - The Highway Research Program includes focus on reducing congestion, improving operations and enhancing freight productivity. The focus also includes active traffic and demand management, accelerated deployment of ITS, arterial management and traffic signal operations, congestion pricing, real-time information, road weather management, and other ITS strategies.
  - ITS is specifically mentioned for eligible activities for the five largest formula highway programs (NHPP, STP, HSIP, CMAQ, and projects to improve freight movement).
  - The Transportation Infrastructure Finance and Innovation Act (TIFIA) can be used for ITS projects that cost at least \$15 million.
  - MAP-21 provides states with authority to toll new and existing highway facilities while ensuring that existing Interstate lanes that are now toll-free remain toll-free.
  - High-Occupancy Vehicle (HOV) to High-Occupancy Toll (HOT) conversions must include automated toll collection systems, and policies to manage demand using variable pricing must be established for such conversions.
  - Within four years, all toll facilities on the Federal-aid highway system must implement technologies or business practices that provide for the interoperability of electronic toll collection programs.

## **2.6.2 State and Local Funding**

The State of Minnesota has a biennial budget. State agency programs and operating budgets are based on a balanced budget. The 2014-2017 STIP is based on one year of approved funding and three years of estimated funding. The funding level for the STIP is estimated to be approximately the same for all 4 years of the STIP.

- State Highway Funding
  - Funding for construction from this source is expected to be about \$290 million per year based on the current revenue forecast.
  - The State Highway cash flow also permits advance construction of projects prior to actual federal dollars being available.
- State Transit Funding
  - Transit assistance comes from three sources, the General Fund, Motor Vehicle Sales Tax (MVST) and Motor Vehicle Leased Sales Tax (MVLST). The transit appropriation from the State General Fund is expected to be about \$16.3 million in each year of the STIP for Greater Minnesota and \$107.9 million in 2014 (of which \$37 million is for the Southwest Corridor Light Rail Transit (LRT) project), \$77.0 million in 2015, and \$76.7 million in the final two years of the STIP for the Metropolitan Area.

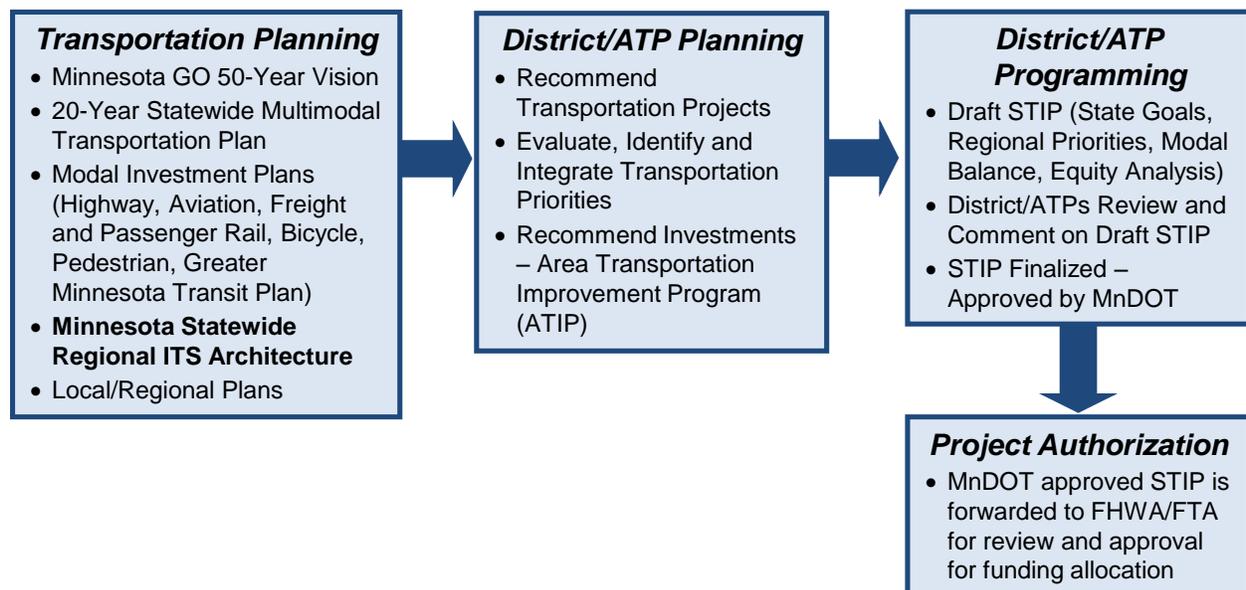
- Minnesota's 2007 Legislature statutorily dedicated 40 percent of the annual MVST collections for transit: 4 percent is dedicated for Greater Minnesota transit operations and 36 percent for Twin Cities Metropolitan Area transit operations.
- Greater Minnesota transit receives 50 percent of MVLST revenues after the fund reaches a threshold of \$32 million. In addition, Minnesota's 2013 Legislature modified the allocation of MVLST revenue for fiscal years 2014 and 2015 by capping the County State Aid Highway (CSAH) fund's allocation at \$9 million.
- State Aid for Local Transportation (SALT)
  - MnDOT distributes funds for highway maintenance and construction to counties, cities and townships based on a formula determined by the Legislature.
  - Staff from SALT provides technical assistance in highway and bridge design, construction and maintenance, authorizes grants for bridge construction, coordinates local federally funded projects and provides overall management of the state aid system.
  - The Minnesota Constitution provides that 95% of the Highway User Tax Distribution (HUTD) Fund revenues are distributed as follows: Trunk Highway (TH) fund - 62%; CSAH fund - 29%; and Municipal State Aid Streets (MSAS) fund - 9%. The remaining 5%, referred to as the five percent set-aside, is distributed in accordance with a formula established by the Legislature,
  - Since July 1, 1999, the five percent set-aside revenues, \$87 million in FY 2012, have been deposited in the CSAH Fund, where they have been further allocated to the Township Roads Account (30.5%), Township Bridges Account (16%), and Flexible Highway Account (53.5%).
- Flexible Highway Account
  - The Flexible Highway Account was created by the 1998 Legislature by combining money from the five percent set-aside that was previously allocated to the Trunk Highway Fund, the county turnback account in the CSAH Fund, and the municipal turnback account in the MSAS Fund.
  - The distribution of money in the Flexible Highway Account is subject to decisions made in the State's biennial budget process.
- Advance Construction
  - Advance Construction is a federal law that allows states to request and receive approval to construct federal-aid projects prior to receiving apportionment or obligation authority.
  - Minnesota may commit future federal funds to a project as long as it goes through the normal FHWA approval and authorization process.
  - Projects using Advance Construction must be fully encumbered in the state road construction budget for the amount of both the state funds and federal Advanced Construction amount.
  - Advance Construction is available to local governments as well as MnDOT.
  - The agency using the Advance Construction procedure must "front-end" the project with their funds.

### 3. ITS Project Development and Requirements

#### 3.1 ITS Project Development Process

Throughout Minnesota ITS Program history the project development process encouraged ITS projects to be more cutting edge and experimental in their program development. This process required that the results and performance of the project or initiative be carefully analyzed and disseminated on a national level so as to allow future projects/initiatives to build on the successes of the original project/initiative.

The development of Minnesota ITS programs, initiatives, project concepts and projects lies in large part to documents such as the Minnesota Statewide Regional ITS Architecture and other plans with ITS components, which have laid the groundwork that will help set the new directions for ITS in Minnesota. Figure 3-1 provides a high level view of the ITS mainstreaming process into the Minnesota Investment Process.



**Figure 3-1. ITS Mainstream Process**

Two high-level diagrams of the MnDOT ITS project development process are presented in Figures 3-2 and 3-3. Typical ITS field equipment projects are similar to construction projects and can be implemented using the MnDOT Highway Project Development Process (HPDP), shown at a high level in Figure 3-2. This figure focuses specifically on the process steps and documentation that relate most directly to the systems engineering process. As shown the project scoping and detailed design steps include several documents that represent good systems engineering practice. Figure 3-3 aligns all three of these processes, a first step in mainstreaming ITS specific processed into the existing HPDP. The Rule 940 conformity process and the Systems Engineering process shown in Figure 3-3 are described in Sections 3.2 and 3.3, respectively.

MnDOT, in working with FHWA, is current exploring the relationship between the processes to facilitate integration of systems engineering activities with traditional MnDOT project development activities and the HPDP.

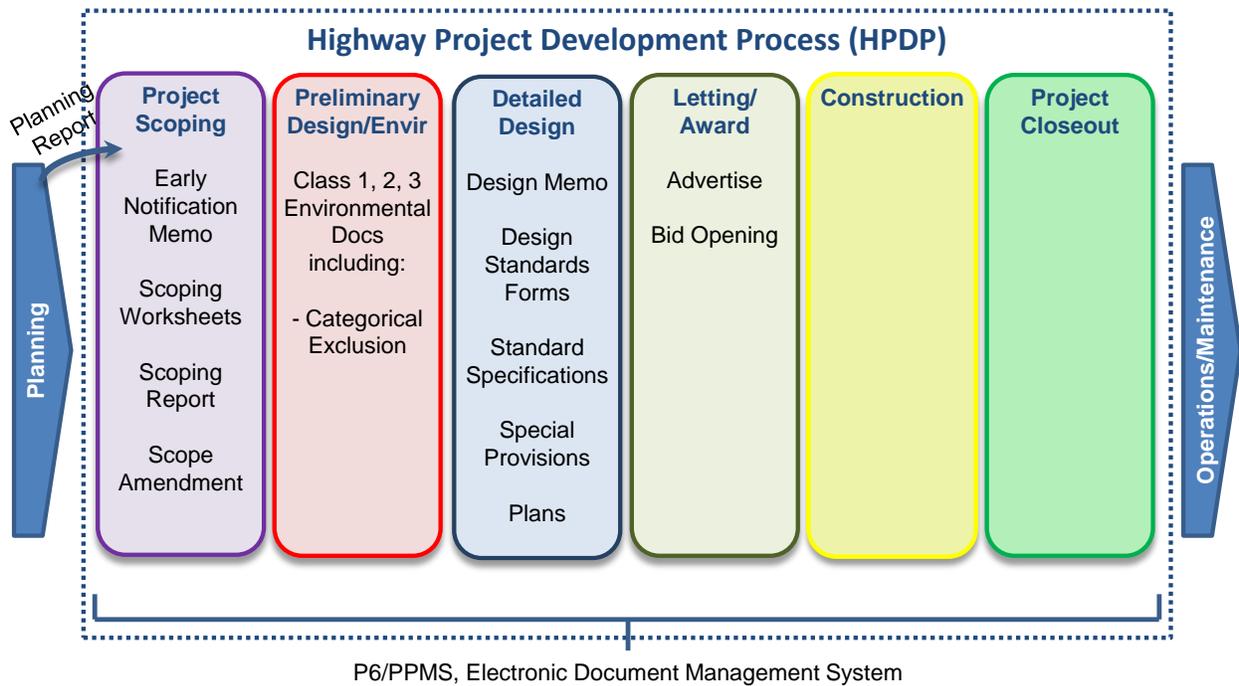


Figure 3-2. MnDOT Highway Project Development Process

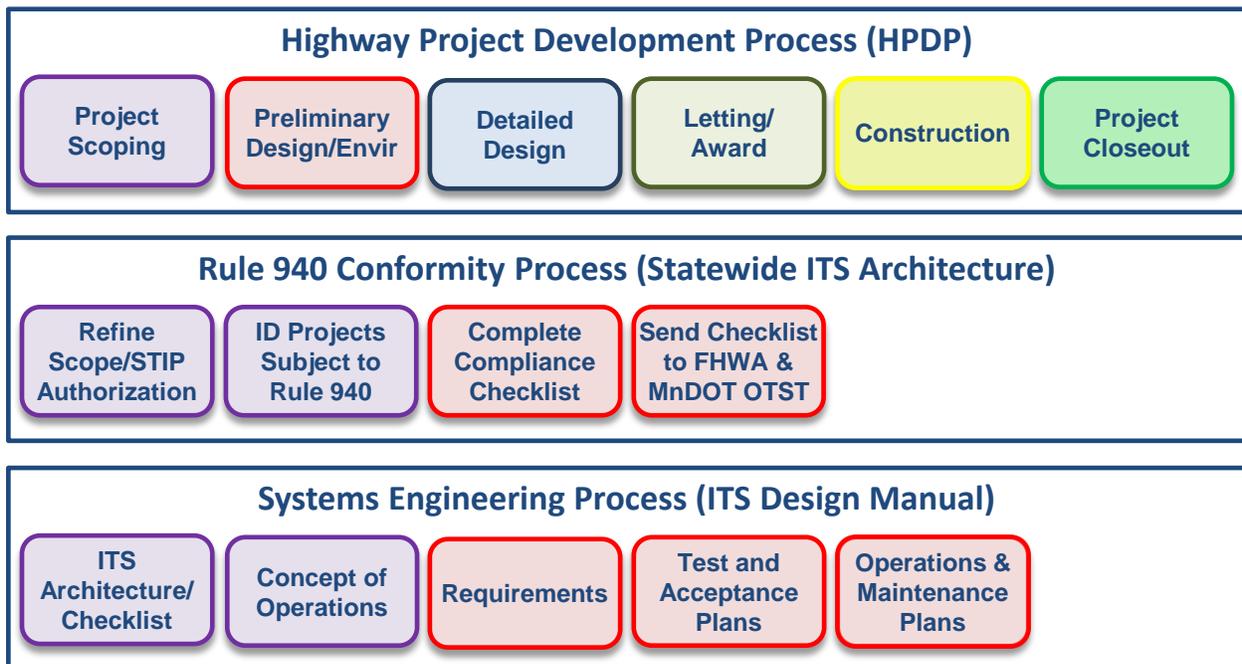


Figure 3-3. Aligning HPDP and ITS-Specific Processes

## 3.2 Rule 940 Requirements and Conformity Process

FHWA Rule 940 ([http://ops.fhwa.dot.gov/its\\_arch\\_imp/docs/20010108.pdf](http://ops.fhwa.dot.gov/its_arch_imp/docs/20010108.pdf)) provides policies and procedures for implementing Section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21), Public Law 105-178, 112 Stat. 457, pertaining to conformance with the National ITS Architecture and Standards. The rule states, in part, that the final design of all ITS projects funded with Highway Trust Funds must accommodate the interface requirements and information exchanges as specified in the regional ITS architecture. The Minnesota Statewide Regional ITS Architecture is a specific application of the framework specified in the National ITS Architecture, tailored to the needs of the transportation stakeholders statewide.

### 3.2.1 Project Initiation and Implementation

After funding has been programmed for a specified ITS project, or a transportation project incorporating ITS elements, the focus is on having the ITS project follow a sound systems engineering process. The following are activities after funding has been programmed into the STIP:

- 1) **Refine Scope/STIP Authorization:** The MnDOT Project Manager, or if a local project, the local Project Manager will work with partners to develop agreements, refine scopes, etc.
- 2) **ATIP/STIP Authorization:** If the project is federally funded projects must be entered on the ATIP/STIP before authorization can be obtained.
- 3) **Identification of Projects to Demonstrate Rule 940 Conformity:** For federally funded ITS projects, several steps need to be followed as part of the systems engineering analysis and Rule 940 requirements. Rule 940 states that the systems engineering analysis shall include, at a minimum:
  - Identification of portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of the National ITS architecture).
  - Identification of participating agencies roles and responsibilities.
  - Requirements definitions.
  - Analysis of alternative system configurations and technology options to meet requirements.
  - Procurement options.
  - Identification of applicable ITS standards and testing procedures.
  - Procedures and resources necessary for operations and management of the system.

The rule requirements are applicable for all ITS projects funded through the Highway Trust Fund account. Conformity with the Rule 940 requirements is required for both routine and non-routine projects. However, with routine projects, the effort and the scope of systems engineering analysis should be minimal. For non-routine projects, the scale of the systems engineering analysis depends on the scope of the project.

While the use of the architecture and the systems engineering approach is mandatory for federally funded projects, project developers are encouraged to use this approach for any ITS project using state or local funds, especially for projects that integrate with other systems in the region.

**4) Minnesota ITS Projects – Architecture Compliance (FHWA Final Rule 940 and FTA National ITS Architecture Policy) Checklist:** MnDOT has developed procedures and checklists for ITS projects for conformity with the FHWA Rule 940 and FTA National ITS Architecture Policy.<sup>1</sup> To facilitate the streamlined implementation of ITS systems engineering requirements, MnDOT has divided ITS projects into two categories: Standard ITS Applications and Large Scale/Complex ITS Applications. Standard ITS Applications include:

- Traffic Signal: including basic traffic signals, flashing yellow arrows, advanced warning flashers, railroad preemption, emergency vehicle preemption, transit signal priority, enforcement lights, and traffic signal interconnects.
- Road Weather Information System (RWIS): including RWIS sensors and stations.
- Railroad-Highway Grade Crossing: including flashing light signals, standard crossing gates, four quadrant gates, traffic signal preemption, etc.
- Weigh in Motion System: for CVO weight enforcement and inspection.

For Standard ITS Applications, a programmatic systems engineering analysis has been completed. This effort created a concept of operations, functional requirements document and systems engineering checklists for this type of ITS projects. The appropriate, pre-approved Systems Engineering Checklist should be completed by the project manager and/or District Traffic Engineer/State Aid Engineer.

Projects not covered by Standard ITS Applications are considered Large Scale/Complex ITS Applications and will require completion of a full systems engineering procedure and one of the following three Systems Engineering Checklists for ITS projects:

- Freeway Traffic Management Checklist
- Arterial Traffic Management Checklist
- General Large Scale/Complex ITS Application Checklist

These checklists are guides for project managers to determine what documents, steps and analyses need to be developed over the life of the project. The checklists are broken down into six and five sections for Standard ITS Applications and Large Scale/Complex ITS Applications, respectively. The sections of the checklist were adapted from federal guidance on using systems engineering in ITS projects, as well referencing other DOT's ITS compliance process. The General Systems Engineering for Large Scale/Complex ITS Application is included in Appendix A with a sample, completed checklist in Appendix B. The project manager should complete the appropriate checklist based on information already available to them. Questions that arise pertaining to the checklists during the completion process should be directed to the MnDOT contact noted on the checklists.

For projects utilizing no federal funds or non-routine projects, it is recommended that a similar process be followed. Examples of such projects might include integration of computer-aided dispatch systems among law enforcement agencies and traffic

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<sup>1</sup> Similar to FHWA Rule 940, the FTA National Architecture Policy provides procedures for implementing section 5206(e) of the Transportation Equity Act for the 21<sup>st</sup> Century. All projects funded with mass transit funds from the highway trust fund will be based on a systems engineering process.

management agencies, setting up a video clearing house, provision of regional traveler information, etc.

- 5) **Send Completed Checklist to MnDOT and FHWA:** Once the Rule 940 checklist is completed and signed by the District Traffic Engineer/State Aid Engineer, it should be submitted along with the project documentation package for federal authorization to MnDOT Pre-Letting Engineer or State Aid Office. MnDOT Office of Traffic, Safety, and Technology (OTST) will provide guidance and technical assistance to properly use systems engineering and complete the checklist. FHWA staff will review checklist and supporting documentation and make a determination as to whether the proposed project demonstrates compliance with Rule 940.

### 3.3 Systems Engineering

Final Rule 940 requires that all ITS projects funded with highway trust funds be developed based on a systems engineering analysis. Systems engineering is a phrase used to describe the cyclical process of planning, designing, implementing, testing, operation, and maintenance of an ITS system or project throughout its useful life. The systems engineering process begins with the development and implementation of an ITS architecture and continues by outlining the steps and level of detail of each phase of project deployment, from high-level tasks such as establishing the Concept of Operations to very detailed component design, installation, and testing. The purpose of the systems engineering process is to ensure that a well-planned foundation is in place and then to affirm the requirements of an ITS system.

As illustrated in Figure 3-4, Systems Engineering Approach recommended by the FHWA, an ITS architecture provides a starting point for systems engineering analyses that are performed during ITS project development.

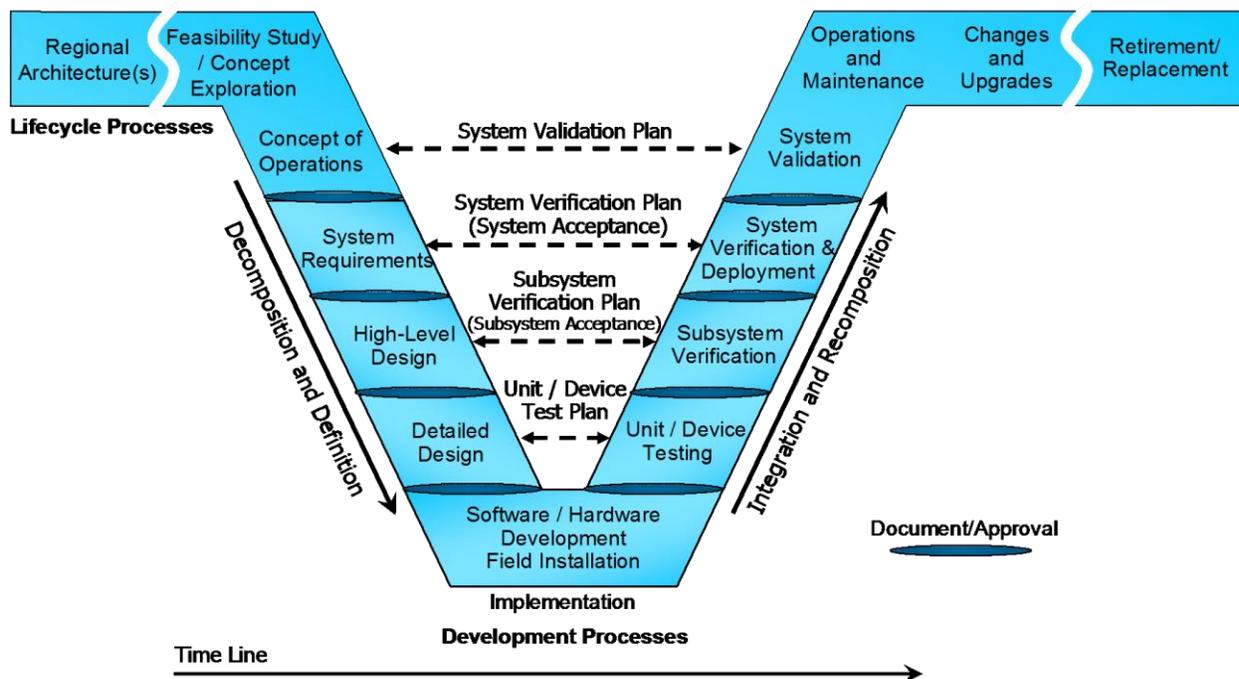
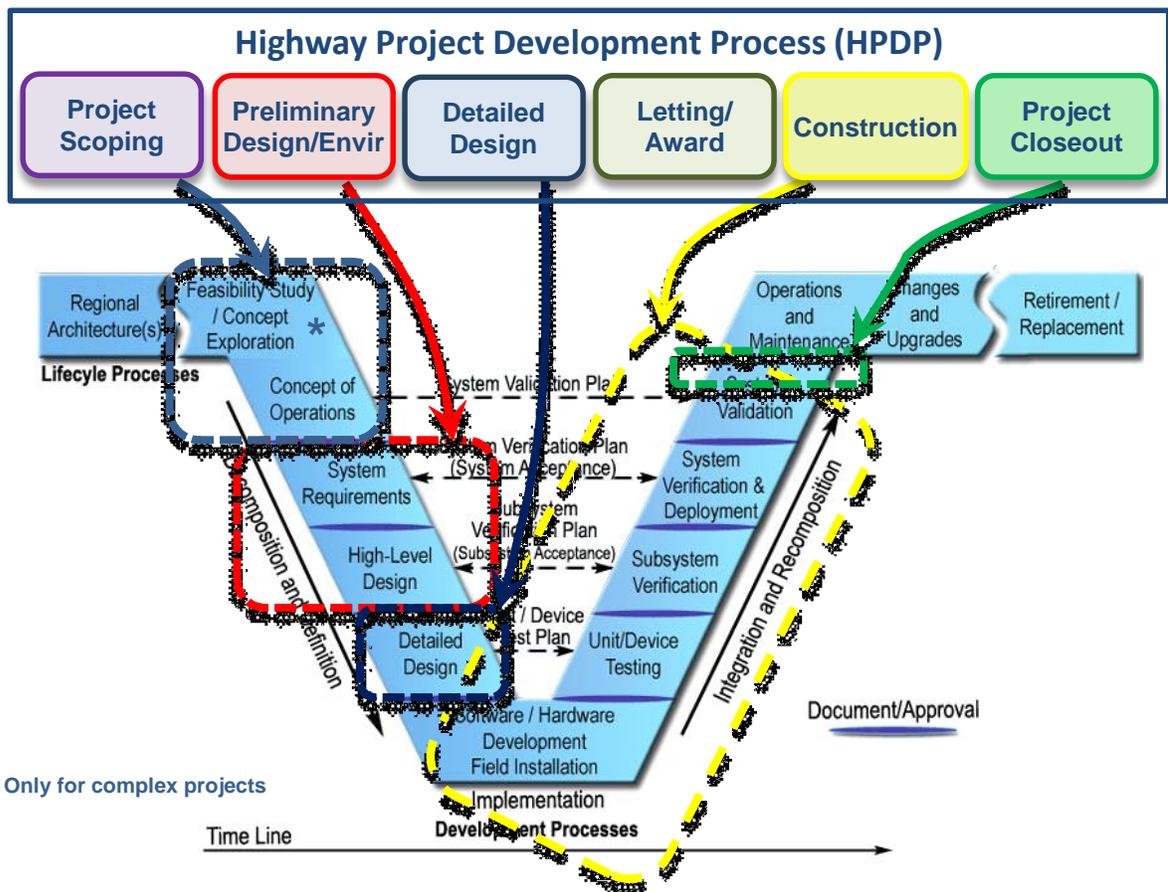


Figure 3-4. Systems Engineering Approach

Figure 3-5 maps the systems engineering “V” diagram to the high-level HPDP. The figure illustrates the high-level connections that exist between the project development process and the process steps that make up the systems engineering process. This relationship should be well understood by stakeholders and management at the outset of the project development process improvement. As illustrated, many of the systems engineering process steps have parallels in the traditional project development process. The challenge is that technology implementation is often more complex from an integration standpoint than traditional capital projects.



**Figure 3-5. HPDP and Systems Engineering Process**

The ITS Architecture is a dynamic document that requires periodic updates to reflect changes in an agency’s ITS program due to funding levels, evolving project or system requirements, or the introduction of improved technology. Once ITS projects are programmed, the ITS architecture provides initial inputs to support the systems engineering process including the establishment of the concept of operations, requirements, and high-level design and test planning of ITS projects. The ITS architecture improves continuity across the project lifecycle, from planning through project development and operations. As required by the FHWA and FTA, the Statewide Regional ITS Architecture serves to meet the criteria of Final Rule 940.

The development and implementation of the Minnesota Statewide Regional ITS Architecture is within the framework of the National ITS Architecture, and using the systems engineering approach will help ensure the stability and longevity of ITS projects and systems deployed throughout Minnesota.

## **4. ITS Initiatives and Project Concepts for Implementation**

This section identifies the overall vision and approach for ITS system deployments over the next 15-20 years throughout Minnesota. Section 4.1 provides a summary of all potential ITS initiatives and project concepts and their relationships with the Minnesota ITS Goals. Section 4.2 summarizes the implementation sequencing and schedule of the identified short-term initiatives and project concepts, along with the costs for implementation. Section 4.3 provides detailed descriptions of the short-term initiatives and project concepts, while Section 4.4 describes the medium- and long-term initiatives and project concepts.

### **4.1 Summary of Potential Initiatives and Project Concepts**

This section presents a list of all potential ITS initiatives and their relationships with the Minnesota ITS Goals and Objectives. The Minnesota ITS Goals and Objectives were presented in the Overview document. Specific objectives were categorized under the following eight Minnesota ITS Goals:

- A. Improve the Safety of the State's Transportation System
- B. Increase Operational Efficiency and Reliability of the Transportation System
- C. Enhance Mobility, Convenience, and Comfort for Transportation System Users
- D. Improve the Security of the Transportation System
- E. Support Regional Economic Productivity and Development
- F. Preserve the Transportation System
- G. Enhance the Integration and Connectivity of the Transportation System
- H. Reduce Environmental Impacts

The goals that would be achieved with potential ITS initiatives have been linked to those initiatives, and such linkages are presented in Table 4-1. Linkages between individual ITS initiatives and Minnesota ITS Objectives are presented in Sections 4.3 and 4.4.

### **4.2 Implementation Schedule and Cost Summary**

Table 4-2 illustrates the implementation sequencing and schedule for the 63 potential short-term ITS initiatives identified in Section 4.3. Implementation schedule is subject to change over time as initiatives are deployed or priorities change. Factors such as funding, impact of previous deployments, and unforeseen circumstances may require alternations of some initiatives, especially those scheduled for deployment in later years. As such, it is recommended that this implementation sequence and schedule is evaluated on an annual basis.

The costs for implementing potential short-term ITS initiatives are estimated at approximately \$100,000,000. Cost estimates for individual initiatives are provided in Section 4.3. It should be noted that the cost estimates are based on current technologies that are most likely to be deployed, along with many assumptions. Final costs may vary based on site-specific circumstances and are more accurately determined during the design/preliminary engineering phase.

**Table 4-1. Mapping of Minnesota ITS Goals with Potential ITS Initiatives and Project Concepts**

| ID   | ITS Initiatives and Project Concepts                            | Minnesota ITS Goals  |   |   |  |   |                                       |  |                                 |
|--|---|--|---|---|--|---|---------------------------------------|--|---------------------------------|
|  |   | A. Improve the Safety of the State's Transportation System | B. Increase Operational Efficiency and Reliability of the Transportation System | C. Enhance Mobility, Convenience, and Comfort for Transportation System Users | D. Improve the Security of the Transportation System | E. Support Regional Economic Productivity and Development | F. Preserve the Transportation System | G. Enhance the Integration and Connectivity of the Transportation System | H. Reduce Environmental Impacts |
| <b>Short Term ITS Initiatives and Project Concepts</b> |   |  |   |   |  |   |                                       |  |                                 |
| S01  | Electronic Alerts to Major Trucking Companies                   |  | ●   | ●   |  | ●   |                                       |  |                                 |
| S02  | Enhance Traveler Information Map for Mobile Devices             | ●  | ●   | ●   |  |   |                                       |  |                                 |
| S03  | 511 Telephone Interface Upgrade                                 | ●  | ●   | ●   | ●  |   |                                       |  |                                 |
| S04  | ATIS Customization  |  |   | ●   |  |   |                                       | ●  | ●                               |
| S05  | Rest Area Truck Parking Availability                            |  |   | ●   |  |   |                                       |  |                                 |
| S06  | Adaptive Signal Control   |  | ●   |   |  |   |                                       |  |                                 |
| S07  | Traffic Signal Timing and Control Improvements                  |  | ●   | ●   |  |   |                                       |  |                                 |
| S08  | Develop an Automated System for Traffic Data Archiving          |  |   |   |  |   |                                       | ●  |                                 |
| S09  | MSP CAD and CARS Integration                                    | ●  | ●   | ●   |  |   |                                       |  |                                 |
| S10  | Dynamic Speed Display Signs ("Your Speed Is")                   | ●  | ●   | ●   |  |   |                                       |  |                                 |
| S11  | Expand Provision of Travel Time and Delay Information           |  | ●   | ●   |  |   |                                       |  |                                 |
| S12  | Advance Warning Flasher Deployment Expansion                    | ●  |   |   |  |   |                                       |  |                                 |
| S13  | Arterial Traffic Management Systems                             | ●  | ●   | ●   | ●  |   |                                       |  |                                 |
| S14  | Integrated Corridor Management (ICM)                            |  | ●   | ●   |  |   |                                       |  |                                 |
| S15  | Dynamic Lane Control and Variable Speed Limit Signs on Freeways | ●  | ●   | ●   |  |   |                                       |  |                                 |
| S16  | Metro Area Ramp Meter Expansion and Enhancements                | ●  | ●   | ●   |  |   |                                       |  |                                 |

Table 4-1. (Continued)

| ID  | ITS Initiatives and Project Concepts                                  | Minnesota ITS Goals  |   |   |  |   |                                       |  |                                 |
|-----|---|--|---|---|--|---|---------------------------------------|--|---------------------------------|
|     |   | A. Improve the Safety of the State's Transportation System | B. Increase Operational Efficiency and Reliability of the Transportation System | C. Enhance Mobility, Convenience, and Comfort for Transportation System Users | D. Improve the Security of the Transportation System | E. Support Regional Economic Productivity and Development | F. Preserve the Transportation System | G. Enhance the Integration and Connectivity of the Transportation System | H. Reduce Environmental Impacts |
| S17 | Travel Time Freeway Sign Expansion                                    | ●  | ●   | ●   |  |   |                                       |  |                                 |
| S18 | Automated Surveillance and Signal Control Software                    |  | ●   |   |  |   |                                       |  |                                 |
| S19 | Expand HOT Lane Deployment in Metro Area                              |  | ●   |   |  |   |                                       |  | ●                               |
| S20 | Allow Law Enforcement to Retrieve Data from Onboard Vehicle Computers | ●  |   | ●   |  |   |                                       |  |                                 |
| S21 | Implement Automated Enforcement of Red Light Running at Intersections | ●  |   | ●   |  |   |                                       |  |                                 |
| S22 | Expand Quick Clearance Policies for Incidents                         |  | ●   | ●   |  |   |                                       |  |                                 |
| S23 | Expand Geographic Coverage of the RTMC Systems                        | ●  | ●   | ●   | ●  |   |                                       |  |                                 |
| S24 | Use Driving Simulation for Teenage and Older Driver Education         | ●  |   |   |  |   |                                       |  |                                 |
| S25 | Static Transit Route and Schedule Information Systems                 |  | ●   | ●   |  |   |                                       |  |                                 |
| S26 | Expand CAD/AVL/GPS Technologies to Rural Systems                      |  | ●   |   |  |   |                                       |  |                                 |
| S27 | Data Analysis Tools for Transit Route Performance                     |  | ●   |   |  | ●   |                                       | ●  |                                 |
| S28 | Bus Authorized Shoulders Assistant System                             | ●  |   |   |  |   |                                       |  |                                 |
| S29 | Security Surveillance at Transit Facilities                           |  |   |   | ●  |   |                                       |  |                                 |
| S30 | Transit Scheduling Software Systems                                   |  | ●   |   |  | ●   |                                       |  |                                 |
| S31 | DARTS On-line Reservation for Seniors                                 |  | ●   | ●   |  |   |                                       |  |                                 |
| S32 | Expand Real-Time Transit Departure Information                        |  | ●   | ●   |  |   |                                       |  |                                 |
| S33 | Real-Time Transit Transfer Information                                |  | ●   | ●   |  |   |                                       |  |                                 |

Table 4-1. (Continued)

| ID  | ITS Initiatives and Project Concepts                              | Minnesota ITS Goals  |   |   |  |   |                                       |  |                                 |
|-----|---|--|---|---|--|---|---------------------------------------|--|---------------------------------|
|     |   | A. Improve the Safety of the State's Transportation System | B. Increase Operational Efficiency and Reliability of the Transportation System | C. Enhance Mobility, Convenience, and Comfort for Transportation System Users | D. Improve the Security of the Transportation System | E. Support Regional Economic Productivity and Development | F. Preserve the Transportation System | G. Enhance the Integration and Connectivity of the Transportation System | H. Reduce Environmental Impacts |
| S34 | HiSPARC Transit System Deployment                                 |  | ●   | ●   |  | ●   |                                       |  |                                 |
| S35 | DTA Facility and Bus Security System Upgrades                     |  | ●   | ●   | ●  | ●   |                                       |  |                                 |
| S36 | Transit Signal Priority along Arterials                           |  |   |   |  |   |                                       |  |                                 |
| S37 | NexTrip Enhancements  |  |   |   |  |   |                                       |  |                                 |
| S38 | Virtual Weigh Stations  |  |   |   |  | ●   | ●                                     |  |                                 |
| S39 | Congestion Reduction in Major Freight Bottlenecks                 |  |   | ●   |  | ●   |                                       |  |                                 |
| S40 | Enhance Automated Permit Routing System                           |  |   |   |  | ●   | ●                                     |  |                                 |
| S41 | CVO Online Database and CARS Database Enhancement                 |  |   | ●   |  | ●   |                                       |  |                                 |
| S42 | Multi-State OS/OW Permitting System                               |  |   |   |  | ●   | ●                                     |  |                                 |
| S43 | Emergency Responder Database                                      |  | ●   |   |  |   |                                       |  |                                 |
| S44 | Enhance Routing of Emergency Vehicles                             |  | ●   |   |  |   |                                       |  |                                 |
| S45 | Critical Infrastructure Surveillance                              |  | ●   |   | ●  |   |                                       |  |                                 |
| S46 | Use Preemption on Vehicle Radios to Provide Real-Time Information | ●  |   |   |  |   |                                       |  |                                 |
| S47 | Maintenance Vehicle AVL Equipment                                 |  |   |   |  | ●   |                                       |  | ●                               |
| S48 | Expand Maintenance and Decision Support System (MDSS) Deployment  | ●  |   |   |  |   |                                       |  | ●                               |
| S49 | Dynamic Speed in Work Zones to Advise Drivers                     | ●  | ●   | ●   |  |   |                                       |  |                                 |
| S50 | CCTV Cameras at RWIS Sites  | ●  |   | ●   |  |   |                                       |  |                                 |

Table 4-1. (Continued)

| ID  | ITS Initiatives and Project Concepts   | Minnesota ITS Goals  |   |   |  |   |                                       |  |                                 |  |
|---|--|--|---|---|--|---|---------------------------------------|--|---------------------------------|--|
|   |  | A. Improve the Safety of the State's Transportation System | B. Increase Operational Efficiency and Reliability of the Transportation System | C. Enhance Mobility, Convenience, and Comfort for Transportation System Users | D. Improve the Security of the Transportation System | E. Support Regional Economic Productivity and Development | F. Preserve the Transportation System | G. Enhance the Integration and Connectivity of the Transportation System | H. Reduce Environmental Impacts |  |
| S51   | Expand Automated Flagging System for Work Zones                                | ●  | ●   |   |  |   |                                       |  |                                 |  |
| S52   | Portable Queue Detection and Stopped Traffic Advisory                          |  | ●   | ●   |  |   |                                       |  |                                 |  |
| S53   | Continue Roadway Automated Treatment System Deployment                         | ●  |   |   |  |   |                                       |  | ●                               |  |
| S54   | Expand Dynamic Late Merge System Deployment                                    |  | ●   |   |  |   |                                       |  |                                 |  |
| S55   | GIS Mapping Enhancement  |  |   |   |  | ●   |                                       | ●  |                                 |  |
| S56   | Enhanced Data Entry and Integration of Work Zone Information                   |  | ●   | ●   |  |   |                                       |  |                                 |  |
| S57   | Expand IWZ Deployment to Greater Minnesota                                     |  | ●   | ●   |  |   |                                       |  |                                 |  |
| S58   | Work Zone Intrusion Alarm System   | ●  |   |   |  |   |                                       |  |                                 |  |
| S59   | Bridge Inspection / Structural Monitoring Roadside Equipment                   |  |   |   |  | ●   |                                       |  |                                 |  |
| S60   | Graphical-Based Construction Scheduling Tool                                   |  | ●   |   |  |   |                                       | ●  |                                 |  |
| S61   | Portable Work Zone Dynamic Speed Display Signs                                 | ●  | ●   | ●   |  |   |                                       |  |                                 |  |
| S62   | Rural Intersection Conflict Warning Systems (RICWS)                            | ●  |   |   |  |   |                                       |  |                                 |  |
| S63   | In-Vehicle Monitoring of Teenage Drivers in Graduated Driver Licensing Program | ●  |   |   |  |   |                                       |  |                                 |  |
| S64   | Blow Ice Signalized Warning System   | ●  |   | ●   |  |   |                                       |  |                                 |  |
| <b>Medium Term ITS Initiatives and Project Concepts</b> |  |  |   |   |  |   |                                       |  |                                 |  |
| M01   | Provide Information on Alternate Routes and Detours Due to Roadwork            | ●  | ●   | ●   |  |   |                                       |  |                                 |  |
| M02   | CARS Integration Across State Borders  | ●  | ●   | ●   | ●  | ●   |                                       | ●  |                                 |  |

Table 4-1. (Continued)

| ID  | ITS Initiatives and Project Concepts   | Minnesota ITS Goals  |   |   |  |   |                                       |  |                                 |
|-----|--|--|---|---|--|---|---------------------------------------|--|---------------------------------|
|     |  | A. Improve the Safety of the State's Transportation System | B. Increase Operational Efficiency and Reliability of the Transportation System | C. Enhance Mobility, Convenience, and Comfort for Transportation System Users | D. Improve the Security of the Transportation System | E. Support Regional Economic Productivity and Development | F. Preserve the Transportation System | G. Enhance the Integration and Connectivity of the Transportation System | H. Reduce Environmental Impacts |
| M03 | ITS Communications Interstate Connectivity   | ●  | ●   | ●   | ●  |   |                                       |  |                                 |
| M04 | CARS ITS Data Addition   | ●  |   | ●   |  |   |                                       |  |                                 |
| M05 | Seasonal Road Weight Restrictions Information                                      |  |   | ●   |  | ●   |                                       |  |                                 |
| M06 | Congestion Information Expanded to Selected Greater Minnesota Locations            | ●  | ●   | ●   | ●  |   |                                       |  |                                 |
| M07 | Traffic Flow Maps for Key Arterials  | ●  | ●   | ●   |  |   |                                       |  |                                 |
| M08 | Seasonal and Recreational Traveler Information                                     | ●  | ●   |   |  |   |                                       |  |                                 |
| M09 | Enhanced Traveler Information for Transit and Other Modes                          | ●  | ●   | ●   |  |   |                                       |  |                                 |
| M10 | Traveler Service Information on 511  |  |   | ●   |  |   |                                       |  |                                 |
| M11 | Congestion and Closure Information for Transit Dispatchers and Operators           |  |   | ●   |  |   |                                       | ●  |                                 |
| M12 | Automated Data Interface between Local Public Safety CAD Systems and CARS          | ●  | ●   | ●   | ●  |   |                                       | ●  |                                 |
| M13 | Traffic Flow Maps for Key Corridors  | ●  | ●   | ●   |  |   |                                       |  |                                 |
| M14 | 511 Expansion to Local Roads   | ●  | ●   | ●   | ●  |   |                                       |  |                                 |
| M15 | Instrument Local Roads   | ●  | ●   | ●   | ●  |   |                                       |  |                                 |
| M16 | Priced Dynamic Shoulder Lanes Expansion  |  | ●   |   |  |   |                                       |  |                                 |
| M17 | Sharing CCTV Images Between Agencies   |  | ●   | ●   |  | ●   |                                       |  |                                 |
| M18 | Expand CCTV Surveillance at High Incident Locations                                |  | ●   | ●   | ●  |   |                                       |  |                                 |
| M19 | ITS and Communications Coordination and Information Sharing for Incident Responses |  | ●   | ●   | ●  |   |                                       |  |                                 |

Table 4-1. (Continued)

| ID  | ITS Initiatives and Project Concepts  | Minnesota ITS Goals  |   |   |  |   |                                       |  |                                 |
|-----|---|--|---|---|--|---|---------------------------------------|--|---------------------------------|
|     |   | A. Improve the Safety of the State's Transportation System | B. Increase Operational Efficiency and Reliability of the Transportation System | C. Enhance Mobility, Convenience, and Comfort for Transportation System Users | D. Improve the Security of the Transportation System | E. Support Regional Economic Productivity and Development | F. Preserve the Transportation System | G. Enhance the Integration and Connectivity of the Transportation System | H. Reduce Environmental Impacts |
| M20 | Maintenance and CVO Alternate Route Database Development                        | ●  | ●   |   | ●  | ●   |                                       |  |                                 |
| M21 | Emergency Management Alternate Route Database Development                       | ●  | ●   | ●   | ●  |   |                                       |  |                                 |
| M22 | ATMS for Major Event Management   |  | ●   |   |  |   |                                       |  |                                 |
| M23 | CCTV External Surveillance on Metro Transit Vehicles                            |  | ●   | ●   | ●  |   |                                       |  |                                 |
| M24 | Emergency Vehicle Strategic Deployment  |  | ●   | ●   |  |   |                                       |  |                                 |
| M25 | Expand Greater Minnesota Population Center Ramp Meter Deployment                | ●  | ●   | ●   |  |   |                                       |  |                                 |
| M26 | Vehicle Occupancy Monitoring/ Enforcement System                                |  | ●   |   |  |   |                                       |  | ●                               |
| M27 | Active Flashing Signals and Gates at Highway/Railroad Intersections             | ●  |   |   |  |   |                                       |  |                                 |
| M28 | Automated/Remote Operated Gate Systems  | ●  | ●   | ●   | ●  |   |                                       |  |                                 |
| M29 | Integrated Payment System for MnPASS, Transit and Parking                       |  |   | ●   |  |   |                                       |  |                                 |
| M30 | Additional Air Quality Sensors at Strategic Locations                           |  |   |   |  |   |                                       |  | ●                               |
| M31 | Curve Speed Warning Systems   | ●  |   | ●   |  |   |                                       |  |                                 |
| M32 | Flood Warning Systems   | ●  |   | ●   |  |   |                                       |  |                                 |
| M33 | Overheight Detection/Warning Systems  | ●  |   | ●   |  |   |                                       |  |                                 |
| M34 | Signal Phase Transition Systems   | ●  |   |   |  |   |                                       |  |                                 |
| M35 | TIGER Corridor Expansion  |  | ●   | ●   |  |   |                                       |  |                                 |
| M36 | Additional Installation of Highway Rail Intersection (HRI) Monitoring Equipment | ●  |   |   |  |   |                                       |  |                                 |

Table 4-1. (Continued)

| ID  | ITS Initiatives and Project Concepts   | Minnesota ITS Goals  |   |   |  |   |                                       |  |                                 |
|-----|--|--|---|---|--|---|---------------------------------------|--|---------------------------------|
|     |  | A. Improve the Safety of the State's Transportation System | B. Increase Operational Efficiency and Reliability of the Transportation System | C. Enhance Mobility, Convenience, and Comfort for Transportation System Users | D. Improve the Security of the Transportation System | E. Support Regional Economic Productivity and Development | F. Preserve the Transportation System | G. Enhance the Integration and Connectivity of the Transportation System | H. Reduce Environmental Impacts |
| M37 | Queue Length at Ramps, Incident and Work Zones                               | ●  | ●   | ●   |  |   |                                       |  |                                 |
| M38 | Expand Total Stations and Photogrammetry Deployment                          | ●  | ●   |   |  |   |                                       |  |                                 |
| M39 | Snowplow Maintenance Activity Alerts Using DMS                               | ●  |   | ●   |  |   |                                       |  |                                 |
| M40 | Detectors for Speed Data Collection at High Incident Locations               | ●  |   | ●   |  |   | ●                                     |  |                                 |
| M41 | Electronic Fare Payment Systems  |  | ●   |   |  |   |                                       |  |                                 |
| M42 | Transit Agencies Smart Card for Employee Management                          |  | ●   |   | ●  | ●   |                                       |  |                                 |
| M43 | St. Cloud MTC Transit Vehicle Security Technologies                          |  |   |   | ●  |   |                                       |  |                                 |
| M44 | Expand Electronic Fare Collection Technologies                               |  | ●   |   |  |   |                                       |  |                                 |
| M45 | Wireless Transmission of Metro Transit Vehicle Diagnostic Data               |  |   |   |  | ●   |                                       |  |                                 |
| M46 | Transit Vehicle Lateral Safety Detection and Warning Systems                 | ●  |   |   |  |   |                                       |  |                                 |
| M47 | Coordinate Scheduling, Historical Route Data and Transit Movements           |  | ●   |   |  | ●   |                                       |  |                                 |
| M48 | Enhance Carpool and Vanpool Ridematching System                              |  | ●   |   |  |   |                                       |  |                                 |
| M49 | Pedestrian and Bicycle Detection with Advance Warning for Drivers            | ●  |   |   |  |   |                                       |  |                                 |
| M50 | Transit Agency On-line Reservation Integration with Fleet Scheduling Systems |  | ●   | ●   |  |   |                                       |  |                                 |
| M51 | Queue Jump Systems at Bottlenecks  |  | ●   |   |  | ●   |                                       |  |                                 |
| M52 | Expand Metro Area Transit Management Systems to Greater Minnesota            |  | ●   | ●   | ●  | ●   |                                       |  |                                 |
| M53 | Surveillance Video Integration   |  |   |   | ●  |   |                                       |  |                                 |

Table 4-1. (Continued)

| ID  | ITS Initiatives and Project Concepts                                | Minnesota ITS Goals  |   |   |  |   |                                       |  |                                 |
|-----|---|--|---|---|--|---|---------------------------------------|--|---------------------------------|
|     |   | A. Improve the Safety of the State's Transportation System | B. Increase Operational Efficiency and Reliability of the Transportation System | C. Enhance Mobility, Convenience, and Comfort for Transportation System Users | D. Improve the Security of the Transportation System | E. Support Regional Economic Productivity and Development | F. Preserve the Transportation System | G. Enhance the Integration and Connectivity of the Transportation System | H. Reduce Environmental Impacts |
| M54 | CVO Database Enhancement  | ●  |   |   | ●  | ●   | ●                                     |  |                                 |
| M55 | Work Zone Restriction Information Automation                        | ●  |   | ●   |  | ●   | ●                                     |  |                                 |
| M56 | ATIS for CVO  |  |   | ●   |  | ●   |                                       |  |                                 |
| M57 | Commercial Vehicles as Probes                                       | ●  |   |   | ●  |   |                                       |  |                                 |
| M58 | RFID Tags for Identification of HAZMAT Materials                    | ●  | ●   |   | ●  | ●   |                                       |  |                                 |
| M59 | Enhanced Crash Database   | ●  |   |   |  |   |                                       | ●  |                                 |
| M60 | Enhance Commercial Vehicle Shipment Performance                     |  |   |   |  | ●   |                                       | ●  |                                 |
| M61 | Evacuation/Reentry Real-time Information ITS Systems                |  |   |   | ●  | ●   |                                       |  |                                 |
| M62 | Enhanced Automated and Manual In-Vehicle Notification Assistance    |  | ●   |   |  |   |                                       |  |                                 |
| M63 | AVL Systems for Local Responders                                    |  | ●   |   |  | ●   |                                       |  |                                 |
| M64 | Expand Deployment of Mobile Data Computers                          |  | ●   | ●   |  |   |                                       |  |                                 |
| M65 | Remote Posting of AMBER Alerts on DMS                               |  | ●   |   | ●  |   |                                       |  |                                 |
| M66 | Wireless Digital Feeds Between MSP and Local EM Responders          |  | ●   | ●   |  |   |                                       |  |                                 |
| M67 | Automated Field Reporting Systems for MSP and Local Law Enforcement |  | ●   |   |  |   |                                       |  |                                 |
| M68 | DVR to Review Central Images during an Incident                     |  | ●   |   |  |   |                                       |  |                                 |
| M69 | Incorporate Road Construction Data in CAD Systems                   |  | ●   |   |  |   |                                       |  |                                 |
| M70 | Local Agency Public Works AVL Equipment                             |  |   |   |  | ●   |                                       |  |                                 |

Table 4-1. (Continued)

| ID  | ITS Initiatives and Project Concepts   | Minnesota ITS Goals  |   |   |  |   |                                       |  |                                 |
|---|--|--|---|---|--|---|---------------------------------------|--|---------------------------------|
|   |  | A. Improve the Safety of the State's Transportation System | B. Increase Operational Efficiency and Reliability of the Transportation System | C. Enhance Mobility, Convenience, and Comfort for Transportation System Users | D. Improve the Security of the Transportation System | E. Support Regional Economic Productivity and Development | F. Preserve the Transportation System | G. Enhance the Integration and Connectivity of the Transportation System | H. Reduce Environmental Impacts |
| M71   | Require Seatbelt Ignition Interlocks on New Vehicles   | ●  |   |   |  |   |                                       |  |                                 |
| M72   | Provide Real-Time Information to Equipped Vehicles That Deliver Warnings to Drivers          | ●  |   |   |  |   |                                       |  |                                 |
| M73   | Research Equipping Vehicles with Systems to Detect Driver Distractions and Provide Warnings  | ●  |   |   |  |   |                                       |  |                                 |
| M74   | Implement Improved Lane Guidance System  | ●  |   |   |  |   |                                       |  |                                 |
| M75   | Develop Vehicle to Vehicle and Vehicle to Infrastructure Communication                       | ●  |   |   |  |   |                                       |  |                                 |
| <b>Long Term ITS Initiatives and Project Concepts</b> |  |  |   |   |  |   |                                       |  |                                 |
| L01   | Route-specific Weather Information   | ●  |   | ●   |  |   |                                       |  |                                 |
| L02   | Use Agency Vehicles as Data Probes   | ●  | ●   | ●   |  |   |                                       |  |                                 |
| L03   | Automated Speed Enforcement  | ●  |   | ●   |  |   |                                       |  |                                 |
| L04   | Contraflow Lanes on Metro Freeways   |  | ●   |   |  |   |                                       |  |                                 |
| L05   | In-Pavement LEDs   | ●  | ●   |   |  |   |                                       |  |                                 |
| L06   | Transit Vehicle Communications to Emergency Response Centers                                 |  | ●   | ●   |  |   |                                       |  |                                 |
| L07   | Enhanced Speed Monitoring Equipment for Work Zones   | ●  | ●   | ●   |  |   |                                       |  |                                 |
| L08   | Transit Vehicle On-Board Annunciator and AVL Integration                                     |  | ●   |   |  |   |                                       |  |                                 |
| L09   | Develop and Provide a Uniform, Real-Time Automated Crash Notification System                 |  | ●   |   |  |   |                                       |  |                                 |
| L10   | Roadway Condition and Environmental Sensors on Maintenance Vehicles for Traveler Information | ●  |   | ●   |  |   |                                       |  |                                 |

**Table 4-2. Implementation Schedule of Short-Term ITS Initiatives and Project Concepts**

| ID  | ITS Initiatives and Project Concepts                                  | Years |   |   |   |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
|-----|---|-------|---|---|---|---|---|---|---|---|------------|--|--|--|--|--|--|--|--|--|--|
|     |   | 0     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 & Beyond |  |  |  |  |  |  |  |  |  |  |
| S06 | Traffic Signal ACS Lite Operational Test                              | █     |   |   |   |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S01 | Email Alerts to Major Trucking Companies                              | █     | █ |   |   |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S02 | Enhance Traveler Information Map for Mobile Devices                   | █     | █ | █ |   |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S07 | Traffic Signal Timing and Control Improvements                        | █     | █ | █ |   |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S08 | Develop an Automated System for Traffic Data Archiving                | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S09 | MSP CAD and CARS Integration  | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S10 | Dynamic Speed Display Signs ("Your Speed Is")                         | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S11 | Expand Provision of Operating Speed and Delay Information             | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S12 | Advance Warning Flasher Deployment Expansion                          | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S19 | Expand HOT Lane Deployment in Metro Area                              | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S20 | Allow Law Enforcement to Retrieve Data from Onboard Vehicle Computers | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S22 | Expand Quick Clearance Policies for Incidents                         | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S23 | Expand Geographic Coverage of the RTMC Systems                        | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S24 | Use Driving Simulation for Teenage and Older Driver Education         | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S25 | Transit Route and Schedule Information Systems                        | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S26 | Expand CAD/AVL/GPS Technologies to Rural Transit Systems              | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S27 | Data Analysis Tools for Transit Route Performance                     | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S28 | Bus Authorized Shoulders Assistant System                             | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S29 | Security Surveillance at Transit Facilities                           | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S30 | Transit Scheduling Software Systems                                   | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S31 | DARTS On-line Reservation for Seniors                                 | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S35 | DTA Facility and Bus Security System Upgrades                         | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S36 | Transit Signal Priority Along Arterials                               | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S37 | NexTrip Enhancements  | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S38 | Virtual Weigh Stations  | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S41 | CVO Online Database and CARS Database Enhancement                     | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S42 | Multi-State OS/OW Permitting System                                   | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S43 | Emergency Responder Database  | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S46 | Use Preemption on Vehicle Radios to Provide Real-Time Information     | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S47 | Maintenance Vehicle AVL Equipment                                     | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S48 | Expand Maintenance and Decision Support System (MDSS) Deployment      | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S49 | Dynamic Speed in Work Zones to Advise Drivers                         | █     | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |

**Table 4-2. (Continued)**

| ID  | ITS Initiatives and Project Concepts   | Years |   |   |   |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
|-----|--|-------|---|---|---|---|---|---|---|---|------------|--|--|--|--|--|--|--|--|--|--|
|     |  | 0     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 & Beyond |  |  |  |  |  |  |  |  |  |  |
| S50 | CCTV Cameras at RWIS Sites   | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S51 | Expand Automated Flagging System for Work Zones                                | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S52 | Portable Queue Detection and Stopped Traffic Advisory                          | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S53 | Continue Roadway Automated Treatment System Deployment                         | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S54 | Expand Dynamic Late Merge System Deployment                                    | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S55 | GIS Mapping Enhancement  | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S56 | Enhanced Data Entry and Integration of Work Zone Information                   | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S57 | Expand IWZ Deployment to Greater Minnesota                                     | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S60 | Graphical-Based Construction Scheduling Tool                                   | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S61 | Portable Work Zone Dynamic Speed Display Signs                                 | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S62 | Rural Intersection Conflict Warning Systems (RICWS)                            | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S63 | In-Vehicle Monitoring of Teenage Drivers in Graduated Driver Licensing Program | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S64 | Blow Ice Signalized Warning System   | █     | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S34 | HiSPARC Transit System Deployment  | █     | █ | █ | █ | █ | █ |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S16 | Metro Area Ramp Meter Expansion and Enhancements                               | █     | █ | █ | █ | █ | █ | █ |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S21 | Implement Automated Enforcement of Red Light Running at Intersections          | █     | █ | █ | █ | █ | █ | █ |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S32 | Expand Real-Time Transit Departure Information                                 | █     | █ | █ | █ | █ | █ | █ |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S33 | Real-Time Transit Transfer Information   | █     | █ | █ | █ | █ | █ | █ |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S59 | Bridge Inspection / Structural Monitoring Roadside Equipment                   | █     | █ | █ | █ | █ | █ | █ |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S17 | Travel Time Freeway Sign Expansion   | █     | █ | █ | █ | █ | █ | █ | █ | █ |            |  |  |  |  |  |  |  |  |  |  |
| S18 | Automated Surveillance and Signal Control Software                             | █     | █ | █ | █ | █ | █ | █ | █ | █ | █          |  |  |  |  |  |  |  |  |  |  |
| S03 | 511 Telephone Interface Upgrade  |       | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S04 | ATIS Customization   |       | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S13 | Arterial Traffic Management Systems  |       | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S14 | Integrated Corridor Management (ICM)   |       | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S39 | Congestion Reduction in Major Freight Bottlenecks                              |       | █ | █ | █ |   |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S40 | Enhance Automated Permit Routing System  |       | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S44 | Enhance Dynamic Routing of Emergency Vehicles                                  |       | █ | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S05 | Rest Area Truck Parking Availability   |       |   | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S15 | Dynamic Lane Control and Variable Speed Limit Signs on Freeways                |       |   | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S58 | Work Zone Intrusion Alarm System   |       |   | █ | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |
| S45 | Critical Infrastructure Surveillance   |       |   |   | █ | █ |   |   |   |   |            |  |  |  |  |  |  |  |  |  |  |

### 4.3 Short Term ITS Initiatives and Project Concepts

This section details the short-term ITS initiatives and project concepts to be considered for implementation over the next 4 years. A total of 63 short-term ITS initiatives and project concepts are identified. Each ITS initiative and project concept is described with the following information:

- **ID:** a unique identification number for each initiative and project concept.
- **Initiative:** Title of the initiative or project concept.
- **Timeframe:** planned or recommended timeframe for implementation.
- **Multimodal Transportation Objective:** Objectives in the Minnesota Statewide Multimodal Transportation Plan addressed by the initiative or project concept.
- **SHSP Focus Area:** Focus areas defined in the 2014 Minnesota SHSP that are relevant to the initiative or project concept. This information is presented only if the initiative/project concept is included in the 2014 Minnesota SHSP.
- **ITS Service Area:** ITS service areas or functional areas the initiative/project concept covered. ITS service areas include: Archived Data (AD) Management, Advanced Public Transportation Systems (APTS), Advanced Traveler Information Systems (ATIS), Advanced Traffic Management Systems (ATMS), Advanced Vehicle Safety Systems (AVSS), Commercial Vehicle Operations (CVO), Emergency Management (EM), and Maintenance and Construction Management (MCM).
- **Type:** Type(s) of the initiative/project concept, including operational test, deployment, research, and policy/legislation.
- **Description:** Scope and general information of the initiative/project concept.
- **Champion and Stakeholder:** Champion agency of the initiatives/project concept and other stakeholder agencies involved.
- **Project Element:** Elements in the Statewide Regional ITS Architecture associated with the initiative/project concept.
- **Service Package:** Architecture service packages included in the initiative/project concept.
- **Interconnect:** High-level architecture interconnections between initiative elements.
- **Technology Assessment:** A brief assessment on relevant technology.
- **Dependency:** Interdependency between the initiative and existing systems and other initiatives.
- **Cost Estimate:** a preliminary cost estimate for the initiative/project concept.
- **Needs and Objectives Addressed:** Stakeholder needs and Minnesota ITS Objectives addressed.
- **Agreement:** Agreement(s) needed for implementation, operations, and/or maintenance.

In addition, initiatives and project concepts that are included in the Minnesota SHSP as safety strategies are denoted with an “SHSP” icon next to their titles. The SHSP icon is as shown on the right.



A sidebar is included on the initiative/project concept description pages. The sidebar indicates to which service area(s) the initiative/project concept belong. This helps readers navigate through the Section and information.

**ID:** S01

**Initiative:** Electronic Alerts to Major Trucking Companies

**Timeframe:** Short Term – Years 0-2

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Asset Management

**ITS Service Area:** ATIS, CVO

**Type:** Operational Test

### Description

This initiative will provide electronic alerts to major trucking companies about seasonal and construction road weight restrictions. This will ensure that trucking companies are receiving timely, accurate information about weight restrictions so that they can adjust their route plans appropriately.

Participating trucking companies will select roadways that they want to receive seasonal weight restriction information. MnDOT will send automated updates to participating trucking companies when weight restrictions change. Initially this initiative will only cover a select number of roadways with significant truck traffic and be offered to all major trucking companies that pick-up or deliver on those roadways. If this pilot initiative is successful, the service will be expanded to cover additional roadways and to allow more trucking companies to participate.

### Champion and Stakeholder

Champion: MnDOT (Office of Materials)

Stakeholders: MnDOT, Major Trucking Companies

### Project Element

- CARS
- Truck Center
- Private Fleet and Freight Management Center
- Commercial Vehicles

### Service Package

- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- CVO01 – Carrier Operations and Fleet Management

### Interconnect

- CARS and Truck Center
- Truck Center and Private Fleet and Freight Management Center
- Private Fleet and Freight Management Center and Commercial Vehicles

### Technology Assessment

This initiative is an expansion of existing technologies.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Total costs have been estimated at \$10,000.

**Needs and Objectives Addressed**

- Need: TI08 - Provide information about seasonal road weight restrictions
- ITS Objectives: B-1-08 - Annual rate of change in regional average commute travel time will not exceed regional rate of population growth
- C-3-13 - Increase number of users of notifications for traveler information (e.g., e-mail, text message)
- C-3-15 - Increase the number of specifically tailored traveler information messages provided
- E-1-05 - Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways

**Agreement**

Agreements may be necessary between MnDOT and participating trucking firms regarding the use and distribution of information in the information in this pilot initiative.

**ID:** S02

**Initiative:** Enhance Traveler Information Map for Mobile Devices



**Timeframe:** Short Term – Years 0-3

**Multimodal Transportation Objective:** Traveler Safety, Asset Management

**SHSP Focus Area:** Intersections, Lane Departure

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

A traffic flow map showing real-time traffic conditions of freeways and selected expressways in the metro area is currently available on MnDOT’s website for use by mobile devices that can access the Internet. This initiative will enhance this service to provide travelers with a better view of the traffic flow map using handheld wireless devices such as smartphones, tablets and personal digital assistants (PDAs) as well as easily accessible road condition information during inclement weather. This will allow users with a better way to access real-time traffic flow and road condition information and make informed travel decisions.

The MnDOT Regional Transportation Management Center (RTMC) creates a data feed from its website to allow handheld devices to properly display the traffic flow map that is updated in real-time.

**Champion and Stakeholder**

Champion: MnDOT (RTMC)

Stakeholders: MnDOT, Private Information Service Providers

**Project Element**

- RTMC
- 511 Traveler Information Website
- User Personal Portable Computing Devices

**Service Package**

- ATIS01 – Broadcast Traveler Information

**Interconnect**

- RTMC (website) and User Personal Portable Computing Devices
- RTMC and 511 Traveler Information Website
- 511 Traveler Information Website and User Personal Portable Computing Devices

**Technology Assessment**

Traffic flow map for the metro area is already available on the MnDOT website. Technology for making information formatted in a way that is usable on handheld devices is readily available.

**Dependency**

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

The development cost ranges roughly between \$5,000 and \$40,000, depending on the features and functionalities desired for the end product.

**Needs and Objectives Addressed**

Need: TI03 - Provide traffic flow maps showing recurring or predicted freeway congestion levels

ITS Objectives: A-1-04 - Reduce number of crashes due to unexpected congestion  
 A-2-04 - Reduce number of fatalities due to unexpected congestion  
 A-2-25 - Reduce number of injuries due to unexpected congestion  
 B-1-02 - Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods  
 B-1-06 - Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion  
 C-3-12 - Increase number of visitors to traveler information website per year

**Agreement**

Agreements may be required for this initiative between MnDOT and Private Companies that distribute handheld devices that disseminate traveler information.

**ID:** S03

**Initiative:** 511 Telephone Interface Upgrade



**Timeframe:** Short Term – Years 1-2

**Multimodal Transportation Objective:** Traveler Safety, Asset Management

**SHSP Focus Area:** Intersections, Lane Departure

**ITS Service Area:** ATIS

**Type:** Deployment

### Description

This initiative aims to improve the Minnesota 511 Traveler Information telephone user interface by developing new, user friendly approaches to deliver real-time information via the 511 telephone system. Travelers along Minnesota roads and highways currently dial 511 on cell phones to obtain real-time travel information on congestion and accidents that may affect their daily travel patterns. An upgrade to the current system will improve traveler information dissemination and reduce recurring and non-recurring traffic congestion. This initiative was identified by the Statewide ITS Strategic Plan (2006).

### Champion and Stakeholder

Champion: MnDOT (RTMC)

Stakeholders: Travelers

### Project Element

- CARS
- 511 Telephone Information Service
- Travelers

### Service Package

- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information

### Interconnect

- CARS and 511 Telephone Information Service
- 511 Telephone Information Service and Travelers

### Technology Assessment

This initiative aims to improve a traveler information service that is currently available.

### Dependency

This initiative is not dependent upon any other initiatives.

### Cost Estimate

Based on available cost data for similar telephone system enhancements, the total cost can vary between \$500,000 and \$2,000,000 depending on the type of upgrades planned for this initiative.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Needs and Objectives Addressed**

- Needs: TM05 - Provide incident and congestion information to travelers  
 TI10 - Operate a statewide web-based and telephone 511 system
- ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions  
 A-1-04 - Reduce number of crashes due to unexpected congestion  
 A-1-17 - Reduce number of crashes due to roadway/geometric restrictions  
 A-1-19 - Reduce number of all secondary crashes  
 A-2-03 - Reduce number of fatalities due to road weather conditions  
 A-2-04 - Reduce number of fatalities due to unexpected congestion  
 A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions  
 A-2-24 - Reduce number of injuries due to road weather conditions  
 A-2-25 - Reduce number of injuries due to unexpected congestion  
 A-2-39 - Reduce number of injuries due to roadway/geometric restrictions  
 B-1-05 - Reduce the daily hours of recurring congestion on major freeways  
 B-1-08 - Annual rate of change in regional average commute travel time will not exceed regional rate of population growth  
 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-3-02 - Reduce single occupancy vehicle vehicle trips through travel demand management strategies (e.g., employer or residential rideshare)  
 C-3-11 - Increase number of 511 calls per year  
 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

**Agreement**

Agreements are not required for this initiative.

**ID: S04**

**Initiative:** ATIS Customization

**Timeframe:** Short Term – Years 1-3

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication

**ITS Service Area:** ATIS

**Type:** Deployment

### Description

This initiative will offer personalized Traveler Information Service to individual users. 511 Web and phone systems will be modified to generate customized reports with such information as travel times, incident, weather, predicted pavement conditions, and other events on roadway segments that subscribers have preselected. Participating users will set up accounts and select the roadway segments and types of information that they would like to receive and the thresholds (time of day, speeds, travel times, etc.) that would need to be met to send the alert. This will allow travelers to receive targeted, real-time information via email, text message, or phone on roadways that they regularly use. This initiative was identified in the Minnesota Guidestar ITS Strategic Plan (2006).

This initiative can follow the Short Term Initiative S02 - Enhance Traveler Information Map for Mobile Devices.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: MnDOT, Travelers, Private Companies

### Project Element

- CARS
- 511 Telephone Information Service and Traveler Information Website
- User Personal Portable and Computing Devices

### Service Package

- ATIS02 – Interactive Traveler Information
- ATIS05 – ISP Based Trip Planning and Route Guidance

### Interconnect

- CARS and 511 Telephone Information Service
- CARS and Traveler Information Website
- 511 Telephone Information Service/Traveler Information Website and User Personal Portable and Computing Devices

### Technology Assessment

511 systems already have the capability to provide data that users select. This would implement preselected data to be sent as alerts when certain thresholds are met. Similar systems have been implemented in other urban areas such as Chicago.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| <b>Traveler Information</b>  |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Dependency**

This initiative may be dependent upon the success of the Short Term Initiative S02 – Enhance Traveler Information Map for Mobile Devices.

**Cost Estimate**

Costs associated with this initiative have not been determined.

**Needs and Objectives Addressed**

Need: TI16 - Improve quality, consistency, and thoroughness of traveler information

ITS Objectives: C-3-15 - Increase the number of specifically tailored traveler information messages provided

G-1-01 - Increase the amount of data gathered from ITS enhancements used in infrastructure and operations planning

G-1-06 - Reduce operations cost deviation

H-1-04 - Reduce MnDOT fleet gasoline use

**Agreement**

Agreements are not required for this initiative.

**ID:** S05

**Initiative:** Rest Area Truck Parking Availability

**Timeframe:** Short Term – Years 2-4

**Multimodal Transportation Objective:** Traveler Safety, Asset Management

**ITS Service Area:** ATIS, ATMS

**Type:** Operational Test, Deployment

### Description

MnDOT and the University of Minnesota are currently working on a truck parking availability demonstration project. The initiative targets the development of an automated truck stop management system that can determine the number of occupied parking spaces at MnDOT safety rest areas and commercial truck stops. The system uses a network of cameras to monitor parking availability at truck stops, automatically identifying available spaces in real time. In this initiative, the information will be used to notify drivers and carriers about parking availability via a website, in-cab messaging, and variable message displays a few miles ahead of the rest area on the highway. The system will be installed at three MnDOT rest areas on Interstate 94 (I-94) west and northwest of the Twin Cities during the demonstration.

Upon a successful demonstration, this initiative will expand on the system for further operational test and subsequent deployment at 2 more sites if deemed feasible. The system will provide parking availability information at roadside rest areas and potentially truck stops to truck drivers through multiple forms of currently available traveler information dissemination, such as Dynamic Message Signs (DMS), 511 traveler information web site and phone system, and Highway Advisory Radio (HAR). Parking availability will be detected with in-pavement or non-intrusive detection technologies to ascertain the level of rest area truck parking space availability. This information will then be disseminated through DMS, 511, and/or HAR to commercial vehicles approaching the rest areas. Specific sites under this initiative have yet to be determined.

### Champion and Stakeholder

Champion: MnDOT OFCVO

Stakeholders: MnDOT, Minnesota Department of Public Safety (DPS), Private Trucking Companies

### Project Element

- 511 Telephone Information Service
- 511 Traveler Information Website
- DMS Roadside Equipment
- HAR Roadside Equipment
- Parking Management Roadside Equipment
- Parking Management System

### Service Package

- ATMS16 – Parking Facility Management
- ATIS01 – Broadcast Traveler Information

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Interconnect**

- Parking Management Roadside Equipment and Parking Management System
- Parking Management System and 511 Telephone Information Service
- Parking Management System and 511 Traveler Information Website
- Parking Management System and DMS Roadside Equipment
- Parking Management System and HAR Roadside Equipment

**Technology Assessment**

Traveler information dissemination technology (511, DMS, HAR, etc.) is currently being used. This initiative will also utilize parking management technology that is readily available from vendors. The City of Saint Paul currently uses DMS to disseminate parking availability information at municipal parking ramps. A similar initiative is being conducted by Metro Transit to display parking availability at transit park-and-ride parking lots. The approved ITS standard ITE TM 1.03 – Standard for Functional Level Traffic Management Data Dictionary – is applicable to this initiative.

**Dependency**

This initiative is not dependent upon any other initiatives. However, the results of the current truck parking availability demonstration may support this initiative.

**Cost Estimate**

Based on available system cost data for dynamic message signs and entrance/exit ramp meters used to detect and count vehicles at the rest area facility, the total cost for one rest area facility is estimated to be between \$70,000 and \$120,000.

**Needs and Objectives Addressed**

- Needs: TI23 - Provide information on available public and private truck parking and rest facilities
- TM21 - Provide information on parking availability
- ITS Objectives: 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-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

**Agreement**

Agreements may be required between MnDOT and private truck stop owners.

**ID:** S06

**Initiative:** Adaptive Signal Control

**Timeframe:** Short Term – Years 0-1

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative is designed to improve the operation of closed loop signal systems by utilizing adaptive signal control software. Adaptive signal control technology adjusts the timing of red, yellow and green lights to accommodate changing traffic patterns and ease traffic congestion. The main benefits of adaptive signal control technology over conventional signal systems are that it can continuously distribute green light time equitably for all traffic movements, improve travel time reliability by progressively moving vehicles through green lights, reduce congestion by creating smoother flow, and prolong the effectiveness of traffic signal timing.

This deployment will address a highly prioritized need from the ATMS stakeholders – TM01: Provide efficient signal timing.

**Champion and Stakeholder**

Champion: MnDOT (District Traffic)  
Stakeholders: Local Agencies

**Project Element**

- Traffic Signal Roadside Equipment
- RTMC
- Local TMCs
- Minneapolis TMC

**Service Package**

- ATMS03 – Traffic Signal Control

**Interconnect**

- RTMC and traffic signal roadside equipment
- Local TMCs/Minneapolis TMC and traffic signal roadside equipment

**Technology Assessment**

Adaptive signal control is readily available from vendors. An ITS standard under development – NTCIP 1210: Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters – provides guidance for traffic management and operations personnel to control, manage, and monitor signal system masters (SSMs) and signal system locals (SSLs) through the SSM.

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

The per-intersection cost for deploying adaptive signal control software is estimated to range from \$2,000 to \$5,000.

**Needs and Objectives Addressed**

Need: TM01 - Provide efficient signal timing

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

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

**Agreement**

Agreements are not required for this initiative.

**ID:** S07

**Initiative:** Traffic Signal Timing and Control Improvements

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will implement the following three strategies to relieve traffic congestion on arterial roads managed by coordinated signal systems: 1) Improve the current signal timing and coordination that extends across jurisdictions, 2) Utilize adaptive signal control strategies along major arterial roads, and 3) Enforce the proper use of emergency vehicle preemption capabilities by police, fire and authorized emergency vehicles. This initiative was identified by the Statewide ITS Strategic Plan (2006).

This deployment will address a highly prioritized need from the ATMS stakeholders – TM01: Provide efficient signal timing.

**Champion and Stakeholder**

Champion: MnDOT (District Traffic)  
Stakeholders: Local Agencies

**Project Element**

- Traffic Signal Roadside Equipment
- RTMC
- Local TMCs

**Service Package**

- ATMS03 – Traffic Signal Control

**Interconnect**

- RTMC and traffic signal roadside equipment
- Local TMCs and traffic signal roadside equipment
- RTMC and Local TMCs

**Technology Assessment**

Hardware and software to be utilized in providing efficient signal timings and emergency vehicle preemption to authorized emergency vehicles is available from numerous vendors.

**Dependency**

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

The per-intersection cost for improving signal timing and coordination is estimated to range from \$2,000 to \$4,000.

**Needs and Objectives Addressed**

Need: TM01 - Provide efficient signal timing

ITS Objectives: B-1-03 - Reduce the share of major intersections operating at LOS F  
C-1-10 - Increase number of traffic signals equipped with emergency vehicle preemption

**Agreement**

This initiative may require jurisdictional agreements for signal timing work performed on arterial coordinated signal systems that span more than one jurisdiction.

**ID: S08**

**Initiative:** Develop an Automated System for Traffic Data Archiving

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context

**ITS Service Area:** AD, ATMS

**Type:** Deployment

### Description

This initiative will develop an automated and more robust central system for management and retrieval of archived traffic data. This system will give state and local agencies the ability to retrieve traffic related data to better manage and plan resources and to determine effective strategies to address transportation challenges. MnDOT Transportation Data and Analysis (TDA) currently manages an archive which stores Automated Traffic Recorder (ATR) data. This initiative will expand and centralize the archived database to include other information such as GIS (geographic information system) data, crashes, lane closures, work zone activities, emergencies, etc. A standard data storage format will be implemented to allow agencies to quickly find and retrieve the focused information necessary for performing planning and analyses.

This deployment will meet a highly prioritized need from the ATMS stakeholder meeting: TM03 – Use archived data for traffic management strategy development and long range planning.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: Local Agencies

### Project Element

- Traffic Data Archive
- RTMC
- TOCCs
- Local TMCs

### Service Package

- ATMS09 – Transportation Decision Support and Demand Management
- AD01 – ITS Data Mart
- AD02 – ITS Data Warehouse

### Interconnect

- RTMC and Traffic Data Archive
- TOCCs and Traffic Data Archive
- Local TMCs and Traffic Data Archive

### Technology Assessment

This initiative utilizes current technology that is readily available. This initiative will require coordination between MnDOT and Local agencies. Applicable ITS standards include: NTCIP

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

C2C: NTCIP Center-to-Center Standards Group; ITE TMDD 2.1: Traffic Management Data Dictionary and Message Sets for External TMC Communication (TMDD and MS/ETMCC); ASTM E2468-05: Standard Practice for Metadata to Support Archived Data Management Systems; and ASTM WK7604: Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Costs associated with this initiative have not been determined.

**Needs and Objectives Addressed**

Need: TM03 - Use archived data for traffic management strategy development and long range planning

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

**Agreement**

This initiative may require jurisdictional agreements between state and local agencies for usage of automated data archiving system.

**ID: S09**

**Initiative:** MSP CAD and CARS Integration



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Traveler Safety, Transportation in Context, Critical Connections, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** ATMS, ATIS, EM

**Type:** Deployment

### Description

Minnesota State Patrol (MSP) district offices manage resources and communicate incident data and resource requests to other public and private agencies. CARS is a central source of roadway event information for both the management and dissemination of traffic-related information to the traveling public. The CARS system is maintained by the MnDOT RTMC and the State Patrol CAD system is maintained by MSP. Minnesota State Patrol users also enter information to CARS on road conditions and incidents each day.

This initiative will automate the integration of CAD data from the Minnesota State Patrol with the CARS. Roadway condition-related data entered into CAD will be integrated into CARS database. Agencies that use CARS will be able to obtain the data to facilitate multi-agency coordination during emergencies. This data will include real-time information on emergency conditions, response resource deployment, lane closures, and other related information. The integration will also increase the amount of information relating to closures due to incidents in the CARS database.

This integration with CARS is part of a planned technology systems upgrade and enhanced functions for State Patrol CAD and will provide opportunities for multi-agency coordination. Lessons learned from this deployment will be used in future CAD integration between responders. This initiative meets an identified stakeholder need for providing incident information to emergency management agencies.

### Champion and Stakeholder

Champion: MnDOT (RTMC)

Stakeholders: MnDOT, Minnesota State Patrol

### Project Element

- 911 Dispatch Center
- Emergency Vehicle Equipment
- Condition Acquisition and Reporting System (CARS)
- Minnesota State Patrol District Office
- RTMC

### Service Package

- EM01 – Emergency Call-Taking and Dispatch

- ATMS06 – Traffic Information Dissemination
- ATIS06 – Transportation Operations Data Sharing

**Interconnect**

- RTMC and Condition Acquisition and Reporting System (CARS)
- RTMC and Minnesota State Patrol District Office
- Emergency Vehicles Equipment and 911 Dispatch Center
- 911 Dispatch Center and CARS

**Technology Assessment**

Technology for data entry automation and integration is readily available. IEEE IM: Incident Management Standards Group and NTCIP C2C: NTCIP Center-to-Center Standards Group are ITS standards that will apply to this data integration.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

The estimated capital cost for CAD to CARS software automation range from \$150,000 to \$300,000. O&M includes software upgrades, revisions and expansion of the system.

**Needs and Objectives Addressed**

Needs: TM13 - Provide incident information to emergency management agencies  
E05 - Operate and enhance CAD Systems

ITS Objectives: A-1-04 - Reduce number of crashes due to unexpected congestion  
A-1-19 - Reduce number of all secondary crashes  
A-2-04 - Reduce number of fatalities due to unexpected congestion  
A-2-25 - Reduce number of injuries due to unexpected congestion  
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-3-10 - Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region

**Agreement**

This initiative may require agency agreements between MnDOT and MSP over the integration of CAD system and MnDOT CARS.

**ID: S10**

**Initiative:** Dynamic Speed Display Signs ("Your Speed Is")



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Speed-Related

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

This initiative will focus on deploying active speed-warning systems (with speed detection and playback signs) on selected arterial roads. Systems will detect the traveling speeds of approaching vehicles and display the detected speeds dynamically via message signs that are located underneath the posted speed limit along the arterial road. This initiative will address deployment of these systems on both a temporary and permanent basis. Replacements of current system equipment are also covered in this initiative. These systems are currently in operation at select locations throughout the metro area.

The purpose of the initiative is to make drivers aware of their traveling speeds compared to the posted speed limit, thereby reducing vehicle speeds along arterial roads and improve pedestrian and roadway safety. Locations for further system deployment have yet to be determined. This initiative was identified in the Minnesota Guidestar ITS Strategic Plan (2006).

### Champion and Stakeholder

Champion: MnDOT (District Traffic)

Stakeholders: MnDOT, Local Agencies

### Project Element

- Speed Monitoring Roadside Equipment
- Dynamic Message Sign Roadside Equipment

### Service Package

- ATMS19 – Speed Warning and Enforcement

### Interconnect

- Speed Monitoring Roadside Equipment and Dynamic Message Sign Roadside Equipment

### Technology Assessment

This technology is currently deployed and operational in the metro area.

### Dependency

This initiative is not dependent upon any other initiatives.

### Cost Estimate

Capital costs for portable speed monitoring systems range from \$5,000 to \$15,000 per unit.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Needs and Objectives Addressed**

Need: TM18 - Provide dynamic speed feedback to drivers and enforcement agencies

ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions  
A-1-04 - Reduce number of crashes due to unexpected congestion  
A-1-17 - Reduce number of crashes due to roadway/geometric restrictions  
A-1-19 - Reduce number of all secondary crashes  
A-2-03 - Reduce number of fatalities due to road weather conditions  
A-2-04 - Reduce number of fatalities due to unexpected congestion  
A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions  
A-2-24 - Reduce number of injuries due to road weather conditions  
A-2-25 - Reduce number of injuries due to unexpected congestion  
A-2-39 - Reduce number of injuries due to roadway/geometric restrictions  
B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period  
C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Agreement**

Agreements are not required for this initiative.

**ID: S11**

**Initiative:** Expand Provision of Travel Time and Delay Information

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

This initiative will expand the provision of travel time or operating speed information outside of the Twin Cities area. MnDOT currently displays estimated travel times on freeway dynamic message signs (DMS) in the Twin Cities area. The travel times are estimated based on traffic data gathered from traffic detectors. Estimated travel times from the DMS to major roadways (i.e. highways and interstates) are presented in numbers of minutes for travelers, who make travel decisions based on the presented information.

This initiative will expand the travel time/travel speed/delay provision service to greater Minnesota. Vehicle operating speed or travel delay information will be gathered through roadway traffic sensors or detection stations. The information will be processed and posted on DMS, the Internet web site (511), as well as be shared with external information service providers (e.g. radio, TV stations, private information service providers, etc.).

This initiative also includes replacements of DMS and/or traffic sensors/detection stations that support provision of travel time and delay information.

### Champion and Stakeholder

MnDOT (District Traffic)

### Project Element

- Traffic Detector Roadside Equipment
- Dynamic Message Sign Roadside Equipment
- TOCCs
- 511 Traveler Information Website
- 511 Telephone Information Service

### Service Package

- ATMS01 – Network Surveillance
- ATMS06 – Traffic Information Dissemination
- ATMS19 – Speed Warning and Enforcement
- ATIS01 – Broadcast Traveler Information
- MC08 – Work Zone Management

### Interconnect

- Traffic Detector Roadside Equipment and TOCCs
- TOCCs and Dynamic Message Sign Roadside Equipment
- TOCCs and 511 Traveler Information Website

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

- TOCCs and 511 Telephone Information Service

**Technology Assessment**

This technology is currently deployed and operational in the metro area and is mature. Technologies for work zone applications are still experimental.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Costs for this initiative include traffic detectors and signs, with speed and delay information generated at the TOCC. Equipment can be deployed either temporarily or permanently. Permanent traffic detectors range from \$3,000 to \$9,000 and permanent DMS range from \$50,000 to \$100,000. Temporary traffic detectors range from \$4,000 to \$14,000 and portable changeable message signs (PCMS) range from \$20,000 to \$45,000.

**Needs and Objectives Addressed**

Need: TM15 - Provide operating or actual speed information to travelers  
ITS Objectives: B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period  
 C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.

**Agreement**

Agreements are not required for this initiative.

**ID:** S12

**Initiative:** Advance Warning Flasher Deployment Expansion



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Intersections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will expand the deployment of Advance Warning Flashers (AWFs) as well as replacements of current AWFs to signalized intersections on high speed approaches. AWF's are installed upstream of traffic signals along high-speed approaches to provide an advance warning to drivers that the traffic signal will be turning from the green phase to a yellow and red phase. AWFs generally consist of two flashing yellow beacons a static sign to indicate that drivers should prepare to stop at the upcoming traffic signal. AWF's are connected to the traffic signal upstream and are activated at the appropriate time during the last few seconds of a green light phase. Drivers can adjust their speeds as appropriate when flashing beacons are activated.

**Champion and Stakeholder**

Champion: MnDOT

**Project Element**

- Advance Warning Flasher Roadside Equipment
- Traffic Signal Roadside Equipment

**Service Package**

- ATMS03 – Traffic Signal Control
- ATMS24 – Dynamic Roadway Warning

**Interconnect**

- Traffic Signal Roadside Equipment and Advance Warning Flasher Roadside Equipment

**Technology Assessment**

This technology is currently deployed and operational statewide.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Based on unit cost estimates, capital costs for this initiative range from \$4,000 to \$7,000 for each installation location.

**Needs and Objectives Addressed**

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

Need:

ITS Objectives:

- TM37 - Provide safe signal phase transition
- A-1-05 - Reduce number of crashes due to red-light running
- A-1-10 - Reduce number of crashes at signalized intersections
- A-2-05 - Reduce number of fatalities due to red-light running
- A-2-11 - Reduce number of fatalities at signalized intersections
- A-2-26 - Reduce number of injuries due to red-light running
- A-2-32 - Reduce number of injuries at signalized intersections
- A-2-44 - Reduce number of traffic law violations

**Agreement**

Agreements are not required for this initiative.

**ID: S13**

**Initiative:** Arterial Traffic Management Systems



**Timeframe:** Short Term – Years 1-3

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Traveler Safety, Transportation in Context, Critical Connections, System Security

**SHSP Focus Area:** Intersections, Lane Departure

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

MnDOT is currently deploying an arterial traffic management system along TH13 between TH55 and US 169 which adds CCTV surveillance equipment, dynamic message signs (DMS), and fiber-optic communications, and provide data to generate travel time information. This initiative will expand surveillance and traveler information dissemination services to other signalized arterial roadway network. Replacements and upgrades of existing equipment of the arterial traffic management system are also covered in this initiative.

The ITS systems identified for this initiative will meet a highly prioritized stakeholder need from the Traveler Information stakeholder meetings, which is to provide incident information on freeways and major arterials. Properly placed DMS equipment will provide travelers with incident and congestion information which can be utilized in selecting an alternate route along the arterial roadway network. Additional CCTV surveillance equipment will also allow for visual confirmation incidents impacting traffic and alert TMC operators to dispatch appropriate state patrol and emergency response personnel.

This initiative is also related to the USDOT-led Integrated Corridor Management (ICM) Program. The system deployed along TH7 and TH 55 will be integrated with other existing systems within the ICM initiative boundary.

### Champion and Stakeholder

Champion: MnDOT (District Traffic)

Stakeholders: MnDOT, Local Agencies

### Project Element

- CCTV Roadside Equipment
- Dynamic Message Sign Roadside Equipment
- RTMC
- Local TMCs
- Minneapolis TMC

### Service Package

- ATMS01 – Network Surveillance
- ATMS06 – Traffic Information Dissemination

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Interconnect**

- CCTV Roadside Equipment and RTMC/Local TMCs/Minneapolis TMC
- Dynamic Message Sign Roadside Equipment and RTMC/Local TMCs/Minneapolis TMC

**Technology Assessment**

This initiative is an expansion of a current application and utilizes current technology already deployed and readily available. Published ITS standards NTCIP 1101, 1203, 1205, and 1208 are applicable to this initiative.

**Dependency**

This initiative is not dependent upon any other initiatives. Equipment in phase 1 of this initiative will support and be integrated with other existing systems in Initiative S14: Integrated Corridor Management.

**Cost Estimate**

Total costs of this initiative are to be determined based on the number and location of devices to be deployed. An initial estimate is \$2,568,800 based on inflation-adjusted cost estimates provided by the Minnesota Guidestar Program: Deployment Assessment (2007).

**Needs and Objectives Addressed**

- Needs:
- TI01 - Provide incident information on freeways and major arterials
  - TM25 - Operate freeway/expressway DMS
  - TM26 - Operate CCTV
- ITS Objectives:
- A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-1-19 - Reduce number of all secondary crashes
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
  - 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-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.
  - C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways
  - D-1-06 - Major and minor arterials are equipped with and operating with closed circuit television (CCTV) cameras

**Agreement**

Agreements are not required for this initiative.

**ID: S14**

**Initiative:** Integrated Corridor Management (ICM)

**Timeframe:** Short Term – Years 1-3

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

This initiative will integrate existing systems that manage the dispersal of traffic along high volume corridors by coordinating multiple transportation and transit networks. This initiative will utilize currently deployed technologies or deploy new devices, such as CCTV cameras, and dynamic message signs during peak period hours and special events impacting the roadway network. Recurring and non-recurring congestion will be reduced by monitoring and guiding traffic through parallel transportation networks to effectively use the available lane capacity in the area. There are already a number of network and corridor management strategies in place and this initiative will upgrade the existing systems as necessary, and integrate these capabilities and the operations of the different facilities and agencies in a more effective manner to decrease congestion.

### Champion and Stakeholder

Champion: MnDOT (Freeway Operations and Traffic Signal Operations)

Stakeholders: MnDOT (Metro District), Minnesota State Patrol, Emergency Management Providers, Local Government Signal Operations, Transit Authorities

### Project Element

- Traffic Detector Roadside Equipment
- CCTV Roadside Equipment
- Dynamic Message Sign Roadside Equipment
- Highway Advisory Radio Roadside Equipment
- Traffic Signal Roadside Equipment
- Ramp Meter Roadside Equipment
- Minneapolis TMC
- Local TMCs
- RTMC
- Metro Area Transit Management Centers
- MnPASS Roadside Equipment
- MnPASS Service Center
- Parking Management System

### Service Package

- ATMS01 – Network Surveillance
- ATMS03 – Traffic Signal Control
- ATMS04 – Traffic Metering
- ATMS05 – HOV Lane Management

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

- ATMS07 – Regional Traffic Management
- ATMS09 – Transportation Decision Support and Demand Management
- ATMS10 – Electronic Toll Collection
- ATMS18 – Reversible Lane Management

**Interconnect**

- Roadside equipment and RTMC
- Roadside equipment and Minneapolis TMC/Local TMCs
- MnPASS roadside equipment and MnPASS Service Center
- Metro area transit management centers and transit vehicles
- RTMC and Minneapolis TMC/Local TMCs
- RTMC and metro area transit management centers
- Minneapolis TMC/Local TMCs and metro area transit management centers
- Minneapolis TMC/Local TMCs and 911 dispatch center
- Minneapolis TMC/Local TMCs and parking management system

**Technology Assessment**

This initiative will integrate existing technology and systems already deployed in the initiative area. NTCIP C2C: NTCIP Center-to-Center Standards Group and NTCIP C2F: Center-to-Field Standards Group are ITS standards that will apply to this initiative.

**Dependency**

None.

**Cost Estimate**

Total costs have been estimated between \$4-5 Million.

**Needs and Objectives Addressed**

- Need: TM36 - Implement Integrated Corridor Management (ICM) Strategies
- ITS Objectives:
- B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
  - 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-2-01 - Increase annual transit ridership
  - 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
  - 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

**Agreement**

This initiative will require a Memorandum of Understanding between MnDOT, City of Minneapolis, Hennepin County, FHWA, Metro Transit, and other stakeholders.

**ID: S15**

**Initiative:** Dynamic Lane Control and Variable Speed Limit Signs on Freeways



**Timeframe:** Short Term – Years 2-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Traveler Safety, Transportation in Context, Critical Connections

**SHSP Focus Area:** Speed-Related

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

This initiative focuses on combining dynamic lane control techniques with Variable Speed Limit (VSL) systems. Lane control signs have been deployed along I-94 to manage traffic entering the Lowry Hill tunnel, as well as with managed lanes on I-35W south of Minneapolis and on I-94 between Minneapolis and St. Paul. Combining this application with VSL systems will provide real-time information on the appropriate speed for current conditions based on traffic flow, traffic speed, weather, and other inputs.

The use of dynamic lane control with VSL systems is a strategy that will enhance dynamic traffic management during non-recurring traffic incidents, peak period congestion, and work zone protection. Careful examination of traffic data will assist MnDOT in guiding the final selection of applying dynamic lane control and VSL systems along a corridor for an operational test. It is important that the corridor chosen includes CCTV camera coverage in order to evaluate and document results of the initiative, as well as identify modifications that are needed throughout the initiative.

This initiative was identified in the Minnesota Guidestar Program: Deployment Assessment (2007) and meets several needs identified in the Traffic Management stakeholder meeting. Public education will be necessary to explain how drivers should react to the variable speed limits and dynamic lane control.

### Champion and Stakeholder

Champion: MnDOT (RTMC)

Stakeholder: MnDOT

### Project Element

- Lane Control Roadside Equipment
- Variable Speed Limit Roadside Equipment
- RTMC
- TOCCs

### Service Package

- ATMS22 – Variable Speed Limits
- ATMS23 – Dynamic Lane Management and Shoulder Use

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Interconnect**

- RTMC/TOCCs and Lane Control Roadside Equipment
- RTMC/TOCCs and Variable Speed Limit Roadside Equipment

**Technology Assessment**

Dynamic lane control systems utilize current technology that is readily available. VSL systems have been deployed as operational tests in other states and are readily available. The approved ITS Standard NTCIP 1103 - Transportation Management Protocols (TMP) – defines the rules and services for exchanging transportation management information between transportation management applications and equipment in an interoperable manner.

**Dependency**

This initiative is dependent upon examination of traffic data that will assist MnDOT in guiding the final selection of a corridor for an operational test.

**Cost Estimate**

The cost is estimated at \$11 million based on a similar system that is being implemented on I-35W in the metro area as part of the Urban Partnership Agreement (UPA) project.

**Needs and Objectives Addressed**

- Need: TM10 - Utilize variable speed limits
- ITS Objectives:
- A-1-03 - Reduce number of crashes due to road weather conditions
  - A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-1-17 - Reduce number of crashes due to roadway/geometric restrictions
  - A-1-19 - Reduce number of all secondary crashes
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - A-2-39 - Reduce number of injuries due to roadway/geometric restrictions
  - B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
  - B-1-05 - Reduce the daily hours of recurring congestion on major freeways
  - B-1-14 - Reduce the variability of travel time on specified routes during peak and off-peak periods
  - B-3-01 - Reduce total vehicle hours of delay by time period (peak, off-peak) caused by work zones
  - C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Agreement**

Agreements are not required for this initiative.

**ID: S16**

**Initiative:** Metro Area Ramp Meter Expansion and Enhancements



**Timeframe:** Short to Medium Term – Years 0-8

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Lane Departure

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will add more ramp meters to metro area on-ramps and enhance operational algorithms for the ramp metering system to improve traffic flow and safety. The current system of ramp meters is used by the RTMC to increase freeway volumes, trip reliability, and freeway speeds, while decreasing travel time and crashes. Ramp meters have the potential to operate during the morning and evening peak traffic periods. Timing and operation of ramp meters is controlled by Intelligent Roadway Information System operated at the MnDOT RTMC. Ramp metering operations and algorithms will be evaluated and enhanced as necessary to improve traffic operations and safety.

**Champion and Stakeholder**

Champion: MnDOT (RTMC)  
Stakeholders: Travelers

**Project Element**

- Ramp Meter Roadside Equipment
- RTMC

**Service Package**

- ATMS04 – Traffic Metering

**Interconnect**

- Ramp Meter Roadside Equipment and RTMC

**Technology Assessment**

This technology is currently deployed and operational in the metro area.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

The capital costs for ramp metering range from \$8,000 to \$12,000 per location.

**Needs and Objectives Addressed**

Need: TM23 - Operate ramp meters

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

ITS Objectives:

- A-1-04 - Reduce number of crashes due to unexpected congestion
- A-1-19 - Reduce number of all secondary crashes
- A-2-04 - Reduce number of fatalities due to unexpected congestion
- A-2-25 - Reduce number of injuries due to unexpected congestion
- 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-1-07 - Reduce the regional average travel time index
- B-2-23 - Increase vehicle throughput on specified routes
- B-2-24 - Increase AM/PM peak hour vehicle throughput on specified routes
- C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Agreement**

Agreements are not required for this initiative.

**ID: S17**

**Initiative:** Travel Time Freeway Sign Expansion



**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Traveler Safety, Transportation in Context, Critical Connections

**Timeframe:** Short to Long Term – Years 0-9 and beyond

**SHSP Focus Area:** Speed-Related

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

This initiative will expand MnDOT’s current application of displaying expected freeway travel times to specific interchanges along interstate and state highways on dynamic message signs (DMS). This application involves the collection of real-time data on traffic speeds and volumes from freeway traffic detectors throughout the metro area. The Intelligent Roadway Information System (IRIS) program housed at the MnDOT RTMC calculates estimated travel times between freeway interchanges. MnDOT has recently expanded the display of freeway travel times at 25 additional locations in the metro area. In order to expand coverage, MnDOT will research and prioritize additional locations for expansion of the display of freeway travel times.

In addition, displaying freeway travel times on signs on arterials before travelers enter the freeway will be considered. This display of travel times before freeway entrances will be tested on TH 13 beginning in 2009.

This initiative also includes replacements of travel time signs and/or traffic sensors/detection stations that support provision of travel time information.

This initiative was identified in the Minnesota Guidestar Program: Deployment Assessment (2007) and supports MnDOT’s development of mobility measures by providing data to measure duration and extent of congestion as well as travel time reliability.

### Champion and Stakeholder

Champion: MnDOT (RTMC)

Stakeholders: Minnesota State Patrol, KBEM, Local Agencies, and Private Information Service Providers

### Project Element

- Traffic Detector Roadside Equipment
- Dynamic Message Sign Roadside Equipment
- RTMC
- 511 Traveler Information Website
- 511 Telephone Information Service

### Service Package

- ATMS01 – Network Surveillance

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| <b>Traffic Management</b>    |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

- ATMS06 – Traffic Information Dissemination
- ATIS01 – Broadcast Traveler Information

**Interconnect**

- Roadside equipment and RTMC
- RTMC and 511 Traveler Information Website
- RTMC and 511 Telephone Information Service

**Technology Assessment**

This initiative is an expansion of a current application and utilizes current technology already deployed. The published ITS standard NTCIP 1203: Object Definitions for Dynamic Message Signs (DMS) – contains object definitions to support the functionality of DMS used for transportation and traffic control applications.

**Dependency**

This initiative is dependent upon the completion of deploying traffic detectors and DMS along the freeway segments where displaying of travel times is desired.

**Cost Estimate**

This initiative will rely on data from detectors and DMS that are either already in place or will be deployed under a separate initiative. The cost of displaying travel times will be relatively small and paid for through staff labor hours.

**Needs and Objectives Addressed**

- Need: TM24 - Operate freeway/expressway DMS
- ITS Objectives:
- A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-1-19 - Reduce number of all secondary crashes
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - B-1-07 - Reduce the regional average travel time index
  - B-1-14 - Reduce the variability of travel time on specified routes during peak and off-peak periods
  - B-2-23 - Increase vehicle throughput on specified routes
  - B-2-24 - Increase AM/PM peak hour vehicle throughput on specified routes
  - C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Agreement**

Agreements are not required for this initiative.

**ID: S18**

**Initiative:** Automated Surveillance and Signal Control Software

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**Timeframe:** Short to Long Term – Years 0-9 and beyond

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will implement additional traffic signal monitoring systems to major corridors and networks to monitor signal timing operations and performance. Key indicators of poor signal timing operations and performance could include skipped traffic phases and/or traffic incidents as a result of traffic signal timing operations. MnDOT could lead the deployment of the initiative and provide lessons learned to local agencies for further deployment statewide.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, Local Agencies

**Project Element**

- Traffic Signal Roadside Equipment
- RTMC
- Minneapolis TMC
- Local TMCs

**Service Package**

- ATMS03 – Traffic Signal Control

**Interconnect**

- Traffic Signal Roadside Equipment and RTMC
- Traffic Signal Roadside Equipment and Minneapolis TMC
- Traffic Signal Roadside Equipment and Local TMCs

**Technology Assessment**

Software and signal controllers for traffic signal timing operation and monitoring are currently available from numerous vendors. Applicable ITS standards include: NTCIP C2F: NTCIP Center-to-Field Standards Group; NTCIP 1201: Global Object Definitions; NTCIP 1210: Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters; and NTCIP 1211: Object Definitions for Signal Control and Prioritization (SCP).

**Dependency**

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| <b>Traffic Management</b>    |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

The estimated cost for signal control software and integration ranges from \$100,000 to \$180,000. The estimated cost for a signal controller and a cabinet ranges from \$10,000 to \$15,000. Upgrading existing signal controller cost approximately between \$3,000 and \$6,000 per controller.

**Needs and Objectives Addressed**

- Need: TM14 - Monitor operation and performance of traffic signals  
ITS Objectives: B-1-03 - Reduce the share of major intersections operating at LOS F  
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

**Agreement**

Agreements are not required for this initiative.

**ID: S19**

**Initiative:** Expand HOT Lane Deployment in Metro Area

**Timeframe:** Short Term – Years 2-4 and Beyond

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

The objective of this initiative is to convert existing traffic lanes or shoulders in the metro area into HOT (High-Occupancy Toll) lanes similar to the I-394 HOT Lane operation. Various traffic management tools that could be utilized include variable speed limit signs, lane control signals, dynamic pricing, and Advanced Traveler Information System (ATIS), as well as improvement in transit reliability. In addition to traffic management tools, major items in creating hard or HOT shoulders include shoulder reconstruction, drainage control, and noise walls.

Existing HOV lanes along I-35W between Minneapolis and Burnsville are being converted into HOT Lanes as part of the Urban Partnership Agreement program with the USDOT. By 2016, HOT Lanes will also be operational along the I-35E corridor between Little Canada and St. Paul. Other areas for HOT lane deployment will be examined by MnDOT in future studies.

### Champion and Stakeholder

Champion: MnDOT

Stakeholder: Minnesota State Patrol

### Project Element

- MnPASS Roadside Equipment
- MnPASS Service Center
- MnPASS Vehicle Equipment
- Account Management Providers
- Vehicle Occupancy Monitoring/Enforcement Roadside Equipment
- RTMC
- Variable Speed Limit Roadside Equipment
- Minnesota State Patrol District Office

### Service Package

- ATMS05 – HOV Lane Management
- ATMS10 – Electronic Toll Collection
- ATMS18 – Reversible Lane Management
- ATMS22 – Variable Speed Limits
- ATMS23 – Dynamic Lane Management and Shoulder Use

### Interconnect

- MnPASS Service Center and MnPASS Roadside Equipment
- MnPASS Service Center and MnPASS Vehicle Equipment

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| <b>Traffic Management</b>    |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

- MnPASS Vehicle Equipment and MnPASS Roadside Equipment
- MnPASS Service Center and Account Management Providers
- RTMC and Vehicle Occupancy Monitoring/Enforcement Roadside Equipment
- RTMC and Minnesota State Patrol District Office
- RTMC and Variable Speed Limit Roadside Equipment

**Technology Assessment**

MnPASS HOT Lane technology has been deployed along the I-394 and I-35W corridors and can readily be deployed along future corridors. Existing variable speed limit roadside equipment currently allows for shoulder use along the I-35W corridor.

**Dependency**

This initiative is not dependent upon any other initiative.

**Cost Estimate**

The overall cost for deploying various tools that are part of a HOT Lane project, such as variable speed limit signs, lane control signals, dynamic pricing, and Advanced Traveler Information System (ATIS), will vary depending on the amount of equipment needed and the amount of road infrastructure that needs to be expanded or re-built.

**Needs and Objectives Addressed**

- Need: TM26 - Operate MnPASS HOT Lanes
- ITS Objectives:
- B-1-02 - Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
  - B-1-14 - Reduce the variability of travel time on specified routes during peak and off-peak periods
  - B-2-19 - Increase the number of carpools
  - B-2-20 - Increase use of 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
  - H-2-01 - Increase the average vehicle occupancy rate in HOV lanes

**Agreement**

Agreements are not required for this initiative.

**ID:** S20

**Initiative:** Allow Law Enforcement to Retrieve Data from Onboard Vehicle Computers



**Timeframe:** Short Term

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Unbelted Occupants, Speed-Related, EMS Response & Trauma Systems, Data Management, Management Systems

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

An onboard vehicle unit, Event Data Recorder (EDR), has been implemented in vehicles to record vehicle data. Insurers have been using these data to help address numerous questions or issues relative to an investigation and/or evaluation of a claim. These data can provide evidence to help determine whether a driver was speeding, wearing a seat belt, had sufficient stopping distance and braking distance, and how severe the impact would be for an incident. Even when the data is not favorable to an insurer, significant investigation and legal costs can be avoided. Ideally, law enforcement would access this data to determine vehicle speed, deceleration, time of incident, etc. However, Minnesota law enforcement is only able to access the data with a warrant even though this type of information is currently available on newer model vehicles.

This initiative is to monitor future legislation that could potentially restrict or expand this initiative. There may be data privacy implications regarding the use of this information for prosecution. In addition, the public and the automotive industry may raise data privacy concerns regarding access to this type of information

### Champion and Stakeholder

Champion: Minnesota State Patrol

Stakeholders: Local Law Enforcement Agencies

### Project Element

- Enforcement Agency
- Vehicle

### Service Package

- ATMS19 – Speed Warning and Enforcement

### Interconnect

- Enforcement Agency and Vehicle

### Technology Assessment

This initiative is an expansion of existing technologies.

### Dependency

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

Total equipment costs have not been estimated given further research required.

**Needs and Objectives Addressed**

Need: TM08 - Provide enhanced manual or automated speed enforcement to improve safety

ITS Objectives: A-2-43 - Reduce number of speed violations  
C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Agreement**

Agreements are not required for this initiative.

**ID:** S21

**Initiative:** Implement Automated Enforcement of Red Light Running at Intersections



**Timeframe:** Short to Medium Term

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Intersections, Safety Culture & Awareness

**ITS Service Area:** ATMS, AVSS

**Type:** Policy/Legislation, Deployment

### Description

The purpose of this initiative is to prevent red light running and improve intersection safety by monitoring red light running, speed and aggressive driving and incorporating engineering, education, and enforcement countermeasures. The initiative is to identify signalized intersections where there have been higher than average crash rates and deploy portable or permanent photo/surveillance systems that automatically mail citations to drivers running red lights.

The effort will require actions to explore if the City of Minneapolis plans to re-start their red light running (Stop on Red) program, and determine how Minneapolis red light running experience may affect future efforts to pursue automated enforcement and/or be implemented in other jurisdictions. There are legal restrictions on the issuance of citations when an officer is not physically present to witness the violation. In addition, institutional issues would be that some members of the public have been resistant to this approach to enforcing traffic violations under the auspices of privacy and accuracy of the technology.

To address the legal restrictions on the issuance of citations when an officer is not physically present to witness the violation, MnDOT is currently conducting a project to design and test an Enhanced Red Light Enforcement (ERLE) system. This system uses current off-the-shelf technology to support police officers in performing safe and effective onsite law enforcement by providing them with real-time red light violation monitoring and visual evidence. It is anticipated that the system can provide a non-disruptive and legally accepted approach to monitor red light violations and become highly focused in optimizing the time and monetary resources necessary for an enforcement program. The system is also anticipated to be operational in 2014 for use by law enforcement.

### Champion and Stakeholder

Champion: Minnesota State Patrol

Stakeholders: Local Law Enforcement Agencies, Judicial System, Minnesota Department of Public Safety-Traffic Safety, MnDOT, Local Transportation Agencies

### Project Element

- Enforcement Agency
- Vehicle
- Traffic Signal Roadside Equipment

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Service Package**

- ATMS01 – Network Surveillance
- ATMS03 – Traffic Signal Control
- AVSS05 – Intersection Safety Warning

**Interconnect**

- Enforcement Agency and Traffic Signal Roadside Equipment
- Traffic Signal Roadside Equipment and Vehicle

**Technology Assessment**

This initiative utilizes technology that is currently available and used in other states.

**Dependency**

This initiative is dependent upon authorized legislation to re-enforce automated red-light running violations. The City of Minneapolis deployed a system as an operational test from 2005 to 2006 which was de-activated when a 2006 legislative ruling declared tickets issued to vehicle owners, as opposed to the actual drivers that caused the violation, was illegal.

**Cost Estimate**

Total costs for one system installation at an intersection have been estimated at \$20,000.

**Needs and Objectives Addressed**

- Need: TM02 - Implement red-light running technology
- ITS Objectives:
- A-1-05 - Reduce number of crashes due to red-light running
  - A-1-10 - Reduce number of crashes at signalized intersections
  - A-2-05 - Reduce number of fatalities due to red-light running
  - A-2-11 - Reduce number of fatalities at signalized intersections
  - A-2-26 - Reduce number of injuries due to red-light running
  - A-2-32 - Reduce number of injuries at signalized intersections
  - A-2-44 - Reduce number of traffic law violations

**Agreement**

Agreements between transportation/signal operating agencies and law enforcement agencies may be required for funding and operations.

**ID:** S22

**Initiative:** Expand Quick Clearance Policies for Incidents



**Timeframe:** Short Term

**Multimodal Transportation Objective:**

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** ATMS

**Type:** Policy/Legislation

**Description**

The quick clearance legislation authorizes the removal of driver-occupied disabled or wrecked vehicles from travel lanes in addition to the authority to tow those vehicles without regard to drivers being present at the incident site. There are four categories of quick clearance legislation including driver stop law, driver removal law, authority removal law, and authority tow law. Quick clearance policies have strong effects on traffic safety and minimize incident related congestion. Studies indicate that good traffic incident management led by quick clearance actions can reduce delay nationally by 170 million hours annually.

This initiative is to expand the quick clearance policies for incidents to inform and educate motorists about existing quick clearance laws and encourage drivers to change their behavior when involved in traffic incidents. The effort will require actions to review existing Traffic Incident Management Operational Guidelines to understand the current policy related to quick clearance and explore recent discussions among the Incident Management Coordination Team to determine the strengths/weaknesses of the current policy. However, there may be jurisdictional or “turf” issues among fire, law enforcement, EMS and transportation staff related to quick clearance for incidents. Coordination with private tow truck or heavy equipment operators will be required.

**Champion and Stakeholder**

Champion: MnDOT State Traffic Engineer

Stakeholders: Local Law Enforcement Agencies, Local EM Agencies, Minnesota State Patrol

**Project Element**

- None.

**Service Package**

- None.

**Interconnect**

- None

**Technology Assessment**

This initiative is policy-related and does not include technologies.

**Dependency**

This initiative is not dependent upon any other initiatives.

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

Total costs have not been estimated given further research required.

**Needs and Objectives Addressed**

- Need: TM12 - Reduce clearance time for primary crashes
- ITS Objectives:
- 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-1-09 - 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

**Agreement**

Agreements are not required for this initiative.

**ID: S23**

**Initiative:** Expand Geographic Coverage of the RTMC Systems



**Timeframe:** Short to Long Term – Years 0-9 and beyond

**Multimodal Transportation Objective:** Traveler Safety, Transportation in Context, Critical Connections, Asset Management, System Security

**SHSP Focus Area:** Management Systems

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

The goal of the Regional Transportation Management Center (RTMC) is to provide motorists with a faster and safer trip on metro-area freeways by using cutting-edge technology, progressive programs, and real time information delivery systems. The MnDOT RTMC integrates Mn/DOT's Metro District Maintenance Dispatch and Office of Traffic, Security, and Operations with the Minnesota Department of Public Safety's State Patrol Dispatch into a unified communications center. The integration provides the communications and computer infrastructure necessary for coordinated transportation management on metro freeways during normal commuting periods, as well as during special events and major incidents.

This initiative will require actions to evaluate current expansion plans and available funding to identify gaps. There may be staffing limitations that could limit the level of monitoring/response that would be needed for expanded RTMC coverage.

**Champion and Stakeholder**

Champion: MnDOT State Traffic Engineer

Stakeholders: Minnesota State Patrol

**Project Element**

- RTMC
- Dynamic Message Sign Roadside Equipment
- CCTV Roadside Equipment
- Traffic Detector Roadside Equipment
- Minnesota State Patrol District Office

**Service Package**

- ATMS01 – Network Surveillance
- ATMS06 – Traffic Information Dissemination
- ATMS07 – Regional Traffic Management
- ATMS08 – Traffic Incident Management System

**Interconnect**

- RTMC and Dynamic Message Sign Roadside Equipment
- RTMC and CCTV Roadside Equipment
- RTMC and Traffic Detector Roadside Equipment

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

- RTMC and Minnesota State Patrol District Office

**Technology Assessment**

This initiative is an expansion of existing technologies. Newer technology will be assessed once it has become available and proven stable for deployment.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Total equipment costs have not been estimated given that scope of initiative needs to be further determined.

**Needs and Objectives Addressed**

- Need: TM24 - Operate freeway/expressway DMS  
 TM25 - Operate CCTV cameras
- ITS Objectives: A-1-04 - Reduce number of crashes due to unexpected congestion  
 A-1-19 - Reduce number of all secondary crashes  
 A-2-04 - Reduce number of fatalities due to unexpected congestion  
 A-2-25 - Reduce number of injuries due to unexpected congestion  
 B-1-07 - Reduce the regional average travel time index  
 B-1-14 - Reduce the variability of travel time on specified routes during peak and off-peak periods  
 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-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.  
 C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways  
 D-1-06 - X percent of major and minor arterials are equipped with and operating with closed circuit television (CCTV) cameras

**Agreement**

No additional agreements have been identified beyond current agreements that have been established for RTMC and State Patrol operations.

**ID:** S24

**Initiative:** Use Driving Simulation for Teenage and Older Driver Education



**Timeframe:** Short Term

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Safety Culture & Awareness, Older Drivers, Younger Drivers

**ITS Service Area:** ATMS

**Type:** Policy/Legislation, Research

**Description**

Driving simulation technology has been developed to address the underlying attitudes that influence how teens drive. It intends to define teen driving problems, identify solutions and test those solutions for real results before they are introduced into the market. Individuals would be asked to participate in driving simulation to see the effects of driving too fast, tailgating, reaction time, etc. This technology has been available for many years. However, political support will be needed to proceed at a state level in enhance the applications.

This initiative will require actions to review driving regulations to determine if they allow for further evaluation of older and new teenaged drivers and evaluate current simulation technology to determine effectiveness, potential application and cost parameters. There are some legal issues that needed to be considered including that driving regulations may need to be evaluated to determine if they allow for further evaluation of older and/or new teenaged drivers. Some institutional issues needed to be considered include that there may be older driver resistance to this additional evaluation of their driving skills and privileges.

**Champion and Stakeholder**

Champion: Minnesota DPS – Driver & Vehicle Services  
Stakeholders: MnDOT

**Project Element**

- None.

**Service Package**

- None.

**Interconnect**

- None.

**Technology Assessment**

None.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Total equipment costs have not been estimated given further research required.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Maintenance and Construction |
| Emergency Management         |
| Commercial Vehicle           |
| Vehicle Safety               |
| Traffic Management           |
| Traveler Information         |
| Transit Management           |
| Data Management              |

**Needs and Objectives Addressed**

Need: CEA 3 – Addressing Young Drivers over Involvement and Curbing Aggressive Driving

ITS Objectives: A-1-18 - Reduce number of crashes involving younger drivers (under 21)  
A-2-19 - Reduce number of fatalities involving younger drivers (under 21)  
A-2-40 - Reduce number of injuries involving younger drivers (under 21)

**Agreement**

Agreements are not required for this initiative.

**ID:** S25

**Initiative:** Static Transit Route and Schedule Information Systems

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

### Description

This initiative will feature deployment of new and upgrade of existing systems that provide static transit route and schedule information for transit providers in small urban and rural areas. Systems may include functions such as providing static route and schedule information, route and trip planning, voice recognition for automated trip planning, etc. Information can be made available to transit users via internet websites, WiFi internet access at transit stops and on transit vehicles, handheld devices, and kiosks at key transit stops and centers. This initiative has the potential to increase transit customer satisfaction and improve overall transit ridership.

### Champion and Stakeholder

Champion: Transit Agencies, MnDOT (Office of Transit)

Stakeholders: Travelers

### Project Element

- Metro Area Transit Management Centers (Regional Transit Providers)
- Local Transit Management Centers
- Intercity Transit Management Centers
- Transit Kiosks
- Transit Information Websites
- Transit Information Telephone Systems
- Transit Vehicle Equipment

### Service Package

- APTS08 – Transit Traveler Information

### Interconnect

- Transit Management Centers and Transit Kiosks
- Transit Management Centers and Transit Information Websites
- Transit Management Centers and Transit Information Telephone Systems
- Transit Management Centers and Transit Vehicle Equipment

### Technology Assessment

This initiative features technology that is readily available and currently operational in the metropolitan area.

### Dependency

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

Unit cost estimates for interactive informational kiosks for transit agencies range from \$15,000 to \$30,000. Software costs for trip planning / route selection technology ranges from \$250,000 to over \$1, 000,000 for systems that include voice recognition, while hardware costs range from \$20,000 to \$30,000. This cost estimate does not include O&M costs.

**Needs and Objectives Addressed**

- Need: TR01 – Provide transit route, schedule, and fare information  
ITS Objectives: B-2-01 - Increase annual transit ridership  
C-3-14 - Increase the number of transit routes with information being provided by ATIS

**Agreement**

Agreements might be necessary to place schedule systems providing route and schedule information on property not owned by listed stakeholders.

**ID: S26**

**Initiative:** Expand CAD/AVL/GPS Technologies to Rural Transit Systems

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

### Description

This initiative will include a series of deployments of ITS technologies that have been deployed in the metro area to transit systems in Greater Minnesota. Some urban transit agencies use CAD/AVL/GPS technology in their fixed-route transit operations, and use GPS/AVL data to provide customers with next bus departure times via telephone and internet. Met Council is currently deploying real-time transit arrival/departure information signs in downtown Minneapolis. CAD/AVL/GPS technology will be expanded to rural and small urban transit providers to give their customers the same benefit. A Communications assessment will need to be conducted for each individual deployment to determine the communication coverage in the rural area.

Additional ITS technologies for rural deployment, as determined necessary, may include:

- Mobile data terminals (MDTs)
- Automated trip duplicating coordination system to prevent duplicating trips (e.g. fixed route and demand response routes)
- Improving route coordination to minimize transit wait times and missed transfers at transfer points
- Transit information websites and phone systems
- Real-time transit trip information

Replacements and upgrades of existing CAD/AVL/GPS technologies are also included in this initiative.

### Champion and Stakeholder

Champion: Local transit providers, Intercity transit providers, paratransit providers  
Stakeholders: MnDOT (Office of Transit), Travelers

### Project Element

- Local Transit Management Centers
- Intercity Transit Management Centers
- Transit Vehicle Equipment
- Real-Time Bus Arrival Time Display Roadside Equipment
- Transit Information Websites
- Transit Information Telephone Systems

### Service Package

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

- APTS07 – Multi-modal Coordination
- APTS08 – Transit Traveler Information

**Interconnect**

- Transit Management Centers and Transit Vehicle Equipment
- Transit Management Centers and Transit Management Centers
- Transit Management Centers and Transit Information Websites
- Transit Management Centers and Transit Information Telephone Systems
- Transit Management Centers and Real-Time Bus Arrival Time Display Roadside Equipment

**Technology Assessment**

The Transit ITS technologies considered in this initiative have been or are being deployed in the metropolitan area.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Costs will vary depending on the type and amount of APTS technologies deployed by Transit Agencies. Transit center software for CAD/GPS/AVL technology can range from \$500,000 to \$1,200,000 for small and medium areas. Vehicle hardware can range from \$2,000 to \$10,000 per bus. Unit cost estimates for real-time transit information signs can range from \$4,000 to \$8,000.

**Needs and Objectives Addressed**

Need: TR04 - Coordinate timed transfers between route segments, providers & modes

ITS Objectives: 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-2-05 - Maintain performance targets set by MnDOT for rides per hour of transit service

**Agreement**

Agreements are not required for this initiative.

**ID:** S27

**Initiative:** Data Analysis Tools for Transit Route Performance

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context

**ITS Service Area:** AD, APTS

**Type:** Deployment

**Description**

The initiative will refine data analysis tools to evaluate transit route performance based on archived data. Transit data is collected via ITS technologies on board of transit vehicles. Several transit agencies currently have the ability to track vehicle locations, measure on-time schedule performance, and obtain transit ridership levels. A refinement of data analysis tools can provide agencies with ability to perform more accurate analysis and lead to better resource management and investment decisions as well as improved transit services and performance.

**Champion and Stakeholder**

Champion: Metro area transit providers

Stakeholders: Local transit providers, Regional transit providers, Intercity transit providers

**Project Element**

- Metro Area Transit Management Centers
- Local Transit Management Centers
- Intercity Transit Management Centers
- Transit Vehicle Equipment
- Transit Data Archives

**Service Package**

- APTS01 – Transit Vehicle Tracking
- APTS10 – Transit Passenger Counting
- AD01 – ITS Data Mart

**Interconnect**

- Transit Vehicle Equipment and Transit Management Centers
- Transit Management Centers and Transit Data Archives

**Technology Assessment**

Tools for evaluating transit route performance are readily available.

**Dependency**

This initiative is not dependent upon any other initiatives. However, deployment of GPS/AVL systems will provide effective way to gather data necessary for performance evaluation.

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

Cost estimates for this initiative are expected to be small, mostly through staff labor, and will vary depending on the amount of data that will be analyzed.

**Needs and Objectives Addressed**

- Need: TR09 - Measure historical transit route performance
- ITS Objectives: 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
- E-4-04 - Increase the rate at which equipment is utilized
- G-1-01 - Increase the amount of data gathered from ITS enhancements used in infrastructure and operations planning
- G-1-06 - Reduce operations cost deviation

**Agreement**

Agreements are not required for this initiative.

**ID:** S28

**Initiative:** Bus Authorized Shoulders Assistant System

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety, Asset Management

**ITS Service Area:** APTS, AVSS

**Type:** Deployment

### Description

This initiative will install a high-accuracy GPS system on Metro Transit and other regional transit provider vehicles for bus authorized shoulder use assistance. MnDOT currently maintains a large network of bus authorized shoulders used by metro area transit providers to facilitate transit vehicles traveling on congested roadways in the metro area. A high-accuracy GPS lane assistant system will provide bus drivers with lateral safety warnings of vehicles that are crossing into the shoulder lane, thus improving the safety of bus travel on shoulder lanes.

In collaboration with the Met Council and MnDOT, the University of Minnesota has developed a lane assist system to help bus drivers under difficult conditions such as bad weather, low visibility, high traffic congestion, etc. This system uses carrier phase, dual frequency differential GPS, a lane-level, high density, high accuracy geospatial database, and a lateral control algorithm for lateral assistance, radar for obstacle detection, and graphical, haptic, and tactile driver interfaces to provide guidance information to a driver. The University of Minnesota is currently working with Minnesota Valley Transit Authority (MVTA) to deploy the system on 10 MVTA buses. This system will help drivers navigate narrow shoulder lanes on Cedar Avenue, the Cross-town Freeway, and I-35W, both into and out of downtown Minneapolis. Based on the success of and lessons learned from this initiative, assistance systems will be deployed by Metro Transit and other regional transit providers.

### Champion and Stakeholder

Champion: University of Minnesota, Regional Transit Providers

Stakeholders: Metro Transit, Regional Transit Providers

### Project Element

- Transit Vehicle Equipment
- Metro Area Transit Management Centers

### Service Package

- AVSS04 – Lateral Safety Warning

### Interconnect

- Transit Vehicle Equipment (GPS equipment) and Transit Vehicle Equipment (warning equipment)
- Transit Vehicle Equipment and Metro Area Transit Management Centers

### Technology Assessment

The technology has been tested and will be installed on 10 MVTA buses.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Dependency**

Results and lessons learned from the MTVA deployment should be considered for this initiative.

**Cost Estimate**

The cost of a lane assistant system is around \$10,000 to \$15,000 per vehicle.

**Needs and Objectives Addressed**

- Need: TR13 - Provide collision avoidance assistance for transit vehicles
- ITS Objectives:
  - A-1-08 - Reduce number of crashes due to inappropriate lane departure, crossing and merging
  - A-1-16 - Reduce number of crashes at intersections due to inappropriate crossing
  - A-2-09 - Reduce number of fatalities due to inappropriate lane departure, crossing and merging
  - A-2-17 - Reduce number of fatalities at intersections due to inappropriate crossing
  - A-2-30 - Reduce number of injuries due to inappropriate lane departure, crossing and merging
  - A-2-38 - Reduce number of injuries at intersections due to inappropriate crossing

**Agreement**

Transit agencies might need to enter agreements with MnDOT to use assistance equipment on bus authorized shoulders.

**ID:** S29

**Initiative:** Security Surveillance at Transit Facilities

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Asset Management, System Security

**ITS Service Area:** APTS

**Type:** Deployment

### Description

This initiative aims to improve safety and security of customers and transit vehicle operators at transit facilities such as park and ride lots, transit centers, and potentially bus shelters. There are a number of facilities where security surveillance systems have been installed. The system uses surveillance cameras to monitor and record suspicious activities. Panic buttons and emergency phones can also be part of the system. The initiative will include the following types of deployment:

- Upgrade existing analog cameras to digital
- Replace existing security surveillance systems
- Install security surveillance systems at additional transit facilities
- Integrate those systems with monitoring alert systems to automatically alert agencies of suspicious activities

### Champion and Stakeholder

Champion: Metro area transit providers

Stakeholders: Local transit providers, intercity transit providers, emergency response agencies

### Project Element

- Transit Center and Station Surveillance System Roadside Equipment
- Metro Area Transit Management Centers
- Local Transit Management Centers
- Enforcement Agency

### Service Package

- APTS05 – Transit Security

### Interconnect

- Transit Center and Station Surveillance System Roadside Equipment and Transit Management Centers
- Transit Center and Station Surveillance System Roadside Equipment and Enforcement Agency
- Transit Management Centers and Enforcement Agency

### Technology Assessment

This initiative utilizes technology that is currently available from numerous technology vendors.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Dependency**

This initiative can provide additional data to and support Medium Term Initiative M17 – Sharing CCTV Images between Agencies.

**Cost Estimate**

Unit cost estimates for a security surveillance system are expected to range from \$30,000 to \$50,000 per site.

**Needs and Objectives Addressed**

Need: TR14 - Provide security at park and ride lots

ITS Objectives: D-1-01 - Reduce on an annual basis the number of complaints per 1,000 boarding passengers

D-1-02 - Increase the number of closed circuit television (CCTV) cameras installed on platforms, park-n-ride lots, vehicles, and other transit facilities

**Agreement**

Agreements are required between transit service providers and enforcement agencies.

**ID:** S30

**Initiative:** Transit Scheduling Software Systems

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

This initiative will upgrade existing or install new scheduling software systems as determined by transit agencies. For existing systems that do not meet expectations but with rooms for enhancement, upgrades of existing systems will be performed. For agencies with obsolete systems or without systems, this initiative provide an opportunity for procuring and installing a transit scheduling system that automates the daily operations and management functions and scheduling and routing capabilities to optimize scheduling efficiency, reduce operating expenses, and improve customer service. The system will provide the capability to automate real time, interactive and/or batch scheduling functions and increase the efficiency of service. The basic program features will include vehicle management, driver management, trip reservations, automated scheduling and routing, coordination, dispatching, reporting, geo-coding, and mapping.

**Champion and Stakeholder**

Champion: Metro area transit providers, local transit providers  
Stakeholders: Travelers

**Project Element**

- Metro Area Transit Management Centers
- Local Transit Management Centers
- Transit Data Archives

**Service Package**

- APTS02 – Transit Fixed-Route Operations

**Interconnect**

- Transit Management Centers and Transit Data Archives

**Technology Assessment**

This initiative utilizes technology that is readily available.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Cost for upgrading scheduling software ranges from \$25,000 to \$50,000. Cost for a new scheduling system ranges from \$220,000 to \$600,000.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

**Needs and Objectives Addressed**

Need: TR15 - Optimize schedule efficiency

ITS Objectives: B-2-07 - Maintain the cost efficiency of the statewide public transit network  
E-4-07 - Increase the number of vehicles operating under CAD

**Agreement**

Agreements are not required for this initiative.

**ID:** S31

**Initiative:** DARTS On-line Reservation for Seniors

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

This initiative will implement an on-line reservation system for Dakota Area Resources and Transportation for Seniors (DARTS). This on-line reservation service will be available for transit riders to request demand response transit service through a DARTS website.

**Champion and Stakeholder**

Champion: DARTS

Stakeholders: Travelers

**Project Element**

- Transit Information Websites
- Local Transit Management Centers

**Service Package**

- APTS03 – Demand Response Transit Operations
- ATIS02 – Interactive Traveler Information

**Interconnect**

- Transit Information Websites and Local Transit Management Centers

**Technology Assessment**

This initiative utilizes technology that is readily available.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Hardware costs for on-line reservation systems could range from \$20,000 to \$30,000.

**Needs and Objectives Addressed**

- Need: TR21 - Provide on-line reservation system for demand-responsive transit
- ITS Objectives: B-2-15 - Improve average on-time performance for specified transit routes/facilities
- C-3-14 - Increase the number of transit routes with information being provided by ATIS
- C-3-18 - Increase annual transit ridership reported by rural area transit providers

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

**Agreement**

Agreements are not required for this initiative.

**ID:** S32

**Initiative:** Expand Real-Time Transit Departure Information

**Timeframe:** Short to Medium Term – Years 0-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

The initiative will expand the capability of some transit agencies to provide real-time next bus departure information at transit stops and centers, as well as at key decision points on freeways and major arterials to help pre-trip and en-route travelers make informed decisions. The improved information system will be more interactive and customer-driven to allow transit users to receive the real-time transit information via mobile devices, internet sites, and other effective media. The real-time information provided will be consistent between transit agencies to avoid any potential confusion.

This initiative also includes replacements and upgrades of the existing real-time next bus departure information systems and components.

**Champion and Stakeholder**

Champion: Metro Transit

Stakeholders: Metro Area Transit Providers, Local Transit Agencies, Intercity Transit Agencies, MnDOT (Office of Transit)

**Project Element**

- Local Transit Management Centers
- Metro Area Transit Management Centers
- Intercity Transit Management Centers
- Real-time Bus Arrival Display Roadside Equipment
- Transit Information Websites
- Transit Kiosks
- User Personal Portable and Computing Devices

**Service Package**

- APTS08 - Transit Traveler Information

**Interconnect**

- Real-Time Bus Arrival Display Roadside Equipment and Local Transit Management Centers/Metro Area Transit Management Centers/Intercity Transit Management Centers
- Transit Information Websites and Local Transit Management Centers/Metro Area Transit Management Centers/Intercity Transit Management Centers
- Transit Kiosks and Local Transit Management Centers/Metro Area Transit Management Centers/Intercity Transit Management Centers

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

- User Personal Portable and Computing Devices and Local Transit Management Centers/Metro Area Transit Management Centers/Intercity Transit Management Centers

### Technology Assessment

This initiative utilizes technology that is readily available and current in use by Metro Transit in the Twin Cities.

### Cost Estimate

Costs for this effort will vary by size of agency, equipment used to convey information, and number of devices used. Projects can range from \$175,000 for software enhancements and integration into a transit website to \$4 million for dense deployment of numerous signs along a corridor. Real-Time Bus Arrival Displays can cost from \$5,000 to \$25,000 per sign to deploy.

### Dependency

An Automated Vehicle Location (AVL) system is required to provide necessary data for this initiative. This initiative is also depending upon the successful deployment of the real-time bus arrival/departure information system as part of the UPA Transit Technology Project in the metro area. This initiative may be implemented in coordination with the Project S31 – Real-Time Transit Transfer Information.

### Needs and Objectives Addressed

Need: TR02 - Provide real-time transit vehicle arrival/departure information

ITS Objectives: B-2-01 - Increase annual transit ridership

C-3-14 - Increase the number of transit routes with information being provided by ATIS

### Agreement

Agreements are not required for this initiative.

**ID:** S33

**Initiative:** Real-Time Transit Transfer Information

**Timeframe:** Short to Medium Term – Years 0-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

### Description

This initiative will provide real-time transfer and next bus departure information at transit centers and transfer points. Real-time transfer and departure information will be provided via changeable message signs at transit centers and transfer points. System may also be interactive to allow transit users to receive the real-time transfer and departure information via mobile devices and other effective media. Project benefits include increased ridership for transit agencies and an improved customer satisfaction with public transportation.

### Champion and Stakeholder

Champion: Metro Transit

Stakeholders: Metro Area Transit Providers, Local Transit Providers, Intercity Transit Providers, MnDOT (Office of Transit)

### Project Element

- Local Transit Management Centers
- Metro Area Transit Management Centers
- Intercity Transit Management Centers
- Transit Kiosks
- Real-time Bus Arrival Display Roadside Equipment
- Transit Information Websites
- User Personal Portable and Computing Devices

### Service Package

- APTS08 - Transit Traveler Information

### Interconnect

- Transit Kiosks and Local Transit Management Centers/Metro Area Transit Management Centers/Intercity Transit Management Centers
- Real-Time Bus Arrival Display Roadside Equipment and Local Transit Management Centers/Metro Area Transit Management Centers/Intercity Transit Management Centers
- Transit Information Websites and Local Transit Management Centers/Metro Area Transit Management Centers/Intercity Transit Management Centers
- User Personal Portable and Computing Devices and Local Transit Management Centers/Metro Area Transit Management Centers/Intercity Transit Management Centers

### Technology Assessment

This initiative utilizes technology that is currently available.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Dependency**

This initiative may be implemented in coordination with the Initiative S32 – Expand Real-Time Transit Departure Information.

**Cost Estimate**

Costs for this effort will vary by size of agency, equipment used to convey information, and number of devices used. Projects can range from \$200,000 for deployment on a website to \$4 million for deployment of numerous signs or kiosks along a corridor. Changeable message signs for transit centers can cost from \$5,000 to \$25,000 per sign to deploy. Kiosks can range from \$10,000 to \$22,000.

**Needs and Objectives Addressed**

Need: TR20 - Provide real-time transfer information to travelers enroute  
ITS Objectives: B-2-01 - Increase annual transit ridership  
C-3-03 - Increase alternative (non-single occupancy vehicle) mode share in transit station communities (or other areas)

**Agreement**

Agreements are not required for this initiative.

**ID:** S34

**Initiative:** HiSPARC Transit System Deployment

**Timeframe:** Short to Medium Term – Years 0-5

**Multimodal Transportation Objective:** Transportation in Context, System Security

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

Metro Transit plans to increase the ability of its vehicles to send and receive data at high speeds through the High-Speed, Accuracy Reliability, and Capacity (HiSPARC) program. 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. The objective of the HiSPARC program is for transit control staff to receive data from all of these vehicle systems at high speeds to improve transit safety and operations. The program contains multiple projects that range from mitigating current problems to projects that migrate the existing communications system to the next generation system that communicates data at high speeds with high accuracy and reliability through increased system capacity, resiliency, and redundancy.

There are multiple phases to the program that Metro Transit has planned from 2012 through 2018. Phase 1 will include improving current radio communications and implementing vehicle software upgrades. Phase 2 will include upgrading hardware on vehicles and investigating hardware options for how high speed data can be communicated between buses and the Metro Transit Control Center. Phase 3 will include implementation of recommended strategies that arise out of the Phase 2 investigation, Phase 4 will include management and evaluation of the projects implemented under Phase 3.

**Champion and Stakeholder**

Champion: Metro Transit

**Project Element**

- Metro Area Transit Management Centers
- Transit Vehicle Equipment
- Communications Equipment

**Service Package**

- APTS01 – Transit Vehicle Tracking
- APTS02 – Transit Fixed-Route Operations
- APTS04 – Transit Fare Collection Management
- APTS05 – Transit Security

**Interconnect**

- Metro Area Transit Management Centers and Transit Vehicle Equipment

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Technology Assessment**

Metro Transit will investigate technology options through Phase 2 of their HiSPARC program. Communications of data through cellular modems is a possibility. The speed and coverage of commercial cellular networks continues to improve as cellular companies increase the capacity of their networks to support greater data consumption at higher speeds.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Metro Transit has estimated costs of all the related projects that fall under the HiSPARC program to cost over \$30 million over the 2012-2018 timeframe of the program. Costs will vary based on the technology recommended and implemented under Phases 2 and 3 of the program.

**Needs and Objectives Addressed**

Need: TR23 - Provide multi-communication mode hub/ infrastructure on buses to transmit/ receive high speed data in the most efficient and cost-effective manner

ITS Objectives: B-2-01 – Increase annual transit ridership  
 B-2-05 – Maintain performance targets set by MnDOT 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  
 C-3-05 – Increase transit mode share during peak periods  
 C-3-06 – Increase average transit load factor

**Agreement**

Agreements are not required for this initiative.

**ID:** S35

**Initiative:** DTA Facility and Bus Security System Upgrades

**Timeframe:** Short Term

**Multimodal Transportation Objective:**

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

The Duluth Transit Authority (DTA) plans to implement a new Multimodal Transit Center to include several new passenger amenities, such as real-time transit traveler information. The new facility will replace an existing transit center along W. Superior St. The DTA will also install security camera equipment at the new Multimodal Transit Center to improve security at the facility for transit customers. Transit Signal Priority is also planned at key signals around the new Multimodal Transit Center to facilitate the movement of buses into and out of the facility.

**Champion and Stakeholder**

Champion: Duluth Transit Authority  
Stakeholders: City of Duluth, Local Law Enforcement Agencies

**Project Element**

- Transit Vehicle Equipment
- Local Transit Management Centers
- Transit Center and Station Surveillance System Roadside Equipment
- Traffic Signal Roadside Equipment
- Enforcement Agency

**Service Package**

- APTS02 – Transit Fixed-Route Operations
- APTS05 – Transit Security
- APTS08 – Transit Traveler Information
- APTS09 – Transit Signal Priority

**Interconnect**

- Transit Vehicle Equipment and Local Transit Management Centers
- Local Transit Management Centers and Transit Center and Station Surveillance System Roadside Equipment
- Transit Vehicle Equipment and Traffic Signal Roadside Equipment
- Local Transit Management Centers and Enforcement Agency

**Technology Assessment**

Multiple vendors are available to provide transit departure information through Dynamic Message Signs at transit locations. Multiple vendors also provide Transit Signal Priority technology that is desired around the transit center.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Dynamic Message Signs for transit traveler information can range between \$5,000 and \$10,000 depending on the amount of information that is desired. Transit Signal Priority technology generally ranges from \$3,000 to \$5,000 for both vehicle and intersection equipment. Unit cost estimates for a security surveillance system are expected to range from \$30,000 to \$50,000 per site.

**Needs and Objectives Addressed**

- Needs:
- TR02 - Provide real-time transit vehicle arrival/departure information
  - TR04 - Coordinate timed transfers between route segments, providers & modes
  - TR06 - Provide surveillance and enforcement on transit vehicles and transit facilities
  - TR-17 - Coordinate transit vehicle movements with traffic control devices
- ITS Objectives:
- B-2-01 - Increase annual transit ridership
  - B-2-02 - Increase annual express bus ridership
  - C-3-14 - Increase the number of transit routes with information being provided by ATIS
  - C-3-17 - Increase annual transit ridership reported by urbanized area transit providers
  - C-4-02 - Increase the number of users aware of park-and-ride lots in their region
  - D-1-01 - Reduce on an annual basis the number of complaints per 1,000 boarding passengers
  - D-1-02 - Increase the number of closed circuit television (CCTV) cameras installed on platforms, park-n-ride lots, vehicles, and other transit facilities
  - D-1-07 - Increase the number of critical sites with security surveillance
  - E-1-02 - Improve average transit travel time compared to auto in major corridors

**Agreement**

Agreements are not required for this initiative.

**ID:** S36

**Initiative:** Transit Signal Priority along Arterials

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

### Description

Based on the success of the Transit Signal Priority (TSP) deployment for the Urban Partnership Agreement Transit Technologies Projects, this initiative will focus on expanding TSP deployment to key signalized intersection along other transit corridors. Metro Transit has deployed TSP equipment on their entire fleet of fixed-route transit vehicles and utilizes a central software package at their Transit Management Center to monitor and configure TSP operations. New TSP equipment can be installed at intersections and monitored by Metro Transit through their central software. Minnesota Valley Transit Authority (MVTA) has recently deployed TSP equipment along a major arterial roadway that is currently integrated with the Metro Transit TSP System. The Snelling Avenue corridor that travels through Roseville, St. Paul, and Minneapolis is an arterial corridor that will include TSP equipment beginning in 2015.

TSP equipment has only been enabled on transit vehicles to improve schedule adherence and on-time performance of transit vehicles. Integration of TSP equipment on vehicles with existing AVL systems allows for TSP operation only when the AVL equipment has detected the vehicle to be behind schedule.

### Champion and Stakeholder

Champion: Metro Transit

Stakeholders: Metro Area Transit Providers, MnDOT, Local Agencies

### Project Element

- Metro Area Transit Management Centers
- Local Transit Management Centers
- Transit Vehicle Equipment
- Traffic Signal Roadside Equipment
- Minneapolis TMC
- RTMC
- Local TMCs

### Service Package

- APTS09 - Transit Signal Priority

### Interconnect

- Transit Vehicle Equipment and Traffic Signal Roadside Equipment
- Minneapolis TMC and Traffic Signal Roadside Equipment
- RTMC and Traffic Signal Roadside Equipment

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

- Local TMCs and Traffic Signal Roadside Equipment
- Metro Area Transit Management Centers and Transit Vehicle Equipment
- Local Transit Management Centers and Transit Vehicle Equipment

**Technology Assessment**

Transit Signal Priority equipment has been deployed at multiple locations in the metro area and the technology is readily available to expand deployment to other arterial corridors.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

At signalized intersections, the general cost to furnish and install TSP equipment is about \$15,000. If new traffic signal controllers are required to successfully provide signal priority, those signal controllers generally cost \$3,000 to \$4,000 per intersection.

If new equipment is required on vehicles, the general cost to furnish and install TSP equipment is about \$10,000 per vehicle.

**Needs and Objectives Addressed**

Need: TR17 – Coordinate transit vehicle movements with traffic control devices

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

C-3-17 – Increase annual transit ridership reported by urbanized area transit providers

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

**Agreement**

This initiative will require agreements between the transit agencies that manage TSP operations and the traffic agency responsible for operating and maintaining safe traffic signal operations.

**ID:** S37

**Initiative:** NexTrip Enhancements

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

This initiative will add rail mode information (commuter, light rail) to Metro Transit NexTrip system and integrate St. Cloud transit information into NexTrip. The NexTrip system currently provides real-time bus departure times for all Metro Transit buses and most regional buses by route, direction and stop location. The NexTrip system will then list up to the next 10 buses leaving the chosen stop location. Vehicle location is derived from the AVL equipment installed on transit vehicles that is reported to the Metro Transit Management Center in Minneapolis.

AVL equipment will need to be installed and configured on commuter and light rail transit services to report vehicle locations to the Metro Transit Management Center in Minneapolis.

**Champion and Stakeholder**

Champions: Metro Transit, St. Cloud Metropolitan Transit Commission (MTC)

**Project Element**

- Transit Information Websites
- Transit Vehicles
- Local Transit Management Centers
- Metro Area Transit Management Centers

**Service Package**

- APTS08 - Transit Traveler Information

**Interconnect**

- Transit Vehicles and Metro Area Transit Management Centers
- Metro Area Transit Management Centers and Local Transit Management Centers
- Metro Area Transit Management Centers and Transit Information Websites

**Technology Assessment**

Metro Transit currently maintains and operates the NexTrip transit traveler information system, which is capable of incorporating transit information from other transit service providers.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Costs associated with this initiative have not been identified.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

**Needs and Objectives Addressed**

Need: TR20 – Provide real-time transfer information to travelers en route  
ITS Objectives: B-2-06 – Maintain transit passengers per capita rate for service types  
C-3-14 – Increase the number of transit routes with information being provided by ATIS

**Agreement**

This initiative will require an agreement between St. Cloud MTC and Metro Transit that identifies the type of information to be shared between the agencies and the dissemination of that information through the NexTrip system.

**ID:** S38

**Initiative:** Virtual Weigh Stations

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Asset Management

**ITS Service Area:** CVO

**Type:** Deployment

**Description**

This initiative is a follow-on deployment based on the demonstration project that was completed in October 2007. Virtual Weigh-in-Motion (WIM) Stations will allow for real-time identification of trucks violating weight restrictions using a weigh-in-motion (WIM) scale and other enhancements, such as weight enforcement equipment (e.g. CCTV) to improve enforcement.

Virtual WIM sites will flag potential violators for enforcement officers to perform further checks. Virtual WIM sites can either act as standalone WIM sites or be connected to a central operating network. Virtual WIM Stations will also investigate the use of a dynamic feedback system that will present a weight compliance message to vehicles immediately after they have passed over a WIM scale.

**Champion and Stakeholder**

Champion: MnDOT OFCVO  
Stakeholders: Minnesota State Patrol

**Project Element**

- Virtual Weigh Stations
- Commercial Vehicles

**Service Package**

- CVO06 – Weigh-in-Motion
- CVO07 – Roadside CVO Safety

**Interconnect**

- Virtual WIM Stations and in-vehicle equipment (Commercial Vehicles)
- MnDOT OFCVO and in-vehicle equipment (Commercial Vehicles)

**Technology Assessment**

This initiative utilizes current technology already tested and proven through an operational test.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Capital costs and operations and maintenance costs have yet to be determined.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

**Needs and Objectives Addressed**

- Needs: CF02 - Provide mobile weight enforcement  
 CF03 - Target enforcement at locations with history of violations
- ITS Objectives: E-2-06 - Reduce the frequency of delays at intermodal facilities  
 E-4-04 - Increase the rate at which equipment is utilized  
 F-1-02 - Decrease the number of size and weight violations

**Agreement**

Agreements are not required for this initiative.

**ID: S39**

**Initiative:** Congestion Reduction in Major Freight Bottlenecks

**Timeframe:** Short Term – Years 1-3

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** CVO

**Type:** Deployment

### Description

This is a program led by the Federal Highway Administration (FHWA) which aims to reduce freight traffic “bottleneck” congestion at major urban highway interchanges throughout the country. Bottlenecks are defined as localized sections of highways that experience reduced travel speeds and inherent delays due to recurring operational influences or nonrecurring impacting events. An initial assessment of freight bottlenecks concluded in 2005 that the FHWA should work closely with states, metropolitan planning organizations, and the trucking industry to monitor truck delay at urban Interstate interchange bottlenecks with heavy amounts of freight traffic.

The FHWA defined eight highway interchange bottlenecks in the Minneapolis-St. Paul metro area located at the following interchanges: I-35W & SR 62, I-35W & I-494, I-394 & I-494, I-94 & I-35E, US 169 & I-394, I-35E & TH 36, I-394 & TH 100, and SR 100 & I-394.

MnDOT will work the FHWA to monitor these bottlenecks and focus future Federal highway improvement and operations programs in these areas. ITS-related efforts that could assist in the reduction of freight congestion at these locations include the dissemination of congestion information at these locations via Dynamic Message Signs (DMS) and 511 traveler information systems. Other alternatives include improving communications between the MnDOT RTMC and Private Fleet and Freight Management Centers that provide route plans to Commercial Vehicles approaching the bottleneck areas.

### Champion and Stakeholder

Champion: FHWA

Stakeholders: MnDOT, Metropolitan Council, Private Trucking Companies

### Project Element

- Traffic Detector Roadside Equipment
- CCTV Roadside Equipment
- Dynamic Message Sign Roadside Equipment
- Highway Advisory Radio Roadside Equipment
- Ramp Meter Roadside Equipment
- Minneapolis TMC
- RTMC
- Metro Area Transit Management Centers
- MnPASS Roadside Equipment
- MnPASS Service Center

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Service Package**

- CVO01 – Carrier Operations and Fleet Management
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- ATMS06 – Traffic Information Dissemination

**Interconnect**

- Roadside equipment and RTMC
- Roadside equipment and Minneapolis TMC
- MnPASS roadside equipment and MnPASS Service Center
- RTMC and Minneapolis TMC
- RTMC and metro area transit management centers
- Minneapolis TMC and metro area transit management centers

**Technology Assessment**

This initiative utilizes current technology already deployed.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Capital costs and operations and maintenance costs will vary depending on the bottleneck improvements that are made.

**Needs and Objectives Addressed**

- Need: CF14 - Direct commercial vehicle operators to the quickest route/time of travel
- ITS Objectives:
- C-3-12 - Increase number of visitors to traveler information website per year
  - 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

**Agreement**

This initiative requires a Memorandum of Understanding between MnDOT, City of Minneapolis, Hennepin County, FHWA, and Metro Transit.

**ID:** S40

**Initiative:** Enhance Automated Permit Routing System

**Timeframe:** Short Term – Years 1-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Asset Management

**ITS Service Area:** CVO

**Type:** Deployment

**Description**

This initiative will automate data entry into Automated Permit Routing System to allow for the provision of real time route information data. Permitted commercial vehicle operators and oversize/ overweight vehicles currently use Automated Permit Routing System to generate route information based on size and weight requirements.

**Champion and Stakeholder**

Champion: MnDOT OFCVO

Stakeholders: Minnesota State Patrol

**Project Element**

- Automated Permit Routing System
- Condition Acquisition and Reporting System (CARS)
- Private Fleet and Freight Management Center

**Service Package**

- CVO01 – Carrier Operations and Fleet Management

**Interconnect**

- Automated Permit Routing System and CARS
- Automated Permit Routing System and Private Fleet and Freight Management Center

**Technology Assessment**

This initiative utilizes technology that is currently being used. This enhancement would require the integration of real time route information data from CARS to the Automated Permit Routing System and an enhancement of CARS data to provide useful data to the commercial vehicle subset of users.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Capital costs and operations and maintenance costs have yet to be determined.

**Needs and Objectives Addressed**

Need: CF12 - Direct commercial vehicle operators to routes that accommodate size and weight requirements

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| <b>Commercial Vehicle</b>    |
| Emergency Management         |
| Maintenance and Construction |

ITS Objectives:

- C-3-12 - Increase number of visitors to traveler information website per year
- 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-2-02 - Increase the percent (or number) of freight shipment tracked
- F-1-02 - Decrease the number of size and weight violations

**Agreement**

Agreements are not required for this initiative.

**ID: S41**

**Initiative:** CVO Online Database and CARS Database Enhancement

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Asset Management

**ITS Service Area:** ATIS, CVO

**Type:** Deployment

### Description

This initiative will automate the data entry into CVO Online to allow for the provision of real time data. MnDOT will provide commercial vehicle operators, fleet managers, and service providers with information on commercial vehicle permit restrictions through the 511 Traveler Information website and the CVO Online. This will allow commercial vehicle operators and fleet managers to route shipments along appropriate routes.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: Commercial Vehicles, Private Fleet and Freight Management Centers, Private Information Service Providers

### Project Element

- Minnesota CVO Online
- 511 Traveler Information Website
- Commercial Vehicles
- Private Fleet and Freight Management Center
- Private Information Service Providers

### Service Package

- ATIS01 – Broadcast Traveler Information
- CVO01 – Carrier Operations and Fleet Management

### Interconnect

- Minnesota CVO Online and Private Fleet and Freight Management Center
- Private Fleet and Freight Management Center and 511 Traveler Information Website
- Private Information Service Providers and 511 Traveler Information Website
- Private Fleet and Freight Management Center and Commercial Vehicles

### Technology Assessment

511 Traveler Information Website and Minnesota CVO Online are already available via the MnDOT website. Technology for automating data entry for providing real-time data is readily available.

### Dependency

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

Costs associated with this initiative have not been identified.

**Needs and Objectives Addressed**

- Need: TI09 - Provide information on CVO permit restrictions
- ITS Objectives:
- 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)
  - 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

**Agreement**

Agreements are not required for this initiative.

**ID:** S42

**Initiative:** Multi-State OS/OW Permitting System

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Asset Management

**ITS Service Area:** CVO

**Type:** Deployment

**Description**

This initiative will integrate the Minnesota Oversize/Overweight (OS/OW) permitting system with those of neighboring states so that commercial vehicle operators can obtain OS/OW permits from multiple states with one application.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: Neighboring States

**Project Element**

- Commercial Vehicle Administration Center
- Private Fleet and Freight Management Center
- Neighboring State Traffic Management Centers

**Service Package**

- CVO04 – CV Administrative Processes

**Interconnect**

- Commercial Vehicle Administration Center and Neighboring State Traffic Management Centers
- Commercial Vehicle Administration Center and Private Fleet and Freight Management Center

**Technology Assessment**

Integration of OS/OW permitting system with other states will require coordination with neighboring states so that commercial vehicle operators obtain an OS/OW permit in a consistent manner across states. Technology currently used for issuing OS/OW permits is anticipated to be utilized for this initiative and is readily available.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Costs associated with this initiative have not been identified.

**Needs and Objectives Addressed**

Need: CF18 - Provide multi-state oversize/overweight permitting

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

ITS Objectives: E-2-02 - Increase the percent (or number) of freight shipment tracked  
E-2-05 - Increase the number of automated permits/credentials issued  
F-1-02 - Decrease the number of size and weight violations

**Agreement**

Agreements between states regarding the integration of systems that provide OS/OW permits may be required for this initiative.

**ID:** S43

**Initiative:** Emergency Responder Database



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** EM, AD

**Type:** Deployment

### Description

This initiative is identified by the Minnesota Guidestar Program: Deployment Assessment (2007) and aims to coordinate emergency responder databases (i.e. Minnesota State Patrol, Local Law Enforcement, Local EMS Agencies, etc.) to create an online database to route on-the-scene incident data, road condition, or other data through a single dispatch center or system for processing. The initiative area would include the seven-county metro area and 10 out-state counties.

The coordination of emergency responder databases could be a further evolution of the Minnesota State Ambulance Report System (MNSTAR) – a web-based, statewide data system that went online April 1, 2003 that gives Minnesota’s 256 agencies the flexibility to collect their own data and Mn Track, a victim tracking system used by emergency responders. Additional research is needed to identify if similar activities are being implemented in other parts of the country.

Such coordination would allow the seamless sharing of consistent information on crash and victim details to facilitate better emergency response and care. A single dispatch center would act on the information request by dispatching the proper emergency personnel to a traffic incident. Road and weather conditions data may also be uploaded to a central source and disseminated via various means from the center. Improved incident clearance will allow for better traffic flow/mobility.

### Champion and Stakeholder

Champion: Minnesota EMSRB (Emergency Medical Services Regulatory Board)

Stakeholders: Minnesota DPS, MSP, local emergency management, local emergency responders, Minnesota State Fire Chiefs Association, Minnesota Ambulance Association, Minnesota Chiefs of Police Association, Chief of Police, MnDOT

### Project Element

- 911Dispatch Center
- County Emergency Operations Centers
- Minnesota State Emergency Operations Center (SEOC)
- Minnesota State Patrol Databases
- Minnesota Emergency Responder Database

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Service Package**

- EM01 – Emergency Call-Taking and Dispatch
- AD02 – ITS Data Warehouse

**Interconnect**

- 911 Dispatch Center and County Emergency Operations Centers
- 911 Dispatch Center and Minnesota SEOC
- 911 Dispatch Center and Minnesota State Patrol Databases
- County Emergency Operations Centers and Minnesota State Patrol Databases
- Minnesota SEOC and Minnesota State Patrol Databases

**Technology Assessment**

This initiative will require software and hardware applications that are readily available from vendors to coordinate information entered into separate databases. The published set of ITS standards IEEE 1512 -2006 - Standard for Common Incident Management Message Sets for use by Emergency Management Centers – allow for the efficient sharing of information between agencies that participate in incident response.

**Dependency**

This initiative is dependent upon additional research into similar database coordination efforts in other parts of the country and upon continued discussions with the Minnesota EMSRB and Minnesota Department of Health.

**Cost Estimate**

Total costs have been estimated at \$10,186,800 based on inflation-adjusted cost estimates provided by the Minnesota Guidestar Program: Deployment Assessment (2007).

**Needs and Objectives Addressed**

- Need: E01 - Provide CAD to CAD integration for multi-agency coordination at major incidents
- ITS Objectives: B-1-15 - Reduce mean incident notification time  
 B-1-16 - Reduce mean time for needed responders to arrive on-scene after notification  
 B-1-18 - Reduce mean incident clearance time for Twin Cities urban freeway incidents

**Agreement**

This coordination of emergency responder databases will require working Memorandums of Understanding between all agencies involved in the initiative, such as Minnesota State Patrol, Local Law Enforcement, and local EM agencies that are independently collecting incident information. These agreements must have language to comply with privacy laws.

**ID: S44**

**Initiative:** Enhance Routing of Emergency Vehicles



**Timeframe:** Short Term – Years 1-4

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** EM

**Type:** Deployment

### Description

This initiative will provide roadway surveillance to incident/emergency dispatch centers and responders. This real-time video data will allow dispatcher to view potential routes to the site of an emergency or incident and direct response vehicles along a route with minimal obstacles to arrive at the site quickly, thereby reducing response time.

The first step of this initiative will focus on the metro area by providing all metro area roadway surveillance videos to MnDOT FIRST (Freeway Incident Response Safety Team), MSP, and other dispatch centers and emergency responders. FIRST and some dispatchers already use camera feeds from MnDOT RTMC to assist with routing to incidents on metro freeways. As cameras are added along freeway system to provide full coverage, this video data will be provided to FIRST and other dispatch centers. Video surveillance from other metro area cities will be provided to responders to provide dynamic routing information along arterials.

The next phase of this initiative will expand this shared video surveillance to areas of greater Minnesota. This initiative will also provide TOCC roadway surveillance videos to local and regional dispatch centers and emergency responders in greater Minnesota.

### Champion and Stakeholder

Champion: MSP

Stakeholders: MSP, Metro area 911 dispatch centers, local and regional emergency response dispatch centers, local emergency response agencies, MnDOT RTMC and TOCCs

### Project Element

- CCTV Roadside Equipment
- 911 Dispatch Centers
- Emergency Vehicle Equipment
- FIRST Emergency Vehicles
- RTMC
- TOCCs

### Service Package

- EM02 – Emergency Routing
- ATMS08 – Traffic Incident Management System

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Interconnect**

- CCTV Roadside Equipment and RTMC/TOCCs
- RTMC/TOCCs and 911 Dispatch Centers
- 911 Dispatch Centers and Emergency Vehicle Equipment
- RTMC and FIRST Emergency Vehicles

**Technology Assessment**

This initiative utilizes technology already deployed or soon to be deployed in the initiative area. This initiative will require coordination between MnDOT TOCCs, MSP, and local and regional emergency responders. ITS Standards that are applicable for this data sharing include: NTCIP C2C: NTCIP Center-to-Center Standards Group and ITE TMDD 2.1: Traffic Management Data Dictionary and Message Sets for External TMC Communication (TMDD and MS/ETMCC).

**Dependency**

This initiative depends on deployment of CCTV cameras along roadways.

**Cost Estimate**

The estimated unit cost per workstation for adding hardware, range between \$8,000 and \$10,000. The annual O&M estimated cost is estimated at 2% of the estimated cost.

Video and surveillance software estimated cost range between \$10,000 and \$20,000. The annual O&M estimated cost is \$3,300.

Unit cost estimates for CCTV with pan/tilt capabilities range between \$10,000 and \$20,000. The annual O&M cost is estimated at \$1,800 per camera.

**Needs and Objectives Addressed**

- Need: E02 - Provide dynamic routing of emergency vehicles
- ITS Objectives: 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

**Agreement**

This initiative will require agreements between MnDOT and participating local emergency response agencies over transmission and use of video data.

**ID:** S45

**Initiative:** Critical Infrastructure Surveillance



**Timeframe:** Short Term – Years 3-4

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** EM

**Type:** Deployment

### Description

This initiative will implement threat detection, CCTV surveillance, and emergency alert systems at critical infrastructure areas (bridges, ports, tunnels, etc...) throughout the state. Critical infrastructure has previously been identified but the specific locations for this initiative have yet to be determined. Surveillance cameras and threat sensors will monitor critical facilities and when suspicious activity or objects in restricted areas detected an alert will automatically be sent to RTMC, TOCC, and emergency management personnel. This initiative was identified by the Statewide ITS Strategic Plan (2006).

### Champion and Stakeholder

Champion: Minnesota Homeland Security and Emergency Management

Stakeholders: MnDOT, MSP, local emergency management agencies, local emergency response agencies

### Project Element

- Security Monitoring Roadside Equipment
- RTMC
- TOCCs
- 911 Dispatch Centers

### Service Package

- EM05 – Transportation Infrastructure Protection
- EM07 – Early Warning System

### Interconnect

- CCTV Roadside Equipment to RTMC and TOCCs
- RTMC and TOCCs to 911 Dispatch Centers

### Technology Assessment

This surveillance and automated alert technology is readily available from various vendors. An application of this type of security is currently operated by MnDOT District 1 and Minnesota State Patrol.

### Dependency

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

The deployment cost depends largely on the number, location, and types of features chosen for the Critical Infrastructure Surveillance system. Infrastructure surveillance systems can range from \$150,000 to \$250,000 per infrastructure facility for hardware, software, installation, and integration.

**Needs and Objectives Addressed**

- Need: E04 - Provide surveillance to monitor transportation infrastructure
- ITS Objectives: B-1-17 - Reduce mean incident clearance time per incident  
 B-1-18 - Reduce mean incident clearance time for Twin Cities urban freeway incidents  
 D-1-02 - Increase the number of closed circuit television (CCTV) 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-1-07 - Increase the number of critical sites with security surveillance  
 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

**Agreement**

Agreements are not required for this initiative.

**ID: S46**

**Initiative:** Use Preemption on Vehicle Radios to Provide Real-Time Information



**Timeframe:** Short Term

**Multimodal Transportation Objective:**

**SHSP Focus Area:** Intersections, Inattentive Drivers, Train Involved, Work Zones

**ITS Service Area:** EM

**Type:** Operational Test, Policy/Legislation

### Description

Real-time information related to road emergencies could be delivered to drivers by preempting radio broadcasts or through Radio Data Systems (RDS) messages. The RDS can enhance driving safety because it lets the driver pay attention to the road instead of to the radio controls. A listener who is traveling or commuting in a vehicle can arrange to have special traffic bulletins break into programs automatically, even if the traffic information is broadcast by a station other than the one the listener is tuned to at the moment.

The RDS receiver can also be set to display brief text messages from broadcasters, and to periodically re-set the car clock to show the exact time. This initiative will require actions to explore the parameters of existing PSA requirements for radio broadcasters, gather information regarding preemption delivery methods used in other countries, identify what type of information may be provided (i.e., road conditions, work zone information, etc.), assess the quality (i.e., consistency, accuracy, reliability, etc.) of information that may be provided, determine if and when information will be provided for all, most or some public roads, and propose the delivery of information to radio broadcasters to gauge their interest.

There may be implications to public service announcement (PSA) requirements for radio broadcasters. If existing emergency broadcast preemption is used as the delivery method for this preemption, there may be some implications to current rules governing emergency broadcasts. Some institutional issues need to be considered include that delivery of information will be dependent upon radio broadcasters, radio broadcasters may interpret this as a loss in air time that could impact their advertising, programming and revenue, accurate information will be necessary to ensure reliability, maintaining information accuracy or quality will have staffing implications, and providing information on all, most or some public roads will have to be decided as this will impact city, county and state staff.

### Champion and Stakeholder

Champion: MnDOT State Traffic Engineer

Stakeholders: Minnesota Homeland Security and Emergency Management, Private Information Service Providers (Radio Broadcasters), Federal Communications Commission, Local Agencies

### Project Element

- CARS
- Minnesota Emergency Alert System
- Minnesota State Emergency Operations Center
- County Emergency Operations Centers

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

- Vehicle
- Private Information Service Providers
- Media Outlets

**Service Package**

- EM06 – Wide-Area Alert
- ATIS01 – Broadcast Traveler Information

**Interconnect**

- CARS and Private Information Service Providers
- CARS and Media Outlets
- Minnesota Emergency Alert System and Private Information Service Providers
- Minnesota Emergency Alert System and Media Outlets
- Minnesota State Emergency Operations Center and Private Information Service Providers
- Minnesota State Emergency Operations Center and Media Outlets
- County Emergency Operations Centers and Private Information Service Providers
- County Emergency Operations Centers and Media Outlets
- Private Information Service Providers and Vehicle
- Media Outlets and Vehicle

**Technology Assessment**

This initiative is an expansion of existing technologies.

**Dependency**

No cost estimate provided for equipment costs.

**Cost Estimate**

Total costs have not been estimated given the nature of the initiative.

**Needs and Objectives Addressed**

Need: CEA 5 – Increasing Driver Safety Awareness and Improving Information Systems

ITS Objectives: A-1-14 - Reduce number of crashes related to driver inattention and distraction  
A-2-15 - Reduce number of fatalities related to driver inattention and distraction  
A-2-36 - Reduce number of injuries related to driver inattention and distraction

**Agreement**

Agreements required for this initiative have not been identified.

**ID:** S47

**Initiative:** Maintenance Vehicle AVL Equipment

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Asset Management, System Security

**ITS Service Area:** MCM

**Type:** Deployment

### Description

This initiative will install or upgrade Automated Vehicle Location (AVL) technology in maintenance vehicles in order to fully maximize available resources during snowfall and icy conditions. Fleet management systems at a regional control center will allow maintenance managers to better deploy and manage their fleet and resources. AVL technology will also improve traffic flow by reducing the number of crashes that would otherwise occur. This initiative can be coordinated with MnDOT's involvement in the Maintenance Decision Support System (MDSS) – an initiative to develop a prototype predictive tool using a variety of weather and maintenance inputs to recommend most effective treatment and timing.

MnDOT has equipped AVL technology on maintenance vehicles in different districts throughout the state. This initiative will focus on integrating the different AVL systems between districts, as well as deploy AVL on additional 900 maintenance vehicles statewide. Standards will need to be developed to ensure consistency between all districts. This initiative was identified in the Minnesota Guidestar Program: Deployment Assessment (2007). This initiative will also meet a highly prioritized need identified in the Maintenance and Construction stakeholder meeting – Track locations of maintenance fleet and personnel and usage of materials.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: Travelers

### Project Element

- Maintenance and Construction Vehicle Equipment
- Maintenance and Construction Management Center
- Condition Acquisition and Reporting System (CARS)
- RTMC
- TOCCs

### Service Package

- MC01 – Maintenance and Construction Vehicle and Equipment Tracking
- MC06 – Winter Maintenance

### Interconnect

- Maintenance and construction vehicle equipment and maintenance and construction management centers.
- Maintenance and construction management centers and CARS
- Maintenance and construction management centers and RTMC/TOCCs

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Technology Assessment**

This initiative is an expansion of a current deployment and utilizes technology that has already been deployed and is readily available.

**Dependency**

This initiative could be implemented in conjunction with Initiative S48 – Expand Maintenance and Decision Support System (MDSS) Deployment. This initiative will support the implementation of Initiative L10 – Roadway Condition and Environmental Sensors on Maintenance Vehicles for Traveler Information.

**Cost Estimate**

Total costs have been estimated at \$3,390,400 based on inflation-adjusted cost estimates provided by the Minnesota Guidestar Program: Deployment Assessment (2007).

**Needs and Objectives Addressed**

Need: WZ01 - Track locations of maintenance fleet and personnel and usage of materials

ITS Objectives: E-4-01 - Increase the number of ITS-related assets tracked  
E-4-07 - Increase the number of vehicles operating under CAD  
H-1-04 - Reduce MnDOT fleet gasoline use  
H-1-05 - Reduce MnDOT fleet diesel use

**Agreement**

Agreements are not required for this initiative.

**ID: S48**

**Initiative:** Expand Maintenance and Decision Support System (MDSS) Deployment



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** Lane Departure

**ITS Service Area:** MCM

**Type:** Deployment

### Description

The Maintenance Decision Support System (MDSS) serves MnDOT maintenance staff as a decision support tool that provides maintenance staff with an optimal maintenance plan based on real-time weather and roadway conditions. Combined with information on maintenance vehicle resources (i.e. salt, sand, etc.), MDSS recommends appropriate roadway maintenance treatments.

MDSS assimilates data on road surface conditions from RWIS stations and on-board vehicle sensors to report pavement temperatures. It also allows for field staff observations on road visibility to be factored into the MDSS recommendation for appropriate maintenance treatments. With all sources of information taken into account, MDSS offers users various treatment options, such as “optimal” treatments – where travel safety is prioritized higher than treatment costs – and “what-if” treatments – where the effects of several maintenance actions on overall resources can be understood by the system user before recommending certain actions.

This initiative will expand the use of MDSS throughout MnDOT districts as the system evolves into a statewide deployment. The deployment of MDSS could be in coordination with Initiative S47 – Maintenance Vehicle AVL Equipment which will deploy AVL equipment on additional 900 MnDOT maintenance vehicles statewide.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: Travelers

### Project Element

- Maintenance Decision Support System (MDSS)
- Maintenance Vehicle Equipment
- Maintenance and Construction Management Center
- RTMC
- TOCCs

### Service Package

- MC06 – Winter Maintenance

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                                     |
|-------------------------------------|
| Data Management                     |
| Transit Management                  |
| Traveler Information                |
| Traffic Management                  |
| Vehicle Safety                      |
| Commercial Vehicle                  |
| Emergency Management                |
| <b>Maintenance and Construction</b> |

**Interconnect**

- Automated treatment systems include interconnects between roadside detection equipment and roadside treatment equipment
- They also include interconnects between roadside equipment and RTMC/TOCCs/ local MCM centers.

**Technology Assessment**

The software applications and communications technology is currently in an operational test phase through the MDSS Pooled Fund Study involving twelve states and FHWA. MDSS has been operationally tested in MnDOT Districts 2 (Bemidji), 4 (Detroit Lakes), 6 (Rochester), 7 (Mankato), and 8 (Marshall) and is being implemented statewide.

**Dependency**

This initiative could be coordinated with Initiative S47 – Maintenance Vehicle AVL Equipment.

**Cost Estimate**

The cost for MDSS deployment is to be determined. MnDOT has contributed \$250,000 toward the development of MDSS through a pooled fund study effort. Estimated average cost per vehicle is \$2500 for MDSS and AVL.

**Needs and Objectives Addressed**

- Need: WZ08 - Provide maintenance decision support
- ITS Objectives:
- A-1-03 - Reduce number of crashes due to road weather conditions
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - H-1-04 - Reduce MnDOT fleet gasoline use
  - H-1-05 - Reduce MnDOT fleet diesel use

**Agreement**

Interagency agreements between district offices may be required to ensure consistent operation and maintenance of equipment.

**ID:** S49

**Initiative:** Dynamic Speed in Work Zones to Advise Drivers



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Speed-Related, Work Zones

**ITS Service Area:** MCM, ATMS

**Type:** Deployment

### Description

This initiative will deploy dynamic advisory speed systems in advance of work zones to provide smooth traffic flow through the work zones. MnDOT Construction and Maintenance and local agencies advise drivers on the actual speed ahead to safely travel through a work zone.

The purpose of the initiative is to make drivers aware of the traveling speeds ahead compared to the posted speed limit. Locations for further system deployment have yet to be determined.

### Champion and Stakeholder

Champion: MnDOT (Construction), Local Agencies

### Project Element

- Dynamic Message Sign Roadside Equipment
- Speed Monitoring Roadside Equipment

### Service Package

- ATMS19 – Speed Warning and Enforcement
- MC08 – Work Zone Management

### Interconnect

- Speed Monitoring Roadside Equipment and Dynamic Message Sign Roadside Equipment

### Technology Assessment

This technology was part of an operational test on the I-494 Wakota project. This technology is readily available, fully developed and ready for implementation.

### Dependency

This initiative is not dependent upon any other initiatives.

### Cost Estimate

Based on unit cost estimates, capital costs for this initiative range from \$5,000 to \$15,000 for each installation location. The duration of the application will also have impact of the overall cost.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

## Needs and Objectives Addressed

Needs: TM18 - Provide dynamic speed feedback to drivers and enforcement agencies

TM47 - Enforce timely sign changes in construction zones

WZ17 - Alert distracted motorists near work zones

ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions

A-1-04 - Reduce number of crashes due to unexpected congestion

A-1-17 - Reduce number of crashes due to roadway/geometric restrictions

A-1-19 - Reduce number of all secondary crashes

A-2-03 - Reduce number of fatalities due to road weather conditions

A-2-04 - Reduce number of fatalities due to unexpected congestion

A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions

A-2-24 - Reduce number of injuries due to road weather conditions

A-2-25 - Reduce number of injuries due to unexpected congestion

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

A-3-01 - 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-3-05 - Reduce the variability of travel time in work zones during peak and off-peak periods

C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

## Agreement

Agreements are not required for this initiative.

**ID: S50**

**Initiative:** CCTV Cameras at RWIS Sites



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** Intersections, Lane Departure

**ITS Service Area:** MCM, ATMS, ATIS

**Type:** Deployment

**Description**

This initiative will equip RWIS Stations with pan/tilt cameras to provide maintenance crews with additional information on pavement conditions. Camera images will also be transmitted to the 511 website for the use of travelers. MnDOT, NWS and local agencies use RWIS and AWOS (automated weather observation system) to measure environmental and pavement surface conditions to assist in decisions on snow plowing schedules and chemical applications. CCTV cameras will be added at RWIS sites where are prone to freezing, snow, curves, fog, high wind, and/or flooding to monitor traffic flows and road conditions and to verify incident and severity. Camera images will also be made available to travelers through the 511 Traveler Information website. Communication connections to some RWIS will need to be enhanced to allow bandwidth for video data. This initiative was identified in the Statewide ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: MnDOT  
Stakeholders: MnDOT, University of Minnesota Duluth

**Project Element**

- CCTV Roadside Equipment
- RWIS Stations
- RWIS Central Control System
- CARS
- 511 Traveler Information Website
- RTMC
- TOCCs

**Service Package**

- MC03 – Road Weather Data Collection
- MC04 – Weather Information Processing and Distribution
- ATIS01 – Broadcast Traveler Information
- ATMS01 – Network Surveillance

**Interconnect**

- CCTV Roadside Equipment and RTMC/TOCCs
- RTMC/TOCCs and 511 Traveler Information Website
- RWIS stations and RWIS Central Control System

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

- RWIS Central Control System and CARS

### Technology Assessment

This initiative utilizes current technology already deployed and readily available. NTCIP C2F: NTCIP Center-to-Field Standards Group are ITS standards that will apply to this initiative.

### Dependency

This initiative is not dependent upon any other initiatives.

### Cost Estimate

Unit cost estimates for CCTV with pan/tilt capabilities range between \$10,000 and \$20,000. The annual O&M cost is estimated at \$1,800 per camera.

### Needs and Objectives Addressed

- Needs: WZ04 - Provide automated monitoring of road weather conditions  
 TI15 - Make camera images available to travelers
- ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions  
 A-2-03 - Reduce number of fatalities due to road weather conditions  
 A-2-24 - Reduce number of injuries due to road weather conditions  
 C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.

### Agreement

If RWIS images are shared with other agencies, an agreement between those agencies and MnDOT on the use of the image data will need to be signed.

**ID:** S51

**Initiative:** Expand Automated Flagging System for Work Zones



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Work Zones

**ITS Service Area:** MCM

**Type:** Deployment

### Description

This initiative will procure additional automated flagging system units for use at more work zones to enhance safety of work zone crews and motorists. An automated flagging system controls traffic in a work zone by automatically providing stop and proceed indications to motorists. It is designed to remove the flag person from the dangers of traffic control on roadways. These systems can operate autonomously, similar to a traffic signal system, or can be manually controlled. Automated flagging systems are one of the Intelligent Work Zone (IWZ) applications. MnDOT currently uses an AutoFlagger system at some work zones. Construction and maintenance crews utilize the system to alert motorists of trucks entering and exiting work zones.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: MnDOT, Counties, Cities, Private Contractors

### Project Element

- Maintenance and Construction Vehicle Equipment
- Intelligent Work Zone System Roadside Equipment

### Service Package

- MC08 – Work Zone Management
- MC09 – Work Zone Safety Monitoring

### Interconnect

- Intelligent Work Zone System Roadside Equipment and Maintenance and Construction Vehicle Equipment

### Technology Assessment

This initiative is an expansion of a current application and utilizes technology already deployed and readily available.

### Dependency

This initiative is not dependent upon any other initiatives.

### Cost Estimate

The cost of an automated flagging system is approximately \$24,000.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

**Needs and Objectives Addressed**

- Needs:           WZ05 - Warn travelers about trucks entering/exiting work zones  
                           WZ14 - Provide automated flagging for stationary work zones  
                           WZ17 - Alert distracted motorists near work zones
- ITS Objectives:   A-3-04 - Reduce number of workers injured by vehicles in work zones  
                           B-3-05 - Reduce the variability of travel time in work zones during peak and off-peak periods

**Agreement**

Agreements are not required for this initiative.

**ID:** S52

**Initiative:** Portable Queue Detection and Stopped Traffic Advisory



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections, System Security

**SHSP Focus Area:** Speed-Related, Work Zones

**ITS Service Area:** MCM

**Type:** Deployment

**Description**

A portable queue detection and stopped traffic advisory system uses portable vehicle queue detection systems or information from existing commercial telematics units and portable changeable message signs to alert drivers of stopped vehicle queue within a work zone, reducing number of crashes. The system consists of multiple portable, non-intrusive detection devices as well as multiple portable changeable message signs spaced incrementally along the roadway approaching the work zone. The system will alert drivers of an upcoming traffic slow-down or stopped traffic. Drivers can use the information to determine whether to take an alternate route or to slow down and be prepared to stop safely. Information from this initiative can also be integrated with Connected Vehicle systems in the future, when roadside infrastructure/equipment is deployed.

Portable queue detection and stopped traffic advisory systems have been used by MnDOT construction crews on freeway construction projects. This initiative will procure additional systems that can be used for more construction projects.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, Local Agencies

**Project Element**

- Intelligent Work Zone System Roadside Equipment

**Service Package**

- MC08 – Work Zone Safety Monitoring
- ATMS01 – Network Surveillance

**Interconnect**

- Intelligent Work Zone System Roadside Equipment (detector) and Intelligent Work Zone System Roadside Equipment (DMS)

**Technology Assessment**

This initiative is an expansion of a current application and utilizes technology already deployed and readily available. This technology supports other maintenance systems such as Dynamic Late Merge systems and travel delay systems.

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                                     |
|-------------------------------------|
| Data Management                     |
| Transit Management                  |
| Traveler Information                |
| Traffic Management                  |
| Vehicle Safety                      |
| Commercial Vehicle                  |
| Emergency Management                |
| <b>Maintenance and Construction</b> |

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

The system cost ranges between \$100,000 and \$150,000 for purchasing the system. Systems can also be rented by vendors, in which case the vendor is responsible for setup and maintenance and cost is dependent upon project duration and is included in the construction project.

**Needs and Objectives Addressed**

- Need: WZ06 - Provide queue detection and advisory to warn traffic of a stopped queue at work zone
- ITS Objectives: 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,
- C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Agreement**

Agreements are not required for this initiative.

**ID:** S53

**Initiative:** Continue Roadway Automated Treatment System Deployment



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety, Transportation in Context

**SHSP Focus Area:** Lane Departure

**ITS Service Area:** MCM

**Type:** Deployment

**Description**

Automated roadway treatment systems have been deployed in the metro area and in MnDOT Districts 1, 4, 6, and 7 to apply anti-icing chemicals to bridges and roadway segments with recurring icing issues. Portable anti-icing systems are being tested in the metro area. This initiative will deploy additional fixed anti-icing systems on bridges and roadways with recurring icing issues, as well as purchase portable anti-icing systems for effective road weather management. Several agencies, including MnDOT, Hennepin County, City of Moorhead, and City of East Grand Forks, have planned to deploy such systems.

**Champion and Stakeholder**

MnDOT (District Maintenance), Local Agencies

**Project Element**

- Roadway Automated Treatment System
- Maintenance and Construction Management Center
- RTMC
- TOCCs

**Service Package**

- MC05 – Roadway Automated Treatment

**Interconnect**

- Roadway Automated Treatment System and Maintenance and Construction Management Center
- Roadway Automated Treatment System and RTMC/TOCC

**Technology Assessment**

This initiative is an expansion of a current application and utilizes current technology already deployed.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Unit cost for automatic anti-icing systems for areas spanning 120 to 180 feet is approximately \$25,000. Costs increase for automated systems that require larger roadway coverage.

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

**Needs and Objectives Addressed**

Need: WZ07 - Provide roadway automated treatment with stationary units  
ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions  
A-2-03 - Reduce number of fatalities due to road weather conditions  
A-2-24 - Reduce number of injuries due to road weather conditions  
H-2-02 - Increase the amount of environmentally friendly de-icing material used

**Agreement**

Agreements are not required for this initiative.

**ID: S54**

**Initiative:** Expand Dynamic Late Merge System Deployment

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** MCM

**Type:** Deployment

**Description**

This initiative will focus on deploying dynamic late merge systems at construction projects in larger urban and rural centers throughout Minnesota. This system is placed in advance of lane closures due to roadway maintenance and construction and consists of three Portable Changeable Message Signs (PCMS) and a Remote Traffic Microwave Sensor (RTMS) detector. As traffic congestion begins to form, the PCMS are activated to provide lane use instructions to drivers. The system is self-contained with the possibility of remote operator override from the RTMC/ TOCC.

**Champion and Stakeholder**

Champion: MnDOT (Construction, District Traffic)

Stakeholders: Local Agencies

**Project Element**

- Dynamic Late Merge Central Control System
- Dynamic Late Merge Roadside Equipment
- RTMC
- TOCCs
- Maintenance and Construction Management Center

**Service Package**

- MC08 – Work Zone Management

**Interconnect**

- Dynamic Late Merge Central Control System and Dynamic Late Merge Roadside Equipment
- Dynamic Late Merge Roadside Equipment and Dynamic Late Merge Roadside Equipment
- Dynamic Late Merge Central Control System and RTMC/TOCCs/Maintenance and Construction Management Center

**Technology Assessment**

This initiative utilizes technology that is used in work zone management and can be included with other intelligent work zone systems to utilize their detection equipment.

**Dependency**

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                                     |
|-------------------------------------|
| Data Management                     |
| Transit Management                  |
| Traveler Information                |
| Traffic Management                  |
| Vehicle Safety                      |
| Commercial Vehicle                  |
| Emergency Management                |
| <b>Maintenance and Construction</b> |

**Cost Estimate**

Unit cost estimates for PCMS can range from \$20,000 to \$45,000. Unit cost estimates for remote traffic microwave sensors for a corridor can range from \$10,000 to \$14,000 per detector.

**Needs and Objectives Addressed**

Need: WZ09 - Provide dynamic late merge systems for construction/ maintenance activities

ITS Objectives: 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

**Agreement**

Interagency agreements between district offices may be required to ensure consistent operation and maintenance of equipment.

**ID:** S55

**Initiative:** GIS Mapping Enhancement

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Asset Management, System Security

**ITS Service Area:** MCM

**Type:** Deployment

**Description**

This initiative will enhance agencies' GIS mapping systems by incorporating infrastructure data. The enhanced systems will keep up-to-date records and allow agencies and contractors to use the data to target and record replacement and repair of infrastructure.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, Local Agencies

**Project Element**

- Infrastructure GIS Database Systems
- Maintenance and Construction Management Center
- RTMC
- TOCCs

**Service Package**

- MC07 – Roadway Maintenance and Construction

**Interconnect**

- Infrastructure GIS Database Systems and Maintenance and Construction Management Center
- Infrastructure GIS Database Systems and RTMC/TOCCs

**Technology Assessment**

This initiative utilizes technology that is currently available from technology vendors.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Costs associated with this initiative have not been determined.

**Needs and Objectives Addressed**

Need: WZ10 - Use GPS/GIS data to target and record replacement and repair of Infrastructure

ITS Objectives: E-4-04 - Increase the rate at which equipment is utilized  
E-4-05 - Increase the percentage of fleet/equipment within its lifecycle  
G-1-06 - Reduce operations cost deviation

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

G-1-07 - Reduce administrative support rate (as part of overall project budget)

**Agreement**

Agreements are not required for this initiative.

**ID: S56**

**Initiative:** Enhanced Data Entry and Integration of Work Zone Information



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Traveler Safety

**SHSP Focus Area:** Management Systems, Work Zones

**ITS Service Area:** MCM

**Type:** Deployment

**Description**

This initiative will expand the capability of entering work zone data via web-enabled cell phones. This capability currently exists in MnDOT District 7 and will be expanded to other MnDOT districts. This initiative will also improve the level of detail of the reporting system and simplify the data entry system. The result of this initiative will improve the accuracy of data entry on work zones and the dissemination of real-time work zone information to travelers through various traveler information systems (511, DMS, HAR, media, etc.).

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, MSP, Local Agencies

**Project Element**

- Condition Acquisition and Reporting System (CARS)
- Maintenance and Construction Management Center
- RTMC
- TOCCs

**Service Package**

- MC08 – Work Zone Management

**Interconnect**

- CARS and Maintenance and Construction Management Center
- CARS and RTMC/TOCCs

**Technology Assessment**

This initiative utilizes technology that is currently deployed.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

The cost for this initiative is estimated around \$50,000. The annual O&M cost is estimated at \$5,000.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                                     |
|-------------------------------------|
| Data Management                     |
| Transit Management                  |
| Traveler Information                |
| Traffic Management                  |
| Vehicle Safety                      |
| Commercial Vehicle                  |
| Emergency Management                |
| <b>Maintenance and Construction</b> |

**Needs and Objectives Addressed**

- Need: WZ11 - Provide work zone information to travelers
- ITS Objectives: B-3-01 - Reduce total vehicle hours of delay by time period (peak, off-peak) caused by work zones
- B-3-05 - Reduce the variability of travel time in work zones during peak and off-peak periods
- C-3-11 - Increase number of 511 calls per year
- C-3-12 - Increase number of visitors to traveler information website per year

**Agreement**

Interagency agreements between district offices may be required to ensure consistent data entry of work zone information.

**ID:** S57

**Initiative:** Expand IWZ Deployment to Greater Minnesota



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Critical Connections

**SHSP Focus Area:** Inattentive Drivers, Speed-Related, Work Zones

**ITS Service Area:** MCM

**Type:** Deployment

### Description

It is planned to expand the deployment of Intelligent Work Zone (IWZ) technologies to work zone areas outside of the RTMC coverage area. IWZ systems represent an automated system of devices that provide motorists and/or workers real-time information for improved safety and mobility through a work zone. Information can be categorized into 3 levels: (1) Conflict Warning - high priority information to warn motorists of eminent traffic and roadway hazards; (2) Traffic Control - provides important driving information such as advisory speeds, merging instructions, and lane control directions; and (3) Travel Information - provides information which the motorist may use to make route decisions, such as travel times, alternate route info, incident warnings and work zone staging information.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: Local Agencies, Travelers

### Project Element

- Intelligent Work Zone System Roadside Equipment
- Maintenance and Construction Management Center
- RTMC
- TOCCs

### Service Package

- MC08 – Work Zone Management

### Interconnect

- IWZ System Roadside Equipment and IWZ System Roadside Equipment
- IWZ System Roadside Equipment and Maintenance and Construction Management Center
- IWZ System Roadside Equipment and RTMC/TOCCs

### Technology Assessment

This initiative utilizes technology that is currently deployed.

### Dependency

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

Unit cost estimates for PCMS can range from \$20,000 to \$45,000. Unit cost estimates for remote traffic microwave sensors for a corridor can range from \$10,000 to \$12,000.

**Needs and Objectives Addressed**

- Need: WZ12 - Notify travelers of delays or travel times through work zones
- ITS Objectives: B-3-01 - Reduce total vehicle hours of delay by time period (peak, off-peak) caused by work zones
- B-3-05 - Reduce the variability of travel time in work zones during peak and off-peak periods
- C-3-15 - Increase the number of specifically tailored traveler information messages provided

**Agreement**

Agreements are not required for this initiative.

**ID:** S58

**Initiative:** Work Zone Intrusion Alarm System



**Timeframe:** Short Term – Years 2-4

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Work Zones

**ITS Service Area:** MCM

**Type:** Deployment

### Description

A work zone intrusion alarm system will detect errant vehicles entering a work zone and provide warning to crew workers and drivers of errant vehicles of imminent encroachment or other potential safety hazards. A pilot project is currently being conducted in MnDOT District 3. Upon successful demonstration of the pilot, additional Work Zone Intrusion Alarm System units will be procured and used in work zones.

### Champion and Stakeholder

MnDOT (Maintenance)

### Project Element

- Intelligent Work Zone System Roadside Equipment
- Maintenance and Construction Field Personnel

### Market Package

- MC09 – Work Zone Safety Monitoring

### Interconnect

- Roadside detection equipment and roadside alarm equipment.

### Technology Assessment

This initiative is an expansion of a current system that is being tested. Commercial, off-the-shelf systems are also available from private vendors.

### Dependency

This initiative depends upon the result of the pilot project that is currently being conducted in MnDOT District 3. Additional research into system design and functionality may be needed to improve system effectiveness.

### Cost Estimate

The capital cost of a work zone intrusion system ranges between \$6,000 and \$12,000. The annual O&M cost is estimated at \$600.

### Needs and Objectives Addressed

Need: WZ03 – Warn work crews of errant vehicles

ITS Objective: A-3-04 - Reduce number of workers injured by vehicles in work zones

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

**Agreement**

Agreements are not required for this initiative.

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

**ID:** S59

**Initiative:** Bridge Inspection / Structural Monitoring Roadside Equipment

**Multimodal Transportation Objective:** Asset Management, System Security

**Timeframe:** Short to Medium Term – Years 0-8

**ITS Service Area:** MCM

**Type:** Deployment

### Description

This initiative will install cameras and/or sensors to assist in the inspection of transportation infrastructure (bridges, tunnels, etc.) by recording key structural measures that indicate when maintenance is needed. Roadside cameras and sensors are planned to be utilized for maintenance inspections of key bridges in Minnesota. Roadside equipment is planned to be controlled by MnDOT RTMC, TOCCs, and Maintenance and Construction Management Centers for maintenance inspections. Initial testing on the I-35W Bridge in Minneapolis will test sensors such as linear potentiometers to measure bridge movements, accelerometers to monitor bridge deflections under loads, and acoustical sensors to detect unusual sounds of a specific frequency. Data on inspection activity can be archived to indicate dates of inspection and exactly what was inspected.

### Champion and Stakeholder

MnDOT

### Project Element

- Bridge Inspection / Structural Monitoring Roadside Equipment
- RTMC
- TOCCs
- Maintenance and Construction Management Center

### Service Package

- MC12 – Infrastructure Monitoring

### Interconnect

- Bridge Inspection/Structural Monitoring Roadside Equipment and RTMC
- Bridge Inspection/Structural Monitoring Roadside Equipment and TOCCs
- Bridge Inspection/Structural Monitoring Roadside Equipment and Maintenance and Construction Management Center

### Technology Assessment

Cameras/sensors for bridge inspection and structural monitoring are available from vendors. However, further R&D is needed to advance to capabilities, accuracy and usability of the technology.

### Dependency

This initiative may be dependent upon results of initial testing on the Minneapolis I-35W Bridge.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

**Cost Estimate**

Costs associated with this initiative have not been determined.

**Needs and Objectives Addressed**

Need: WZ13 - Provide cameras/ sensors on bridges to assist for inspection and continual monitoring

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

**Agreement**

Agreements are not required for this initiative.

**ID:** S60

**Initiative:** Graphical-Based Construction Scheduling Tool

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Asset Management

**ITS Service Area:** MCM

**Type:** Deployment

**Description**

This initiative will develop a dynamic graphical-based tool for communication of construction and maintenance activity within and between multiple maintenance agencies. MnDOT will need to investigate staffing requirements for data entry into the dynamic scheduling tool. MnDOT maintenance and local agencies currently release project schedules of construction and maintenance activity via website and media outlets and communicate with local stakeholders as appropriate. A centrally managed graphical-based tool will improve communication of maintenance and construction activities within and between multiple maintenance agencies.

**Champion and Stakeholder**

Champion: MnDOT

**Project Element**

- Maintenance and Construction Management Center
- Local Maintenance and Construction Management Centers
- 511 Traveler Information Website

**Service Package**

- MC10 – Maintenance and Construction Activity Coordination

**Interconnect**

- Maintenance and Construction Management Center and Local Maintenance and Construction Management Centers
- Maintenance and Construction Management Center and 511 Traveler Information Website

**Technology Assessment**

MnDOT currently disseminates traveler information through the 511 Traveler Information Website on maintenance and construction activity. Additional information from local agencies can readily be added to the 511 Website.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Costs associated with this initiative have not been identified.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Maintenance and Construction |
| Emergency Management         |
| Commercial Vehicle           |
| Vehicle Safety               |
| Traffic Management           |
| Traveler Information         |
| Transit Management           |
| Data Management              |

**Needs and Objectives Addressed**

Need: WZ02 - Coordinate construction and maintenance project schedules within and between agencies

ITS Objectives: B-3-01 - Reduce total vehicle hours of delay by time period (peak, off-peak) caused by work zones  
 B-3-05 - Reduce the variability of travel time in work zones during peak and off-peak periods  
 G-1-01 - Increase the amount of data gathered from ITS enhancements used in infrastructure and operations planning

**Agreement**

Agreements regarding the frequency of maintenance and construction information to be shared among agencies may be required for this initiative.

**ID:** S61

**Initiative:** Portable Work Zone Dynamic Speed Display Signs



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Traveler Safety, Asset Management

**SHSP Focus Area:** Speed-Related, Work Zones

**ITS Service Area:** MCM

**Type:** Deployment

**Description**

This initiative will deploy portable dynamic speed displays at more work zones to increase worker safety and expand the use of permanent dynamic speed displays to additional locations. Systems will detect the traveling speeds of approaching vehicles and display the detected speeds dynamically via message signs that are located underneath the posted speed limit along the arterial road. These systems are currently in operation at select locations throughout the metro area. The purpose of the initiative is to make drivers aware of their traveling speeds compared to the posted speed limit, thereby reducing vehicle speeds along arterial roads and improve pedestrian and roadway safety.

**Champion and Stakeholder**

Champion: MnDOT

**Project Element**

- Speed Monitoring Roadside Equipment
- Driver

**Service Package**

- MC08 – Work Zone Management

**Interconnect**

- Speed Monitoring Roadside Equipment and Driver

**Technology Assessment**

This technology has been deployed previously at work zones and is readily available.

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

General cost estimate for a system installation can range from \$5,000 to \$10,000. System could include a trailer mounted two-digit dynamic message sign, radar gun, and computer for storing information presented to drivers. Equipment could be powered by local generator or solar power if available.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                                     |
|-------------------------------------|
| Data Management                     |
| Transit Management                  |
| Traveler Information                |
| Traffic Management                  |
| Vehicle Safety                      |
| Commercial Vehicle                  |
| Emergency Management                |
| <b>Maintenance and Construction</b> |

**Needs and Objectives Addressed**

- Needs: WZ15 – Provide dynamic speed display  
WZ17 – Alert distracted motorists near work zones
- ITS Objectives: 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-3-05 - Reduce the variability of travel time in work zones during peak and off-peak periods  
C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Agreement**

Agreements are not required for this initiative.

**ID:** S62

**Initiative:** Rural Intersection Conflict Warning Systems (RICWS)



**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** Intersections

**ITS Service Area:** AVSS

**Type:** Deployment

### Description

This initiative will install Rural Intersection Conflict Warning Systems (RICWS) at specific rural locations along Minnesota roads and highways. Automated systems will consist of field equipment at key intersections that will detect a vehicle's presence that cannot be seen by oncoming vehicles due to poor geometric field conditions, resulting in potential traffic incidents. The field equipment will send a notification to additional field equipment that will alert drivers on rural highways with information indicating when entry into an intersection is unsafe. This initiative was identified in the Minnesota Guidestar Program: Deployment Assessment (2007). This is a follow-on deployment of the Intersection Warning System Operational Test at rural highway and rural highway/rail intersections in Mankato.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: Local Agencies

### Project Element

- Intersection Collision Warning Roadside Equipment
- Traffic
- Driver

### Service Package

- AVSS05 – Intersection Safety Warning

### Interconnect

- Traffic and Intersection Collision Warning Roadside Equipment
- Driver and Intersection Collision Warning Roadside Equipment

### Technology Assessment

Intersection Collision Warning Roadside Equipment has been deployed at various locations and is readily available.

### Dependency

This initiative is dependent upon the success of the Intersection Warning System Operational Test at rural highway and rural highway/rail intersections in Mankato.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Cost Estimate**

The costs of the system range from \$60,000 to \$100,000 per intersection.

**Needs and Objectives Addressed**

- Need: TM33 - Provide intersection collision avoidance systems
- ITS Objectives:
- A-1-11 - Reduce number of crashes at un-signalized intersections
  - A-1-17 - Reduce number of crashes due to roadway/geometric restrictions
  - A-2-12 - Reduce number of fatalities at un-signalized intersections
  - A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions
  - A-2-33 - Reduce number of injuries at un-signalized intersections
  - A-2-39 - Reduce number of injuries due to roadway/geometric restrictions

**Agreement**

Agreements may be required if systems are deployed on facilities operated by multiple agencies.

**ID: S63**

**Initiative:** In-Vehicle Monitoring of Teenage Drivers in Graduated Driver Licensing Program



**Timeframe:** Short Term

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Younger Drivers

**ITS Service Area:** AVSS

**Type:** Policy/Legislation, Research

### Description

The graduated driver licensing program complements the existing driver's license program by introducing a provisional license stage for young drivers. The program intends to ease young novice drivers into the driving environment and provides additional parental/legal guardian involvement. New drivers are rewarded for safe driving under graduated driver licensing programs. Currently, a limited graduated driver licensing program exists in Minnesota. However, using technology such as in-vehicle monitoring could be added to enhance the program to reward safe drivers. This initiative intends to expand graduated driver licensing programs to improve graduated driver education and licensing using ITS.

The initiative will require actions to review existing graduated driver licensing laws to ensure that the laws allow for additional restrictions and monitoring of teenage drivers, evaluate technology options for in-vehicle monitoring (i.e., camera, on-board vehicle systems), and determine the status and potential applications of the University of Minnesota's Teen Driver Support System program. There are some legal and institutional issues that need to be considered. One legal issue is that existing graduated driver licensing laws should be reviewed to ensure that they allow for additional restrictions and monitoring of teenage drivers. The institutional issues include privacy issues associated with in-vehicle monitoring and public resistance to further restricting the driving privileges of teenage drivers.

### Champion and Stakeholder

Champion: Minnesota Department of Public Safety  
Stakeholder: MnDOT

### Project Element

- None.

### Service Package

- None.

### Interconnect

- None.

### Technology Assessment

In-vehicle monitoring technology is currently available and will be assessed as part of this initiative.

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| <b>Vehicle Safety</b>        |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**Dependency**

This initiative is not dependent upon any other initiatives.

**Cost Estimate**

Total equipment costs have not been estimated given further research required.

**Needs and Objectives Addressed**

Need: CEA 3 – Addressing Young Drivers over Involvement and Curbing Aggressive Driving

ITS Objectives: A-1-18 - Reduce number of crashes involving younger drivers (under 21)  
A-2-19 - Reduce number of fatalities involving younger drivers (under 21)  
A-2-40 - Reduce number of injuries involving younger drivers (under 21)

**Agreement**

Agreements may be required for widespread deployment and will be identified in this initiative.

**ID:** S64

**Initiative:** Blow Ice Signalized Warning System

**Timeframe:** Short Term – Years 0-4

**Multimodal Transportation Objective:** Traveler Safety

**ITS Service Area:** MCM

**Type:** Deployment

**Description**

Roadway segments with unique land use can experience snow and sleet blowing across the road and creating slippery conditions in a relatively short section when the rest of the highway is clear and dry. For example, this phenomenon can be problematic when there is an open farm field on one side of the roadway with prevailing winds blowing toward the roadway. This condition is commonly referred to as blow ice. Not only does this condition violate driver's expectations increasing risks of crashes and injuries, it also prevents MnDOT from obtaining their goal of clear roadways during the winter months. This project will install pavement condition sensors that monitor the pavement status and active warning signs that alert drivers to the icy conditions. System activations will be sent to the corresponding maintenance shop to assist in decisions on scheduling of maintenance vehicle activity.

**Project Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MSP, Dassel-Cokato High School Community, and Travelers

**Project Element**

- Maintenance and Construction Management Center
- Advanced Pavement Condition and Visibility Warning System Roadside Equipment

**Service Package**

- MC03 – Road Weather Data Collection
- MC04 – Weather Information Processing and Distribution
- ATMS24 – Dynamic Roadway Warning

**Interconnect**

- Advanced Pavement Condition and Visibility Warning System Roadside Equipment and Maintenance and Construction Management Center

**Technology Assessment**

This project is an expansion of a current application and utilizes technology already deployed and readily available.

**Dependency**

This initiative is not dependent upon any other initiatives.

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                                     |
|-------------------------------------|
| Data Management                     |
| Transit Management                  |
| Traveler Information                |
| Traffic Management                  |
| Vehicle Safety                      |
| Commercial Vehicle                  |
| Emergency Management                |
| <b>Maintenance and Construction</b> |

**Cost Estimate**

The cost for road condition sensor and warning system depends on the number of sensors and active warning flashers and whether the system is wireless or wired. A wired system with three sensors and two flashers is estimated to cost \$190,000. The annual O&M cost is estimated at \$550.

**Needs and Objectives Addressed**

Need: WZ04 – Provide automated monitoring of road weather conditions

ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions  
 A-2-03 - Reduce number of fatalities due to road weather conditions  
 A-2-24 - Reduce number of injuries due to road weather conditions  
 C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.  
 C-3-15 - Increase the number of specifically tailored traveler information messages provided

**Agreement**

Agreements are not required for this initiative.

## 4.4 Medium and Long Term ITS Initiatives and Project Concepts

**ID:** M01

**Initiative:** Provide Information on Alternate Routes and Detours Due to Roadwork



**Timeframe:** Medium Term – Years 5-6

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Work Zones

**ITS Service Area:** ATIS, MCM

**Type:** Deployment

### Description

This initiative will provide recommended alternate routes around roadways closures or heavy congestion caused by construction or maintenance activities. This alternate route information will be provided through existing traveler information systems. This information will provide travelers with timely information about their route of travel and enhance their confidence in traveler systems by being provided with constructive information about roadway closures and construction activities.

MnDOT RTMC will provide information on recommended alternate routes and detours in the metro area on the MnDOT website and through, the 511 telephone system, and MnDOT operated DMS alongside roadways. This initiative will require MnDOT, counties, and cities to provide timely information about construction and maintenance activities and develop recommended alternate routes or detours for their construction projects that require close lanes of traffic.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: MnDOT, Counties, Cities

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

Need: TI05 - Provide information on roadway construction and maintenance activities

ITS Objectives:

- A-1-17 - Reduce number of crashes due to roadway/geometric restrictions
- A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions
- A-2-39 - Reduce number of injuries due to roadway/geometric restrictions
- B-3-01 - Reduce total vehicle hours of delay by time period (peak, off-peak) caused by work zones
- B-3-05 - Reduce the variability of travel time in work zones during peak and off-peak periods
- C-3-11 - Increase number of 511 calls per year
- C-3-12 - Increase number of visitors to traveler information website per year

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

**Service Package**

- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- MC08 – Work Zone Management

**ID: M02**

**Initiative:** CARS Integration Across State Borders



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, Critical Connections, System Security

**SHSP Focus Area:** Lane Departure

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

The focus of this initiative will be to integrate the Minnesota Condition and Acquisition Reporting System (CARS) with neighboring state reporting systems similar to CARS. The benefits to this initiative include improved traffic incident management, improved emergency traffic operations, and enhanced transportation security at interstate border areas. Interstate partnerships with Iowa, North and South Dakota, and Wisconsin will also improve the detection of hazardous highway conditions and security threats along the roadway. This initiative is identified in the Statewide ITS Strategic Plan (2006) and the ITS Safety Plan (2006).

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: Neighboring States (North Dakota, South Dakota, Iowa, and Wisconsin)

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Needs: TI02 - Provide traveler information across state borders  
TI21 - Make real-time transportation operations data available to other transportation system operators

ITS Objectives: TM45 - Provide road closure information for far away closures  
A-1-01 - Reduce number of vehicle crashes  
A-1-02 - Reduce number of vehicle crashes per VMT  
A-2-01 - Reduce number of roadway fatalities  
A-2-02 - Reduce number of roadway fatalities per VMT  
A-2-22 - Reduce number of roadway injuries  
A-2-23 - Reduce number of roadway injuries per VMT  
B-1-07 - Reduce the regional average travel time index  
B-1-09 - Improve average travel time during peak periods  
C-3-10 - Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region  
D-2-03 - Increase the number of travelers routed around Hazmat incidents  
D-2-04 - Increase the number of travelers routed around homeland security incidents  
E-4-04 - Increase the rate at which equipment is utilized

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

G-1-02 - Increase the number of planning activities using data from ITS systems  
G-1-06 - Reduce operations cost deviation

**Service Package**

- ATIS06 – Transportation Operations Data Sharing

**ID: M03**

**Initiative:** ITS Communications Interstate Connectivity



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, Critical Connections, System Security

**SHSP Focus Area:** Lane Departure

**ITS Service Area:** ATIS

**Type:** Deployment

### Description

This focus of this initiative will be to implement communications connectivity to adjacent states that support ITS deployments. This initiative has potential to improve traffic and incident management in border areas governed by metropolitan planning organizations, such as Duluth-Superior, Fargo-Moorhead, and Grand Forks-East Grand Forks. Regional ITS Architectures have been developed for these areas that indicate planned traffic control and information coordination between MnDOT and neighboring state agencies. This initiative is identified in the Statewide ITS Strategic Plan (2006).

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: MnDOT, Neighboring States (North Dakota and Wisconsin)

### Dependency

This initiative depends on planned deployment of a National ATIS Network or standards.

### Needs and Objectives Addressed

Need: TI02 - Provide traveler information across state borders

ITS Objectives: A-1-01 - Reduce number of vehicle crashes

A-1-02 - Reduce number of vehicle crashes per VMT

A-2-01 - Reduce number of roadway fatalities

A-2-02 - Reduce number of roadway fatalities per VMT

A-2-22 - Reduce number of roadway injuries

A-2-23 - Reduce number of roadway injuries per VMT

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

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

C-3-10 - Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region

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

### Service Package

- ATIS06 – Transportation Operations Data Sharing

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M04**

**Initiative:** CARS ITS Data Addition



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Critical Connections, System Security

**SHSP Focus Area:** Lane Departure

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

This initiative will focus on adding ITS and weather-related information data from ITS devices and RWIS stations to the Minnesota Condition Acquisition and Reporting Systems (CARS). Weather-related information is currently sent to the RWIS Central Control Server. Information entered directly into CARS is available for dissemination via the 511 traveler information webpage and the 511 traveler information phone number. This initiative can provide travelers en route with current and forecast road and weather condition information that may affect their travel behavior and improve travel safety. This initiative was previously identified in the Statewide ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is not dependent upon other initiatives.

**Needs and Objectives Addressed**

Need: TI04 - Provide current and forecast road and weather conditions information

- ITS Objectives:
- A-1-03 - Reduce number of crashes due to road weather conditions
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - C-3-11 - Increase number of 511 calls per year
  - C-3-12 - Increase number of visitors to traveler information website per year

**Service Package**

- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- MC04 – Weather Information Processing and Distribution

**ID: M05**

**Initiative:** Seasonal Road Weight Restrictions Information

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Critical Connections

**ITS Service Area:** ATIS, CVO

**Type:** Deployment

**Description**

This initiative will provide information on seasonal road weight restrictions via MnDOT trucking website to allow truck drivers, especially owner/operated ones that do not use dispatchers, to view updated information and let them choose their route accordingly.

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TI08 - Provide information on seasonal road weight restrictions

- ITS Objectives:
- C-3-12 - Increase number of visitors to traveler information website per year
  - 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

**Service Package**

- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- CVO04 – CV Administrative Processes

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M06**

**Initiative:** Congestion Information Expanded to Selected Greater Minnesota Locations



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Critical Connections

**SHSP Focus Area:** Lane Departure, Speed-Related

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

This initiative will expand the incident and congestion information that is available on non-MnDOT roadways outside of the metro area and make it available through the 511 website and telephone information service. MnDOT currently provides a traffic flow map for the metro area indicating free flowing, slow or congested conditions. Congestion and incident information is also available for the metro area and displayed on a metro area map. MnDOT and local agencies will enable increasing the coverage of MnDOT’s traffic flow map beyond the metro area by deploying roadway sensors / traffic detectors on additional freeway and major arterial segments and other state/county roads. Reporting of traffic incidents by local agencies to MnDOT will also provide travelers with up-to-date incident information.

**Champion and Stakeholder**

Champion: MnDOT  
Stakeholders: Local Agencies

**Dependency**

This initiative may be dependent upon the deployment of roadway sensors / traffic detectors on additional freeway and major arterial segments and other state/county roads.

**Needs and Objectives Addressed**

Needs: T114 - Expand traveler information coverage in Greater Minnesota  
TM45 - Provide road closure information for far away closures

ITS Objectives: A-1-01 - Reduce number of vehicle crashes  
A-1-02 - Reduce number of vehicle crashes per VMT  
A-2-01 - Reduce number of roadway fatalities  
A-2-02 - Reduce number of roadway fatalities per VMT  
A-2-22 - Reduce number of roadway injuries  
A-2-23 - Reduce number of roadway injuries per VMT  
B-1-07 - Reduce the regional average travel time index  
B-1-09 - Improve average travel time during peak periods  
C-3-10 - Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region

**Service Package**

- ATIS01 – Broadcast Traveler Information

**ID: M07**

**Initiative:** Traffic Flow Maps for Key Arterials



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Lane Departure, Speed-Related

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

MnDOT plans to use roadway sensors / traffic detectors to collect traffic flow data on traffic volume, travel speed, and lane occupancy for congestion information on key signalized arterials. Roadways include signalized arterials within as well as outside of the metro area as instrumentation becomes available. Traffic flow data will then be entered into the MnDOT Condition Acquisition and Reporting System (CARS) for dissemination to the public through the Minnesota 511 Telephone Information Service and Traveler Information Website. This information will allow travelers to make an informed decision on travel routes to their specific destinations.

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is dependent upon the deployment of roadway sensors / traffic detectors on key signalized arterial roadway segments.

**Needs and Objectives Addressed**

Need: T117 - Provide travel time or traffic flow maps for major signalized intersections

ITS Objectives: A-1-19 - Reduce number of all secondary crashes  
A-2-03 - Reduce number of fatalities due to road weather conditions  
A-2-04 - Reduce number of fatalities due to unexpected congestion  
B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period  
C-3-11 - Increase number of 511 calls per year  
C-3-12 - Increase number of visitors to traveler information website per year

**Service Package**

- ATIS01 – Broadcast Traveler Information

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M08**

**Initiative:** Seasonal and Recreational Traveler Information

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Security, Critical Connections

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

This initiative will focus on providing traffic congestion information for travelers in areas where high amounts of seasonal and recreational traffic are generated on Minnesota roads and highways. Traffic congestion information is currently entered into a central database for dissemination via the Minnesota 511 traveler information web-page and the 511 traveler information phone number. This initiative will alert travelers to seasonal and recreational traffic information that may affect their travel behavior and reduce traffic congestion. This initiative is identified in the Statewide ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is dependent upon the expansion of the CARS database to include traffic information for areas impacted by seasonal and recreational traffic.

**Needs and Objectives Addressed**

- Needs:
- TM05 - Provide incident and congestion information to travelers
  - TI18 - Provide congestion information to travelers for seasonal or recreational traffic generators
- ITS Objectives:
- A-1-03 - Reduce number of crashes due to road weather conditions
  - A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-1-19 - Reduce number of all secondary crashes
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - 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

**Service Package**

- ATIS01 – Broadcast Traveler Information
- ATMS06 – Traffic Information Dissemination

**ID: M09**

**Initiative:** Enhanced Traveler Information for Transit and Other Modes

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATIS, APTS

**Type:** Deployment

**Description**

This initiative will enhance the provision of traveler information through the MnDOT 511 Telephone Information Service and Traveler Information Website by providing travel information on public transit and other modes of transportation, as well as personalized travel information for customers. Types of public transit information could include real-time bus departure information currently provided by Metro Transit to passengers through their website (NexTrip) and customer telephone information system (TransitLine). Information on other modes of transportation could include the locations of existing and planned bicycle-only lanes in the metro area. Personalized travel information can be provided through individual accounts for customers that frequently request travel information specific to their daily travel patterns. This enhanced traveler information will also be disseminated to other Information Service Providers (ISPs) that currently receive real-time data from the MnDOT 511 system.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, Metro Area Transit Providers, Local Transit Providers

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: T119 - Provide different alternatives to travelers for the most appropriate route/mode/time of travel

- ITS Objectives:
- B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
  - B-1-02 - Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
  - C-3-10 - Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region
  - C-3-14 - Increase the number of transit routes with information being provided by ATIS

**Service Package**

- ATIS01 – Broadcast Traveler Information
- ATIS05 – ISP Based Trip Planning and Route Guidance
- APTS08 – Transit Traveler Information

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M10**

**Initiative:** Traveler Service Information on 511

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

This initiative will provide users of the MnDOT 511 Telephone Information Service and Traveler Information Website to request information about some commercial traveler services (i.e. lodging, restaurants, and service stations) and be provided contact information to make reservations and advance payment.

**Champion and Stakeholder**

Champion: MnDOT  
Stakeholders: Private Service Providers

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TI20 - Provide traveler service information for reservations and advanced payment for traveler services  
ITS Objectives: C-3-11 - Increase number of 511 calls per year  
C-3-12 - Increase number of visitors to traveler information website per year

**Service Package**

- ATIS05 – ISP Based Trip Planning and Route Guidance
- ATIS07 – Travel Services Information and Reservation

**ID: M11**

**Initiative:** Congestion and Closure Information for Transit Dispatchers and Operators

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

This initiative will provide real-time traffic congestion/ roadway closure information to Metro Transit dispatchers and bus operators. Traveler information currently collected and disseminated by the MnDOT RTMC will be sent to Metro Transit Control Center for use in suggesting more efficient transit routes to buses that will be affected by traffic congestion/ roadway closures. This initiative could also be expanded to serve suburban transit providers with traffic congestion/ roadway closure information. This initiative was identified in the Statewide ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: Metro Transit

Stakeholders: Metro Area Transit Providers, MnDOT

**Dependency**

This initiative is not dependent on any other initiatives.

**Needs and Objectives Addressed**

Need: TI21 - Make real-time transportation operations data available to other transportation operators

ITS Objectives: C-3-10 - Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region

G-1-01 - Increase the amount of data gathered from ITS enhancements used in infrastructure and operations planning

G-1-06 - Reduce operations cost deviation

**Service Package**

- ATIS06 – Transportation Operations Data Sharing

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M12**

**Initiative:** Automated Data Interface between Local Public Safety CAD Systems and CARS



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

This initiative will provide an automated data interface between CARS and local public safety CAD systems. This initiative will automate data entry from local public safety CAD systems to the CARS database to provide more complete and accurate information about incidents outside of the metro area. This initiative will also implement a data quality and consistency verification system as part of this effort. MnDOT CARS will automatically incorporate data from local public safety agencies' CAD systems, increasing the timeliness and accuracy of information in CARS.

**Champion and Stakeholder**

MnDOT, Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Needs:
- TM13 - Provide incident information to emergency management agencies
  - TI12 - Share/integrate public safety CAD data with CARS
  - TI16 - Improve quality, consistency and thoroughness of traveler information
- ITS Objectives:
- A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-1-19 - Reduce number of all secondary crashes
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - B-4-01 - Reduce vehicle hours of delay per capita during evacuation from homeland security and Hazmat incidents
  - C-1-01 - Reduce the vehicle hours of total delay associated with traffic incidents during peak and off-peak periods
  - C-3-12 - Increase number of visitors to traveler information website per year
  - D-2-03 - Increase the number of travelers routed around Hazmat incidents
  - G-1-01 - Increase the amount of data gathered from ITS enhancements used in infrastructure and operations planning

**Service Package**

- ATIS06 – Transportation Operations Data Sharing

**ID: M13**



**Initiative:** Traffic Flow Maps for Key Corridors

**Timeframe:** Medium to Long Term – Years 5 and beyond

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Lane Departure, Speed-Related

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

This initiative will incorporate traffic flow data (volume, speed and occupancy) for congestion information into traffic flow maps for key arterials in the metro area and areas and key highways outside the Metro area. This will provide real-time traveler information for more roads. This will provide Roadways include but are not limited to I-94, U.S. 10, TH 52 in Rochester, and key arterial roadways within the metro area as instrumentation becomes available.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, MSP, Local Agencies

**Dependency**

This initiative is dependent upon key arterial and highway corridors being instrumented with sensors/detector for collecting volume, speed and occupancy data.

**Needs and Objectives Addressed**

Need: TI03 - Provide traffic flow maps showing recurring or predicted freeway congestion levels

- ITS Objectives:
- A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
  - C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.
  - C-3-12 - Increase number of visitors to traveler information website per year

**Service Package**

- ATIS01 – Broadcast Traveler Information

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M14**



**Initiative:** 511 Expansion to Local Roads

**Timeframe:** Medium to Long Term – Year 5 and Beyond

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Intersections, Lane Departure

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

This initiative will focus on enhancing the current 511 telephone and website information system by adding traveler information for minor arterial roads and/or County roads within the metro area and in Greater Minnesota through expansion of the Condition Acquisition and Reporting System (CARS) or adding data acquired from private sector partners. As information on these local roads is reported, MnDOT will expand coverage of the traffic flow map to include those additional roadways within the Metro area and in Greater Minnesota as well. This initiative will require the establishment of real-time or near real-time data sharing between MnDOT and local agencies on road conditions. This initiative is identified in the Statewide ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: MnDOT  
Stakeholders: Local Agencies

**Dependency**

Availability of real-time information depends on instrumentation of local roads (Initiative M15).

**Needs and Objectives Addressed**

- Need: TI22 - Include information on local roads in 511
- ITS Objectives:
  - A-1-03 - Reduce number of crashes due to road weather conditions
  - A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-1-17 - Reduce number of crashes due to roadway/geometric restrictions
  - A-1-19 - Reduce number of all secondary crashes
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - A-2-39 - Reduce number of injuries due to roadway/geometric restrictions
  - B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
  - C-3-11 - Increase number of 511 calls per year
  - C-3-12 - Increase number of visitors to traveler information website per year
  - 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

**Service Package**

- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| <b>Traveler Information</b>  |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M15**



**Initiative:** Instrument Local Roads

**Timeframe:** Medium to Long Term – Year 5 and Beyond

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Intersections, Lane Departure, Speed-Related

**ITS Service Area:** ATIS, ATMS

**Type:** Deployment

**Description**

This initiative would expand the instrumentation of traffic detectors and roadway sensors to local arterial roads to gather traveler information on local roadways. Detectors collect data on traffic patterns, volumes, and vehicle speeds. This data would be entered into the MnDOT Condition Acquisition and Reporting System (CARS) for dissemination to the public through the Minnesota 511 Telephone Information Service and Traveler Information Website.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TI22 - Include information on local roads in 511

- ITS Objectives:
- A-1-03 - Reduce number of crashes due to road weather conditions
  - A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-1-17 - Reduce number of crashes due to roadway/geometric restrictions
  - A-1-19 - Reduce number of all secondary crashes
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - A-2-39 - Reduce number of injuries due to roadway/geometric restrictions
  - B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
  - C-3-11 - Increase number of 511 calls per year
  - C-3-12 - Increase number of visitors to traveler information website per year
  - 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

**Service Package**

- ATIS01 – Broadcast Traveler Information

- ATIS02 – Interactive Traveler Information
- ATMS01 – Network Surveillance

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M16**

**Initiative:** Priced Dynamic Shoulder Lanes Expansion

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will create Priced Dynamic Shoulder Lanes (PDSLs). MnDOT RTMC has deployed PDSLs along I-35W between downtown Minneapolis and the 46<sup>th</sup> St. S. interchange through the Urban Partnership Agreement between the U.S. Department of Transportation (USDOT), MnDOT, and the Metropolitan Council of the Twin Cities. This initiative will focus on expanding the deployment of PDSLs to other corridors.

MnDOT RTMC will operate the PDSLs to allow single occupancy vehicles (SOVs) to use the shoulders in order to reduce overall congestion and divert traffic from other lanes during traffic incidents. Transit vehicles, high occupancy vehicles (HOVs), and motorcycles will be able to use the lanes free of charge. SOV drivers will be able to enter the lanes for a fee based on the level of traffic congestion along the PDSL corridor.

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Needs: TM07 - Provide lane and shoulder control  
 TM20 - Operate dynamic shoulders

ITS Objectives: B-1-02 - Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods  
 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-2-19 - Increase the number of carpools  
 B-2-20 - Increase use of 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

**Service Package**

- ATMS23 – Dynamic Lane Management and Shoulder Use
- ATMS05 – HOV Lane Management

**ID: M17**

**Initiative:** Sharing CCTV Images Between Agencies



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Intersections, Lane Departure, EMS Response & Trauma Systems

**ITS Service Area:** ATIS, ATMS, EM

**Type:** Deployment

### Description

This initiative will ensure the sharing of CCTV camera images with transportation agencies, transit agencies, public safety, and emergency services to assist them in incident/emergency response and management. Transportation agencies that operate CCTV cameras will send available images to control centers or dispatchers at other agencies. Control of the cameras will not be shared, but agencies will be able to contact the camera operator and request changing camera views. Types of images shared (e.g. snapshots vs. streamed) will vary by agency needs and camera locations. The purpose of this initiative is to improve the effectiveness of emergency response to traffic incidents, emergencies, and other events. This initiative was identified in the Statewide ITS Strategic Plan (2006).

This deployment will meet a highly prioritized need from the EM stakeholder meeting – Share video with other PSAPs (Public Safety Answering Points).

### Champion and Stakeholder

Champion: MnDOT (RTMC), Minnesota DPS

Stakeholders: MnDOT, Local Transportation Agencies, Minnesota DPS, Local EM Agencies, Transit Agencies

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

Needs: TM09 - Share surveillance video, data, and other information with PSAPs  
TI21 - Make real-time transportation operations data available to other transportation system operators

ITS Objectives: B-1-16 - Reduce mean time for needed responders to arrive on-scene after notification  
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

|                              |
|------------------------------|
| Maintenance and Construction |
| Emergency Management         |
| Commercial Vehicle           |
| Vehicle Safety               |
| Traffic Management           |
| Traveler Information         |
| Transit Management           |
| Data Management              |

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

**Service Package**

- ATMS01 – Network Surveillance
- ATMS08 – Traffic Incident Management System
- ATIS06 – Transportation Operations Data Sharing
- EM01 – Emergency Call-Taking and Dispatch

**ID: M18**

**Initiative:** Expand CCTV Surveillance at High Incident Locations



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections, System Security

**SHSP Focus Area:** Intersections, Lane Departure, EMS Response & Trauma Systems

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

This initiative will improve CCTV camera surveillance at high incident locations throughout Minnesota. This includes providing surveillance of rural high incident roadways and areas of high importance to TOCCs, such as sections of I-35 to the Rochester TOCC. This initiative may also include providing surveillance video from local agencies to the RTMC and TOCCs and providing live motion video to the public over the Internet.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: MnDOT, MSP, Local Agencies

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

**Need:** TM04 - Provide cameras at locations with high incidents and areas of high importance for incident identification and verification

**ITS Objectives:**

- 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
- C-1-01 - Reduce the vehicle hours of total delay associated with traffic incidents during peak and off-peak periods
- 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
- D-1-06 - Increase number of major and minor arterials that are equipped with and operating with closed circuit television (CCTV) cameras

### Service Package

- ATMS01 – Network Surveillance
- ATMS08 – Traffic Incident Management System

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M19**

**Initiative:** ITS and Communications Coordination and Information Sharing for Incident Responses



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections, System Security

**SHSP Focus Area:** Intersections, Lane Departure, EMS Response & Trauma Systems

**ITS Service Area:** ATMS, EM

**Type:** Deployment

**Description**

This initiative focuses on providing avenues of interagency coordination and sharing of ITS technologies (e.g. CCTV, RWIS, DMS, EVP etc.) and communications (e.g. CAD to CAD from MSP to local law enforcement agencies) for incident response and clearance.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MSP, Local Law Enforcement Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Needs: TM12 - Reduce clearance time for primary crashes

TM22 - Provide system-coordinated response to incidents

ITS Objectives: 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-1-02 - 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-1-09 - 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

D-2-05 - Reduce the Hazmat incident response time

D-2-06 - Reduce the homeland security incident response time

**Service Package**

- ATMS08 – Traffic Incident Management System
- EM01 – Emergency Call-Taking and Dispatch
- EM02 – Emergency Routing

**ID: M20**

**Initiative:** Maintenance and CVO Alternate Route Database Development



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections, System Security

**SHSP Focus Area:** Commercial Vehicle Involved

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

Develop maintenance/CVO database incorporating roadway capacity, restrictions, construction information, and additional information to be used in recommending alternate routes.

**Champion and Stakeholder**

Champion: MnDOT Maintenance

Stakeholders: MnDOT OFCVO, Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM16 - Identify alternate routes

ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions

A-1-04 - Reduce number of crashes due to unexpected congestion

A-2-03 - Reduce number of fatalities due to road weather conditions

A-2-04 - Reduce number of fatalities due to unexpected congestion

A-2-24 - Reduce number of injuries due to road weather conditions

A-2-25 - Reduce number of injuries due to unexpected congestion

B-1-17 - Reduce mean incident clearance time per incident

B-1-18 - Reduce mean incident clearance time for Twin Cities urban freeway 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

E-1-05 - Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways

**Service Package**

- ATMS08 – Traffic Incident Management System
- EM09 – Evacuation and Reentry Management
- EM10 – Disaster Traveler Information

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M21**

**Initiative:** Emergency Management Alternate Route Database Development



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, Accountability, Transparency, & Communication, Critical Connections, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

Develop emergency management database identifying roadways that are closed or congested due to incidents, emergencies, evacuations or planned events.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MSP, Local EM Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM16 - Identify alternate routes

ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions

A-1-04 - Reduce number of crashes due to unexpected congestion

A-2-03 - Reduce number of fatalities due to road weather conditions

A-2-04 - Reduce number of fatalities due to unexpected congestion

A-2-24 - Reduce number of injuries due to road weather conditions

A-2-25 - Reduce number of injuries due to unexpected congestion

B-1-17 - Reduce mean incident clearance time per incident

C-1-01 - Reduce the vehicle hours of total delay associated with traffic incidents during peak and off-peak periods

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

**Service Package**

- ATMS08 – Traffic Incident Management System
- EM09 – Evacuation and Reentry Management
- EM10 – Disaster Traveler Information

**ID:** M22

**Initiative:** ATMS for Major Event Management

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will deploy technologies to help manage major events by utilizing the following techniques: 1) Adaptive traffic signal control on approach arterials, 2) Parking demand/exit management systems, including use of debit cards and/or transponders, 3) Traveler information directing arriving/departing customers to appropriate freeway exit access points to available parking locations and other way-finding information, 4) Portable Intelligent Work Zone technology (i.e., DMS, cameras, communications) to control work zone traffic during major events. Specific sites for further deployment have yet to be determined. This initiative is identified in the Statewide ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, Local Agencies, MSP, Event Organizers

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM17 - Provide travel information on special events

ITS Objectives: 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

**Service Package**

- ATMS06 – Traffic Information Dissemination
- ATMS08 – Traffic Incident Management System
- ATIS01 – Broadcast Traveler Information

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M23**

**Initiative:** CCTV External Surveillance on Metro Transit Vehicles

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Asset Management, System Security, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will allow Metro Transit vehicles to transmit roof-mounted traffic surveillance camera images of surrounding arterial traffic conditions to the MnDOT RTMC and Metro Transit Control Center. Camera images will provide the RTMC and Transit Control Center with additional information to manage traffic congestion. This initiative was identified in the Minnesota Guidestar ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: Metro Transit  
Stakeholder: MnDOT

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Need: TM25 - Operate CCTV cameras
- ITS Objectives: B-1-02 - Reduce the percentage of Twin Cities freeway miles congested in weekday peak periods
- 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
- D-1-08 - Reduce the number of security incidents on transportation infrastructure

**Service Package**

- ATMS01 – Network Surveillance

**ID:** M24

**Initiative:** Emergency Vehicle Strategic Deployment



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will utilize and convert available crash location information in developing an operational guide used by MnDOT and emergency/incident response agencies to strategically deploy emergency vehicles at high-risk accident locations along the roadway. This initiative is identified in the Statewide ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, MSP, Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM22 - Provide system-coordinated response to incidents

ITS Objectives: 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-2-14 - Create a transportation access guide, which provides concise directions to reach destinations by alternative modes (transit, walking, bike, etc.)

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

**Service Package**

- ATMS08 – Traffic Incident Management System

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M25**

**Initiative:** Expand Greater Minnesota Population Center Ramp Meter Deployment

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative entails placing ramp meters on I-35 in Duluth to mitigate construction traffic. Ramp meters work to increase freeway volumes, trip reliability, and freeway speeds, while decreasing travel time and crashes. Ramp meters have the potential to operate during the morning and evening peak traffic periods. Timing and operation of ramp meters in the metropolitan area is controlled by Intelligent Roadway Information System at the MnDOT RTMC.

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM23 - Operate Ramp Meters

- ITS Objectives:
- A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-1-19 - Reduce number of all secondary crashes
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
  - B-1-09 - Improve average travel time during peak periods
  - 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-2-24 - Increase AM/PM peak hour vehicle throughput on specified routes
  - C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Service Package**

- ATMS04 – Traffic Metering

**ID: M26**

**Initiative:** Vehicle Occupancy Monitoring/ Enforcement System

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will deploy roadside equipment to monitor vehicle occupancies along designated HOV lanes. When vehicle occupancy violations are detected, a signal will be sent to the appropriate law enforcement agency to issue a traffic violation. Based on results of operational testing, deployment will occur on a larger scale.

HOV lanes are currently in operation along I-394 and I-35W in the metro area. HOV bypass lanes are also provided at ramp meter locations to allow vehicles with 2 or more people to bypass traffic queues at the ramp meter.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, MSP

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM27 - Provide HOV bypass lanes at ramp meter locations

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

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

H-2-01 - Increase the average vehicle occupancy rate in HOV lanes

**Service Package**

- ATMS05 – HOV Lane Management

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M27**

**Initiative:** Active Flashing Signals and Gates at Highway/Railroad Intersections



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** Train Involved

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will deploy active flashing light signals and gates at highway/ railroad intersections that have historically high incident rates. Standard deployments generally include warning systems that are activated on notification by interfaced wayside equipment of an approaching train. Standard railroad crossing equipment may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Advanced deployments are needed where approaching train speeds exceed 80 miles per hour and have additional safety features to mitigate the risks associated with higher rail speeds.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, Local Agencies, Railroad Companies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM28 - Provide railroad flashing light signals and gates

ITS Objectives: A-1-09 - Reduce number of crashes at railroad crossings

A-2-10 - Reduce number of fatalities at railroad crossings

A-2-31 - Reduce number of injuries at railroad crossings

**Service Package**

- ATMS13 – Standard Railroad Grade Crossing
- ATMS14 – Advanced Railroad Grade Crossing

**ID:** M28

**Initiative:** Automated/Remote Operated Gate Systems



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** Lane Departure, EMS Response & Trauma Systems

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will deploy automated/remote control gate systems at rural locations experiencing unsafe driving conditions. This system will include CCTVs to assure safe operation.

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Need: TM29 - Provide automated/remote control gate systems
- ITS Objectives:
  - A-1-03 - Reduce number of crashes due to road weather conditions
  - A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - B-1-15 - Reduce mean incident notification time
  - B-4-01 - Reduce vehicle hours of delay per capita during evacuation from homeland security and Hazmat incidents
  - C-1-01 - Reduce the vehicle hours of total delay associated with traffic incidents during peak and off-peak periods
  - D-2-05 - Reduce the Hazmat incident response time
  - D-2-06 - Reduce the homeland security incident response time

**Service Package**

- ATMS21 – Roadway Closure Management

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M29**

**Initiative:** Integrated Payment System for MnPASS, Transit and Parking

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will integrate various payment systems for transit, parking, and MnPASS into a single electronic payment system. Currently, MnPASS transponders that are mounted on the dashboards of vehicles traveling in the I-394 HOT Lane are used to electronically deduct variable toll amounts from separate accounts that are maintained by drivers. The same transponder used to pay the tolls could be used to pay parking fees at various parking ramps in the metro area and to pay for transit fares on board transit vehicles. Electronic readers currently exist on transit vehicles that allow passengers to swipe their transit card past the reader to pay the fare.

Drivers and transit passengers will benefit from a simple and integrated electronic payment system. Violation notifications of parking payments can be designed in the same way that violations are detected along I-394.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: City of Minneapolis, Metro Transit, Private Parking Operators

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM30 - Provide simple and integrated electronic payment systems

ITS Objectives: C-4-03 - Increase the number parking facilities with electronic fee collection  
 C-4-06 - Increase the number of parking facilities with coordinated electronic payment systems

**Service Package**

- ATMS10 – Electronic Toll Collection
- ATMS16 – Parking Facility Management
- APTS04 – Electronic Fare Payment

**ID: M30**

**Initiative:** Additional Air Quality Sensors at Strategic Locations

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Transportation in Context

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will allow federal and state agencies to collect air quality data in selected locations to measure air pollution and emissions levels. Travelers will use air quality information to make travel and modal choices.

**Champion and Stakeholder**

Champion: Federal Agencies, Minnesota Pollution Control Agency (MPCA)  
Stakeholders: MnDOT, Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM31 - Monitor and collect air quality data  
ITS Objectives: H-1-06 - Reduce the amount of all emissions in the atmosphere  
H-1-07 - Reduce the amount of carbon dioxide emissions measured

**Service Package**

- ATMS11 – Emissions Monitoring and Management

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M31**

**Initiative:** Curve Speed Warning Systems



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Lane Departure, Speed-Related

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will focus on deploying speed warning systems at curves with recurring adverse roadway conditions and/or high crash rates. Roadside equipment placed before the curve in the roadway can notify drivers of adverse roadway conditions through a combination of static information on the sign and flashing lights to indicate adverse conditions. Additional roadside equipment placed at the curve can detect adverse conditions and send a signal to the roadside equipment placed before the curve.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM32 - Provide curve speed warnings

ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions  
 A-1-17 - Reduce number of crashes due to roadway/geometric restrictions  
 A-2-03 - Reduce number of fatalities due to road weather conditions  
 A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions  
 A-2-24 - Reduce number of injuries due to road weather conditions  
 A-2-39 - Reduce number of injuries due to roadway/geometric restrictions  
 C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.

**Service Package**

- ATMS19 – Speed Warning and Enforcement

**ID:** M32

**Initiative:** Flood Warning Systems

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** Lane Departure

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

This initiative will place flood warning systems at locations with a history of flooding. The flood warning systems will detect potential and actual flood of roadways and alert state and local agencies to divert travelers to alternate roadways. This initiative will also allow automated data entry regarding flood information and alternate routes into the statewide 511 system. A system currently exists on TH 59 and TH 60 near Worthington that automatically detects a rise in water level and issues an alert based on commands from the Mankato Signal Center in District 7. A system is also planned in Mower County that would alert the Mower County dispatch center and trigger advanced warning signs (static signs with flashing beacons) to alert approaching vehicles. This planned system would also include communication and utilities at both the flood-warning sensor and the static warning signs with flashing beacons.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: Local Agencies

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

Need: TM34 - Provide roadway flood warnings

ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions

A-2-03 - Reduce number of fatalities due to road weather conditions

A-2-24 - Reduce number of injuries due to road weather conditions

C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.

### Service Package

- ATMS06 – Traffic Information Dissemination
- ATMS08 – Traffic Incident Management System
- MC12 – Infrastructure Monitoring

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M33**



**Initiative:** Overheight Detection/Warning Systems

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** Lane Departure, Commercial Vehicle Involved

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will target and deploy overheight detection/warning systems at bridge, overpasses, and tunnels with low height clearance. A system of roadside detectors and electronic warning signs currently exists in MnDOT District 7 that warns drivers of vehicles that are too tall or too wide to pass under bridges or through tunnels. The system is operated by the MnDOT District 7.

**Champion and Stakeholder**

Champion: MnDOT  
Stakeholders: Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Need: TM35 - Provide vehicle overheight detection/warning systems
- ITS Objectives:
- A-1-17 - Reduce number of crashes due to roadway/geometric restrictions
  - A-2-18 - Reduce number of fatalities due to roadway/geometric restrictions
  - A-2-39 - Reduce number of injuries due to roadway/geometric restrictions
  - C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.

**Service Package**

- ATMS24 – Dynamic Roadway Warning
- EM05 – Transportation Infrastructure Protection

**ID: M34**

**Initiative:** Signal Phase Transition Systems



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Intersections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will implement signal phase transition (i.e. sufficient yellow and all-red signal phases) and advance warning flashers at intersections with high crash rates throughout the state.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TM37 - Provide safe signal phase transition

- ITS Objectives:
- A-1-05 - Reduce number of crashes due to red-light running
  - A-1-10 - Reduce number of crashes at signalized intersections
  - A-2-05 - Reduce number of fatalities due to red-light running
  - A-2-11 - Reduce number of fatalities at signalized intersections
  - A-2-26 - Reduce number of injuries due to red-light running
  - A-2-32 - Reduce number of injuries at signalized intersections
  - A-2-44 - Reduce number of traffic law violations

**Service Package**

- ATMS03 – Traffic Signal Control

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M35**

**Initiative:** TIGER Corridor Expansion

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will focus on extending the TIGER (Traveler Information, Guidance, and Evacuation Routing) Corridor along I-94 to the North Dakota and Wisconsin borders. The current geographical scope of this initiative is the transportation corridor between the Minneapolis/St. Paul metropolitan area and St. Cloud, which is located 60 miles to the northwest. This corridor is comprised of three parallel roadways, Interstate 94, US Highway 10, and State Highway 55. The TIGER initiative is part of a larger multi-modal effort to address urgent concerns resulting from rapid growth in population and development in one of the fastest growing corridor in the state.

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative may be dependent upon federal funding for extending ICM technologies along I-94 to the North Dakota and Wisconsin borders.

**Needs and Objectives Addressed**

Need: TM36 - Implement Integrated Corridor Management (ICM) strategies

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

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-2-01 - Increase annual transit ridership

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

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

**Service Package**

- ATMS01 – Network Surveillance
- ATMS03 – Traffic Signal Control
- ATMS04 – Traffic Metering
- ATMS05 – HOV Lane Management
- ATMS07 – Regional Traffic Management
- ATMS10 – Electronic Toll Collection



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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M36**

**Initiative:** Additional Installation of Highway Rail Intersection (HRI) Monitoring Equipment



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** Intersections, Bicycle Involved

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will allow MnDOT to detect faults in the HRI equipment and send maintenance crews to make appropriate repairs. Local agencies and railroad companies will perform health monitoring of rail crossings.

**Champion and Stakeholder**

Champion: MnDOT  
Stakeholders: Local Agencies, Railroad Companies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Need: TM38 - Provide health monitoring of rail crossings  
ITS Objectives: A-1-09 - Reduce number of crashes at railroad crossings  
A-2-10 - Reduce number of fatalities at railroad crossings  
A-2-31 - Reduce number of injuries at railroad crossings

**Service Package**

- ATMS13 – Standard Railroad Grade Crossing
- ATMS14 – Advanced Railroad Grade Crossing

**ID: M37**

**Initiative:** Queue Length at Ramps, Incident and Work Zones



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Critical Connections

**SHSP Focus Area:** Inattentive Drivers, Speed-Related, Work Zones

**ITS Service Area:** ATMS

**Type:** Deployment

### Description

This initiative will deploy enhanced queue detection technology to monitor queues at ramps, incidents (i.e. crashes, congestion etc.) maintenance and construction projects. Lengthy vehicle queues can result in increased traffic congestion and potential risks to traffic safety. Automated monitoring of queues can provide traffic management personnel and maintenance and construction personnel of potential changes that will need to be made to reduce traffic queues at certain areas.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: Local Agencies

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

Need: TM39 - Monitor queue length at ramps, incidents, and work zones

ITS Objectives: A-1-04 - Reduce number of crashes due to unexpected congestion

A-2-04 - Reduce number of fatalities due to unexpected congestion

A-2-25 - Reduce number of injuries due to unexpected congestion

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-3-01 - Reduce total vehicle hours of delay by time period (peak, off-peak) caused by work zones

C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

### Service Package

- ATMS01 – Network Surveillance
- MC08 – Work Zone Management

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M38**

**Initiative:** Expand Total Stations and Photogrammetry Deployment



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Data Management

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will make Total Stations and/or photogrammetry available to public safety agencies for incident investigation, crash scene reconstruction and documentation. Currently, these systems are not distributed to all agencies that could use them.

**Champion and Stakeholder**

Champion: MSP

Stakeholders: Local Law Enforcement Agencies

**Dependency**

This initiative is not dependent upon any other initiatives

**Needs and Objectives Addressed**

Need: TM41 - Improve incident investigation capabilities

ITS Objectives: A-2-44 - Reduce number of traffic law violations

B-1-17 - Reduce mean incident clearance time per incident

**Service Package**

- ATMS08 – Traffic Incident Management System

**ID: M39**

**Initiative:** Snowplow Maintenance Activity Alerts Using DMS



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Lane Departure

**ITS Service Area:** ATMS, MCM

**Type:** Deployment

**Description**

This ITS system will alert travelers of snowplow locations and snowplow activities (i.e. snow removal cleanup) utilizing existing and planned DMS with messages to indicate that snow cleanup maintenance activities are ahead on the roadway.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives

**Needs and Objectives Addressed**

- Need: TM43 - Notify travelers of snowplow operations and cleanup using DMS  
WZ16 - Provide additional warning system on back of snowplow
- ITS Objectives: A-1-03 - Reduce number of crashes due to road weather conditions  
A-1-16 - Reduce number of crashes at intersections due to inappropriate crossing  
A-2-03 - Reduce number of fatalities due to road weather conditions  
A-2-17 - Reduce number of fatalities at intersections due to inappropriate crossing  
A-2-24 - Reduce number of injuries due to road weather conditions  
A-2-38 - Reduce number of injuries at intersections due to inappropriate crossing  
C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.

**Service Package**

- ATMS06 – Traffic Information Dissemination
- MC01 – Maintenance and Construction Vehicle and Equipment Tracking
- MC06 – Winter Maintenance

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M40**

**Initiative:** Detectors for Speed Data Collection at High Incident Locations



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Transportation in Context, Critical Connections

**SHSP Focus Area:** Speed-Related, Management Systems

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will install speed detection systems at locations with history of high incidents and incidents with high speeds. The purpose of the initiative is to collect and analyze speed data at those locations to investigate and evaluate counter measures to reduce incidents, in particular with those of high speeds.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives

**Needs and Objectives Addressed**

Need: TM42 - Use roadside data collectors to determine locations with high incident of speeding

ITS Objectives: A-2-44 - Reduce number of traffic law violations

C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

G-1-01 - Increase the amount of data gathered from ITS enhancements used in infrastructure and operations planning

**Service Packages**

- ATMS01 – Network Surveillance
- ATMS19 – Speed Warning and Enforcement

**ID:** M41

**Initiative:** Electronic Fare Payment Systems

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

This deployment uses simple electronic fare payment systems to make it easier for customers to pay. This deployment should allow agencies in the same region to integrate their fare payment systems to allow customers to use a single fare card to ride on transit services provided by different agencies. This system should allow travelers to use electronic fare cards or debit/credit card payment to simplify payment system and easily allow charges for additional services.

**Champion and Stakeholder**

Champion: Transit Agencies

**Dependency**

This initiative is dependent upon a study of electronic fare card parking and paratransit.

**Needs and Objectives Addressed**

Need: TR03 - Provide simple fare payment systems

ITS Objectives: B-2-16 - Increase use of automated fare collection system

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

**Service Package**

- APTS04 – Transit Fare Collection Management

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M42**

**Initiative:** Transit Agencies Smart Card for Employee Management

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

The initiative will implement the smart cards systems to support transit fleet and personnel resource management for transit agencies. In selected rural locations, transit smart cards will be used for employee time-clock management and potentially for personnel management, fleet operations, and customer service.

**Champion and Stakeholder**

Champion: Transit Agencies

**Dependency**

This initiative could build upon a similar deployment by the Duluth Transit Agency.

**Needs and Objectives Addressed**

- Need: TR05 - Manage transit fleet and personnel operations
- ITS Objectives: B-2-07 - Maintain the cost efficiency of the statewide public transit network
- D-1-01 - Reduce on an annual basis the number of complaints per 1,000 boarding passengers
- E-4-04 - Increase the rate at which equipment is utilized

**Service Package**

- APTS01 – Transit Vehicle Tracking
- APTS02 – Transit Fixed-Route Operations
- APTS04 – Transit Fare Collection Management

**ID: M43**

**Initiative:** St. Cloud MTC Transit Vehicle Security Technologies

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Asset Management, System Security

**ITS Service Area:** APTS

**Type:** Operational Test, Deployment

**Description**

This initiative will enhance wireless information systems on St. Cloud Metropolitan Transit Commission (MTC) transit vehicles, allowing them to: 1) Download stored video to garage systems, and 2) Initiate security alerts to transit dispatch center and transit security by using a “panic button” as an activator which will transmit on-board CCTV images directly to transit dispatch center and transit security personnel. This initiative is identified in the Statewide ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: St. Cloud MTC

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Need: TR06 - Provide surveillance and enforcement on transit vehicles and transit facilities
- ITS Objectives: D-1-02 - Increase the number of closed circuit television (CCTV) cameras installed on platforms, park-n-ride lots, vehicles, and other transit facilities
- D-1-08 - Reduce the number of security incidents on transportation infrastructure

**Service Package**

- APTS05 – Transit Security

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M44**

**Initiative:** Expand Electronic Fare Collection Technologies

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Asset Management, System Security, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

This initiative will focus on expanding the use of electronic fare collection to paratransit agencies and transit agencies in greater Minnesota. Electronic transit fare collection currently is operational in for metropolitan area transit providers (Metro Transit, Duluth Transit Authority, St. Cloud MTC, and Regional Transit Providers). Technologies include farebox card readers on board the transit vehicle that communicate transit fare information back to the transit agencies operations center.

**Champion and Stakeholder**

Champion: Local Transit Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TR07 - Provide electronic fare payment card  
ITS Objectives: B-1-09 - Improve average travel time during peak periods  
 B-2-16 - Increase use of automated fare collection system

**Service Package**

- APTS04 – Transit Fare Collection Management

**ID:** M45

**Initiative:** Wireless Transmission of Metro Transit Vehicle Diagnostic Data

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Asset Management, System Security

**ITS Service Area:** APTS

**Type:** Operational Test, Deployment

**Description**

This initiative will allow Metro Transit garage systems to wirelessly download transit vehicle diagnostic data from Metro Transit vehicles as they enter maintenance garages. The purpose of the initiative is to improve vehicle diagnostics and preventative maintenance. Metro Transit uses a TxBase interface to generate work orders when some error codes are received. This initiative was identified in the Minnesota Guidestar ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: Metro Transit

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TR08 - Support vehicle diagnostics and maintenance

ITS Objectives: 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

**Service Package**

- APTS06 – Transit Fleet Management

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M46**

**Initiative:** Transit Vehicle Lateral Safety Detection and Warning Systems



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Lane Departure, Pedestrian Involved, Bicycle Involved, Commercial Vehicle Involved

**ITS Service Area:** APTS, AVSS

**Type:** Deployment

**Description**

This initiative will deploy lateral safety detection and warning systems to improve safety of buses merging. Transit drivers will 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. Automated warnings about potential hazards will be presented to transit drivers. The University of Minnesota is testing a lane-assist system along the Cedar Avenue corridor in conjunction with the Minnesota Valley Transit Authority (MVTA). Lessons learned from this initiative can be used by additional transit agencies in future deployments of lateral safety detection and warning systems.

**Champion and Stakeholder**

Champion: Transit Agencies

**Dependency**

This initiative is an expansion of the technology that will be tested and evaluated in Initiative S28 – Bus Authorized Shoulder Assistant Systems.

**Needs and Objectives Addressed**

- Need: TR13 - Provide collision avoidance assistance for transit vehicles
- ITS Objectives:
- A-1-08 - Reduce number of crashes due to inappropriate lane departure, crossing and merging
  - A-1-16 - Reduce number of crashes at intersections due to inappropriate crossing
  - A-2-09 - Reduce number of fatalities due to inappropriate lane departure, crossing and merging
  - A-2-17 - Reduce number of fatalities at intersections due to inappropriate crossing
  - A-2-30 - Reduce number of injuries due to inappropriate lane departure, crossing and merging
  - A-2-38 - Reduce number of injuries at intersections due to inappropriate crossing

**Service Package**

- AVSS04 – Lateral Safety Warning

**ID: M47**

**Initiative:** Coordinate Scheduling, Historical Route Data and Transit Movements

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

The initiative will improve transit schedule efficiency using performance analysis results, implementing on-line reservation systems on agency web-site and enhancing scheduling software to provide better service to the public at a lower cost. The transit scheduling efficiency will be assessed based on transit schedule coordination, historical route data and transit movement.

**Champion and Stakeholder**

Champion: Transit Agencies

**Dependency**

This initiative is dependent upon Initiative S27 – Data Analysis Tools for Transit Route Performance.

**Needs and Objectives Addressed**

Need: TR15 - Optimize schedule efficiency

ITS Objectives: 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

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

**Service Package**

- APTS02 - Transit Fixed-Route Operations

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M48**

**Initiative:** Enhance Carpool and Vanpool Ridematching System

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

The initiative will enhance the capabilities and efficiency of the carpool and vanpool rider-matching system. The improved rider-matching system will better collect rideshare information from the public and provide rideshare opportunities to customers to help them make informed decisions in carpooling. Coordination will be conducted in developing and enhancing the system in greater Minnesota with city, county, and regional transit providers as needed.

**Champion and Stakeholder**

Champion: Transit Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: TR16 - Provide information on ridesharing opportunities

ITS Objective: B-2-21 - Provide carpool/vanpool matching and ridesharing information services

**Service Package**

- APTS08 - Transit Traveler Information
- ATIS08 – Dynamic Ridesharing

**ID: M49**

**Initiative:** Pedestrian and Bicycle Detection with Advance Warning for Drivers



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Pedestrian Involved, Bicycle Involved, Commercial Vehicle Involved

**ITS Service Area:** APTS, AVSS

**Type:** Deployment

**Description**

This initiative will focus on improving pedestrian's and bike rider's safety by deploying on-board pedestrian detection/warning systems to alert bus drivers for pedestrians and bike riders around the buses or in obstructed view area. The initiative will deploy the system at areas with high pedestrian accident rates

**Champion and Stakeholder**

Champion: Transit Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Need: TR18 - Install pedestrian detection/warning system to reduce incidents
- ITS Objectives:
- 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-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-2-37 - Reduce number of injuries involving pedestrians and non-motorized vehicles
  - A-2-38 - Reduce number of injuries at intersections due to inappropriate crossing

**Service Package**

- AVSS03 – Longitudinal Safety Warning
- AVSS04 – Lateral Safety Warning

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

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|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M50**

**Initiative:** Transit Agency On-line Reservation Integration with Fleet Scheduling Systems

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

This initiative will implement on-line reservation systems on transit agency web-sites and integrate them with fleet scheduling systems. Integration with fixed route systems is recommended.

**Champion and Stakeholder**

Champion: Metro Area Transit Providers

Stakeholders: Local Area Transit Providers, Intercity Transit Providers

**Dependency**

This initiative is similar to the initiative of DARTS On-line Reservation for Seniors.

**Needs and Objectives Addressed**

- Need: TR21 - Provide on-line reservation system for demand-responsive transit
- ITS Objectives: 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
- C-3-18 - Increase annual transit ridership reported by rural area transit providers

**Service Package**

- APTS03 - Demand Response Transit Operations
- APTS08 – Transit Traveler Information
- ATIS02 - Interactive Traveler Information

**ID:** M51

**Initiative:** Queue Jump Systems at Bottlenecks

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

This initiative will test and implement queue jump systems at selected bottle necked areas and along routes with Transit Signal Priority to reduce delay and improve schedule adherence and operations efficiency.

**Champion and Stakeholder**

Champion: Transit Agencies  
Stakeholders: MnDOT, Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives but could support Transit Signal Priority along Arterials initiative.

**Needs and Objectives Addressed**

Need: TR19 - Provide queue jumping  
ITS Objectives: 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  
E-1-02 - Improve average transit travel time compared to auto in major corridors

**Service Packages**

- APTS09 - Transit Signal Priority

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M52**

**Initiative:** Expand Metro Area Transit Management Systems to Greater Minnesota

**Timeframe:** Medium to Long Term – Year 5 and Beyond

**Multimodal Transportation Objective:** Asset Management, System Security, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

This initiative will incorporate, as determined necessary, an expansion of AVL systems for transit agencies and integrate transit resources and information sharing systems between agencies to better manage transit fleet and personnel operations and real-time transit trip information.

**Champion and Stakeholder**

Champion:  
Stakeholders: Transit Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Needs: TR05 - Manage transit fleet and personnel operations  
TI14 - Expand traveler information coverage in Greater Minnesota
- ITS Objectives: B-1-14 - Reduce the variability of travel time on specified routes during peak and off-peak periods  
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-2-15 - Improve average on-time performance for specified transit routes/facilities  
C-3-14 - Increase the number of transit routes with information being provided by ATIS  
D-1-01 - Reduce on an annual basis the number of complaints per 1,000 boarding passengers  
D-2-03 - Increase the number of travelers routed around Hazmat incidents  
D-2-04 - Increase the number of travelers routed around homeland security incidents  
E-4-07 - Increase the number of vehicles operating under CAD

**Service Package**

- APTS01 – Transit Vehicle Tracking
- APTS02 – Transit Fixed-Route Operations
- APTS03 – Demand Response Transit Operations



|                              |
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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M53**

**Initiative:** Surveillance Video Integration

**Timeframe:** Medium to Long Term – Year 5 and Beyond

**Multimodal Transportation Objective:** Asset Management, System Security

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

This initiative will focus on the integration of transit vehicle and center surveillance video with other local agencies operations centers (i.e. police, DOT, etc.). In the event of an emergency on-board a transit vehicle, drivers can initiate an alarm that alerts transit center staff of the emergency. Transit center staff will then be able to send surveillance video from the vehicle or center to the appropriate local emergency responders.

**Champion and Stakeholder**

Champion: Transit Agencies

Stakeholders: Local Agencies, Local Law Enforcement and Emergency Agencies

**Dependency**

This initiative is dependent upon the installation of on-board transit security cameras and agreements between local transit agencies and local law enforcement and emergency agencies.

**Needs and Objectives Addressed**

Needs: TR06 - Provide surveillance and enforcement on transit vehicles and transit facilities

TR24 - Metro Transit Police records integration with other PD's

ITS Objectives: D-1-02 - Increase the number of closed circuit television (CCTV) cameras installed on platforms, park-n-ride lots, vehicles, and other transit facilities

D-1-08 - Reduce the number of security incidents on transportation infrastructure

**Service Package**

- APTS05 – Transit Security

**ID: M54**

**Initiative:** CVO Database Enhancement



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Asset Management

**SHSP Focus Area:** Commercial Vehicle Involved

**ITS Service Area:** CVO, AD

**Type:** Deployment

### Description

This initiative will implement ways to improve efficiency of using multiple databases, such as the Motor Carrier Management Information System (MCMIS), to identify vehicles or operators with safety issues. This enhanced database system will also perform analysis and identification of carriers, vehicles, and drivers that have a high level of violations, and thus provide assistance to enforcement agencies to perform target enforcement. MnDOT and MSP currently use databases such as PRISM (Performance and Registration information Systems Management) and SAFER (Safety and Fitness Electronic Records) to query vehicle or operator safety issues.

### Champion and Stakeholder

Champion: MnDOT OFCVO

Stakeholders: Minnesota State Patrol

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

**Needs:** CF04 - Target enforcement on carriers, vehicles and drivers with history of violations

CF07 - Provide safety information from CVO databases to roadside and enforcement vehicles/personnel

**ITS Objectives:** A-1-06 - Reduce number of crashes involving large trucks and buses

A-2-06 - Reduce number of fatalities involving large trucks and buses

A-2-27 - Reduce number of injuries involving large trucks and buses

D-1-04 - Reduce the number of reported personal safety incidents

D-1-05 - Decrease the number of security incidents on roadways

D-2-01 - Reduce the number of Hazmat incidents

D-2-02 - Reduce the number of homeland security incidents

D-2-07 - Increase the number of Hazmat shipments tracked in real-time

E-2-02 - Increase the percent (or number) of freight shipment tracked

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

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

F-1-01 - Decrease the number of pavement miles damaged by commercial vehicles

**Service Package**

- CVO04 – CV Administrative Processes
- CVO07 – Roadside CVO Safety
- AD01 – ITS Data Mart

**ID: M55**

**Initiative:** Work Zone Restriction Information Automation



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** Commercial Vehicle Involved, Work Zones

**ITS Service Area:** CVO

**Type:** Deployment

**Description**

This initiative will automate commercial vehicle restriction data due to work zone data entered into CARS and Automated Permit Routing Systems. Permitted commercial vehicle operators and oversize/ overweight vehicles currently use the Automated Permit Routing System to generate route information based on size and weight requirements. Work zone information will help generate more accurate routes for commercial vehicles.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: Local Agencies

**Dependency**

This initiative could be built upon Initiative S35: Enhance Automated Permit Routing System.”

**Needs and Objectives Addressed**

Need: CF13 - Provide size and weight restrictions due to work zones

ITS Objectives: A-1-06 - Reduce number of crashes involving large trucks and buses

A-2-06 - Reduce number of fatalities involving large trucks and buses

A-2-27 - Reduce number of injuries involving large trucks and buses

C-3-12 - Increase number of visitors to traveler information website per year

E-1-05 - Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways

F-1-02 - Decrease the number of size and weight violations

**Service Package**

- CVO01 – Carrier Operations and Fleet Management

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M56**

**Initiative:** ATIS for CVO

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** CVO, ATIS

**Type:** Deployment

**Description**

This initiative will extend real-time traveler information to commercial vehicles. This information includes construction zone and detour information, parking availability in rest areas, and real-time traffic congestion information. This initiative was identified in the Statewide ITS Strategic Plan (2006).

**Champion and Stakeholder**

Champion: Private Trucking Companies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: CF14 - Direct commercial vehicle operators to the quickest route/time of travel

- ITS Objectives:
- C-3-12 - Increase number of visitors to traveler information website per year
  - 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

**Service Package**

- CVO01 – Carrier Operations and Fleet Management
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information

**ID: M57**

**Initiative:** Commercial Vehicles as Probes



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Commercial Vehicle Involved

**ITS Service Area:** CVO, ATMS

**Type:** Deployment

**Description**

This initiative will utilize private fleet management vehicle GPS systems to provide MnDOT with anonymous probe traffic data. This data would provide MnDOT with more accurate information on travel conditions on metro area freeways. MnDOT will need to develop a partnership with private trucking companies.

**Champion and Stakeholder**

Champion: MnDOT OFCVO  
Stakeholders: Private Trucking Companies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Need: CF16 - Track commercial fleet
- ITS Objectives:
- A-1-06 - Reduce number of crashes involving large trucks and buses
  - A-2-06 - Reduce number of fatalities involving large trucks and buses
  - A-2-27 - Reduce number of injuries involving large trucks and buses
  - D-1-08 - Reduce the number of security incidents on transportation infrastructure
  - 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

**Service Package**

- CVO01 – Carrier Operations and Fleet Management
- ATMS02 – Traffic Probe Surveillance

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

**ID: M58**

**Initiative:** RFID Tags for Identification of HAZMAT Materials



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** Commercial Vehicle Involved

**ITS Service Area:** CVO

**Type:** Deployment

### Description

This initiative will focus on developing Radio Frequency Identification (RFID) tags that will help identify HAZMAT materials that may be involved commercial vehicle rollovers and incidents. RFID tags are objects that can be applied to or incorporated into a product for the purpose of identification and tracking using radio waves. In the event of a HAZMAT incident, local maintenance, law enforcement and emergency response agencies will be notified of the incident and have the ability to quickly identify type(s) of hazardous materials carried by a commercial vehicle involved in an incident or at an inspection request.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: Law Enforcement and Emergency Management Agencies

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

Need: CF17 - Manage HAZMAT Incidents

ITS Objectives: A-1-06 - Reduce number of crashes involving large trucks and buses

A-2-06 - Reduce number of fatalities involving large trucks and buses

A-2-27 - Reduce number of injuries involving large trucks and buses

B-1-15 - Reduce mean incident notification time

D-2-01 - Reduce the number of Hazmat incidents

D-2-03 - Increase the number of travelers routed around Hazmat incidents

D-2-05 - Reduce the Hazmat incident response time

E-2-02 - Increase the percent (or number) of freight shipment tracked

### Service Package

- CVO01 – Carrier Operations and Fleet Management
- CVO10 – HAZMAT Management

**ID:** M59

**Initiative:** Enhanced Crash Database



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, Accountability, Transparency, & Communication

**SHSP Focus Area:** Data Management

**ITS Service Area:** CVO, AD

**Type:** Deployment

### Description

This initiative will investigate the use of advanced equipment to more efficiently collect crash data while minimizing the amount of field investigation time needed. Minnesota State Patrol (MSP) and other law enforcement agencies currently collect relevant information during investigations of crashes. This initiative will provide MSP and local law enforcement the ability to collect and enter more detailed data regarding crashes involving commercial vehicles into crash databases.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: MSP

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

Need: CF19 - Improve quality and accessibility of commercial vehicle-related crash data

ITS Objectives: A-1-06 - Reduce number of crashes involving large trucks and buses  
A-2-06 - Reduce number of fatalities involving large trucks and buses  
A-2-27 - Reduce number of injuries involving large trucks and buses  
G-1-03 - Increase the number of years of data in database that is easily searchable and extractable  
G-1-06 - Reduce operations cost deviation

### Service Package

- AD01 – ITS Data Mart
- AD02 – ITS Data Warehouse

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M60**

**Initiative:** Enhance Commercial Vehicle Shipment Performance

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Asset Management, Asset Management, System Security, Critical Connections

**ITS Service Area:** CVO

**Type:** Deployment

**Description**

This initiative will improve the timeliness and accuracy of shipment information to provide better data for commercial vehicle shipment performance analysis. This initiative will also provide new types of freight shipment data for new analysis and planning. MnDOT Office of Commercial Vehicle Operations (OFCVO) currently obtains information on freight movement and analyzes it to develop strategies and performance measures for MnDOT’s role in improving or augmenting freight movement.

**Champion and Stakeholder**

Champion: MnDOT OFCVO

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

- Need: CF20 - Measure historic commercial vehicle shipment performance
- ITS Objectives: E-2-02 - Increase the percent (or number) of freight shipment tracked
- 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-1-06 - Reduce operations cost deviation
- G-1-07 - Reduce administrative support rate (as part of overall project budget)

**Service Package**

- CVO01 – Carrier Operations and Fleet Management
- CVO04 – CV Administrative Processes

**ID:** M61

**Initiative:** Evacuation/Reentry Real-time Information ITS Systems

**Timeframe:** Medium Term – Years 5-7

**Multimodal Transportation Objective:** Asset Management, System Security, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** EM

**Type:** Deployment

**Description**

This initiative will develop systems to recommend alternate routes based on real-time traffic information and historic travel information. This initiative will also enhance evacuation/ reentry simulations to provide better information. Travelers use this service to determine time to travel and routes to take during evacuation and reentry.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, MSP, Minnesota DPS, Local Emergency Management Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: E09 - Provide emergency/evacuation and reentry information

- ITS Objectives:
- D-2-03 - Increase the number of travelers routed around Hazmat incidents
  - D-2-04 - Increase the number of travelers routed around homeland security incidents
  - E-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

**Service Package**

- EM10 – Disaster Traveler Information

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M62**

**Initiative:** Enhanced Automated and Manual In-Vehicle Notification Assistance



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** EM

**Type:** Deployment

**Description**

This initiative will deploy an Enhanced Mayday system (i.e. Next-Generation 911) to process data and voice messages from commercial systems to provide automatic crash location and severity notification. This information would reduce incident response time for local emergency responders and provide them with more information to provide appropriate response. A uniform, real-time automated crash notification system can be an extension of the current Mayday System. This initiative is identified in the Minnesota ITS Safety Plan (2006).

**Champion and Stakeholder**

Champion: Minnesota State Patrol

Stakeholders: PSAPs, First Responders, MnDOT, Local Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: E03 - Provide enhanced Mayday services

ITS Objectives: B-1-15 - Reduce mean incident notification time

B-1-16 - Reduce mean time for needed responders to arrive on-scene after notification

**Service Package**

- EM03 – Mayday and Alarms Support

**ID: M63**

**Initiative:** AVL Systems for Local Responders



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security, Accountability, Transparency, & Communication

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** EM

**Type:** Deployment

**Description**

This initiative will deploy AVL systems to local emergency responding agencies. AVL will assist local emergency response agencies in tracking resources. AVL in coordination with Computer Aided Dispatch (CAD) will also assist in reducing incident response time and effectively providing resources to emergency response. Minnesota State Patrol vehicles already have CAD.

**Champion and Stakeholder**

Champion: Local Emergency Management Agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: E06 - Provide AVL to emergency vehicles

ITS Objectives: 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

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

**Service Package**

- EM01 – Emergency Call-Taking and Dispatch
- EM02 – Emergency Routing

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M64**

**Initiative:** Expand Deployment of Mobile Data Computers



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security, Accountability, Transparency, & Communication

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** EM

**Type:** Deployment

**Description**

Emergency response agencies that do not have mobile data computers will install equipment in their vehicles and integrate it with databases. These data computers allow responders to access information in a central database and to transmit and receive data to a dispatch center. This enhances the flow of information between responders and dispatch centers, improving response effectiveness.

**Champion and Stakeholder**

Champion: Minnesota State Patrol

Stakeholders: Minnesota State Patrol, Local Emergency Response Agencies, MnDOT

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: E08 - Provide mobile data computers in emergency vehicles to provide real-time information

ITS Objectives: B-1-15 - Reduce mean incident notification time

B-1-17 - Reduce mean incident clearance time per incident

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

**Service Package**

- EM01 – Emergency Call-Taking and Dispatch
- EM02 – Emergency Routing

**ID: M65**

**Initiative:** Remote Posting of AMBER Alerts on DMS



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** EM

**Type:** Deployment

**Description**

This initiative will provide MnDOT TOCC operators the ability to remotely post traffic-related messages and AMBER Alert messages on Dynamic Message Signs (DMS). Operators would not have to be present at TOCCs to post traffic-related and/or AMBER Alert messages on DMS.

**Champion and Stakeholder**

Champion: MnDOT TOCCs

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: E10 - Provide ability to remotely post AMBER alert information on DMS

ITS Objectives: B-1-15 - Reduce mean incident notification time

D-1-03 - Increase customer service and personal safety ratings

**Service Package**

- EM06 – Wide Area Alert

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M66**

**Initiative:** Wireless Digital Feeds Between MSP and Local EM Responders



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** EM

**Type:** Deployment

**Description**

This initiative will enhance the coordination and data sharing capability between emergency management responders. It will complete the conversion of data transmissions to digital format and deploy additional stations/repeaters and transmitters in area where topography limits transmissions. This will ensure coverage in non-urban areas and allow transmission of more data between agencies.

**Champion and Stakeholder**

Champion: MSP

Stakeholders: MSP, Local Emergency Management Agencies, MnDOT

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: E11 - Provide wireless digital feed between patrol and emergency responder vehicles and dispatch centers

ITS Objectives: B-1-15 - Reduce mean incident notification time

B-1-17 - Reduce mean incident clearance time per incident

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

**Service Package**

- EM01 – Emergency Call-Taking and Dispatch
- EM08 – Disaster Response and Recovery
- ATMS08 – Traffic Incident Management System

**ID:** M67

**Initiative:** Automated Field Reporting Systems for MSP and Local Law Enforcement



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems

**ITS Service Area:** EM, AD

**Type:** Deployment

### Description

Test and deploy automated field reporting system that ties in license swipe technology, automated filling of report fields, and DUI/DWI automated reporting. These systems would automatically fill in some of the fields that law enforcement personnel have to fill in on multiple reports that are necessary at incidents. This automation will save them time on filling out multiple reports and reduce their exposure to traffic at incidents.

### Champion and Stakeholder

Champion: MSP

Stakeholders: MSP, Local Law Enforcement Agencies

### Dependency

This initiative is dependent upon the Rapid Incident Clearance Initiative that is currently underway.

### Needs and Objectives Addressed

Need: E12 - Implement automated field reporting system

ITS Objectives: B-1-17 - Reduce mean incident clearance time per incident

B-1-18 - Reduce mean incident clearance time for Twin Cities urban freeway incidents

### Service Package

- AD01 – ITS Data Mart

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M68**

**Initiative:** DVR to Review Central Images during an Incident



**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** Data Management

**ITS Service Area:** EM, AD

**Type:** Deployment

**Description**

Integrate digital video recorder (DVR) technology into MSP dispatch center, RTMC and TOCCs, and vehicles to allow personnel to review images. Emergency responders and dispatchers will use DVR to review camera images during an incident to verify events at incident sites and make decisions to better respond to an incident.

**Champion and Stakeholder**

Champion: MnDOT  
Stakeholders: MSP

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: E13 - Provide Real-time Digital Video Recordings (DVR)

ITS Objective: B-1-15 - Reduce mean incident notification time

**Service Package**

- EM01 – Emergency Call-Taking and Dispatch
- EM08 – Disaster Response and Recovery
- AD01 – ITS Data Mart

**ID: M69**

**Initiative:** Incorporate Road Construction Data in CAD Systems



**Timeframe:** Medium Term – Years 7-8

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems, Work Zones

**ITS Service Area:** EM, ATIS

**Type:** Deployment

**Description**

Enhance CAD systems to incorporate current construction and evacuation traffic management routing information into GIS maps. This initiative would ensure dispatchers have real-time information on construction and alternate routing to assist in routing emergency response resources to an incident site to make emergency response more effective.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MnDOT, Minnesota State Patrol, Local Emergency Management Agencies

**Dependency**

The real-time evacuation traffic management data component is dependent on Initiative M65: Evacuation/ Reentry Real-time Information ITS Systems.

**Needs and Objectives Addressed**

Need: E07 - Enhance GIS capabilities

ITS Objective: B-1-15 - Reduce mean incident notification time

**Service Package**

- EM02 – Emergency Routing
- ATIS06 – Transportation Operations Data Sharing

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M70**

**Initiative:** Local Agency Public Works AVL Equipment

**Timeframe:** Medium Term – Years 5-8

**Multimodal Transportation Objective:** Asset Management, System Security, Accountability, Transparency, & Communication

**ITS Service Area:** MCM

**Type:** Deployment

**Description**

This initiative will install Automated Vehicle Locator (AVL) devices in local agency-level maintenance vehicles in order to fully maximize available resources during snowfall and icy conditions. Local agencies can take advantage of lessons learned from MnDOT which is in the process of expanding the deployment of AVL systems on their maintenance vehicles throughout the state.

**Champion and Stakeholder**

Champion: Local Agencies

**Dependency**

This initiative may be dependent upon the completion of statewide deployment of AVL technology on MnDOT maintenance vehicles.

**Needs and Objectives Addressed**

Need: WZ01 - Track locations of maintenance fleet and personnel and usage of materials

ITS Objectives: E-4-04 - Increase the rate at which equipment is utilized  
E-4-07 - Increase the number of vehicles operating under CAD

**Service Package**

- MC01 – Maintenance and Construction Vehicle and Equipment Tracking

**ID:** M71

**Initiative:** Seatbelt Ignition Interlocks on New Vehicles



**Timeframe:** Medium Term

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Unbelted Occupants, Vehicle Safety Enhancements

**ITS Service Area:** AVSS

**Type:** Policy/Legislation, Deployment

### Description

In-vehicle devices such as safety belt interlocks can be effective at increasing safety belt use among certain populations. A safety belt interlock device prevents the driver from either operating the vehicle or operating entertainment systems if the front seat (or other) occupants fail to use their safety belts. This initiative is to expand existing seatbelt interlocks so that a driver would be unable to start a vehicle unless the seatbelt is fully engaged for everyone in the vehicle. Technology is currently available to interlock the ignition if front-seat occupants are not buckled. However, the technology is not widespread for various reasons, including seat belt comfort, sensor accuracy and public acceptance. Currently, most new vehicles issue an audible alarm that will continue until everyone in the front seat is buckled.

This initiative will require actions to identify current efforts by National Highway Traffic Safety Administration (NHTSA) related to this subject and determine if Minnesota stakeholder interest is strong enough to influence national movement. This effort involves a legal/legislative issue that national legislation may be required to allow NHTSA to require auto manufacturers to install the advanced seatbelt/ignition interlock. In addition, some institutional issues may also need to be considered including human factors implications, drivers who may find unsafe ways around the interlock, and coordination with the automotive industry that will be required to implement the advanced interlock.

### Champion and Stakeholder

Champion: MnDOT State Traffic Engineer

Stakeholders: Automotive industry, Minnesota Department of Public Safety, Minnesota Safety Council, Minnesota Department of Health

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

Need: CEA 1 – Reducing impaired driving and increasing seat belt use

ITS Objective: A-2-44 – Reduce number of traffic law violations

### Service Package

- AVSS02 – Driver Safety Monitoring

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M72**

**Initiative:** Provide Real-Time Information to Equipped Vehicles That Deliver Warnings to Drivers



**Timeframe:** Medium Term

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Lane Departure, Inattentive Drivers, Speed-Related, Pedestrian Involved, Commercial Vehicle Involved, Work Zones

**ITS Service Area:** AVSS

**Type:** Research, Operational Test

**Description**

This system includes technologies to notify drivers of the posted speed limit based on their locations. Other notifications could include indications of an unsafe area ahead, such as hazardous roadway locations, alignment changes, upcoming work zones, crash spots, or bridge surface conditions. Technologies have been developed and implemented for vehicles and infrastructures to help drivers recognize infrastructure features, traffic-control devices, and other key environmental elements surrounding the vehicle by providing drivers with real-time video or audio warning information.

MnDOT performed a Mileage Based User Fee Demonstration in 2011, in which drivers elected to have smartphones installed within their vehicles that provided audible messages to drivers notifying them of the speed limit, as well as the presence of school zones, construction zones, and upcoming right or left curves in the roadway. The primary purpose of the demonstration was to measure the mileage driven by participants and assess a mileage-based fee using the GPS capability of the smartphones installed in the vehicles.

This initiative will require actions to identify what other types of information may be provided (i.e., speed limits, road conditions, etc.), assess the quality (i.e., consistency, accuracy, reliability, etc.) of information that may be provided, determine if information will be provided for all, most or some public roads, and propose the delivery of information to the automotive industry and information service providers to gauge their interest.

Some institutional issues need to be considered include human factors implications, careful design that will be necessary to avoid driver distraction or confusion from the additional feedback, accurate roadway characteristics and daily conditions that will be necessary to make information reliable and maintaining information to specific levels of accuracy or quality that will have staffing implications. Additional institutional issues include providing information on all, most or some public roads to be decided as this that will impact city, county and state staff, and delivering information that will be dependent upon the automotive industry and information service providers.

**Champion and Stakeholder**

Champion: MnDOT State Traffic Engineer

Stakeholders: Automotive industry, Information service providers (i.e., Traffic.com, OnStar, etc.), Minnesota Department of Public Safety-State Patrol, City transportation agencies, County transportation agencies

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: CEA 5 – Increasing Driver Safety Awareness and Improving Information Systems

ITS Objectives: A-1-14 – Reduce number of crashes related to driver inattention and distraction  
 A-1-17 – Reduce number of crashes due to roadway/geometric restrictions  
 A-2-15 – Reduce number of fatalities related to driver inattention and distraction  
 A-2-18 – Reduce number of fatalities due to roadway/geometric restrictions  
 A-2-36 – Reduce number of injuries related to driver inattention and distraction  
 A-2-39 – Reduce number of injuries due to roadway/geometric restrictions  
 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

**Service Package**

- AVSS12 – Cooperative Vehicle Safety Systems

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M73**

**Initiative:** Research Equipping Vehicles with Systems to Detect Driver Distractions and Provide Warnings



**Timeframe:** Medium Term

**Multimodal Transportation Objective:**

**SHSP Focus Area:** Inattentive Drivers, Vehicle Safety Enhancements

**ITS Service Area:** AVSS

**Type:** Research, Operational Test

**Description**

A driver would receive an audible (i.e., beeping) or tactile (i.e., seat vibration) alert as a warning if distraction or unresponsiveness are detected. The University of Minnesota has previously developed technology and conducted research in this area. This initiative is to enhance research in equipping vehicles with standard vehicle safety systems such as electronic stability control (ESC) system to detect and prevent driver distraction and reduce crashes. The next generation of vehicles will have anticipatory qualities that enable them to provide operating recommendations and active support to the driver such as adaptive cruise control and adaptive passive integration approach.

The effort will require actions to work with universities to identify opportunities for research, begin with the University of Minnesota and their previous work in this area, and identify current practices in the commercial vehicle auto industry to understand what may be used today. Some institutional issues need to be considered including human factors implications, careful design necessary to ensure appropriate detection and then driver understanding and response, and needs to be close coordination with the automotive industry as technology would need to be integrated with vehicle equipment.

**Champion and Stakeholder**

Champion: MnDOT State Traffic Engineer

Stakeholders: Automotive Industry, University Research Facilities; Private Sector Vendors

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Need: CEA 5 – Increasing Driver Safety Awareness and Improving Information Systems

ITS Objectives: A-1-14 – Reduce number of crashes related to driver inattention and distraction

A-2-15 – Reduce number of fatalities related to driver inattention and distraction

A-2-36 – Reduce number of injuries related to driver inattention and distraction

**Service Package**

- AVSS02 – Driver Safety Monitoring

|                              |                      |                    |                |                    |                      |                    |                 |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|
| Maintenance and Construction | Emergency Management | Commercial Vehicle | Vehicle Safety | Traffic Management | Traveler Information | Transit Management | Data Management |
|------------------------------|----------------------|--------------------|----------------|--------------------|----------------------|--------------------|-----------------|

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M74**

**Initiative:** Implement Improved Lane Guidance System



**Timeframe:** Medium Term

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Lane Departure, Vehicle Safety Enhancements

**ITS Service Area:** AVSS

**Type:** Research, Deployment

**Description**

The lane guidance technology is anticipated to provide greater mobility benefits as Connected Vehicle technology improves. Current discussions regarding the deployment of Connected Vehicle technology include a path from current autonomous adaptive cruise control (ACC) systems to full automation with mobility benefits at each stage of the deployment. The lane guidance concepts currently under development include assisted lateral control, adaptive cruise control, full assistance with driver vigilance, gap creation, individualized traffic flow encouragement, intelligent speed and advisory control, intersection reservation, and enhanced work zone operation.

This initiative is to provide drivers/vehicles with route guidance through the use of magnetic, GPS and pavement markings. The effort will require actions to explore current directions being taken for the national Connected Vehicle initiative, determine if and how Minnesota will attempt to secure federal funding related to the national Connected Vehicle initiative, and discuss technical approach options with the University of Minnesota.

This initiative should be closely coordinated with national Connected Vehicle efforts. There may be considerable infrastructure cost associated with implementing this initiative and coordination with the automotive industry will be necessary for this initiative to determine how road infrastructure will integrate with vehicles.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: Automotive Industry, University Research Facilities

**Dependency**

This initiative is dependent upon further research and development of the Connected Vehicle Initiative led by the FHWA.

**Needs and Objectives Addressed**

- Needs: TR13 – Provide collision avoidance assistance for transit vehicles  
 CF08 – Provide collision avoidance assistance for commercial vehicles

- ITS Objectives: A-1-08 – Reduce number of crashes due to inappropriate lane departure, crossing and merging  
 A-1-16 – Reduce number of crashes at intersections due to inappropriate crossing

- A-2-09 – Reduce number of fatalities due to inappropriate lane departure, crossing and merging
- A-2-17 – Reduce number of fatalities at intersections due to inappropriate crossing
- A-2-30 – Reduce number of injuries due to inappropriate lane departure, crossing and merging
- A-2-38 – Reduce number of injuries at intersections due to inappropriate crossing

**Service Package**

- AVSS04 – Lateral Safety Warning

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| <b>Vehicle Safety</b>        |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: M75**

**Initiative:** Develop Vehicle to Vehicle and Vehicle to Infrastructure Communication



**Timeframe:** Medium Term

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Vehicle Safety Enhancements

**ITS Service Area:** AVSS

**Type:** Research, Deployment

### Description

The aim of the Connected Vehicle initiative is to deploy and enable a communications infrastructure that supports vehicle-to-infrastructure, as well as vehicle-to-vehicle communications. This initiative encompasses the national vision for Connected Vehicle, which will build on the availability of advanced vehicle safety systems and on the results of related research and operational tests. It is also supported by radio spectrum at 5.9 GHz specifically allocated for dedicated short range communications (DSRC).

This initiative will require actions to consider applications to USDOT to be a Connected Vehicle demonstration state, maintain leadership in the national initiative through MnDOT Commissioner, and monitor the progress of MnDOT's Ford vehicle probe operational test (using State Patrol vehicles as probes to identify travel times). However, some institutional issues needed to be considered include that the public may be resistant to this initiative under the auspices of privacy and reliability of the technology, there will be driver education challenges regarding the appropriate use of the new technology, and roadside infrastructure deployment will be costly and may be challenging for public agencies to manage.

### Champion and Stakeholder

Champion: MnDOT

Stakeholders: USDOT, AASHTO, Automotive Industry

### Dependency

This initiative is dependent upon further research and development of the Connected Vehicle Initiative led by the FHWA.

### Needs and Objectives Addressed

Need: CEA 2 – Improving the Design and Operation of Highway Intersections

ITS Objectives:

- A-1-01 – Reduce number of vehicle crashes
- A-1-02 – Reduce number of vehicle crashes per VMT
- A-2-01 – Reduce number of roadway fatalities
- A-2-02 – Reduce number of roadway fatalities per VMT
- A-2-22 – Reduce number of roadway injuries
- A-2-23 – Reduce number of roadway injuries per VMT

### Service Package

This initiative supports the applications of AVSS service packages.

**ID:** L01

**Initiative:** Route-specific Weather Information



**Timeframe:** Long Term – Year 9 and Beyond

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Lane Departure

**ITS Service Area:** ATIS

**Type:** Deployment

**Description**

This initiative will enhance 511 and evolve from county-wide condition reports to route-specific weather reports. Route-specific reports will include information on current conditions and forecasted roadway conditions. This more focused weather information will provide travelers better information for them to plan their trips.

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is dependent upon deployments of road weather data collection systems on specific routes.

**Needs and Objectives Addressed**

Need: TI04 - Provide current and forecast road and weather conditions information

- ITS Objectives:
- A-1-03 - Reduce number of crashes due to road weather conditions
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - C-3-15 - Increase the number of specifically tailored traveler information messages provided

**Service Package**

- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- MC04 – Weather Information Processing and Distribution

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: L02**

**Initiative:** Use Agency Vehicles as Data Probes



**Timeframe:** Long Term – Years 9 and beyond

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Lane Departure, Data Management, Management Systems

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will equip maintenance and other agency vehicles with sensors to gather traffic data for traveler information as they drive. Types of data could include pavement conditions during inclement weather and travel speeds of maintenance and other agency vehicles. This data would then be entered into the MnDOT Condition Acquisition and Reporting System (CARS) for dissemination to the public through the Minnesota 511 Telephone Information Service and Traveler Information Website. This initiative would increase detection coverage in Greater Minnesota.

**Champion and Stakeholder**

Champion: MnDOT  
Stakeholders: Local EM Agencies

**Dependency**

This initiative may support the implementation of the Medium Term Initiative M06 – Congestion Information Expanded to Selected Greater Minnesota Locations.

**Needs and Objectives Addressed**

- Need: T114 - Expand traveler information coverage in Greater Minnesota
- ITS Objectives:
- A-1-03 - Reduce number of crashes due to road weather conditions
  - A-1-04 - Reduce number of crashes due to unexpected congestion
  - A-1-19 - Reduce number of all secondary crashes
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-04 - Reduce number of fatalities due to unexpected congestion
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - A-2-25 - Reduce number of injuries due to unexpected congestion
  - B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period
  - C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.

**Service Package**

- ATMS02 – Traffic Probe Surveillance

**ID:** L03

**Initiative:** Automated Speed Enforcement



**Timeframe:** Long Term – Year 9 and Beyond

**Multimodal Transportation Objective:** Traveler Safety

**SHSP Focus Area:** Speed-Related

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative focuses on exploring the existing legal restrictions and determining how to address them in a way that will allow for a limited deployment of automated photo enforcement of speed violations. Photo enforcement for speeding could be deployed at rural or work zone locations where there is a history of crashes with excessive speed as a contributing factor. This initiative is identified in the Minnesota Guidestar ITS Strategic Plan (2006) and Deployment Assessment (2007).

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MSP, Local Law Enforcement Agencies

**Dependency**

This initiative is dependent upon authorized speed enforcement legislation.

**Needs and Objectives Addressed**

Needs: TM06 - Provide speed enforcement at high risk locations to improve safety  
TM08 - Provide enhanced manual or automated speed enforcement to improve safety

ITS Objectives: A-2-43 - Reduce number of speed violations  
C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Service Package**

- ATMS19 – Speed Warning and Enforcement

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: L04**

**Initiative:** Contraflow Lanes on Metro Freeways

**Timeframe:** Long Term – Years 9 and Beyond

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will look at using a moveable barrier system on the metro freeway system in order to better utilize existing capacity and infrastructure on the system. Moveable barrier allows for the use of contra flow lanes in order to provide additional lanes in the peak direction of flow. For example, a 6-lane corridor with an existing 3-3 lane configuration can be used as a 4-2 lane facility during peak hours. MnDOT will focus on developing and deploying a moveable barrier system, which will also require signage and other traffic control devices. This initiative is identified in the Minnesota Guidestar ITS Deployment Assessment (2007).

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is dependent upon corridor studies to determine deployment location(s) and upon the development and deployment of a moveable barrier system.

**Needs and Objectives Addressed**

- Need: TM11 - Operate reversible lanes
- ITS Objectives: B-1-09 - Improve average travel time during peak periods
- 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-2-23 - Increase vehicle throughput on specified routes
- B-2-24 - Increase AM/PM peak hour vehicle throughput on specified routes

**Service Package**

- ATMS18 – Reversible Lane Management

**ID:** L05



**Initiative:** In-Pavement LEDs

**Timeframe:** Long Term – Year 9 and Beyond

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Intersections, Lane Departure, Inattentive Drivers

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**

This initiative will deploy LED (Light-Emitting Diode) Roadway Lighting to remotely direct traffic into other lanes or onto shoulders during incidents and emergencies impacting travel along Minnesota highways. Drivers will use this service to tell them what lane they should use and to be aware of upcoming intersections or crosswalks. Lighting is planned to be controlled by MnDOT staff from a central and/or remote location along the roadway. LED Roadway Lighting also has strong potential to reduce night-time driving accidents in urban and rural areas. In-pavement LEDs have been tested at the MnROAD Testing Facility.

**Champion and Stakeholder**

Champion: MnDOT

**Dependency**

This initiative is dependent upon additional testing of in-pavement LED roadway lighting techniques.

**Needs and Objectives Addressed**

- Need: TM19 - Operate in-pavement dynamic lane markings
- ITS Objectives:
  - A-1-08 - Reduce number of crashes due to inappropriate lane departure, crossing and merging
  - A-2-09 - Reduce number of fatalities due to inappropriate lane departure, crossing and merging
  - A-2-30 - Reduce number of injuries due to inappropriate lane departure, crossing and merging
  - B-1-01 - Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period

**Service Package**

- ATMS23 – Dynamic Lane Management and Shoulder Use

|                              |
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| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: L06**

**Initiative:** Transit Vehicle Communications to Emergency Response Centers



**Timeframe:** Long Term – Year 9 and Beyond

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security

**SHSP Focus Area:** EMS Response & Trauma Systems, Commercial Vehicle Involved

**ITS Service Area:** ATMS, EM

**Type:** Deployment

**Description**

This initiative will equip bus fleets with communications systems to allow bus drivers to connect directly with emergency-response command centers during emergency situations.

**Champion and Stakeholder**

Champion: Metro Transit

Stakeholders: Metro Area Transit Providers, Local agencies, MSP, Minnesota Homeland Security and Emergency Management

**Dependency**

This initiative is not dependent upon any other initiatives.

**Needs and Objectives Addressed**

Needs: TM22 - Provide system-coordinated response to incidents  
 TR23 - Provide multi-communication mode hub/ infrastructure on buses to transmit/ receive high speed data in the most efficient and cost-effective manner

ITS Objectives: B-1-15 - Reduce mean incident notification time  
 B-1-16 - Reduce mean time for needed responders to arrive on-scene after notification  
 B-1-18 - Reduce mean incident clearance time for Twin Cities urban freeway incidents  
 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

**Service Package**

- ATMS08 – Traffic Incident Management System
- EM08 – Disaster Response and Recovery

**ID:** L07

**Initiative:** Enhanced Speed Monitoring Equipment for Work Zone



**Timeframe:** Long Term – Years 9 and Beyond

**Multimodal Transportation Objective:** Traveler Safety, Asset Management, System Security, Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**SHSP Focus Area:** Speed-Related

**ITS Service Area:** ATMS, MCM

**Type:** Deployment

**Description**

This initiative will increase manual enforcement in work zones and gradually move toward automated enforcement through operational tests and enabling legislation. Automated speed enforcement is not permissible under current statute. Legislation must be passed to authorize it.

**Champion and Stakeholder**

Champion: MnDOT

Stakeholders: MSP, Local Law Enforcement Agencies

**Dependency**

This initiative may be dependent upon Initiative S52 – Portable Queue Detection and Stopped Traffic Advisory.

**Needs and Objectives Addressed**

Need: TM40 - Monitor queue length at ramps, incidents, and work zones

- ITS Objectives: A-1-04 - Reduce number of crashes due to unexpected congestion
- A-2-04 - Reduce number of fatalities due to unexpected congestion
- A-2-25 - Reduce number of injuries due to unexpected congestion
- A-3-04 - Reduce number of workers injured by vehicles in work zones
- B-1-15 - Reduce mean incident notification time
- B-3-01 - Reduce total vehicle hours of delay by time period (peak, off-peak) caused by work zones
- C-4-01 - Reduce the speed differential between lanes of traffic on multi-lane highways

**Service Package**

- ATMS19 – Speed Warning and Enforcement
- MC08 – Work Zone Management

Data Management

Transit Management

Traveler Information

Traffic Management

Vehicle Safety

Commercial Vehicle

Emergency Management

Maintenance and Construction

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: L08**

**Initiative:** Transit Vehicle On-Board Enunciator and AVL Integration

**Timeframe:** Long Term – Years 9 and Beyond

**Multimodal Transportation Objective:** Accountability, Transparency, & Communication, Transportation in Context, Critical Connections

**ITS Service Area:** APTS

**Type:** Deployment

**Description**

The initiative will deploy on-board enunciators / visual display systems and integrate them with Automated Vehicle Locator (AVL) systems. Currently, Metro Transit’s light rail system uses on-board automated enunciators to announce next stops/routes and safety messages. Enunciators at LRT stations also provide safety messages. Duluth Transit Authority (DTA) also utilizes on-board enunciators 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.

**Champion and Stakeholder**

Champion: Transit Agencies

**Dependency**

This initiative is dependent upon the expansion of metro area transit management systems (i.e. AVL technology) to transit agencies in Greater Minnesota.

**Needs and Objectives Addressed**

Need: TR10 - Provide on-board automated enunciators

ITS Objective: B-2-08 - Maintain the service effectiveness of the statewide public transit network in terms of passengers/service hour and passengers/mile

**Service Package**

- APTS01 – Transit Vehicle Tracking
- APTS08 – Transit Traveler Information

**ID: L09**

**Initiative:** Develop and Provide a Uniform, Real-Time Automated Crash Notification System



**Timeframe:** Long Term

**Multimodal Transportation Objective:** Traveler Safety, Accountability, Transparency, & Communication

**SHSP Focus Area:** EMS Response & Trauma Systems, Management Systems, Vehicle Safety Enhancements

**ITS Service Area:** EM

**Type:** Deployment

### Description

This initiative would provide immediate notification of a crash to emergency responders and provide access to driver, passenger and vehicle information. This would reduce emergency response time and, ultimately, improve crash fatality and injury rates through faster and more targeted medical care. This could be viewed as a continuation of the previous Mayday projects conducted in Minnesota. The initiative is to develop and provide common location information and communication standards to assist emergency responders in quickly and efficiently locating crash or other road safety related incidents. The system will need to be developed based on Location Referencing Message Specification (LRMS) standard and data concepts supported by the LRMS standard.

The initiative will require actions to monitor future legislation that could potentially restrict or expand this initiative and monitor implementation of a statewide trauma system. There is an institutional issue for this effort that the public may raise data privacy concerns regarding access to this type of information.

### Champion and Stakeholder

Champion: MnDOT State Traffic Engineer

Stakeholders: Law enforcement community, Minnesota Department of Health, Private Sector, EMS

### Dependency

This initiative is not dependent upon any other initiatives.

### Needs and Objectives Addressed

Needs: E03 - Provide enhanced Mayday services  
E14 - Provide incident detection system

ITS Objectives: B-1-15 - Reduce mean incident notification time  
B-1-16 - Reduce mean time for needed responders to arrive on-scene after notification

### Service Package

- EM03 – Mayday and Alarms Support

|                              |
|------------------------------|
| Data Management              |
| Transit Management           |
| Traveler Information         |
| Traffic Management           |
| Vehicle Safety               |
| Commercial Vehicle           |
| Emergency Management         |
| Maintenance and Construction |

**ID: L10**

**Initiative:** Roadway Condition and Environmental Sensors on Maintenance Vehicles for Traveler Information



**Timeframe:** Long Term – Years 9 and Beyond

**Multimodal Transportation Objective:** Traveler Safety, Asset Management

**SHSP Focus Area:** Intersections, Lane Departure

**ITS Service Area:** MCM, ATIS

**Type:** Deployment

**Description**

MnDOT currently has 80 maintenance vehicles equipped with sensors to collect pavement and environmental conditions. This initiative will equip additional 700 plus maintenance vehicles with sensors to monitor pavement surface and other environmental conditions. Data will be used to assist in decisions on scheduling of maintenance vehicle activity during inclement weather conditions. Data will also be integrated with RWIS data, entered into CARS, and made available to the public via the 511 Traveler Information Website.

**Champion and Stakeholder**

MnDOT

**Dependency**

This initiative could be implemented in conjunction with Initiative S47 – Maintenance Vehicle AVL Equipment.

**Needs and Objectives Addressed**

- Need: WZ04 - Provide automated monitoring of road weather conditions
- ITS Objectives:
- A-1-03 - Reduce number of crashes due to road weather conditions
  - A-2-03 - Reduce number of fatalities due to road weather conditions
  - A-2-24 - Reduce number of injuries due to road weather conditions
  - C-3-09 - Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc.
  - C-3-12 - Increase number of visitors to traveler information website per year

**Service Package**

- MC03 – Road Weather Data Collection
- MC04 – Weather Information Processing and Distribution
- ATIS01 – Broadcast Traveler Information

**Appendix A**  
**Minnesota Statewide Regional ITS Architecture**  
**and Systems Engineering Checklist for**  
**Large Scale/Complex ITS Application: General**  
**FHWA Final Rule 940 and FTA National ITS Architecture Policy**

For all ITS projects or projects with an ITS component, a Systems Engineering Checklist must be completed and submitted with the Federal-Aid Authorization Form. For questions regarding the completion of this checklist contact Rashmi Brewer, P.E. – MnDOT Office of Traffic, Safety and Technology at 651-234-7063 or e-mail at [Rashmi.Brewer@state.mn.us](mailto:Rashmi.Brewer@state.mn.us).

\_\_\_\_\_  
*(Enter project name or type)*

**SECTION 1 – Project Information**

**1.1 CONTACT PERSON (e.g. PROJECT MANAGER)**

Name/Title: \_\_\_\_\_ Agency: \_\_\_\_\_  
 Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 Telephone: \_\_\_\_\_ Email: \_\_\_\_\_

**1.2 PROJECT LOCATION (list all)**

**1.3 PROJECT NUMBER**

1.3A Federal Project Number: \_\_\_\_\_  
 1.3B State/Local Project Number: \_\_\_\_\_

**1.4 PROJECT SCHEDULE**

Anticipated Start Date: \_\_\_\_\_  
 Expected Completion Date: \_\_\_\_\_

**1.5 NATURE OF WORK (Check all that apply)**

- Scoping    Design    Software/Integration    Construction    Operations & Management  
 Evaluations    Planning    Equipment Replacement    Research & Development  
 Others (Please Specify) \_\_\_\_\_

**1.6 PROJECT FEATURES AND TYPES OF ITS APPLICATIONS (Check all that apply)**

- Arterial Management   **STOP!** Please use Arterial Traffic Management or Traffic Signal Checklist  
 Freeway Management   **STOP!** Please use Freeway Traffic Management Checklist  
 Work Zone Management    Incident and Emergency Management

- Traveler Information       Parking Management       Transit  
 Data/Information Management     Commercial Vehicle Operations  
 Advanced Vehicle Technology     Others (Please Specify) \_\_\_\_\_

**1.7 NEEDS ASSESSMENT**

*Please describe the problem statement, goals and objectives of the project.*

*How were these needs identified? (Check all that apply)*

- Internal Assessment       Stakeholder Involvement       Regional ITS Architecture  
 Standard Systems Engineering Concept of Operations/Functional Requirements Documents  
 Other ITS Planning or Technical Documents (Please Specify) \_\_\_\_\_  
 Design Documents (Please Specify) \_\_\_\_\_

**1.8 SYSTEMS ENGINEERING DOCUMENTATION**

|                          | Existing                 | Existing To Be Modified  | To Be Developed          | Not Applicable           | Document Reference (file number or name)/Comments |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---|
| Alternatives Analysis    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |   |
| Concept of Operations    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |   |
| Requirements             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |   |
| Design                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |   |
| System Test Plan         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |   |
| System Verification Plan | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |   |
| Evaluation               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |   |
| Others (Please Specify)  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |   |

Standard Systems Engineering/Concept of Operations/Functional Requirements have been reviewed:

- Yes       No

**1.9 RELATIONSHIP TO OTHER PROJECTS AND PHASES**

*Please list any construction and tied projects.*

**Project Title**

**Project Number**

|       |       |
|-------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

**SECTION 2 – Regional Architecture Assessment**

**2.1 PROJECT IS INCLUDED IN THE MINNESOTA STATEWIDE REGIONAL ITS ARCHITECTURE**

(Refer to Sections 4.3 and 4.4 of Volume 9: Initiative and Project Concepts for Implementation of Minnesota Statewide Regional ITS Architecture, January 2014)  Yes  No

If "No", please list additional ITS devices, features, and/or functions that are not listed in 1.6 and send a copy of the complete checklist via email to the MnDOT Office of Traffic, Safety and Technology contact person listed at top of page 1.

If "Yes", Project ID (from Sections 4.3 and 4.4 of Volume 9): \_\_\_\_\_

Is the project consistent with the description in the Architecture?  Yes  No

If "No", please summarize the differences below and send a copy of the complete checklist via email to the MnDOT Office of Traffic, Safety and Technology contact person listed at top of page 1.

---

**2.2 DOES THE DESIGN INCORPORATE NATIONAL ITS STANDARDS?**

Yes  No

If "Yes", please specify what ITS Standards are being used:

General information on ITS Standards can be found at <http://www.standards.its.dot.gov/>.

\*Minnesota Standards are listed in Section 10 of Volume 10 of the *Minnesota Statewide Regional ITS Architecture* document as generated by Turbo Architecture.

---

**2.3 IS AN INTERAGENCY AGREEMENT NEEDED FOR THIS PROJECT?**

Existing  To be Developed  No

Please describe: (Agency name, agreement number, and nature of contract)

**SECTION 3 – Procurement**

**3.1 PROCUREMENT METHODS** *(Check all that apply)*

- Construction Contract
- Professional Technical Services Contract/Agreement
- Joint Powers Contract/Agreement
- Interagency Contract/Agreement
- Work Order Contract/Agreement
- Commodities Contract
- Purchase Order
- Other

Comments:

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**SECTION 4 – Operations and Management**

**4.1 STAFFING AND RESOURCES NEEDED FOR OPERATIONS AND MANAGEMENT**

*(Staff hours covering, for example, device/system maintenance plus management. Estimate and specify per year and per site or for all sites in project)*

---

**4.2 ESTIMATED ANNUAL OPERATIONS AND MANAGEMENT COSTS**

*(Question 4.1 staffing labor hours x average direct hourly rate, plus direct expenses)*

**SECTION 5 - Approval**

**APPROVAL**

Name/Title: \_\_\_\_\_ Agency: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Telephone: \_\_\_\_\_ Email: \_\_\_\_\_

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## Appendix B - A Sample of Completed Checklist for Large Scale/Complex ITS Application: General

### Minnesota Statewide Regional ITS Architecture and Systems Engineering Checklist for Large Scale/Complex ITS Application: GENERAL FHWA Final Rule 940 and FTA National ITS Architecture Policy

For all ITS projects or projects with an ITS component, a Systems Engineering Checklist must be completed and submitted with the Federal-Aid Authorization Form. For questions regarding the completion of this checklist contact Rashmi Brewer, P.E. – MnDOT Office of Traffic, Safety and Technology at 651-234-7063 or e-mail at [Rashmi.Brewer@state.mn.us](mailto:Rashmi.Brewer@state.mn.us).

#### Dynamic Speed in Work Zones to Advise Drivers

(Enter project name or type)

#### SECTION 1 – Project Information

##### 1.1 CONTACT PERSON (e.g. PROJECT MANAGER)

Name/Title: Joe Smith, Project Manager

Agency: MnDOT District 4

Signature: \_\_\_\_\_

Date: April 14, 2013

Telephone: xxx-xxx-xxxx

Email: joe.smith@state.mn.us

##### 1.2 PROJECT LOCATION (list all)

Highway 7 between Appleton and Milan and for future road construction/maintenance projects

##### 1.3 PROJECT NUMBER

1.3A Federal Project Number: XXXXX

1.3B State/Local Project Number: XXXXX

##### 1.4 PROJECT SCHEDULE

Anticipated Start Date: August 25, 2013

Expected Completion Date: October 26, 2013

##### 1.5 NATURE OF WORK (Check all that apply)

- Scoping    Design    Software/Integration    Construction    Operations & Management  
 Evaluations    Planning    Equipment Replacement    Research & Development  
 Others (Please Specify) Equipment procurement

**1.6 PROJECT FEATURES AND TYPES OF ITS APPLICATIONS** *(Check all that apply)*

- Arterial Management **STOP!** Please use Arterial Traffic Management or Traffic Signal Checklist
- Freeway Management **STOP!** Please use Freeway Traffic Management Checklist
- Work Zone Management  Incident and Emergency Management
- Traveler Information  Parking Management  Transit
- Data/Information Management  Commercial Vehicle Operations
- Advanced Vehicle Technology  Others (Please Specify) \_\_\_\_\_

**1.7 NEEDS ASSESSMENT**

*Please describe the problem statement, goals and objectives of the project.*

Provide advance warning to drivers approaching work zones; provide dynamic speed feedback to drivers.  
 Goal: improve safety and traffic flow in and around work zones  
 Objectives: reduce work zone crashes, reduce crashes due to unexpected congestion, reduce speed differential, and maintain smooth traffic flow.

*How were these needs identified? (Check all that apply)*

- Internal Assessment  Stakeholder Involvement  Regional ITS Architecture
- Standard Systems Engineering Concept of Operations/Functional Requirements Documents
- Other ITS Planning or Technical Documents (Please Specify) \_\_\_\_\_
- Design Documents (Please Specify) \_\_\_\_\_

**1.8 SYSTEMS ENGINEERING DOCUMENTATION**

|                          | Existing                            | Existing To Be Modified  | To Be Developed                     | Not Applicable                      | Document Reference (file number or name)/Comments |
|--------------------------|-------------------------------------|--------------------------|-------------------------------------|-------------------------------------|---|
| Alternatives Analysis    | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |   |
| Concept of Operations    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | IWZ Toolbox                                       |
| Requirements             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | IWZ Toobox  |
| Design                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | IWZ Toolbox                                       |
| System Test Plan         | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |   |
| System Verification Plan | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |   |
| Evaluation               | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |   |
| Others (Please Specify)  | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |   |

Standard Systems Engineering/Concept of Operations/Functional Requirements have been reviewed:  
 Yes  No

**1.9 RELATIONSHIP TO OTHER PROJECTS AND PHASES**

*Please list any construction and tied projects.*

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**Project Title**

**Project Number**

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**SECTION 2 – Regional Architecture Assessment**

**2.1 PROJECT IS INCLUDED IN THE MINNESOTA STATEWIDE REGIONAL ITS ARCHITECTURE**

(Refer to Sections 4.3 and 4.4 of Volume 9: Initiative and Project Concepts for Implementation of Minnesota Statewide Regional ITS Architecture, January 2014)  Yes  No

If "No", please list additional ITS devices, features, and/or functions that are not listed in **1.6** and send a copy of the complete checklist via email to the MnDOT Office of Traffic, Safety and Technology contact person listed at top of page 1.

If "Yes", Project ID (from Sections 4.3 and 4.4 of Volume 9):           S49          

Is the project consistent with the description in the Architecture?  Yes  No

If "No", please summarize the differences below and send a copy of the complete checklist via email to the MnDOT Office of Traffic, Safety and Technology contact person listed at top of page 1.

---

**2.2 DOES THE DESIGN INCORPORATE NATIONAL ITS STANDARDS?**

Yes  No

If "Yes", please specify what ITS Standards are being used:

NTCIP C2F Standards Group, NTCIP C2C Standards Group, NTCIP 1201, 1202, 1203, 1209, 1210 and 1214.

General information on ITS Standards can be found at <http://www.standards.its.dot.gov/>.

\*Minnesota Standards are listed in Section 10 of Volume 10 of the *Minnesota Statewide Regional ITS Architecture* document as generated by Turbo Architecture.

---

**2.3 IS AN INTERAGENCY AGREEMENT NEEDED FOR THIS PROJECT?**

Existing  To be Developed  No

Please describe: (Agency name, agreement number, and nature of contract)

**SECTION 3 – Procurement**

**3.1 PROCUREMENT METHODS** *(Check all that apply)*

- Construction Contract
- Professional Technical Services Contract/Agreement
- Joint Powers Contract/Agreement
- Interagency Contract/Agreement
- Work Order Contract/Agreement
- Commodities Contract
- Purchase Order
- Other

Comments:

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**SECTION 4 – Operations and Management**

**4.1 STAFFING AND RESOURCES NEEDED FOR OPERATIONS AND MANAGEMENT**

*(Staff hours covering, for example, device/system maintenance plus management. Estimate and specify per year and per site or for all sites in project)*

80 hours

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**4.2 ESTIMATED ANNUAL OPERATIONS AND MANAGEMENT COSTS**

*(Question 4.1 staffing labor hours x average direct hourly rate, plus direct expenses)*

\$20,000

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**SECTION 5 - Approval**

**APPROVAL**

Name/Title: \_\_\_\_\_ Agency: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Telephone: \_\_\_\_\_ Email: \_\_\_\_\_

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